

DC-DC Converter DATA Sheet

MPDTY411S/MPDTY412S

1. Features

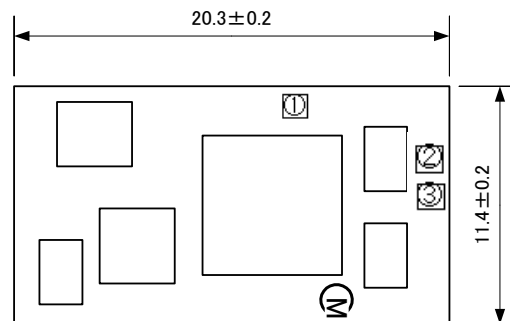
These are the Low Voltage/High current non-insulated type DC-DC Converter.
 Low profile ; 6.2mmMAX.
 Output voltage is adjustable by using single external resistance.
 (0.8-3.3V : MPDTY411S 0.8-2.5V : MPDTY412S)
 ON/OFF function is built in.
 Short circuit protection & over temperature protection is built in.



Product line up

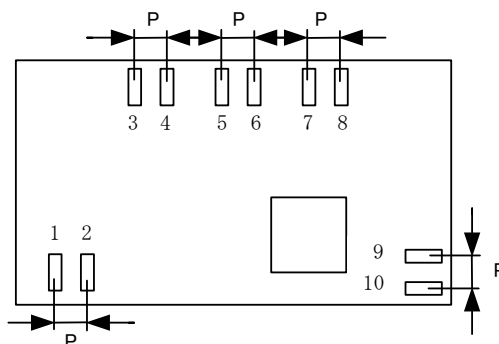
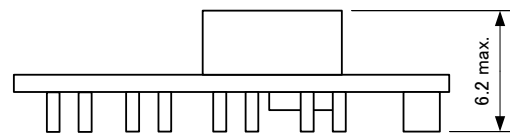
Input Voltage	
5.0V type	3.3V type
MPDTY411S	MPDTY412S

2. Appearance, Dimensions




$P=1.5 \pm 0.2\text{mm}$

【Unit : mm】



Marking

(1) Pin No.1 Marking / MFG ID 
 (2) Parts No. PPU
 (3) Lot No. □□□
 ①②③

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

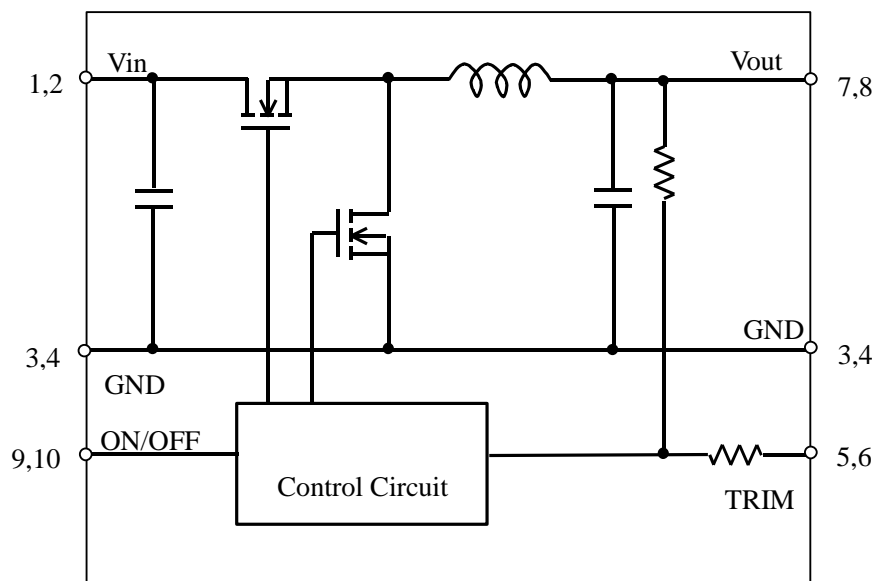
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Pin Number and Function

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

3. Block Diagram



4. Environmental Conditions

4.1 Operating Temperature Range	-40°C ~ +85°C (Temperature gradient ≤ 10 oC /H)
4.2 Storage Temperature Range	-40°C ~ +85°C (Temperature gradient ≤ 25 oC /H)
4.3 Operating Humidity Range	20% ~ 85% (No water condenses in any case.)
4.4 Storage Humidity Range	10% ~ 90% (No water condenses in any case.)
4.5 Maximum Wet Bulb	39°C

5. Absolute Maximum Rating

5.1 Absolute Maximum Input Voltage Rating	5.9V(411S) ,4.0V(412S)
5.2 Absolute Maximum TRIM,ON/OFF Pin Voltage Range	Vin+0.3V

※No voltage, no matter how instantaneous, shall be applied beyond the absolute maximum voltage rating to this product. If you apply any voltage over this limit the product characteristics will deteriorate or the product itself will be destroyed. Even though it may continue operating for a while after the over-voltage event its life will likely be shortened significantly. Reliability and life of the module may degrade similarly if the maximum operating voltage rating is continuously exceeded. This product is designed to operate within the maximum operating voltage rating specification.

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6. Characteristics

6. 1 Electrical Characteristics (Ta=25 °C)

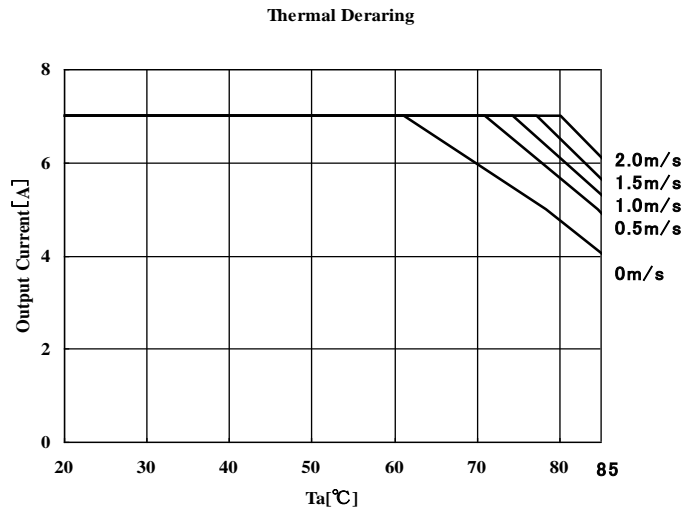
Item	Symbol	Condition	Model Number	Value			Unit
				Min.	Typ.	Max.	
Input Voltage	Vin		MPDXY411S	4.5	5.0	5.5	V
			MPDXY412S	3.0	3.3	3.6	
UVLO Threshold	UVLO		MPDXY411S	-	4.0	-	V
			MPDXY412S	-	2.7	-	
Output Voltage Adjustable Range	Vout		MPDXY411S	0.8	-	3.63	V
			MPDXY412S	0.8	-	2.5	
Output Voltage Accuracy	Vout-0.8	Vin =4.5~5.5V, Iout= 0~7A TRIM = Open	MPDXY411S	0.776	0.80	0.824	V
	Vout-3.3	Vin =4.5~5.5V, Iout= 0~7A TRIM = 5460Ω		3.201	3.30	3.399	
	Vout-0.8	Vin =3.0~3.6V, Iout= 0~7A TRIM = Open	MPDXY412S	0.776	0.80	0.824	
	Vout-2.5	Vin =3.0~3.6V, Iout= 0~7A TRIM = 10429Ω		2.425	2.50	2.575	
Output Current	Iout		All	0	-	7	A
Ripple Noise Voltage	Vripl	Vin=5.0V, Vout=3.3V, Iout=7A,BW=20MHZ	MPDXY411S	-	20	50	mV(p_p)
		Vin=3.3V, Vout=2.5V, Iout=7A,BW=20MHZ	MPDXY412S	-	15	50	
Efficiency	EFF	Vin =5.0V, Vout=3.3V, Iout= 7A	MPDXY411S	89	94	-	%
		Vin =3.3V, Vout=2.5V, Iout= 7A	MPDXY412S	88	93	-	
Operating Frequency	Frq		All	-	600	-	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	Vin
ON/OFF pin Low Voltage	VIL	If ON/OFF pin is pulled down to GNDor is opened, the DC-DC Convertershall 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.					
Over Temperature Protection	OTP	If OTP event is occurred, DC-DC Converter shall be shut down. After theOTP event has cleared, the output is automatically brought back into regulation.		-	115	-	°C
Additional Output Capacitor	Cout	When input voltage is ideal voltage source		47	-	1000	μF
Output Delay	Td	Output voltage 0-10% (remote on)		0.1	-	8	msec
Output Rise Time	Tr	Output voltage 10-90%		1	-	10	msec

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6.2 Thermal Derating

When using this product at the ambient air temperature of 60°C more, it is used by the following temperature derating.

