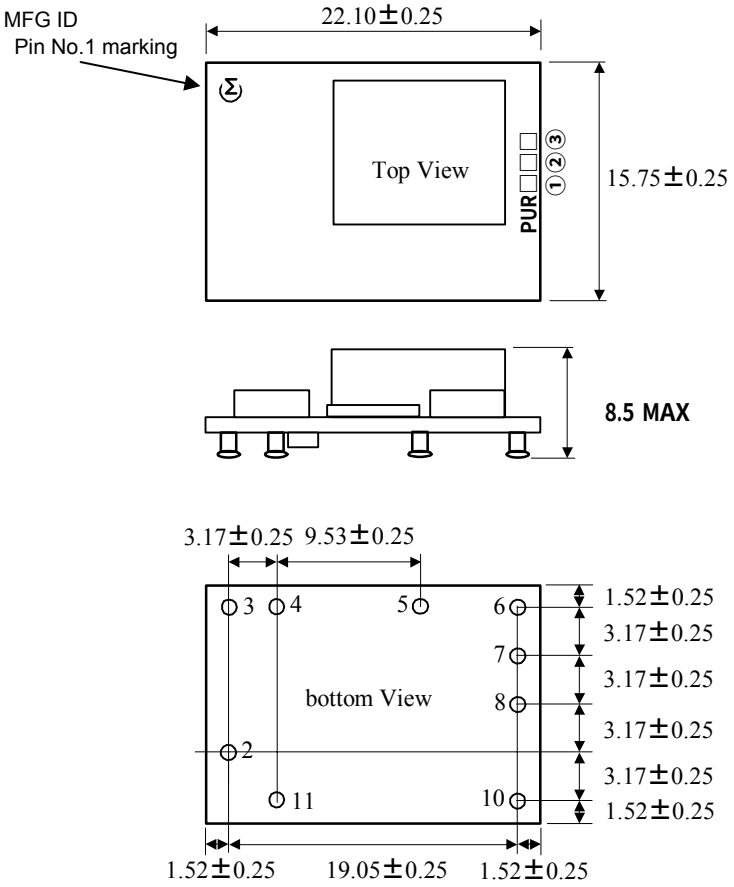
DC-DC Converter Application Manual

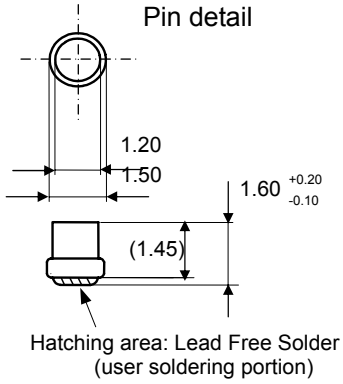
MPDRX021S

1. Features
・Ultra high-speed response is realized by using original ripple detecting control.
・Up to 10A output current, non-isolated POL.
・Wide adjustable output voltage range by connecting external resistance (0.85V to 1.8V).
・Wide operating temperature（-40°C to +85°C）.
・ON/OFF function, Output voltage sense function, Over-current function, Over-temperature function, and Tracking function are built in.

2. Appearance, Dimensions



( )…reference value
Tolerance is not accumulated.



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

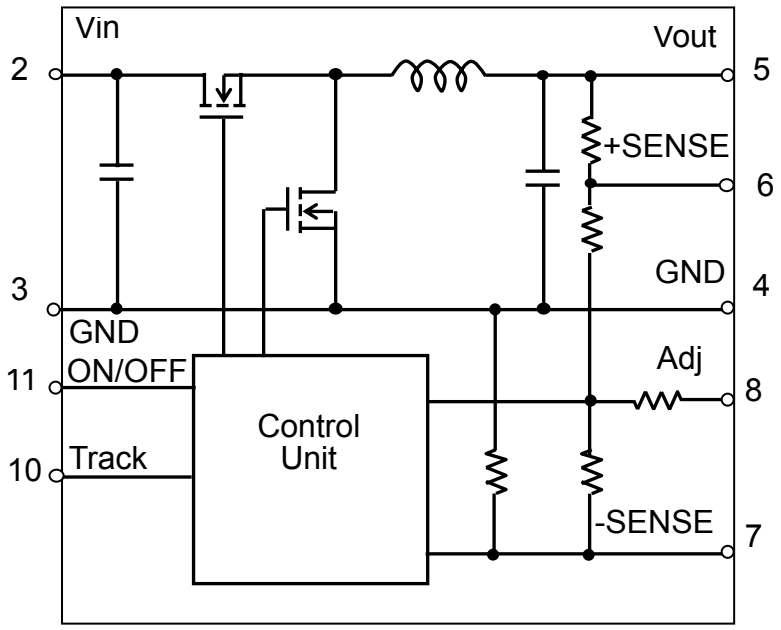
⚠ **Note:**

1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it' s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

