

P-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	0.023 at $V_{GS} = 10$ V	- 20	20.6 nC
	0.030 at $V_{GS} = 4.5$ V	- 20	

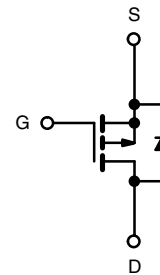
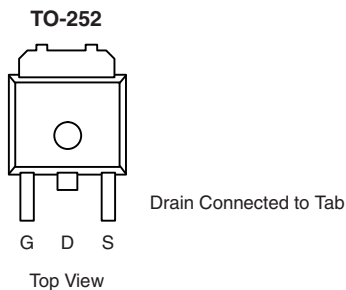
FEATURES

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


RoHS
COMPLIANT

APPLICATIONS

- LCD TV Inverter



P-Channel MOSFET

Ordering Information: SUD50P04-23-E3 (Lead (Pb)-free)

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		- 8.2 ^b	
	$T_A = 100$ °C		- 5.7 ^b	
Pulsed Drain Current		I_{DM}	- 50	
Continuous Source-Drain Diode Current	$T_C = 25$ °C	I_S	- 20 ^a	
	$T_A = 25$ °C		- 2.5 ^b	
Single Pulse Avalanche Current		I_{AS}	- 20	
Avalanche Energy		E_{AS}	20	mJ
Maximum Power Dissipation	$T_C = 25$ °C	P_D	45.4	W
	$T_C = 100$ °C		22.7	
	$T_A = 25$ °C		3.1 ^b	
	$T_A = 100$ °C		1.5 ^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}	40	48	°C/W
Maximum Junction-to-Case	Steady State	R_{thJC}	2.75	3.3	

Notes:

a. Package limited.

b. Surface mounted on 1" x 1" FR4 board.

SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-40			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		-40		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		3.7			
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-0.8		-2	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 16\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -40\text{ V}, V_{GS} = 0\text{ V}$			-1	μA
		$V_{DS} = -40\text{ V}, V_{GS} = 0\text{ V}, T_J = 100\text{ }^\circ\text{C}$			-20	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \geq -5\text{ V}, V_{GS} = -10\text{ V}$	-30			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -15\text{ A}$		0.019	0.023	Ω
		$V_{GS} = -4.5\text{ V}, I_D = -10\text{ A}$		0.024	0.030	
Forward Transconductance ^a	g_{fs}	$V_{DS} = 15\text{ V}, I_D = -15\text{ A}$		30		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		1880		pF
Output Capacitance	C_{oss}		286			
Reverse Transfer Capacitance	C_{rss}		192			
Total Gate Charge	Q_g	$V_{DS} = -20\text{ V}, V_{GS} = -10\text{ V}, I_D = -30\text{ A}$		43.5	65	nC
				20.6	31	
Gate-Source Charge	Q_{gs}	$V_{DS} = -20\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -30\text{ A}$		4.6		nC
Gate-Drain Charge	Q_{gd}		7.6			
Gate Resistance	R_g		$f = 1\text{ MHz}$		3	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -20\text{ V}, R_L = 0.66\text{ }\Omega$ $I_D \cong -30\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\text{ }\Omega$		22	35	ns
Rise Time	t_r		217	325		
Turn-Off Delay Time	$t_{d(off)}$		42	65		
Fall Time	t_f		21	32		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -20\text{ V}, R_L = 0.66\text{ }\Omega$ $I_D \cong -30\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\text{ }\Omega$		8	15	
Rise Time	t_r		12	20		
Turn-Off Delay Time	$t_{d(off)}$		36	55		
Fall Time	t_f		9	15		
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^\circ\text{C}$			-20	A
Pulse Diode Forward Current ^a	I_{SM}				-50	
Body Diode Voltage	V_{SD}	$I_S = -10\text{ A}$		-0.85	-1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = -20\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		44	66	ns
Body Diode Reverse Recovery Charge	Q_{rr}		53	80	nC	
Reverse Recovery Fall Time	t_a		18		ns	
Reverse Recovery Rise Time	t_b		26			

