

## **Notification about the transfer of the semiconductor business**

The semiconductor business of Panasonic Corporation was transferred on September 1, 2020 to Nuvoton Technology Corporation (hereinafter referred to as "Nuvoton"). Accordingly, Panasonic Semiconductor Solutions Co., Ltd. became under the umbrella of the Nuvoton Group, with the new name of Nuvoton Technology Corporation Japan (hereinafter referred to as "NTCJ").

In accordance with this transfer, semiconductor products will be handled as NTCJ-made products after September 1, 2020. However, such products will be continuously sold through Panasonic Corporation.

Publisher of this Document is NTCJ.

If you would find description "Panasonic" or "Panasonic semiconductor solutions", please replace it with NTCJ.

※ Except below description page

"Request for your special attention and precautions in using the technical information and semiconductors described in this book"

**Nuvoton Technology Corporation Japan**

# FC6A21060L

## Gate Resistor installed Dual N-Channel MOS FET

For lithium-ion secondary battery protection circuit

■ Features

- Low Source-source On-state Resistance:RSS(on)typ. = 8.7 mΩ (VGS = 4.5 V)
- CSP package:smallest & thinnest size
- Halogen-free / RoHS compliant  
(EU RoHS / UL-94 V-0 / MSL:Level 1 compliant)

■ Marking Symbol:31

■ Packaging

FC6A21060L Embossed type (Thermo-compression sealing):  
5 000 pcs / reel (standard)

■ Absolute Maximum Ratings Ta = 25 °C

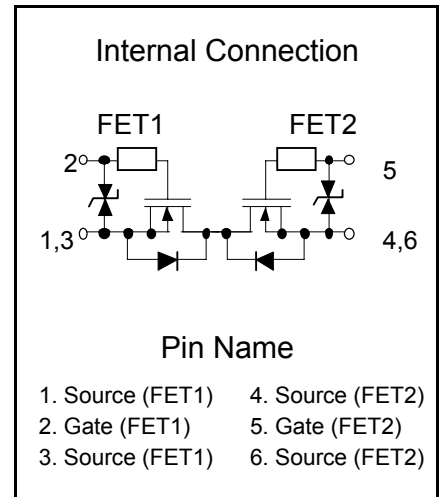
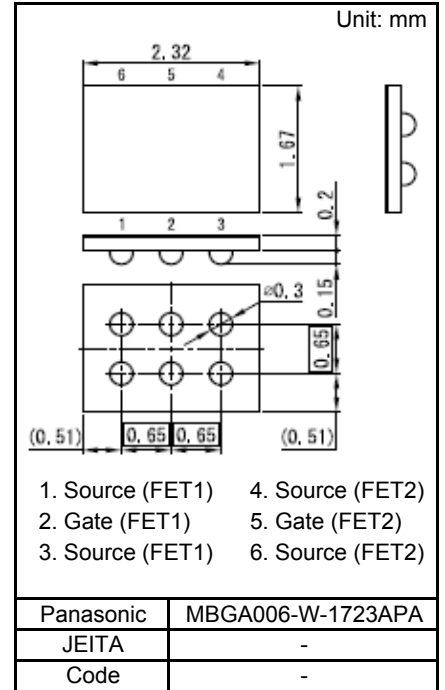
| Parameter    |                               | Symbol | Rating      | Unit |
|--------------|-------------------------------|--------|-------------|------|
| FET1<br>FET2 | Source-source Voltage         | VSS    | 12          | V    |
|              | Gate-source Voltage           | VGS    | ±12         | V    |
|              | Source Current (DC) *1        | IS     | 6           | A    |
|              | Source Current (Pulsed) *1,*2 | ISp    | 60          | A    |
| Overall      | Total Power Dissipation *1    | PD     | 0.45        | W    |
|              | Channel Temperature           | Tch    | 150         | °C   |
|              | Storage Temperature Range     | Tstg   | -55 to +150 | °C   |

■ Thermal Characteristics

| Parameter                              | Symbol     | Rating | Unit |
|--|------------|--------|------|
| Thermal Resistance, Channel to Ambient | Rth (ch-a) | 278    | °C/W |

Note \*1 Mounted on FR4 board (25.4 mm × 25.4 mm × t1.0 mm).  
Surface Mounted on FR4 Board using the minimum recommended pad size(Cu area = 47 mm<sup>2</sup> including traces).

