



Qualification of DBS100A, 150A to Railway applications

(General Standard EN50155)
(Shock and Vibration Standard EN61373)



Contents

| | Page |
|--|------|
| 1. Purpose | A-1 |
| 2. Scope | A-1 |
| 3. Qualification to EN 55015 | A-1 |
| 3.1 Visual inspection | A-1 |
| 3.2 Performance test | A-1 |
| 3.3 Cooling test | A-2 |
| 3.4 Dry heat test | A-2 |
| 3.5 Damp heat test, cyclic | A-2 |
| 3.6 Supply overvoltages | A-2 |
| 3.7 Surges, electrostatic discharge and transient burst susceptibility | A-2 |
| 3.8 Radio interference test | A-3 |
| 3.9 Insulation test | A-3 |
| 3.10 Salt mist test | A-3 |
| 3.11 Vibration, shock and bump test | A-3 |
| 3.12 Water tightness test | A-3 |
| 4. Qualification to EN 61373 | A-3 |
| 4.1 Vibration test | A-3 |
| 4.2 Shock test | A-4 |
| 5. External circuit for Surge Protection | A-5 |

For Railway Applications

1. Purpose

To verify compliance of our product to shock and vibration standard EN61373, parts of general standard EN50155 for electronic equipment used in Railway applications by existing test data and additional test.

2. Scope

The following products which have the input voltage range suited to railway market are as follows.

- DBS100A05 ▪ DBS100A13R8
- DBS150A12 ▪ DBS150A15 ▪ DBS150A24

3. Qualification to EN 50155

3.1 Visual inspection

No marked damage appears during or after the following test mentioned on this document.

3.2 Performance test

Refer to Performance data for each product on web site.

Address: [Cosel HP](#) ▶ [Technical Data](#) ▶ [Technical data down load](#)
 ▶ [DBS series](#) ▶ [Performance data](#) for each product

To continue operation under 10ms interruptions, input electrical capacitor is required. Example for calculation is shown below.

In case of DBS150A12 7.5A load current,

Pin : Maximum Power from Input power(by Load Current) test data on performance data

V1 : Regular input voltage

V2 : 60V(Minimum operating Input voltage)

T : Interruption time

$$C_{in} = \frac{2 \times P_{in} \times T}{V_1^2 - V_2^2} = \frac{2 \times 105 \times 0.01}{(110^2 - 60^2)} \doteq 250 \text{ [}\mu\text{F]}$$

3.3 Cooling test

Refer to Performance data for each product.

Test data at -35 °C is shown on Ambient Temperature Drift and Minimum Input for Regulated Output Voltage test data.

3.4 Dry heat test

Refer to High temp./overload test of Safety test results on appendix 1.

No failure with overload at 85 °C on base plate during 48 hours is confirmed.

The base plate and ambient temperature are different. Therefore the design, in which the base plate temperature is within specification even if ambient temperature goes up, is required.

3.5 Damp heat test, cyclic

Refer to High temp./High humidity bias test of Reliability Test results on appendix 2.

No degradation of electric characteristics after 1000h at 85 °C and 85%Rh is confirmed.

3.6 Supply overvoltages

Refer to High temp./overload test of Safety test results on appendix 1.

No smoke, and no fire at 220Vdc input is confirmed.

Input voltage 154V (rated voltage 110Vdc x 1.4) is within specification.

3.7 Surges, electrostatic discharge and transient burst susceptibility

Refer to EMI/EMS test results on appendix 3.

3.7.1 Surges

By Surge immunity test (EN61000-4-5), no stop, no drop down, no abnormality, and no degradation under condition of Line to Line 2kV, Line to earth 4kV is confirmed.

3.7.2 Electrostatic discharge susceptibility test

By Static electricity immunity test (EN61000-4-2), no function failure under condition of contact discharge 8kV is confirmed.

3.7.3 Transient burst susceptibility test

By Electrical fast transient/burst immunity test(EN61000-4-4), no function failure under condition of 4 kV peak voltage is confirmed.

3.8 Radio interference test

By Radiated, radio-frequency, electromagnetic field immunity test on EMI/EMS test results, no function failure under condition of 10V/m field strength is confirmed.

By Immunity to conducted disturbances, induced by radio - frequency fields test, no function failure under voltage level 10V is confirmed.

Concerning other condition, contact us. The each condition is dealt with.

3.9 Insulation test

By Withstand voltage test on Safety test results, no insulation breakdown, no flashover under condition of 4200Vac and 700Vdc is confirmed.

