

Complementary N- and P-Channel 40-V (D-S) MOSFET

PRODUCT SUMMARY

	V _{DS} (V)	r _{DS(on)} (Ω)	I _D (A) ^a	Q _g (Typ)
N-Channel	40	0.030 at V _{GS} = 10 V	8	9.6
		0.034 at V _{GS} = 4.5 V	8	
P-Channel	- 40	0.032 at V _{GS} = - 10 V	- 8	21
		0.041 at V _{GS} = - 4.5 V	- 8	

FEATURES

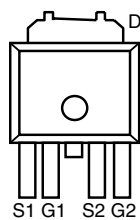
- TrenchFET[®] Power MOSFET
- 100 % R_g and UIS Tested

APPLICATIONS

- CCFL Inverter
- LCD TV and Monitor

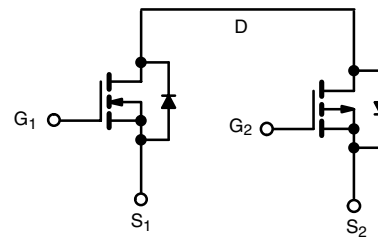


TO-252-4L
D-PAK



Top View
Drain Connected to
Tab

Ordering Information: SUD50NP04-62-T4-E3 (Lead (Pb)-free)



N-Channel MOSFET P-Channel MOSFET

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

Parameter		Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage		V _{DS}	40	- 40	V
Gate-Source Voltage		V _{GS}	± 16		
Continuous Drain Current (T _J = 150 °C)	T _C = 25 °C	I _D	8	- 8	A
	T _C = 70 °C		8	- 8	
	T _A = 25 °C		8 ^{b, c}	- 8 ^{b, c}	
	T _A = 70 °C		8 ^{b, c}	- 8 ^{b, c}	
Pulsed Drain Current (10 μs Pulse Width)		I _{DM}	35	- 35	
Source-Drain Current Diode Current	T _C = 25 °C	I _S	8	- 8	
	T _A = 25 °C		5 ^{b, c}	- 5.5 ^{b, c}	
Pulsed Source-Drain Current		I _{SM}	35	- 35	
Single Pulse Avalanche Current	L = 0.1 mH	I _{AS}	10	20	mJ
Single Pulse Avalanche Energy		E _{AS}	5	20	
Maximum Power Dissipation	T _C = 25 °C	P _D	15.6	23.5	W
	T _C = 70 °C		10	15	
	T _A = 25 °C		6 ^{b, c}	6.7 ^{b, c}	
	T _A = 70 °C		3.9 ^{b, c}	4.3 ^{b, c}	
Operating Junction and Storage Temperature Range		T _J , T _{stg}	- 55 to 150		°C

THERMAL RESISTANCE RATINGS

Parameter		Symbol	N-Channel		P-Channel		Unit
			Typ	Max	Typ	Max	
Maximum Junction-to-Ambient ^{b, d}	t ≤ 10 sec	R _{thJA}	17	20.5	15.2	18.5	°C/W
Maximum Junction-to-Case (Drain)	Steady State	R _{thJC}	6.6	8	4.4	5.3	

Notes:

a. Based on T_C = 25 °C.

b. Surface Mounted on 1" x 1" FR4 Board.

c. t = 10 sec.

d. Maximum under Steady State conditions is 53 °C/W (N-Channel) and 50 °C/W (P-Channel).

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 = 250 μA	N-Ch	40			V		
		V _{GS} = 0 V, I _D = - 250 μA	P-Ch	- 40					
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA	N-Ch		37				
		I _D = - 250 μA	P-Ch		- 38				
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J	I _D = 250 μA	N-Ch		- 5				
		I _D = - 250 μA	P-Ch		4.0				
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	N-Ch	0.6		2.0			
		V _{DS} = V _{GS} , I _D = - 250 μA	P-Ch	- 0.8		- 2.2			
Gate-Body Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 16 V	N-Ch P-Ch			100 - 100	nA		
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 40 V, V _{GS} = 0 V	N-Ch			1	μA		
		V _{DS} = - 40 V, V _{GS} = 0 V	P-Ch			- 1			
		V _{DS} = 40 V, V _{GS} = 0 V, T _J = 55 °C	N-Ch			10			
		V _{DS} = - 40 V, V _{GS} = 0 V, T _J = 55 °C	P-Ch			- 10			
On-State Drain Current ^b	I _{D(on)}	V _{DS} = 5 V, V _{GS} = 10 V	N-Ch	20			A		
		V _{DS} = - 5 V, V _{GS} = - 10 V	P-Ch	- 20					
Drain-Source On-State Resistance ^b	r _{DS(on)}	V _{GS} = 10 V, I _D = 6 A	N-Ch		0.025	0.030	Ω		
		V _{GS} = - 10 V, I _D = - 6 A	P-Ch		0.026	0.032			
		V _{GS} = 4.5 V, I _D = 4.8 A	N-Ch		0.028	0.034			
		V _{GS} = - 4.5 V, I _D = - 4.9 A	P-Ch		0.034	0.041			
Forward Transconductance ^b	g _{fs}	V _{DS} = 15 V, I _D = 6 A	N-Ch		20		S		
		V _{DS} = - 15 V, I _D = - 6 A	P-Ch		17				
Dynamic ^a									
Input Capacitance	C _{iss}	N-Channel V _{DS} = 20 V, V _{GS} = 0 V, f = 1 MHz	N-Ch P-Ch		855 1505		pF		
Output Capacitance	C _{oss}		N-Ch P-Ch		105 230				
Reverse Transfer Capacitance	C _{rss}	P-Channel V _{DS} = - 20 V, V _{GS} = 0 V, f = 1 MHz	N-Ch P-Ch		65 175				
Total Gate Charge	Q _g	V _{DS} = 20 V, V _{GS} = 10 V, I _D = 5 A	N-Ch		21	32	nC		
		V _{DS} = - 20 V, V _{GS} = - 10 V, I _D = - 5 A	P-Ch		41	62			
Gate-Source Charge	Q _{gs}	N-Channel V _{DS} = 20 V, V _{GS} = 4.5 V, I _D = 5 A	N-Ch P-Ch		9.6 21	14.5 31			
			N-Ch P-Ch		2.3 4.5				
		Gate-Drain Charge	Q _{gd}	P-Channel V _{DS} = - 20 V, V _{GS} = - 4.5 V, I _D = - 5 A	N-Ch P-Ch			3.2 9.2	
Gate Resistance	R _g	f = 1 MHz	N-Ch P-Ch		2.5 6.5	3.8 10		Ω	



