N-Channel 40-V (D-S), 175 °C MOSFET

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)[a]	Q_g (Typ.)
40	0.010 at V_{GS} = 10 V	20	30 nC
	0.012 at V_{GS} = 4.5 V	20	

FEATURES

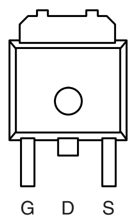
- TrenchFET® Power MOSFET
- 100 % R_g and UIS Tested

RoHS
COMPLIANT

APPLICATIONS

- LCD TV Inverter
- Secondary Synchronous Rectification

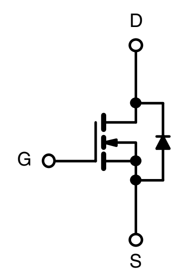
TO-252



Drain Connected to Tab

Top View

Ordering Information: SUD50N04-10P-E3 (Lead (Pb)-free)



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS T_A = 25 °C, unless otherwise noted				
Parameter		**Symbol**	**Limit**	**Unit**
Drain-Source Voltage		V_{DS}	40	V
Gate-Source Voltage		V_{GS}	± 16	
Continuous Drain Current (T_J = 150 °C)	T_C = 25 °C	I_D	20[a]	A
	T_C = 100 °C		20[a]	
	T_A = 25 °C		12.6[b]	
	T_A = 100 °C		8.9[b]	
Pulsed Drain Current		I_{DM}	100	
Continuous Source-Drain Diode Current	T_C = 25 °C	I_S	20[a]	
	T_A = 25 °C		2.5[b]	
Single Pulse Avalanche Current	L = 0.1 mH	I_{AS}	30	
Avalanche Energy		E_{AS}	45	mJ
Maximum Power Dissipation	T_C = 25 °C	P_D	53.5	W
	T_C = 100 °C		26.7	
	T_A = 25 °C		3.2[b]	
	T_A = 100 °C		1.6[b]	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 175	°C

THERMAL RESISTANCE RATINGS					
Parameter		**Symbol**	**Typical**	**Maximum**	**Unit**
Maximum Junction-to-Ambient[b]	Steady State	R_{thJA}	38	47	°C/W
Maximum Junction-to-Case	Steady State	R_{thJC}	2	2.8	

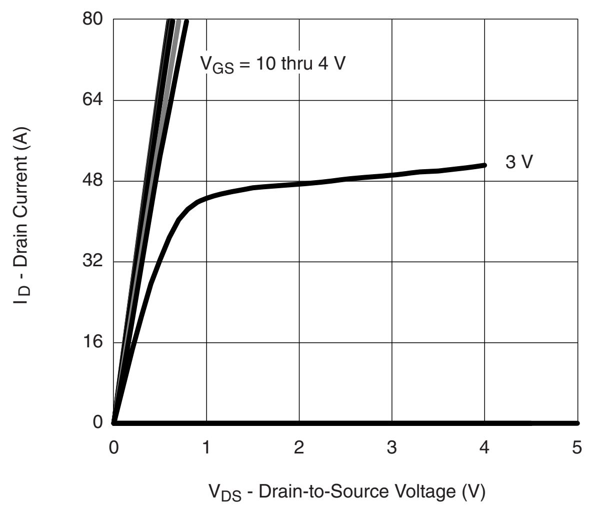
Notes:
a. Package limited.
b. Surface Mounted on 1" x 1" FR4 board.

