

# Gate resistor installed Dual N-channel MOSFET

## FC6B21100L Datasheet

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## 1. GENERAL DESCRIPTION

Gate resistor installed Dual N-channel MOSFET for lithium-ion secondary battery protection circuits.

## 2. FEATURES

- Low source-source ON Resistance:  $R_{ss(on)}$  typ = 4.5 m $\Omega$  ( $V_{GS}$  = 4.5 V)
- CSP package:smallest & thinnest size
- RoHS compliant (EU RoHS / MSL: Level 1)

## 3. MARKING SYMBOL: 33

## 4. PACKAGING

Embossed type (Thermo-compression sealing): 10,000 pcs / reel (standard)

## 5. ABSOLUTE MAXIMUM RATINGS $T_a = 25\text{ }^{\circ}\text{C}$

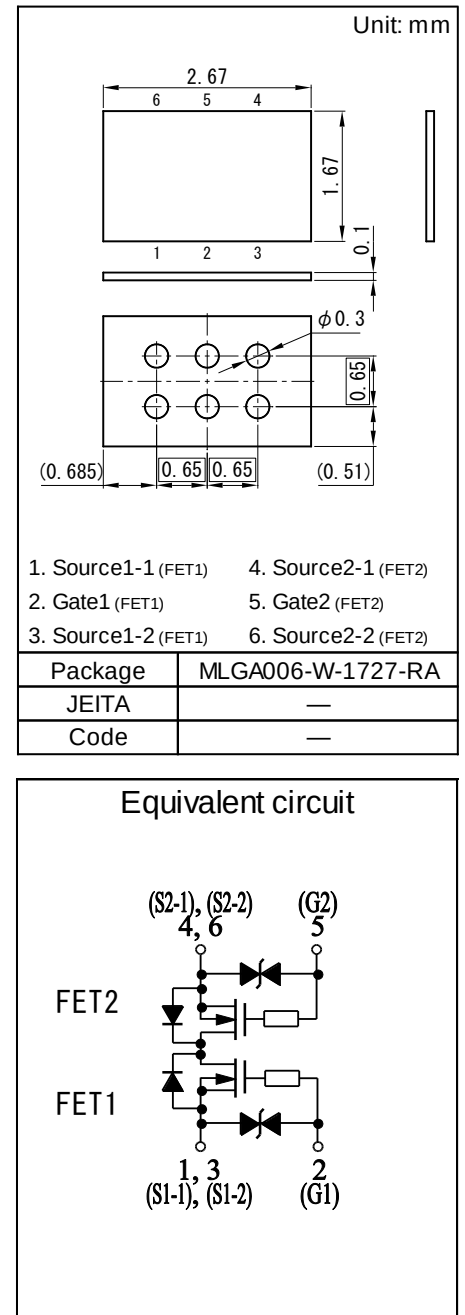
| Parameter                                | Symbol | Rating        | Unit               |
|------------------------------------------|--------|---------------|--------------------|
| Source-source Voltage                    | VSS    | 12            | V                  |
| Gate-source Voltage                      | VGS    | $\pm 8$       | V                  |
| Source Current (DC) <sup>*1</sup>        | IS     | 8             | A                  |
| Source Current (Pulsed) <sup>*1,*2</sup> | ISp    | 80            | A                  |
| Total Power Dissipation <sup>*1</sup>    | PD     | 0.45          | W                  |
| Channel Temperature                      | Tch    | 150           | $^{\circ}\text{C}$ |
| Storage Temperature Range                | Tstg   | - 55 to + 150 | $^{\circ}\text{C}$ |

## 6. THERMAL CHARACTERISTICS $T_a = 25\text{ }^{\circ}\text{C}$

| Parameter                 | Symbol    | Rating | Unit                          |
|---------------------------|-----------|--------|-------------------------------|
| Thermal resistance (ch-a) | Rth(ch-a) | 278    | $^{\circ}\text{C} / \text{W}$ |

Note <sup>\*1</sup> Mounted on FR4 board (25.4 mm x 25.4 mm x t1.0 mm).  
using the minimum recommended pad size (36 $\mu\text{m}$  Copper).

