Quarter Brick DC-DC Converter Specification

1. Application

This specification applies to DC-DC Converter for datacommunications and telecommunications equipment, MPDKN00_S series.

Please contact us before using our products for applications other than data/telecom equipment.

If any uncertainties and/or suspicions arise from this English translation, such shall be entirely construed by the Japanese original.

2. Customer Reference

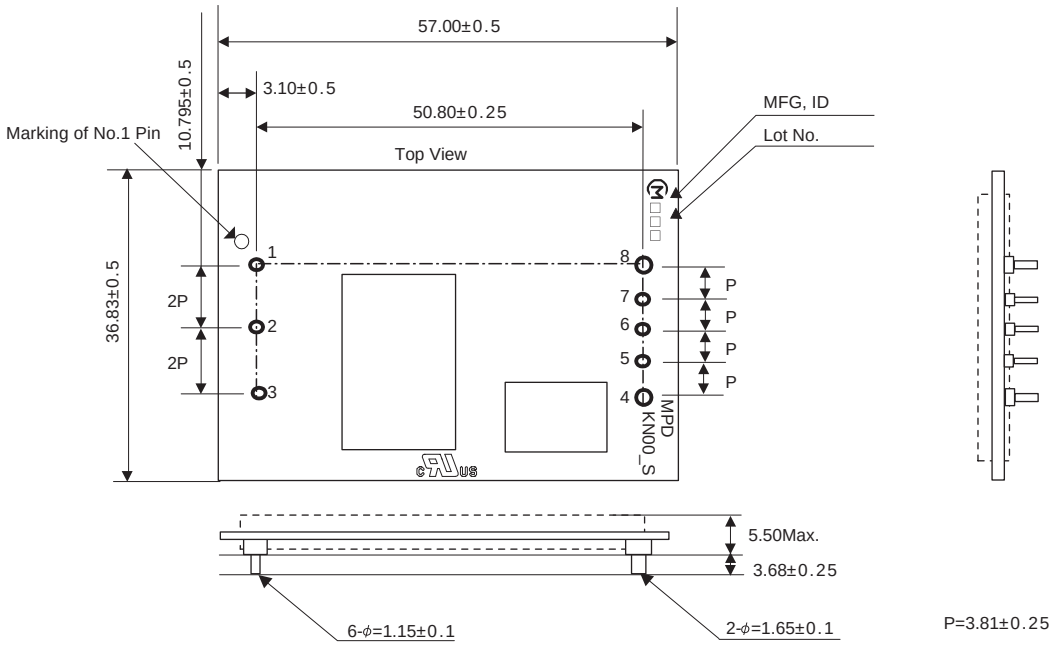
Customer Spec. Number

Customer Part Number

3. Murata Part Number

Nominal Output Voltage (V)	Part No.
1.8	MPDKN004S
2.5	MPDKN006S
3.3	MPDKN007S
5.0	MPDKN008S

4. Appearance and Dimensions



(in mm)

Marking

Part No. MPDKN00_S

Murata CM Mark

Lot No. □□□

①②③

① Production Factory

② Production Year

③ Production Month（1,2,3,…9, O, N, D）

Pin Number and Function

Pin No.	Pin Symbol	Function
1	Vin(+)	(+)Positive Input Voltage
2	On/Off	Remote On/Off
3	Vin(-)	(-)Negative Input Voltage
4	Vout(-)	(-)Negative Output Voltage
5	SENSE(-)	(-)Negative Remote Sense
6	TRIM	Output Voltage Trim
7	SENSE(+)	(+)Positive Remote Sense
8	Vout(+)	(+)Positive Output Voltage

5. Absolute Maximum Ratings

Items	Unit	Absolute Maximum Ratings		Remark
Minimum Input Voltage	V	0		
Maximum Input Voltage	V	75	Continuous	
		90	200us	Voltage Slew Rate : 52V/10us
On/Off Pin Voltage	V	20		

6. Ratings

Operating Temperature Range -40 to +85 degreeC (Please refer to the temperature derating table.)
Operating Humidity Range 20 to 85%RH (No condensation)
Storage Temperature Range -45 to +90 degreeC
Storage Humidity Range 10 to 95%RH(No condensation)

