

# MSKSEMI 美森科

SEMICONDUCTOR



ESD



TVS



TSS



MOV



GDT



PLED

## 2N7002DW

Product specification


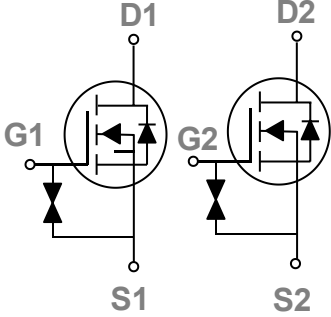

**General Features**

- 60V,0.3A,RDS(ON)=1.8Ω@VGS=10V  
Improved dv/dt capability
- Fast switching
- Green Device Available
- G-S ESD Protection Diode Embedded

**Application**

- Motor Drive
- Power Tools
- LED Lighting

**Reference News**

PACKAGE OUTLINE	Pin Configuration	Marking
 <p>SOT-363</p>		

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

Symbol	Parameter	Rating	Units
V <sub>DS</sub>	Drain- Source Voltage	60	V
V <sub>GS</sub>	Gate- Source Voltage	±20	V
I <sub>D</sub>	Drain Current – Continuous (TA=25°C)	0.3	A
	Drain Current – Continuous (TA=70°C)	0.24	A
I <sub>DM</sub>	Drain Current – Pulsed <sup>1</sup>	1.2	A
P <sub>D</sub>	Power Dissipation (TA=25°C)	0.28	W
	Power Dissipation – Derate above 25°C	0.002	W/°C
T <sub>STG</sub>	Storage Temperature Range	-50 to 150	°C
T <sub>J</sub>	Operating Junction Temperature Range	-50 to 150	°C

**Thermal Characteristics**

Symbol	Parameter	Typ.	Max.	Unit
R <sub>θJA</sub>	Thermal Resistance Junction to ambient	---	450	°C/W

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BVDSS	Drain- Source Breakdown Voltage	V <sub>GS</sub> =0V , I <sub>D</sub> =250μA	60	---	---	V
ΔBVDSS/ ΔT <sub>J</sub>	BVDSS Temperature Coefficient	Reference to 25°C , I <sub>D</sub> =1mA	---	0.04	---	V/°C
I <sub>DSS</sub>	Drain- Source Leakage Current	V <sub>DS</sub> =60V , V <sub>GS</sub> =0V , T <sub>J</sub> =25°C	---	---	1	A
		V <sub>DS</sub> =48V , V <sub>GS</sub> =0V , T <sub>J</sub> =125°C	---	---	100	A
I <sub>GSS</sub>	Gate- Source Leakage Current	V <sub>GS</sub> = ±20V , V <sub>DS</sub> =0V	---	---	±10	A

**On Characteristics**

R <sub>DS(ON)</sub>	Static Drain- Source On-Resistance	V <sub>GS</sub> =10V , I <sub>D</sub> =0.3A	---	1.8	2.8	Ω
		V <sub>GS</sub> =4.5V , I <sub>D</sub> =0.2A	---	2.2	3	Ω
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250μA	1	1.6	2.5	V
ΔV <sub>GS(th)</sub> )	V <sub>GS(th)</sub> Temperature Coefficient		---	-4	---	MV/°C
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =10V , I <sub>D</sub> =0.1A	---	0.24	---	S

## Dynamic and switching Characteristics

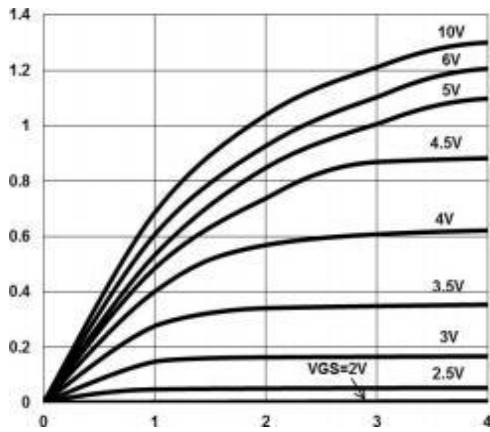
Qg	Total Gate Charge <sup>2, 3</sup>	VDS=30V , VGS=10V , ID=0.2A	---	1.1		nC
Qgs	Gate-Source Charge <sup>2, 3</sup>		---	0.1		
Qgd	Gate-Drain Charge <sup>2, 3</sup>		---	0.23		
Td(on)	Turn-On Delay Time <sup>2, 3</sup>	VDD=30V , VGS=10V , RG=6Ω ID=0.2A	---	3		nS
Tr	Rise Time <sup>2, 3</sup>		---	5		
Td(off)	Turn-Off Delay Time <sup>2, 3</sup>		---	14		
Tf	Fall Time <sup>2, 3</sup>		---	9		
Ciss	Input Capacitance	VDS=10V , VGS=0V , F=1MHz	---	30.6		pF
Coss	Output Capacitance		---	5.5		
Crss	Reverse Transfer Capacitance		---	4		