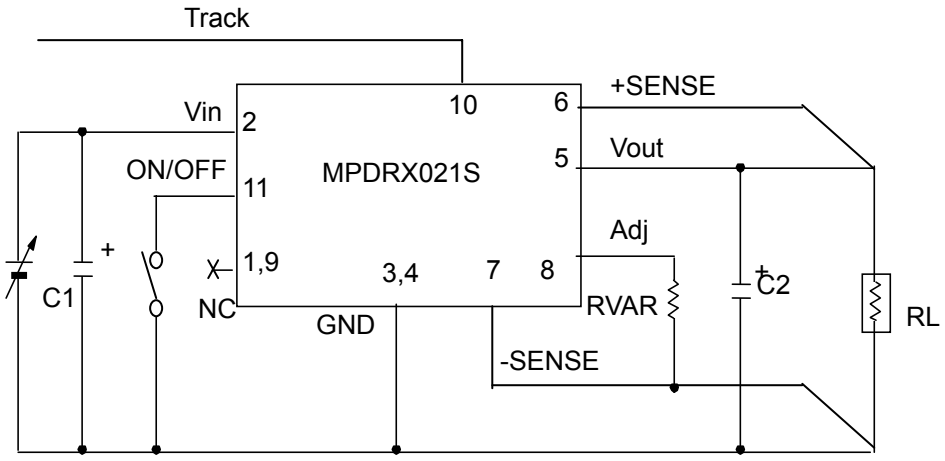
Pin Number and Function

Pin No.	Symbol	Function
2	Vin	Input voltage
3,4	GND	GND
5	Vout	Output Voltage
6	+SENSE	Output voltage +sense
7	-SENSE	Output voltage -sense
8	Vout Adjust	Output Voltage Adjustment
10	Track	Tracking Function
11	ON/OFF	Remote ON/OFF Control

3. Block Diagram



4. Test Circuit



C1 ：300μF／8V Low ESR tantalum Capacitor
ex.) Panasonic: EEFUE01J151R(150μF/8V) ×2
C2：1000μF／4V Low ESR tantalum Capacitor
ex.) Kemet: T530X108M4AE6(1000μF/4V)

Please make sure to place C1 and C2 nearby input and output terminal of DC-DC converter.

⚠ **Note:**

1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it' s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

5. Characteristics

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

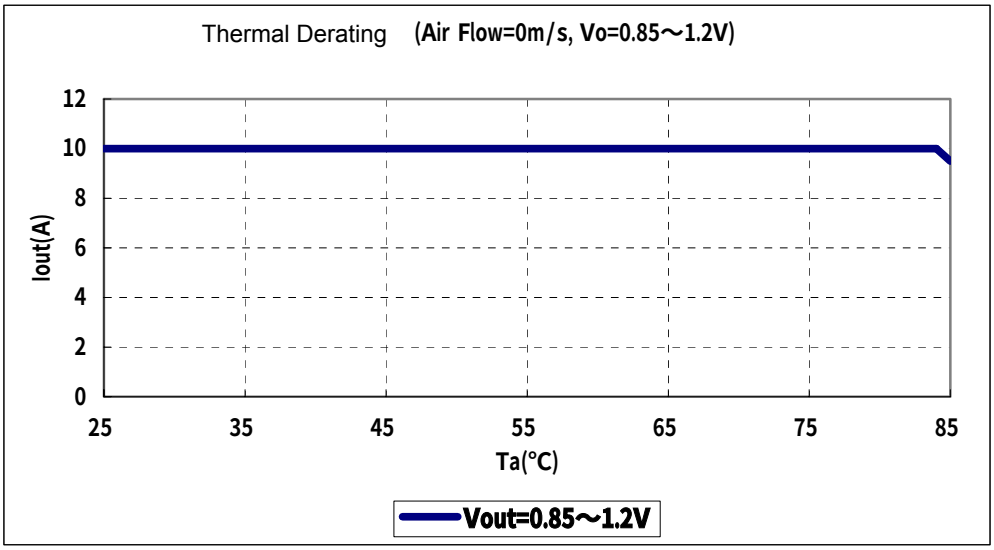
Item	Symbol	Condition		Value Min.	Value Typ.	Value Max.	Unit
Input Voltage Range	Vin			4.5	-	5.5	V
Output Voltage Adjustable Range	Vout	Vin=3.0V-5.5V Note： VinMin.=Vout+1.2V at Vout≧1.6V		0.85	-	1.8	V
Output Voltage Tolerance	Vo tol	Over Vin,Temperature range	Vo=0.85～1.2V	-1.5	-	+1.5	%Vo
			Vo=1.2～1.8V	-2		+2	
Output Current	Iout	See the thermal derating curve in section 5.2.		0	-	10	A
Ripple Voltage	Vrpl	Vin=5V, Vout=1.2V, Iout=10A BW =20MHz,		-	10	-	mV(pp)
Efficiency	EFF	Vin =5V, Vout=1.1V, Iout=10A		-	86	-	%
Operating Frequency	Freq	Vin=5V,Vout=1.1V		-	660	-	kHz
ON/OFF pin High Voltage	VIH	ON/OFF pin is pulled up to Vin inside of the DC-DC converter. If ON/OFF pin is left open, the DC-DC converter shall be “ON”. This pin will be pulled down to GND inside the DC-DC converter when UVLO events occur. Please do NOT connect this pin to power supply with low impedance line, so as not to damage the converter.					
ON/OFF pin Low Voltage	VIL	If ON/OFF pin is pulled down to GND, the DC-DC converter shall be “OFF”.	OFF	0	-	0.3	V
Short Circuit Protection	SCP	If output is shorted to GND,DC-DC converter will be interrupted (hiccup mode operation). After correction of the abnormal condition, DC-DC converter will automatically restart.		-	23	-	A
External Input Capacitor	Cin	When input voltage is ideal voltage source		-	330	-	μF
External Output Capacitor	Cout	Low ESR tantalum Capacitor When input voltage is ideal voltage source		1000		5000	μF
Tracking slew rate capability				-	-	1	V/ms