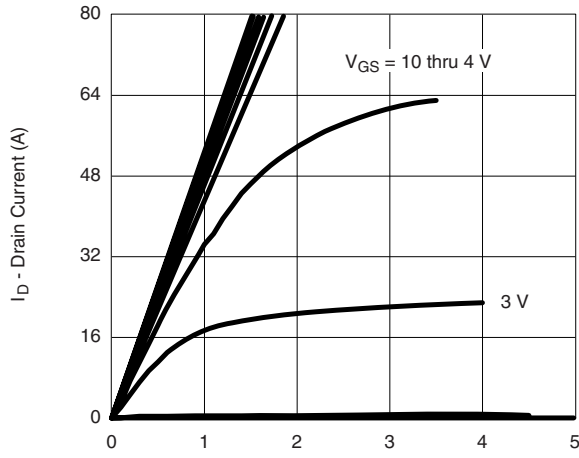
Notes:

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

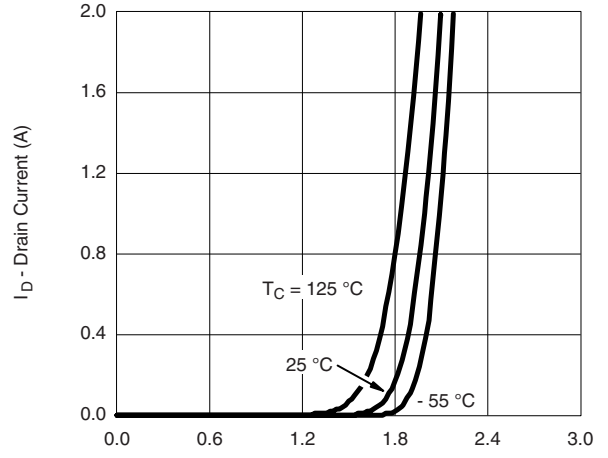
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



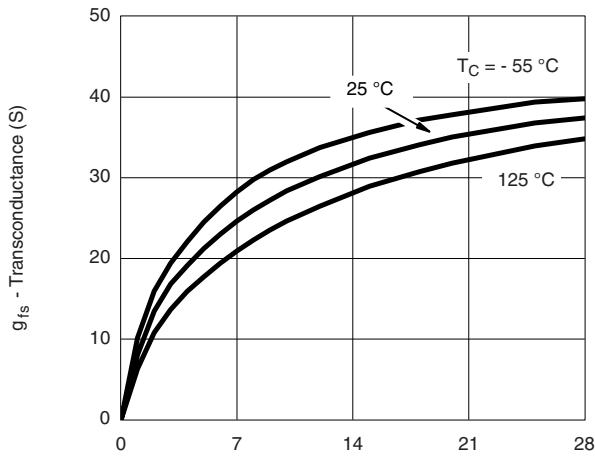
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



