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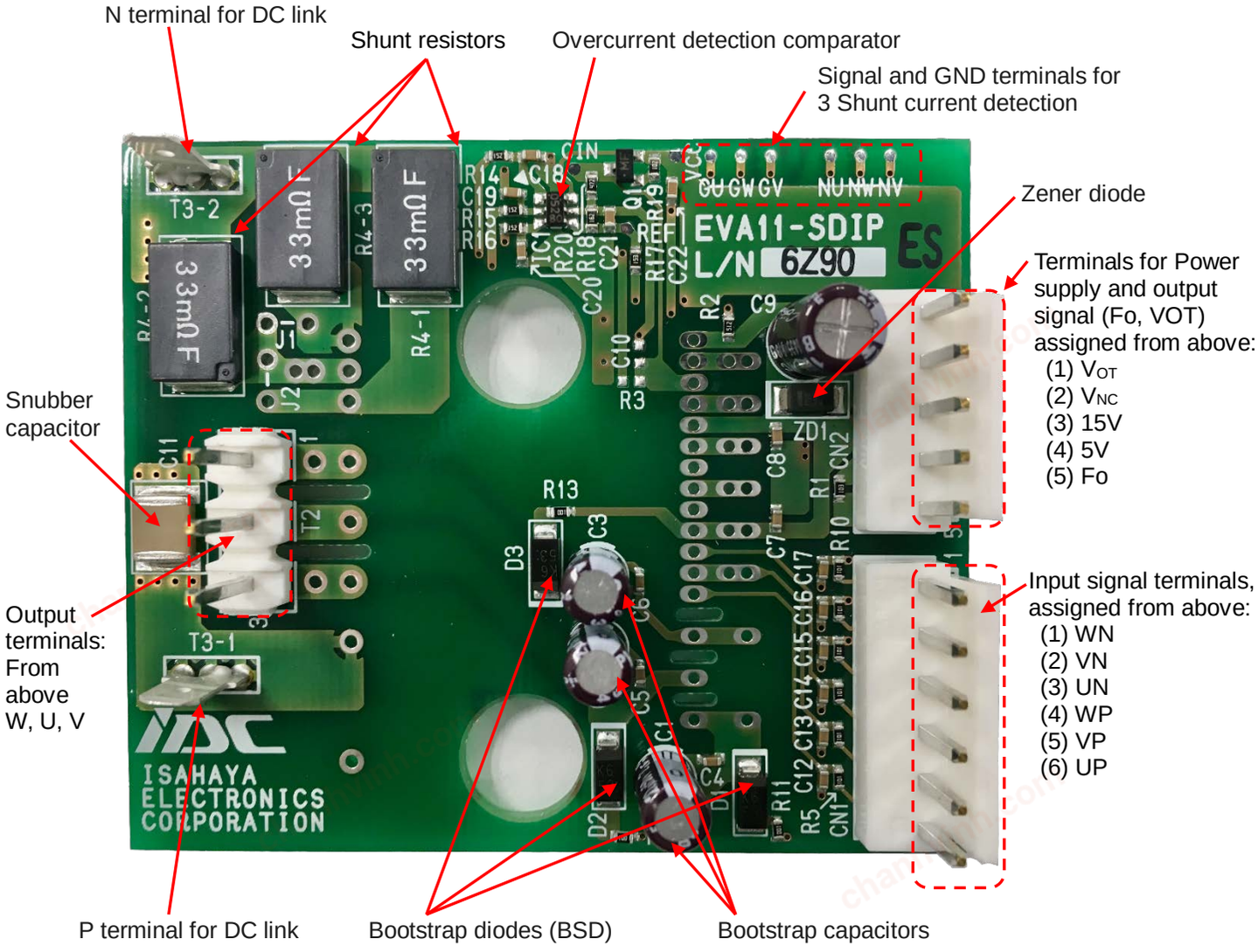
MITSUBISHI ELECTRIC

< Dual-In-Line Package Intelligent Power Module >

Instruction manual of the evaluation board (EVA11-SDIP) for Super Mini DIPIPM series

This is an instruction manual of the evaluation board “EVA11-SDIP” for evaluating Super Mini DIPIPM series. This manual describes usage and precautions for safe use. Please confirm the following items before using the board.

