

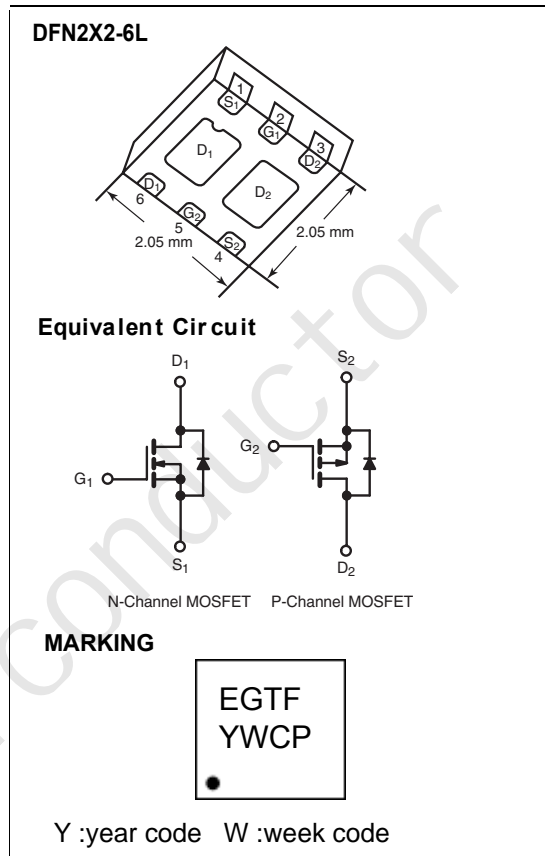
PRODUCT SUMMARY				
	V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)	Q <sub>g</sub> (Typ.)
N-Channel	20	0.040 at V <sub>GS</sub> = 4.5 V	4.2	3.7 nC
		0.065 at V <sub>GS</sub> = 2.5 V	3.3	
P-Channel	-20	0.090 at V <sub>GS</sub> = -4.5 V	-2.9	5.3 nC
		0.137 at V <sub>GS</sub> = -2.5 V	-2.3	

**FEATURES**

- Halogen-free According to IEC 61249-2-21 Definition
- Power MOSFETs
- New Thermally Enhanced PowerPAK<sup>®</sup> SC-70 Package
  - Small Footprint Area
  - Low On-Resistance
- Compliant to RoHS Directive 2002/95/EC

**APPLICATIONS**

- Load Switch for Portable Devices



ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)				
Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	V <sub>DS</sub>	20	-20	V
Gate-Source Voltage	V <sub>GS</sub>	± 12		
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	4.2	-2.9	A
Pulsed Drain Current				
Source Drain Current Diode Current	I <sub>S</sub>	4.5	-4.5	
Maximum Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	7.8	W
		T <sub>A</sub> = 25 °C	1.9	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to 150		°C
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>		260		

THERMAL RESISTANCE RATINGS						
Parameter	Symbol	N-Channel		P-Channel		Unit
		Typ.	Max.	Typ.	Max.	
Maximum Junction-to-Ambient <sup>b, f</sup>	R <sub>thJA</sub>	52	65	52	65	°C/W
Maximum Junction-to-Case (Drain)	R <sub>thJC</sub>	12.5	16	12.5	16	

<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)								
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit		
<b>Static</b>								
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	N-Ch	20			V	
		$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	P-Ch	-20				
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$	N-Ch		23		mV/°C	
		$I_D = -250\text{ }\mu\text{A}$	P-Ch		-11			
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	$I_D = 250\text{ }\mu\text{A}$	N-Ch		-3.3			
		$I_D = -250\text{ }\mu\text{A}$	P-Ch		2.6			
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	N-Ch	0.6		1.4	V	
		$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	P-Ch	-0.5		-1.3		
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$	N-Ch			$\pm 0.1$	$\mu\text{A}$	
			P-Ch			$\pm 0.1$		
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$	N-Ch			0.1		
		$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$	P-Ch			-0.1		
On-State Drain Current <sup>b</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 4.5\text{ V}$	N-Ch	10			A	
		$V_{DS} \leq -5\text{ V}, V_{GS} = -4.5\text{ V}$	P-Ch	-10				
Drain-Source On-State Resistance <sup>b</sup>	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 4.2\text{ A}$	N-Ch		0.032	0.040	$\Omega$	
		$V_{GS} = -4.5\text{ V}, I_D = -2.9\text{ A}$	P-Ch		0.074	0.090		
		$V_{GS} = 2.5\text{ V}, I_D = 3.3\text{ A}$	N-Ch		0.053	0.065		
		$V_{GS} = -2.5\text{ V}, I_D = -2.3\text{ A}$	P-Ch		0.113	0.137		
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = 10\text{ V}, I_D = 4.2\text{ A}$	N-Ch		12		S	
		$V_{DS} = -10\text{ V}, I_D = -2.9\text{ A}$	P-Ch		7			
<b>Dynamic<sup>a</sup></b>								
Input Capacitance	$C_{iss}$	N-Channel $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	N-Ch		350		$\mu\text{F}$	
Output Capacitance	$C_{oss}$		P-Ch		340			
Reverse Transfer Capacitance	$C_{rss}$	P-Channel $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	N-Ch		82			
			P-Ch		105			
Total Gate Charge	$Q_g$	$V_{DS} = 10\text{ V}, V_{GS} = 10\text{ V}, I_D = 5.5\text{ A}$	N-Ch		7.7	12	nC	
		$V_{DS} = -10\text{ V}, V_{GS} = -10\text{ V}, I_D = -3.7\text{ A}$	P-Ch		10.5	16		
		N-Channel $V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 5.5\text{ A}$	N-Ch		3.7	6		
			P-Ch		5.3	8		
Gate-Source Charge	$Q_{gs}$	P-Channel $V_{DS} = -10\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -3.7\text{ A}$	N-Ch		0.85			
Gate-Drain Charge	$Q_{gd}$		P-Ch		0.75			
Gate Resistance	$R_g$	$f = 1\text{ MHz}$	N-Ch	0.7	3.5	7		$\Omega$
			P-Ch	0.2	10	20		

