

MSD60P16

P-Channel 60-V (D-S) MOSFET

Description

The device is the highest performance trench P-ch MOSFETs with extreme high cell density, which provide excellent $R_{DS(ON)}$ and gate charge for most of the synchronous buck converter applications.

The device meets the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

Features

- $R_{DS(ON)} = 48m\Omega @ V_{GS} = -10V$
- Low Reverse Transfer Capacitance
- High Switching Speed
- 100% EAS Guaranteed
- Green Device Available

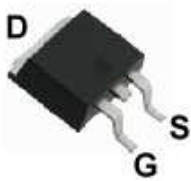
Typical Applications

- Motor Drive
- Power Tools
- LED Lighting

Package type : TO-252

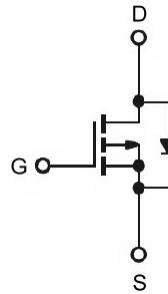
Packing & Order Information

3,000/Reel

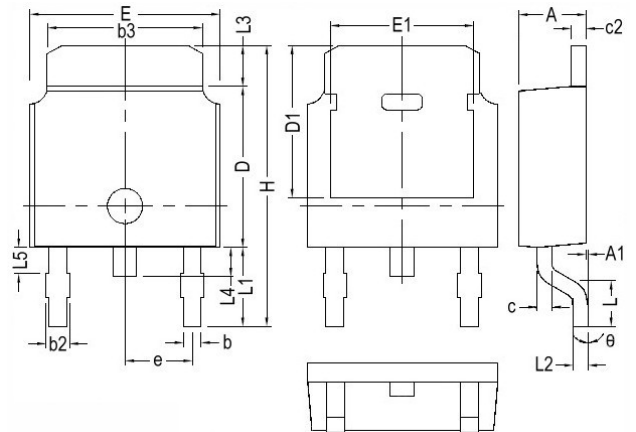


RoHS Compliant

Graphic Symbol

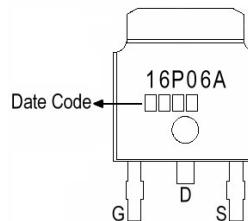


Package Dimension



REF.	Millimeter			REF.	Millimeter		
	Min.	Nom.	Max.		Min.	Nom.	Max.
A	2.20	2.30	2.38	E1	4.40	-	-
A1	0	-	0.127	e	2.286 BSC		
b	0.64	0.76	0.88	H	9.40	10.00	10.40
b2	0.77	0.84	1.14	L	1.40	1.52	1.77
b3	5.21	5.34	5.46	L1	2.743 Ref.		
c	0.45	0.50	0.60	L2	0.508 BSC		
c2	0.45	0.50	0.58	L3	0.89	-	1.27
D	6.00	6.10	6.223	L4	0.64	-	1.01
D1	5.21	-	-	L5	-	-	-
E	6.40	6.60	6.731	θ	0°	-	10°

Marking



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MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings

Symbol	Parameter	Value	Units
V_{DS}	Drain-Source Voltage	-60	V
V_{GS}	Gate-Source Voltage	± 20	V
I_D	Continuous Drain Current ¹ ($T_C=25^\circ\text{C}$)	-16	A
	Continuous Drain Current ¹ ($T_C=100^\circ\text{C}$)	-10	A
I_{DM}	Pulsed Drain Current ^{1,2}	-64	A
I_{AS}	Single Pulse Avalanche Current, $L=0.1\text{mH}^3$	-32	A
E_{AS}	Single Pulse Avalanche Energy, $L=0.1\text{mH}^3$	51	mJ
P_D	Power Dissipation ⁴ ($T_C=25^\circ\text{C}$)	25	W
	Power Dissipation ⁴ ($T_A=25^\circ\text{C}$)	2	W
T_J/T_{STG}	Operating Junction and Storage Temperature	-55 to +150	$^\circ\text{C}$

