TEST REPORT
IEC 62109-1
Safety of Power Converter for use in Photovoltaic Power Systems
Part 1: General requirements

Report		
Report Reference No.	:	130918053GZU-004
Date of issue	:	10 Jan., 2014
Total number of pages	:	135 pages
Testing Laboratory	:	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Address	:	Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD, Guangzhou, China
Applicant's name	:	Shenzhen SOFARSOLAR Co., Ltd.
Address	:	3A-1, Huake Building, East Technology Park, Qiaoxiang Road, Nanshan District, Shenzhen, China
Test specification:		
Standard	:	IEC/EN 62109-1:2010 (First Edition)
Test procedure	:	SAA
Non-standard test method	:	N/A
Test Report Form No.	:	TTRF_IEC62109_1A
TRF Originator	:	Intertek Guangzhou
Master TRF	:	Dated 2011-03

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

Test item description..... :	Grid-connected PV inverter
Trade Mark..... :	SOFAR SOLAR
Manufacturer..... :	Same as applicant
Model/Type reference..... :	Sofar 20000TL-Sx, Sofar 17000TL-Sx, Sofar 15000TL-Sx, Sofar 10000TL-Sx (x=0-6)
Ratings..... :	Maximum d.c. input voltage: 1000 V Input voltage rang: 250-960 V Max. input current: 2×24 A (for Sofar 20000TL-Sx); 2×21 A (for Sofar 17000TL-Sx, Sofar 15000TL-Sx); 2×15 A (for Sofar 10000TL-Sx) Max. PV Isc: 2×30 A (for Sofar 20000TL-Sx); 2×27 A (for Sofar 17000TL-Sx, Sofar 15000TL-Sx); 2×20 A (for Sofar 10000TL-Sx) Nominal output voltage: 3/N/PE230V/400V Max. output current: 3×29 A (for Sofar 20000TL-Sx); 3×25 A (for Sofar 17000TL-Sx); 3×22 A (for Sofar 15000TL-Sx); 3×15 A (for Sofar 10000TL-Sx) Nominal frequency: 50 Hz Max. output power: 20000 W (for Sofar 20000TL-Sx); 17000 W (for Sofar 17000TL-Sx); 15000 W (for Sofar 15000TL-Sx); 10000 W (for Sofar 10000TL-Sx) Ingress protection: IP65 Operating temperature range: -25～60℃

Testing procedure and testing location:	
☒ **Testing Laboratory**:	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Testing location/ address ..... :	Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD, Guangzhou, China
☐ **Associated Laboratory:**	
Testing location/ address ..... :	N/A
Tested by (name + signature)..... :	Tommy Zhong
Approved by (+ signature) ..... :	Grady Ye
☐ Testing procedure: TMP	
Testing location/ address ..... :	N/A
Tested by (name + signature)..... :	N/A
Approved by (+ signature) ..... :	N/A
☐ Testing procedure: WMT	
Testing location/ address ..... :	N/A
Tested by (name + signature)..... :	N/A
Witnessed by (+ signature)..... :	N/A
Approved by (+ signature) ..... :	N/A
☐ Testing procedure: SMT	
Testing location/ address ..... :	N/A
Tested by (name + signature)..... :	N/A
Approved by (+ signature) ..... :	N/A
Supervised by (+ signature)..... :	N/A
☐ Testing procedure: RMT	
Testing location/ address ..... :	N/A
Tested by (name + signature)..... :	N/A
Approved by (+ signature) ..... :	N/A
Supervised by (+ signature)..... :	N/A

Summary of testing:	
Tests performed (name of test and test clause): All applicable tests	Testing location: Intertek Testing Services Shenzhen Ltd. Guangzhou Branch Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD, Guangzhou, China
Summary of compliance with National Differences: N/A	

Copy of marking plate:

SOFAR SOLAR

Solar Inverter	Sofar 20000TL-S0
Maximum d.c. input voltage	1000V
DC voltage range	250-960V
Max. input current	2*24A
Maximum PV Isc	2*30A
Nominal output voltage	3/N/PE230V/400V
Max. output current	3*29A
Nominal frequency	50Hz
Max. output power	20000W
Power factor	>0. 99(adjustable)
Ingress protection	IP65
Operating temperature range	-25-+60°C
Protective class	Class I

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd

Made in China

SOFAR SOLAR

Solar Inverter	Sofar 17000TL-S0
Maximum d.c. input voltage	1000V
DC voltage range	250-960V
Max. input current	2*21A
Maximum PV Isc	2*27A
Nominal output voltage	3/N/PE230V/400V
Max. output current	3*25A
Nominal frequency	50Hz
Max. output power	17000W
Power factor	>0. 99(adjustable)
Ingress protection	IP65
Operating temperature range	-25-+60°C
Protective class	Class I

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd

Made in China

SOFAR SOLAR

Solar Inverter	Sofar 15000TL-S0
Maximum d.c. input voltage	1000V
DC voltage range	250-960V
Max. input current	2*21A
Maximum PV Isc	2*27A
Nominal output voltage	3/N/PE230V/400V
Max. output current	3*22A
Nominal frequency	50Hz
Max. output power	15000W
Power factor	>0. 99(adjustable)
Ingress protection	IP65
Operating temperature range	-25-+60°C
Protective class	Class I

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd

Made in China

SOFAR SOLAR

Solar Inverter	Sofar 10000TL-S0
Maximum d.c. input voltage	1000V
DC voltage range	250-960V
Max. input current	2*15A
Maximum PV Isc	2*20A
Nominal output voltage	3/N/PE230V/400V
Max. output current	3*15A
Nominal frequency	50Hz
Max. output power	10000W
Power factor	>0. 99(adjustable)
Ingress protection	IP65
Operating temperature range	-25-+60°C
Protective class	Class I

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd

Made in China

S/N 9990123456789

Note:

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
2. Label is attached on the side surface of enclosure and visible after installation

Test item particulars ..... :	
Equipment mobility ..... :	☐ movable ☐ hand-held ☐ stationary ☒ fixed ☐ transportable ☐ for building-in
Connection to the mains ..... :	☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Enviromental category ..... :	☒ outdoor ☐ indoor unconditional ☐ indoor conditional
Over voltage category Mains ..... :	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV ..... :	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%) ..... :	-90 / +110 %
Tested for power systems ..... :	TN systems
IT testing, phase-phase voltage (V) ..... :	N/A
Class of equipment ..... :	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg) ..... :	46
Pollution degree ..... :	Outside PD3; Inside PD2
IP protection class ..... :	IP 65

Testing	
Date of receipt of test item(s) ..... :	18 Sep., 2013
Dates tests performed ..... :	05 Nov., 2013 – 30 Dec., 2013

Possible test case verdicts:	
– test case does not apply to the test object ..... :	N/A
– test object does meet the requirement ..... :	Pass (P)
– test object was not evaluated for the requirement ..... :	N/E
– test object does not meet the requirement ..... :	Fail (F)

General remarks:

"(see Attachment #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.
The tests results presented in this report relate only to the object tested.
This report shall not be reproduced except in full without the written approval of the testing laboratory.
List of test equipment must be kept on file and available for review.
Additional test data and/or information provided in the attachments to this report.
Throughout this report a ☒ comma / ☐ point is used as the decimal separator.

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

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The test report only allows to be revised only within the report defined retention period unless standard or regulation was withdrawn or invalid.

This report shall be used together with the report 130918053GZU-005.

Manufacturer's Declaration per sub-clause 6.2.5 of IECEE 02:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided :

☐ Yes
☒ Not applicable

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies) ..... :

Suga Networks Equipment (Shenzhen) Co., Ltd.

Floor 1 East & Floor 2 of Building B(Manufacturing Site), Floor 3 & 4 of Building A(Office Site), Block 12, Xi Cheng Industrial Park, Xi Xiang Street, BaoAn District, Shenzhen City, China

General product information:

Product covered by this report is grid-connected PV inverter for indoor or outdoor installation. The connection to the DC input and AC output are through connectors. The structure of the unit complied with the IP 65 requirement.

The inverters intended to operate at ambient temperature -25℃ - +60℃ and 250-960 Vdc input, which will be specified in the user manual, The inverters will output full power when operated at 45℃. If operated at higher than 45℃ temperature, the output power derating.

For all models, if the DC input voltage is higher than 850 Vdc the output power will be derating.

For model Sofar 20000TL-Sx, if the DC input voltage is lower than 430 Vdc, the output power will be derating.

For model Sofar 17000TL-Sx, if the DC input voltage is lower than 420 Vdc, the output power will be derating.

For model Sofar 15000TL-Sx, if the DC input voltage is lower than 370 Vdc, the output power will be derating.

For model Sofar 10000TL-Sx, if the DC input voltage is lower than 350 Vdc, the output power will be derating.

For all models, if the AC output voltage is lower than 230 Vac the output current will be limited to not higher than rated output current.

All the models have identical mechanical and electrical construction except some componnents and some parameter of the software architecture in order to control the max output power. And refer to the following table for detail.

Model	DC Cable Gland	PV connector	DC inside connector	Fuse PCB+ String detection board	DC surge arrester	DC switch	AC switch	AC surge arrester
Sofar 20000TL-S0 Sofar 17000TL-S0 Sofar 15000TL-S0 Sofar 10000TL-S0	√		√					
Sofar 20000TL-S1 Sofar 17000TL-S1 Sofar 15000TL-S1 Sofar 10000TL-S1	√		√			√		
Sofar 20000TL-S2 Sofar 17000TL-S2 Sofar 15000TL-S2 Sofar 10000TL-S2		√	√			√		
Sofar 20000TL-S3 Sofar 17000TL-S3 Sofar 15000TL-S3 Sofar 10000TL-S3		√		√		√		
Sofar 20000TL-S4 Sofar 17000TL-S4 Sofar 15000TL-S4 Sofar 10000TL-S4		√		√	√	√		
Sofar 20000TL-S5 Sofar 17000TL-S5 Sofar 15000TL-S5 Sofar 10000TL-S5		√		√	√	√		√

Sofar 20000TL-S6 Sofar 17000TL-S6 Sofar 15000TL-S6 Sofar 10000TL-S6		√		√	√	√	√	√
√ denote incorporating this component								

	Sofar 20000TL-Sx	Sofar 17000TL-Sx	Sofar 15000TL-Sx	Sofar 10000TL-Sx
PV connector (pair)	3×2	3×2	2×2	2×2
Boost chock	1800 μH	2100 μH	2100 μH	3000 μH
Boost IGBT (Q19, Q20, Q28, Q29)	2×2 parallel	2×2 parallel	2×2 parallel	2×1
Boost diode (D19, D20, D24, D25)	2×2 parallel	2×2 parallel	2×2 parallel	2×1
Input current sampling resistor (REA79, REA71, REA81, REA73)	15 kΩ	15 kΩ	15 kΩ	10 kΩ
Bus capacitor (CD1, CD2, CD3, CD4, CD5, CD6, CD7, CD8, CD39, CD40)	10 units	8 units	6 units	4 units
Boost capacitor (CA129, CA131, CA145, CA148)	4 units	4 units	3 units	2 units
Inverter chock	730 μH	850 μH	960 μH	1460 μH
IGBT module (QD1, QD2, QD3)	10-FZ12NMA080SH01-M260F DS_F3L80R12W1H3_B11	10-FZ12NMA080SH01-M260F DS_F3L80R12W1H3_B11	10-FZ12NMA080SH01-M260F DS_F3L80R12W1H3_B11 10-FZ12NMA040SH-M267F	10-FZ12NMA080SH01-M260F DS_F3L80R12W1H3_B11 10-FZ12NMA040SH-M267F
Input current sampling resistor (RB46, RB52, RB79, RB81, RB95, RB58)	2,7 kΩ	2,7 kΩ	2,7 kΩ	1,5 kΩ

Other than special notice, the model Sofar 20000TL-S6 is as the representative test model in this report.

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4	General testing requirements		P
4.1	General		P
4.2	General conditions for testing		P
4.2.1	Sequence of tests		P
4.2.2	Reference test conditions		P
4.2.2.1	Environmental conditions		P
	Unless otherwise specified, the following ambient environmental conditions shall exist in the test location: a) temperature of 15 °C to 40 °C b) a relative humidity of not more than 75 % and not less than 5% c) an air pressure of 75 kPa to 106 kPa. d) no frost, dew, percolating water, rain, solar radiation, etc.	Max. 60°C rated ambient temperature tested.	P
4.2.2.2	State of equipment		P
4.2.2.3	Position of equipment	Be fixed in accordance with the manufacturer's instruction.	P
4.2.2.4	Accessories		N/A
4.2.2.5	Covers and removable parts		N/A
4.2.2.6	Main supply	230 Vac, 50 Hz, three phase, TN system	P
4.2.2.7	Supply ports other than the mains		P
4.2.2.7.1	Photovoltaic supply sources		P
4.2.2.7.2	Battery inputs		N/A
4.2.2.8	Conditions of loading for output ports		P
4.2.2.9	Earthing terminals		P
4.2.2.10	Controls		N/A
	Controls which the operator can adjust shall be set to any position except that		N/A
	a) mains selection devices shall be set to the correct value unless otherwise noted in this standard;		N/A
	b) Combinations of settings shall not be made if they are prohibited by the manufacturer's instructions provided with the equipment.		N/A
4.2.2.11	Available short circuit current		P
4.3	Thermal testing		P
4.3.1	General		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4.3.2	Maximum temperature		P
4.3.2.1	General		P
	Materials and components shall be selected so that under the most severe rated operating conditions, the temperatures do not exceed the temperature limits below.		P
	Conformity is verified by measuring temperatures under the conditions given in 4.2 for each rated operating condition or mode of the PCE that could affect the resulting temperatures.		P
	The temperature limits specified below are total temperature limits (not temperature rise limits).		P
	Tests of equipment rated for use in ambient temperatures up to 50°C may be conducted at any ambient temperature in the range given in 4.2.2.1, in which case the difference between the maximum rated ambient temperature and the test ambient is to be subtracted from or added to (as appropriate) the measured temperatures for comparison to the limits specified below.		N/A
	PCE rated for use in ambient temperatures more than 50°C shall be tested at the maximum rated ambient temperature +/- 5°C. the difference between the maximum rated ambient temperature and the test ambient is to be subtracted from or added to the measured temperatures for comparison to the limits specified.	Maximum rated ambient temperature of the unit: 45°C@full loading, 60°C@derating Tested at an ambient temperature to simulate the worst condition. (See appended tables)	P
	PCE with different output ratings or with automatic derating for different ambient temperatures shall be tested under as many conditions as are necessary to record worst-case temperatures, including at least the maximum ambient before derating, and the maximum ambient with derating.		N/A
	During thermal testing within NORMAL CONDITIONS protective devices shall not operate.		P
	Temperatures are to be measured by thermocouples, except that for coils the change of resistance method may be used.	Method of thermocouples is used, including coils.	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Limits: - for coils and their insulation systems, the temperature limits in Table 1 apply.		P
	- for other components the measured temperatures shall not exceed the lower of:	(See appended tables)	P
	- the applicable IEC component standards		P
	- the component or material's rated manufacturer's operating temperature		P
	- if neither of the above exists, temperature limits are given in Table 2.		P
4.3.2.2	Touch temperatures		P
	The maximum temperature for accessible parts of the PCE shall be in compliance with table 3	(See appended tables)	P
	It is permitted that accessible parts that are required to get hot as part of their intended function (for example heatsinks) may have temperatures up to 100 °C, if the parts are marked with the hot surface marking of symbol 14 of Annex C. For products only for use in a closed electrical operating area the 100 °C limit does not apply.		P
4.3.2.3	Temperature limits for mounting surfaces		P
	In order to protect against long-term degradation of building materials, surfaces of the PCE that will be in contact with the mounting surface shall not exceed a maximum total temperature of 90 °C.		P
4.4	Testing in single fault condition		P
4.4.1	General		P
	Testing in single fault conditions is done to determine that no hazards result from reasonably expected fault conditions that may arise in normal service or from reasonably expected misuse.		P
	Fault testing shall be done unless it can be conclusively demonstrated that no hazards could arise from a particular fault condition, or unless alternative methods of checking conformity are specified in this standard in place of fault testing.		P
4.4.2	Test conditions and duration for testing under fault conditions		P
4.4.2.1	General		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The equipment shall be operated under the combination of conditions in 4.2, which is least favourable for the particular fault test being performed.		P
	Fault conditions are to be applied only one at a time and shall be applied in turn in any convenient order. Multiple simultaneous faults shall not be applied, but a subsequent fault may arise as a consequence from an applied fault. Separate samples of the EUT may be used for each separate fault test applied, or the same sample may be used for many tests if damage from previous fault tests has been repaired or will not affect the results of further tests.		P
4.4.2.2	Duration of tests		P
	The equipment shall be operated until further change as a result of the applied fault is unlikely, as determined by (for example) opening of a device that removes the influence of the fault, stabilization of temperatures, etc.		P
	If a non-resettable, manual, or automatically resetting protective device or circuit operates in such a way as to interrupt or mitigate the fault condition, the test duration is as follows:		P
	- automatic reset devices or circuits: allow the protection to cycle on and off until no further change as a result of the applied fault is likely, until the ultimate result is obtained, or until temperatures stabilize		P
	- manual reset devices or circuits: three cycles, with the device or circuit reset as soon as possible after tripping		N/A
	- non-resettable devices or circuits: one cycle		P
4.4.3	Pass/fail criteria for testing under fault conditions		P
4.4.3.1	Protection against shock hazard		P
	Compliance with requirements for protection against electric shock is checked after the application of single faults as follows:	(See appended tables)	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	a) by making measurements to check that no accessible DVC-A circuits have become shock hazardous using the steady state limits for DVC-A in Table 6 and the short-term limits of 7.3.2.3, and that such circuits remain separated from live parts at voltages greater than DVC A with at least basic insulation. Compliance is checked by the test of 7.5.2 (without humidity preconditioning) for basic insulation; and		P
	b) by performing a dielectric strength test as per 7.5.2 (without humidity preconditioning) in the following cases:		P
	i) on reinforced or double Insulation, using the test level for Basic insulation, and		N/A
	ii) on basic insulation in Protective Class I equipment, using the test level for Basic insulation, unless it can be determined that the fault did not result in any damage to the protective earthing conductor or terminal, or to protective bonding means; and		P
	c) by inspection to ensure a fuse connected between the protective earthing terminal and the protective earthing conductor in the test setup has not opened; the fuse shall be rated 3A non-time-delay (for equipment rated for use on circuits protected by overcurrent protection rated 30A or less) or 30A to 35A non-time-delay(for equipment rated for use on circuits protected by overcurrent protection rated more than 30A); the enclosure is not to be contacting earth in any other location during the testing; and		P
	d) by inspection of the enclosure to ensure that no damage has resulted that allows access to parts that are hazardous live.		P
4.4.3.2	Protection against the spread of fire		P
	Compliance with requirements for protection against the spread of fire is checked by placing the equipment on white tissue-paper covering a soft-wood surface and covering the equipment with cheesecloth or surgical cotton during the fault testing. As an alternative, the cheesecloth or surgical cotton may be placed only over the openings of large equipment.		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	There shall be no emission of molten metal, burning insulation, or flaming or glowing particles from the fire enclosure, and there shall be no charring, glowing, or flaming of the tissue paper, cheesecloth, or glowing or flaming of surgical cotton.		P
4.4.3.3	Protection against other hazards		P
	Conformity with requirements for protection against other HAZARDS after application of the fault tests is checked as specified elsewhere in this standard.		P
4.4.3.4	Protection against parts expulsion hazards		P
	Failure of any component within the PCE shall not release parts outside the PCE enclosure with sufficient energy to lead to a hazard, for example, expulsion of material into an area occupied by personnel.		P
4.4.4	Single Fault conditions to be applied	(See appended tables)	P
4.4.4.1	Component fault tests		P
	The following faults are simulated:		P
	a) Short circuit or open circuit of relevant components		P
	b) Short circuit or open circuit of any components or insulation where failure could adversely affect supplementary insulation or reinforced insulation.		N/A
	c) In addition, where required by Method 2 of 9.1.1, components that could result in a fire hazard are to be overloaded unless they comply with the requirements of 9.1.3		P
4.4.4.2	Equipment or parts for short-term or intermittent operation	Not for short-term or intermittent operation	N/A
	Components such as motors, relays, other electromagnetic devices and heaters, which are normally operated only intermittently, shall be operated continuously if continuous operation could occur in a single fault conditions.		N/A
4.4.4.3	Motors		P
	Motors shall be stopped while fully energized or prevented from starting, whichever is less favourable		P
4.4.4.4	Transformer short circuit tests	(See appended table)	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The output windings of transformers shall be short circuited one at a time. A transformer damaged during one test may be repaired or replaced before the next test.		P
4.4.4.5	Output short circuit		P
	Testing is required to be performed on all combinations of terminals for the port under consideration, two at a time, including neutral and earth terminals, and one test with all current-carrying terminals of the port shorted together at once.		P
	the short-circuit currents are to be recorded and if they exceed the maximum rated current of the circuit, the maximum measured current shall be provided in the installation manual for the purpose of coordination of overcurrent protection of the external circuit conductors.	The values are recorded and stated in the installation manual.	P
4.4.4.6	Backfeed current test for equipment with more than one source of supply		P
	For equipment intended to be connected simultaneously to more than one source of supply, each input of the PCE shall be tested one at a time, to determine if hazardous conditions can result from current from one source of supply flowing into the wiring for another source under fault conditions.		P
	With the PCE operating under normal conditions, a short circuit shall be applied at the field wiring terminals of the circuit under consideration, with all intended other sources connected to the PCE through the overcurrent protective devices (if any) intended to be present in the installation.	Test at 1. short circuit DC input 2. decrease the input voltage to simulate de-energy of PV module	P
	the short-circuit currents are to be recorded and if they exceed the maximum rated current for the port, the maximum measured current shall be provided in the installation manual for the purpose of coordination of overcurrent protection of the external circuit conductors		P
4.4.4.7	Output overload		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Each output of the PCE, and each section of a tapped output, shall be overloaded in turn, one at a time. The other windings are loaded or not loaded, whichever load condition of normal use is less favorable. Overloading is carried out by connecting a variable resistor across the winding. The resistor is adjusted as quickly as possible and readjusted, if necessary, after 1 min to maintain the applicable overload. No further readjustments are then permitted.	(See appended table)	P
	If overcurrent protection is provided by a currentsensitive device or circuit, the overload test current is the maximum current which the overcurrent protection device is just capable of passing for 1 h. If this value cannot be derived from the specification, it is to be established by test. Before the test, the device is made inoperative or replaced by a link with negligible impedance.		P
	For equipment in which the output voltage is designed to collapse when a specified overload current is reached, the overload is slowly increased to the point of maximum output power before the point which causes the output voltage to collapse.	The PCE is overloaded to the max. output power before the point voltage collapse	P
	In all other cases, the loading is the maximum power output obtainable from the output.		P
4.4.4.8	Cooling system failure	Blanketing test for the heatsink according to IEC 62109-2 Clause 4.4.4.17	P
4.4.4.9	Heating devices	No heating devices	N/A
	In equipment incorporating heating devices, the following faults shall be applied one at a time: a) timers which limit the heating period shall be overridden to energize the heating circuit continuously; b) temperature control devices or circuits shall have single fault conditions applied such that control over the heater is lost. Over-temperature protection devices meeting the requirements of 14.3 are left operational during the test.		N/A
4.4.4.10	Safety interlock	No safety interlock	N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4.4.4.11	Reverse d.c. connections	Reverse DC+ and DC-, the unit cannot start-up. No damage.	P
4.4.4.12	Voltage selector mismatch	No voltage selector	N/A
4.4.4.13	Mis-wiring with incorrect phase sequence or polarity	Inverter did not work.	P
4.4.4.14	PWB short-circuit test	The functional insulation less than required, then short-circuit	P
4.5	Humidity preconditioning		P
4.5.1	General		P
4.5.2	Conditions		P
	Relative humidity (%), temperature (°C)	93% R.H. 40℃. 48H	P
4.6	Voltage Backfeed protection		P
4.6.1	Backfeed tests under normal conditions		P
4.6.2	Backfeed tests under single-fault conditions		P
4.6.3	Compliance with backfeed tests		P
	The PCE is compliant with the requirements if during the tests in 4.6.1 and 4.6.2 no hazardous voltage or energy is present on the PCE terminals for the source under test. Measurements are taken 15 s or 1 s after the source is de-energized or disconnected, as follows:		P
	- 15 s for sources that are connected by fixed wiring		P
	- 1 s for sources that are cord-connected or use connectors that can be opened without the use of a tool		N/A
4.7	Electrical ratings tests	(See appended table)	P
4.7.1	Input ratings		P
4.7.1.1	Measurement requirements for DC input ports		P
4.7.2	Output ratings		P

5	**MARKING AND DOCUMENTATION**		P
5.1	Marking		P
5.1.1	General		P
	Equipment shall bear markings as specified in 5.1 and 5.2	Label are marked on PCE and graphic symbol is explained in user manual	P

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Clause	Requirement – Test	Result – Remark	Verdict
	Graphic symbols may be used and shall be in accordance with Annex C or IEC 60417 as applicable.		P
	Graphic symbols shall be explained in the documentation provided with the PCE.		P
5.1.2	Durability of markings		P
	Markings required by this clause to be located on the PCE shall remain clear and legible under conditions of NORMAL USE and resist the effects of cleaning agents specified by the manufacturer		P
5.1.3	Identification		P
	The equipment shall, as a minimum, be permanently marked with:		P
	a) the name or trade mark of the manufacturer or supplier	Trade mark: 	P
	b) model number, name or other means to identify the equipment	Sofar 20000TL-Sx, Sofar 17000TL-Sx, Sofar 15000TL-Sx, Sofar 10000TL-Sx (x=0-6)	P
	c) a serial number, code or other marking allowing identification of manufacturing location and the manufacturing batch or date within a three month time period.	Within three month	P
5.1.4	Equipment ratings	See below	P
	Unless otherwise specified in another part of IEC 62109, the following ratings, as applicable shall be marked on the equipment:	Special requirement as EN 62109-2	P
	– input voltage, type of voltage (a.c. or d.c.), frequency, and max. continuous current for each input	Refer to the marking label on page 5	P
	– output voltage, type of voltage (a.c. or d.c.), frequency, max. continuous current, and for a.c. outputs, either the power or power factor for each output	Refer to the marking label on page 5	P
	– the ingress protection (IP) rating as in 6.3 below	IP 65	P
5.1.5	Fuse identification		P
	Marking shall be located adjacent to each fuse or fuseholder, or on the fuseholder, or in another location provided that it is obvious to which fuse the marking applies, giving the fuse current rating and where fuses of different voltage rating value could be fitted, the fuse voltage rating.		N/A
	Where fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	For fuses not located in operator access areas and for soldered-in fuses located in operator access areas, it is permitted to provide an unambiguous cross-reference (for example, F1, F2, etc.) to the servicing instructions which shall contain the relevant information.		P
5.1.6	Terminals, Connections, and Controls		P
	If necessary for safety, an indication shall be given of the purpose of Terminals, connectors, controls, and indicators, and their various positions, including any connections for coolant fluids such as water and drainage. The symbols in Annex C may be used, and where there is insufficient space, symbol 9 of Annex C may be used.		P
	Push-buttons and actuators of emergency stop devices, and indicator lamps used only to indicate a warning of danger or the need for urgent action shall be coloured red.	No such device.	N/A
	A multiple-voltage unit shall be marked to indicate the particular voltage for which it is set when shipped from the factory. The marking is allowed to be in the form of a paper tag or any other nonpermanent material.	The PCE is not intended to connect to multiple-voltage and there is no voltage setting device.	N/A
	A unit with d.c. terminals shall be plainly marked indicating the polarity of the connections, with:	See below	P
	– the sign “+“ for positive and “-„ for negative; or		P
	– a pictorial representation illustrating the proper polarity where the correct polarity can be unambiguously determined from the representation	Not provided	N/A
5.1.6.1	Protective Conductor Terminals		P
	The means of connection for the protective earthing conductor shall be marked with:	The protective earthing terminal is connected via AC connector.	P
	– symbol 7 of Annex C; or		P
	– the letters “PE“; or		N/A
	– the colour coding green-yellow.		N/A
5.1.7	Switches and circuit-breakers		P
	The on and off-positions of switches and circuits breakers shall be clearly marked. If a push-button switch is used as the power switch, symbols 10 and 16 of Annex C may be used to indicate the on-position, or symbols 11 and 17 to indicate the off-position, with the pair of symbols (10 and 16, or 11 and 17) close together.		P
5.1.8	Class II Equipment	Class I	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	Equipment using Class II protective means throughout shall be marked with symbol 12 of Annex C. Equipment which is only partially protected by DOUBLE INSULATION or REINFORCED INSULATION shall not bear symbol 12 of Table Annex C.		N/A
	Where such equipment has provision for the connection of an earthing conductor for functional reasons (see 7.3.6.4) it shall be marked with symbol 6 of Annex C		N/A
5.1.9	Terminal boxes for External Connections	No such terminal box	N/A
	Where required by note 1 of Table 2 as a result of high temperatures of terminals or parts in the wiring compartment, there shall be a marking, visible beside the terminal before connection, of either:		N/A
	a) the minimum temperature Rating and size of the cable to be connected to the TERMINALS; or		N/A
	b) a marking to warn the installer to consult the installation instruction. Symbol 9 of Table D-1 is an acceptable marking		N/A
5.2	Warning markings		P
5.2.1	Visibility and legibility requirements for warning markings		P
	Warning markings shall be legible, and shall have minimum dimensions as follows:		P
	– Printed symbols shall be at least 2,75 mm high		P
	– Printed text characters shall be at least 1.5 mm high and shall contrast in colour with the background		P
	– Symbols or text that are moulded, stamped or engraved in a material shall have a character height of at least 2,0 mm, and if not contrasting in colour from the background, shall have a depht or raised height of at least 0,5 mm.		P
	If it is necessary to refer to the instruction manual to preserve the protection afforded by the equipment, the equipment shall be marked with symbol 9 of Annex C	The manual provide necessary information for warning marking	P
	Symbol 9 of Annex C is not required to be used adjacent to symbols that are explained in the manual		P
5.2.2	Content for warning markings		P
5.2.2.1	Ungrounded heatsinks and similar parts	Grounded heatsink and metal enclosure	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	An ungrounded heat sink or other part that may be mistaken for a grounded part and involves a risk of electric shock in accordance with 7.3 shall be marked with symbol 13 of Annex C, or equivalent. The marking may be on or adjacent to the heatsink and shall be clearly visible when the PCE is disassembled to the extent that a risk of contact with the heatsink exists.		N/A
5.2.2.2	Hot Surfaces		P
	A part of the PCE that exceeds the temperature limits specified in 4.3.2 shall be marked with symbol 14 of Annex C or equivalent.		P
5.2.2.3	Coolant	Coolant is not used	N/A
	A unit containing coolant that exceeds 70 °C shall be legibly marked externally where readily visible after installation with symbol 15 of Annex C. The documentation shall provide a warning regarding the risk of burns from hot coolant, and either:		N/A
	a) statement that coolant system servicing is to be done only by SERVICE PERSONNEL, or		N/A
	b) instructions for safe venting, draining, or otherwise working on the cooling system, if these operations can be performed without OPERATOR access to HAZARDS internal to the equipment		N/A
5.2.2.4	Stored energy		P
	Where required by 7.3.9.2 or 7.4.2 the PCE shall be marked with Symbol 21 of Annex C and the time to discharge capacitors to safe voltage and energy levels shall accompany the symbol.	Refer to label with symbol 21 of Annex C and the time	P
5.2.2.5	Motor guarding		N/A
	Where required by 8.2 a marking shall be provided where it is visible to service personnel before removal of a guard, warning of the hazard and giving instructions for safe servicing (for example disconnection of the source before removing the guard).	Not danger moving parts	N/A
5.2.3	Sonic hazard markings and instructions	Hazardous noise level not produced	N/A
	If required by 10.2.1 a PCE shall:		N/A
	a) be marked to warn the operator of the sonic pressure hazard; or		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	b) be provided with installation instructions that specify how the installer can enxure that the sound pressure level from equipment at its point of use after installation, will not reach a value, which could cause a hazard. These instructions shall include the measured sound pressure level, and shall identify readily available and practicable protective materials or measures which may be used.		N/A
5.2.4	Equipment with multiple sources of supply		P
	A PCE with connections for multiple energy sources shall be marked with symbol 13 of Annex C and the manual shall contain the information required in 5.3.4.		P
	The symbol shall be located on the outside of the unit or shall be prominently visible behind any cover giving access to hazardous parts.		P
5.2.5	Excessive touch current		N/A
	Where required by 7.3.6.3.7 the PCE shall be marked with symbol 15 of Annex C. See also 5.3.2 for information to be provided in the installation manual.	The touch current does not exceed limited	N/A
5.3	Documentation		P
5.3.1	General		P
	The documentation provided with the PCE shall provide the information needed for the safe operation, installation, and (where applicable) maintenance of the equipment. The documentation shall include the items required in 5.3.2 through 5.3.4, and the following:		P
	a) explanations of equipment makings, including symbols used		P
	b) location and function of terminals and controls		P
	c) all ratings or specifications that are necessary to safely install and operate the PCE, including the following environmental ratings along with an explanation of their meaning and any resulting installation requirements:		P
	– ENVIRONMENTAL CATEGORY as per 6.1	Outdoor	P
	– WET LOCATIONS classification fort he intended external environment as per 6.1	Suitable for wet location	P
	– POLLUTION DEGREE classification for the intended external environment as per 6.2	Outside: PD3, Inside: PD2	P
	– INGRESS PROTECTION rating as per 6.3	IP 65	P
	– Ambient temperature and relative humidity ratings	Max. +60℃ and 95% R.H.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	– MAXIMUM altitude rating	2000 m	P
	– OVERVOLTAGE CATEGORY assigned to each input and output port as per 7.3.7.1.2, accompanied by guidance regarding how to ensure that the installation complies with the required overvoltage categories;	OVC II (PV), OVC III (Mains)	P
	d) a warning that when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE		P
5.3.1.1	Language	English provide	P
	Instructions related to safety shall be in a language that is acceptable in the country where the equipment is to be installed.	For other country language further evaluated is needed	N/A
5.3.1.2	Format		P
	In general, the documentation must be provided in printed form and is to be delivered with the equipment.	Printed form provided	P
	For equipment which requires the use of a computer for both installation and operation, documentation may be provided in electronic format without accompanying printed format.		N/A
5.3.2	Information related to installation		P
	The documentation shall include installation and where applicable, specific commissioning instructions and, if necessary for safety, warnings against hazards which could arise during installation or commissioning of the equipment. The information provided shall include:		P
	a) assembly, location, and mounting requirements:		P
	b) ratings and means of connection to each source of supply and any requirements related to wiring and external controls, colour coding of leads, disconnection means, or overcurrent protection needed, including instructions that the installation position shall not prevent access to the disconnection means;		P
	c) ratings and means of connection of any outputs from the PCE, and any requirements related to wiring and externals controls, colour coding of leads, or overcurrent protection needed;		P
	d) explanation of the pin-out of connectors for external connections, unless the connector is used for a standard purpose (e.g. RS 232)		P
	e) ventilation requirements;		P

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Clause	Requirement – Test	Result – Remark	Verdict
	f) requirements for special services, for example cooling liquid;	No special services	N/A
	g) instructions and information relating to sound pressure level if required by 10.2.1;		N/A
	h) where required by 14.8.1.3, instructions for the adequate ventilation of the room or location in which PCE containing vented or valve-regulated batteries is located, to prevent the accumulation of hazardous gases;	No such battery	N/A
	i) tightening torque to be applied to wiring terminals;		N/A
	j) values of backfeed short-circuit currents available from the PCE on input and output conductors under fault conditions, if those currents exceeds the max. rated current of the circuit, as per 4.4.4.6;	Not exceeds the max. rated current.	N/A
	k) for each input to the PCE, the max value of short-circuit current available from the source, for which the PCE is designed; and		P
	l) compatibility with RCD and RCM;	Internal RCM is used	N/A
	m) instructions for protective earthing, including the information required by 7.3.6.3.7 if a second protective earthing conductor is to be installed:	Touch current is not exceed limit	N/A
	n) where required by 7.3.8, the installation instructions shall include the following or equivalent wording:		N/A
	"This product can cause a d.c. current in the external protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in a case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product."	Internal RCM is used	N/A
	o) for PCE intended to charge batteries, the battery nominal voltage rating, size, and type	Grid interactive	N/A
	p) PV array configuration information, such as ratings, whether the array is to be grounded or floating, any external protection devices needed, etc.		P
5.3.3	Information related to operation		P
	Instructions for use shall include any operating instructions necessary to ensure safe operation, including the following, as applicable:		P
	– Instructions for adjustment of controls including the effects of adjustment;		P

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Clause	Requirement – Test	Result – Remark	Verdict
	– Instructions for interconnection to accessories and other equipment, including indication of suitable accessories, detachable parts and any special materials;		P
	– Warnings regarding the risk of burns from surfaces permitted to exceed the temperature limits of 4.3.2 and required operator actions to reduce the risk; and		P
	– Instructions, that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.		P
5.3.4	Information related to maintenance		P
	Maintenance instructions shall include the following:		P
	– Intervals and instructions for any preventive maintenance that is required to maintain safety (for example air filter replacement or periodic re-tightening of terminals);		P
	– Instructions for accessing operator access areas, if any are present, including a warning not to enter other areas of the equipment;		N/A
	– Part numbers and instructions for obtaining any required operator replaceable parts;	No such part	N/A
	– Instructions for safe cleaning (if recommended)		N/A
	– Where there is more than one source of supply energizing the PCE, information shall be provided in the manual to indicate which disconnect device or devices are required to be operated in order to completely isolate the equipment.		P
5.3.4.1	Battery maintenance	No battery inside	N/A
	Where required by 14.8.5, the documentation shall include the applicable items from the following list of instructions regarding maintenance of batteries:		N/A
	– Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions		N/A
	– When replacing batteries, replace with the same type and number of batteries or battery packs		N/A
	– General instructions regarding removal and installation of batteries		N/A
	– CAUTION: Do not dispose of batteries in a fire. The batteries may explode.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	– CAUTION: Do not open or damage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.		N/A
	– CAUTION: A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:		N/A
	a) Remove watches, rings, or other metal objects.		N/A
	b) Use tools with insulated handles.		N/A
	c) Wear rubber gloves and boots.		N/A
	d) Do not lay tools or metal parts on top of batteries		N/A
	e) Disconnect charging source prior to connecting or disconnecting battery terminals		N/A
	f) Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).		N/A
6	**ENVIRONMENTAL REQUIREMENTS AND CONDITIONS**		P
	The manufacturer shall rate the PCE for the following environmental conditions:		P
	– ENVIRONMENTAL CATEGORY, as in 6.1 below	Outdoor use	P
	– Suitability for WET LOCATIONS or not	Yes	P
	– POLLUTION DEGREE rating in 6.2 below	Outside: PD3, Inside: PD2	P
	– INGRESS PROTECTION (IP) rating, as in 6.3 below	IP 65	P
	– Ultraviolet (UV) exposure rating, as in 6.4 below	Yes	P
	– Ambient temperature and relative humidity ratings, as in 6.5 below	Max. 60℃, 95%R.H.	P
6.1	Environmental categories and minimum environmental conditions		P
6.1.1	Outdoor		P
6.1.2	Indoor, unconditioned		N/A
6.1.3	Indoor, conditioned		N/A
6.2	Pollution degree	PD3 outside. PD2 inside	P
6.3	Ingress Protection	IP 65	P

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Clause	Requirement – Test	Result – Remark	Verdict
6.4	UV exposure	Yes	P
6.5	Temperature and humidity	Max. 60℃, 95%R.H.	P
7	**PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS**		P
7.1	General		P
7.2	Fault conditions	Normal and single fault condition are considered	P
7.3	Protection against electric shock		P
7.3.1	General	In the PCE the earthed metal enclosure is evaluated by means of basic insulation from DVC C circuit DVC A circuit and unearthed accessible parts are evaluated by means of reinforced insulation from DVC C or protective impedance DVC C circuit: The PV input and the Main output DVC A circuit: The signal communication output port.	P
7.3.2	Decisive voltage classification		P
7.3.2.1	Use of decisive voltage class (DVC)	Working voltage and protective measure and considered	P
7.3.2.2	Limits of DVC (according table 6)	Wet location is considered for PCE outside only	P
7.3.2.3	Short-terms limits of accessible voltages under fault conditions		P
7.3.2.4	Requirements for protection (according table 7)	Single fault condition is considered	P
7.3.2.5	Connection to PELV and SELV circuits	The external signal communication port are considered as SELV	P
7.3.2.6	Working voltage and DVC		P
7.3.2.6.1	General	Transients and voltage fluctuation are disregarded. And worst case normal operation condition is considered	P
7.3.2.6.2	AC working voltage (see Figure 2)		P
7.3.2.6.3	DC working voltage (see Figure 3)		P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.2.6.4	Pulsating working voltage (see Figure 4)		P
7.3.3	protective separation	In the PCE the earthed metal enclosure is evaluated by means of basic insulation from DVC C circuit DVC A circuit and unearthed accessible parts are evaluated by means of reinforced insulation from DVC C or protective impedance DVC C circuit: The PV input and the Main output DVC A circuit: The signal communication output port	P
	Protective separation shall be achieved by:		P
	▪ double or reinforced insulation, or		P
	▪ protective screening, i.e. by a conductive screen connected to earth by protective bonding in the PCE, or connected to the protective earth conductor itself, whereby the screen is separated from live parts by at least basic insulation, or		P
	▪ protective impedance comprising limitation of current per 7.3.5.3 and of discharged energy per 7.3.5.4, or		P
	▪ limitation of voltage according to 7.3.5.4.		N/A
	The protective separation shall be fully and effectively maintained under all conditions of intended use of the PCE		P
7.3.4	Protection against direct contact		P
7.3.4.1	General		P
	Protection against direct contact is employed to prevent persons from touching live parts that do not meet the requirements of 7.3.5 and shall be provided by one or more of the measure given in 7.3.4.2 (enclosures and barriers) and 7.3.4.3 (insulation).	Enclosure provided	P
	Open type sub-assemblies and devices do not require protective measures against direct contact but the instruction provided with the equipment must indicate that such measures must be provided in the end equipment or in the installation.	End use product	N/A
	Product intended for installation in CLOSED ELECTRICAL OPERATING AREAS, (see 3.9) need not have protective measures against direct contact, except as required by 7.3.4.2.4.	Not use under this condition	N/A
7.3.4.2	Protection by means of enclosures and barriers		P

