

N-Channel 60 V (D-S) MOSFET

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^{a, e}	Q_g (Typ.)
60	0.0015 at $V_{GS} = 10$ V	220	88 nC
	0.0022 at $V_{GS} = 4.5$ V		

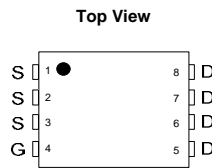
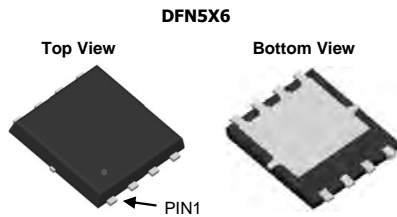
FEATURES

- DT-Trench Power MOSFET
- 100 % R_g and UIS Tested



APPLICATIONS

- Notebook PC Core
- VRM/POL



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted)				
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	V_{DS}	60	V	
Gate-Source Voltage	V_{GS}	± 20		
Continuous Drain Current ($T_J = 175$ °C)	$T_C = 25$ °C	220 ^{a, e}	A	
	$T_C = 70$ °C	190 ^e		
	$T_A = 25$ °C	36 ^{b, c}		
	$T_A = 70$ °C	29 ^{b, c}		
Pulsed Drain Current	I_{DM}	880	mJ	
Avalanche Current Pulse	I_{AS}	195		
Single Pulse Avalanche Energy	E_{AS}	730		
Continuous Source-Drain Diode Current	$T_C = 25$ °C	220 ^{a, e}	A	
	$T_A = 25$ °C	5.39 ^{b, c}		
Maximum Power Dissipation	$T_C = 25$ °C	272 ^a	W	
	$T_C = 70$ °C	185		
	$T_A = 25$ °C	8.3 ^{b, c}		
	$T_A = 70$ °C	5.8 ^{b, c}		
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 175	°C	

THERMAL RESISTANCE RATINGS					
Parameter	Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient ^{b, d}	R_{thJA}	18	25	°C/W	
Maximum Junction-to-Case	R_{thJC}	0.6	0.8		

Notes:

- a. Based on $T_C = 25$ °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 120 A.

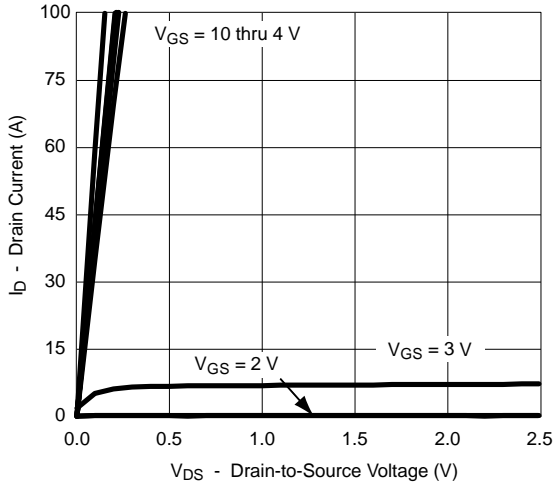
SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min .	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	60			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		35		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			- 5.5		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.0		3.0	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$			1	μA
		$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	220			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 30\text{ A}$		0.0015	0.0020	Ω
		$V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$		0.0022	0.0030	
Forward Transconductance ^a	g_{fs}	$V_{DS} = 15\text{ V}, I_D = 20\text{ A}$		30		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		6975		pF
Output Capacitance	C_{oss}			2897		
Reverse Transfer Capacitance	C_{rss}			48		
Total Gate Charge	Q_g	$V_{DS} = 48\text{ V}, V_{GS} = 10\text{ V}, I_D = 30\text{ A}$		88		nC
		$V_{DS} = 48\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$		35		
Gate-Source Charge	Q_{gs}		14			
Gate-Drain Charge	Q_{gd}		25			
Gate Resistance	R_g	$f = 1\text{ MHz}$		2.0	3.5	Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 48\text{ V}, R_L = 0.555\text{ }\Omega$ $I_D \cong 50\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		18	30	ns
Rise Time	t_r			15	25	
Turn-Off Delay Time	$t_{d(off)}$			29	50	
Fall Time	t_f			5	10	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 48\text{ V}, R_L = 0.625\text{ }\Omega$ $I_D \cong 30\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		8	15	
Rise Time	t_r			60	79	
Turn-Off Delay Time	$t_{d(off)}$			21	47	
Fall Time	t_f			8	13	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^\circ\text{C}$			220	A
Pulse Diode Forward Current ^a	I_{SM}				880	
Body Diode Voltage	V_{SD}	$I_S = 20\text{ A}$		0.8	1.2	
V Body Diode Reverse Recovery Time	t_{rr}	$I_F = 20\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		55	78	ns
Body Diode Reverse Recovery Charge	Q_{rr}			97	170	nC
Reverse Recovery Fall Time	t_a			29		ns
Reverse Recovery Rise Time	t_b			23		

