

P-Channel 30-V (D-S) MOSFET

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^d	Q_g (Typ.)
- 30	0.032 at $V_{GS} = - 10$ V	- 9.0	13 nC
	0.049 at $V_{GS} = - 4.5$ V	- 5.8	

FEATURES

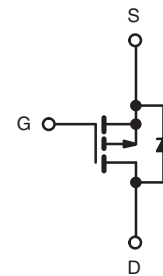
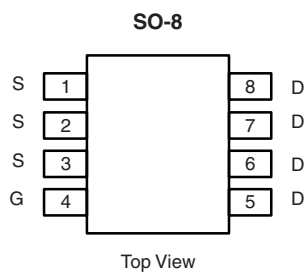
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET[®] Power MOSFET
- 100 % R_g Tested



RoHS
COMPLIANT
HALOGEN
FREE
Available

APPLICATIONS

- Load Switch
- Battery Switch



Ordering Information: Si4431CDY-T1-E3 (Lead (Pb)-free)
Si4431CDY-T1-GE3 (Lead (Pb)-free and Halogen-free)

P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted				
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	V_{DS}	- 30	V	
Gate-Source Voltage	V_{GS}	± 20		
Continuous Drain Current ($T_J = 150$ °C)	I_D	$T_C = 25$ °C	- 9.0	A
		$T_C = 70$ °C	- 7.2	
		$T_A = 25$ °C	- 7.0 ^{a, b}	
		$T_A = 70$ °C	- 5.6 ^{a, b}	
Pulsed Drain Current	I_{DM}	- 30		
Continuous Source-Drain Diode Current	I_S	$T_C = 25$ °C	- 3.5	
		$T_A = 25$ °C	- 2.1 ^{a, b}	
Maximum Power Dissipation	P_D	$T_C = 25$ °C	4.2	W
		$T_C = 70$ °C	2.7	
		$T_A = 25$ °C	2.5 ^{a, b}	
		$T_A = 70$ °C	1.6 ^{a, b}	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 150	°C	

THERMAL RESISTANCE RATINGS					
Parameter	Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient ^{a, c}	R_{thJA}	40	50	°C/W	
Maximum Junction-to-Foot	R_{thJF}	24	30		

Notes:

- Surface mounted on 1" x 1" FR4 board.
- $t = 10$ s.
- Maximum under Steady State conditions is 95 °C/W.
- Based on $T_C = 25$ °C.



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}	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-30			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		-31		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		4.5			
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-1.0		-2.5	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -30\text{ V}, V_{GS} = 0\text{ V}$			-1	μA
		$V_{DS} = -30\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			-5	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \leq -5\text{ V}, V_{GS} = -10\text{ V}$	-20			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -7.0\text{ A}$		0.026	0.032	Ω
		$V_{GS} = -4.5\text{ V}, I_D = -5.6\text{ A}$		0.037	0.049	
Forward Transconductance ^a	g_{fs}	$V_{DS} = -15\text{ V}, I_D = -7.0\text{ A}$		18		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = -15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		1006		pF
Output Capacitance	C_{oss}		180			
Reverse Transfer Capacitance	C_{rss}		145			
Total Gate Charge	Q_g	$V_{DS} = -15\text{ V}, V_{GS} = -10\text{ V}, I_D = -7.0\text{ A}$		25	38	nC
			13	20		
Gate-Source Charge	Q_{gs}	$V_{DS} = -15\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -7.0\text{ A}$		3.5		nC
Gate-Drain Charge	Q_{gd}		5.5			
Gate Resistance	R_g		$f = 1\text{ MHz}$	0.4	2.0	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -15\text{ V}, R_L = 2.7\text{ }\Omega$ $I_D \cong -5.6\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\text{ }\Omega$		10	20	ns
Rise Time	t_r		13	20		
Turn-Off Delay Time	$t_{d(off)}$		23	35		
Fall Time	t_f		9	18		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -15\text{ V}, R_L = 2.7\text{ }\Omega$ $I_D \cong -5.6\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\text{ }\Omega$		38	57	ns
Rise Time	t_r		89	134		
Turn-Off Delay Time	$t_{d(off)}$		22	33		
Fall Time	t_f		11	17		
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^\circ\text{C}$			-3.5	A
Pulse Diode Forward Current	I_{SM}				-30	
Body Diode Voltage	V_{SD}	$I_S = -5.6\text{ A}, V_{GS} = 0\text{ V}$		-0.71	-1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = -5.6\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		22	33	ns
Body Diode Reverse Recovery Charge	Q_{rr}		17	26	nC	
Reverse Recovery Fall Time	t_a		13		ns	
Reverse Recovery Rise Time	t_b		9			

