Single N-channel MOSFET

KFK9B0652ZL
Datasheet

For additional information or question, please contact Nuvoton Technology Corporation Japan.
www.nuvoton.co.jp

1. GENERAL DESCRIPTION

Single N-channel MOSFET for automotive.

2. FEATURES

- Drain-source On-state Resistance: RDS(on) typ = 18 mΩ (VGS = 10 V)
- CSP (Chip Size Package)
- Halogen-free / RoHS compliant (EU RoHS / UL-94 V-0 / MSL: Level 1)
- AEC-Q101 Qualified

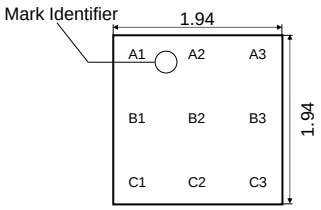
3. MARKING SYMBOL: WW

4. PACKAGING

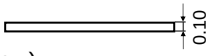
Embossed type (Thermo-compression sealing): 10,000 pcs / reel (standard)

Unit: mm

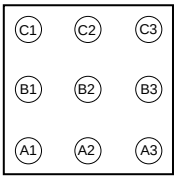
(Top View)



(Front View)



(Bottom View)



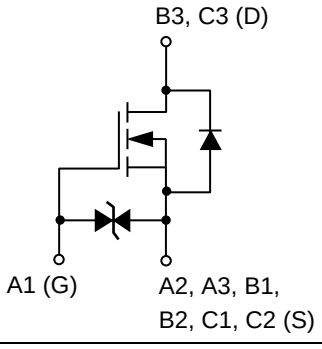
A1. Gate

B3, C3. Drain

A2, A3, B1, B2, C1, C2. Source

Package	MLGA009-W-1919-RA

Equivalent Circuit



5. ABSOLUTE MAXIMUM RATINGS Ta = 25 °C

Parameter		Symbol	Rating	Unit
Drain-source Voltage		VDS	60	V
Gate-source Voltage		VGS	+ 20 / - 10	V
Drain Current	DC *1	ID1	5.5	A
	DC *2	ID2	8.3	
	DC *3	ID3	10.0	
	Pulsed *4	IDp	66.4	
Total Power Dissipation	DC *1	PD1	0.71	W
	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	175	°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 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 (616 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 %.

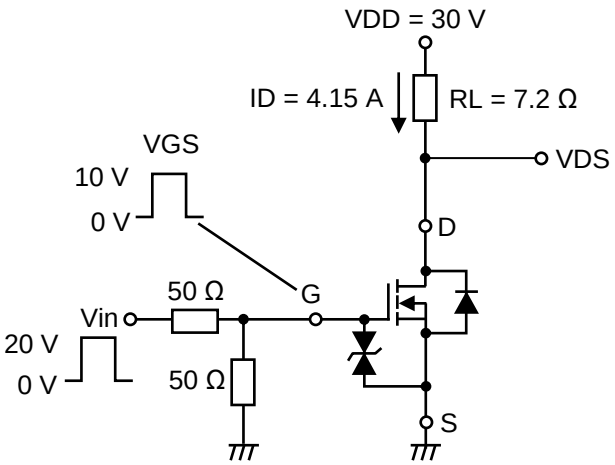
7. ELECTRICAL CHARACTERISTICS Ta = 25 °C ± 3 °C