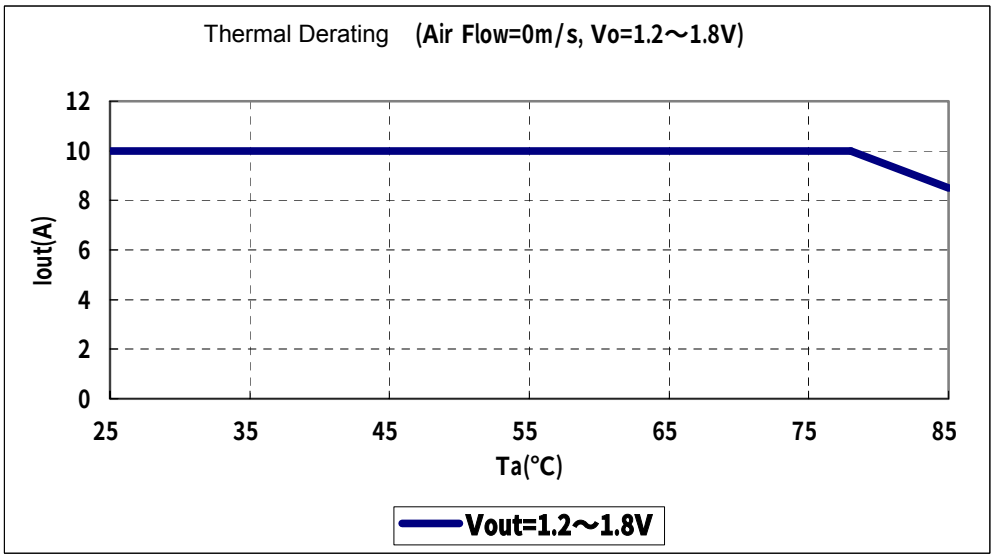
This DC-DC converter thermally shuts down when temperature of a control IC reaches to 180°C typically.

⚠ 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*101.6mm*1.6mm PCB. Any adjacent parts of high temperature may cause overheating. For reliable operation, please ensure that the FET temperature of this product is maintained below 120°C and the inductor temperature is below 106°C.

5.3.Thermal shutdown

This DC-DC converter thermally shuts down when temperature of a control IC reaches to 180℃ typically.

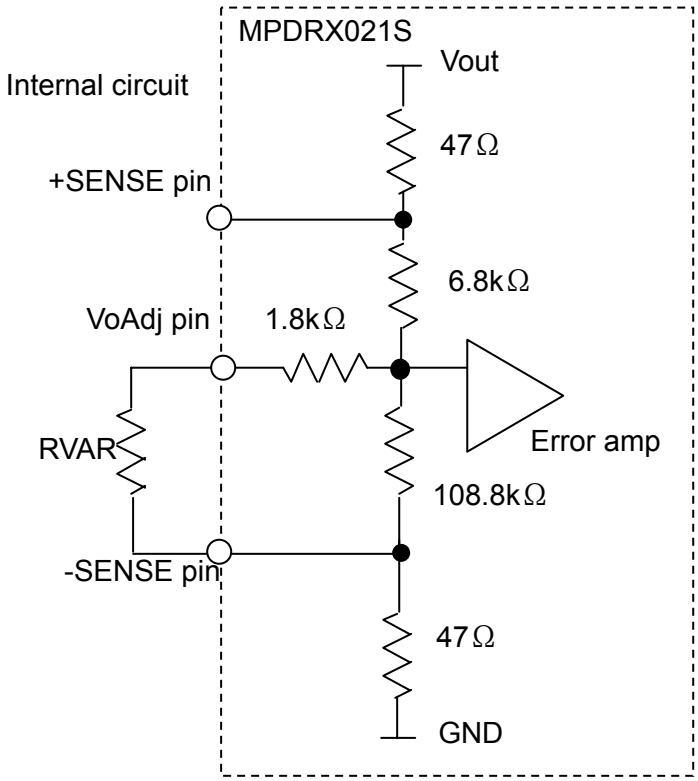
⚠ **Note:**

1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it' s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