<sup>\*2</sup>  $t = 10\text{ }\mu\text{s}$ , Duty Cycle  $\leq 1\%$ .



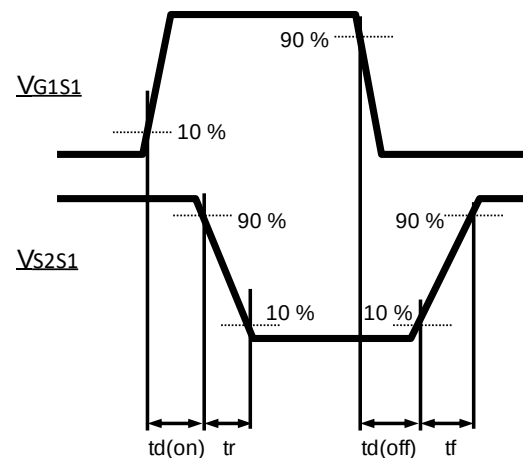
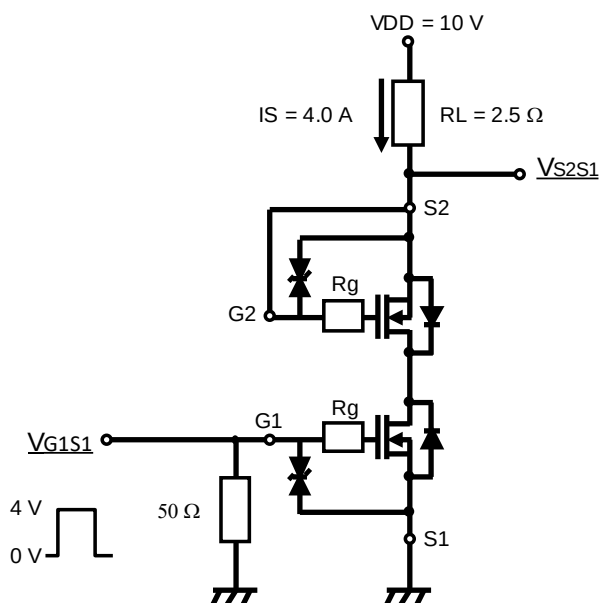
## 7. ELECTRICAL CHARACTERISTICS $T_a = 25^\circ\text{C} \pm 3^\circ\text{C}$

