

## 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>a, e</sup>	Q <sub>g</sub> (Typ.)
60	0.010 at V <sub>GS</sub> = 10 V	48	65 nC
	0.020 at V <sub>GS</sub> = 4.5 V	35	

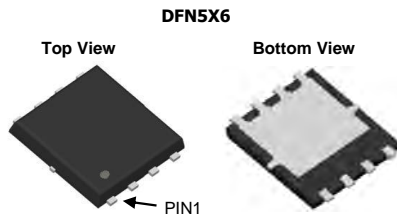
### FEATURES

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

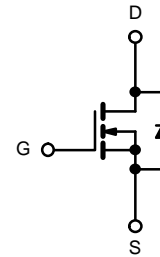
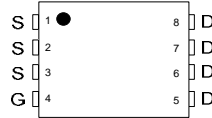


### APPLICATIONS

- Notebook PC Core
- VRM/POL



Top View



N-Channel MOSFET

### 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> = 175 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	48 <sup>a, e</sup>
		T <sub>C</sub> = 70 °C	40 <sup>e</sup>
		T <sub>A</sub> = 25 °C	18 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	16.2 <sup>b, c</sup>
Pulsed Drain Current	I <sub>DM</sub>	210	A
Avalanche Current Pulse	I <sub>AS</sub>	18	
Single Pulse Avalanche Energy		E <sub>AS</sub>	
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	48 <sup>a, e</sup>
		T <sub>A</sub> = 25 °C	3.12 <sup>b, c</sup>
Maximum Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	130 <sup>a</sup>
		T <sub>C</sub> = 70 °C	86
		T <sub>A</sub> = 25 °C	3.02 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	1.96 <sup>b, c</sup>
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 175	°C

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b, d</sup>	R <sub>thJA</sub>	15	18	°C/W
Maximum Junction-to-Case	R <sub>thJC</sub>	0.8	1.1	

Notes:

a. Based on T<sub>C</sub> = 25 °C.

b. Surface mounted on 1" x 1" FR4 board.

c. t = 10 s.

d. Maximum under steady state conditions is 90 °C/W.

e. Calculated based on maximum junction temperature. Package limitation current is 50 A.

**SPECIFICATIONS** ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)

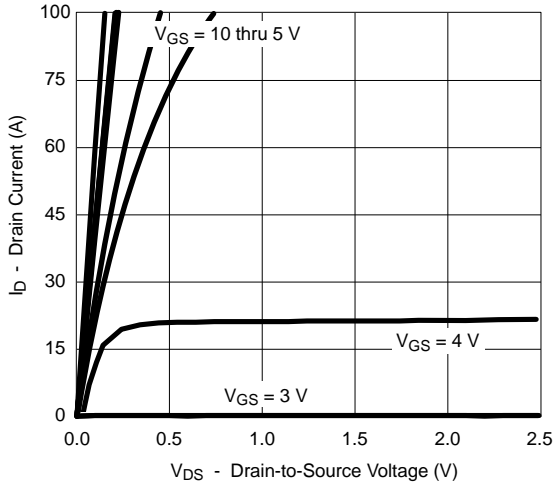
Parameter	Symbol	Test Conditions	Min .	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	60			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		35		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			- 5.5		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.5		3.5	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>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	48			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 15\text{ A}$		0.010	0.013	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$		0.020	0.035	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 30\text{ A}$		39		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		3015		pF
Output Capacitance	$C_{oss}$			652		
Reverse Transfer Capacitance	$C_{rss}$			23		
Total Gate Charge	$Q_g$	$V_{DS} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 15\text{ A}$		65		nC
		$V_{DS} = 30\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$		53		
Gate-Source Charge	$Q_{gs}$	$V_{DS} = 30\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$		12		
Gate-Drain Charge	$Q_{gd}$			8.8		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		1.5	2.2	$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 0.555\text{ }\Omega$ $I_D \cong 15\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		13	29	ns
Rise Time	$t_r$			8	12	
Turn-Off Delay Time	$t_{d(off)}$			75	101	
Fall Time	$t_f$			10	15	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 0.625\text{ }\Omega$ $I_D \cong 10\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		26	42	
Rise Time	$t_r$			85	123	
Turn-Off Delay Time	$t_{d(off)}$			55	86	
Fall Time	$t_f$			12	18	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			48	A
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$				210	
Body Diode Voltage	$V_{SD}$	$I_S = 1\text{ A}$		0.8	1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 15\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		50	75	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			68.5	100	nC
Reverse Recovery Fall Time	$t_a$			26		ns
Reverse Recovery Rise Time	$t_b$			23		

