

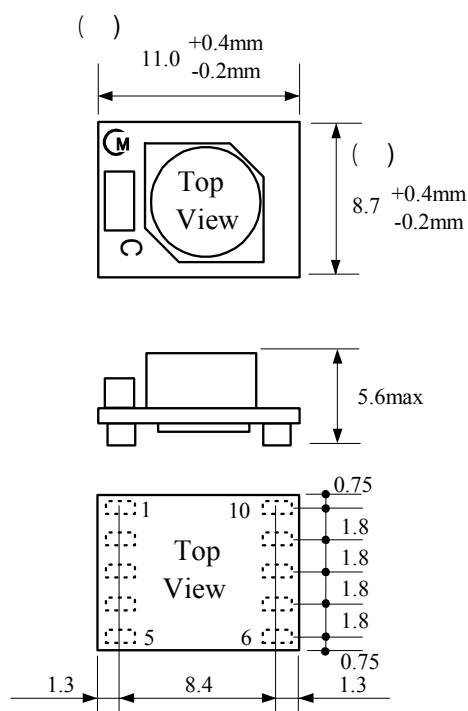
# DC-DC Converter Application Manual

## MYFSP3R303FMS

### 1. Features

- Ultra small size foot print (8.7mm × 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 °C to +85 °C ) .
- UVLO function, ON/OFF function, P-GOOD function, Output voltage sense function, Over-current function, Over-temperature function and Current share and Synchronous Turn-off function for parallel operation are built in.


### 2. Appearance, Dimensions



[Unit : mm] Tolerance : 0.2mm

Tolerance is not accumulated.

#### Marking

- (1) Pin No.1 Marking / MFG ID 
- (2) Parts No. C
- (3) Lot No.

Production Year

Production Month ( 1,2,3,...9,O,N,D )

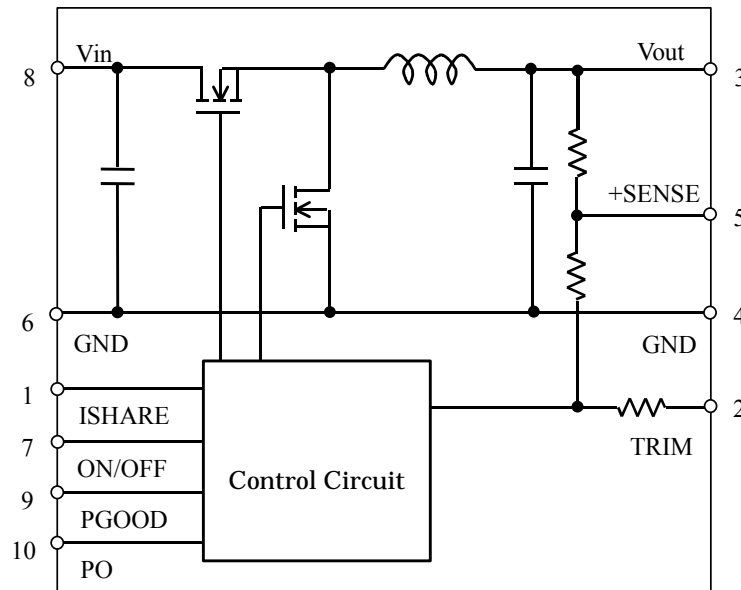
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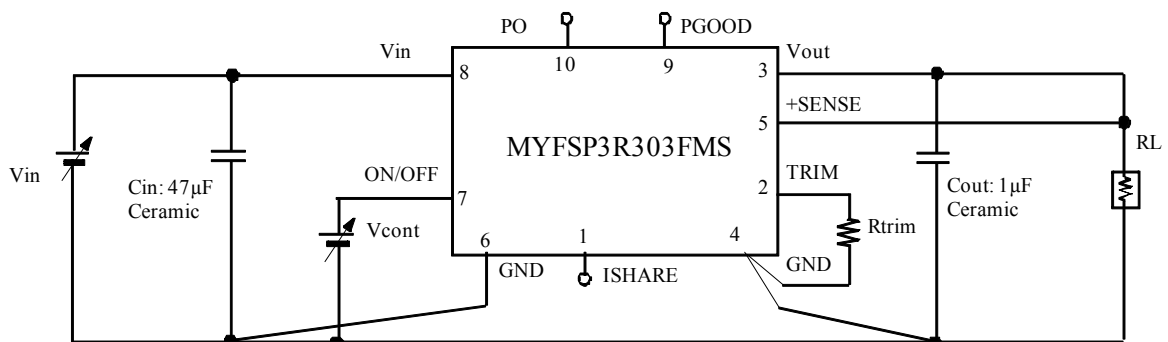
## Pin Number and Function

Pin No.	Symbol	Function
1	ISHARE	Current Share (for parallel operation)
2	TRIM	Output voltage adjustment
3	Vout	Output
4,6	GND	GND
5	+SENSE	Output voltage sense
7	ON/OFF	Remote ON/OFF
8	Vin	Input
9	Pgood	Power good output
10	PO	Synchronous Turn-off (for parallel operation)