| Parameter                                  | Symbol       | Conditions                                                                          | Min  | Typ  | Max      | Unit          |
|--------------------------------------------|--------------|-------------------------------------------------------------------------------------|------|------|----------|---------------|
| Source-source Breakdown Voltage            | VSSS         | $I_S = 1\text{ mA}$ , $V_{GS} = 0\text{ V}$                                         | 12   |      |          | V             |
| Zero Gate Voltage Source Current           | ISSS         | $V_{SS} = 12\text{ V}$ , $V_{GS} = 0\text{ V}$                                      |      |      | 1        | $\mu\text{A}$ |
| Gate-source Leakage Current                | IGSS         | $V_{GS} = \pm 8\text{ V}$ , $V_{SS} = 0\text{ V}$                                   |      |      | $\pm 10$ | $\mu\text{A}$ |
|                                            |              | $V_{GS} = \pm 5\text{ V}$ , $V_{SS} = 0\text{ V}$                                   |      |      | $\pm 1$  |               |
| Gate-source Threshold Voltage              | $V_{th}$     | $I_S = 1.0\text{ mA}$ , $V_{SS} = 10\text{ V}$                                      | 0.35 | 0.90 | 1.40     | V             |
| Source-source On-state Resistance          | RSS(on)1     | $I_S = 4.0\text{ A}$ , $V_{GS} = 4.5\text{ V}$                                      | 3.4  | 4.5  | 5.7      | m $\Omega$    |
|                                            | RSS(on)2     | $I_S = 4.0\text{ A}$ , $V_{GS} = 3.8\text{ V}$                                      | 3.6  | 4.9  | 6.3      |               |
|                                            | RSS(on)3     | $I_S = 4.0\text{ A}$ , $V_{GS} = 3.1\text{ V}$                                      | 4.0  | 5.5  | 7.8      |               |
|                                            | RSS(on)4     | $I_S = 4.0\text{ A}$ , $V_{GS} = 2.5\text{ V}$                                      | 4.2  | 6.5  | 11.0     |               |
| Body Diode Forward Voltage                 | $V_{F(s-s)}$ | $I_F = 8.0\text{ A}$ , $V_{GS} = 0\text{ V}$                                        |      | 0.8  | 1.2      | V             |
| Input Capacitance <sup>*1</sup>            | Ciss         | $V_{SS} = 10\text{ V}$ , $V_{GS} = 0\text{ V}$ ,<br>$f = 1\text{ MHz}$              |      | 4360 |          | pF            |
| Output Capacitance <sup>*1</sup>           | Coss         |                                                                                     |      | 720  |          |               |
| Reverse Transfer Capacitance <sup>*1</sup> | Crss         |                                                                                     |      | 670  |          |               |
| Turn-on delay Time <sup>*1,*2</sup>        | td(on)       | $V_{DD} = 10\text{ V}$ , $V_{GS} = 0\text{ to }4\text{ V}$<br>$I_S = 4.0\text{ A}$  |      | 2.2  |          | $\mu\text{s}$ |
| Rise Time <sup>*1,*2</sup>                 | tr           |                                                                                     |      | 5.3  |          |               |
| Turn-off delay Time <sup>*1,*2</sup>       | td(off)      | $V_{DD} = 10\text{ V}$ , $V_{GS} = 4\text{ to }0\text{ V}$<br>$I_S = 4.0\text{ A}$  |      | 13.9 |          | $\mu\text{s}$ |
| Fall Time <sup>*1,*2</sup>                 | tf           |                                                                                     |      | 12.1 |          |               |
| Total Gate Charge <sup>*1</sup>            | Qg           | $V_{DD} = 10\text{ V}$<br>$V_{GS} = 0\text{ to }4\text{ V}$<br>$I_S = 8.0\text{ A}$ |      | 42   |          | nC            |
| Gate-source Charge <sup>*1</sup>           | Qgs          |                                                                                     |      | 14   |          |               |
| Gate-drain Charge <sup>*1</sup>            | Qgd          |                                                                                     |      | 13   |          |               |