7. Characteristics

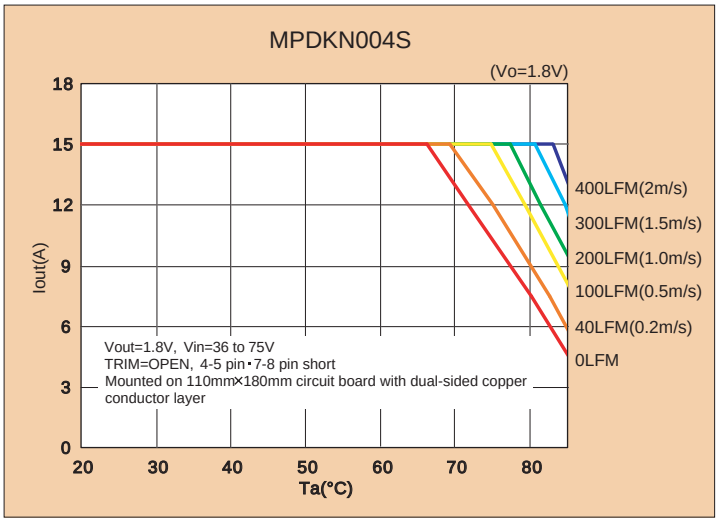
7-1. Electrical Characteristics (Ta=25 degreeC, Airflow=1m/s [200 LFM], TRIM=Open)
Test circuit is indicated in section 8.

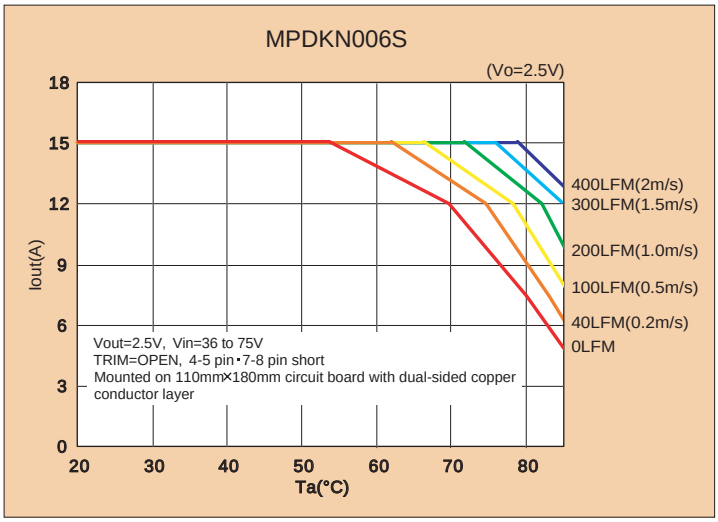
Items	Symbol	Condition	Model Number	Value			Unit
				Min.	Typ.	Max.	
Input Voltage	Vin		All	36	48	75	V
Output Voltage	Vout	Vin=Min～Max Iout=Min～Max	MPDKN008S MPDKN007S MPDKN006S MPDKN004S	4.850 3.200 2.425 1.746	5.0 3.3 2.5 1.8	5.150 3.400 2.575 1.854	V
Output Voltage Adjustable Range	Vout (adj)	Vin =Min～Max Iout=Min～Max	All	-20	-	10	%
Output Voltage Remote Sense Range	Vout (sense)	Between 4-5 and 7-8 pin voltage	All	-	-	10	%
Output Current	Iout		MPDKN008S MPDKN007S MPDKN006S MPDKN004S	0 0 0 0	-	10 15 15 15	A
Ripple Noise Voltage	Vripplel	Vin=48V Iout=Max f_{BW}=20MHz	All	-	-	100	mV(p_p)
Efficiency	η	Vin=48V Iout=Max	MPDKN008S MPDKN007S MPDKN006S MPDKN004S	84.0 83.0 82.0 80.0	89.0 88.0 87.0 85.0	- - - -	%
On/Off pin Control Voltage	Von		All	0	-	0.7	V
	Voff		All	3	-	20	V
Setting Point of Over Current Protection	OCP	Vin=48V	MPDKN008S MPDKN007S MPDKN006S MPDKN004S	10.3 15.45 15.45 15.45	-	16.0 24.0 24.0 24.0	A
Setting Point of Over Voltage Protection	OVP	Vin=48V	MPDKN008S MPDKN007S MPDKN006S MPDKN004S	6.0 3.96 3.00 2.16	-	7.0 4.62 3.50 2.52	V
Output-to-GND Short and Over-temperature Protection			All	If output is shorted to GND, or output voltage is over the value specified in OVP, DC-DC Converter will shut down. After reject the abnormal mode, DC-DC Converter will restart by re-inputting Vin or toggling On/Off pin. If DC-DC Converter is heated abnormally, it will shut down. After it is cooled down, DC-DC Converter will automatically restart.			
Input to Output Isolation Voltage		DC for one minute	All	1500	-	-	V
Safety Standards			All	UL60950 recognized.			