## 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			Unit	
			Min.	Typ.	Max.		
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=0.1A ~ 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=3.3V, Iout=3A BW =20MHz,	-	20	-	mV(pp)	
Efficiency	EFF	Vin =5V, Vout=3.3V, Iout=3A	-	89	-	%	
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	Hiccup-mode operation after a mask time: Thd. After correction of the abnormal condition, the DC-DC Converter will restart.	-	5	-	A	
Hiccup Delay Time	Thd		0.5	1	2		
Operating Frequency	Frq		-	1000	-	msec	
Power Good Detection Range	ΔVpg		-	± 10	-	%Vo	
External Output Capacitor	Cout	When input voltage is ideal voltage source	0		300	μF	
Rising Overshoot	Vover		-	0	+5	%	
Output Rise Time	Tr	Output voltage 0-90% (remote on)	0.5	1	5	msec	

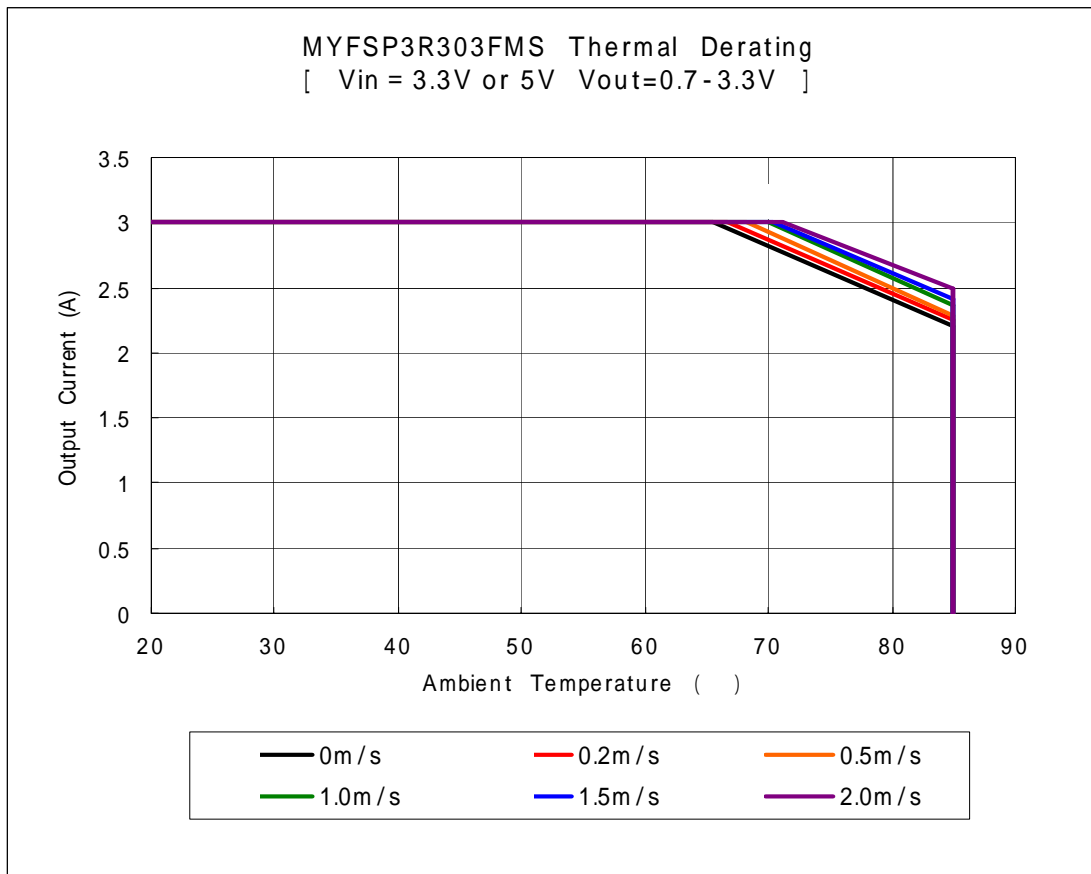
 Caution

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.

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## 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.

⚠ **Note:**

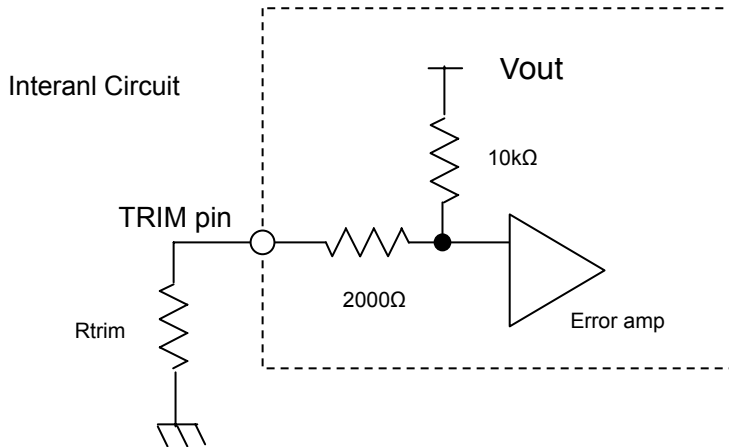
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## 6. Pin Description

### 6.1. Adjusting the Output Voltage

The output voltage can be adjusted from 0.7V to 3.3V by connecting resistors between TRIM-pin(2Pin) to GND-pin(Pin 4 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.