1. Appearance (Board size: 60x72mm)



(Note) Mounted circuit parts and printing contents on the board are subject to be changed without notice.

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2. Handling methods and precautions

(1)This evaluation board can be applied to the evaluation for all our Super Mini DIPIPM series from Ver.4 to Ver.6, MOSFET and Full SiC MOSFET DIPIPM. It applies 70μm pattern thickness, 2W shunt resistors (initially mounted) and assures reasonable clearance and creepage distance for high voltage area; however, each live parts are exposed without any cover and mounted parts haven't been confirmed about the long term operation, life time and reliability. Please use this board for conducting initial evaluation on the condition of light load with securing safety

(2) This evaluation board can be applied to all our Super Mini DIPIPM series; however, some connections and parts may have to be changed or removed depending on the series and the circuit configuration. Please refer the Table 1 and change the parts and the wirings following the instructions.

Table 1

Series	Required change	
Super Mini DIPIPM Ver.4 PS2196x-xxx PS2199x-xxx [Specifications] • N side IGBT emitter terminal: Common		• Insert connecting jumper wires J1 and J2 between each N side IGBT emitters (Note 1) • Set shunt resistance value to obtain desired short circuit protection value (Note 2) • Remove Q1 and R20 to disable the comparator output • Insert R3 and C10 as RC filter for Cin terminal
Super Mini DIPIPM Ver.4 PS2196x-xxx (Included 'S') PS2199x-xxx (Included 'S') [Specifications] • N side IGBT emitter terminal: Open		• Set shunt resistance value to obtain desired short circuit protection value (Note 2)
Super Mini DIPIPM Ver.4 with BSD PS219Ax-xxx [Specifications] • N side IGBT emitter terminal: Open • Built-in bootstrap diodes	N side IGBT emitter terminal: Open	• Set shunt resistance value to obtain desired short circuit protection value (Note 2) • Remove bootstrap diodes D1, D2 and D3 (Note 3)
Super Mini DIPIPM Ver.5 PS219Bx-xxx [Specifications] • N side IGBT emitter terminal: Open • Built-in bootstrap diodes **Super Mini DIPIPM Ver.6** PSSxxS92x6-AG [Specifications] • N side IGBT emitter terminal: Open • Built-in bootstrap diodes • Temperature output (VOT) (Note 4) **MOSFET Super Mini DIPIPM** PSMxxS93E5-A [Specifications] • N side IGBT emitter terminal: Open • Built-in bootstrap diodes	N side IGBT emitter terminal: Common	• Insert connecting jumper wires J1 and J2 between each N side IGBT emitters (Note1) • Set shunt resistance value to obtain desired short circuit protection value (Note2) • Remove Q1 and R20 to disable the comparator output • Insert R3 and C10 as RC filter for Cin terminal • Remove bootstrap diodes D1, D2 and D3 (Note 3)
Full SiC Super Mini DIPIPM PSFxxS92F6-A [Specifications] • N side IGBT emitter terminal: Open • Built-in bootstrap diodes • Temperature output (VOT) (Note 4)	N side IGBT emitter terminal: Open	• Set shunt resistance value to obtain desired short circuit protection value (Note 2) • Remove bootstrap diodes D1, D2 and D3 (Note 3) • Supply No.3 pin of CN2 with 18V, instead of 15V
	N side IGBT emitter terminal: Common	• Insert connecting jumper wires J1 and J2 between each N side IGBT emitters (Note 1) • Set shunt resistance value to obtain desired short circuit protection value (Note 2) • Remove Q1 and R20 to disable the comparator output • Insert R3 and C10 as RC filter for Cin terminal • Remove bootstrap diodes D1, D2 and D3 (Note 3) • Supply No.3 pin of CN2 with 18V, instead of 15V
Super Mini DIPIPM for Automobile PS21997-J [Specifications] • N side IGBT emitter terminal: Open	N side IGBT emitter terminal: Open	• Set shunt resistance value to obtain desired short circuit protection value (Note2)
	N side IGBT emitter terminal: Common	• Insert connecting jumper wires J1 and J2 between N side IGBT emitters (Note 1) • Set shunt resistance value to obtain desired short circuit protection value (Note 2) • Remove Q1 and R20 to disable the comparator output • Insert R3 and C10 as RC filter for Cin terminal