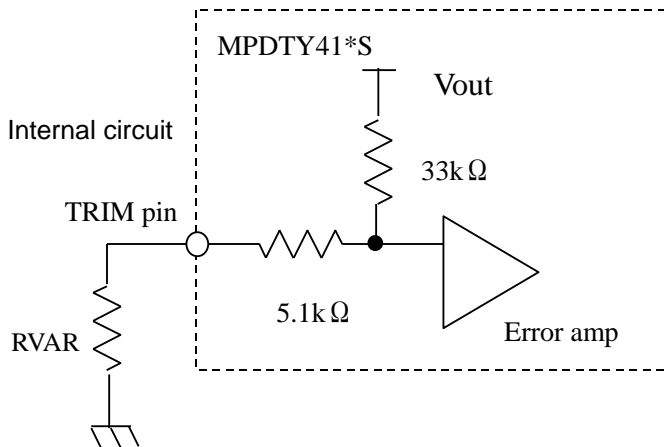


7. Operation information

7.1. Adjusting the Output Voltage

The output voltage can be adjusted ranging from 0.8V to 3.63V(MPDTY411S), from 0.8V to 2.5V (MPDTY412S) by connecting resistors between TRIM-pin(5pin、6pin) to GND-pin(3pin、4pin).

The following equation gives the required external-resistor value to adjust the output voltage to Voadj. It is strictly recommended to evaluate the characteristics of DC-DC Converter at your board conditions.



$$RVAR = \frac{26400}{Voadj[V] - 0.8[V]} - 5100 \quad [\Omega]$$

< RVAR calculation example >

Voadj [V]	Calculated RVAR[Ω]	RVAR example
3.63	4229	3.9kΩ +330Ω
3.3	5460	5.1kΩ +360Ω
2.5	10429.4	10 kΩ +430Ω
2.0	16900	16kΩ +910Ω
1.8	21300	18kΩ +3.3kΩ
1.5	32614.3	27kΩ +5.6kΩ
1.2	60900	51kΩ +10kΩ
1.0	126900	120kΩ +6.8kΩ
0.8	∞	Open

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7.2. ON/OFF Control

ON/OFF function

The DC-DC Converter can be inactive by using ON/OFF function.

This function is effective when the sequence of a power supply system is constituted.

And it can be used for power-saving control.

In case of not using ON/OFF function

In case of not using ON/OFF function, please left open ON/OFF-pin(9,10pin).

ON/OFF control method

Between ON/OFF-pin(9,10pin) and Vin-pin(1,2pin)

Open.....Output Voltage=ON

Short.....Output Voltage=OFF

8. Reliability

8.1. Humidity

According to JIS-C-0022.

$40\pm 2^{\circ}\text{C}$, 90 to 95%RH, 100 hours. Leave for 4 hours at room temperature.

No damage in appearance and no deviation from electrical characteristics (section 6.1.).

8.2. Temperature Cycles

Repeat cycle 5 times. Leave 2 hours at room temp.

No damage in appearance and no deviation from electrical characteristics (section 6.1)..

Step	Condition	Time
1	$-40^{\circ}\text{C}\pm 3^{\circ}\text{C}$	30 minutes
2	Room Temp.	5-10 minutes
3	$+85^{\circ}\text{C}\pm 2^{\circ}\text{C}$	30 minutes
4	Room Temp.	5-10 minutes

8.3. Vibration

10 to 55Hz, 1.5mm amplitude (1minute cycle), 1 hour for each of X, Y, Z directions.

No damage in appearance and no deviation from electrical characteristics (section 6.1.).

8.4. Mechanical Shock

20G, 1 time for each X, Y, Z directions.

No damage in appearance and no deviation from electrical characteristics (section 6.1.).

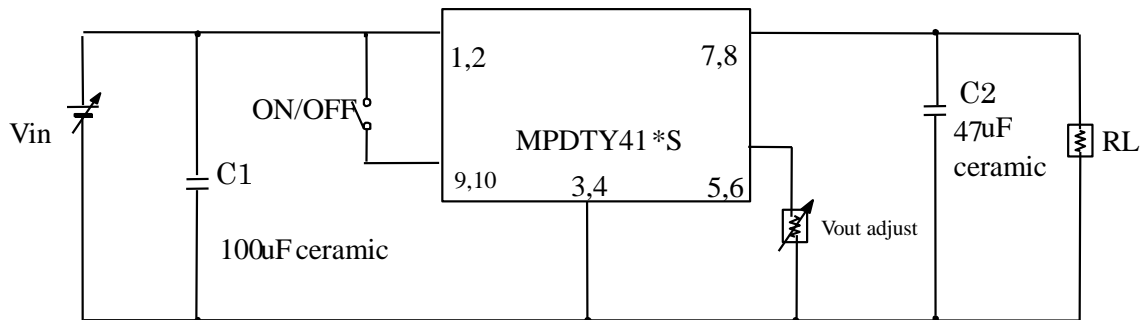
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9. Test Circuit

In the following test circuit, the initial values under item 6.1. should be met.

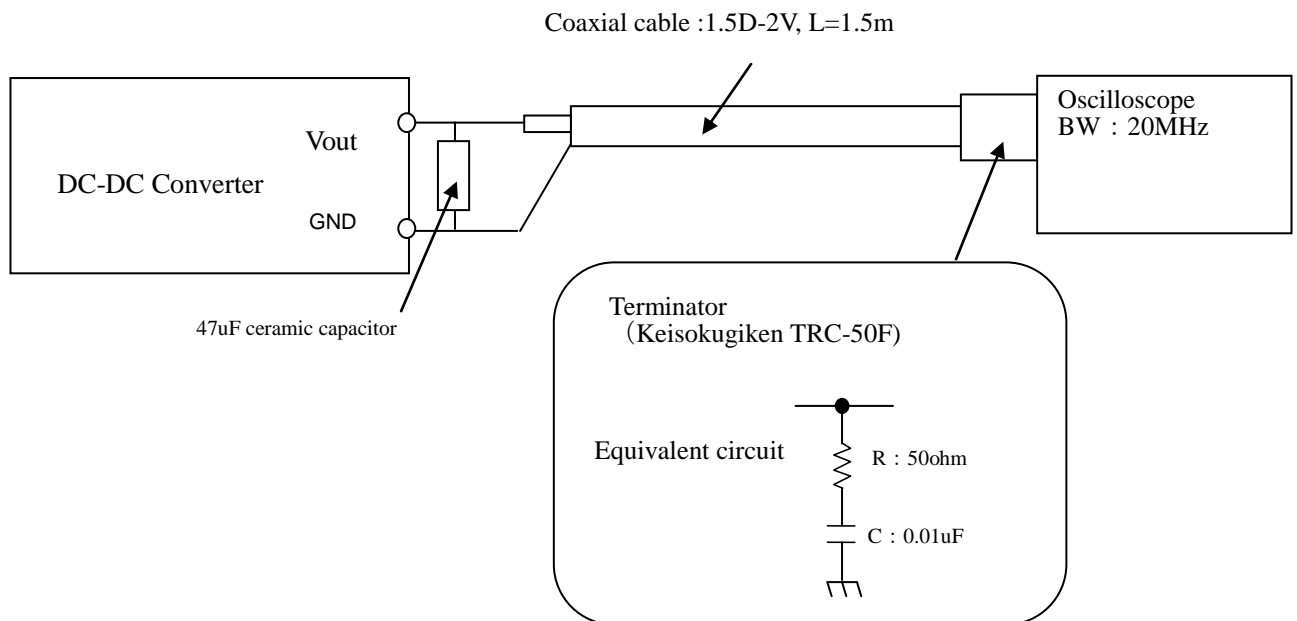
9.1. General Measure Circuit



C1 : 100 μ F/6.3V (Ceramic Capacitor)
C2 : 47 μ F/6.3V (Ceramic Capacitor)