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Clause	Requirement – Test	Result – Remark	Verdict
	The following requirements apply where protection against contact with live parts is provided by enclosures or barriers, not by insulation in accordance with 7.3.4.3.	Enclosure provided to prevent access to inside live parts	P
7.3.4.2.1	General		P
	Parts of enclosures and barriers that provide protection in accordance with these requirements shall not be removable without the use of a tool (see 7.3.4.2.3).	Secured by screws	P
	Polymeric materials used to meet these requirements shall also meet the requirements of 13.6	The plastic board as part of enclosure is evaluated as clause 13.6	P
7.3.4.2.2	Access probe criteria		P
	Protection is considered to be achieved when the separation between the test probes and live parts, when tested as described below, is as follows:		P
	a) decisive voltage classification A, (DVC A) - the probe may touch the live parts	The signal is considered as DVC A	P
	b) decisive voltage classification B, (DVC B) - the probe must not touch bare live parts	The DVC B circuit is not accessible by probe	P
	c) decisive voltage classification C, (DVC C) – the probe must have adequate clearance to live parts, based on the clearance for Basic insulation using the recurring peak working voltage involved,	The DVC C circuit is not accessible by probe	P
7.3.4.2.3	Access probe tests		P
	Compliance with 7.3.4.2.1 is checked by all of the following:		P
	a) Inspection; and		P
	b) Tests with the test finger (Figure D.1) and test pin (Figure D.2) of 0E, the results of which shall comply with the requirements of 7.3.4.2.1 a), b), and c) as applicable. Probe tests are performed on openings in the enclosures after removal of parts that can be detached or opened by an operator without the use of a tool, including fuseholders, and with operator access doors and covers open. It is permitted to leave lamps in place for this test. Connectors that can be separated by an operator without use of a tool, shall also be tested during and after disconnection. Any movable parts are to be put in the most unfavorable position.		P

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Clause	Requirement – Test	Result – Remark	Verdict
	The test finger and the test pin are applied as above, without appreciable force, in every possible position, except that floor-standing equipment having a mass exceeding 40 kg is not tilted.		P
	Equipment intended for building-in or rack mounting, or for incorporation in larger equipment, is tested with access to the equipment limited according to the method of mounting detailed in the installation instructions.		N/A
	c) Openings preventing the entry of the jointed test finger (Figure E-1 of 0E) during test b) above, are further tested by means of straight unjointed test finger (Figure E-3 of 0E), applied with a force of 30 N. If the unjointed finger enters, the test with the jointed finger is repeated except that the finger is applied using any necessary force up to 30 N.		P
	d) In addition to a) – c) above, top surfaces of enclosure shall be tested with the IP3X probe of IEC 60529. The test probe shall not penetrate the top surface of the enclosure when probed from the vertical direction ±5 ° only.	IP65	P
7.3.4.2.4	Service access areas	Inside PCE are not intentionally touched with energized part when installation and maintenance. Symbol 21 of Annex C are marked on PCE and explained in user manual	P
7.3.4.3	Protection by means of insulation of live parts	The earthed enclosure is with basic insulation form the live parts inside	P
	Where the requirements of 7.3.4.2 are not met, live parts shall be provided with insulation if:		P
	– their working voltage is greater than the maximum limit of decisive voltage class A, or		P
	– for a DVC A or B circuit, protective separation from adjacent circuit of DVC C is not provided (see note “‡“ under Table 7)		P
7.3.5	Protection in case of direct contact	The single communication port are direct contact and evaluated with reinforced insulation from live part	P
7.3.5.1	General		P
	Protection in case of direct contact is required to ensure that contact with live parts does not produce a shock hazard.		P

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Clause	Requirement – Test	Result – Remark	Verdict
	The protection against direct contact according to 7.3.4 is not required if the circuit contacted is separated from other circuits according to 7.3.2.3, and:	Considered	P
	– is of decisive voltage class A and complies with 7.3.5.2, or	The single communication port is DVC A and reinforced insulation from the live part by means of isolation transformer	P
	– is provided with protective impedance according to 7.3.5.3, or		N/A
	– is limited in voltage according to 7.3.5.4		N/A
	In addition to the measures as given in 7.3.5.2 to 7.3.5.4, it shall be ensured that in the event of error or polarity reversal of connectors no voltages that exceed DVC A can be connected into a circuit with protective separation. This applies for example to plug-in-sub-assemblies or other plug-in devices which can be plugged-in without the use of a tool (key) or which are accessible without the use of a tool.	Considered	P
	Conformity is checked by visual inspection and trial insertion.		P
7.3.5.2	Protection using decisive voltage class A	The single communication port is DVC A and reinforced insulation from the live part by means of isolation transformer	P
7.3.5.3	Protection by means of protective impedance	Protective impedance not used as protective separation in the PCE	N/A
	Circuits and conductive parts do not require protection against direct contact if any connection to circuits of DVC-B or DVC-C is through protective impedance, and the accessible circuit or part is otherwise provided with protective separation from circuits of DVC-B or DVC-C according 7.3.3.		N/A
7.3.5.3.1	Limitation of current through protective impedance		N/A
	The current available through protective impedance to earth and between simultaneously accessible parts, measured at the accessible live parts, shall not exceed a value of 3,5 mA a.c. or 10 mA d.c. under normal and single-fault conditions.		N/A
7.3.5.3.2	Limitation of discharging energy through protective impedance		N/A
	The discharging energy available between simultaneously accessible parts protected by protective impedance shall not exceed the charging voltage and capacitance limits given in Table 9, which applies to both wet and dry locations, under normal and single fault conditions. Refer to figure 8.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.5.4	Protection by means of limited voltages	No such design	N/A
	That portion of a circuit that has its voltage reduced to DVC-A by a voltage divider that complies with the following requirements, and that is otherwise provided with protective separation from circuits of DVC-B or DVC-C according to 7.3.3, does not require protection against direct contact.		N/A
	The voltage divider shall be designed so that under normal and single fault conditions, including faults in the voltage division circuit, the voltage across the output of the voltage divider does not exceed the limit for DVC-A.		N/A
	This type of protection shall not be used in case of protective class II or unearthed circuits, because it relies on protective earth being connected.		N/A
7.3.6	Protection against indirect contact		P
7.3.6.1	General		P
	Protection against indirect contact is required to prevent shock- hazardous current being accessible from conductive parts during an insulation failure. This protection shall comply with the requirements for protective class I (basic insulation plus protective earthing), class II (double or reinforced insulation) or class III (limitation of voltages)	Class I also with reinforced insulation design inside PCE	P
	That part of a PCE meets the requirements of 7.3.6.2 and 7.3.6.3 is defined as protective class I	The earthed metal enclosure meet this requirement	P
	That part of a PCE meets the requirements of 7.3.6.4 is defined as protective class II.	The signal communication port is reinforced insulation from live parts inside	N/A
	That part of PCE which meets the requirements of decisive voltage class A and in which no hazardous voltages are derived, is defined as protective class III. No shock hazard is present in such circuits.		N/A
	Where protection against indirect contact is dependent on means provided during installation, the installation instructions shall provide details of the required means and shall indicate the associated hazards.	The manual require the PCE must be securely earthed	P
7.3.6.2	Insulation between live parts and accessible conductive parts		P
	Accessible conductive parts of equipment shall be separated from live parts by insulation meeting the requirements of Table 7 or by clearances as specified in 7.3.7.4 and creepages as specified in 7.3.7.5	See Cl. 7.3.7.4 and Cl. 7.3.7.5	P
7.3.6.3	Protective class I – Protective bonding and earthing		P
7.3.6.3.1	General		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Equipment of protective class I shall be provided with protective earthing, and with protective bonding to ensure electrical contact between accessible conductive parts and the means of connection for the external protective earthing conductor, except bonding is not required for:		P
	a) accessible conductive parts that are protected by one of the measures in 7.3.5.2 to 7.3.5.4, or		N/A
	b) accessible conductive parts are separated from live parts of DVC-B or -C using double or reinforced insulation.		N/A
7.3.6.3.2	Requirements for protective bonding		P
	Electrical contact with the means of connection of the external protective earthing conductor shall be achieved by one or more of the following means:	The earthing wire is reliable secured to internal metal enclosure	P
	a) through direct metallic contact;		P
	b) through other conductive parts which are not removed when the PCE or sub-units are used as intended ;		N/A
	c) through a dedicated protective bonding conductor;		P
	d) through other metallic components of the PCE		N/A
	Where direct metallic contact is used and one or both of the parts involved is painted or coated, the paint or coating shall be removed in the area of contact, or reliably penetrated, to ensure metal to metal contact.	The metal enclosure is reliably penetrated and earthed	P
	For moving or removable parts, hinges or sliding contacts designed and maintained to have a low resistance are examples of acceptable means if they comply with the requirements of 7.3.6.3.3.	No such design	N/A
	Metal ducts of flexible or rigid construction and metallic sheaths shall not be used as protective bonding conductors, unless the device or material has been investigated as suitable for protective bonding purposes.	No such design	N/A
7.3.6.3.3	Rating of protective bonding		P
	Protective bonding shall withstand the highest thermal and dynamic stresses that can occur to the PCE item(s) concerned when they are subjected to a fault connecting live parts to accessible conductive parts. The protective bonding shall remain effective for as long as a fault to the accessible conductive parts persists or until an upstream protective device removes power from the part.		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Protective bonding shall meet following requirements:		P
	a) For PCE with an overcurrent protective device rating of 16 A or less, the impedance of the protective bonding means shall not exceed 0,1 Ω during or at the end of the test below.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the voltage drop in the protective bonding test shall not exceed 2,5 V during or at the end of the test below.		N/A
	As alternative to a) and b) the protective bonding may designed according to the requirements for the external protective earthing conductor in 7.3.6.3.5, in which case no testing is required.	The protective bonding is designed min. 4mm^2 wire	P
	The impedance of protective bonding means shall be checked by passing a test current through the bond for a period of time as specified below. The test current is based on the rating of the overcurrent protection for the equipment or part of the equipment under consideration, as follows:		N/A
	a) For pluggable equipment type A, the overcurrent protective device is that provided external to the equipment (for example, in the building wiring, in the mains plug or in an equipment rack);		N/A
	b) For pluggable equipment type B and fixed equipment, the maximum rating of the overcurrent protective device specified in the equipment installation instructions to be provided external to the equipment;		N/A
	c) For a circuit or part of the equipment for which an overcurrent protective device is provided as part of the equipment, the rating of the provided overcurrent device.		N/A
	Voltages are measured from the protective earthing terminal to all parts whose protective bonding means are being considered. The impedance of the protective earthing conductor is not included in the measurement. However, if the protective earthing conductor is supplied with the equipment, it is permitted to include the conductor in the test circuit but the measurement of the voltage drop is made only from the main protective earthing terminal to the accessible part required to be earthed.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	On equipment where the protective earth conncection to a subassembly or to a separate unit is part of a cable that also supplies power to that subassembly or unit, the resistance of the protective bonding conductor in that cable is not included in the protective bond impedance measurements for the subassembly or separate unit, as shown in Figure 11. However, this option is only permitted if the cable is protected by a suitably rated protective device that takes into account the size of the conductor. Otherwise the impedance of the protective bonding conductor between the separate units is to be included, by measuring to the protective earthing terminal where the power source enters the first unit in the system, as shown in Figure 12.		N/A
7.3.6.3.3.1	Test current, duration, and acceptance criteria		N/A
	The test current, duration of the test and acceptance criteria are as follows:		N/A
	a) For PCE with an overcurrent protective device rating of 16 A or less, the test current is 200% of the overcurrent protective device rating, but not less than 32 A, applied for 120s. The impedance of the protective bonding means during and at the end of the test shall not exceed 0,1 Ω.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the test current is 200% of the overcurrent protective device rating and the duration of the test is as shown in Table 10 below. The voltage drop in the protective bonding means, during and at the end of the test, shall not exceed 2,5 V.		N/A
	c) During and after the test, there shall be no melting, loosening, or other damage that would impair the effectiveness of the protective bonding means.		N/A
	The test current is derived from an a.c or d.c supply source, the output of which is not earthed.		N/A
	As an alternative to Table 10, where the time-current characteristic of the overcurrent protective device that limits the fault current in the protective bonding means is known because the device is either provided in the equipment or fully specified in the installation instructions, the test duration may be based on that specific device's time-current characteristic,. The tests are conducted for a duration corresponding to the 200% current value on the time-current characteristic.		N/A
7.3.6.3.4	Protective bonding impedance (routine test)	Manufacture declaration for this	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	If the continuity of the protective bonding is achieved at any point by a single means only (for example a single conductor or single fastener), or if the PCE is assembled at the installation location, then the impedance of the protective bonding shall also be tested as a routine test. The test shall be as in 7.3.6.3.3, except for the following:		N/A
	▪ the test current may be reduced to any convenient value greater than 10 A sufficient to allow measurement or calculation of the impedance of the protective bonding means:		N/A
	▪ the test duration may be reduced to no less than 2 s		N/A
	For equipment subject to the type test in 7.3.6.3.3.1a), the impedance during the routine test shall not exceed 0,1Ω.		N/A
	For equipment subject to the type test in 7.3.6.3.3.1b) the impedance during the routine test shall not exceed 2,5 V divided by the test current required by 7.3.6.3.3.1b).		N/A
7.3.6.3.5	External protective earthing conductor		P
	A protective earthing conductor shall be connected at all times when power is supplied to PCE of protective class I. Unless local wiring regulations state otherwise, the protective earthing conductor cross-sectional area shall be determined from Table 11 or by calculation according to IEC 60364-5-54.		P
	If the external protective earthing conductor is routed through a plug and socket or similar means of disconnection, it shall not be possible to disconnect it unless power is simultaneously removed from the part to be protected.	Permanently connected	N/A
	The cross-sectional area of every external protective earthing conductor which does not form part of the supply cable or cable enclosure shall, in any case, be not less than:		P
	▪ 2,5 mm² if mechanical protection is provided;		N/A
	▪ 4 mm² if mechanical protection is not provided.	The installation manual requires min 4mm^2 wire	P
	For cord-connected equipment, provisions shall be made so that the external protective earthing conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted.	Not cord-connected equipment.	N/A
7.3.6.3.6	Means of connection for the external protective earthing conductor		P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.6.3.6.1	General		P
	The means of connection for the external protective earthing conductor shall be located near the terminals for the respective live conductors. The means of connections shall be corrosion-resistant and shall be suitable for the connection of cables according to 7.3.6.3.5. The means of connection for the protective earthing conductor shall not be used as a part of the mechanical assembly of the equipment or for other connections. A separate means of connection shall be provided for each external protective earthing conductor. Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences. Where enclosures and/or conductors of aluminium or aluminium alloys are used, particular attention should be given to the problems of electrolytic corrosion.		P
	The means of connection for the protective earthing conductor shall be permanently marked with:		P
	• symbol 7 of Annex C; or		P
	• the colour coding green-yellow		N/A
	Marking shall not be done on easily changeable parts such as screws.		P
7.3.6.3.7	Touch current in case of failure of the protective earthing conductor		P
	The requirements of this sub-clause shall be satisfied to maintain safety in case of damage to or disconnection of the protective earthing conductor.		P
	For pluggable equipment type A, the touch current measured in accordance with 7.5.4 shall not exceed 3,5 mA a.c. or mA d.c.		N/A
	For all other PCE, one or more of the following measure shall be applied, unless the touch current measured in accordance with 7.5.4 using the test network of IEC 60990 test figure 4 shall not exceed 3,5 mA a.c. or 10 mA d.c.	Not exceed 3.5 mA a.c.	N/A
	a) Permanently connected wiring, and:		N/A
	• a cross-section of the protective earthing conductor of at least 10 mm² Cu or 16 mm² Al; or		N/A
	• automatic disconnection of the supply in case of discontinuity of the protective earthing conductor; or		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	• provision of an additional terminal for a second protective earthing conductor of the same cross-sectional area as the original protective earthing conductor and installation instruction requiring a second protective earthing conductor to be installed or		N/A
	b) Connection with an industrial connector according to IEC 60309 and a minimum protective earthing conductor cross-section of 2,5 mm² as part of a multi-conductor power cable. Adequate strain relief shall be provided.		N/A
	In addition, the caution symbol 15 of Annex C shall be fixed to the product and the installation manual shall provide details of the protective earthing measures required in the installation as required in 5.3.2.		N/A
	When it is intended and allowed to connect two or more PCEs in parallel using one common PE conductor, the above touch current requirements apply to the maximum number of the PCEs to be connected in parallel, unless one of the measures in a)		N/A
	or b) above is used. The maximum number of parallel PCEs is used in the testing and has to be stated in the installation manual.		N/A
7.3.6.4	Protective Class II – Double or Reinforced Insulation	Signal communication port are evaluated with reinforced insulation form live parts inside	P
	Equipment or parts of equipment designed for protective class II shall have insulation between live parts and accessible surfaces in accordance with 7.3.4.3. The following requirements also apply:		P
	• equipment designed to protective class II shall not have means of connection for the external protective earthing conductor. However this does not apply if the external protective earthing conductor is passed through the equipment to equipment series-connected beyond it. In the latter event, the external protective earthing conductor and its means for connection shall be insulated with basic insulation from the accessible surface of the equipment and from circuits that employ protective separation, extra-low voltage, protective impedance and limited discharging energy, according to 7.3.5. This basic insulation shall correspond to the rated voltage of the series-connected equipment;		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	• metal-encased equipment of protective class II may have provision on its enclosure for the connection of an equipotential bonding conductor;		N/A
	• equipment of protective class II may have provision for the connection of an earthing conductor for functional reasons or for damping of overvoltages; it shall, however, be insulated as though it is a live part;		N/A
	• equipment employing protective class II shall be marked according to 5.1.8.		N/A
7.3.7	Insulation Including Clearance and Creepage Distance		P
7.3.7.1	General		P
	This subclause gives minimum requirements for insulation, based on the principles of IEC 60664.		P
	Manufacturing tolerances shall be taken into account during measurement of creepage, clearance, and insulation distance in the PCE.		P
	Insulation shall be selected after consideration of the following influences:		P
	• pollution degree	PD3 outside, PD2 inside	P
	• overvoltage category	PV (OVC II), Main (OVC III)	P
	• supply earthing system	TN	P
	• insulation voltage	PV input: max. 1000 Vdc and Main: 230 Vac/ 400 Vac	P
	• location of insulation	See table 7.3.7.4 and 7.3.7.5 for detail	P
	• type of insulation	See table 7.3.7.4 and 7.3.7.5 for detail	P
	Compliance of insulation, creepage distances, and clearance distances, shall be verified by measurement or visual inspection, and the tests of 7.5.		P
7.3.7.1.3	Supply earthing systems		P
	Three basic types of earthing system are described in IEC 60364-1. They are:	Inverter is intended to installed in TN system	P
	• TN system: has one point directly earthed, the accessible conductive parts of the installation being connected to that point by protective conductors. Three types of TN systems, TN-C, TN-S and TN-C-S, are defined according to the arrangement of the neutral and protective conductor.		P

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Clause	Requirement – Test	Result – Remark	Verdict
	• TT system: has one point directly earthed, the accessible conductive parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the power system;		N/A
	• IT sytem: has all live parts isolated from earth or one point connected to earth through an impedance, the accessible conductive parts of the installation being earthed independently or collectively to the earthing system.		N/A
7.3.7.1.4	Insulation voltages	See table 7.3.7.4 and 7.3.7.5 for detail	P
	Table 12 makes use of the circuit system voltage and overvoltage category to define the impulse withstand voltage and the temporary overvoltage.		P
7.3.7.2	Insulation between a circuit and its surroundings		P
7.3.7.2.1	General Basic, supplementary and reinforced insulation between a circuit and its surroundings shall be designed according to: Impulse voltage; temporary overvoltage; working voltage of the circuit;		P
7.3.7.2.2	Circuit connected directly to the mains Clearance and solid insulation between circuit connected directly to the mains and their surroundings shall be designed according to the impulse voltage, temporary overvoltage, or working voltage, whichever gives the most severe requirement		P
7.3.7.2.3	Circuit other than mains circuit Clearance and solid insulation between circuit other than the mains and their surroundings shall be designed according to impulse voltage and recurring peak voltage		P
7.3.7.2.4	Insulation between circuits a) For clearances and insulation, the requirements are determined by the circuit having the higher impulse voltage; b) For creepages, r.m.s. working voltage across the insulation determines the requirements.		P
7.3.7.3	Functional insulation For parts or circuit in OVC I, functional insulation shall be designed according to the working voltage across the insulation For parts or circuit in OVC II, functional insulation shall be designed according to the applicable impulse voltage as determined by 7.3.7.1.4		P
7.3.7.4	Clearance distances		P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.4.1	Determination Table 13 defines the minimum clearance distances required to provide functional, basic , or supplementary insulation		P
	Clearance for use in altitudes above 2000m shall be calculated with correction factor according to Table A.2 of IEC 60664-1	Not designed for use in altitudes above 2000 m.	N/A
	For reinforced insulation, the value corresponding to the next higher impulse voltage, or 1.6 times the temporary overvoltage, or 1.6 times the working voltage shall be used, whichever results in the most severe requirement		N/A
7.3.7.4.2	Electric field homogeneity For homogeneous electric field and impulse voltage is equal to or greater than 6000V for a circuit connected directly to the mains or 4000V within a circuit, the clearance may be reduced to the requirement by Table F.2 Case B of IEC 60664-1. In this case, impulse voltage test shall be performed on the clearance	Inhomogeneous electric field is considered for PCE	N/A
7.3.7.4.3	Clearance to conductive enclosures Clearance shall be measured following the deformation test of 13.7 for conductive enclosures		P
7.3.7.5	Creeage distances		P
7.3.7.5.1	General Creepage distances shall be large enough to prevent long-term degradation of the surface of solid insulators. For reinforced insulation, the value is doubled. If less than clearance, it shall be increased to that clearance		P
7.3.7.5.2	Voltage r.m.s. value of working voltage is used. Interpolation is permitted		P
7.3.7.5.3	Materials		P
7.3.7.6	Coating		N/A
7.3.7.7	PWB spacings for functional insulation	V-0 and short circuit test are considered	P
7.3.7.8	Solid insulation		P
7.3.7.8.1	General Material for solid insulation shall be able to withstand mechanical, electrical, thermal and climatic stresses in normal use and ageing during the expected lifetime. Compliance is evaluated by test and inspection.		P
7.3.7.8.2	Requirements for electrical withstand capability of solid insulation		P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.8.2.1	Basic and supplementary, reinforced, and double insulation Solid insulation shall withstand the impulse voltage test 7.5.1 and voltage test 7.5.2. In addition, if recurring peak working voltage across the insulation is greater than 700V and voltage stress on insulation is greater than 1Kv/mm, double and reinforced insulation shall withstand the partial discharge test according to 7.5.3		P
7.3.7.8.2.2	Functional insulation		P
7.3.7.8.3	Thin sheet or tape material		P
7.3.7.8.3.1	General Insulation of thin sheet or tape less than 0.7mm is subject to this requirement		P
7.3.7.8.3.2	Material thickness not less than 0,2 mm Basic or supplementary insulation at least one layer Double insulation at least two layers Reinforced insulation with single layer is permitted		P
7.3.7.8.3.3	Material thickness less than 0,2 mm Basic or supplementary insulation at least one layer Double insulation at least three layers Reinforced insulation with single layer is not permitted		N/A
7.3.7.8.3.4	Compliance Component, sub-assembly, or material is checked by applicable tests 7.5.1 to 7.5.3 according to 7.3.7.8.		N/A
7.3.7.8.4	Printed wiring boards (PWBs)		P
7.3.7.8.4.1	General For double-sided single-layer PWBs, multi-layer PWBs and metal core PWBs, insulation between conductors shall meet the requirement for solid insulation in 7.3.7.8 For the inner layer of multi-layer PWBs, the insulation between adjacent pollution		P
7.3.7.8.4.2	Use of coating materials		N/A
7.3.7.8.5	Wound components	Varnish is not considered as insulation and voltage test performed as routine test.	P
7.3.7.8.6	Potting materials		N/A
7.3.7.9	Insulation requirements above 30 kHz		N/A
7.3.8	Residual Current-operated protective (RCD) or monitoring (RCM) device compatibility	Internal RCM is used. An external built RCD is not necessary	P
	RCD and RCM are used to provide protection against insulation faults in some domestic and industrial installations, additional to that provided by the installed equipment.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.9	Capacitor discharge		P
7.3.9.1	Operator access area	Accessible signal communication port is DVA circuit.	P
	Equipment shall be so designed that there is no risk of electric shock in operator access areas from charge stored on capacitors after disconnection of the PCE.		P
7.3.9.2	Service access areas	Inside capacitor discharge to DVC A and no energy hazard level within 300 s	P
	Capacitors located behind panels that are removable for servicing, installation, or disconnection shall present no risk of electric shock or energy hazard from charge stored on capacitors after disconnection of the PCE.	Warning symbol 21 of annex C is marked on PCE with 5 mins.	P
7.4	Protection against energy hazards		P
7.4.1	Determination of hazardous energy level	No such high energy level presented in the operator access area.	P
	A hazardous energy level is considered to exist if	No hazardous energy level exist	P
	a) The voltage is 2 V or more, and power available after 60 s exceeds 240 VA.		N/A
	b) The stored energy in a capacitor is at a voltage. U of 2 V or more, and the stored energy. E, calculated from the following equation, exceeds 20J: $E = 0,5\ CU^2$		N/A
7.4.2	Operator Access Areas	No energized parts accessible by user	P
	Equipment shall be so designed that there is no risk of energy hazard in operator access areas from accessible circuits.		P
7.4.3	Services Access Areas		P
	Energy storage devices located behind panels that are removable for servicing, installation or disconnection shall present no risk of electric energy hazard from charge stored after disconnection of the PCE.	The capacitor inside the equipment stored hazardous energy. A symbol 21 of Annex C is provided.	P
	Energy storage devices within a PCE shall be discharged to an energy level less than 20 J, as in 7.4.1, within 10 s after the removal	Warning symbol 21 of Annex C is marked	P
7.5	Electrical tests related to shock hazard		P
7.5.1	Impulse voltage test (type test)	(See appended table)	P

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Clause	Requirement – Test	Result – Remark	Verdict
7.5.2	Voltage test (dielectric strength test) (type test and routine test)	(See appended table)	P
7.5.3	Partial discharge test (type test or sample test)		N/A
7.5.4	Touch current measurement (type test)		P
	The touch current shall be measured if required by 7.3.6.3.7 and shall not be greater than 3.5 mA a.c. or 10 mA d.c. or special measures of protection as given in 7.3.6.3.7 are required.	1,71 mA a.c. max.	P
	For type tests on PCE for which wet locations requirements apply according to 6.1, the humidity pre-conditioning of 4.5 shall be performed immediately prior to the touch current test.		P
7.5.6	Equipment with multiple sources of supply		N/A
8	**PROTECTION AGAINST MECHANICAL HAZARDS**		P
8.1	General		P
	Operation shall not lead to a mechanical HAZARD in NORMAL CONDITION or SINGLE FAULT CONDITION. Edges, projections, corners, openings, guards, handles and the like, that are accessible to the operator shall be smooth and rounded so as not to cause injury during normal use of the equipment.		P
	Conformity is checked as specified in 8.2 to 8.6.		P
8.2	Moving parts		P
	Moving parts shall not be able to crush, cut or pierce parts of the body of an OPERATOR likely to contact them, nor severely pinch the OPERATOR's skin. Hazardous moving parts of equipment, that is moving parts which have the potential to cause injury, shall be so arranged, enclosed or guarded as to provide adequate protection against the risk of personal injury.	Not danger moving parts	P
8.2.1	Protection of service persons		N/A
	Protection shall be provided such that unintentional contact with hazardous moving parts is unlikely during servicing operations. If a guard over a hazardous moving part may need to be removed for servicing, the marking of symbol 15 of Table D-1 shall be applied on or near the guard.	Not danger moving parts	N/A
8.3	Stability		N/A
	Equipment and assemblies of equipment not secured to the building structure before operation shall be physically stable in NORMAL USE.	Wall mounted	N/A
8.4	Provisions for lifting and carrying		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	If carrying handles or grips are fitted to, or supplied with, the equipment, they shall be capable of withstanding a force of four times the weight of the equipment.		N/A
	Equipment or parts having a mass of 18 kg or more shall be provided with a means for lifting and carrying or directions shall be given in the manufacturer's documentation.		N/A
8.5	Wall mounting		P
	Mounting brackets on equipment intended to be mounted on a wall or ceiling shall withstand a force of four times the weight of the equipment.	It is intended to be mounted on concrete wall and metal structure	P
8.6	Expelled parts		N/A
	Equipment shall contain or limit the energy of parts that could cause a HAZARD if expelled in the event of a fault.		N/A
9	**PROTECTION AGAINST FIRE HAZARDS**		P
9.1	Resistance to fire		P
	This subclause specifies requirements intended to reduce the risk of ignition and the spread of flame, both within the equipment and to the outside, by the appropriate use of materials and components and by suitable construction.	Components are witnessed at normal condition and abnormal test are verified	P
9.1.1	Reducing the risk of ignition and spread of flame		P
	For equipment or a portion of equipment, there are two alternative methods of providing protection against ignition and spread of flame that could affect materials, wiring, wound components and electronic components such as integrated circuits, transistors, thyristors, diodes, resistors and capacitors.	Method 1 used	P
9.1.2	Conditions for a fire enclosure		P
	A FIRE ENCLOSURE is required for equipment or parts of equipment for which Method 2 is not fully applied and complied with.		P
9.1.2.1	Parts requiring a fire enclosure		P
	Except where Method 2 is used, or as permitted in 9.1.2.2, the following are considered to have a risk of ignition and, therefore, require a FIRE ENCLOSURE:		P
	– components in PRIMARY CIRCUITS		P
	– components in SECONDARY CIRCUITS supplied by power sources which exceed the limits for a LIMITED POWER SOURCE as specified in 9.2;		P

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Clause	Requirement – Test	Result – Remark	Verdict
	– components in SECONDARY CIRCUITS supplied by a LIMITED POWER SOURCE as specified in 9.2, but not mounted on a material of FLAMMABILITY CLASS V-1;	PWB rated V-0	N/A
	– components within a power supply unit or assembly having a limited power output complying with the criteria for a LIMITED POWER SOURCE as specified in 9.2, including overcurrent protective devices, limiting impedances, regulating networks and wiring, up to the point where the LIMITED POWER SOURCE output criteria are met;		P
	– components having unenclosed arcing parts, such as open switch and relay contacts and commutators, in a circuit at HAZARDOUS VOLTAGE or at a HAZARDOUS ENERGY LEVEL; and	Certified relay	N/A
	– insulated wiring, except as permitte in 9.1.2.2.	PVC wire	N/A
9.1.2.2	Parts not requiring a fire enclosure	Fire enclosure used	N/A
9.1.3	Materials requirements for protection against fire hazard		P
9.1.3.1	General		P
	ENCLOSURES, components and other parts shall be so constructed, or shall make use of such materials, that the propagation of fire is limited.		P
9.1.3.2	Materials for fire enclosures	Metal fire enclosure	P
	If an enclosure material is not classified as specified below, a test may be performed on the final enclosure or part of the enclosure, in which case the material shall additionally be subjected to periodic SAMPLE testing.		P
9.1.3.3	Materials for components and other parts outside fire enclosures		P
	Except as otherwise noted below, materials for components and other parts (including MECHANICAL ENCLOSURES, ELECTRICAL ENCLOSURES and DECORATIVE PARTS); located outside FIRE ENCLOSURES, shall be of FLAMMABILITY CLASS HB.		P
9.1.3.4	Materials for components and other parts inside fire enclosures		P
9.1.3.5	Materials for air filter assemblies		N/A
9.1.4	Openings in fire enclosures	No openings in fire enclosures	N/A
9.1.4.1	General		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	For equipment that is intended to be used or installed in more than one orientation as specified in the product documentation, the following requirements apply in each orientation.		N/A
	These requirements are in addition to those in the following sections:		N/A
	– 7.3.4, Protection against direct contact;		N/A
	– 7.4, Protection against energy hazards;		N/A
	– 13.5, Openings in enclosures		N/A
9.1.4.2	Side openings treated as bottom openings		N/A
9.1.4.3	Openings in the bottom of a fire enclosure		N/A
	The bottom of a FIRE ENCLOSURE or individual barriers, shall provide protection against emission of flaming or molten material under all internal parts, including partially enclosed components or assemblies, for which Method 2 of 9.1.1 has not been fully applied and complied with.		N/A
9.1.4.4	Equipment for use in a CLOSED ELECTRICAL OPERATING AREA	Not intend use at this area	N/A
	The requirements of 9.1.4.3 do not apply to FIXED EQUIPMENT intended only for use in a CLOSED ELECTRICAL OPERATING AREA and to be mounted on a concrete floor or other non-combustible surface. Such equipment shall be marked as follows:		N/A
	WARNING: FIRE HAZARD SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY		N/A
9.1.4.5	Doors or covers in fire enclosures	No door or cover operated by user	N/A
9.1.4.6	Additional requirements for openings in transportable equipment		N/A
9.2	LIMITED POWER SOURCES		P
9.2.1	General		P
9.2.2	Limited power source tests	For communication output port	P
9.3	Short-circuit and overcurrent protection		P
9.3.1	General		P
	The PCE shall not present a hazard, under short-circuit or overcurrent conditions at any port, including phase-to-phase, phase-to-earth and phase-to-neutral, and adequate information shall be provided to allow proper selection of external wiring and external protective devices.		P

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Clause	Requirement – Test	Result – Remark	Verdict
9.3.2	Protection against short-circuits and overcurrents shall be provided for all input circuits, and for output circuits that do not comply with the requirements for limited power sources in 9.2, except for circuits in which no overcurrent hazard is presented by short-circuits and overloads.	The overcurrent device will provide specified in manual	P
9.3.3	Protective devices provided or specified shall have adequate breaking capacity to interrupt the maximum short circuit current specified for the port to which they are connected. If protection that is provided integral to the PCE for an input port is not rated for the short-circuit current of the circuit in which it is used, the installation instructions shall specify that an upstream protective device, rated for the prospective short-circuit current of that port, shall be used to provide backup protection.		P
10	**PROTECTION AGAINST SONIC PRESSURE HAZARDS**		N/A
10.1	General		N/A
	The equipment shall provide protection against the effect of sonic pressure. Conformity tests are carried out if the equipment is likely to cause such HAZARDS.	No hazardous noise when operating	N/A
10.2	Sonic pressure and Sound level		N/A
10.2.1	Hazardous Noise Levels		N/A
11	**PROTECTION AGAINST LIQUID HAZARDS**		N/A
11.1	Liquid Containment, Pressure and Leakage	No liquid containment system	N/A
	The liquid containment system components shall be compatible with the liquid to be used.		N/A
	There shall be no leakage of liquid onto live parts as a result of:		N/A
	a) Normal operation, including condensation;		N/A
	b) Servicing of the equipment; or		N/A
	c) Inadvertent loosening or detachment of hoses or other cooling system parts over time.		N/A
11.2	Fluid pressure and leakage		N/A
11.2.1	Maximum pressure		N/A
11.2.2	Leakage from parts		N/A
11.2.3	Overpressure safety device		N/A
11.3	Oil and grease		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
12	**CHEMICAL HAZARDS**		N/A
12.1	General		N/A
13	**PHYSICAL REQUIREMENTS**		P
13.1	Handles and manual controls		N/A
	Handles, knobs, grips, levers and the like shall be reliably fixed so that they will not work loose in normal use, if this might result in a hazard. Sealing compounds and the like, other than selfhardening resins, shall not be used to prevent loosening. If handles, knobs and the like are used to indicate the position of switches or similar components, it shall not be possible to fix them in a wrong position if this might result in hazard.	No such handle	N/A
13.1.1	Adjustable controls	No such setting control	N/A
13.2	Securing of parts		P
13.3	Provisions for external connections		P
13.3.1	General	Certified PV connectors are used. AC terminal provided for grid connection and secured by a cable gland. Installation manual provide information for the disconnection means	P
13.3.2	Connection to an a.c. Mains supply	AC connector used and it is detachable with tool	P
13.3.2.1	General		P
	For safe and reliable connection to a MAINS supply, equipment shall be provided with one of the following:	See above	P
	– terminals or leads or a non-detachable power supply cord for permanent connection to the supply; or		P
	– a non-detachable power supply cord for connection to the supply by means of a plug		N/A
	– an appliance inlet for connection of a detachable power supply cord; or		N/A
	– a mains plug that is part of direct plug-in equipment as in 13.3.8		N/A
13.3.2.2	Permanently connected equipment		P
13.3.2.3	Appliance inlets		N/A
13.3.2.4	Power supply cord		N/A
13.3.2.5	Cord anchorages and strain relief		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	For equipment with a non-detachable power supply cord, a cord anchorage shall be supplied such that:		N/A
	– the connecting points of the cord conductors are relieved from strain; and		N/A
	– the outer covering of the cord is protected from abrasion.		N/A
13.3.2.6	Protection against mechanical damage		P
13.3.3	Wiring terminals for connection of external conductors		P
13.3.3.1	Wiring terminals		P
13.3.3.2	Screw terminals		P
13.3.3.3	Wiring terminal sizes		P
13.3.3.4	Wiring terminal design		P
13.3.3.5	Grouping of wiring terminals		P
13.3.3.6	Stranded wire		P
13.3.4	Supply wiring space		N/A
13.3.5	Wire bending space for wires 10 mm² and greater		N/A
13.3.6	Disconnection from supply sources	Installation manual instruct the disconnect device when connection DC and AC main	P
13.3.7	Connectors, plugs and sockets		P
13.3.8	Direct plug-in equipment		N/A
13.4	Internal wiring and connections		P
13.4.1	General		P
13.4.2	Routing	Internal wire is routed to avoid sharp edge and overheat	P
13.4.3	Colour coding	Green-yellow wire used as protective bonding only	P
13.4.4	Splices and connections		P
13.4.5	Interconnections between parts of the PCE		P
13.5	Openings in enclosures		N/A
13.5.1	Top and side openings	No openings in the fire enclosure except the DVC A outer fan	N/A
	Openings in the top and sides of ENCLOSURES shall be so located or constructed that it is unlikely that objects will enter the openings and create hazards by contacting bare conductive parts.		N/A
13.6	Polymeric Materials		P
13.6.1	General		P

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Clause	Requirement – Test	Result – Remark	Verdict
13.6.1.1	Thermal index or capability		P
13.6.2	Polymers serving as enclosures or barriers preventing access to hazards		P
13.6.2.1	Stress relief test		N/A
13.6.3	Polymers serving as solid insulation		P
13.6.3.1	Resistance to arcing		N/A
13.6.4	UV resistance		P
	Polymeric parts of an OUTDOOR ENCLOSURE required for compliance with this standard shall be sufficiently resistance to degradation by ultra-violet (UV) radiation	The enclosure of the unit is made of metal with painting and the plastic window frame rated UV resistance according to UL 746C	P
13.7	Mechanical resistance to deflection, impact, or drop		P
13.7.1	General		P
13.7.2	250-N deflection test for metal enclosures		P
13.7.3	7-J impact test for polymeric enclosures		P
13.7.4	Drop test		N/A
13.8	Thickness requirements for metal enclosures		P
13.8.1	General		P
13.8.2	Cast metal		N/A
13.8.3	Sheet metal	Metal sheet	P

14	**COMPONENTS**		P
14.1	General		P
	Where safety is involved, components shall be used in accordance with their specified RATINGS unless a specific exception is made. They shall conform to one of the following:		P
	a) applicable safety requirements of a relevant IEC standard. Conformity with other requirements of the component standard is not required. If necessary for the application, components shall be subjected to the test of this standard, except that it is not necessary to carry out identical or equivalent tests already performed to check conformity with the component standard;		P
	b) the requirements of this standard and, where necessary for the application, any additional applicable safety requirements of the relevant IEC component standard;		P