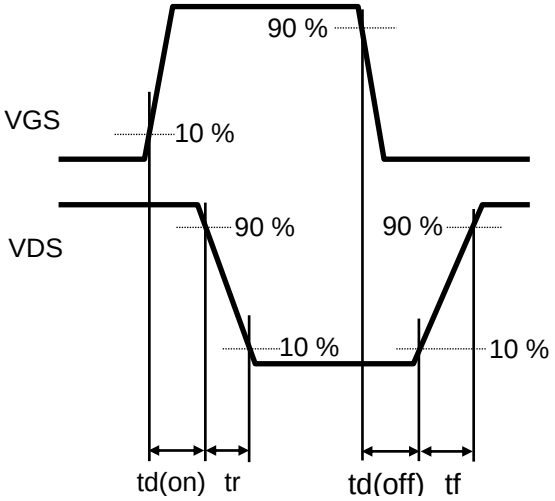
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Drain-source Breakdown Voltage	VDSS	ID = 1 mA, VGS = 0 V	60			V
Zero Gate Voltage Drain Current	IDSS	VDS = 60 V, VGS = 0 V			1	µA
Gate-source Leakage Current	IGSS	VGS = + 16 V, VDS = 0 V			10	µA
		VGS = - 8 V, VDS = 0 V			- 10	
Gate-source Threshold Voltage	Vth	ID = -1.85 mA, VDS = 10 V	1	2	3	V
Drain-source On-state Resistance	RDS(on)1	ID = 2 A, VGS = 10 V	10	18	23	mΩ
	RDS(on)2	ID = 2 A, VGS = 4.5 V	12	20	33	
Body Diode Forward Voltage	VF(s-d)	IF = 2 A, VGS = 0 V		0.77	1.2	V
Input Capacitance *1	Ciss	VDS = 30 V, VGS = 0 V f = 1 MHz		1400		pF
Output Capacitance *1	Coss			110		
Reverse Transfer Capacitance *1	Crss			60		
Turn-on Delay Time *1, *2	td(on)	VDD = 30 V, VGS = 0 to 10 V ID = 4.15 A		13		ns
Rise Time *1, *2	tr			25		
Turn-off Delay Time *1, *2	td(off)	VDD = 30 V, VGS = 10 to 0 V ID = 4.15 A		80		
Fall Time *1, *2	tf			60		
Total Gate Charge *1	Qg1	VDD = 30 V, VGS = 4.5 V ID = 8.3 A		13		nC
	Qg2	VDD = 30 V, VGS = 10 V ID = 8.3 A		26		
Gate-source Charge *1	Qgs			4.5		
Gate-drain Charge *1	Qgd			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.

