

## Dual N-Channel 60-V (D-S) MOSFET

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A) <sup>d</sup>	Q <sub>g</sub> (Typ.)
60	0.010 at V <sub>GS</sub> = 10 V	40	23 nC

**FEATURES**

- DT-Trench Power MOSFET
- 100 % R<sub>G</sub> and UIS Tested

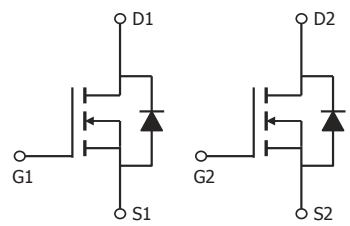
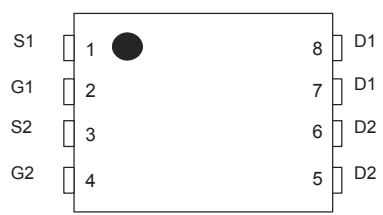


**RoHS**  
COMPLIANT

**APPLICATIONS**

- 12 V Automotive systems
- Motors, lamps and solenoid control
- Transmission control
- Ultra high performance power switching

Top View



ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted				
Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V <sub>DS</sub>	60	V
Gate-Source Voltage		V <sub>GS</sub>	± 20	
Continuous Drain Current (T <sub>J</sub> = 150 °C)	T <sub>C</sub> = 25 °C	I <sub>D</sub>	40 <sup>a</sup>	A
	T <sub>C</sub> = 70 °C		33	
	T <sub>A</sub> = 25 °C		26 <sup>b, c</sup>	
	T <sub>A</sub> = 70 °C		18 <sup>b, c</sup>	
Pulsed Drain Current		I <sub>DM</sub>	168	A
Continuous Source-Drain Diode Current	T <sub>C</sub> = 25 °C	I <sub>S</sub>	32	
	T <sub>A</sub> = 25 °C		26 <sup>b, c</sup>	
Avalanche Current	L = 0.1 mH	I <sub>AS</sub>	30	mJ
Single-Pulse Avalanche Energy		E <sub>AS</sub>	61	
Maximum Power Dissipation	T <sub>C</sub> = 25 °C	P <sub>D</sub>	57	W
	T <sub>C</sub> = 70 °C		36.5	
	T <sub>A</sub> = 25 °C		33 <sup>b, c</sup>	
	T <sub>A</sub> = 70 °C		21 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b, d</sup>	t ≤ 10 s	R <sub>thJA</sub>	30	42	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R <sub>thJF</sub>	3	8	

- Notes:
- a. Package limited.
  - b. Surface mounted on 1" x 1" FR4 board.
  - c. t = 10 s.
  - d. Maximum under Steady State conditions is 85 °C/W.

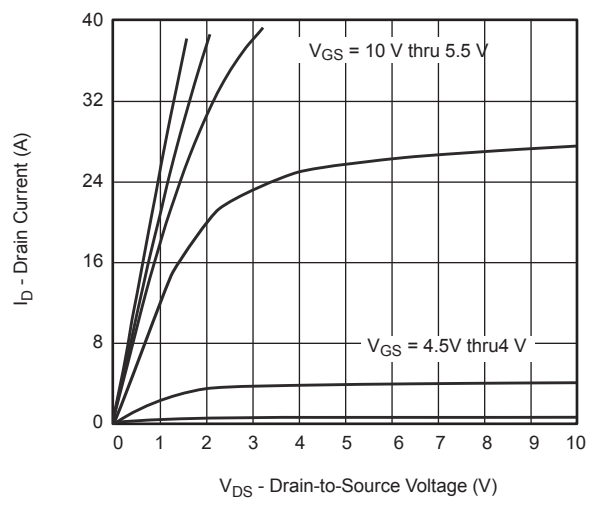
<b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	60			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		55		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			-6.3		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	0.5		2.5	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	40			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$		0.010	0.013	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 8\text{ A}$		0.015	0.019	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 10\text{ V}, I_D = 10\text{ A}$		50		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		2160		pF
Output Capacitance	$C_{oss}$			198		
Reverse Transfer Capacitance	$C_{rss}$			83		
Total Gate Charge	$Q_g$	$V_{DS} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 10\text{ A}$		25		nC
Gate-Source Charge	$Q_{gs}$			4.7		
Gate-Drain Charge	$Q_{gd}$			8.5		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		4.3	5.5	$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 5.4\text{ }\Omega$ $I_D \cong 10\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		12	19	ns
Rise Time	$t_r$			30	55	
Turn-Off Delay Time	$t_{d(off)}$			20	33	
Fall Time	$t_f$			20	29	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 5.4\text{ }\Omega$ $I_D \cong 10\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		8	16	
Rise Time	$t_r$			13	18	
Turn-Off Delay Time	$t_{d(off)}$			15	23	
Fall Time	$t_f$			10	15	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			40	A
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$				168	
Body Diode Voltage	$V_{SD}$	$I_S = 2\text{ A}$		0.7	1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 5.5\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		25	50	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			25	53	nC
Reverse Recovery Fall Time	$t_a$			19		ns
Reverse Recovery Rise Time	$t_b$			6		

