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

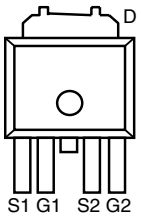
- TrenchFET® Power MOSFET
- 100 % R_g and UIS Tested

RoHS COMPLIANT

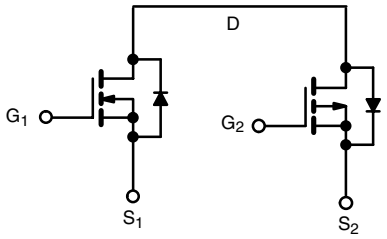
APPLICATIONS

- CCFL Inverter
  - LCD TV and Monitor

TO-252-4L
D-PAK



Top View
Drain Connected to Tab



N-Channel MOSFET P-Channel MOSFET

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

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	
Single Pulse Avalanche Energy		E_{AS}	5	20	mJ
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	$\Delta V_{DS}/T_J$	I_D = 250 µA	N-Ch		37		
		I_D = - 250 µA	P-Ch		- 38		
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	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			100	nA
			P-Ch			- 100	
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		855		pF
			P-Ch		1505		
Output Capacitance	C_{oss}		N-Ch		105		
		P-Channel V_{DS} = - 20 V, V_{GS} = 0 V, f = 1 MHz	P-Ch		230		
Reverse Transfer Capacitance	C_{rss}		N-Ch		65		
			P-Ch		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	
		N-Channel V_{DS} = 20 V, V_{GS} = 4.5 V, I_D = 5 A	N-Ch		9.6	14.5	
			P-Ch		21	31	
Gate-Source Charge	Q_{gs}		N-Ch		2.3		
		P-Channel V_{DS} = - 20 V, V_{GS} = - 4.5 V, I_D = - 5 A	P-Ch		4.5		
Gate-Drain Charge	Q_{gd}		N-Ch		3.2		
			P-Ch		9.2		
Gate Resistance	R_g	f = 1 MHz	N-Ch		2.5	3.8	Ω
			P-Ch		6.5	10	

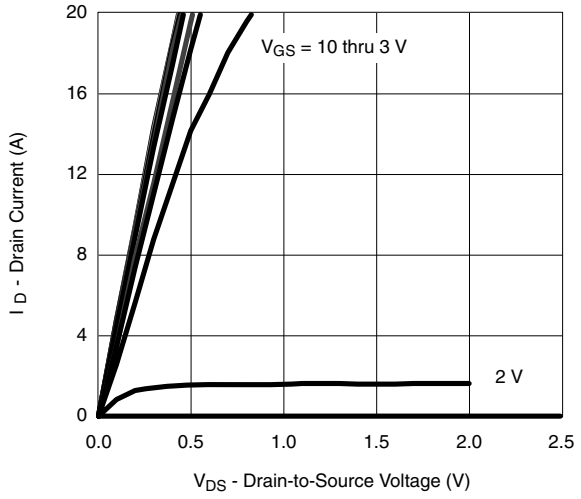
SPECIFICATIONS T_J = 25 °C, unless otherwise noted

Parameter	Symbol	Test Conditions		Min	Typ[a]	Max	Unit
Dynamic[a]							
Turn-On Delay Time	$t_{d(on)}$	N-Channel V_{DD} = 20 V, R_L = 4 Ω, $I_D \cong$ 5 A, V_{GEN} = 10 V, R_g = 1 Ω P-Channel V_{DD} = - 20 V, R_L = 4 Ω, $I_D \cong$ - 5 A, V_{GEN} = - 10 V, R_g = 1 Ω	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	$t_{d(off)}$		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 V, R_L = 4 Ω, $I_D \cong$ 5 A, V_{GEN} = 4.5 V, R_g = 1 Ω P-Channel V_{DD} = - 20 V, R_L = 4 Ω, $I_D \cong$ - 5 A, V_{GEN} = - 4.5 V, R_g = 1 Ω	N-Ch		12	20	
			P-Ch		40	60	
Rise Time	t_r		N-Ch		75	115	
			P-Ch		106	160	
Turn-Off Delay Time	$t_{d(off)}$		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 °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 A	N-Ch		0.73	1.2	V
		I_S = - 1.6 A	P-Ch		- 0.73	- 1.2	
Body Diode Reverse Recovery Time	t_{rr}	N-Channel I_F = 5 A, di/dt = 100 A/µs, T_J = 25 °C P-Channel I_F = - 5 A, di/dt = - 100 A/µs, T_J = 25 °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		N-Ch		13		ns
			P-Ch		15		
Reverse Recovery Rise Time	t_b		N-Ch		13		
			P-Ch		15		

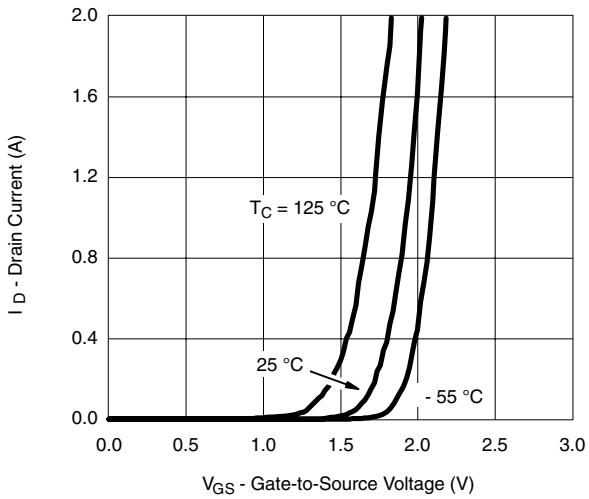
Notes:
a. Guaranteed by design, not subject to production testing.
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.

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.