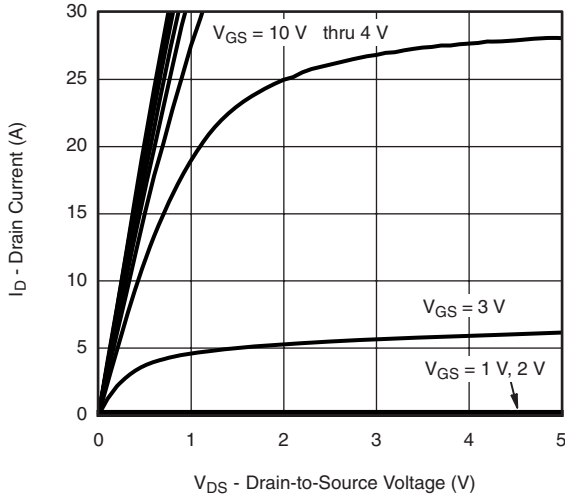
Notes:

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

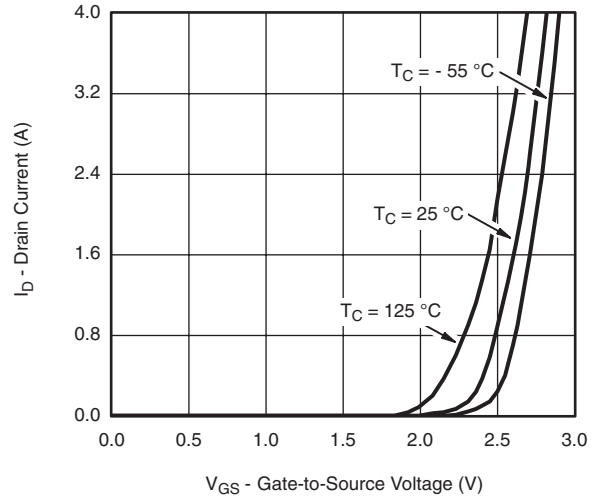
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



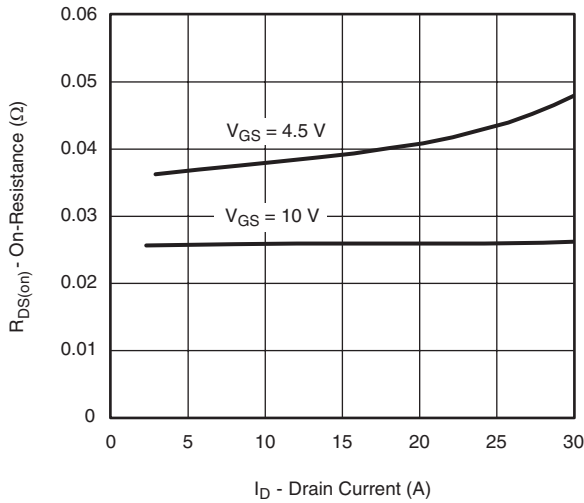
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