6. Pin Description

6.1. Adjusting the Output Voltage

The output voltage can be adjusted from 0.85V to 1.8V by connecting a resistor between Adjust-pin (8Pin) to -SENSE-pin (7Pin).
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.



$$RVAR = \frac{5440}{Vout[V]-0.85[V]} - 1800[ohm]$$

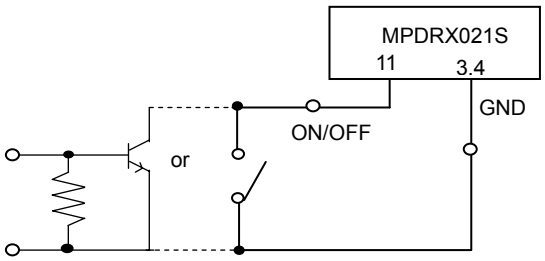
<RVAR Calculation Example>

Vout(V)	Calculated RVAR(Ω)	RVAR Example(Ω)
1.8	3926	3.9k + 24 + 2
1.5	6569	6.2k + 360 + 9.1
1.2	13743	13k + 680 + 62
1.0	34467	33k + 1.3k + 160
0.85	∞	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(11pin) is left open …… Output Voltage =ON
When ON/OFF-pin(11pin) is connected to GND …… Output Voltage =OFF

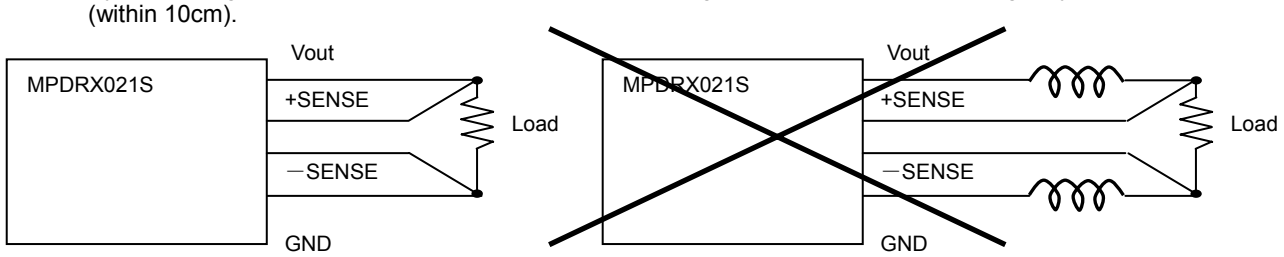


⚠ **Note:**

1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it' s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

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. Input External capacitor

It is recommended to connect a low-impedance tantalum capacitor of 300uF or more at Vin terminal. Smaller input capacitor may leads to an unstable operation of this product caused by input voltage fluctuation. Please check the proper operation of it on your product when smaller input capacitor is used.

6.5. Output External capacitor

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

Output capacitor should be within 1000uF to 5000uF. Output capacitor shall be placed near the output terminal. When using plural capacitors, please make sure to place a capacitor of at least 1000uF near the output terminal, and place other capacitors near the load.

When using LC output filter, please make sure to place a capacitor of at least 1000uF near the output terminal.

