



N-Channel 20-V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^{a, e}	Q_g (Typ.)
20	0.027 at $V_{GS} = 4.5$ V	8	8.3 nC
	0.032 at $V_{GS} = 2.5$ V	8	
	0.040 at $V_{GS} = 1.8$ V	8	

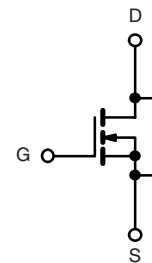
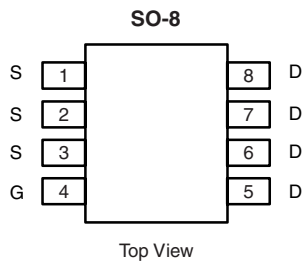
FEATURES

- TrenchFET[®] Power MOSFET
- 100 % R_g Tested
- 100 % UIS Tested
- Compliant to RoHS Directive 2002/95/EC


RoHS
 COMPLIANT

APPLICATIONS

- DC/DC Converter
- Load Switches



Ordering Information: Si4196DY-T1-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}	20	V
Gate-Source Voltage	V_{GS}	± 8	V
Continuous Drain Current ($T_J = 150$ °C)	I_D	$T_C = 25$ °C	8 ^e
		$T_C = 70$ °C	8 ^e
		$T_A = 25$ °C	6.4 ^{b, c}
		$T_A = 70$ °C	5.1 ^{b, c}
Pulsed Drain Current	I_{DM}	20	A
Continuous Source-Drain Diode Current	I_S	$T_C = 25$ °C	3.8
		$T_A = 25$ °C	1.6 ^{b, c}
Single Pulse Avalanche Current	I_{AS}	5	A
Avalanche Energy	E_{AS}	1.25	mJ
Maximum Power Dissipation	P_D	$T_C = 25$ °C	4.6
		$T_C = 70$ °C	2.9
		$T_A = 25$ °C	2.0 ^{b, c}
		$T_A = 70$ °C	1.28 ^{b, c}
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 ^{b, d}	R_{thJA}	52	62.5	°C/W
Maximum Junction-to-Foot (Drain)	R_{thJF}	22	27	

Notes:

- Based on $T_C = 25$ °C.
- Surface Mounted on 1" x 1" FR4 board.
- $t = 10$ s.
- Maximum under Steady State conditions is 110 °C/W.
- Package limited.

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}	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	20			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		21		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			- 3.0		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	0.4		1.0	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 8\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 20\text{ V}$, $V_{GS} = 0\text{ V}$			1	μA
		$V_{DS} = 20\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 55\text{ }^\circ\text{C}$			10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}$, $V_{GS} = 4.5\text{ V}$	10			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}$, $I_D = 8\text{ A}$		0.021	0.027	Ω
		$V_{GS} = 2.5\text{ V}$, $I_D = 5\text{ A}$		0.025	0.032	
		$V_{GS} = 1.8\text{ V}$, $I_D = 2.5\text{ A}$		0.031	0.040	
Forward Transconductance ^a	g_{fs}	$V_{DS} = 10\text{ V}$, $I_D = 8\text{ A}$		28		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = 10\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$		830		pF
Output Capacitance	C_{oss}			115		
Reverse Transfer Capacitance	C_{rss}			63		
Total Gate Charge	Q_g	$V_{DS} = 10\text{ V}$, $V_{GS} = 8\text{ V}$, $I_D = 8\text{ A}$		14.5	22	nC
				8.3	12.5	
Gate-Source Charge	Q_{gs}	$V_{DS} = 10\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 8\text{ A}$		1.1		
Gate-Drain Charge	Q_{gd}			1.1		
Gate Resistance	R_g	$f = 1\text{ MHz}$	0.6	3.0	6.0	Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}$, $R_L = 2\text{ }\Omega$ $I_D \cong 5\text{ A}$, $V_{GEN} = 4.5\text{ V}$, $R_g = 1\text{ }\Omega$		8	16	ns
Rise Time	t_r			13	25	
Turn-Off Delay Time	$t_{d(off)}$			33	60	
Fall Time	t_f			9	18	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}$, $R_L = 2\text{ }\Omega$ $I_D \cong 5\text{ A}$, $V_{GEN} = 8\text{ V}$, $R_g = 1\text{ }\Omega$		5	10	
Rise Time	t_r			12	24	
Turn-Off Delay Time	$t_{d(off)}$			22	40	
Fall Time	t_f			8	16	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^\circ\text{C}$			3.8	A
Pulse Diode Forward Current ^a	I_{SM}				20	
Body Diode Voltage	V_{SD}	$I_S = 5.4\text{ A}$		0.78	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 5.4\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^\circ\text{C}$		11	22	ns
Body Diode Reverse Recovery Charge	Q_{rr}			4	8	nC
Reverse Recovery Fall Time	t_a			6		ns
Reverse Recovery Rise Time	t_b			5		

