SM9989DSQA-VB Datasheet

Dual N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)	Q_g (TYP.)
20	0.0120 at V_{GS} = 4.5 V	25	12 nC
	0.0160 at V_{GS} = 2.5 V	20	
	0.0190 at V_{GS} = 1.8 V	16	

FEATURES

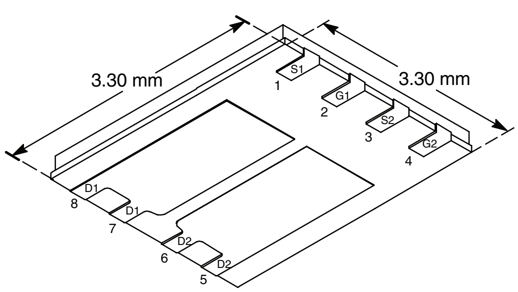
- Trench power MOSFET

APPLICATIONS

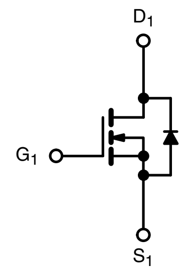
- DC/DC
- Notebook system power
- POL

RoHS COMPLIANT
HALOGEN FREE

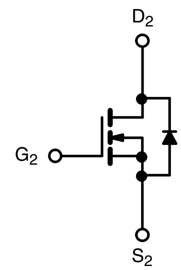
DFN 3.3x3.3



Bottom View



N-Channel MOSFET



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	20	V
Gate-Source Voltage		V_{GS}	± 8	
Continuous Drain Current (T_J = 150 °C)	T_C = 25 °C	I_D	25	A
	T_C = 70 °C		23.8	
	T_A = 25 °C		10 [a, b]	
	T_A = 70 °C		8 [a, b]	
Pulsed Drain Current		I_{DM}	40	
Continuous Source-Drain Diode Current	T_C = 25 °C	I_S	19	
	T_A = 25 °C		2.2 [a, b]	
Single Pulse Avalanche Current	L = 0.1 mH	I_{AS}	15	
Single Pulse Avalanche Energy		E_{AS}	11	mJ
Maximum Power Dissipation	T_C = 25 °C	P_D	23	W
	T_C = 70 °C		14.8	
	T_A = 25 °C		2.6 [a, b]	
	T_A = 70 °C		1.7 [a, b]	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to +150	°C
Soldering Recommendations (Peak Temperature) [c, d]			260	

THERMAL RESISTANCE RATINGS					
PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum Junction-to-Ambient	t ≤ 10 s	R_{thJA}	38	48	°C/W
Maximum Junction-to-Case (Drain)	Steady State	R_{thJC}	4.3	5.4	

Notes

a. Package limited, T_C = 25 °C.
b. Surface Mounted on 1" x 1" FR4 board.
c. t = 10 s.
d. Maximum under Steady State conditions is 110 °C/W.

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	20	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = 250 µA	-	22	-	mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		-	-3	-	
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS} , I_D = 250 µA	0.4	-	1	V
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 8 V	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V	-	-	1	µA
		V_{DS} = 20 V, V_{GS} = 0 V, T_J = 55 °C	-	-	10	
On-State Drain Current [a]	$I_{D(on)}$	$V_{DS} \geq$ 5 V, V_{GS} = 10 V	20	-	-	A
Drain-Source On-State Resistance [a]	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 10 A	-	0.0120		Ω
		V_{GS} = 2.5 V, I_D = 9 A	-	0.0160		
		V_{GS} = 1.8 V, I_D = 8.2 A	-	0.0190		
Forward Transconductance [a]	g_{fs}	V_{DS} = 10 V, I_D = 10 A	-	47	-	S
Dynamic [b]						
Input Capacitance	C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	-	1220	-	pF
Output Capacitance	C_{oss}		-	180	-	
Reverse Transfer Capacitance	C_{rss}		-	80	-	
Total Gate Charge	Q_g	V_{DS} = 15 V, V_{GS} = 8 V, I_D = 10 A	-	21	32	nC
		V_{DS} = 15 V, V_{GS} = 4.5 V, I_D = 10 A	-	12	18	
Gate-Source Charge	Q_{gs}		-	2	-	
Gate-Drain Charge	Q_{gd}		-	1.3	-	
Gate Resistance	R_g	f = 1 MHz	-	1.8	3.6	Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 10 V, R_L = 1.25 Ω $I_D \cong$ 8 A, V_{GEN} = 4.5 V, R_g = 1 Ω	-	10	15	ns
Rise Time	t_r		-	10	15	
Turn-Off Delay Time	$t_{d(off)}$		-	35	55	
Fall Time	t_f		-	10	15	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 10 V, R_L = 1.25 Ω $I_D \cong$ 8 A, V_{GEN} = 8 V, R_g = 1 Ω	-	10	15	
Rise Time	t_r		-	10	15	
Turn-Off Delay Time	$t_{d(off)}$		-	25	40	
Fall Time	t_f		-	10	15	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	T_C = 25 °C	-	-	19	A
Pulse Diode Forward Current	I_{SM}		-	-	40	
Body Diode Voltage	V_{SD}	I_S = 8 A, V_{GS} = 0 V	-	0.81	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	I_F = 8 A, dI/dt = 100 A/µs, T_J = 25 °C	-	20	30	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	15	25	nC
Reverse Recovery Fall Time	t_a		-	12.5	-	ns
Reverse Recovery Rise Time	t_b		-	7.5	-	