$$R_{trim} = \frac{7000}{V_{out} - 0.7} - 2000 \quad [ \Omega ]$$

<Rtrim Calculation Example>

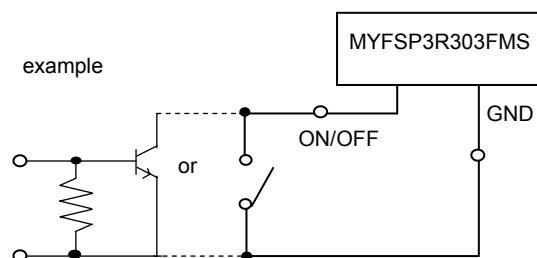
Vout(V)	Calculated Rtrim(Ω)	Rtrim Example(Ω)
3.3	692.3	680 + 12
2.5	1888.9	1500 + 390
1.8	4363.6	3900 + 470
1.5	6750	5600 + 1200
1.2	12000	12000
1.0	21333.3	18000 + 3300 + 33
0.8	68000	68000
0.7	∞	Open

### 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.

To avoid the influence with the UVLO threshold difference (Rising /Falling UVLO Threshold shown in 9.1.1), when starting or stopping by Vin increasing or decreasing in case of parallel operation. We recommend the ON/OFF control.

When ON/OFF-pin(7pin) is left open ..... Output Voltage =ON  
 When ON/OFF-pin(7pin) is connected to GND ..... Output Voltage =OFF

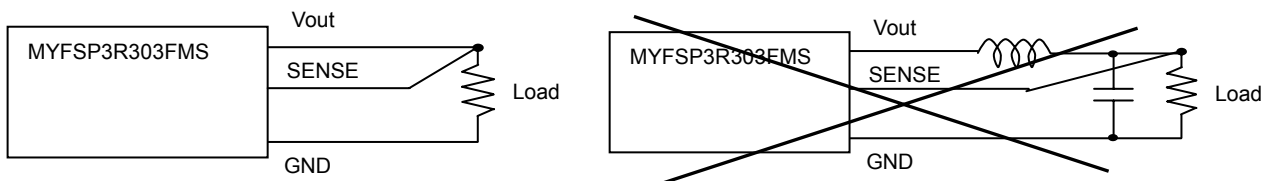


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### 6.3. Output voltage sensing

By connecting the SENSE-pin to the load, the output voltage drop due to the PCB wiring may be compensated for (within 10cm).



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.

### 6.4. Power Good Function

Power Good Detection output is sent when the DC-DC converter begins the output operation, and it becomes a range of Power Good Detection Range. PGOOD pin is open drain output and it has internal ON resistance.

The output voltage is a range of Power Good Detection Range : PGOOD is open.

The output voltage is not a range of Power Good Detection Range : Internal ON resistance is connected between PGOOD-pin and GND-pin.

### 6.5. Parallel Operation.

This product can easily increase the output current by the parallel operation, when setting each output voltage to the same by the function of Trimming (Adjusting) the Output Voltage. The maximum number connecting DC-DC converters is 3pcs of parallel operation. Please connect the each terminal - Vin, Vout, GND, ISHARE, PGOOD, ON/OFF and PO mutually, and connect Rtrim between TRIM-pin and GND-pin respectively. If the ON/OFF or Power good function is not used, PGOOD or ON/OFF terminal can be used by the opening.