9.2. Ripple Noise Measurement Circuit

Ripple Noise Measurement Circuit

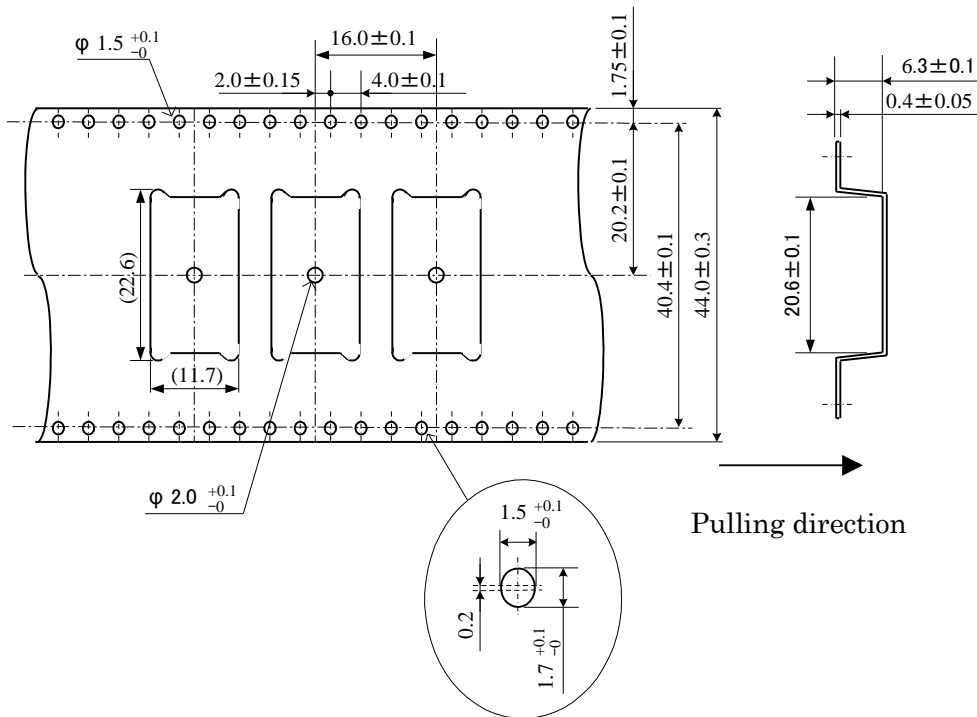


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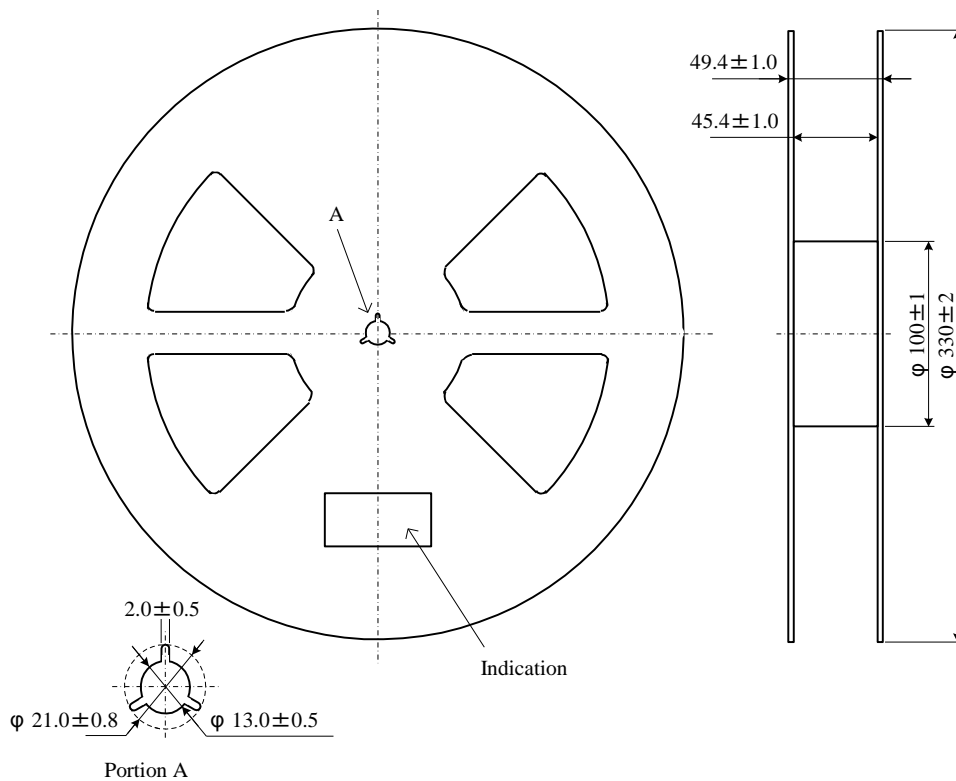
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10. Packaging Specification

10.1. Emboss Tape Dimensions



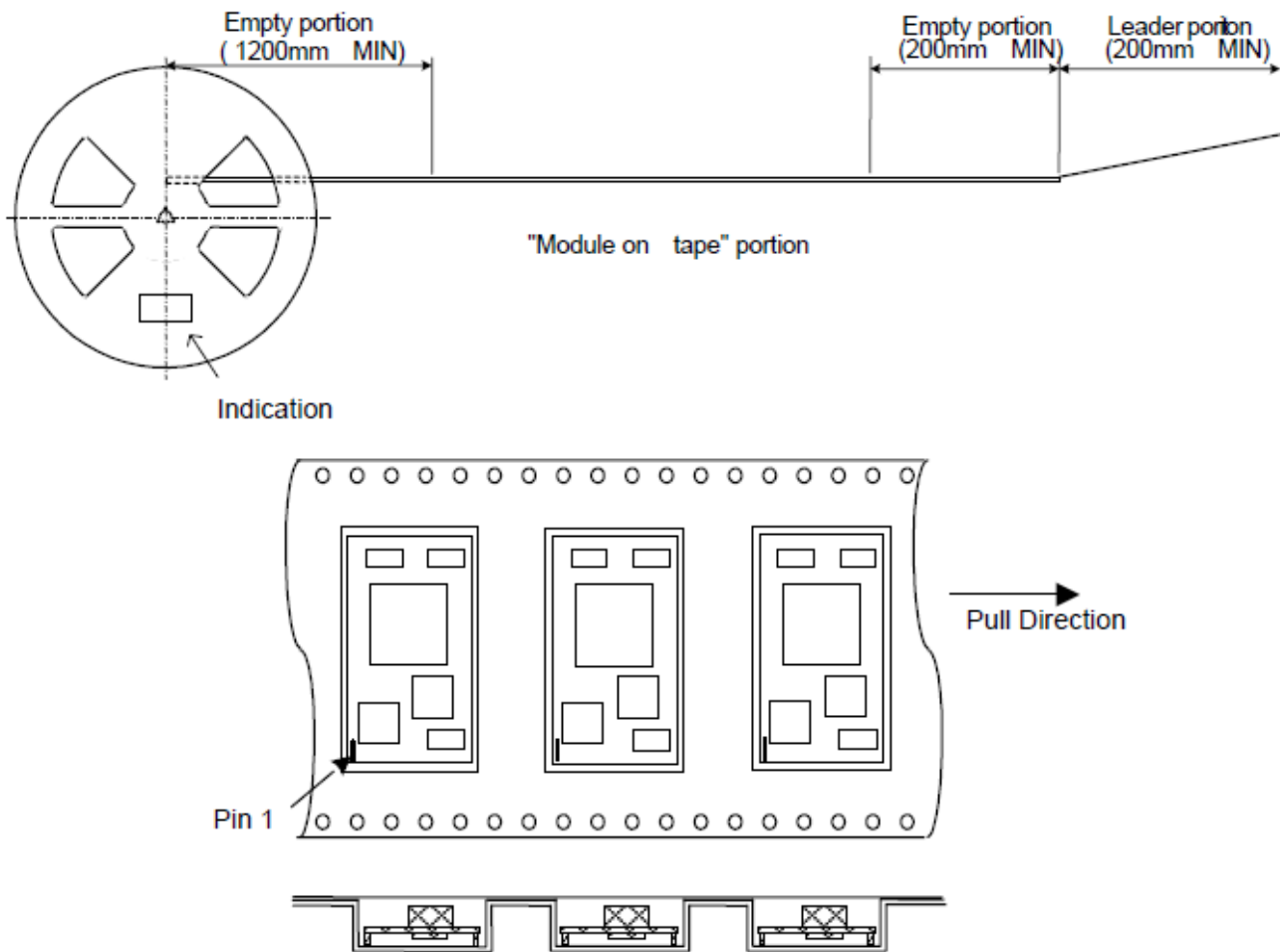
10.2. Real Dimensions



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10.3. Taping Specification



The module is oriented such that the inductor coil is located on the top side and the terminal pins on the bottom side