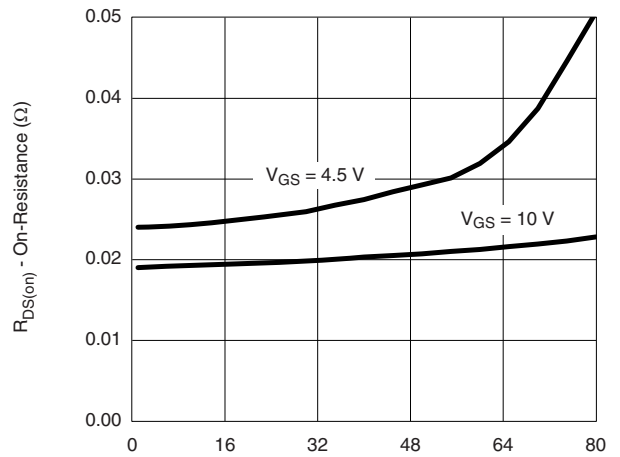
Output Characteristics



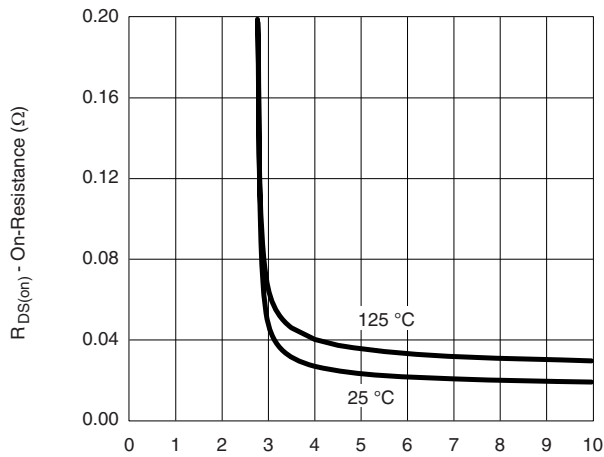
Transfer Characteristics



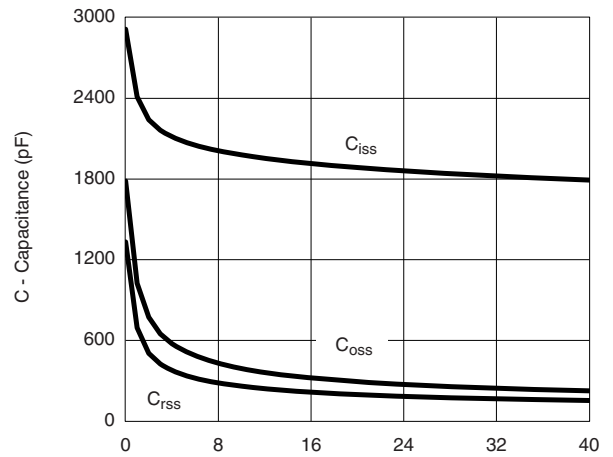
Transconductance



On-Resistance vs. Drain Current

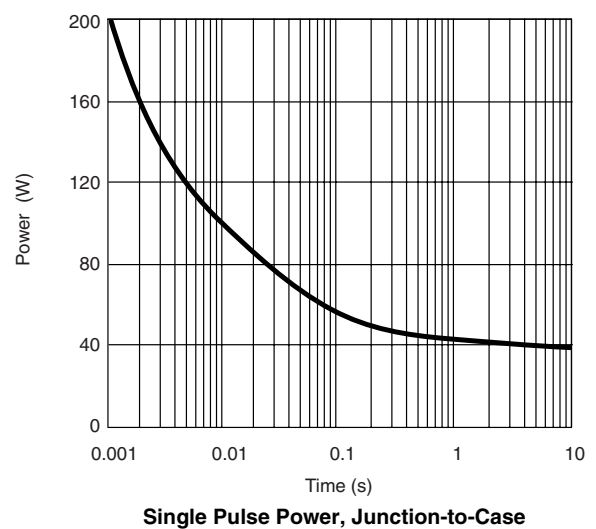
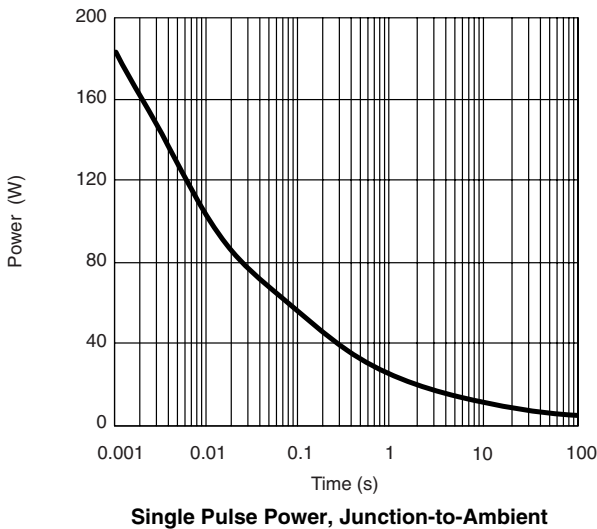
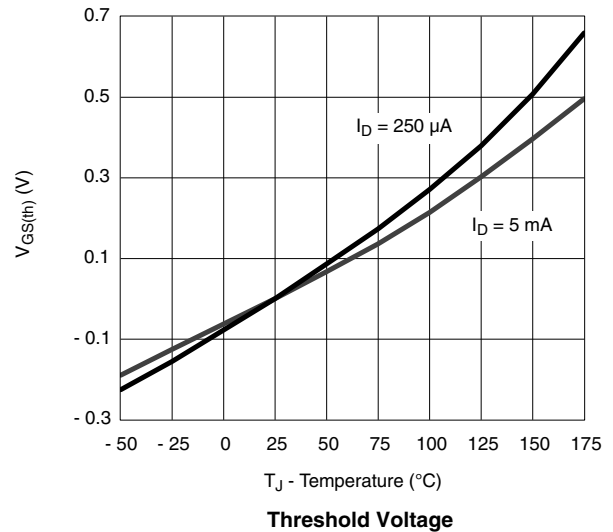
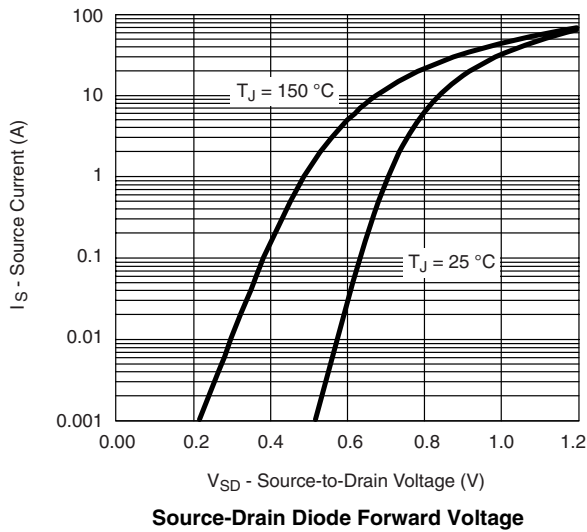
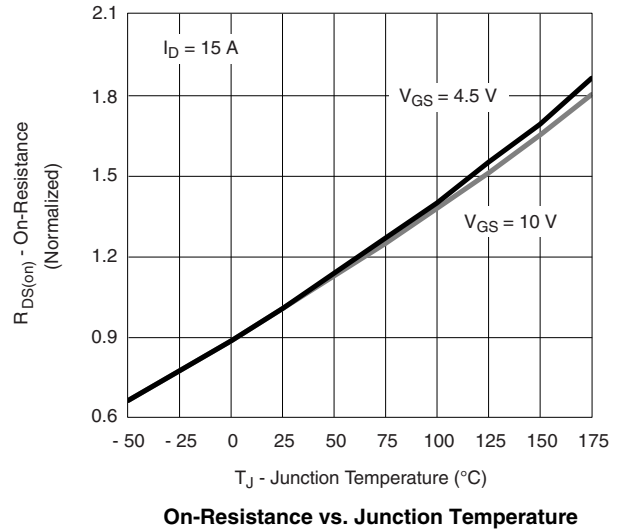
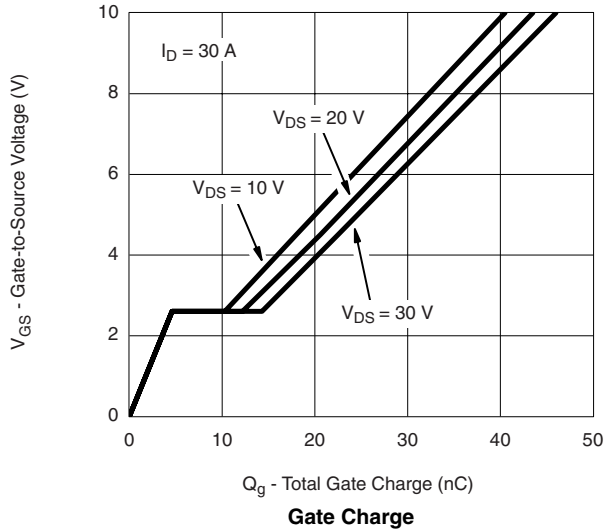


