

Excellent Integrated System Limited

Stocking Distributor

Click to view price, real time Inventory, Delivery & Lifecycle Information:

[Murata Power Solutions Inc.](#)

[MPDTY413S](#)

For any questions, you can email us directly:

sales@integrated-circuit.com

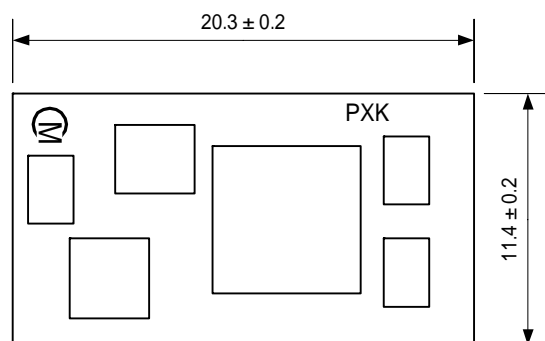
DC-DC Converter Application Manual

MPDTY413S

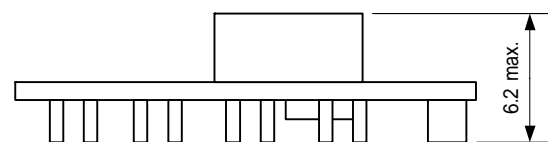
1. Features

- Up to 6A output current, non-isolated POL.
- Wide adjustable output voltage range by connecting external resistance (0.7525V to 5.5V).
- Wide operating temperature (-40°C to +85°C).
- UVLO function / ON/OFF function, Over-current function and Over temperature function are built in.

2. Appearance, Dimensions

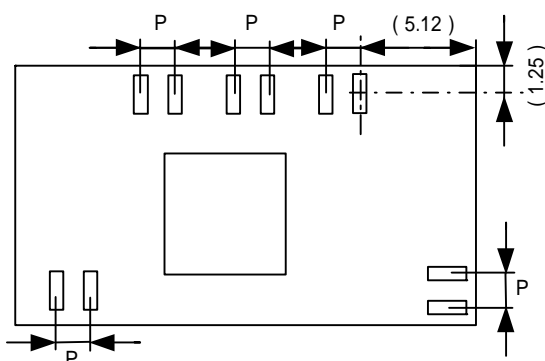


()...reference value
 P=2.54 ± 0.2mm
 Tolerance is not accumulated.



Marking

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



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

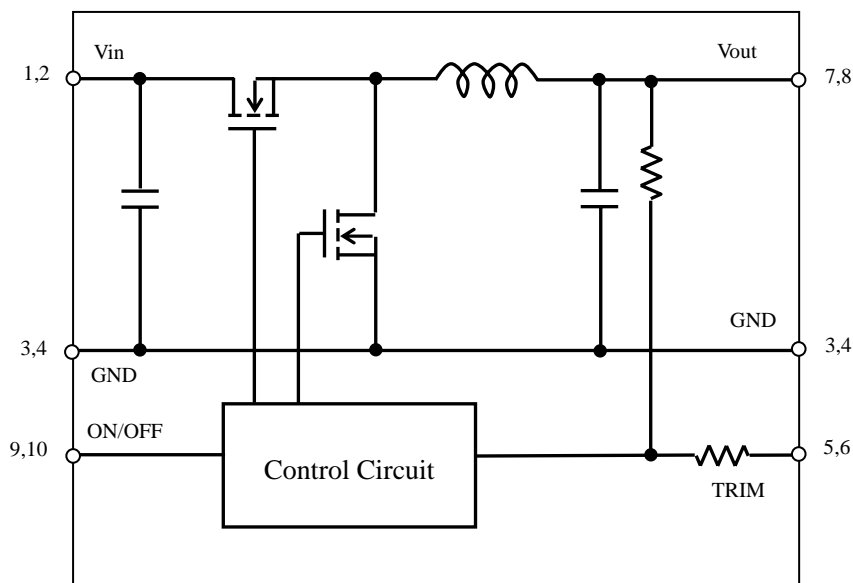
⚠ Note:

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.

