

IRF7904UTRPBF-VB Datasheet

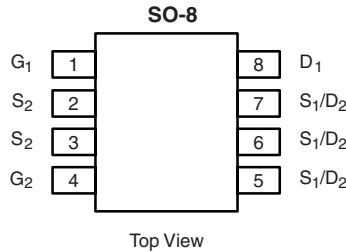
Dual N-Channel 30-V (D-S) MOSFET with Schottky Diode

PRODUCT SUMMARY

	V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A) ^a	Q _g (Typ.)
Channel-1	30	0.017 at V _{GS} = 10 V	8.0	12.5
		0.021 at V _{GS} = 4.5 V	7.5	
Channel-2	30	0.009 at V _{GS} = 10 V	15.0	17
		0.010 at V _{GS} = 4.5 V	14.0	

SCHOTTKY PRODUCT SUMMARY

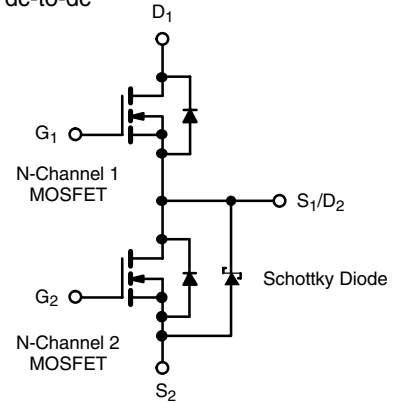
V _{DS} (V)	V _{SD} (V) Diode Forward Voltage	I _F (A) ^a
30	0.43 V at 1.0 A	3.8

**FEATURES**

- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 % R_g and UIS Tested
- Compliant to RoHS Directive 2002/95/EC


RoHS
 COMPLIANT
APPLICATIONS

- Notebook Logic dc-to-dc
- Low Current dc-to-dc

**ABSOLUTE MAXIMUM RATINGS** T_A = 25 °C, unless otherwise noted

Parameter	Symbol	Channel-1	Channel-2	Unit
Drain-Source Voltage	V _{DS}	30	30	V
Gate-Source Voltage	V _{GS}	± 16	± 16	
Continuous Drain Current (T _J = 150 °C)	I _D	8.0	15.0	A
		6.4	12.0	
		6.7 ^{b, c}	11.4 ^{b, c}	
		5.4 ^{b, c}	9.1 ^{b, c}	
Pulsed Drain Current (10 μs Pulse Width)	I _{DM}	35	60	
Source-Drain Current Diode Current	I _S	1.8	3.8	
		1.25 ^{b, c}	2.4 ^{b, c}	
Pulsed Source-Drain Current	I _{SM}	35	35	
Single Pulse Avalanche Current	I _{AS}	15	15	
Single Pulse Avalanche Energy	E _{AS}	11.2	11.2	mJ
Maximum Power Dissipation	P _D	1.98	4.16	W
		1.26	2.66	
		1.38 ^{b, c}	2.35 ^{b, c}	
		0.88 ^{b, c}	1.5 ^{b, c}	
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 55 to 150		°C

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Channel-1		Channel-2		Unit
		Typ.	Max.	Typ.	Max.	
Maximum Junction-to-Ambient ^{b, d}	R _{thJA}	72	90	43	53	°C/W
Maximum Junction-to-Foot (Drain)	R _{thJF}	51	63	25	30	

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 125 °C/W (Channel-1) and 100 °C/W (Channel-2).

SPECIFICATIONS T _J = 25 °C, unless otherwise noted								
Parameter	Symbol	Test Conditions		Min.	Typ. ^a	Max.	Unit	
Static								
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 1 mA	Ch-1	30			V	
		V _{GS} = 0 V, I _D = 1 mA	Ch-2	30				
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA	Ch-1		35			
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J	I _D = 250 μA	Ch-1		- 6			
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 1 mA	Ch-1	1		2.5		
		V _{DS} = V _{GS} , I _D = 1 mA	Ch-2	1		2.5		
Gate-Body Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 16 V	Ch-1			100	μA	
		V _{DS} = 0 V, V _{GS} = ± 16 V	Ch-2			100		
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 30 V, V _{GS} = 0 V	Ch-1			0.001	mA	
		V _{DS} = 30 V, V _{GS} = 0 V	Ch-2		0.05	0.5		
		V _{DS} = 30 V, V _{GS} = 0 V, T _J = 100 °C	Ch-1			0.025		
		V _{DS} = 30 V, V _{GS} = 0 V, T _J = 100 °C	Ch-2		3	15		
On-State Drain Current ^b	I _{D(on)}	V _{DS} = 5 V, V _{GS} = 10 V	Ch-1	20			A	
		V _{DS} = 5 V, V _{GS} = 10 V	Ch-2	20				
Drain-Source On-State Resistance ^b	R _{DS(on)}	V _{GS} = 10 V, I _D = 8 A	Ch-1		0.017		Ω	
		V _{GS} = 10 V, I _D = 8 A	Ch-2		0.009			
		V _{GS} = 4.5 V, I _D = 5 A	Ch-1		0.021			
		V _{GS} = 4.5 V, I _D = 5 A	Ch-2		0.010			
Forward Transconductance ^b	g _{fs}	V _{DS} = 15 V, I _D = 8 A	Ch-1		40		S	
		V _{DS} = 15 V, I _D = 8 A	Ch-2		47			
Dynamic ^a								
Input Capacitance	C _{iss}	Channel-1 V _{DS} = 15 V, V _{GS} = 0 V, f = 1 MHz	Ch-1		1535		pF	
			Ch-2		2290			
Output Capacitance	C _{oss}	Channel-2 V _{DS} = 15 V, V _{GS} = 0 V, f = 1 MHz	Ch-1		205			
			Ch-2		360			
Reverse Transfer Capacitance	C _{rss}		Ch-1		91			
			Ch-2		117			
Total Gate Charge	Q _g	V _{DS} = 15 V, V _{GS} = 10 V, I _D = 8 A	Ch-1		29	44	nC	
		V _{DS} = 15 V, V _{GS} = 10 V, I _D = 8 A	Ch-2		39	59		
Gate-Source Charge	Q _{gs}	Channel-1 V _{DS} = 15 V, V _{GS} = 4.5 V, I _D = 8 A	Ch-1		12.5	19		
			Ch-2		17	26		
Gate-Drain Charge	Q _{gd}	Channel-2 V _{DS} = 15 V, V _{GS} = 4.5 V, I _D = 8 A	Ch-1		4.1			
			Ch-2		5.6			
Gate Resistance	R _g	f = 1 MHz	Ch-1		3.4			Ω
			Ch-2		4			
					1.8	3.0		
					1.9	3.0		

SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted							
Parameter	Symbol	Test Conditions	Min.	Typ. ^a	Max.	Unit	
Dynamic ^a							
Turn-On Delay Time	$t_{d(on)}$	Channel-1 $V_{DD} = 15\text{ V}$, $R_L = 3\text{ }\Omega$ $I_D \cong 5\text{ A}$, $V_{GEN} = 10\text{ V}$, $R_g = 1\text{ }\Omega$	Ch-1		8	15	ns
			Ch-2		9	16	
Rise Time	t_r		Ch-1		22	33	
			Ch-2		24	36	
Turn-Off Delay Time	$t_{d(off)}$	Ch-1		20	30		
		Ch-2		26	39		
Fall Time	t_f	Ch-1		8	15		
		Ch-2		8	15		
Turn-On Delay Time	$t_{d(on)}$	Channel-1 $V_{DD} = 15\text{ V}$, $R_L = 3\text{ }\Omega$ $I_D \cong 5\text{ A}$, $V_{GEN} = 4.5\text{ V}$, $R_g = 1\text{ }\Omega$	Ch-1		24	36	
			Ch-2		24	36	
Rise Time	t_r		Ch-1		87	130	
			Ch-2		97	145	
Turn-Off Delay Time	$t_{d(off)}$	Ch-1		30	45		
		Ch-2		35	53		
Fall Time	t_f	Ch-1		34	51		
		Ch-2		45	68		
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^{\circ}\text{C}$	Ch-1			1.8	A
			Ch-2			3.8	
Pulse Diode Forward Current ^a	I_{SM}		Ch-1			35	
			Ch-2			35	
Body Diode Voltage	V_{SD}	$I_S = 2\text{ A}$	Ch-1		0.77	1.1	V
		$I_S = 1\text{ A}$	Ch-2		0.37	0.43	
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 4\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^{\circ}\text{C}$	Ch-1		22	33	ns
			Ch-2		26	39	
Body Diode Reverse Recovery Charge	Q_{rr}		Ch-1		15	23	nC
			Ch-2		15	23	
Reverse Recovery Fall Time	t_a	$I_F = 4\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^{\circ}\text{C}$	Ch-1		13		ns
			Ch-2		13		
Reverse Recovery Rise Time	t_b		Ch-1		9		
			Ch-2		13		

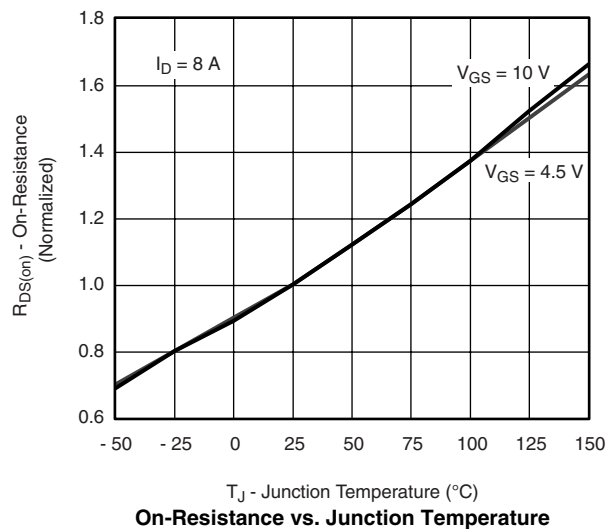
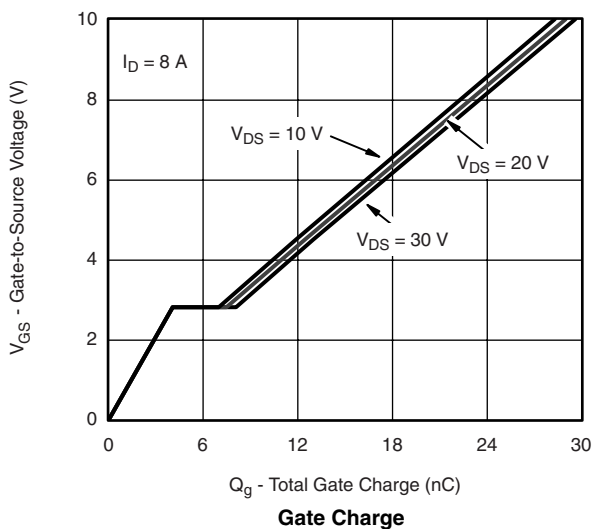
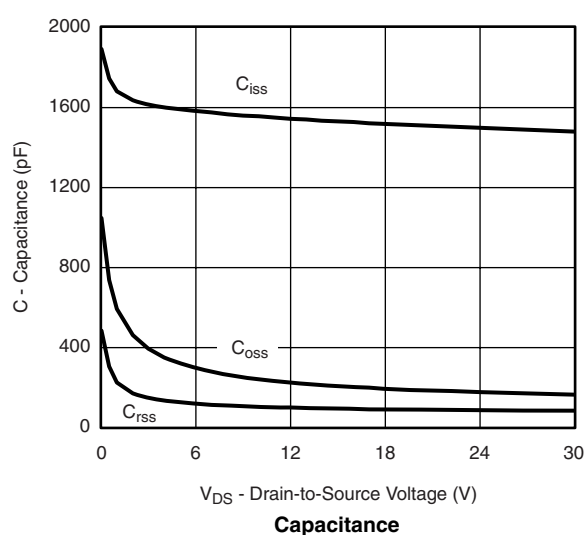
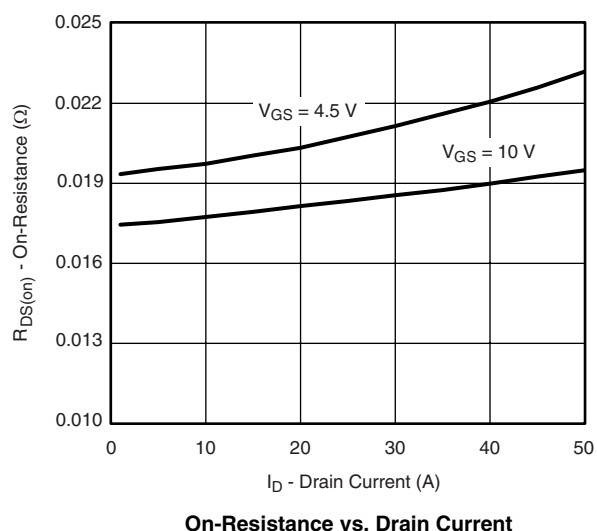
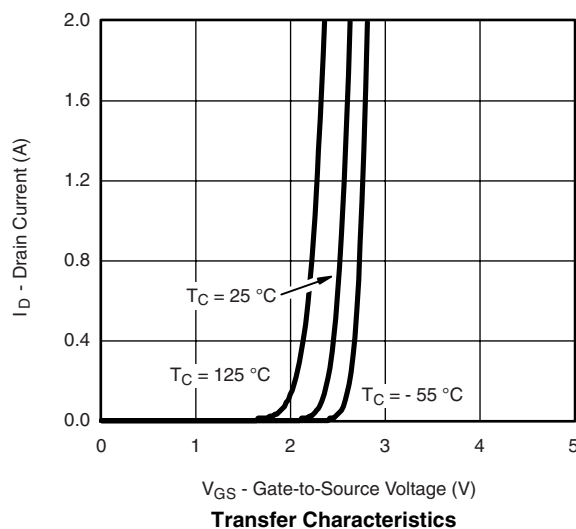
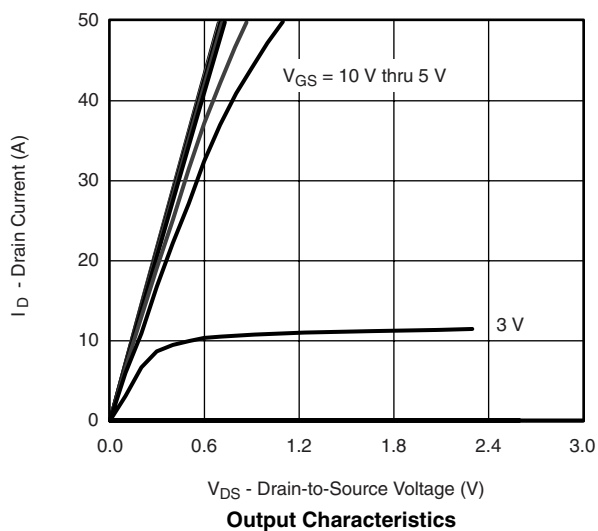
Notes:

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

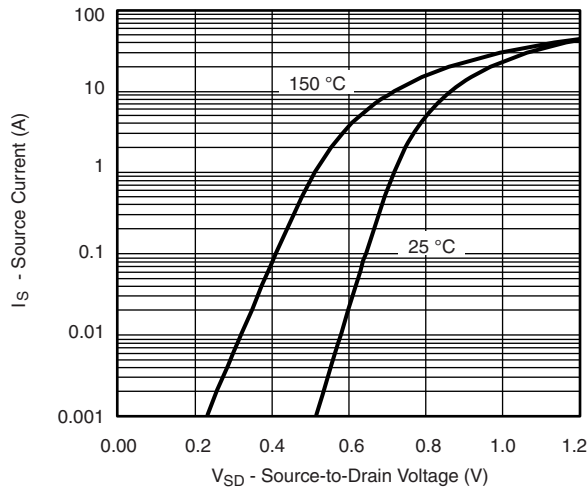
b. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

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.

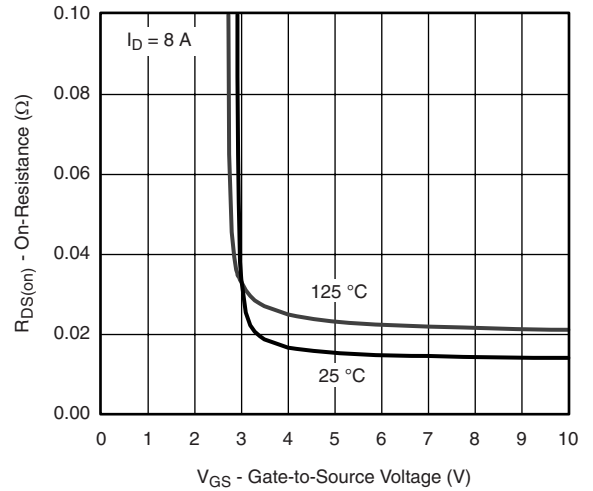
CHANNEL-1 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



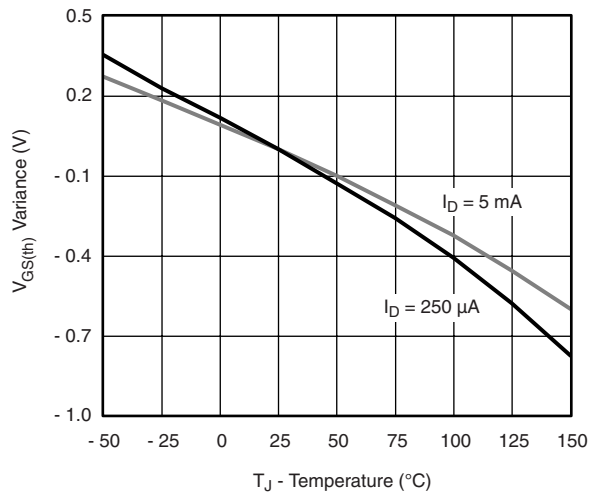
CHANNEL-1 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