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Clause	Requirement – Test	Result – Remark	Verdict
	c) if there is no relevant IEC standard, the requirements of this standard;		P
	d) applicable safety requirements of a non-IEC standard which are at least as high as those of the applicable IEC standard, provided that the component has been approved to the non-IEC standard by a recognized testing authority.		P
	Components such as optocouplers, capacitors, transformers, and relays connected across basic, supplemental, reinforced, or double insulation shall comply with the requirements applicable for the grade of insulation being bridged, and if not previously certified to the applicable component safety standard shall be subjected to the voltage test of 7.5.2 as routine test.		P
14.2	Motor Overtemperature Protection		N/A
	Motors which, when stopped or prevented from starting (see 4.4.4.3), would present an electric shock HAZARD, a temperatur HAZARD, or a fire HAZARD, shall be protected by an overtemperature or thermal protection device meeting the requirements of 14.3.		N/A
14.3	Overtemperature protection devices		N/A
14.4	Fuse holders		N/A
14.5	MAINS voltage selecting devices		N/A
14.6	Printed circuit boards		P
	Printed circuit boards shall be made of material with a flammability classification of V-1 of IEC 60707 or better.	V-0	P
	This requirements does not apply to thin-film flexible printed circuit boards that contain only circuits powered from limited power sources meeting the requirements of 9.2.		P
	Conformity of the flammability RATING is checked by inspection of data on the materials. Alternatively, conformity is checked by performing the V-1 tests specified in IEC 60707 on three samples of the relevant parts.		P
14.7	Circuits or components used as transient overvoltage limiting devices		N/A
	If control of transient overvoltage is employed in the equipment, any overvoltage limiting component or circuit shall be tested with the applicable impulse withstand voltage of Table 7-10 using the test method from 7.5.1 except 10 positive and 10 negative impulses are to be applied and may be spaced up to 1 min apart.		N/A
14.8	Batteries		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	Equipment containing batteries shall be designed to reduce the risk of fire, explosion and chemical leaks under normal conditions and after a single fault in the equipment including a fault in circuitry within the equipment battery pack.	No battery	N/A
14.8.1	Battery Enclosure Ventilation		N/A
14.8.1.1	Ventilation requirements		N/A
14.8.1.2	Ventilation testing		N/A
14.8.1.3	Ventilation instructions		N/A
14.8.2	Battery Mounting		N/A
	Compliance is verified by the application of the force to the battery's mounting surface. The test force is to be increased gradually so as to reach the required value in 5 to 10 s, and is to be maintained at that value for 1 min. A nonmetallic rack or tray shall be tested at the highest normal condition operating temperature.		N/A
14.8.3	Electrolyte spillage		N/A
	Battery trays and cabinets shall have an electrolyte-resistant coating.		N/A
	The ENCLOSURE or compartment housing a VENTED BATTERY shall be constructed so that spillage or leakage of the electrolyte from one battery will be contained within the ENCLOSURE and be prevented from:		N/A
	a) reaching the PCE outer surfaces that can be contacted by the USER		N/A
	b) contaminating adjacent electrical components or materials; and		N/A
	c) bridging required electrical distances		N/A
14.8.4	Battery Connections		N/A
	Reverse battery connection of the terminals shall be prevented if reverse connection could result in a hazard within the meaning of this Standard		N/A
14.8.5	Battery maintenance instructions		N/A
	The information and instructions listed in 5.3.4.1 shall be included in the operator manual for equipment in which battery maintenance is performed by the operator, or in the service manual if battery maintenance is to be performed by service personnel only.		N/A
14.8.6	Battery accessibility and maintainability		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	Battery terminals and connectors shall be accessible for maintenance with the correct TOOLS. Batteries with liquid electrolyte, requiring maintained shall be so located that the battery cell caps are accessible for electrolyte tests and readjusting of electrolyte levels.		N/A
15	Software and firmware performing safety functions	Refer to annex B for details	P
Annex A	Measurement of clearances and creepage distances (see 7.3.7.4 and 7.3.7.5)		P
Annex B	Programmable Equipment		P
B.1	Software or firmware that perform safety critical functions		P
B.1.1	Firmware or software that performs a critical safety function/s, the failure of which can result in a risk of fire, electric shock or other hazard as specified by this standard, shall be evaluated by one of the following means.		P
	a) All software or firmware limits or controls shall be disabled before the test to evaluate the hardware circuitry during the abnormal test condition related to the safety function.		P
	b) Protective controls employing software or firmware to perform their function(s), shall be so constructed that they comply with IEC 60730-1 Annex H to address the risks identified in B.2.1.		N/A
B.2	Evaluation of controls employing software		P
Annex C	Symbols to be used in equipment markings		P
Annex D	Test Probes for Determining Access		P
Annex E	RCDs	Integrated RCM used	N/A
Annex F	Altitude correction for clearances		N/A
Annex G	Clearance and creepage distance determination for frequencies greater than 30 kHz	Only clock for IC	P
Annex H	Measuring Instrument for Touch Current Measurements		P
H.1	Measuring instrument		P
H.2	Alternative measuring instrument		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
Annex I	Examples of Protection, Insulation, and Overvoltage Category Requirements for PCE		P
Annex J	Ultraviolet light conditioning test	UV approved	N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4.2.2.6/4.7	**TABLE: mains supply electrical data in normal condition/ Electrical ratings test**		P

Input ratings									
Input voltage (Vdc)	Input current (Adc)	Input power (kW)	Rated input current (Adc)	Measured -Rating / Rating value (%) input cur-rent	Rated input Power (kW)	Meas-ured - Rating / Rating value (%) in-put power	Output condition/status		
							Output voltage(Vac)	Output Current(Aac)	Output Power (kW)
Model: Sofar 20000TL-S6									
250	27,150	6,808	2×24	-43,44	--	--	230	9,530 9,500 9,500	6,575
430	43,157	18,600	2×24	-10,09	--	--	207	28,900 29,000 29,000	18,042
430	47,910	20,620	2×24	-0,19	--	--	230	28,860 28,840 28,870	20,007
430	47,910	20,622	2×24	-0,19	--	--	253	26,310 26,290 26,320	20,001
850	21,856	18,600	2×24	-54,47	--	--	207	29,050 29,080 29,070	18,050
850	24,230	20,620	2×24	-49,52	--	--	230	28,940 28,920 28,950	20,001
850	24,230	20,620	2×24	-49,52	--	--	253	26,320 26,310 26,290	20,008
Model: Sofar 17000TL-S6									
250	27,084	6,797	2×21	-35,51	--	--	230	9,488 9,496 9,518	6,567

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Clause	Requirement – Test	Result – Remark	Verdict

420	37,984	15,980	2×21	-9,56	--	--	207	25,040 25,012 24,969	17,014
420	41,833	17,550	2×21	-0,40	--	--	230	24,616 24,623 24,649	17,061
420	41,546	17,450	2×21	-1,08	--	--	253	22,380 22,353 22,363	17,000
850	18,758	15950	2×21	-55,34	--	--	207	24,986 25,080 24,967	15,570
850	20,539	17,460	2×21	-51,10	--	--	230	24,543 24,551 24,576	17,014
850	20,542	17,470	2×21	-51,09	--	--	253	22,376 22,363 22,353	17,020
Model: Sofar 15000TL-S6									
250	27,621	6,899	2×21	-34,24	--	--	230	9,615 9,617 9,647	6,653
370	37,928	14,050	2×21	-9,70	--	--	207	22,018 22,048 22,045	13,716
370	41,468	15,527	2×21	-1,27	--	--	230	21,717 21,723 21,768	15,055
370	41,663	15440	2×21	-0,80	--	--	253	19,752 19,750 19,743	15,011
850	14,562	14090	2×21	-65,33	--	--	207	22,034 22,023 21,968	13,689

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Clause	Requirement – Test	Result – Remark	Verdict

850	18,080	15,392	2×21	-56,95	--	--	230	21,647 21,665 21,745	15,011
850	18,141	15, 430	2×21	-56,81	--	--	253	19,765 19,746 19,741	15, 005
Model: Sofar 10000TL-S6									
250	27,508	6,874	2×15	-8,31	--	--	230	9,580 9,591 9,616	6,631
350	27,314	9,570	2×15	-8,95	--	--	207	14,967 14,961 14,953	9,309
350	29,345	10,329	2×15	-2,18	--	--	230	14,441 14,454 14,479	10,004
350	29,247	10,280	2×15	-2,51	--	--	253	13,174 13,170 13,156	10, 013
850	11,288	9,590	2×15	-62,37	--	--	207	14,979 14,974 14, 963	9,316
850	12,025	10,243	2×15	-59,92	--	--	230	14,418 14,448 14,494	10,001
850	12,053	10260	2×15	-59,82	--	--	253	13,176 13,171 13,166	10, 010

Output ratings									
Output voltage (Vac)	Output current (Aac)	Output power (kW)	Rated Output current (Aac)	Measured -Rating / Rating value (%) output current	Rated output Power (kW)	Measured -Rating / Rating value (%) output power	Input condition/status		
							Input voltage(Vdc)	Input Current (Aac)	Input Power (kW)
Model: Sofar 20000TL-S6									

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Clause	Requirement – Test			Result – Remark					Verdict
230	9,530 9,500 9,500	6,575	29	-67,14 -67,24 -67,24	20	-67,12	250	27,15	6,808
207	28,900 29,000 29,000	18,042	29	-0,34 0 0	20	-9,79	430	43,157	18,600
230	28,860 28,840 28,870	20,007	29	-0,48 -0,55 0,45	20	0,04	430	47,910	20,620
253	26,310 26,290 26,320	20,001	29	-9,28 -9,34 -9,24	20	0,01	430	47,910	20,622
207	29,050 29,080 29,070	18,050	29	0,17 0,28 0,24	20	-9,75	850	21,856	18,600
230	28,940 28,920 28,950	20,001	29	-0,21 -0,28 -0,17	20	0,01	850	24,230	20,620
253	26,320 26,310 26,290	20,008	29	-9,24 -9,28 -9,34	20	0,04	850	24,230	20,620
Model: Sofar 17000TL-S6									
230	9,488 9,496 9,518	6,567	25	-62,05 -62,02 -61,93	17	-61,37	250	27,084	6,797
207	25,040 25,012 24,969	17,014	25	0,16 0,05 -0,12	17	0,08	420	37,984	15,980
230	24,616 24,623 24,649	17,061	25	-1,54 -1,51 -1,40	17	0,36	420	41,833	17,550
253	22,380 22,353 22,363	17,000	25	-10,48 -10,59 -10,55	17	0	420	41,546	17,450

IEC 62109-1									
Clause	Requirement – Test			Result – Remark					Verdict
207	24,986 25,080 24,967	15,570	25	-0,06 0,32 -0,13	17	-8,41	850	18,758	15950
230	24,543 24,551 24,576	17,014	25	-1,83 -1,80 -1,70	17	0,08	850	20,539	17,460
253	22,376 22,363 22,353	17,020	25	-10,50 -10,55 -10,59	17	0,12	850	20,542	17,470
Model: Sofar 15000TL-S6									
230	9,615 9,617 9,647	6,653	22	-56,30 -56,29 -56,15	15	-55,65	250	27,621	6,899
207	22,018 22,048 22,045	13,716	22	0,08 0,22 0,20	15	-8,56	370	37,928	14,050
230	21,717 21,723 21,768	15,055	22	-1,29 -1,26 -1,05	15	0,37	370	41,468	15,527
253	19,752 19,750 19,743	15,011	22	-10,22 -10,23 -10,26	15	0,07	370	41,663	15440
207	22,034 22,023 21,968	13,689	22	0,15 0,10 -0,15	15	-8,74	850	14,562	14090
230	21,647 21,665 21,745	15,011	22	-1,60 -1,52 -1,16	15	0,07	850	18,080	15,392
253	19,765 19,746 19,741	15, 005	22	-10,16 -10,25 -10,27	15	0,03	850	18,141	15, 430
Model: Sofar 10000TL-S6									
230	9,580 9,591 9,616	6,631	15	-36,13 -36,06 -35,89	10	-33,69	250	27,508	6,874

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Clause	Requirement – Test	Result – Remark	Verdict

207	14,967 14,961 14,953	9,309	15	-0,22 -0,26 -0,31	10	-6,91	350	27,314	9,570
230	14,441 14,454 14,479	10,004	15	-3,73 -3,64 -3,47	10	0,04	350	29,345	10,329
253	13,174 13,170 13,156	10, 013	15	-12,17 -12,20 -12,29	10	0,13	350	29,247	10,280
207	14,979 14,974 14, 963	9,316	15	-0,14 -0,17 -0,25	10	-6,84	850	11,288	9,590
230	14,418 14,448 14,494	10,001	15	-3,88 -3,68 -3,37	10	0,01	850	12,025	10,243
253	13,176 13,171 13,166	10, 010	15	-12,16 -12,19 -12,23	10	0,10	850	12,053	10260

4.3 TABLE: Thermal testing							P
Model	Sofar 20000TL-S6						—
Temperature t of part/at:	t (°C)						permitted t (°C)
Test Condition :	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	—
Ambient 1	45,0	45,0	45,0	45,0	45,0	45,0	--
Ambient 2	47,0	46,7	46,1	45,2	45,8	45,5	--
PV terminal	53,1	53,5	52,4	48,1	47,9	45,8	85
DC wire	66,3	65,5	62,2	57,5	53,4	51,4	90
Connector CNJ2	75,7	74,3	67,8	62,6	55,8	53,8	105
Connector CNF11	75,7	74,0	66,7	61,7	55,0	52,8	Ref.
PCB of fuse board	80,9	79,2	69,8	64,6	57,5	55,5	130
Wire (fuse board to DC switch)	74,4	73,5	66,4	61,0	54,2	52,2	90
DC switch	66,4	68,6	62,9	57,9	52,1	50,2	70
Y capacitor CA19	76,2	76,6	69,9	64,4	58,3	55,9	125
MOVA6	78,8	79,3	69,7	64,4	57,9	55,5	85
Capacitor CA24	77,2	76,7	70,5	65,1	58,5	56,4	105

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Clause	Requirement – Test	Result – Remark	Verdict

Input inductor LA1	95,0	95,3	74,8	69,5	59,6	57,4	105
Capacitor CA25	74,7	73,3	71,0	65,1	57,3	55,5	105
Y capacitor CA29	78,9	77,1	71,9	66,3	59,8	57,5	125
Capacitor RYA1	77,2	75,6	72,5	67,5	59,6	57,6	85
Current transducer HLEA2	81,2	79,9	74,9	68,9	60,9	59,0	105
Connector CNA3	80,1	78,8	71,3	65,7	57,7	55,7	105
PCB of input board	86,9	86,8	73,1	67,8	59,2	57,0	130
Boost inductor lead wire	77,5	76,6	70,7	64,5	57,3	55,0	90
Boost inductor	96,7	102,7	66,8	60,4	53,4	51,4	105
DA18	70,6	70,0	76,2	69,9	56,3	54,0	Ref
DA19	86,8	85,5	67,6	61,2	53,2	50,8	Ref
Capacitor CA136	76,3	74,9	70,0	63,9	56,4	54,2	Ref
IGBT QA19	93,4	95,8	67,4	60,8	53,6	51,2	Ref
Capacitor CA145	75,2	73,3	70,4	64,2	56,0	54,1	85
Busbar Capacitor CD4	72,1	70,2	71,8	65,5	57,6	55,5	85
IGBT module	75,8	74,4	80,5	71,3	60,4	57,9	Ref
PCB of power board	79,9	77,5	85,3	76,7	62,6	59,9	130
Capacitor CD11	78,0	75,8	79,5	72,0	61,0	58,5	Ref
Transformer TA2	74,2	72,5	72,4	66,5	60,2	58,0	110
Y capacitor CYD2	71,6	70,6	67,7	61,9	55,0	52,9	125
Inverter inductor	81,7	79,1	97,1	86,0	76,5	73,0	105
Inverter inductor lead wire	72,8	70,7	72,5	66,0	57,6	55,4	90
Current transducer HLB2	73,4	71,3	72,1	66,1	57,5	55,6	105
X capacitor CB33	73,0	70,4	71,4	65,6	57,5	55,6	100
Capacitor CB36	72,4	69,7	70,3	64,4	57,4	55,2	85
Relay RLB3	70,7	68,3	67,2	61,8	55,0	52,8	85
Y capacitor CYB5	83,5	79,5	81,5	73,5	58,9	56,6	125
Output inductor LB1	76,7	75,4	77,5	71,2	59,7	57,3	105
X capacitor CB51	77,4	74,8	76,8	70,8	59,1	56,9	100
MOVB3	74,0	71,8	72,9	67,6	59,1	56,7	85
Output PCB	78,5	75,7	76,2	69,9	57,6	55,4	130
Output AC switch	68,6	66,9	66,1	60,4	53,5	51,6	70
AC output wire	74,9	72,7	72,8	66,4	57,4	55,7	80
Output terminal	67,4	65,9	64,6	59,2	53,1	51,1	Ref.

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Clause	Requirement – Test	Result – Remark	Verdict

DC fan (inside)	67,8	68,5	67,3	63,8	57,6	55,5	70
Control board Input wire	74,5	72,6	73,6	67,7	66,7	63,0	90
Connector CNBA3	79,2	77,4	79,2	73,3	71,8	69,1	105
Capacitor CA75	78,9	77,5	80,7	75,2	70,7	70,8	85
QA5	81,8	80,2	85,1	79,4	80,9	77,8	Ref
Transformer TA1	82,5	81,1	83,2	78,6	75,5	73,1	110
Opto-coupler UC68	81,3	79,5	80,0	74,9	67,1	64,9	100
PCB of Control board	78,7	77,1	77,5	73,1	66,5	64,4	130
Opto-coupler UF14	68,7	67,6	66,3	60,4	54,3	52,0	100
DC fan (outside)	51,2	52,4	55,0	50,3	50,5	48,8	70
Accessible enclosure surface (Front)	62,7	60,7	61,0	56,7	53,1	50,9	100
Display button	58,1	56,8	56,7	53,0	51,1	49,0	85
Accessible enclosure surface (Side)	63,8	62,6	64,3	59,0	53,5	51,4	70
Accessible enclosure surface (Top)	63,4	62,1	65,1	59,3	54,1	51,7	70
Mounting surface	70,4	68,9	75,9	67,7	56,7	53,9	90
Switch knob	49,1	46,3	48,9	44,9	46,4	44,3	85

Remark:

	Ambient temperature (°C)	Input voltage (Vdc)	Output voltage (Vac)	Output power (W)
Test 1	45	430	230	20000
Test 2	45	430	253	20000
Test 3	45	850	230	20000
Test 4	45	850	253	20000
Test 5	45	960	230	8010
Test 6	45	960	253	8020

4.3 TABLE: Thermal testing							P
Model	Sofar 20000TL-S6						—
Temperature t of part/at:	t (°C)						permitted t (°C)
Test Condition :	Test 7	Test 8	Test 9	Test 10	Test 11	Test 12	—
Ambient 1	60,9	60,4	61,1	60,6	62,1	62,3	--
Ambient 2	61,5	61,4	62,1	61,4	62,5	62,5	--
PV terminal	64,6	64,9	64,1	64,1	62,9	63,1	85

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Clause	Requirement – Test	Result – Remark	Verdict

DC wire	69,7	70,2	69,0	69,0	67,9	68,1	90
Connector CNJ2	72,6	73,2	71,2	71,1	70,2	70,3	105
Connector CNF11	72,1	72,5	70,6	70,5	69,2	69,3	Ref.
PCB of fuse board	73,4	74,0	72,7	72,5	71,7	71,9	130
Wire (fuse board to DC switch)	72,0	72,6	69,8	69,7	68,6	68,7	90
DC switch	68,3	68,9	68,0	68,0	66,8	66,9	70
Y capacitor CA19	74,6	75,3	73,7	73,6	72,2	72,3	125
MOVA6	75,0	76,1	73,3	73,1	71,9	71,8	85
Capacitor CA24	75,4	76,2	73,9	73,7	72,8	72,5	105
Input inductor LA1	79,4	81,0	75,1	74,9	73,6	73,4	105
Capacitor CA25	74,0	74,7	72,7	72,5	71,8	72,1	105
Y capacitor CA29	76,0	76,7	75,2	74,9	74,0	73,5	125
Capacitor RYA1	75,7	76,3	74,8	74,6	73,9	73,7	85
Current transducer HLEA2	76,8	77,4	76,0	75,8	75,4	75,7	105
Connector CNA3	74,2	74,9	73,0	72,7	72,1	72,1	105
PCB of input board	77,5	78,7	74,7	74,4	73,3	73,1	130
Boost inductor lead wire	74,4	75,4	72,5	72,1	71,5	71,3	90
Boost inductor	85,0	90,7	69,2	68,8	67,8	67,7	105
DA18	71,4	71,8	72,5	72,2	69,4	69,4	Ref
DA19	76,3	76,6	69,0	68,6	67,0	66,9	Ref
Capacitor CA136	74,0	74,5	71,8	71,5	70,6	70,5	Ref
IGBT QA19	79,6	81,1	69,3	68,9	67,6	67,5	Ref
Capacitor CA145	73,4	73,7	71,7	71,4	70,4	70,3	85
Busbar Capacitor CD4	72,8	73,1	73,0	72,7	71,8	71,6	85
IGBT module	73,3	73,5	75,6	74,9	73,9	73,5	Ref
PCB of power board	75,5	75,8	77,5	76,6	75,4	75,0	130
Capacitor CD11	75,3	75,6	76,2	75,5	74,4	74,1	Ref
Transformer TA2	75,3	75,7	75,6	75,2	74,4	74,3	110
Y capacitor CYD2	72,5	73,0	70,6	70,3	69,3	69,3	125
Inverter inductor	75,4	76,0	86,8	85,0	90,0	88,7	105
Inverter inductor lead wire	72,4	72,7	72,8	72,4	71,7	71,5	90
Current transducer HLB2	73,3	73,7	73,0	72,9	71,9	71,9	105
X capacitor CB33	72,9	73,4	72,9	72,8	71,9	72,0	100
Capacitor CB36	72,1	72,4	72,5	72,2	71,7	71,6	85

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Clause	Requirement – Test	Result – Remark	Verdict

Relay RLB3	71,2	71,6	70,6	70,4	69,3	69,4	85
Y capacitor CYB5	75,2	75,2	74,5	74,0	72,7	72,7	125
Output inductor LB1	75,5	75,7	75,3	74,7	72,7	72,6	105
X capacitor CB51	75,1	75,3	74,5	74,2	73,0	73,2	100
MOVB3	74,7	75,0	74,6	74,4	73,0	73,5	85
Output PCB	73,9	74,1	73,1	72,9	71,5	71,8	130
Output AC switch	68,6	68,0	69,3	69,2	68,0	68,1	70
AC output wire	73,6	73,9	72,9	72,7	71,9	71,9	80
Output terminal	70,0	70,4	68,8	68,8	67,6	67,7	Ref.
DC fan (inside)	68,7	69,1	69,2	69,1	69,0	68,9	70
Control board Input wire	76,1	76,7	80,9	80,9	80,0	76,7	90
Connector CNBA3	80,0	80,9	85,2	85,3	86,7	81,2	105
Capacitor CA75	82,2	82,8	83,6	83,8	84,5	82,6	85
QA5	85,2	85,2	90,6	91,2	94,2	93,9	Ref
Transformer TA1	86,0	86,7	90,1	90,0	89,5	89,3	110
Opto-coupler UC68	83,9	84,1	82,8	82,5	81,3	81,5	100
PCB of Control board	81,0	81,2	82,0	81,8	80,8	81,1	130
Opto-coupler UF14	71,1	71,6	69,8	69,7	69,4	68,4	100
DC fan (outside)	67,8	68,1	66,9	67,1	65,2	65,7	70
Accessible enclosure surface (Front)	68,7	68,8	68,8	68,9	67,6	67,8	100
Display button	66,9	67,0	67,0	67,2	65,8	66,1	85
Accessible enclosure surface (Side)	69,2	69,5	69,1	69,0	67,8	67,9	70
Accessible enclosure surface (Top)	68,7	69,0	69,6	69,7	68,4	68,2	70
Mounting surface	71,0	71,4	72,3	71,2	69,7	69,4	90
Switch knob	62,4	63,2	61,9	62,2	61,5	61,7	85

Remark:

	Ambient temperature (°C)	Input voltage (Vdc)	Output voltage (Vac)	Output power (W)
Test 7	60	430	230	8272
Test 8	60	430	253	8110
Test 9	60	850	230	8100
Test 10	60	850	253	8197
Test 11	60	960	230	6010
Test 12	60	960	253	6050

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Clause	Requirement – Test	Result – Remark	Verdict

4.3 TABLE: Thermal testing			P
Model	Sofar 17000TL-S6		—
Temperature t of part/at:	t (°C)		permitted t (°C)
Test Condition :	Test 1	Test 2	—
Ambient 1	45,0	45,0	--
Ambient 2	45,7	45,5	--
PV terminal	50,1	48,4	85
DC wire	59,7	56,1	90
Connector CNJ2	66,9	60,5	105
Connector CNF11	69,8	60,1	Ref.
PCB of fuse board	71,2	62,5	130
Wire (fuse board to DC switch)	66,3	58,7	90
DC switch	63,0	55,8	70
Y capacitor CA19	69,1	63,6	125
MOVA6	70,3	63,3	85
Capacitor CA24	69,2	63,8	105
Input inductor LA1	82,9	66,9	105
Capacitor CA25	66,6	63,4	105
Y capacitor CA29	70,1	65,0	125
Capacitor RYA1	69,5	65,8	85
Current transducer HLEA2	71,9	66,8	105
Connector CNA3	69,8	63,3	105
PCB of input board	76,7	65,8	130
Boost inductor lead wire	70,0	63,4	90
Boost inductor	70,8	58,2	105
DA18	63,8	66,0	Ref
DA19	76,9	58,7	Ref
Capacitor CA136	70,0	62,2	Ref
IGBT QA19	84,7	58,5	Ref
Capacitor CA145	67,4	62,4	85
Busbar Capacitor CD4	65,4	63,9	85
IGBT module	69,7	70,5	Ref
PCB of power board	71,0	73,7	130

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Clause	Requirement – Test	Result – Remark	Verdict

Capacitor CD11	70,0	69,9	Ref
Transformer TA2	68,3	65,7	110
Y capacitor CYD2	64,8	60,1	125
Inverter inductor	72,0	81,7	105
Inverter inductor lead wire	66,0	65,4	90
Current transducer HLB2	64,9	63,1	105
X capacitor CB33	64,4	62,6	100
Capacitor CB36	64,2	62,1	85
Relay RLB3	63,8	60,9	85
Y capacitor CYB5	71,4	69,6	125
Output inductor LB1	79,3	77,5	105
X capacitor CB51	69,9	68,2	100
MOVB3	68,1	66,3	85
Output PCB	69,5	67,1	130
Output AC switch	61,3	58,1	70
AC output wire	66,8	63,8	80
Output terminal	60,5	57,1	Ref.
DC fan (inside)	65,8	62,6	70
Control board Input wire	69,3	68,7	90
Connector CNBA3	70,7	71,1	105
Capacitor CA75	75,6	77,4	85
QA5	77,4	80,2	Ref
Transformer TA1	79,7	79,6	110
Opto-coupler UC68	75,0	73,3	100
PCB of Control board	74,6	72,6	130
Opto-coupler UF14	61,2	57,5	100
DC fan (outside)	48,7	48,6	70
Accessible enclosure surface (Front)	57,0	56,0	100
Display button	52,8	52,1	85
Accessible enclosure surface (Side)	58,2	57,3	70
Accessible enclosure surface (Top)	57,7	57,9	70
Mounting surface	63,0	65,3	90
Switch knob	45,0	44,9	85

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

Remark:

	Ambient temperature (°C)	Input voltage (Vdc)	Output voltage (Vac)	Output power (W)
Test 1	45	420	230	17000
Test 2	45	850	230	17000

4.3 TABLE: Thermal testing			P
Model	Sofar 15000TL-S6		—
Temperature t of part/at:	t (°C)		permitted t (°C)
Test Condition :	Test 1	Test 2	—
Ambient 1	45,0	45,0	--
Ambient 2	45,1	44,8	--
PV terminal	52,4	48,6	85
DC wire	60,5	54,6	90
Connector CNJ2	67,3	59,7	105
Connector CNF11	69,9	59,3	Ref.
PCB of fuse board	71,5	61,3	130
Wire (fuse board to DC switch)	66,9	58,2	90
DC switch	63,5	55,5	70
Y capacitor CA19	69,8	61,7	125
MOVA6	71,4	61,6	85
Capacitor CA24	70,9	62,1	105
Input inductor LA1	82,1	64,6	105
Capacitor CA25	65,5	61,5	105
Y capacitor CA29	67,6	63,6	125
Capacitor RYA1	68,2	62,8	85
Current transducer HLEA2	71,5	64,5	105
Connector CNA3	68,8	62,8	105
PCB of input board	76,6	63,9	130
Boost inductor lead wire	69,9	62,9	90
Boost inductor	85,8	58,0	105
DA18	64,2	64,4	Ref
DA19	76,2	58,1	Ref
Capacitor CA136	70,8	61,2	Ref

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Clause	Requirement – Test	Result – Remark	Verdict

IGBT QA19	86,3	58,1	Ref
Capacitor CA145	66,8	60,9	85
Busbar Capacitor CD4	64,9	62,4	85
IGBT module	68,7	68,9	Ref
PCB of power board	69,9	71,3	130
Capacitor CD11	69,5	67,9	Ref
Transformer TA2	69,2	64,9	110
Y capacitor CYD2	64,4	58,9	125
Inverter inductor	72,6	84,9	105
Inverter inductor lead wire	66,2	66,2	90
Current transducer HLB2	64,9	61,9	105
X capacitor CB33	64,5	61,2	100
Capacitor CB36	64,1	61,7	85
Relay RLB3	64,3	60,5	85
Y capacitor CYB5	70,5	66,9	125
Output inductor LB1	78,4	74,0	105
X capacitor CB51	69,3	65,6	100
MOVB3	67,1	63,5	85
Output PCB	69,4	65,1	130
Output AC switch	61,5	57,4	70
AC output wire	66,4	62,2	80
Output terminal	61,1	56,5	Ref.
DC fan (inside)	66,3	61,1	70
Control board Input wire	68,5	67,8	90
Connector CNBA3	72,9	74,0	105
Capacitor CA75	72,1	73,0	85
QA5	74,8	76,4	Ref
Transformer TA1	77,5	75,4	110
Opto-coupler UC68	74,4	70,3	100
PCB of Control board	73,8	69,6	130
Opto-coupler UF14	61,5	57,3	100
DC fan (outside)	51,6	50,8	70
Accessible enclosure surface (Front)	57,6	55,3	100
Display button	53,9	52,5	85

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Clause	Requirement – Test	Result – Remark	Verdict

Accessible enclosure surface (Side)	58,7	56,9	70
Accessible enclosure surface (Top)	58,7	57,8	70
Mounting surface	63,3	63,9	90
Switch knob	47,4	48,5	85

Remark:

	Ambient temperature (°C)	Input voltage (Vdc)	Output voltage (Vac)	Output power (W)
Test 1	45	370	230	15000
Test 2	45	850	230	15000

4.3 TABLE: Thermal testing			P
Model	Sofar 10000TL-S6		—
Temperature t of part/at:	t (°C)		permitted t (°C)
Test Condition :	Test 1	Test 2	—
Ambient 1	45,0	45,0	--
Ambient 2	46,1	45,4	--
PV terminal	50,0	47,8	85
DC wire	55,5	51,2	90
Connector CNJ2	60,3	54,7	105
Connector CNF11	60,5	53,8	Ref.
PCB of fuse board	62,2	56,1	130
Wire (fuse board to DC switch)	59,9	53,2	90
DC switch	57,5	51,2	70
Y capacitor CA19	62,0	56,4	125
MOVA6	62,2	56,3	85
Capacitor CA24	61,6	56,6	105
Input inductor LA1	68,8	58,2	105
Capacitor CA25	60,4	56,4	105
Y capacitor CA29	63,0	57,9	125
Capacitor RYA1	62,4	58,1	85
Current transducer HLEA2	64,8	59,4	105
Connector CNA3	62,3	57,1	105
PCB of input board	65,9	57,8	130
Boost inductor lead wire	64,8	55,7	90

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Clause	Requirement – Test	Result – Remark	Verdict

Boost inductor	86,4	52,6	105
DA18	58,2	57,0	Ref
DA19	65,5	52,8	Ref
Capacitor CA136	64,2	54,6	Ref
IGBT QA19	73,6	52,6	Ref
Capacitor CA145	60,5	55,3	85
Busbar Capacitor CD4	59,4	56,6	85
IGBT module	61,5	60,4	Ref
PCB of power board	62,3	62,2	130
Capacitor CD11	62,4	60,4	Ref
Transformer TA2	63,8	59,8	110
Y capacitor CYD2	59,1	53,8	125
Inverter inductor	66,1	75,0	105
Inverter inductor lead wire	59,6	57,9	90
Current transducer HLB2	59,1	56,2	105
X capacitor CB33	58,8	56,0	100
Capacitor CB36	58,4	55,5	85
Relay RLB3	58,4	55,0	85
Y capacitor CYB5	61,2	58,1	125
Output inductor LB1	63,7	60,4	105
X capacitor CB51	61,1	58,0	100
MOVB3	61,2	58,2	85
Output PCB	61,4	58,0	130
Output AC switch	56,6	52,7	70
AC output wire	60,1	56,5	80
Output terminal	56,2	52,3	Ref.
DC fan (inside)	60,4	56,6	70
Control board Input wire	63,4	60,7	90
Connector CNBA3	68,1	66,5	105
Capacitor CA75	67,3	66,7	85
QA5	69,1	70,2	Ref
Transformer TA1	73,5	71,9	110
Opto-coupler UC68	69,1	66,4	100
PCB of Control board	69,0	66,2	130

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Clause	Requirement – Test	Result – Remark	Verdict

Opto-coupler UF14	57,4	52,8	100
DC fan (outside)	50,8	51,6	70
Accessible enclosure surface (Front)	54,4	52,0	100
Display button	52,3	50,0	85
Accessible enclosure surface (Side)	54,8	52,6	70
Accessible enclosure surface (Top)	54,9	52,9	70
Mounting surface	57,1	56,3	90
Switch knob	46,6	47,2	85

Remark:

	Ambient temperature (°C)	Input voltage (Vdc)	Output voltage (Vac)	Output power (W)
Test 1	45	350	230	10000
Test 2	45	850	230	10000

4.4	Testing in single fault condition		P
	Ambient temperature (°C)	25	—
	Model	Sofar 20000TL-S6	—

No.	Component No.	fault	Test voltage	Duration	Result
1	DC input	Reverse polarity	Input: 850 Vdc Output: 230 Vac	1 min	Inverter did not work. No hazard.
2	CEA4 (for DC Current transducer)	S/C	Input: 850 Vdc Output: 230 Vac	10 min	The unit operated normally at beginning. LCD displayed error input current, after about 3 min. And the unit shut down and disconnected from the grid. Error message:"permanent".
3	CC1	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. Error message:"ID11". No damaged and no hazards.
4	QA1 Pin D-S	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit operated normally. No damaged and no hazards.
5	CA37	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit operated normally. No damaged and no hazards.
6	DA18 pin 1-2	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. Error message:"permanent". No damaged and no hazards.

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Clause	Requirement – Test	Result – Remark	Verdict

7	DA19 Pin 1-2	S/C	Input: 500 Vdc Output: 230 Vac	1 s	Output breaker opened. The unit shut down and disconnected from the grid immediately. Component DA19, QA19, QA20, DA20 damaged. LCD no display. No hazards.
8	QA29 Pin C-G	S/C	Input: 500 Vdc Output: 230 Vac	1s	Output breaker opened. The unit shut down and disconnected from the grid immediately. Component QA29, QA28 damaged. LCD no display and no hazards.
9	QA19 Pin C-E	S/C	Input: 500 Vdc Output: 230 Vac	3 min	The unit shut down and disconnected from the grid immediately. LCD no display. No damaged and no hazards.
10	CA129	S/C	Input: 960 Vdc Output: 230 Vac	3 min	The unit shut down and disconnected from the grid immediately. Components QD1, QD2, QD3, DA19, DA20, QA19, QA20, DA24, DA25, QA28, QA29 damaged. LCD no display. No hazards.
11	CD1	S/C	Input: 960 Vdc Output: 230 Vac	3 min	The unit shut down and disconnected from the grid immediately. Output breaker opened. Components QD2, QD3, QD1 damaged. Error message:"ID66, ID27, ID26, ID02, ID70". No hazards
12	CB25	S/C	Input: 500 Vdc Output: 230 Vac	5 min	The unit operated normally. No damage and no hazard.
13	CB44 (for AC current transducer)	S/C	Input: 500 Vdc Output: 230 Vac	3 min	The unit shut down and disconnected from the grid immediately. No damaged and no hazards.
14	DA11	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. DC fan stopped. LCD no display. No damaged and no hazards.
15	DA13	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. DC fan stop. LCD no display. No damaged and no hazards.
16	DA8	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. LCD no display. No damaged and no hazards.
17	DA6	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. LCD no display. No damaged and no hazards
18	QA5 D-G	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. Components QA5, RA146, RA145, RA152, RA153, RA154,QA12, DA6 damaged. LCD no display. No hazards

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Clause	Requirement – Test	Result – Remark	Verdict

19	QA5 D-S	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. Components QA5, RA146, RA145, RA152, RA153, RA154, UA12, CA85, DA6, RA124, QD1, QD2, QD3 damaged. LCD no display. No hazards.
20	UA14 Pin1-2	S/C	Input: 850 Vdc Output: 230 Vac	5 min	DC fan speeded up. After about 3 min, the unit shut down and disconnected from the grid immediately. Components DA15, RA47, QA6, CA110, CA114, UA12, QA9 damaged. LCD no display. No hazards.
21	UA14 pin 3-4	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. LCD no display. No damaged and no hazards.
22	AC Output	Reverse Phase	Input: 850 Vdc Output: 230 Vac	5 min	Inverter did not work. No hazard.
23	TA1 Pin4-8	S/C	Input: 850 Vdc Output: 230 Vac	5min	The unit shut down and disconnected from the grid immediately. LCD no display. No damaged and no hazards.
24	TA1 Pin Pin 9-11	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. LCD no display. No damaged and no hazards.
25	TA1 Pin14-16	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. No damaged and no hazards.
26	12V_FANOUT to GND_fan	O/L	Input: 850 Vdc Output: 230 Vac	6 h 54 min	When 12V_fan overloaded to 1,2 A, FA2 opened and DC fan stop, the unit operating normal. No damaged and no hazards. The maximum temperature of TA1=70,6°C, Tamb=25,1°C
27	12V fan to GND_fan	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. LCD no display. No damaged and no hazards.
28	+7VCOM to GND_fan	O/L	Input: 850 Vdc Output: 230 Vac	4 h 15 min	When +7V_com overloaded to 0,8 A, unit operating normal. When overloaded to 1A, after about 30 min, the unit shut down and disconnected from the grid. No damaged and no hazards. The maximum temperature of TA1=64,2°C, Tamb=24,2°C.
29	+7VCOM to GND_fan	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. LCD no display. No damaged and no hazards.
30	CB18 (for RCD)	S/C	Input: 850 Vdc Output: 230 Vac	5 min	The unit shut down and disconnected from the grid immediately. Error message:”ID20”. No damaged and no hazards.

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Clause	Requirement – Test	Result – Remark	Verdict

31	Output	O/L	Input: 850 Vdc Output: 230 Vac	2 h 40 min	When output overloaded to 33,26 A rms, the unit output hiccup to 68 kW – 22,9 KW. When overloaded to 34 A, the unit shut dow. Restart no damaged. No hazards. The maximum temperature of TA1=65,6°C, Tamb=26,3°C.
32	Inside fan	Blocked	Input: 850 Vdc Output: 230 Vac	2 h 42 min	The unit operated normal. No damaged and no hazards. The maximum of temperature of TA1=65,6°C, Tamb=26,3 °C.
33	Outside fan	Blocked	Input: 850 Vdc Output: 230 Vac	5 h 25 min	The unit operated normal. No damaged and no hazards. The maximum of temperature of TA1=68,7°C, Tamb=27,9 °C.

Supplementary information and remarks:

S/C: Short circuit, O/C: Open circuit

During the test:

Fire do not propagates beyond the EUT;

Equipment do not emitt molten metal;

Enclosures do not deform to cause non-compliance with the standard.

Pass the dielectric test.