3.10 Salt mist test

Water proof design is required in order to prevent water infiltration.

Especially be careful when the PCB board under the product, because it is weak.

3.11 Vibration, shock and bump test

Refer to 4. Qualification to EN 61373.

3.12 Water tightness test

Basically not required as equipment inside rolling stock. Water proof design may be required depending on equipment.

4. Qualification to EN 61373

4.1 Shock test

By Impact test on Reliability test results, no degradation of electric characteristics, no crack at solder joint and no marked damage of appearance under condition of 20G(196.1m/s²) one time each X, Y and Z axis is confirmed.

4.2 Vibration test

4.2.1 Test conditions

Vibration condition: 5G(49m/s²) 5-150Hz X, Y, Z axis 5hour/axis
 Input Voltage: 140V
 Output: No load
 Model: ▪ DBS100A05 ▪ DBS100A13R8
 ▪ DBS150A12 ▪ DBS150A24 each 1 piece
 External component: Input rectifier circuit only against 100Vac input

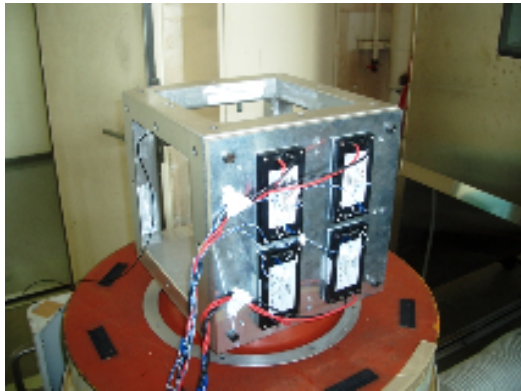


Fig.4.2.1 X axis

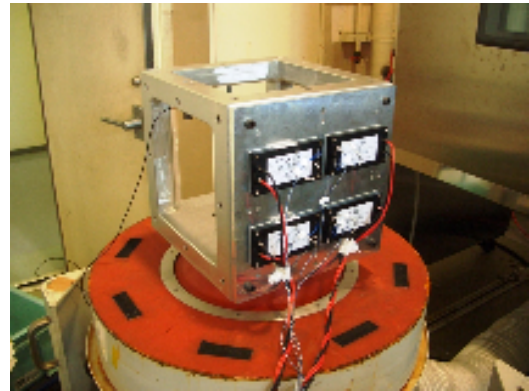


Fig.4.2.2 Y axis

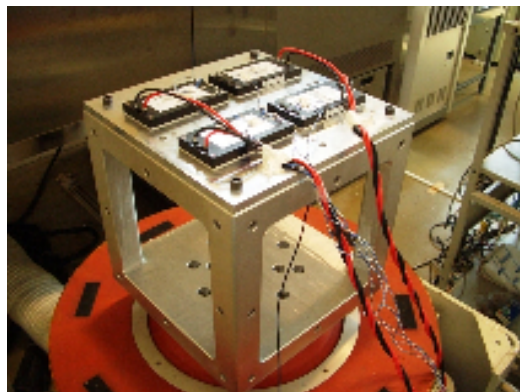


Fig.4.2.3 Z axis

4.2.2 Test result

Table 4.2
Test result

| Model | Apparent condition | Output voltage monitoring |
|-------------|--------------------|---------------------------|
| DBS100A05 | Pass | Pass |
| DBS100A13R8 | Pass | Pass |
| DBS150A12 | Pass | Pass |
| DBS150A24 | Pass | Pass |

No degradation of electric characteristics no marked damage of appearance after test is confirmed. And no interruption of output voltage during and after test is confirmed.

5. External circuit for RIA12 Surge Protection

- The surge protection circuit for Railway application is shown in Fig.5.1.