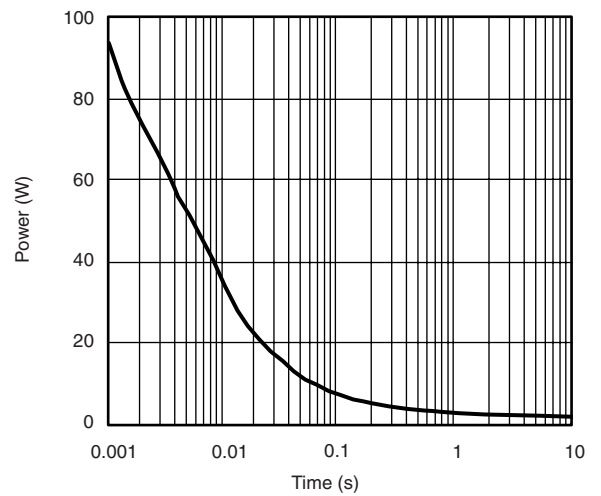
Source-Drain Diode Forward Voltage



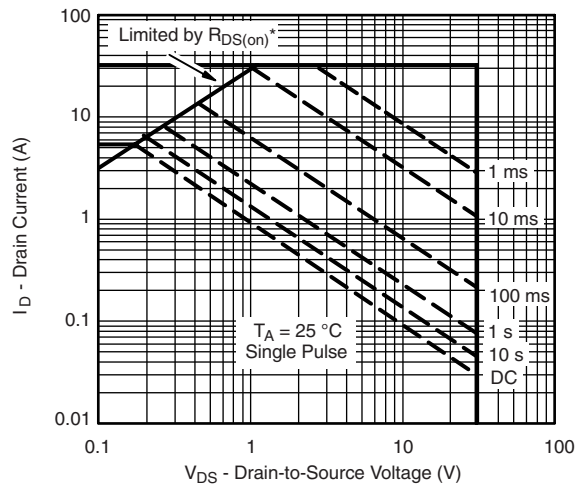
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



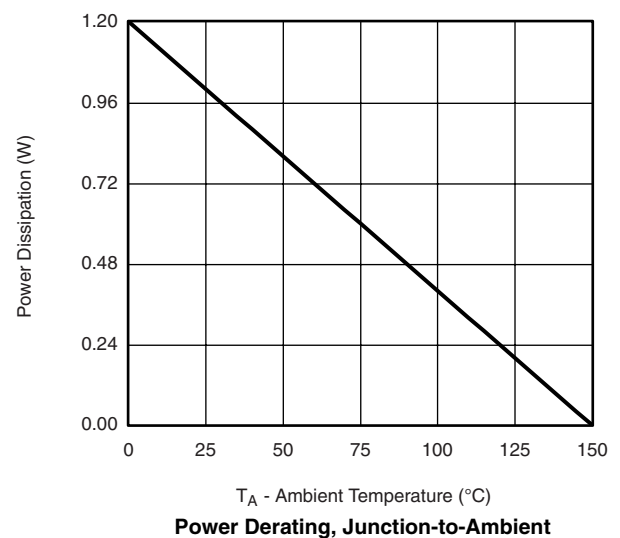
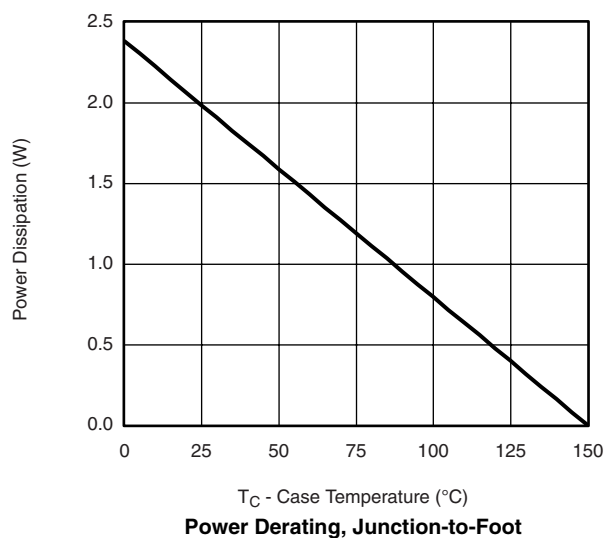
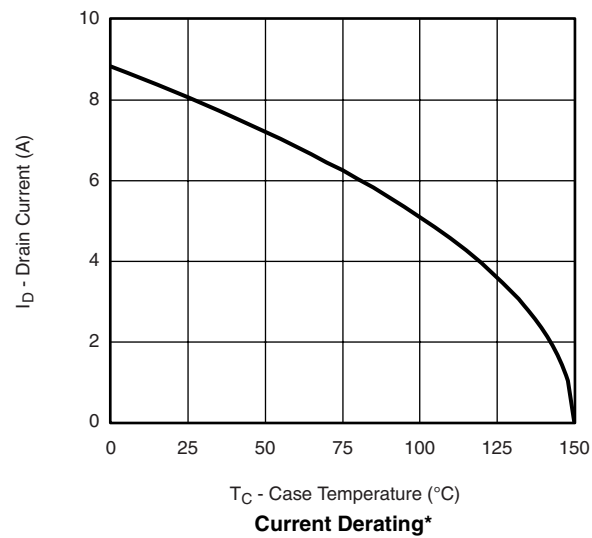
Single Pulse Power, Junction-to-Ambient