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	40			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = 250 µA		38		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			- 6		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, I_D = 250 µA	0.8		2.2	V
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 16 V			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 40 V, V_{GS} = 0 V			1	µA
		V_{DS} = 40 V, V_{GS} = 0 V, T_J = 100 °C			20	
On-State Drain Current[a]	$I_{D(on)}$	$V_{DS} \geq 5$ V, V_{GS} = 10 V	30			A
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 15 A		0.0075	0.01	Ω
		V_{GS} = 4.5 V, I_D = 10 A		0.009	0.012	
Forward Transconductance[a]	g_{fs}	V_{DS} = 15 V, I_D = 15 A		77		S
Dynamic[b]						
Input Capacitance	C_{iss}	V_{DS} = 20 V, V_{GS} = 0 V, f = 1 MHz		3050		pF
Output Capacitance	C_{oss}			330		
Reverse Transfer Capacitance	C_{rss}			190		
Total Gate Charge	Q_g	V_{DS} = 20 V, V_{GS} = 10 V, I_D = 30 A		64	100	nC
		V_{DS} = 20 V, V_{GS} = 4.5 V, I_D = 30 A		30	45	
Gate-Source Charge	Q_{gs}			7.7		
Gate-Drain Charge	Q_{gd}			10.8		
Gate Resistance	R_g	f = 1 MHz		1.1	1.7	Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 20 V, R_L = 0.66 Ω $I_D \cong 30$ A, V_{GEN} = 4.5 V, R_g = 1 Ω		20	30	ns
Rise Time	t_r			130	200	
Turn-Off Delay Time	$t_{d(off)}$			56	85	
Fall Time	t_f			35	53	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 20 V, R_L = 0.66 Ω $I_D \cong 30$ A, V_{GEN} = 10 V, R_g = 1 Ω		7	14	
Rise Time	t_r			18	30	
Turn-Off Delay Time	$t_{d(off)}$			28	45	
Fall Time	t_f			8	16	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	T_C = 25 °C			20	A
Pulse Diode Forward Current[a]	I_{SM}				50	
Body Diode Voltage	V_{SD}	I_S = 10 A		0.81	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	I_F = 20 A, dI/dt = 100 A/µs, T_J = 25 °C		22	35	ns
Body Diode Reverse Recovery Charge	Q_{rr}			26	41	nC
Reverse Recovery Fall Time	t_a			17		ns
Reverse Recovery Rise Time	t_b			9		

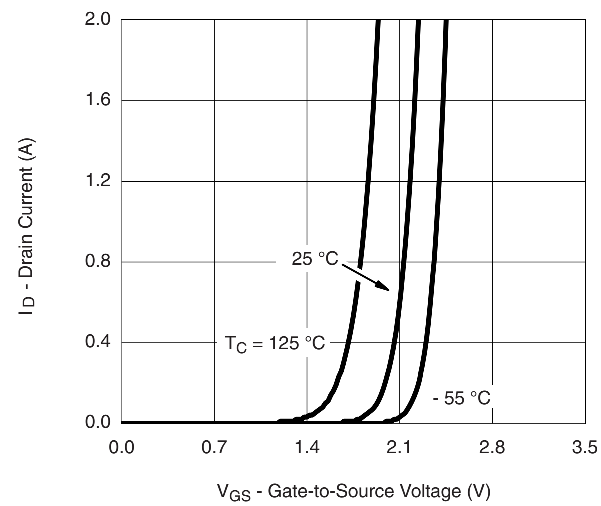
Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.

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.

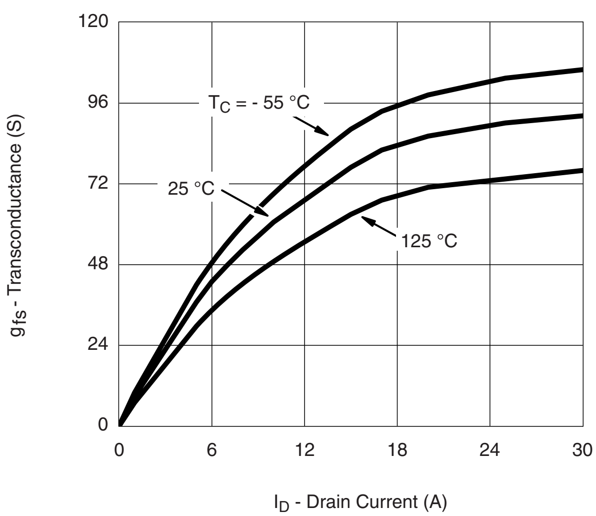
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



