

DC-DC Converter Specification

MPDTH04040WAS/H

1 . Application

This specification applies to DC-DC Converter for telecommunication / data-communication equipment, MPDTH04040WAS/WAH.

For any other application, please contact us before using this product.

2 . Customer Reference

Customer Spec. Number

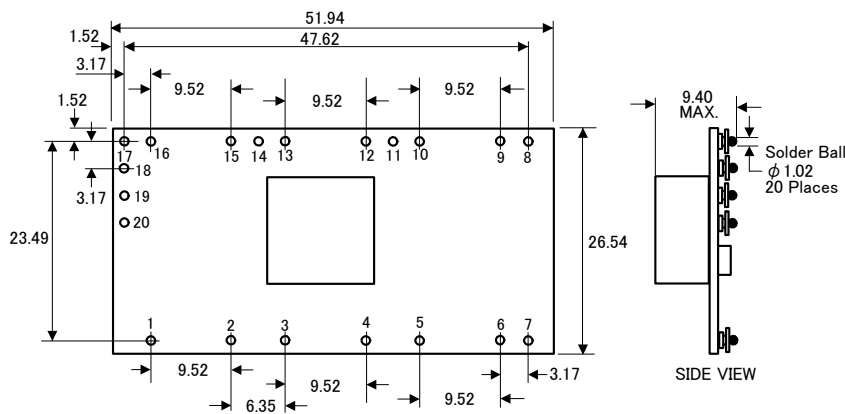
Customer Part Number

3 . Murata Part Number

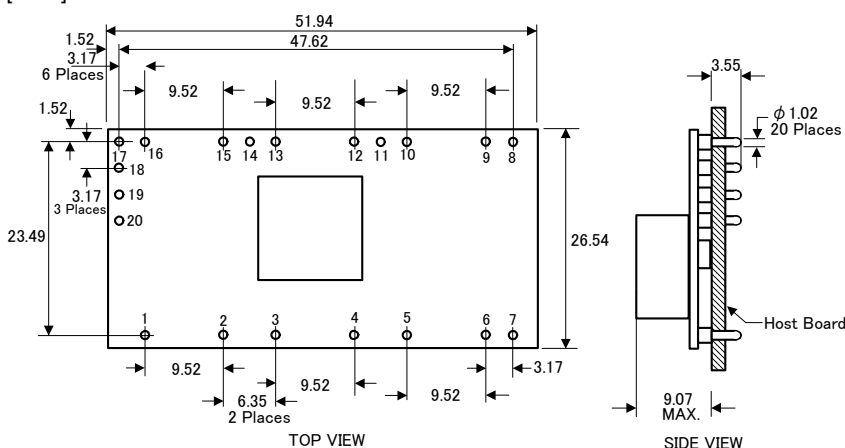
MPDTH04040WAS / MPDTH04040WAH

4 . Appearance, Dimensions

[WAS]



[WAH]



Marking

(1) MFG ID

(2) Part No. ---WAS → PRG

---WAH → PRE

(3) Lot No. ①②③

① Production factory Mark

② Production Year

③ Production Month (1,2,3,...9,O,N,D)

unit : mm

Tolerance : 0.25mm

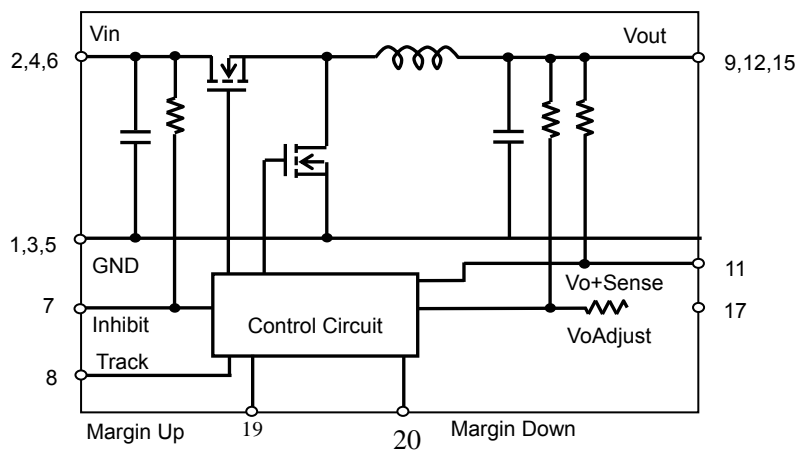
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5 . Pin Number and Function

