

## VSP004P03MS-VB Datasheet

### P-Channel 30-V (D-S) MOSFET

#### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
- 30	0.004 at $V_{GS} = -10$ V	- 120	130 nC
	0.006 at $V_{GS} = -4.5$ V	- 100	

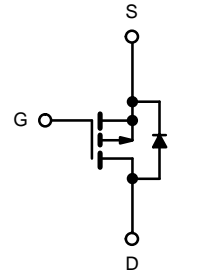
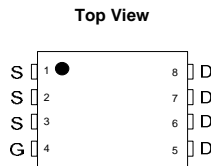
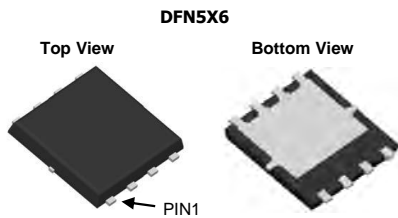
#### FEATURES

- Halogen-free
- Trench Power MOSFET
- 100 %  $R_g$  Tested



#### APPLICATIONS

- Notebook
- Load Switch



P-Channel MOSFET

#### ABSOLUTE MAXIMUM RATINGS $T_A = 25^\circ\text{C}$ , unless otherwise noted

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	- 30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 150^\circ\text{C}$ )	$I_D$	$T_C = 25^\circ\text{C}$	A
		$T_C = 70^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	
		$T_A = 70^\circ\text{C}$	
Pulsed Drain Current	$I_{DM}$	- 280	mJ
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	
Single Pulse Avalanche Current	$I_{AS}$	- 60	
Single Pulse Avalanche Energy	$E_{AS}$	160	
Maximum Power Dissipation	$P_D$	$T_C = 25^\circ\text{C}$	W
		$T_C = 70^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	
		$T_A = 70^\circ\text{C}$	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>		260	

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b, f</sup>	$R_{thJA}$	15	20	$^\circ\text{C/W}$
Maximum Junction-to-Case (Drain)	$R_{thJC}$	0.9	1.2	

Notes:

a. Package limited.

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

c.  $t = 10$  s.

d. The DFN5x6 is a leadless package. The end of the lead terminal is exposed

copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.

e. Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.