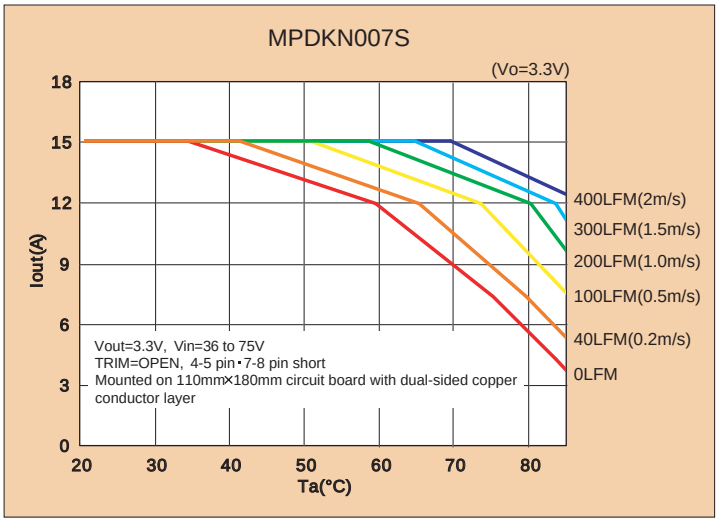
7-2. Typical Temperature Derating

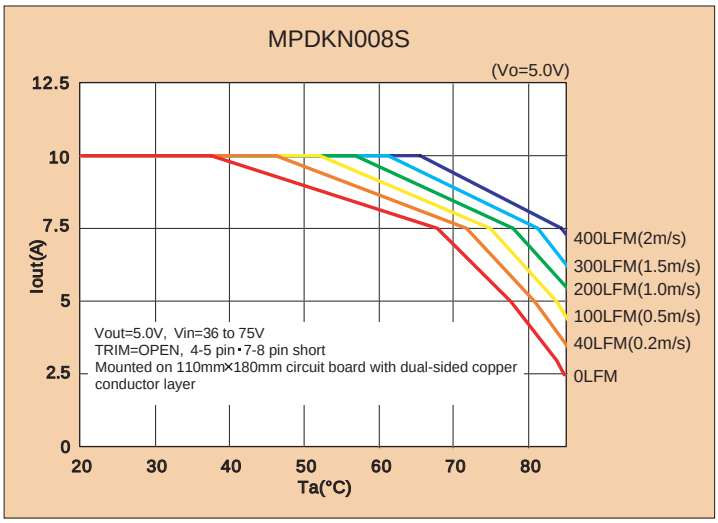
When using this product at an ambient air temperature of more than 30 degreeC, please use to the below temperature derating charts. Use these with the condition of air velocity of more than 1m/s(200 LFM).

