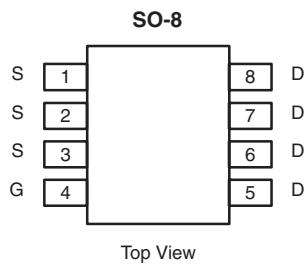


N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^{a, e}	Q_g (Typ.)
20	0.0138 at $V_{GS} = 10$ V	12	10.6 nC
	0.0192 at $V_{GS} = 4.5$ V	12	



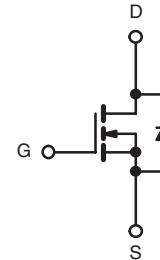
FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- 100 % R_g and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



APPLICATIONS

- DC/DC Converters



Ordering Information: Si4004DY-T1-GE3 (Lead (Pb)-free and Halogen-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}	± 20	
Continuous Drain Current ($T_J = 150$ °C)	I_D	12 ^e	A
		12 ^e	
		11 ^{b, c}	
		8.8 ^{b, c}	
Pulsed Drain Current	I_{DM}	70	
Continuous Source-Drain Diode Current	I_S	4.2	mJ
		2.1 ^{b, c}	
Single Pulse Avalanche Current	I_{AS}	25	
Avalanche Energy	E_{AS}	31	
Maximum Power Dissipation	P_D	5.0	W
		3.2	
		2.5 ^{b, c}	
		1.6 ^{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}	43	50	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	19	

Notes:

- a. Based on $T_C = 25$ °C.
- b. Surface mounted on 1" x 1" FR4 board.
- c. $t = 10$ s.
- d. Maximum under steady state conditions is 92 °C/W.
- e. Package limited.

