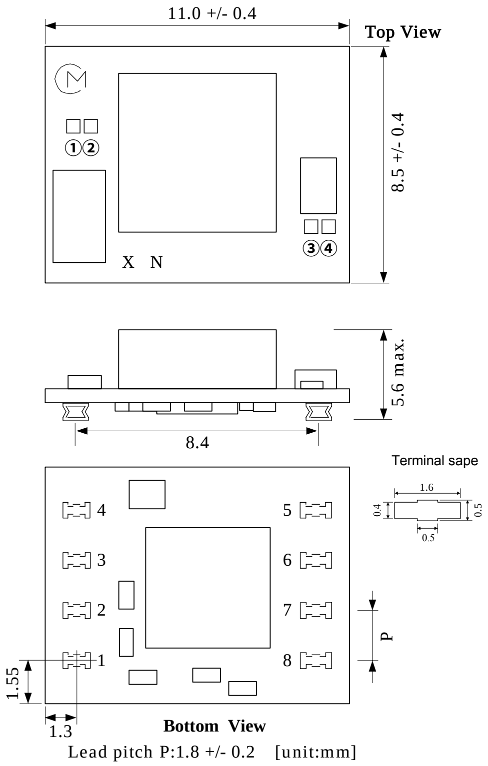
DC-DC Converter Application Manual

MYUSP3R303FMP

1. Features
- ・Ultra small size foot print (8.5mm×11.0mm), 3A output current, non-isolated POL.
- ・Wide adjustable output voltage range by connecting external resistance (0.7V to 3.3V).
- ・Wide operating temperature（-40℃ to +85℃）.
- ・UVLO function, ON/OFF function, P-GOOD function, Output voltage sense function, Over-current function and, Over-temperature function are built in.

2. Appearance, Dimensions



Marking

(1)	Pin No.1 Side Marking	Ⓜ
(2)	Parts Number	XN
(3)	Manufacturer ID	Ⓜ
(4)	Lot No.	□□ □□ ①② ③④

① Production Year
② Production Month（1,2,3,…9,O,N,D）
③④ Production Control Marking

⚠ **Note:**

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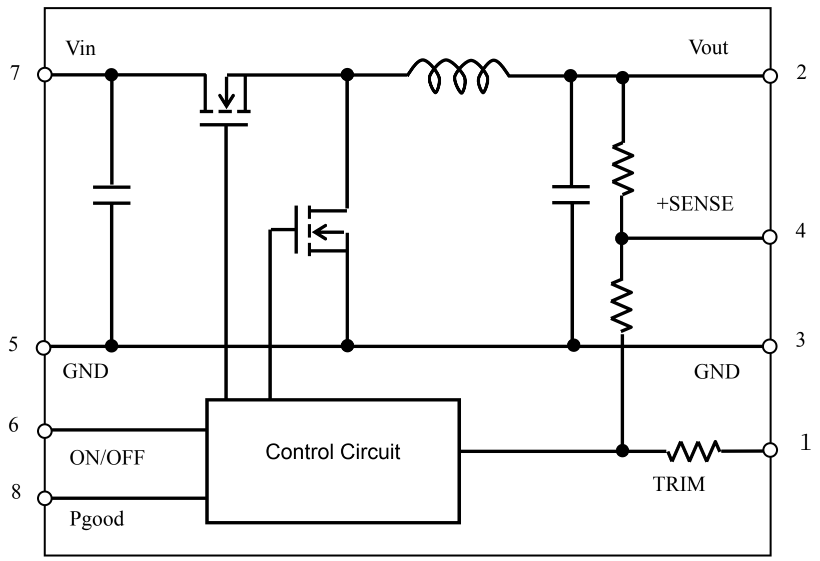
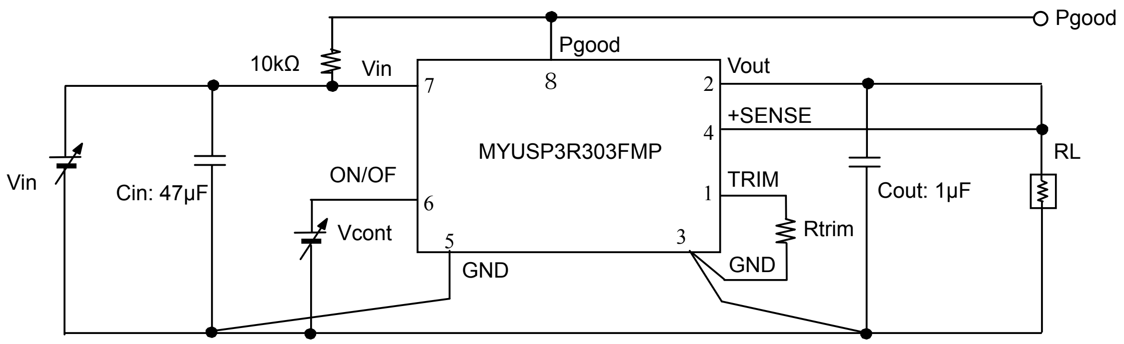
Pin Number and Function

Pin No.	Symbol	Function
1	TRIM	Output voltage adjustment
2	Vout	Output
3,5	GND	GND
4	+SENSE	Output voltage sense
6	ON/OFF	Remote ON/OFF
7	Vin	Input
8	Pgood	Power good output

3. Block Diagram



4. Test Circuit



Cin　：47μF／6.3V　　Ceramic Capacitor
Cout ：1μF／10V　　Ceramic Capacitor

Please make sure to place Cin and Cout nearby input and output terminal of DC-DC converter.

