DC-DC Converter Specification

1. Application

This product specification applies to DC-DC Converter,
MPDTY1__S series.

2. Customer Reference

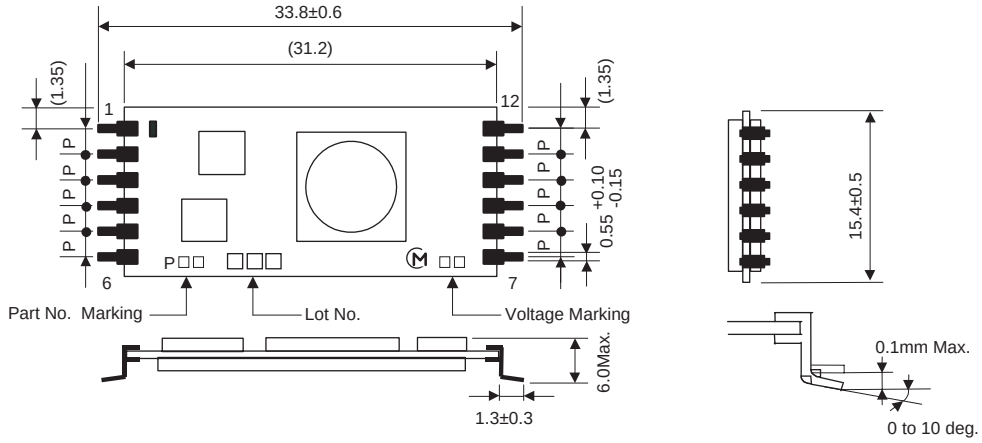
Customer Spec. Number

Customer Part Number

3. Murata Part Number

MPDTY1__S (__ represents 11 to 27.)

4. Appearance and Dimensions



*Distance between the centers of leads. P=2.54±0.3mm Tolerance is not accumulated. (in mm)
( ) … Reference Value

Pin No.	Signal	Pin No.	Signal
1.	On/Off	7.	GND
2.	VIN	8.	GND
3.	VIN	9.	Vout
4.	VIN	10.	Vout
5.	GND	11.	Vout
6.	GND	12.	Adjust

Marking

Part No. P□□ (Refer to Table 1.)
MFG ID Ⓜ
Lot No. □□□ (①②③)

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

1 Pin marking ▮
Voltage Marking □□ (①②) (Refer to Table 2.)

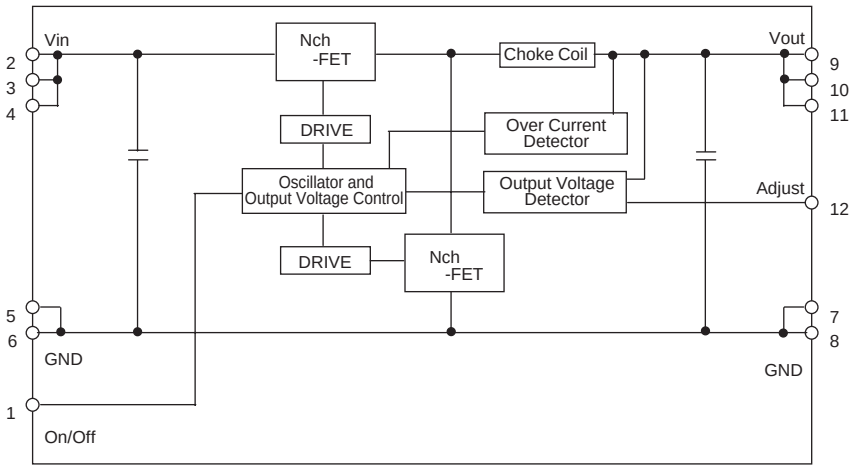
Table 1 Part Number Marking

Part No	Marking	Part No	Marking
MPDTY111S	PJS	MPDTY121S	PKE
MPDTY112S	PJN	MPDTY122S	PKF
MPDTY113S	PJT	MPDTY123S	PKG
MPDTY114S	PJU	MPDTY124S	PKH
MPDTY115S	PJP	MPDTY125S	PKJ
MPDTY116S	PJR	MPDTY126S	PKK
		MPDTY127S	PKL

Table 2 Voltage Marking

	Voltage Marking	
(1) Input Voltage	3.3V	1
	5.0V	2
(2) Output Voltage	1.0V	1
	1.2V	2
	1.5V	3
	1.8V	4
	2.0V	5
	2.5V	6
	3.3V	7

5. Block Diagram



6. Environmental Conditions

Ambient Temperature : -40 to +85 degreeC (Please refer to a temperature derating table.)
Ambient Humidity : 10 to 85% (No condensation.)
Storage Temperature : -40 to +85 degreeC
Storage Humidity : 5 to 90% (No condensation.)