7.3.7	**TABLE: clearance and creepage distance measurements**	P

clearnace cl and creepage distance dcr at / of:	Up (V)	U r.m.s. (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
Between “+” and “-“ of DC input (FI)	1000 Vp	1000 VDC	3,6	6,2	5,0	6,2
Two poles of DC fuse (FI)	1000 Vp	1000 VDC	3,6	6,0	5,0	6,0
Between L and N of AC output (FI)	325 Vp	230 VAC	3,0	4,3	3,0	4,3
Between Lines of AC output (FI)	566 Vp	400 VAC	3,0	3,8	3,0	3,8
DC live part and earthed metal (BI)	1000 Vp	1000 VDC 230 VAC	3,6	6,4	5,0	6,4
AC live part and earthed metal (BI)	1000 Vp	1000 VDC 230 VAC	3,6	5,5	5,0	5,5
Input lead wire to plastic accessible surface (SI)	1000 Vp	1000 VDC 230 VAC	3,6	16	10,0	16
DC live part to the accessible surface of the input terminal (RI)	1000 Vp	1000 VDC 230 VAC	6,1	23	20,0	23

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Clause	Requirement – Test	Result – Remark	Verdict

7.3.7	**TABLE: clearance and creepage distance measurements**						P
AC live part to the accessible surface of the output terminal (RI)		1000 Vp	1000 VDC 230 VAC	6,1	36	20,0	36
Primary circuit and secondary circuit of the auxiliary power (on PCB) (RI)		1090 Vp	225 VAC	5,5	10	8	10
Remarks: 1) FI: function insulation BI: Basic insulation SI: Supplementary insulation RI: Reinforced insulation							

7.3.7.8.3.2 to 7.3.7.8.3.3	**TABLE: distance through insulation measurement**				P
distance through insulation di at/of:		U r.m.s. (V)	test voltage (V)	required di (mm)	di (mm)
Insulating sheet between IGBT and heat sink (K-10)		1000 VDC 230 VAC	Impulse test: 4535 V Voltage test: 1500 V	--	0,13
Insulating sheet between IGBT and heat sink (900S)		1000 VDC 230 VAC	Impulse test: 4535 V Voltage test: 1500 V	--	0,2
Insulating sheet between IGBT and heat sink (K52)		1000 VDC 230 VAC	Impulse test: 4535 V Voltage test: 1500 V	--	0,051
Insulating sheet (between power board and enclosure) (PP-BK18)		1000 VDC 230 VAC	Impulse test: 4535 V Voltage test: 1500 V	--	0,4
Insulating sheet (between power board and enclosure) (FORMEX GK-(a)(b)(f2))		1000 VDC 230 VAC	Impulse test: 4535 V Voltage test: 1500 V	--	0,2
Insulating sheet (between power board and enclosure) (FR1, FR7, FR25)		1000 VDC 230 VAC	Impulse test: 4535 V Voltage test: 1500 V	--	0,23

7.5	**TABLE: electric strength measurements, impulse voltage test and partial discharge test**	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

test voltage applied between:	test voltage (V)	impulse withstand voltage (V)	partial discharge extinction voltage (V)	result
PV input and Ground (BI)	1500 Vac	4535 V	N/A	No breakdown
AC mains output and Ground (BI)	1500 Vac	4000 V	N/A	No breakdown
PV input and communication output port (RI)	3000 Vac	6535 V	N/A	No breakdown
AC mains and communication output port (RI)	3000 Vac	6000 V	N/A	No breakdown

14	**TABLE: list of critical components**				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
DC input PV connector (for model "-S2" to "-S6")	Amphenol Industrial Operations	Helios H4	4 mm^2, DC 1000 V, 40 A, 120°C	EN 50521	TUV Rheinland*
(Alternative)	Phoenix Contact GmbH & Co. KG	PV-FT-CF-C-4 PV-FT-CM-C-4	DC 1000 V, 4 mm^2, 40 A, 85°C	EN 50521	TUV Rheinland*
DC inside connector (for model "-S0" to "-S2")	Jite Industrial (Shenzhen) Co Ltd	RTB450-00	1000 V	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Phoenix Contact GmbH & Co. KG	UK 35	1000 V, 150 A, 125°C	EN 60947-7-1 IEC/EN 62109-1 IEC/EN 62109-2	KEMA-KEUR Tested with appliance
Internal wiring (for PV terminal to fuse board) (for model "-S3" to "-S6")	Various	1032 or 10269	12AWG, 1000 V, 90°C or better	UL 758	UL*
Internal wiring (for power board to control board)	Various	1032 or 10269	22AWG, 1000 V, 90°C or better	UL 758	UL*
Internal wiring (for the other DC input)	Various	1032 or 10269	10AWG, 1000 V, 90°C or better	UL 758	UL*
Internal wiring (for AC output)	Various	1015	10AWG, 300 V or better, 80°C or better	UL 758	UL*

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Clause	Requirement – Test	Result – Remark	Verdict

DC switch (for model "-S1" to "-S6")	Santon International B.V.	XA100.16	1000 Vdc/ 16 A, 800 Vdc/ 25 A, 4 poles, 70°C, 4 poles	EN 60947-3	KEMA-KEUR*
(Alternative)	Sensata Technologies Changzhou Co., Ltd.	PVSW10FDF1-25F4-2-000	1000 Vdc, 25 A, 70°C, 4 poles	EN 60947-3	TUV Rheinland*
(Alternative)	Merz Schaltgerate GmbH + Co KG	MDC1A-025-600	1000 Vdc, 25 A, IP65, 4 poles	EN 60947-1 EN 60947-3	KEMA-KEUR*
Connector on fuse PCB and input PCB (CNJ1, CNJ2, CNK1, CNK2, CNA1, CNA3, CNA8)	Phoenix Contact Gmbh & Co Kg	MKDSP 10N/ 2-10,16	AC 1000 V, 105°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Dinkle Enterprise Co. Ltd.	ESK116	1000 V, 57 A	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Connector on control PCB (CNBA3)	Phoenix Contact Gmbh & Co Kg	MKDS 5 HV/ 2-9,52	AC 1000 V, 105°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Dinkle Enterprise Co. Ltd.	EK950	AC 1000 V, 105°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Fuse on fuse PCB (for model "-S3" to "-S6")	Bussmann	PV-15A-10F	1000 Vdc, 15 A, 10×38 mm	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Littelfuse, Inc.	SPF	1000 Vdc, 15 A, 10×38 mm	IEC 60269-6	VDE*
(Alternative)	Various	Various	1000 Vdc, 15 A, 10×38 mm	IEC 60269-6	VDE* or other EU certificate
DC surge arrester (for model "-S4" to "-S6")	Shanghai Citel electronics Co., Ltd	DS50PVS-1000	1000 Vdc, 85°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Shanghai Citel Electronics Co., Ltd	DS50PV-1000	1000 Vdc, 85°C	IEC 61643-1 IEC/EN 62109-1 IEC/EN 62109-2	TUV PS* Tested with appliance
(Alternative)	Zhongguang Hitech	ZGG40-1000(2+1)PV	1200 Vdc, 85°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
PCB	Total Electronics Ltd	1368MLB	130°C, V-0, Min thickness: 1,6 mm	UL94 IEC/EN 62109-1 IEC/EN 62109-2	UL* Tested with appliance

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Clause	Requirement – Test	Result – Remark	Verdict

(Alternative)	Shantou Lucky Star Pcb Co Ltd	WS888	130°C, V-0, CTI: min.175, Min thickness: 1,6 mm	UL94	UL*
(Alternative)	Various	Various	130°C, V-0, CTI: min.175, Min thickness: 1,6 mm	UL94	UL*
-PCB material	Shengyi Technology Co Ltd	S1000 S1141	130°C, V-0, CTI: min.175	UL94	UL
(Alternative)	Various	Various	130°C, V-0, CTI: min.175	UL94	UL
Capacitor (CA12, CA25)	Chang Jie	LBB61	30 µF, 1100 Vdc, 85°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Faratronic	C3D	30 µF, 1100 Vdc, 85°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
X capacitor on output PCB (CB24, CB33, CB42, CB49, CB51, CB52, CB54, CB56, CB57)	Shantou High-New Technology Dev. Zone Songtian Enterprise Co., Ltd	MPX	X2, 2,2 µF, 305 Vac, 110°C	IEC 60384-14	VDE*
(Alternative)	Various	Various	X2, 2,2 µF, 305 Vac, 100°C or above	IEC 60384-14	VDE or other EU certificate
Y capacitor on input PCB, control PCB and power PCB (CA10, CA11, CA13, CA14, CA17, CA18, CA19, CA21, CA26, CA29, CA31, CA32, CYD1, CYD2, CYD3, CYD4)	Shantou High-New Technology Dev. Zone Songtian Enterprise Co., Ltd	CD	4700 pF, 400 Vac, Y1, 125°C	IEC 60384-14	VDE*
(Alternative)	VISHAY Electronic GmbH	VY1	4700 pF, 500 Vac, Y1, 125°C	IEC 60384-14	VDE*
(Alternative)	Various	Various	4700 pF, 400 Vac or above, Y1, 125°C	IEC 60384-14	VDE or other EU certificate

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Clause	Requirement – Test	Result – Remark	Verdict

Y capacitor on output PCB (CYB1, CYB2, CYB4, CYB5, CYB7, CYB8, CYB11)	Shantou High-New Technology Dev. Zone Song-tian Enterprise Co., Ltd	CE	Y2, 250 Vac, 100 pF, 125°C	IEC 60384-14	VDE*
(Alternative)	Various	Various	Y1 or Y2, 250 Vac, 100 pF, 125°C	IEC 60384-14	VDE or other EU certificate
Y capacitor on output PCB (CYB3, CYB6, CYB9)	Shantou High-New Technology Dev. Zone Song-tian Enterprise Co., Ltd	CE	Y2, 250 Vac, 10000 pF, 125°C	IEC 60384-14	VDE*
(Alternative)	Various	Various	Y1 or Y2, 250 Vac, 10000 pF, 125°C	IEC 60384-14	VDE or other EU certificate
Varistor on input PCB and output PCB (MOVA1, MOVA2, MOVA3, MOVA4, MOVA5, MOVA6, MOVB1, MOVB2, MOVB3, MOVB4)	Dongguan Littel-fuse Electronics Co Ltd	V1000LA160BP	1000 Vac, 1200 Vdc, 85 °C	IEC 61051-1 IEC 61051-2 IEC 61051-2-2	VDE*
Input inductor (LA1)	Bo Luo Da Xin Electronic Co.,Ltd	SH-L001	130°C, Class B	IEC/EN 62109-1 IEC/EN 62109-2	Tested with ap-pliance
(Alternative)	Huizhou Baohui Electronics Technology Co.,Ltd	SH-L001	130°C, Class B	IEC/EN 62109-1 IEC/EN 62109-2	Tested with ap-pliance
- Winding of the input inductor	Various	Various	130°C or above, Φ2,0 mm	UL 1446	UL*
Current trans-ducer (HLEA1, HLEA2)	LEM	HXN25-P	25 A	IEC/EN 62109-1 IEC/EN 62109-2	Tested with ap-pliance
(Alternative)	TAMURA CORP	L18P025D15	25 A	IEC/EN 62109-1 IEC/EN 62109-2	Tested with ap-pliance
Boost chock (for Sofar 20000TL-Sx)	Bo Luo Da Xin Electronic Co., Ltd	SH-L003	1800 µH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with ap-pliance

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Clause	Requirement – Test	Result – Remark	Verdict

(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L003	1800 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Boost chock (for Sofar 17000TL-Sx, Sofar 15000TL-Sx)	Bo Luo Da Xin Electronic Co.,Ltd	SH-L009	2100 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L009	2100 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Boost chock (for Sofar 10000TL-Sx)	Bo Luo Da Xin Electronic Co., Ltd	SH-L013	3000 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L013	3000 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
- Lead wire of the boost chock	Various	1032 or 10269	10AWG, 1000 V, 90°C or better	UL 758	UL*
- Winding of the boost chock	Various	Various	130°C or above, Φ2,1 mm	UL 1446	UL*
- Insulation tape of the boost chock	Jingjiang Yahua Pressure Sensitive Glue Co Ltd	CT, WF	Min 130°C	UL 510	UL*
(Alternative)	Various	Various	130°C	UL 510	UL*
- Pouring material of the boost chock	Jiangsu Feixiang Chemical Co Ltd	DG8626A&B	V-0, 105°C	UL 94	UL*
(Alternative)	Various	Various	V-0, min.105°C	UL 94	UL*
Inverter chock (for Sofar 20000TL-Sx)	Bo Luo Da Xin Electronic Co., Ltd	SH-L002	730 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L002	730 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Inverter chock (for Sofar 17000TL-Sx)	Bo Luo Da Xin Electronic Co., Ltd	SH-L011	850 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L011	850 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance

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Clause	Requirement – Test	Result – Remark	Verdict

Inverter chock (for Sofar 15000TL-Sx)	Bo Luo Da Xin Electronic Co., Ltd	SH-L010	960 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L010	960 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Inverter chock (for Sofar 10000TL-Sx)	Bo Luo Da Xin Electronic Co., Ltd	SH-L012	1460 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L012	1460 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
- Lead wire of the inverter chock	Various	1015, 1032 or 10269	10AWG, Min 300 V, 90°C or better	UL 758	UL*
- Winding of the inverter chock	Various	Various	130°C or above, Φ1,8 mm	UL 1446	UL*
- Insulation tape of the inverter chock	Jingjiang Yahua Pressure Sensitive Glue Co Ltd	CT, WF	130°C	UL 510	UL*
(Alternative)	Various	Various	130°C	UL 510	UL*
- Pouring material of the inverter chock	Jiangsu Feixiang Chemical Co Ltd	DG8626A&B	V-0, 105°C	UL 94	UL*
(Alternative)	Various	Various	V-0, 105°C or above	UL 94	UL*
IGBT module (QD1, QD2, QD3)	Vincotech (Hungary) Ltd	10-FZ12NMA080SH01-M260F	1200 V, 80 A	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Infineon	DS_F3L80R12W1H3_B11	1200 V, 80 A	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Vincotech (Hungary) Ltd	10-FZ12NMA040SH-M267F (only for model Sofar 15000TL-Sx and 10000TL-Sx)	1200 V, 40 A	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Insulating sheet between IGBT and heat sink	Bergquist Co	K-10	Min 0,13 mm, VTM-0, 150°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Bergquist Co	900S	Min 0,2 mm, V-0, 150°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance

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Clause	Requirement – Test	Result – Remark	Verdict

(Alternative)	Laird Technologies	K52	V-0, 0,051 mm	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Insulating sheet (between power board and enclosure)	Mianyang Longhua Film Co Ltd	PP-BK18	V-0, min 0,4 mm, 100°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Formex, Div Of Illinois Tool Works Inc, Formerly	FORMEX GK-(a)(b)(f2)	VTM-0, 115°C, Min 0,2 mm	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Sabic Innovative Plastics Us L L C	FR1, FR7, FR25	V-0, 125°C, min 0,23 mm thickness	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Busbar Capacitor (CA129, CA131, CA145, CA148) (for 20 kW & 17 kW models incorporating all 4 capacitors; for 15 kW models incorporating any 3 capacitors; for 10 kW models incorporatings any 2 capacitors)	Faratronic	C3D	30 µF, 1100 Vdc, 85°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Chang Jie	LBB61	30 µF, 1100 Vdc, 85°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Busbar Capacitor (CD1, CD2, CD3, CD4, CD5, CD6, CD7, CD8, CD39, CD40) (for 20 kW models incorporating all 10 capacitors; 17 kW models incorporating any 8 capacitors; for 15 kW models incorporating any 6 capacitors; for 10 kW models incorporatings any 4 capacitors)	Faratronic	C3D	700 Vdc, 75 µF, 85°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance

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Clause	Requirement – Test	Result – Remark	Verdict

(Alternative)	Chang Jie	LBB61	700 Vdc, 75 μF, 85°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Transformer on power PCB (TA2, TE1*6pcs)	Bo Luo Da Xin Electronic Co., Ltd	SH-T001	Class B	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	SH-T001	Class B	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
- Winding	E&B Technology Co Ltd	E&B-XXXB	130°C(Class B)	UL2353	UL*
(Alternative)	Furukawa Electric Co Ltd	TEX-E	130°C(Class B)	UL2353	UL*
(Alternative)	Huizhou Huiqiang Electronics Co Ltd	JY0160	155°C (Class F)	UL2353	UL*
- Bobbin	Sumitomo Bakelite Co Ltd	PM 9630 or PM9820	V-0, 150°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Chang Chun Plastics Co Ltd	T375HF	V-0, 150°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
- Insulating tape	Jingjiang Yahua Pressure Sensitive Glue Co Ltd	CT	130°C	UL 510	UL*
Output inductor (LB1, LB2)	Bo Luo Da Xin Electronic Co., Ltd	SH-L004	2,4 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L004	2,4 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Output inductor (LB3, LB4, LB5)	Bo Luo Da Xin Electronic Co., Ltd	SH-L005	13,5 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L005	13,5 μH, 130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
- Winding of the output inductor	Various	Various	130°C or above, Φ1,2 mm	UL 1446	UL*
Relay (RLB1, RLB2, RLB3, RLB4, RLB5, RLB6)	Panasonic Corporation Ise Factory	ALFG2PF12 ALFG2PF121	250 V, 31 A, 12 Vdc, 85°C, 30000 cycles	IEC/EN 61810-1	VDE*

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Clause	Requirement – Test	Result – Remark	Verdict

(Alternative)	Fujitsu Component Limited	FTR-K3AB012W-PV FTR-K3AB012W-PS	250 V, 32 A, 12 Vdc, 85°C, 30000 cycles	IEC/EN 61810-1	VDE*
Current transducer (HLB1, HLB2, HLB3)	LEM	CASR25-NP	25 A	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	VAC	T60404-N4646-X661	25 A	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	TAMURA	F02P025S05	25 A	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
AC surge arrester (for model "-S5" to "-S6")	Shanghai Citel electronics Co., Ltd	DS44S-400/G	400 Vac, 85°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Zhongguang Hitech	ZGG40-385(3+1)	230 Vac, 80°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
AC switch (for model "-S6")	Merz GmbH	ML1-040	690 Vac, 40 A	EN 60947-3	KEMA
AC output connector	Shenzhen Succeed Electronics Technology Co Ltd	TR-35N	600 V, 115 A, 115°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Phoenix Contact GmbH & Co. Kg	UK 5 N	800 V, 32 A	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Transformer on control PCB (TA1)	Huizhou Baohui Electronics Technology Co., Ltd	SH-T002	Class B	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Bo Luo Da Xin Electronic Co., Ltd	SH-T002	Class B	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
- Bobbin of the transformer	Sumitomo Bakelite Co Ltd	PM-9820 PM-9830	150°C, V-0	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Chang Chun Plastics Co Ltd	T375HF	V-0, 150°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
- Insulating tape of the transformer	Jingjiang Yahua Pressure Sensitive Glue Co Ltd	CT	130°C	UL 510	UL*
(Alternative)	Various	Various	130°C	UL 510	UL*
- Margin Tape	Jingjiang Yahua Pressure Sensitive Glue Co Ltd	WF	130°C	UL 510	UL*

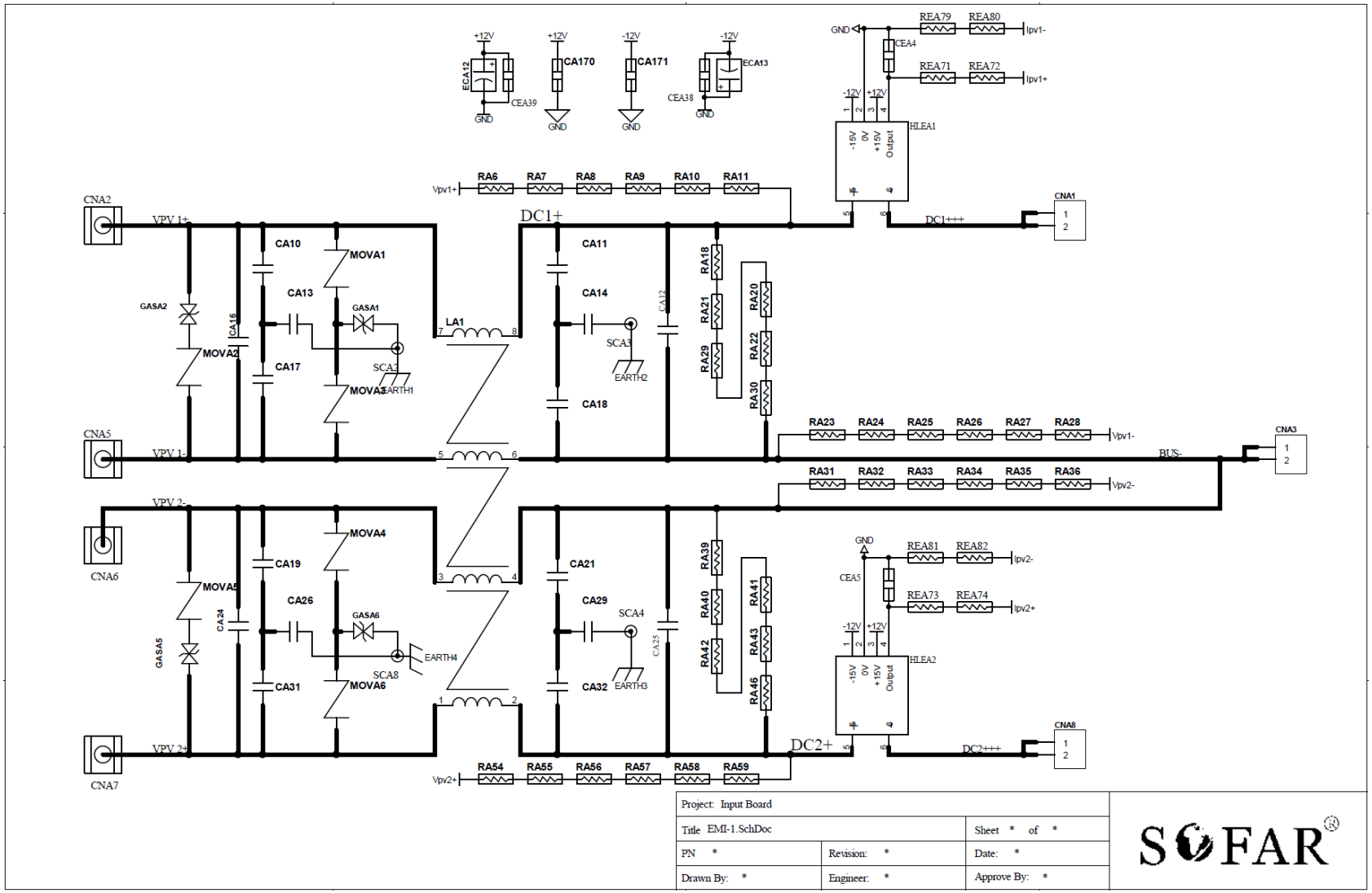
IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

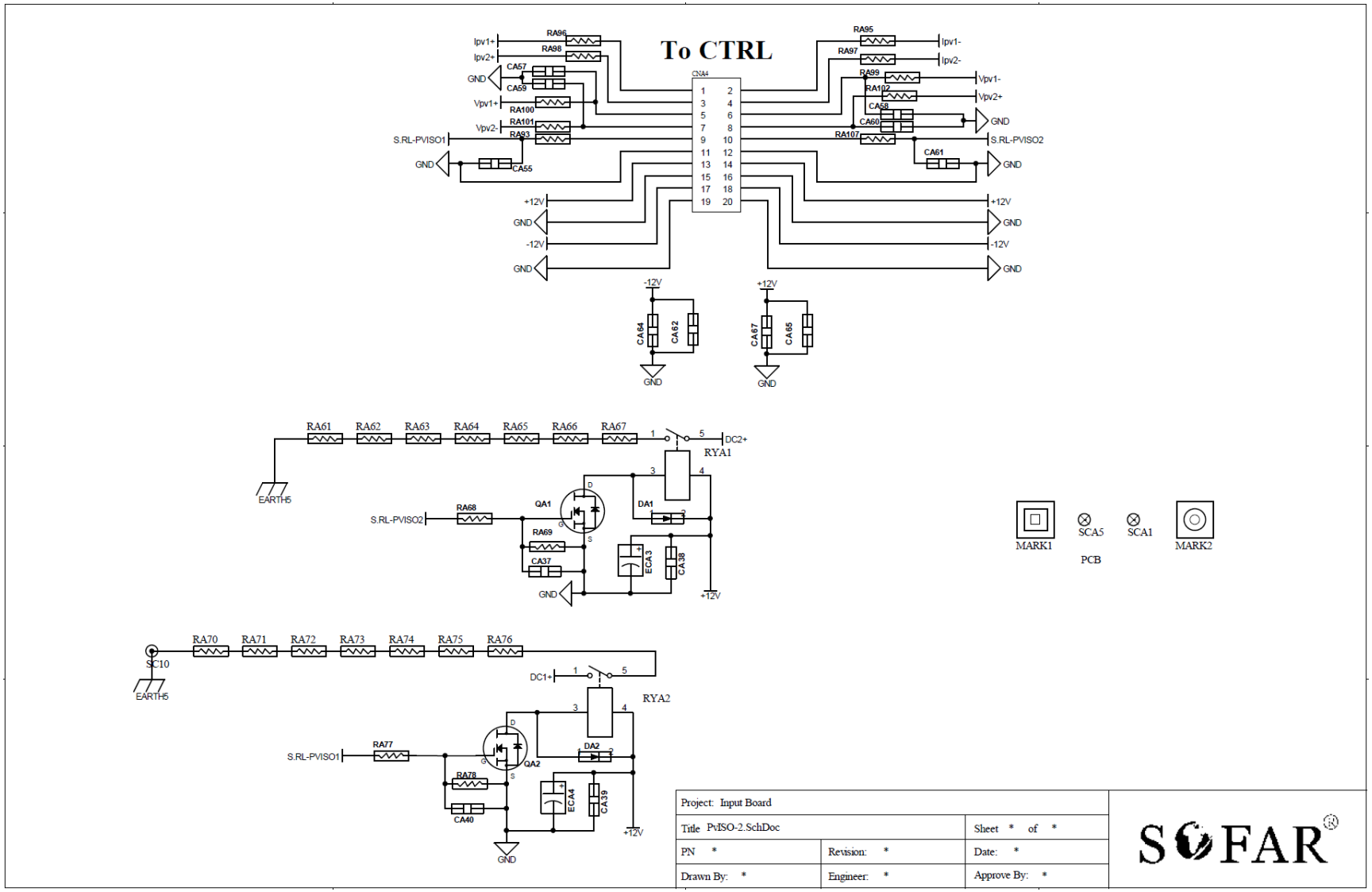
(Alternative)	Various	Various	130°C	UL 510	UL*
- Magnet wire of the transformer	Tai-I Electric Wire & Cable Co Ltd	UEW	130°C, Φ0,45 mm	UL 1446	UL*
(Alternative)	Various	Various	130°C, Φ0,45 mm	UL 1446	UL*
- Tubing of the transformer	Shenzhen Woer Heat-Shrinkable Material Co Ltd	WF	600 V, 200°C	UL 224	UL*
(Alternative)	Various	Various	600 V, 200°C	UL 224	UL*
- Varnishes	Suzhou Taihu Electric Advanced Material Co Ltd	T-4260	130°C	UL 1446	UL*
(Alternative)	Various	Various	130°C	UL 1446	UL*
Optocoupler	Lite-On Technology Corporation	LTV816	Cr. ≥ 7,0 mm, Cl. ≥ 7,0 mm, 55/115/21	EN 60747-5-5	VDE*
Inductor on control PCB (LA2, LA4, LA10, LA12, LA14)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L006	130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Bo Luo Da Xin Electronic Co., Ltd	SH-L006	130°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
- Winding of the inductor on control PCB	Various	Various	130°C or above, Φ0,35 mm	UL 1446	UL*
Outer fan	Sanyo Denki Co Ltd	9WP0812H401	12 Vdc/ 0,13 A, IP55, 70°C, CFM=53	EN 60950-1 IEC/EN 62109-1 IEC/EN 62109-2	TUV Rheinland* Tested with appliance
(Alternative)	Adda Corporation	AQ0812HB-A73GL	12 Vdc/ 0,24 A, IP58, 70°C, CFM=34.78	EN 60950-1 IEC/EN 62109-1 IEC/EN 62109-2	TUV Rheinland* Tested with appliance
Inner fan	Adda Corporation	AD0612MB-A73GL	12 Vdc, 0,14 A	EN 60950-1 IEC/EN 62109-1 IEC/EN 62109-2	TUV Rheinland* Tested with appliance

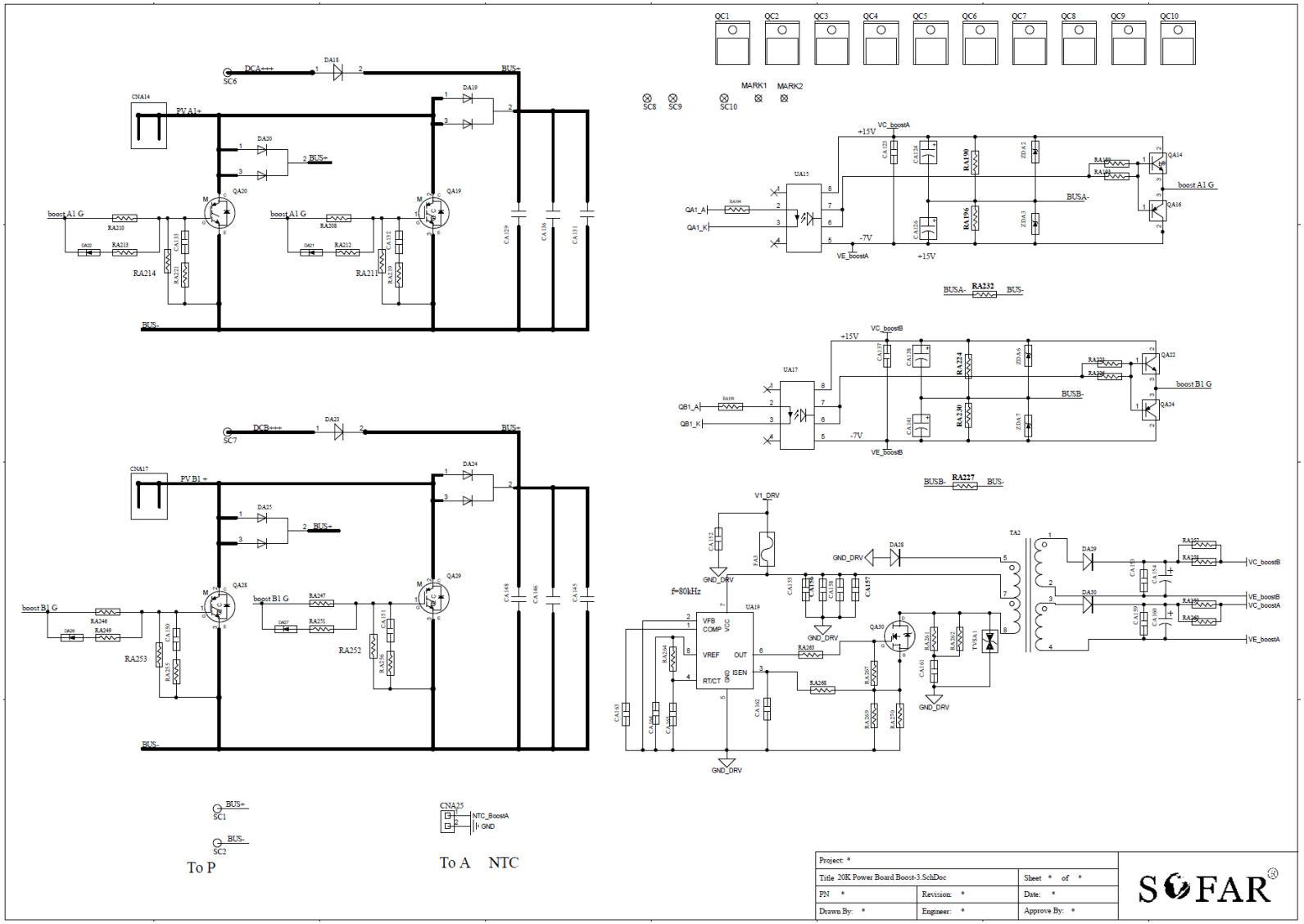
IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

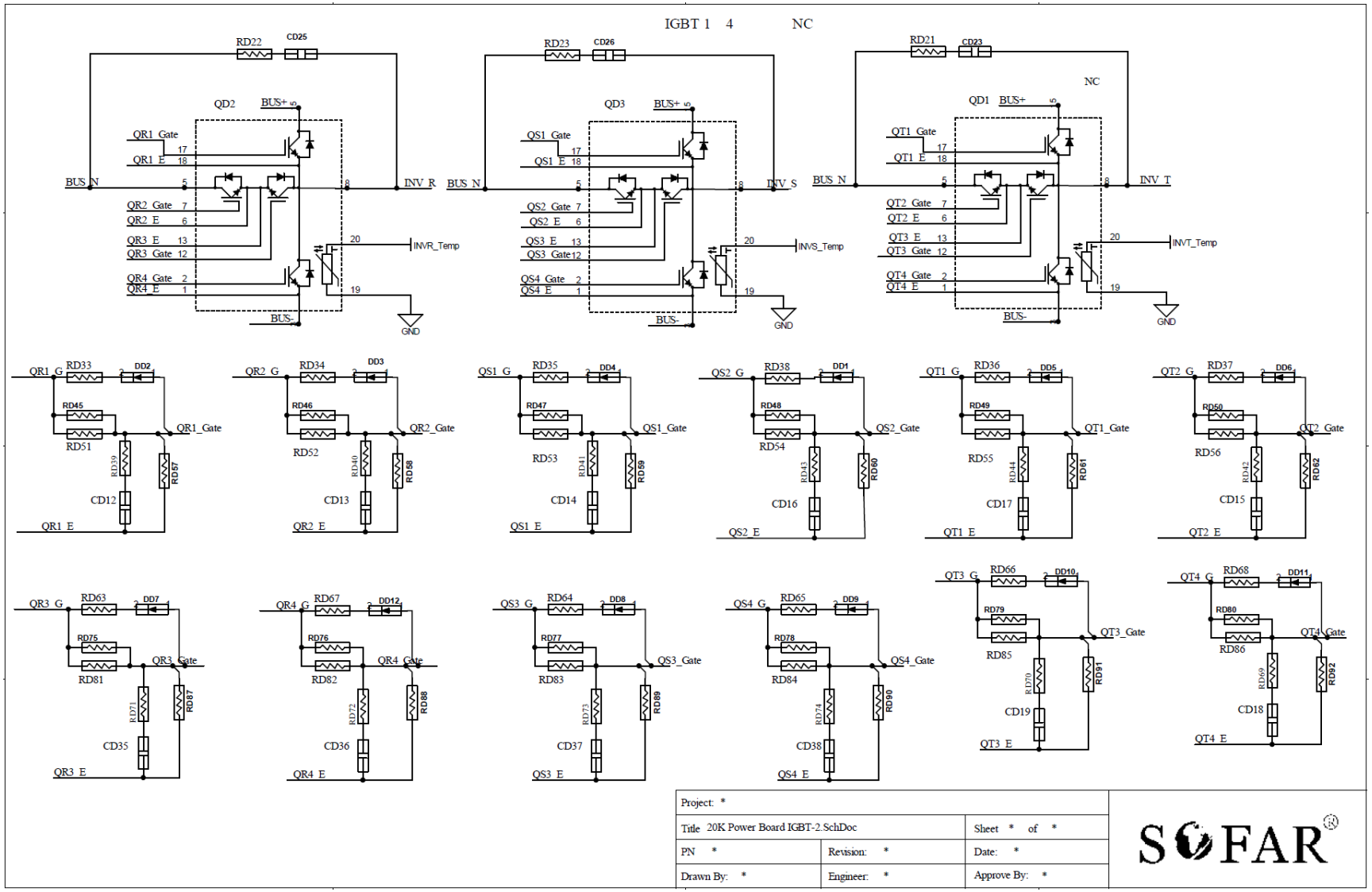
(Alternative)	Kaimei Electronic Corp.	JF0625B1MS	12 Vdc, 0,2 A	EN 60950-1 IEC/EN 62109-1 IEC/EN 62109-2	TUV Rheinland* Tested with appliance
LCD panel	Teijin Chemicals Plastic Compounds Shanghai Ltd	L-1250Z(#)(f1)	V-2, 80°C, Anti-UV	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
[1]) an asterisk indicates a mark which assures the agreed level of surveillance					

Appendix 1: Circuit Diagram




To CTRL
CNA4
Ipv1+
Ipv2+
GND
Vpv1+
Vpv2-
S.RL-PVISO1
GND
RA96
RA98
CA57
CA59
RA100
RA101
RA93
CA55
RA95
RA97
RA99
RA102
CA58
CA60
RA107
CA61
Ipv1-
Ipv2-
Vpv1-
Vpv2+
GND
S.RL-PVISO2
GND
+12V
GND
-12V
GND
CA64
CA62
CA67
CA65
GND
GND
RA61 RA62 RA63 RA64 RA65 RA66 RA67
EARTH5
DC2+
RYA1
S.RL-PVISO2
RA68
QA1
RA69
CA37
DA1
ECA3
CA38
GND
+12V
RA70 RA71 RA72 RA73 RA74 RA75 RA76
SC10
EARTH5
DC1+
RYA2
S.RL-PVISO1
RA77
QA2
RA78
CA40
DA2
ECA4
CA39
GND
+12V
MARK1
SCA5
SCA1
MARK2
PCB
Project: Input Board
Title PvISO-2.SchDoc
Sheet * of *
PN *
Revision: *
Date: *
Drawn By: *
Engineer: *
Approve By: *
SOFAR®


QC1 QC2 QC3 QC4 QC5 QC6 QC7 QC8 QC9 QC10
MARK1 MARK2
SC8 SC9 SC10
DCA+++
BUS+
BUS-
PV A1+
boost A1 G
RA214
RA212
DCB+++
PV B1 +
boost B1 G
RA253
RA252
VC_boostA
VE_boostA
BUSA-
RA232
VC_boostB
VE_boostB
BUSB-
RA227
V1_DRV
GND_DRV
f=80kHz
UA19
UA15
UA17
To P
To A NTC
CNA25
NTC_BoostA
GND
Project: *
Title 20K Power Board Boost-3.SchDoc
Sheet * of *
PN *
Revision: *
Date: *
Drawn By: *
Engineer: *
Approve By: *
SOFAR


