Dual N-channel MOSFET

1. GENERAL DESCRIPTION

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

2. FEATURES

- Source-source On-state Resistance: RSS(on) typ = 2.2 mΩ (VGS = 3.8 V)
- CSP (Chip Size Package)
- Halogen-free / RoHS compliant (EU RoHS / UL-94 V-0 / MSL: Level 1)

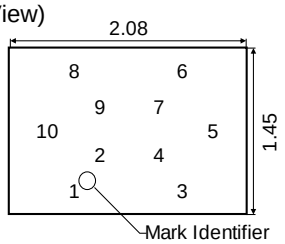
3. MARKING SYMBOL: UP

4. PACKAGING

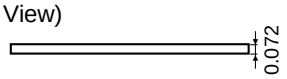
Embossed type (Thermo-compression sealing): 10,000 pcs / reel (standard)

Unit: mm

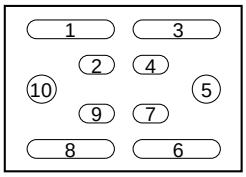
(Top View)



(Front View)



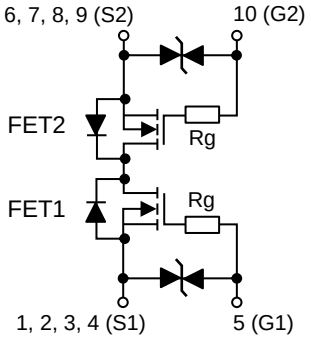
(Bottom View)



1, 2, 3, 4. Source1 (FET1) 5. Gate1 (FET1)
6, 7, 8, 9. Source2 (FET2) 10. Gate2 (FET2)

Package	TCSP1521007-N1

Equivalent Circuit



5. ABSOLUTE MAXIMUM RATINGS Ta = 25 °C

Parameter		Symbol	Rating	Unit
Source-source Voltage		VSS	12	V
Gate-source Voltage		VGS	± 8	V
Source Current	DC *1	IS1	14.6	A
	DC *2	IS2	23.0	
	DC *3	IS3	31.0	
	Pulsed *4	ISp	146	
Total Power Dissipation	DC *1	PD1	0.61	W
	DC *2	PD2	1.60	
	DC *3	PD3	2.80	
Operating Junction and Storage Temperature Range		Tj, Tstg	- 55 to + 150	°C

6. THERMAL CHARACTERISTICS Ta = 25 °C

Parameter	Symbol	Rating	Unit
Thermal Resistance (ch-a)	Rth1 *1	205	°C / W
	Rth2 *2	79	
	Rth3 *3	45	

Note *1 Mounted on FR4 board (25.4 mm x 25.4 mm x t1.0 mm).
FR4 board partially covered with copper pad (60 mm^2 area, 36 µm thickness).
*2 Mounted on FR4 board (25.4 mm x 25.4 mm x t1.0 mm).
FR4 board fully covered with copper pad (611 mm^2 area, 36 µm thickness).
*3 Mounted on ceramic board (70 mm x 70 mm x t1.0 mm).
*4 t = 10 µs, Duty Cycle ≤ 1 %.

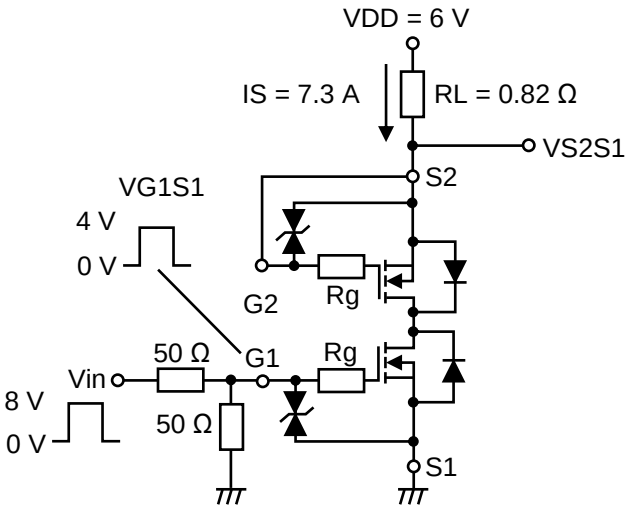
7. ELECTRICAL CHARACTERISTICS Ta = 25 °C ± 3 °C