7. Absolute Maximum Ratings

Input Voltage Range

Vin : 0 to 4.6 V (MPDTY11_S)
0 to 6.3 V (MPDTY12_S)
On/Off : 0 to 6.3 V
Adjust : 0 to Vin

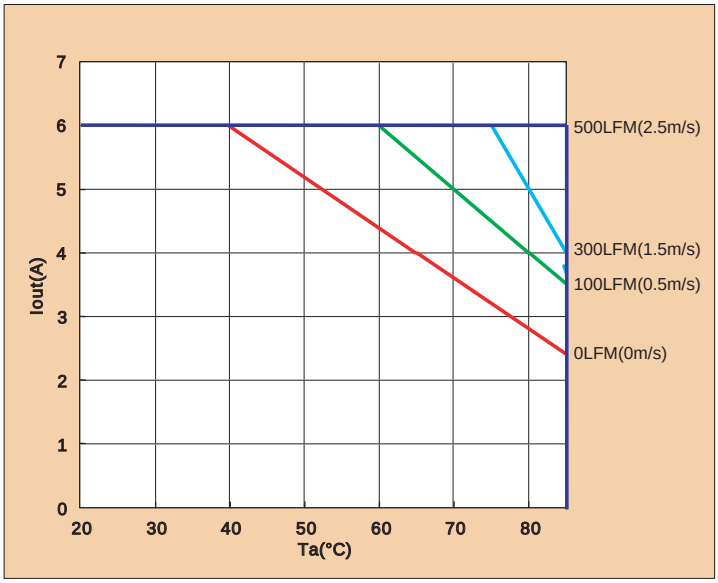
8. Electrical Characteristics (Ta=25 degreeC)

Test circuit is indicated in Section 10.

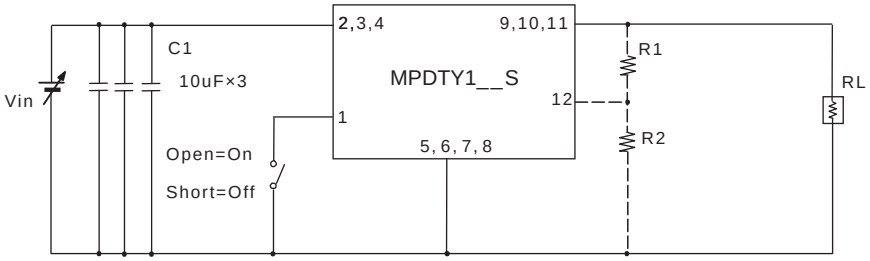
Item	Symbol	Condition	Part Number	Value			Unit
				Min.	Typ.	Max.	
Input Voltage	Vin		MPDTY12_S	4.5	5.0	5.5	V
			MPDTY11_S	2.97	3.3	3.63	
Output Voltage	Vout	Vin=4.50 to 5.50V(02_S) Vin=2.97 to 3.63V(01_S) Iout=0 to 6A Adjust=Open On/Off=Open	MPDTY127S MPDTY1_6S MPDTY1_5S MPDTY1_4S MPDTY1_3S MPDTY1_2S MPDTY1_1S	3.201 2.425 1.940 1.746 1.455 1.164 0.970	3.3 2.5 2.0 1.8 1.5 1.2 1.0	3.399 2.575 2.060 1.854 1.545 1.236 1.030	V
Output Voltage Adjustable Range	Vout (adj)	Vin=4.50 to 5.50V(02_S) Vin>Vout+1.0V Iout= 0 to 6A	MPDTY12_S	-10		10	%
		Vin=2.97 to 3.63V(01_S) Vin>Vout+0.5V Iout=0 to 6A	MPDTY11_S	-10		10	
Output Current	Iout		All	0		6.0	A
Ripple Voltage	Vripl	Vin=5.0V, Iout=6A	MPDTY12_S		50	100	mV (p-p)
		Vin=3.3V, Iout=6A	MPDTY11_S		40	80	
Efficiency	η	Vin=5.0V, Iout=4A	MPDTY127S MPDTY126S MPDTY125S MPDTY124S MPDTY123S MPDTY122S MPDTY121S		93 91 89 88 86 84 82		%
		Vin=3.3V, Iout=4A	MPDTY116S MPDTY115S MPDTY114S MPDTY113S MPDTY112S MPDTY111S		93 92 90 89 87 84		
On/Off pin High Level Voltage	VIH	All	MPDTY11_S	2.7			V
			MPDTY12_S	4.2			
On/Off pin Low Level Voltage	VIL	All	MPDTY11_S			0.4	
			MPDTY12_S			1.2	
Protection		If output is shorted to GND, or the module is heated abnormally, the DC-DC Converter will shut down. After correction of the abnormal condition, the DC-DC Converter will restart by re-inputting Vin or toggling On/Off pin.					

