

NDS9948-VB Datasheet

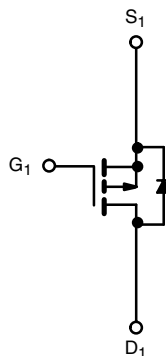
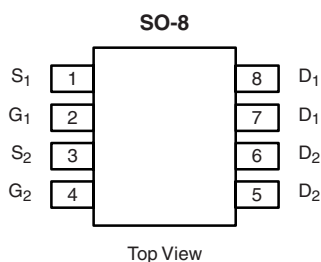
Dual P-Channel 60-V (D-S) MOSFET

PRODUCT SUMMARY

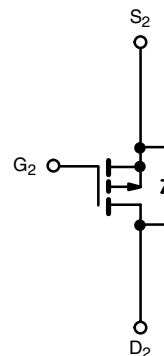
V_{DS} (V)	$R_{DS(on)}$ (Ω) Typ.	I_D (A) ^d	Q_g (TYP.)
-60	0.120 at $V_{GS} = -10$ V	-4.0	10.1 nC
	0.145 at $V_{GS} = -4.5$ V	-3.0	

FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- Compliant to RoHS Directive 2002/95/EC


RoHS
 COMPLIANT


P-Channel MOSFET



P-Channel MOSFET

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

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	-60	V
Gate-Source Voltage		V_{GS}	± 20	
Continuous Drain Current ($T_J = 150^\circ\text{C}$)	$T_C = 25^\circ\text{C}$	I_D	-4.0	A
	$T_C = 70^\circ\text{C}$		-3.0	
	$T_A = 25^\circ\text{C}$		-2.8 a,b	
	$T_A = 70^\circ\text{C}$		-2.1 a,b	
Pulsed Drain Current ($t = 100\ \mu\text{s}$)		I_{DM}	-12	
Continuous Source-Drain Diode Current	$T_C = 25^\circ\text{C}$	I_S	-3.9	A
	$T_A = 25^\circ\text{C}$		-2.1 a,b	
Avalanche Current	$L = 0.1\ \text{mH}$	I_{AS}	-15	mJ
Single-Pulse Avalanche Energy		E_{AS}	11.25	
Maximum Power Dissipation	$T_C = 25^\circ\text{C}$	P_D	4.2	W
	$T_C = 70^\circ\text{C}$		2.7	
	$T_A = 25^\circ\text{C}$		2 a,b	
	$T_A = 70^\circ\text{C}$		1.3 a,b	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to 150	$^\circ\text{C}$

THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^a	$t \leq 10\ \text{s}$	R_{thJA}	53	62.5	$^\circ\text{C/W}$
	Steady State		85	110	
Maximum Junction-to-Foot	Steady State	R_{thJF}	30	37	

Notes

- Surface mounted on 1" x 1" FR4 board.
- $t = 10\ \text{s}$.
- Maximum under steady state conditions is 110 $^\circ\text{C/W}$.
- Based on $T_C = 25^\circ\text{C}$.