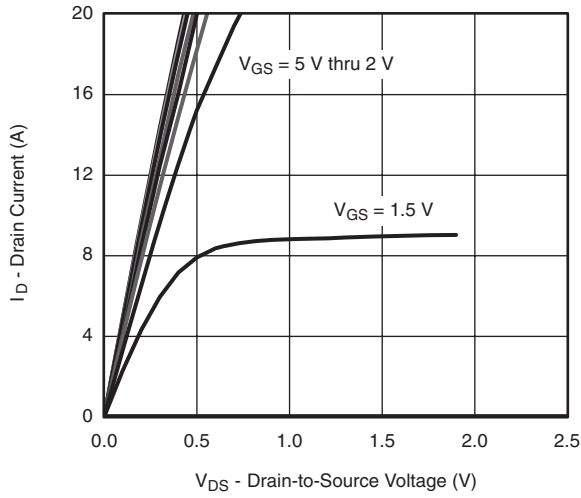
Notes:

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

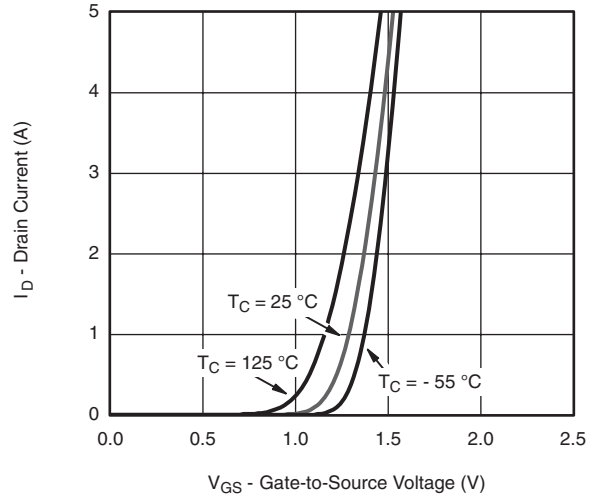
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



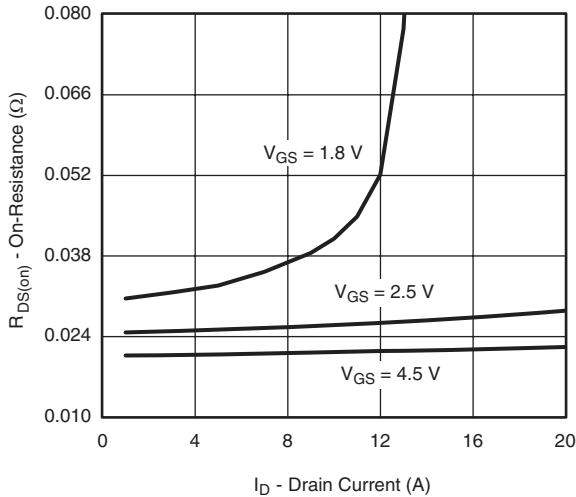
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