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5. Characteristics

5. 1 Electrical Characteristics (Ta=25 °C)

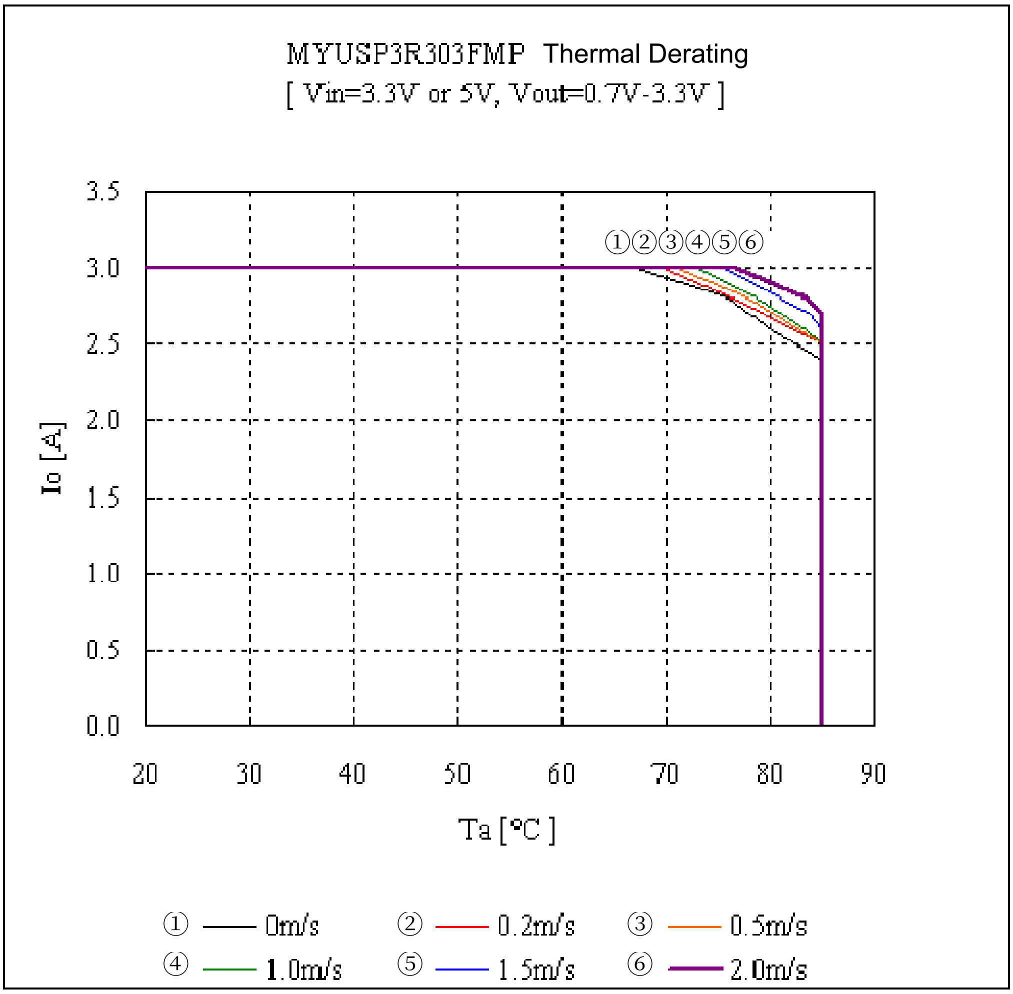
Item	Symbol	Condition		Value Min.	Value Typ.	Value Max.	Unit
Input Voltage Range	Vin			3.0	-	5.5	V
Output Voltage Adjustable Range	Vout	Vin=3.0V-5.5V Note： VinMin.=Vout+1.2V at Vout≧1.6V		0.7	-	3.3	V
Output Voltage Tolerance	Vo tol	Over Vin,Temperature range Rset=0.5% tolerance Io=5mA～3A		-3.0	-	+3.0	%Vo
Output Current	Iout	See the thermal derating curve in section 5.2.		0	-	3	A
Ripple Voltage	Vrpl	Vin=5V, Vout=1.2V, Iout=3A BW =20MHz,		-	-	80	mV(pp)
Efficiency	EFF	Vin =5V, Vout=3.3V, Iout=1A		-	94	-	%
ON/OFF pin High Voltage	VIH		ON	2.0	-	Vin	V
ON/OFF pin Low Voltage	VIL		OFF	0	-	0.8	V
Short Circuit Protection	SCP	When a short circuit state continues, the product becomes the latch up mode and stops.. After correction of the abnormal condition, the DC-DC Converter will restart by re-inputting Vin or toggling On/Off pin.					
Soft Start Time	TSS			2	4	8	msec
Timer Latch Mask Time	Tlatch			0.5	1	2	msec

The Pgood pin is the Open drain output.

⚠ Caution

The above electrical characteristics are guaranteed with the condition that the impedance of the input voltage source is sufficiently low as shown in section 4. Connecting an input inductance or using an input power supply with output inductance may cause an unstable operation of this device. Please check the proper operation of this device with the peripheral circuits on your system.

5. 2 Thermal Derating



The above derating limits apply to this product soldered directly to 101.6*180mm*1.6mm PCB (double-sided, with 70um copper). Any adjacent parts of high temperature may cause overheating. For reliable operation, please ensure that the IC temperature of this product is maintained below 120°C and the inductor temperature is below 119°C.

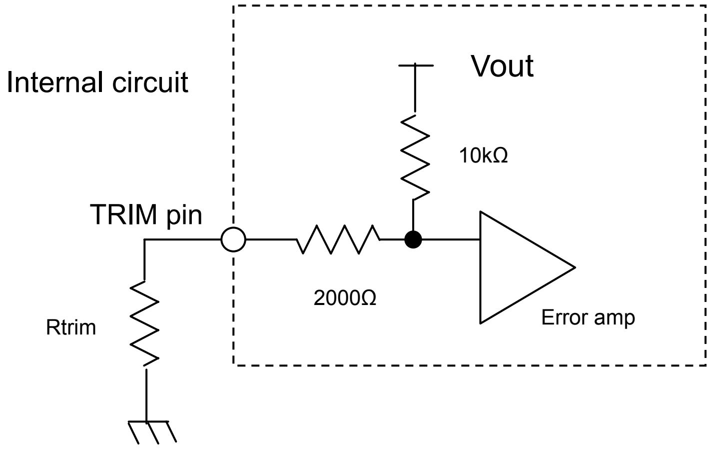
6. Pin Description

6.1. Adjusting the Output Voltage

The output voltage can be adjusted from 0.7V to 3.3V by connecting resistors between TRIM-pin(1Pin) to GND-pin(Pin 3 is recommended for accurate Vout setting).

The following equation gives the required external-resistor values to adjust the output voltage to the required Vout.