| Pin No. | Symbol | Function |
|---------|-------------|--------------------------|
| 1 | GND | GND |
| 2 | Vin | Input |
| 3 | GND | GND |
| 4 | Vin | Input |
| 5 | GND | GND |
| 6 | Vin | Input |
| 7 | Inhibit | Remote ON/OFF |
| 8 | UVLOProg | UVLO |
| 9 | Vout | Output |
| 10 | GND | GND |
| 11 | Vo+Sense | Vout +sense |
| 12 | Vout | Output |
| 13 | GND | GND |
| 14 | Vo-Sense | Vout -sense |
| 15 | Vout | Output |
| 16 | GND | GND |
| 17 | VoAdjust | Vout control |
| 18 | Track | Tracking signal input |
| 19 | Margin Up | Margin up signal input |
| 20 | Margin Down | Margin down signal input |

6. Block Diagram



7. Ambient Condition

7.1 Operating Temperature Range -40 to +85 °C

7.2 Storage Temperature Range -40 to +125 °C

8. Absolute Rating

8.1 Track Pin Input Voltage Range -0.3V to Vin+0.3V

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8. Characteristics

8.1 Electrical Characteristics (Ta=25 °C)

| Item | Symbol | Condition | Value | | | Unit | |
|-----------------------------|-------------|---|---|---------|---------|---------------------|------|
| | | | Min. | Typ. | Max. | | |
| Output Current | Io | 60°C, 200 LFM airflow | 0 | - | 60 (*1) | A | |
| Input Voltage Range | Vin | Over Io range | 2.95 (*2) | - | 5.5 | V | |
| Set-point Voltage Tolerance | Vo tol | | - | - | ±2(*3) | %Vo | |
| Temperature Variation | ΔRegtemp | Ta=-40°C to 85°C | - | ±0.5 | - | %Vo | |
| Line Regulation | ΔRegline | Over Vin range | - | ±5 | - | mV | |
| Load Regulation | ΔRegload | Over Io range | - | ±5 | - | mV | |
| Total Output Variation | ΔRegtot | Includes set-point, line, load, Ta= -40°C to 85°C | - | - | ±3 (*3) | %Vo | |
| Output Adjust Range | ΔVadj | Vin= 2.95 to 4.5V(*3) | 0.8 | - | 1.65 | V | |
| | | Vin= 4.5 to 5.5V(*3) | 0.8 | - | 2.5 | | |
| Efficiency | η | Vin=5V Io=45A | Rset=2.21kΩ Vo=2.5V | - | 93 | - | % |
| | | | Rset=5.49kΩ Vo=1.8V | - | 90 | - | |
| | | | Rset=8.87kΩ Vo=1.5V | - | 88 | - | |
| | | | Rset=17.4kΩ Vo=1.2V | - | 86 | - | |
| | | Vin=3.3V Io=45A | Rset=5.49kΩ Vo=1.8V | - | 92 | - | |
| | | | Rset=8.87kΩ Vo=1.5V | - | 91 | - | |
| | | Rset=36.5kΩ Vo=1.0V | - | 87 | - | | |
| Ripple Voltage | Vr | BW=20MHz, Co=10 μF ceramic | - | 15 (*4) | - | mVpp | |
| Short Circuit Protection | Io trip | Reset, followed by auto-recovery | - | 90 | - | A | |
| Transient Response | ttr | 1A/us load step, 50 to 100% Iomax, Co=660 μF | Recovery time | - | 100 | - | usec |
| | ΔVtr | | Vo deviation | - | 200 | - | mV |
| Margin Up/Down Adjust | ΔVomargin | Pin to GND | - | ±5 | - | % | |
| Margin Input Current | IIL margin | Pin to GND | - | -8 | - | μA | |
| Track Input Current | IIL track | Pin to GND | - | - | -0.11 | mA | |
| Track Slew Rate Capability | dVtrack/dt | Vtrack-Vo < 50mV, Vtrack<Vo(nom) | - | - | 1 | V/ms | |
| UVLO Under-voltage lockout | UVLOr | Pin 8 open | Vin=increasing | - | 2.6 | - | V |
| | - | | Hysteresis | - | 0.6 | - | V |
| Input High Voltage | VIH | Referenced to GND | This pin should left open to operate (*5) | | | V | |
| Input Low Voltage | VIL | Referenced to GND | -0.2 | - | 0.5 | V | |
| Input Low Current | IIL inhibit | Pin to GND | - | -0.5 | - | mA | |
| Input Standby Current | Iin inh | Inhibit to GND | - | 60 | - | mA | |
| Switching Frequency | Frq | Over Vin and Io ranges | - | 825 | - | k Hz | |
| External Input Capacitor | Cin | | 940 (*6) | - | - | μF | |
| External Output Capacitor | Cout | non-ceramic (ESR>2mΩ) | 660 (*7) | - | 14000 | μF | |
| | | ceramic | - | - | 400 | | |
| MTBF | MTBF | Per Bellcore TR-332, 50% stress, Ta=40°C, ground benign | 2.1 | - | - | 10 ⁶ Hrs | |