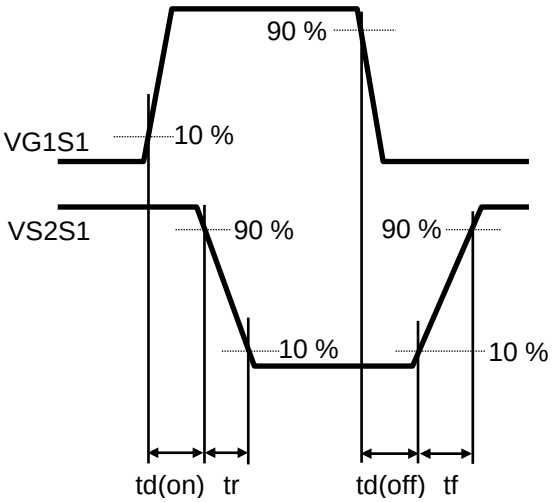
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Source-source Breakdown Voltage	VSSS	IS = 1 mA, VGS = 0 V	12			V
Zero Gate Voltage Source Current	ISSS	VSS = 12 V, VGS = 0 V			1	μA
Gate-source Leakage Current	IGSS1	VGS = ± 8 V, VSS = 0 V			± 10	μA
	IGSS2	VGS = ± 5 V, VSS = 0 V			± 1	
Gate-source Threshold Voltage	Vth	IS = 0.46 mA, VSS = 6 V	0.35	0.90	1.40	V
Source-source On-state Resistance	RSS(on)1	IS = 7.3 A, VGS = 4.5 V	1.50	2.05	2.70	mΩ
	RSS(on)2	IS = 7.3 A, VGS = 3.8 V	1.60	2.20	2.85	
	RSS(on)3	IS = 7.3 A, VGS = 3.1 V	1.75	2.55	3.90	
	RSS(on)4	IS = 7.3 A, VGS = 2.5 V	2.00	3.30	6.60	
Body Diode Forward Voltage	VF(s-s)	IF = 7.3 A, VGS = 0 V		0.71	1.00	V
Input Capacitance *1	Ciss	VSS = 10 V, VGS = 0 V, f = 1 kHz		3490		pF
Output Capacitance *1	Coss			425		
Reverse Transfer Capacitance *1	Crss			360		
Turn-on Delay Time *1, *2	td(on)	VDD = 6 V, VGS = 0 to 4 V		1.0		μs
Rise Time *1, *2	tr	IS = 7.3 A		1.6		
Turn-off Delay Time *1, *2	td(off)	VDD = 6 V, VGS = 4 to 0 V		6.1		μs
Fall Time *1, *2	tf	IS = 7.3 A		2.8		
Total Gate Charge *1	Qg	VDD = 6 V		32		nC
Gate-source Charge *1	Qgs	VGS = 0 to 4 V		7		
Gate-drain Charge *1	Qgd	IS = 14.6 A		6		
Gate Resistance *1	Rg	f = 1 MHz	400	700	1000	Ω

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

*1 Guaranteed by design, not subject to production testing.

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



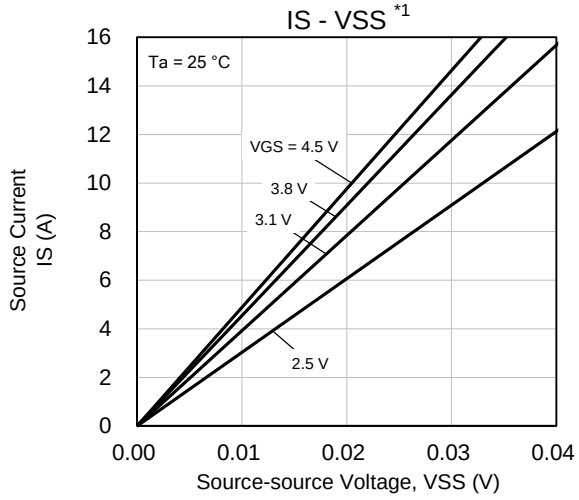


8. ELECTROSTATIC DISCHARGE CHARACTERISTIC Ta = 25 °C ± 3 °C

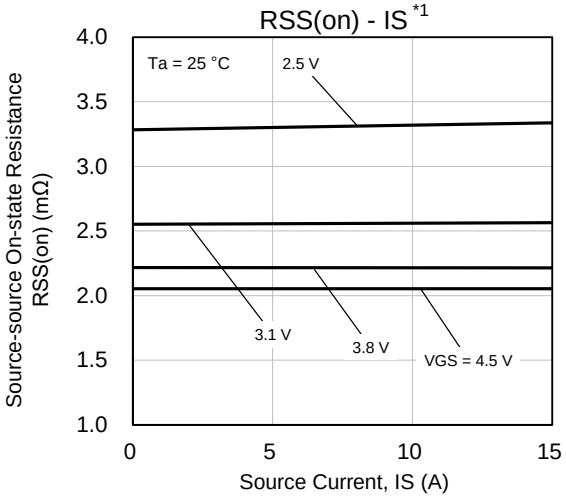
Standard	Test Type	Symbol	Conditions	Class	Value	Unit
AEC-Q101-001	Human Body Model	HBM	C = 100 pF, R = 1.5 kΩ	H2	> 2 to ≤ 4	kV