7-2-1. Temperature Derating Characteristic






MPDKN007S
(Vo=3.3V)
Iout(A)
18
15
12
9
6
3
0
20
30
40
50
60
70
80
Ta(°C)
400LFM(2m/s)
300LFM(1.5m/s)
200LFM(1.0m/s)
100LFM(0.5m/s)
40LFM(0.2m/s)
0LFM
Vout=3.3V, Vin=36 to 75V
TRIM=OPEN, 4-5 pin・7-8 pin short
Mounted on 110mm×180mm circuit board with dual-sided copper conductor layer


MPDKN008S
(Vo=5.0V)
Iout(A)
12.5
10
7.5
5
2.5
0
20
30
40
50
60
70
80
Ta(°C)
400LFM(2m/s)
300LFM(1.5m/s)
200LFM(1.0m/s)
100LFM(0.5m/s)
40LFM(0.2m/s)
0LFM
Vout=5.0V, Vin=36 to 75V
TRIM=OPEN, 4-5 pin・7-8 pin short
Mounted on 110mm×180mm circuit board with dual-sided copper conductor layer

7-3. Output Voltage Control

· When TRIM pin (pin 6) is left open, DC-DC Converter applies nominal output voltage.
Vout-Up Adjust: Resistors connected between TRIM (pin 6) to SENSE(+) pin (pin 7) will increase the output voltage (Vo, adj) between 100 to 110% of the nominal output voltage (Vo, nom).
Vout-Down Adjust: Resistors connected between TRIM (pin 6) to SENSE(-)pin (pin 5) will decrease the output voltage(Vo, adj) between 80 to 100% of the nominal output voltage (Vo, nom).

· The following equations provide necessary external-resistor value to adjust the output voltage to Vo, adj.
After calculating the external resistance, it is necessary to confirm the output voltage and adjust the resistance value to compensate for your board conditions.

· When increasing the output voltage,

$$\text{Radj - up} = \left[\frac{5.11 \times \text{Vo}(100(\%) + \Delta(\%))}{1.225 \times \Delta(\%)} - \frac{5.11 \times 100(\%)}{\Delta(\%)} - 10.22 \right] (\text{k}\Omega)$$

· When decreasing the output voltage,

$$\text{Radj - down} = \left[\frac{5.11 \times 100(\%)}{\Delta(\%)} - 10.22 \right] (\text{k}\Omega)$$

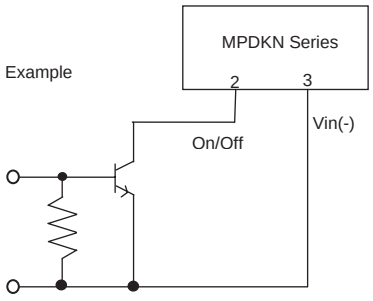
Where,

$$\Delta = \left| \frac{\text{Vo, nom - Vo, adj}}{\text{Vo, nom}} \right| \times 100\,(\%)$$

· If changing output voltage, it is necessary to evaluate the characteristics of DC-DC Converter characteristics under your board conditions.

7-4. On/Off Control

· On control : On/Off pin (pin 2) should be connected to Vin(-) pin (pin 3) or set at less than 0.7V.
· Off control : On/Off pin (pin 2) should be opened or set at greater than 3.0V.



When the On/Off terminal is open a voltage condition of 20V maximum is present on the pin.

7-5. External Input-Output Capacitor

<External Input Capacitor>

When an inductance or a switch device are connected to the input line, or when the transient characteristics of the input power supply is unstable, the input voltage may be effected significantly by a sudden change of DC-DC Converter load.

Because the load response of the DC-DC Converter may not be adequately demonstrated by this influence, and the DC-DC Converter may cause unusual oscillations in such a case, please connect input capacitors.

<External Output Capacitor>

When applying an external output capacitor, the total output capacitance should be the following maximum value or less.

Maximum External Output Capacitance : 300μF Max.

7-6. Output Voltage Remote Sense

The remote sense function corrects for voltage drops caused by line impedance from the DC-DC Converter output terminal to the load terminal.

A voltage drop from line impedance can be corrected by connecting No.5 pin and No.7 pin to the load terminal.

When utilizing the remote sense feature, a remote sense line should use a shielding wire, a twist line, a side by side pattern, etc., to minimize the influence of the noise.

