

Single N-channel MOSFET

FK9B0439ZL Datasheet

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1. GENERAL DESCRIPTION

Single N-channel MOSFET for automotive.

2. FEATURES

- Drain-source On-state Resistance: RDS(on) typ = 9.5 mΩ (VGS = 10 V)
- CSP (Chip Size Package)
- Halogen-free / RoHS compliant (EU RoHS / UL-94 V-0 / MSL: Level 1)
- AEC-Q101 Qualified

3. MARKING SYMBOL: 5S

4. PACKAGING

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

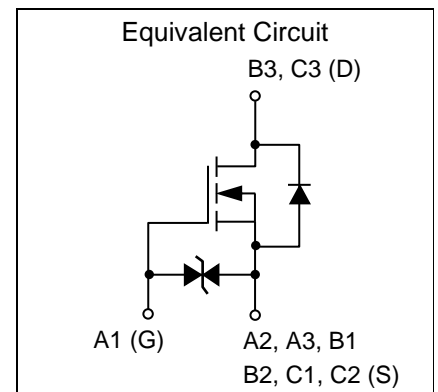
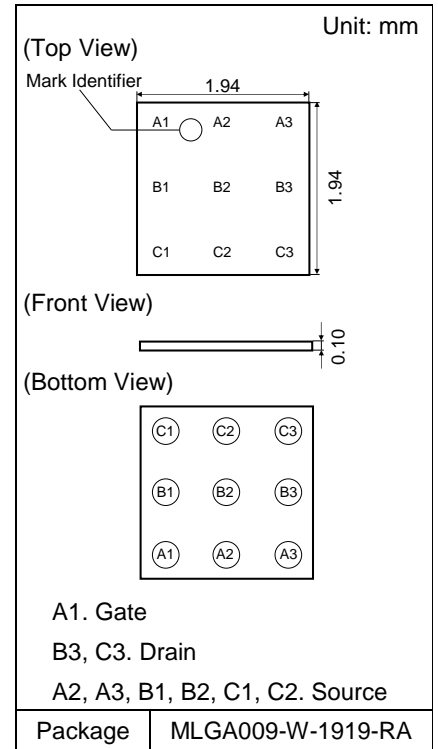
5. ABSOLUTE MAXIMUM RATINGS Ta = 25 °C

Parameter	Symbol	Rating	Unit
Drain-source Voltage	VDS	40	V
Gate-source Voltage	VGS	+ 20 / - 10	V
Drain Current	DC *1	ID1	7.1
	DC *2	ID2	11.0
	DC *3	ID3	13.8
	Pulsed *4	IDp	88.0
Total Power Dissipation	DC *1	PD1	0.61
	DC *2	PD2	1.60
	DC *3	PD3	2.31
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	54	

- Note *1 Mounted on FR4 board (25.4 mm x 25.4 mm x t1.0 mm).
FR4 board partially covered with copper pad (79.2 mm² 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 (616 mm² 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 %.



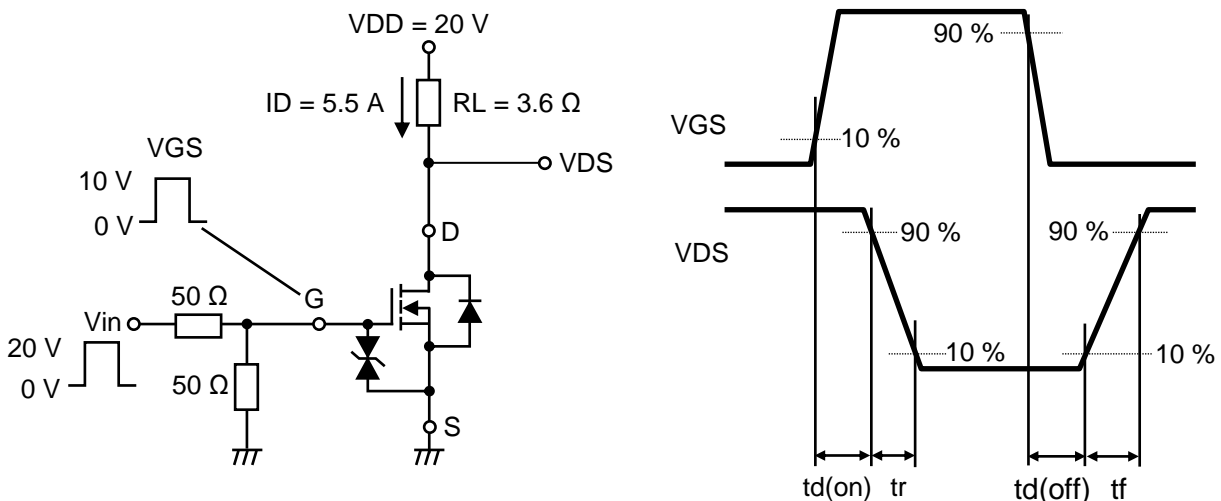
7. ELECTRICAL CHARACTERISTICS Ta = 25 °C ± 3 °C