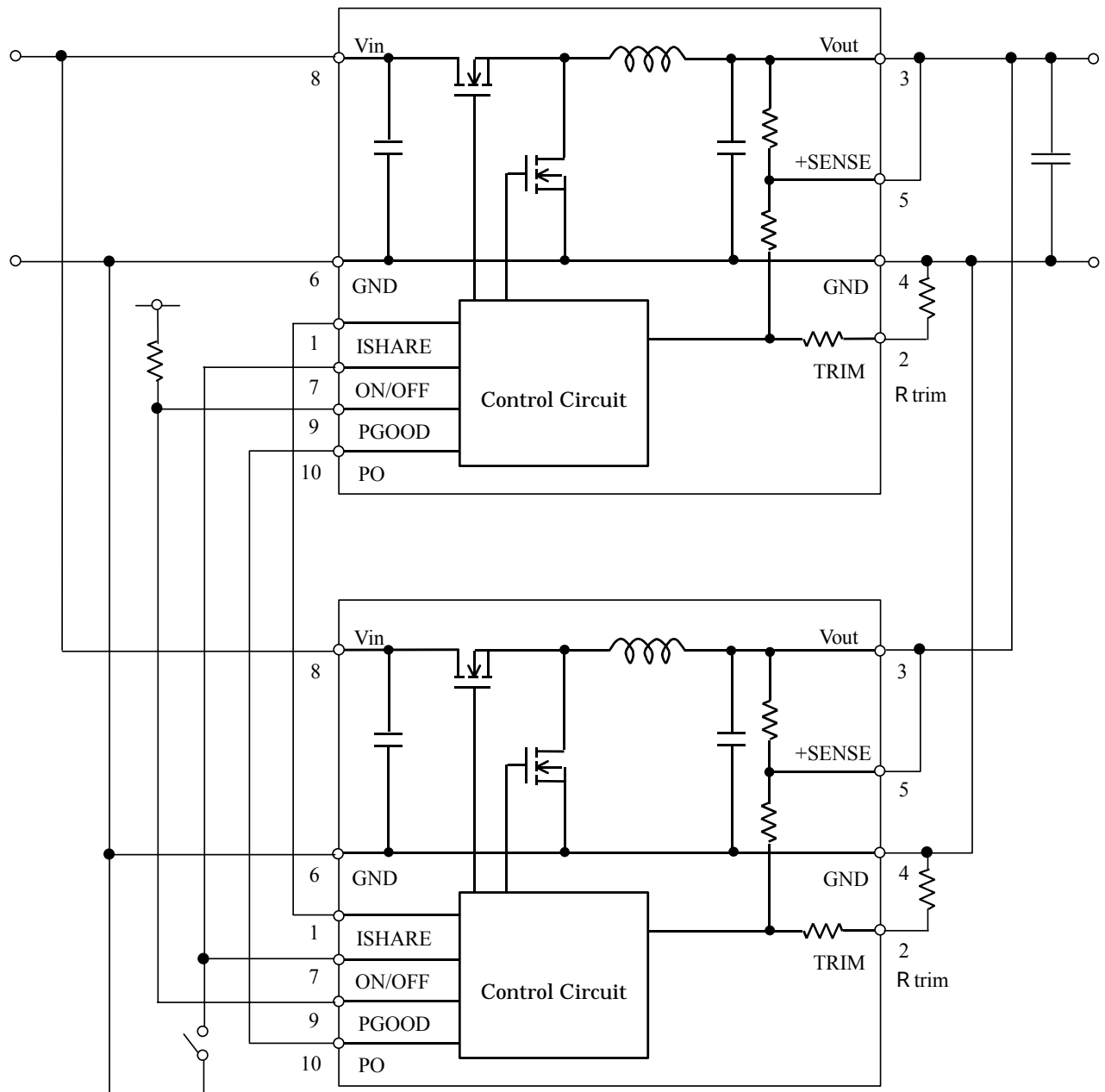
< Caution >

Please do not use the Output Voltage sensing and connect SENSE-pin to Vout-pin nearby the product, if you drive in parallel.

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### 6.5.1. The application of parallel operation with plural DC-DC converters (n=2)



### 6.6. Current share

For the parallel operation of multiple DC-DC converters the output current valance of each converter may be improved by inter-connecting the ISHARE-pins between the parallel devices.

However, please consider so that the exogenous noise should not influence, and do not impress the voltage from the outside to wiring that connects the terminal ISHARE mutually. And please note that the output current is limited by Thermal Derating shown in 5.2.. The maximum number connecting DC-DC converters is 3pcs of parallel operation. Please contact us when more than these figures.

### 6.7. Synchronous Turn-off

All of the DC-DC converters are interrupted (hiccup mode operation) when any one is halted with over current protection or over temperature protection, with connecting all PO pins for the application of parallel operation with plural DC-DC converters. However, please consider so that the exogenous noise should not influence, and do not impress the voltage from the outside to wiring that connects the terminal PO mutually. The maximum number connecting DC-DC converters is 3pcs of parallel operation. Please contact us when more than these figures.

### 6.8. Over Temperature Protection

The DC-DC converters thermally shut down(hiccup mode operation) when junction temperature of a control IC reaches to  $175^{\circ}\text{C}$  typically.

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### 6.9. Input External capacitor

It is recommended to connect a low-impedance electrolytic capacitor of 47 $\mu$ F or more between Vintterminal(8pin) and GND(6pin). 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.

### 6.10. 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 300 $\mu$ F or less. Output capacitor shall be placed near the output terminal.

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## 7. Typical Characteristics Data

## 7.1. Static Electrical Characteristics

$V_{out}=1.8V$

( $T_a=25^\circ C$ ,  $C_{in}=GRM32EC80J476KE64$ ,  $C_{out}=GRM216B11A105KA01$ ,  $R_{trim}=4370\Omega$ )