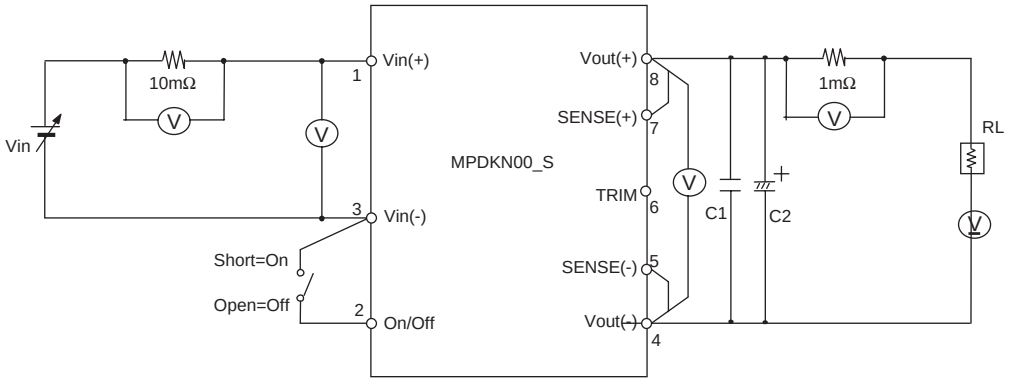
The Output Voltage Remote Sense Range is within Vout (nom) +10% and, provides an output voltage within the output adjustment range.

Short-circuit No.4-No.5 terminal and No.7-No.8 terminal respectively when a remote sense is not necessary.

If you use the output voltage remote sense feature, it is necessary to evaluate the characteristics of DC-DC Converter at your board conditions.

8. Test Circuit

In the following test circuit, the initial values under Section 7 (Electrical Characteristics) will be met.



C1 : Ceramic Capacitor 1uF

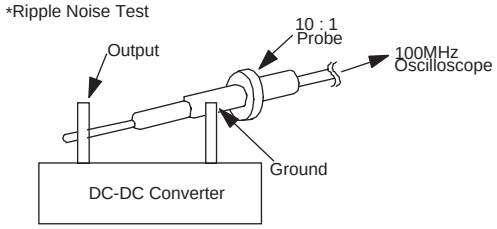
C2 : Low Impedance Tantalum Capacitor 10uF

RL : Electronic Load Device : Model EUL150 α XL Fujitsu DENSO Equivalent

Vin : DC Power Supply : Model HP6655A HP Equivalent

Ⓥ : Digital Multimeter : Model HP34401A HP Equivalent

When deviating from the above, DC-DC Converter may operate incorrectly. Before use, please fully confirm operation on your board.



9. Reliability

9-1. Humidity

40±2degree 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 7-1).
According to JIS-C-0022.

9-2. Temperature Cycles

Repeat 5 times of the cycle. Leave for 2 hours at room temperature.
No damage in appearance and no deviation from electrical characteristics (Section 7-1).

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

9-3. Vibration

10 to 55Hz, 1.5mm amplitude, 1 hour for each each of X, Y, Z directions.
No damage in appearance and no deviation from electrical characteristics (Section 7-1).

9-4. Mechanical Shock

20G, 1 time for each X, Y, Z directions.
No damage in appearance and no deviation from electrical characteristics (Section 7-1).

9-5. Soldering Heat Resistance

Immerse lead pins in a solder bath of 260±5degree C for 3±0.5seconds.
Then tested products are left for 2 hours.
No damage in appearance and no deviation from electrical characteristics (Section 7-1).

9-6. Lead Pin Strength

Strain lead pin by gradualy-increasingl to 5.0N along axial direction; withstand for 5seconds.
No damage to the lead pin.

9-7. Solderability of Leads

The lead pins will be immersed in the Isopropyl Alcohol (JIS K 1522) with Rosin (JIS K5902) solution (the concentration of Rosin ranging from 10 to 35wt%, and typically 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±5degree C for 3±0.5seconds, and pulled up completely.
The solder will adhere to over 75% of immersed area.

10. Production Factory

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

11. ⚠ Caution

11-1. Be sure to provide an appropriate fail-safe function on your product to prevent a secondary damage that may be caused by abnormal function or failure of the DC-DC Converter.

