

## 12DN20NS3-VB Datasheet

### N-Channel 200 V (D-S) MOSFET

#### PRODUCT SUMMARY

$V_{DS}$ (V)	200
$R_{DS(on)}$ Typ. ( $\Omega$ ) at $V_{GS} = 10$ V	0.038
$R_{DS(on)}$ Typ. ( $\Omega$ ) at $V_{GS} = 7.5$ V	0.043
$Q_g$ typ. (nC)	20
$I_D$ (A)	30
Configuration	Single

#### FEATURES

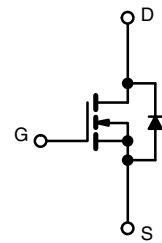
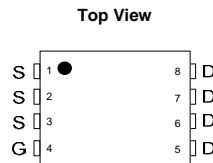
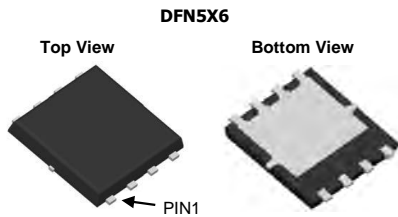
- Thunder technology optimizes balance of  $R_{DS(on)}$ ,  $Q_g$ ,  $Q_{sw}$  and  $Q_{oss}$
- 100 %  $R_g$  and UIS tested

#### APPLICATIONS

- Fixed telecom
- DC/DC converter
- Primary and secondary side switch
- Synchronous rectification
- LED lighting
- Power supplies
- Class D amplifier



**RoHS**  
COMPLIANT  
HALOGEN  
FREE



N-Channel MOSFET

#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	$V_{DS}$	200	V
Gate-source voltage	$V_{GS}$	$\pm 20$	
Continuous drain current ( $T_J = 150$ °C)	$T_C = 25$ °C	30	A
	$T_C = 70$ °C	23	
	$T_A = 25$ °C	7.6 <sup>b, c</sup>	
	$T_A = 70$ °C	5.9 <sup>b, c</sup>	
Pulsed drain current ( $t = 100$ $\mu$ s)	$I_{DM}$	70	A
Continuous source-drain diode current	$T_C = 25$ °C	30	
	$T_A = 25$ °C	5.6 <sup>b, c</sup>	
Single pulse avalanche current	$I_{AS}$	30	
Single pulse avalanche energy	$E_{AS}$	45	mJ
Maximum power dissipation	$T_C = 25$ °C	104	W
	$T_C = 70$ °C	66.6	
	$T_A = 25$ °C	6.25 <sup>b, c</sup>	
	$T_A = 70$ °C	4 <sup>b, c</sup>	
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to +150	°C
Soldering recommendations (peak temperature) <sup>c</sup>		260	

#### THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient <sup>b</sup>	$R_{thJA}$	15	20	°C/W
Maximum junction-to-case (drain)	$R_{thJC}$	0.9	1.2	

#### Notes

- Package limited.
- Surface mounted on 1" x 1" FR4 board.
- $t = 10$  s.
- 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.
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.
- Maximum under steady state conditions is 54 °C/W.
- $T_C = 25$  °C.