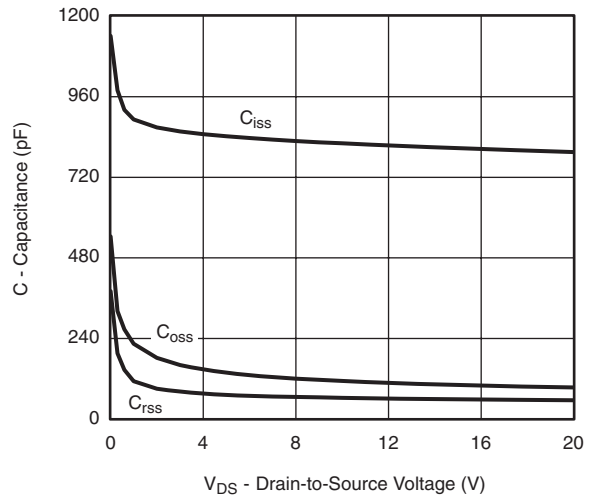
Output Characteristics



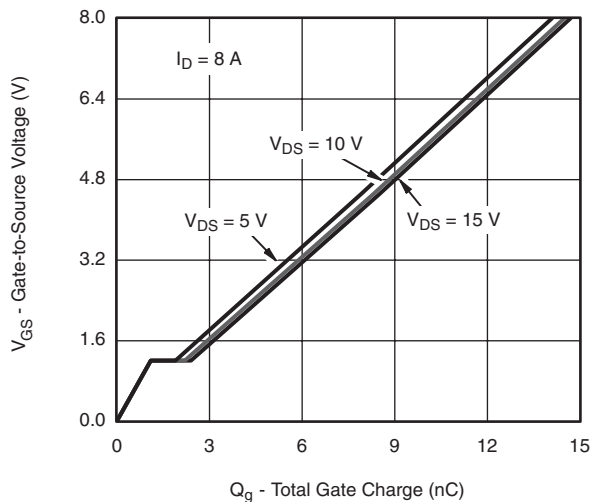
Transfer Characteristics



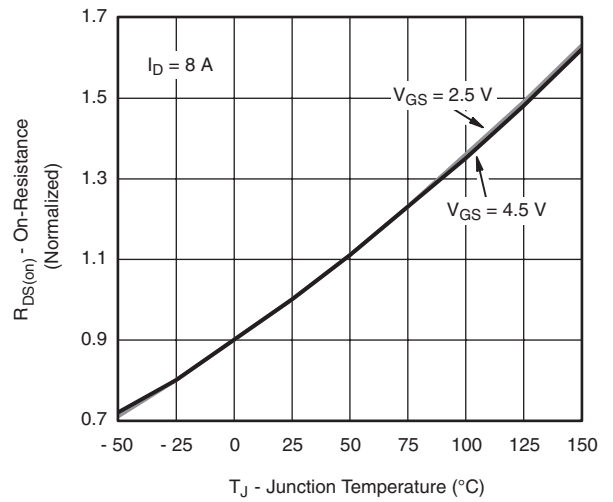
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