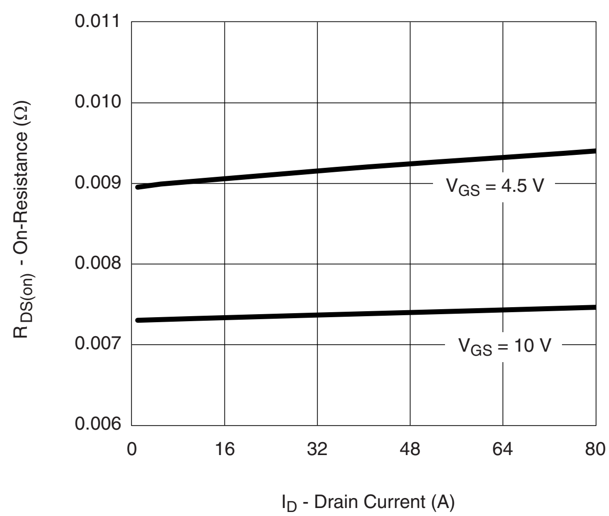
Output Characteristics



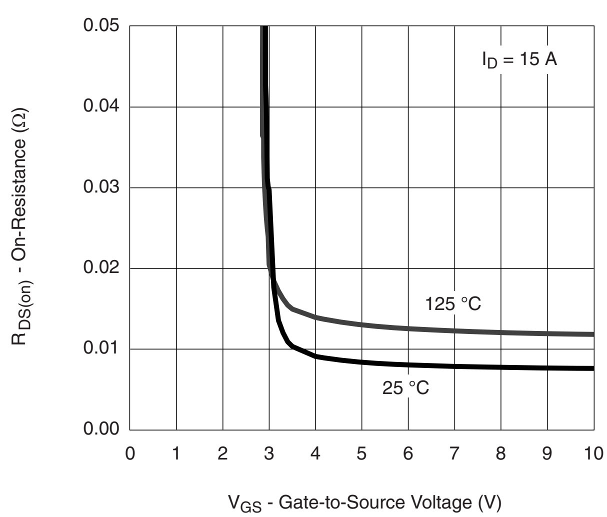
Transfer Characteristics



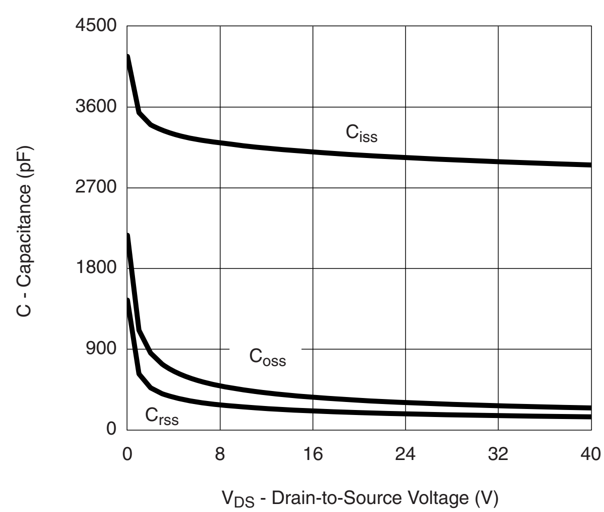
Transconductance



On-Resistance vs. Drain Current

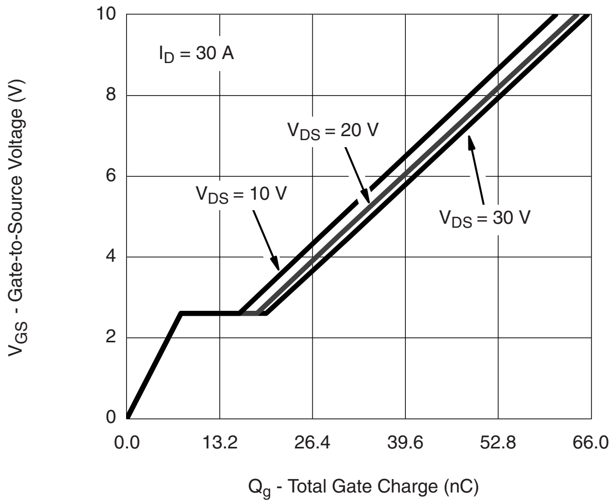


On-Resistance vs. Gate-to-Source Voltage

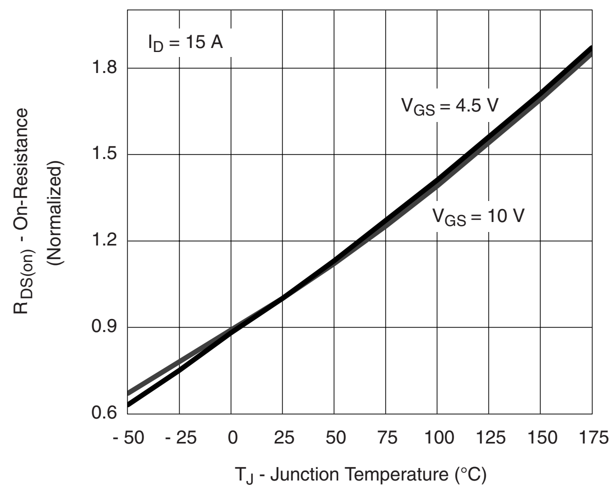


Capacitance

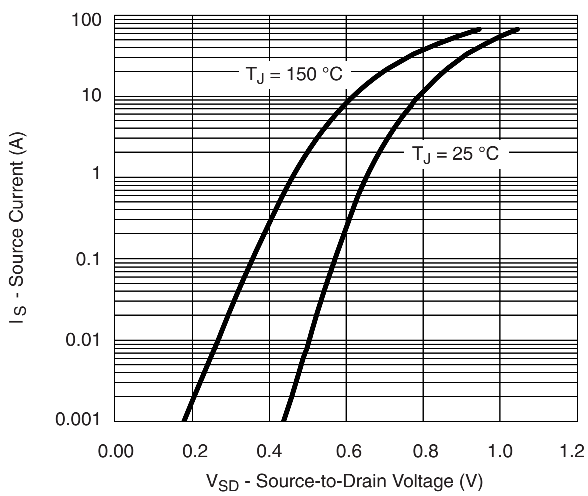
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