It is highly recommended that evaluation of the characteristics of this DC-DC converter's operation under your board conditions be thoroughly conducted.



$$Rtrim = \frac{7000}{Vout - 0.7} - 2000 \quad [\Omega]$$

<Rtrim Calculation Example>

Vout(V)	Calculated Rtrim(Ω)	Rtrim Example(Ω)
3.3	692.3	680 + 12
2.5	1888.9	1500 + 390
1.8	4363.6	3900 + 470
1.5	6750	5600 + 1200
1.2	12000	12000
1.0	21333.3	18000 + 3300 + 33
0.8	68000	68000
0.7	∞	Open

6. 2. ON/OFF Control

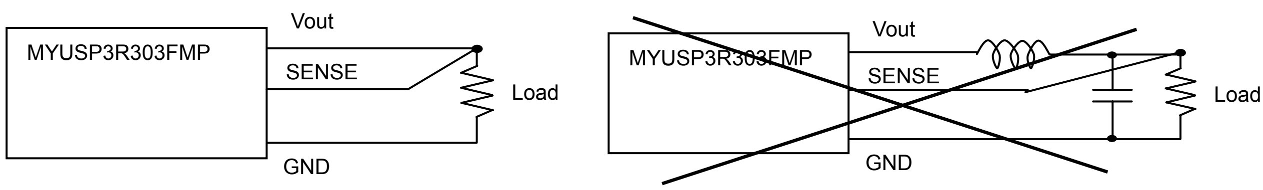
Using the ON/OFF feature, the operation of this product can be disabled without removal of the input voltage. Sequencing of a power supply system and power-saving control can be easily achieved using this function.

When ON/OFF-pin(6pin) is connected to Vin …… Output Voltage =ON
When ON/OFF-pin(6pin) is connected to GND …… Output Voltage =OFF

6.3. Output Voltage Sensing

By connecting SENSE-pin to the load, output voltage drop in wiring shall be compensated.
Please do NOT connect SENSE-pin to the output of LC filter that is set to the Vout line.
When using this way, this product will not operate properly.

< Caution>



Please connect SENSE-pin to Vout-pin nearby the product, if sense function is not used.

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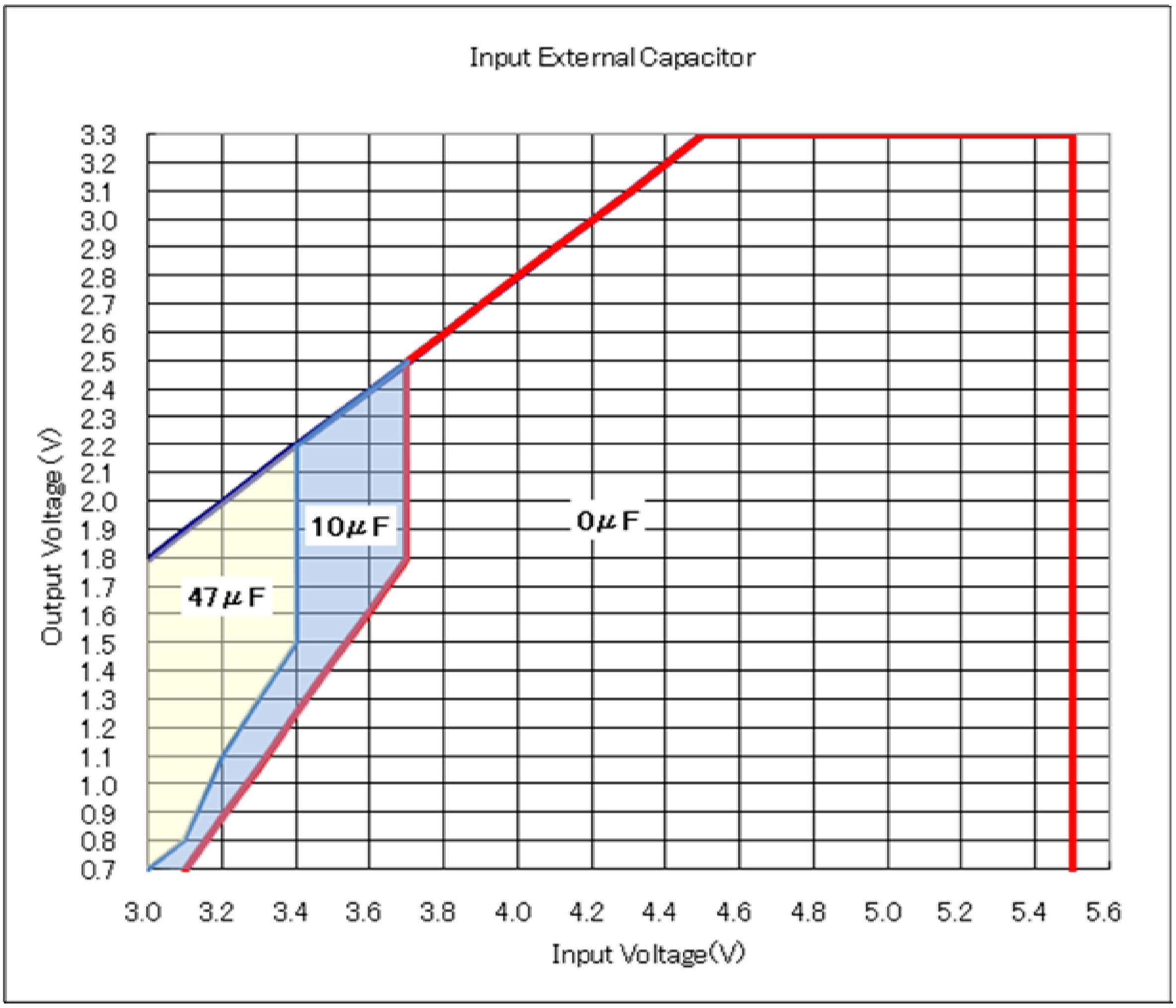
6.4. Input External capacitor

It is recommended to connect Ceramic capacitor of 47uF or more between Vin terminal(7pin) and GND(5pin). But according to Fig6-4, it can smaller capacity value by a combination of input voltage and output voltage.
But smaller input capacitor may leads to an unstable operation of this product caused by input voltage fluctuation. When the impedance of input line is enough small, smaller input capacitor can be applied after checking the stable operation on your product.

Please place the input capacitor as close as possible to this product.
Long wiring between the input capacitor and this product may lead to increased radiation noise and unstable operation of this product.

Fig6-4 Input external capacitor by the combination of input voltage and output voltage.
（When Slew Rate of the output current is less than 1A/μs.）



6.5. Output External capacitor

Ceramic capacitors are recommended as output external capacitor.
Using ceramic capacitors, small output variation and small ripple voltage are realized.

Output capacitor should be 300uF or less. Output capacitor shall be placed near the output terminal.