IGBT 1 4 NC
RD22 CD25
RD23 CD26
RD21 CD23
NC
QD2 BUS+
QD3 BUS+
QD1 BUS+
QR1 Gate
QR1 E
QR2 Gate
QR2 E
QR3 E
QR3 Gate
QR4 Gate
QR4 E
QS1 Gate
QS1 E
QS2 Gate
QS2 E
QS3 E
QS3 Gate
QS4 Gate
QS4 E
QT1 Gate
QT1 E
QT2 Gate
QT2 E
QT3 E
QT3 Gate
QT4 Gate
QT4 E
BUS_N
INV_R
INV_S
INV_T
INVR_Temp
INVS_Temp
INVT_Temp
BUS-
GND
QR1_G RD33 DD2 RD45 RD51 QR1_Gate CD12 QR1_E
QR2_G RD34 DD3 RD46 RD52 QR2_Gate CD13 QR2_E
QS1_G RD35 DD4 RD47 RD53 QS1_Gate CD14 QS1_E
QS2_G RD38 DD1 RD48 RD54 QS2_Gate CD16 QS2_E
QT1_G RD36 DD5 RD49 RD55 QT1_Gate CD17 QT1_E
QT2_G RD37 DD6 RD50 RD56 QT2_Gate CD15 QT2_E
QR3_G RD63 DD7 RD75 RD81 QR3_Gate CD35 QR3_E
QR4_G RD67 DD12 RD76 RD82 QR4_Gate CD36 QR4_E
QS3_G RD64 DD8 RD77 RD83 QS3_Gate CD37 QS3_E
QS4_G RD65 DD9 RD78 RD84 QS4_Gate CD38 QS4_E
QT3_G RD66 DD10 RD79 RD85 QT3_Gate CD19 QT3_E
QT4_G RD68 DD11 RD80 RD86 QT4_Gate CD18 QT4_E
Project: *
Title 20K Power Board IGBT-2.SchDoc
Sheet * of *
PN *
Revision: *
Date: *
Drawn By: *
Engineer: *
Approve By: *
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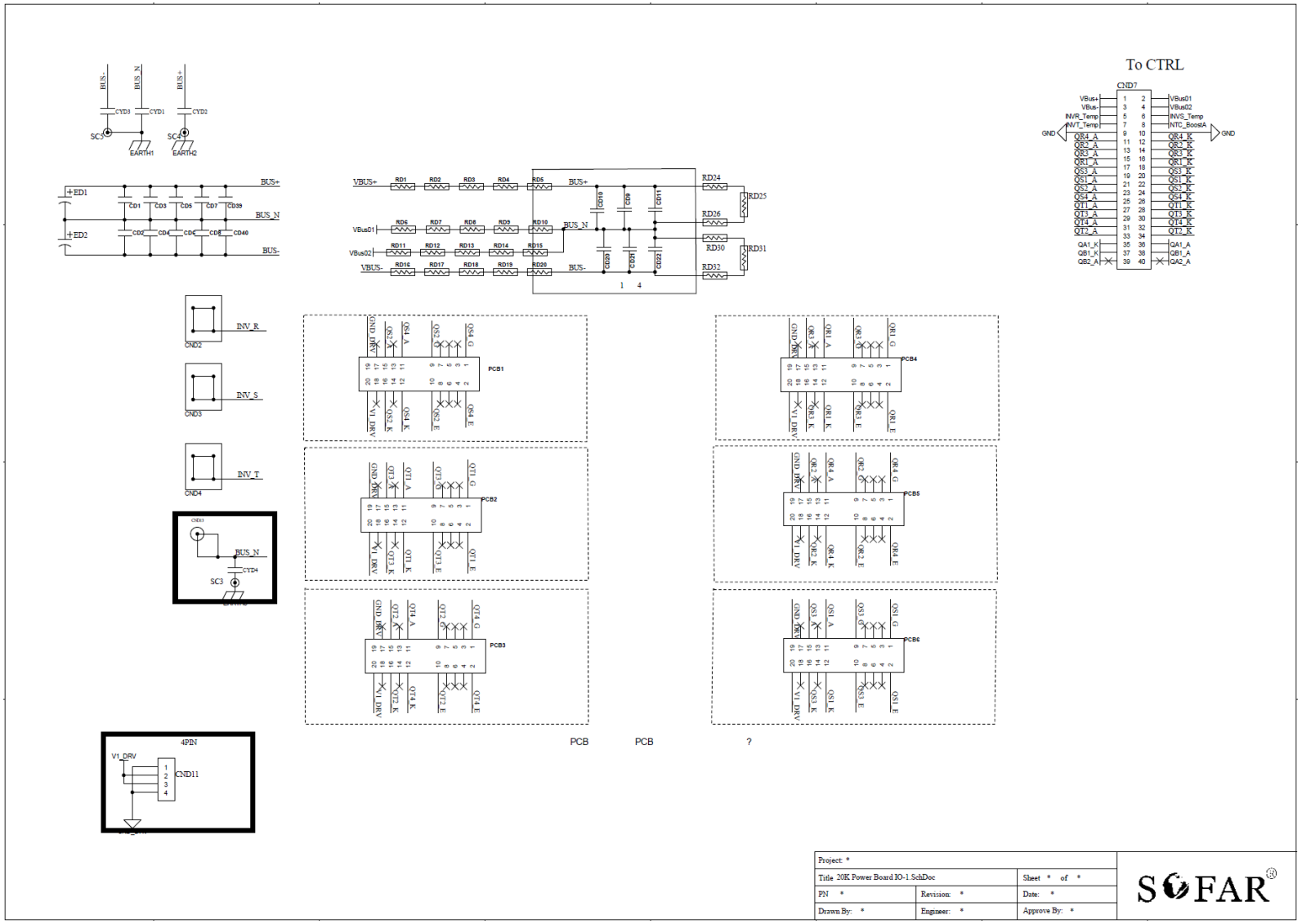
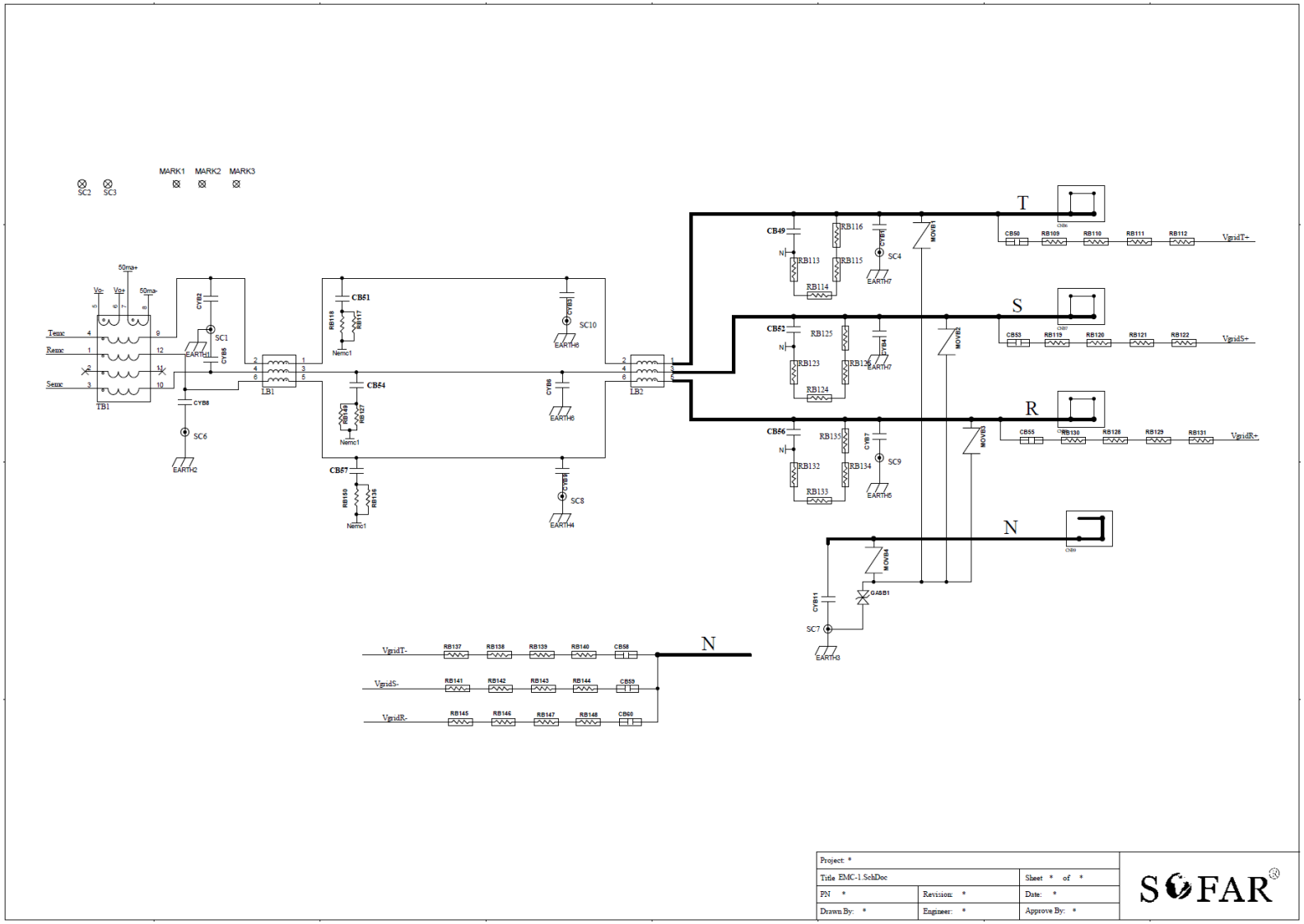
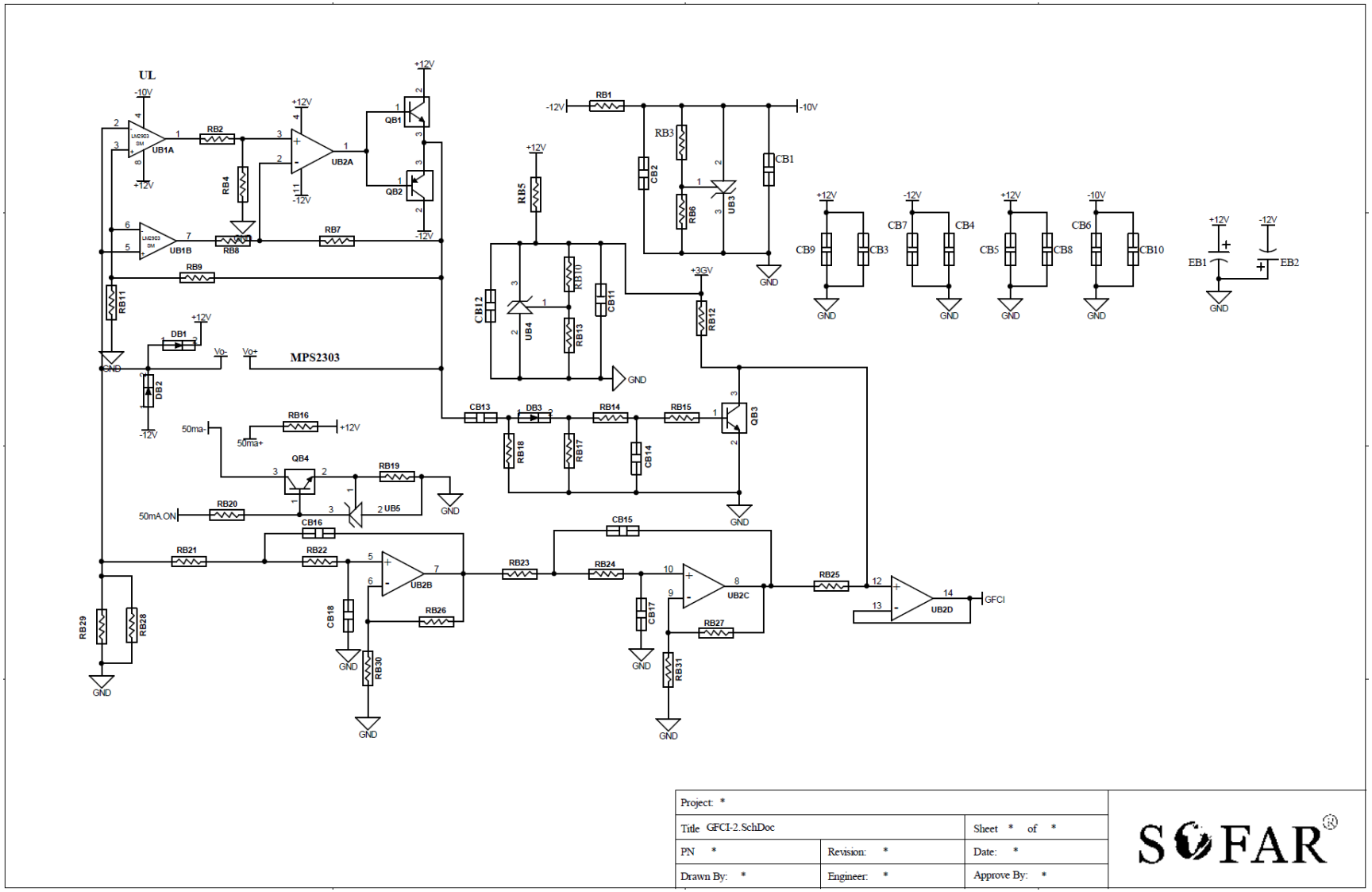
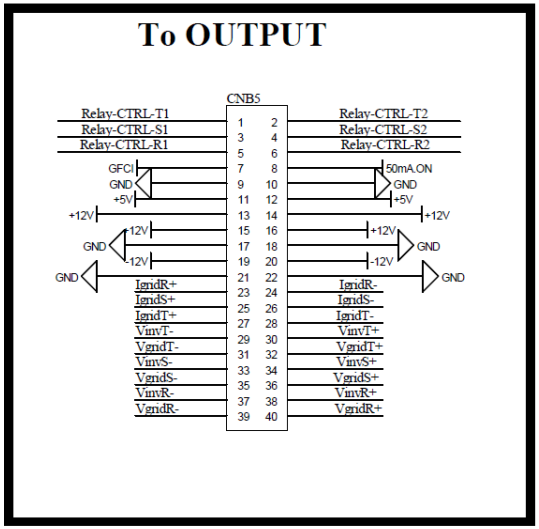

To CTRL
CND7
PCB
PCB
?
Project: *
Title 20K Power Board IO-1.SchDoc
Sheet * of *
PN *
Revision: *
Date: *
Drawn By: *
Engineer: *
Approve By: *
SOFAR


MARK1
MARK2
MARK3
SC2
SC3
50ma+
50ma-
Vo-
Vo+
Teux
Reux
Seux
TB1
CYB2
SC1
EARTH1
CYB5
CYB8
SC6
EARTH2
LB1
CB51
RB116
RB117
Nemc1
CB54
RB130
RB127
CB57
RB135
RB136
CYB6
SC10
EARTH6
CYB9
SC8
EARTH4
LB2
CB49
RB116
RB113
RB115
RB114
CYB3
SC4
EARTH7
MOV1
T
CB50
RB109
RB110
RB111
RB112
VgridT+
CB52
RB125
RB123
RB126
RB124
CYB4
SC5
EARTH7
MOV2
S
CB53
RB119
RB120
RB121
RB122
VgridS+
CB56
RB135
RB132
RB134
RB133
CYB7
SC9
EARTH6
MOV3
R
CB55
RB130
RB128
RB129
RB131
VgridR+
MOV4
GASB1
CYB11
SC7
EARTH3
N
VgridT-
RB137
RB138
RB139
RB140
CB58
VgridS-
RB141
RB142
RB143
RB144
CB59
VgridR-
RB145
RB146
RB147
RB148
CB60
Project: *
Title EMC-1.SchDoc
Sheet * of *
PN *
Revision: *
Date: *
Drawn By: *
Engineer: *
Approve By: *
SOFAR


UL
MPS2303
UB1A
UB1B
UB2A
UB2B
UB2C
UB2D
UB3
UB4
UB5
QB1
QB2
QB3
QB4
DB1
DB2
DB3
GFCI
50ma-
50ma+
50mA.ON
Project: *
Title GFCI-2.SchDoc
Sheet * of *
PN *
Revision: *
Date: *
Drawn By: *
Engineer: *
Approve By: *
SOFAR



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Title IO-3.SchDoc		Sheet * of *
PN *	Revision: *	Date: *
Drawn By: *	Engineer: *	Approve By: *

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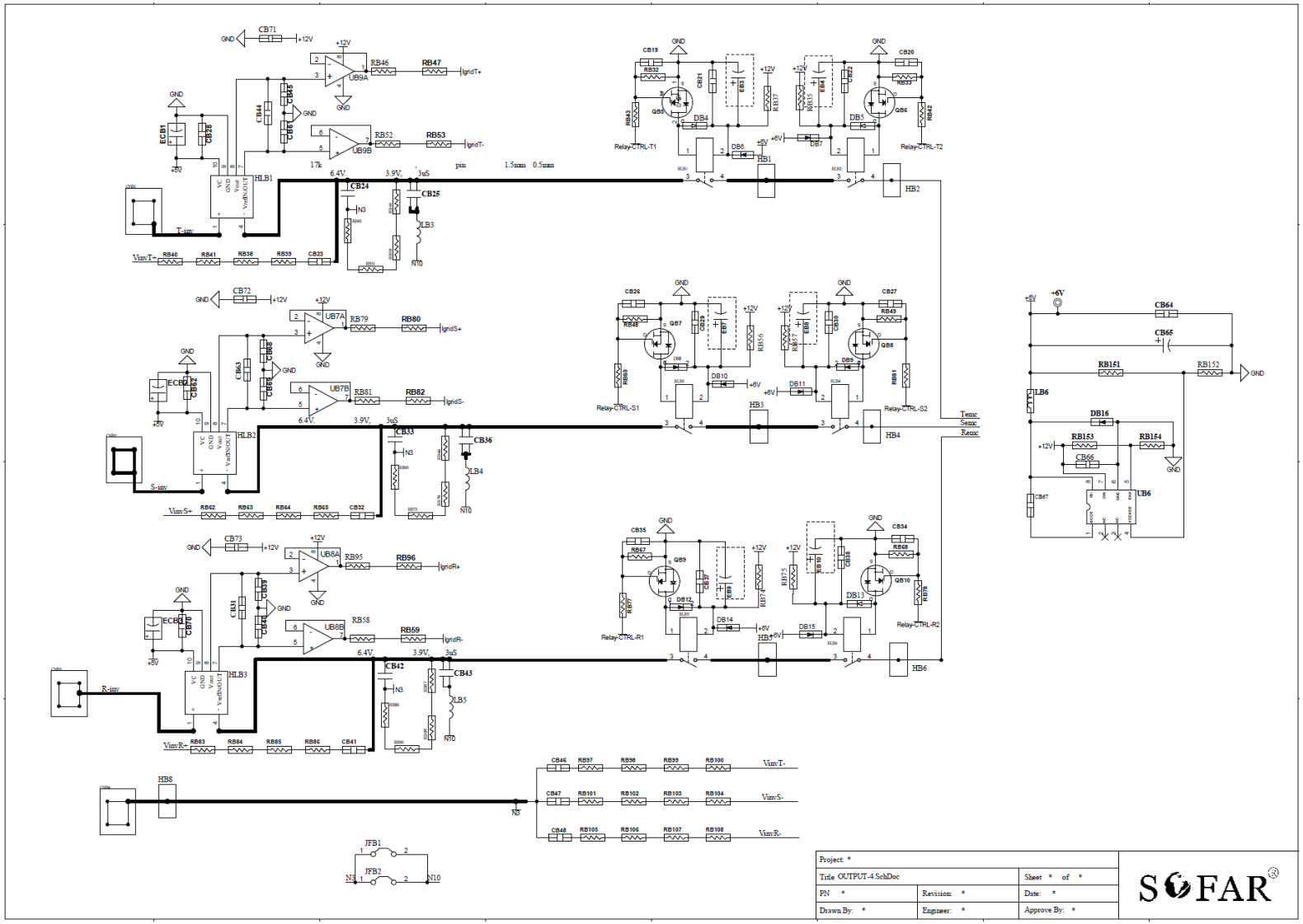
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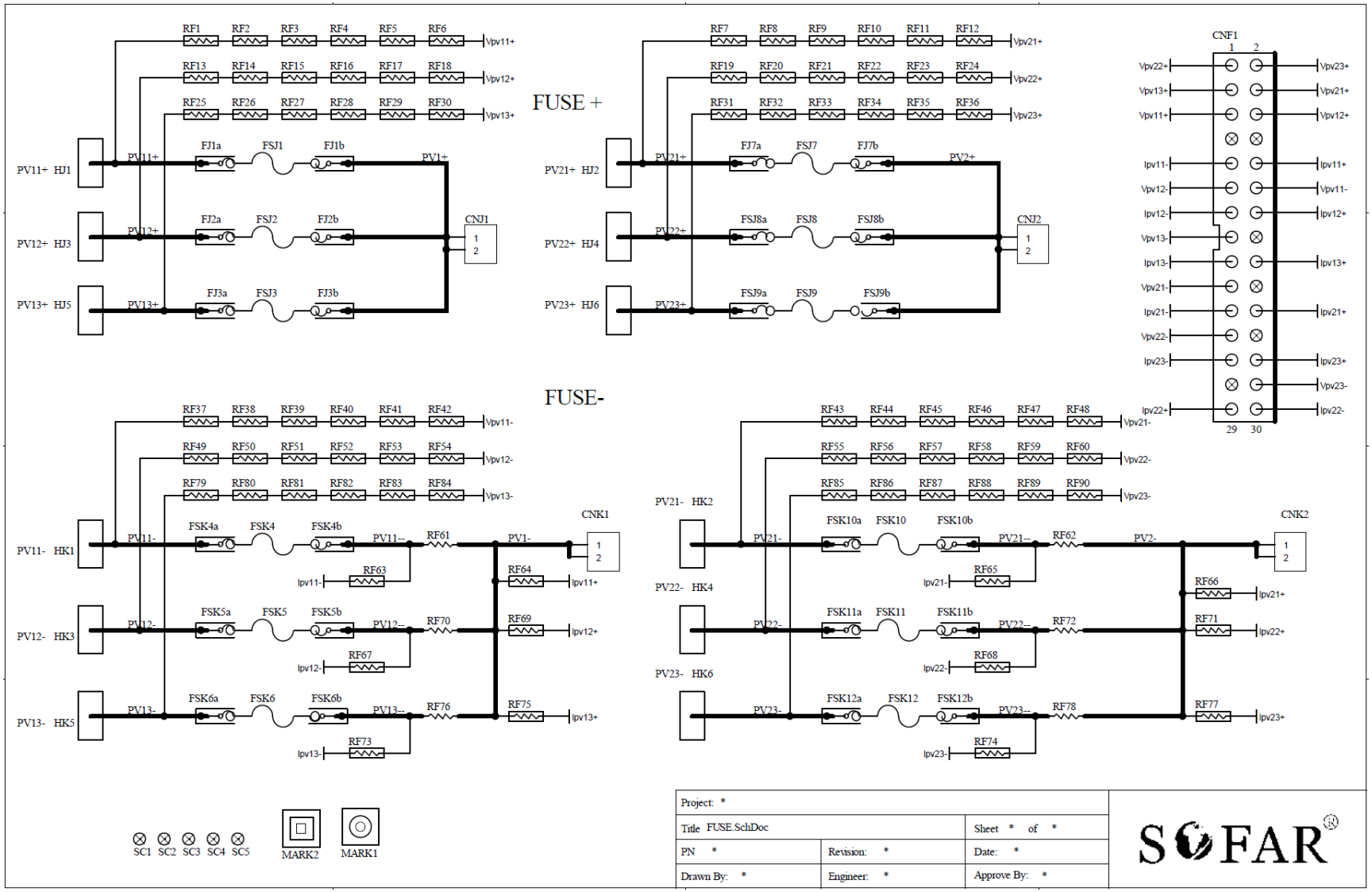
Title OUTPUT-4.SchDoc
Sheet * of *
PN *
Revision: *
Date: *
Drawn By: *
Engineer: *
Approve By: *
SOFAR


FUSE +
FUSE-
CNF1
CNJ1
CNJ2
CNK1
CNK2
PV11+ HJ1
PV12+ HJ3
PV13+ HJ5
PV21+ HJ2
PV22+ HJ4
PV23+ HJ6
PV11- HK1
PV12- HK3
PV13- HK5
PV21- HK2
PV22- HK4
PV23- HK6
SC1 SC2 SC3 SC4 SC5
MARK2 MARK1
Project: *
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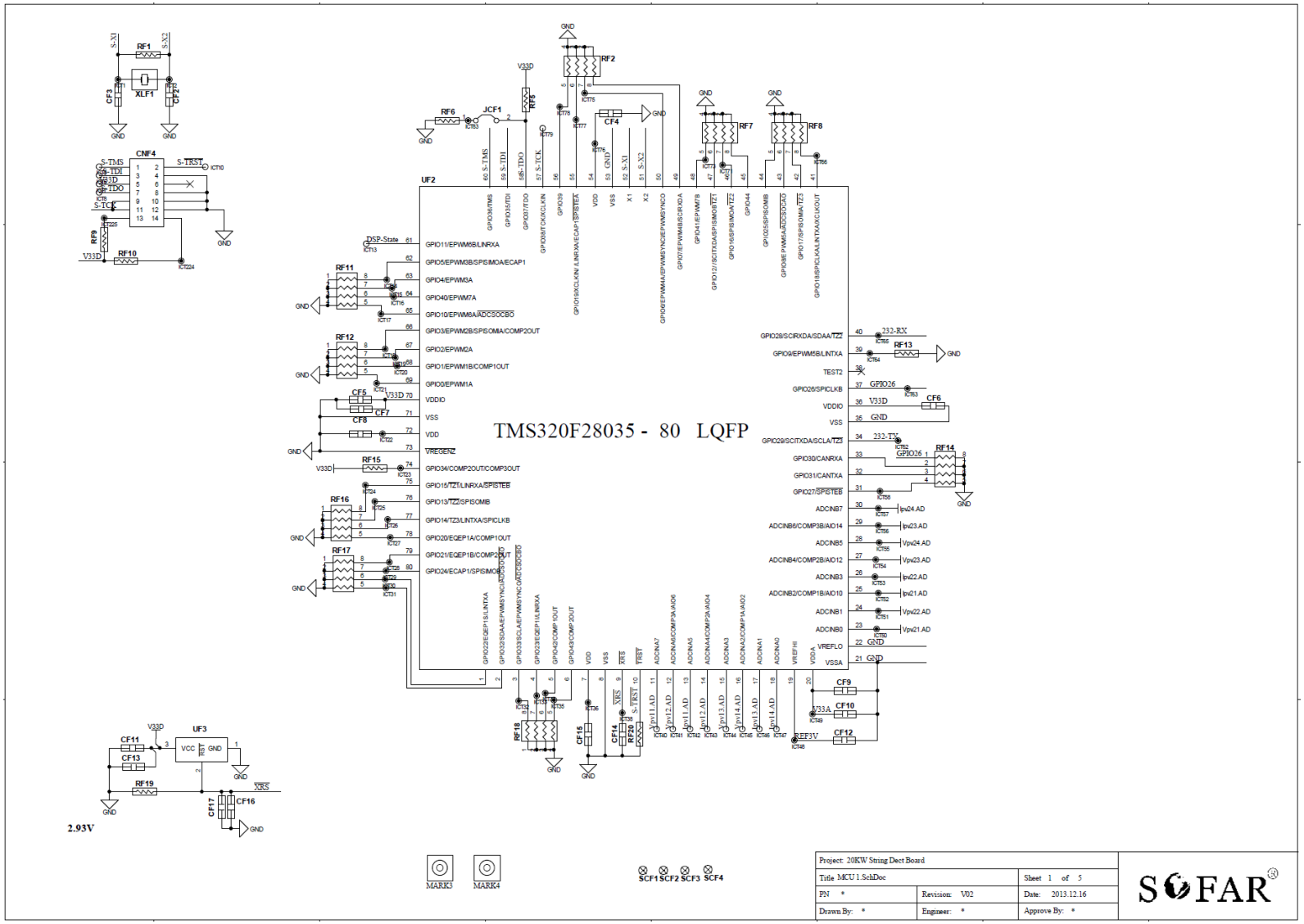
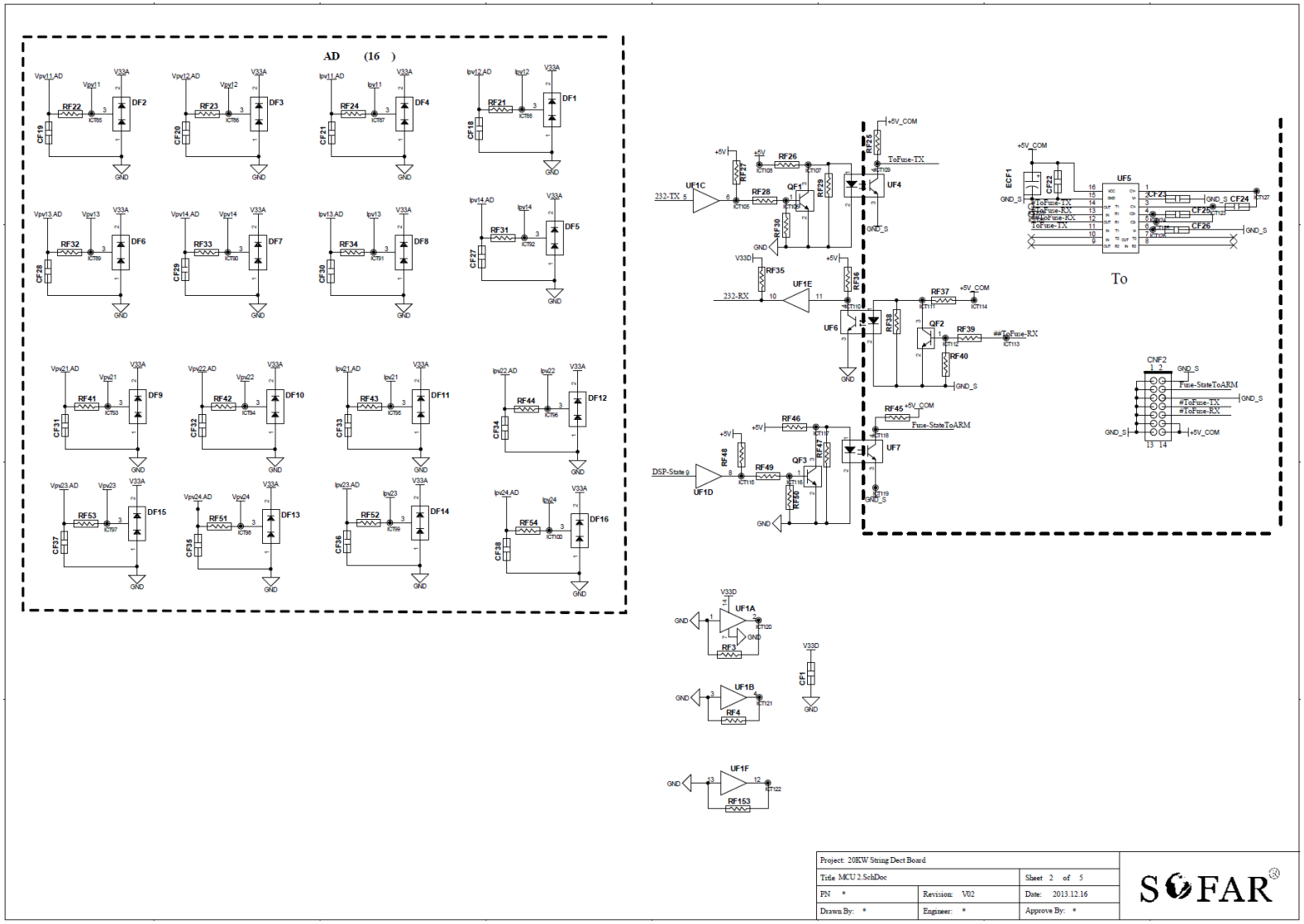
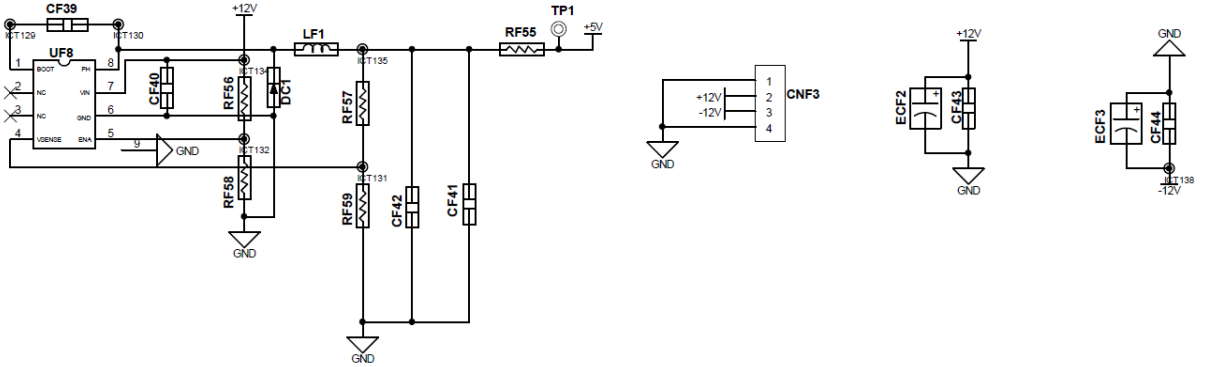
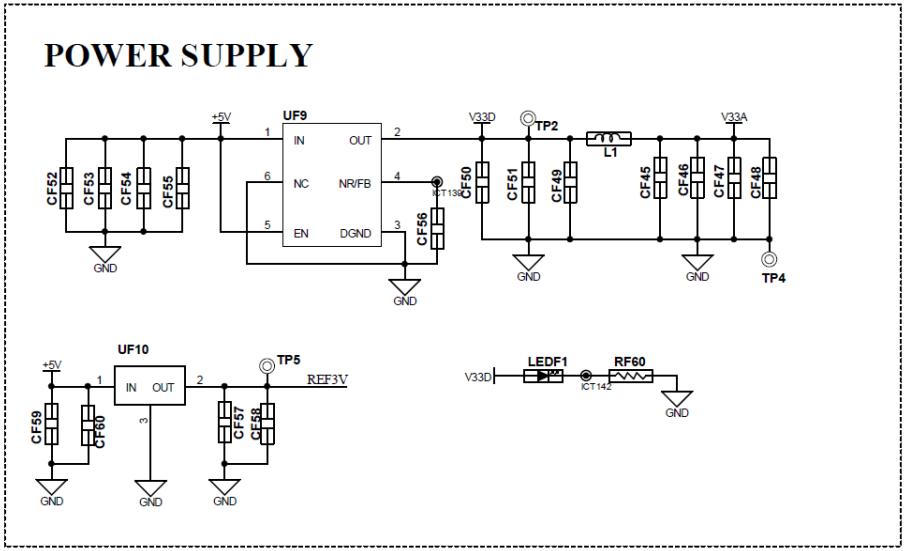
Sheet * of *
PN *
Revision: *
Date: *
Drawn By: *
Engineer: *
Approve By: *
SOFAR


TMS320F28035 - 80 LQFP
UF2
UF3
CNF4
JCF1
XLF1
RF1
RF2
RF6
RF7
RF8
RF9
RF10
RF11
RF12
RF13
RF14
RF15
RF16
RF17
RF18
RF19
RF20
CF3
CF4
CF5
CF6
CF7
CF8
CF9
CF10
CF11
CF12
CF13
CF14
CF15
CF16
CF17
V33D
GND
S-TMS
S-TDI
S-TDO
S-TCK
S-TRST
S-X1
S-X2
DSP-State
232-RX
232-TX
GPIO26
2.93V
MARK3
MARK4
SCF1 SCF2 SCF3 SCF4
Project: 20KW String Dect Board
Title MCU 1.SchDoc
Sheet 1 of 5
PN *
Revision: V02
Date: 2013.12.16
Drawn By: *
Engineer: *
Approve By: *
SOFAR


AD (16)
DF1
DF2
DF3
DF4
DF5
DF6
DF7
DF8
DF9
DF10
DF11
DF12
DF13
DF14
DF15
DF16
UF1A
UF1B
UF1C
UF1D
UF1E
UF1F
UF4
UF5
UF6
UF7
QF1
QF2
QF3
ToFuse-TX
#ToFuse-RX
Fuse-StateToARM
DSP-State
232-TX
232-RX
To
Project: 20KW String Dect Board
Title MCU 2.SchDoc
Sheet 2 of 5
PN *
Revision: V02
Date: 2013.12.16
Drawn By: *
Engineer: *
Approve By: *
SOFAR





Project: 20KW String Dect Board		
Title Power.SchDoc		Sheet 3 of 5
PN *	Revision: V02	Date: 2013.12.16
Drawn By: *	Engineer: *	Approve By: *

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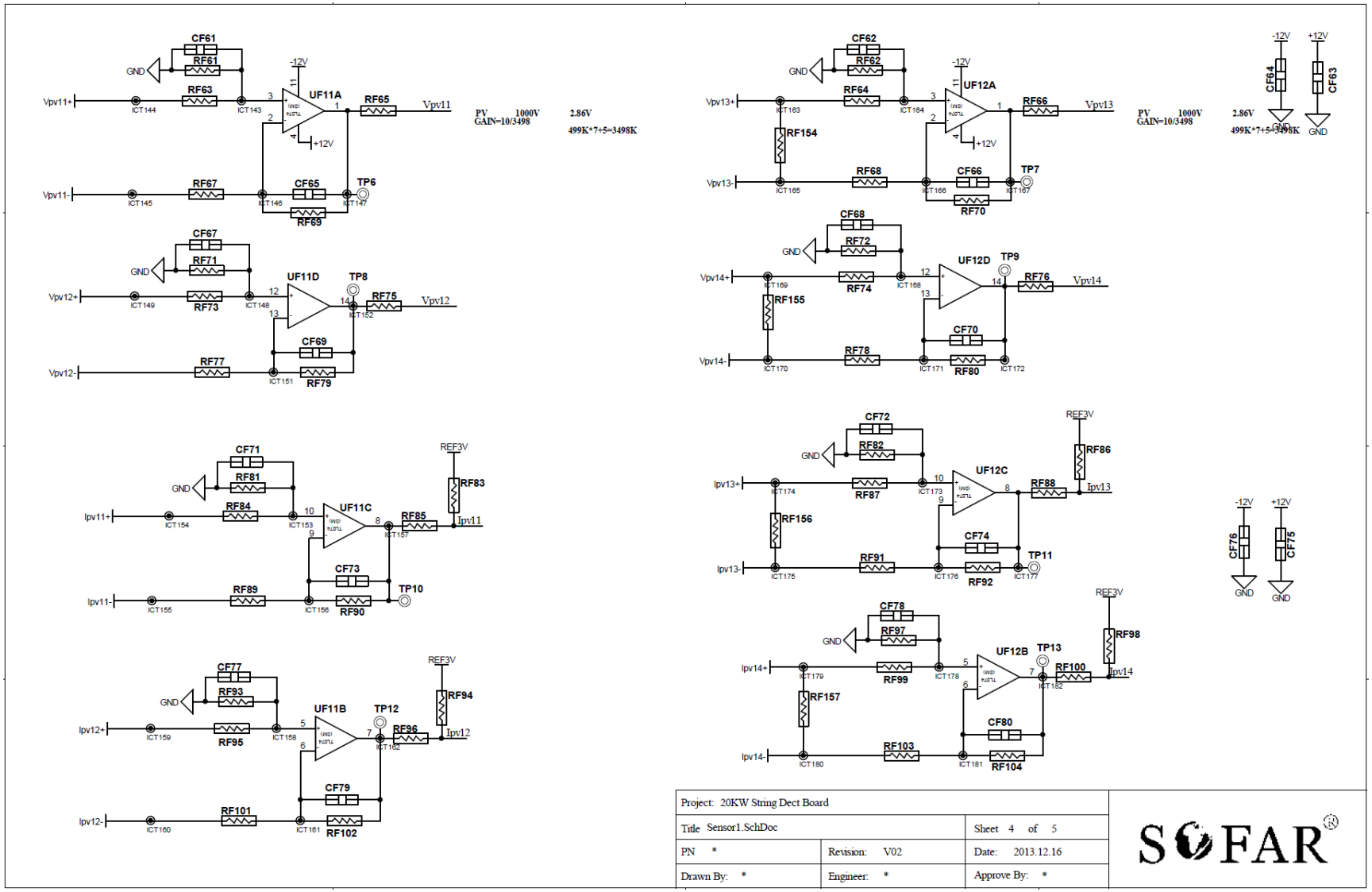
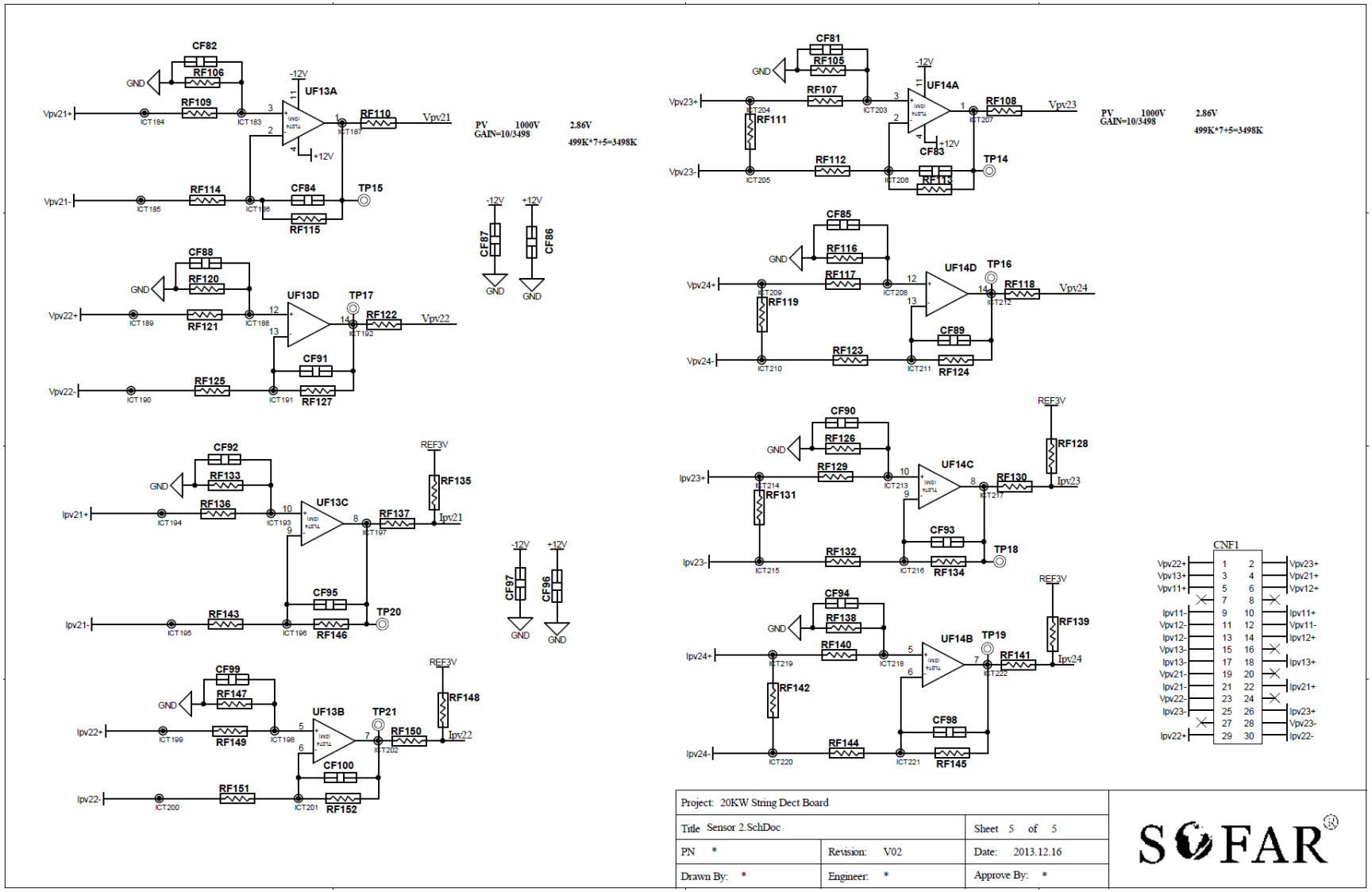