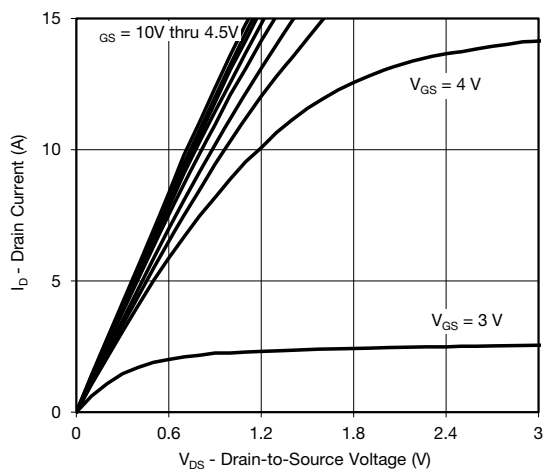
SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = -250 μA	-60	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = -250 μA	-	-6.7	-	mV/°C
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J		-	-4.3	-	
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = -250 μA	-0.5	-	-2.5	V
Gate-Source Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V	-	-	± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = -60 V, V _{GS} = 0 V	-	-	-1	μA
		V _{DS} = -60 V, V _{GS} = 0 V, T _J = 55 °C	-	-	-5	
On-State Drain Current ^a	I _{D(on)}	V _{DS} ≥ -10 V, V _{GS} = -10 V	-30	-	-	A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = -10 V, I _D = -3.5 A	-	0.120	-	Ω
		V _{GS} = -4.5 V, I _D = -2.8 A	-	0.145	-	
Forward Transconductance ^a	g _{fs}	V _{DS} = -30 V, I _D = -3.5 A	-	11	-	S
Dynamic ^b						
Input Capacitance	C _{iss}	V _{DS} = -30 V, V _{GS} = 0 V, f = 1 MHz	-	1000	-	pF
Output Capacitance	C _{oss}		-	88	-	
Reverse Transfer Capacitance	C _{rss}		-	63	-	
Total Gate Charge	Q _g	V _{DS} = -30 V, V _{GS} = -10 V, I _D = -3.5 A	-	20	30	nC
		V _{DS} = -30 V, V _{GS} = -4.5 V, I _D = -3.5 A	-	10.1	15.2	
			-	3.3	-	
			-	3.9	-	
Gate-Source Charge	Q _{gs}	V _{DS} = -30 V, V _{GS} = -4.5 V, I _D = -3.5 A	-	3.3	-	
Gate-Drain Charge	Q _{gd}		-	3.9	-	
Gate Resistance	R _g	f = 1 MHz	1.8	9	18	Ω
Turn-On Delay Time	t _{d(on)}	V _{DD} = -30 V, R _L = 10.7 Ω I _D ≅ -2.8 A, V _{GEN} = -10 V, R _g = 1 Ω	-	8	16	ns
Rise Time	t _r		-	6	12	
Turn-Off DelayTime	t _{d(off)}		-	35	53	
Fall Time	t _f		-	16	24	
Turn-On Delay Time	t _{d(on)}	V _{DD} = -30 V, R _L = 10.7 Ω I _D ≅ -2.8 A, V _{GEN} = -4.5 V, R _g = 1 Ω	-	40	60	
Rise Time	t _r		-	28	42	
Turn-Off DelayTime	t _{d(off)}		-	31	47	
Fall Time	t _f		-	15	23	
Drain-Source Body Diode Characteristics						
Continous Source-Drain Diode Current	I _S	T _C = 25 °C	-	-	-4	A
Pulse Diode Forward Current (t = 100 μs)	I _{SM}		-	-	-12	
Body Diode Voltage	V _{SD}	I _S = -2.8 A, V _{GS} = 0 V	-	-0.85	-1.2	V
Body Diode Reverse Recovery Time	t _{rr}	I _F = -2.8 A, dI/dt = 100 A/μs, T _J = 25 °C	-	32	48	ns
Body Diode Reverse Recovery Charge	Q _{rr}		-	45	68	nC
Reverse Recovery Fall Time	t _a		-	24	-	ns
Reverse Recovery Rise Time	t _b		-	8	-	

Notes

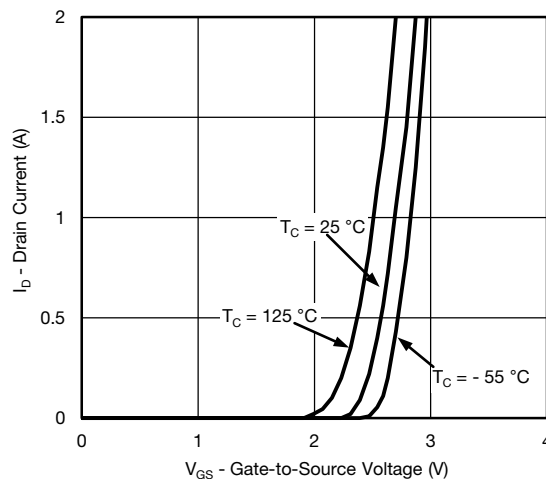
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
 b. Guaranteed by design, not subject to production testing.

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.