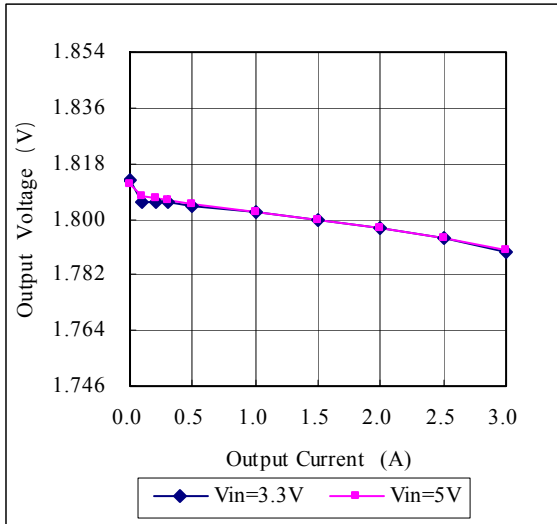


Fig.7-1-1. Output Voltage v.s. Output Current

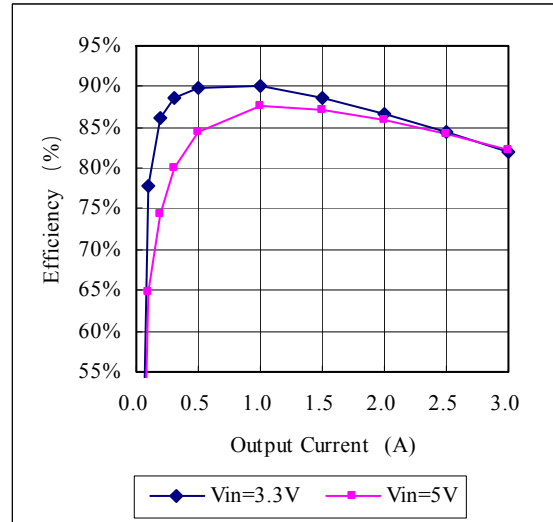


Fig.7-1-2. Efficiency v.s. Output Current

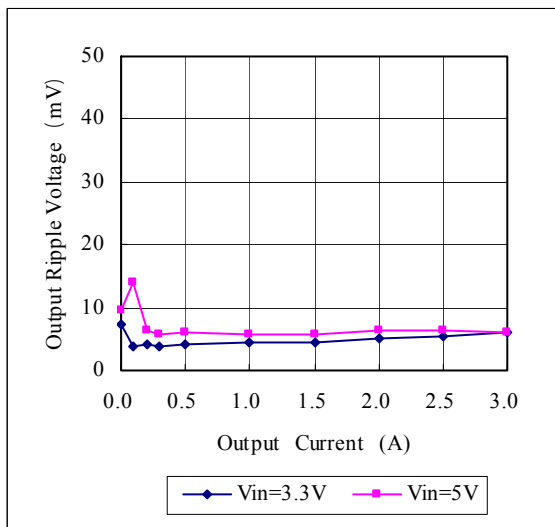


Fig.7-1-3. Ripple Voltage v. s. Output Current

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$V_{out}=1.2V$   
 (  $T_a=25^{\circ}C$ ,  $C_{in}= GRM32EC80J476KE64$ ,  $C_{out}= GRM216B11A105KA01$ ,  $R_{trim}=12000\Omega$  )