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
IS	Continuous Source Current	VG=VD=0V , Force Current	---	---	0.3	A
ISM	Pulsed Source Current		---	---	0.6	A
VSD	Diode Forward Voltage	VGS=0V , IS=1A , TJ=25C	---	---	1.2	V

Note :

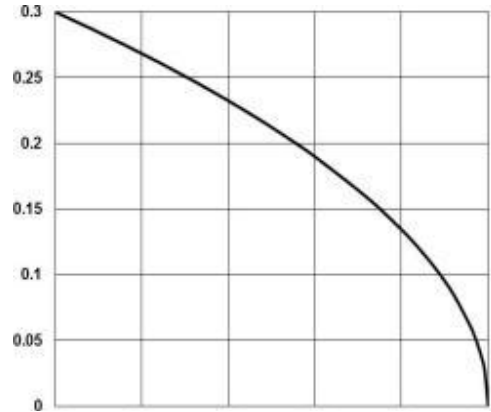
1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed , pulse width  $\cong$  300us , duty cycle  $\cong$  2%.
3. Essentially independent of operating temperature.

$I_D$ , Continuous Drain Current (A)



$V_{DS}$ , Drain to Source Voltage (V)

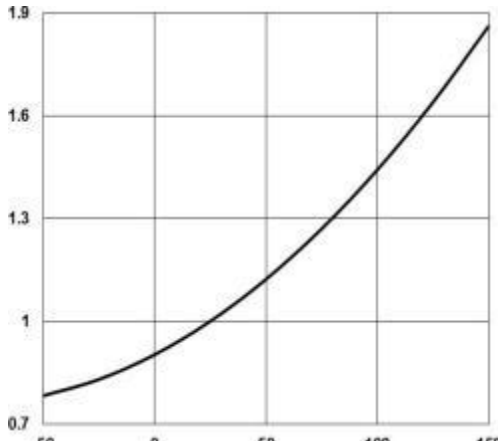
**Fig. 1 Output Characteristics**



$T_J$ , Junction Temperature ( $^{\circ}C$ )

**Fig. 2 Continuous Drain Current vs.  $T_J$**

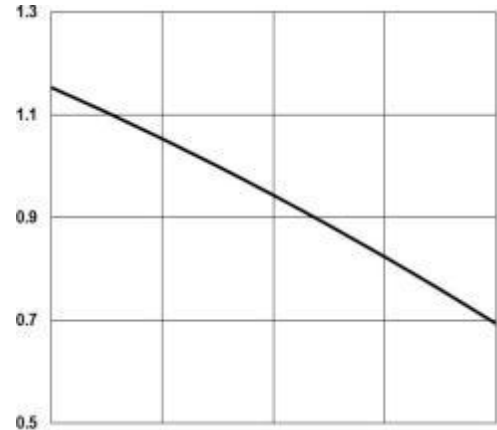
Normalized On Resistance



$T_J$ , Junction Temperature ( $^{\circ}C$ )

**Fig. 3 Normalized  $R_{DS(ON)}$  vs.  $T_J$**

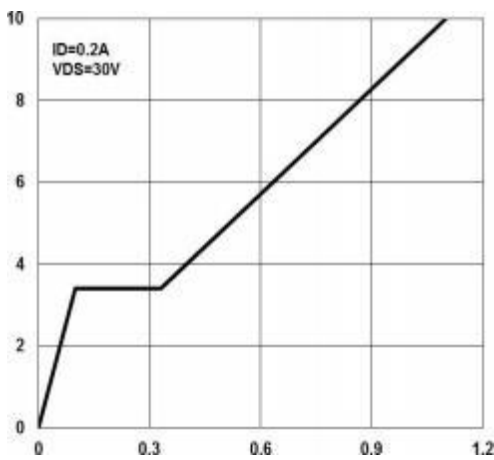
Normalized Gate Threshold Voltage (V)



$T_J$ , Junction Temperature ( $^{\circ}C$ )

**Fig. 4 Normalized  $V_{th}$  vs.  $T_J$**

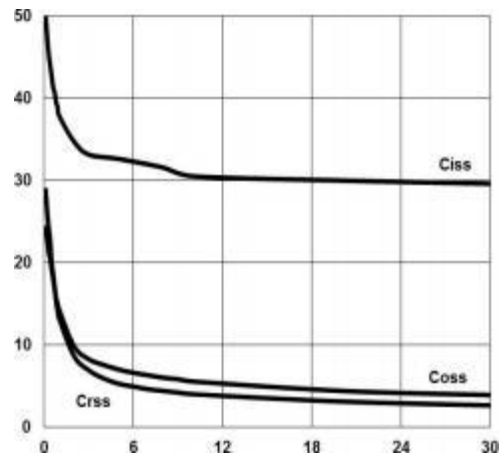
$V_{GS}$ , Gate to Source Voltage (V)