(*1) See SOA curves or consult factory for appropriate derating.

(*2) The nominal input voltage must be at least 2×Vo. Output voltage regulation is guaranteed with an input voltage within ±10% from nominal 3.3V or 5V.

For example, for Vi=5V and Vo=2.5V, the input can vary between 4.5V and 5.5V.

(*3) The set-point voltage tolerance is affected by the tolerance and stability of Rset. The stated limit is unconditionally met if Rset has a tolerance of 1% with 100ppm/°C or better temperature stability.

(*4) The peak to peak output ripple voltage is measured with an external 10μF ceramic capacitor.

(*5) This control pin has an internal pull-up. If it is left open-circuit the module will operate when input power is applied.

(*6) The external input capacitor must be rated at or above 400mA rms of ripple current.

(*7) A minimum value of output capacitance is required for proper operation. Adding additional capacitance at the load will further improve transient response.

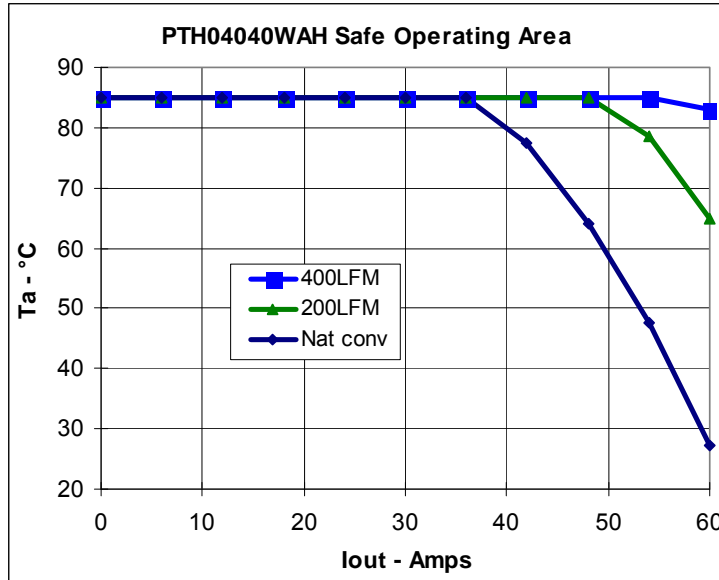
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Caution

The above electrical characteristics are guaranteed in the condition that the impedance of the input voltage source is sufficiently low as shown in clause 11. Connecting an input inductance or using an input power supply with output inductance may cause an unstable operation of this product. Please check the proper operation of this product with the peripheral circuits on your product.

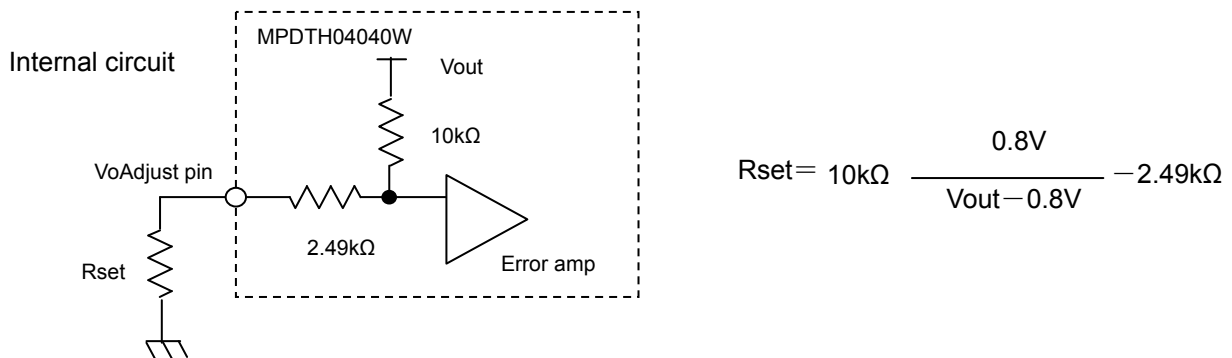
8.2 Thermal Derating



The above SOA represents the condition at which internal components are at or below the manufacturer's maximum operating temperatures. Derating limits apply to modules soldered directly to 4 inch×4inch, 4-layer PCB with 1 oz. copper. For more reliable operation, appropriate derating is desirable.

