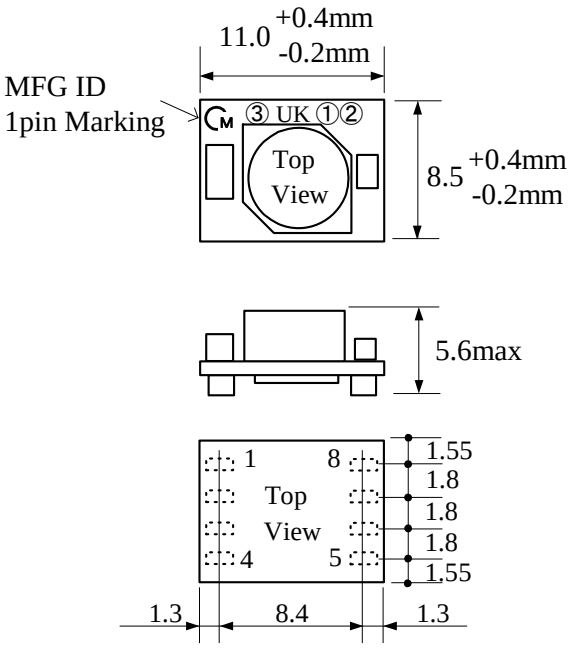
DC-DC Converter Application Manual

MPDTY201S

1. Features

- Small size foot print (8.5mm×11mm), 3A output current, non-isolated POL.
- Wide adjustable output voltage range by connecting external resistance (0.8V to 1.8V).
- Wide operating temperature（-40 ˚C to +85 ˚C）.
- UVLOfunction, ON/OFF function, Output voltage sense function, Over-current function and Over-temperature function are built in.

2. Appearance, Dimensions



Marking (1) MFG ID/ Pin No.1 marking Ⓜ
(2) Part No. UK
(3) Lot No. ①②③
①Production factory Mark
②Production Year
③Production Month（1,2,3,…9,O,N,D）

unit：mm
Tolerance：0.25mm

⚠ **Note:**

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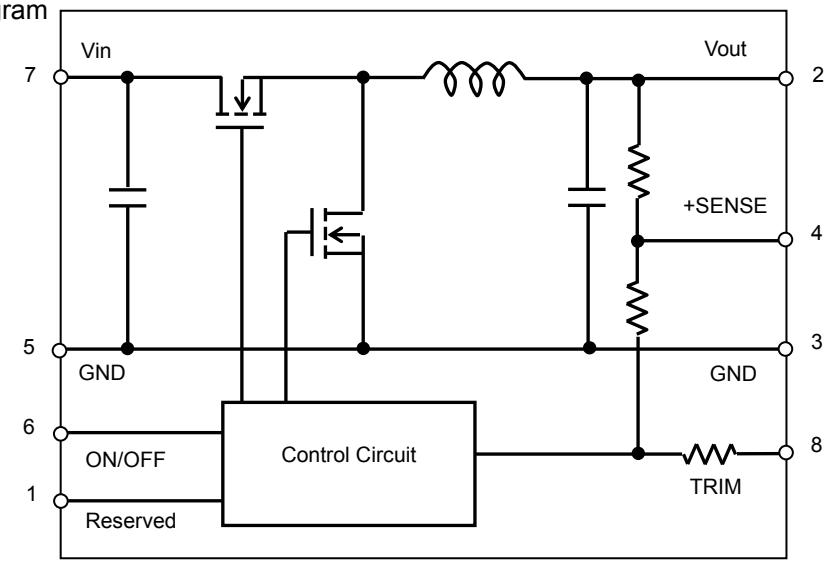
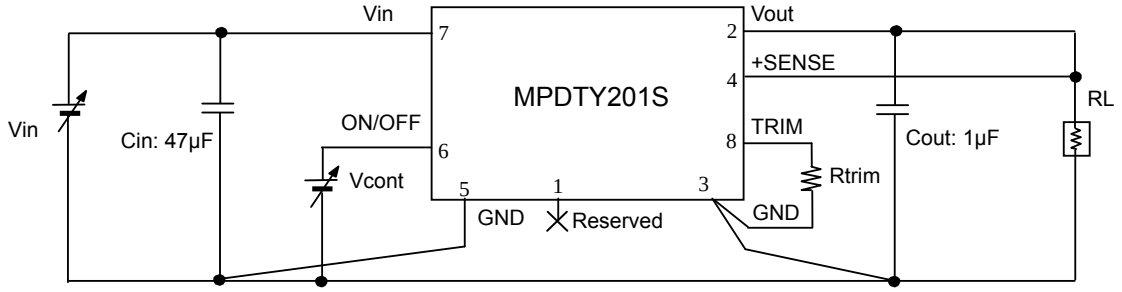
Pin Number and Function