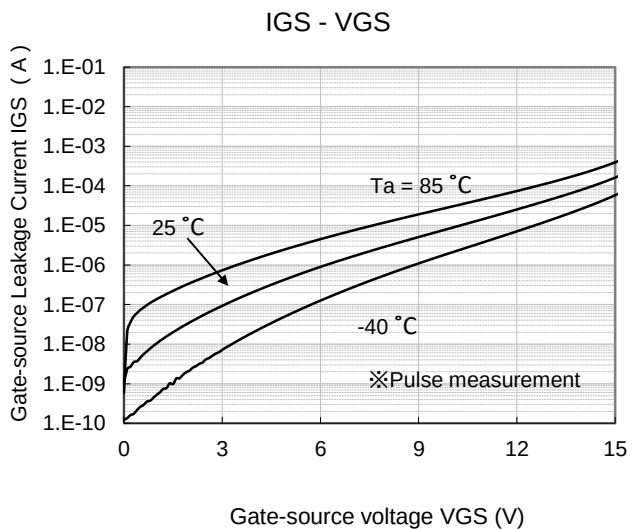
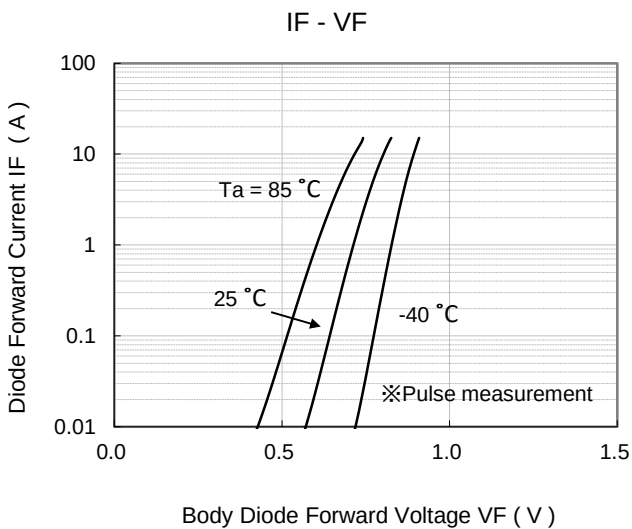
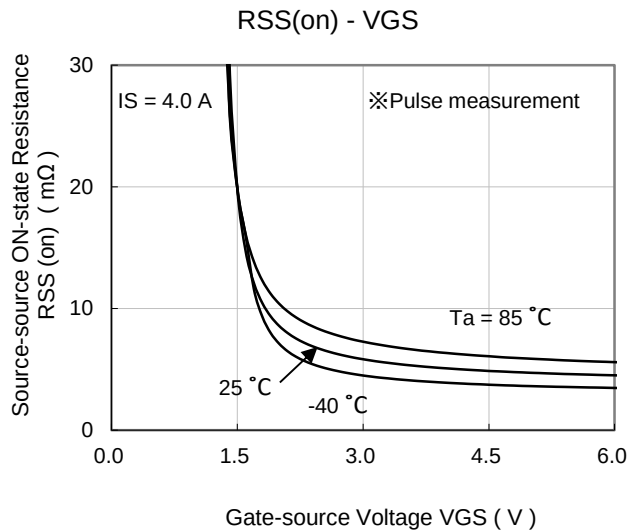
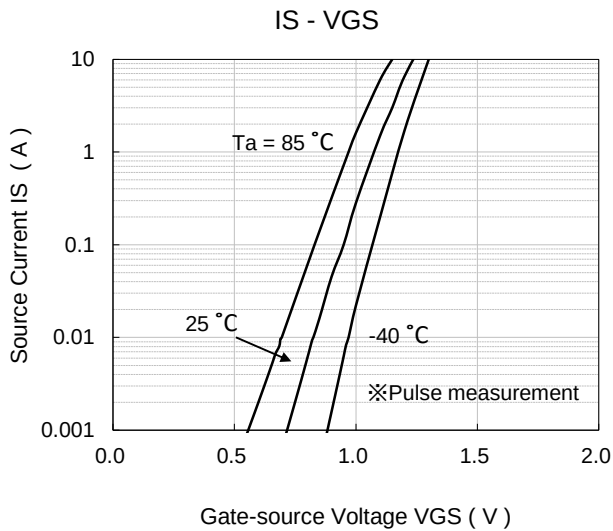
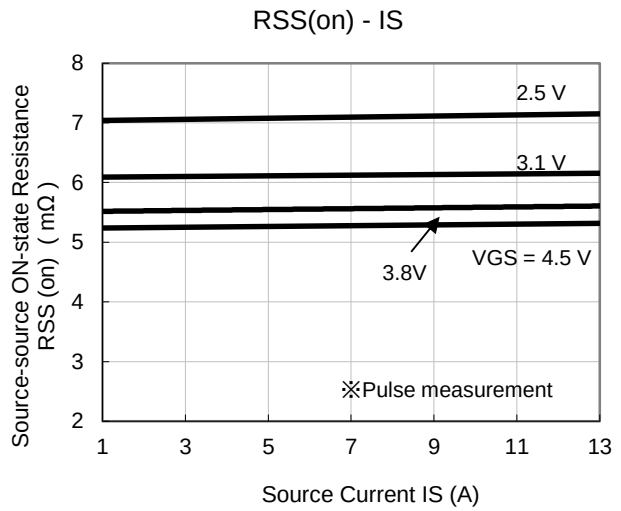
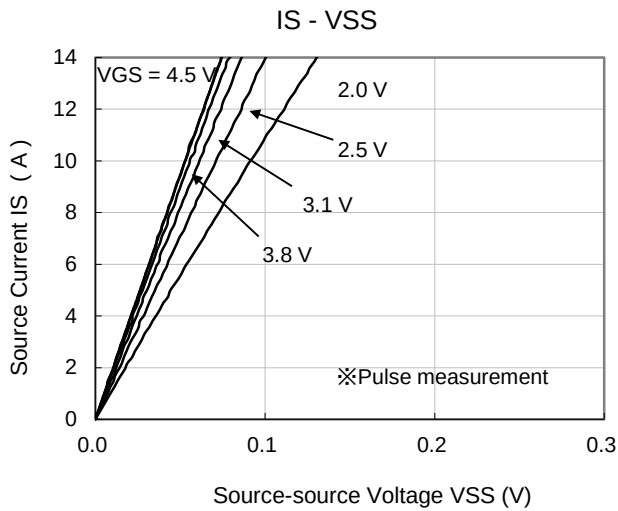
Note Measuring methods are based on JAPANESE INDUSTRIAL STANDARD JIS C 7030 Measuring methods for transistors.