9. Typical Temperature Derating

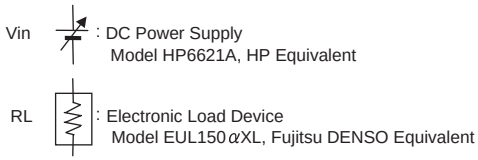
When using this product at the ambient temperature of 40 degreeC or more please use according to the following temperature derating.



10. Test Circuit

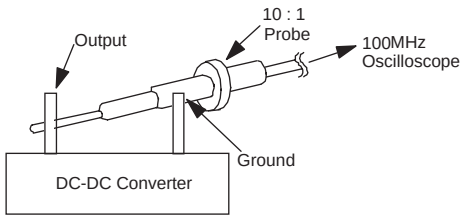


C1: GRM42-6B106K10×3 parallel (Murata)



Pin5, 6, 7 and 8 are connected inside of DC-DC Converter.
However, please provide external connectivity as well in order to prevent noise-induced malfunction.

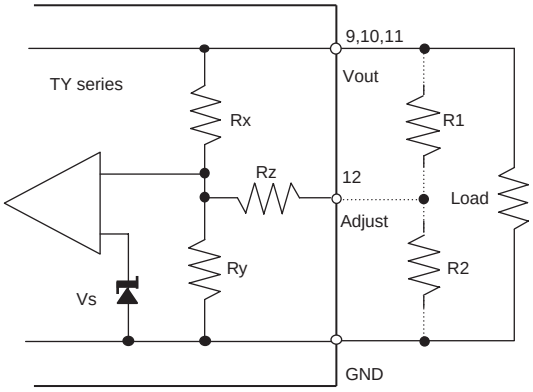
*Ripple Noise Test



11. Output Voltage Trim Adjustment

· When the Adjust-pin (pin12) is left open, the DC-DC Converter provides the nominal output voltage.
· Resistors connected between Adjust-pin (pin12) to Vout-pin (9 to 11) will decrease the output voltage to between 90 to 100% of the nominal output voltage. (Vout-Down Control)
· Resistors connected between Adjust-pin (pin12) to GND-pin (pin5 to 8) will increase the output voltage to between 100 to 110% of the nominal output voltage. (Vout-Up Control)
· The following equations give the required external-resistor value to adjust the output voltage to Voadj.
When you change the output voltage, it is necessary to evaluate the characteristics of DC-DC Converter under your specific board conditions.
· When using Vout-Up control the input voltage must be maintained at the following level: (Vin>Vout+α).

MPDTY11_S (Vin=3.3V)	Vin＞Vout+0.5V
MPDTY12_S (Vin=5V)	Vin＞Vout+1.0V



● When trim adjusting the output voltage down,

$$R1 = \frac{Rx \cdot Ry(Vout - Vs)}{Rx \cdot Vs - Ry(Vout - Vs)} - Rz$$

$$R2 = \text{Open}$$

● When trim adjusting the output voltage up,

$$R1 = \text{Open}$$

$$R2 = \frac{Rx \cdot Ry \cdot Vs}{Ry(Vout - Vs) - Rx \cdot Vs} - Rz$$

<Internal Parameter of DC-DC Converter>

Product Name		MPDTY1_1S	MPDTY1_2S	MPDTY1_3S	MPDTY1_4S	MPDTY1_5S	MPDTY1_6S	MPDTY127S
Nominal Output Voltage	(V)	1.0	1.2	1.5	1.8	2.0	2.5	3.3
Rx	(kΩ)	4.7	3.6	4.7	4.7	5.6	6.8	8.2
Ry	(kΩ)	29.73	14.64	16.16	8.40	7.00	6.80	4.60
Rz	(kΩ)	1.0	1.0	2.2	5.6	10.0	15.0	18.0
Vs	(V)	0.864	0.963	1.162	1.154	1.111	1.250	1.186

12. Reliability

12-1 Humidity

According to JIS-C-0022.
40±2 degreeC, 90 to 95 %RH, 100 hours.
Leave for 4 hours at room temperature.
No damage in appearance and no deviation from electrical characteristics.