Thermal Resistance Ratings

Symbol	Parameter	Maximum	Units
$R_{\theta JA}$	Maximum Junction-to-Ambient ¹	62.5	$^\circ\text{C/W}$
$R_{\theta JC}$	Maximum Junction-to-Case ¹	5	$^\circ\text{C/W}$

Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$	-1.0	-1.7	-2.5	V
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}$, $I_D=-250\mu\text{A}$	-60	-	-	V
g_{fs}	Forward Transconductance	$V_{DS}=-10\text{V}$, $I_D=-8\text{A}$	-	10	-	S
I_{GSS}	Gate-Source Leakage Current	$V_{DS}=0\text{V}$, $V_{GS}=\pm 20\text{V}$	-	-	± 100	nA
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=-60\text{V}$, $V_{GS}=0\text{V}$, $T_J=25^\circ\text{C}$	-	-	-1	μA
		$V_{DS}=-48\text{V}$, $V_{GS}=0\text{V}$, $T_J=125^\circ\text{C}$	-	-	-10	μA
$R_{DS(on)}$	Static Drain-Source On-Resistance ²	$V_{GS}=-10\text{V}$, $I_D=-8\text{A}$	-	40	48	m Ω
		$V_{GS}=-4.5\text{V}$, $I_D=-4\text{A}$	-	55	65	
E_{AS}	Single Pulse Avalanche Energy ⁵	$V_{DD}=-25\text{V}$, $L=0.1\text{mH}$, $I_{AS}=-16\text{A}$	12.8	-	-	mJ
V_{SD}	Diode Forward Voltage ²	$I_S=-8\text{A}$, $V_{GS}=0\text{V}$, $T_J=25^\circ\text{C}$	-	-	-1.0	V
I_S	Continuous Source Current ^{1,6}	$V_G=V_D=0\text{V}$, Force Current	-	-	-16	A
I_{SM}	Pulsed Source Current ^{2,6}		-	-	-64	

Notes

1. The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
2. The data tested by pulsed, pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
3. The EAS data shows maximum rating. The test condition is $V_{DD}=-25\text{V}$, $V_{GS}=-10\text{V}$, $L=0.1\text{mH}$, $I_{AS}=-32\text{A}$.
4. The power dissipation is limited by 150 $^\circ\text{C}$ junction temperature.
5. The Min. value is 100% EAS tested guarantee.
6. The data is theoretically the same as I_D and I_{DM} , in real applications, should be limited by total power dissipation.

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Dynamic						
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Q_g	Total Gate Charge ²	$V_{DS} = -30V$	--	22	--	nC
Q_{gs}	Gate-Source Charge	$I_D = -8A$	--	4.1	--	
Q_{gd}	Gate-Drain Charge	$V_{GS} = -10V$	--	5.2	--	
$t_{d(on)}$	Turn-On Delay Time ²	$V_{DS} = -30V$	--	13	--	ns
t_r	Rise Time	$I_D = -1A$	--	42	--	
$t_{d(off)}$	Turn-Off Delay Time	$V_{GS} = -10V$	--	65	--	
t_f	Fall Time	$R_G = 6\Omega$	--	16	--	
C_{ISS}	Input Capacitance	$V_{DS} = -30V$	--	1256	--	pF
C_{OSS}	Output Capacitance	$V_{GS} = 0V$	--	87	--	
C_{RSS}	Reverse Transfer Capacitance	$f = 1.0MHz$	--	59	--	
R_g	Gate Resistance	$V_{GS} = V_{DS} = 0V, f = 1.0MHz$	--	15	--	Ω

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- Typical Electrical Characteristics