9. Adjusting the Output Voltage

The output voltage can be adjusted ranging from 0.8V to 3.6V by connecting resistors between VoAdjust-pin(17pin) to GND-pin. The resistor's tolerance should be 1%, with 100ppm/°C (or better). The following equation gives the required external-resistor value to adjust the output voltage to Vout.



Rset calculation example

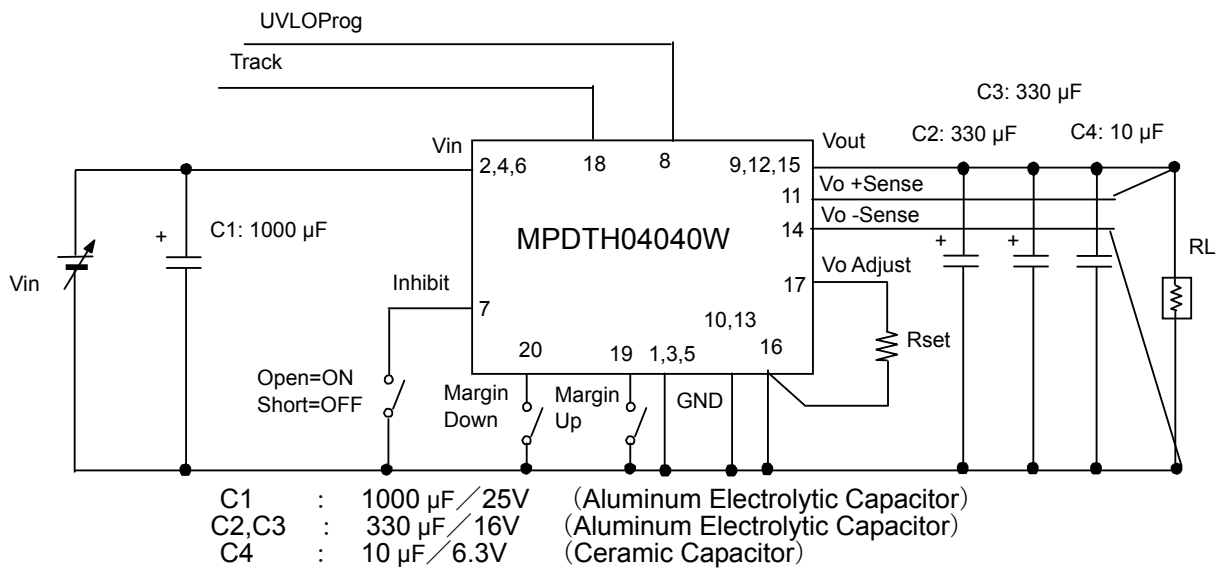
| Vout [V] | Calculated Rset[kΩ] | Rset example |
|----------|---------------------|--------------|
| 2.5 | 2.22 | 2kΩ+220Ω |
| 2.0 | 4.18 | 3.9kΩ+270Ω |
| 1.8 | 5.51 | 5.1kΩ+390Ω |
| 1.5 | 8.94 | 8.2kΩ+750Ω |
| 1.2 | 17.5 | 16kΩ+1.5kΩ |
| 1.0 | 37.5 | 36kΩ+1.5kΩ |
| 0.8 | ∞ | Open |

Note:

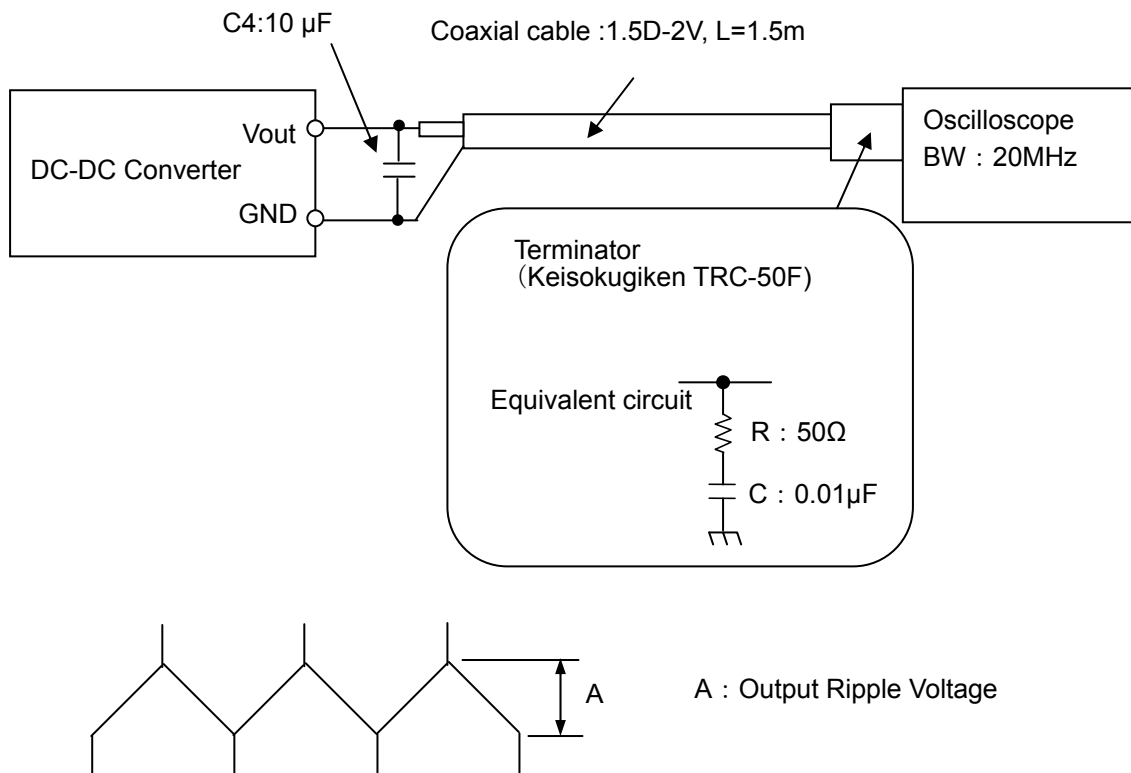
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11. Test Circuit

In the following test circuit, the initial values under item 9 should be met.



Ripple Noise Measurement Circuit



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12. Packaging Information

12.1 Tray Dimensions

DC-DC converters are put in the trays. (See Fig.1)