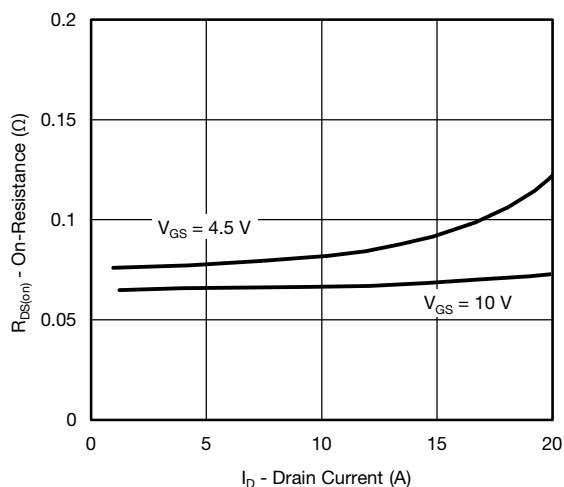
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



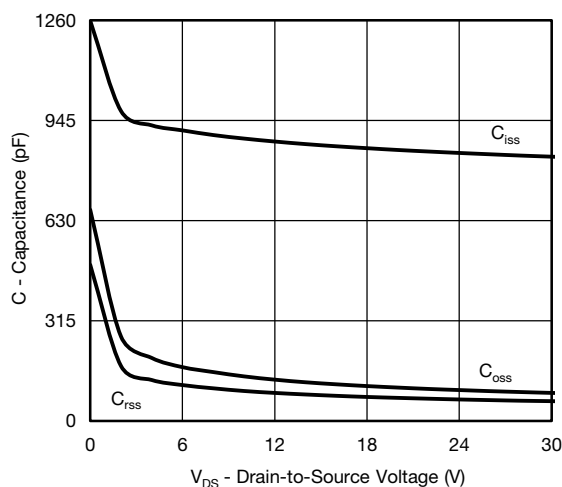
Output Characteristics



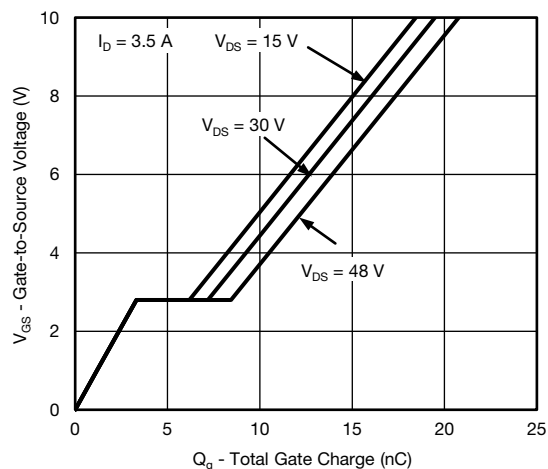
Transfer Characteristics



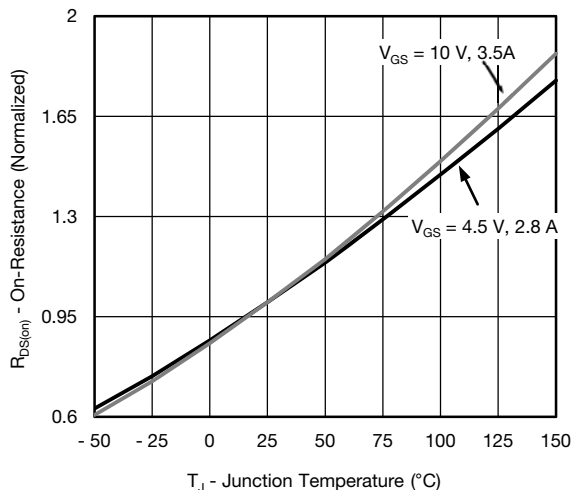