Pin No.	Symbol	Function
1	Reserved	N.C. Please leave this pin open.
2	Vout	Output
3	GND	GND
4	+SENSE	Vout sense input
5	GND	GND
6	ON/OFF	Remote ON/OFF
7	Vin	Input
8	TRIM	Vout adjust control

3. Block Diagram



4. Test Circuit



Cin : 47µF / 6.3V (GRM32EC80J476KE64, Murata)（Ceramic Capacitor）
Cout : 1µF / 16V (GRM21BR11C105KA01, Murata)（Ceramic Capacitor）

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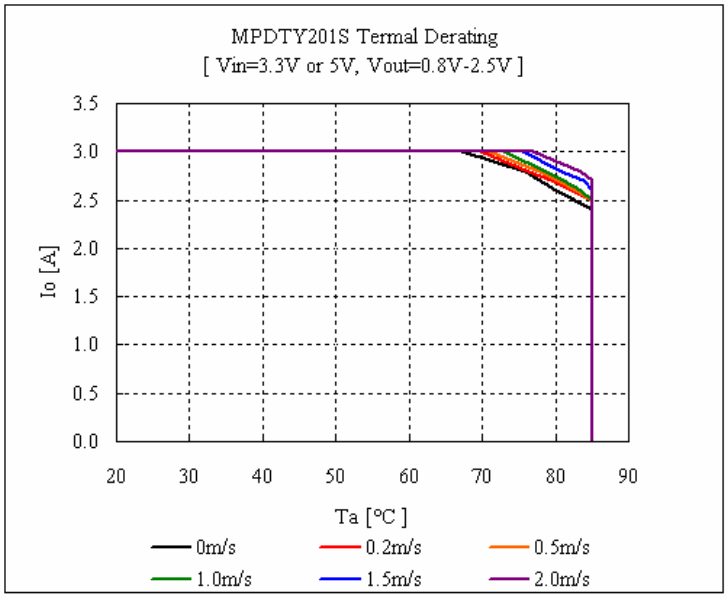
5. Characteristics

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

Item	Symbol	Condition		Value Min.	Value Typ.	Value Max.	Unit
Input Voltage Range	Vin			3.0	3.3	5.5	V
Rising UVLO Threshold	UVLOr	Vin increasing		2.42	2.55	2.7	V
Falling UVLO Threshold	UVLOf	Vin decreasing		2.4	2.5	2.6	V
ON/OFF pin High Voltage	VIH			2.0	Vin	-	V
ON/OFF pin Low Voltage	VIL			-	0	0.8	V
Output Voltage Adjustable Range	Vout	Vin=4.5V-5.5V		0.8	-	2.5	V
		Vin=3.0V-4.5V		0.8	-	1.8	
Output Voltage Tolerance	Vo tol	Over Vin, temperature range Rset=0.5% tolerance Io=5mA-3A		-3	-	+3	%Vo
Output Current	Iout	See the thermal derating curve in section 9.1.5		0	-	3	A
Ripple Voltage	Vrpl	Vin =5V, Iout=3A BW=20MHz, Cout=1µF	Vout=2.5V	-	20	50	mV(p-p)
			Vout=0.8V	-	20	50	
Efficiency	EFF	Vin =5V, Vout=2.5V, Iout=3A		-	87	-	%
Operating Frequency	Freq.			-	1000	-	kHz
Short Circuit Protection	SCP	Latch-up mode after a mask time: Tlatch. After correction of the abnormal condition, the DC-DC Converter will restart by re-inputting Vin or toggling On/Off pin.		-	6	-	A
Timer Latch Mask Time	Tlatch			0.5	1	2	msec
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)		2.5	5	10	msec