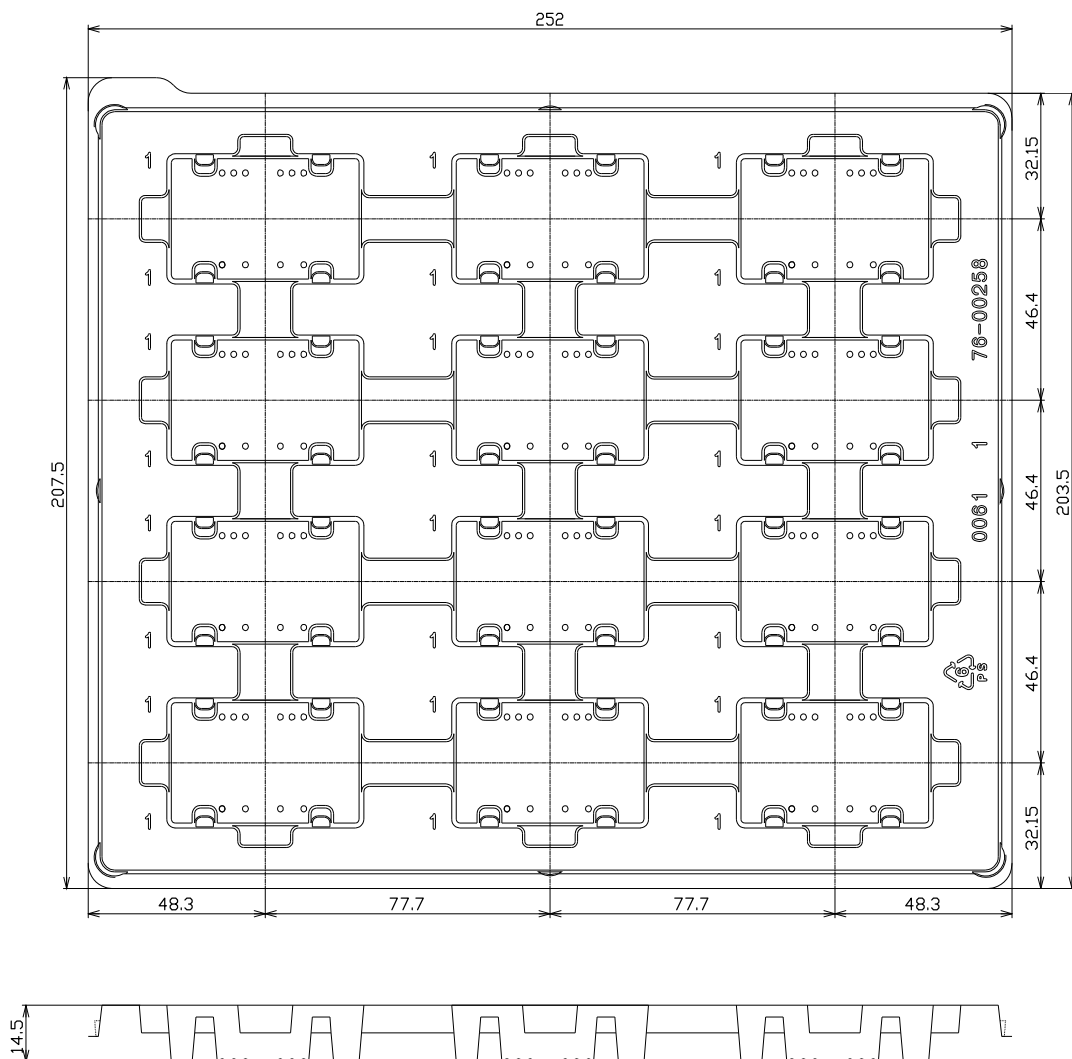


Fig.1

12.2 Maximum Pieces per a Tray

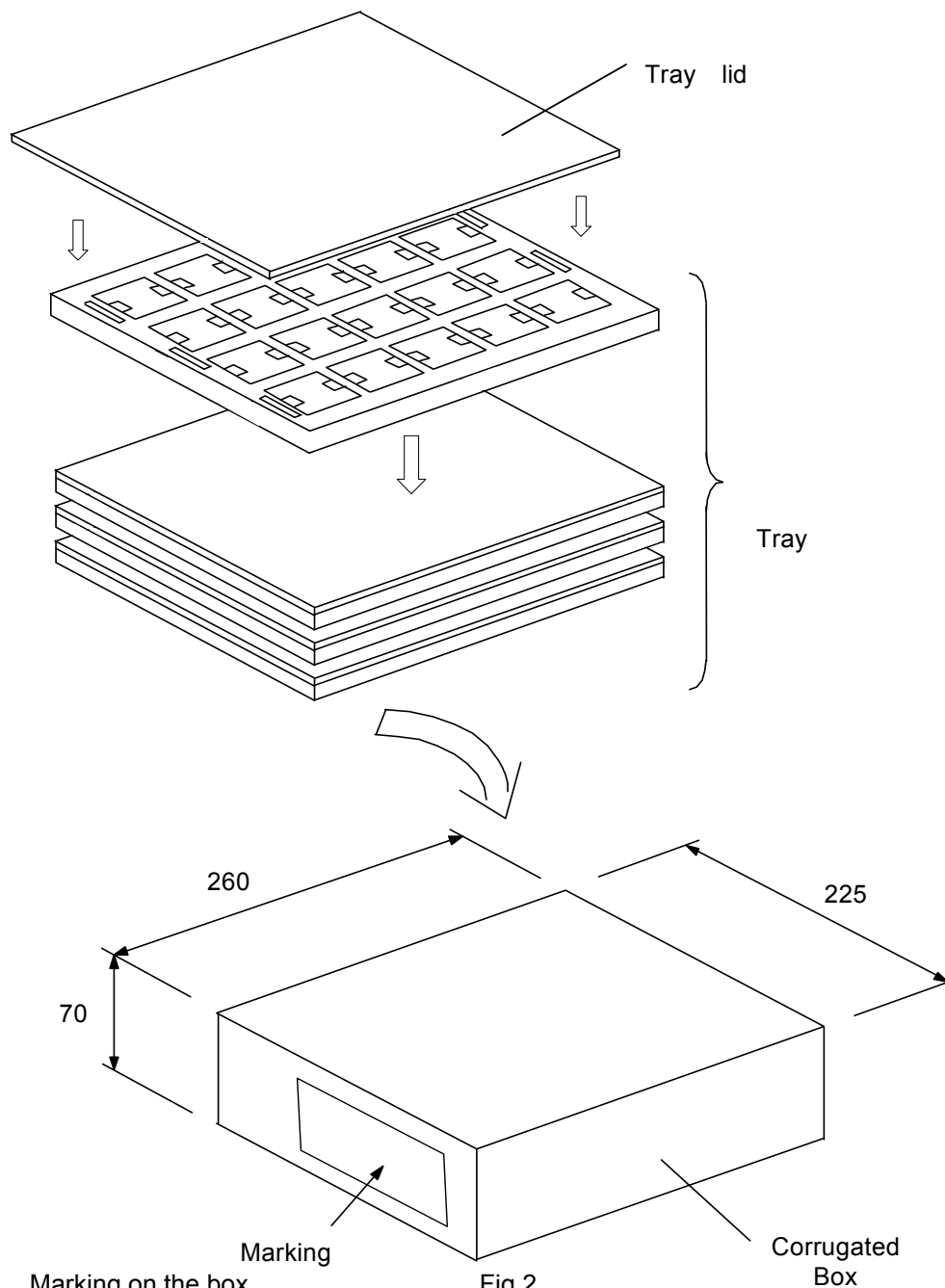
12pcs/tray
(except when less than 12)