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(Note 1) For SC detection with 1 shunt resistor, please insert jumper wires J1 and J2 in order to contact between each N side IGBT emitters, NU-NV and NV-NW. Please refer the below enlarged view of mounting surface pattern. In that case, please review its shunt resistance value R4-1, 2 and 3 because those shunt resistors are parallel.

(Note 2) Please refer following note for SC detection with 3 shunt resistors or 1 shunt resistor.

- For SC detection with 3 shunt resistors (Open emitter)

  This evaluation board initially uses 3 shunt resistors R4 and overcurrent detection comparator IC1 for SC detection. The threshold voltage Vref of the comparator is set to typ.0.482V generated by the resistance voltage dividing of 5V using R17 and R18.

  The initially mounted shunt resistance is 33mΩ and then SC trip level is set to typ.14.6A. Please adjust the shunt resistance to obtain desired short circuit protection value. Please also note that the SC trip level is less than 1.7 times of the current rating including deviation of each parts.

  Initial IC1 is RT8H052C from Isahaya Electronics Corporation. Please refer its datasheet in details.

- For SC detection with 1 shunt resistor (Common emitter)

  Some connections and parts are required to change or remove depending on for SC detection with 1 shunt resistor.

  It is recommended to monitor the shunt resistor voltage with Cin terminal directly, instead of using the initial overcurrent detection comparator IC1. Cin terminal is SC trip detect terminal for Super Mini DIPIPM series. In this case, need to remove Q1 and R20 in order to disable the comparator output and then set R3 and C10 as a RC filter for noise absorption before inputting to the Cin terminal. It is recommended to set RC time constant 1.5~2.0μs so that IGBT (or MOSFET) shut down within 2.0μs when SC.

  Please refer the datasheet and the application note of each product for confirming its SC trip level Vsc(ref) and how to set the shunt resistance.