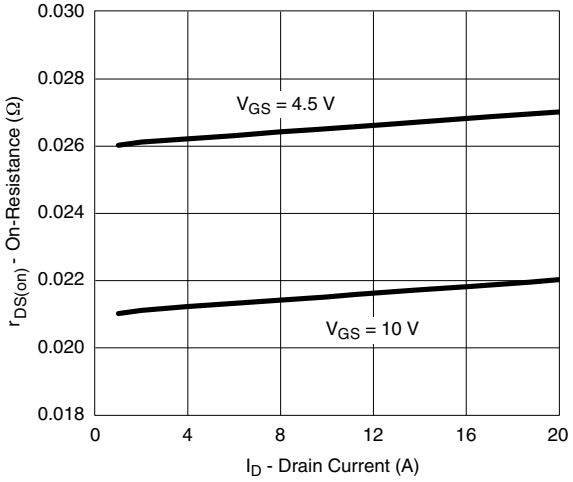
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted



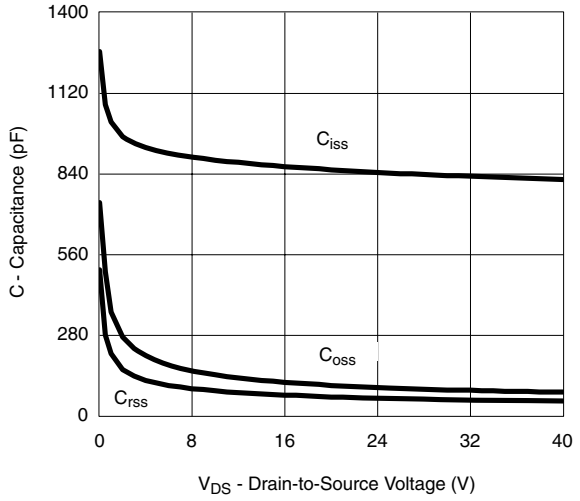
Output Characteristics



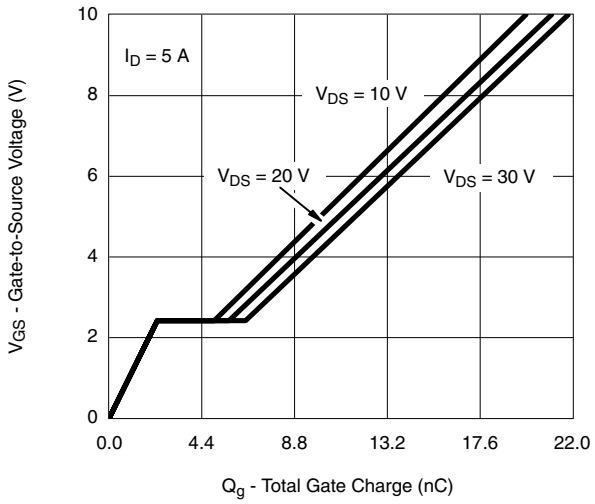
Transfer Characteristics



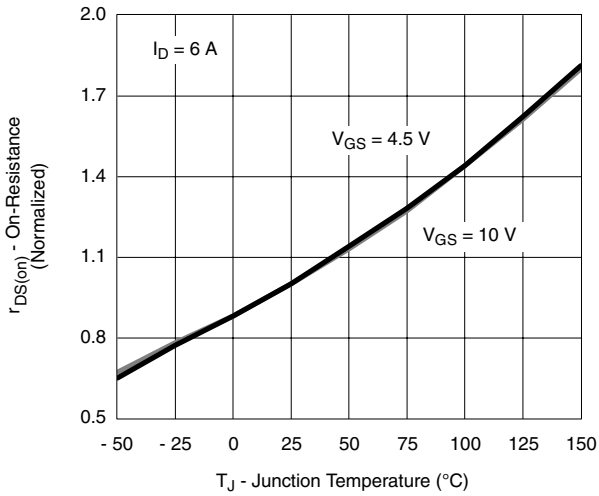
On-Resistance vs. Drain Current



Capacitance

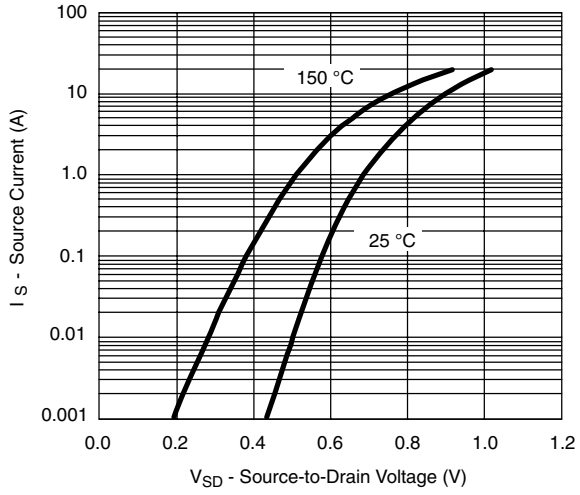


Gate Charge

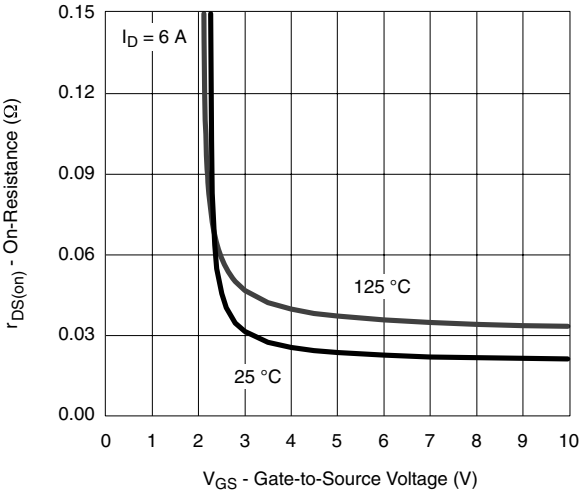


On-Resistance vs. Junction Temperature

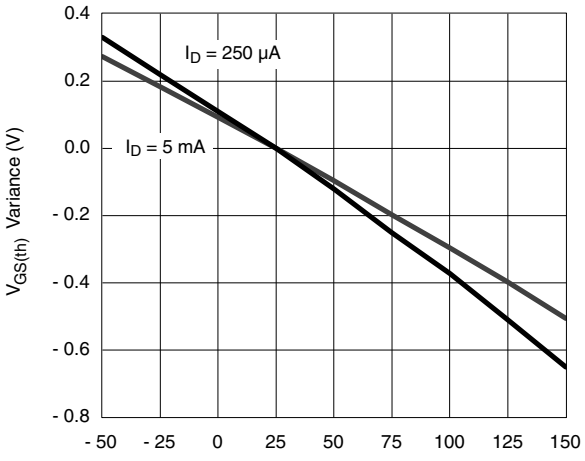