Fig.5.1
Surge protection
circuit

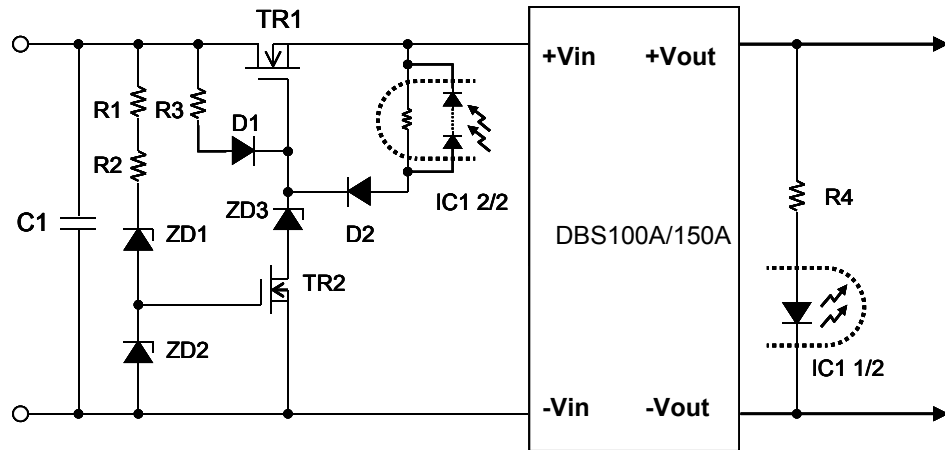
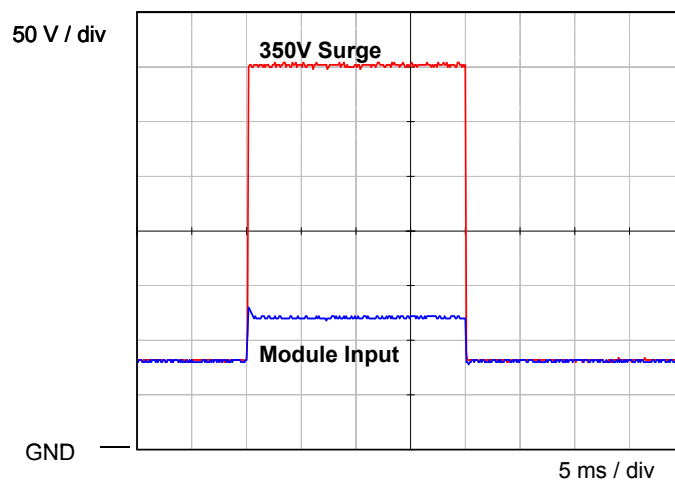


Table 5.1
Example of value

| | | | |
|----|---------------------------------------|-----|---------------------|
| C1 | 400V, 1 μ F | ZD1 | 1/2W, 160V |
| R1 | 1/4W, 22k Ω | ZD2 | 1/4W, 10V |
| R2 | 1/4W, 22k Ω | ZD3 | 1/2W, 160V |
| R3 | 1/4W, 33k Ω | IC1 | TLP591B (TOSHIBA) |
| D1 | 1N4148 | TR1 | TK15J50D (TOSHIBA) |
| D2 | 1N4148 | TR2 | SSM6K361NU(TOSHIBA) |
| R4 | 1/4W, (Output voltage / 5) k Ω | | |

Fig.5.2
Clamped surge
voltage



- Input transient surge voltage (20 ms max) is clamped to the module's input range, through the circuit in Fig.5.1.



DBS100A, DBS150A Safety Test Result

October 30, 2009
Design engineering dep.

Approved : *Takuya Mori*

Prepared : *Takuya Mori*

| No. | Test item | Conditions | Conditions of acceptability | Result |
|-----|---|--|---|--------|
| 1 | High temp./overload test | (1) Input Max.voltage, Min.voltage (2) Overload (3) Baseplate temp. 85 °C (4) Test period 48 hours (5) Testing circuitry Fig.1 | (1)Power supply does not fail. | OK |
| 2 | High voltage input test | (1) Input (DC220V) (2) Rated output (3) Ambient temp. 25±10 °C (4) Testing circuitry Fig.1 | (1)No smoke, no fire. | OK |
| 3 | Low voltage input test | (1) Input Min. regulation voltage (2) Rated output (3) Baseplate temp. 85 °C (4) Test period 48 hours (5) Testing circuitry Fig.1 | (1)Power supply does not fail. | OK |
| 4 | Input ON/OFF test | (1) Input Max.voltage (DC160V) T= 2sec Duty= 50% (2) Rated output (3) Ambient temp. 25±10 °C (4) Testing circuitry Fig.1 | (1)Power supply does not fail. (2)The surge current of each component should not exceed the rated value. | OK |
| 5 | Output ON/OFF test | (1) Rated input (DC110V) (2) Output 0% ↔ 100% T= 2sec Duty= 50% (3) Ambient temp. 25±10 °C (4) Testing circuitry Fig.1 | (1)Power supply does not fail. | OK |
| 6 | Output-short start test | (1) Rated input (DC110V) (2) Output Short start (3) Ambient temp. 25±10 °C (4) Testing circuitry Fig.1 | (1)Power supply does not fail. | OK |
| 7 | Output short test | (1) Rated input (DC110V) (2) Output Short (3) Ambient temp. 25±10 °C (4) Test period 48 hours (5) Testing circuitry Fig.1 | (1)Power supply does not fail. | OK |
| 8 | Withstand voltage test (High-pot test) | (1) Input Not applied. (2) Ambient temp. 25±10 °C (3) The applied voltage is 1.4 times that of specifications. | (1)Insulation breakdown , flashover or electric arc does not occur | OK |
| 9 | Isolation resistance test | (1) Input Not applied. (2) Ambient temp. 25±10 °C | (1)When a regulation voltage is applied, isolation resistance is 1.4 times of specifications. | OK |
| 10 | Vibration/impact test | Vibration (1)f=10~55Hz : 49.0m/s ² (2)3 minutes period (3)60 minutes along X, Y and Z axis Impact (1)196.1m/s ² 11ms (2)Once each X, Y and Z axis | (1)No degradation of electric characteristics after test. (2)No crack at solder joint. (3)No marked damage appears. | OK |