**Notes:**

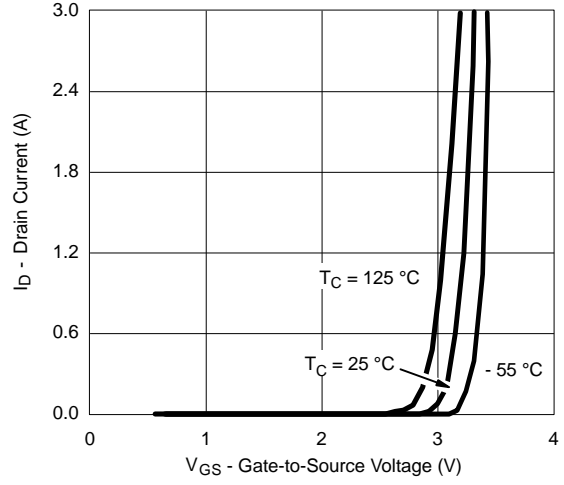
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 b. Guaranteed by design, not subject to production testing.

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.

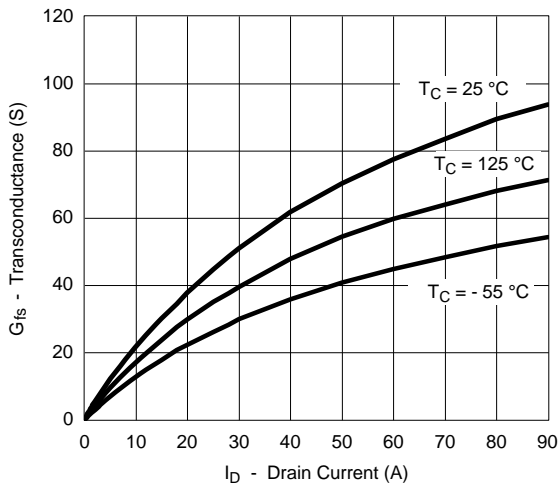
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