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

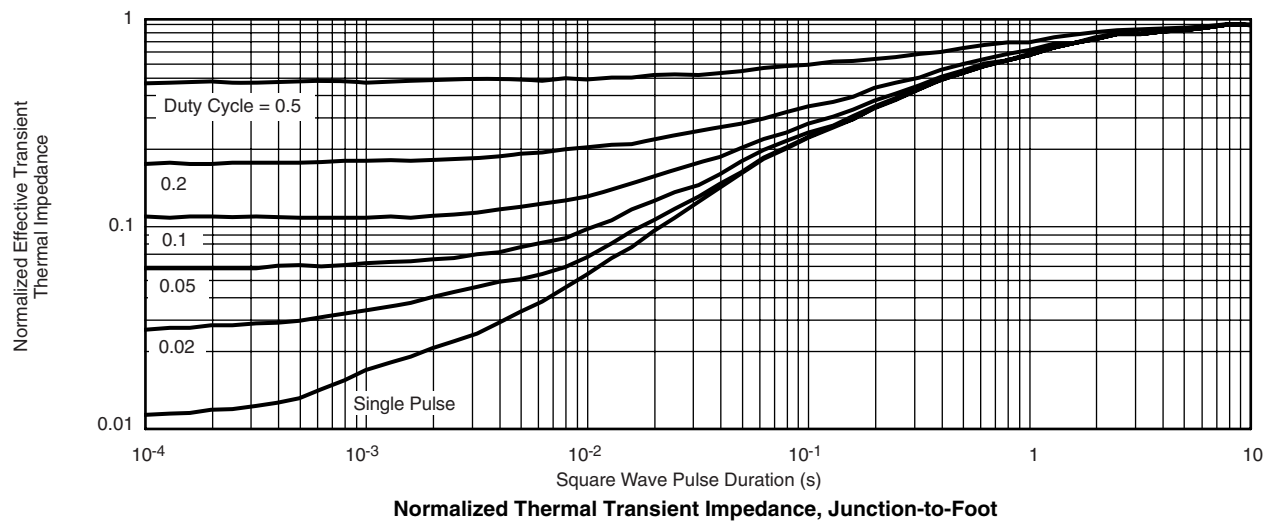
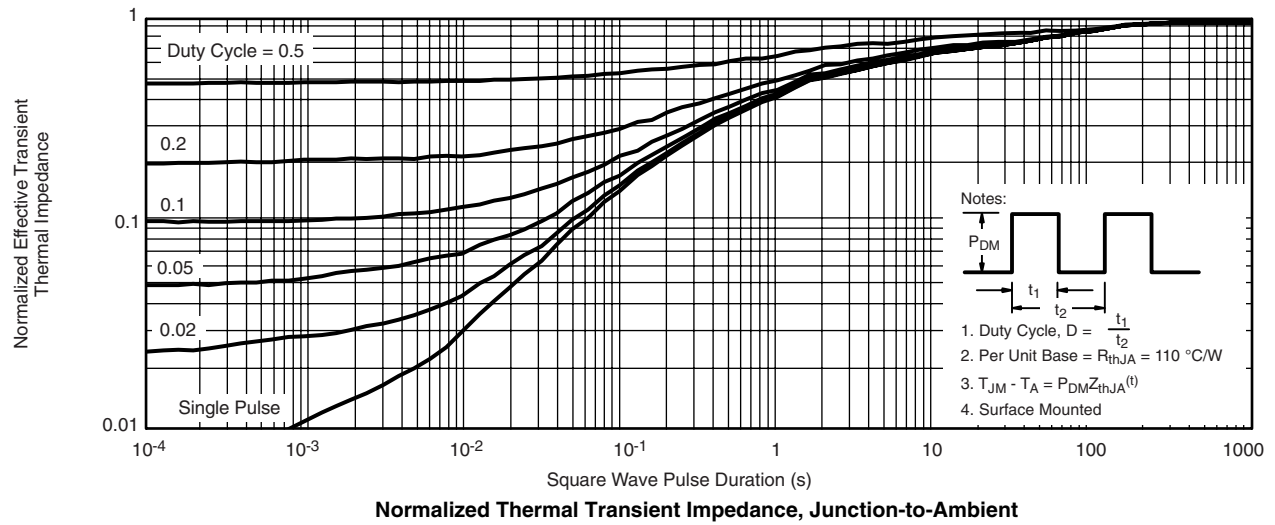
Safe Operating Area, Junction-to-Ambient

CHANNEL-1 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

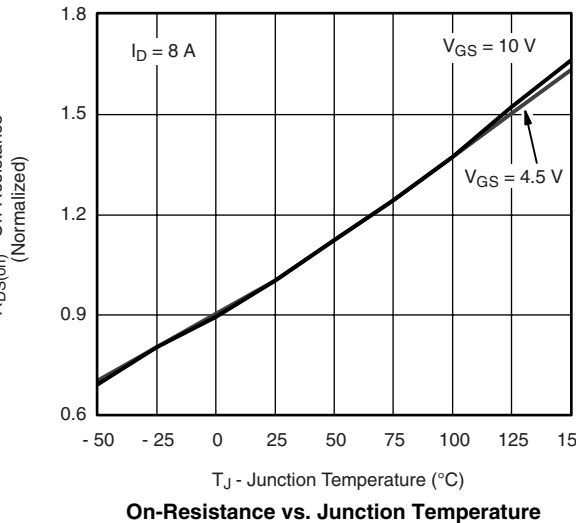
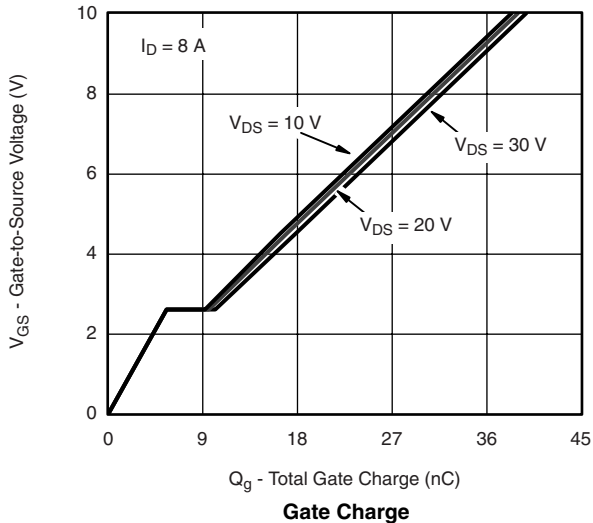
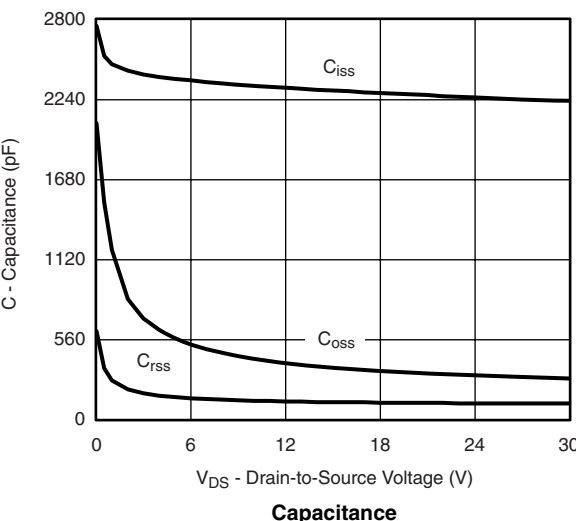
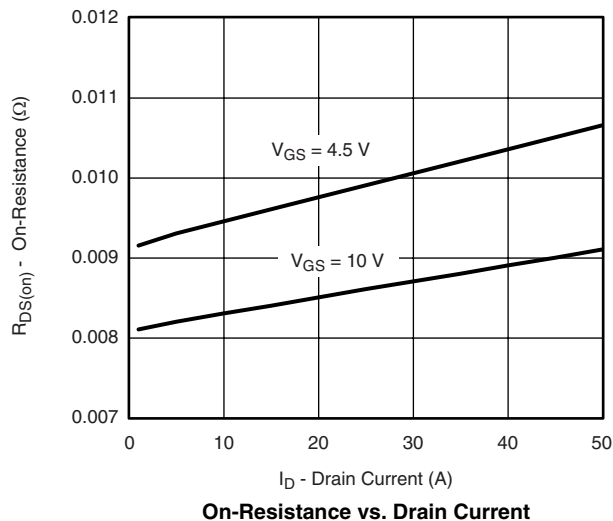
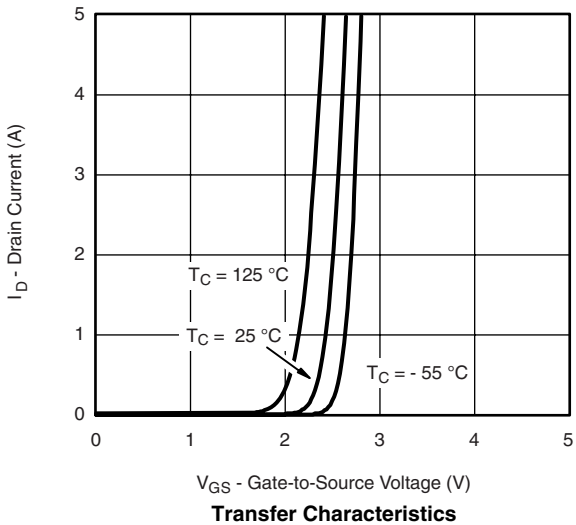
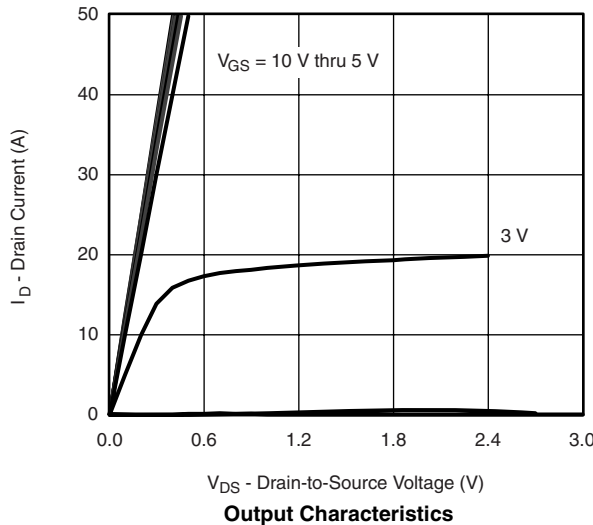


* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

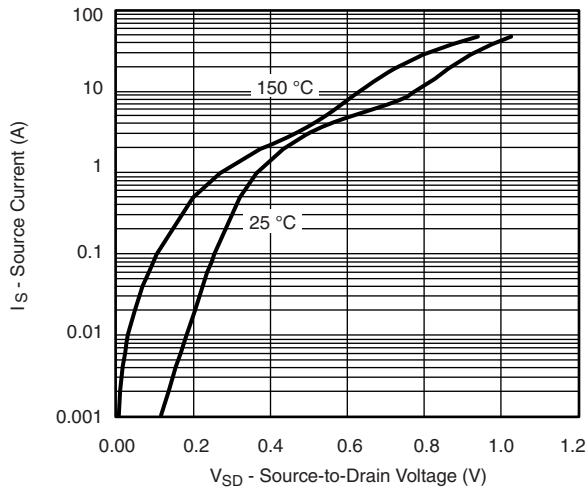
CHANNEL-1 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



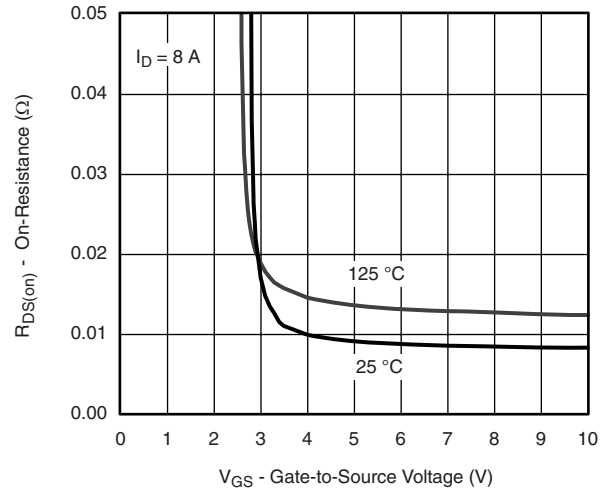
CHANNEL-2 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



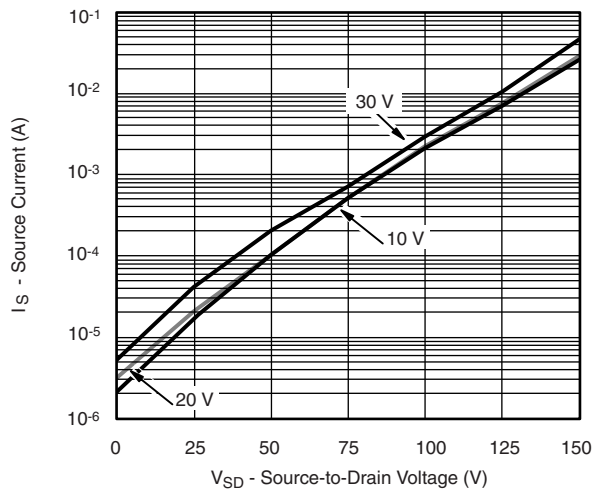
CHANNEL-2 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