\*2 t = 10 μs, Duty Cycle ≤ 1 %



■ Electrical Characteristics Ta = 25 °C ± 3 °C

| Parameter                                  | Symbol   | Conditions                               | Min | Typ   | Max   | Unit |
|--|----------|--|-----|-------|-------|------|
| Source-source Breakdown Voltage            | VSSS     | IS = 1 mA, VGS = 0 V                     | 12  |       |       | V    |
| Zero Gate Voltage source Current           | ISSS     | VSS = 12 V, VGS = 0 V                    |     |       | 1.0   | μA   |
| Gate-source Leakage Current                | IGSS1    | VGS = ±5.0 V, VSS = 0 V                  |     | ±0.50 | ±1.0  | μA   |
|  | IGSS2    | VGS = ±4.3 V, VSS = 0 V                  |     | ±0.25 | ±0.5  |      |
|  | IGSS3    | VGS = ±4.1 V, VSS = 0 V                  |     | ±0.20 | ±0.4  |      |
|  | IGSS4    | VGS = ±3.8 V, VSS = 0 V                  |     | ±0.18 | ±0.36 |      |
|  | IGSS5    | VGS = ±3.5 V, VSS = 0 V                  |     | ±0.15 | ±0.3  |      |
|  | IGSS6    | VGS = ±3.0 V, VSS = 0 V                  |     | ±0.10 | ±0.2  |      |
|  | IGSS7    | VGS = ±2.5 V, VSS = 0 V                  |     | ±0.05 | ±0.1  |      |
| Gate-source Threshold Voltage              | Vth      | IS = 1.0 mA, VSS = 10.0 V                | 0.4 | 0.85  | 1.4   | V    |
| Source-source On-State Resistance          | RSS(on)1 | IS = 3.5 A, VGS = 4.5 V                  | 6.0 | 8.7   | 12.0  | mΩ   |
|  | RSS(on)2 | IS = 3.5 A, VGS = 3.8 V                  | 6.5 | 9.0   | 12.5  |      |
|  | RSS(on)3 | IS = 3.5 A, VGS = 3.1 V                  | 7.0 | 10.5  | 15.5  |      |
|  | RSS(on)4 | IS = 3.5 A, VGS = 2.5 V                  | 8.0 | 12.5  | 19.0  |      |
| Input Capacitance <sup>*1</sup>            | Ciss     | VSS = 10 V, VGS = 0 V, f = 1MHz          |     | 2 300 |       | pF   |
| Output Capacitance <sup>*1</sup>           | Coss     |  |     | 680   |       |      |
| Reverse Transfer Capacitance <sup>*1</sup> | Crss     |  |     | 670   |       |      |
| Turn-on Delay Time <sup>*1,2</sup>         | td(on)   | VDD = 10 V, VGS = 0 to 4.0 V             |     | 5.2   |       | μs   |
| Rise Time <sup>*1,2</sup>                  | tr       | IS = 3.5 A                               |     | 19.0  |       |      |
| Turn-off Delay Time <sup>*1,2</sup>        | td(off)  | VDD = 10 V, VGS = 4.0 to 0 V             |     | 3.5   |       | μs   |
| Fall Time <sup>*1,2</sup>                  | tf       | IS = 3.5 A                               |     | 8.2   |       |      |
| Total Gate Charge <sup>*1</sup>            | Qg       | VDD = 10 V, VGS = 0 to 4.0 V<br>IS = 6 A |     | 30.0  |       | nC   |
| Gate-source Charge <sup>*1</sup>           | Qgs      |  |     | 6.5   |       |      |
| Gate-drain Charge <sup>*1</sup>            | Qgd      |  |     | 10.0  |       |      |
| Body Diode Forward Voltage                 | VF(s-s)  | IF = 6.0 A, VGS = 0 V                    |     | 0.8   | 1.2   | V    |