9. TECHNICAL DATA (Reference)

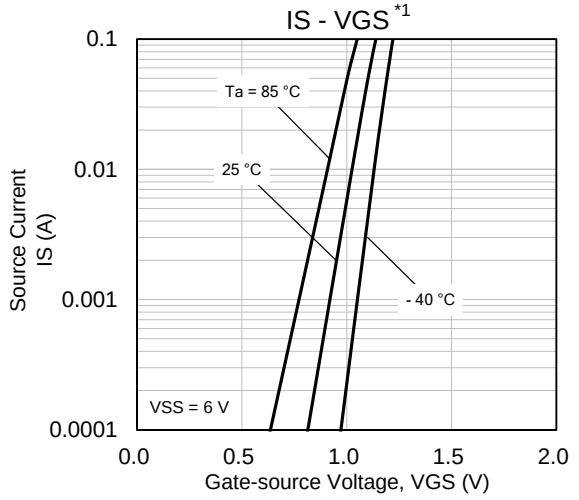
IS - VSS *1



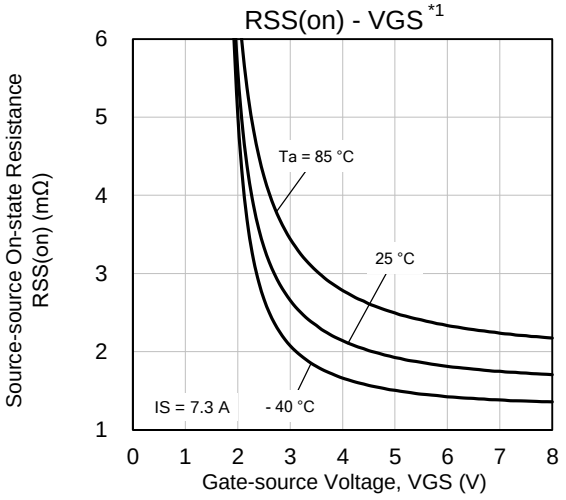
RSS(on) - IS *1



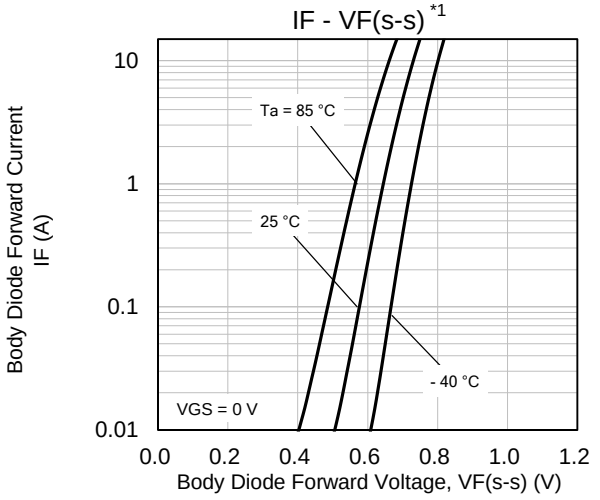
IS - VGS *1



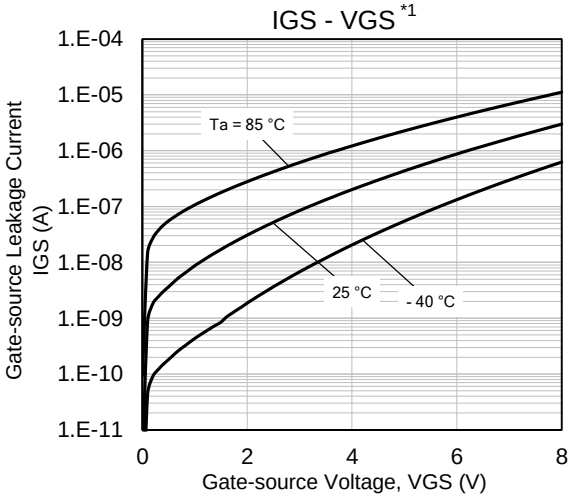
RSS(on) - VGS *1



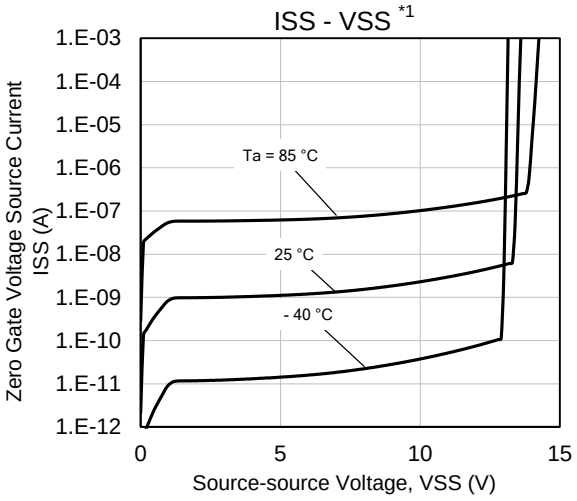