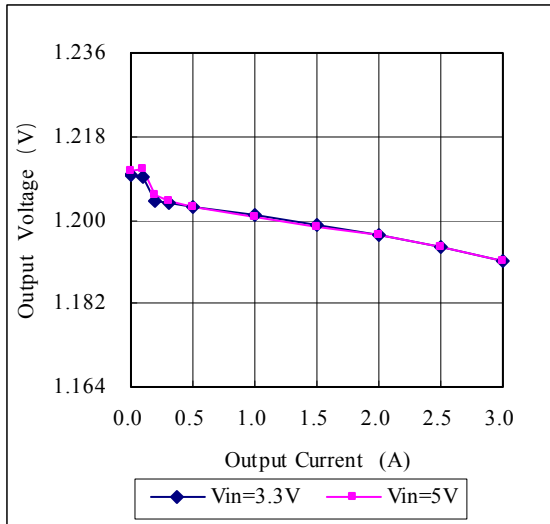


Fig.7-1-4. Output Voltage v.s. Output Current

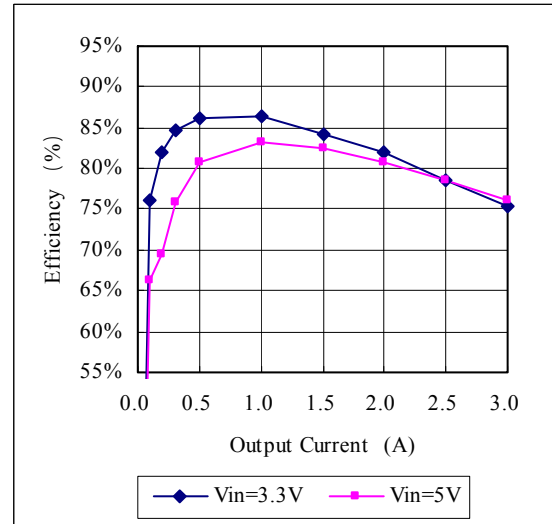


Fig.7-1-5. Efficiency v.s. Output Current

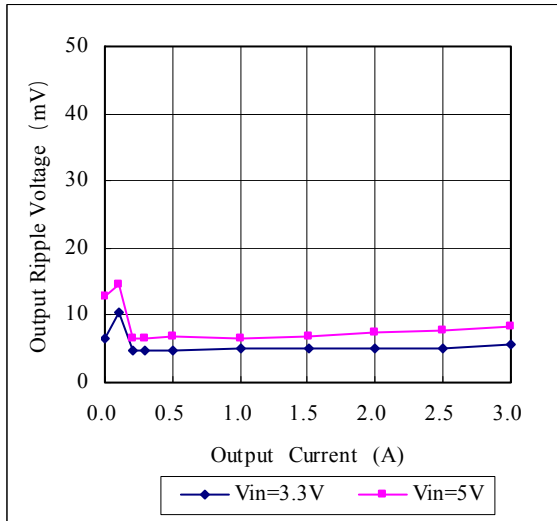


Fig.7-1-6. Ripple Voltage v. s. Output Current

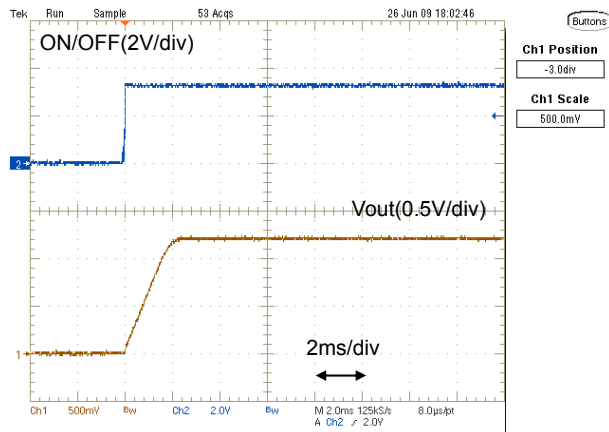
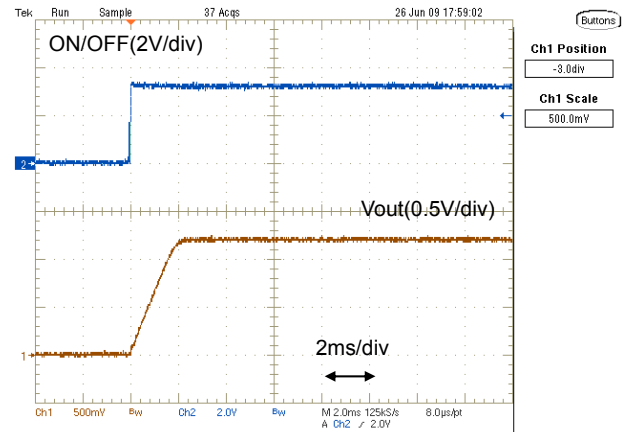
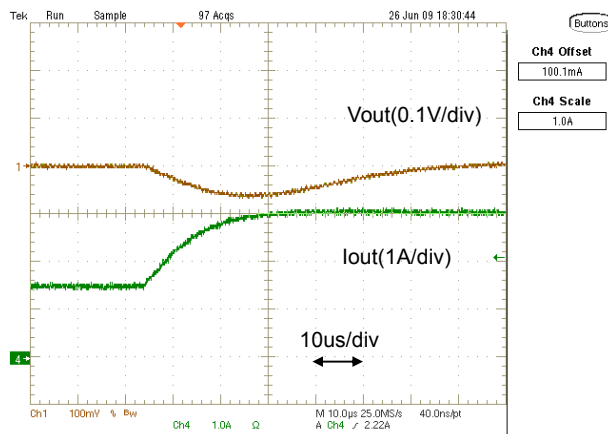
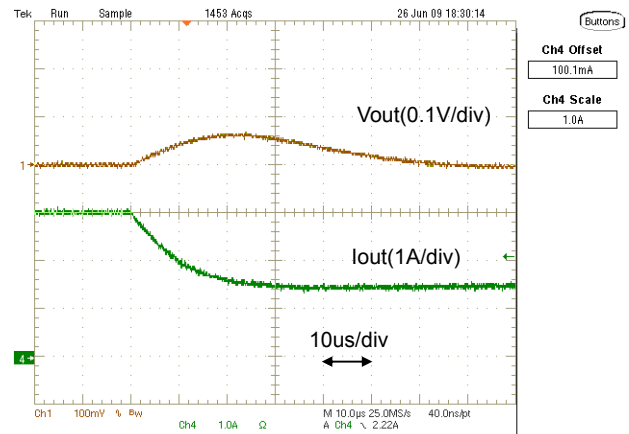
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## 7.2. Dynamic Electrical Characteristics