Note: \*1 Assured by design

\*2 See Test circuit

## DESTRUCTION CURRENT

|                     | Condition                           | Result |
|---------------------|-------------------------------------|--------|
| Operation test      | VGS = 3.8 V<br>t = 3 ms, IS = 40 A  | PASS   |
|                     | VGS = 3.8 V<br>t = 11 ms, IS = 15 A | PASS   |
| Destruction current | VGS = 3.8 V<br>t = 3 ms             | 95 A   |
|                     | VGS = 3.8 V<br>t = 11 ms            | 63 A   |

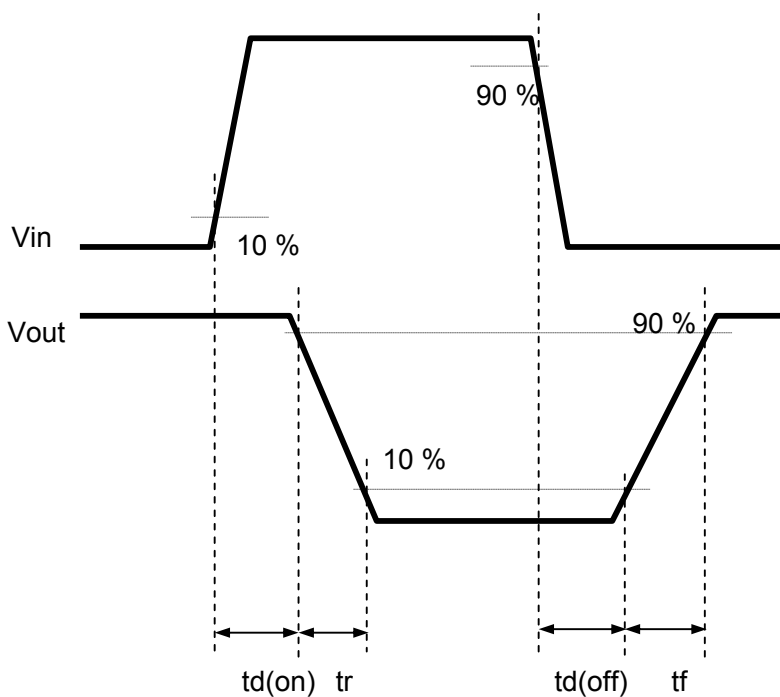
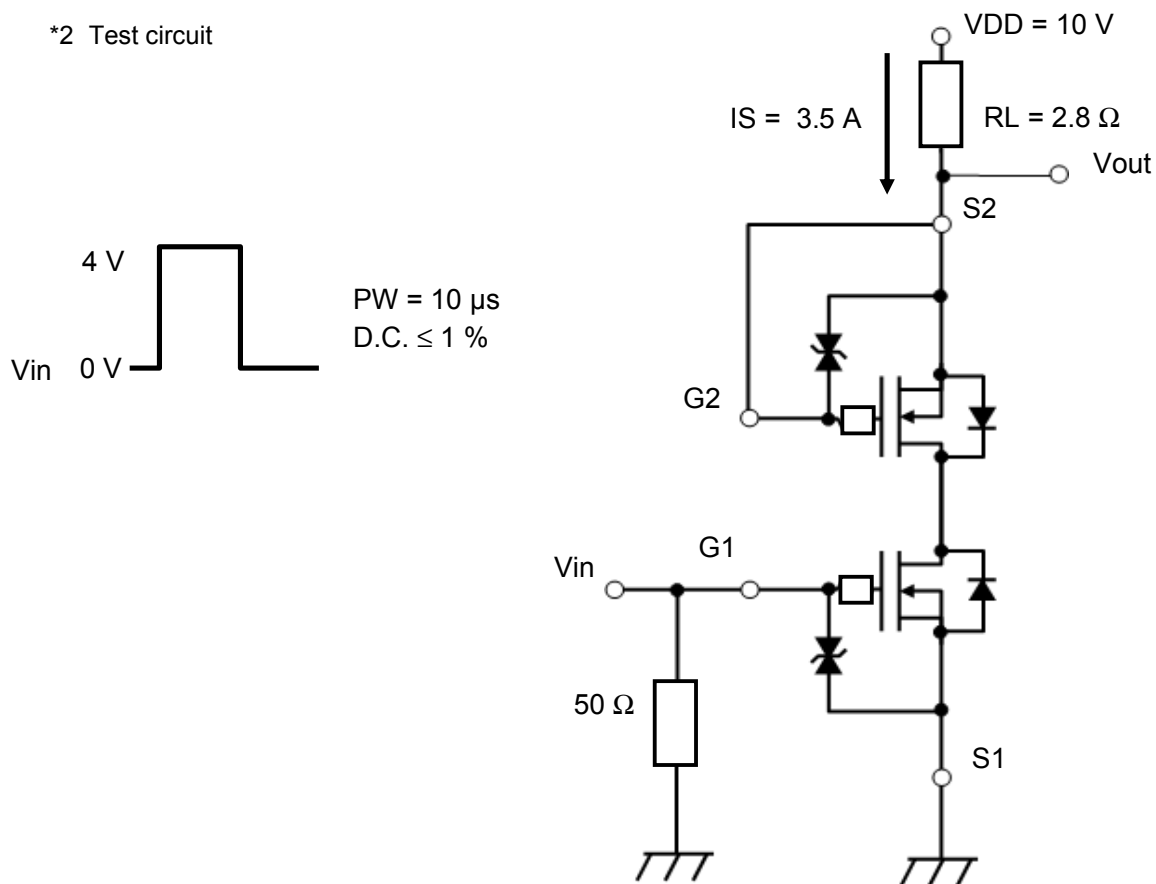
Ta = 25 °C,