12.3 Packaging Form

Trays with products are lidded and packed in a corrugated box. (See Fig.2)

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Marking on the box
 MURATA Parts Number
 Quantity
 Inspection No.

13. Production factory

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

⚠ Note:

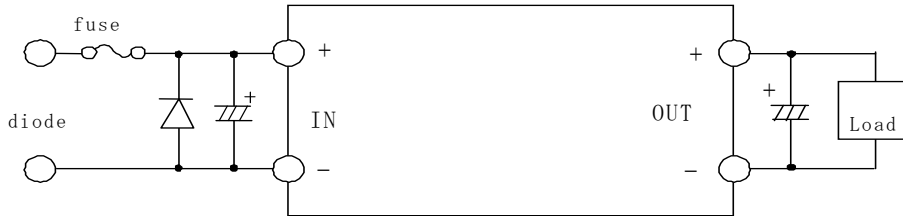
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14. Caution

14-1. Be sure to provide an appropriate fail-safe function on your product to prevent secondary damage that may be caused by the functional trouble or the failure of this product.

14-2. This product has no inrush protection circuit. If any inrush current is applied to this product (ex. using mechanical switch), it may be damaged by surge voltage.

14-3. Please connect the input terminal with the correct polarity. If connected incorrectly, this product may be damaged. If this product is damaged internally, an elevated input current may flow, and an abnormal temperature rise of this product or the damage of your product may be caused. Please add a diode and fuse per the following diagram to prevent these problems.



Please select diode and fuse after confirming the operation of your product.

14-4. Limitation of Application

Please contact us before using this product 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 Any other application of similar complexity and/or reliability requirements to the applications listed above.