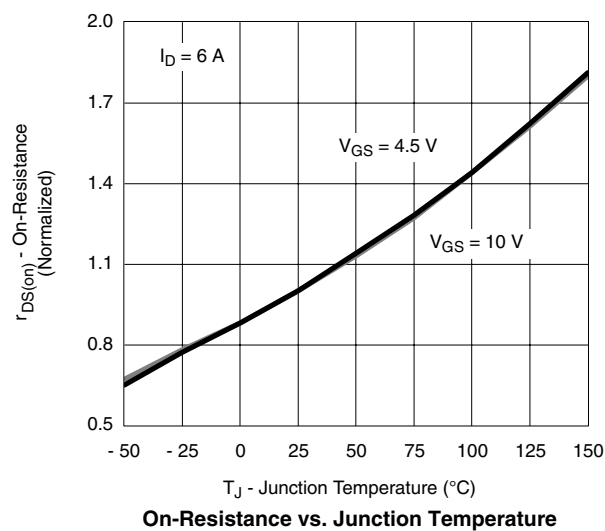
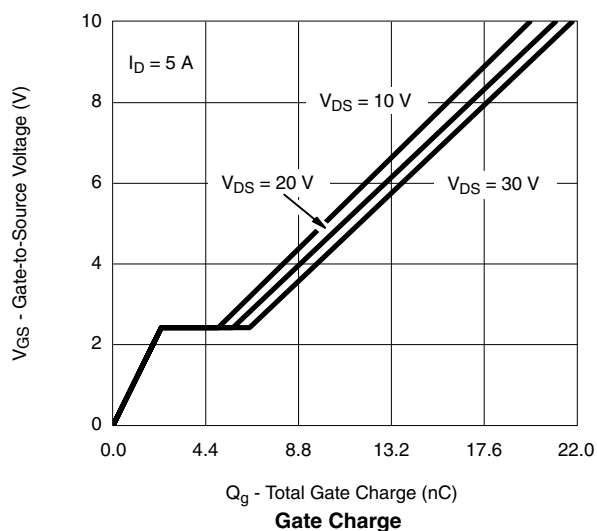
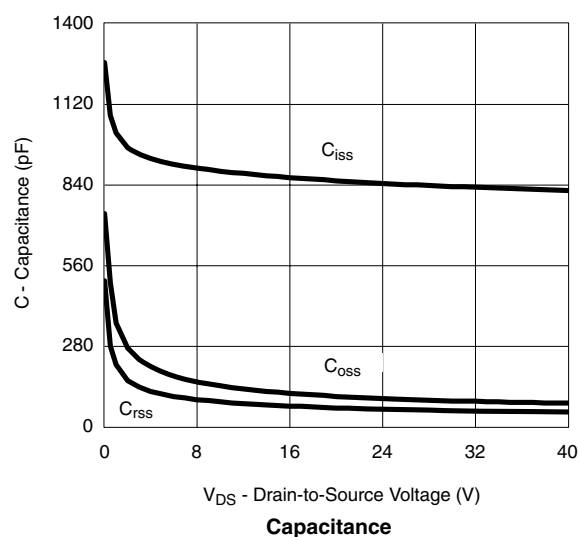
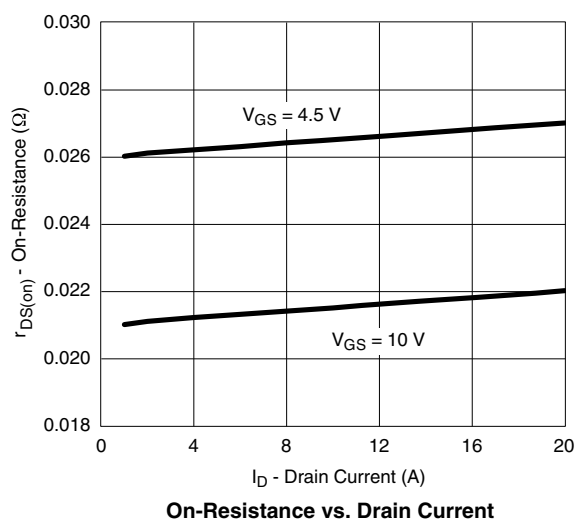
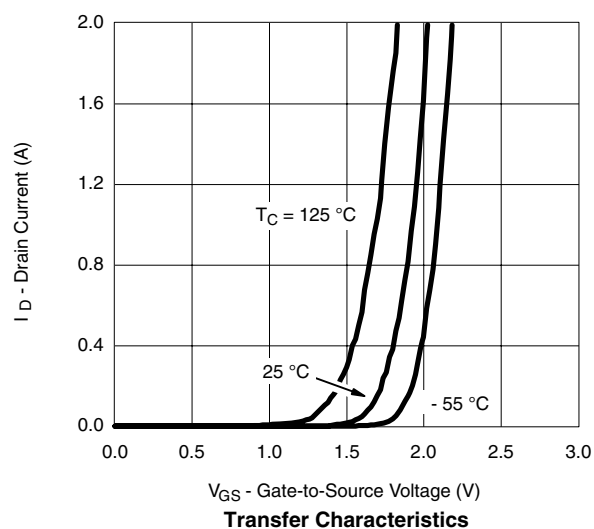
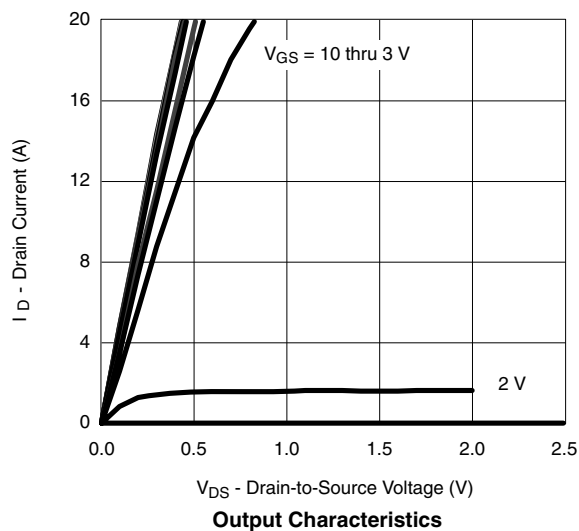
SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted							
Parameter	Symbol	Test Conditions		Min	Typ ^a	Max	Unit
Dynamic ^a							
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 20\text{ V}$, $R_L = 4\text{ }\Omega$ $I_D \cong 5\text{ A}$, $V_{GEN} = 10\text{ V}$, $R_g = 1\text{ }\Omega$	N-Ch		6	12	ns
			P-Ch		7	14	
Rise Time	t_r		N-Ch		21	32	
			P-Ch		23	35	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel $V_{DD} = -20\text{ V}$, $R_L = 4\text{ }\Omega$ $I_D \cong -5\text{ A}$, $V_{GEN} = -10\text{ V}$, $R_g = 1\text{ }\Omega$	N-Ch		24	36	
			P-Ch		51	77	
Fall Time	t_f		N-Ch		9	15	
			P-Ch		50	80	
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 20\text{ V}$, $R_L = 4\text{ }\Omega$ $I_D \cong 5\text{ A}$, $V_{GEN} = 4.5\text{ V}$, $R_g = 1\text{ }\Omega$	N-Ch		12	20	
			P-Ch		40	60	
Rise Time	t_r		N-Ch		75	115	
			P-Ch		106	160	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel $V_{DD} = -20\text{ V}$, $R_L = 4\text{ }\Omega$ $I_D \cong -5\text{ A}$, $V_{GEN} = -4.5\text{ V}$, $R_g = 1\text{ }\Omega$	N-Ch		40	60	
			P-Ch		45	70	
Fall Time	t_f		N-Ch		56	85	
			P-Ch		50	75	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^{\circ}\text{C}$	N-Ch			8	A
			P-Ch			- 8	
Pulse Diode Forward Current ^a	I_{SM}		N-Ch			35	
			P-Ch			- 35	
Body Diode Voltage	V_{SD}	$I_S = 1.5\text{ A}$	N-Ch		0.73	1.2	V
		$I_S = -1.6\text{ A}$	P-Ch		- 0.73	- 1.2	
Body Diode Reverse Recovery Time	t_{rr}	N-Channel $I_F = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^{\circ}\text{C}$	N-Ch		26	40	ns
			P-Ch		30	45	
Body Diode Reverse Recovery Charge	Q_{rr}		N-Ch		21	32	nC
			P-Ch		24	36	
Reverse Recovery Fall Time	t_a	P-Channel $I_F = -5\text{ A}$, $di/dt = -100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^{\circ}\text{C}$	N-Ch		13		ns
			P-Ch		15		
Reverse Recovery Rise Time	t_b		N-Ch		13		
			P-Ch		15		