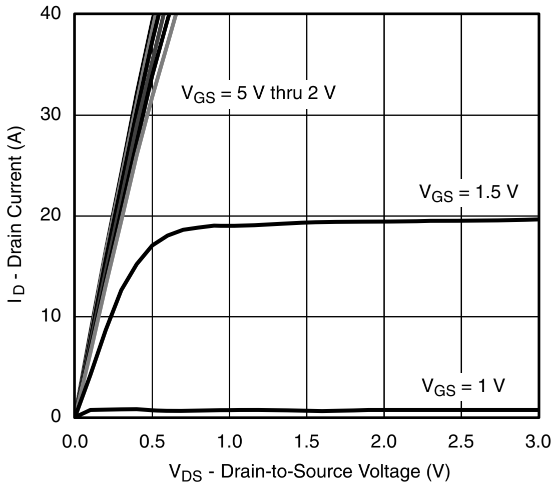
Notes

a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %

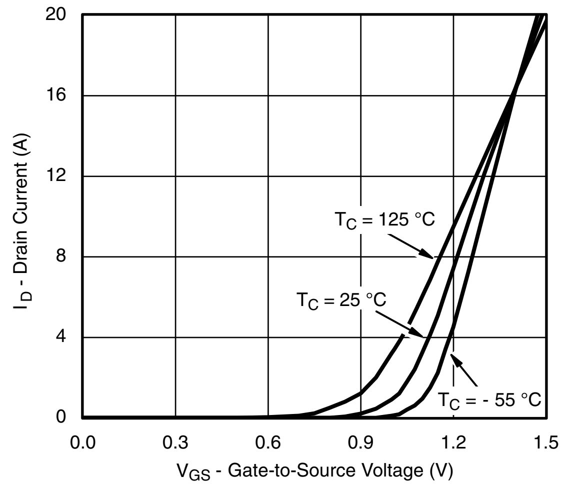
b. Guaranteed by design, not subject to production testing.

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.

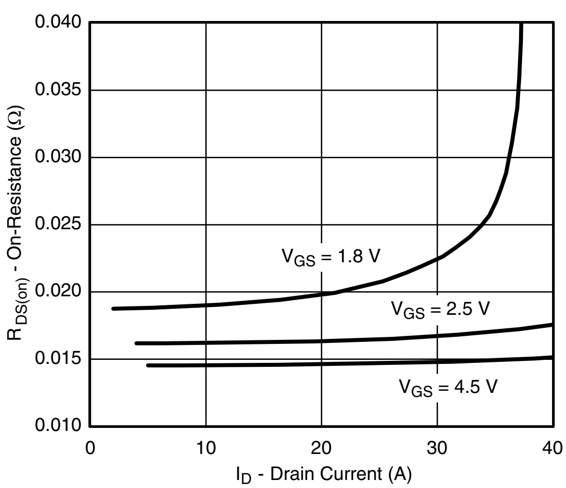
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