Notes:

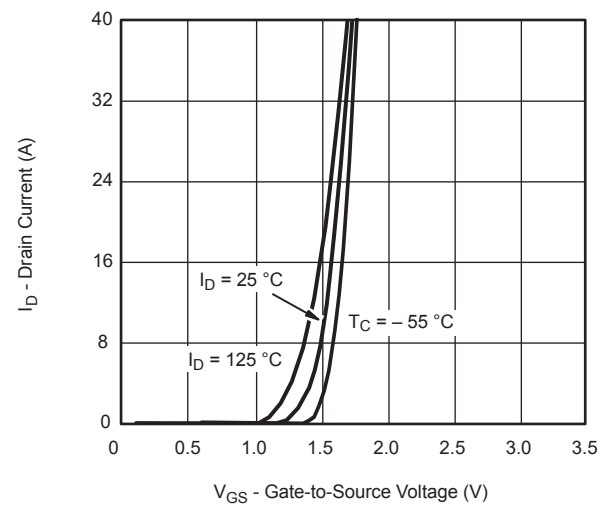
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

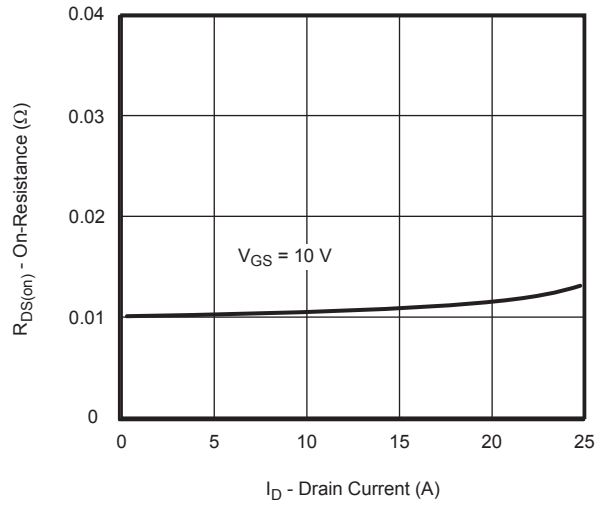
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