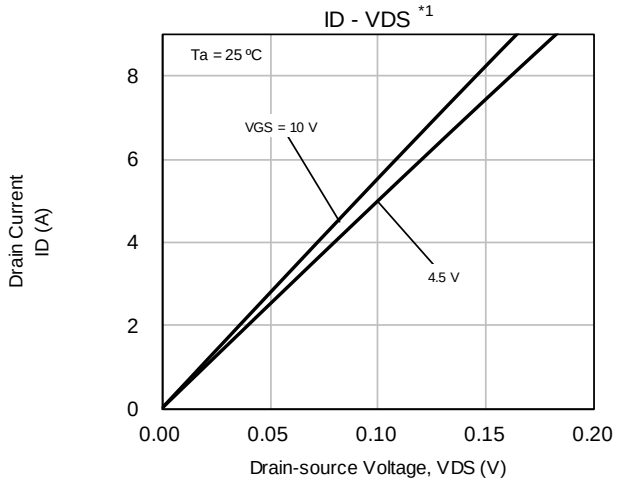


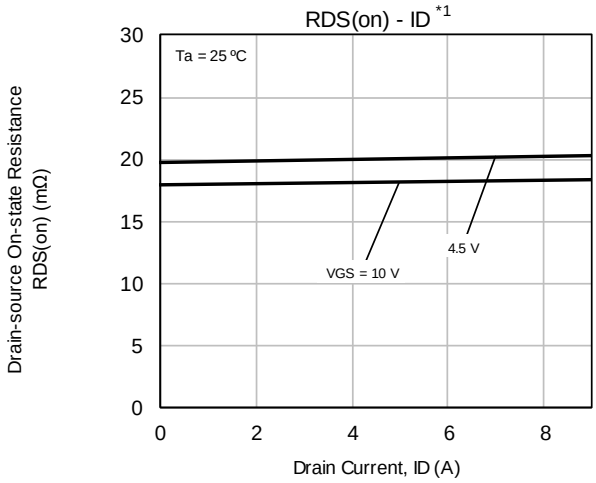


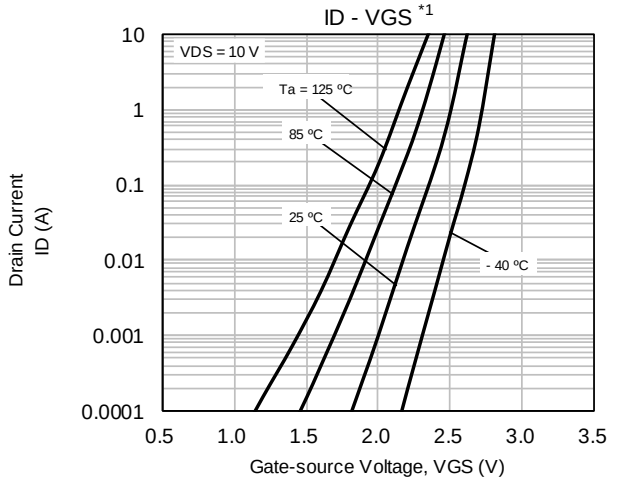
8. ELECTROSTATIC DISCHARGE CHARACTERISTIC Ta = 25 °C ± 3 °C

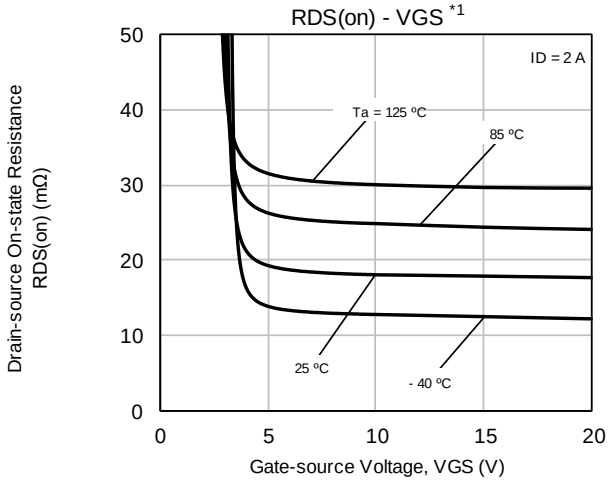
Standard	Test Type	Symbol	Conditions	Class	Value	Unit
AEC-Q101-001	Human Body Model	HBM	C = 100 pF, R = 1.5 kΩ	H2	> 2 to ≤ 4	kV

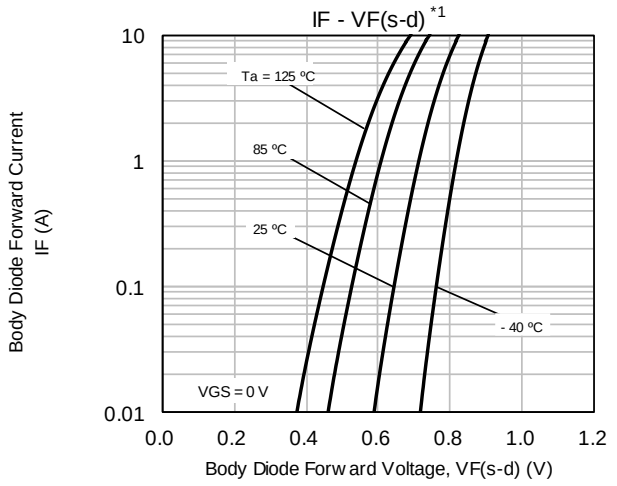
9. TECHNICAL DATA (Reference)