IF - VF(s-s) *1

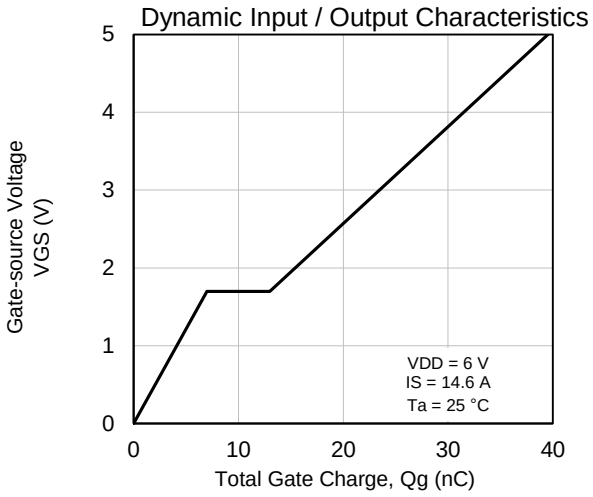


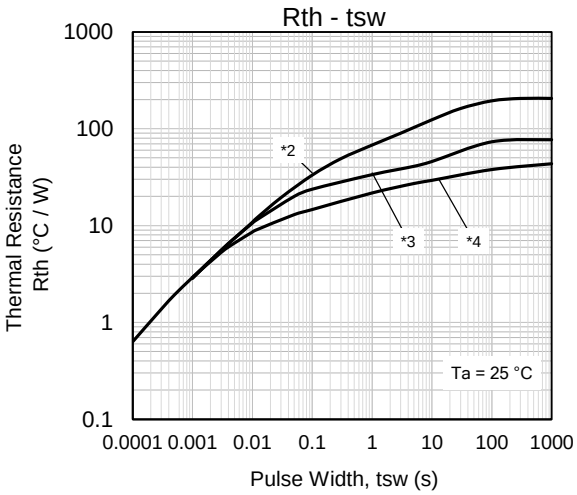
IGS - VGS *1

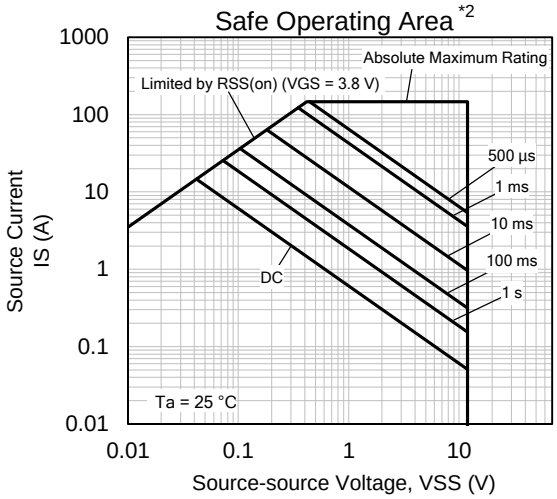


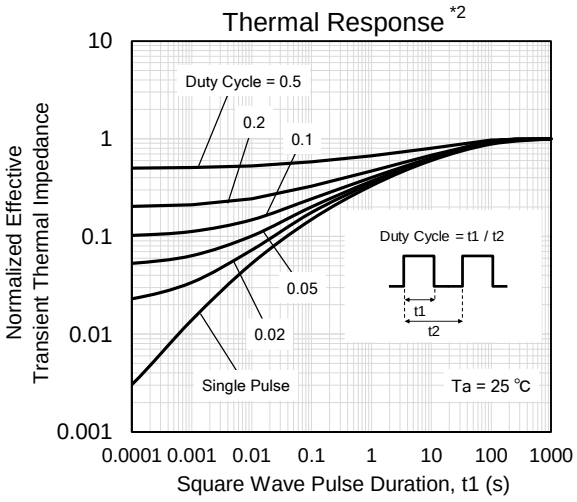
TECHNICAL DATA (Reference)











Note

*1 Pulse measurement.