7. Typical Characteristics Data

7.1. Vout=0.85V

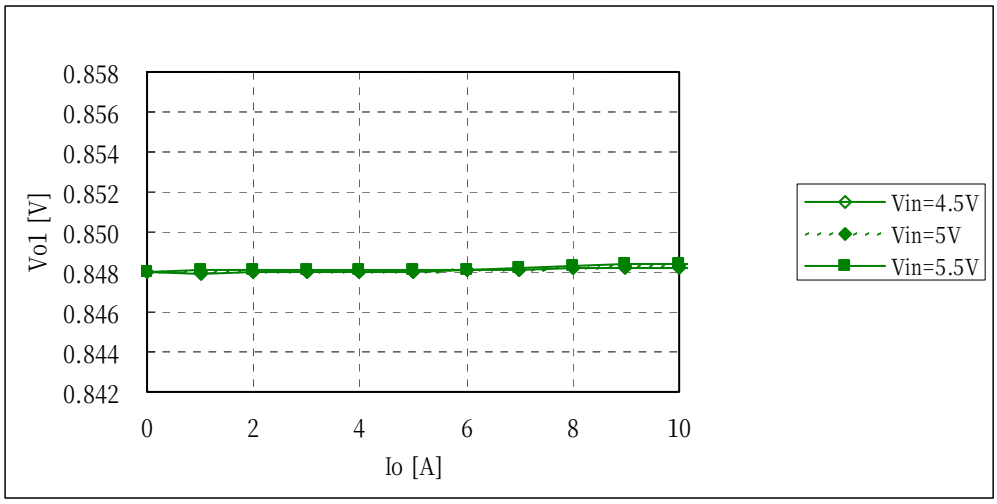


Fig.7-1-1. Output Voltage v.s. Output Current

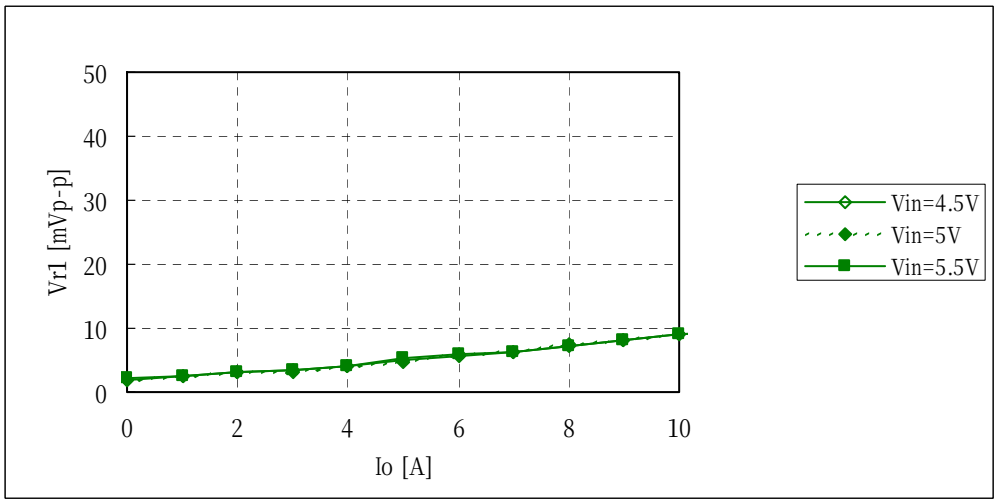


Fig.7-1-2. Ripple Voltage v. s. Output Current

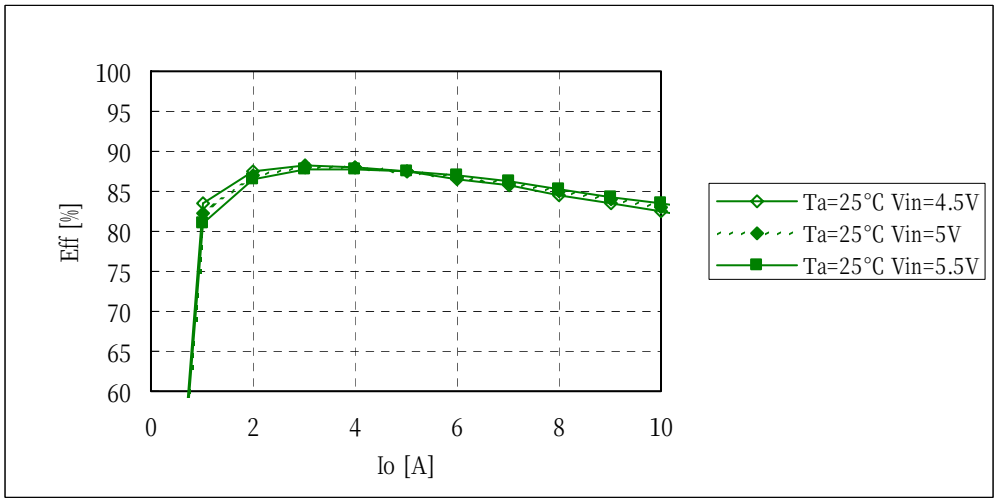


Fig.7-1-3. Efficiency v.s. Output Current

⚠ **Note:**

1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it' s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