12-2 Temperature Cycles

Step	Temp.	Period.
1	-40±3°C	30 minutes
2	at room temp.	5 to 10 minutes
3	+85±3°C	30 minutes
4	at room temp.	5 to 10 minutes

Repeat cycle 5 times.
Leave 2 hours at room temp.
No damage in appearance and no deviation from electrical characteristics.

12-3 Vibration

10 to 55Hz, 1.5mm amplitude, 1 hour for each of X, Y, Z directions.
No damage in appearance and no deviation from electrical characteristics.

12-4 Mechanical Shock

20G, 1 time for each X, Y, Z directions.
No damage in appearance and no deviation from electrical characteristics.

12-5 Soldering Heat Resistance (JIS C 0050)

Immerse lead pins in a solder bath of 260±5 degreeC for 3±0.5s.
Then products under test are left for 2 hours.
No damage in appearance and no deviation from electrical characteristics

12-6 Lead Pin Strength

Strain one lead pin by gradually-increasing to 5.0N along axial direction; maintaining for 5s.
No damage to the lead pin.

12-7 Solderability of Leads

The lead pins will be immersed in the isopropyl alcohol (JIS K 1522) with Rosin (JIS K 5902) solution (the concentration of Rosin allowed is 10 to 35wt%, and normally approx. 25wt% will be used without any specific requirement.).
Then the lead pins will be immersed in the solder H63A (JIS Z 3282) solution at the temperature of 230±5 degreeC for 3±0.5 seconds, and pulled up completely.
The solder will adhere to over 75% of immersed area.

13. Packaging Specification

13-1 Packing Form

These are packed in a tray. (See Fig.1)

13-2 The number of products in a package specification are from 40 pcs./tray

If the number of products is a fraction of this increment, packaging may not follow this specification.

13-3 Packaging Form

These trays are packed in a corrugated box by stacking each, alternately, in a 180° orientation. (See Fig.2)