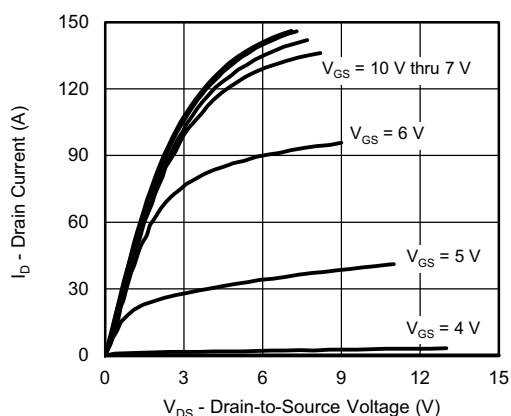
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	200	-	-	V
V <sub>DS</sub> temperature coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 10 mA	-	173	-	mV/°C
V <sub>GS(th)</sub> temperature coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA	-	-7.1	-	
Gate-source threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	2.0		4.0	
Gate-source leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V	-	-	100	nA
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V	-	-	1	μA
		V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 70 °C	-	-	15	
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 10 V, V <sub>GS</sub> = 10 V	30	-	-	A
Drain-source on-state resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A	-	0.038	-	Ω
		V <sub>GS</sub> = 7.5 V, I <sub>D</sub> = 10 A	-	0.043	-	
Forward transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 10 A	-	27	-	S
Dynamic <sup>b</sup>						
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	1380	-	pF
Output capacitance	C <sub>oss</sub>		-	142	-	
Reverse transfer capacitance	C <sub>rss</sub>		-	11	-	
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A	-	25	38	nC
		V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 7.5 V, I <sub>D</sub> = 10 A	-	20	30	
Gate-source charge	Q <sub>gs</sub>		-	6.4	-	
Gate-drain charge	Q <sub>gd</sub>		-	6.8	-	
Output charge	Q <sub>oss</sub>	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V	-	52	-	
Gate resistance	R <sub>g</sub>	f = 1 MHz	0.6	2.1	4	Ω
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 100 V, R <sub>L</sub> = 10 Ω, I <sub>D</sub> ≅ 10 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω	-	9	18	ns
Rise time	t <sub>r</sub>		-	20	40	
Turn-off delay time	t <sub>d(off)</sub>		-	20	40	
Fall time	t <sub>f</sub>		-	24	48	
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 100 V, R <sub>L</sub> = 10 Ω, I <sub>D</sub> ≅ 10 A, V <sub>GEN</sub> = 7.5 V, R <sub>g</sub> = 1 Ω	-	11	22	
Rise time	t <sub>r</sub>		-	27	54	
Turn-off delay time	t <sub>d(off)</sub>		-	18	36	
Fall time	t <sub>f</sub>		-	24	48	
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	-	-	35.4	A
Pulse diode forward current	I <sub>SM</sub>		-	-	80	
Body diode voltage	V <sub>SD</sub>	I <sub>S</sub> = 5 A, V <sub>GS</sub> = 0 V	-	0.77	1.1	V
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 10 A, dI/dt = 100 A/μs, T <sub>J</sub> = 25 °C	-	100	200	ns
Body diode reverse recovery charge	Q <sub>rr</sub>		-	400	800	nC
Reverse recovery fall time	t <sub>a</sub>		-	80	-	ns
Reverse recovery rise time	t <sub>b</sub>		-	20	-	

**Notes**

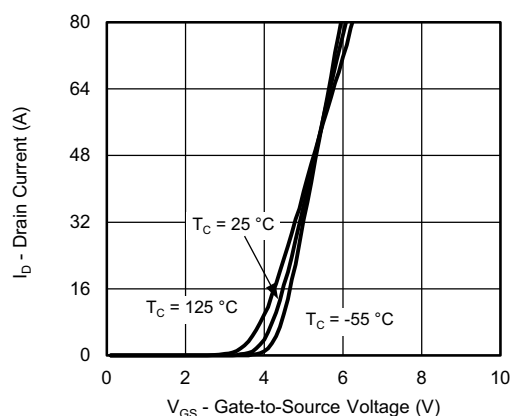
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 b. Guaranteed by design, not subject to production testing.

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.

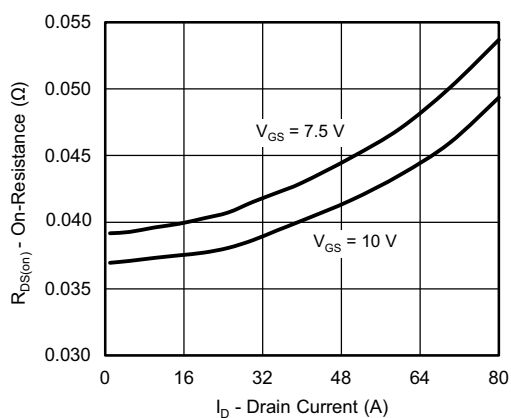
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