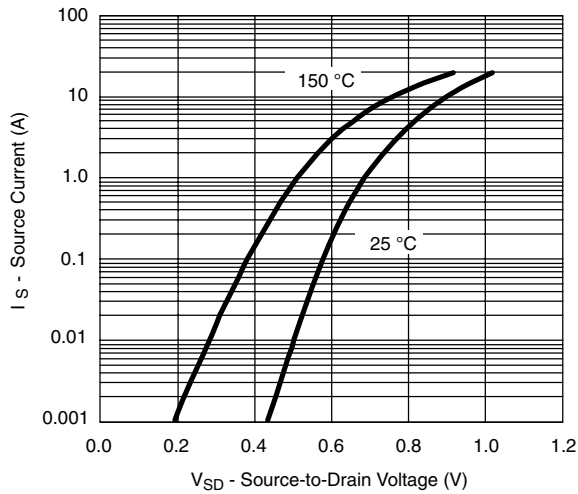
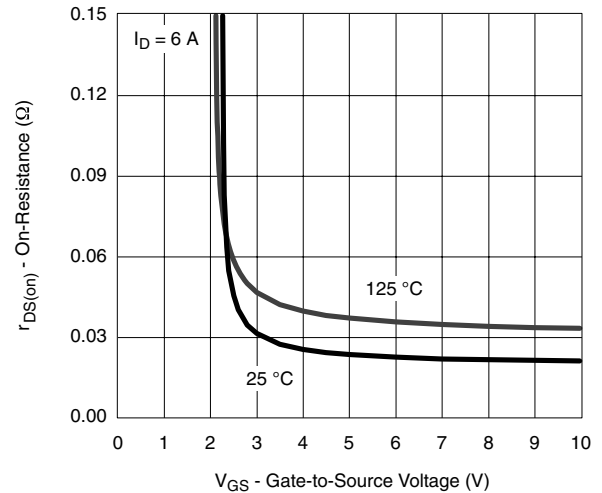
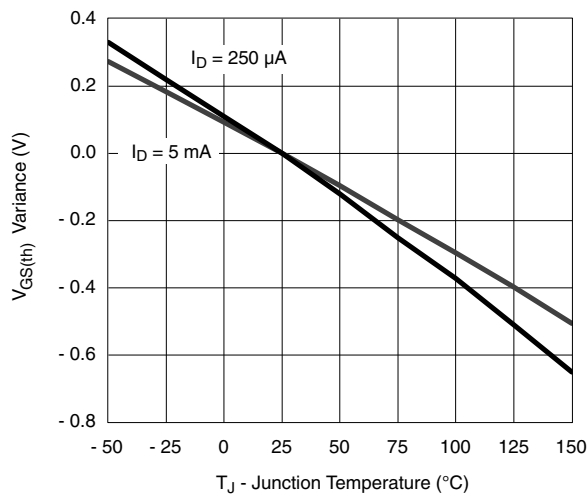
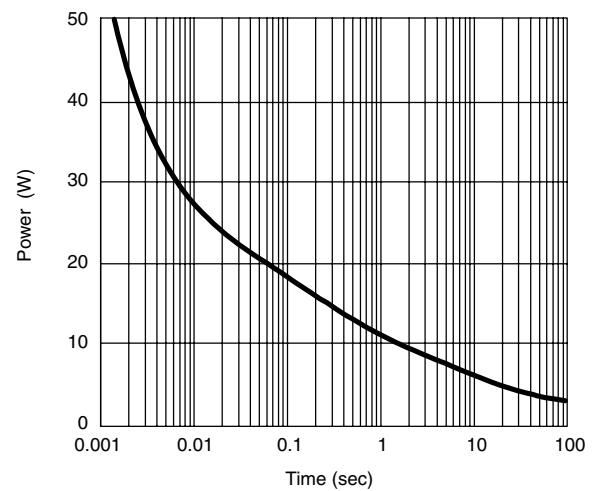
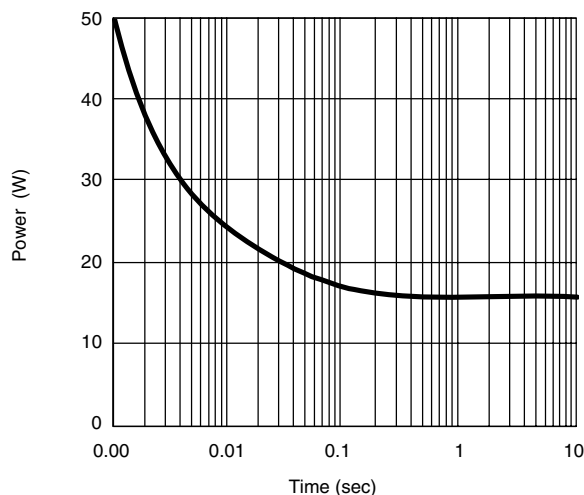
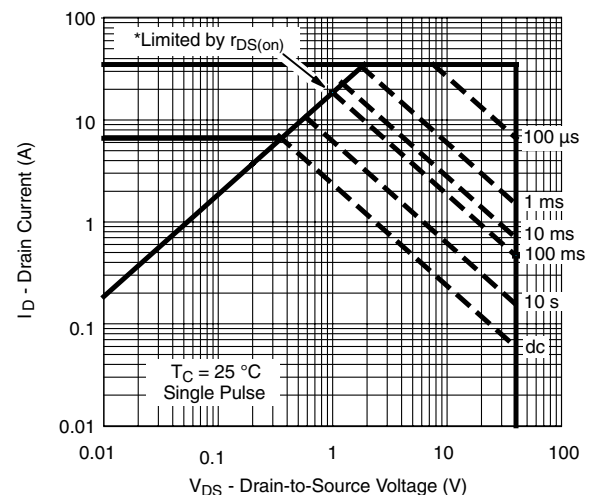
Notes:

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

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

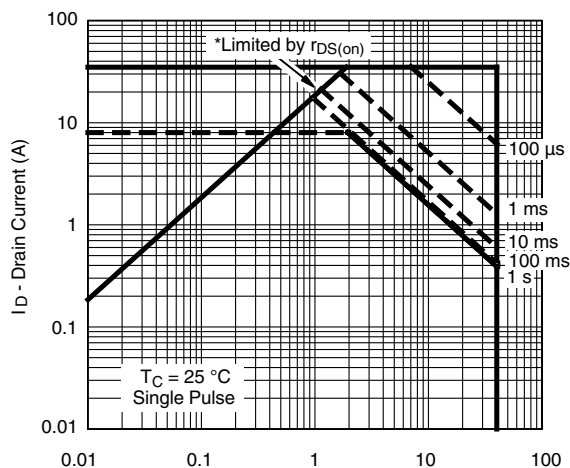
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted

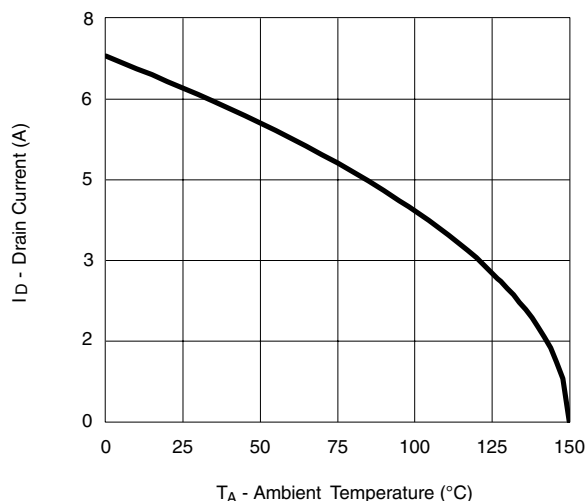
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted

Source-Drain Diode Forward Voltage

On-Resistance vs. Gate-to-Source Voltage

Threshold Voltage

Single Pulse Power, Junction-to-Ambient

Single Pulse Power, Junction-to-Case


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

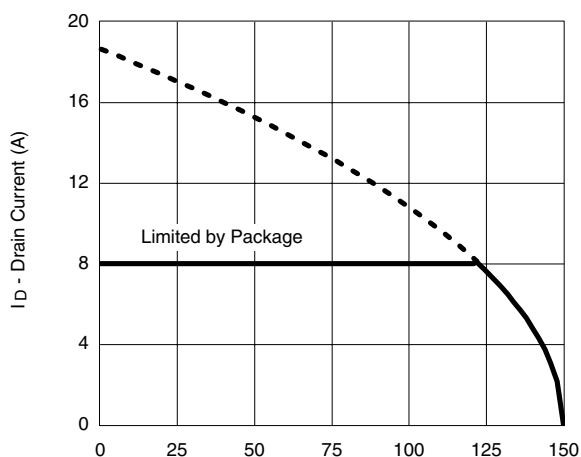
Safe Operating Area, Junction-to-Ambient

N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted

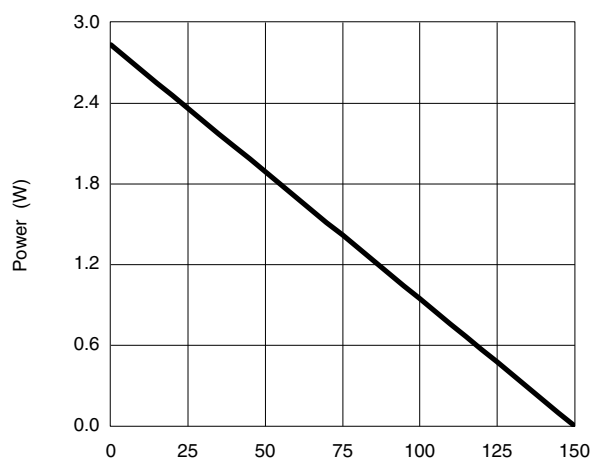
* $V_{GS} >$ minimum V_{GS} at which $r_{DS(on)}$ is specified
Safe Operating Area, Junction-to-Case