Gate Charge



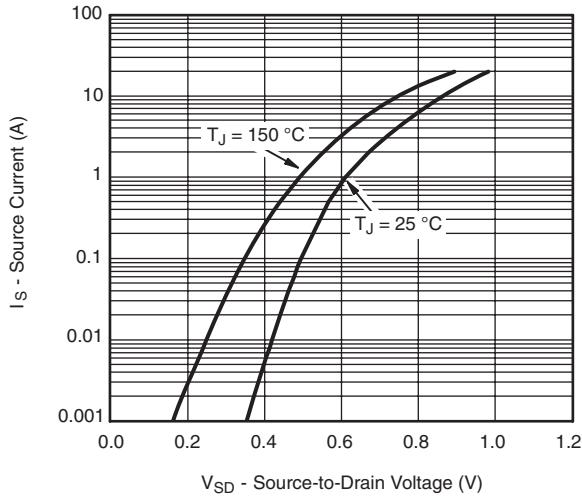
On-Resistance vs. Junction Temperature

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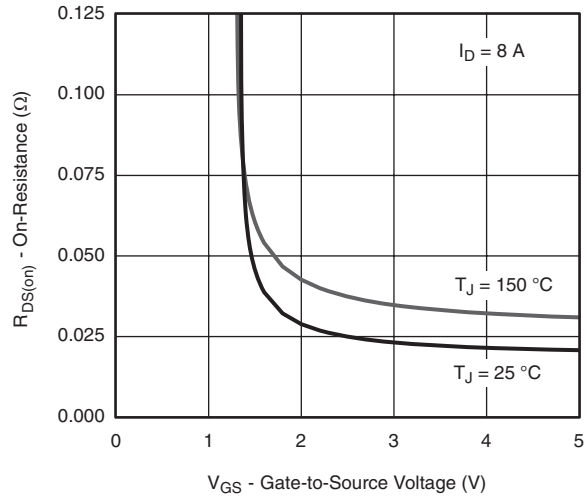
Vishay Siliconix



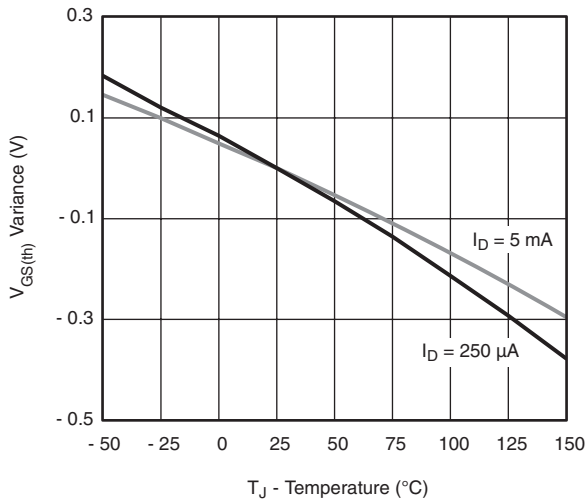
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



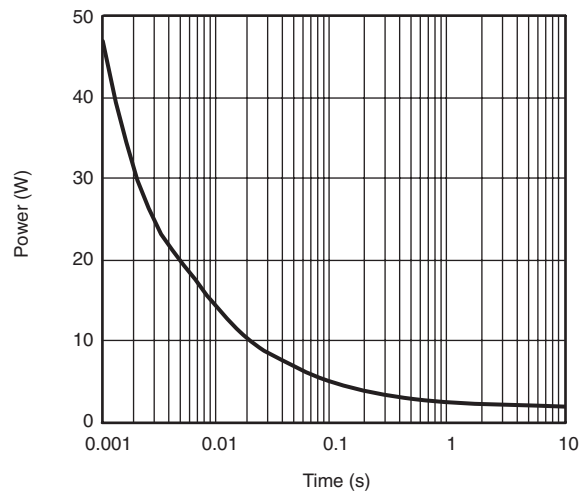
Source-Drain Diode Forward Voltage



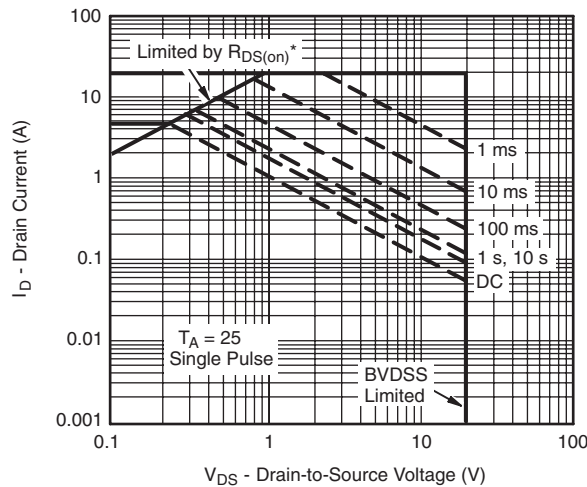
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power, Junction-to-Ambient