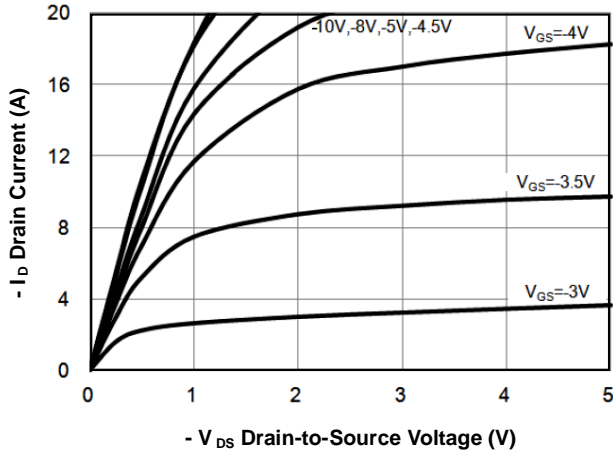


FIG.1-Typical Output Characteristics

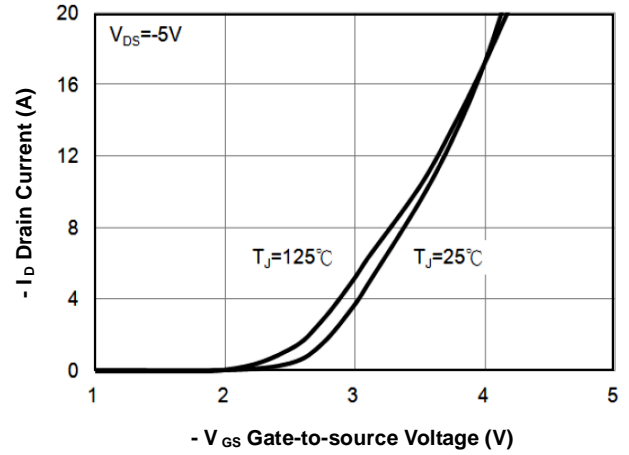


FIG.2-Transfer Characteristics

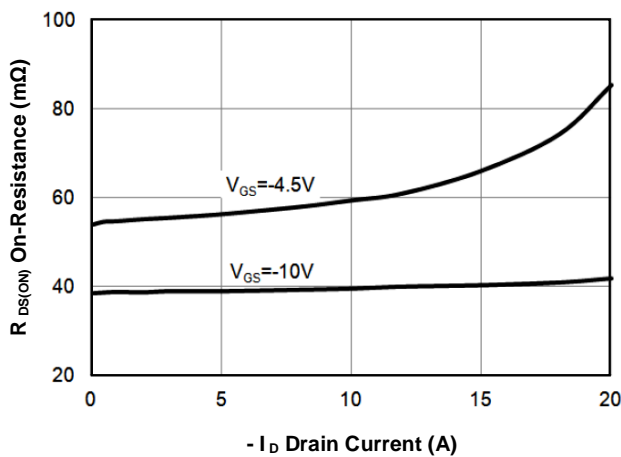


FIG.3-On-Resistance vs. Drain Current

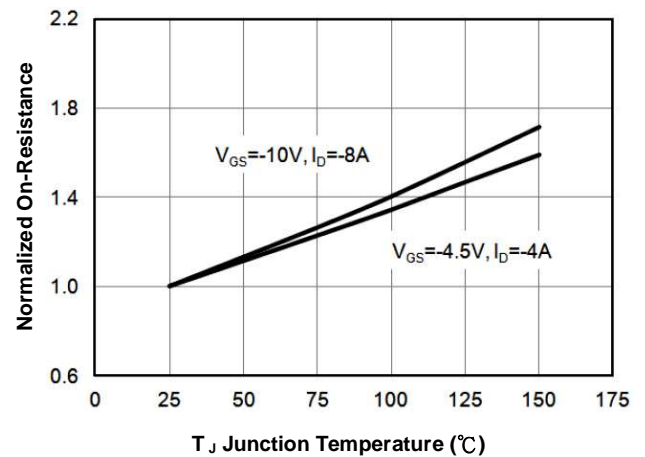