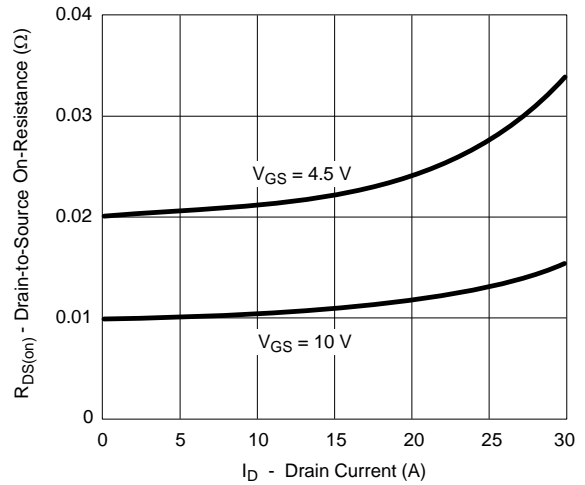
**Output Characteristics**



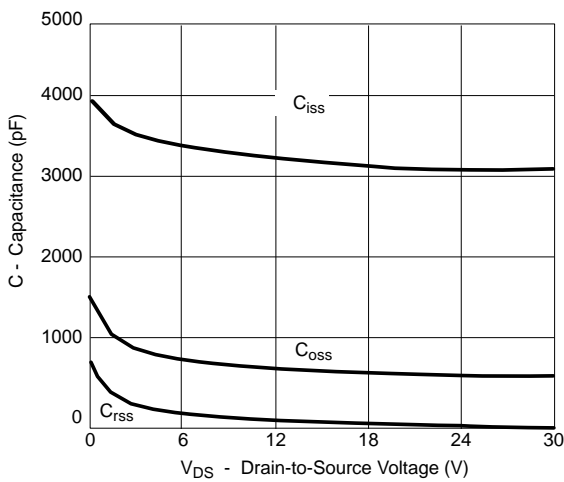
**Transfer Characteristics**



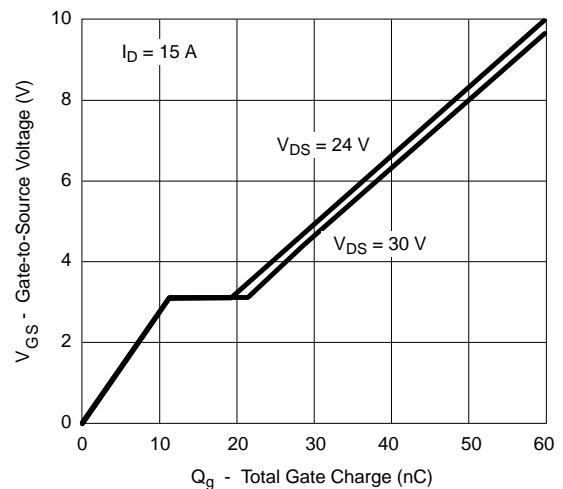
**Transconductance**



**$R_{DS(on)}$  vs. Drain Current**

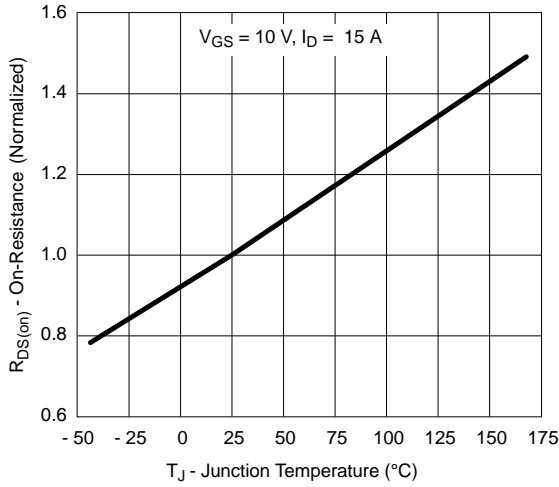


**Capacitance**

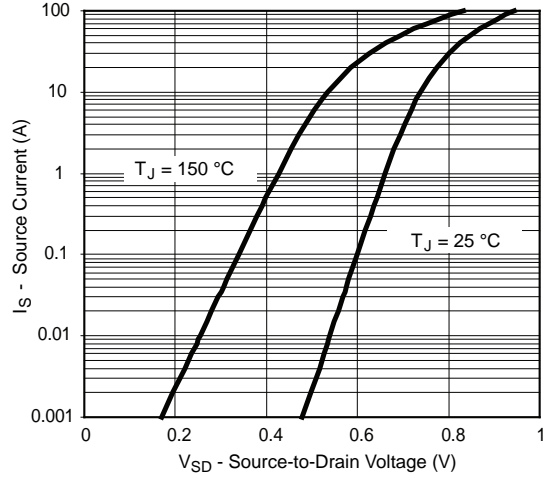


**Gate Charge**

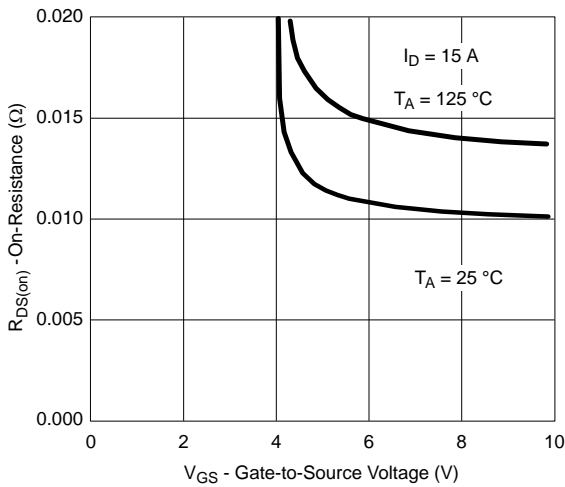