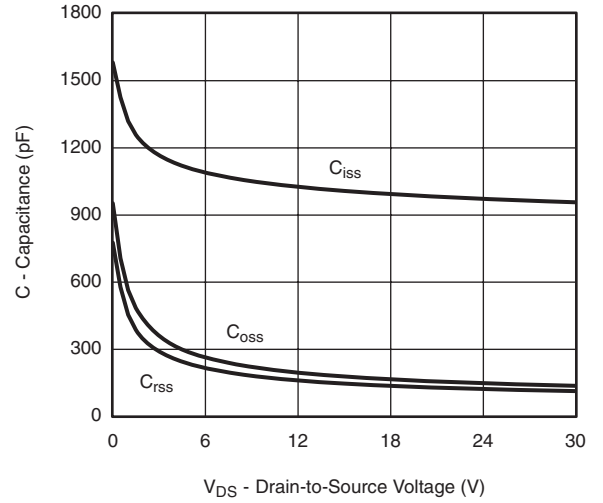
Output Characteristics



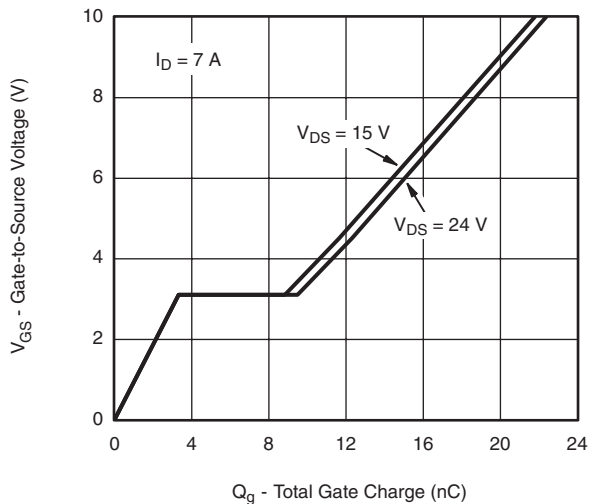
Transfer Characteristics



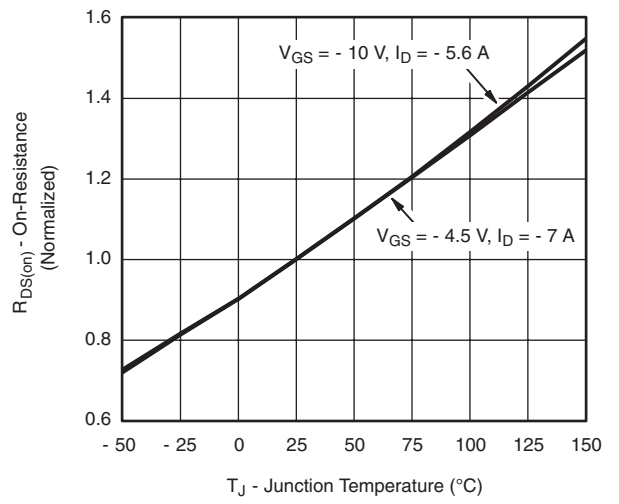
On-Resistance vs. Drain Current



Capacitance



Gate Charge



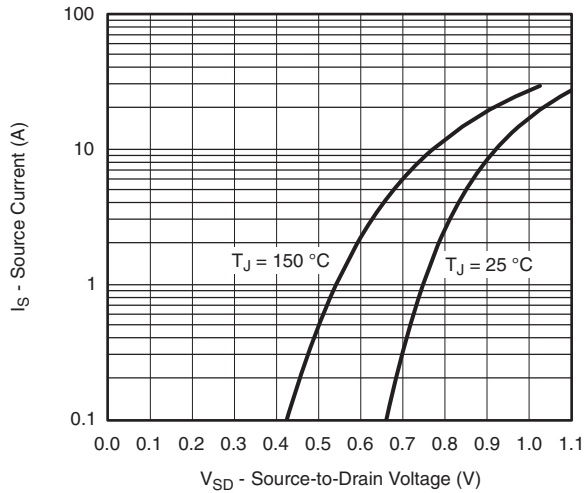
On-Resistance vs. Junction Temperature

Si4431CDY

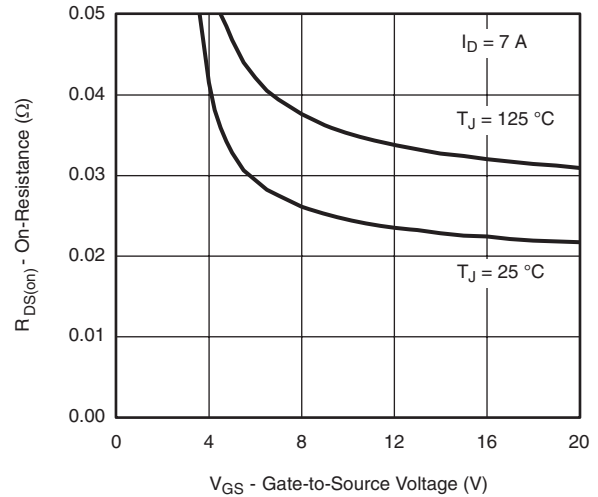
Vishay Siliconix



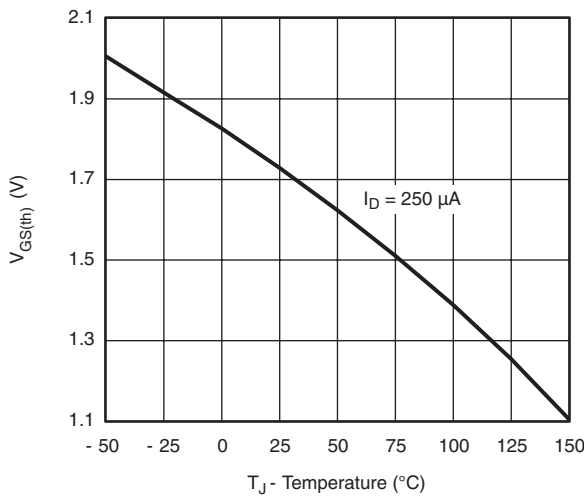
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