On-Resistance vs. Drain Current



Capacitance

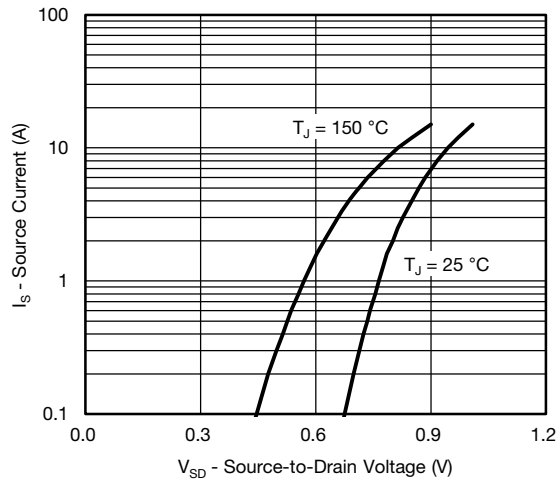


Gate Charge

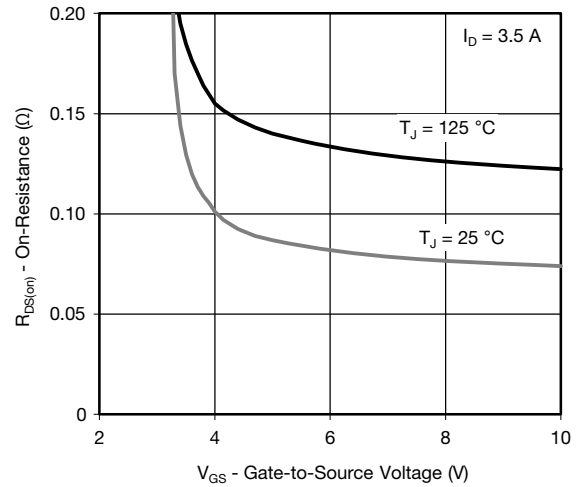


On-Resistance vs. Junction Temperature

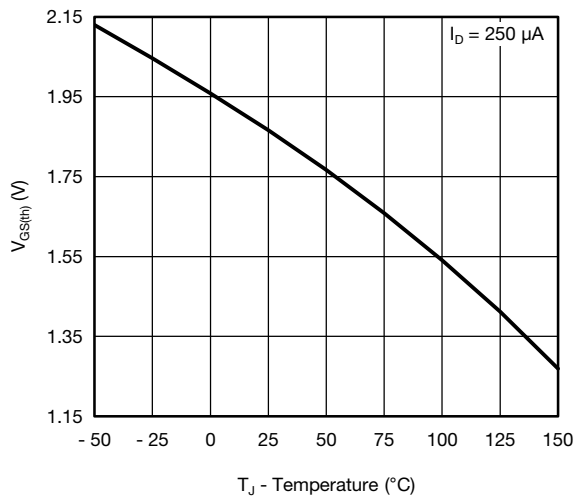
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