7. Typical Characteristics Data

7.1. Static Electrical Characteristics

Vout=1.0V
（Ta=25 °C, Cin= GRM32EC80J476K, Cout= GRM216B11A105K, Rtrim=21333Ω）

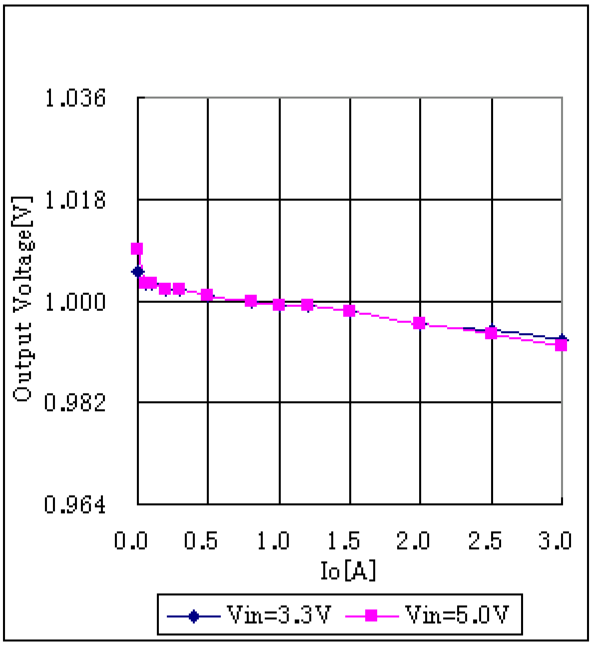


Fig.7-1-1. Output Voltage v.s. Output Current

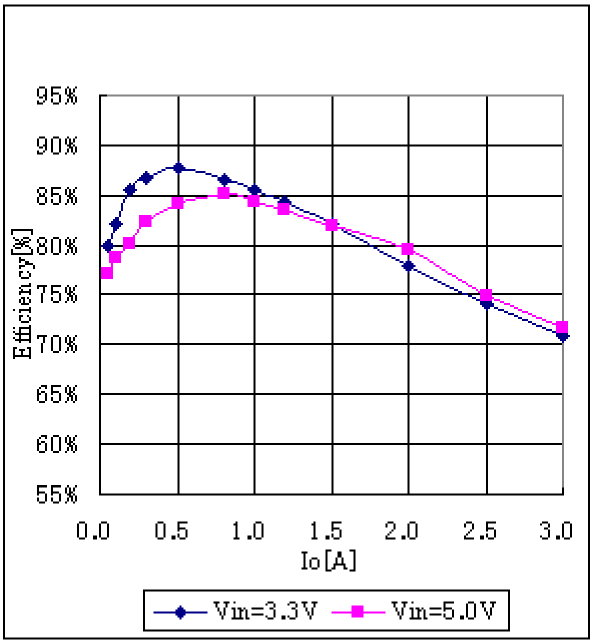


Fig.7-1-2. Efficiency v.s. Output Current

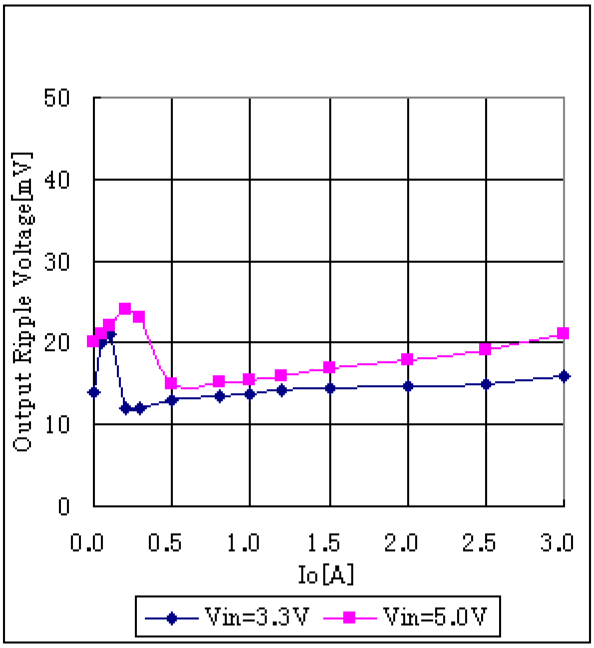


Fig.7-1-3. Ripple Voltage v. s. Output Current

Vout=1.2V
（Ta=25 °C, Cin= GRM32EC80J476K, Cout= GRM216B11A105K, Rtrim=12000Ω）

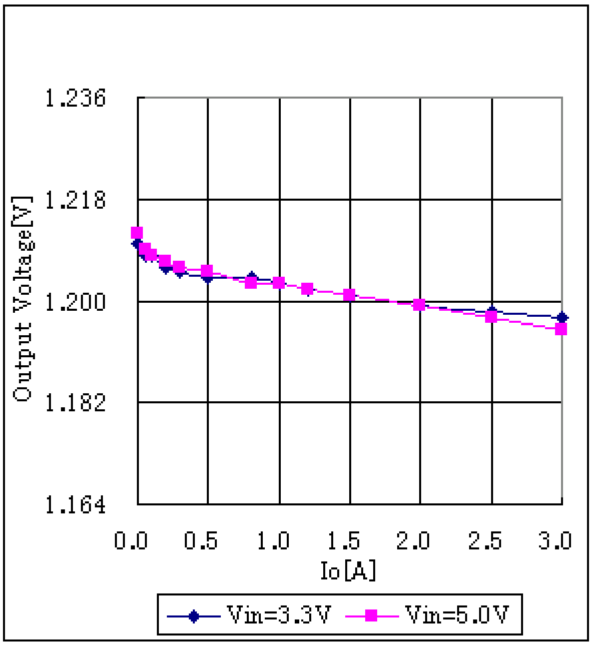


Fig.7-1-4. Output Voltage v.s. Output Current