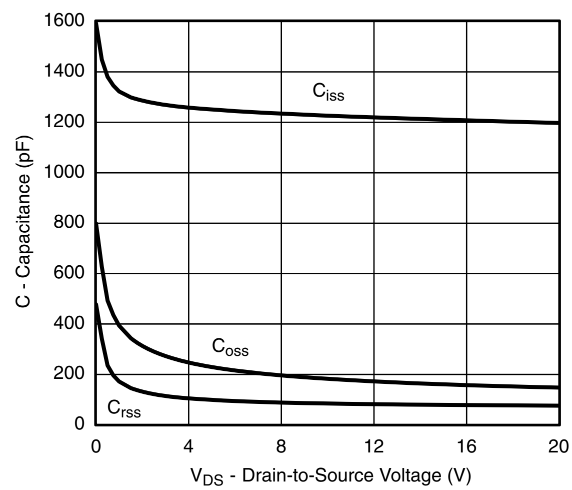
Output Characteristics



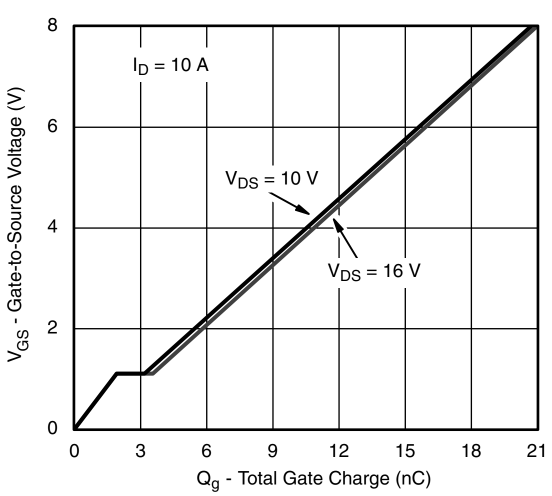
Transfer Characteristics



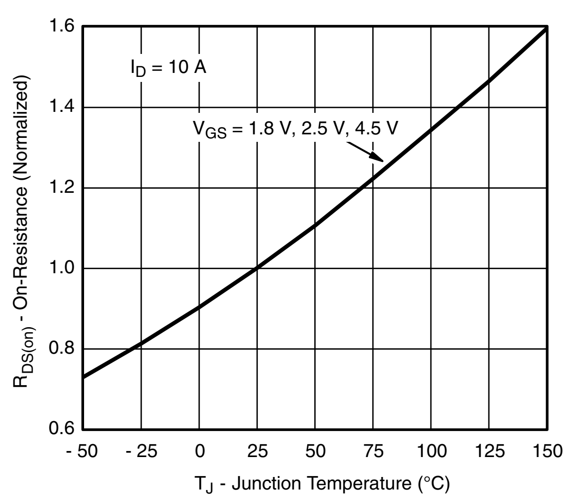
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