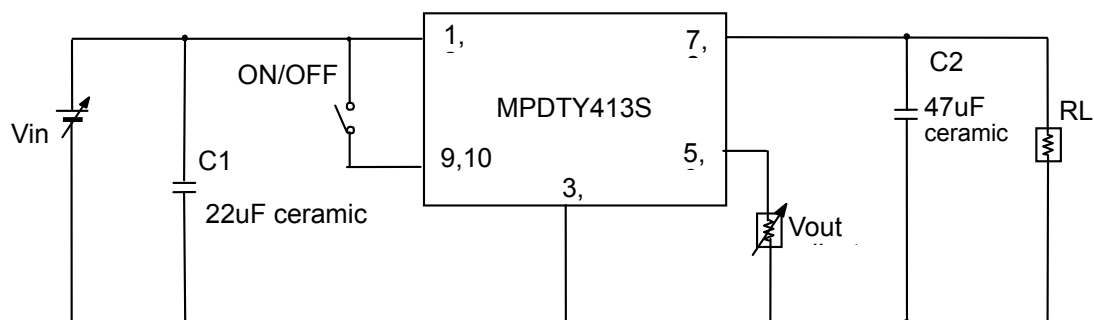
Pin Number and Function

| Pin No. | Symbol | Function |
|---------|--------|---------------------------|
| 1,2 | Vin | Input Voltage |
| 3,4 | GND | GND |
| 5,6 | TRIM | Output Voltage Adjustment |
| 7,8 | Vout | Output Voltage |
| 9,10 | ON/OFF | Remote ON/OFF |

3. Block Diagram



4. Test Circuit



C1 : 22µF / 25V Ceramic Capacitor

C2 : 47µF / 10V Ceramic Capacitor

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.

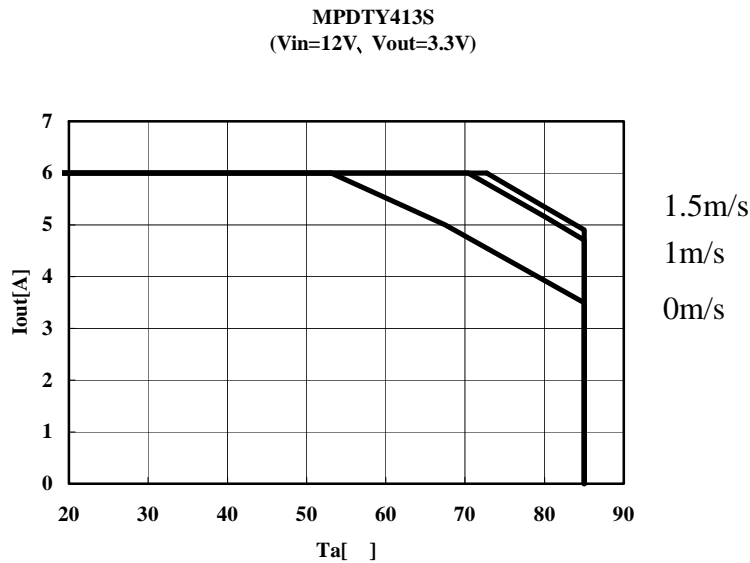
5. Characteristics
5. 1 Electrical Characteristics (Ta=25 °C)

| Item | Symbol | Condition | Value | | | Unit | |
|---------------------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------|------|--------|---|
| | | | Min. | Typ. | Max. | | |
| Input Voltage Range | Vin | | 10.0 | 12.0 | 14.0 | V | |
| UVLO Threshold | UVLO | | - | 9.4 | - | V | |
| Output Voltage Adjustable Range | Vout | | 0.7525 | - | 5.5 | V | |
| Output Voltage Tolerance | Vo tol | Vin=10 ~ 14V Iout=0 ~ 6A | Vout=1.2 V | 1.164 | 1.2 | 1.236 | V |
| | | | Vout=5.0 V | 4.85 | 5.0 | 5.15 | |
| Output Current | Iout | See the thermal derating curve in section 5.2. | 0 | - | 6 | A | |
| Ripple Voltage | Vrpl | Vin =12V, Vout=2.5V, Iout=6A, BW=20MHz | - | 35 | 70 | mV(pp) | |
| Efficiency | EFF | Vin =12V, Iout=6A | Vout=2.5 V | - | 90 | - | % |
| | | | Vout=3.3 V | - | 94 | - | |
| Operating Frequency | Frq | | - | 400 | - | kHz | |
| ON/OFF pin High Voltage | VIH | If ON/OFF pin is connected to Vin, the DC-DC converter shall be "OFF". | OFF | Vin-0.3 | - | Vin | V |
| ON/OFF pin Low Voltage | VIL | If ON/OFF pin is connected to GND, the DC-DC Converter shall be "ON". | ON | 0 | - | 0.3 | V |
| Short Circuit Protection | SCP | If output is shorted to GND, DC-DC converter shall be operated in a hiccup mode. After the short circuit event has cleared, the output is automatically brought back into regulation. | | | | | |
| External Output Capacitor | Cout | When input voltage is ideal voltage source | 47 | - | 1000 | μF | |
| Output Rise Time | Tr | Vo=10% ~ 90% | - | 4 | - | msec | |
| Rising Overshoot | Vover | | - | - | +10 | % | |
| Output Delay | Td | Vin High :ON/OFF High→Low Vo=10% | - | 5 | - | msec | |

⚠ 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.