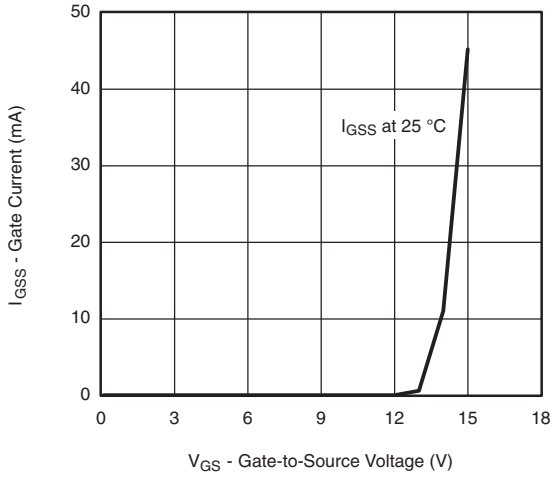
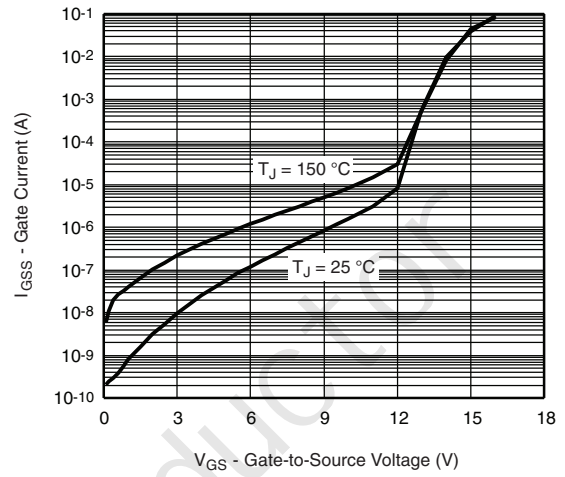
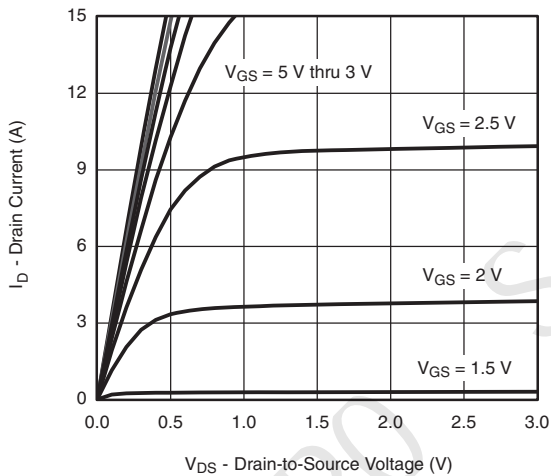
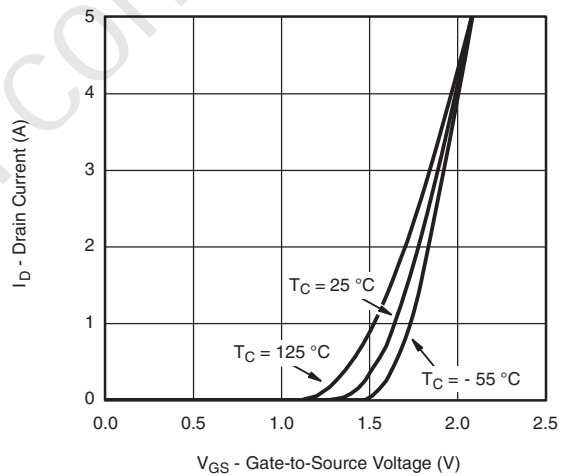
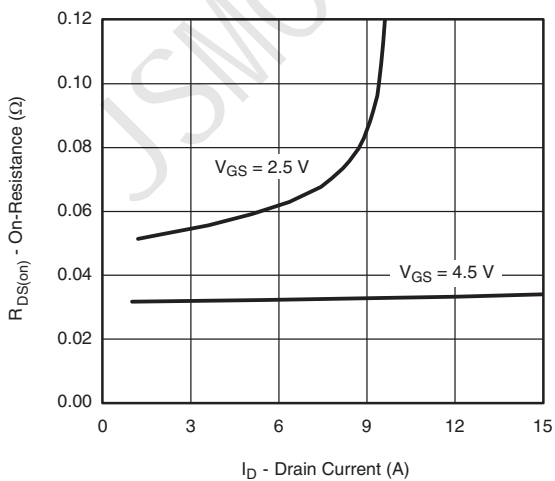
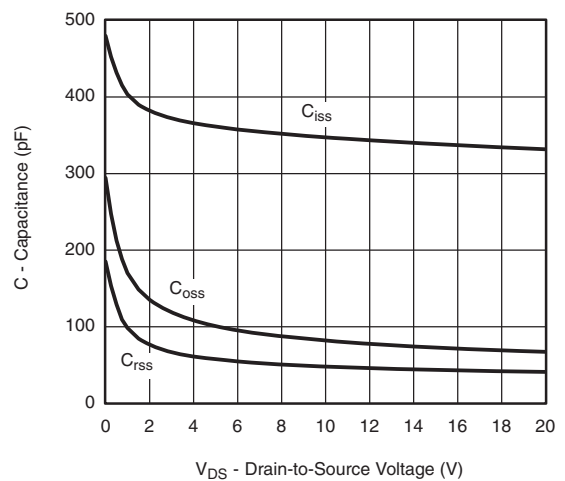
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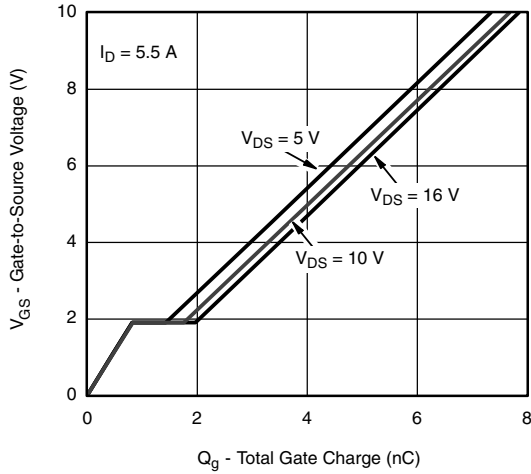