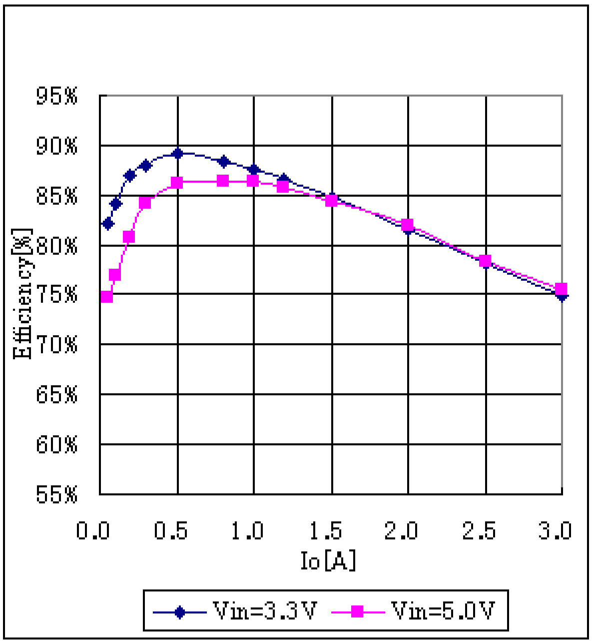


Fig.7-1-5. Efficiency v.s. Output Current

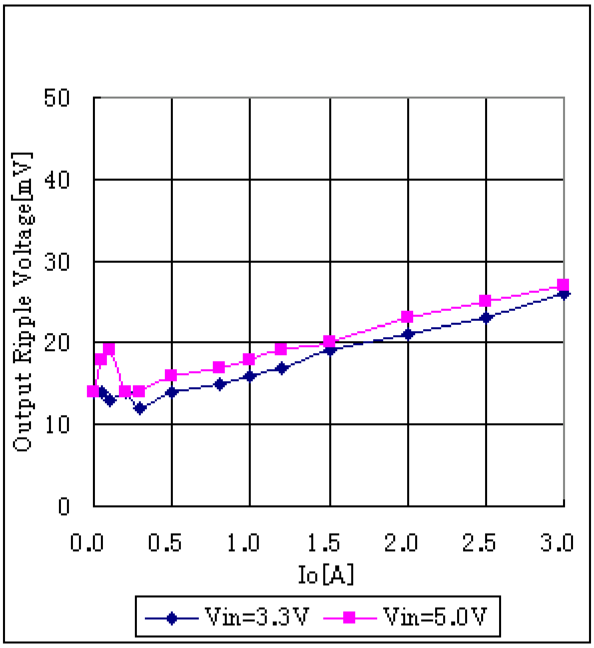


Fig.7-1-6. Ripple Voltage v. s. Output Current

Vout=1.8V
（Ta=25 °C, Cin= GRM32EC80J476K, Cout= GRM216B11A105K, Rtrim=4370Ω）

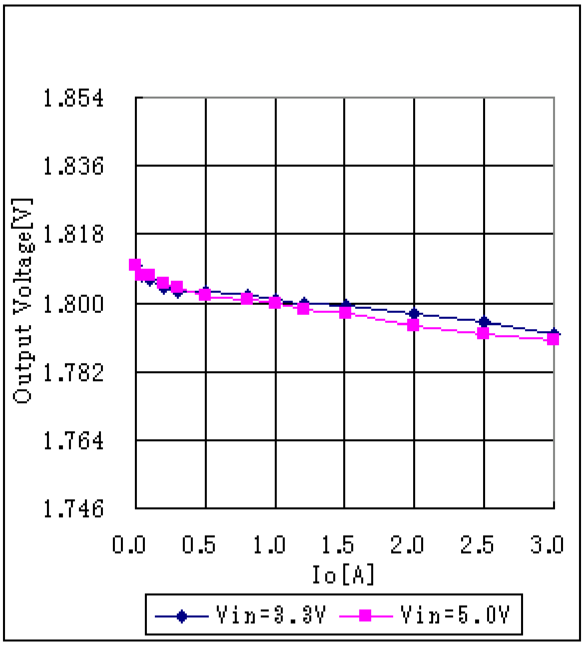


Fig.7-1-7. Output Voltage v.s. Output Current

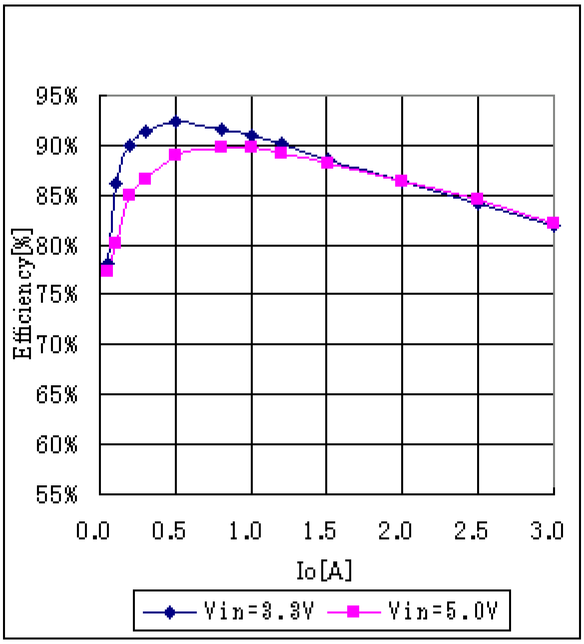


Fig.7-1-8. Efficiency v.s. Output Current

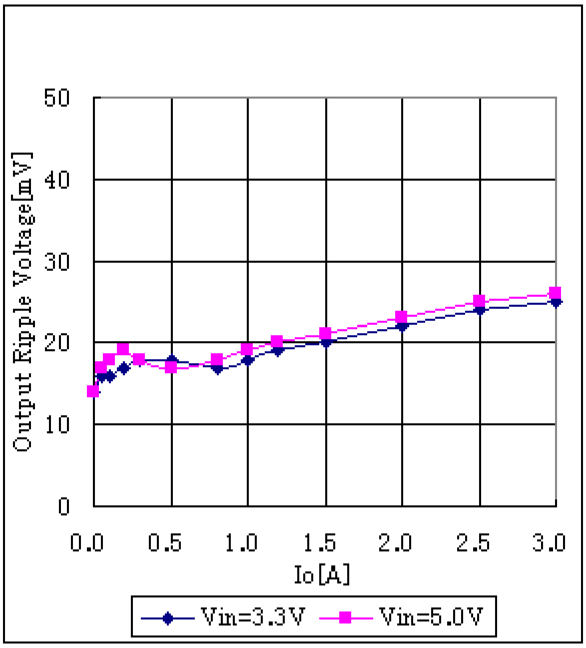


Fig.7-1-9. Ripple Voltage v. s. Output Current

Vout=3.3V
（Ta=25 °C, Cin= GRM32EC80J476K, Cout= GRM216B11A105K, Rtrim=692Ω）