CF61
RF61
GND
RF63
Vpv11+
ICT144
ICT143
UF11A
-12V
+12V
RF65
Vpv11
PV 1000V
GAIN=10/3498
2.86V
499K*7+5=3498K
Vpv11-
RF67
ICT145
ICT146
CF65
TP6
ICT147
RF69
CF67
RF71
GND
Vpv12+
ICT149
RF73
ICT148
UF11D
TP8
RF75
Vpv12
ICT152
CF69
Vpv12-
RF77
ICT151
RF79
CF71
RF81
GND
RF84
Ipv11+
ICT154
ICT153
UF11C
REF3V
RF83
RF85
Ipv11
ICT157
CF73
Ipv11-
RF89
ICT155
ICT156
RF90
TP10
CF77
RF93
GND
RF95
Ipv12+
ICT159
ICT158
UF11B
TP12
REF3V
RF94
RF96
Ipv12
ICT162
CF79
Ipv12-
RF101
ICT160
ICT161
RF102
CF62
RF62
GND
RF64
Vpv13+
ICT163
ICT164
UF12A
-12V
+12V
RF66
Vpv13
PV 1000V
GAIN=10/3498
2.86V
499K*7+5=3498K
CF64
CF63
GND
GND
RF154
Vpv13-
RF68
ICT165
ICT166
CF66
TP7
ICT167
RF70
CF68
RF72
GND
Vpv14+
ICT169
RF74
ICT168
UF12D
TP9
RF76
Vpv14
RF155
CF70
Vpv14-
RF78
ICT170
ICT171
RF80
ICT172
CF72
RF82
GND
REF3V
RF86
Ipv13+
ICT174
RF87
ICT173
UF12C
RF88
Ipv13
RF156
CF74
Ipv13-
RF91
ICT175
ICT176
RF92
TP11
ICT177
CF76
CF75
GND
GND
CF78
RF97
GND
REF3V
RF98
Ipv14+
ICT179
RF99
ICT178
UF12B
TP13
RF100
Ipv14
ICT182
RF157
CF80
Ipv14-
RF103
ICT180
ICT181
RF104
Project: 20KW String Dect Board
Title Sensor1.SchDoc
Sheet 4 of 5
PN *
Revision: V02
Date: 2013.12.16
Drawn By: *
Engineer: *
Approve By: *
SOFAR


CF82
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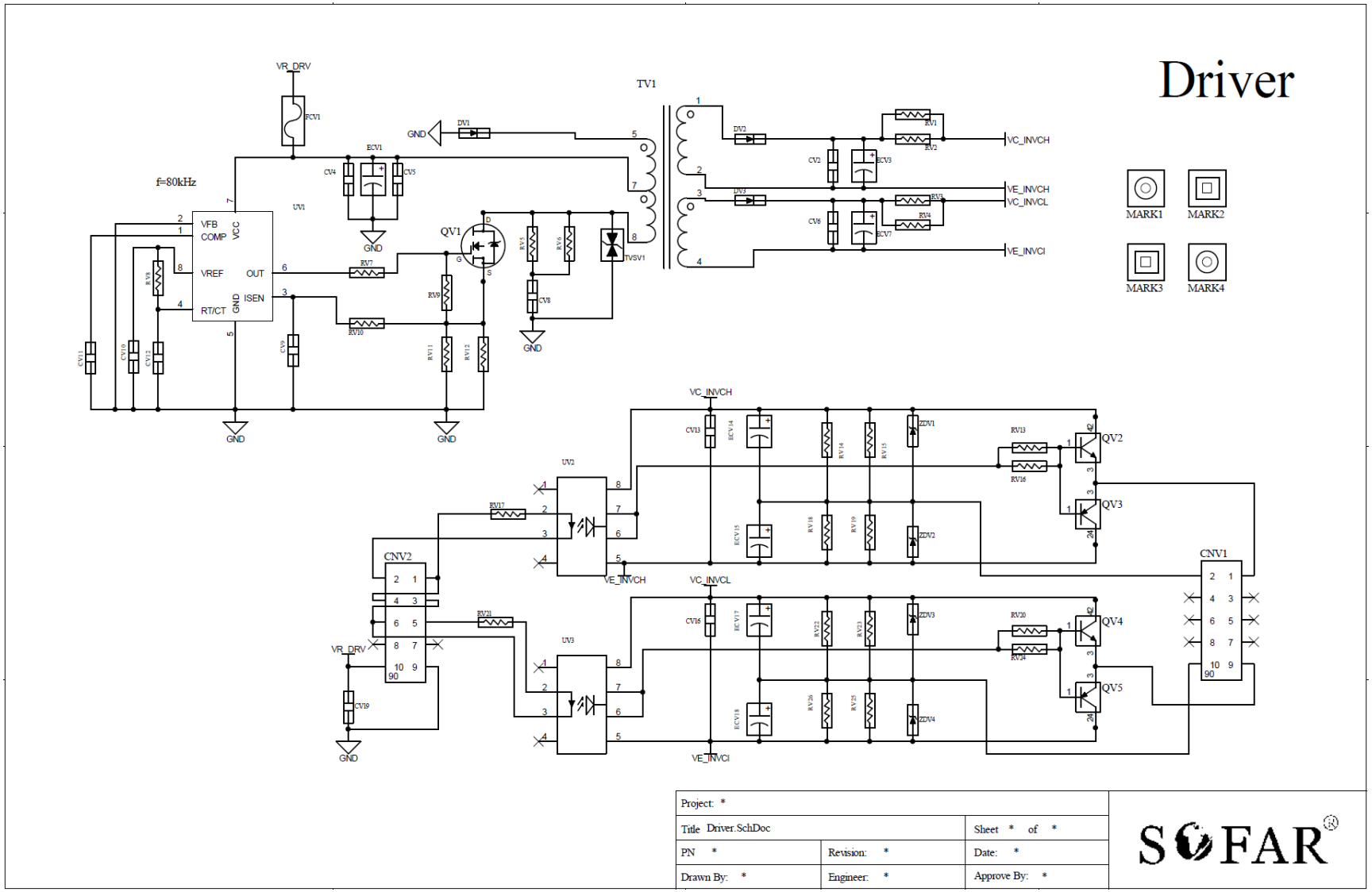
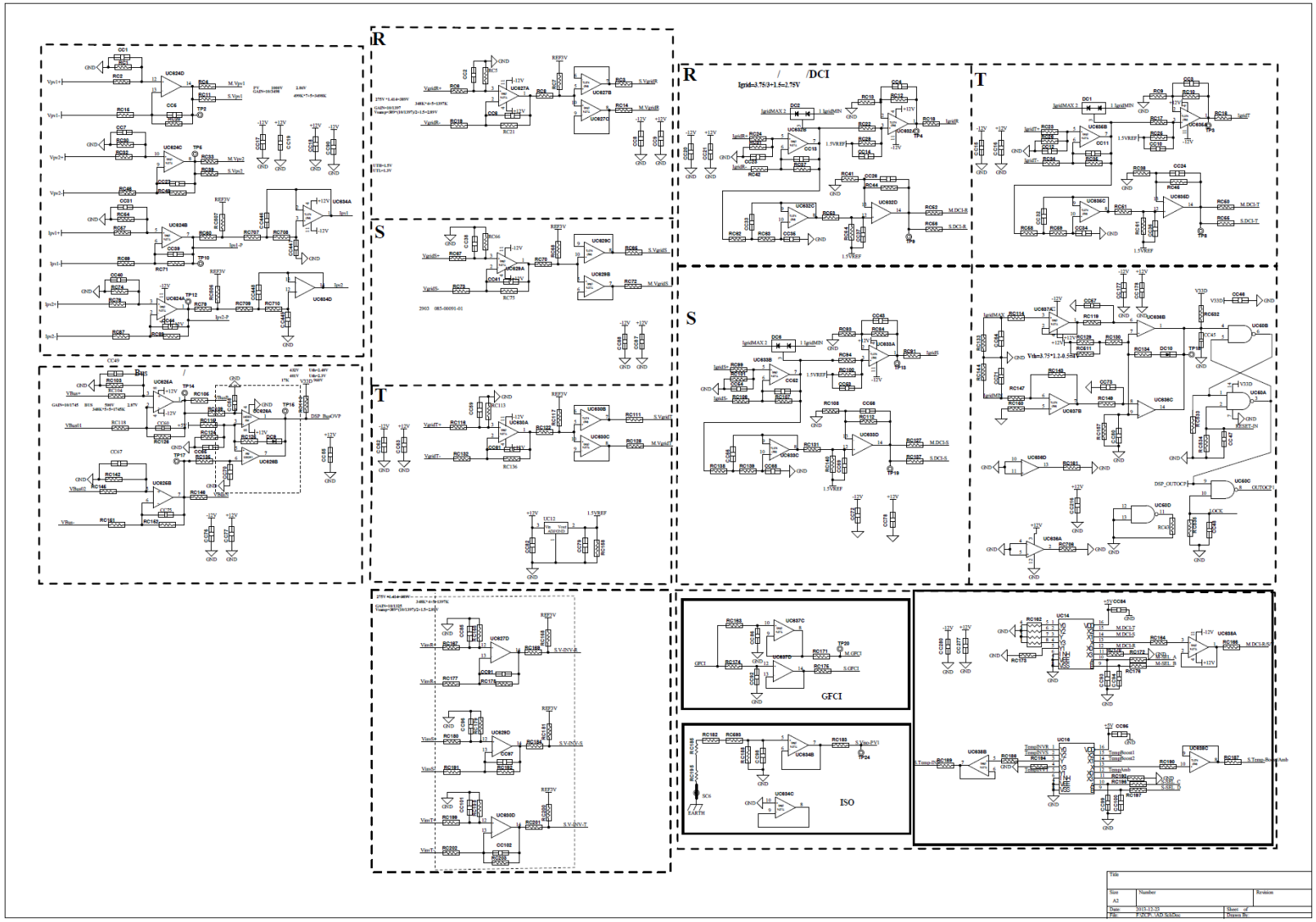
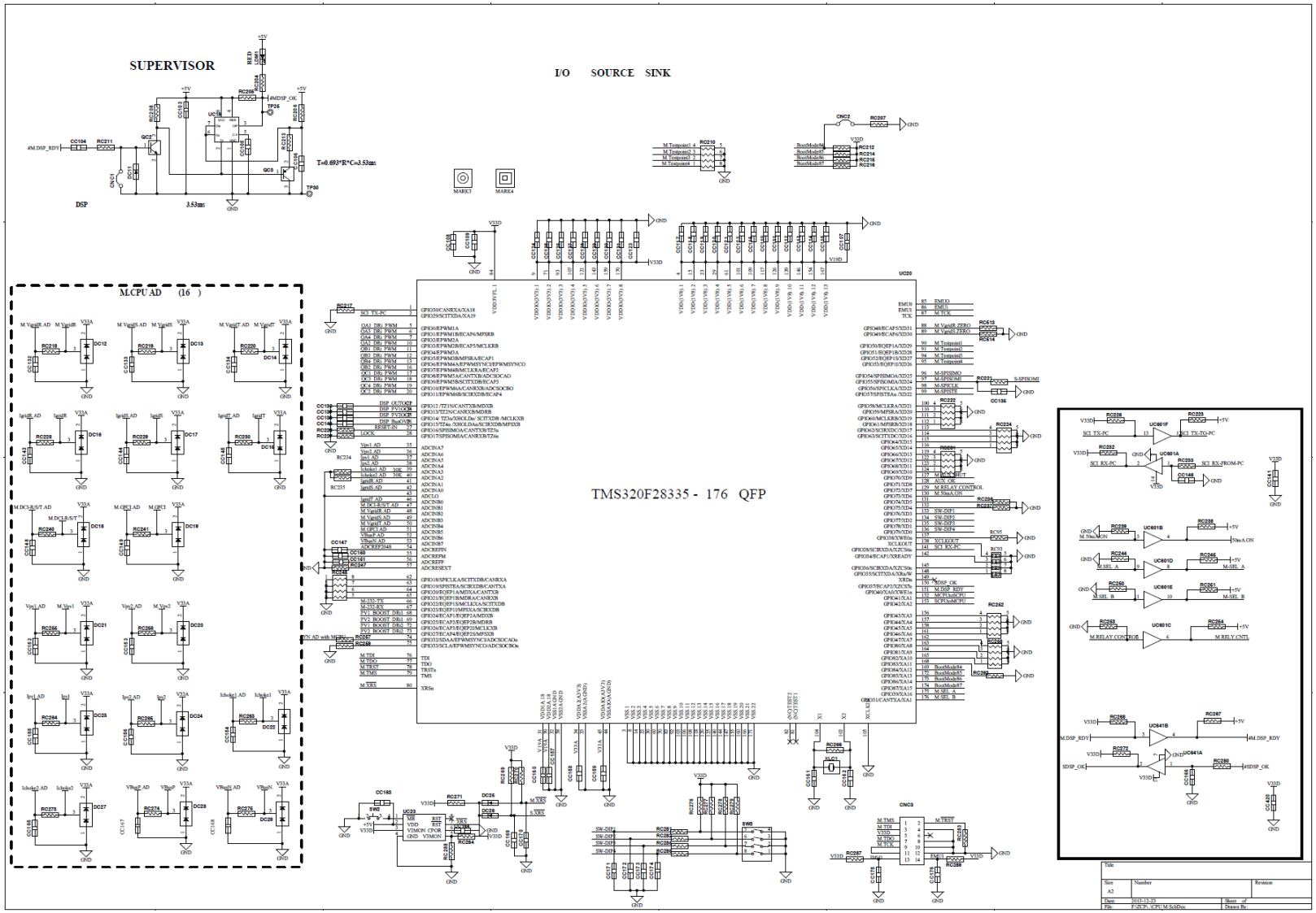
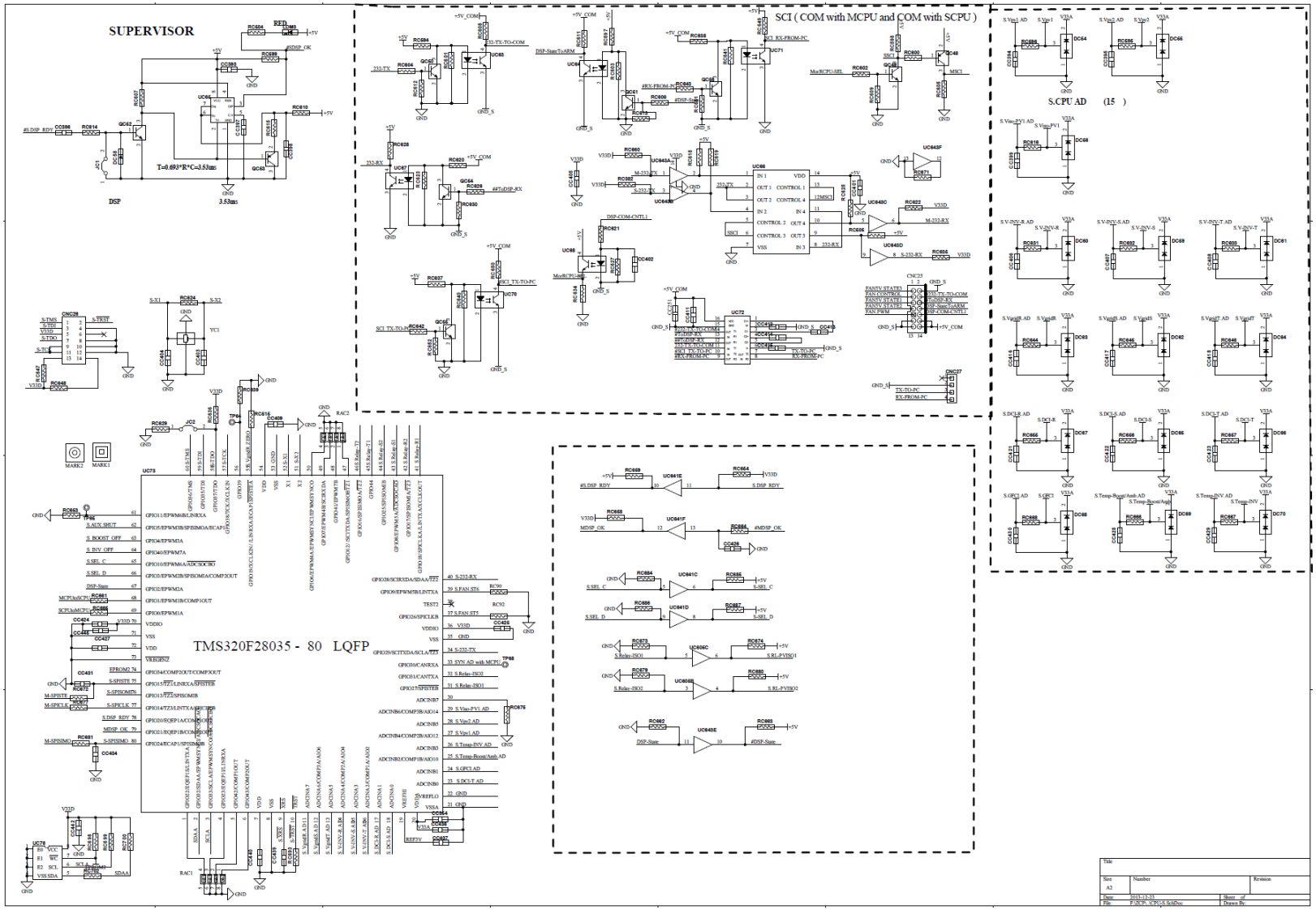
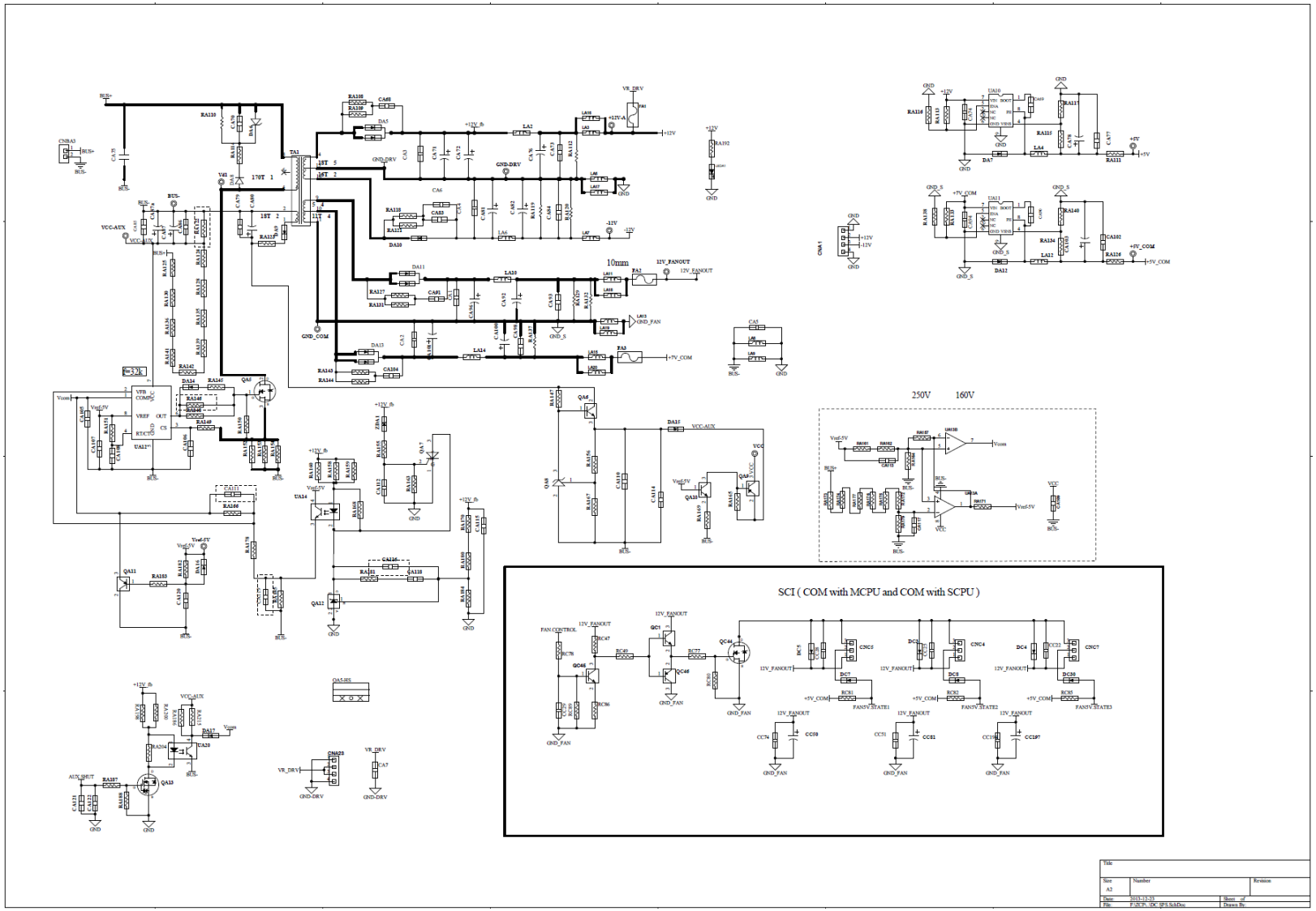
GND
RF109
Vpv21+
ICT184
ICT183
-12V
UF13A
RF110
Vpv21
+12V
RF114
CF84
TP15
Vpv21-
ICT185
RF115
PV GAIN=10/3498
1000V
2.86V
499K*7+5=3498K
CF87
CF86
CF88
RF120
GND
UF13D
TP17
Vpv22+
ICT189
RF121
ICT188
RF122
Vpv22
CF91
Vpv22-
RF125
ICT190
ICT191
RF127
CF92
RF133
GND
RF136
Ipv21+
ICT194
ICT193
UF13C
REF3V
RF135
RF137
Ipv21
CF95
Ipv21-
RF143
ICT195
ICT196
RF146
TP20
CF97
CF96
CF99
RF147
GND
RF149
Ipv22+
ICT199
ICT198
UF13B
TP21
REF3V
RF148
RF150
Ipv22
CF100
Ipv22-
RF151
ICT200
ICT201
RF152
CF81
RF105
GND
RF107
Vpv23+
ICT204
RF111
ICT203
UF14A
RF108
Vpv23
ICT207
CF83
Vpv23-
RF112
ICT205
ICT206
TP14
CF85
RF116
GND
RF117
Vpv24+
ICT209
RF119
ICT208
UF14D
TP16
RF118
Vpv24
ICT212
CF89
Vpv24-
RF123
ICT210
ICT211
RF124
CF90
RF126
GND
RF129
Ipv23+
ICT214
RF131
ICT213
UF14C
REF3V
RF128
RF130
Ipv23
ICT217
CF93
Ipv23-
RF132
ICT215
ICT216
TP18
RF134
CF94
RF138
GND
RF140
Ipv24+
ICT219
ICT218
UF14B
TP19
REF3V
RF139
RF141
Ipv24
ICT222
RF142
CF98
Ipv24-
RF144
ICT220
ICT221
RF145
CNF1
Vpv22+
Vpv13+
Vpv11+
Ipv11-
Vpv12-
Ipv12-
Vpv13-
Ipv13-
Vpv21-
Ipv21-
Vpv22-
Ipv23-
Ipv22+
Vpv23+
Vpv21+
Vpv12+
Ipv11+
Vpv11-
Ipv12+
Ipv13+
Ipv21+
Ipv23+
Vpv23-
Ipv22-
Project: 20KW String Dect Board
Title Sensor 2.SchDoc
Sheet 5 of 5
PN *
Revision: V02
Date: 2013.12.16
Drawn By: *
Engineer: *
Approve By: *
SOFAR

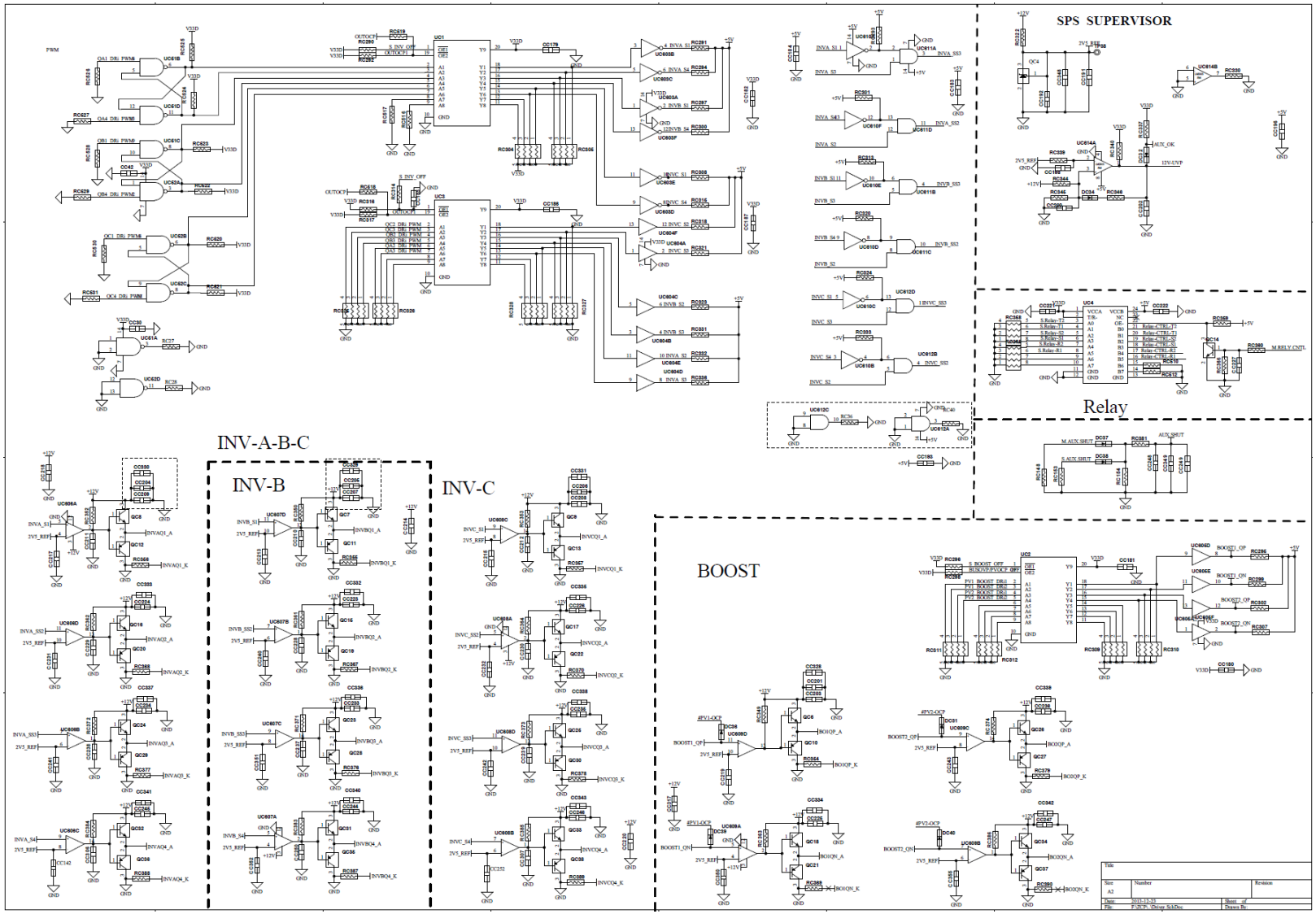

Driver
VR_DRV
TV1
f=80kHz
GND
VC_INVCH
VE_INVCH
VC_INVCL
VE_INVCL
MARK1
MARK2
MARK3
MARK4
QV1
QV2
QV3
QV4
QV5
CNV1
CNV2
Project: *
Title Driver.SchDoc
Sheet * of *
PN *
Revision: *
Date: *
Drawn By: *
Engineer: *
Approve By: *
SOFAR

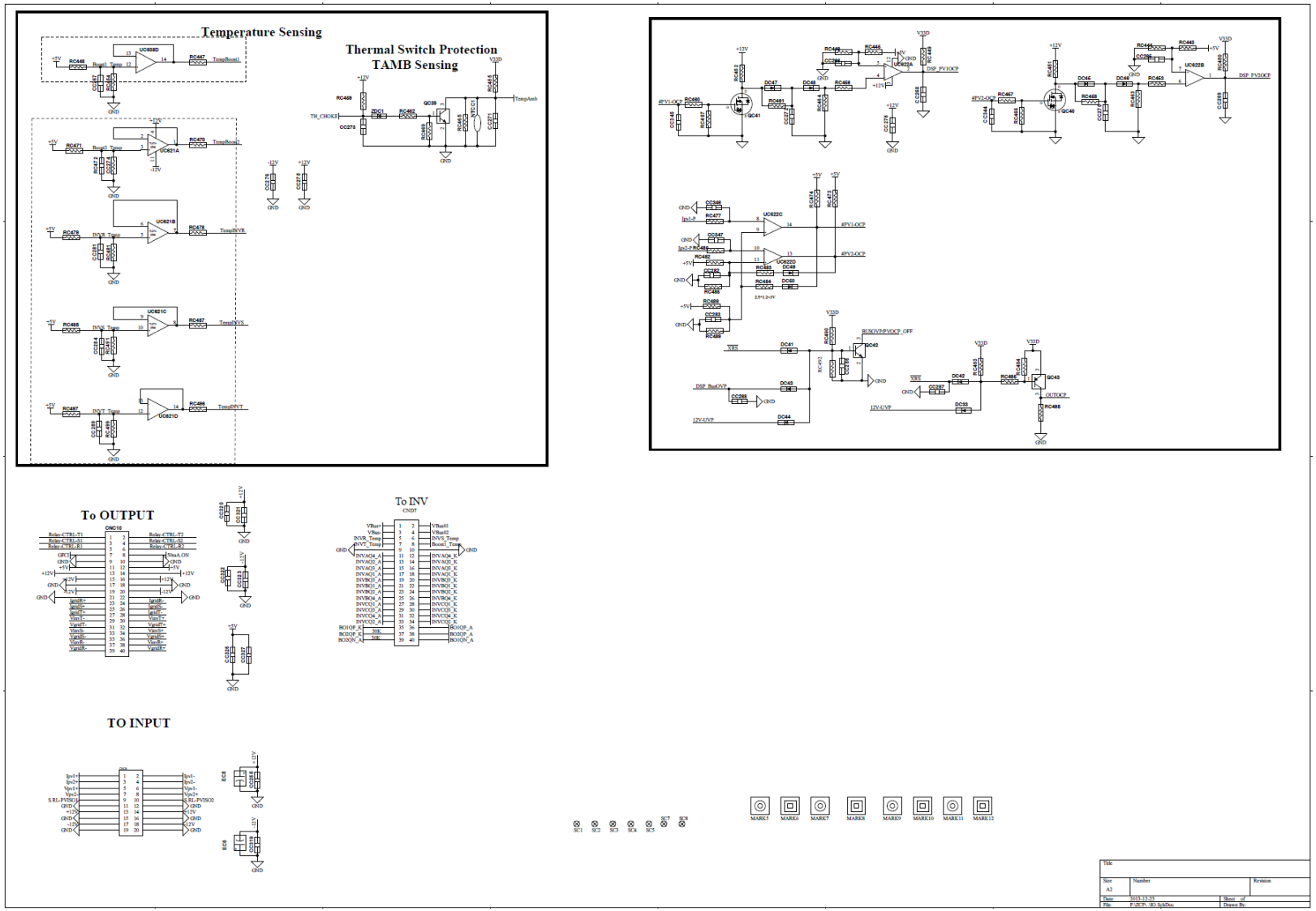

R
S
T
R
/DCI
T
S
GFCI
ISO

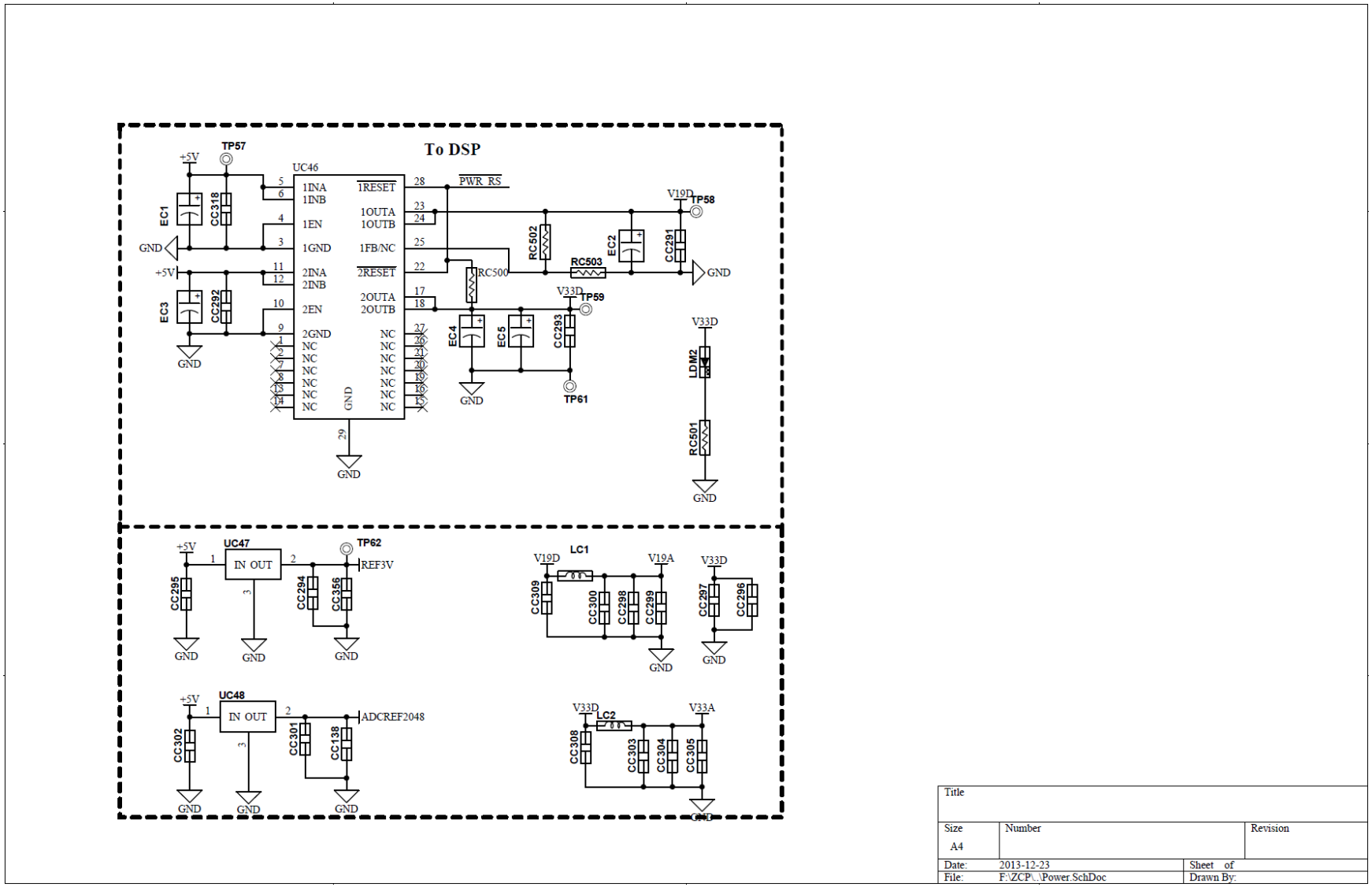

SUPERVISOR
DSP
3.53ms
I/O SOURCE SINK
M.CPU AD (16)
TMS320F28335 - 176 QFP


SUPERVISOR
SCI (COM with MCPU and COM with SCPU)
S.CPU AD (15)
TMS320F28035 - 80 LQFP

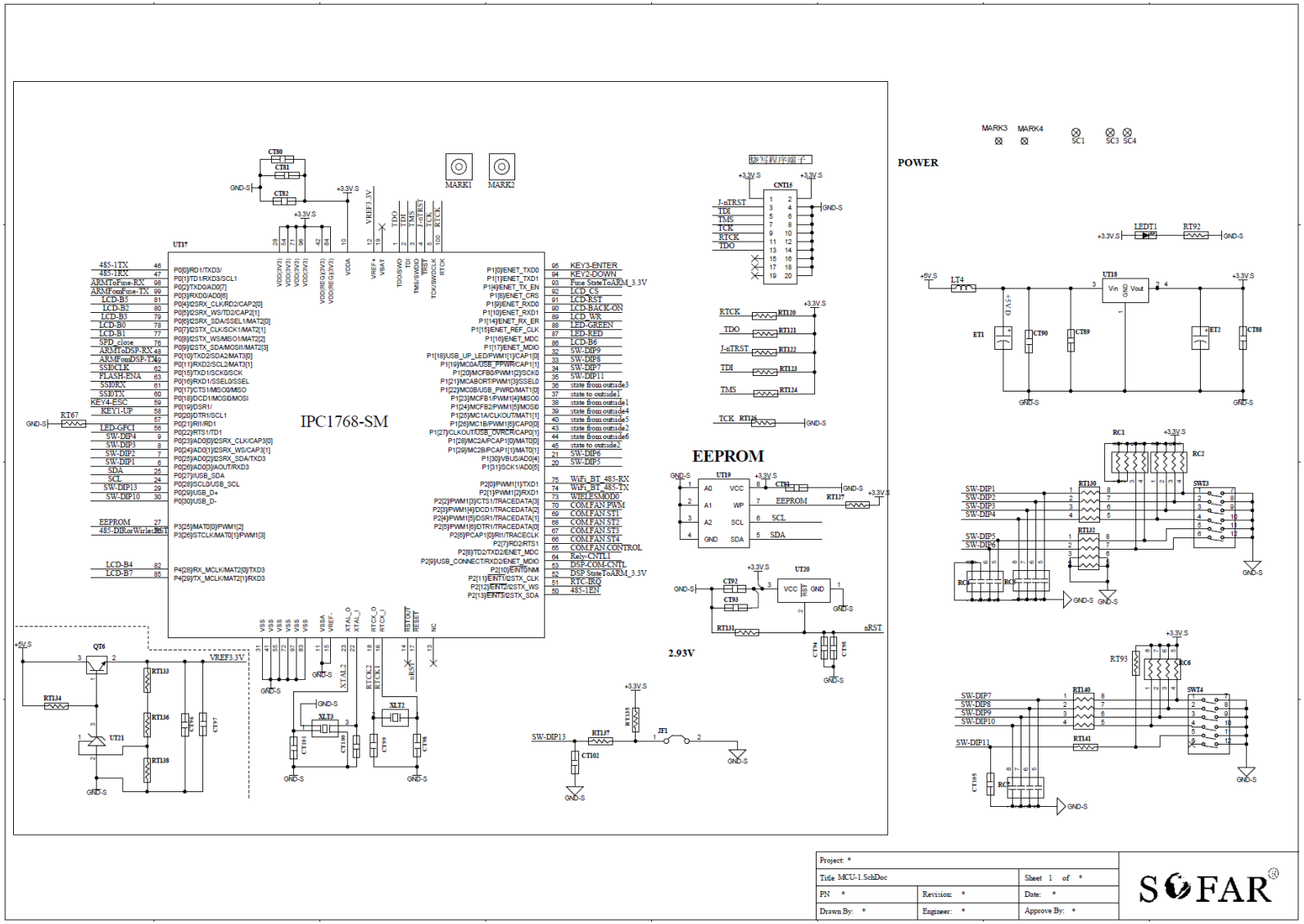

SCI (COM with MCPU and COM with SCPU)
250V
160V

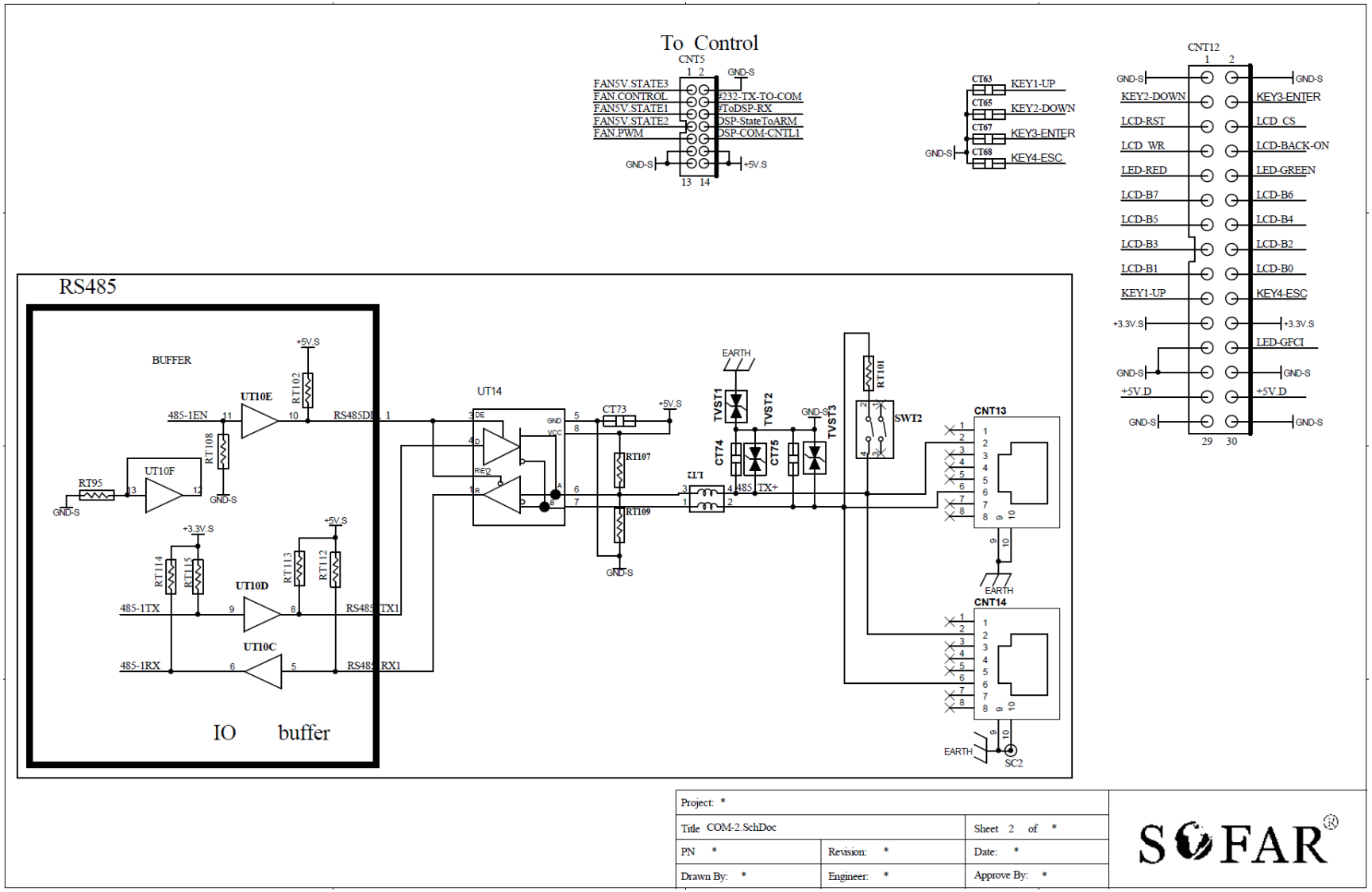

SPS SUPERVISOR
Relay
INV-A-B-C
INV-B
INV-C
BOOST


Temperature Sensing
Thermal Switch Protection
TAMB Sensing
To OUTPUT
To INV
TO INPUT