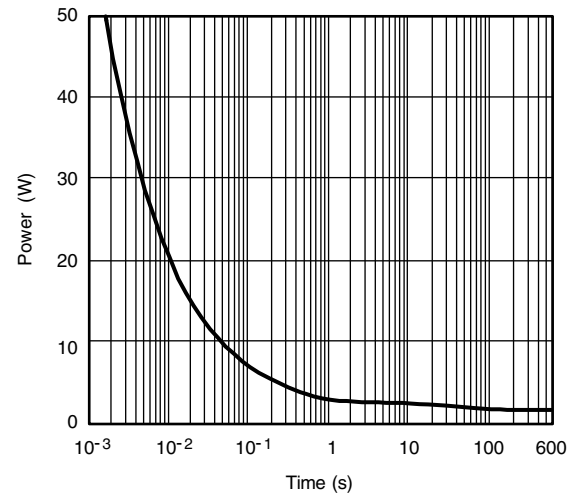
Source-Drain Diode Forward Voltage



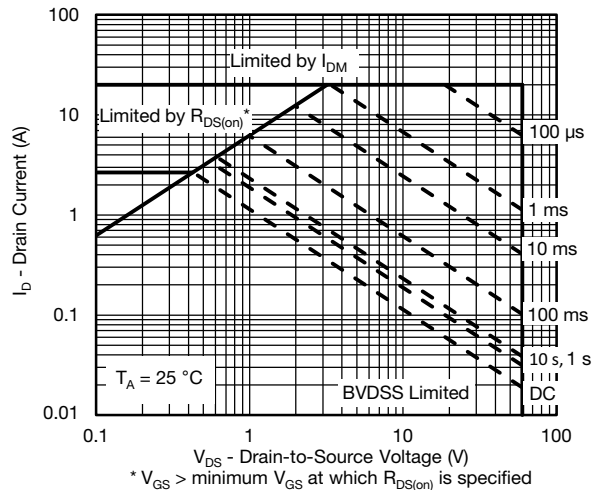
On-Resistance vs. Gate-to-Source Voltage



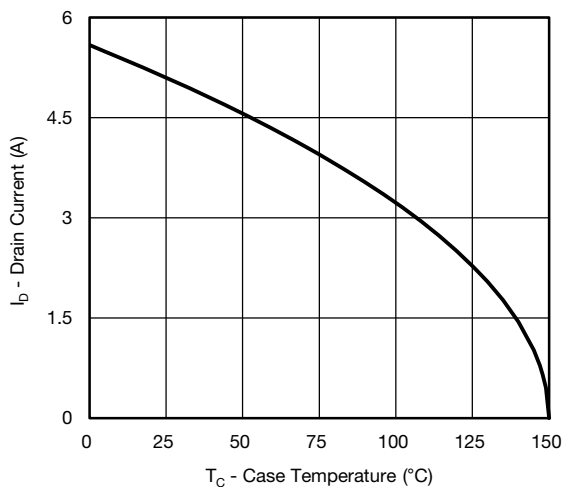
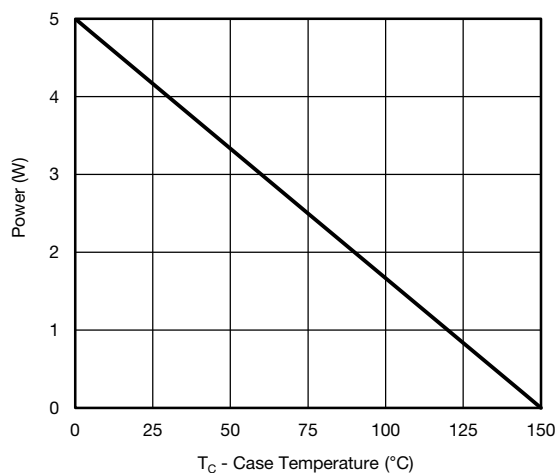
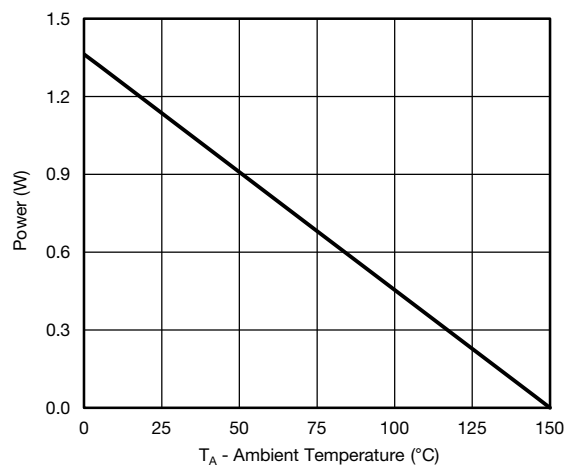
Threshold Voltage