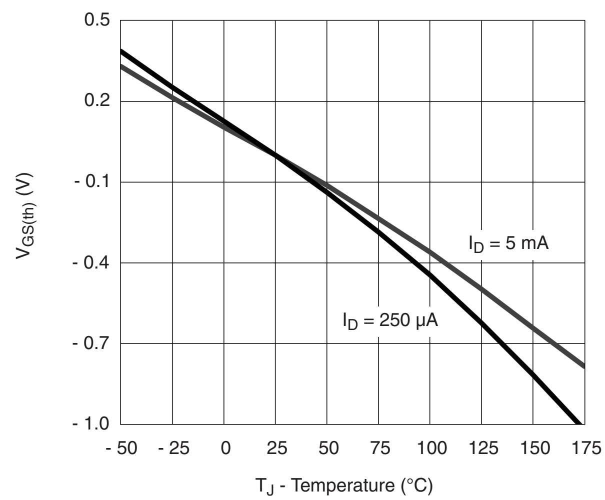
Gate Charge



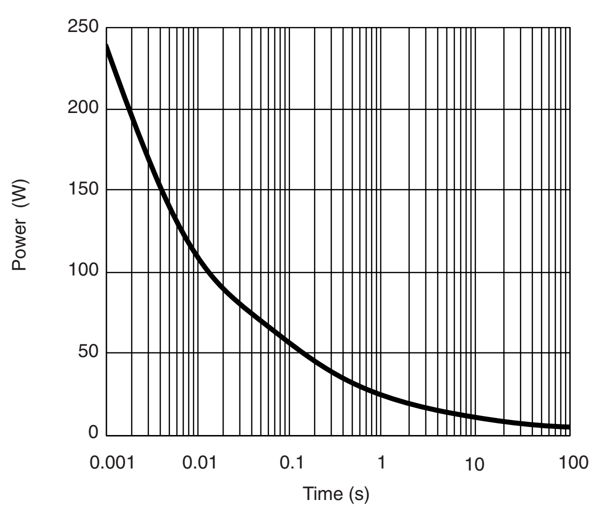
On-Resistance vs. Junction Temperature



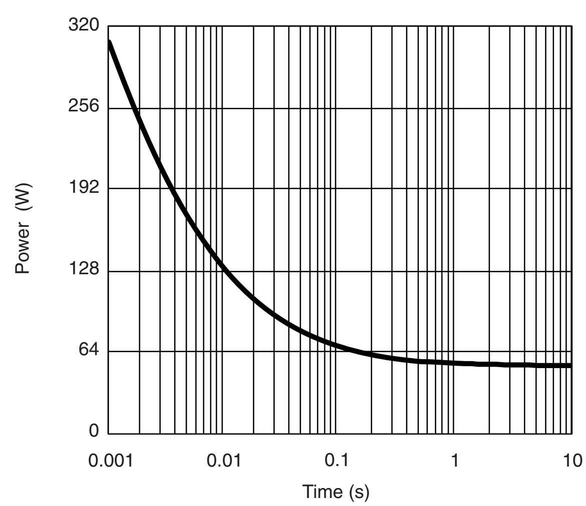
Source-Drain Diode Forward Voltage



Threshold Voltage

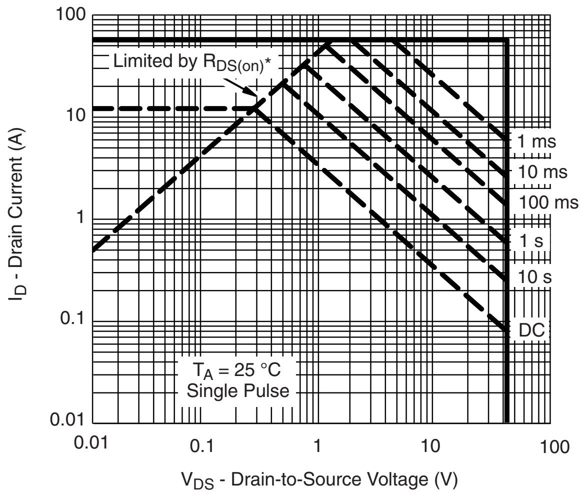


Single Pulse Power, Junction-to-Ambient