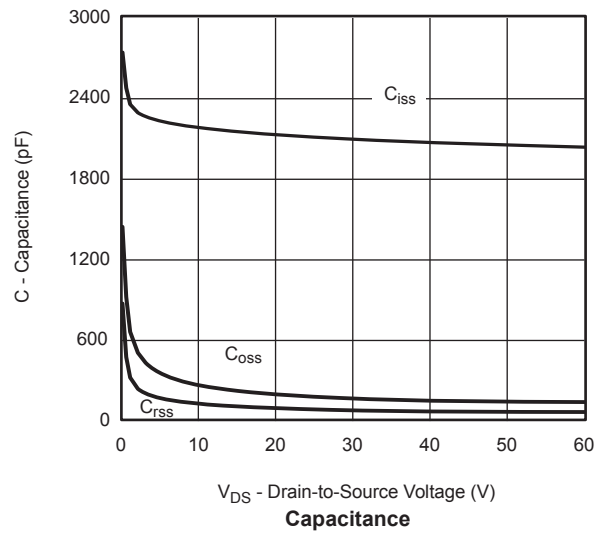
**Output Characteristics**



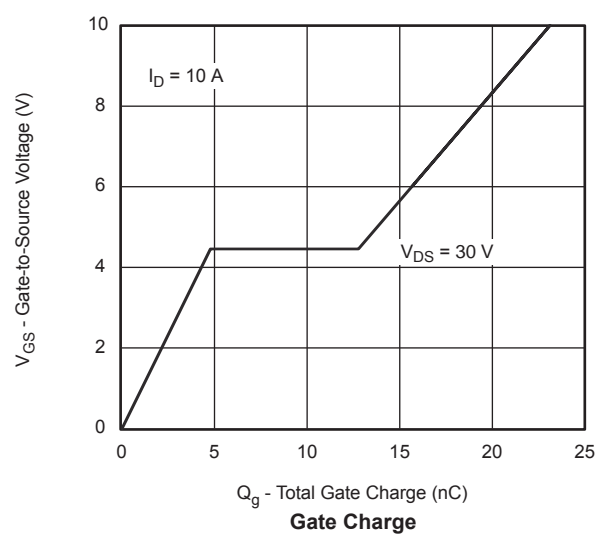
**Transfer Characteristics**



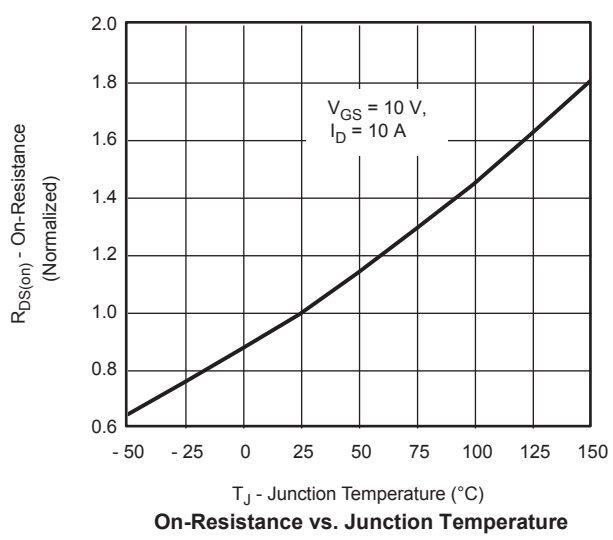