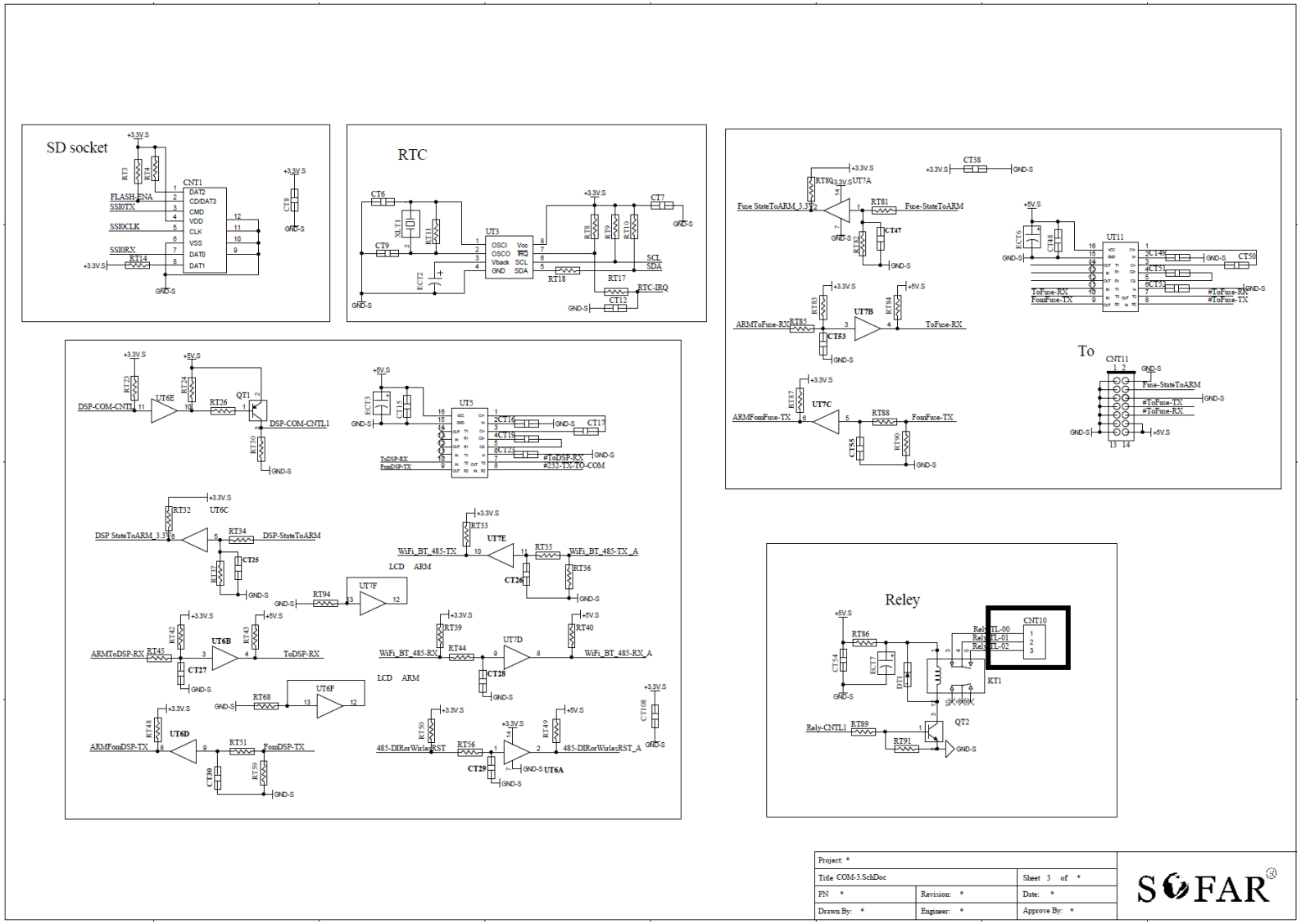
Title		
Size A4	Number	Revision
Date: 2013-12-23		Sheet of
File: F:\ZCP\..\Power.SchDoc		Drawn By:

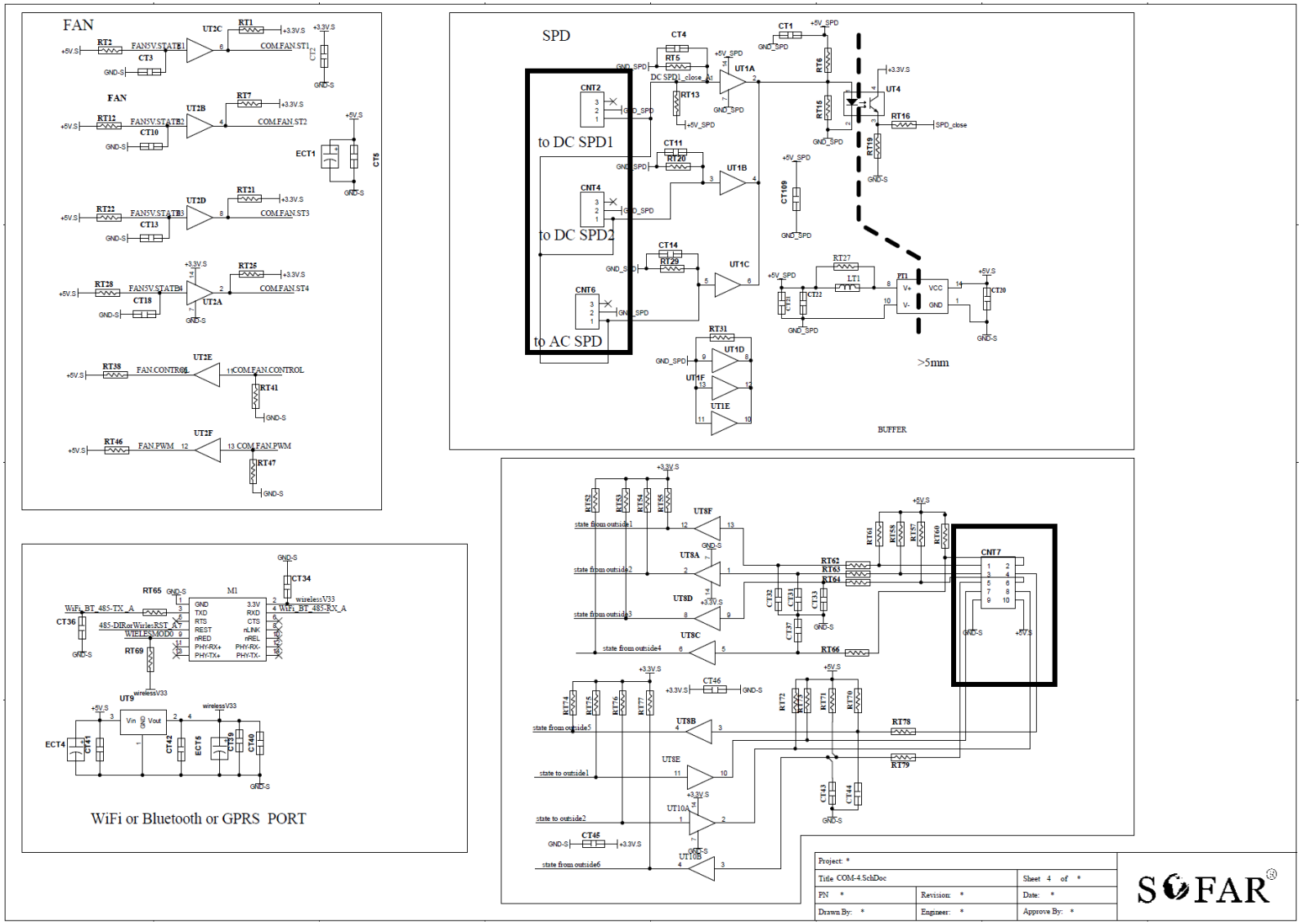

IPC1768-SM
EEPROM
POWER
2.93V
Project: *
Title MCU-1.SchDoc
Sheet 1 of *
PN *
Revision: *
Date: *
Drawn By: *
Engineer: *
Approve By: *
SOFAR



Project: *		
Title COM-2.SchDoc		Sheet 2 of *
PN *	Revision: *	Date: *
Drawn By: *	Engineer: *	Approve By: *

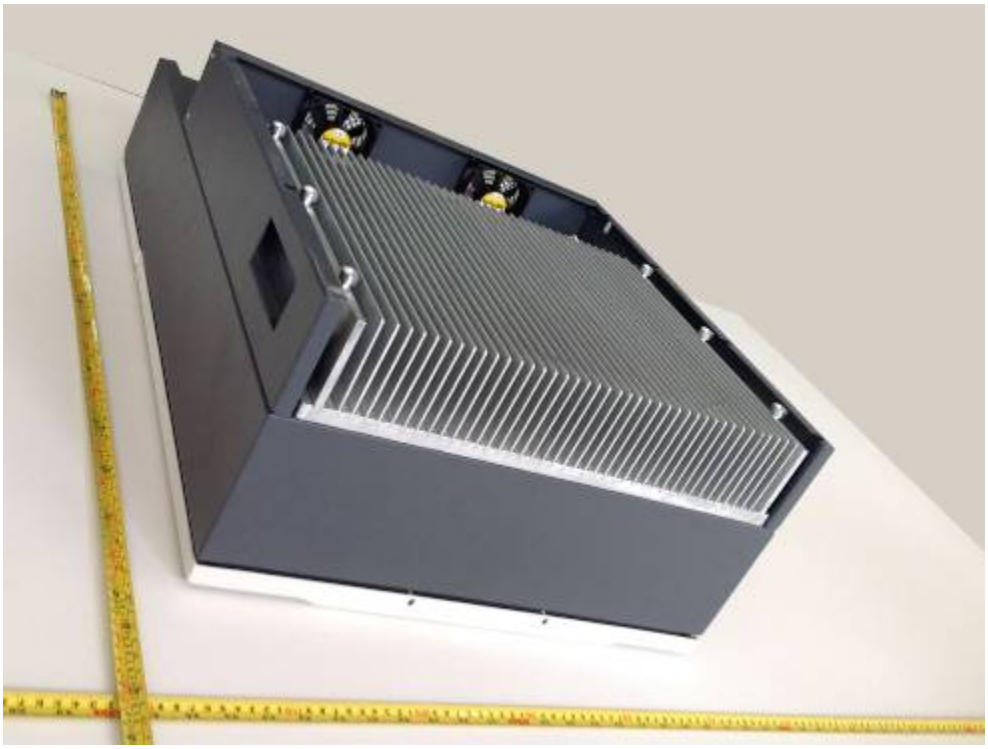
SOFAR®


SD socket
RTC
Reley
To
Project: *
Title COM-3.SchDoc
Sheet 3 of *
PN *
Revision: *
Date: *
Drawn By: *
Engineer: *
Approve By: *
SOFAR


FAN
SPD
to DC SPD1
to DC SPD2
to AC SPD
>5mm
BUFFER
WiFi or Bluetooth or GPRS PORT
Project: *
Title COM-4.SchDoc
Sheet 4 of *
PN *
Revision: *
Date: *
Drawn By: *
Engineer: *
Approve By: *
SOFAR

Appendix 2: Photos:

Overall view of the unit



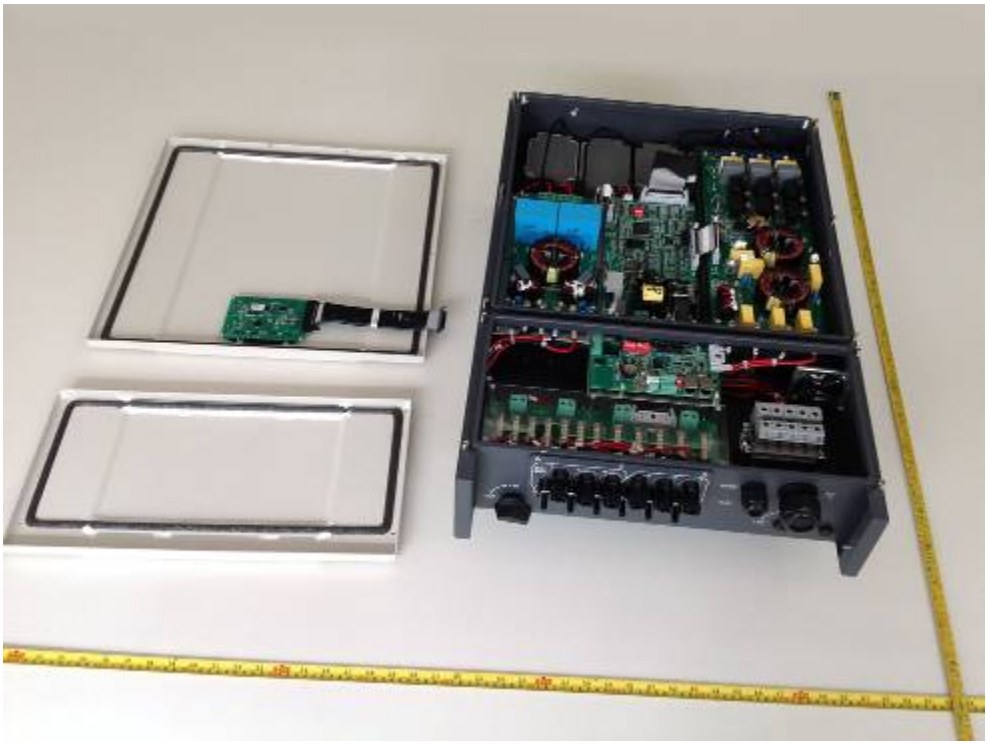
Bottom view of the unit

PV connector (Sofar 20000TL-Sx and Sofar 17000TL-Sx has 3×2 pairs)
(Sofar 15000TL-Sx and Sofar 10000TL-Sx has 2×2 pairs)

Terminals view of the unit (for models “-S2” to “-S6”)

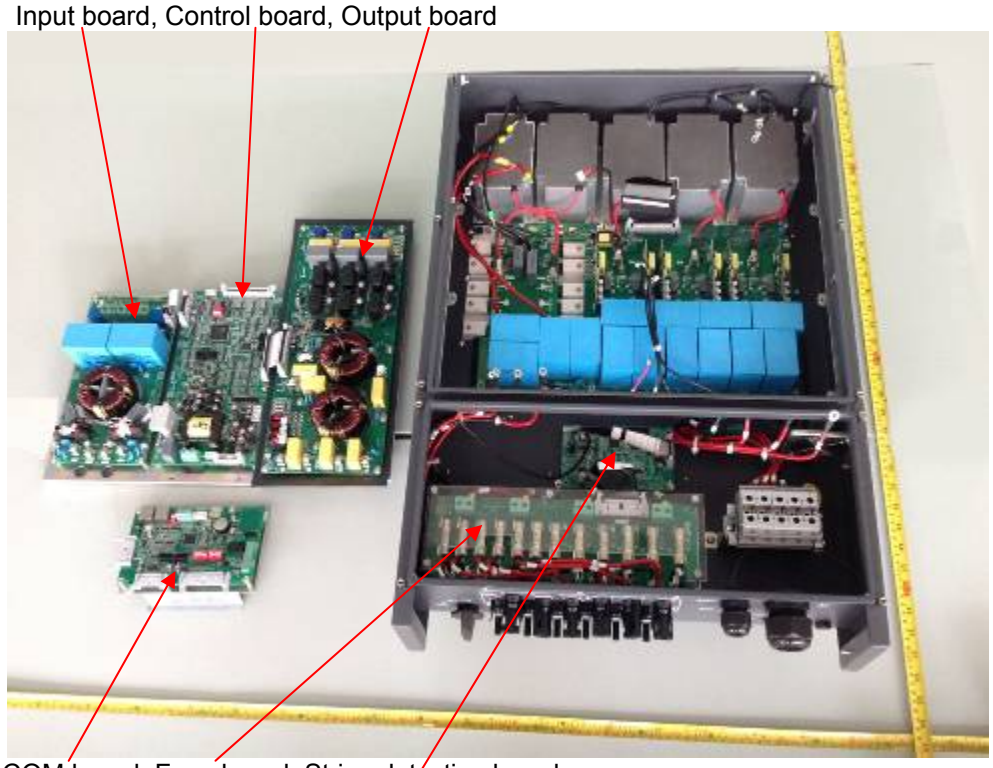
DC Cable Gland

Terminals view of the unit (for models “-S0” to “-S1”)