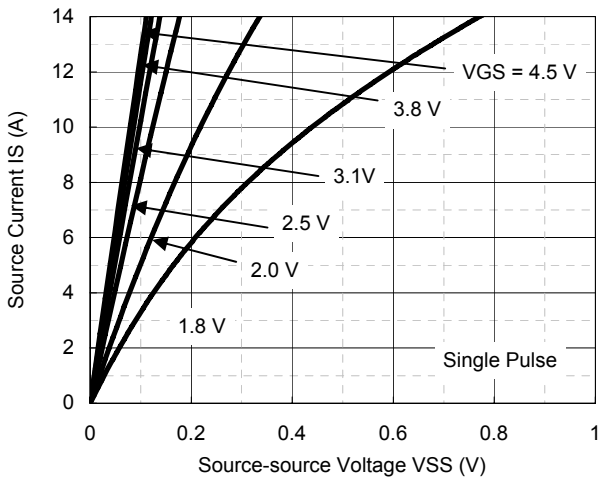
Mounted on FR4 board (25.4 × 25.4 × 1.0 mm)

Surface Mounted on FR4 Board using the minimum recommended

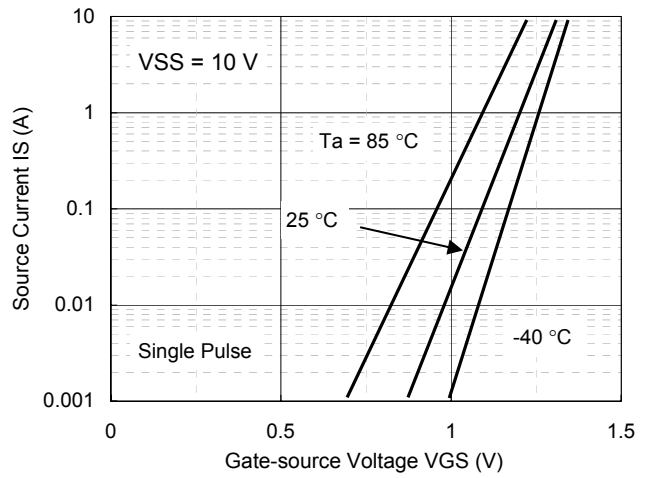
pad size (Cu area = 47 mm<sup>2</sup> including traces)