*2 Mounted on FR4 board (25.4 mm × 25.4 mm × t1.0 mm).
FR4 board partially covered with copper pad
(60 mm^2 area, 36 µm thickness).

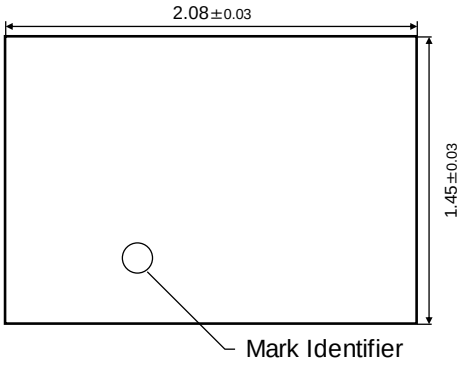
*3 Mounted on FR4 board (25.4 mm × 25.4 mm × t1.0 mm).
FR4 board fully covered with copper pad
(611 mm^2 area, 36 µm thickness).

*4 Mounted on ceramic board (70 mm × 70 mm × t1.0 mm).

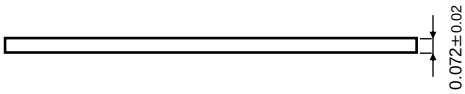
10. OUTLINE

(Top View)

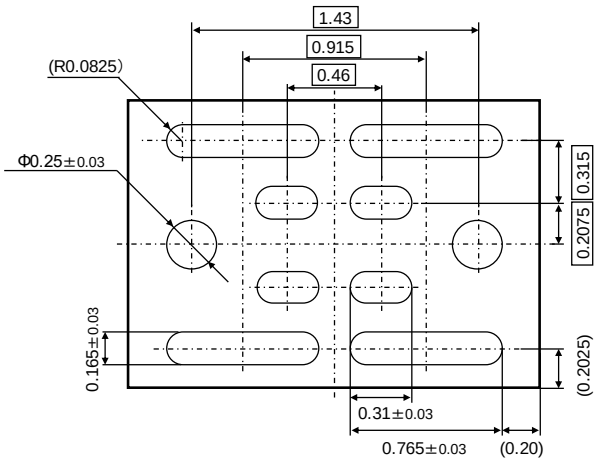
Unit: mm



(Front View)



(Bottom View)

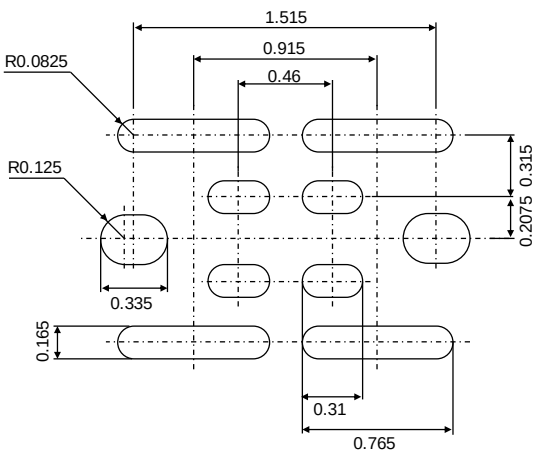


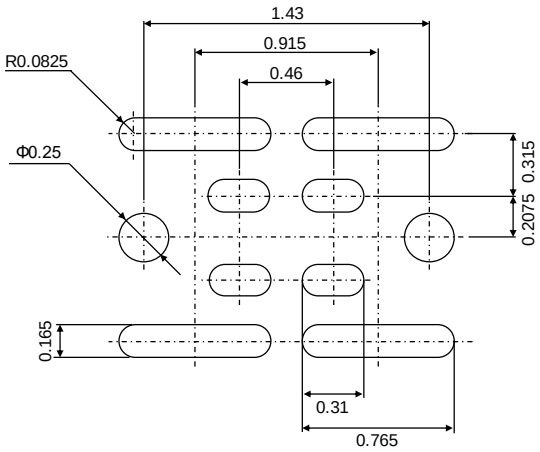
11. LAND & STENCIL PATTERN (Reference)

LAND

STENCIL

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.

12. REVISION HISTORY

Date	Revision	Description
2021.9.16	1.00	1. Initially issued.