10.4. Note

1. The adhesive strength of the protective tape must be within 0.1-1N.
2. Each reel contains 300pcs.
3. The deficiency per reel is 0 piece.
4. The reel shows customer part number, Murata part number and quantity.
5. The color of reel is not designated.

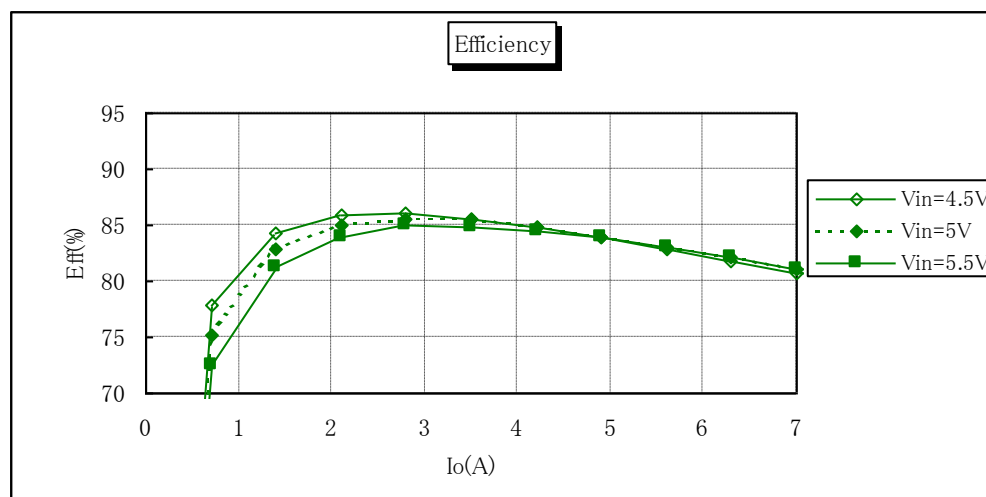
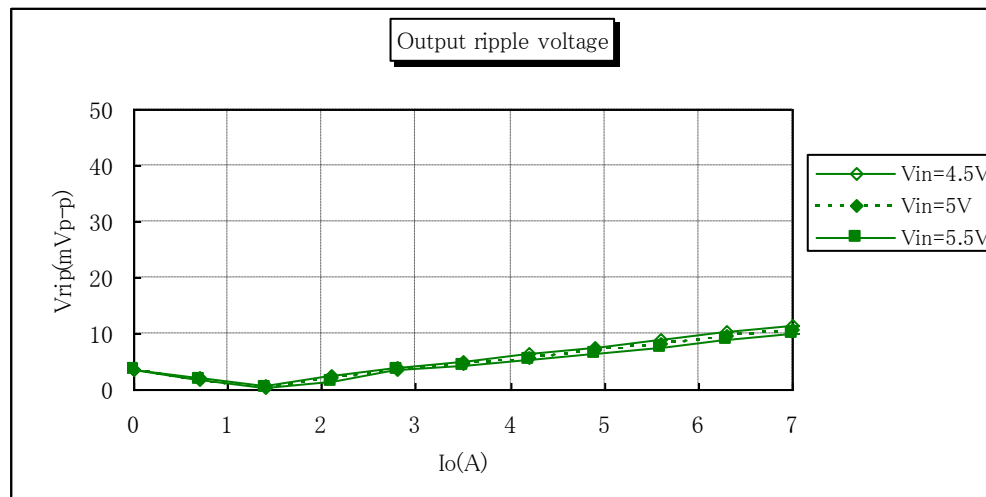
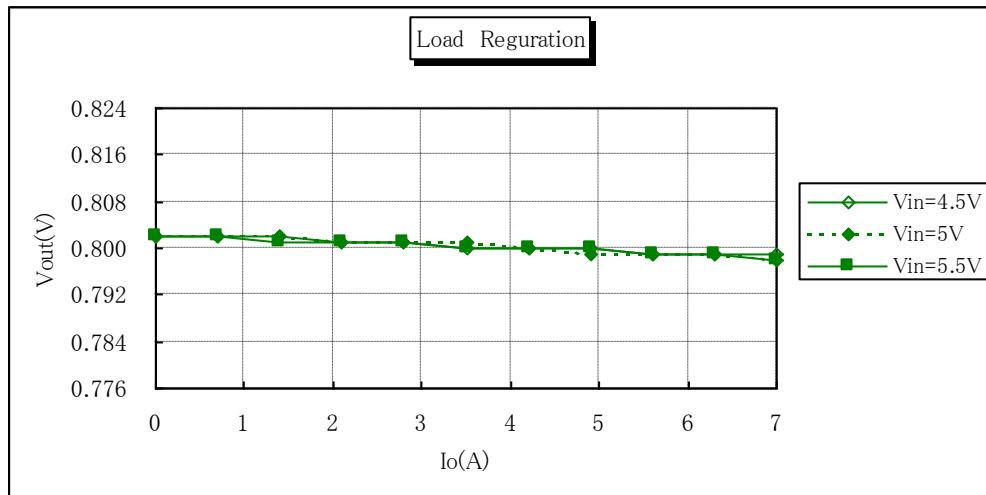
11. Production factory

Komatsu Murata Mfg.Co., Ltd.
 Kanazu Murata Mfg. Co., Ltd.
 Wakura Murata Mfg. Co., Ltd.

⚠ Note:

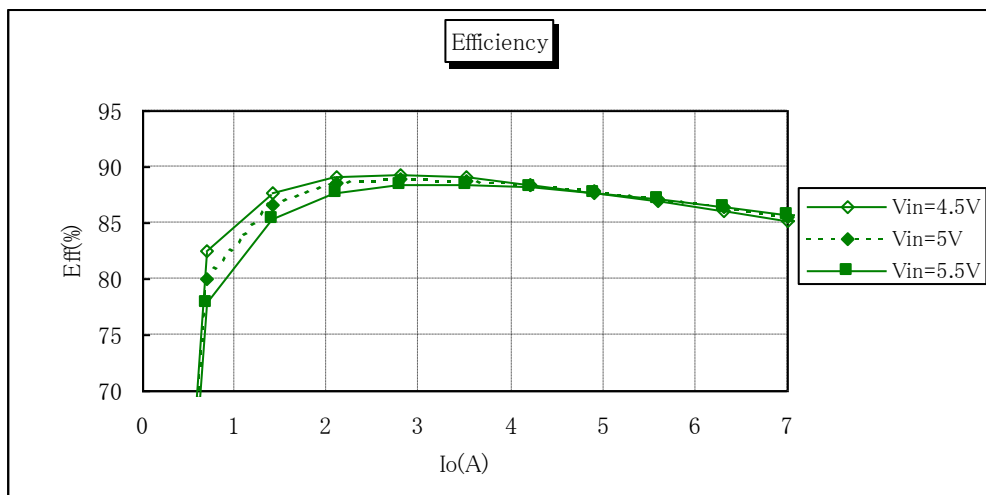
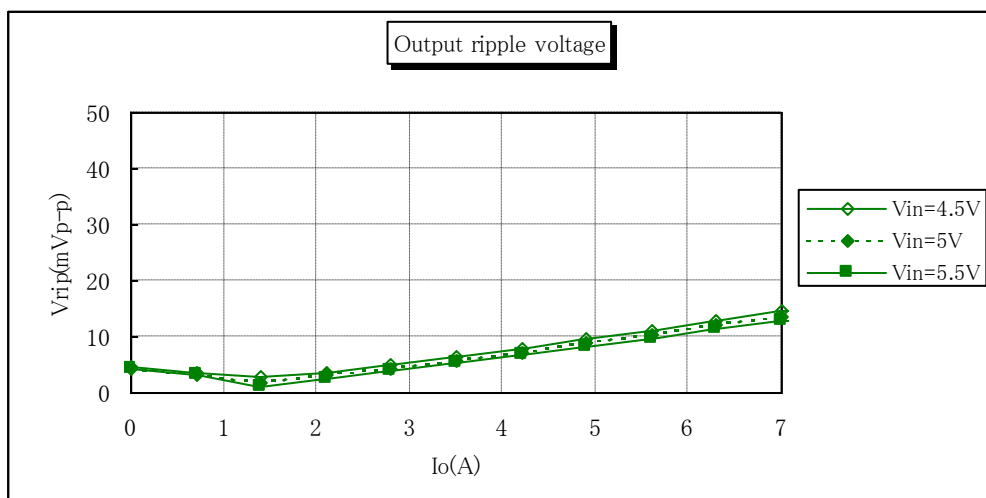
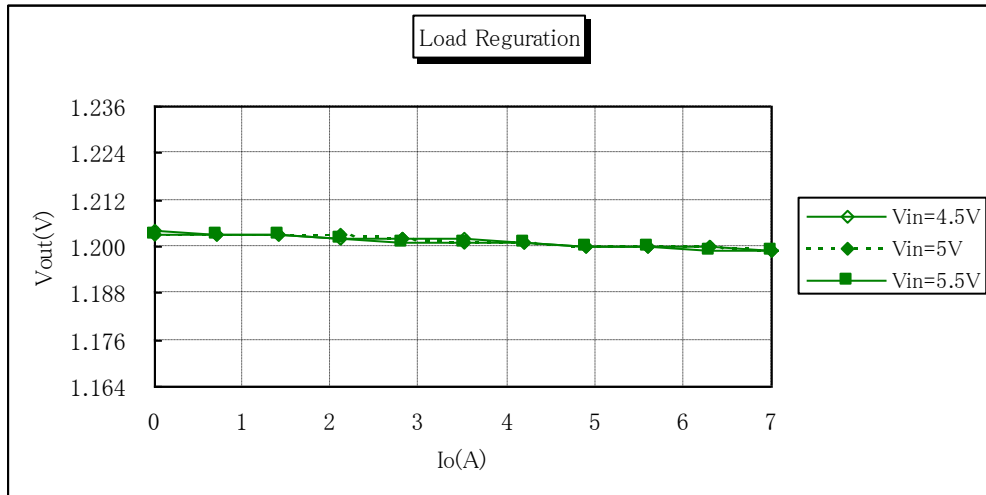
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12. Characteristics Data

12.1 MPDTY411S ($V_{out}=0.8V$)

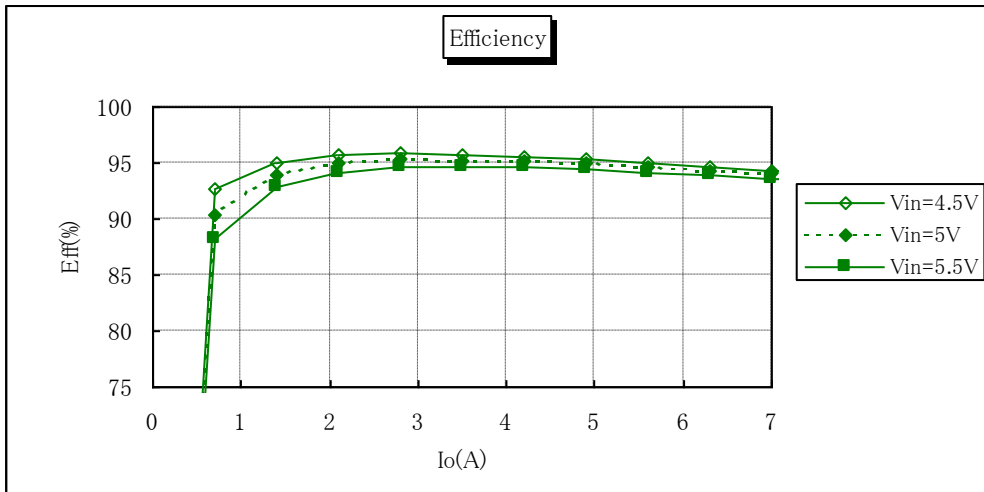
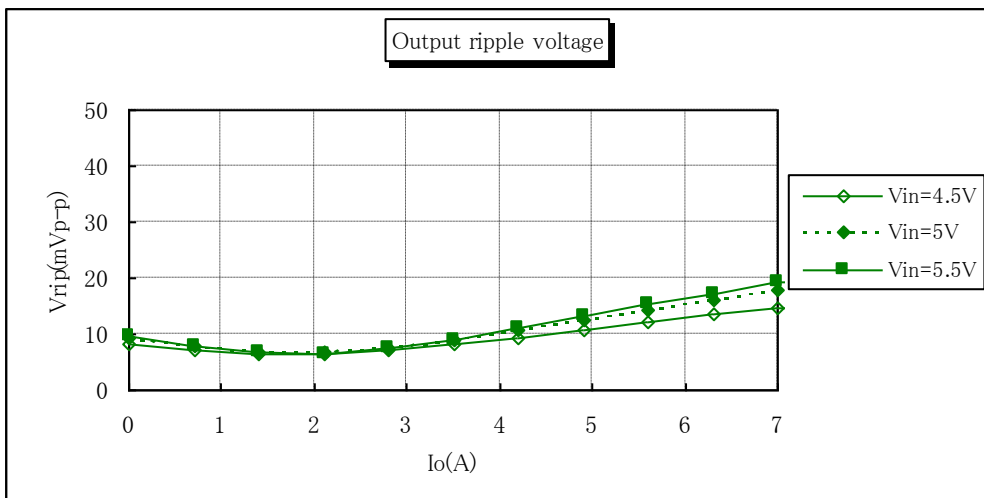
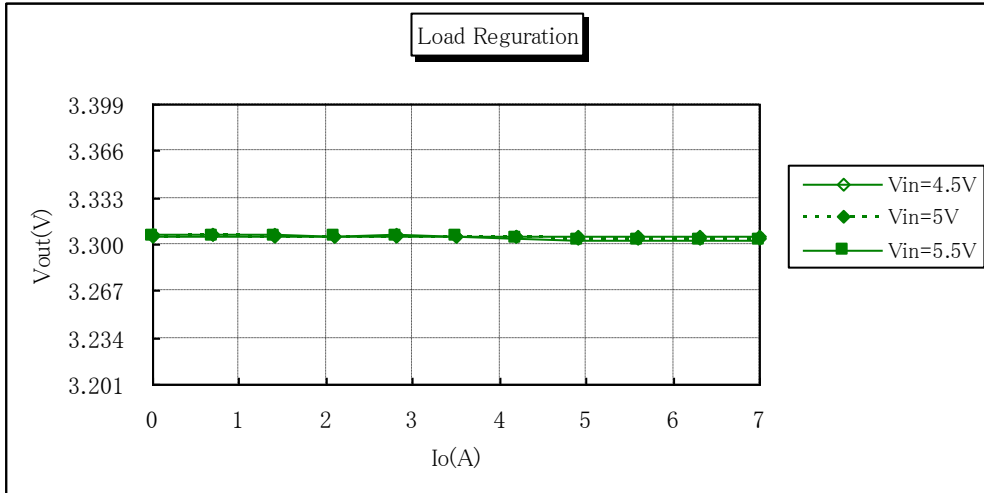
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12.2 MPDTY411S ($V_{out}=1.2V$)

Note:

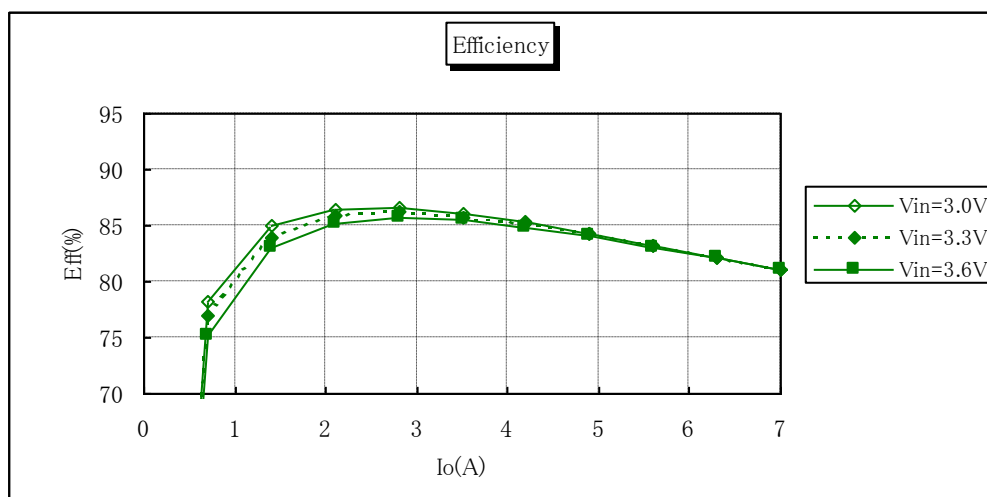
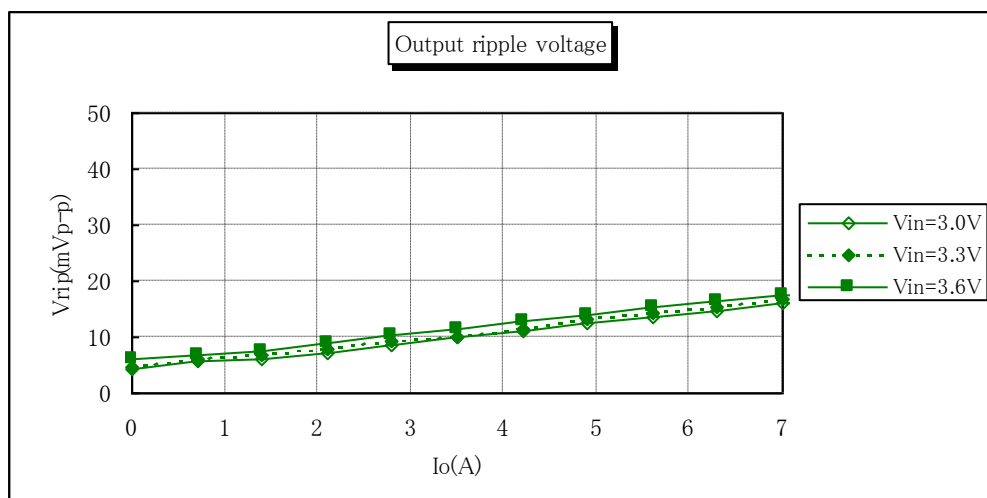
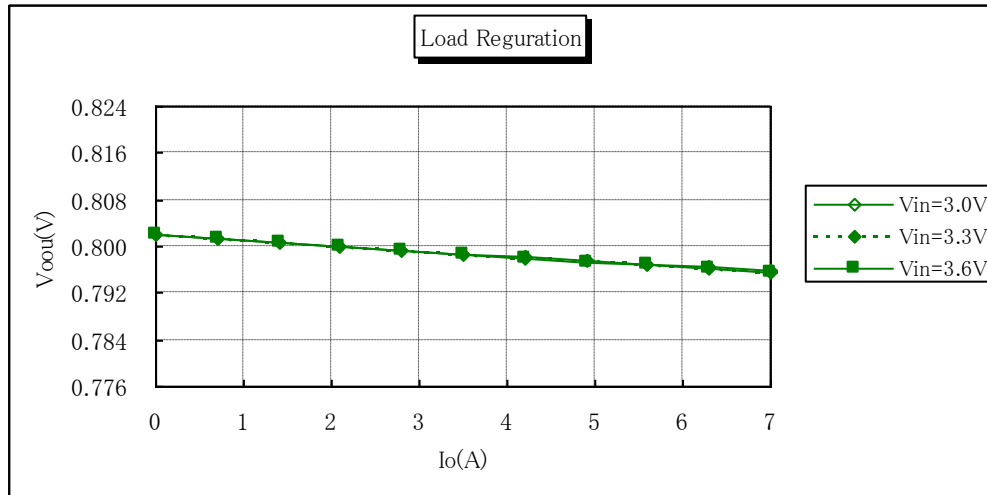
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12.3 MPDTY411S ($V_{out}=3.3V$)

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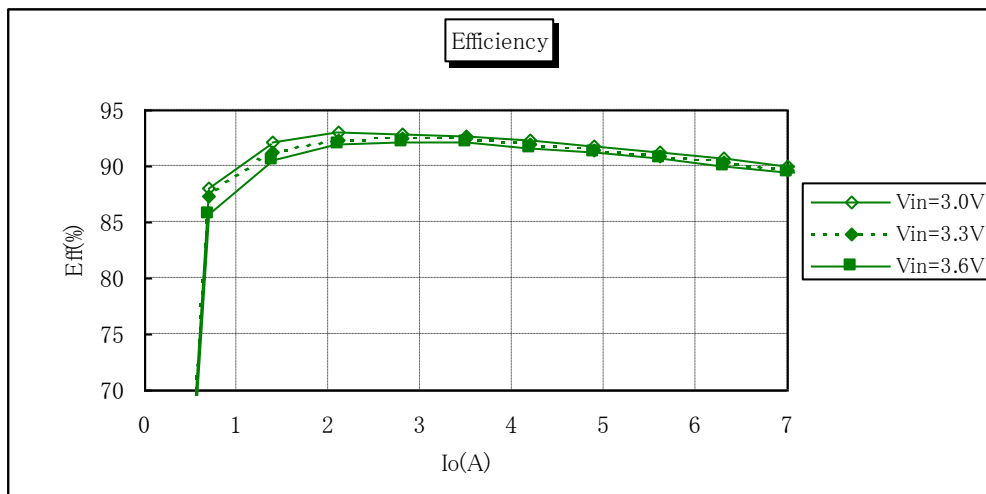
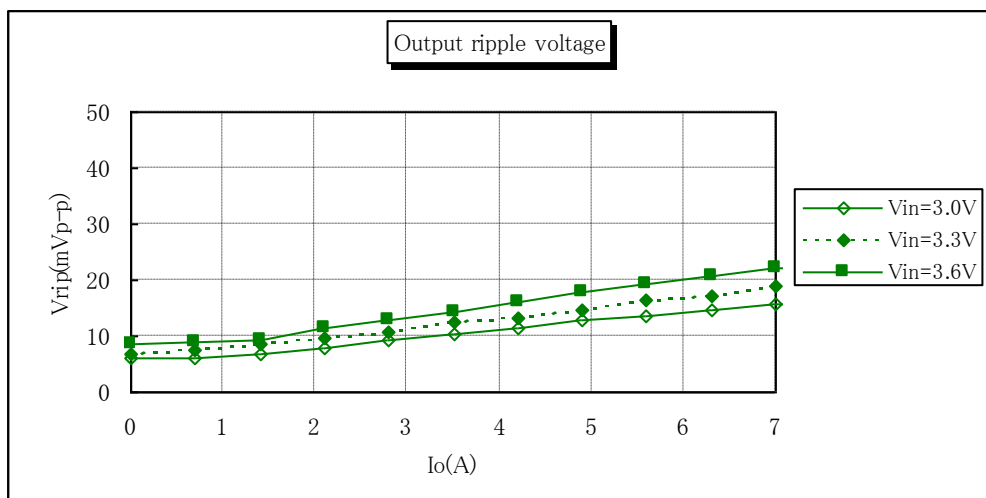
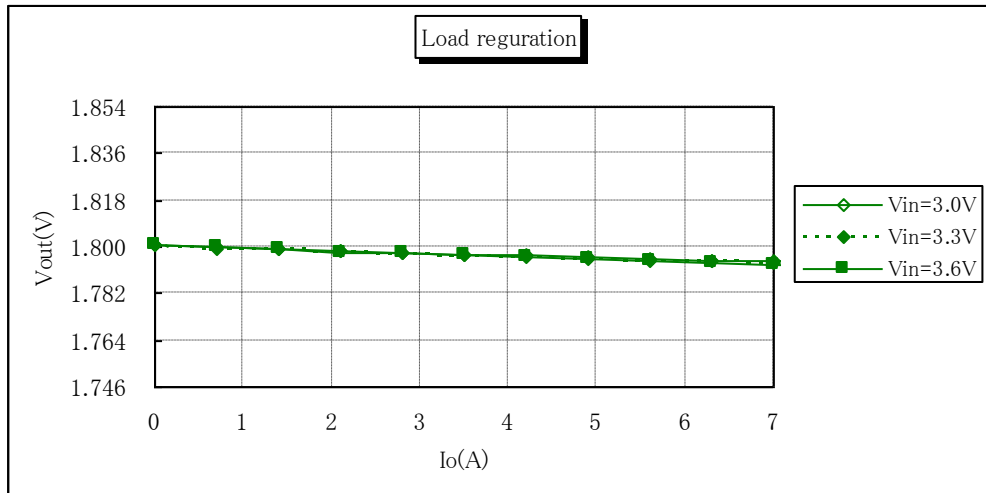
12.4 MPDTY412S (Vout=0.8V)