FIG.4-Normalized $R_{DS(on)}$ vs. T_J

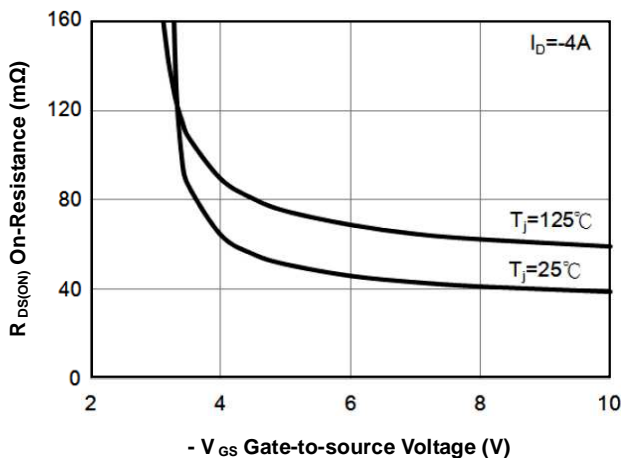


FIG.5-On-Resistance vs. G-S Voltage

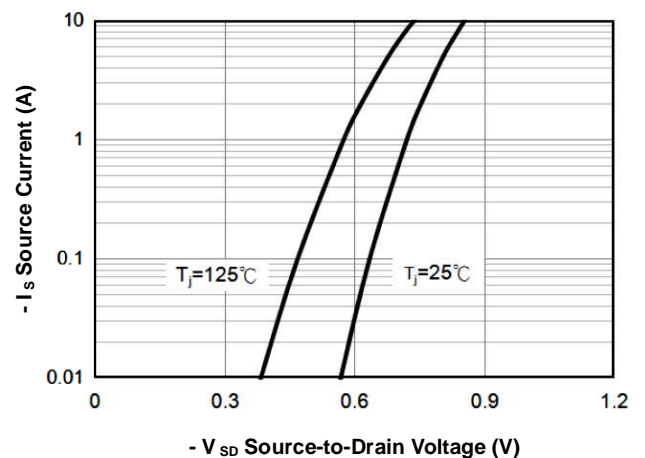


FIG.6-Forward Characteristics of Reverse

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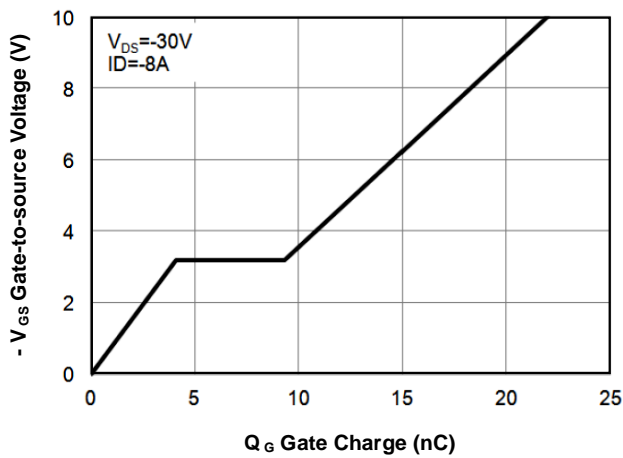