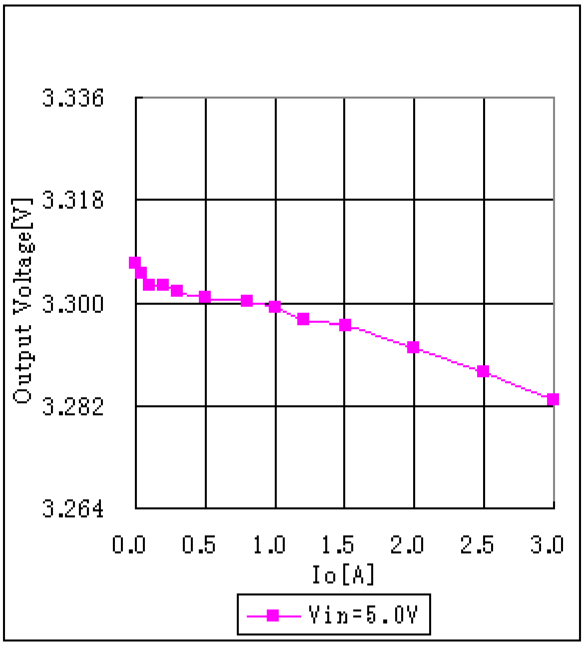


Fig.7-1-10. Output Voltage v.s. Output Current

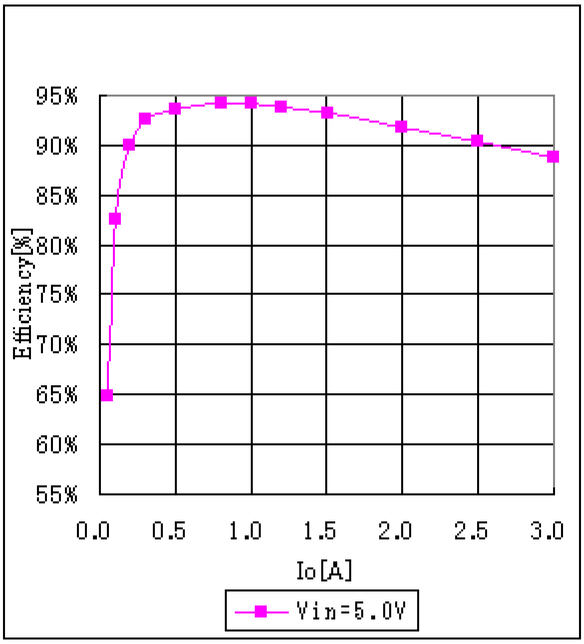


Fig.7-1-11. Efficiency v.s. Output Current

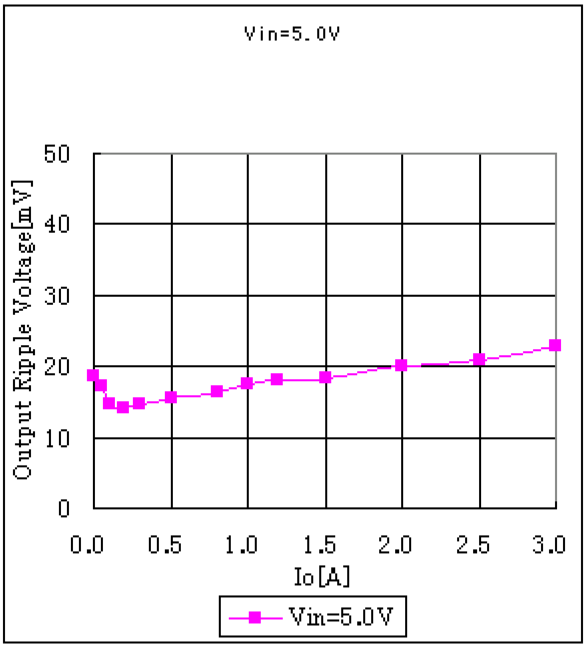


Fig.7-1-12. Ripple Voltage v. s. Output Current

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7.2. Dynamic Electrical Characteristics

Vin=3.3V, Vout=1.2V
（Ta=25 °C, Cin= GRM32EC80J476K, Cout= GRM216B11A105K, Rtrim=12000Ω）

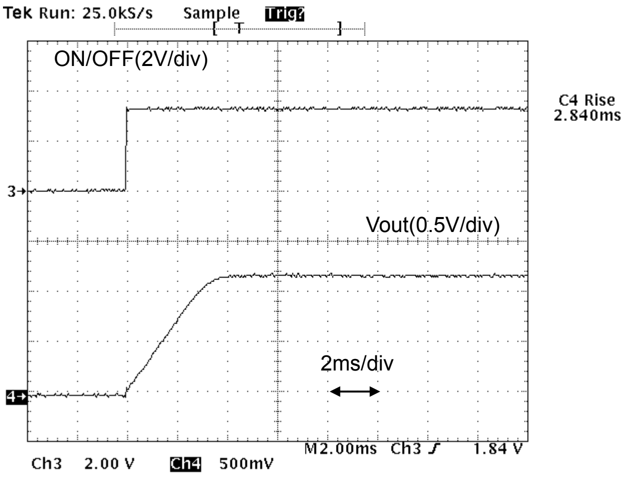


Fig.7-2-1. Start-up Waveform (Io=0A)

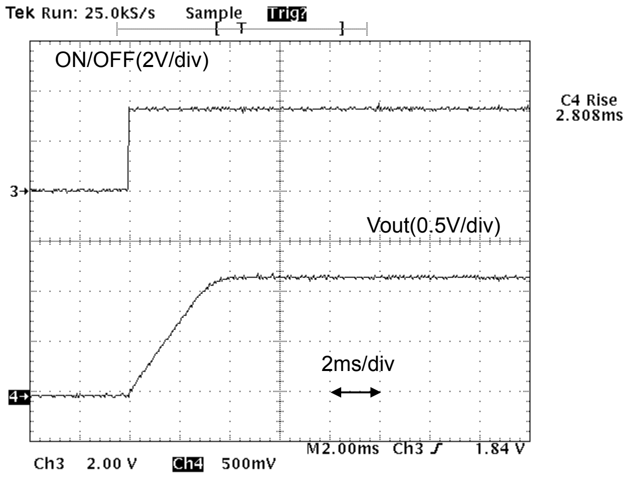


Fig.7-2-2. Start-up Waveform (Io=3A)