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Drain-source Breakdown Voltage	VDSS	ID = 1 mA, VGS = 0 V	40			V
Zero Gate Voltage Drain Current	IDSS	VDS = 40 V, VGS = 0 V			1	μA
Gate-source Leakage Current	IGSS	VGS = + 16 V, VDS = 0 V			10	μA
		VGS = - 8 V, VDS = 0 V			- 10	
Gate-source Threshold Voltage	Vth	ID = 0.6 mA, VDS = 10 V	1	2	3	V
Drain-source On-state Resistance	RDS(on)1	ID = 2 A, VGS = 10 V		9.5	12	mΩ
	RDS(on)2	ID = 2 A, VGS = 4.5 V		11	18	
Body Diode Forward Voltage	VF(s-d)	IF = 2 A, VGS = 0 V		0.77	1.2	V
Input Capacitance *1	Ciss	VDS = 20 V, VGS = 0 V f = 1 MHz		1500		pF
Output Capacitance *1	Coss			190		
Reverse Transfer Capacitance *1	Crss			100		
Turn-on Delay Time *1, *2	td(on)	VDD = 20 V, VGS = 0 to 10 V		15		ns
Rise Time *1, *2	tr	ID = 5.5 A		20		
Turn-off Delay Time *1, *2	td(off)	VDD = 20 V, VGS = 10 to 0 V		85		
Fall Time *1, *2	tf	ID = 5.5 A		55		
Total Gate Charge *1	Qg1	VDD = 20 V, VGS = 4.5 V ID = 11 A		14		nC
	Qg2	VDD = 20 V, VGS = 10 V ID = 11 A		28		
Gate-source Charge *1	Qgs	VDD = 20 V, VGS = 10 V ID = 11 A		4.5		
Gate-drain Charge *1	Qgd	VDD = 20 V, VGS = 10 V ID = 11 A		5		

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.