Notes:

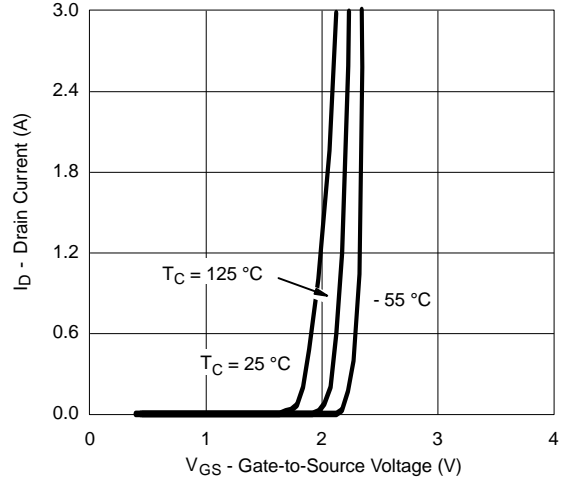
- Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
- Guaranteed by design, not subject to production testing.

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.

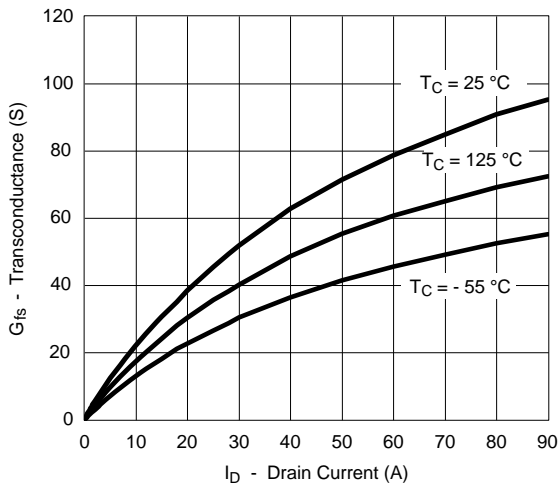
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