● Safety testing circuitry

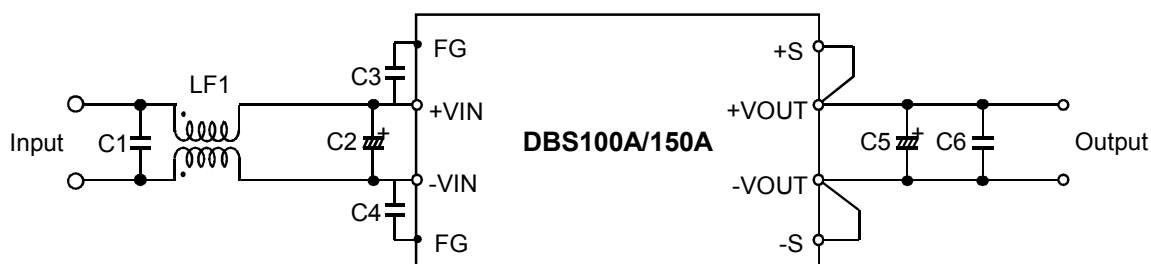


Fig.1 testing circuitry (from No.1 to No.7)

- C1 : 0.1uF 250V Film capacitor
- C2 : 47uF 250V Electric capacitor
- C3, C4 : 2200pF 250V Ceramic capacitor
- C5 : 2200uF 10V Electric capacitor (DBS100A05)
: 1000uF 25V Electric capacitor (DBS100A13R8/DBS150A12, 15)
: 470uF 35V Electric capacitor (DBS150A24)
- C6 : 0.1uF 50V Film capacitor
- LF1 : 1mH 3A Common mode Choke Coil

or equivalent.



DBS100A,150A Reliability Test Results

Nov 20, 2008
OS Design DEPT.

Approved: Tatsuya Mano
Tatsuya Mano

Prepared: Takuya Mori
Takuya Mori

| No. | Test Item | Testing conditions | Conditions of acceptability | Number of samples | Number of failures |
|-----|---|---|---|-------------------|--------------------|
| 1 | Heat cycle test | (1) -40°C ~ 125°C 30minutes each (2) 600cycles | (1)No degradation of electric characteristics after test. | 5 | 0 |
| 2 | High temperature/ High humidity bias test | (1) Ta=85°C,RH=85% (2) At rated input (3) Load 0% (4) 1000hours | (1)No degradation of electric characteristics after test. | 3 | 0 |
| 3 | Vibration test | (1) f=10~55Hz,49.0m/s ² (5G) (2) 3minutes period (3) 1hour each X,Y and Z axis | (1)No degradation of electric characteristics after test. (2)No crack at solder joint. (3)No marked damage appears. | 3 | 0 |
| 4 | Impact test | (1) 196.1m/s ² (20G),11ms (2) Once each X,Y and Z axis | (1)No degradation of electric characteristics after test. (2)No crack at solder joint. (3)No marked damage appears. | 3 | 0 |
| 5 | Soldering heat test | (1) 260°C,15seconds (2) Mounting board : t=1.6mm / FR-4 | (1)No crack at solder joint. (2)No marked damage appears. | 1 | 0 |
| 6 | Pin strength test immunity test | (1) Weight φ1 pin : 1kg (2) Bending angle:90 deg., total 180 deg. (3) 1 cycle | (1)No degration of electric characteristics after test. (2)No broken or bent pin. | 1 | 0 |
| 7 | Static electricity immunity test | (1) Applied voltage ±8kV (2) At rated input and load | (1)No protection circuit failure. (2)No output voltage drop with control circuit failure. (3)No any other function failure. | 1 | 0 |



DBS100A, DBS150A EMI/EMS Test result

October 30, 2009
Design engineering dep.