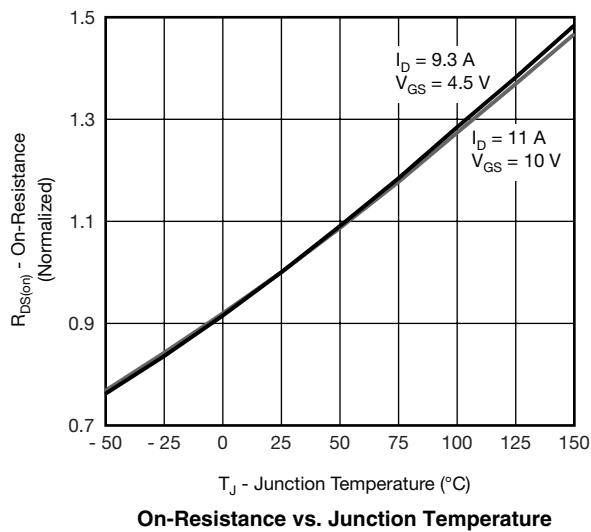
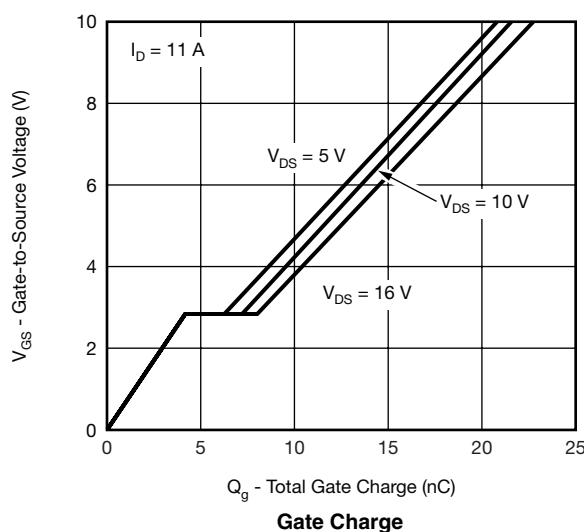
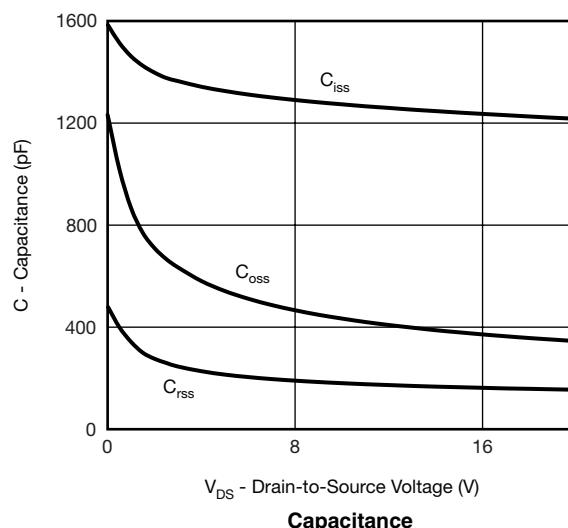
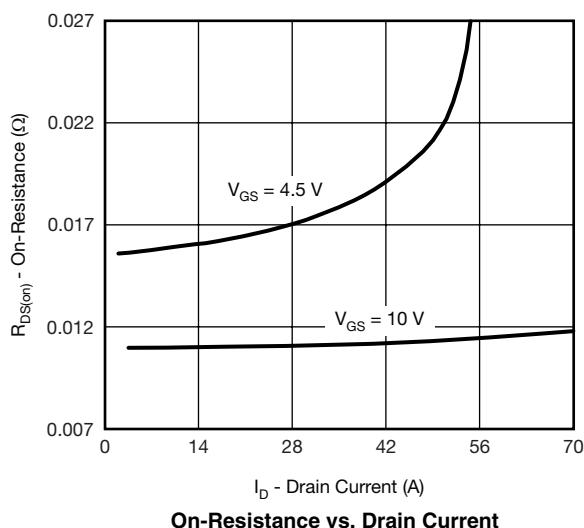
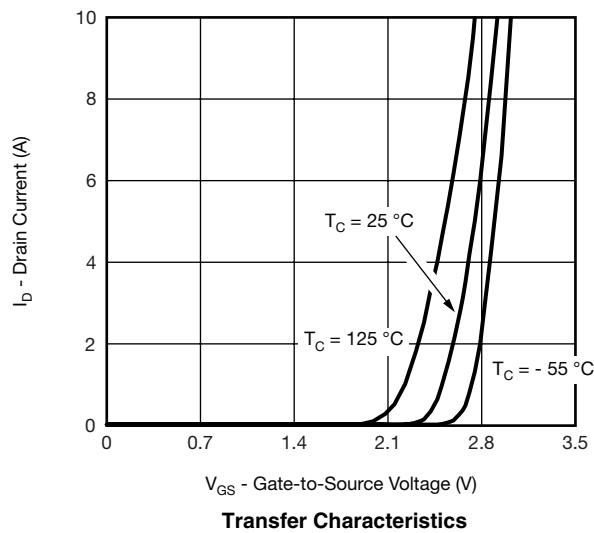
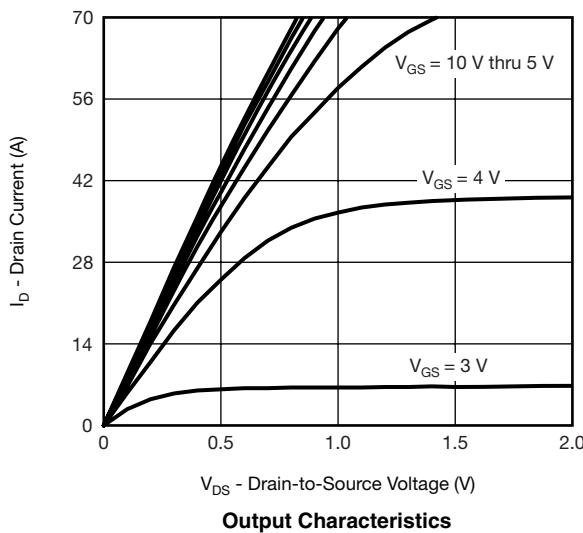
SPECIFICATIONS $T_J = 25^\circ\text{C}$, unless otherwise noted