Single Pulse Power, Junction-to-Ambient

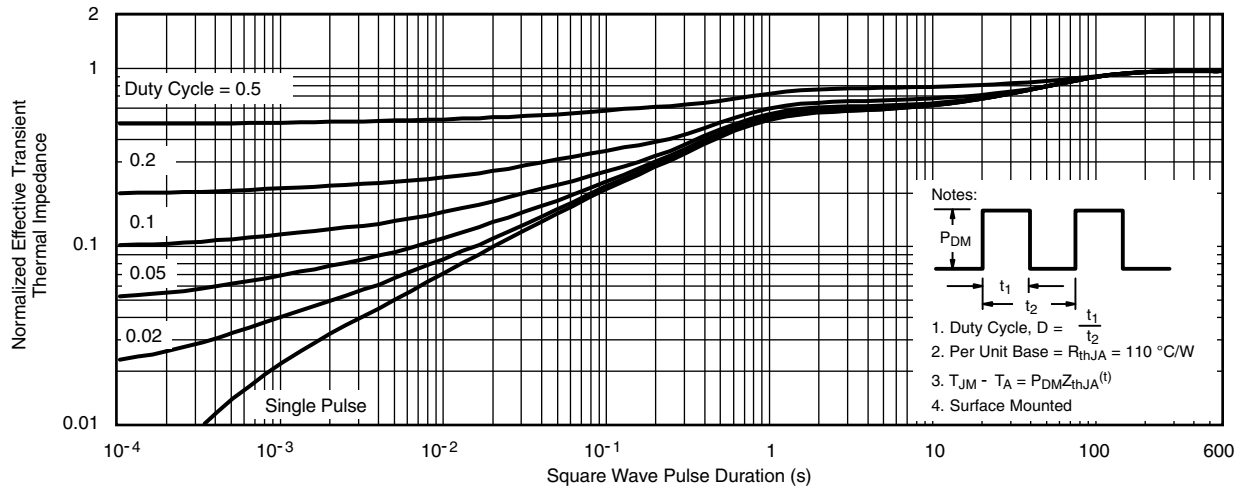


Safe Operating Area

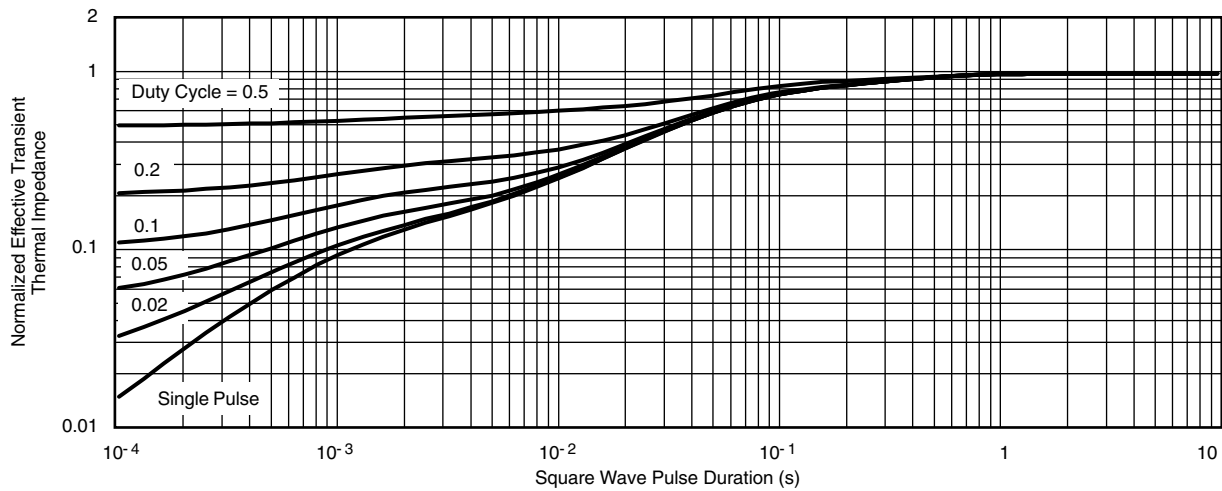
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Current Derating*