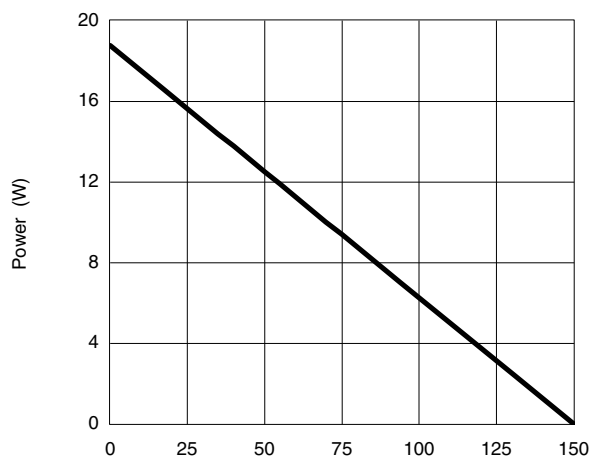
Current Derating, Junction-to-Ambient



Current Derating, Junction-to-Case

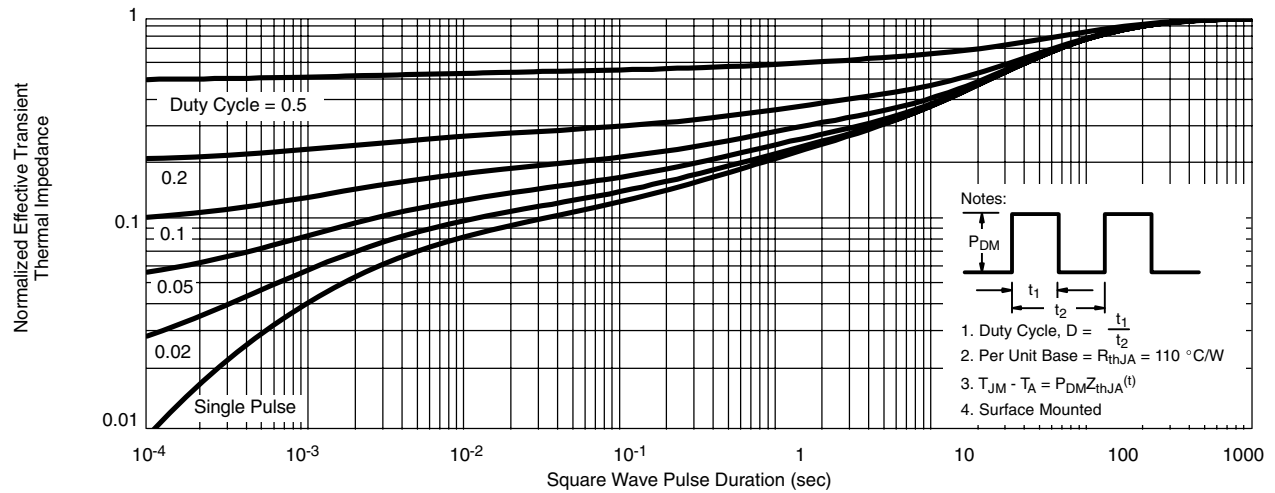


Power Derating, Junction-to-Ambient

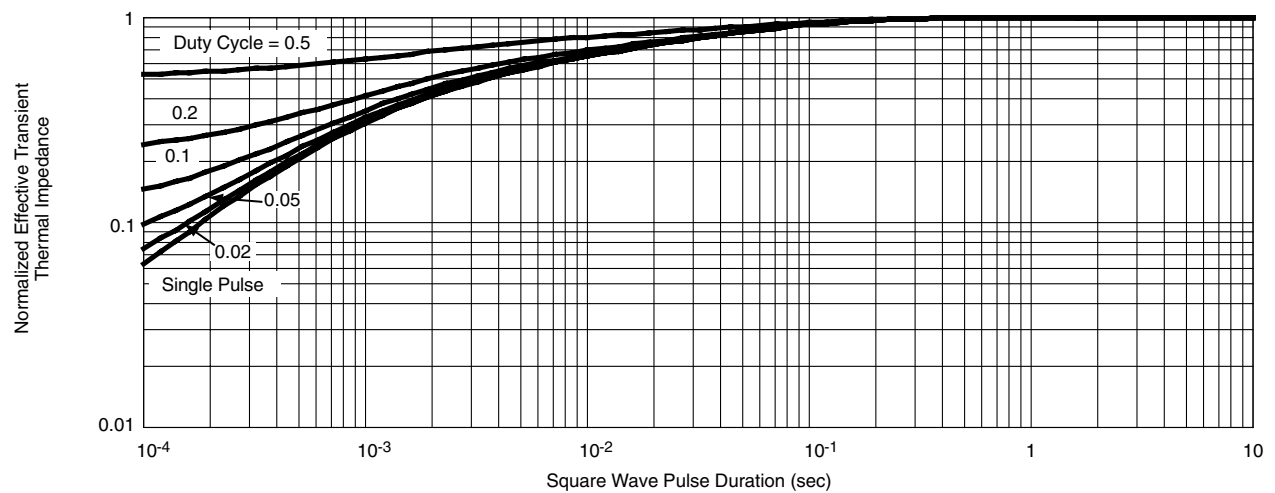


Power Derating, Junction-to-Case

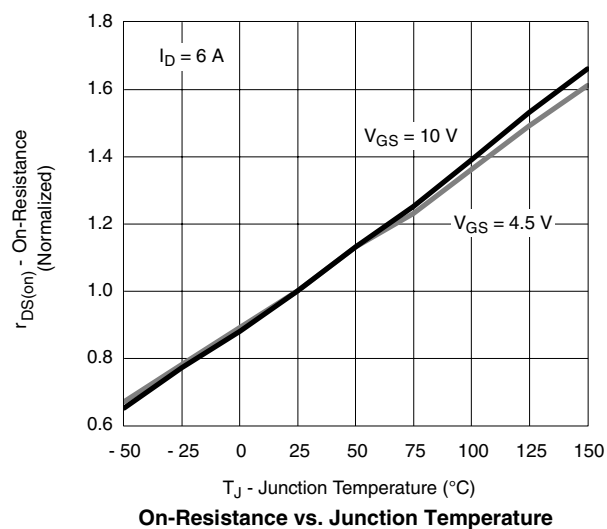
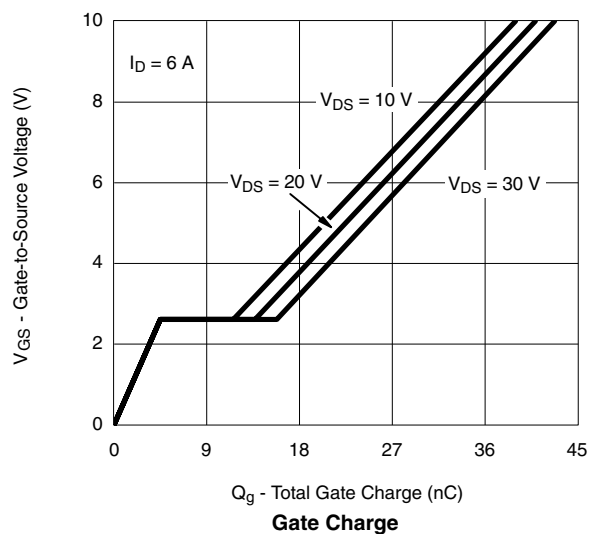