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0 \text{ V}$, $I_D = 250 \mu\text{A}$	20			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250 \mu\text{A}$		22		$\text{mV}/^\circ\text{C}$
$V_{GS(\text{th})}$ Temperature Coefficient	$\Delta V_{GS(\text{th})}/T_J$			- 5.5		
Gate-Source Threshold Voltage	$V_{GS(\text{th})}$	$V_{DS} = V_{GS}$, $I_D = 250 \mu\text{A}$	1.2		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}	$V_{DS} = 20 \text{ V}$, $V_{GS} = 0 \text{ V}$			1	μA
		$V_{DS} = 20 \text{ V}$, $V_{GS} = 0 \text{ V}$, $T_J = 55^\circ\text{C}$			10	
On-State Drain Current ^a	$I_{D(\text{on})}$	$V_{DS} \geq 5 \text{ V}$, $V_{GS} = 10 \text{ V}$	30			A
Drain-Source On-State Resistance ^a	$R_{DS(\text{on})}$	$V_{GS} = 10 \text{ V}$, $I_D = 11 \text{ A}$		0.0115	0.0138	Ω
		$V_{GS} = 4.5 \text{ V}$, $I_D = 9.3 \text{ A}$		0.0160	0.0192	
Forward Transconductance ^a	g_{fs}	$V_{DS} = 10 \text{ V}$, $I_D = 11 \text{ A}$		25		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = 10 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$		1280		pF
Output Capacitance	C_{oss}			440		
Reverse Transfer Capacitance	C_{rss}			195		
Total Gate Charge	Q_g	$V_{DS} = 10 \text{ V}$, $V_{GS} = 10 \text{ V}$, $I_D = 11 \text{ A}$		21.6	33	nC
Gate-Source Charge	Q_{gs}	$V_{DS} = 10 \text{ V}$, $V_{GS} = 4.5 \text{ V}$, $I_D = 11 \text{ A}$		10.6	16	
Gate-Drain Charge	Q_{gd}			4.2		
Gate Resistance	R_g	$f = 1 \text{ MHz}$	0.7	3.6	7.2	Ω
Turn-On Delay Time	$t_{d(\text{on})}$	$V_{DD} = 10 \text{ V}$, $R_L = 1.1 \Omega$ $I_D \geq 8.8 \text{ A}$, $V_{GEN} = 4.5 \text{ V}$, $R_g = 1 \Omega$		15	25	ns
Rise Time	t_r			12	20	
Turn-Off Delay Time	$t_{d(\text{off})}$			17	26	
Fall Time	t_f			9	18	
Turn-On Delay Time	$t_{d(\text{on})}$			7	14	
Rise Time	t_r	$V_{DD} = 10 \text{ V}$, $R_L = 1.1 \Omega$ $I_D \geq 8.8 \text{ A}$, $V_{GEN} = 10 \text{ V}$, $R_g = 1 \Omega$		10	20	ns
Turn-Off Delay Time	$t_{d(\text{off})}$			23	35	
Fall Time	t_f			9	18	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25^\circ\text{C}$			4.2	A
Pulse Diode Forward Current ^a	I_{SM}				70	
Body Diode Voltage	V_{SD}	$I_S = 8.8 \text{ A}$		0.84	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 8.8 \text{ A}$, $dl/dt = 100 \text{ A}/\mu\text{s}$, $T_J = 25^\circ\text{C}$		26	39	ns
Body Diode Reverse Recovery Charge	Q_{rr}			15	23	nC
Reverse Recovery Fall Time	t_a			13		
Reverse Recovery Rise Time	t_b			13		ns