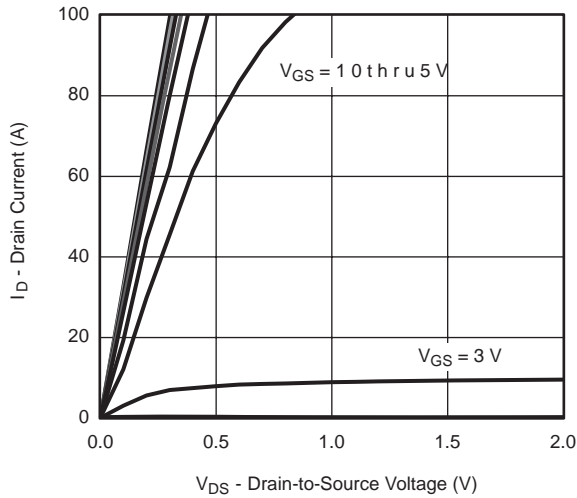
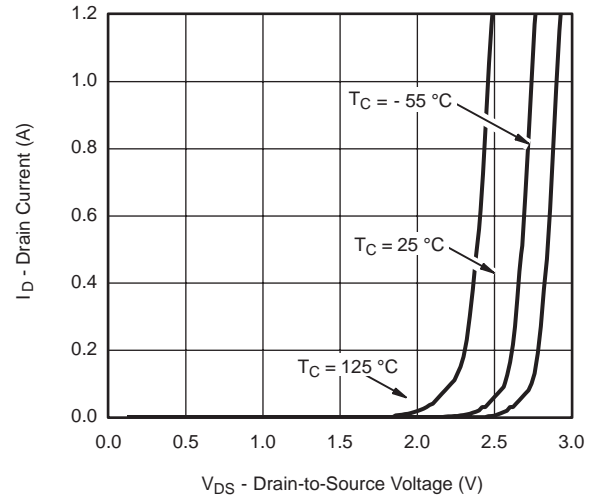
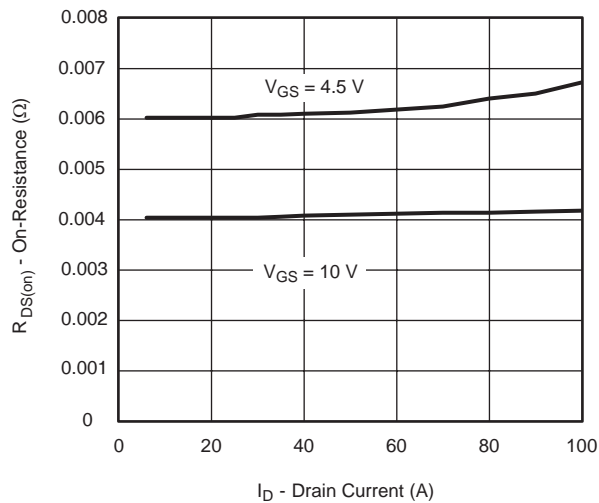
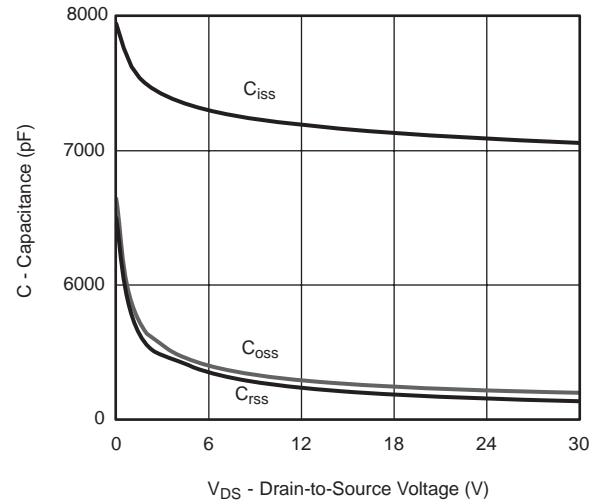
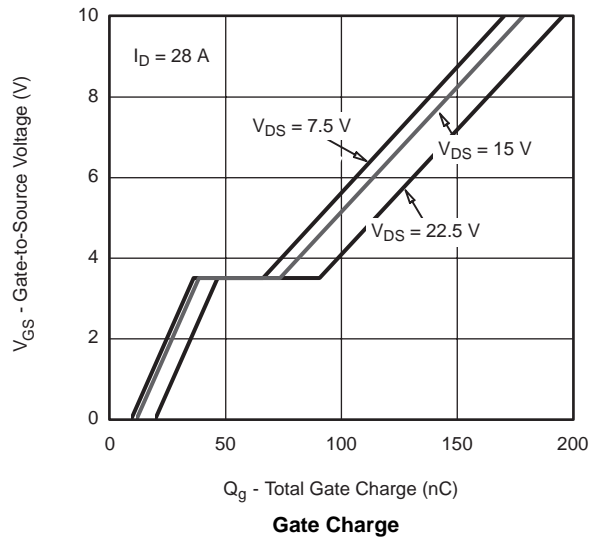
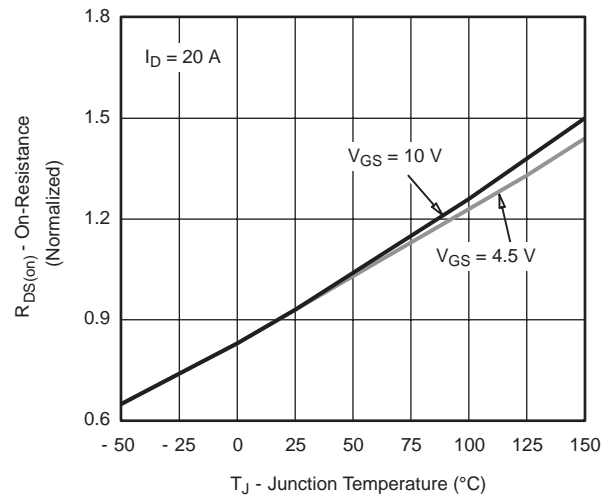
f. Maximum under Steady State conditions is  $54^\circ\text{C/W}$ .