5. 2 Thermal Derating



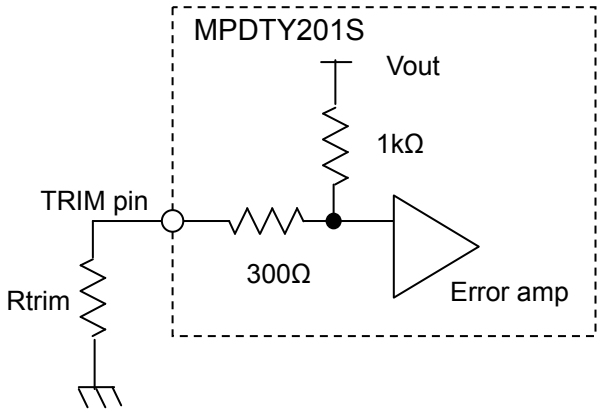
The above derating limits apply to this product soldered directly to 101.6×180mm×1.6mm PCB (double-sided, with 70μm copper). Any adjacent parts of high temperature may cause overheating. For reliable operation, please ensure that the IC temperature of this product is maintained below 120°C and the inductor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

6. Pin Description

6. 1 Adjusting the Output Voltage

The output voltage can be adjusted from 0.8V to 1.8V by connecting a resistor between TRIM-pin(8Pin) to GND-pin(Pin 3 is recommended for accurate Vout setting).
The following equation gives the required external-resistance value to adjust the output voltage to the required Vout.

Internal circuit



$$Rtrim = \frac{800}{Vout - 0.8} - 300 \quad [\Omega]$$

<Rtrim calculation example>

Vout [V]	Calculated Rtrim[Ω]	Applied Rtrim (example) [Ω]
2.5	170.6	160+10
1.8	500	470+30
1.5	842.9	820+22
1.2	1700	1.5k＋200
1.0	3700	36k＋100
0.8	∞	Open

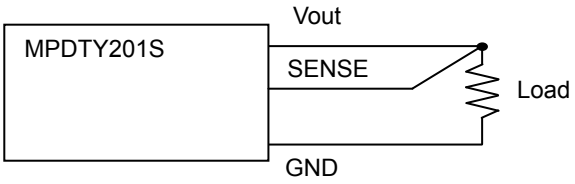
6. 2 ON/OFF Control

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

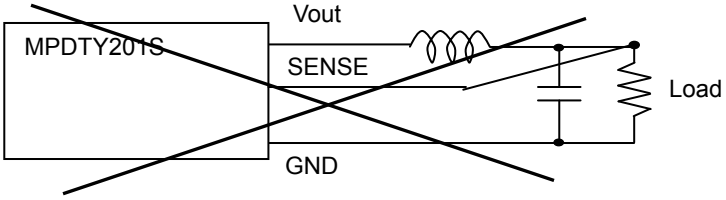
ON/OFF control usage

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



6.4 Input External capacitor

・It is recommended to connect a low-impedance electrolytic capacitor of 47μF or more between Vin terminal(7pin) and GND(5pin). 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.

6-5.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 300μF or less. Output capacitor shall be placed near the output terminal.