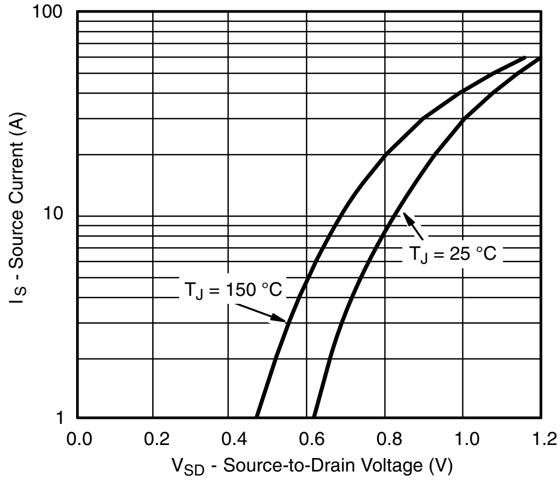


Gate Charge

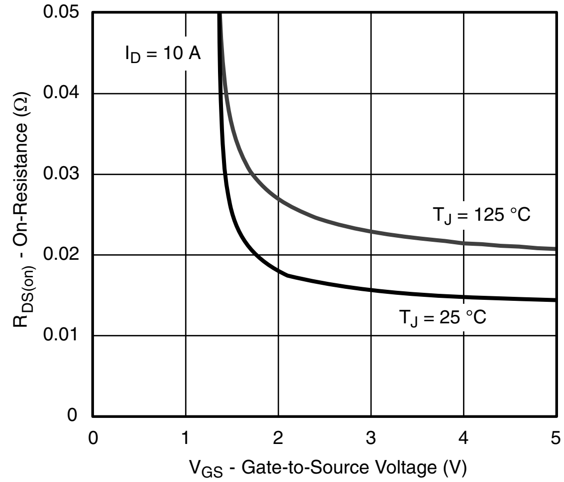


On-Resistance vs. Junction Temperature

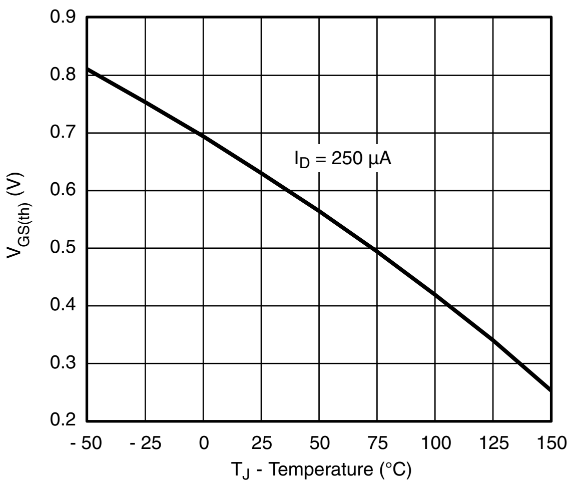
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



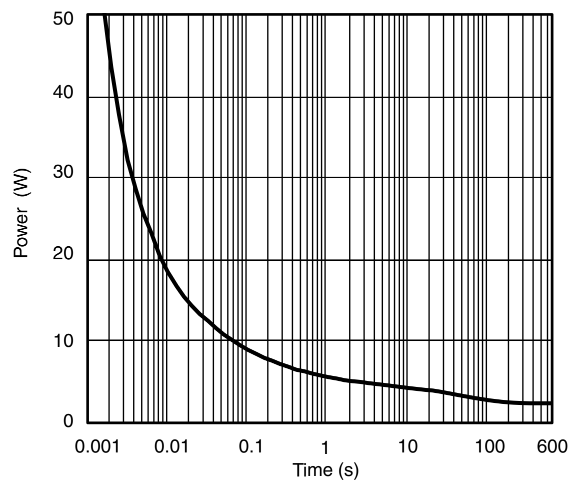
Source-Drain Diode Forward Voltage



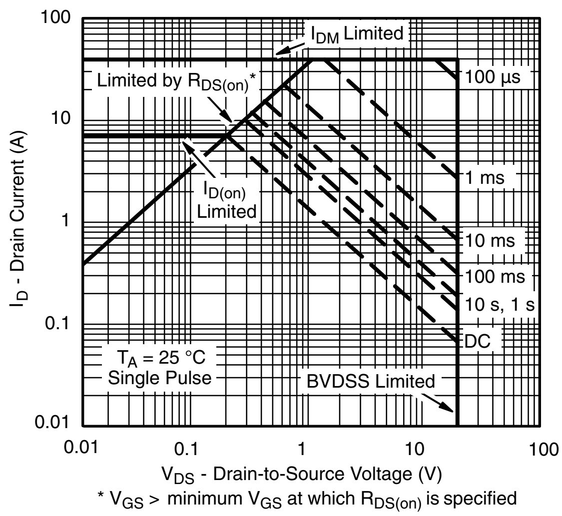
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