Approved : *Takuya Mori*

Prepared : *Takuya Mori*

| No. | Test item | Conditions | Conditions of acceptability | Result |
|-----|---|--|---|--------|
| 1 | Line conduction | (1) Rated input(DC110V/AC90V) (2) Rated load (3) Ambient temp. 25±10°C (4) Testing circuitry Fig.1 | (1)Meets the undermentioned FCC Part15 classB , VCCI classB CISPR22 classB , EN55022-B | OK |
| 2 | Radiated emission | (1) Rated input(DC110V/AC90V) (2) Rated load (3) Ambient temp. 25±10°C (4) Testing circuitry Fig.1 | (1)Meets the undermentioned FCC Part15 classB , VCCI classB CISPR22 classB , EN55022-B | OK |
| 3 | Static electricity immunity test (EN61000-4-2) | (1) Rated input(DC110V/AC90V) (2) Rated load (3) Ambient temp. 25±10°C (4) Contact discharge voltage 8[kV] (EN61000-4-2 Level 4) (5) Testing circuitry Fig.1 | (1)No protection circuit failure. (2)No output voltage drop with control circuit failure. (3)no other function failure | OK |
| 4 | Radiated, radio-frequency, electromagnetic field immunity test (EN61000-4-3) | (1) Rated input(DC110V/AC90V) (2) Rated load (3) Ambient temp. 25±10°C (4)Testing field strength 10[V/m] (EN61000-4-3 Level 3) (5) Testing circuitry Fig.1 | (1)No protection circuit failure. (2)No output voltage drop with control circuit failure. (3)no other function failure | OK |
| 5 | Electrical fast transient/ burst immunity test (EN61000-4-4) | (1) Rated input(DC110V/AC90V) (2) Rated load (3) Ambient temp. 25±10°C (4) Test peak voltage 4[kV] (IEC61000-4-4 Level 4) (5) Testing circuitry Fig.1 | (1)No protection circuit failure. (2)No output voltage drop with control circuit failure. (3)no other function failure | OK |
| 6 | Surge immunity test (EN61000-4-5) | (1) Rated input(DC110V/AC90V) (2) Rated load (3) Ambient temp. 25±10°C (4) Test voltage Line to line 2[kV] (Level 3) Line to earth 4[kV] (Level 4) (5) Testing circuitry Fig.2 | (1)The power supply does not stop. (2)Circuit does not malfunction. (3)No abnormality of the insulation or destruction etc. (4)Parts are not damaged. | OK |
| 7 | Immunity to conducted disturbances, induced by radio-frequency fields (EN61000-4-6) | (1) Rated input(DC110V/AC90V) (2) Rated load (3) Ambient temp. 25±10°C (4) Voltage level (e.m.f.) 10[V] (Level 3) (5) Testing circuitry Fig.1 | (1)No protection circuit failure. (2)No output voltage drop with control circuit failure. (3)no other function failure | OK |