\*2 Test circuit

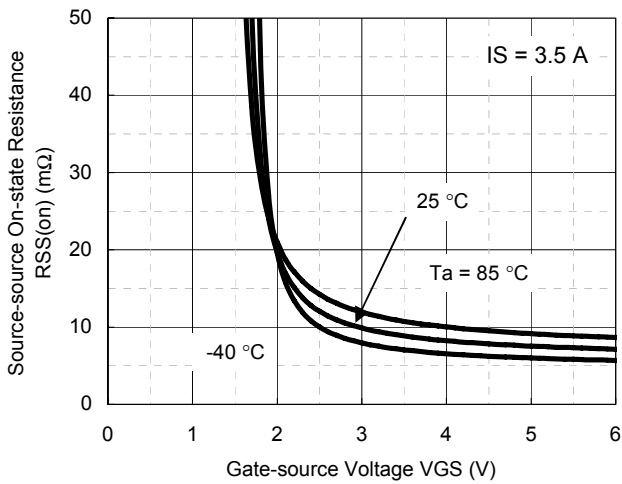




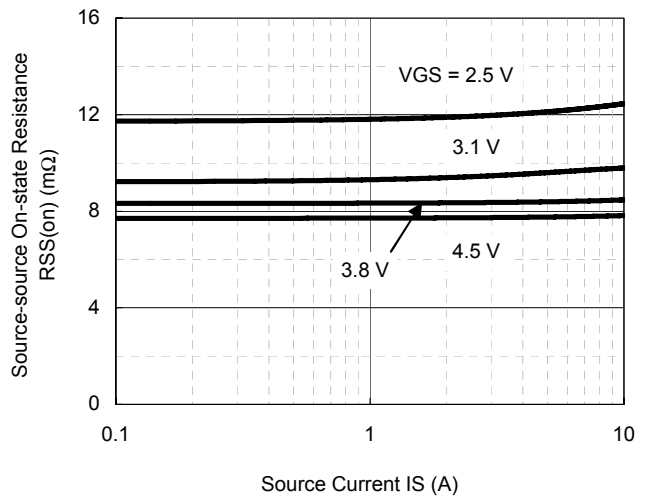
IS - VSS



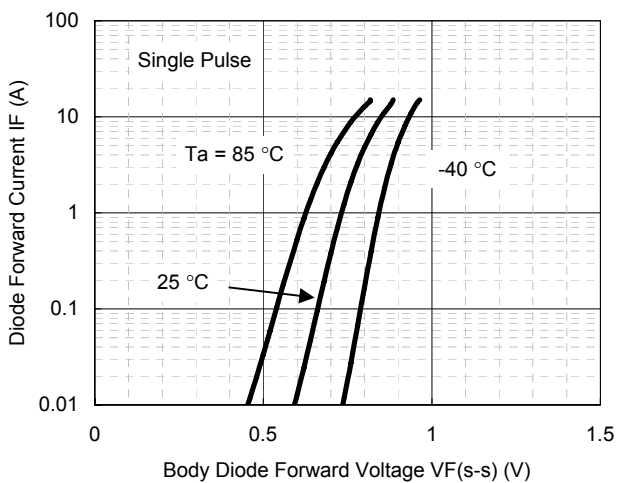
IS - VGS