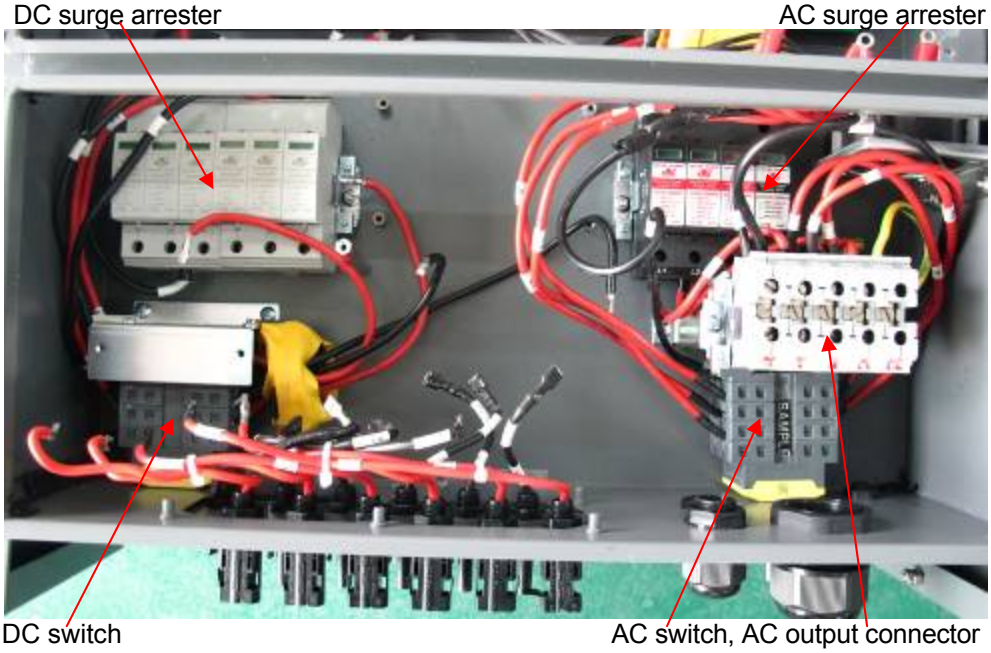


Internal view of the unit

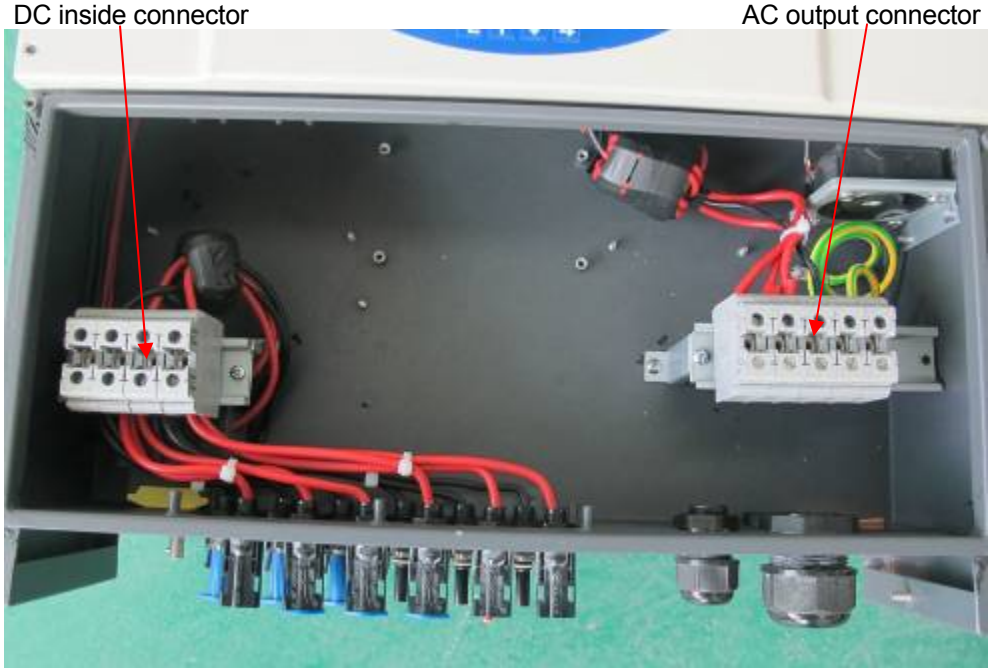
Internal view of the unit



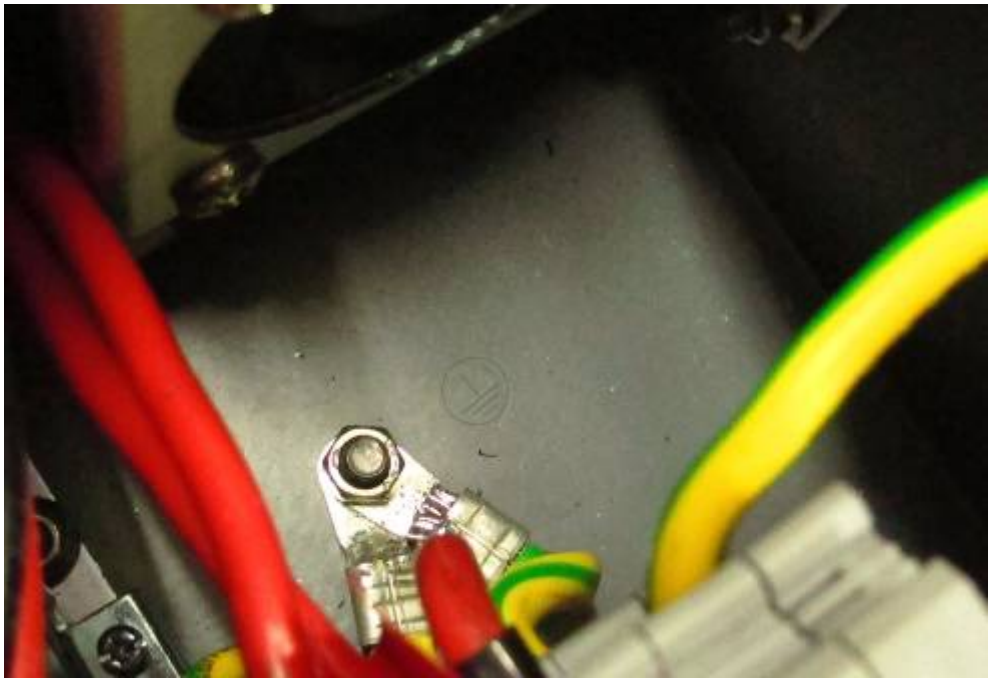
Internal view of the unit



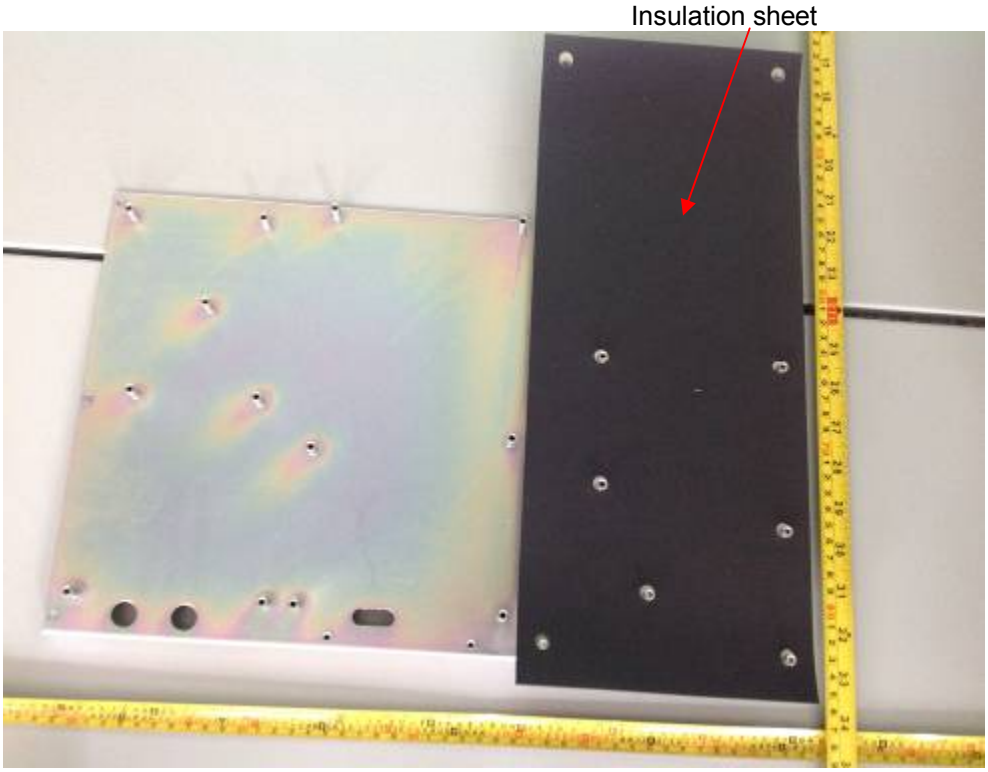
Internal view of the unit



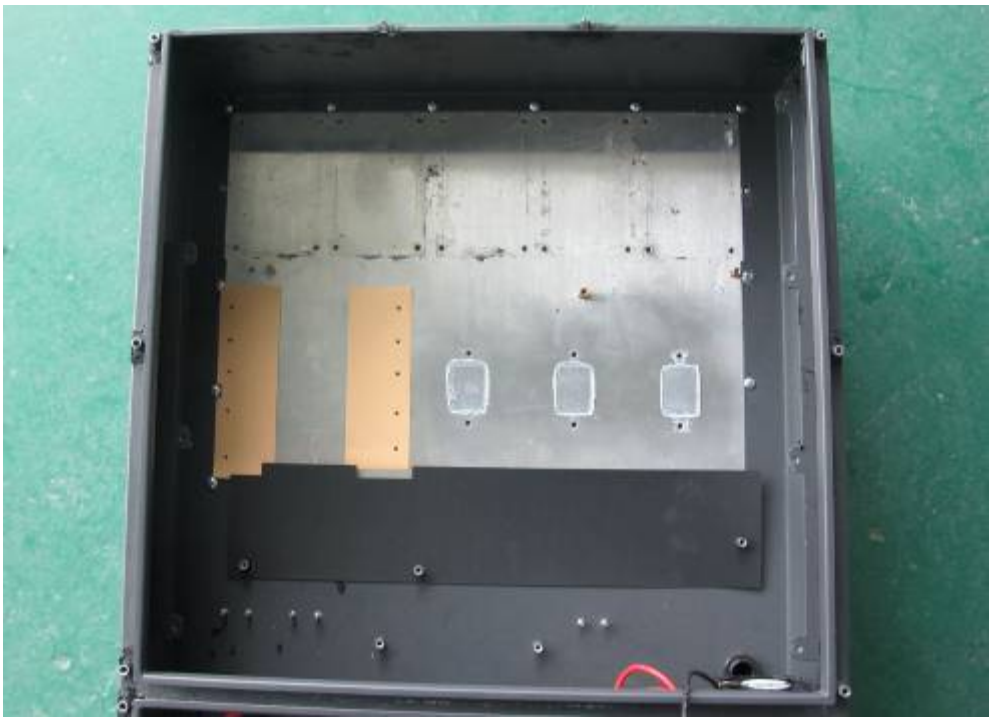
Internal view of the unit



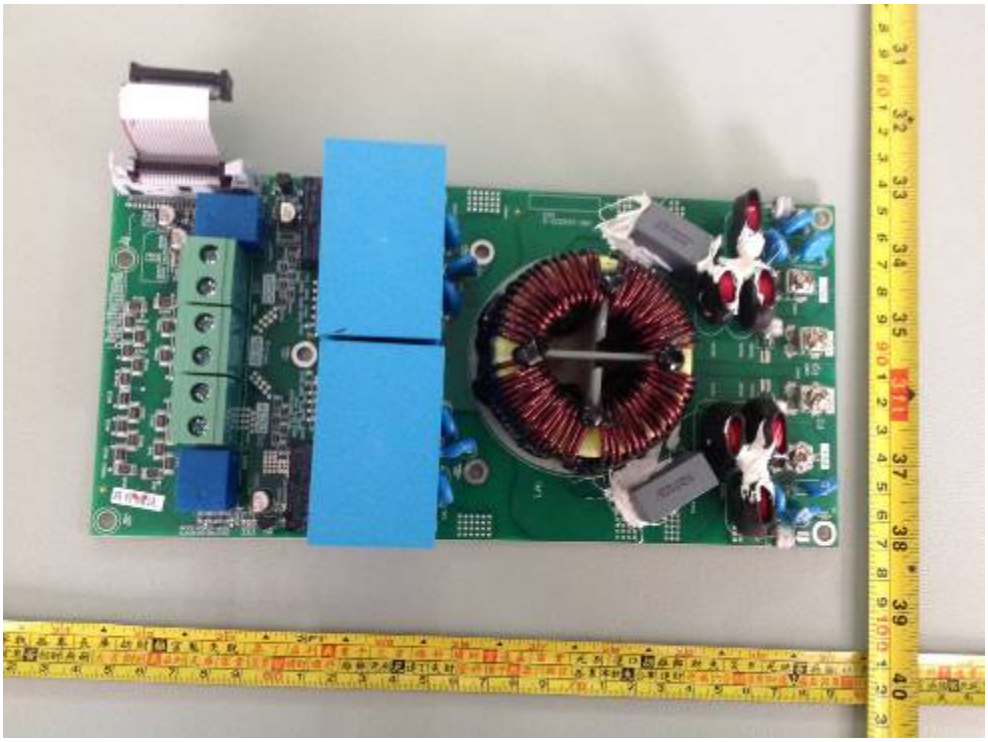
Earthing terminal of the unit



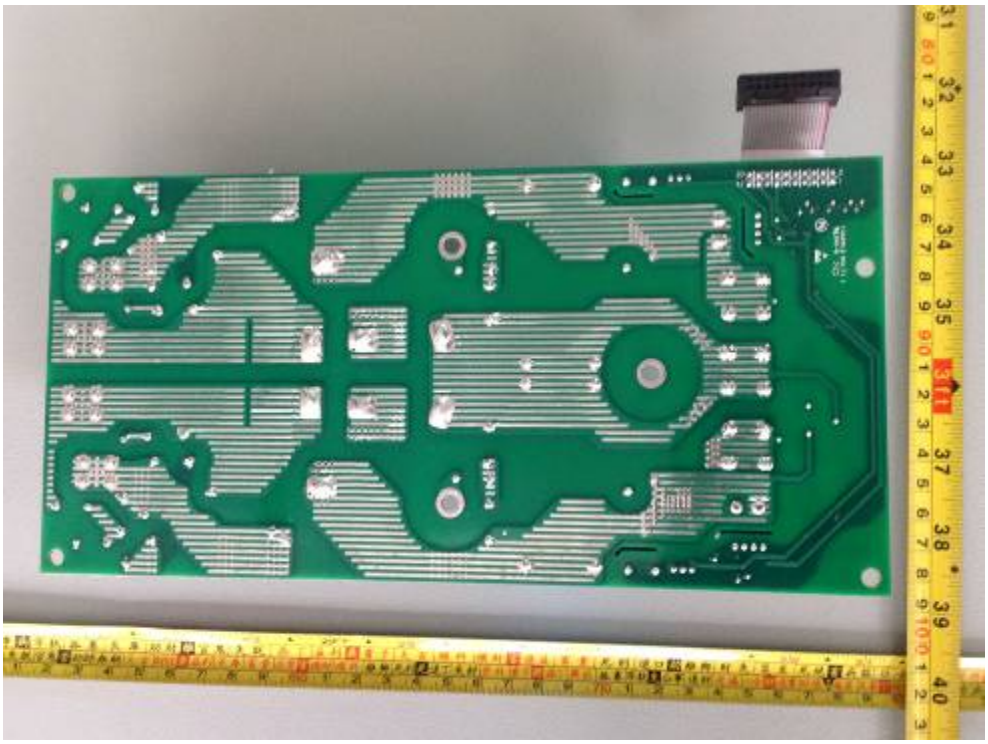
Support board for the PCBs



Cavity view of the enclosure

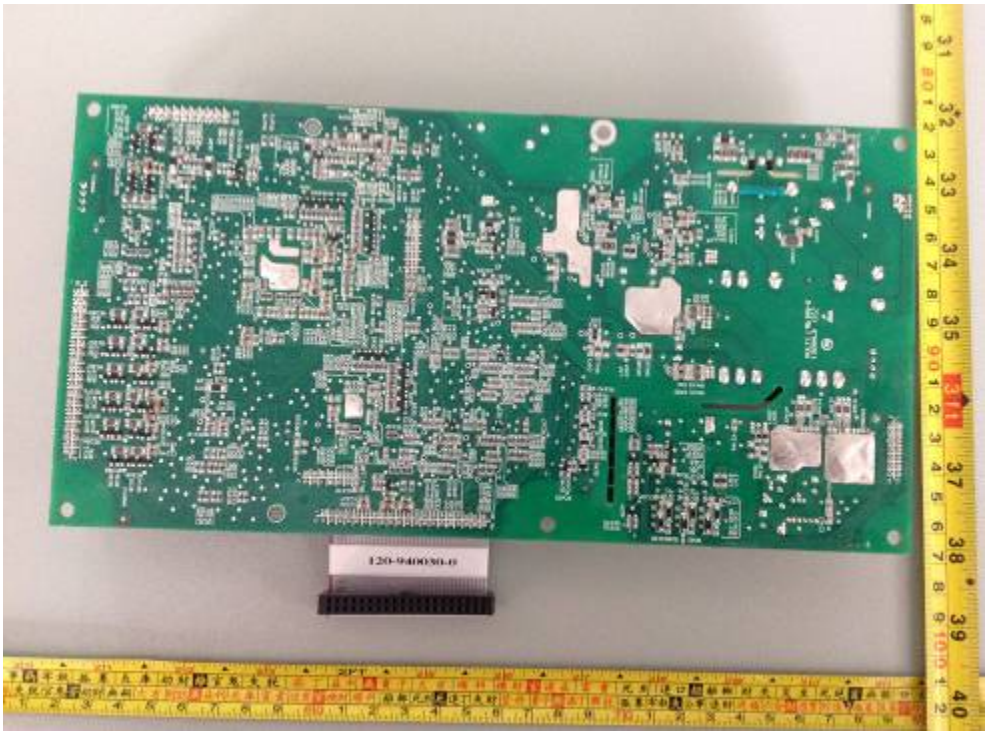


Front view of the input board



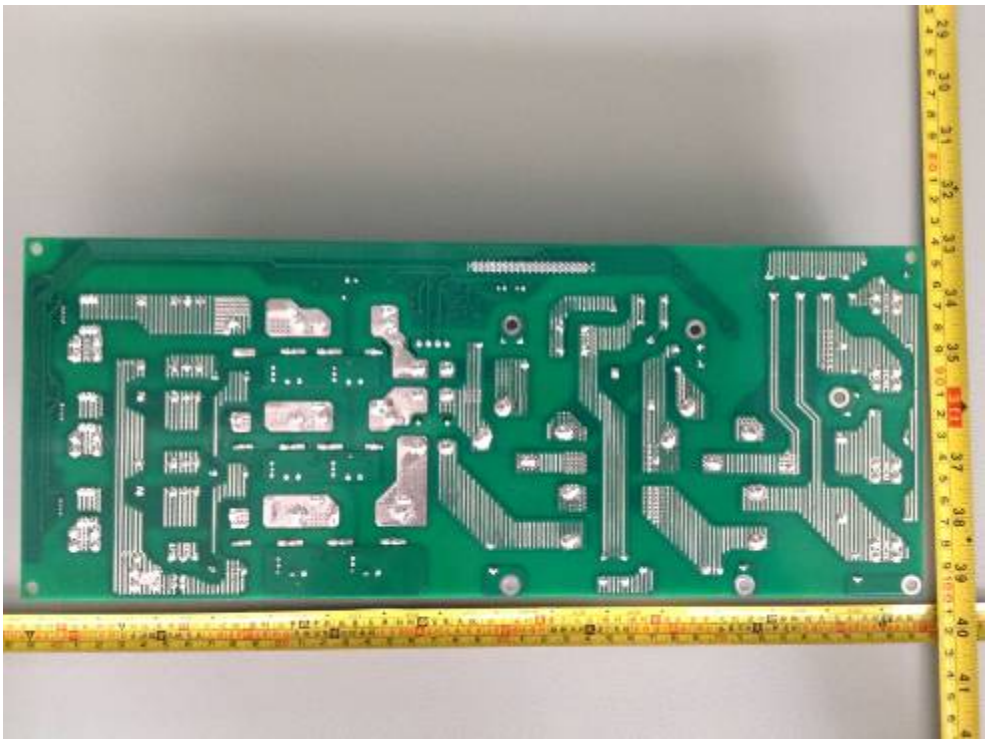
Bottom view of the input board

Front view of the control board

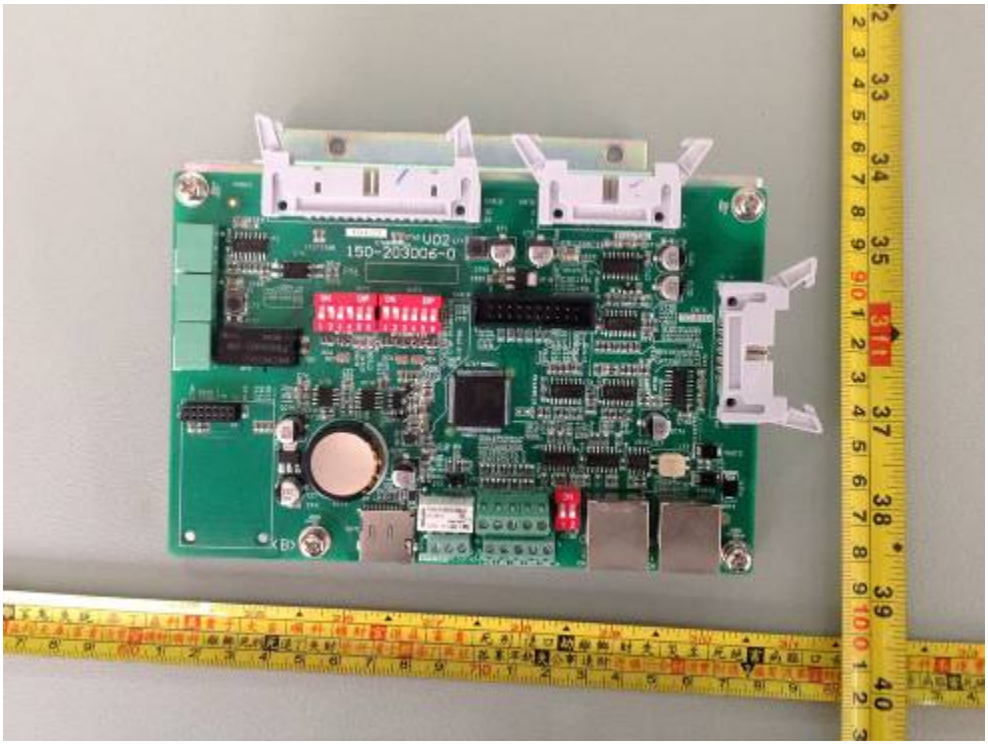


Bottom view of the control board

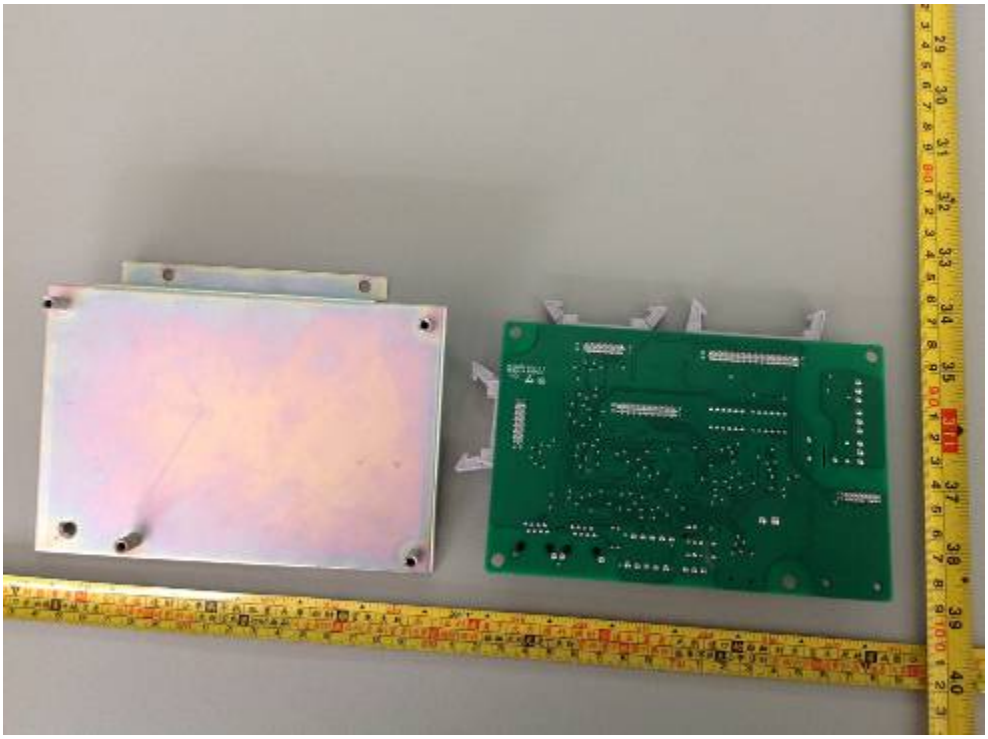
Front view of the output board



Bottom view of the output board

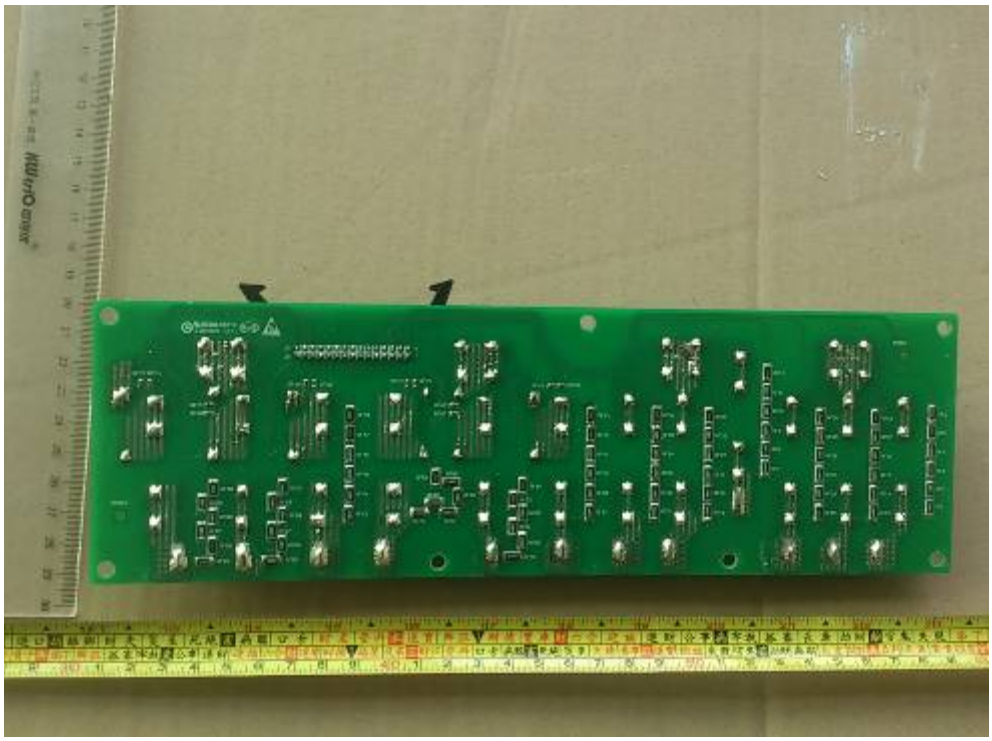


Front view of the COM board

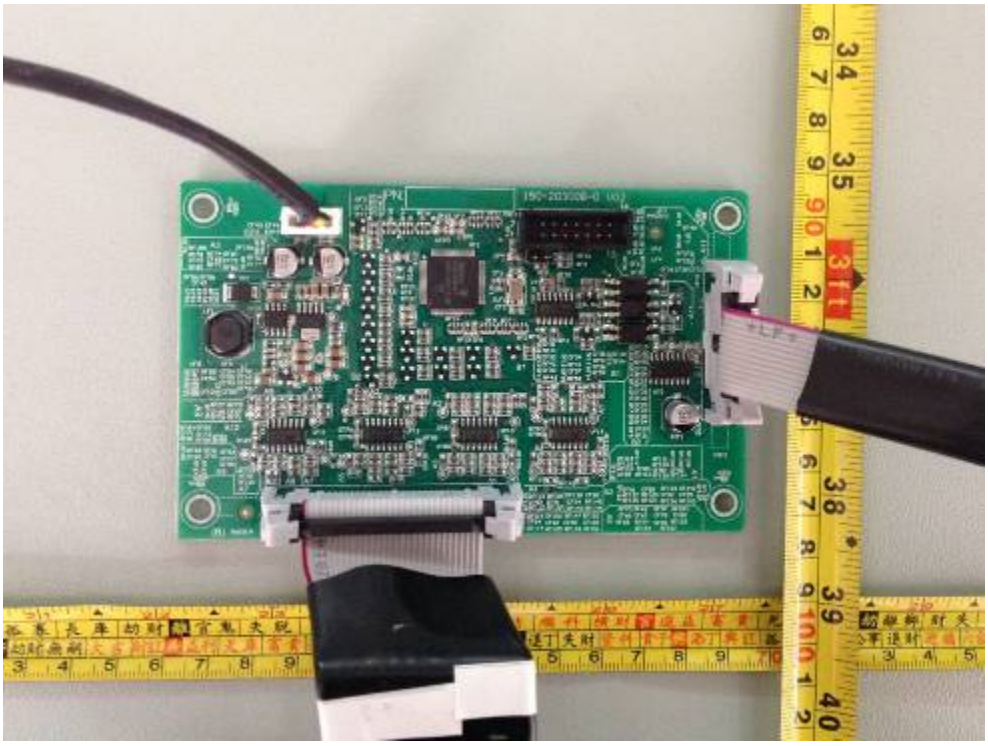


Bottom view of the COM board

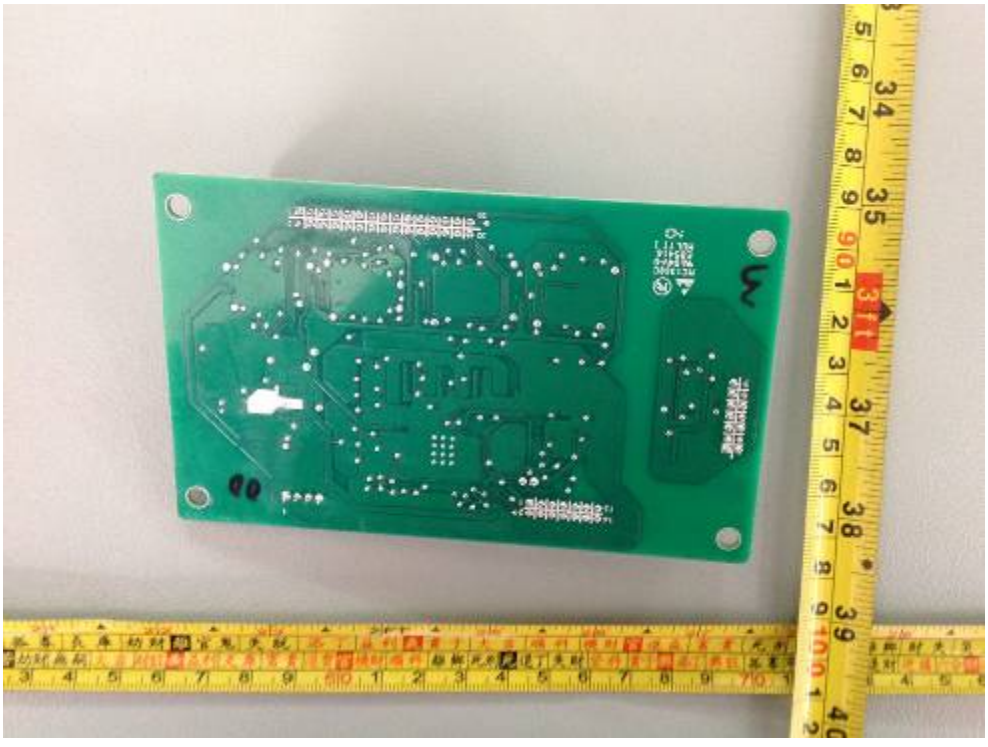
Front view of the fuse board



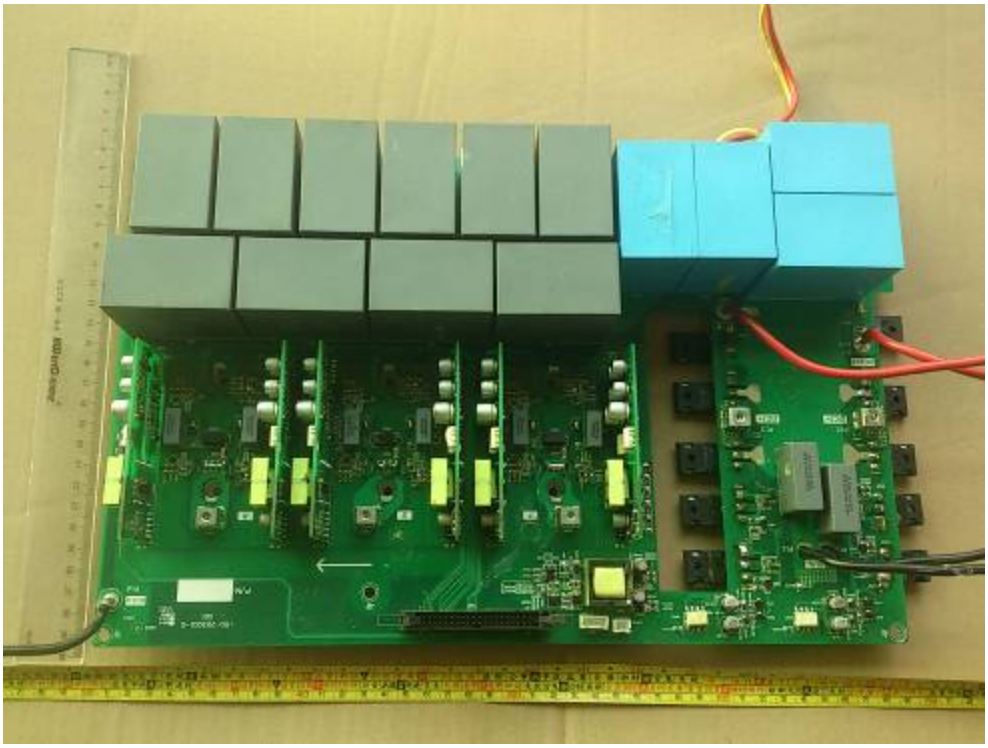
Bottom view of the fuse board



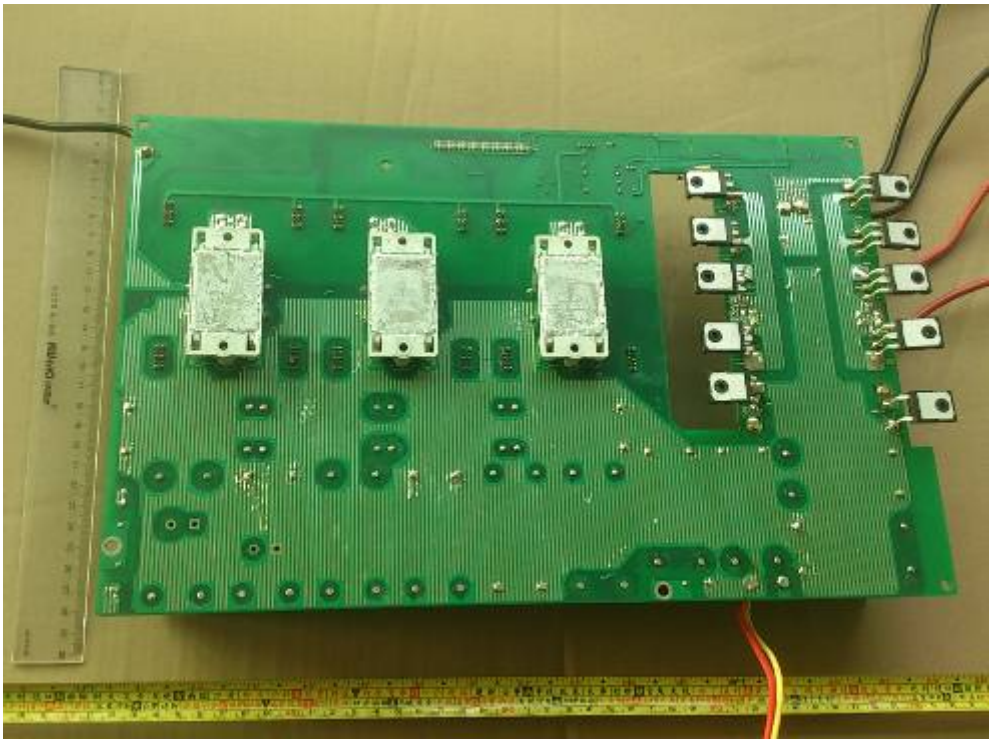
Front view of the string detection board



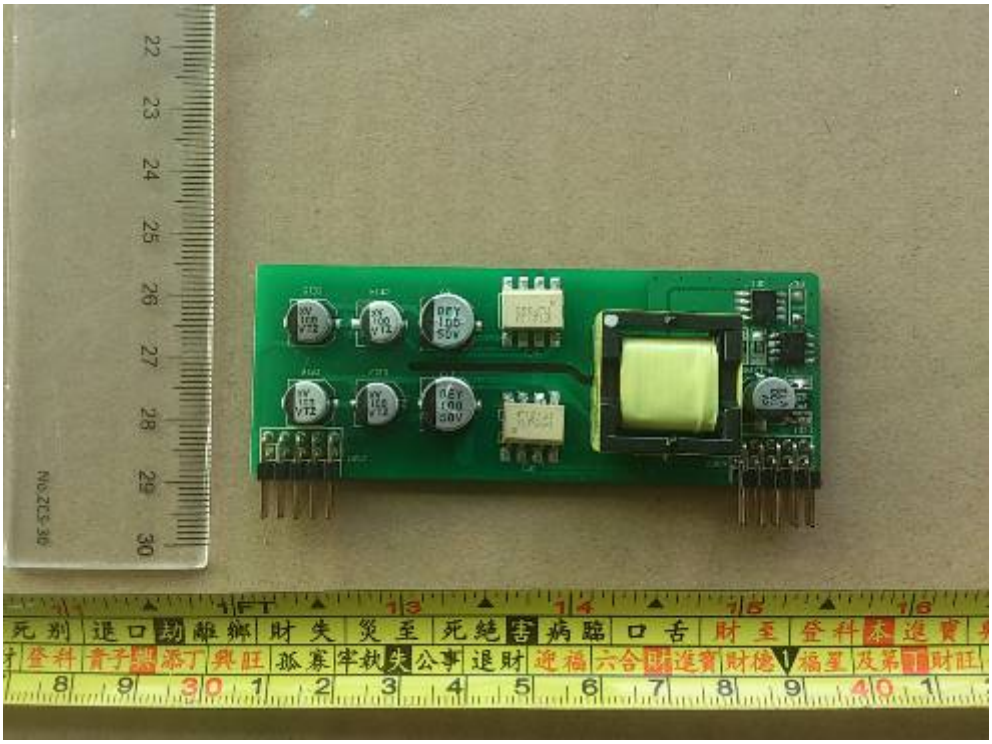
Bottom view of the string detection board



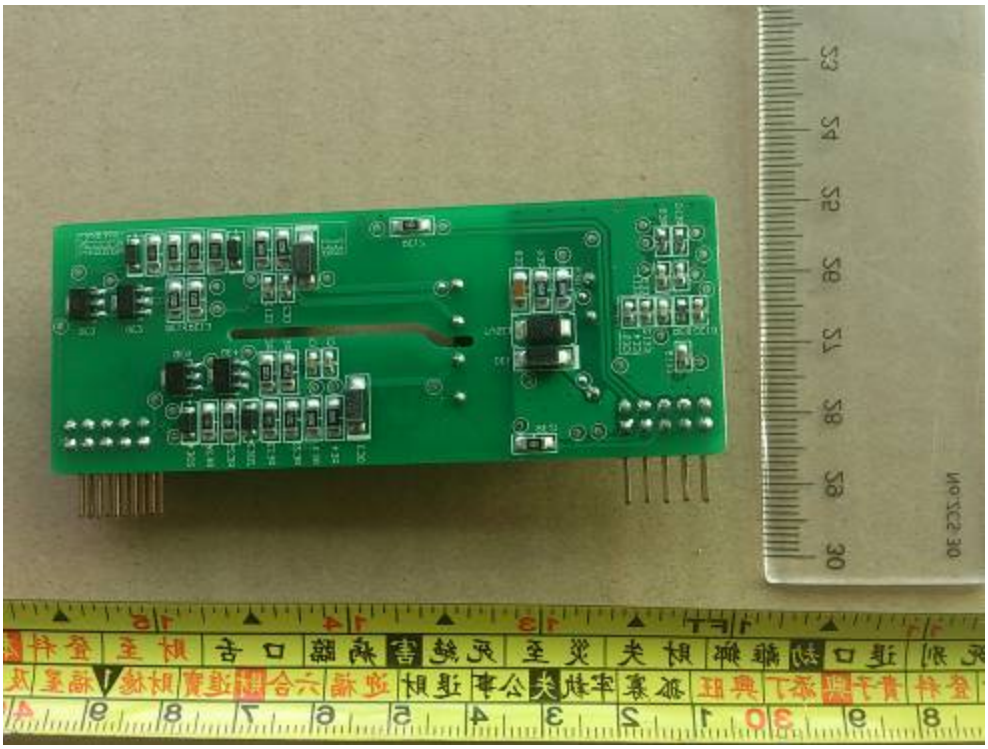
Front view of the power board



Bottom view of the power board

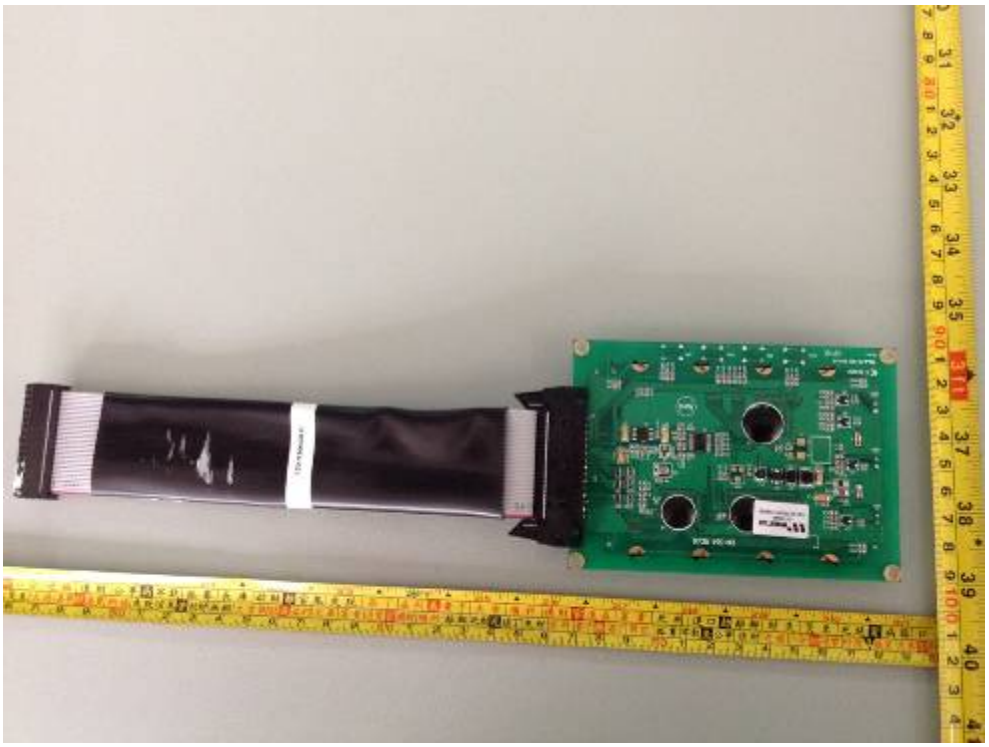


Front view of the driver board

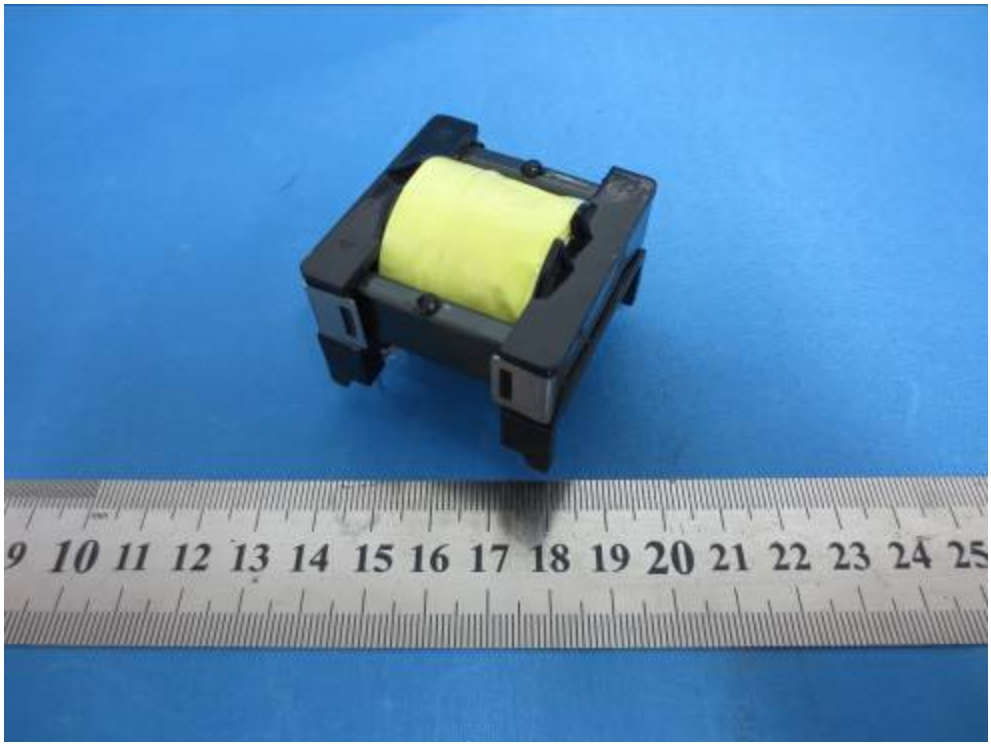


Bottom view of the driver board

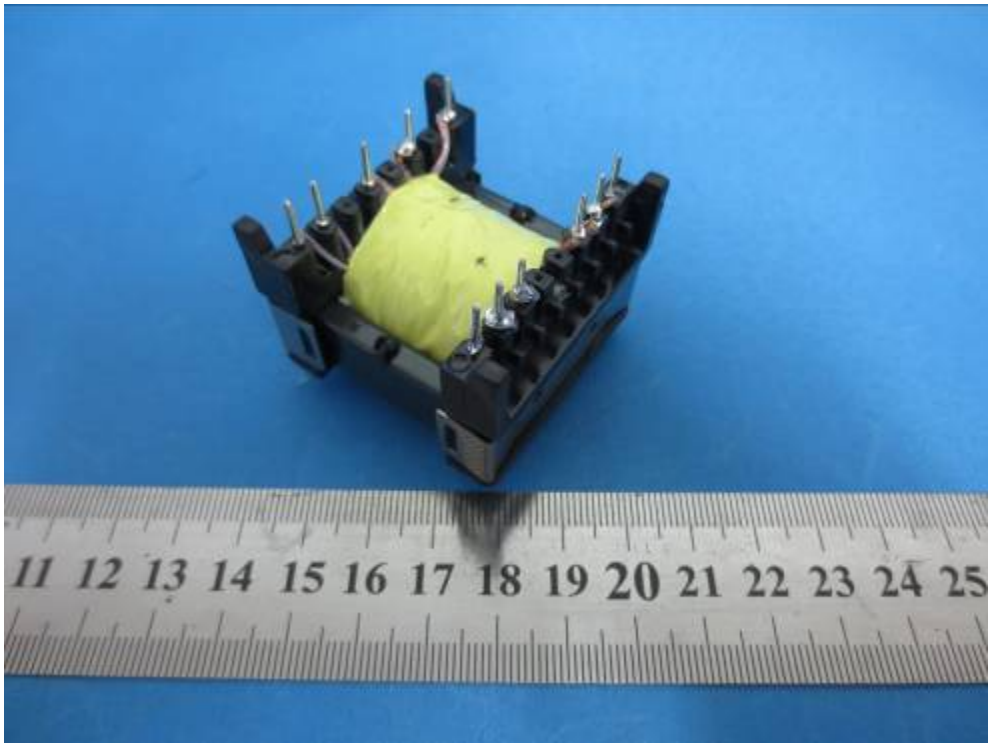
Front view of the display board



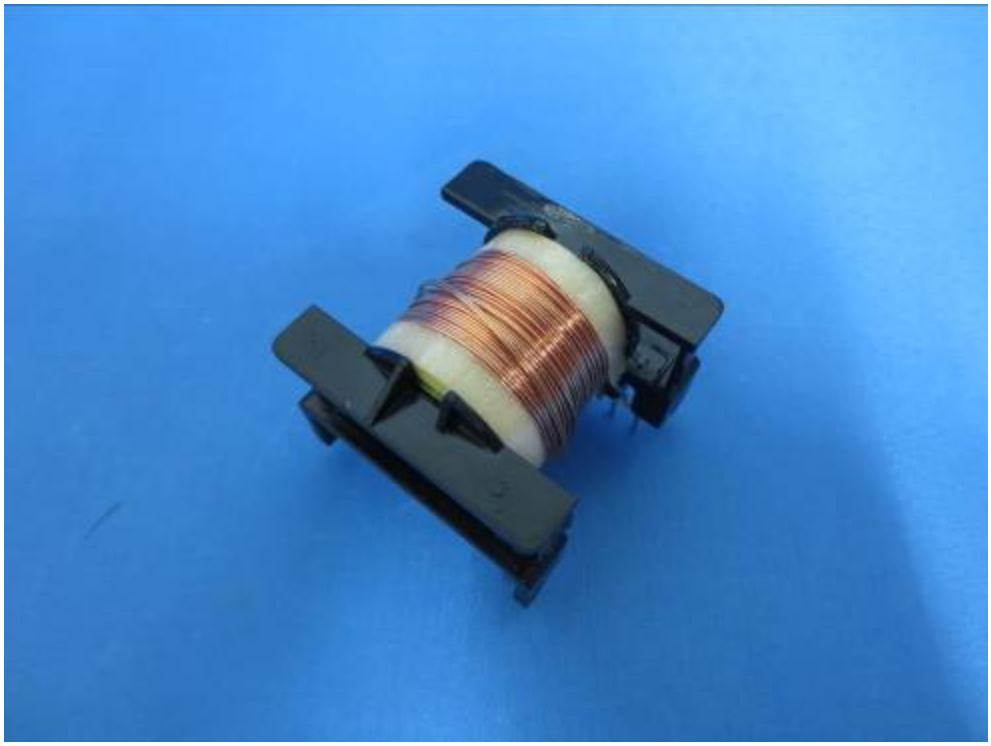
Bottom view of the display board



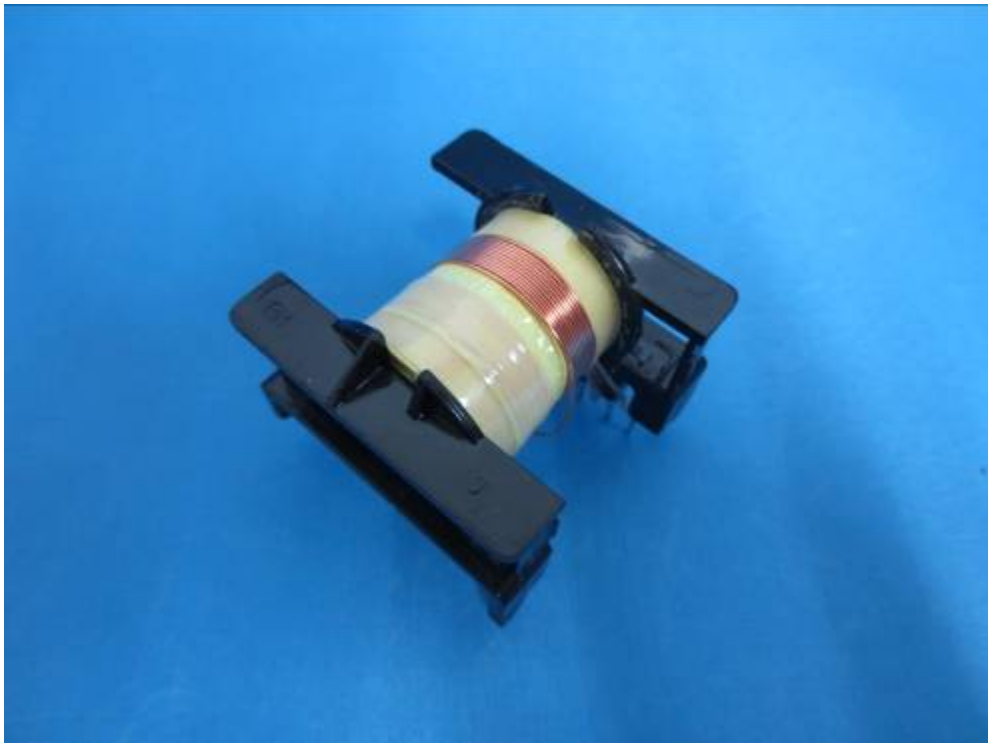
Transformer on control PCB (TA1)



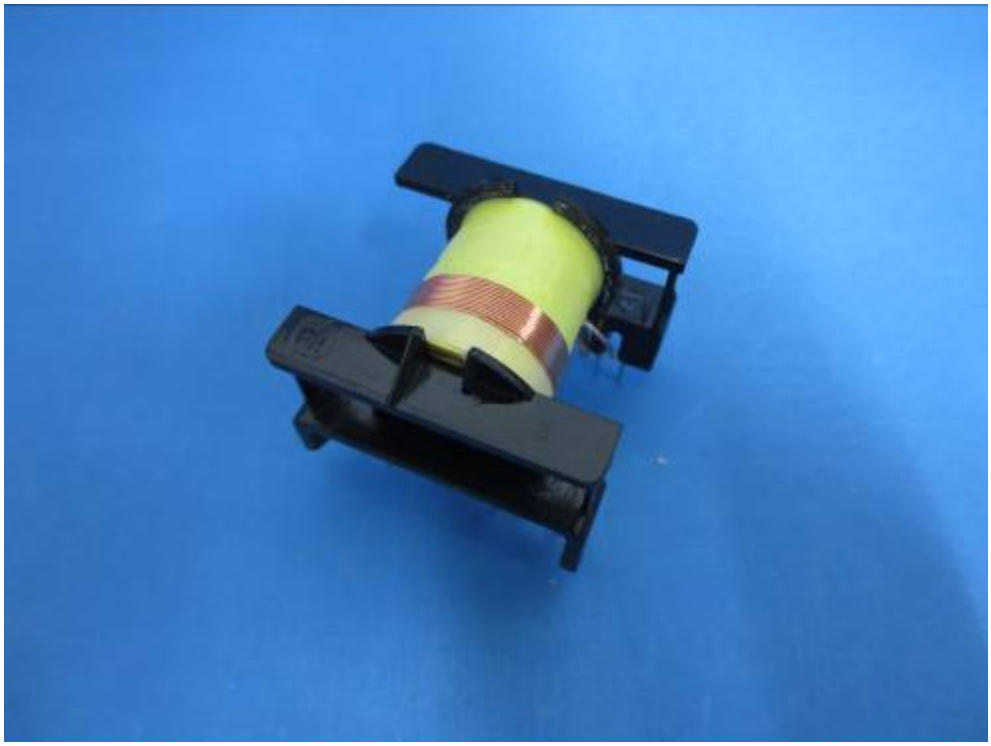
Transformer on control PCB (TA1)



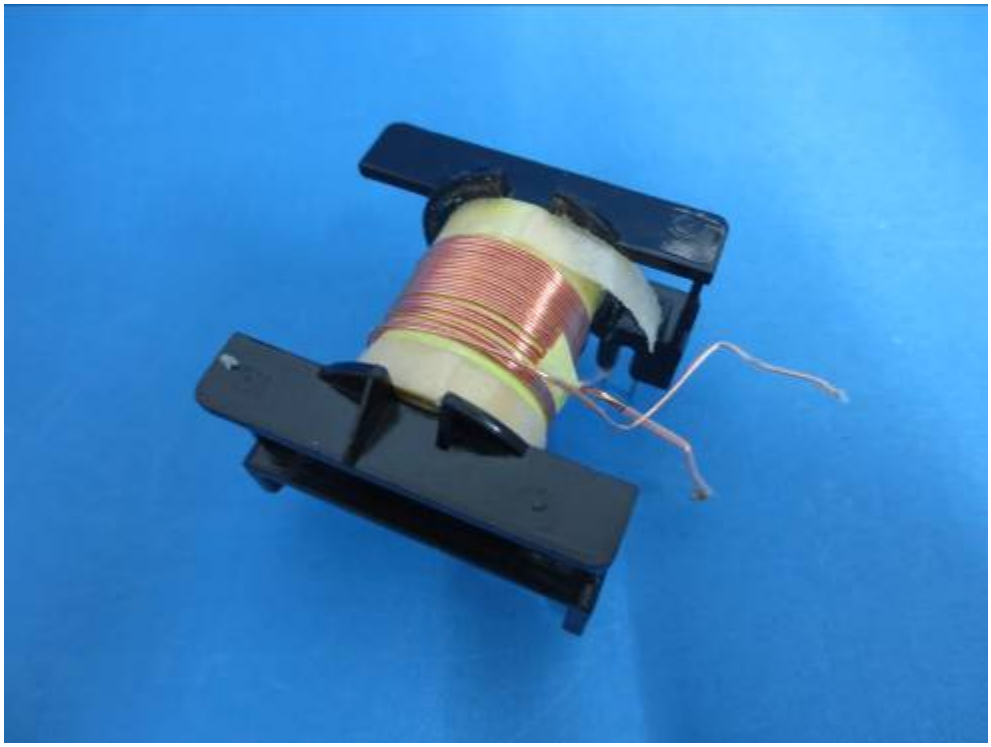
Transformer on control PCB (TA1)



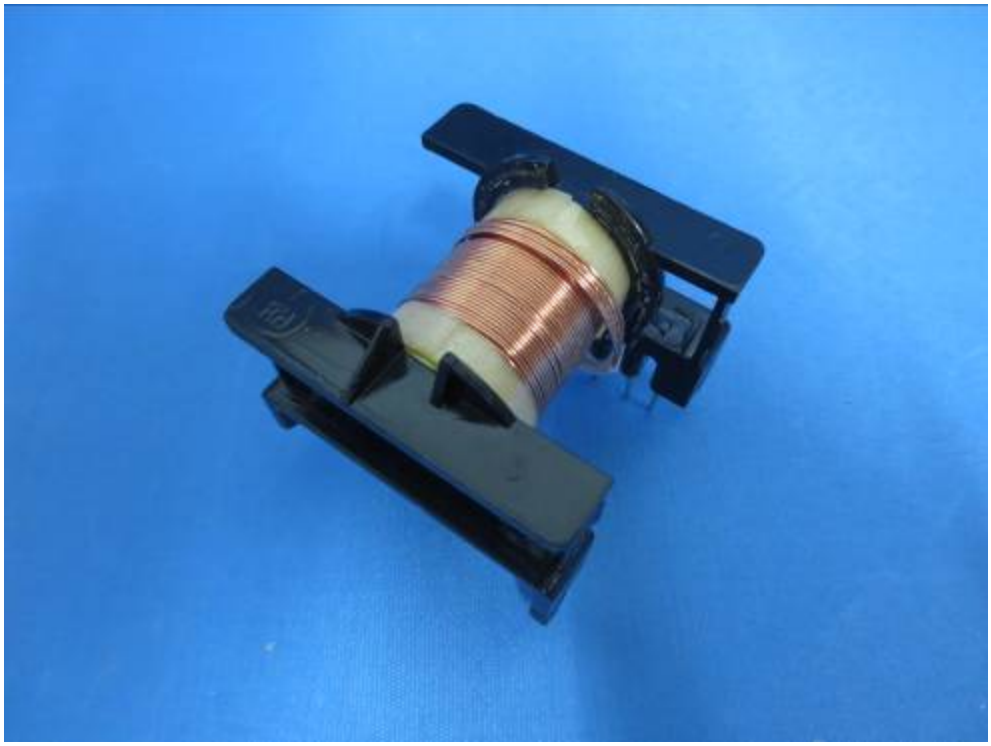
Transformer on control PCB (TA1)



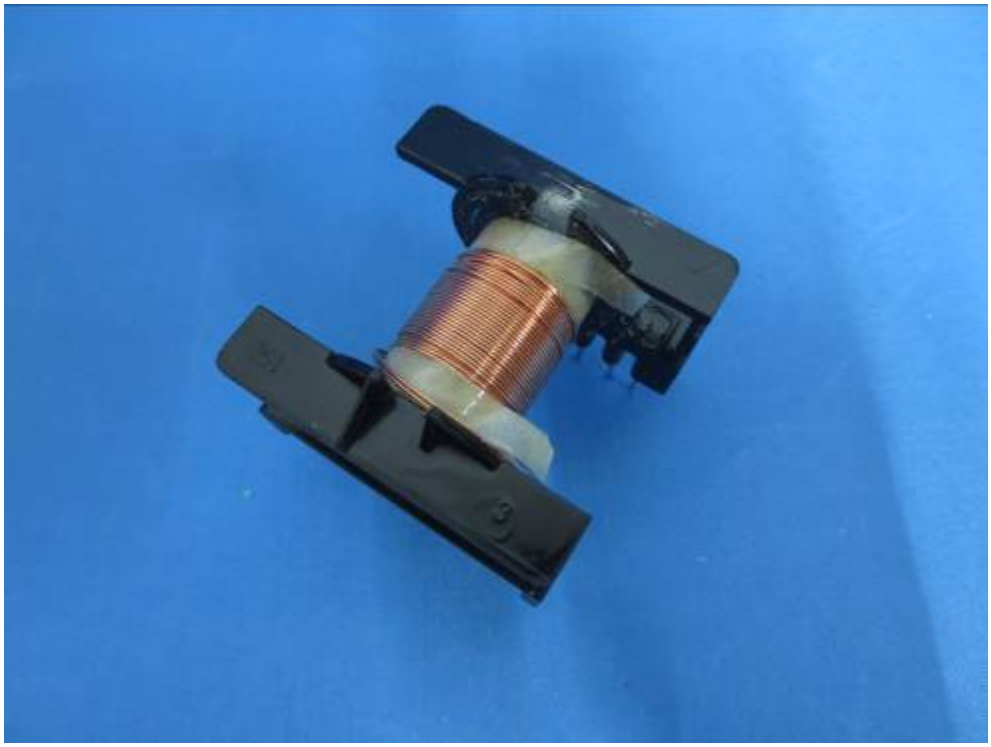
Transformer on control PCB (TA1)



Transformer on control PCB (TA1)



Transformer on control PCB (TA1)



Transformer on control PCB (TA1)

Bobbin of the transformer on control PCB (TA1)

(End of the report)