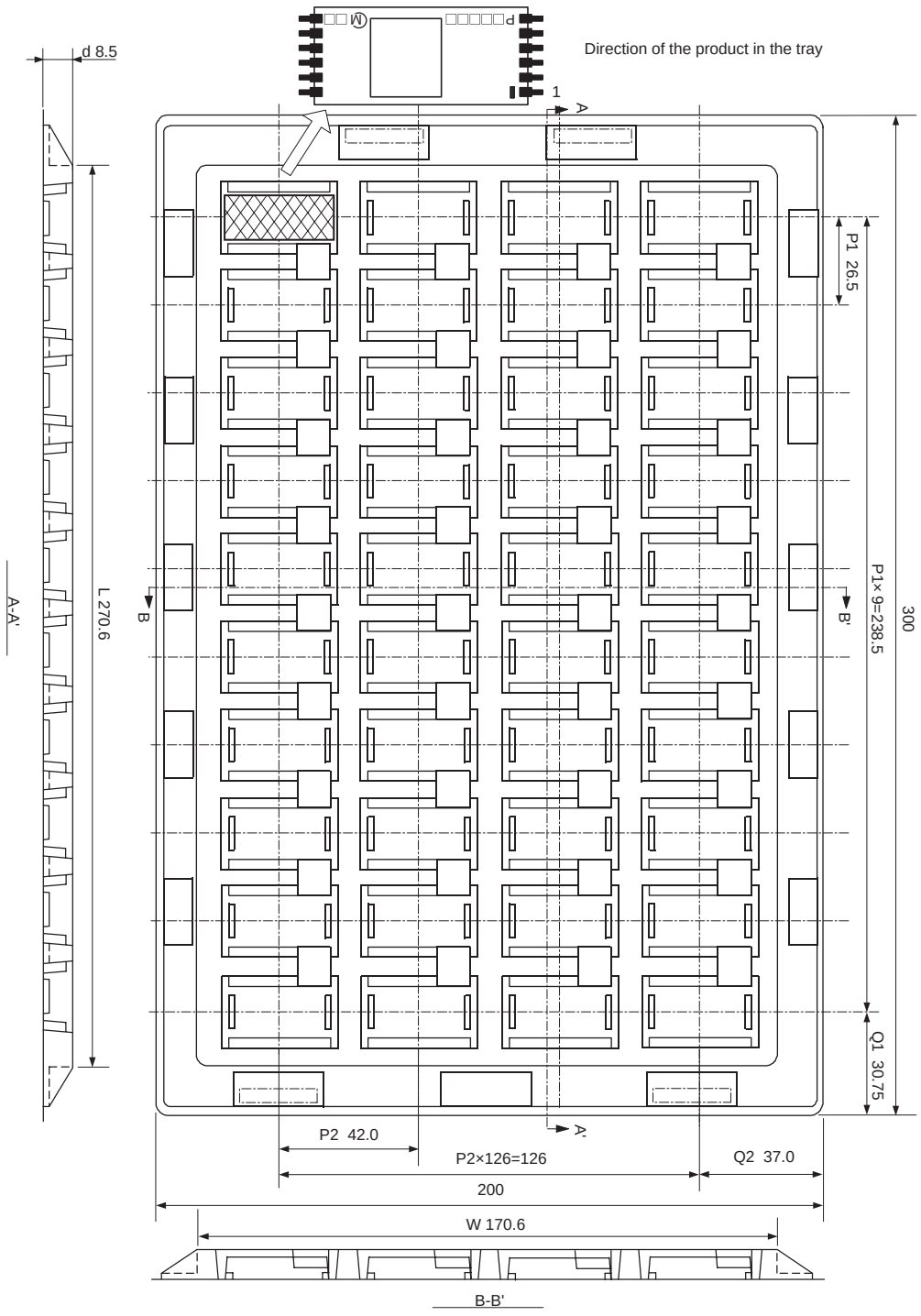

Direction of the product in the tray
1
A
A'
B
B'
d 8.5
L 270.6
A-A'
P1 26.5
P1×9=238.5
300
Q1 30.75
P2 42.0
P2×126=126
Q2 37.0
200
W 170.6
B-B'

Fig.1

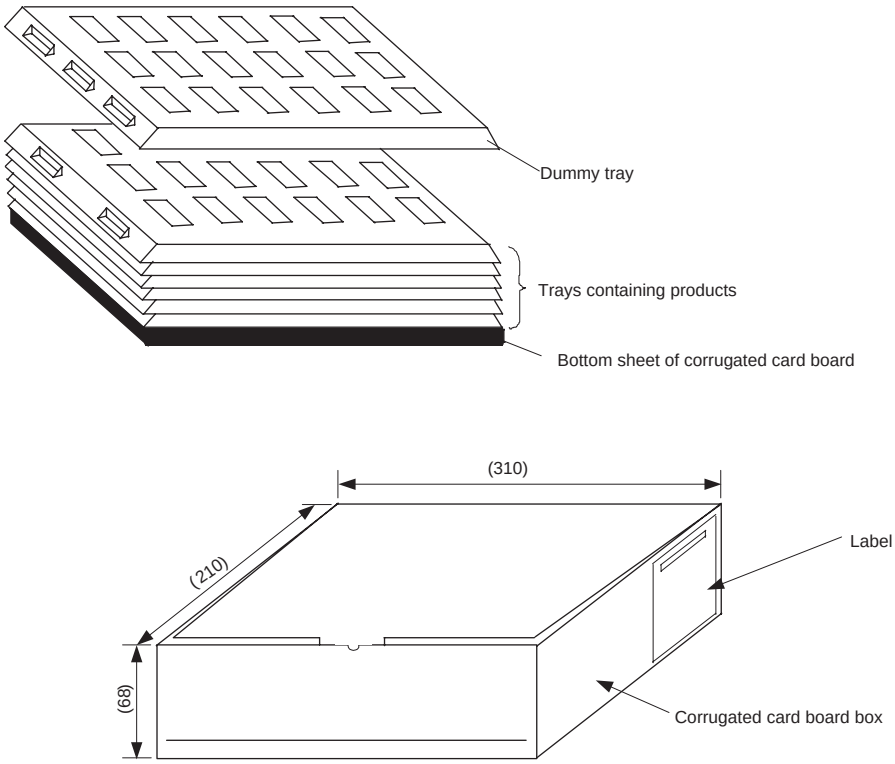


Fig. 2

Numerals in parentheses are reference only. (in mm)