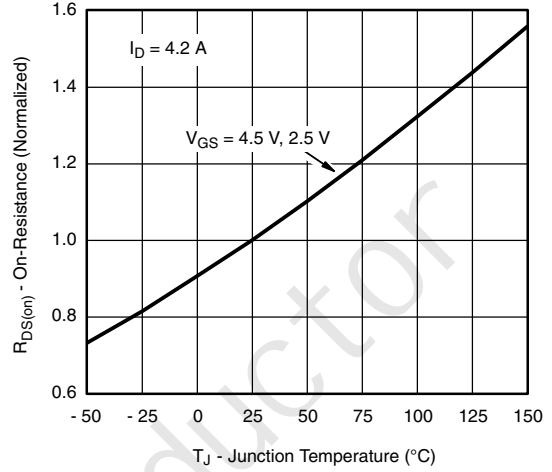
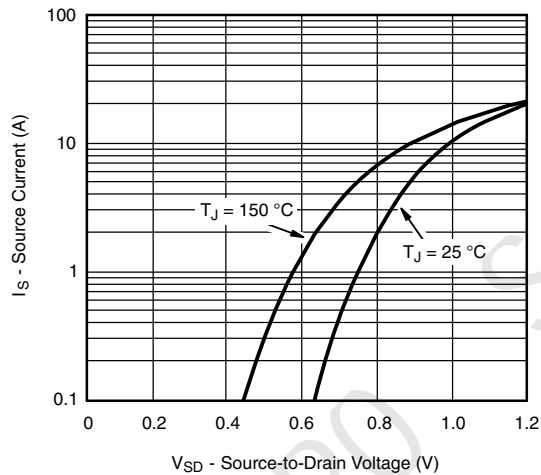
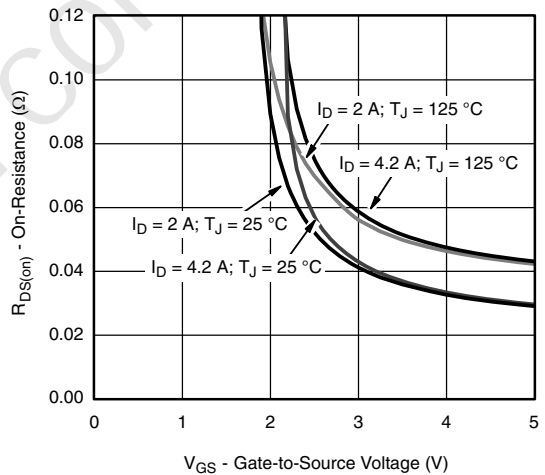
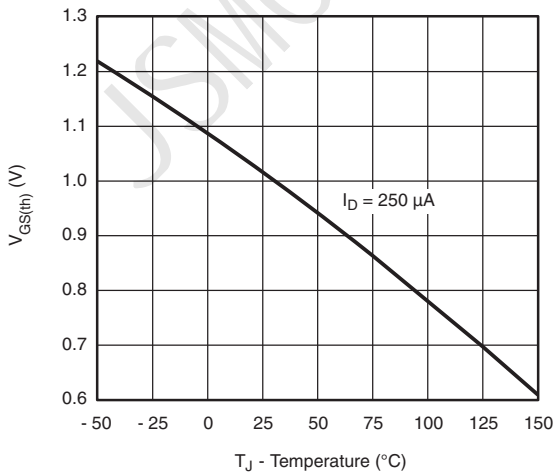
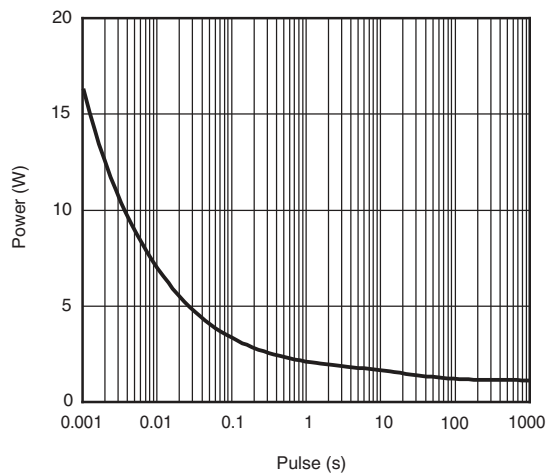
- a. Guaranteed by design, not subject to production testing.  
 b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