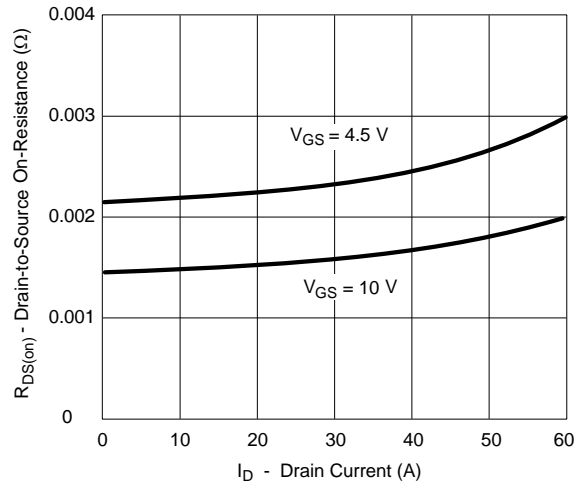
Output Characteristics



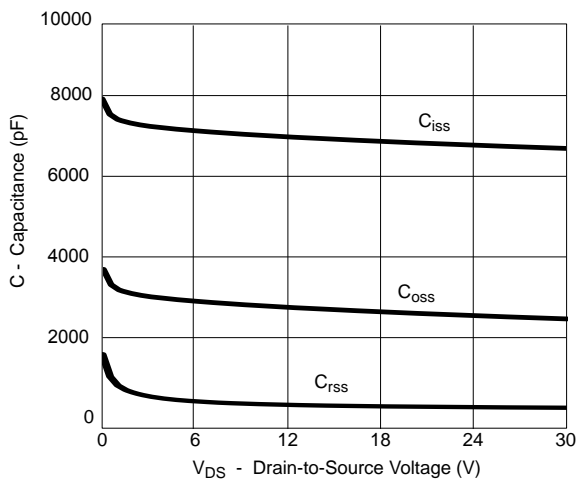
Transfer Characteristics



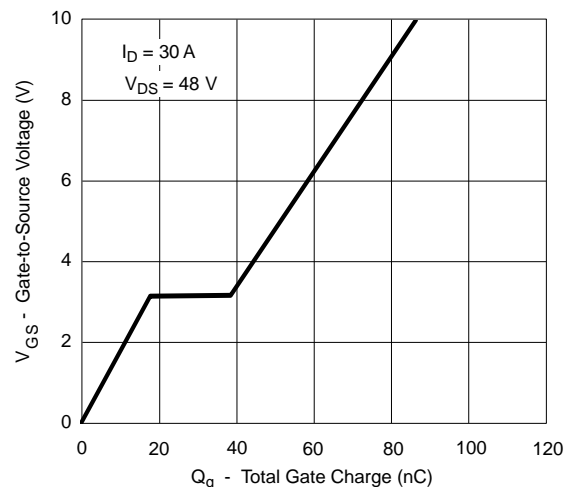
Transconductance



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

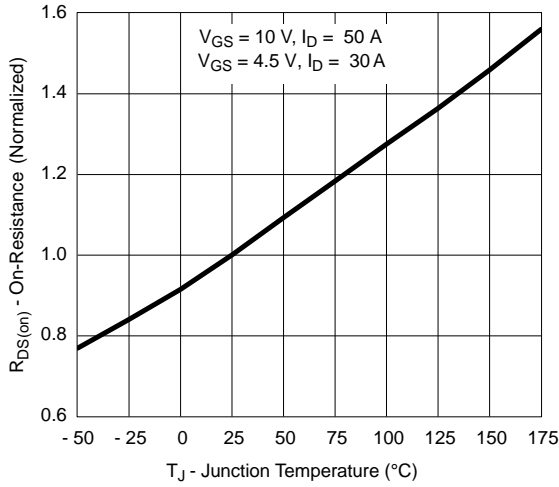


Capacitance

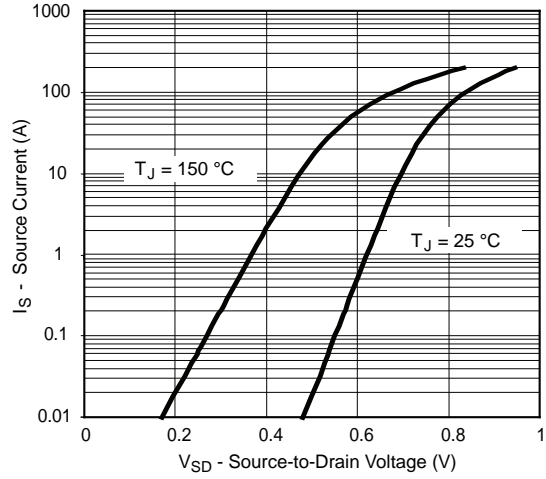


Gate Charge

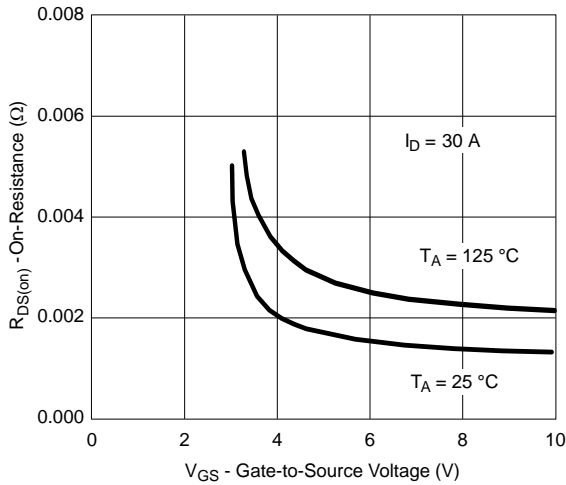
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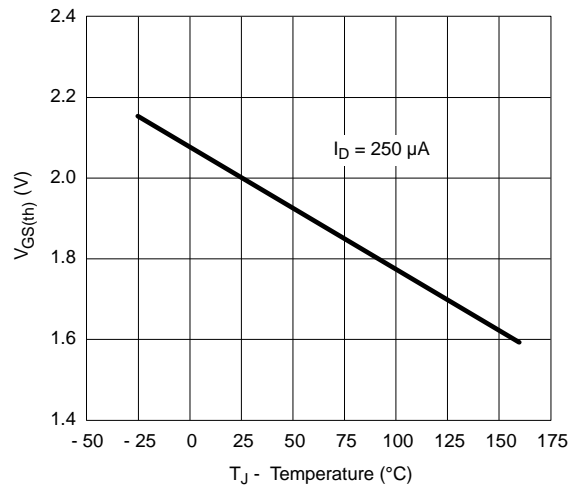
On-Resistance vs. Junction Temperature