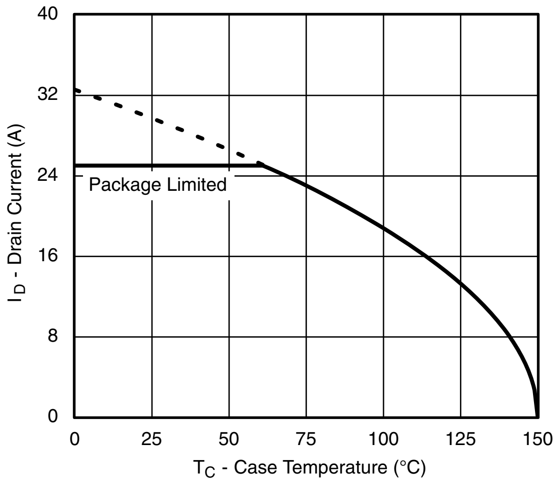
Single Pulse Power, Junction-to-Ambient



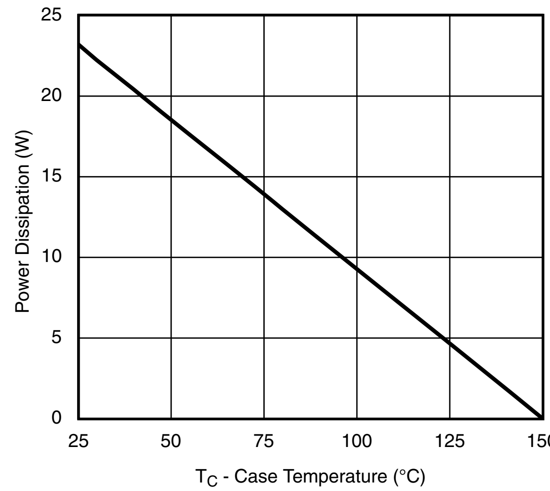
* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