7. Typical Characteristics Data

7-1. Static Electrical Characteristics

Vout=1.8V

（Ta=25°C, Cin GRM32EC80J476KE64, Cout= GRM21BR11C105KA01, Rtrim=500Ω）

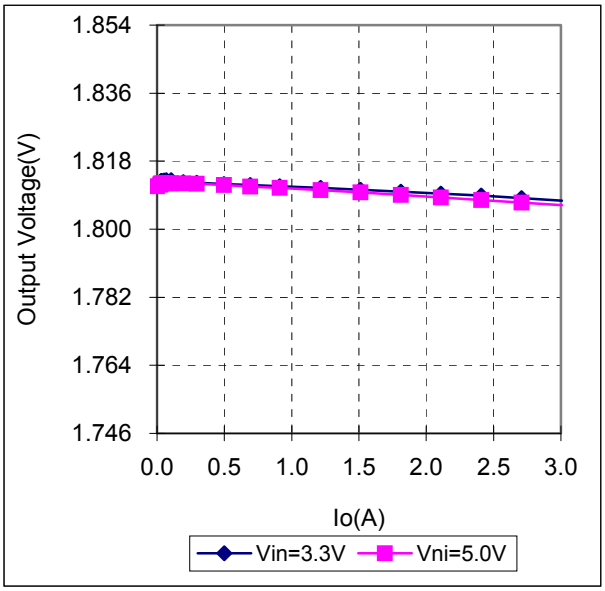


Fig.7-1-1. Output Voltage v.s. Output Current

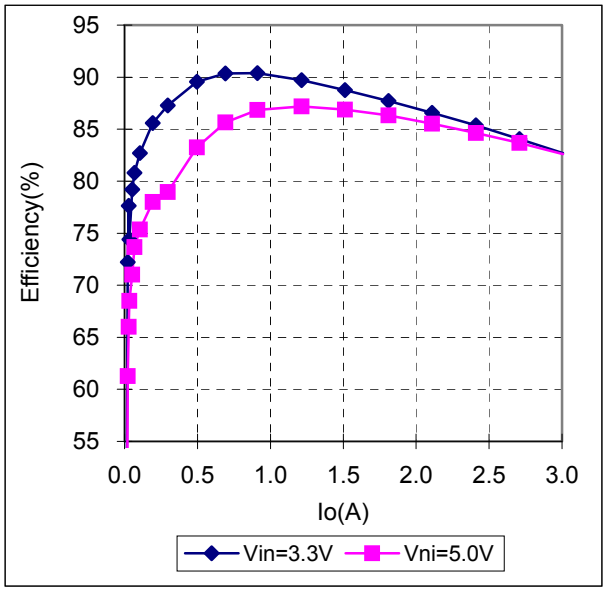


Fig.7-1-2. Efficiency v.s. Output Current

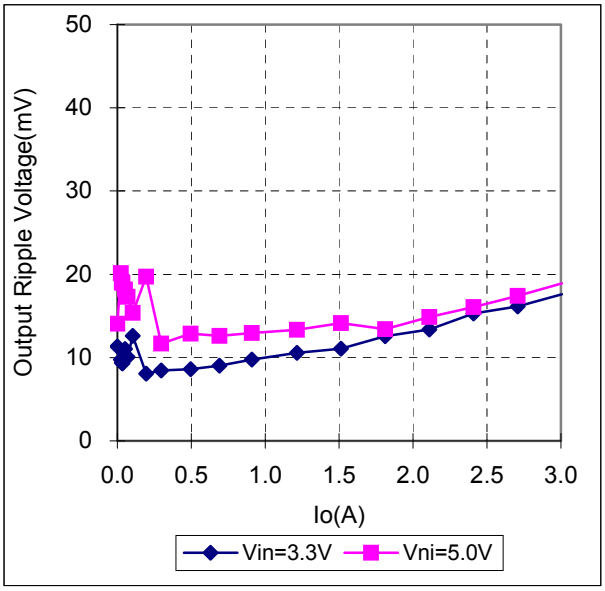


Fig.7-1-3. Ripple Voltage v.s. Output Current

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Vout=1.2V

（Ta=25°C, Cin GRM32EC80J476KE64, Cout= GRM21BR11C105KA01, Rtrim=1700Ω）