On-Resistance vs. Gate-to-Source Voltage

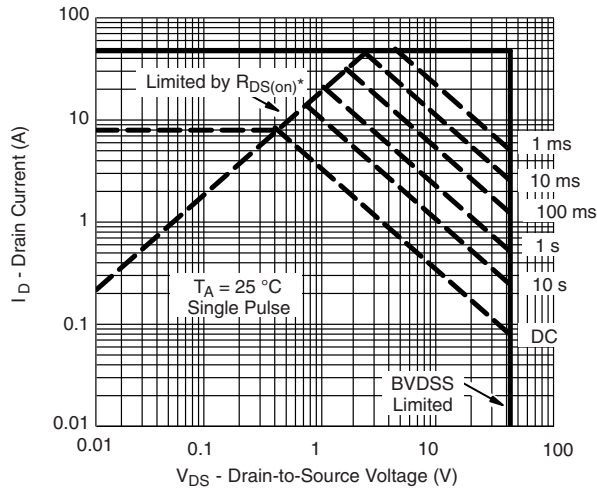


Capacitance

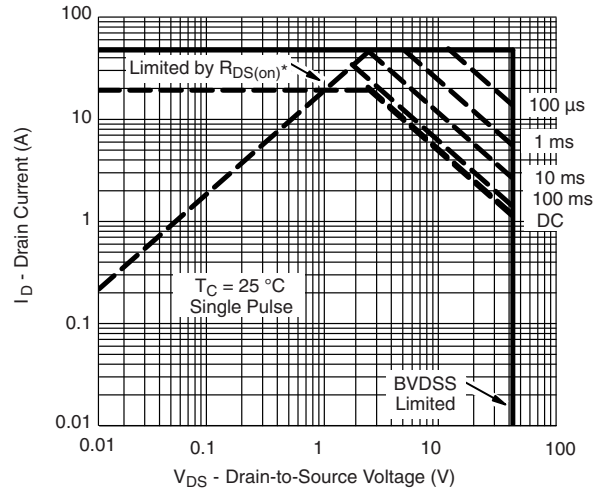
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