\*1 Guaranteed by design

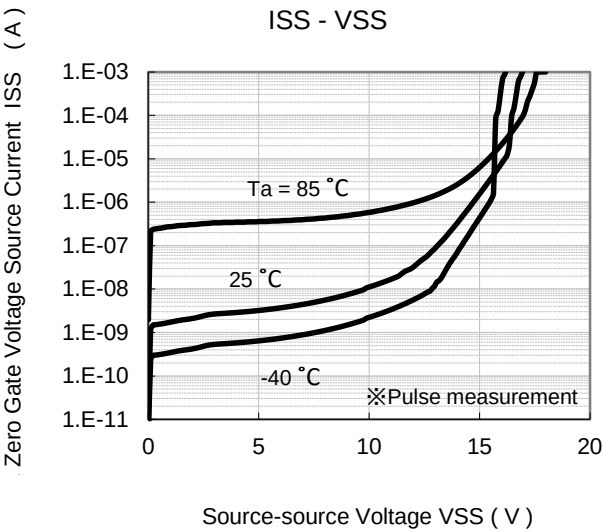
\*2 Measurement circuit for Turn-on Delay Time / Rise Time / Turn-off Delay Time / Fall Time



## 8. TECHNICAL DATA (Reference)



TECHNICAL DATA (Reference)