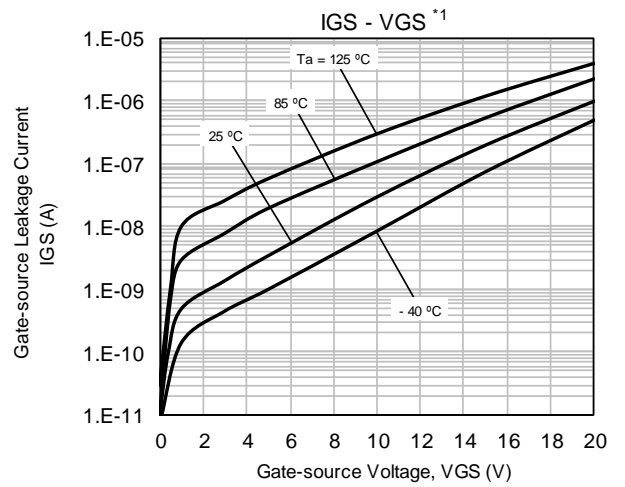
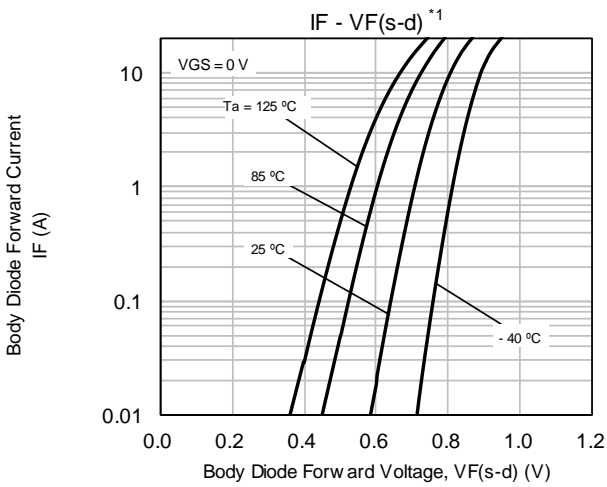
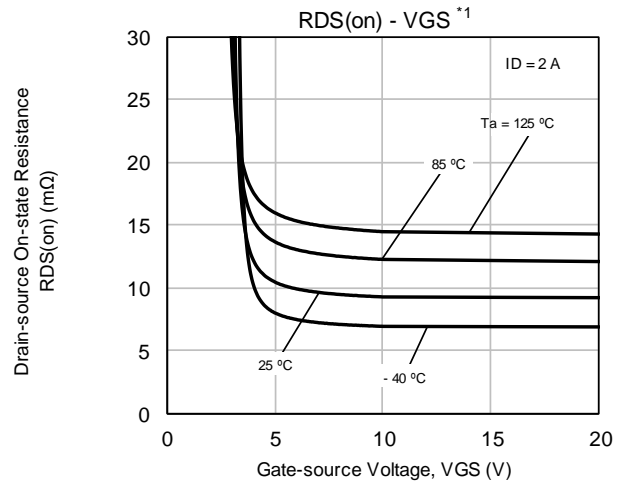
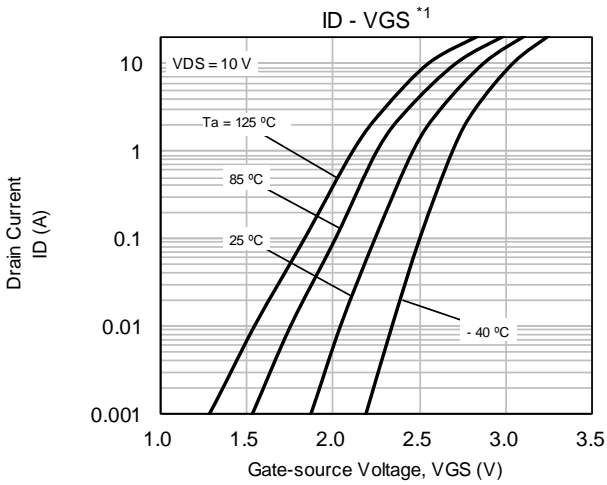
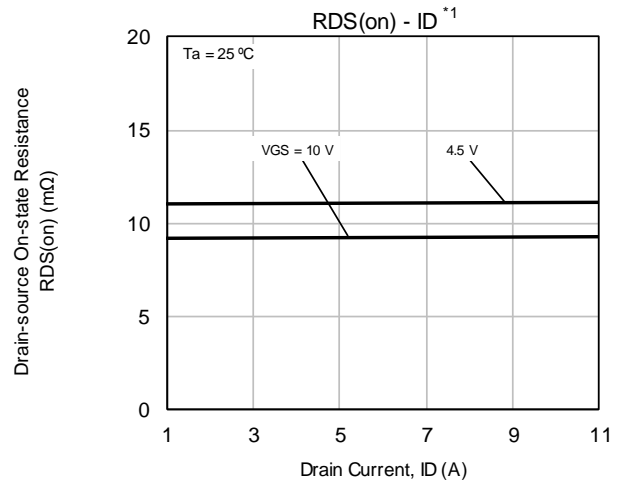
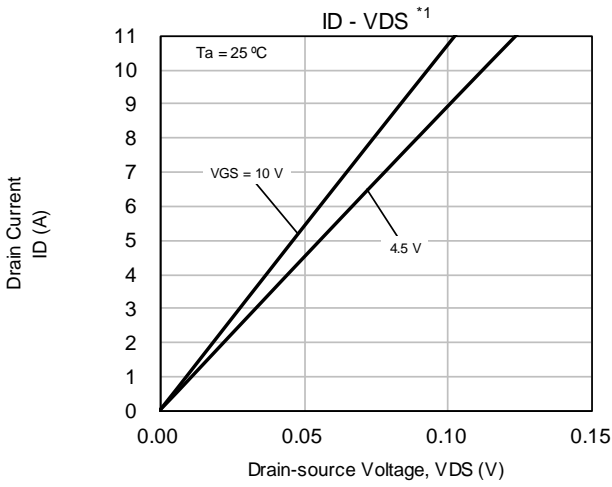
*2 Measurement circuit for Turn-on Delay Time / Rise Time / Turn-off Delay Time / Fall Time.