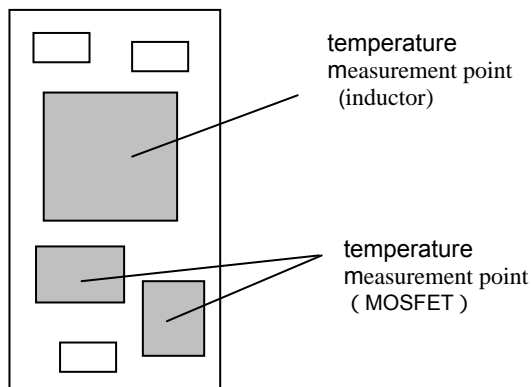
5. 2 Thermal Derating



When using this product at the ambient air temperature of 55°C more, it is used by the following temperature derating.

But when any other heat generating parts are close to this product, it may be over heated.

Please confirm that the MOSFET temperature is below 120°C, the inductor temperature is below 106°C to secure operation reliability(see following fig).



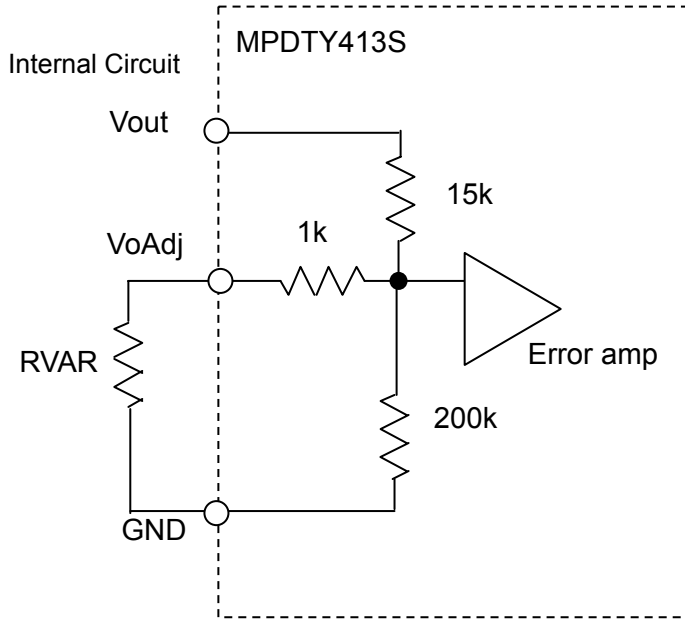
⚠ Note:

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 0.7525V to 5.5V by connecting resistors between TRIM-pin(5,6Pin) to GND-pin. 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.



$$RVAR = \frac{10500}{Voadj[V] - 0.7525[V]} - 1000 \quad [\Omega]$$

<RVAR Calculation Example>

| Voadj [V] | Calculated RVAR[Ω] | RVAR example |
|-----------|--------------------|--------------|
| 5 | 1472 | 1.47 kΩ + 2Ω |
| 3.3 | 3122 | 3kΩ + 120Ω |
| 2.5 | 5009 | 4.99kΩ + 20Ω |
| 1.8 | 9024 | 8.2kΩ + 820Ω |
| 1.5 | 13047 | 13kΩ+47Ω |
| 1.2 | 22464 | 22kΩ + 470Ω |
| 0.7525 | ∞ | Open |

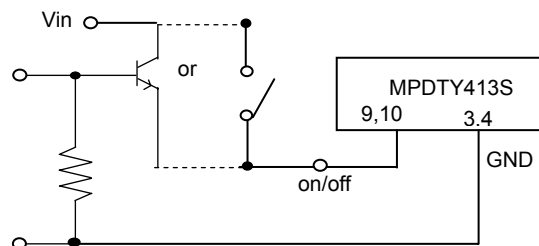
6.2. ON/OFF Control

ON/OFF function

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.