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted



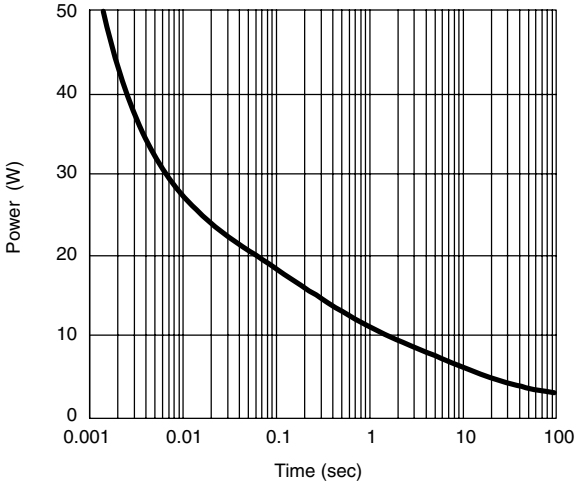
Source-Drain Diode Forward Voltage



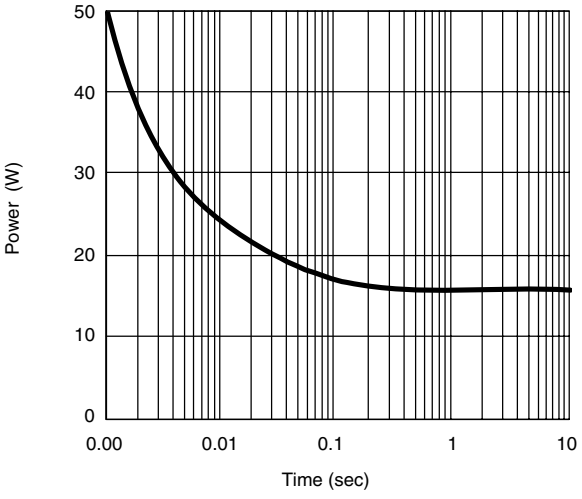
On-Resistance vs. Gate-to-Source Voltage



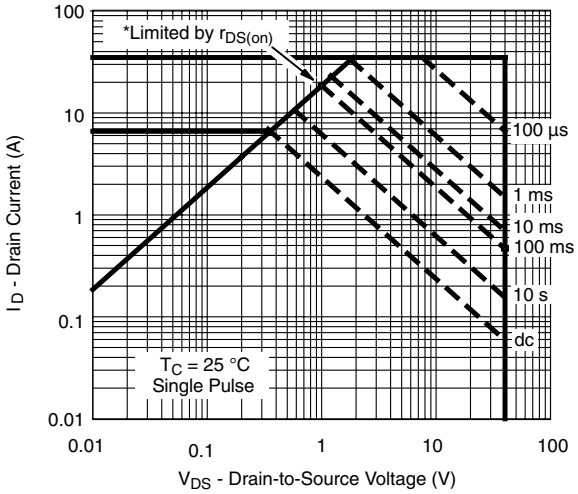
Threshold Voltage



Single Pulse Power, Junction-to-Ambient



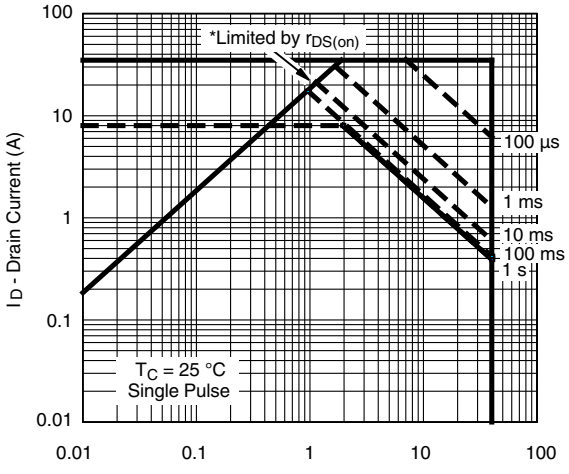
Single Pulse Power, Junction-to-Case



*V GS > minimum V GS at which r DS(on) is specified

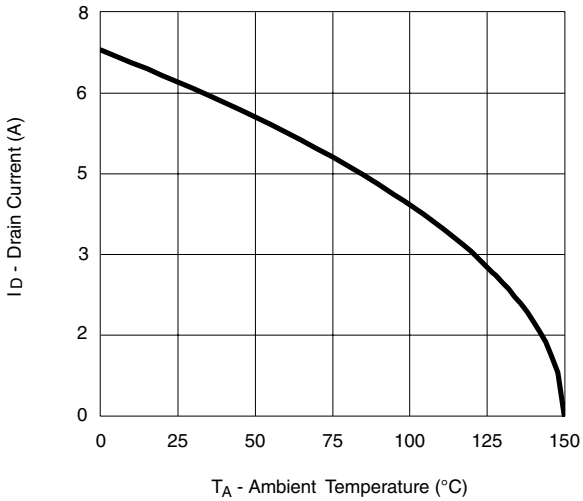
Safe Operating Area, Junction-to-Ambient