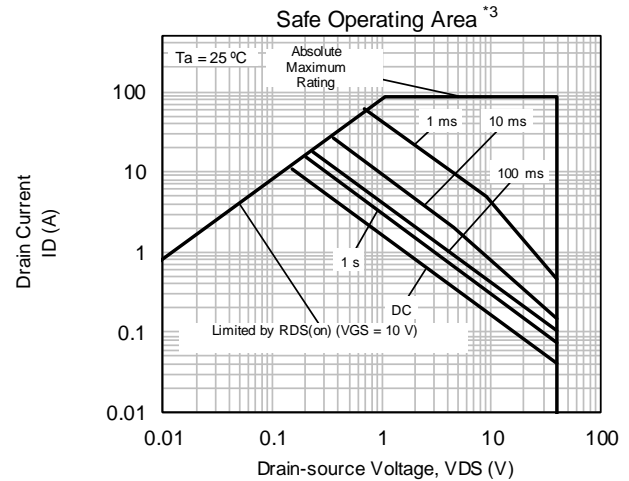
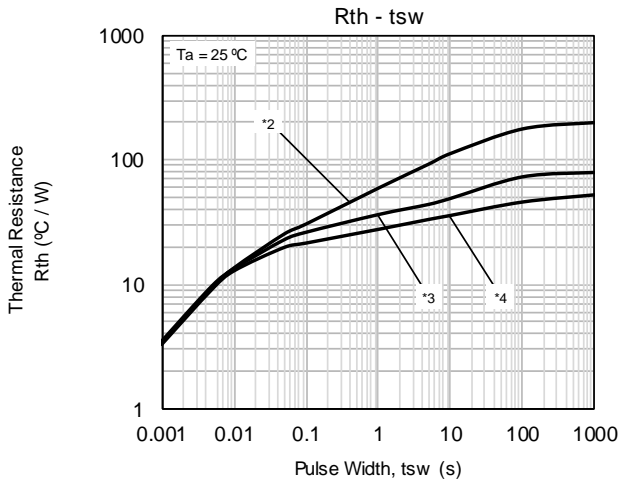
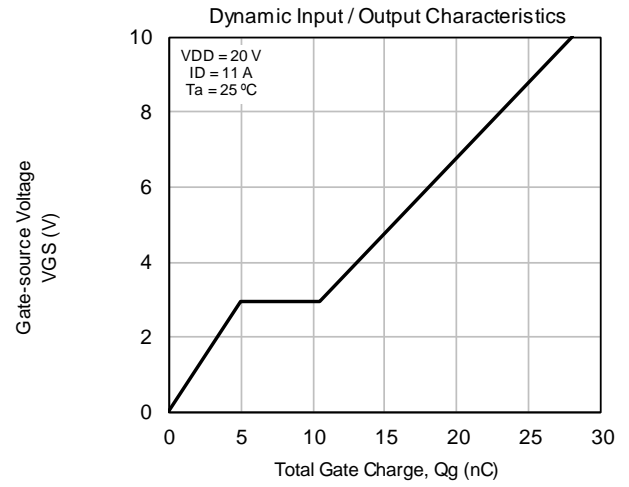
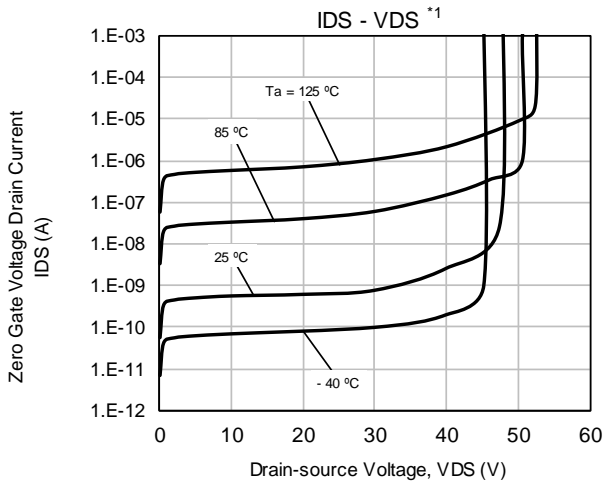
8. ELECTROSTATIC DISCHARGE CHARACTERISTIC Ta = 25 °C ± 3 °C