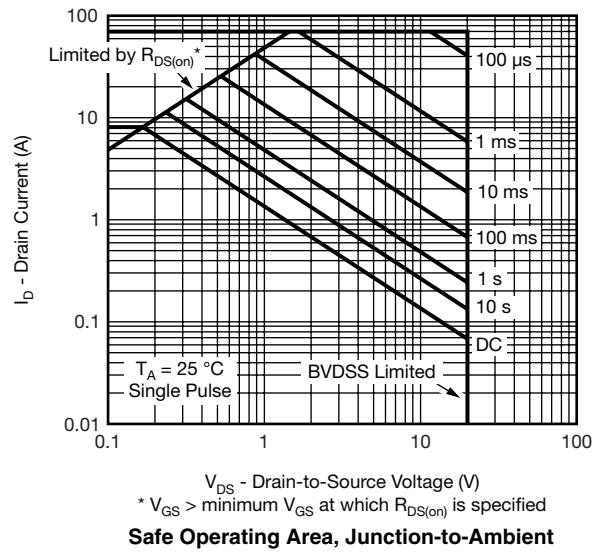
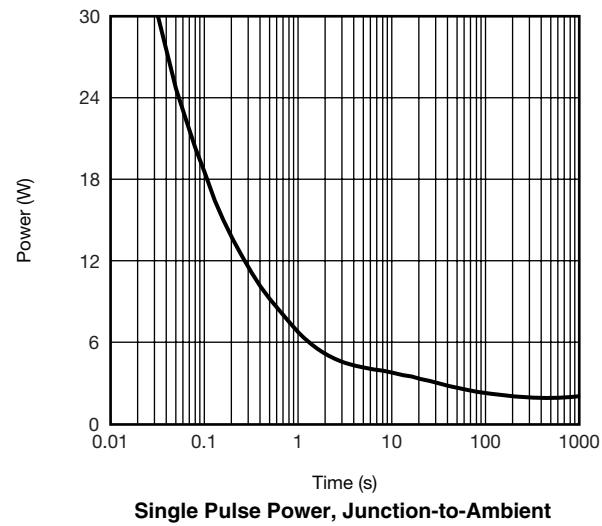
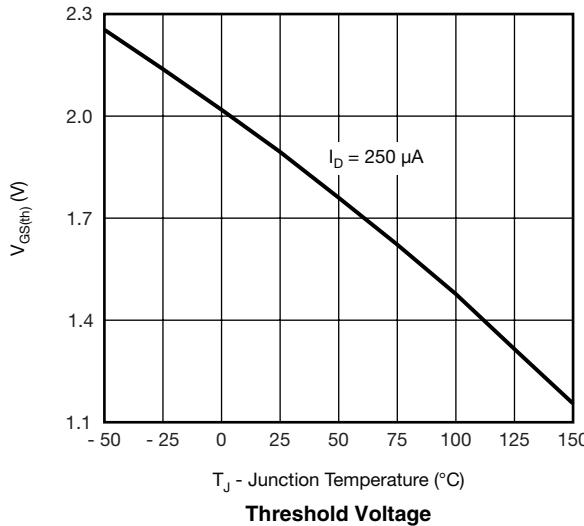
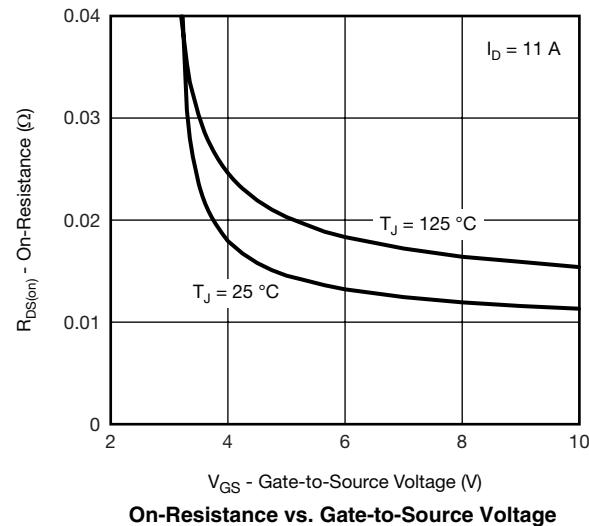
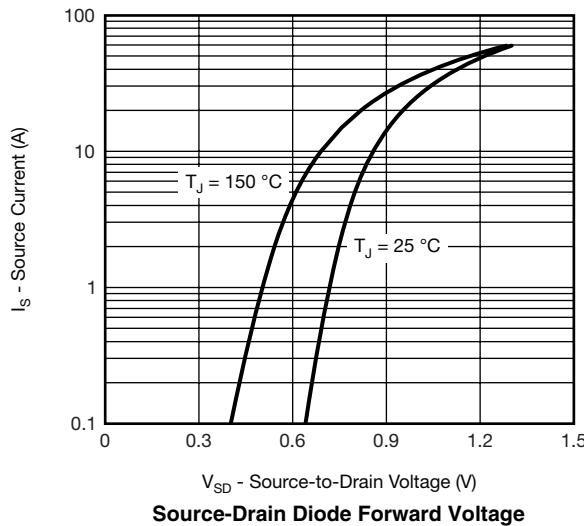
Notes

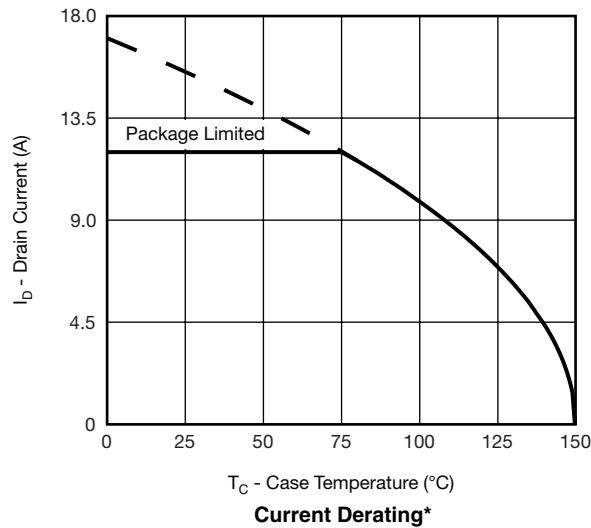
a. Pulse test; pulse width $\leq 300 \mu\text{s}$, duty cycle $\leq 2\%$
 b. Guaranteed by design, not subject to production testing.