N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted

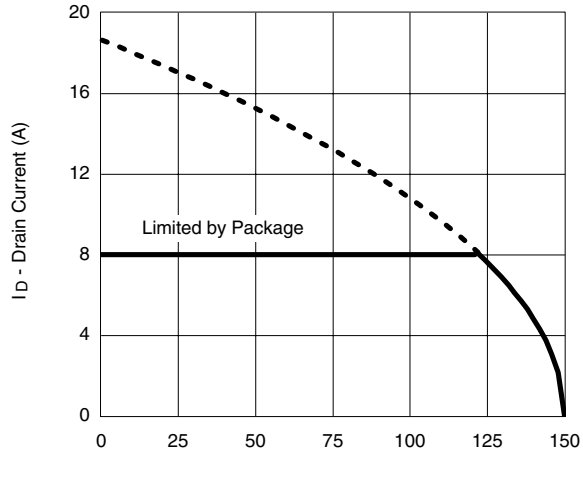


*V_{GS} > minimum V_{GS} at which $r_{DS(on)}$ is specified

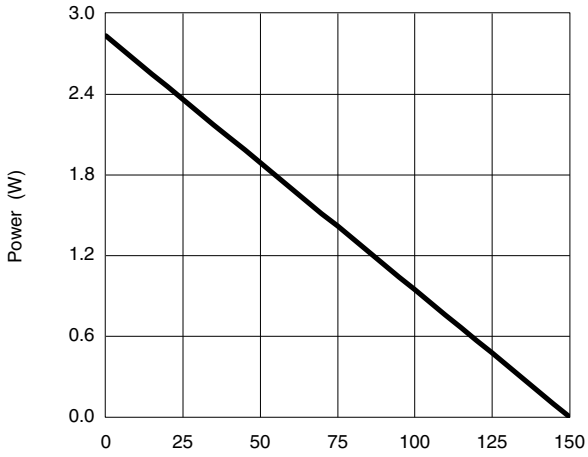
Safe Operating Area, Junction-to-Case



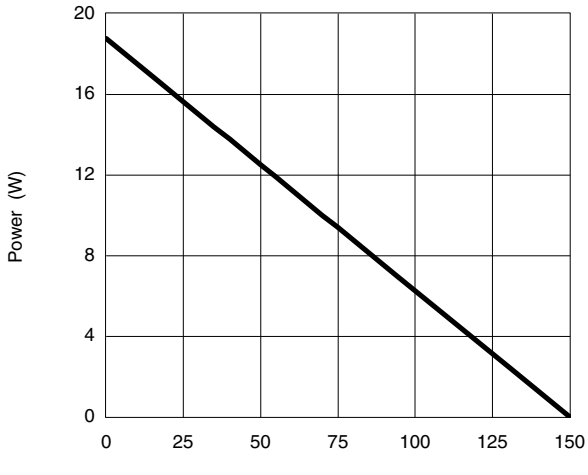
Current Derating, Junction-to-Ambient



Current Derating, Junction-to-Case



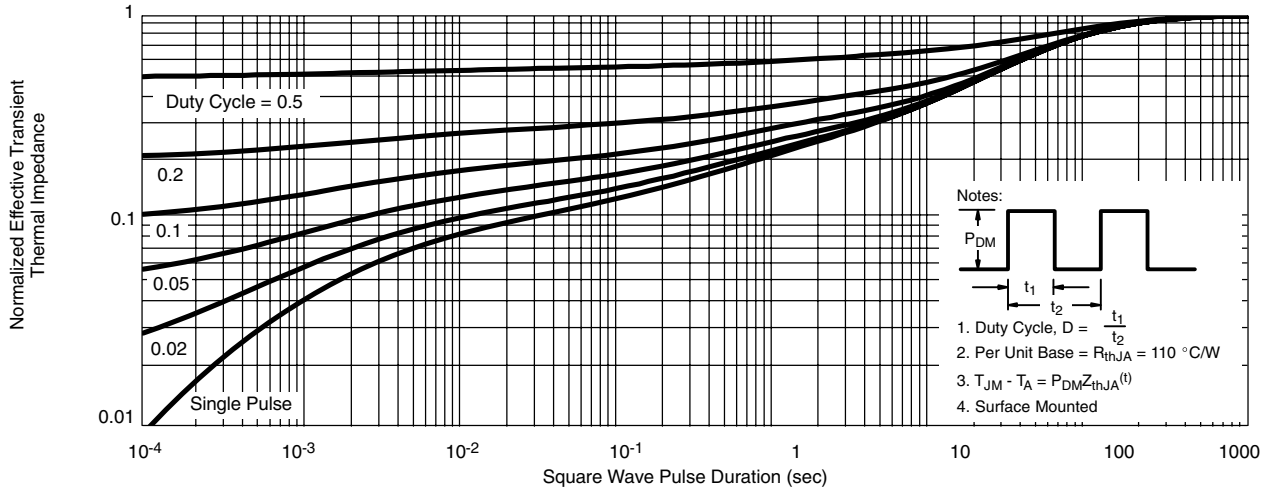
Power Derating, Junction-to-Ambient