ON/OFF Control Operation

- When ON/OFF-pin(9,10pin)are left open Output Voltage =ON
- When ON/OFF-pin(9,10pin) is connected to Vin Output Voltage =OFF



⚠ **Note:**

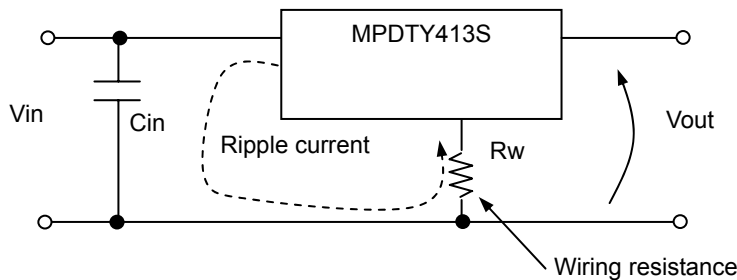
- This datasheet is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.
- This datasheet has 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.

6.4. Input External capacitor

It is recommended to connect a low-impedance electrolytic capacitor of 22 μ F 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.

Using ceramic capacitors as input capacitor may cause an increase of output voltage, because input ripple current flows through the external input capacitor and wiring resistance.

This phenomenon is affected by the position of external capacitors, the value of external capacitors and voltage difference between Vin and Vout. Using low-impedance electrolytic capacitor will ease this problem. Please check the proper operation of it on your product when ceramic input capacitor is used.



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 within 47 μ F to 1000 μ F. Output capacitor shall be placed near the output terminal. When using plural capacitors, please make sure to place a capacitor of at least 47 μ F 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 47 μ F near the output terminal.

⚠ 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. Typical Characteristics Data