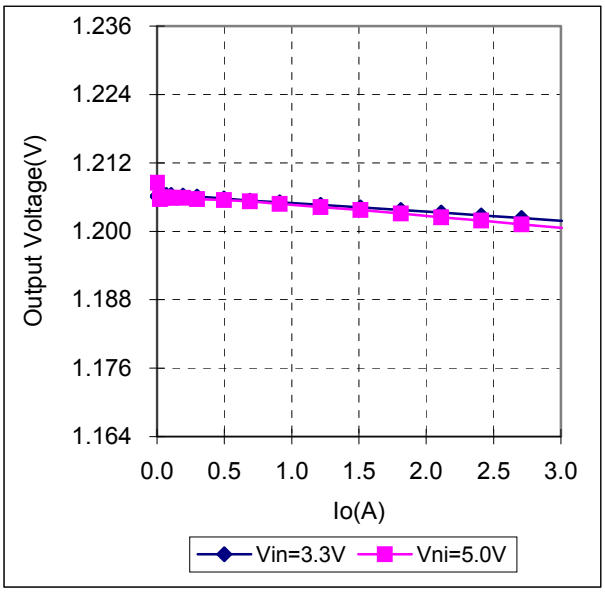

Fig.7-1-4. Output Voltage v.s. Output Current

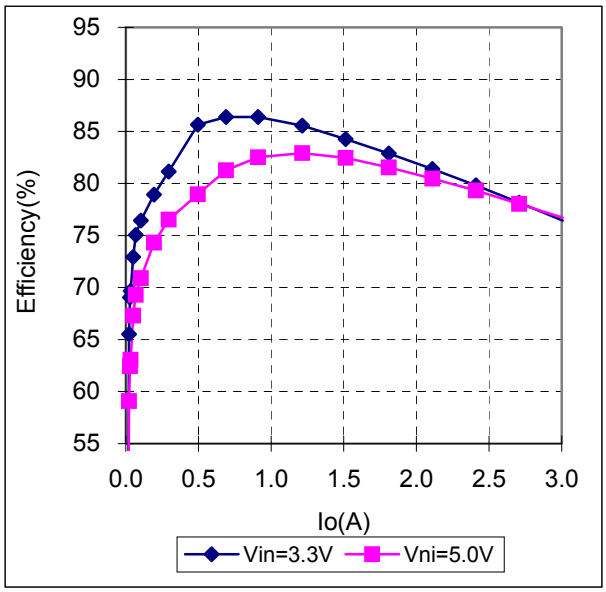

Fig.7-1-5. Efficiency v.s. Output Current

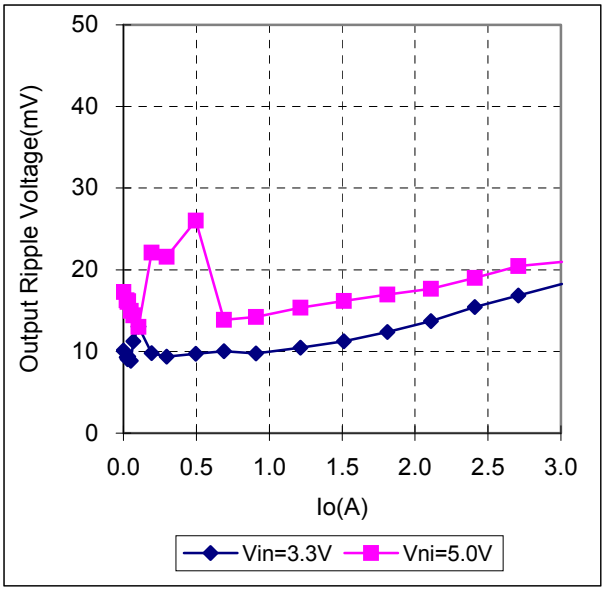

Fig.7-1-6. Ripple Voltage v.s. Output Current

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7-2. Dynamic Electrical Characteristics

Vin=3.3V, Vout=1.2V

（Ta=25°C, Cin GRM32EC80J476KE64, Cout= GRM21BR11C105KA01, Rtrim=1700Ω）

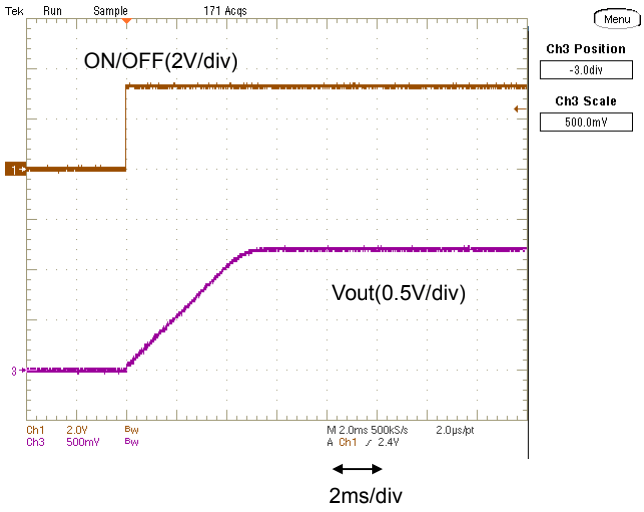

Fig.7-2-1. Start-up Waveform (Io=0A)