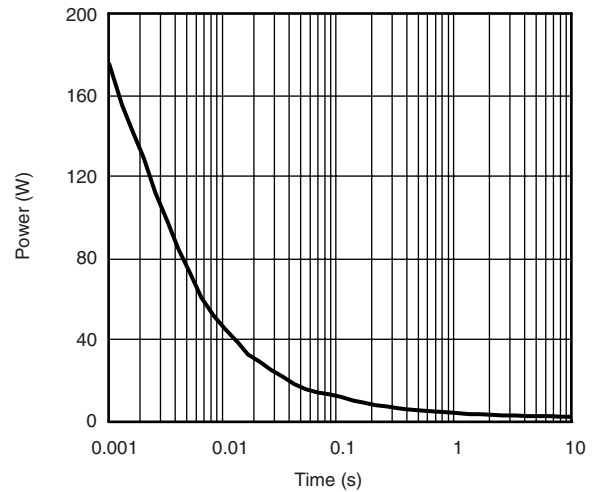
Source-Drain Diode Forward Voltage



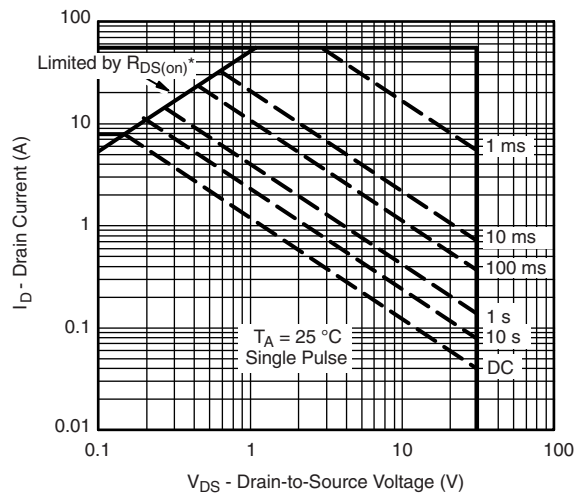
On-Resistance vs. Gate-to-Source Voltage



Reverse Current (Schottky)



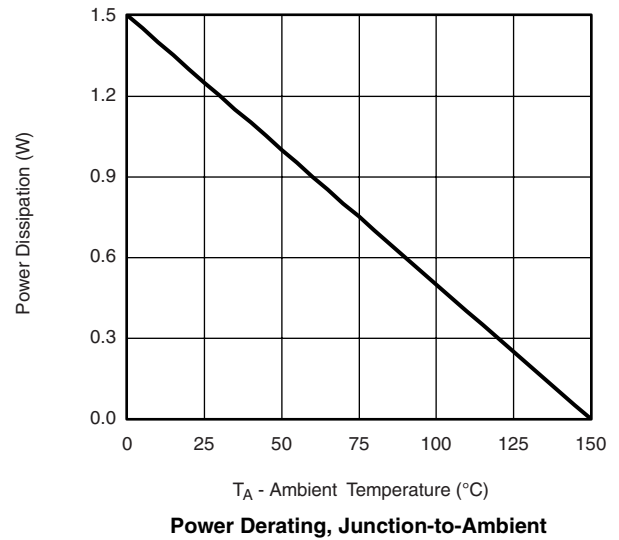
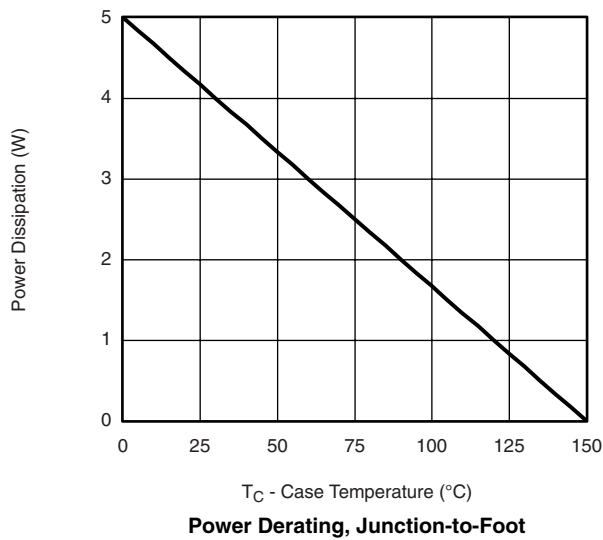
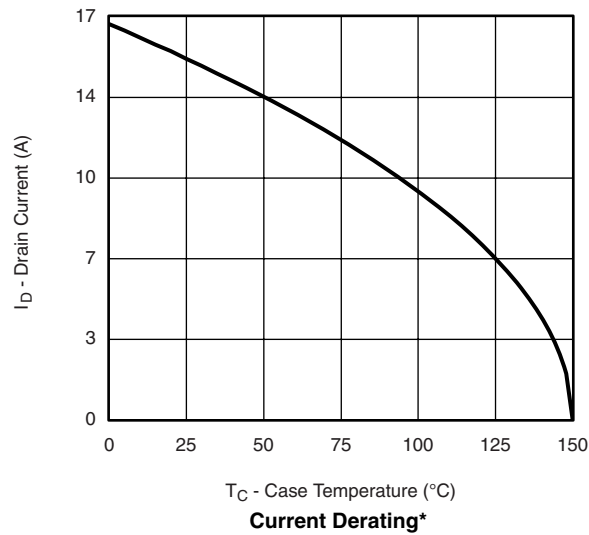
Single Pulse Power, Junction-to-Ambient