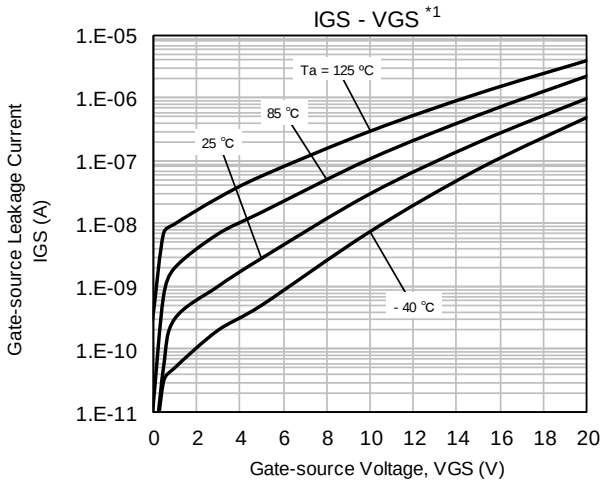




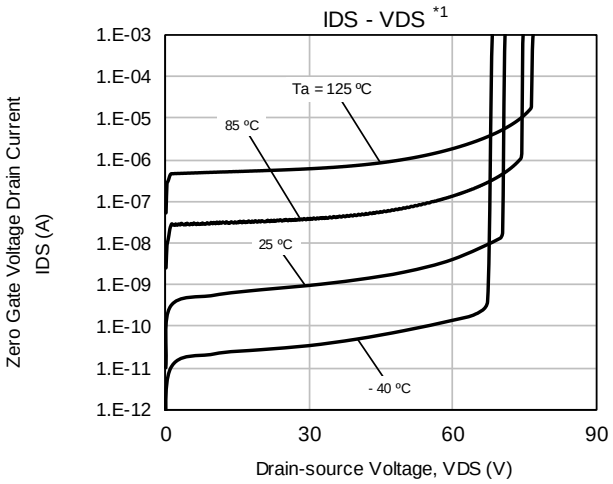


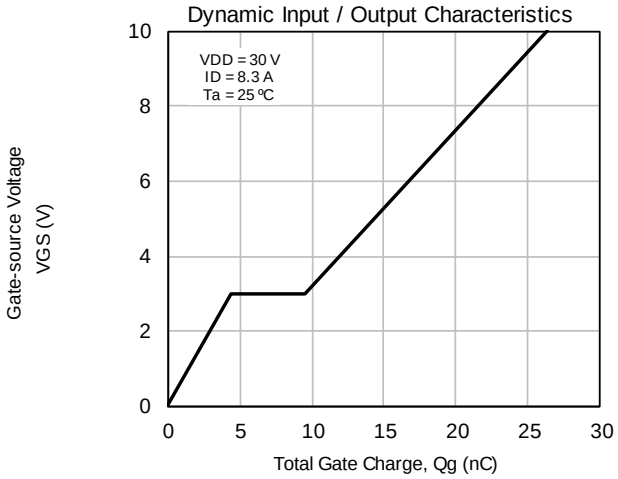


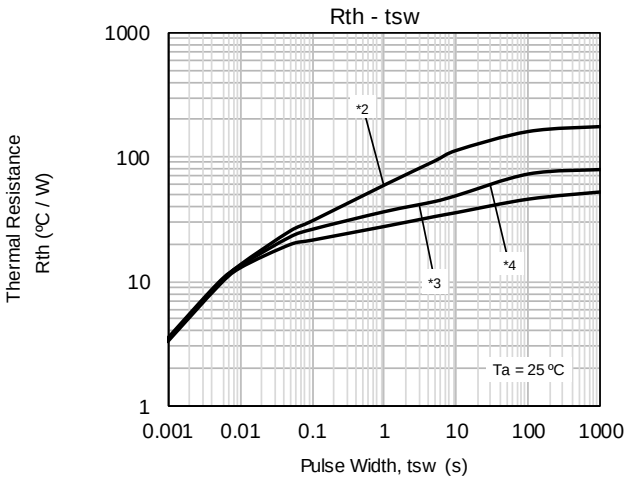


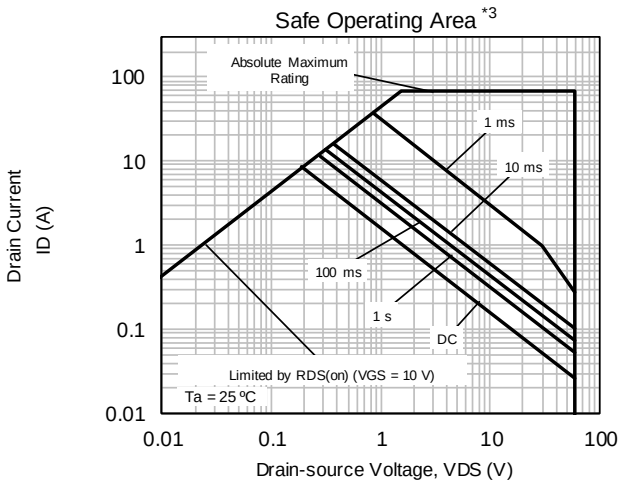


TECHNICAL DATA (Reference)









Note

*1 Pulse measurement.