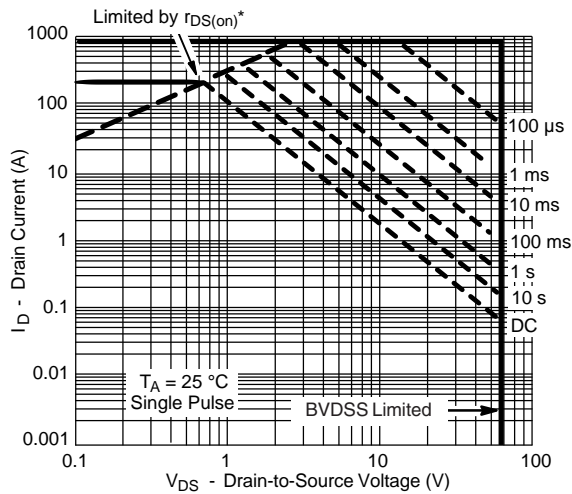
Forward Diode Voltage vs. Temperature



R_{DS(on)} vs. V_{GS} vs. Temperature



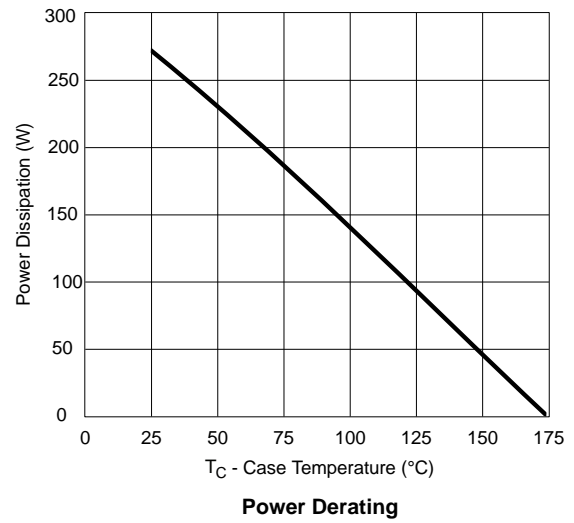
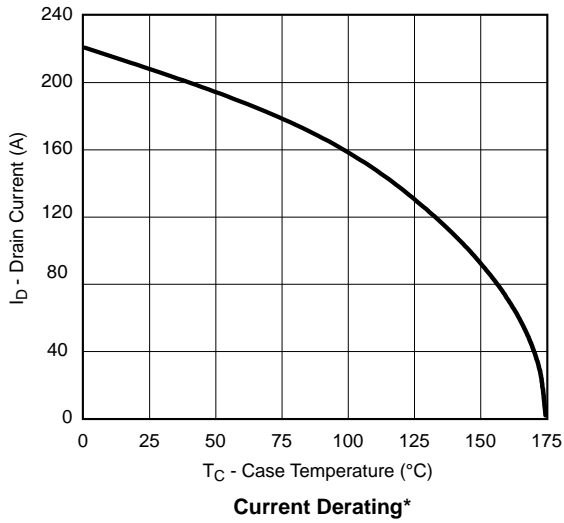
Threshold Voltage



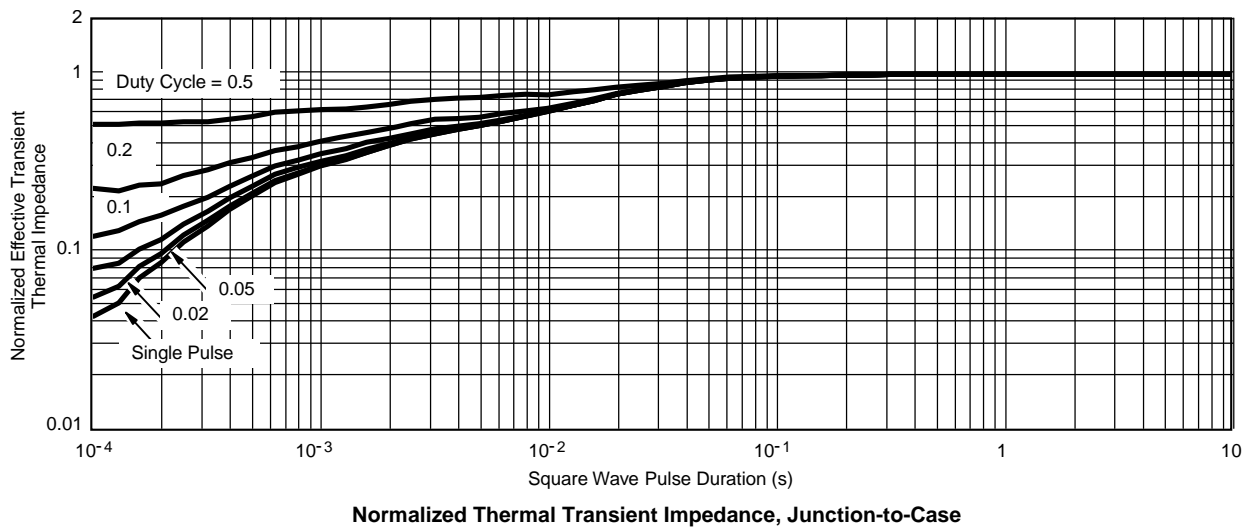
*V_{GS} > minimum V_{GS} at which r_{DS(on)} is specified