Note:

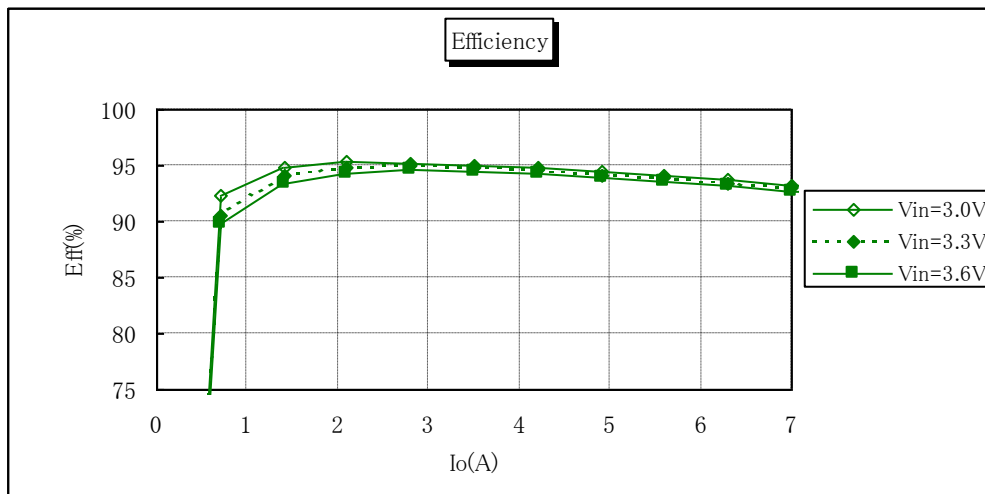
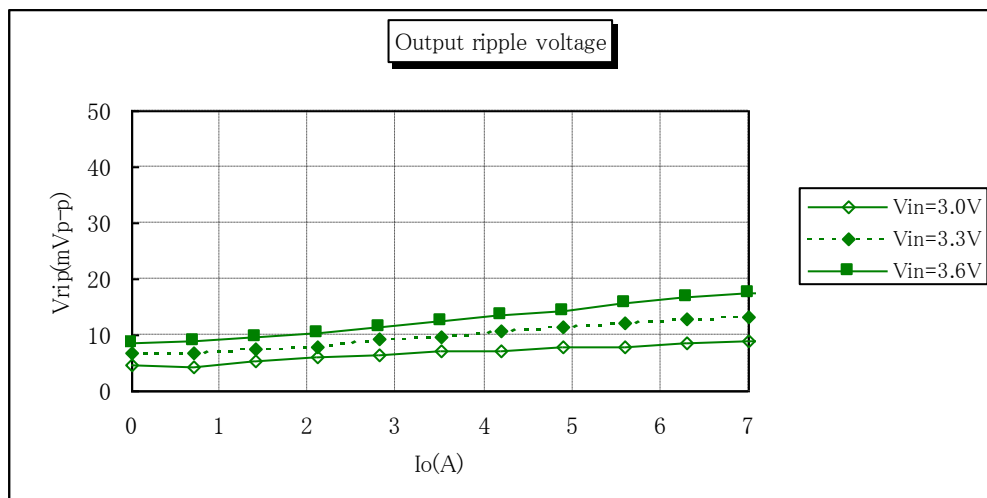
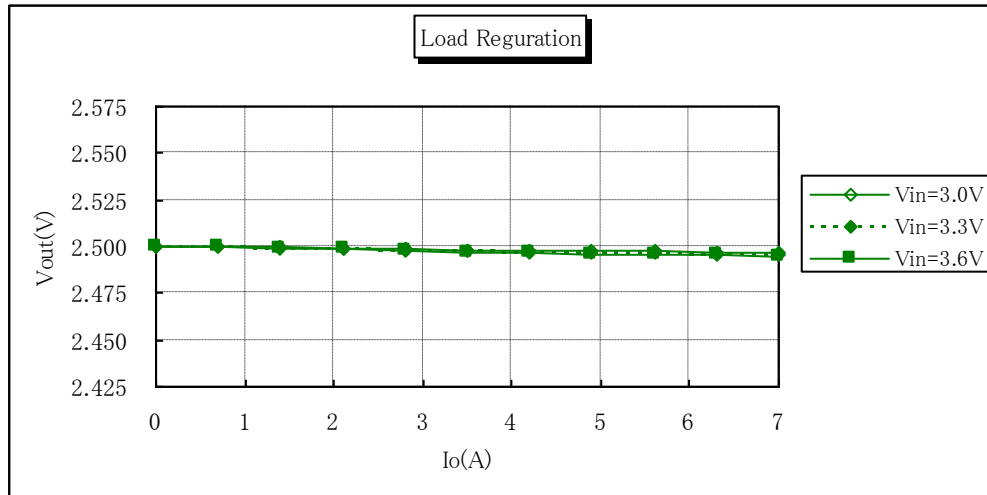
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12.5 MPDXY412S (Vout=1.8V)



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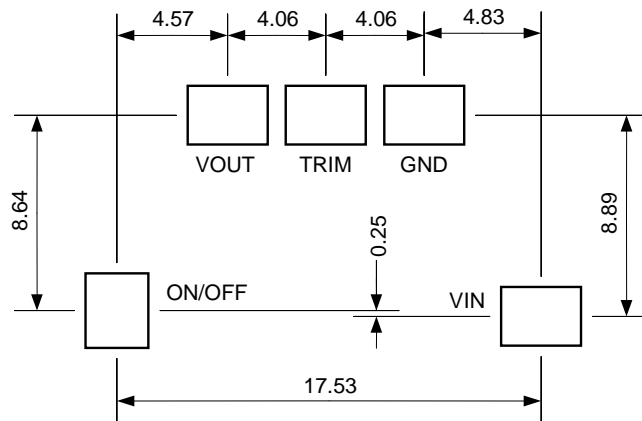
12.6 MPDXY412S ($V_{out}=2.5V$)