**On-Resistance vs. Drain Current**



**Capacitance**

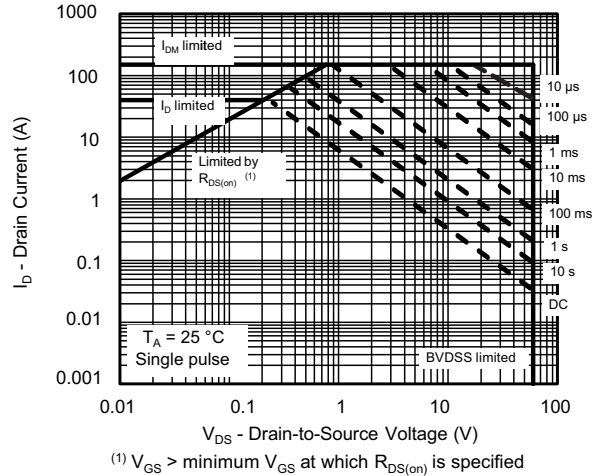
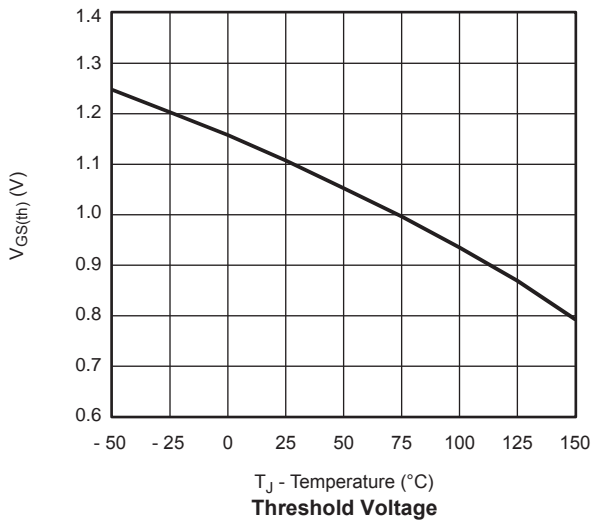
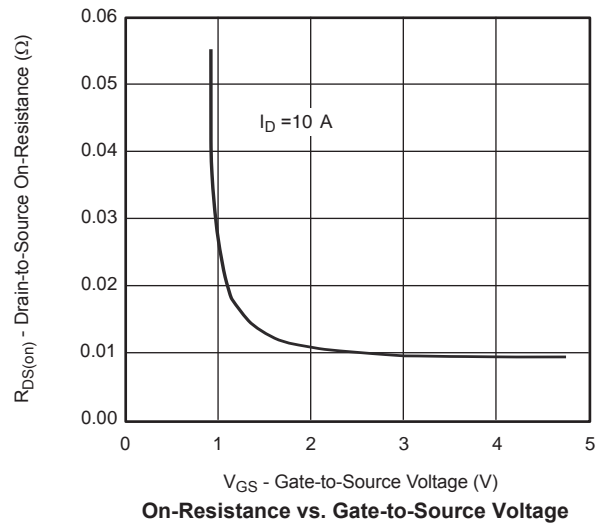
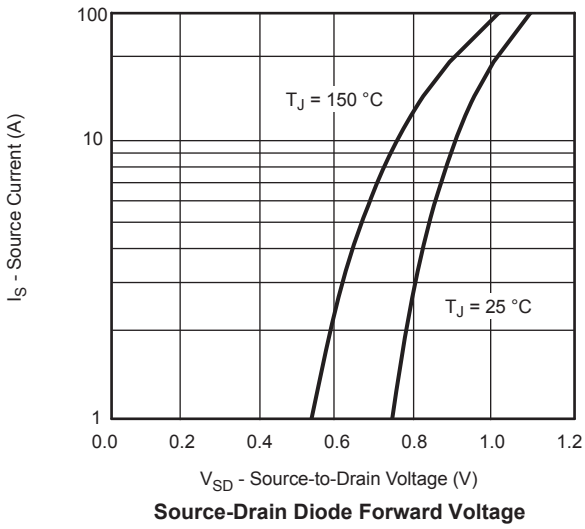