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

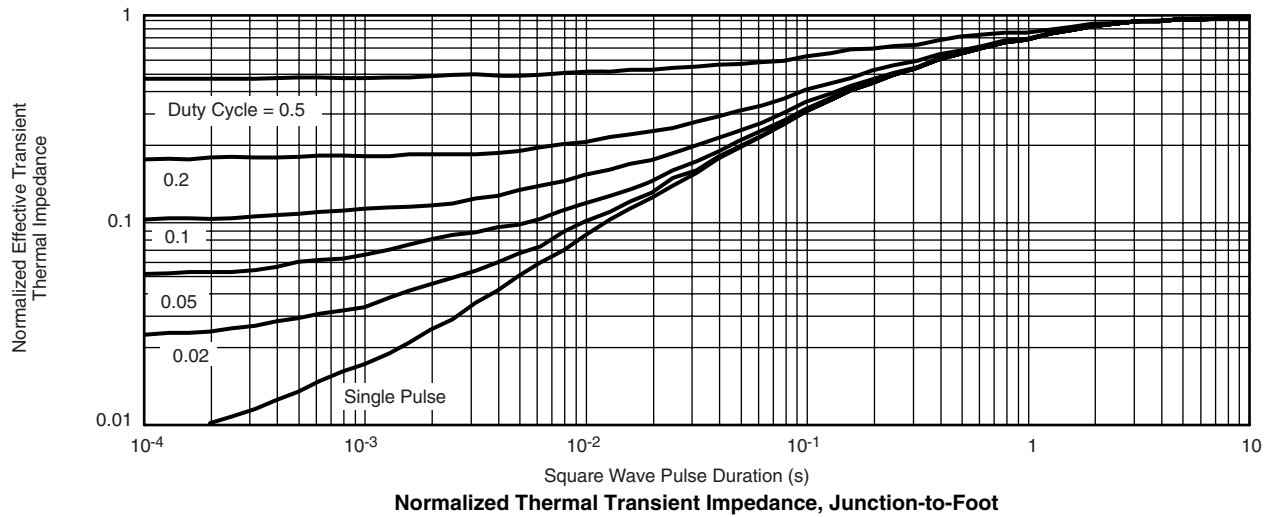
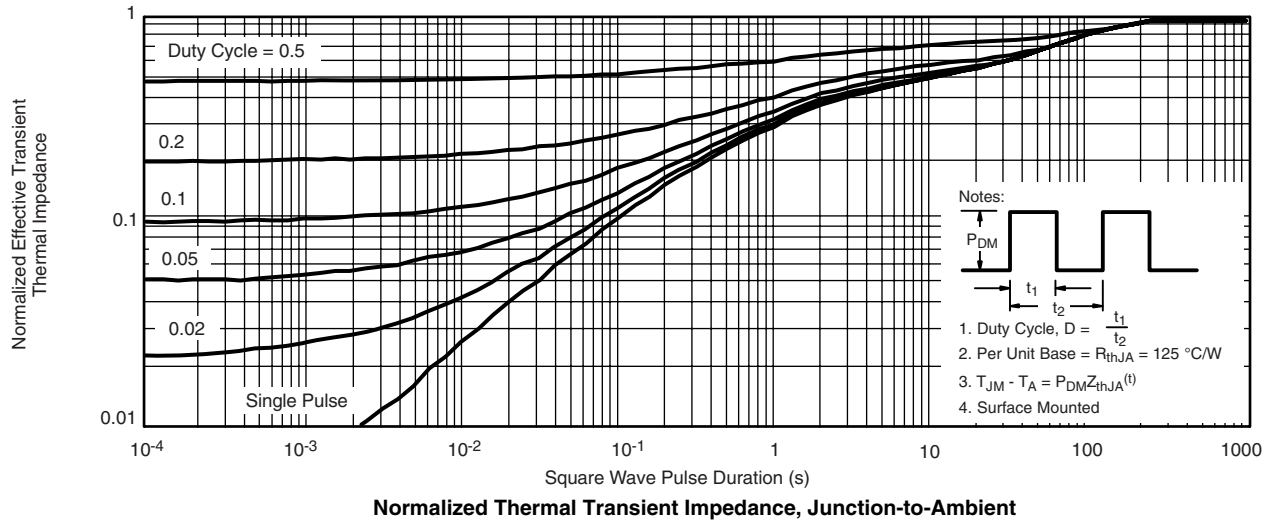
Safe Operating Area, Junction-to-Ambient

CHANNEL-2 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

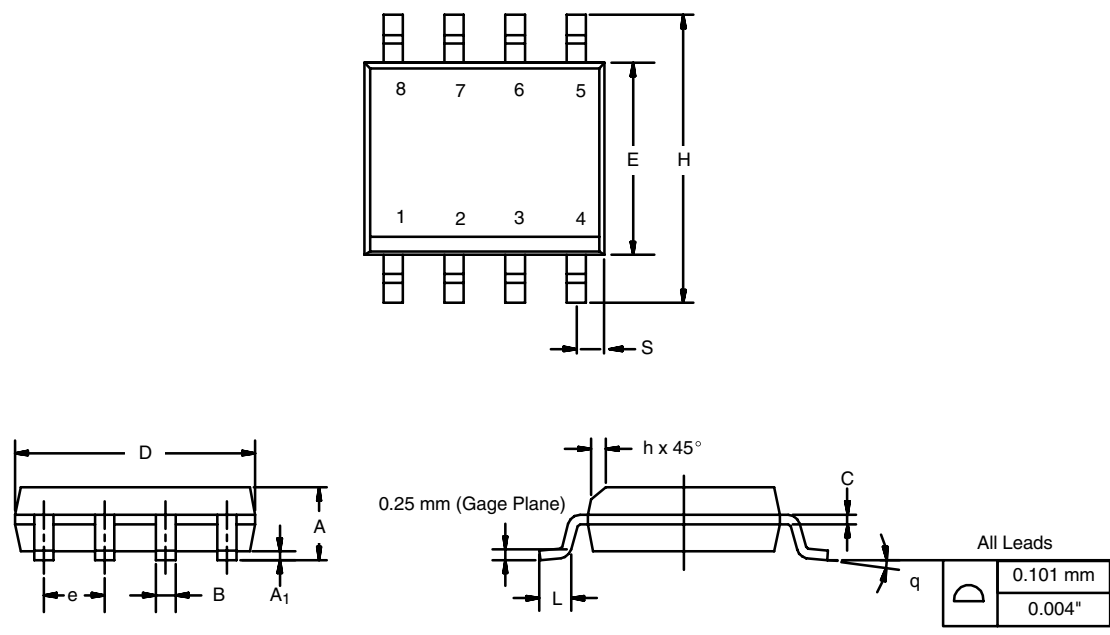


* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

CHANNEL-2 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

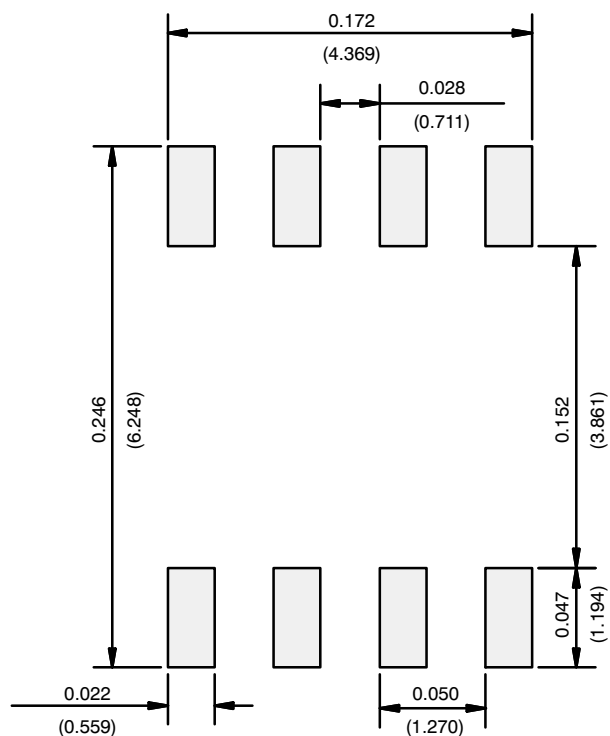


SOIC (NARROW): 8-LEAD
JEDEC Part Number: MS-012



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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