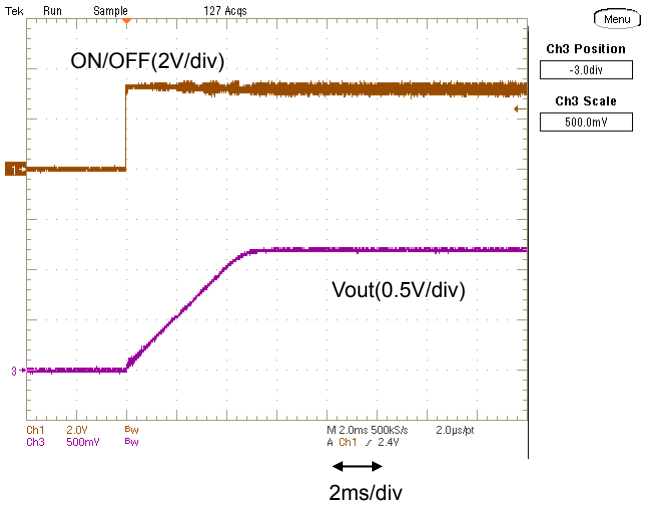

Fig.7-2-2. Start-up Waveform (Io=3A)

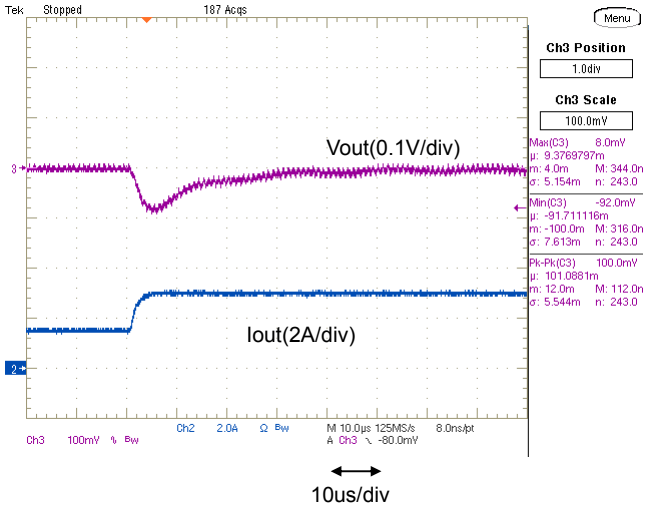

Fig.7-2-3. Load Transient Response

(Io=1.5->3A)

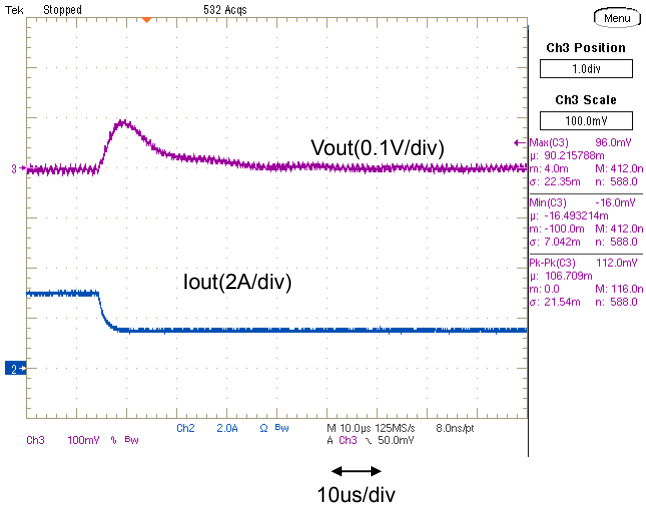

Fig.7-2-4. Load Transient Response

(Io=3->1.5A)

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Vin=5.0V, Vout=1.2V

（Ta=25°C, Cin GRM32EC80J476KE64, Cout= GRM21BR11C105KA01, Rtrim=1700Ω）

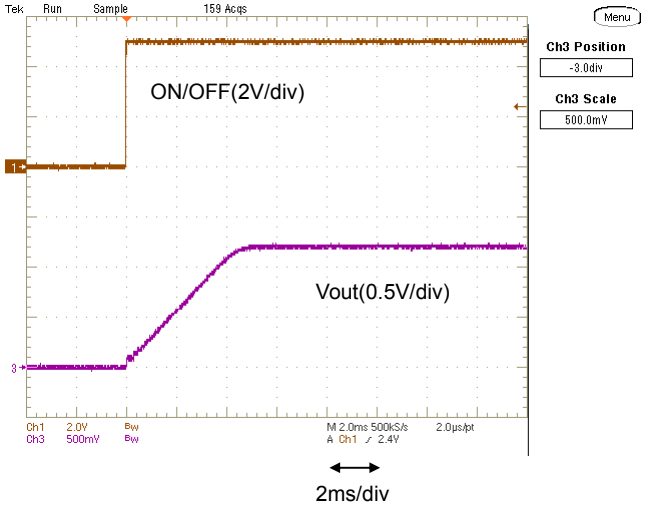

Fig.7-2-5. Start-up Waveform (Io=0A)