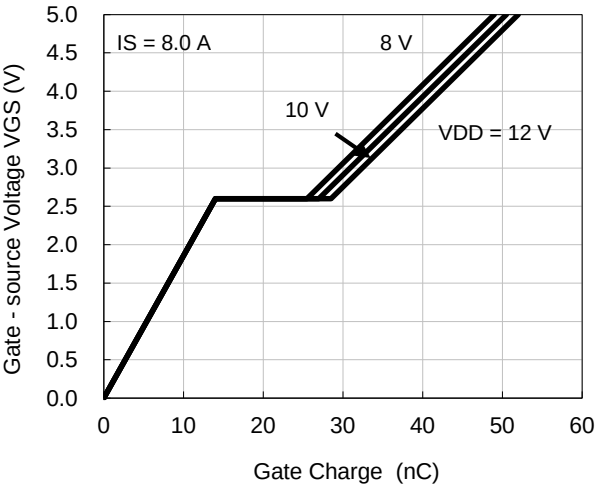


Destruction Current

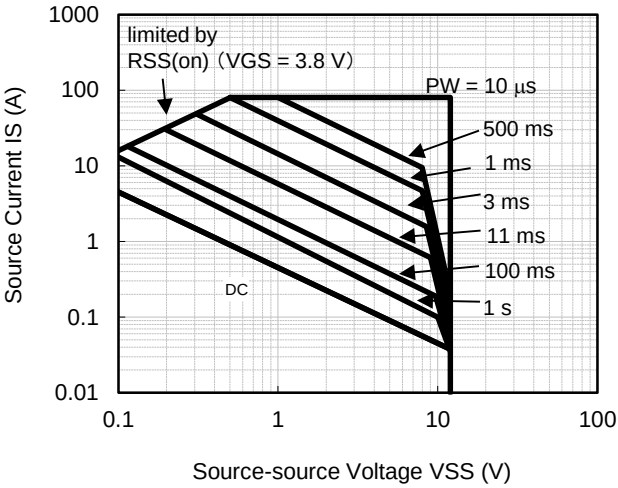
| Parameter                         | Conditions                        | Result |
|-----------------------------------|-----------------------------------|--------|
| Operation Test <sup>*1</sup>      | VGS = 3.8 V, IS = 40 A, t = 3 ms  | PASS   |
|                                   | VGS = 3.8 V, IS = 15 A, t = 11 ms | PASS   |
| Destruction Current <sup>*1</sup> | VGS = 3.8 V, t = 300 μs           | 90 A   |
|                                   | VGS = 3.8 V, t = 10 ms            | 72 A   |
|                                   | VGS = 3.8 V, t = 20 ms            | 59 A   |
|                                   | VGS = 3.8 V, t = 50 ms            | 47 A   |
|                                   | VGS = 3.8 V, t = 100 ms           | 42 A   |
|                                   | VGS = 3.8 V, t = 200 ms           | 35 A   |

Ta = 25 °C,  
Mounted on FR4 board (25.4 mm x 25.4 mm x t1.0 mm)  
using the minimum recommended pad size (36μm Copper).