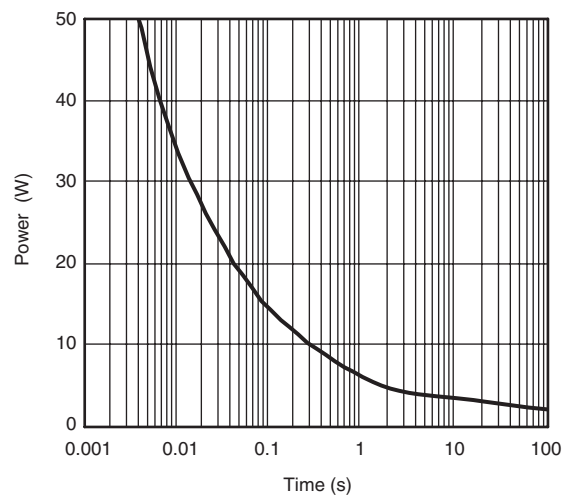
Source-Drain Diode Forward Voltage



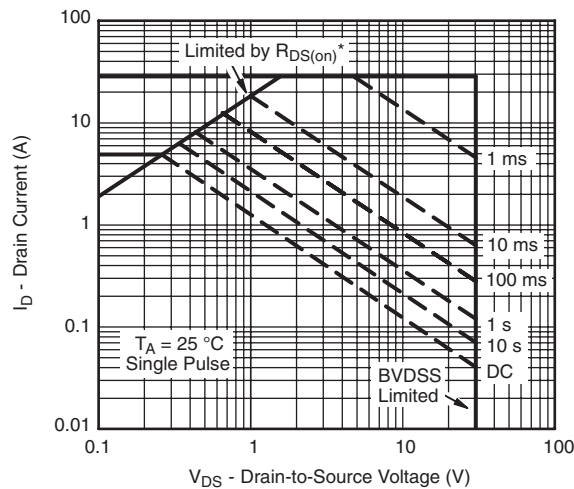
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power, Junction-to-Ambient

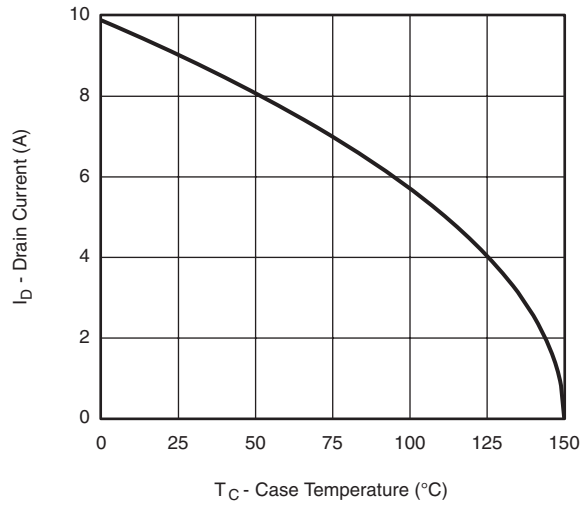


* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

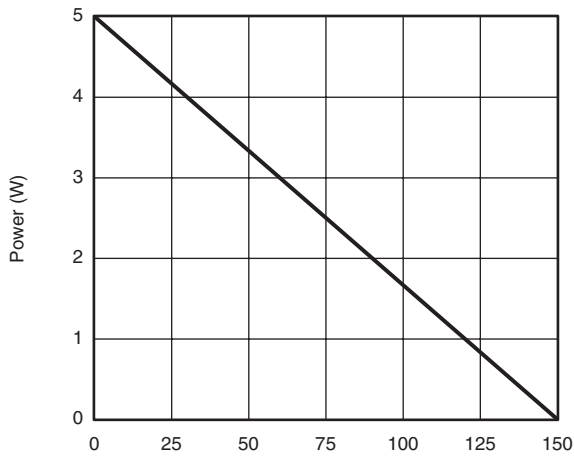
Safe Operating Area



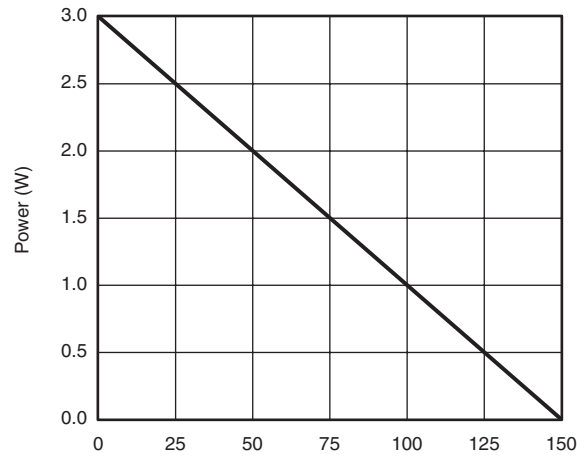
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Current Derating*