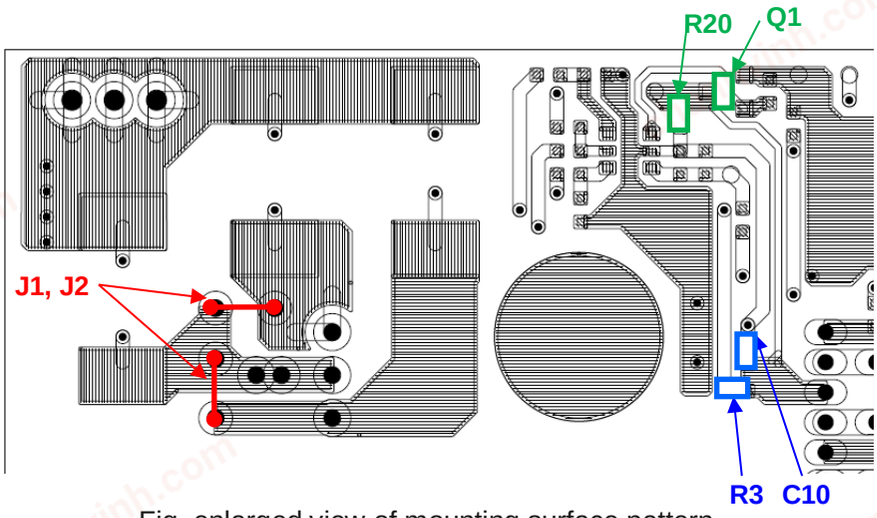


Fig. enlarged view of mounting surface pattern

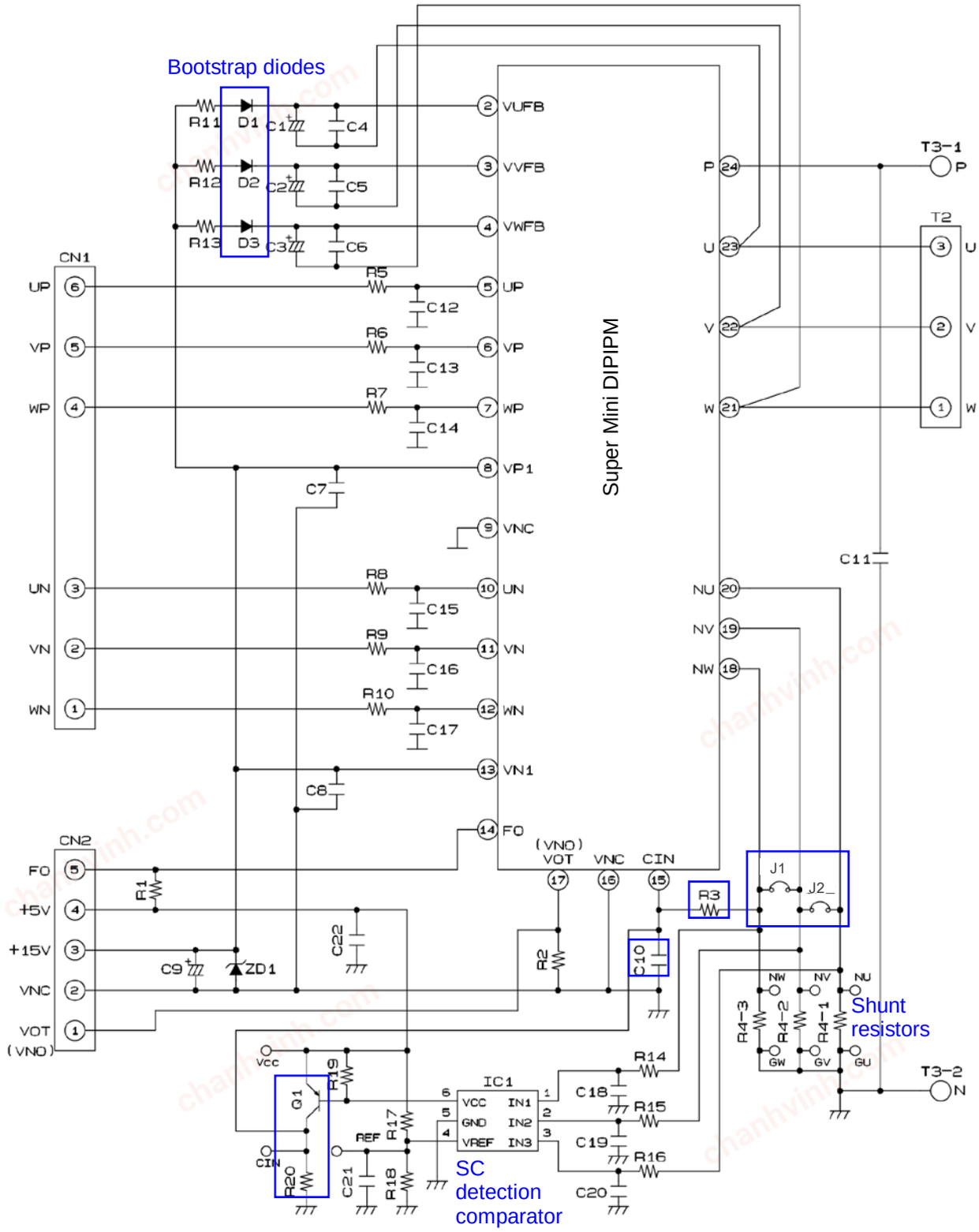
(Note 3) For built-in bootstrap diodes type DIPIPM, Need to remove mounted bootstrap diodes D1, D2 and D3 in order to disable these initial bootstrap diodes.