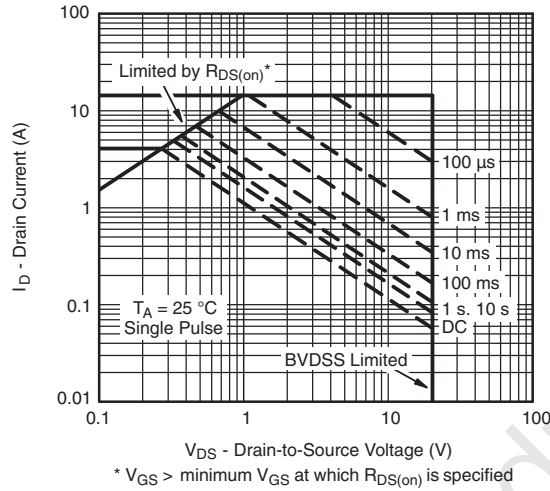
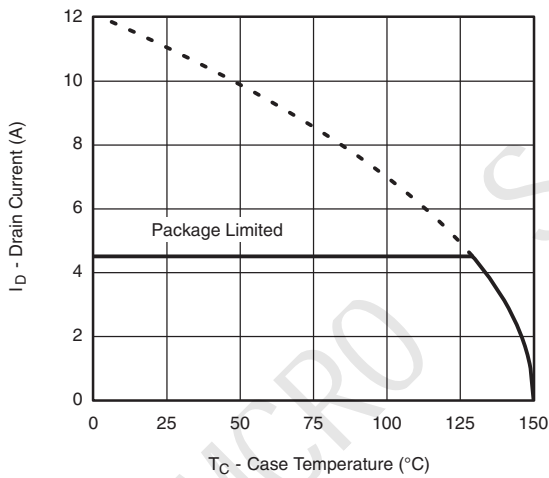
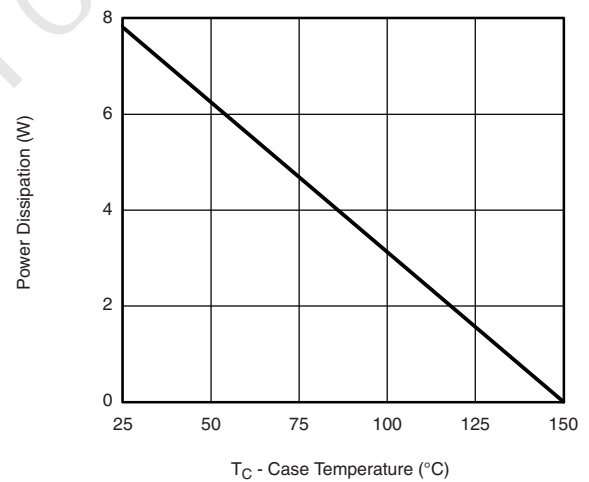
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	
<b>Dynamic<sup>a</sup></b>							
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 10\text{ V}, R_L = 2.3\ \Omega$ $I_D \cong 4.4\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\ \Omega$	N-Ch		10	15	ns
Rise Time	$t_r$		P-Ch		20	30	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel $V_{DD} = -10\text{ V}, R_L = 3.3\ \Omega$ $I_D \cong -3\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\ \Omega$	N-Ch		21	35	
			P-Ch		25	40	
Fall Time	$t_f$		N-Ch		16	25	
			P-Ch		10	15	
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 10\text{ V}, R_L = 2.3\ \Omega$ $I_D \cong 4.4\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\ \Omega$	N-Ch		5	10	
Rise Time	$t_r$		P-Ch		5	10	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel $V_{DD} = -10\text{ V}, R_L = 3.3\ \Omega$ $I_D \cong -3\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\ \Omega$	N-Ch		10	15	
			P-Ch		10	15	
Fall Time	$t_f$		N-Ch		15	25	
			P-Ch		20	30	
			N-Ch		10	15	
			P-Ch		10	15	
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$	N-Ch			4.5	A
			P-Ch			-4.5	
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$		N-Ch			15	
			P-Ch			-15	
Body Diode Voltage	$V_{SD}$	$I_S = 4.4\text{ A}, V_{GS} = 0\text{ V}$ $I_S = -3\text{ A}, V_{GS} = 0\text{ V}$	N-Ch		0.8	1.2	V
			P-Ch		-0.8	-1.2	
Body Diode Reverse Recovery Time	$t_{rr}$	N-Channel $I_F = 4.4\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$	N-Ch		15	30	ns
			P-Ch		26	50	
Body Diode Reverse Recovery Charge	$Q_{rr}$	P-Channel $I_F = -3\text{ A}, di/dt = -100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$	N-Ch		8	20	nC
			P-Ch		13	25	
Reverse Recovery Fall Time	$t_a$		N-Ch		8		ns
Reverse Recovery Rise Time	$t_b$		P-Ch		14		
		N-Ch		7			
			P-Ch		12		