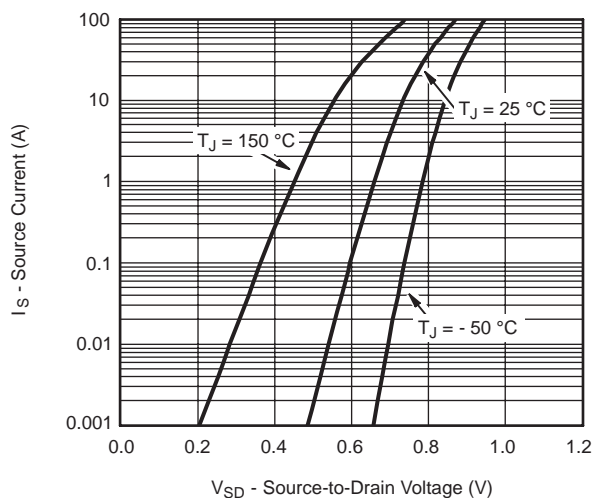
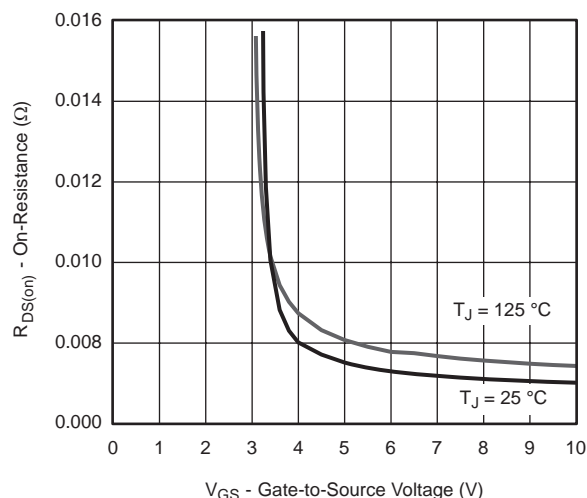
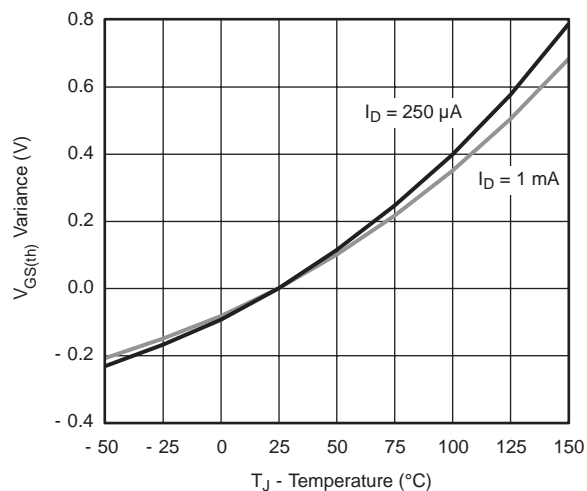
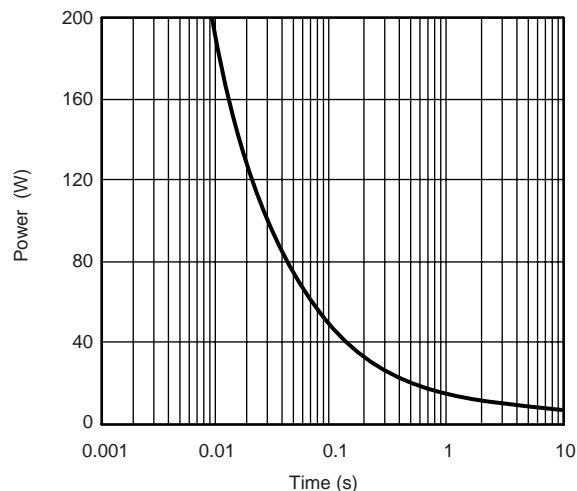
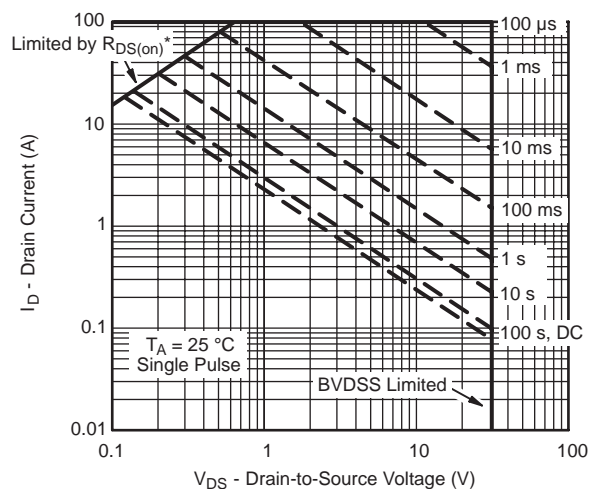
SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	- 30			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		- 31		mV/ $^{\circ}\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			6.5		
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	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -30\text{ V}, V_{GS} = 0\text{ V}$			- 1	$\mu\text{A}$
		$V_{DS} = -30\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^{\circ}\text{C}$			- 10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} = -5\text{ V}, V_{GS} = -10\text{ V}$	- 30			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -20\text{ A}$		0.004		$\Omega$
		$V_{GS} = -4.5\text{ V}, I_D = -15\text{ A}$		0.006		
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -15\text{ V}, I_D = -20\text{ A}$		97		S
Dynamic <sup>b</sup>						
Input Capacitance	$C_{iss}$	$V_{DS} = -15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		7050		pF
Output Capacitance	$C_{oss}$			1375		
Reverse Transfer Capacitance	$C_{rss}$			1215		
Total Gate Charge	$Q_g$	$V_{DS} = -15\text{ V}, V_{GS} = -10\text{ V}, I_D = -20\text{ A}$		130	250	nC
				78	130	
Gate-Source Charge	$Q_{gs}$	$V_{DS} = -15\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -20\text{ A}$		29		
Gate-Drain Charge	$Q_{gd}$			37		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		1.9		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -15\text{ V}, R_L = 15\text{ }\Omega$ $I_D \cong -1.0\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\text{ }\Omega$		25	40	ns
Rise Time	$t_r$			15	30	
Turn-Off Delay Time	$t_{d(off)}$			110	170	
Fall Time	$t_f$			30	50	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -15\text{ V}, R_L = 15\text{ }\Omega$ $I_D \cong -1.0\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\text{ }\Omega$		110	170	
Rise Time	$t_r$			100	150	
Turn-Off Delay Time	$t_{d(off)}$			100	150	
Fall Time	$t_f$			50	75	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^{\circ}\text{C}$			100	A
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$				120	
Body Diode Voltage	$V_{SD}$	$I_S = -5\text{ A}$		- 0.54	- 1.1	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 3.5\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^{\circ}\text{C}$		50	100	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			65	130	nC
Reverse Recovery Fall Time	$t_a$			26		ns
Reverse Recovery Rise Time	$t_b$			24		