(Note 4) This evaluation board can be monitored temperature output (VOT) from No.1 pin of the connector CN2. Without VOT function type, the terminal is set to 0V by pull down resistor R2.

It is recommended to refer the datasheet of each DIPIPM product and its application note when using the evaluation board. The circuit diagram, parts list, and pattern diagram of the board are described on the following pages.

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3. Circuit diagram



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4. Parts list

Please refer the following table for its parts list.

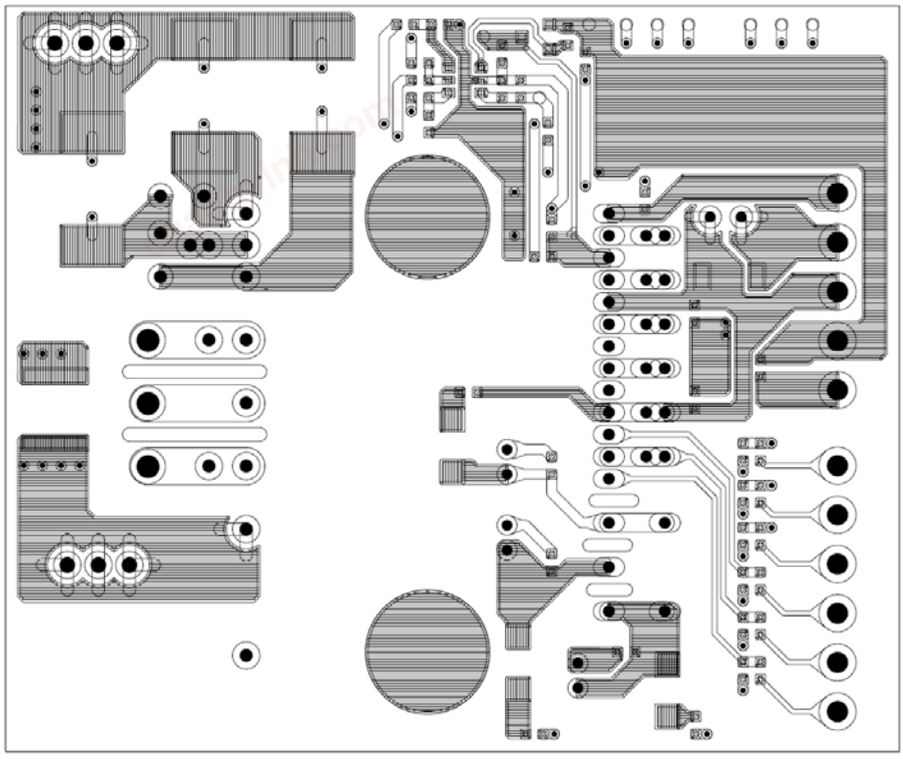
Table 2

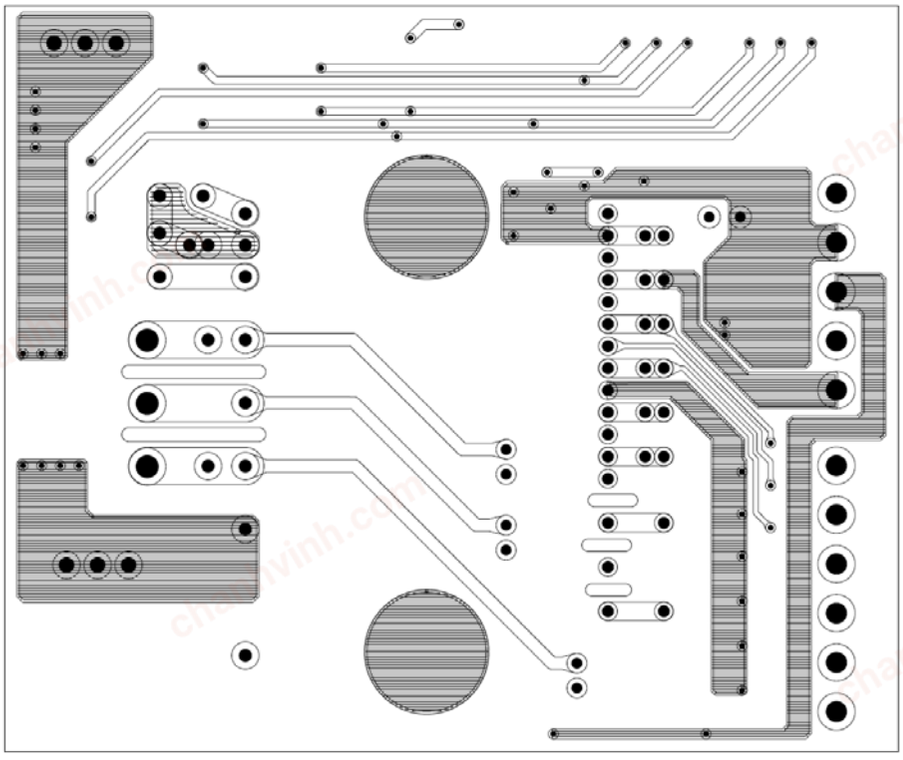
Symbol	Type Name	Description	Note
IC1	RT8H052C	Overcurrent protection IC	ISAHAYA
Q1	ISA1235AC1	-0.2A -50V Transistor	ISAHAYA
ZD1	CMZB24	24V 1W Zener Diode	Toshiba
D1~3	D1FK60	0.8A 600V Diode	Shindengen
C1~3	UPW1H220MDD	22μF 50V Al electrolytic capacitor	Nichicon
C4~8,10	GRM188R71H102K	1000pF 50V ceramic capacitor	Murata
C9	UPW1E101MED	100μF 25V Al electrolytic capacitor	Nichicon
C11	GRJ55DR72J224KWJ1	0.22μF 630V snubber capacitor	Murata
C12~20	GRM188R71H102K	1000pF 50V ceramic capacitor	Murata
C21,22	GRM188R71H104K	0.1μF 50V ceramic capacitor	Murata
R1	CR1/16W103F	1/16W 10KΩ	Hokuriku Denko
R2	CR1/16W512F	1/16W 5.1KΩ	Hokuriku Denko