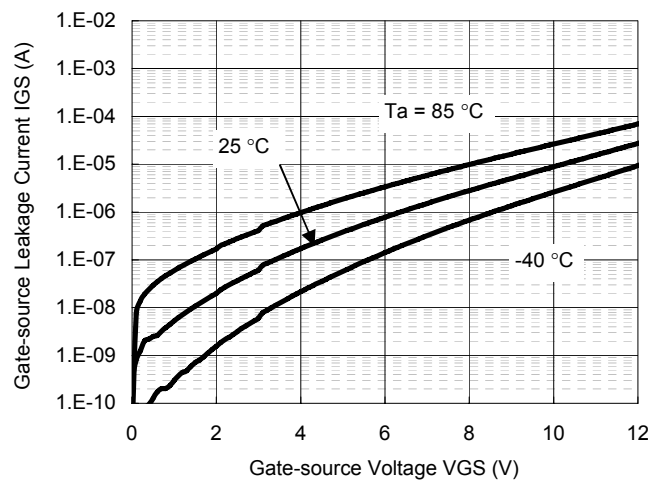
RSS(on) - VGS



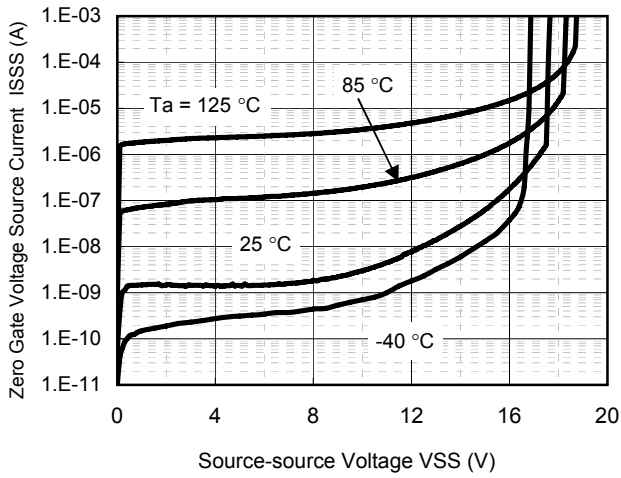
RSS(on) - IS



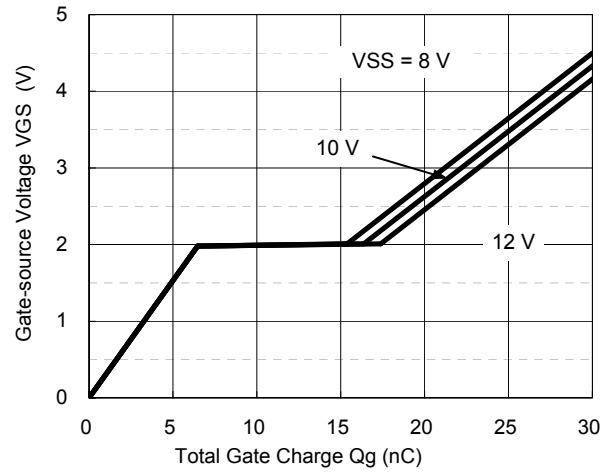
IF - VF(s-s)