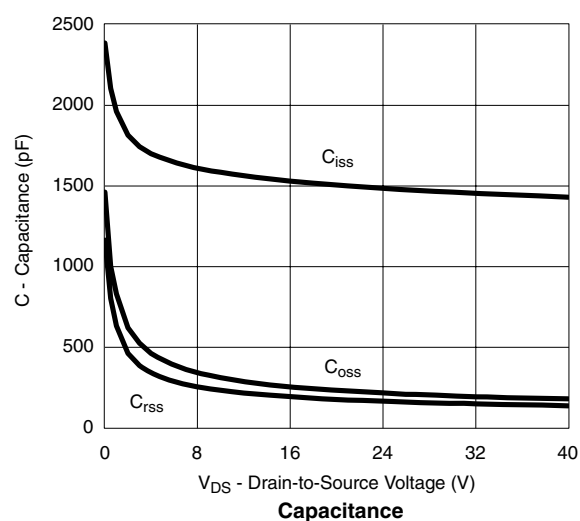
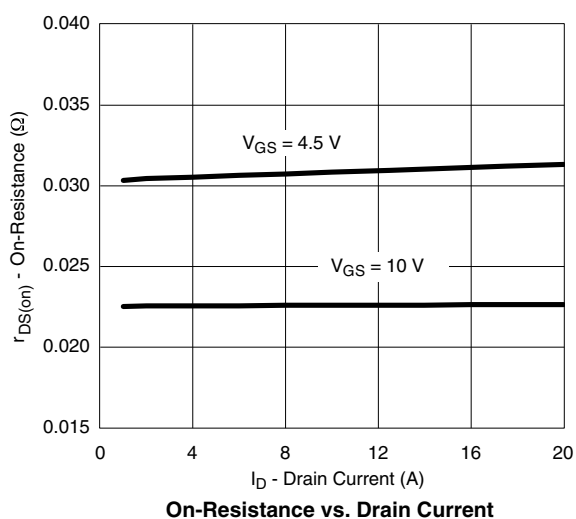
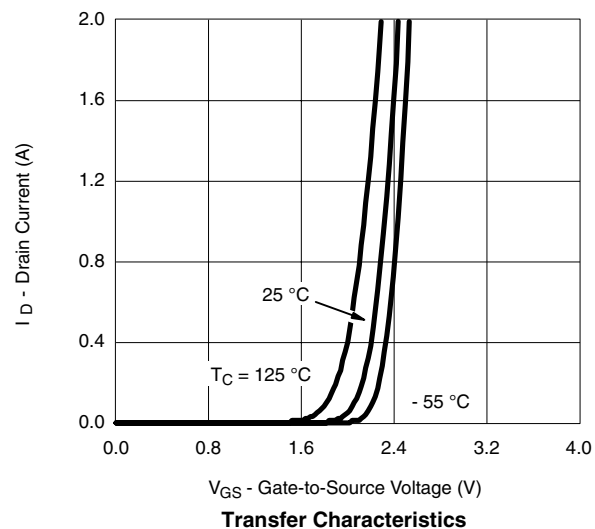
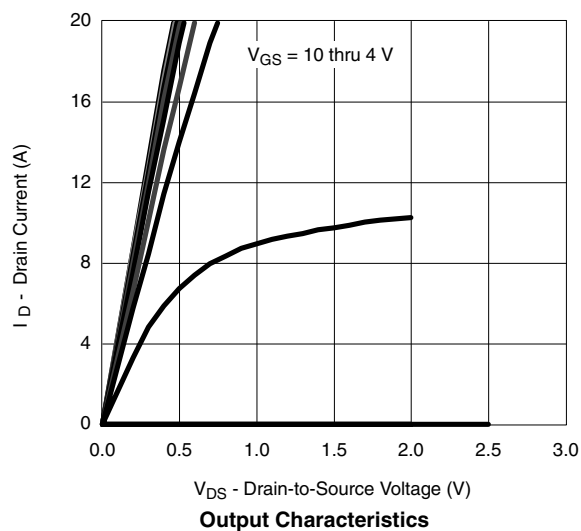
*The power dissipation P_D is based on $T_{J(max)} = 150\text{ }^\circ\text{C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below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