Notes:

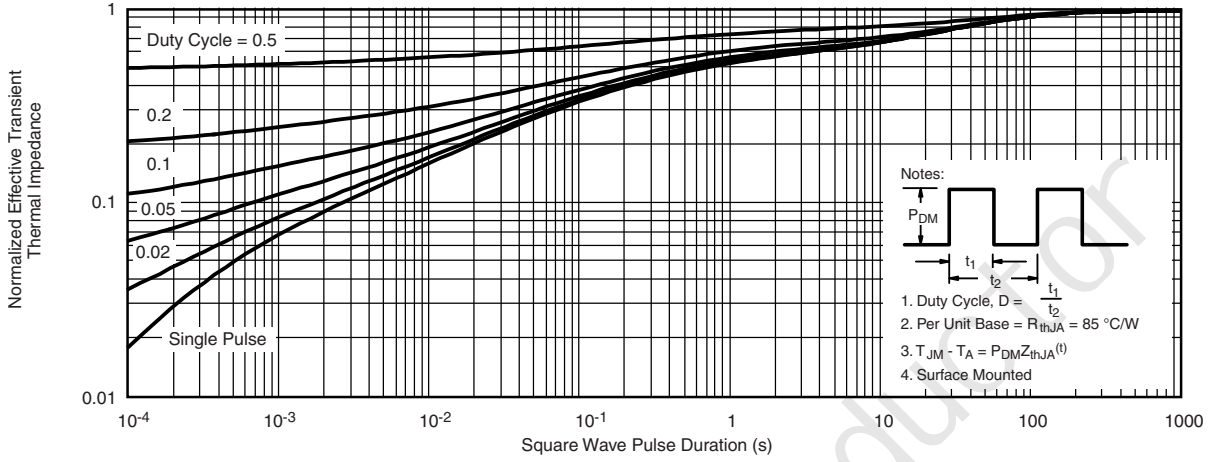
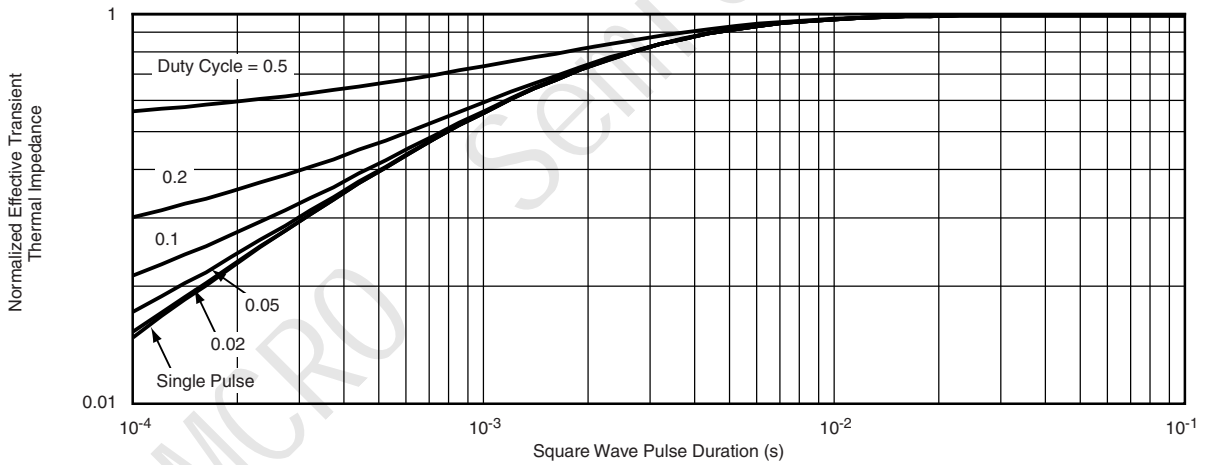
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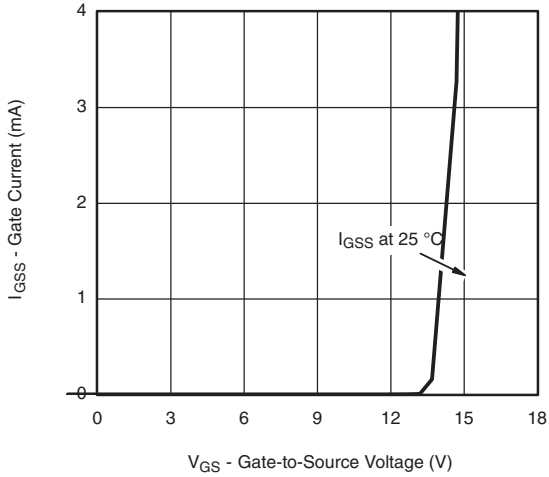
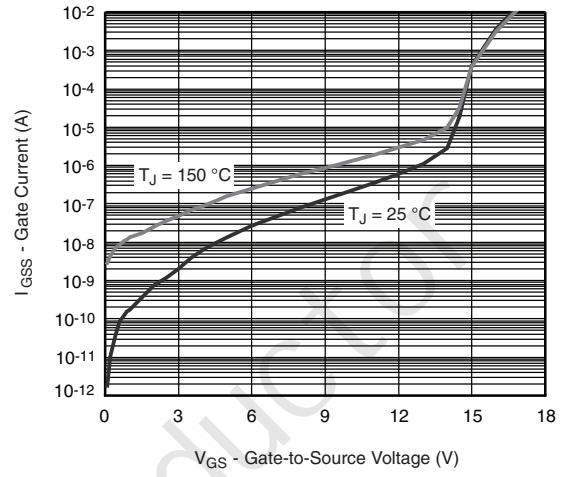
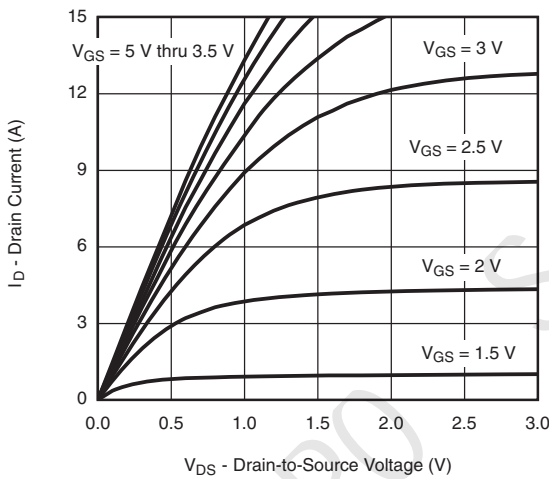
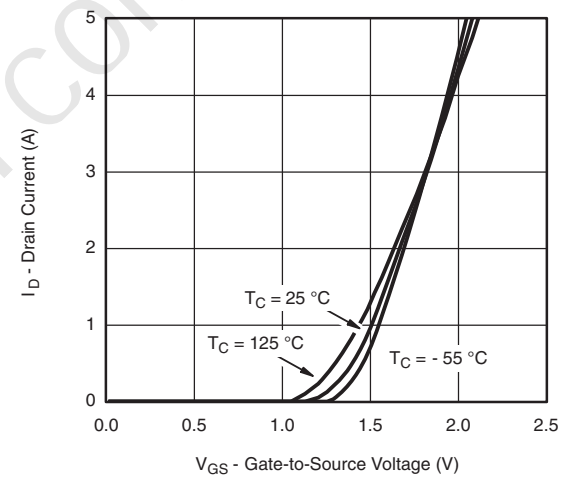
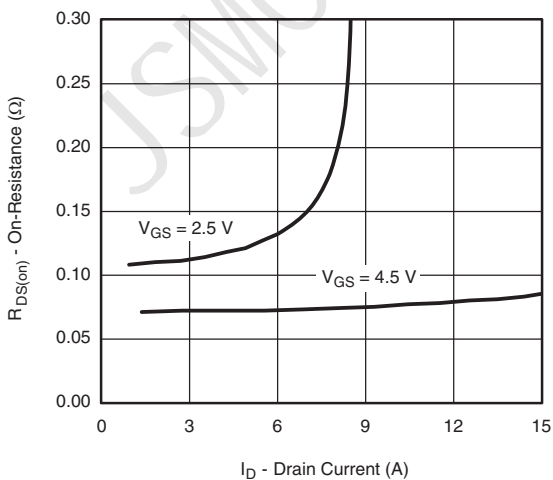
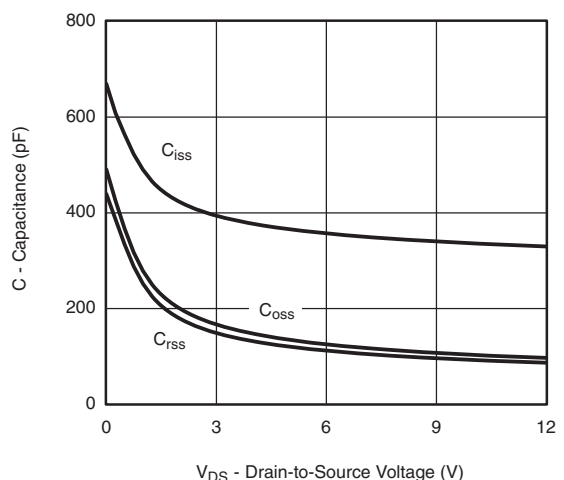
**N-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Gate Current vs. Gate-Source Voltage**