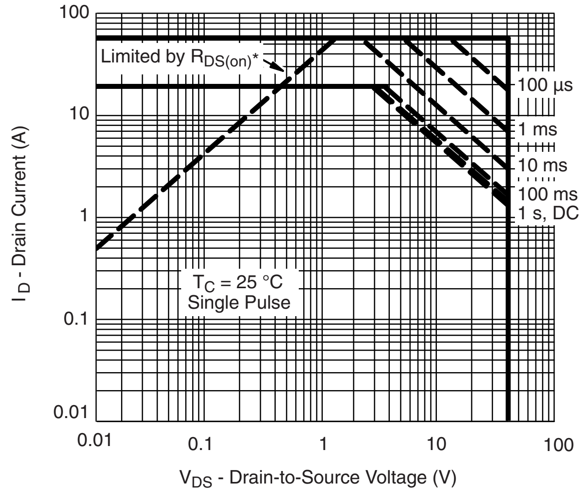
Single Pulse Power, Junction-to-Case

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



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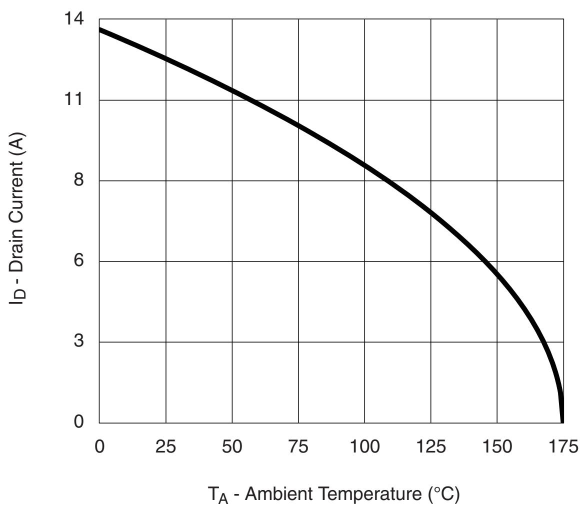
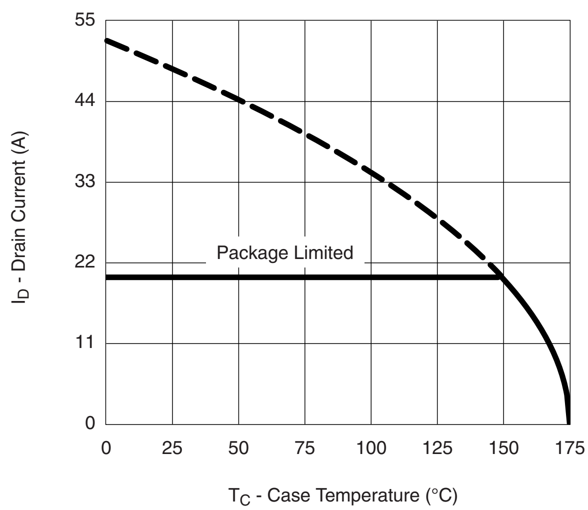
Safe Operating Area, Junction-to-Case