7.2. Vout=1.1V

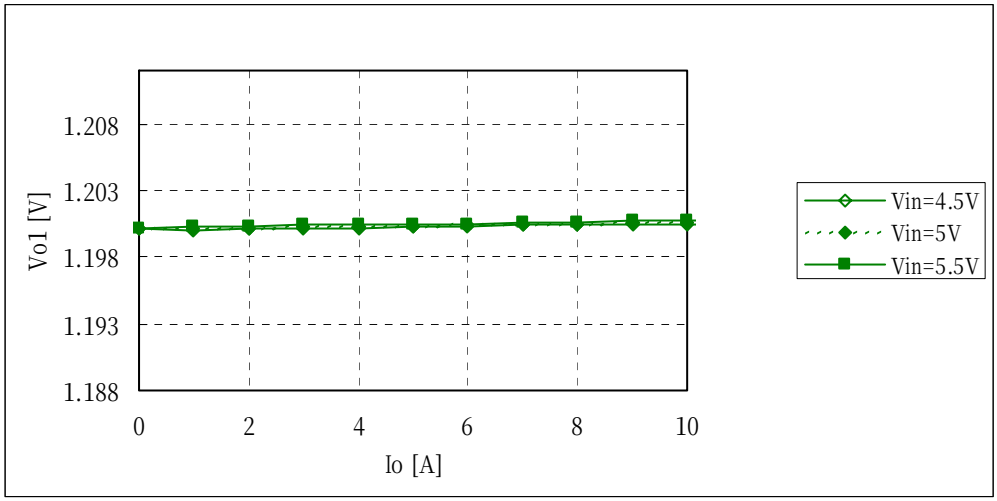


Fig.7-2-1. Output Voltage v.s. Output Current

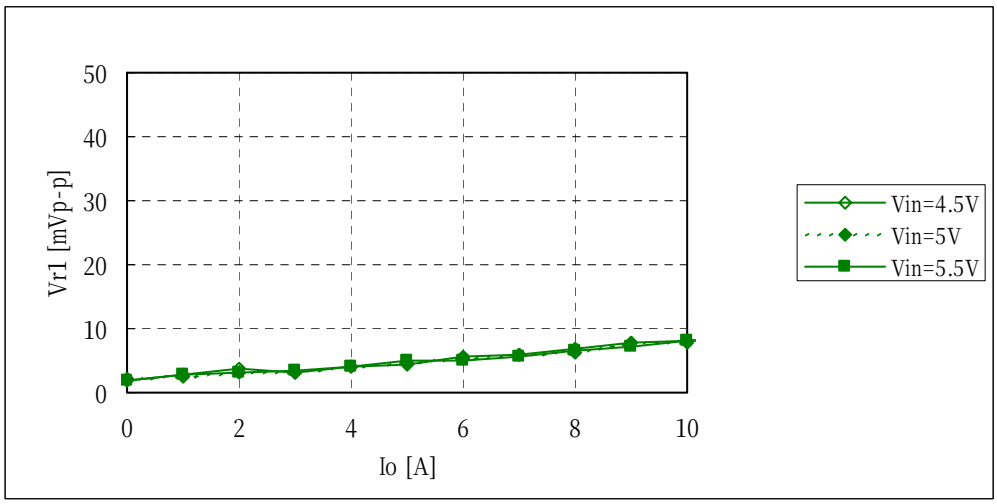


Fig.7-2-2. Ripple Voltage v. s. Output Current

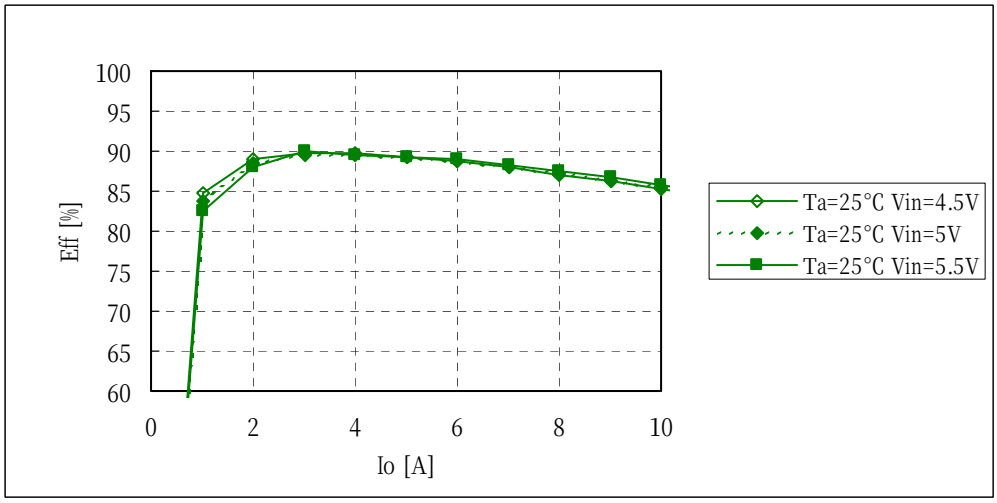


Fig.7-2-3. Efficiency v.s. Output Current

⚠ **Note:**

1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it' s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