**Gate Current vs. Gate-Source Voltage**

**Output Characteristics**

**Transfer Characteristics**

**On-Resistance vs. Drain Current and Gate Voltage**

**Capacitance**

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

**Gate Charge**

**On-Resistance vs. Junction Temperature**

**Source-Drain Diode Forward Voltage**

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

**Threshold Voltage**

**Single Pulse Power (Junction-to-Ambient)**

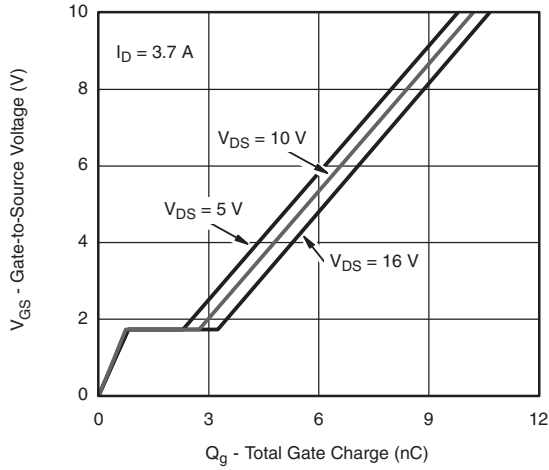
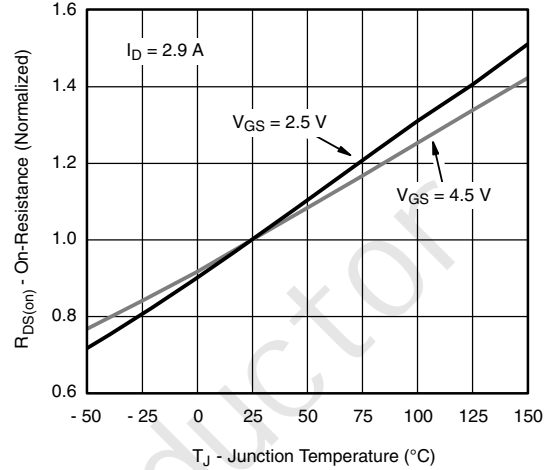
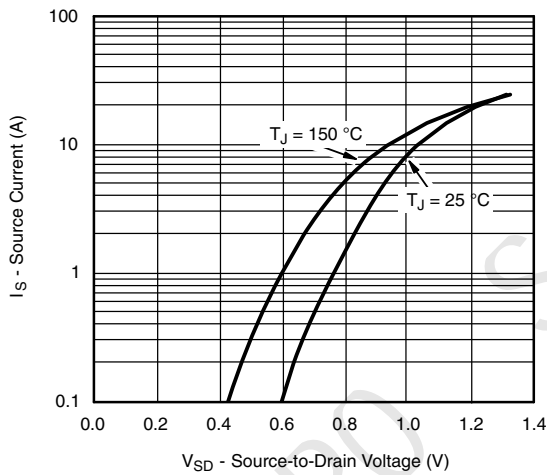
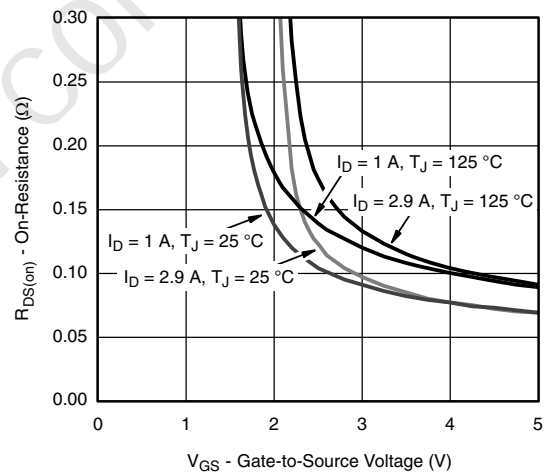
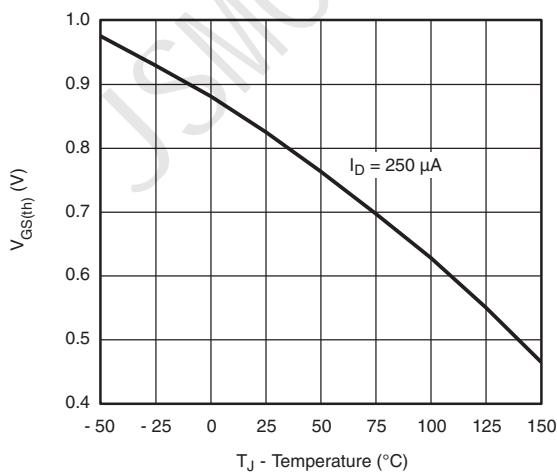
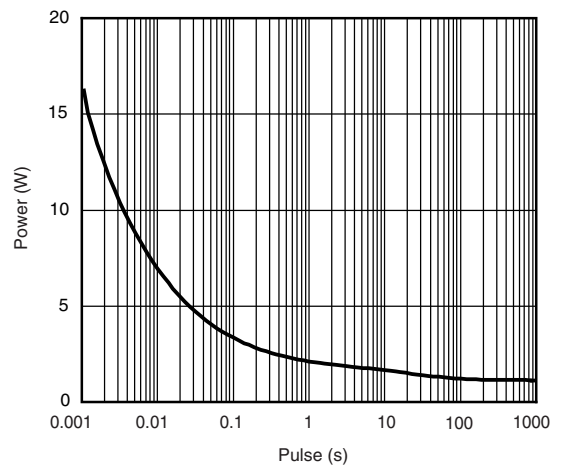
**N-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