Dynamic Input/Output Characteristics

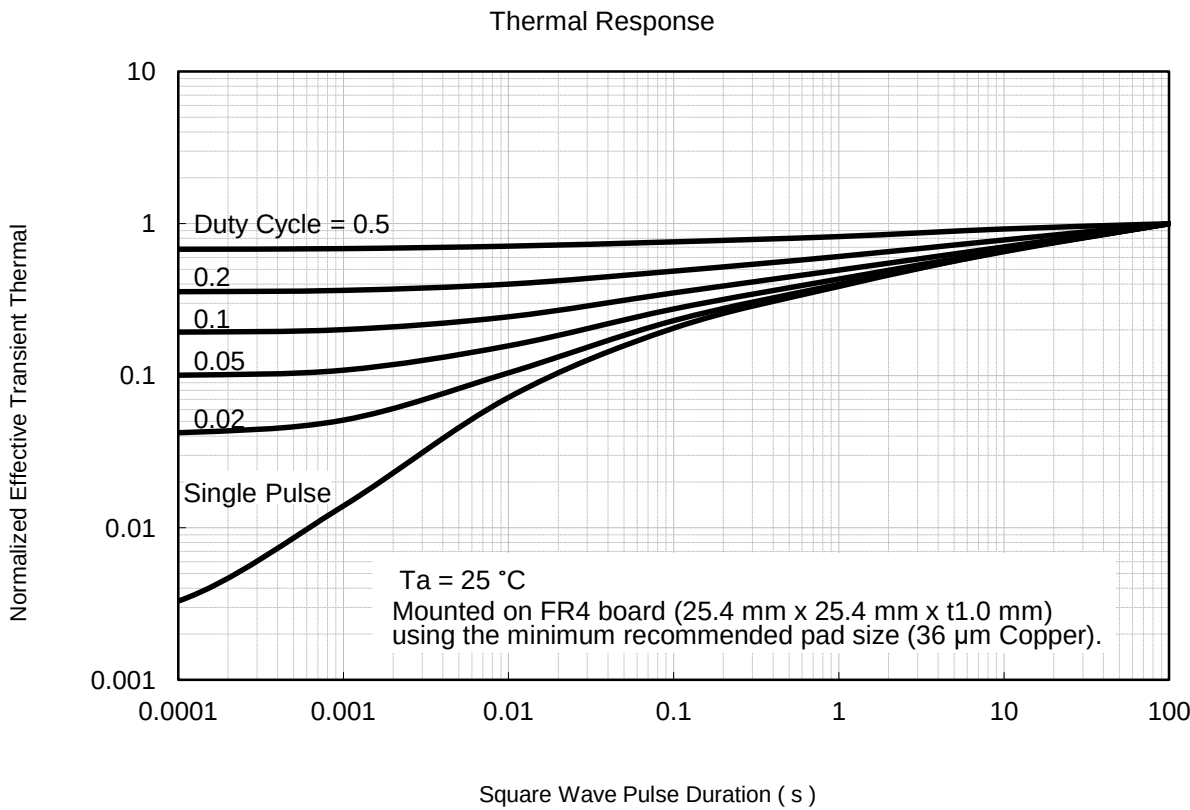
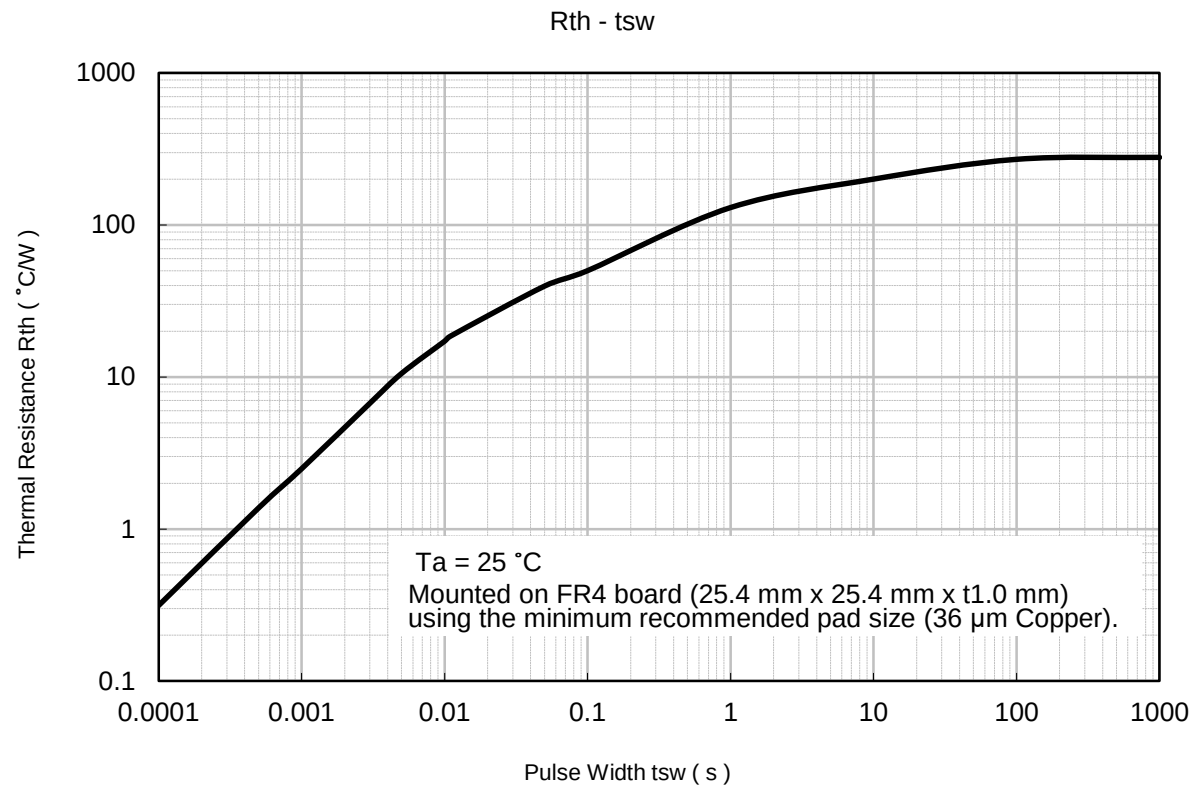