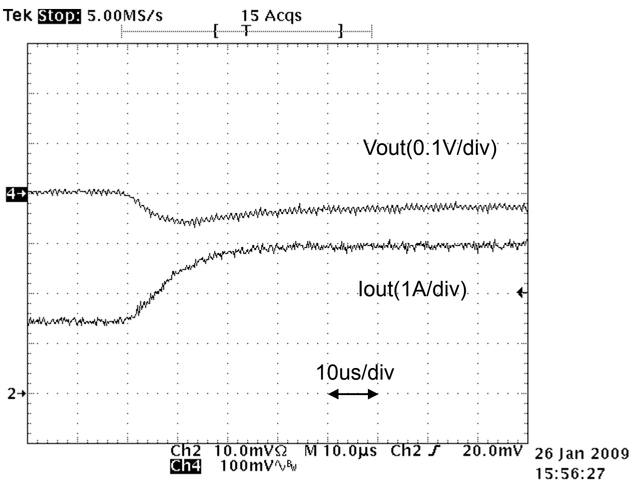


Fig.7-2-3. Load Transient Response
(Io=1.5->3A)

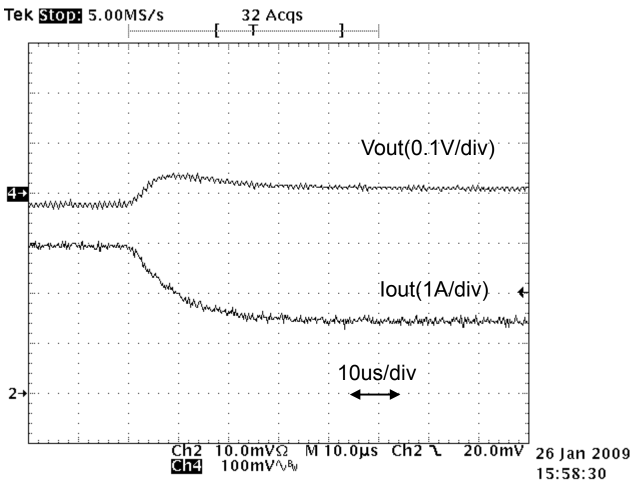


Fig.7-2-4. Load Transient Response
(Io=3->1.5A)

Vin=5.0V, Vout=1.2V
(Ta=25 °C, Cin= GRM32EC80J476K, Cout= GRM216B11A105K, Rtrim=12000Ω)

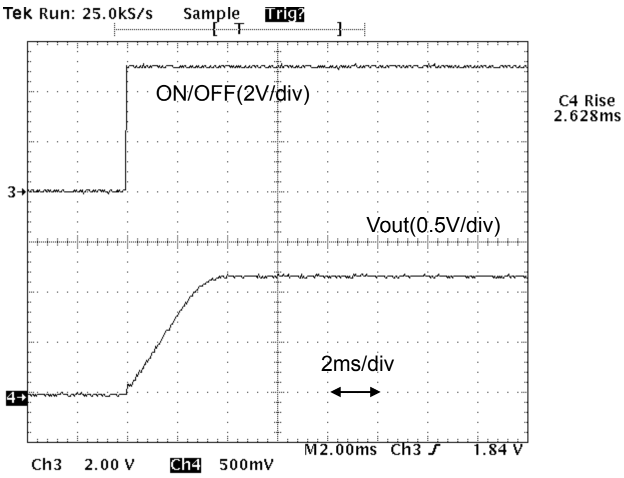


Fig.7-2-1. Start-up Waveform (Io=0A)

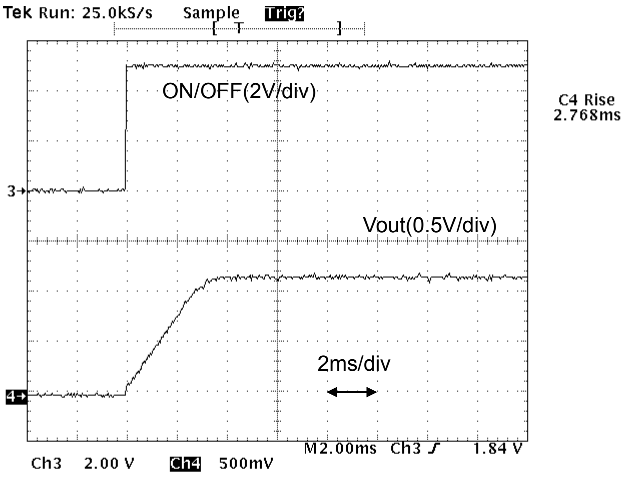


Fig.7-2-2. Start-up Waveform (Io=3A)

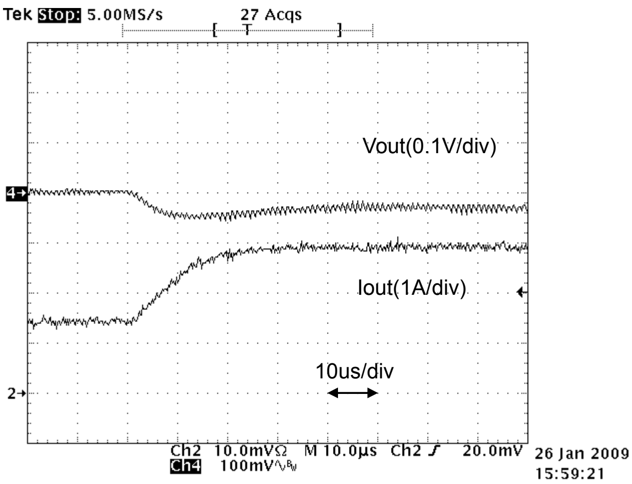


Fig.7-2-3. Load Transient Response
(Io=1.5->3A)