FIG.7-Gate Charge Characteristics

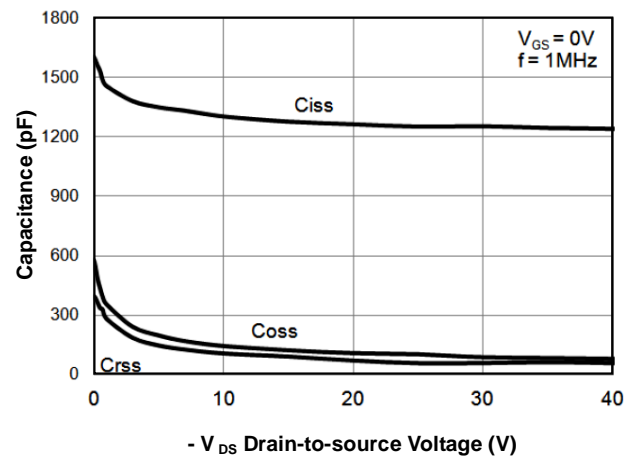


FIG.8-Capacitance Characteristics

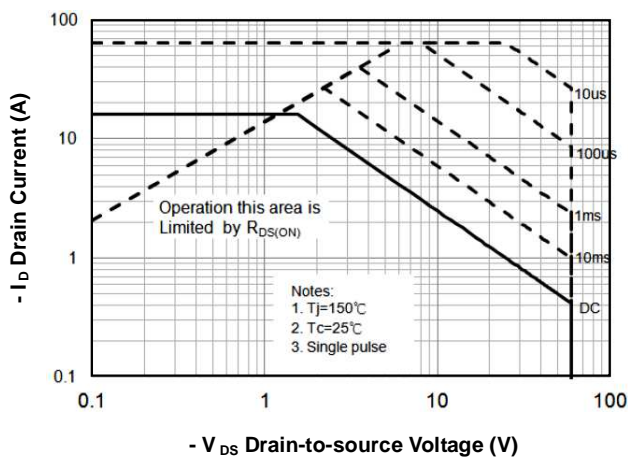


FIG.9-Safe Operating Area

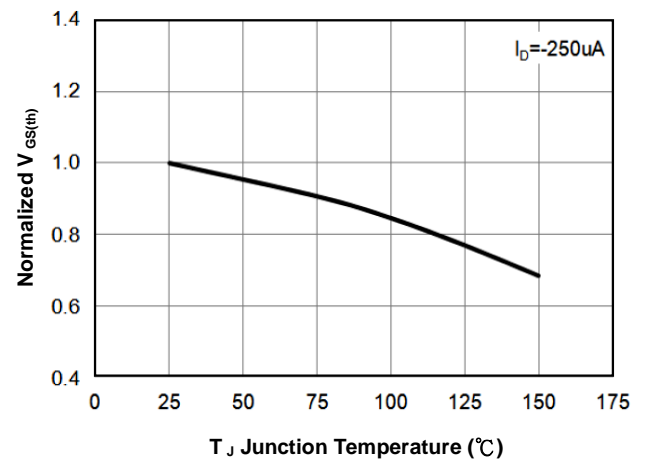


FIG.10-Normalized $V_{GS(th)}$ vs. T_J

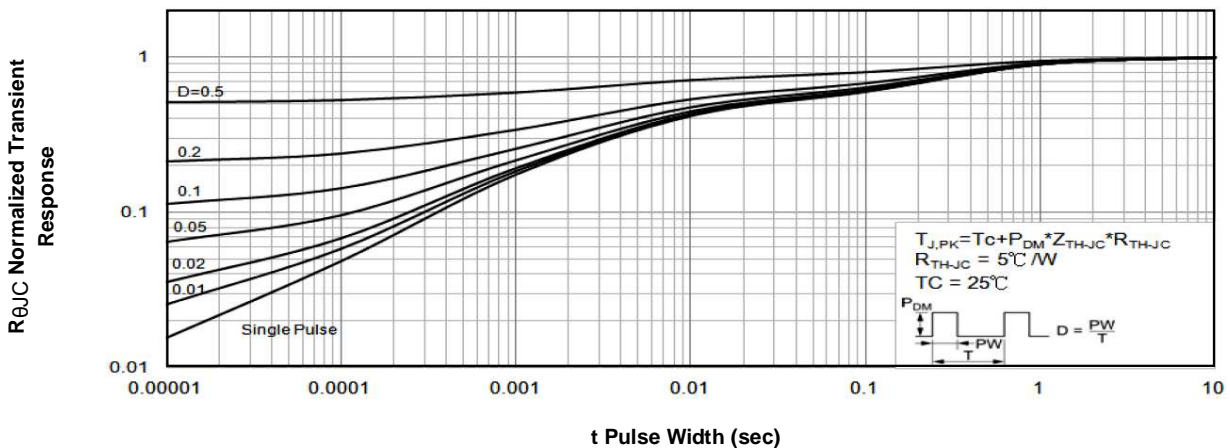


FIG.11-Normalized Maximum Transient Thermal Impedance

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