11-2. 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, 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 : MPDKN006S, MPDKN007S, MPDKN008S : 4A
MPDKN004S : 3A

Please select diode and fuse after confirming the operation.

11-3. 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.

12. Notice

12-1. Soldering

12-1-1. Flux

Please solder the product with Rosin Flux containing chlorine 0.2wt% or less.
Please do NOT use acid flux or water-soluble flux, which could corrode metals and glass of the product.

12-1-2. Solder

· Lead Free Solder
Please use solder Sn-3Ag-0.5Cu.
· Eutectic Solder
Please use solder H60, H63 (in JIS Z 3282) or the equivalent type.

12-1-3. Condition of Soldering

Please solder under the following conditions.
Condition of soldering iron : 350 degreeC Max. 3 seconds at maximum
(Soldering iron of less than 30W only should be used.)

12-1-4. Recommended Solder Land Pattern

Pin No.	Pin Size	Hole Diameter	Land Diameter
1. Vin(+) 2. On/Off 3. Vin(-) 5. SENSE(-) 6. TRIM 7. SENSE(+)	Φ1.15	Φ1.5	Φ3.0
4. Vout(-) 8. Vout(+)	Φ1.65	Φ2.0	Φ4.0

(in mm)

Refer to the Dimensions, Appearance figure (Section 4) for hole position.

12-2. Cleaning

12-2-1. When cleaning the products, please wash in isopropyl alcohol for up to 5 minutes using the dipping, boiling, and vapor methods.
Please inform us if you are to use aqueous, semi-aqueous cleaning or another methods.
Do not use ultrasonic cleaning because semiconductor device on the products, bonding wires may be destroyed by resonant effects.

12-2-2. After cleaning, please dry the products thoroughly. If you touch the products that have not been dried enough yet, please take care as the marking of the products may get thin or blurred.
Do not measure electrical characteristics, until the products are thoroughly dried.

12-2-3. If you use no-clean type flux and do not clean our products, please confirm the reliability of the products fully in advance.

12-3. Storage

12-3-1. Please store the products in room where the temperature/humidity is stable and direct sunlight cannot come in.
Use the products within 6 months of delivery.
Avoid damp heated places or such places where there are large temperature changes, because water may condense on the products, characteristics may be diminish in quality, and/or be degraded in the solderability.
If you store the products for a long time (more than 1 year), use caution because the products may be degraded in solderability and/or corroded.
Please confirm solderability and characteristics for the products regularly.

12-3-2. Please do not store the products in the locations such as:
A dusty place, a place exposed directly to ocean breeze, or in an atmosphere containing corrosive gas (Cl_2, NH_3, SO_2, NO_X and so on).

12-4. Operational Environment and Operational Conditions

12-4-1. Operational Environment
The products are not waterproof, chemical-proof or rustproof.
In order to prevent of electrical leakage or 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 location
(3) in a location exposed to direct sunlight
(4) in a location where water splashes or in a high humidity environment where condensation may form
(5) in a location exposed to sea breeze
(6) in any other locations similar to the above (1) through (5)

12-4-2. Operational Conditions
Please use the products within specified values (power supply, temperature, input, output and load condition, and so on). Input voltage drop due to line impedance requires that that “actual” input voltage be included in specified values.

If you use the products outside of specified values, the products may be destroyed, reduced in quality, and though the products may possibly endure a stressed condition for short time, it may degrade reliability.

12-4-3. Note: Prior to Use

· If you apply high static electricity, over rated voltage or reverse voltage to the products, it may cause defects in the products or degrade their reliability.
Please avoid the following conditions:
(1) Over-rating power supply, reverse power supply or insufficient connection of 0V (DC)line
(2) Electrostatic discharge by production line and/or operator
(3) Electrified product by electrostatic induction

· Do not apply excessive mechanical shock.
If the product is dropped on the floor, etc., cracks in the core of inductors and monolithic ceramic capacitors may occur.
Do not apply a strong shock such as a drop during handling.

· Do not bend this product more than 0.1mm.

12-5. Transportation

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

Note

1. Please make sure that your product has been evaluated and confirmed against your specifications when our product is mounted to your 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 inappropriate 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 clause, 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.