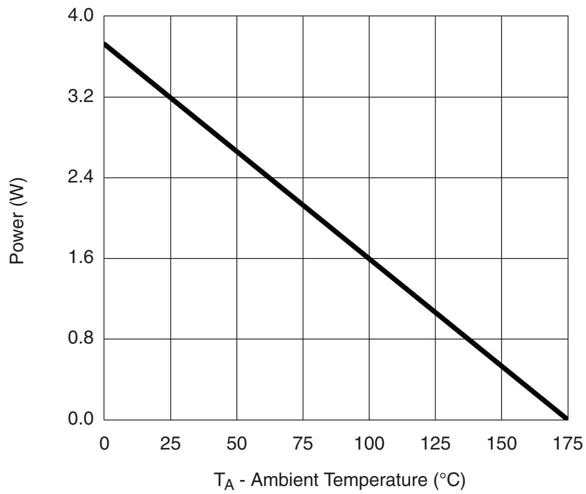
Current Derating, Junction-to-Ambient**



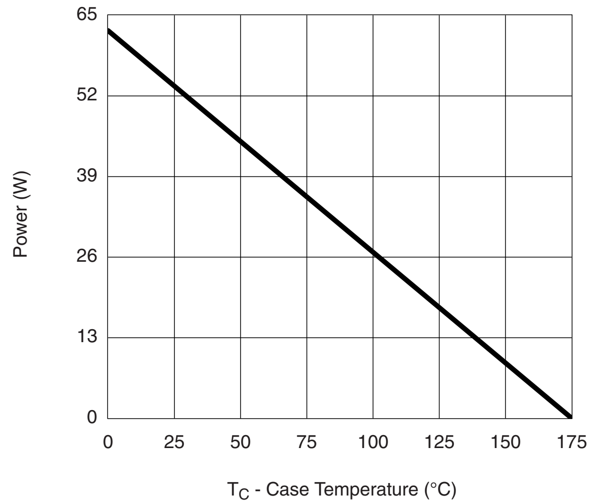
Current Derating, Junction-to-Case**

** The power dissipation P_D is based on $T_{J(max)}$ = 175 °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



Power Derating*, Junction-to-Ambient