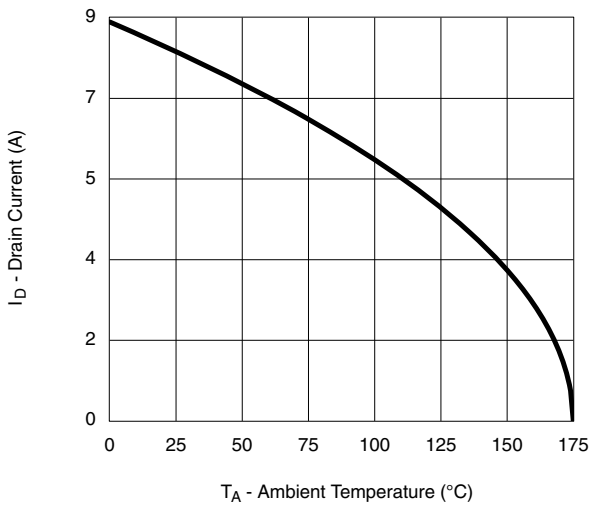
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



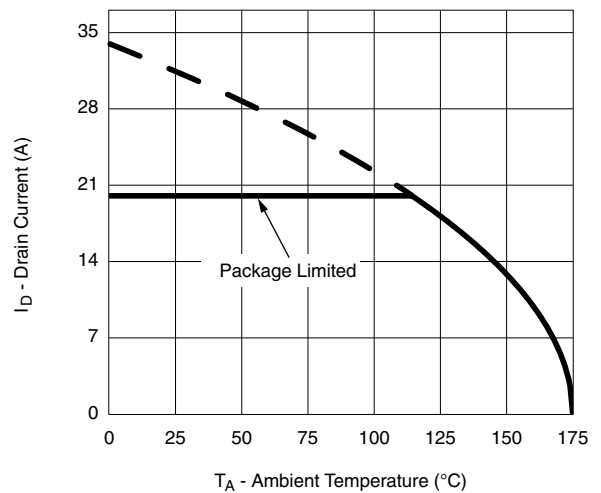
* V_{GS} > minimum V_{GS} at which R_{DS(on)} is specified
Safe Operating Area, Junction-to-Ambient



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



Current Derating, Junction-to-Ambient**

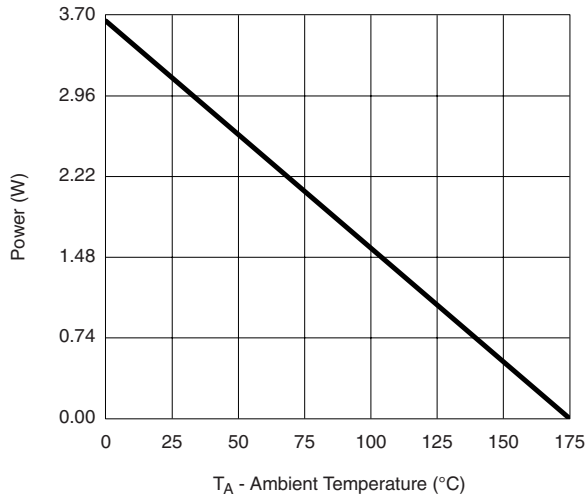


Current Derating, Junction-to-Case**

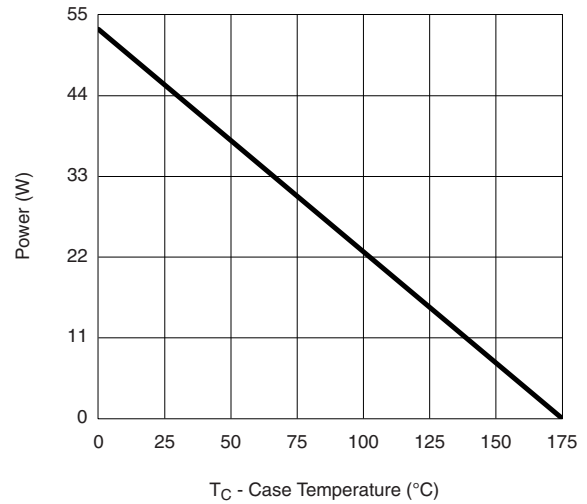
** The power dissipation P_D is based on T_{J(max)} = 175 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