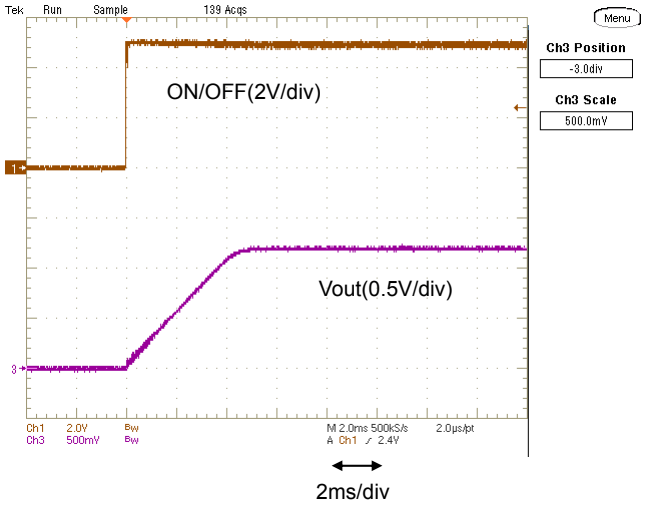

Fig.7-2-6. Start-up Waveform (Io=3A)

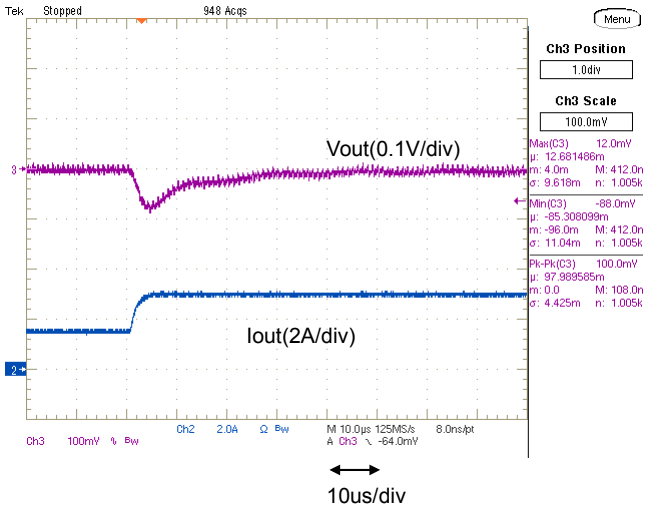

Fig.7-2-7. Load Transient Response

(Io=1.5->3A)

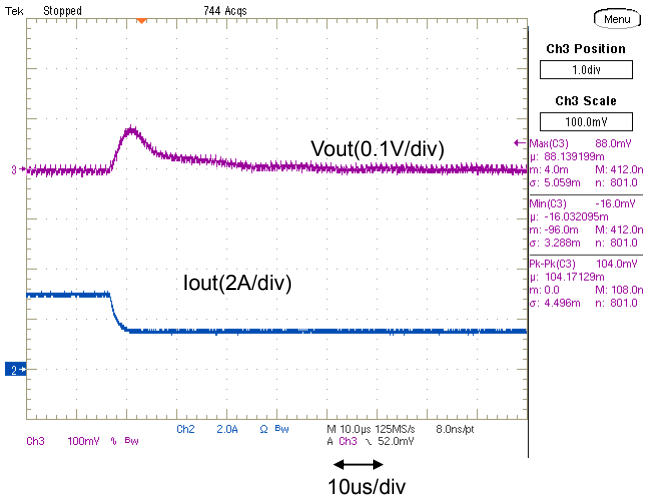

Fig.7-2-8. Load Transient Response

(Io=3->1.5A)

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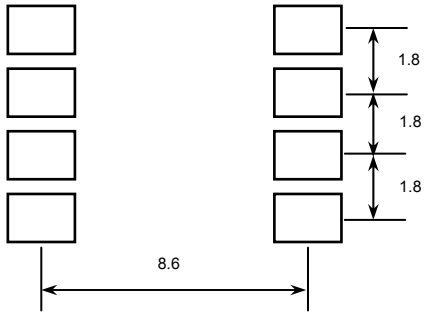
8. Mounting Condition