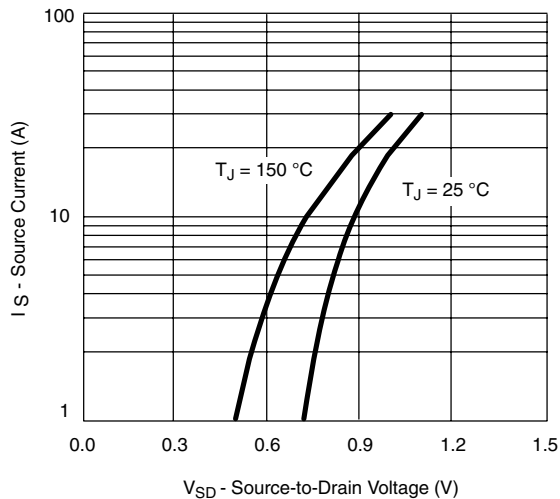
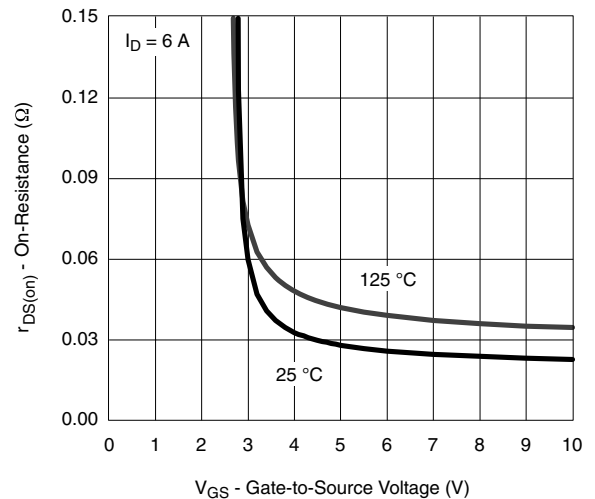
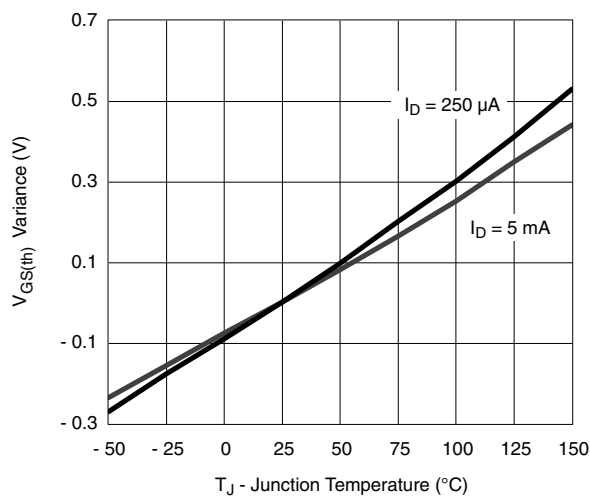
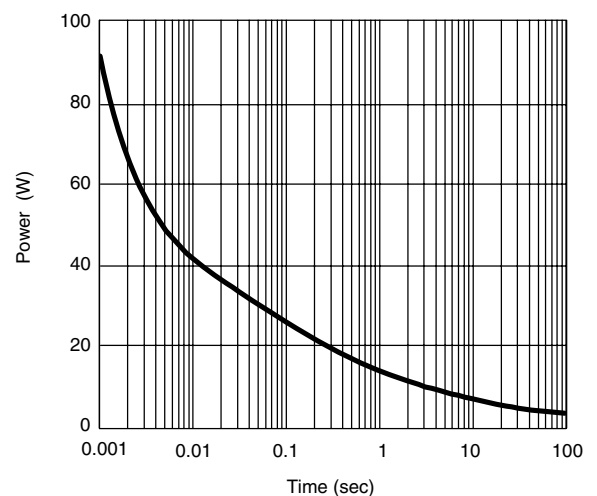
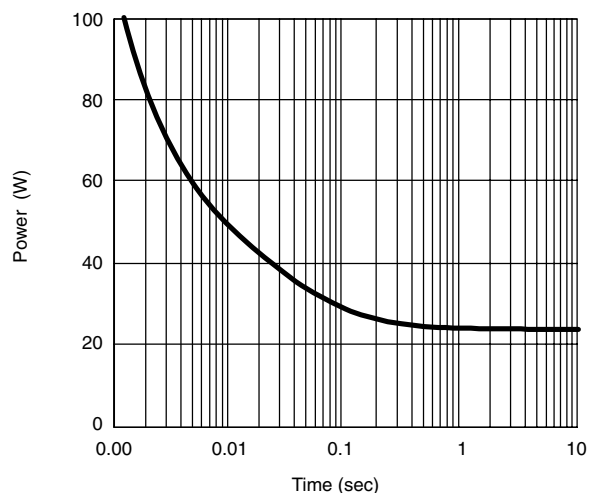
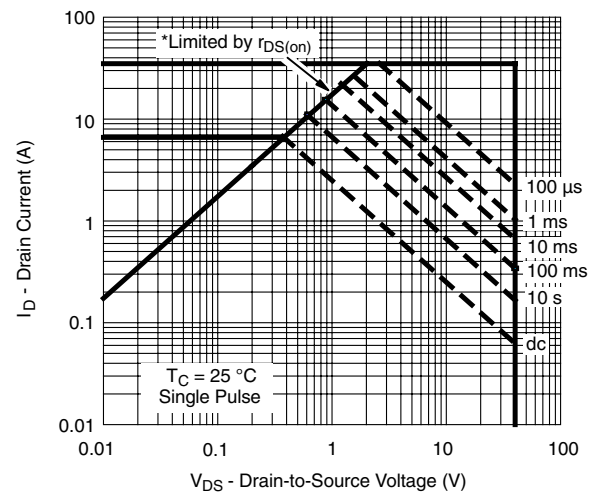
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted


Normalized Thermal Transient Impedance, Junction-to-Ambient

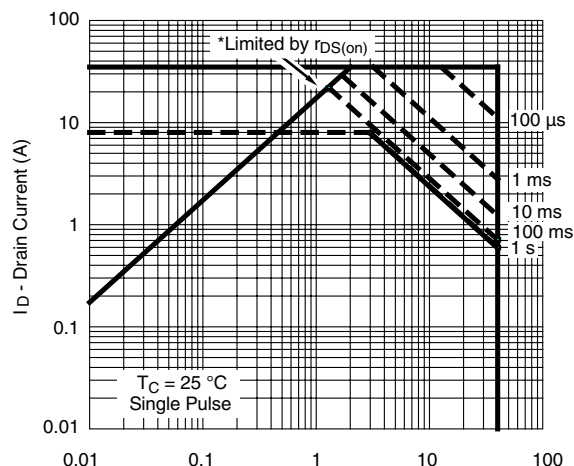


Normalized Thermal Transient Impedance, Junction-to-Case

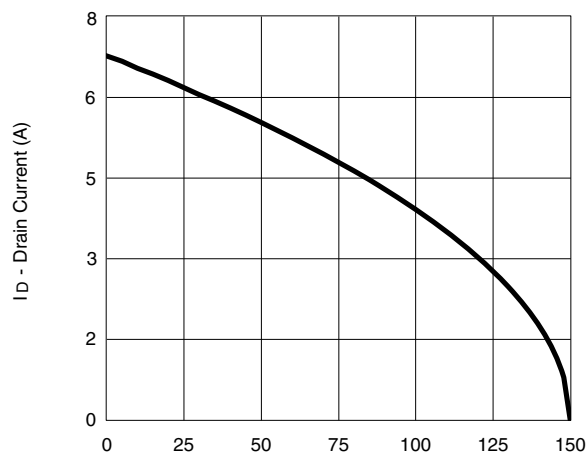
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted

P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted

Source-Drain Diode Forward Voltage

On-Resistance vs. Gate-to-Source Voltage

Threshold Voltage

Single Pulse Power, Junction-to-Ambient

Single Pulse Power, Junction-to-Case

Safe Operating Area, Junction-to-Ambient

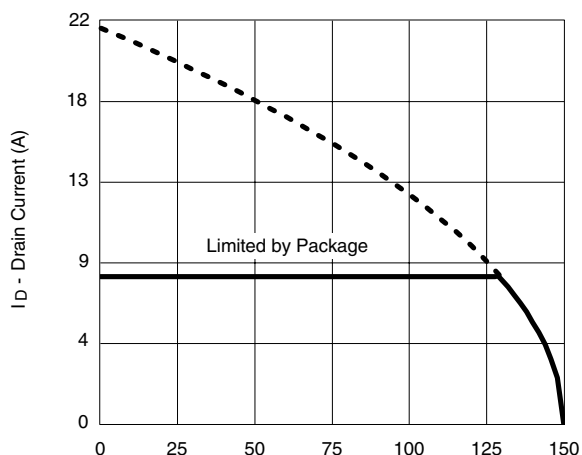
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted



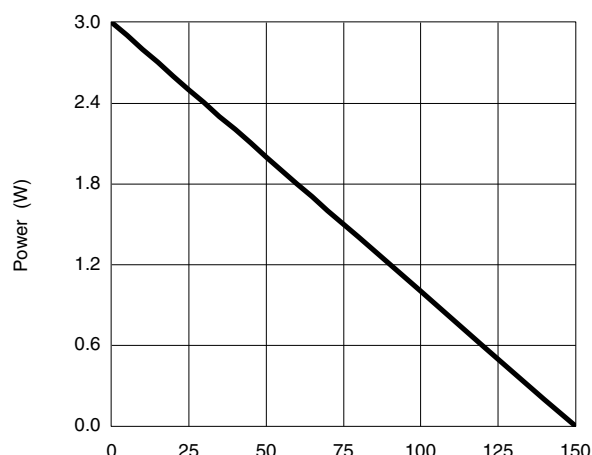
* $V_{GS} >$ minimum V_{GS} at which $r_{DS(on)}$ is specified
Safe Operating Area, Junction-to-Case



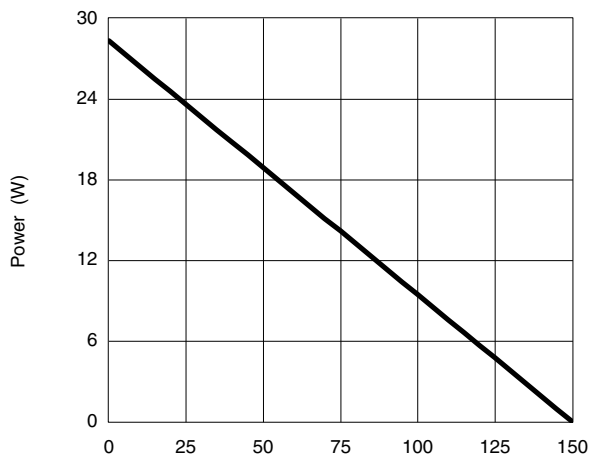
Current Derating, Junction-to-Ambient



Current Derating, Junction-to-Case

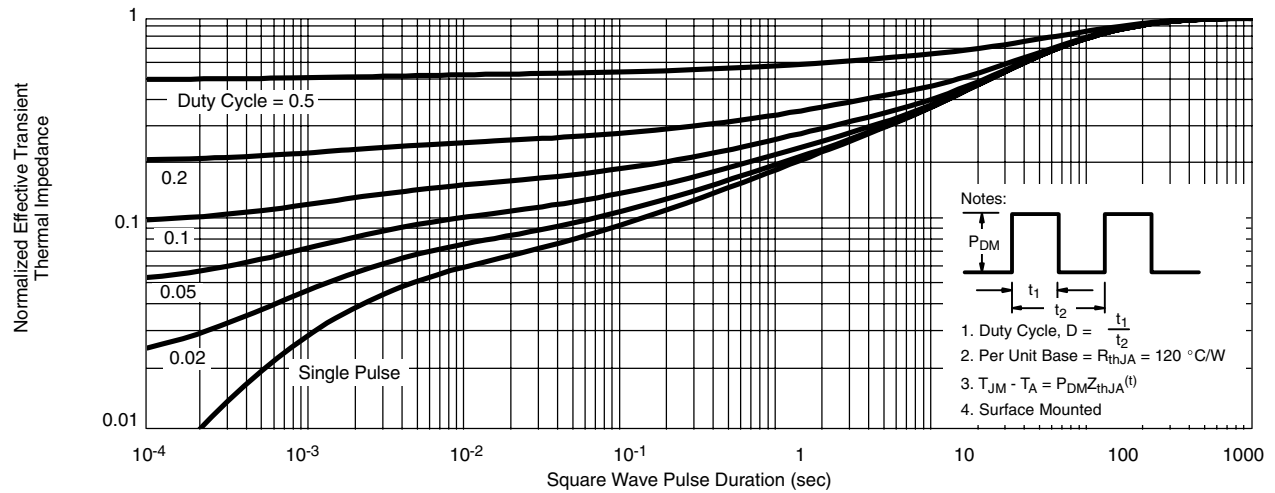


Power Derating, Junction-to-Ambient

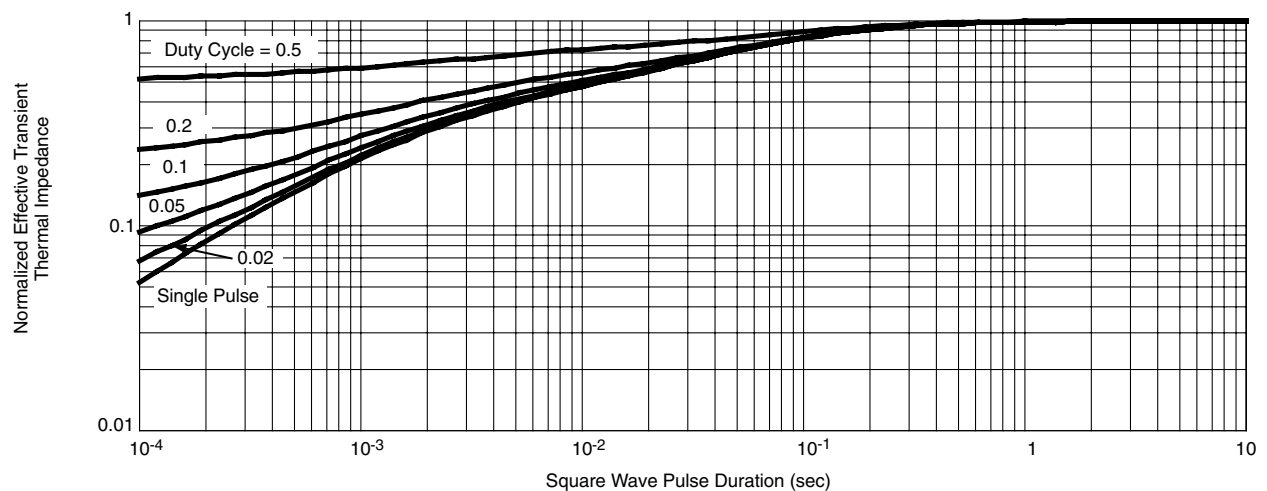


Power Derating, Junction-to-Case

*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.

P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted


Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

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