

# MSKSEMI 美森科

SEMICONDUCTOR



ESD



TVS



TSS



MOV



GDT



PLED

## 2N7002ET1G-MS

Product specification

## Features

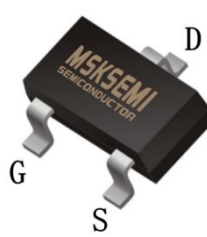
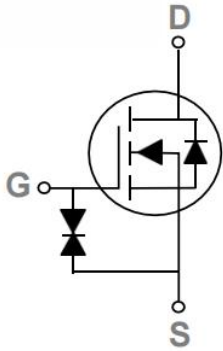

- 60V,0.3A,  $R_{DS(ON)} = 2.2\Omega @ V_{GS}=10V$
- Improved dv/dt capability
- Fast switching
- Green Device Available
- G-S ESD Protection Diode Embedded
- ESD protected up to 2KV

## Application

- Motor Drive
- Power Tools
- LED Lighting

BVDSS	RDSON	ID
60V	2.2Ω	0.3A

## Reference News

PACKAGE OUTLINE	Pin Configuration	Marking
 <p>SOT-23</p>		

## Absolute Maximum Ratings (TA=25°C unless otherwise noted)

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain- Source Voltage	60	V
$V_{GS}$	Gate- Source Voltage	±20	V
$I_D$	Drain Current – Continuous ( $T_C=25^\circ C$ )	0.3	A
	Drain Current – Continuous ( $T_C=100^\circ C$ )	0.1	A
$I_{DM}$	Drain Current – Pulsed <sup>1</sup>	0.8	A
$P_D$	Power Dissipation ( $T_C=25^\circ C$ )	0.35	W
	Power Dissipation – Derate above 25 °C	0.003	W/°C
$T_{STG}$	Storage Temperature Range	-50 to 150	°C
$T_J$	Operating Junction Temperature Range	-50 to 150	°C

## Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction to ambient	---	357	°C/W

## Electrical Characteristics (T<sub>J</sub>=25 °C , unless otherwise noted)

### Off Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$BV_{DSS}$	Drain- Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	60	---	---	V
$I_{DSS}$	Drain- Source Leakage Current	$V_{DS}=60V, V_{GS}=0V, T_J=25^\circ C$	---	---	1	$\mu A$
		$V_{DS}=48V, V_{GS}=0V, T_J=125^\circ C$	---	---	10	$\mu A$
$I_{GSS}$	Gate- Source Leakage Current	$V_{GS} \pm 20V, V_{DS}=0V$	---	---	±10	$\mu A$

### On Characteristics

$R_{DS(ON)}$	Static Drain- Source On- Resistance	$V_{GS}=10V, I_D=0.3A$	---	2.2	2.8	$\Omega$
		$V_{GS}=4.5V, I_D=0.2A$	---	2.4	3.0	$\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	1	1.6	2.5	V
$g_{fs}$	Forward Transconductance	$V_{DS}=10V, I_D=0.3A$	---	0.5	---	S

### Dynamic and switching Characteristics

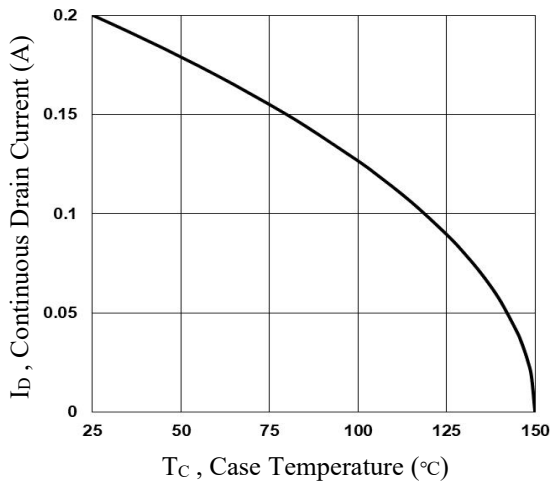
$Q_g$	Total Gate Charge <sup>2, 3</sup>	$V_{DS}=30V, V_{GS}=10V, I_D=1A$	---	3.7	5.6	nC
$Q_{gs}$	Gate-Source Charge <sup>2, 3</sup>		---	0.9	1.4	
$Q_{gd}$	Gate-Drain Charge <sup>2, 3</sup>		---	0.4	0.6	
$T_{d(on)}$	Turn-On Delay Time <sup>2, 3</sup>	$V_{DD}=30V, V_{GS}=10V, R_G=6\Omega$ $I_D=0.2A$	---	3	6	ns
$T_r$	Rise Time <sup>2, 3</sup>		---	5	10	
$T_{d(off)}$	Turn-Off Delay Time <sup>2, 3</sup>		---	14	27	
$T_f$	Fall Time <sup>2, 3</sup>		---	9	17	
$C_{iss}$	Input Capacitance	$V_{DS}=30V, V_{GS}=0V, F=1MHz$	---	25.5	38	pF
$C_{oss}$	Output Capacitance		---	17	26	
$C_{rss}$	Reverse Transfer Capacitance		---	7.8	12	