7.1. Vout=0.7525V

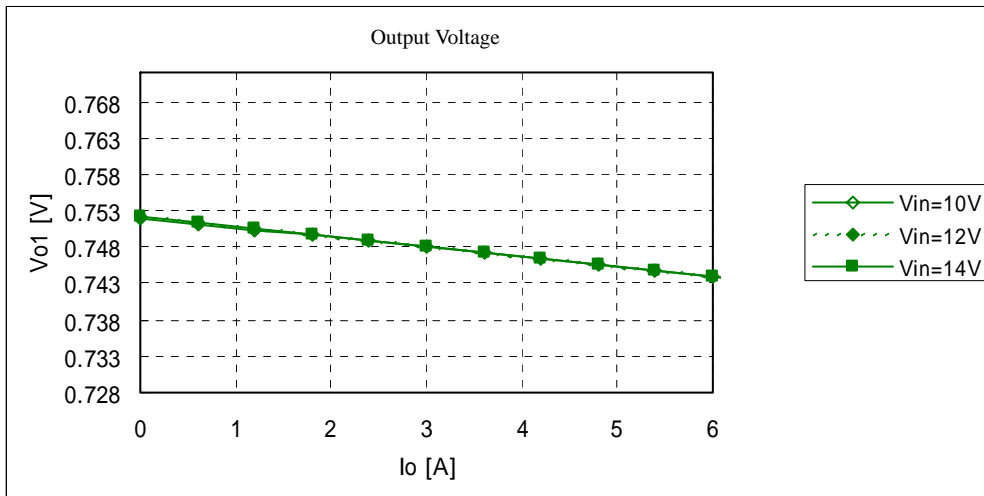


Fig.7-1-1. Output Voltage v.s. Output Current

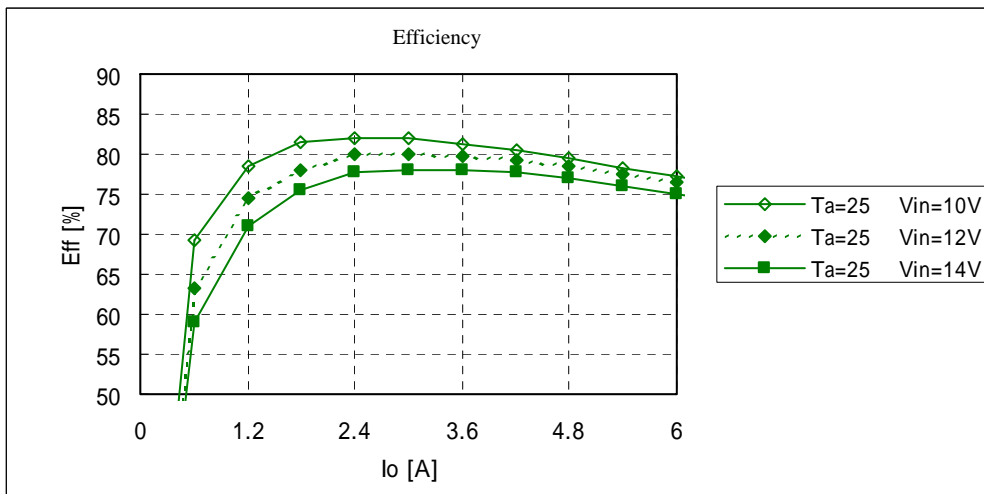


Fig.7-1-2. Efficiency v. s. Output Current

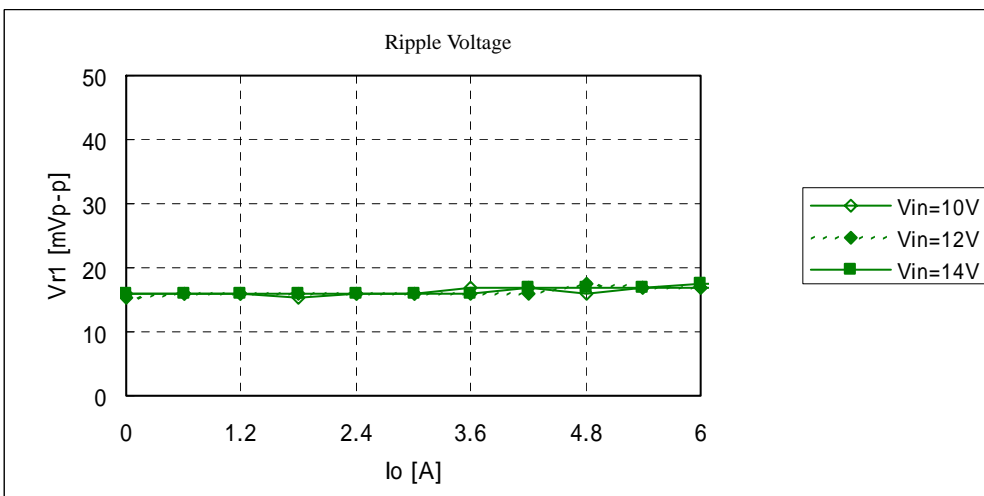


Fig.7-1-3. Ripple Voltage v. s. Output Current

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=3.3V

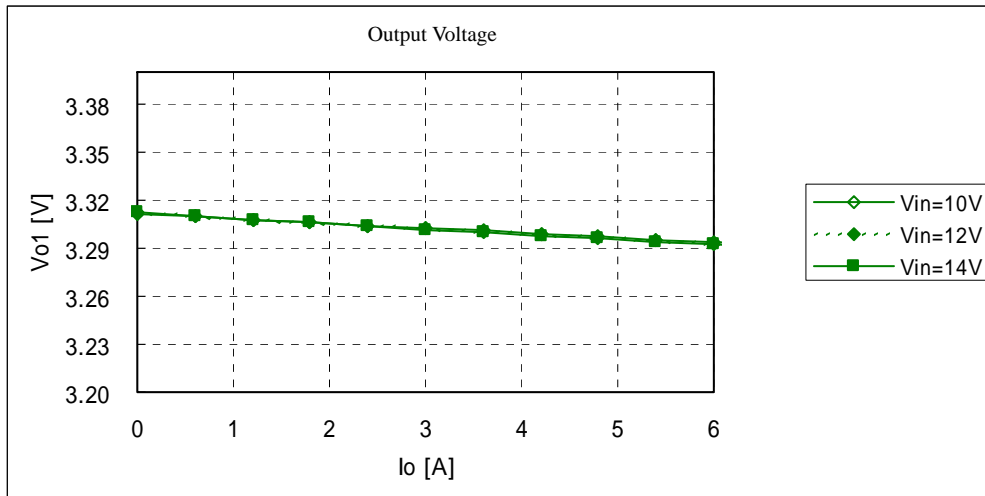


Fig.7-2-1. Output Voltage v.s. Output Current