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



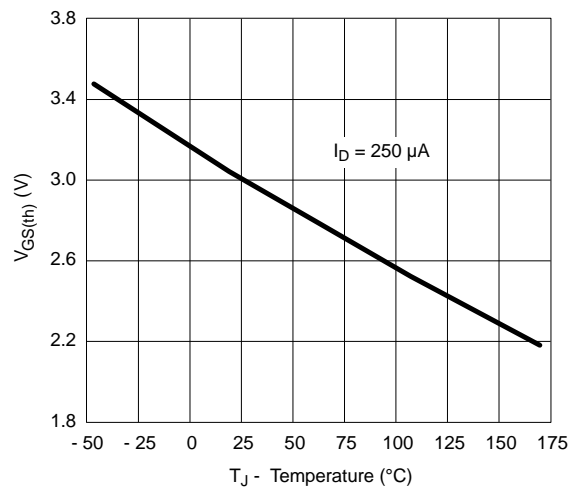
**On-Resistance vs. Junction Temperature**



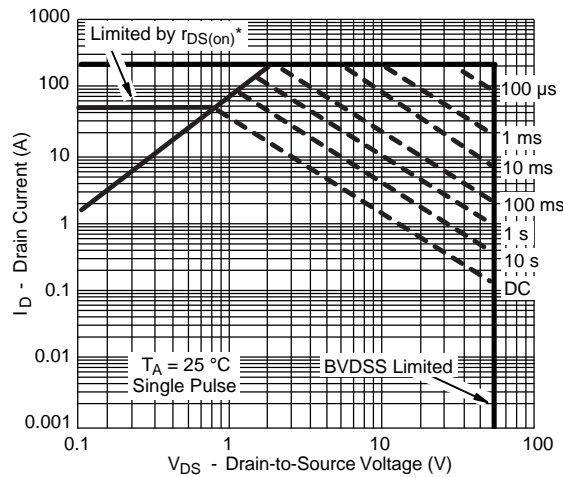
**Forward Diode Voltage vs. Temperature**



**R<sub>DS(on)</sub> vs. V<sub>GS</sub> vs. Temperature**

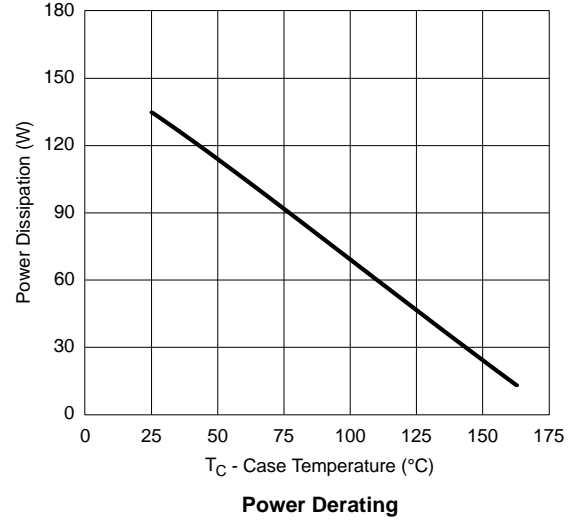
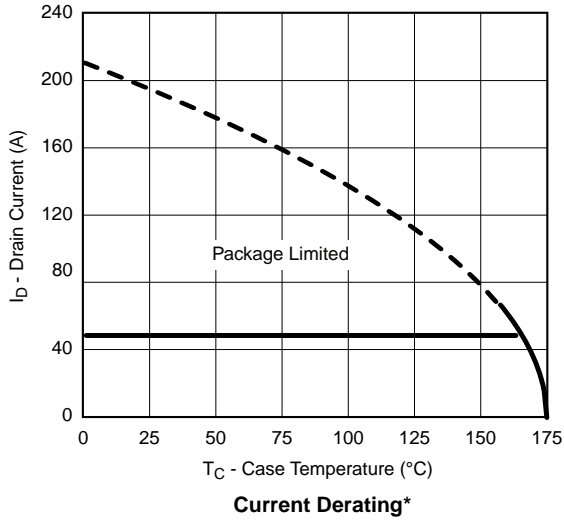