Label; written by : Part Number
: Quantity
: Inspection Number

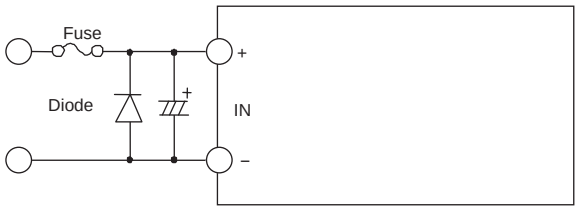
14. Production factories

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

15. ⚠ Caution

1. Be sure to provide an appropriate fail-safe function on your product to prevent secondary damage that may be caused due to abnormal function or failure of the DC-DC Converter.

2. Please connect the input terminals with the correct polarity. If an error in polarity connection is made the DC-DC Converter may be damaged. If the DC-DC Converter is damaged internally, an elevated input current may flow, and so the DC-DC Converter 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.



Fuse Standard: Current Rating
MPDTY11_S : 0.8×*IoutMax.* ×*Vout* (A)
MPDTY12_S : 0.6×*IoutMax.* ×*Vout* (A)
Please select diode and fuse after confirming operation.

3. Please contact us 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.

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.

16. Notice

16-1 Soldering

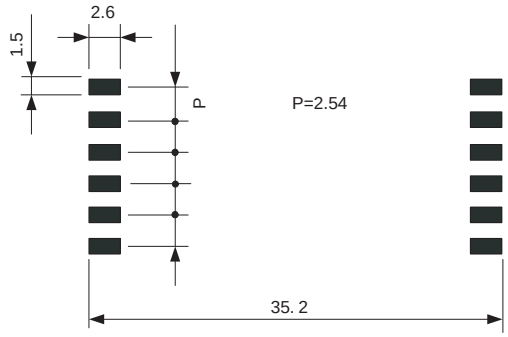
16-1-1 Flux

Please solder the products with Rosin Flux (0.2wt%. chloride or less).
Do not use acid or soluble flux, because they may damage metallic parts and glass parts and may cause defective or low quality of products.

16-1-2 Solder

Please use the solder H60, H63 (in JIS Z 3282) or an equivalent type.
Please use the same type solder as stated above when using solder paste.

16-1-3 Recommended Solder Land Pattern



16-1-4 Recommended Solder Conditions

Reflow Soldering

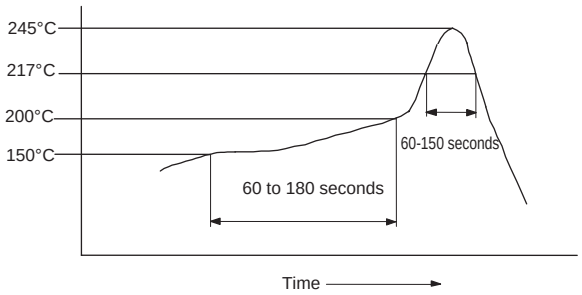
Reflow Soldering Profiles

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

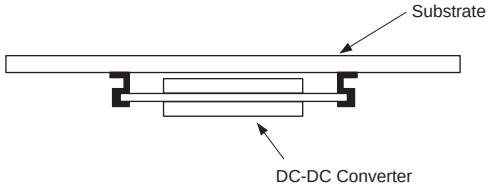
Profile details

Soldering temperature	: 245±5 degreeC
Soldering time	: 10 to 30 seconds, 240 to 245 degreeC
Heating time	: 60 to 150 seconds, over 217 degreeC
Preheating time	: 60 to 180 seconds, 150 to 200 degreeC
Ramp-up rate	: 3 degreeC/sec. Max., 217 to 245 degreeC
Ramp-down rate	: 6 degreeC/sec. Max.
Total soldering time	: 8 minutes Max., 25 to 245 degreeC
Times	: 1 time

Parts Surface Temperature



*Do not allow the products to vibrate during reflow.
Please carefully regulate temperature control as mounted components may separate from the product if the product are left under high temperature for an extended time period.
If reflowing the DC-DC Converter as follows, it is necessary to provide a resin stop as DC-DC Converter may fall from a substrate during reflow.