Power, Junction-to-Foot

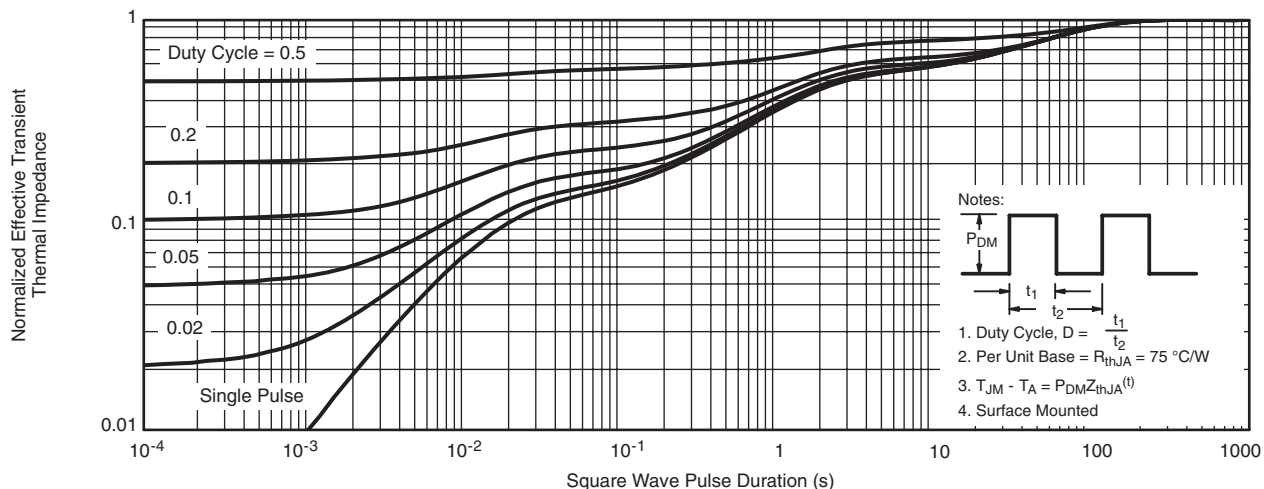


Power Derating, Junction-to-Ambient

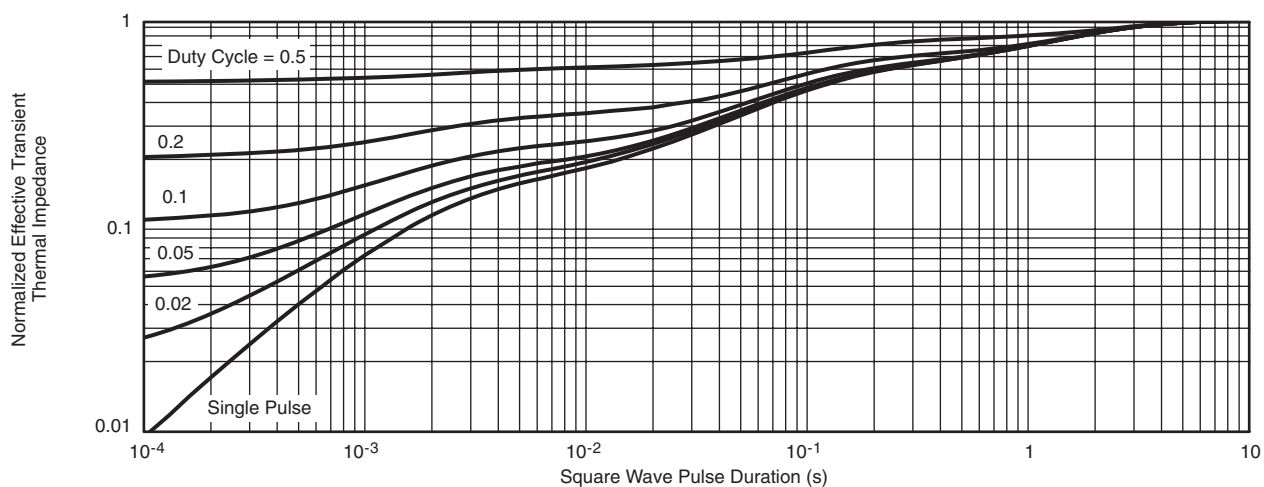
* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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