Safe Operating Area



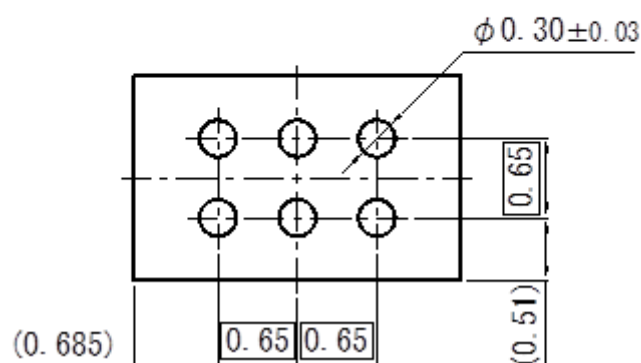
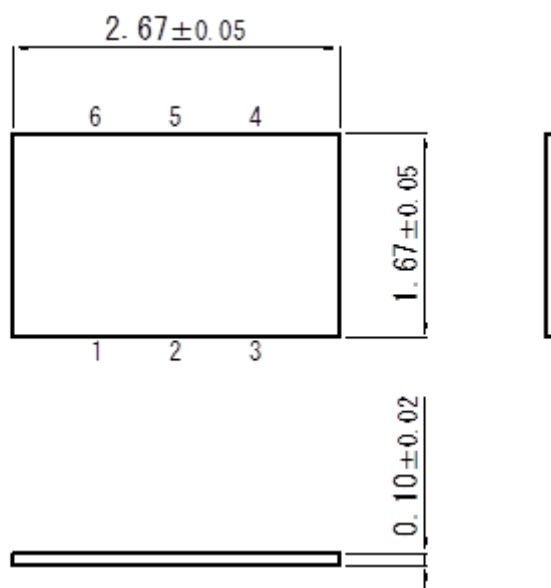
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TECHNICAL DATA (Reference)



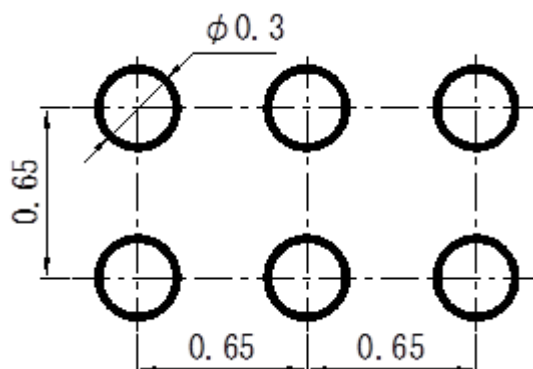
## 9. OUTLINE

Unit: mm



## 10. LAND PATTERN (Reference)

Unit: mm



### Important notice:

Solder Mask Defined (SMD) pattern is strongly recommended for pad design.  
Please check the information in the Nuvoton WL-CSP Application Notes about mounting process.

## 11. REVISION HISTORY

| Date       | Revision | Description                                                                                     |
|------------|----------|-------------------------------------------------------------------------------------------------|
| 2021.04.21 | 1.00     | 1. Initially issued.                                                                            |
| 2021.08.31 | 1.01     | 1. Added important notice in Land Pattern.<br>2. Added special attention and precautions notes. |
| 2021.11.11 | 1.02     | 1. Changed document name from Product Standards to Datasheet.                                   |



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