●EMI/EMS testing circuitry

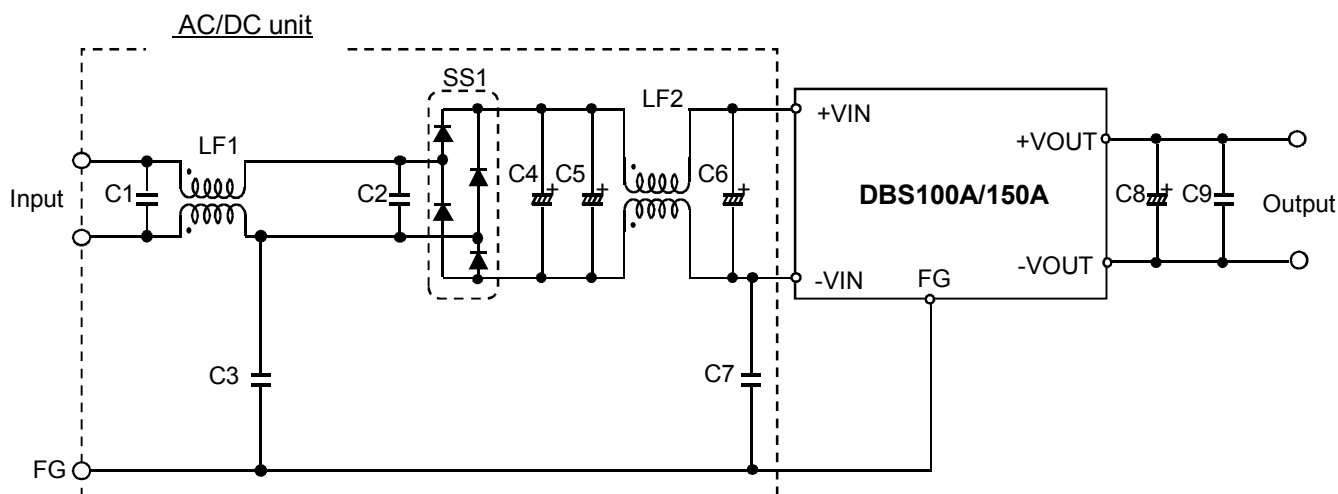


Fig.1 testing circuitry (from No.1 to No.5, No.7)

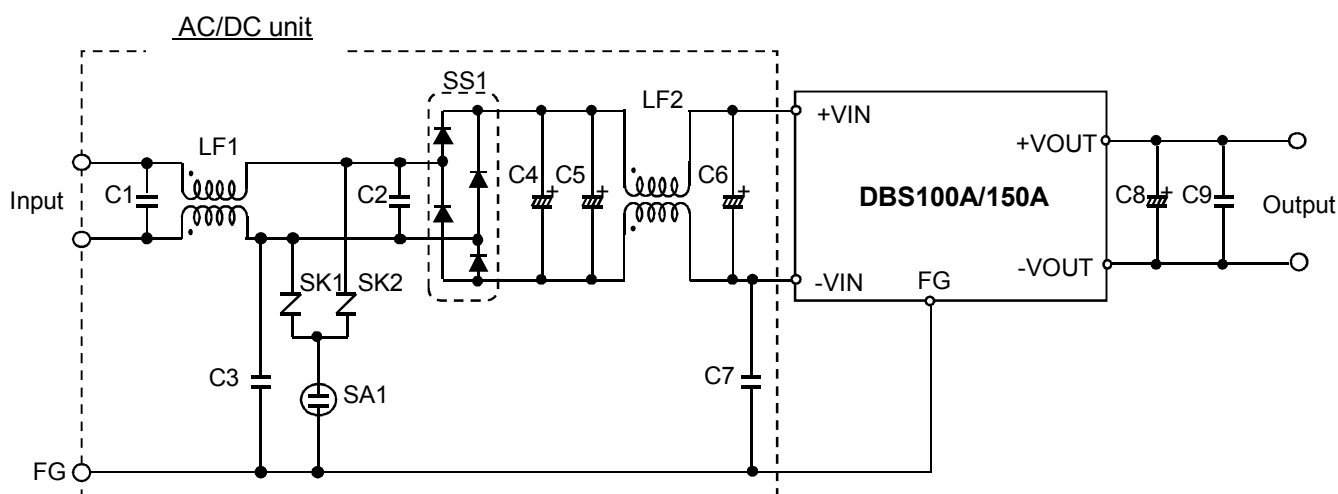


Fig.2 testing circuitry (No.6)

- | | | | |
|----------|--|----|---|
| C1, C2 | : 0.47 μ F 250V Film capacitor | C8 | : 2200 μ F 10V Electric capacitor (DBS100A05) |
| C3, C7 | : 3300pF 250V Ceramic capacitor | | : 1000 μ F 25V Electric capacitor |
| C4, C5 | : 1000 μ F 250V Electric capacitor | | (DBS100A13R8/DBS150A12, 15) |
| C6 | : 47 μ F 250V Electric capacitor | | : 470 μ F 35V Electric capacitor (DBS150A24) |
| LF1 | : 2mH 5A Common mode Choke Coil | C9 | : 0.1 μ F 50V Film capacitor |
| LF2 | : 1mH 5A Common mode Choke Coil | | |
| SA1 | : DSA302 (MITSUBISHI MATERIALS CORP ADVANCED PRODUCTS) | | |
| SK1, SK2 | : ERZV10D271(PANASONIC CO LTD) | | |
| SS1 | : 25A 600V Bridge diode | | or equivalent. |