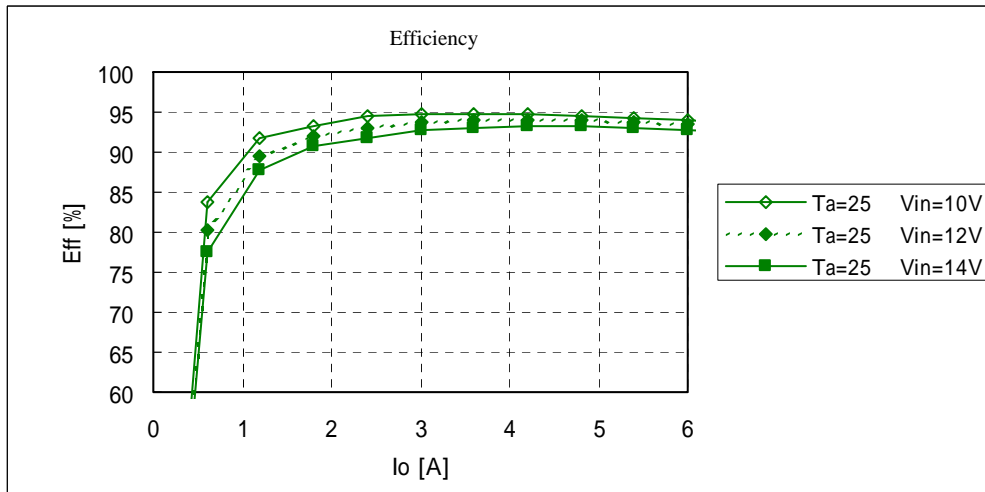


Fig.7-2-2. Efficiency v. s. Output Current

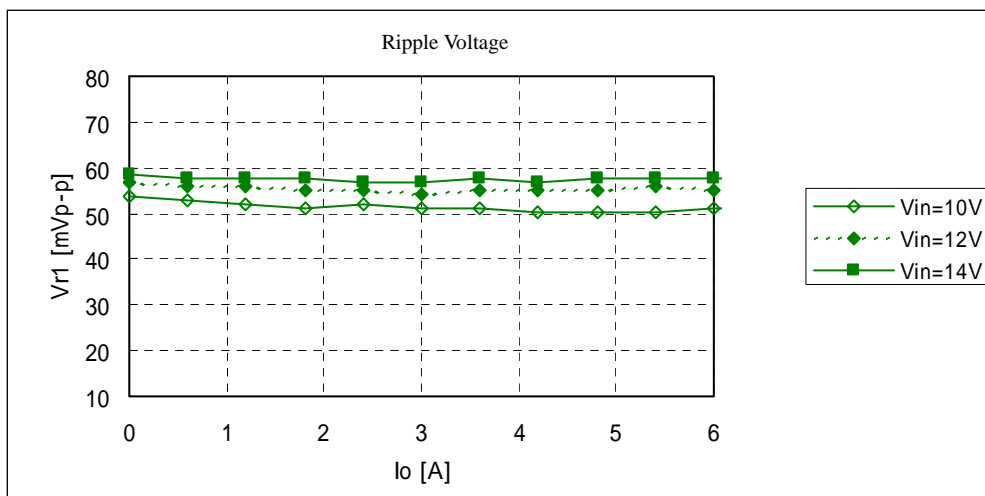


Fig.7-2-3. Ripple Voltage v. s. Output Current

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=5.5V

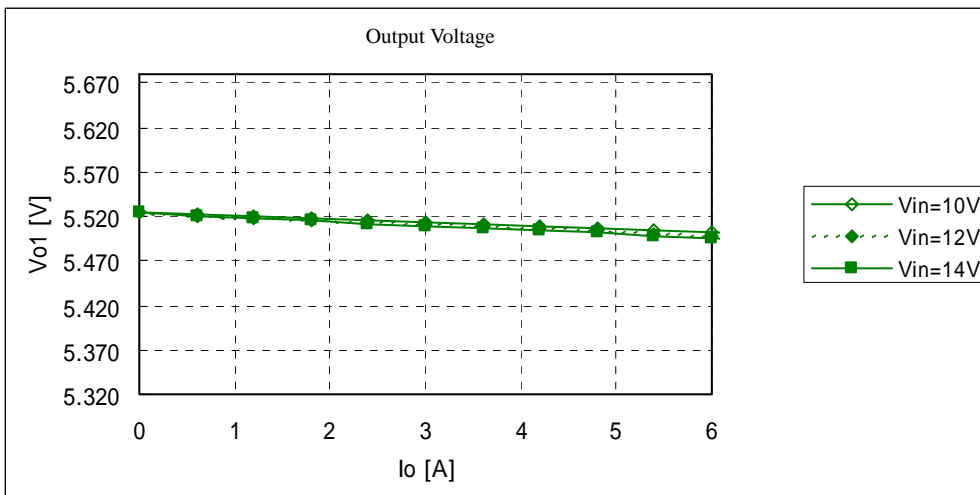


Fig.7-3-1. Output Voltage v.s. Output Current

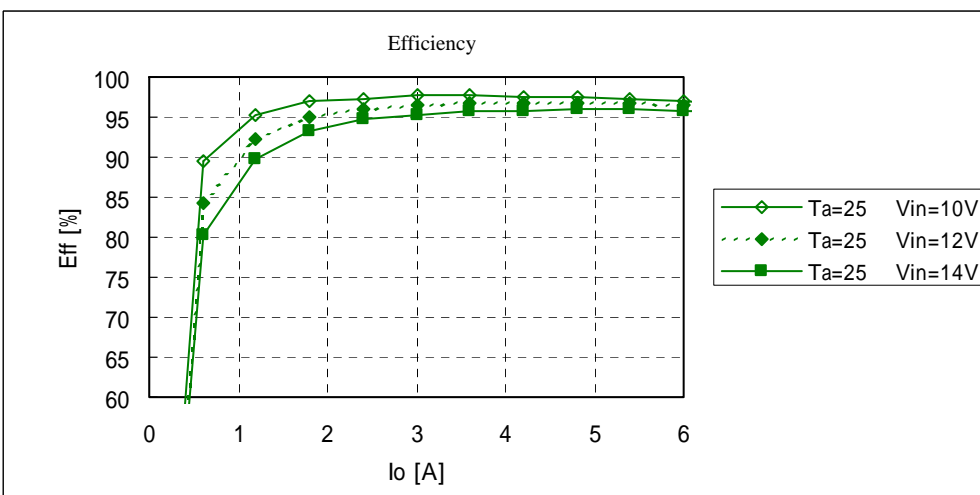


Fig.7-3-2. Efficiency v. s. Output Current