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

**Current Derating\***

**Power Derating**

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

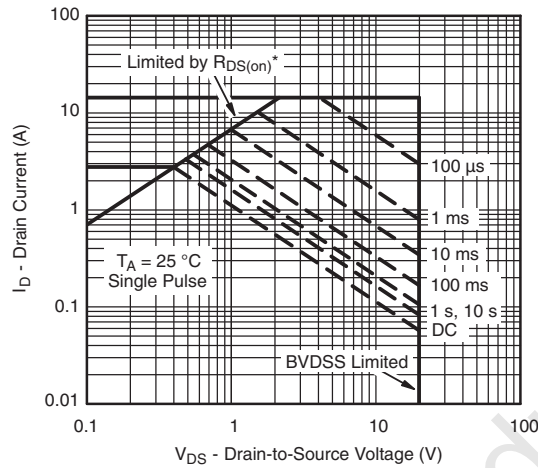
**N-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

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

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

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

**Gate Current vs. Gate-Source Voltage**

**Gate Current vs. Gate-Source Voltage**

**Output Characteristics**

**Transfer Characteristics**

**On-Resistance vs. Drain Current and Gate Voltage**

**Capacitance**

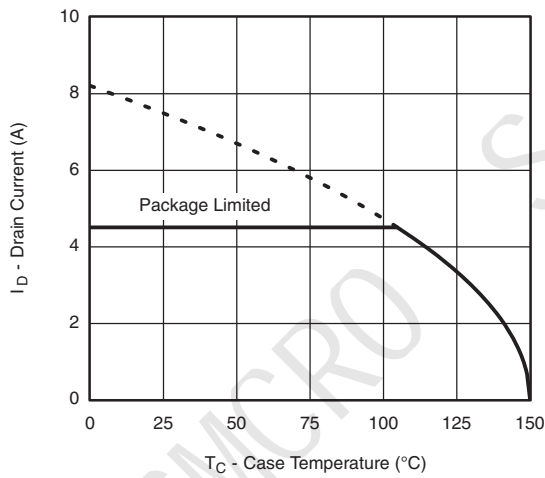


**P-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Gate Charge**

**On-Resistance vs. Junction Temperature**

**Source-Drain Diode Forward Voltage**

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

**Threshold Voltage**

**Single Pulse Power (Junction-to-Ambient)**

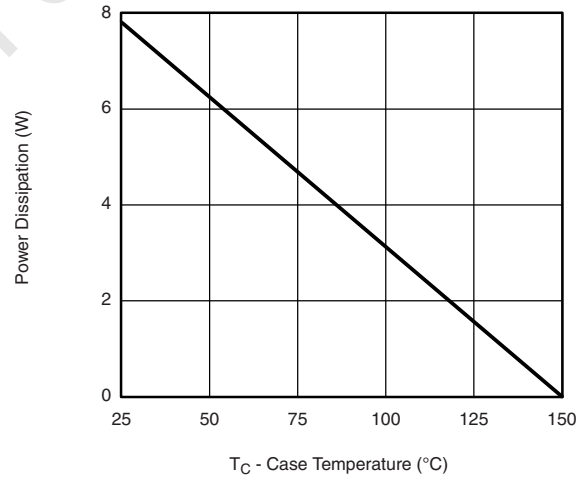
**P-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified  
**Safe Operating Area, Junction-to-Ambient**