7.3. Vout=1.8V

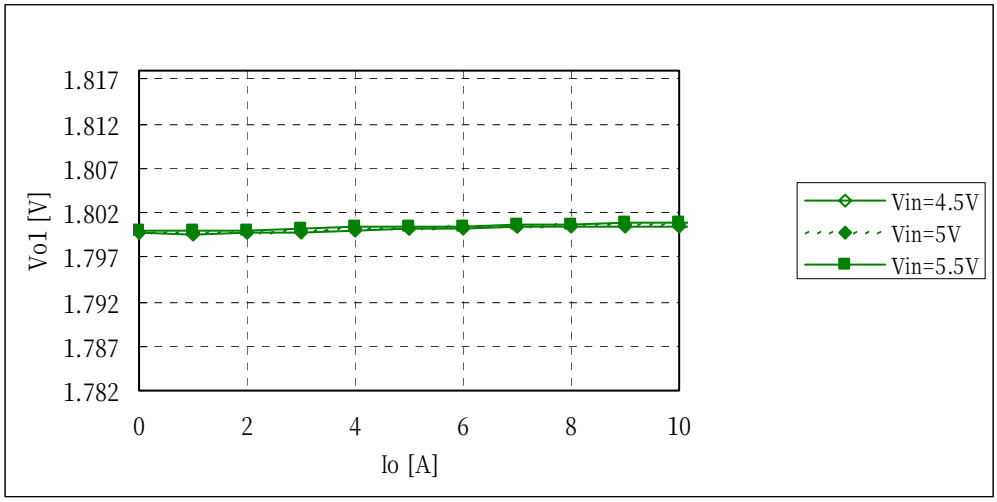


Fig.7-2-1. Output Voltage v.s. Output Current

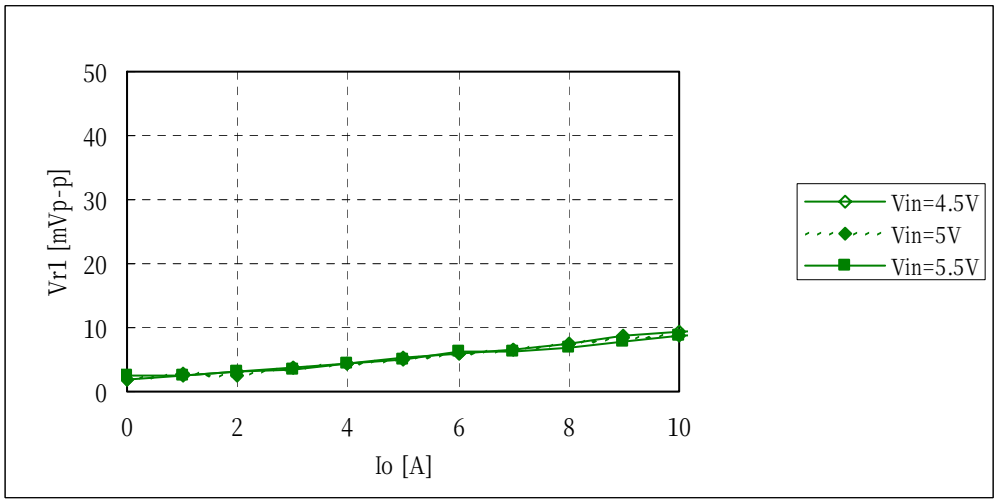


Fig.7-2-2. Ripple Voltage v. s. Output Current

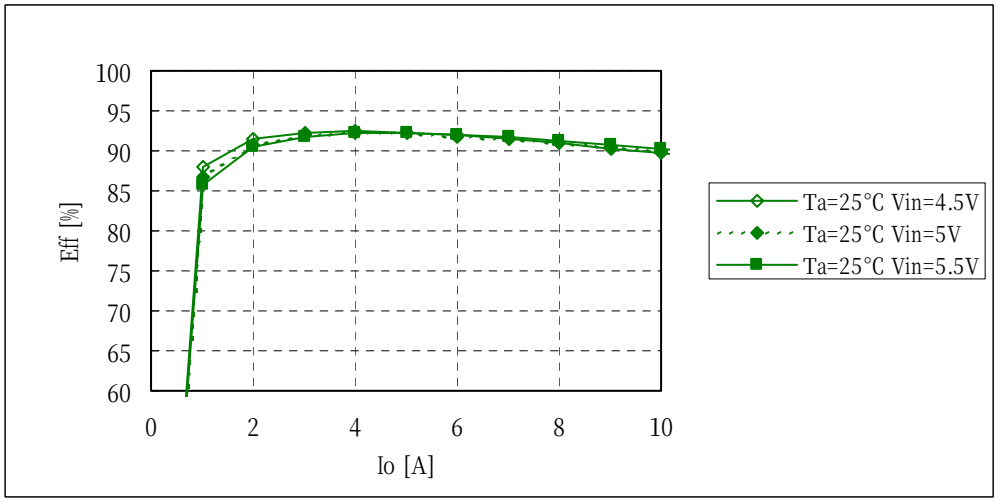


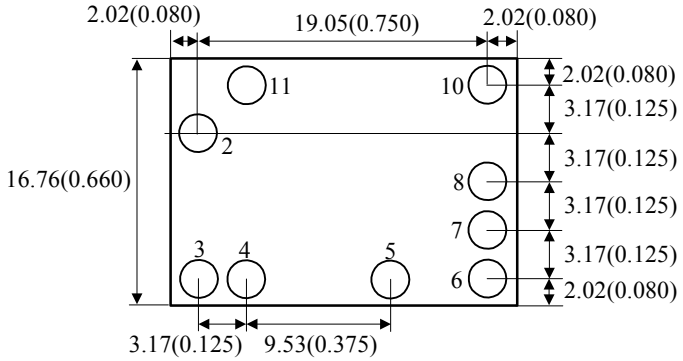
Fig.7-2-3. Efficiency v.s. Output Current

⚠ **Note:**

1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it' s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

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

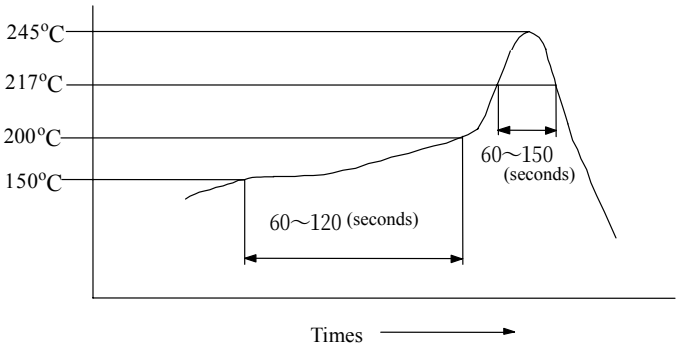
Reflow Soldering Profile

JEDEC IPC/JEDEC J-STD-020D
Table 5-2 Classification Reflow Profile
Pb-Free Assembly Large Body

Profile details

Soldering temperature	:	245ºC+0/-5ºC
Soldering time	:	30 seconds, 240 to 245ºC
Heating time	:	60 to 150 seconds, over217ºC
Preheating time	:	60 to 120 seconds,150 to 200ºC