Power, Junction-to-Foot

Power Derating, Junction-to-Ambient

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

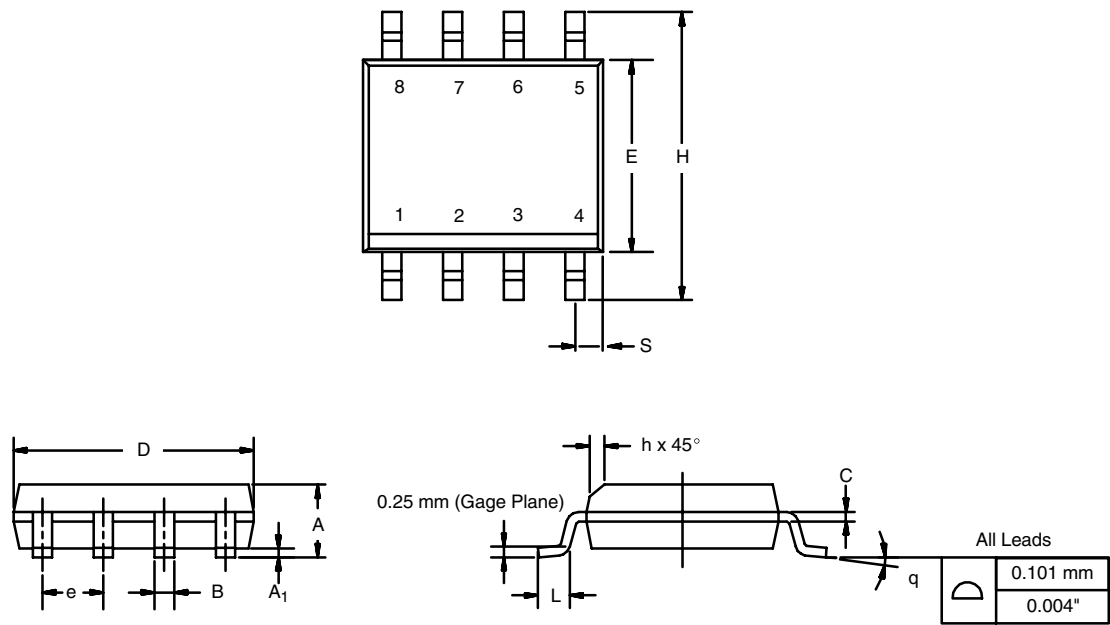


Normalized Thermal Transient Impedance, Junction-to-Ambient



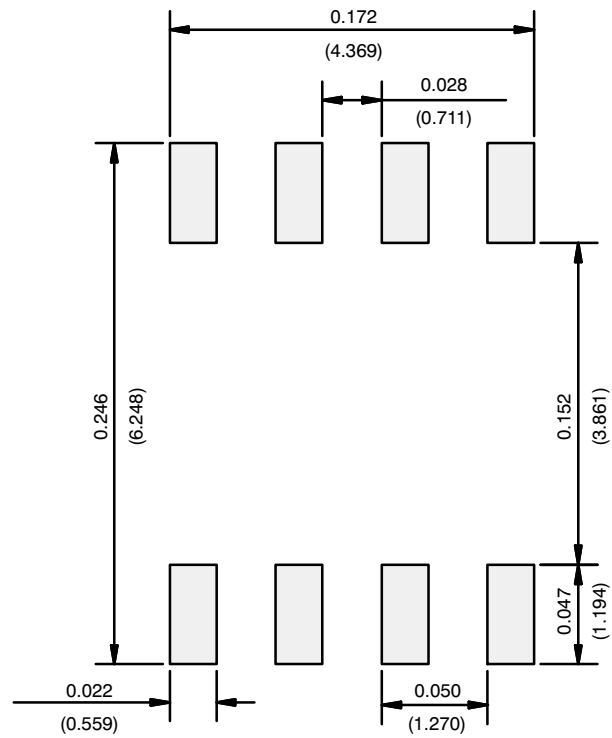
Normalized Thermal Transient Impedance, Junction-to-Foot

SOIC (NARROW): 8-LEAD
JEDEC Part Number: MS-012



DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A ₁	0.10	0.20	0.004	0.008
B	0.35	0.51	0.014	0.020
C	0.19	0.25	0.0075	0.010
D	4.80	5.00	0.189	0.196
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.020
L	0.50	0.93	0.020	0.037
q	0°	8°	0°	8°
S	0.44	0.64	0.018	0.026
ECN: C-06527-Rev. I, 11-Sep-06				
DWG: 5498				

RECOMMENDED MINIMUM PADS FOR SO-8



Recommended Minimum Pads
Dimensions in Inches/(mm)

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