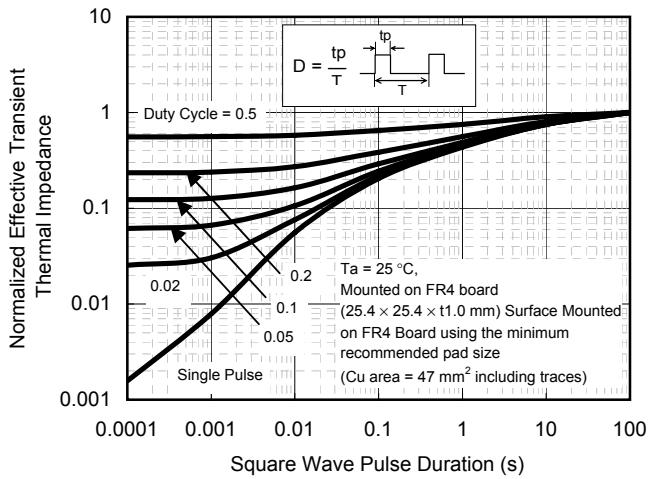
IGS - VGS



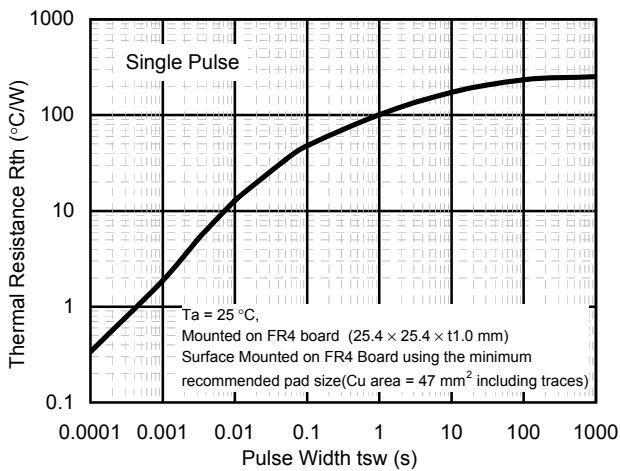
ISSS - VSS



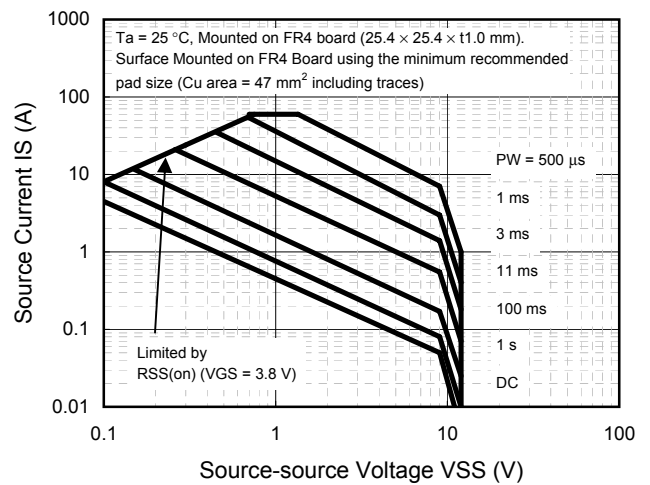
Dynamic Input/Output Characteristics



Thermal Response



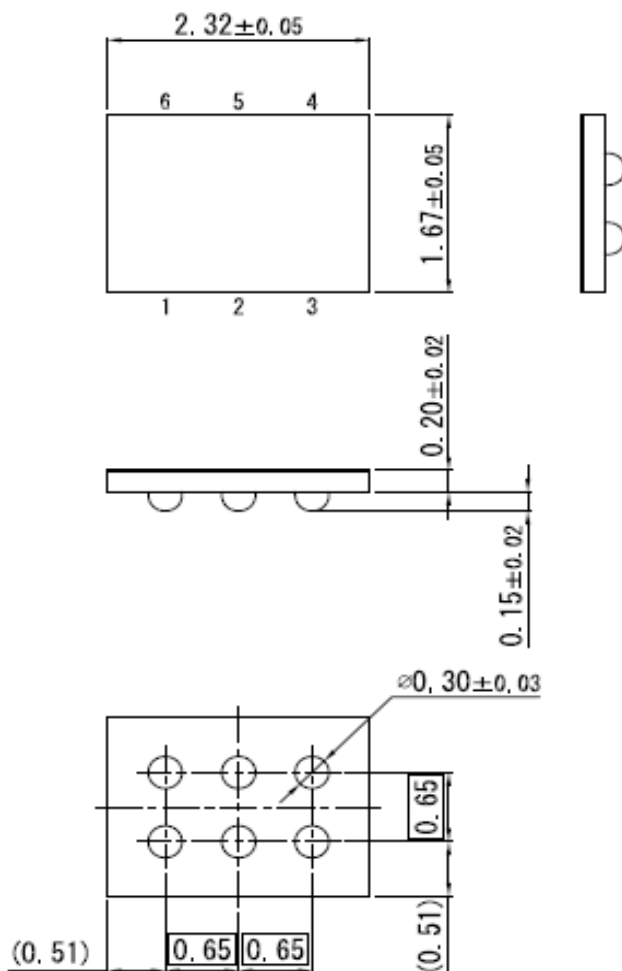
Rth - tsw



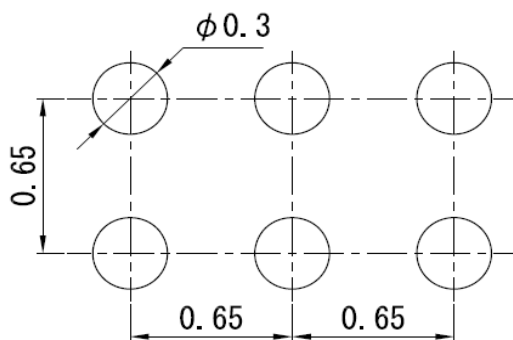
Safe Operating Area

MBGA006-W-1723APA

Unit: mm



■ Land Pattern (Reference) (Unit: mm)



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