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.

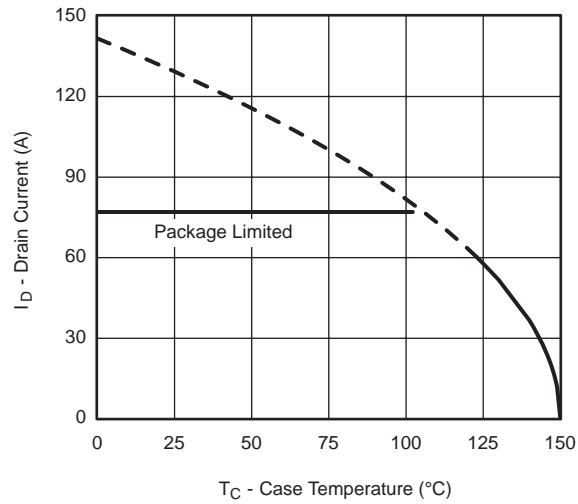
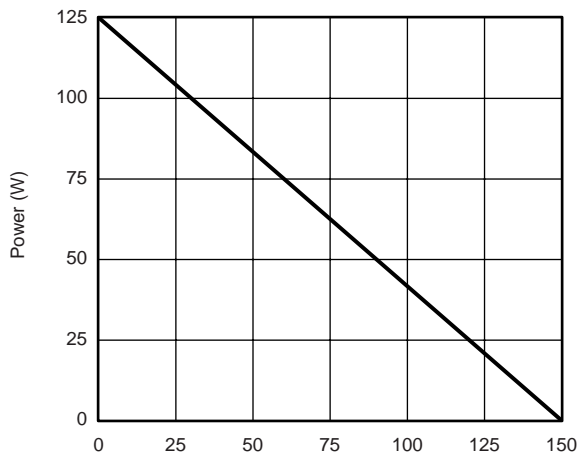
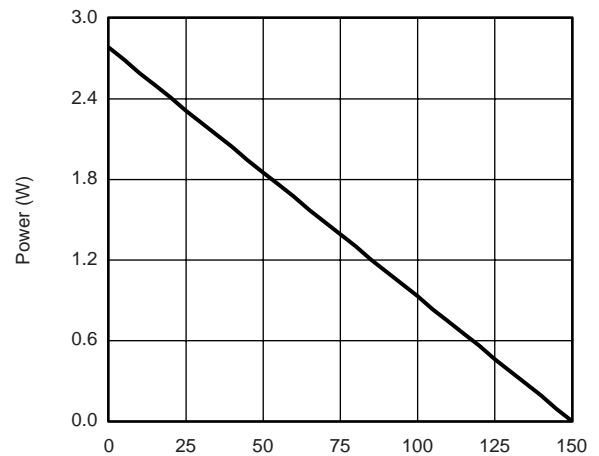
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure 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 and Gate Voltage**