8. 1 PCB Land Pattern Recommendation

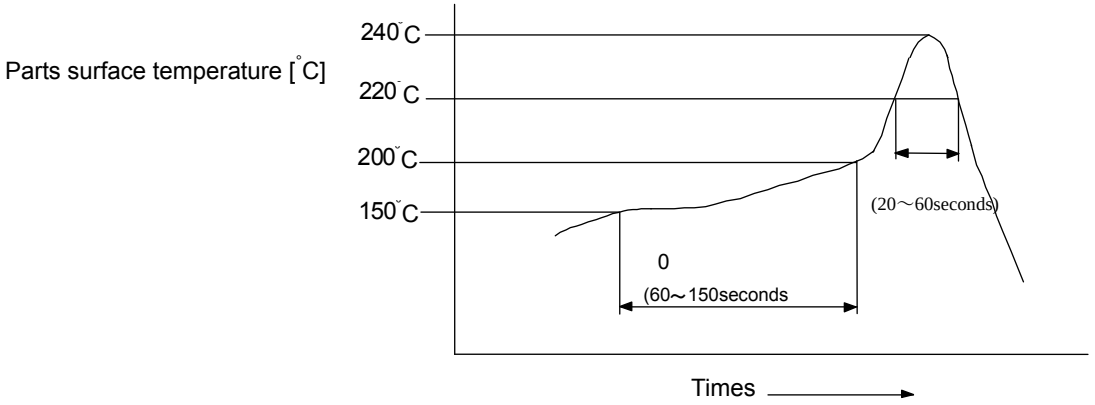


Unit: mm

Recommended land size 2.4mm × 1.4mm

8. 2 Recommended Soldering Conditions

Method	: Full convection reflow soldering
Soldering temperature	: 245°C +0/-5°C (Parts surface temperature)
Soldering time	: 20 to 60 seconds max. (Over 220°C)
Preheating	: 60 to 150 seconds (150-200°C)
Time	: 1 time



* Elimination of any additional vibration applied to this product during reflow is highly recommended. Careful regulation of temperature is recommended to avoid the separation of mounted components from this product during reflow.

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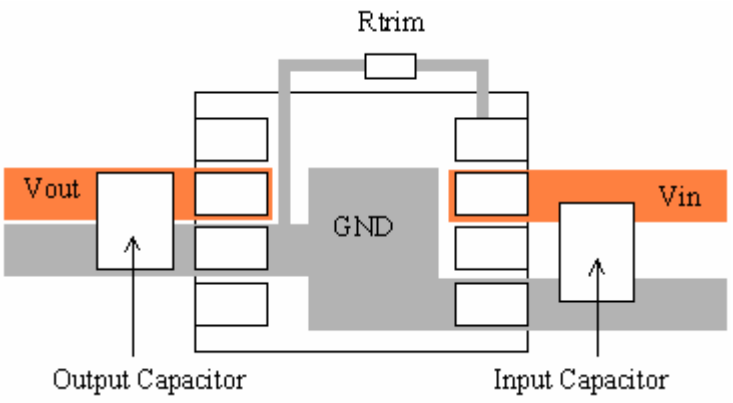
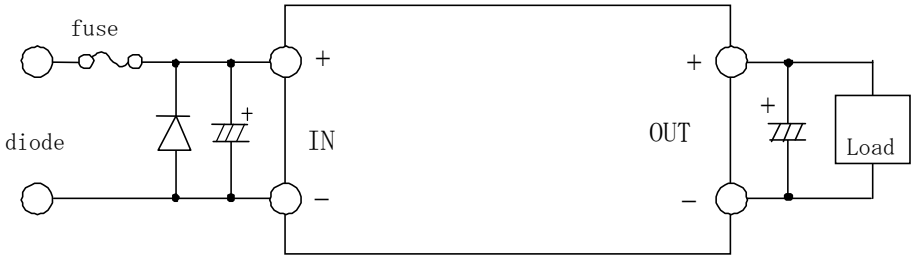
9. Notice

・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 8pin 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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   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 July 2007. 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.