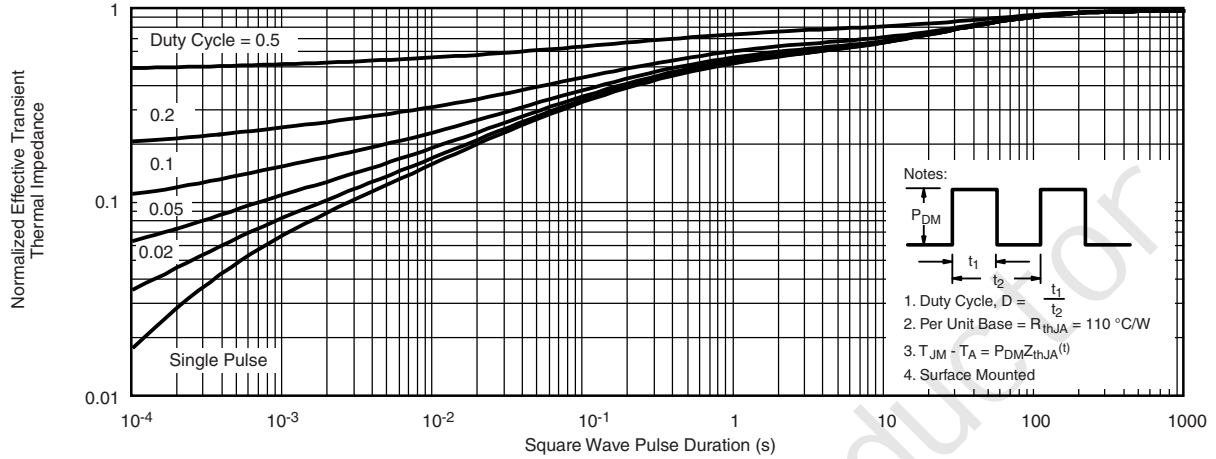
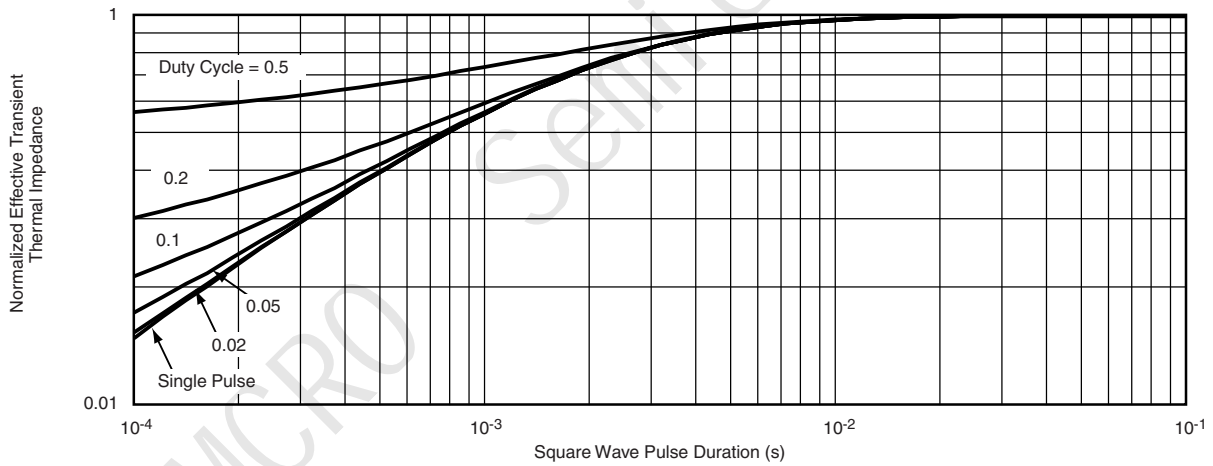


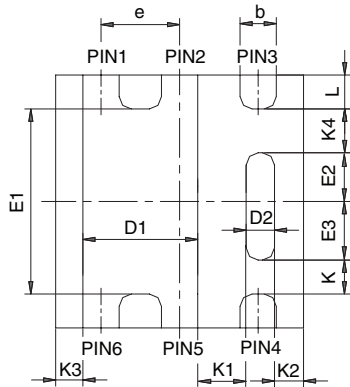
**Current Derating\***



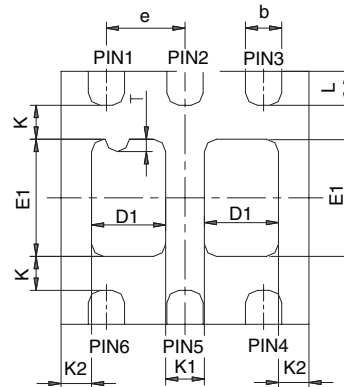
**Power Derating**

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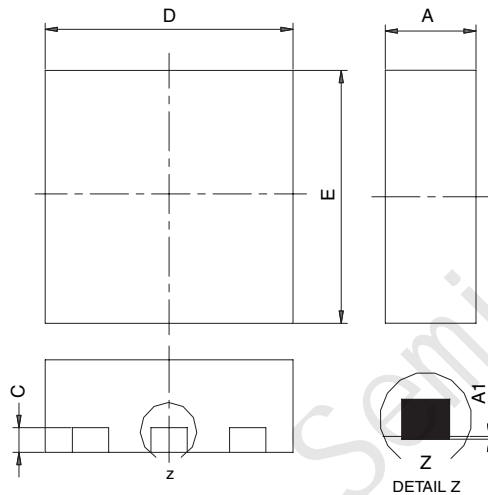
**P-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

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

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



BACKSIDE VIEW OF SINGLE



BACKSIDE VIEW OF DUAL



- Notes:
1. All dimensions are in millimeters
  2. Package outline exclusive of mold flash and metal burr
  3. Package outline inclusive of plating

DIM	SINGLE PAD						DUAL PAD					
	MILLIMETERS			INCHES			MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
A	0.675	0.75	0.80	0.027	0.030	0.032	0.675	0.75	0.80	0.027	0.030	0.032
A1	0	-	0.05	0	-	0.002	0	-	0.05	0	-	0.002
b	0.23	0.30	0.38	0.009	0.012	0.015	0.23	0.30	0.38	0.009	0.012	0.015
C	0.15	0.20	0.25	0.006	0.008	0.010	0.15	0.20	0.25	0.006	0.008	0.010
D	1.98	2.05	2.15	0.078	0.081	0.085	1.98	2.05	2.15	0.078	0.081	0.085
D1	0.85	0.95	1.05	0.033	0.037	0.041	0.513	0.613	0.713	0.020	0.024	0.028
D2	0.135	0.235	0.335	0.005	0.009	0.013						
E	1.98	2.05	2.15	0.078	0.081	0.085	1.98	2.05	2.15	0.078	0.081	0.085
E1	1.40	1.50	1.60	0.055	0.059	0.063	0.85	0.95	1.05	0.033	0.037	0.041
E2	0.345	0.395	0.445	0.014	0.016	0.018						
E3	0.425	0.475	0.525	0.017	0.019	0.021						
e	0.65 BSC			0.026 BSC			0.65 BSC			0.026 BSC		
K	0.275 TYP			0.011 TYP			0.275 TYP			0.011 TYP		
K1	0.400 TYP			0.016 TYP			0.320 TYP			0.013 TYP		
K2	0.240 TYP			0.009 TYP			0.252 TYP			0.010 TYP		
K3	0.225 TYP			0.009 TYP								
K4	0.355 TYP			0.014 TYP								
L	0.175	0.275	0.375	0.007	0.011	0.015	0.175	0.275	0.375	0.007	0.011	0.015
T							0.05	0.10	0.15	0.002	0.004	0.006

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