15. Notice

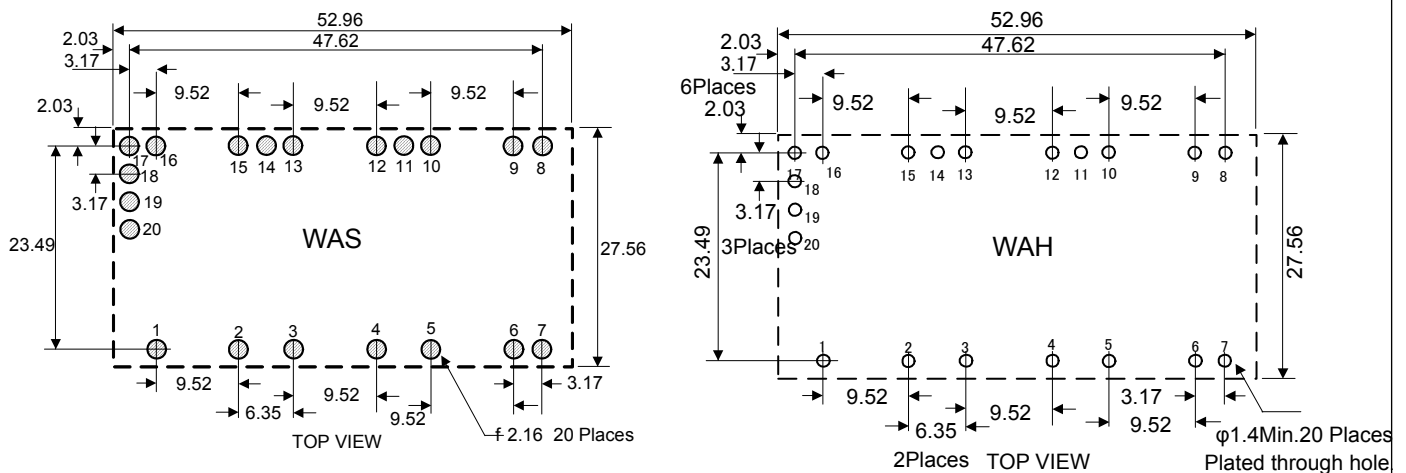
15.1 Soldering

15.1.1 Flux

Please solder this product with Rosin Flux which contains of 0.2wt% or less chlorine.

Please do not use high activity acid flux or water soluble flux because they may erode metal or glass portion of this product and may cause defectiveness or deterioration of this product.

15.1.2 Recommended PCB Land Pattern



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15. 1. 3 Recommended Soldering Conditions

- Reflow Soldering

This product is RoHS compatible. The following profile is recommended for the reflow of the SMD product (WAS) using Pb-free solder paste (Sn-Ag-Cu).

Method : Full convection reflow soldering

Reflow Soldering Profile

JEDEC IPC/JEDEC J-STD-020C

Table 5-2 Classification Reflow Profile

Pb-Free Assembly Large Body

Profile details

| | |
|-----------------------|------------------------------------|
| Soldering temperature | : 245 °C +0/-5 °C |
| Soldering time | : 20 to 40 seconds, 240 to 245 °C |
| Heating time | : 60 to 150 seconds, over 217 °C |
| Preheating time | : 60 to 180 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 | : 1time |

Do not add vibration to this product during reflow.

Please carefully regulate temperature control as mounted parts may come off from this product if left under the high temperature for an extended time.

15. 2 Cleaning

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

15. 3 Storage

15. 3. 1 This product should be treated as MSL2 product when it is reflowed according to the recommended soldering condition, which is described at 15.1.3. .

At below 30 °C 60%R.H., this product can be stored 1 year without baking.

If stored over 1 year, please bake this product before soldering.

The recommendable baking condition is at 125±5 °C /24hour.

If baked in a tray of in a tape, 60±5 °C /168hour is recommended.

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.

15. 3. 2 Please do not store this product in the conditons such as : a dusty place, a place exposed directly to sea breeze, or in an atmosphere containing corrosive gas (Cl₂, NH₃, SO₂, NOX and so on).

15. 4 Operational Environment and Operational Conditions

15. 4. 1 Operational Environment

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

In order to prevent leakage of electricity and abnormal temperature rise of this product, do not use this product in the following conditions:

- (1) in an atmosphere containing corrosive gas (Cl₂, NH₃, SO₂, NOX 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

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15. 4. 2 Operational Conditions

Please use this product within specified values (power supply, temperature, input, output and load condition, and so on). As the input voltage may drop due to line impedance, please make sure that the input voltage is within the specified values.

If not used within the specified values, defectiveness and deterioration of this product may be caused. Even if this product can endure the condition for short time, it may cause degradation of reliability.

15. 4. 3 Note prior to use

Defectiveness and reliability degradation may be caused if high static electricity, over rated voltage or reverse voltage are applied to this product. Please be sure to avoid the followings:

- (1) over rating power supply, reverse power supply or inadequate connection of 0 V(DC)line
- (2) electrostatic discharge from production line and/or operator
- (3) electrified product from electrostatic induction

Please avoid an excessive mechanical shock.

If this product is dropped on the floor, etc., a crack to the core of inductors and monolithic ceramic capacitors may occur.

Please handle with care to avoid a strong shock to this product.

15. 5 Transportation

When transporting this product, please pack it in order to avoid damage by mechanical vibration or mechanical shock, and please give instructions and set guidelines to the carriers to prevent rough handling. When transporting this product overseas (in particular, by sea), bad environment of transportation may be expected, therefore please pack this product considering mechanical strength, vibration-resistance and humidity-resistance.

The packaging designed for domestic sales may not suitable for overseas transportation.

Please contact us if this product with domestic packing is transported overseas.

16. 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. All the items and parameters in this product specification have been prescribed on the premise that Murata's product is used for the purpose, under the condition and in the environment mutually agreed upon.

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