Safe Operating Area, Junction-to-Ambient

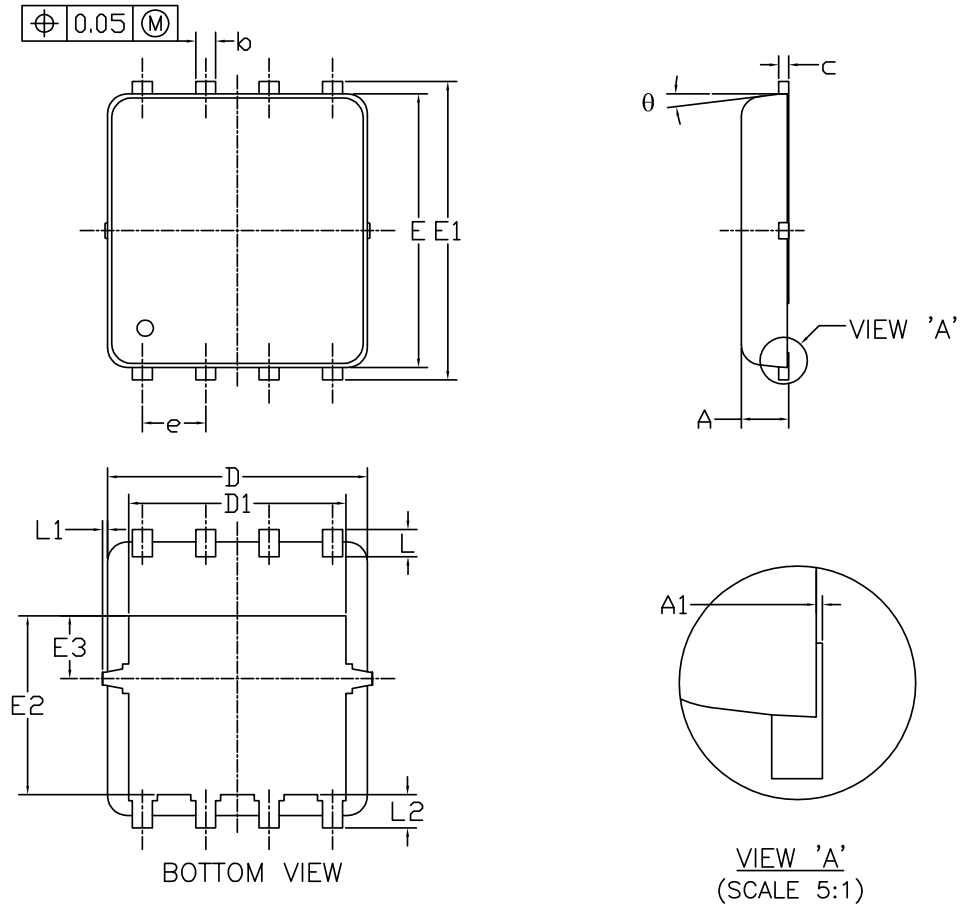
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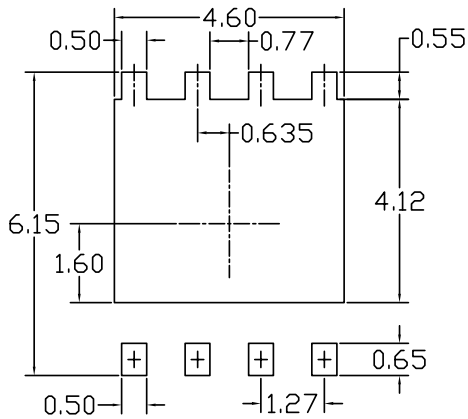
* The power dissipation P_D is based on $T_{J(max)} = 175$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



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	1.00	1.20	0.033	0.039	0.047
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	5.10	5.25	5.40	0.201	0.207	0.213
D1	4.25	4.35	4.45	0.167	0.171	0.175
E	5.45	5.60	5.75	0.215	0.221	0.226
E1	5.95	6.10	6.25	0.234	0.240	0.246
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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