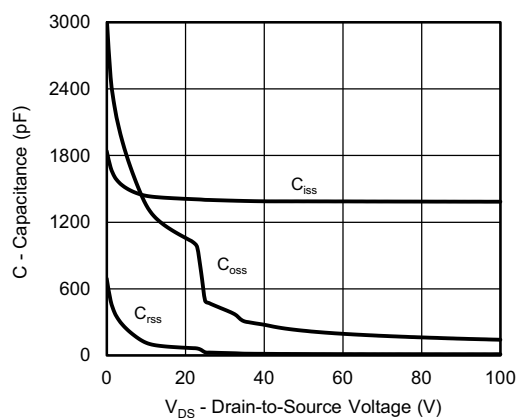
Output Characteristics



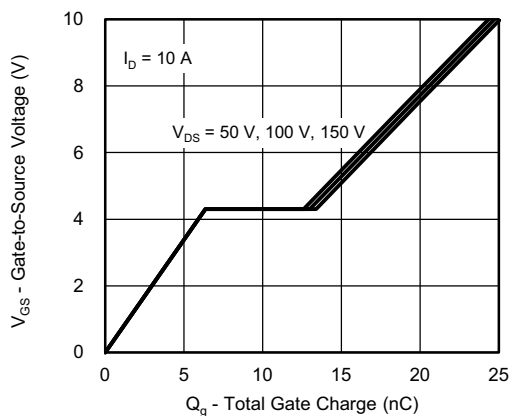
Transfer Characteristics



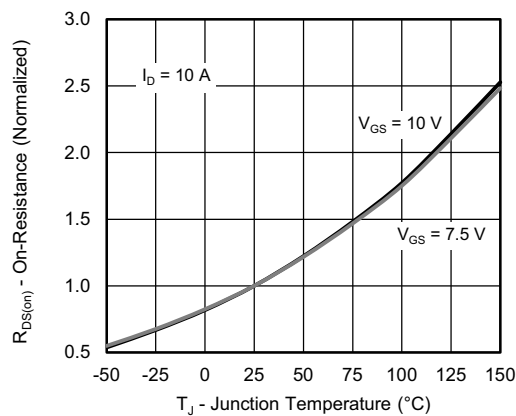
On-Resistance vs. Drain Current and Gate Voltage



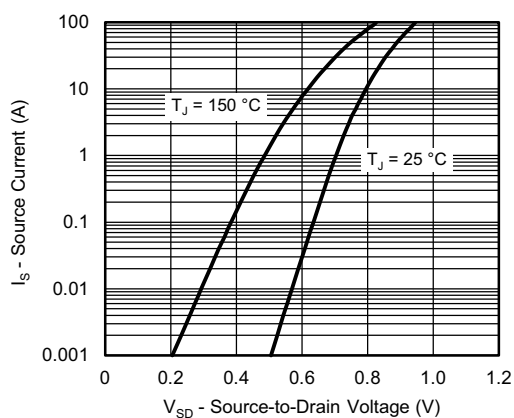
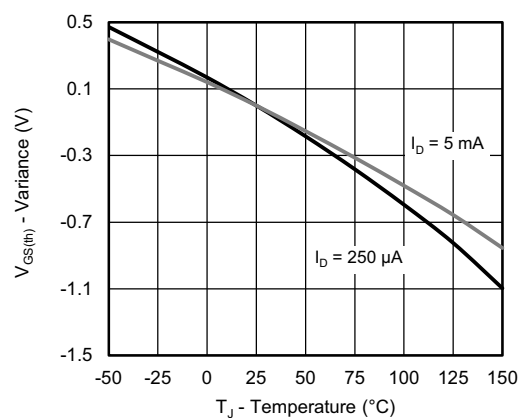
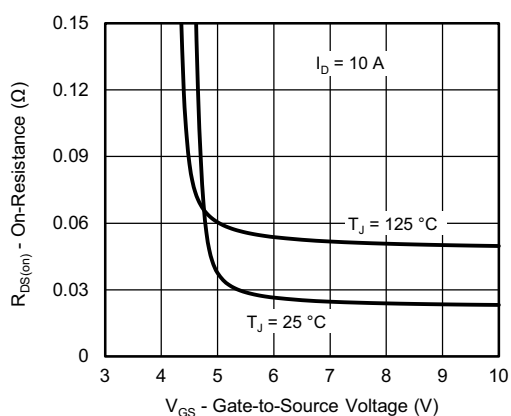
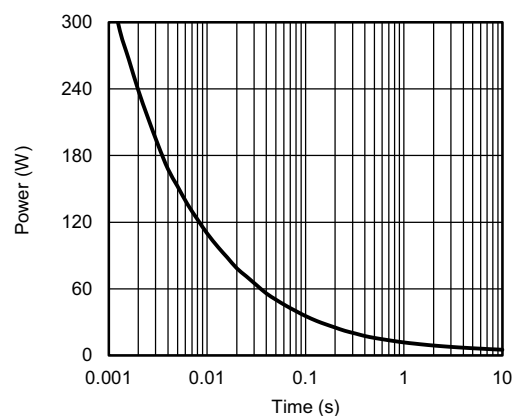
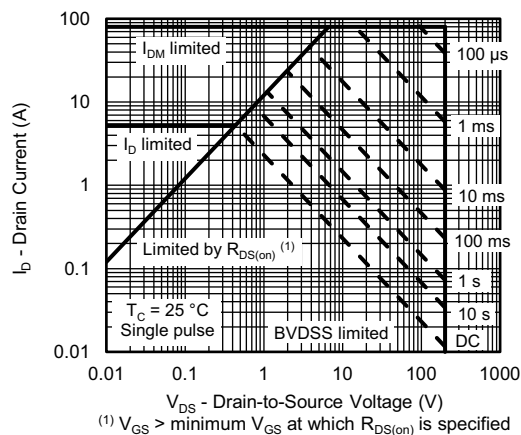
Capacitance