**Capacitance**

**Gate Charge**

**On-Resistance vs. Junction Temperature**

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

**Source-Drain Diode Forward Voltage**

**On-Resistance vs. Gate-to-Source Voltage**

**Threshold Voltage**

**Single Pulse Power, Junction-to-Ambient**


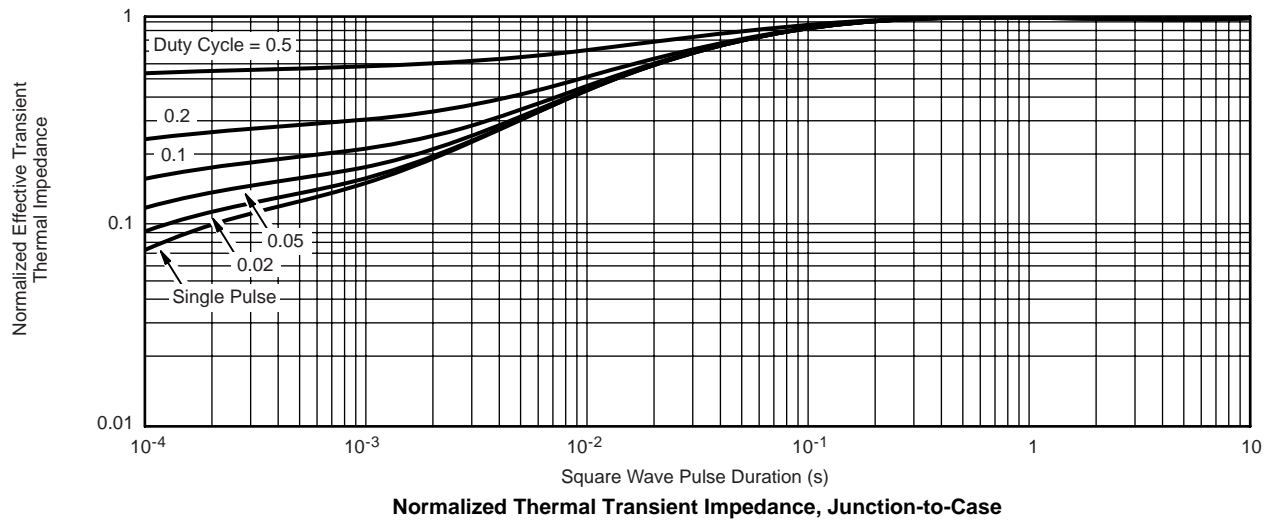
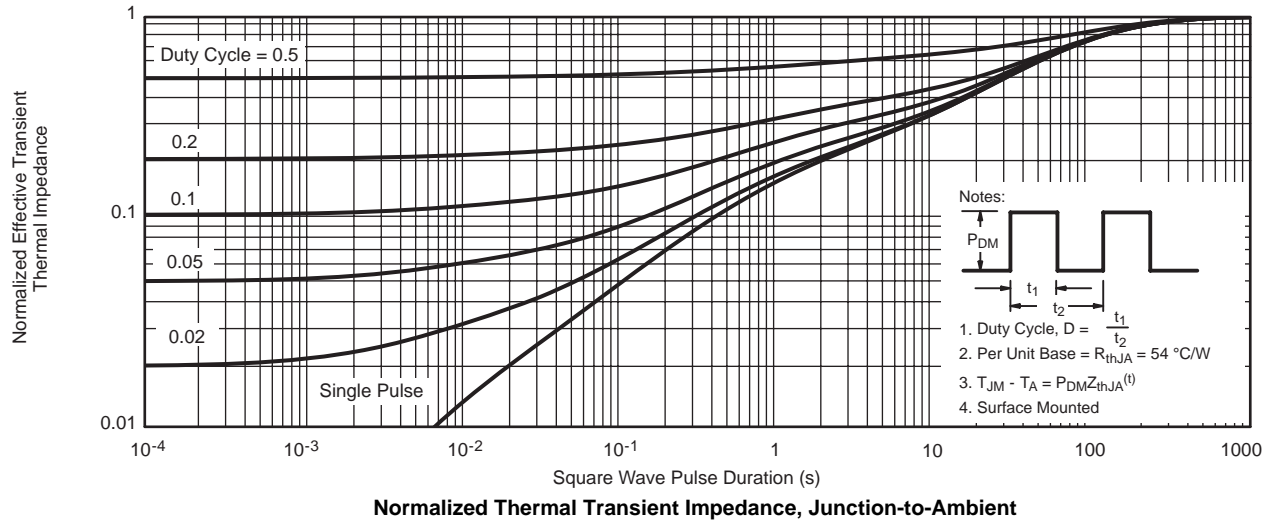
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