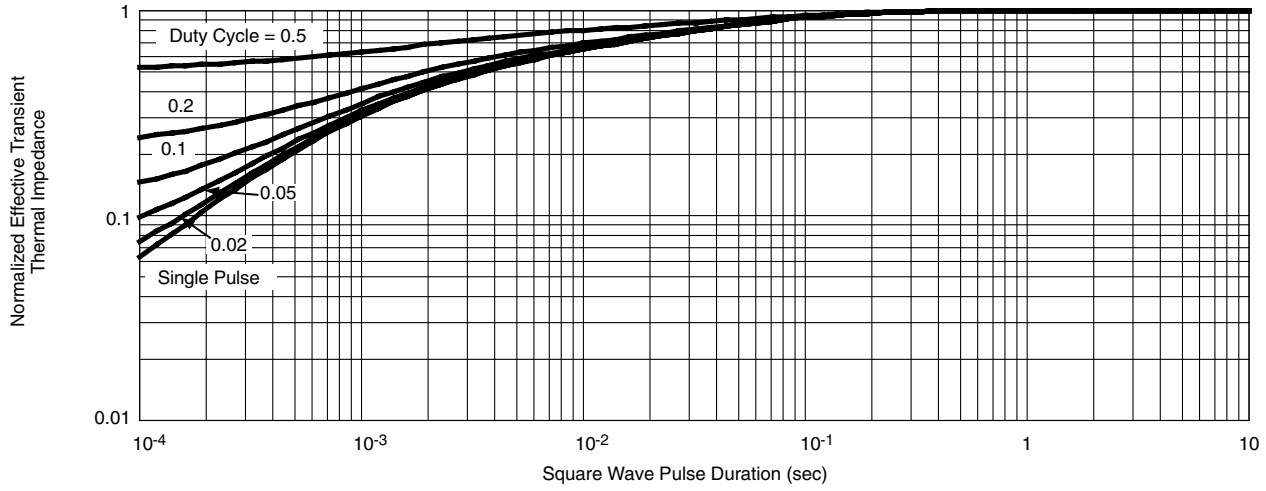
Power Derating, Junction-to-Case

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

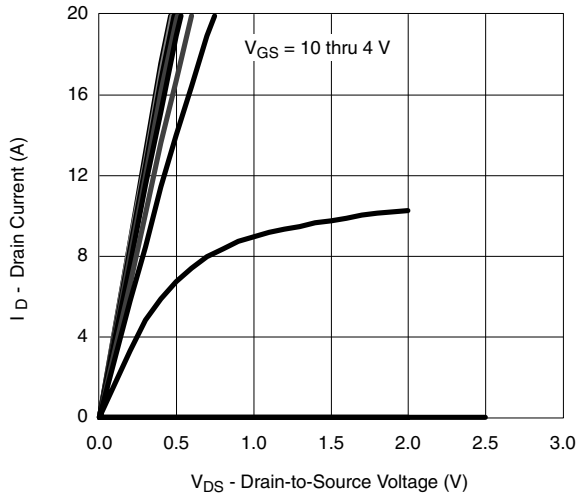


Normalized Thermal Transient Impedance, Junction-to-Ambient

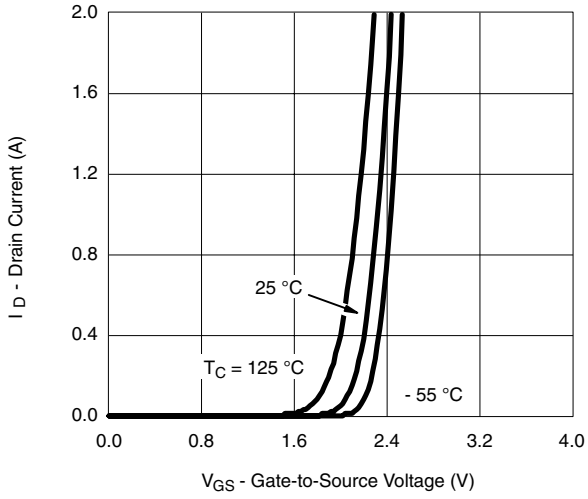


Normalized Thermal Transient Impedance, Junction-to-Case

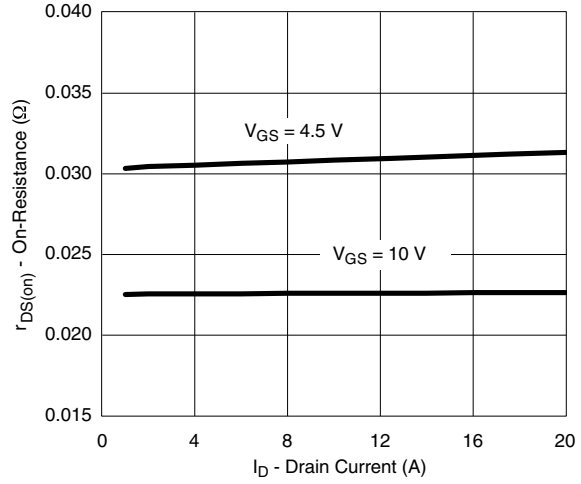
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted



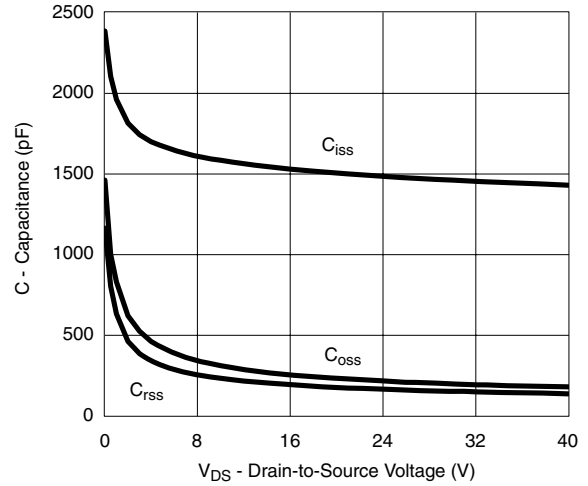
Output Characteristics



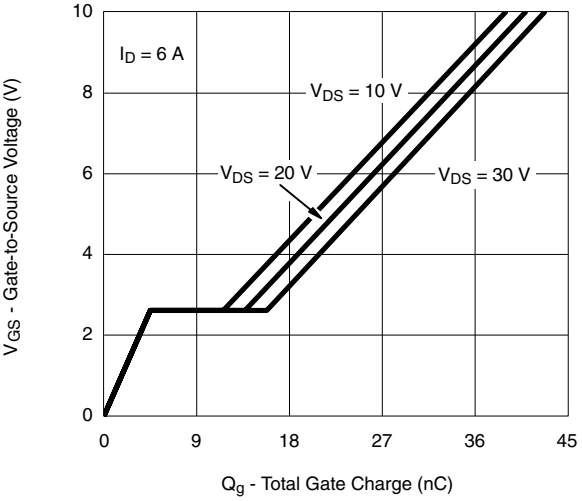
Transfer Characteristics



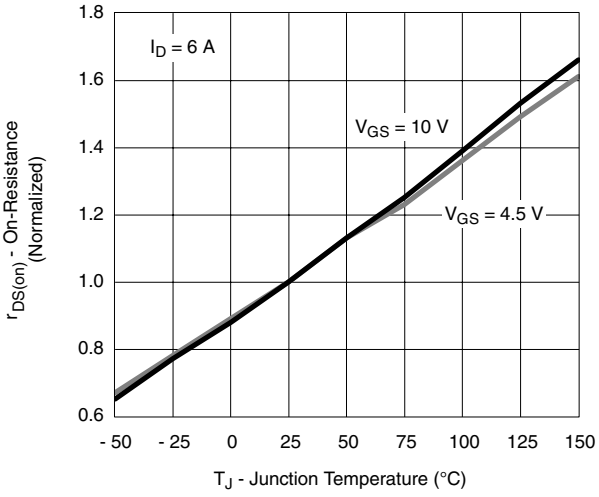
On-Resistance vs. Drain Current



Capacitance

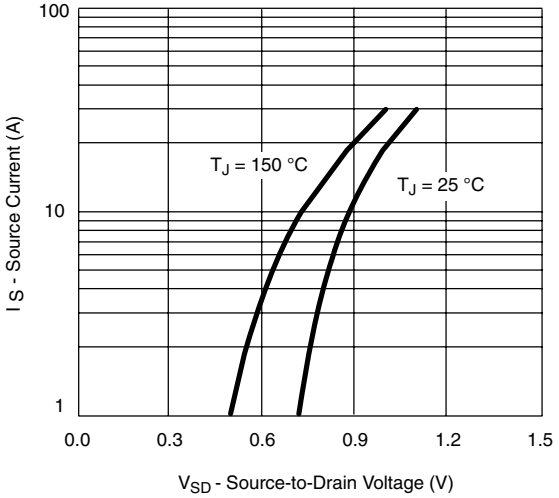


Gate Charge

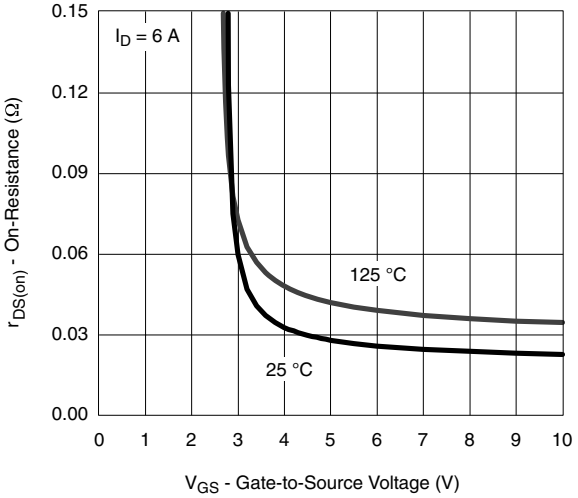


On-Resistance vs. Junction Temperature

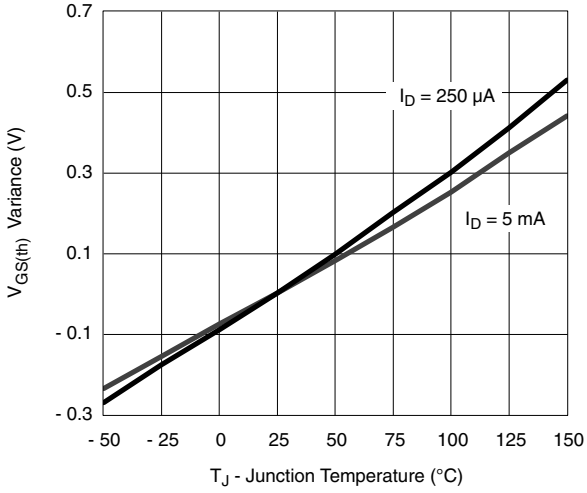
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted



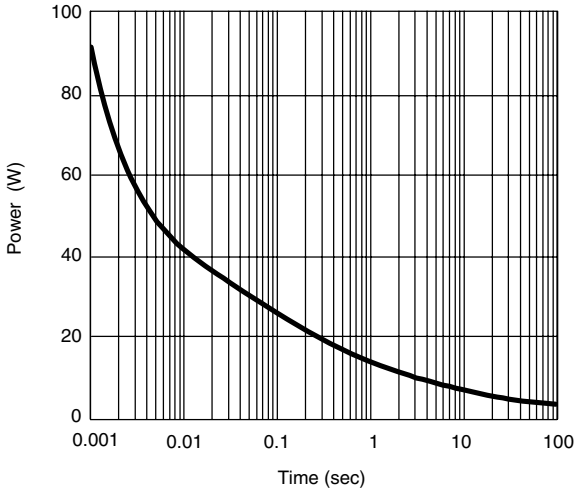
Source-Drain Diode Forward Voltage



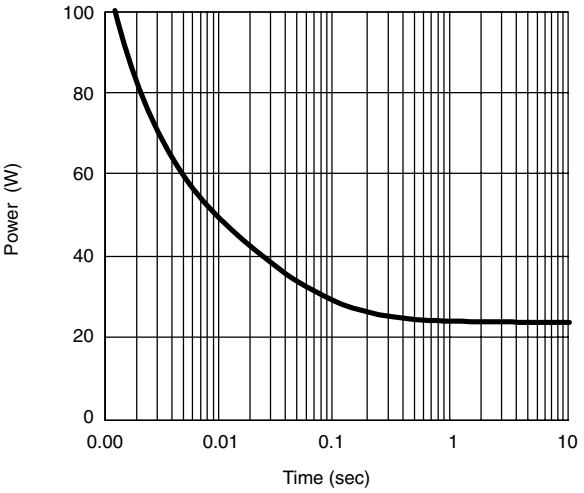
On-Resistance vs. Gate-to-Source Voltage



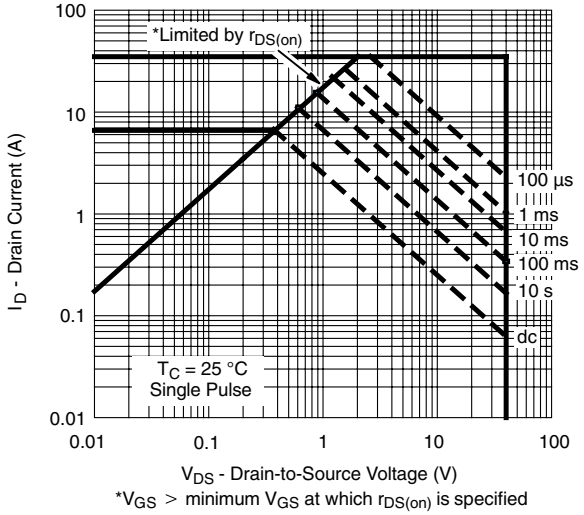
Threshold Voltage



Single Pulse Power, Junction-to-Ambient



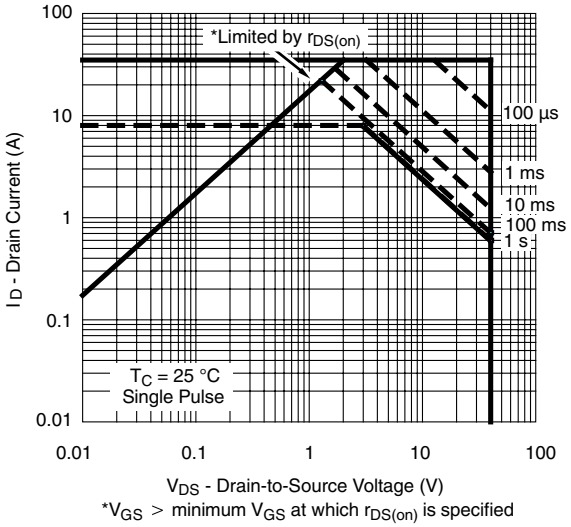
Single Pulse Power, Junction-to-Case



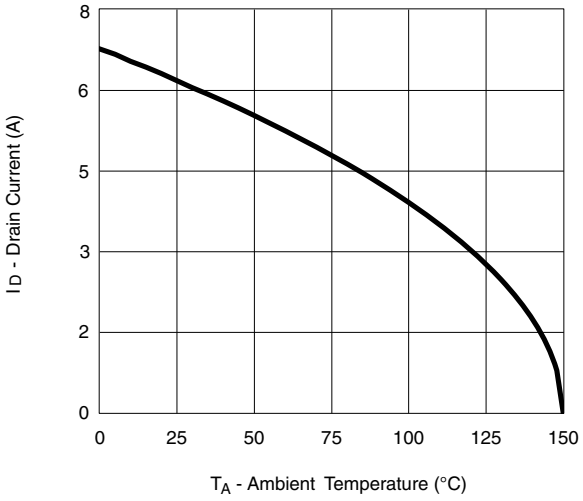
*V GS > minimum V GS at which r DS(on) is specified

Safe Operating Area, Junction-to-Ambient

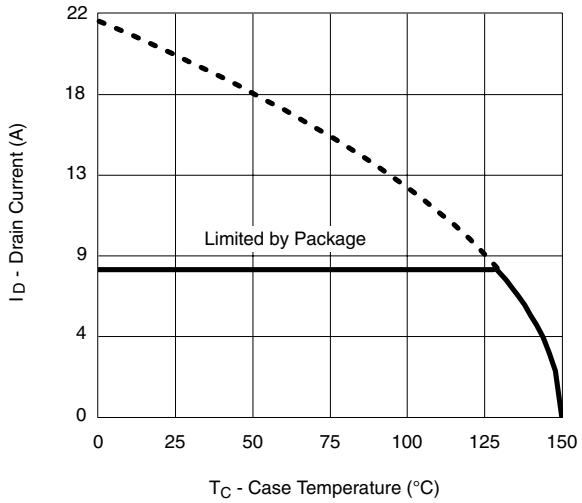
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless noted