Gate Charge

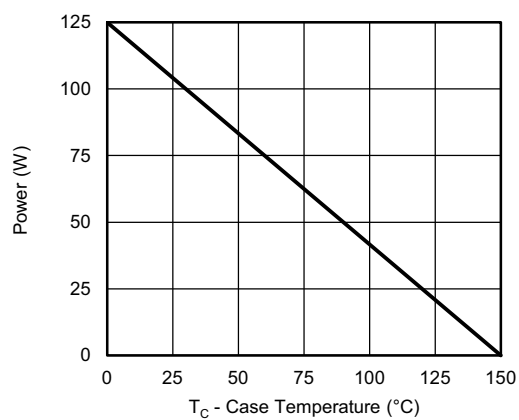
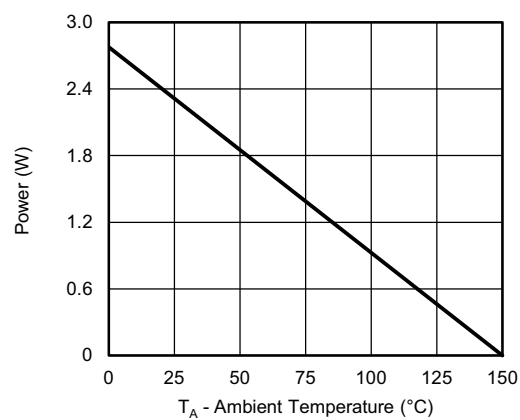


On-Resistance vs. Junction Temperature

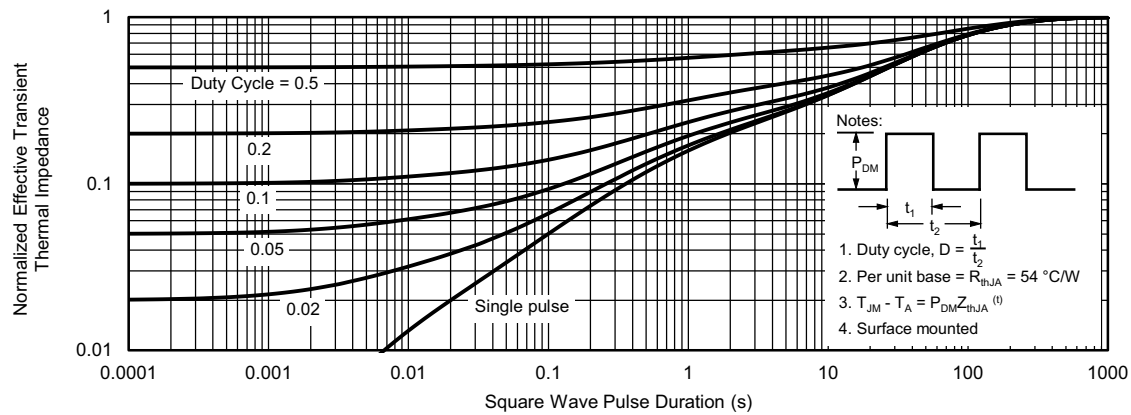
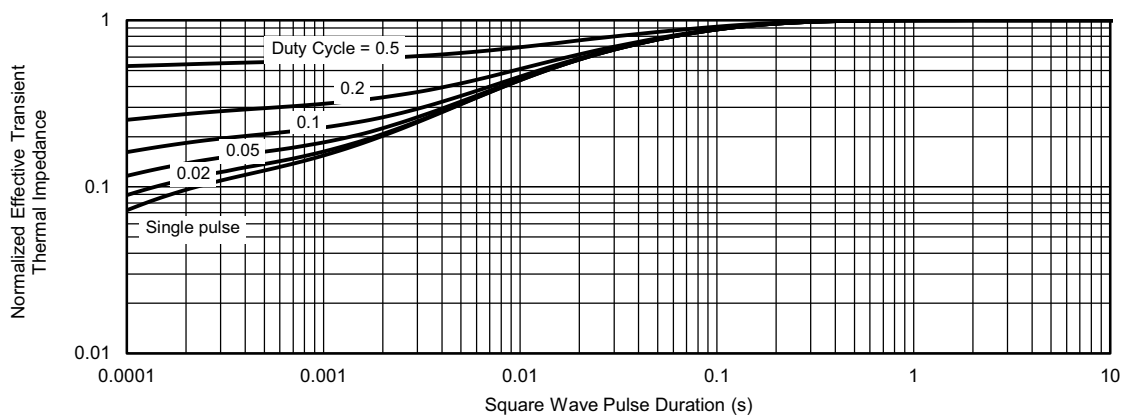
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Source-Drain Diode Forward Voltage**