$Q_g$ , Gate Charge (nC)

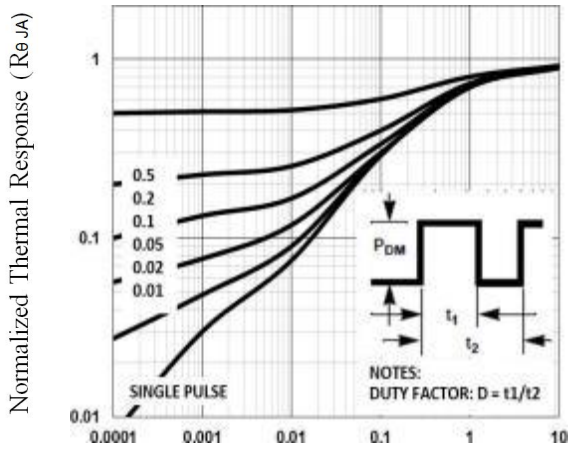
**Fig. 5 Gate Charge Waveform**

C, Capacitance (pF)



$V_{DS}$ , Drain to Source Voltage (V)

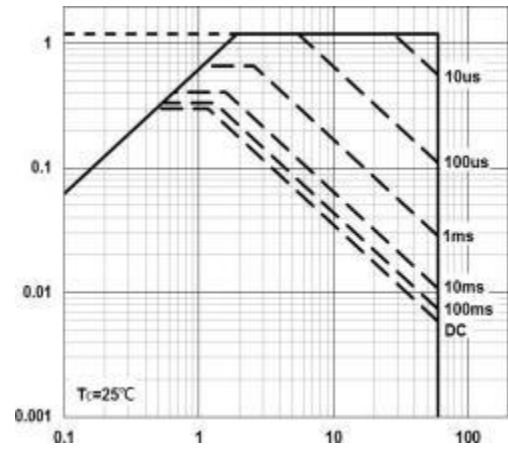
**Fig. 6 Capacitance Characteristics**



**Square Wave Pulse Duration (s)**

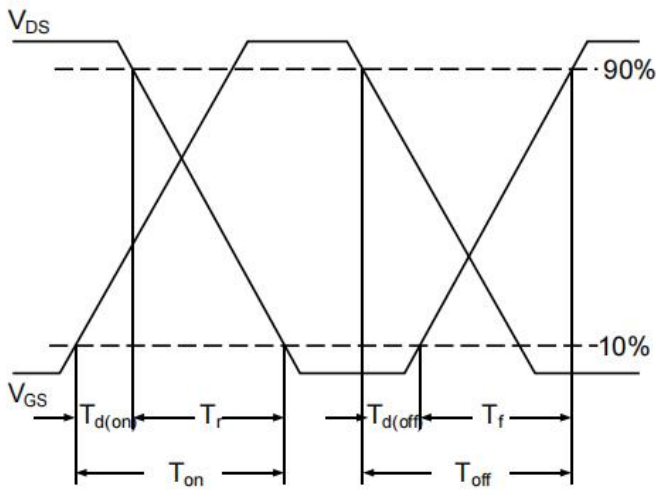
**Fig. 7 Normalized Transient Impedance**

$I_D$ , Continuous Drain Current (A)



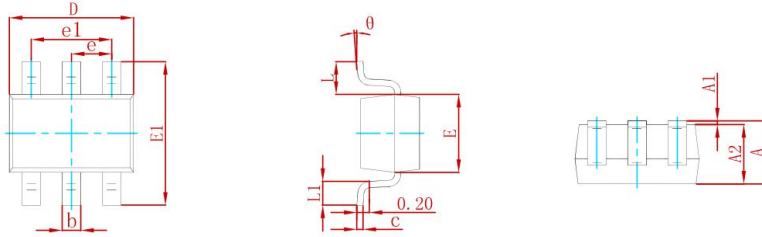
**VDS , Drain to Source Voltage(V)**

**Fig. 8 Maximum Safe Operation Area**



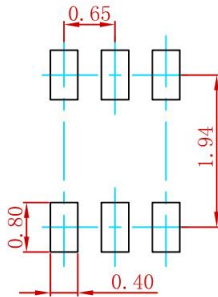
**Fig.9 Switching Time Waveform**

**PACKAGE MECHANICAL DATA**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.100	0.150	0.004	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.400	0.085	0.094
e	0.650 TYP		0.026 TYP	
e1	1.200	1.400	0.047	0.055
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
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**

P/N	PKG	QTY
2N7002DW	SOT-363	3000

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