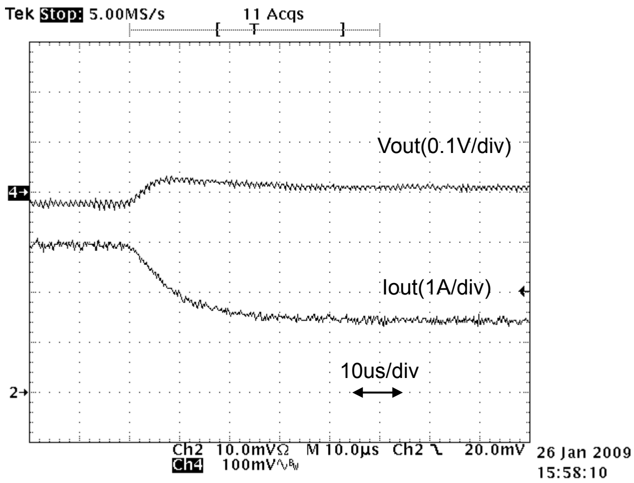
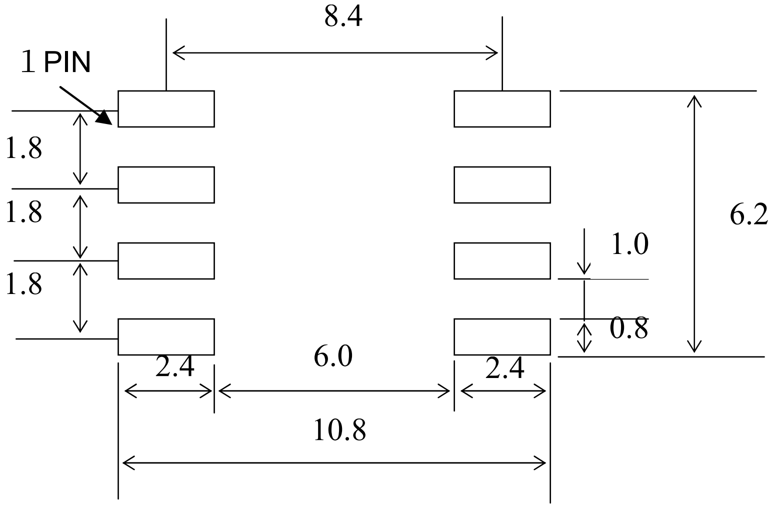


Fig.7-2-4. Load Transient Response
(Io=3->1.5A)

8. Mounting Condition
8. 1 PCB Land Pattern Recommendation



8. 2 Recommended Soldering Conditions

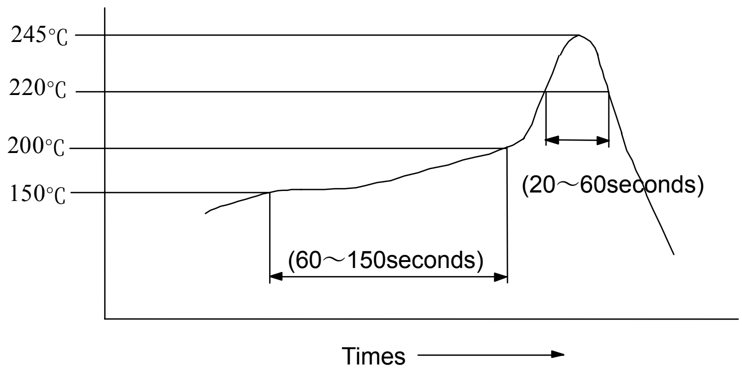
Reflow Soldering
This product is RoHS compliant. The following profile is recommended for the reflow of this product using Pb-free solder paste (Sn-Ag-Cu).

Method : Full convection reflow soldering

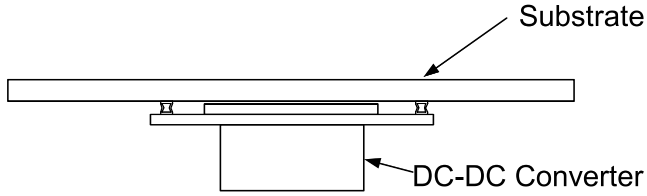
Profile details

Soldering temperature	:	245ºC+0/-5ºC
Soldering time	:	20 to 60 seconds, over220ºC
Preheating	:	60 to 150 seconds,150 to 200ºC
Programming rate	:	3ºC/ sec. Max., 217 to 245ºC
Times	:	1 time

Parts surface temperature [ºC]



※Do not vibrate for the products on reflow.
Please need to take care temperature control because mounted parts may come off if the product are left under the high temperature.
Do not reflow DC-DC converter as follows, because DC-DC converter may fall down from a substrate during reflowing.



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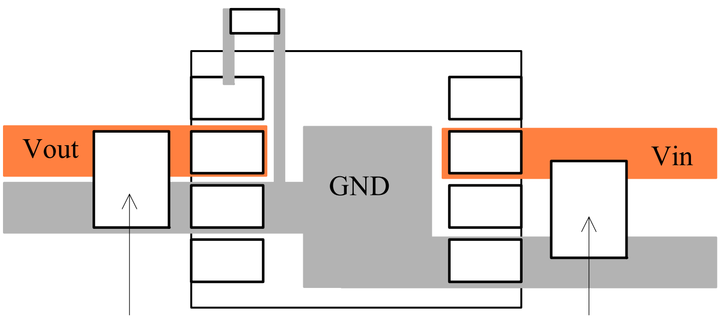
9. Notice
PCB Design

① Both input-side and output side, please make the wiring loop between plus and minus as small as possible. The influence of a leakage inductance can be reduced.
② Please place Rtrim (resistor for output voltage setting) such as it connects 1pin and 3pin.
③ Please make the power line pattern as wide and short as possible.
The Following figure is an example of recommendable PCB design.



This product should not be operated in parallel or in series.

Please do not use a connector or a socket to connect this product to your product.
The electric characteristics may be deteriorated by the influence of contact resistance.

Be sure to provide an appropriate fail-safe function on your product to prevent secondary damage that may be caused due to abnormal functional or failure of this product.

Inrush current protection is not a feature of this product.

Please connect the input terminals with the correct polarity. If an error in polarity connection is made this product may be damaged. If this product is damaged internally, an elevated input current may flow, and so this product may exhibit an abnormal temperature rise, or your product may be damaged.
Please add a diode and fuse per the following diagram to protect them.

※Please select diode and fuse after confirming the operation of your product.

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⚠ Note

1. Please contact our main sales office or nearby sales office before using our products for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property or this products for any other applications that described in the above.

   ①Aircraft equipment
   ②Aerospace equipment
   ③Undersea equipment
   ④Power plant control equipment
   ⑤Medical equipment
   ⑥Transportation equipment (vehicles, trains, ships, etc.)
   ⑦Traffic signal equipment
   ⑧Disaster prevention /crime prevention equipment
   ⑨Data-processing equipment
   ⑩Application of similar complexity and/or reliability requirements to the applications listed in the above.

2. This catalog is indicated in March 2009. About the written contents, since changing without a preliminary announcement for improvement and supply are sometimes stopped, please confirm in case of ordering. If written contents are unknown, please ask to our main sales office or nearby sales office.

3. Types and specification in this catalog are referenced for your information only. Please confirm detailed specifications by approving our individual drawing and specification sheet.