### Drain-Source Diode Characteristics and Maximum Ratings

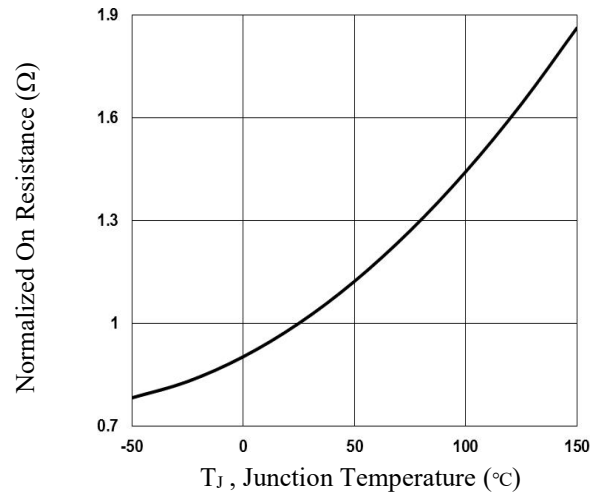
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_S$	Continuous Source Current	$V_G=V_D=0V, \text{Force Current}$	---	---	0.3	A
$I_{SM}$	Pulsed Source Current		---	---	1.2	A
$V_{SD}$	Diode Forward Voltage	$V_{GS}=0V, I_S=1A, T_J=25^\circ C$	---	---	1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS}=50V, I_S=1A, dI/dt=100A/\mu s$	---	3.4	---	ns
$Q_{rr}$	Reverse Recovery Charge	$T_J=25^\circ C$	---	0.7	---	nC

#### Note :

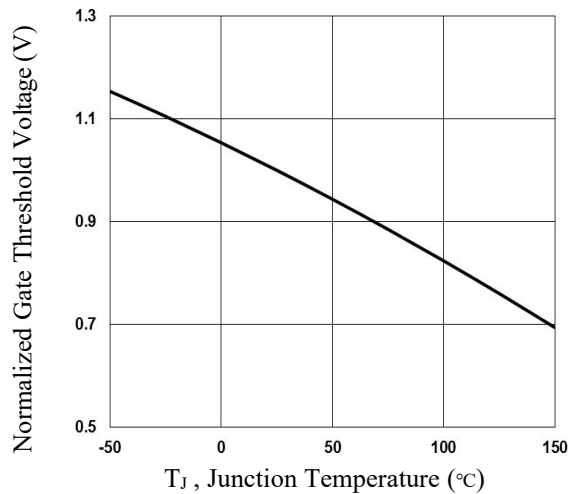
- 1.Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$ .
3. Essentially independent of operating temperature.



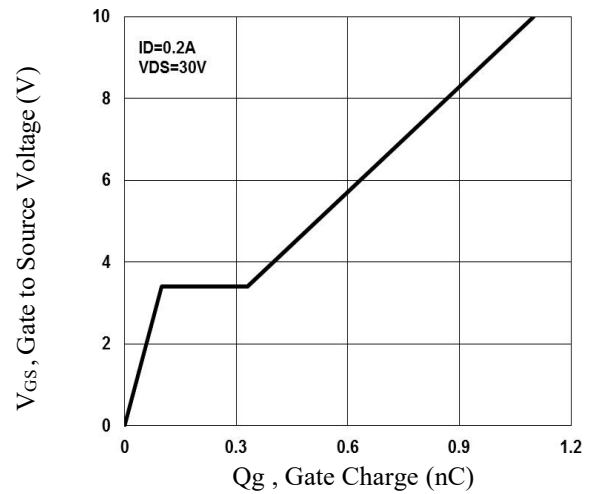
**Fig.1 Continuous Drain Current vs. T<sub>c</sub>**