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13. Mounting Condition

13.1. PCB Land Pattern Recommendation

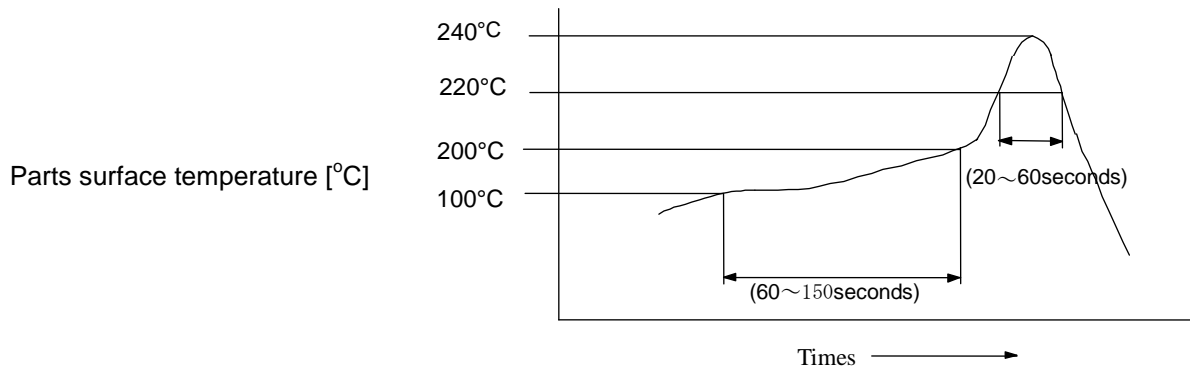


Recommmendable 3.3mm × 2.2mm

13.2. Recommended Soldering Conditions

Reflow Soldering

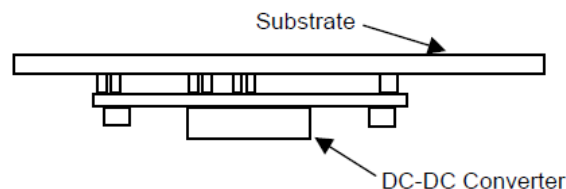
Method	: Full convection reflow soldering
Soldering temperature	: 245°C +0/-5°C (Parts surface temperature)
Soldering time	: 20 to 60 seconds max. (Over 220°C)
Preheating	: 60 to 150 seconds (150-200°C)
Time	: 1 time



※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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14. Notice

14. 1. Input / output capacitor

When an inductance or a switch device is connected to the input line, or when you use a power supply with output inductance as the input voltage source, the input voltage of the DC-DC Converter will be fluctuated.

By this input voltage fluctuation, the transient load response of the DC-DC Converter may be deteriorated or abnormal oscillation may occur. So please confirm normal operation on each application. Please use external input capacitor in order to decrease inductance of input line.

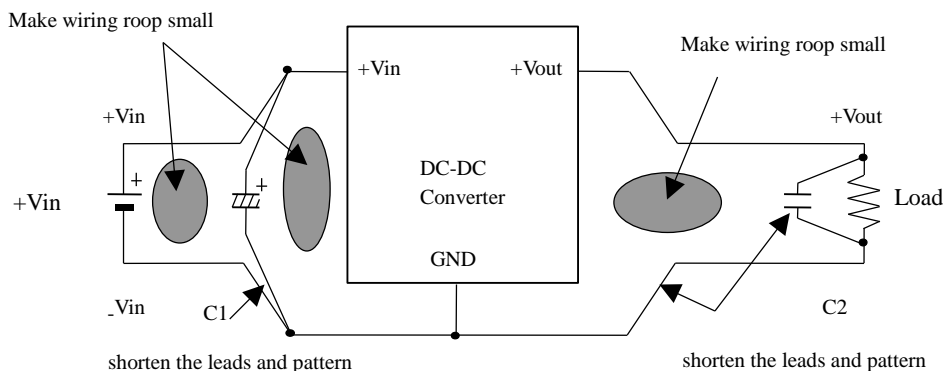
In case you use external output capacitor in order to improve transient load response, please use input capacitor to prevent abnormal oscillation. When you use external capacitors, following capacitors are recommendable.

※Input capacitor C1 : Please use capacitors more than 100 μ F of low impedance in high frequency range.
Output capacitor C2 : Please use capacitors less than 1000 μ F

14. 2. Wiring of input / output capacitor

In the case of input / output capacitor connection, in order to reduce electrical noise, please design PCBs with consideration of the following item.

- ① Please be sure to check normal operation on your system.
- ② Please use low impedance capacitors with good high frequency characteristic.
- ③ Please shorten those leads of each capacitor as much as possible, and make sure the lead inductance low.
- ④ Both input-side and output side, please make the wiring loop between plus and minus as small as possible. The influence of leakage inductance can be reduced.
- ⑤ Please design the print pattern of the main circuit as wide and short as possible.



14. 3. This product could not be operated parallel or series.

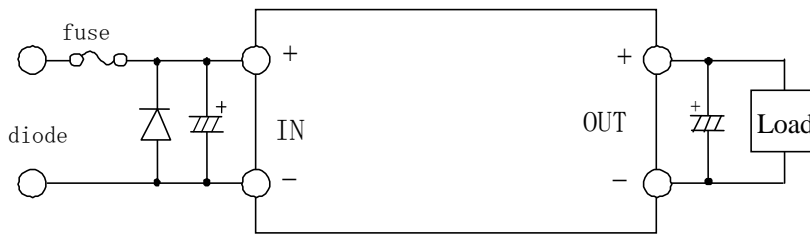
14. 4. Please do not use a connector or a socket for connection with your board of this product. Electrical performance may be deteriorated the influence of contact resistance. Please be sure to mount this product with solder.

14. 5. Be sure to provide an appropriate fail-safe function on your product to prevent a second damage that may be caused by the abnormal function or the failure of our product.

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14. 6. Please connect the input terminal with proper polarity. If you connect wrong polarity, the DC-DC Converter may be broken. In the case of the DC-DC Converter is damaged, abnormal input current may flow in, and abnormal overheat of the DC-DC Converter, or some damage of your products may occur. Please use a diode and a fuse to as following figure.



※Please select diode and fuse after confirming the operation.

14. 7. Cleaning

Please use no-cleaning type flux and do not wash this product.

14.8. Storage

- 14.8.1. Please store the products in room where the temperature/humidity is stable and direct sunlight cannot come in, and use the products within 6 months after delivery.

Please avoid damp and heat or such places where the temperature greatly changes, as water may condense on this product, and the quality of characteristics may be reduced, and/or be the solderability may be degraded.

If this product needs to be stored for a long time (more than 1 year), this product may be degraded in solderability and/or corroded. Please test the solderability of this product regularly.

Baking before reflow process is unnecessary to store the products under 30°C, 60%RH or less up to 6 months.

In case the storage condition is over above mentioned, if these are unpacked condition, please bake them at 125°C ± 5°C/24hour. If these are packed in a tape, please bake them before soldering at 60°C ± 5°C/168hour.

- 14.8.2. Please do not store this product in places such as :

A dusty place, a place exposed directly to sea breeze, or in an atmosphere containing corrosive gas (Cl₂, NH₃, SO₂, NO_x and so on).

⚠ 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.

14. 9 Operational Environment and Operational Conditions

14. 9. 1. Operational Environment

This product is not water-, chemical- or corrosion-proof.

In order to prevent leakage of electricity and abnormal temperature rise of the product, do not operate under the following environmental conditions:

- (1) An atmosphere containing corrosive gas (Cl₂, NH₃, SO₂, NO_x and so on)
- (2) A high-dust environment
- (3) Under the exposure of direct sunlight
- (4) A location where the likelihood of exposure to water or water condensation exists.
- (5) A location exposed to ocean air
- (6) Any locations similar to the above

14. 9. 2. Operational Conditions

Please use this product within specified values (power supply, temperature, input, output and load condition, and so on). If the product is exposed to conditions outside of the specified values reliability of the product may be adversely effected.

14. 9. 3. Note prior to use

Diminished reliability and/ or failure may result if the product is exposed to a high-level static charge, over-rated voltage or reverse voltage. Please avoid the following conditions be avoided prior to use of the product:

- (1) Supply of power outside of rated values (see section 8)
- (2) Supply of reverse power or inadequate connection of a 0 V(DC)line
- (3) Electrostatic discharge from production line and/ or operator
- (4) Electrification of the product from electrostatic induction
- (5) Excessive mechanical shock

14. 10. Transportation

Murata recommends that when transporting this product, it be packed so as to avoid damage by mechanical

vibration or exposure to adverse conditions such as ocean air, high humidity. It is additionally recommended

that appropriate instructions and guidelines be communicated to carriers to prevent exposure to these same conditions.



Note

1. Murata recommends that customers ensure that the evaluation and testing of these devices are completed with this product actually assembled on their product.
2. 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.

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

3. This DATA Sheet 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.

Note:

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