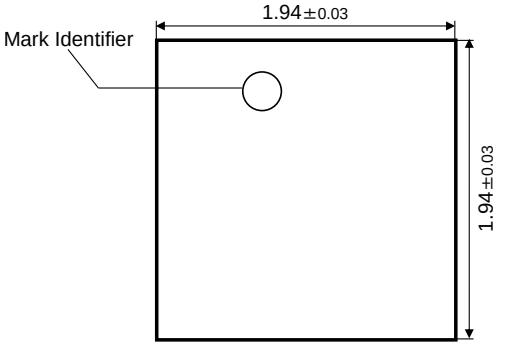
*2 Mounted on FR4 board (25.4 mm × 25.4 mm × t1.0 mm).
FR4 board partially covered with copper pad (79.2 mm^2 area, 36 µm thickness).

*3 Mounted on FR4 board (25.4 mm × 25.4 mm × t1.0 mm).
FR4 board fully covered with copper pad (616 mm^2 area, 36 µm thickness).

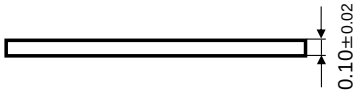
*4 Mounted on ceramic board (70 mm × 70 mm × t1.0 mm).

10. OUTLINE

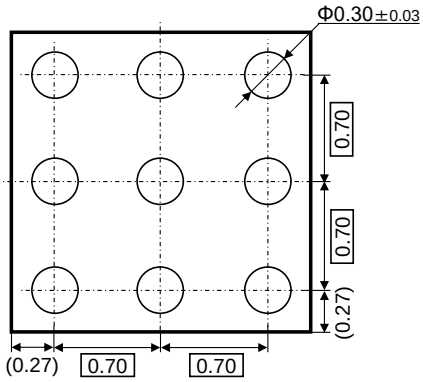
(Top View) Unit: mm



(Front View)

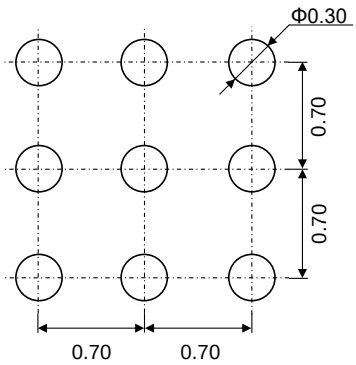


(Bottom View)



11. LAND & STENCIL PATTERN (Reference)

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
2021.11.19	1.00	1. Initially issued.

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

(1) If any of the products or technical information described in this book is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially, those with regard to security export control, must be observed.

(2) The technical information described in this book is intended only to show the main characteristics and application circuit examples of the products. No license is granted in and to any intellectual property right or other right owned by Nuvoton Technology Corporation Japan or any other company. Therefore, no responsibility is assumed by our company as to the infringement upon any such right owned by any other company which may arise as a result of the use of technical information de-scribed in this book.

(3) The products described in this book are intended to be used for automotive applications. It is to be understood that we can not assume responsibility for damages caused by being used for any special applications other than automotive applications without obtaining prior written consent.

(4) When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Other-wise, we will not be liable for any defect which may arise later in your equipment. Please pay attention about moisture proof because the product is unmolded device. It is not special consideration to use in environmental which is high temperature or high humidity where dew condensation may occur. Any use and storage under the circumstance may affect the performance of the product. Prior confirmation of performance and reliability is requested to customers.

Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.

(5) Please pay attention about breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress, touching the product with bare hands) at the time of handling, mounting or at customer‘s process. We do not guarantee quality for disassembled products or the product re-mounted after removing from the mounting board. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.

(6) When reselling products described in this book to other companies without our permission and receiving any claim of request from the resale destination, please understand that customers will bear the burden.

(7) This book may be not reprinted or reproduced whether wholly or partially, without the prior written permission of our company.

Important Notice

Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, "Insecure Usage".

Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

All Insecure Usage shall be made at customer's risk, and in the event that third parties lay claims to Nuvoton as a result of customer's Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.