**Threshold Voltage**

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

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

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

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

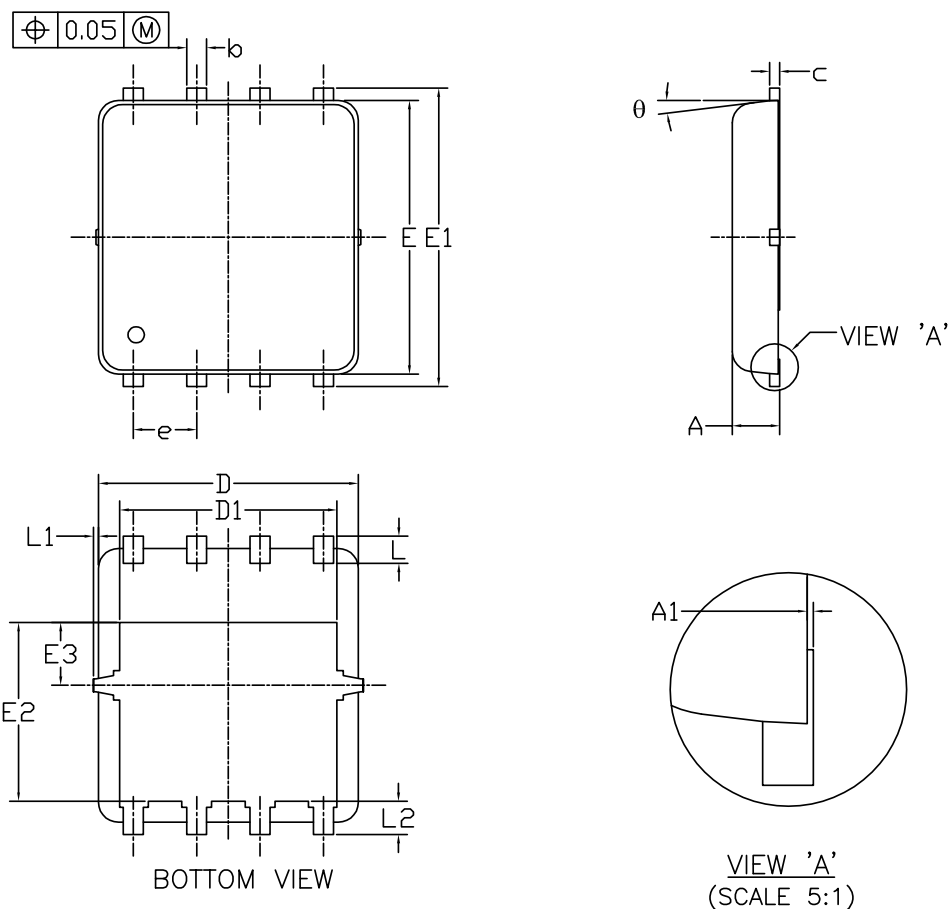
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Current Derating <sup>a</sup>**

**Power, Junction-to-Case**

**Power, Junction-to-Ambient**
**Note**

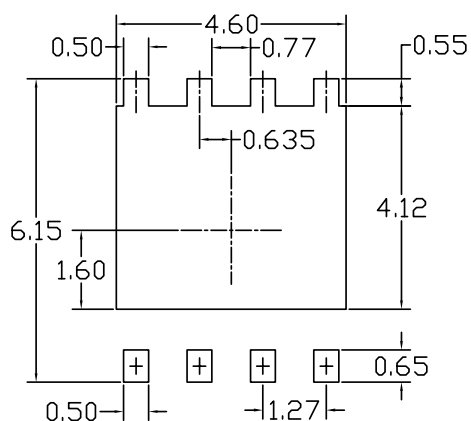
- a. The power dissipation  $P_D$  is based on  $T_J \text{ max.} = 150^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

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

**Normalized Thermal Transient Impedance, Junction-to-Ambient**

**Normalized Thermal Transient Impedance, Junction-to-Case**

## 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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