R3	CR1/16W202F	1/16W 2KΩ	Hokuriku Denko
R4-1,2,3	SL2TTE33L0F	2W 33mΩ Current sensing resistor	KOA
R5~10	CR1/16W101F	1/16W 100Ω	Hokuriku Denko
R11~13	CR1/16W100F	1/16W 10Ω	Hokuriku Denko
R14~16	CR1/16W152F	1/16W 1.5kΩ	Hokuriku Denko
R17	CR1/16W153F	1/16W 15kΩ	Hokuriku Denko
R18	CR1/16W162F	1/16W 1.6kΩ	Hokuriku Denko
R19	CR1/16W102F	1/16W 1kΩ	Hokuriku Denko
R20	CR1/16W472F	1/16W 4.7kΩ	Hokuriku Denko
CN1	B6P-VH	6pin Socket	JST
CN2	B5P-VH	5pin Socket	JST
T2	B3P-VB-2	3-terminal connector	JST
T3-1,2	TP42097-21	Tab	Kyoushin
J1,2		Jumper 3.5mm pitch	
DIPIPM	PS*	Super Mini DIPIPM Ver.4, Ver.5, Ver.6	Mitsubishi

(Note) The evaluation board does not mount initially either C10, R3, J1, J2 or DIPIPM.
These mounted parts are subject to be changed without notice.

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5. Pattern diagram





6. Note

This evaluation board is just designed for operational check with light load. Its mounted parts aren't tested before shipment and specifications do not guaranteed the actual operation. Please take them as a reference and design your actual system board pattern based on your own design rules.

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Revision Record

Rev.	Date	Page	Revised contents
1	28/03/2016	-	New

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