**Threshold Voltage**

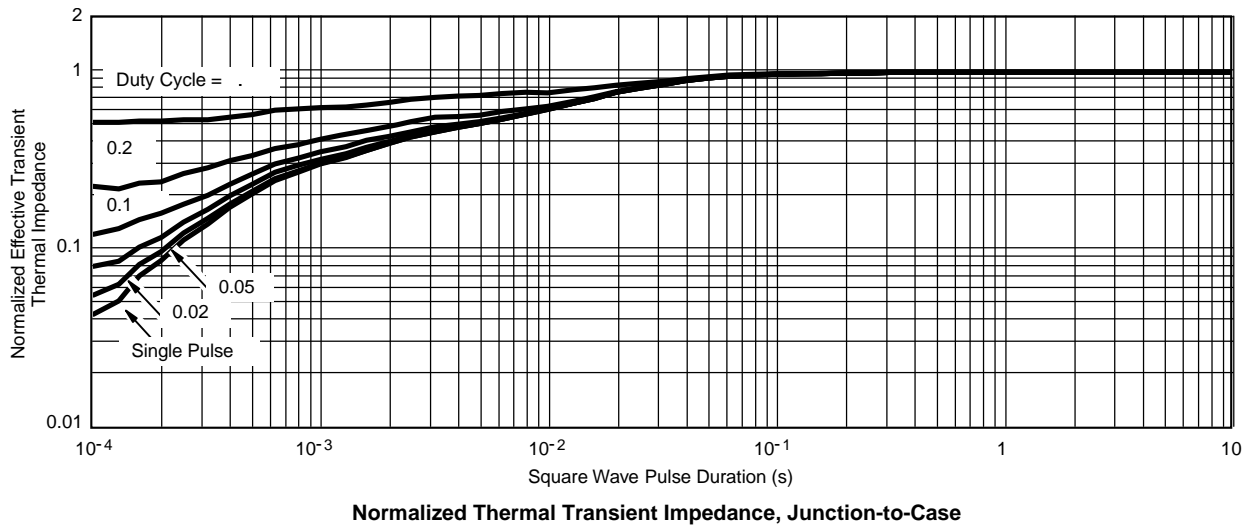


**Safe Operating Area, Junction-to-Ambient**

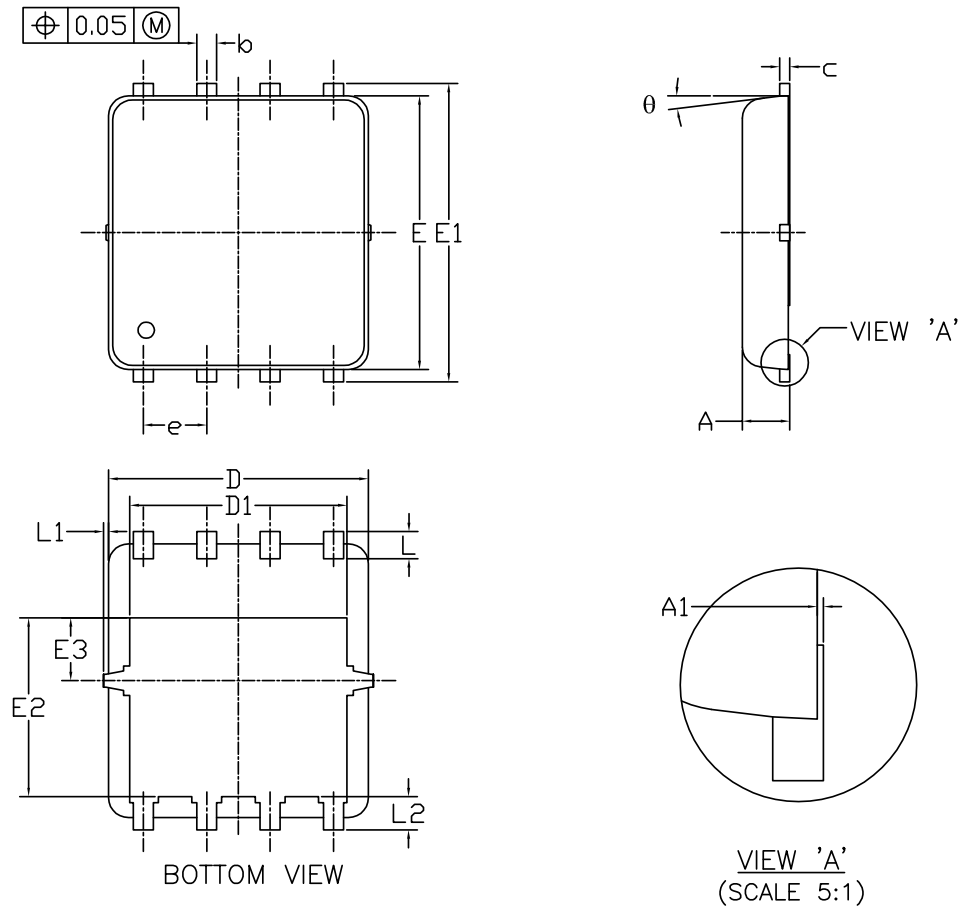
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



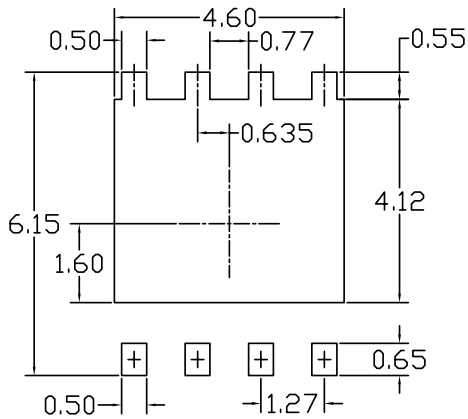
\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 175$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



DFN5x6\_8L\_EP1\_P PACKAGE OUTLIN



RECOMMENDED LAND PATTERN



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.85	0.95	1.00	0.033	0.037	0.039
A1	0.00	---	0.05	0.000	---	0.002
b	0.30	0.40	0.50	0.012	0.016	0.020
c	0.15	0.20	0.25	0.006	0.008	0.010
D	4.80	5.20	5.30	0.201	0.205	0.209
D1	4.25	4.35	4.45	0.167	0.171	0.175
E	5.45	5.55	5.65	0.215	0.219	0.222
E1	5.95	6.05	6.15	0.234	0.238	0.242
E2	3.525	3.625	3.725	0.139	0.143	0.147
E3	1.175	1.275	1.375	0.046	0.050	0.054
e	1.27 BSC			0.050 BSC		
L	0.45	0.55	0.65	0.018	0.022	0.026
L1	0	---	0.15	0	---	0.006
L2	0.68 REF			0.027 REF		
θ	0°	---	10°	0°	---	10°

NOTE

UNIT: mm

- PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.  
MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 6 MILS EACH.
- CONTROLLING DIMENSION IS MILLIMETER.  
CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

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