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

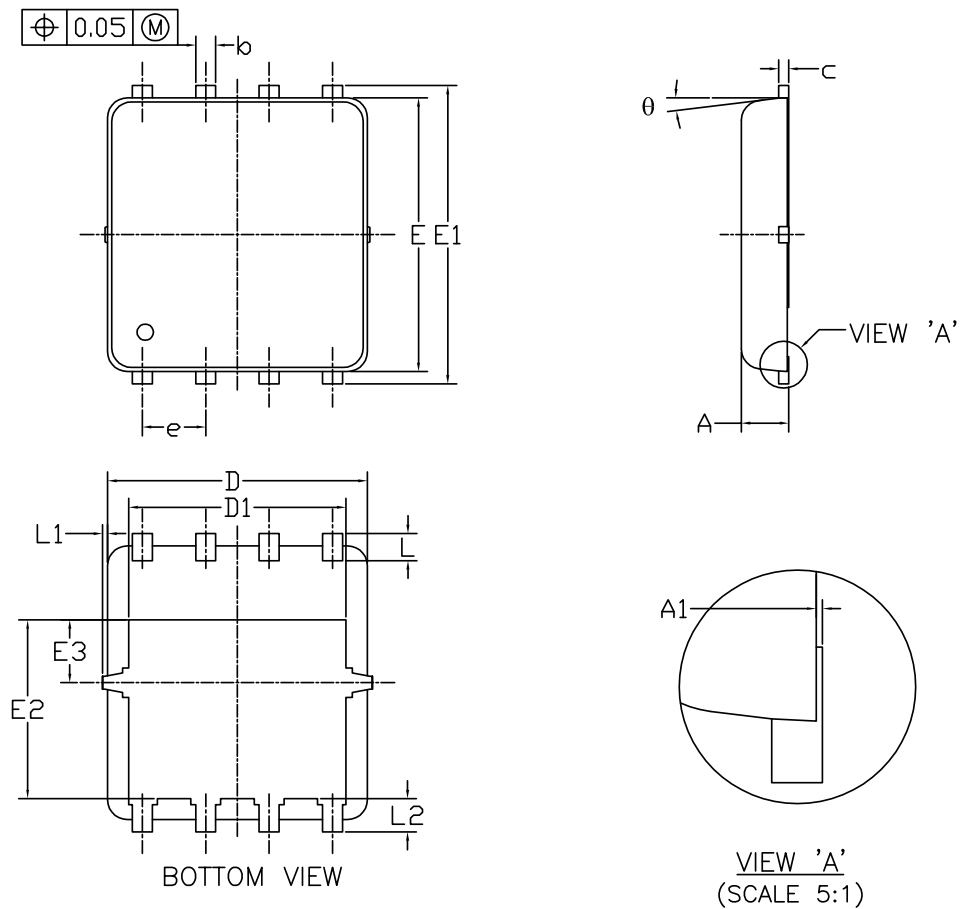
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Current Derating\***

**Power, Junction-to-Case**

**Power, Junction-to-Ambient**

\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °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.

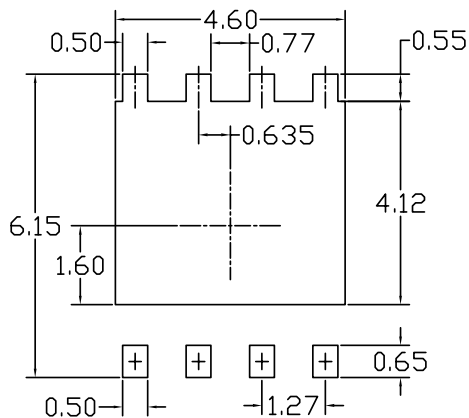
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



## 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	5.10	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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