·Reconditioning of the solder after reflow

Perform within 3 seconds while the temperature of soldering iron is +300±10 degreeC, and it's power is 30W or less.
Do not put the edge of soldering iron and solder on the lead of product. Instead put on the end of solder land.

16-2 Cleaning

16-2-1 Please clean the products to remove flux from them using the dipping, boiling, and vapor methods in isopropyl alcohol for up to 5 minutes. Please inform us if you are to use aqueous or semi-aqueous cleaning or another methods.
Do not use ultrasonic cleaning as semiconductor devices on the products, may be damaged by resonance.

16-2-2 After cleaning, please dry the products thoroughly. If you touch the products that have not been dried enough, you must take care because the products markings may thin or blur.
Do not measure electrical characteristics, until the products are completely dry.

16-2-3 If you use no-clean flux and do not clean our products, you must confirm the reliability of the products fully in advance.

16-3 Storage

16-3-1 Please store the products in a room where the temperature/humidity is stable and direct sunlight does not enter Use the products within 6 months after delivery.
Avoid damp heated places or such places where there are large temperature changes, as water may condense on the products, and the quality of characteristics may be reduced and/or the solderability may be degraded. If you must store the products for a long time (more than 1 year), use caution because the products may degrade in solderability and/or corrode.
Please confirm the solderability and characteristics for the products regularly.

16-3-2 Please do not store the products in places such as: A dusty place, a place exposed directly to sea breeze, or in an atmosphere containing corrosive gas (Cl_2, NH_3, SO_2, NO_X and so on).

16-4 Operational Environment and Operational Conditions

16-4-1 Operational Environment
The products are not waterproof, chemical-proof or corrosion-proof.
In order to prevent leakage of electricity and abnormal temperature increase of the products, do not use the products under the following circumstances:
(1) in an atmosphere containing corrosive gas (Cl_2, NH_3, SO_2, NO_X and so on)
(2) in a dusty place
(3) in a place exposed to direct sunlight
(4) in such a place where water splashes or in such a humid place where water condenses
(5) in a place exposed to sea breeze
(6) in any other places similar to the above (1) through (5)

16-4-2 Operational Conditions
Please use the products within specified values (power supply, temperature, input, output and load condition, and so on). As the input voltage may drop due to impedance, please make sure that the input voltage is included in specified values.
If you use the products outside of the specified values, it may break the products, reduce the quality, and even if the products can endure the condition for short time, it may cause degradation of reliability.

16-4-3 Note Prior to Use
If you apply high static electricity, over rated voltage or reverse voltage to the products, defects may be caused in the products or the reliability degrade. Please avoid the following conditions:
(1) over rating power supply, reverse power supply or inadequate connection of 0V(DC) line
(2) electrostatic discharge from production line and/or operator
(3) electrified product from electrostatic induction
Do not allow any excessive mechanical shock.
If the products are dropped on the floor, etc., a crack to the core of inductors and monolithic ceramic capacitors may occur. Do not allow a strong shock such as a drop in handling.

16-5 Transportation

When transporting products, please pack them so that the package will not be damaged by mechanical vibration or mechanical shock, and please educate and guide carriers to prevent rough handling.
When transporting products overseas (in particular, by sea), it is expected that the transportation environment will be the worst, so please pack the products, in packaging designed for mechanical strength, vibration-resistantance and humidity-resistantance .
The package of the products, which Murata sells in Japan, may not resist oversea transport.
Please consult us if you are to use the Murata package of the products sold in Japan for transport overseas.

17. ⚠ Note

1. Please ensure that your product has been evaluated and confirmed to your specifications while assembled with our product.

2. All the items and parameters in this product specification have been prescribed on the premise that our product is used for the purpose, under the condition and in the environment agreed upon between you and us. You are requested not to use our product deviating from such agreement.

3. We consider it not appropriate to include other terms and conditions for transaction warranty in product specifications, drawings or other technical documents. Therefore, if your technical documents as above include such terms and conditions as warranty clause, product liability clause, or intellectual property infringement liability cause, we will not be able to accept such terms and conditions unless they are based on the governmental regulation or they are stated in a separate contract agreement.

The document is for reference only and is subject to revision without notices.
Please contact Murata for formal documentation.