$V_{in}=3.3V$ ,  $V_{out}=1.2V$

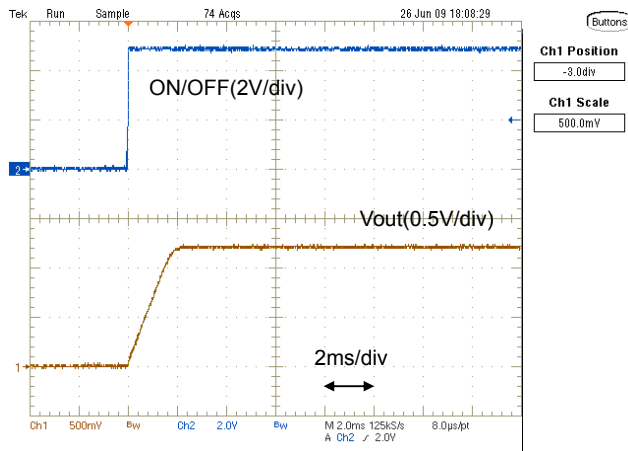
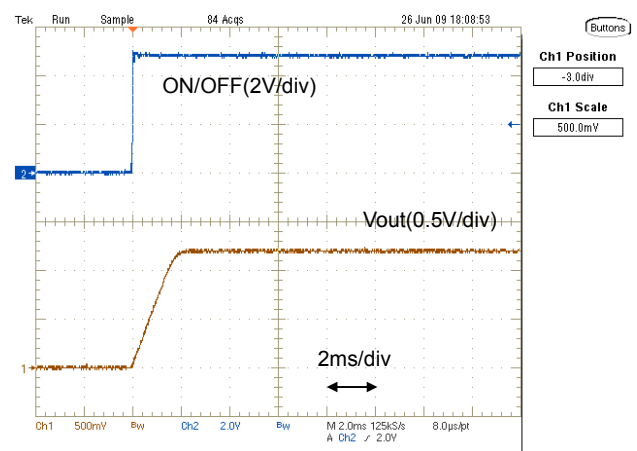
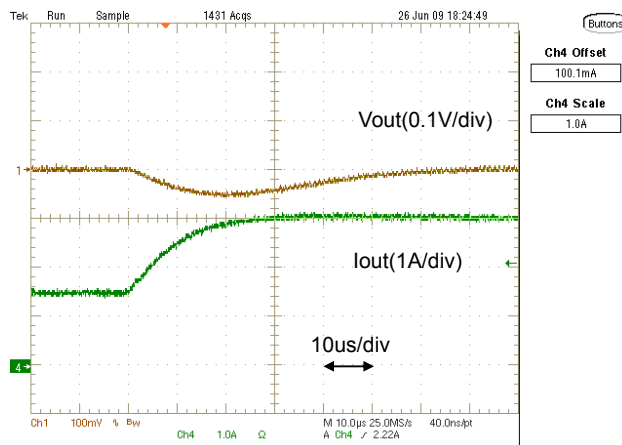
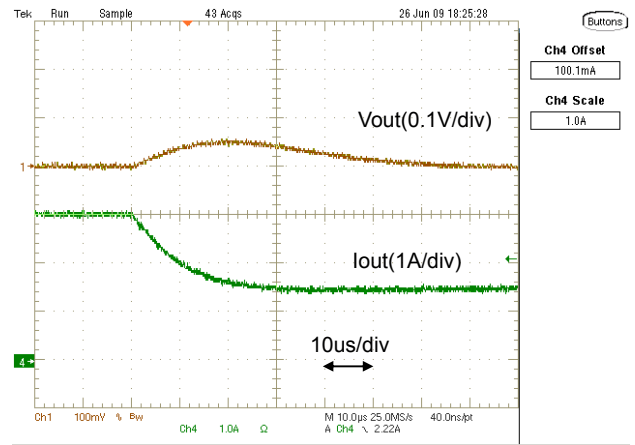
( $T_a=25^{\circ}C$ ,  $C_{in}=GRM32EC80J476KE64$ ,  $C_{out}=GRM216B11A105KA01$ ,  $R_{trim}=12000\Omega$ )

Fig.7-2-1. Start-up Waveform ( $I_o=0A$ )Fig.7-2-2. Start-up Waveform ( $I_o=3A$ )Fig.7-2-3. Load Transient Response ( $I_o=1.5\rightarrow 3A$ )Fig.7-2-4. Load Transient Response ( $I_o=3\rightarrow 1.5A$ )

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$V_{in}=5.0V$ ,  $V_{out}=1.2V$   
 ( $T_a=25^{\circ}C$ ,  $C_{in}=GRM32EC80J476KE64$ ,  $C_{out}=GRM216B11A105KA01$ ,  $R_{trim}=12000\Omega$ )

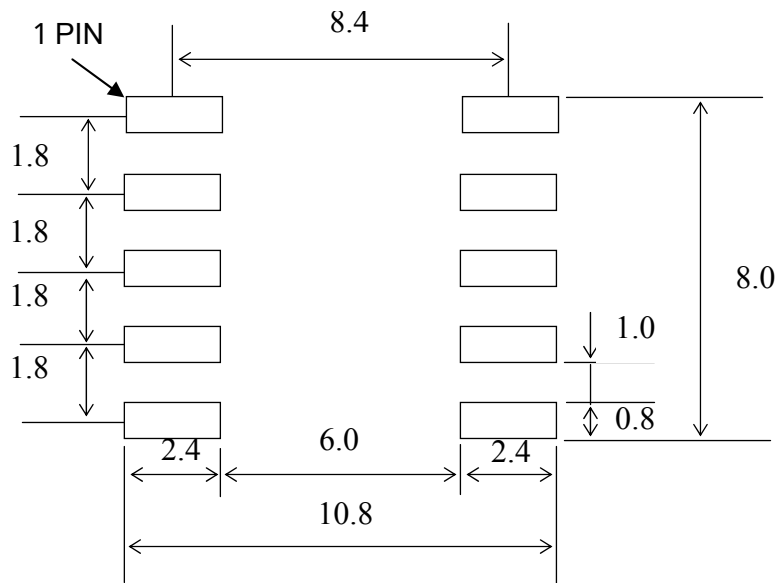
Fig.7-2-1. Start-up Waveform ( $I_o=0A$ )Fig.7-2-2. Start-up Waveform ( $I_o=3A$ )Fig.7-2-3. Load Transient Response ( $I_o=1.5\rightarrow 3A$ )Fig.7-2-4. Load Transient Response ( $I_o=3\rightarrow 1.5A$ )