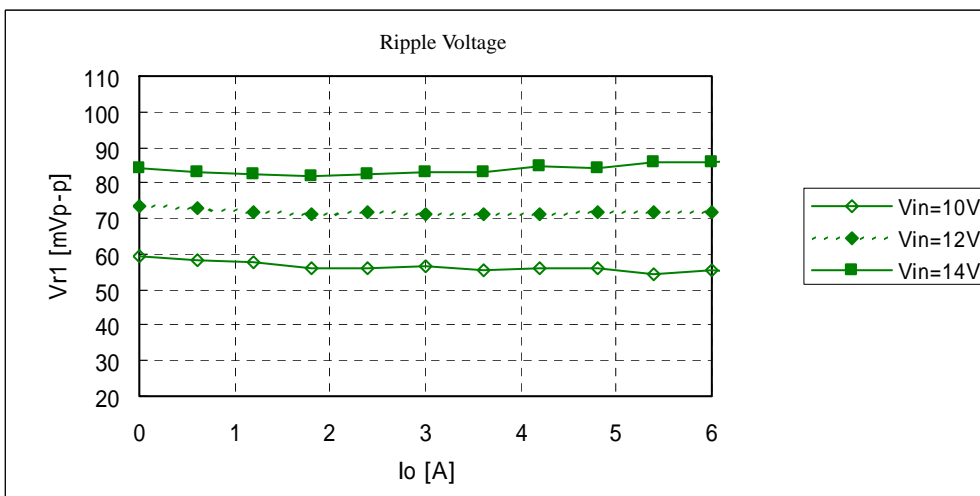


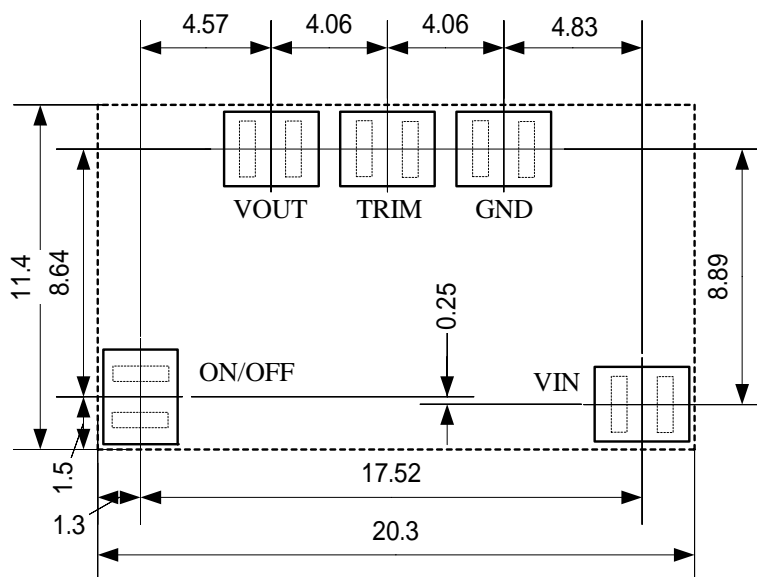
Fig.7-3-3. Ripple Voltage v. s. Output Current

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



Recommendable Land Size 3.3mm × 2.2 mm

There are wiring coppers or through-hole via at the bottom side of the DC-DC converter. When you design your PCBs, please be careful not to short the circuit of the DC-DC converter or PCBs.