Programming rate	:	3ºC/ sec. Max., 217 to 245ºC
Descending rate	:	6ºC/ sec. Max.
Total soldering time	:	8 minutes Max., 25 to 245ºC
Times	:	1 time

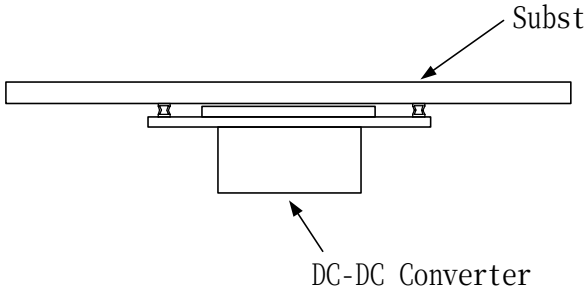
Parts surface temperature [ºC]



※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.

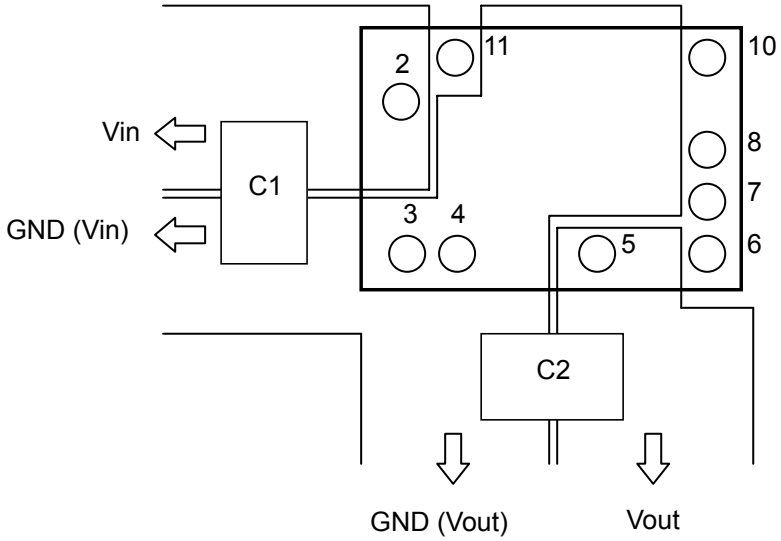


⚠ **Note:**

1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it' s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

9. Notice
·Input/Output capacitor

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 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.

⚠ **Note:**

1. This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it' s specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
2. This datasheet has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

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.