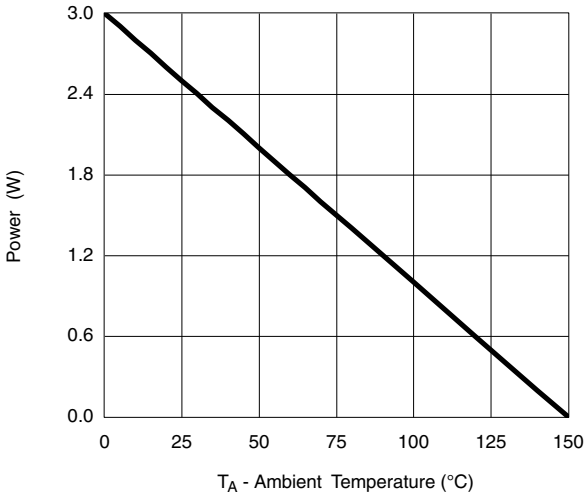
Safe Operating Area, Junction-to-Case



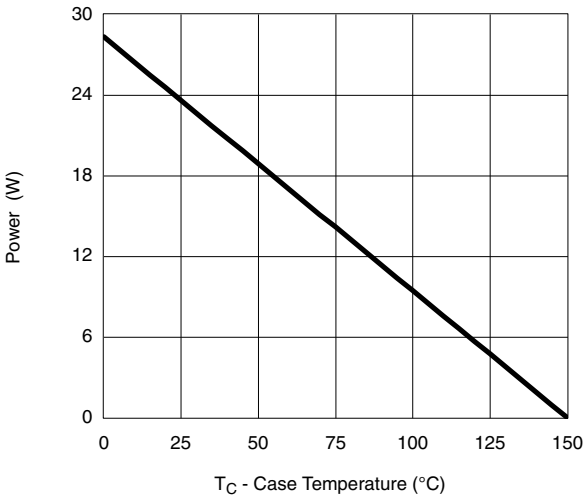
Current Derating, Junction-to-Ambient



Current Derating, Junction-to-Case



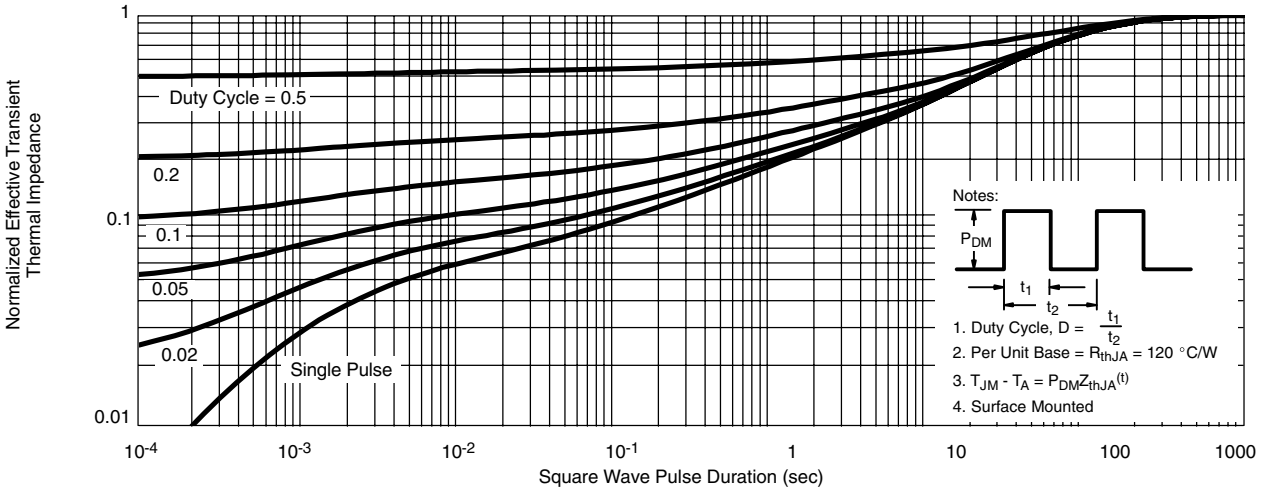
Power Derating, Junction-to-Ambient



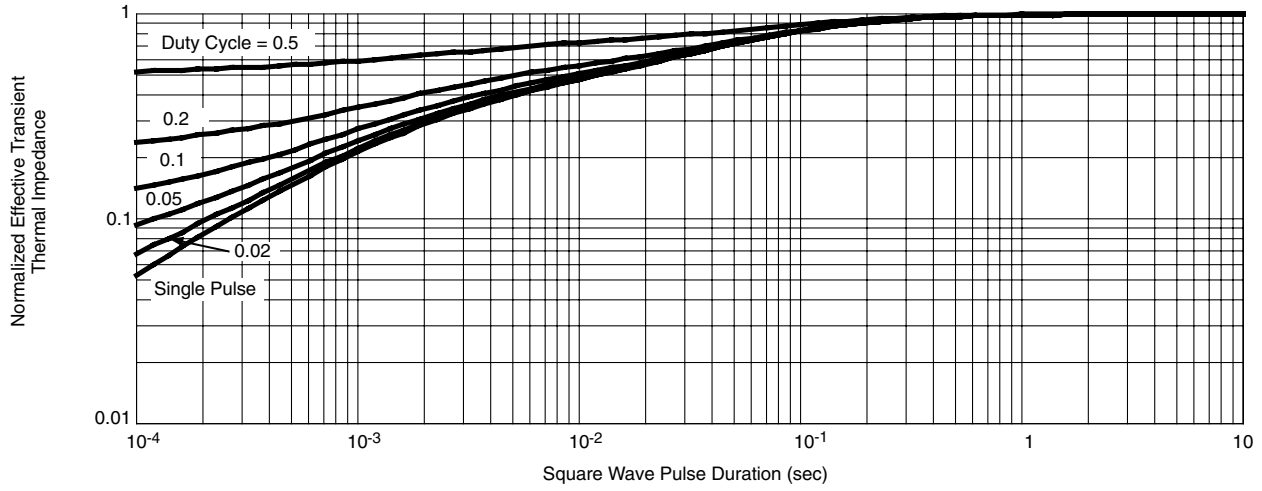
Power Derating, Junction-to-Case

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

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see http://www.vishay.com/ppg?74401.

Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.