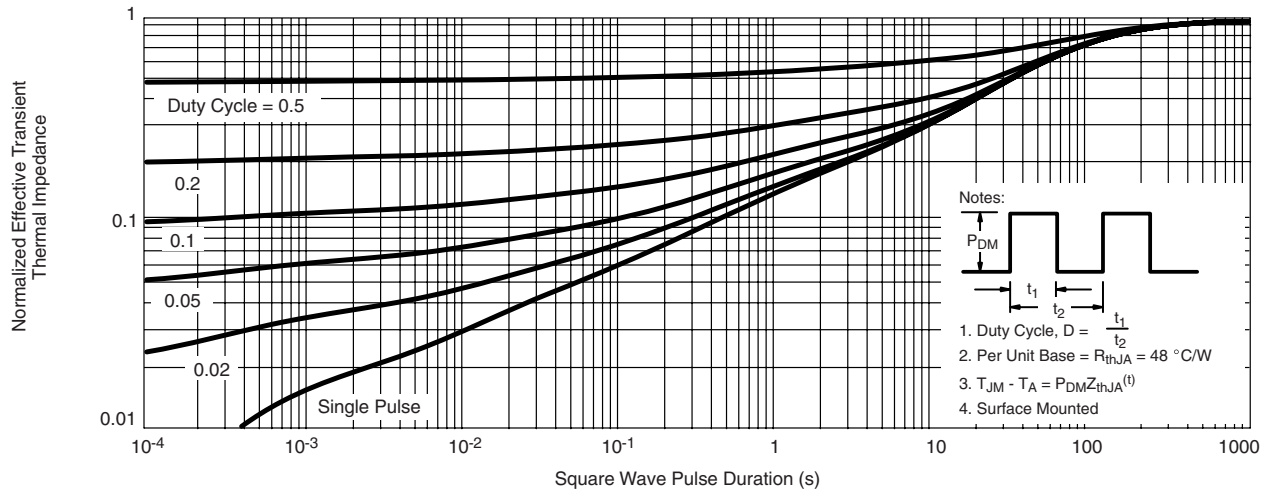
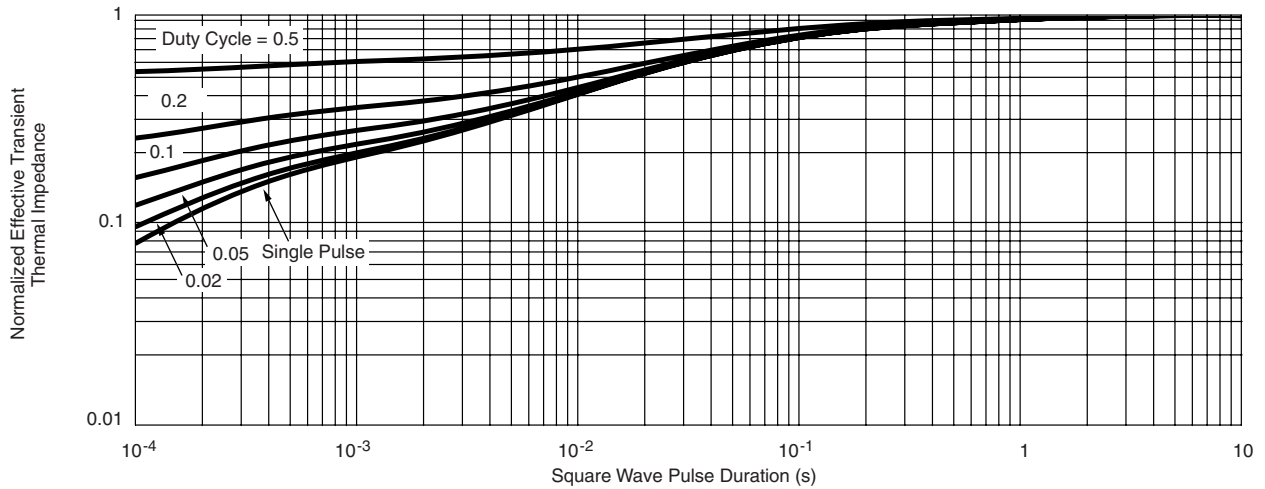


Power Derating*, Junction-to-Ambient



Power Derating*, Junction-to-Case

* 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

Normalized Thermal Transient Impedance, Junction-to-Ambient

Normalized Thermal Transient Impedance, Junction-to-Case

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