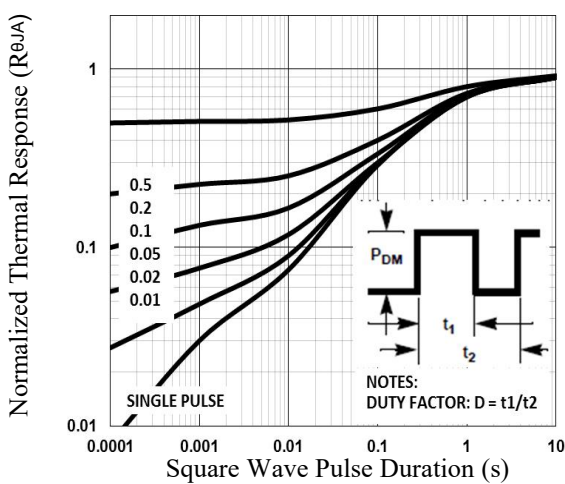
**Fig.2 Normalized R<sub>DS(on)</sub> vs. T<sub>j</sub>**



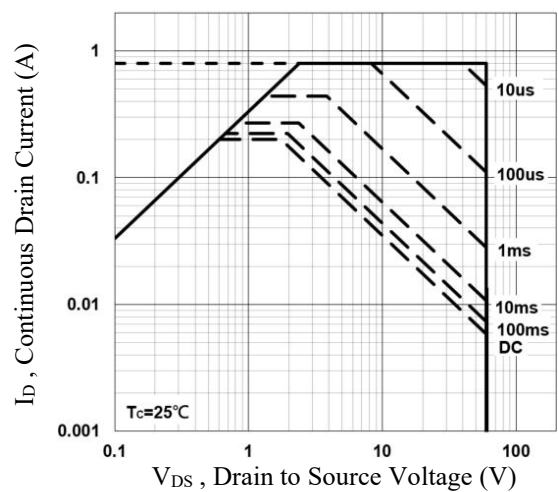
**Fig.3 Normalized V<sub>th</sub> vs. T<sub>j</sub>**



**Fig.4 Gate Charge Waveform**

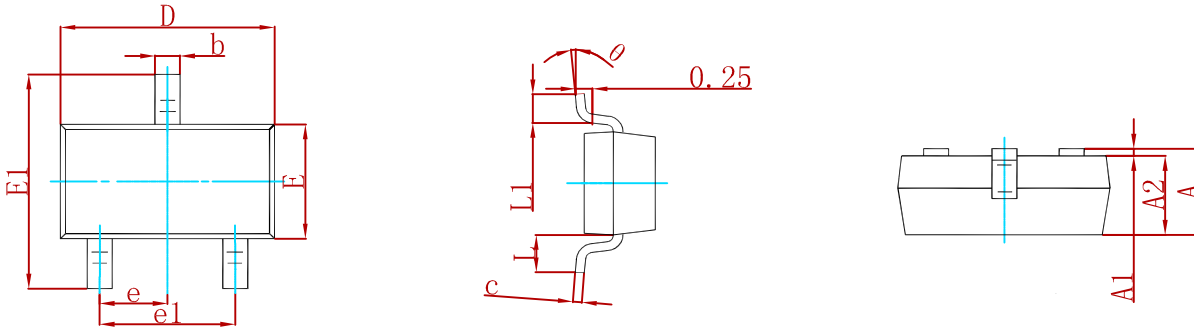


**Fig.5 Normalized Transient Impedance**



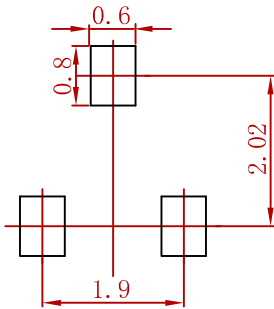
**Fig.6 Maximum Safe Operation Area**

**PACKAGE MECHANICAL DATA**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.550 REF		0.022 REF	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

**Suggested Pad Layout**



Note:  
 1. Controlling dimension: in millimeters.  
 2. General tolerance: ± 0.05mm.  
 3. The pad layout is for reference purposes only.

**REEL SPECIFICATION**

P/N	PKG	QTY
2N7002ET1G-MS	SOT-23	3000

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