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## 8. Mounting Condition

### 8. 1 PCB Land Pattern Recommendation



### 8. 2 Recommended Soldering Conditions

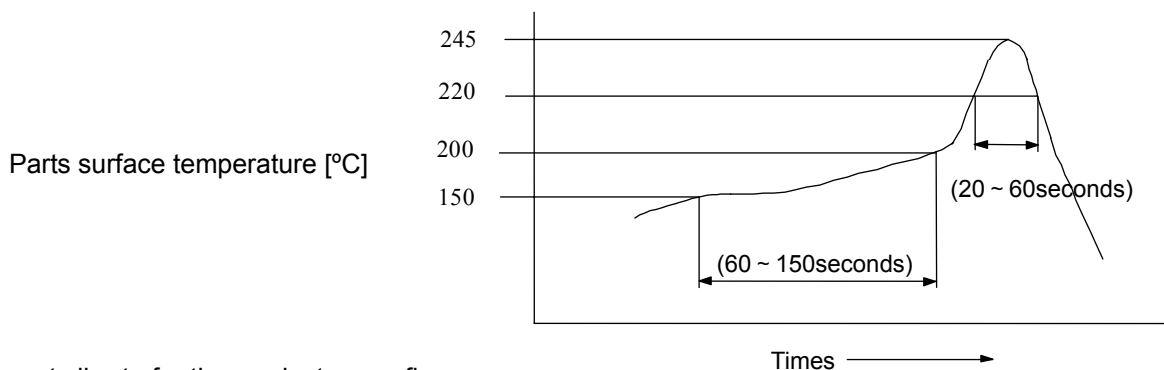
#### Reflow Soldering

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

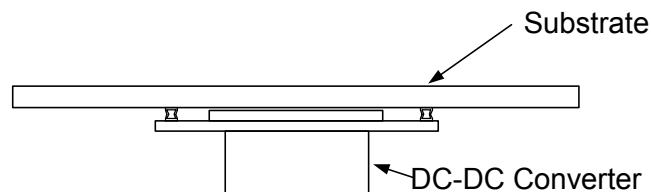
Soldering temperature : 245°C+0/-5°C  
 Soldering time : 20 to 60 seconds, over 220°C  
 Preheating : 60 to 150 seconds, 150 to 200°C  
 Programming rate : 3°C/ sec. Max., 217 to 245°C  
 Times : 1 time



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.

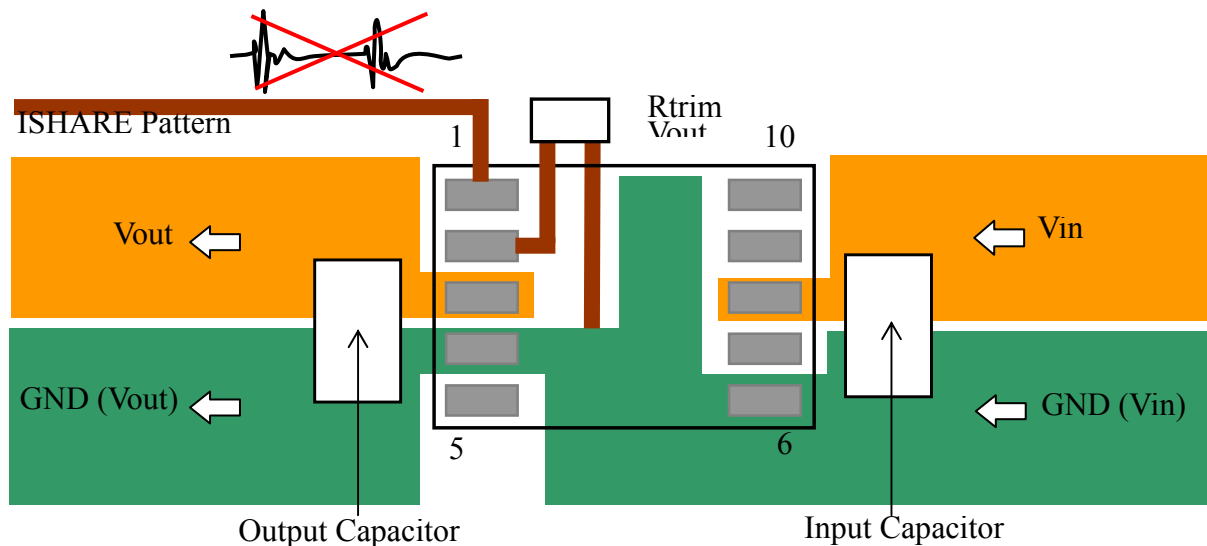


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## 9. Notice PCB Design

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.  
Please place Rtrim ( resistor for output voltage setting ) such as it connects 2pin and 4pin.  
Please consider so that the exogenous noise should not influence, and do not impress the voltage from the outside to wiring that connects the terminal ISHARE mutually.  
Please make the power line pattern as wide and short as possible.  
The Following figure is an example of recommendable PCB design.



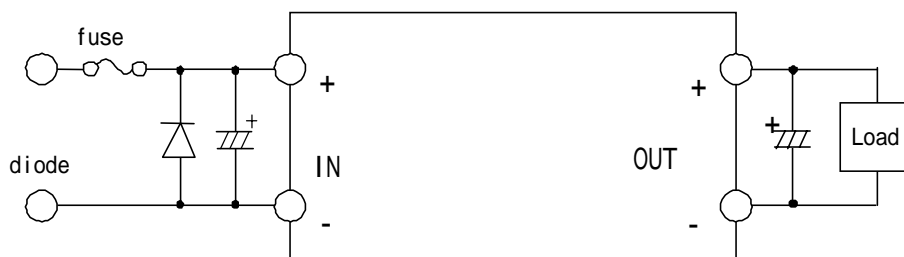
This product should not be operated in series.

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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. 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.

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

2. This catalog is indicated in June 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.

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