**Gate Charge**



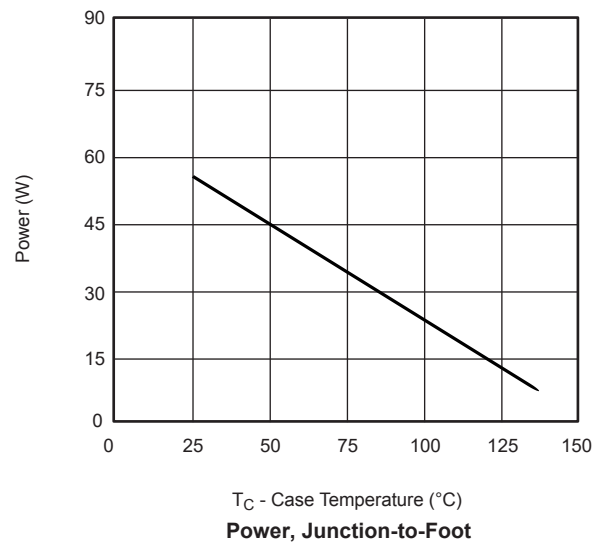
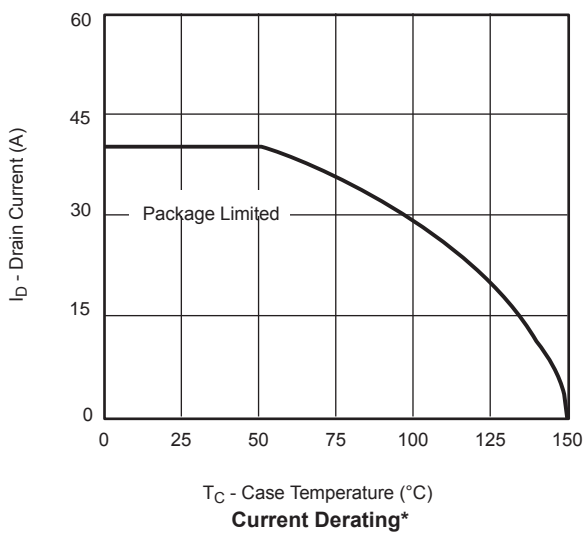
**On-Resistance vs. Junction Temperature**

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

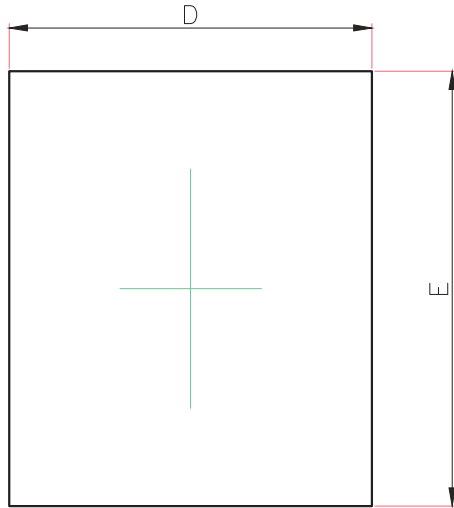


<sup>(1)</sup>  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

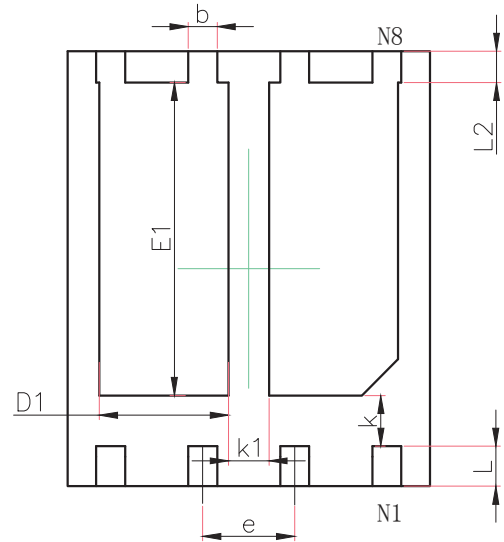
**Safe Operating Area, Junction-to-Ambient**



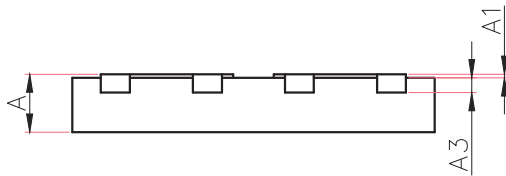
DFNWB5×6-8L-B(P1.27T0.75/0.85) PACKAGE OUTLINE DIMENSIONS



TOP VIEW



BOTTOM VIEW



SIDE VIEW

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	4.950	5.050	0.195	0.199
E	5.950	6.050	0.234	0.238
D1	1.680	1.880	0.066	0.074
E1	4.220	4.420	0.166	0.174
k	0.200MIN.		0.008MIN.	
k1	0.200MIN.		0.008MIN.	
b	0.350	0.450	0.014	0.018
e	1.270TYP.		0.05TYP.	
L	0.474	0.626	0.019	0.025

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