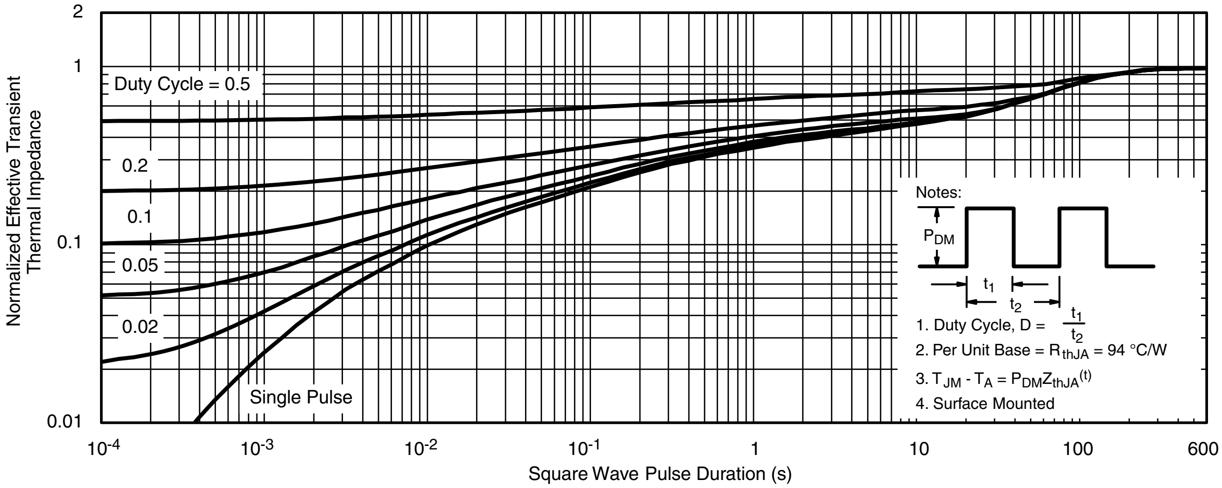
Current Derating*



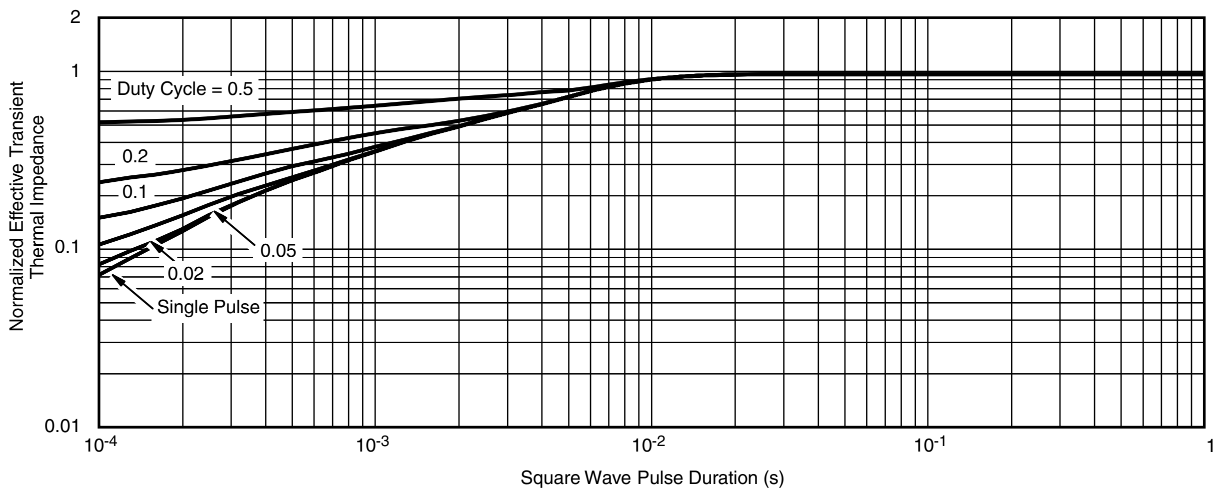
Power Derating

* 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)

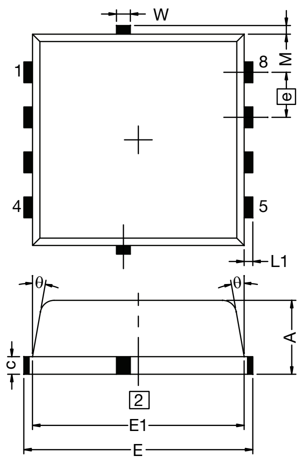


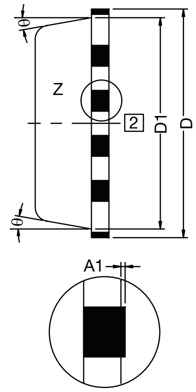
Normalized Thermal Transient Impedance, Junction-to-Ambient



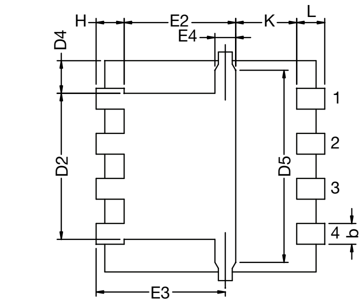
Normalized Thermal Transient Impedance, Junction-to-Case

DFN3.3X3.3 (Dual)

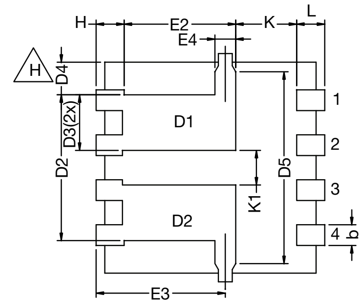




Detail Z



Backside view of single pad



Backside view of dual pad

Notes
1. Inch will govern
2 Dimensions exclusive of mold gate burrs
3. Dimensions exclusive of mold flash and cutting burrs

DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.97	1.04	1.12	0.038	0.041	0.044
A1	0.00	-	0.05	0.000	-	0.002
b	0.23	0.30	0.41	0.009	0.012	0.016
c	0.23	0.28	0.33	0.009	0.011	0.013
D	3.20	3.30	3.40	0.126	0.130	0.134
D1	2.95	3.05	3.15	0.116	0.120	0.124
D2	1.98	2.11	2.24	0.078	0.083	0.088
D3	0.48	-	0.89	0.019	-	0.035
D4	0.47 typ.			0.0185 typ		
D5	2.3 typ.			0.090 typ		
E	3.20	3.30	3.40	0.126	0.130	0.134
E1	2.95	3.05	3.15	0.116	0.120	0.124
E2	1.47	1.60	1.73	0.058	0.063	0.068
E3	1.75	1.85	1.98	0.069	0.073	0.078
E4	0.034 typ.			0.013 typ.		
e	0.65 BSC			0.026 BSC		
K	0.86 typ.			0.034 typ.		
K1	0.35	-	-	0.014	-	-
H	0.30	0.41	0.51	0.012	0.016	0.020
L	0.30	0.43	0.56	0.012	0.017	0.022
L1	0.06	0.13	0.20	0.002	0.005	0.008
θ	0°	-	12°	0°	-	12°
W	0.15	0.25	0.36	0.006	0.010	0.014
M	0.125 typ.			0.005 typ.		
ECN: S16-2667-Rev. M, 09-Jan-17 DWG: 5882						

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