Power Derating*, Junction-to-Case

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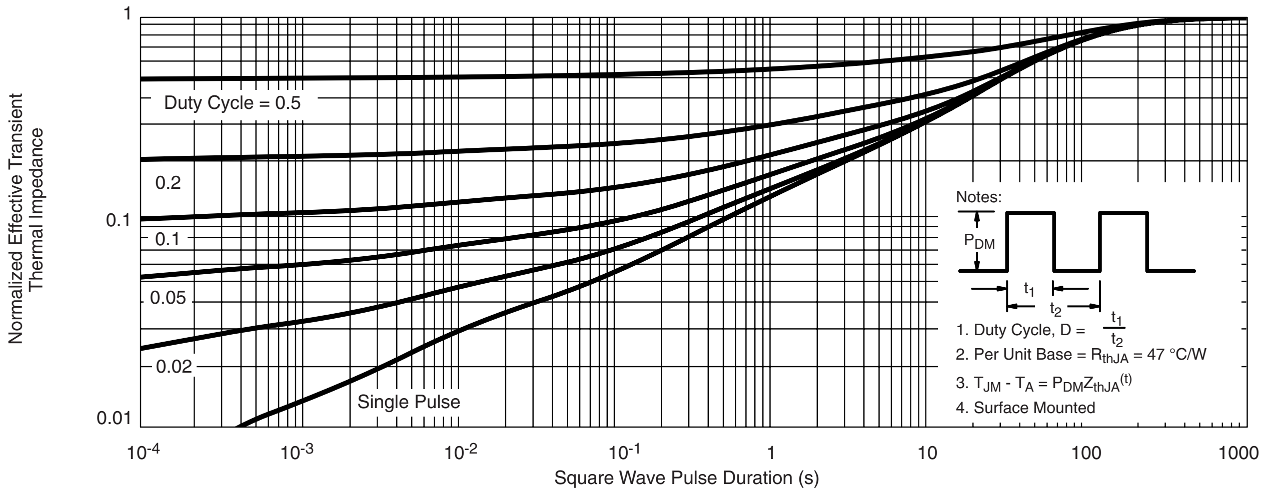
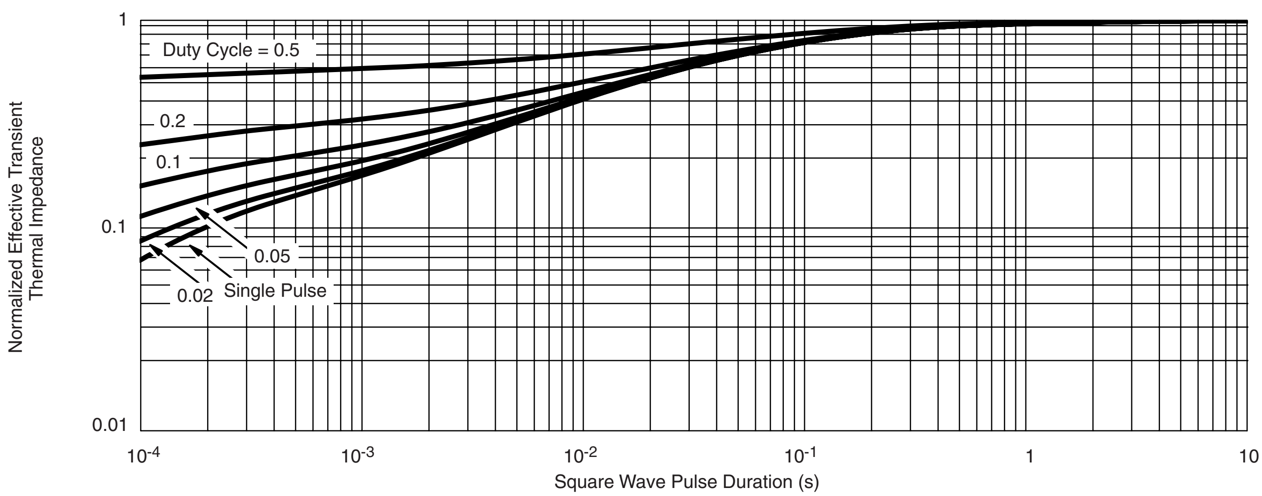


Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

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