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)



TECHNICAL DATA (Reference)



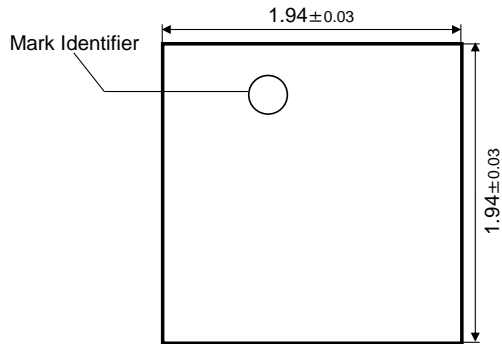
Note

- *1 Pulse measurement.
- *2 Mounted on FR4 board (25.4 mm x 25.4 mm x t1.0 mm).
FR4 board partially covered with copper pad (79.2 mm² area, 35 μm thickness).
- *3 Mounted on FR4 board (25.4 mm x 25.4 mm x t1.0 mm).
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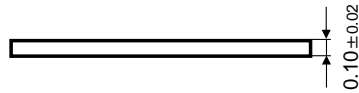
10. OUTLINE

(Top View)

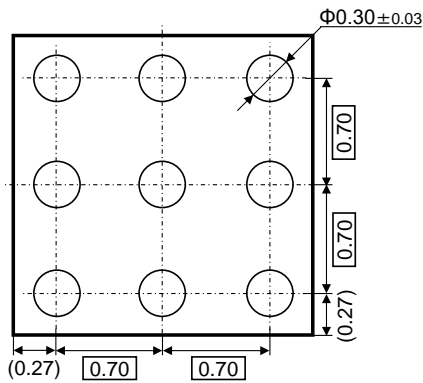
Unit: mm



(Front View)

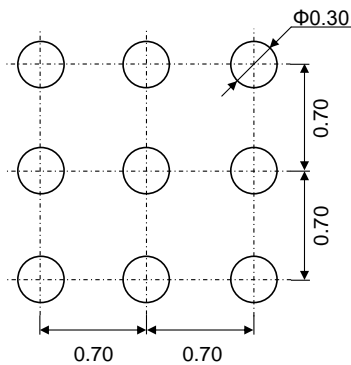


(Bottom View)



11. LAND & STENCIL 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.

12. REVISION HISTORY

Date	Revision	Description
2017.9.7	1.00	1. Initially issued.
2021.11.16	1.01	1. Changed document name from Product Standards to Datasheet.
		2. Added electrostatic discharge
		3. Added important notice in Land Pattern.
		4. Added special attention and precautions notes.

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