⚠ 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.

8.2. 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

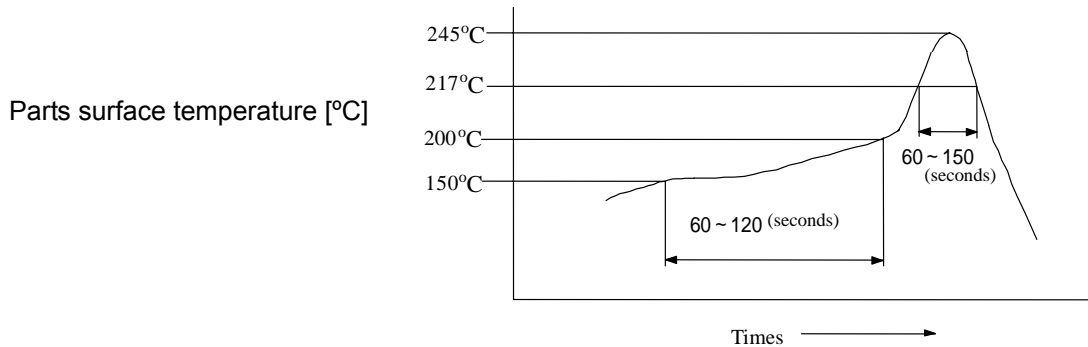
JEDEC IPC/JEDEC J-STD-020D

Table 5-2 Classification Reflow Profile

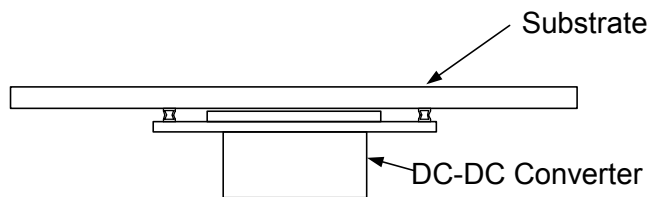
Pb-Free Assembly Large Body

Profile details

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



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

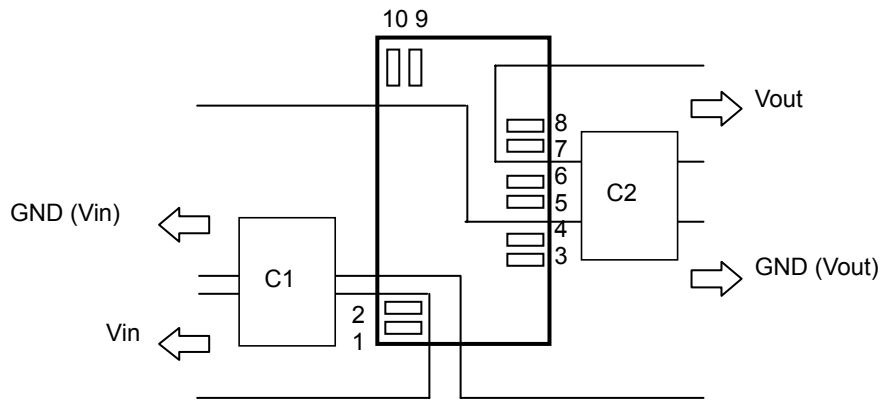


⚠ Note:

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

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 make the power line pattern as wide and short as possible.
The Following figure is an example of recommendable PCB design.



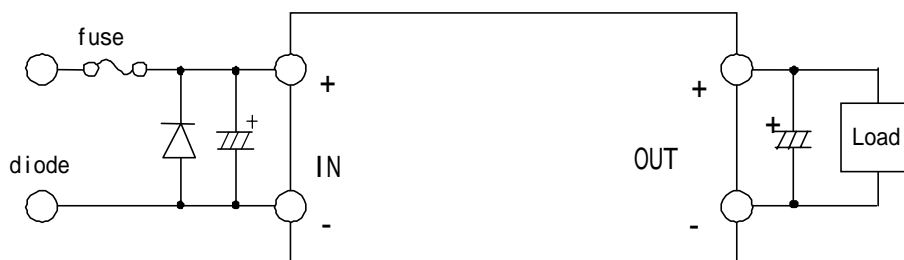
This product should not be operated in parallel or in series.

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.

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 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.

⚠ 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.