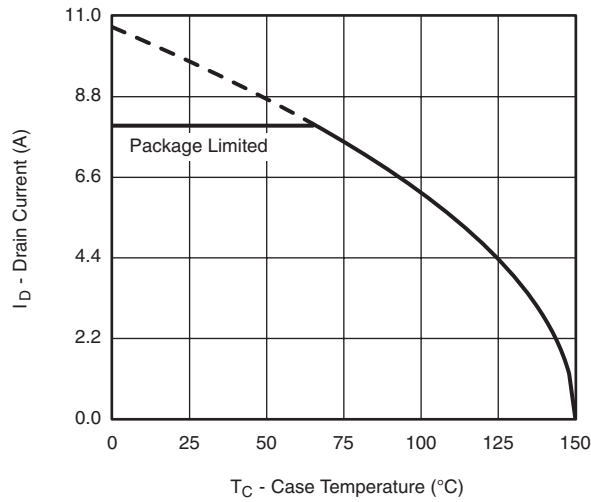


* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

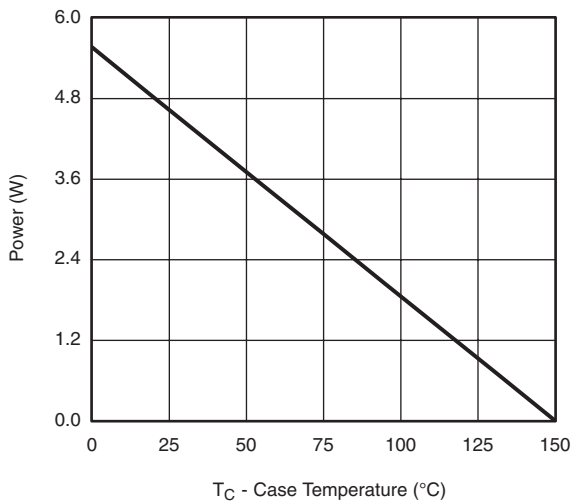
Safe Operating Area, Junction-to-Ambient



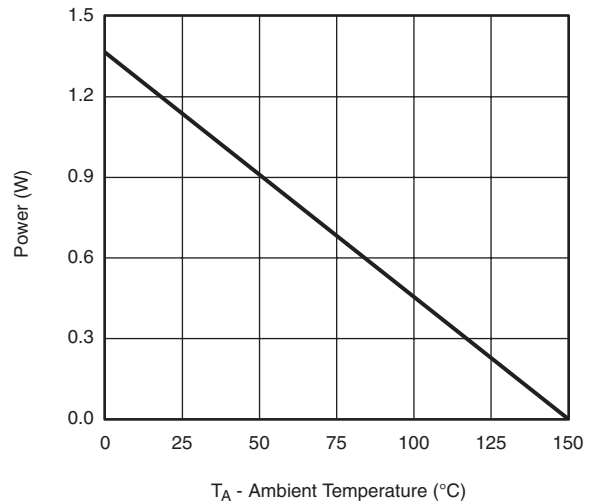
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Current Derating*



Power, Junction-to-Foot



Power, Junction-to-Ambient

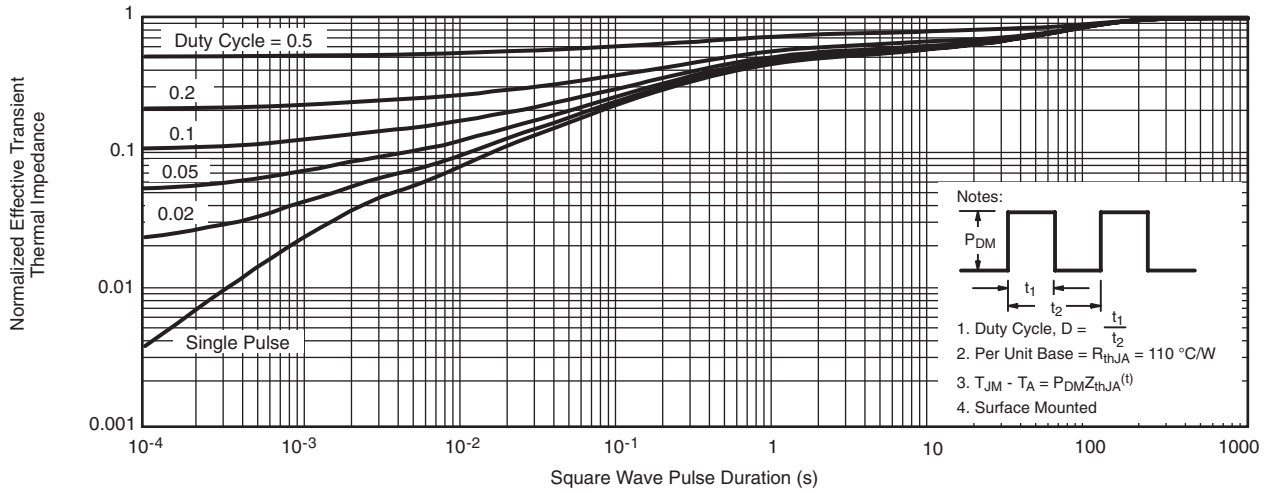
* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

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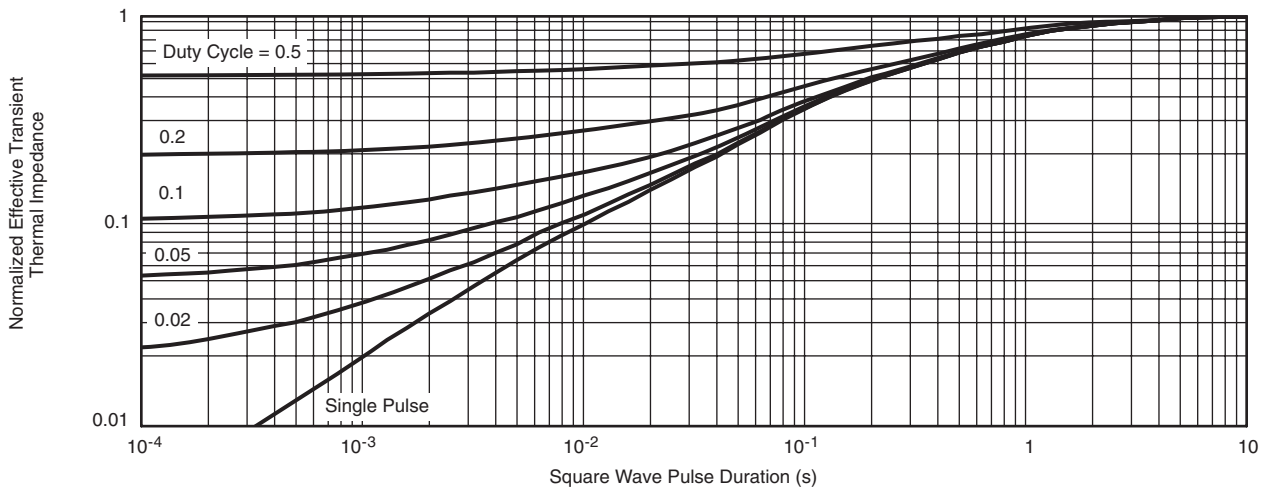
Vishay Siliconix



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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