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.

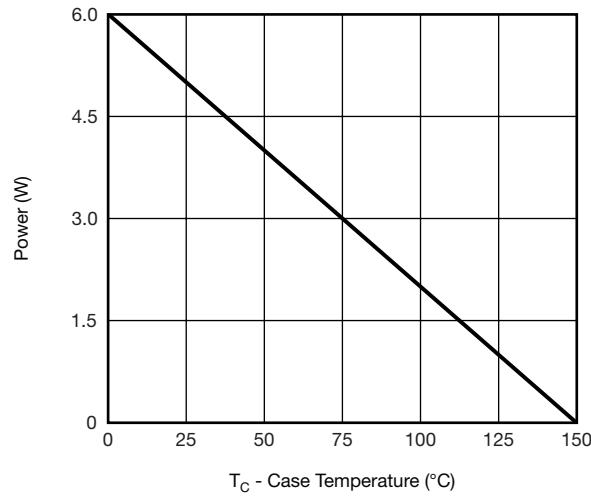
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted


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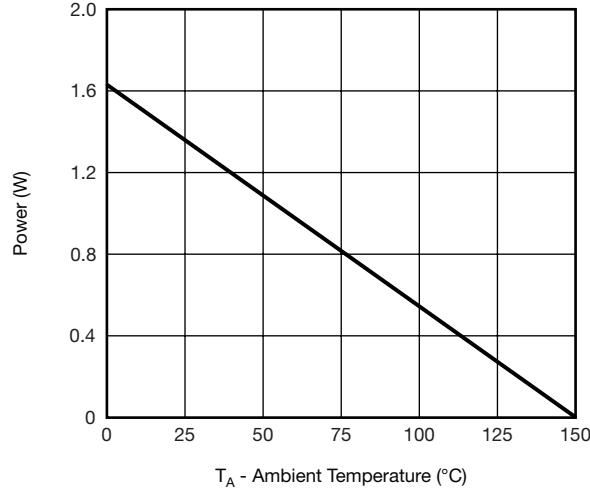


TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted


Current Derating*



Power Derating, Junction-to-Foot

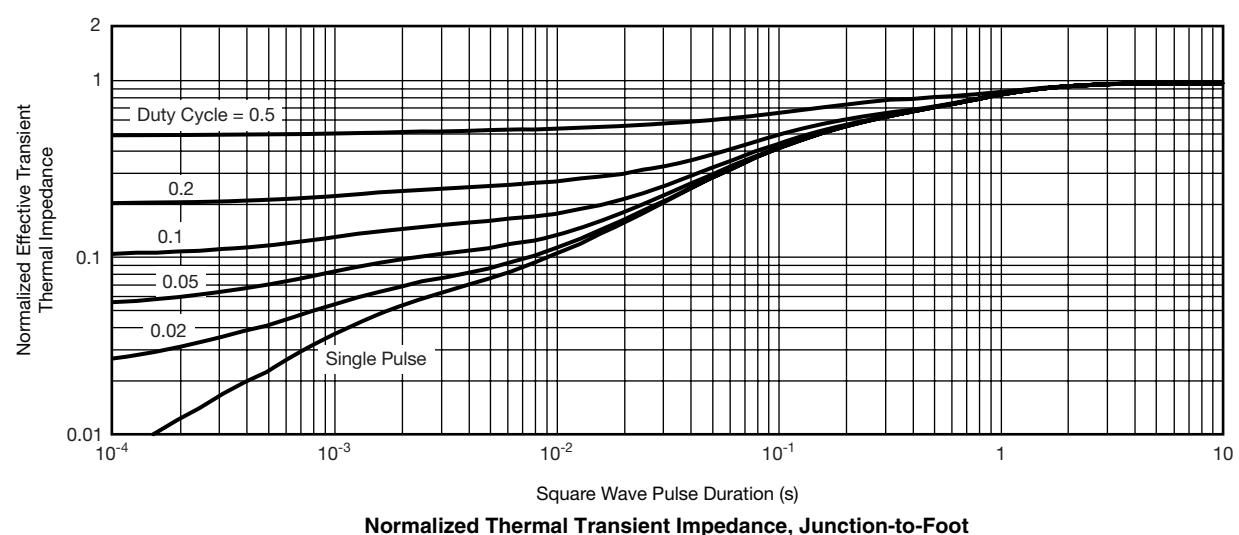
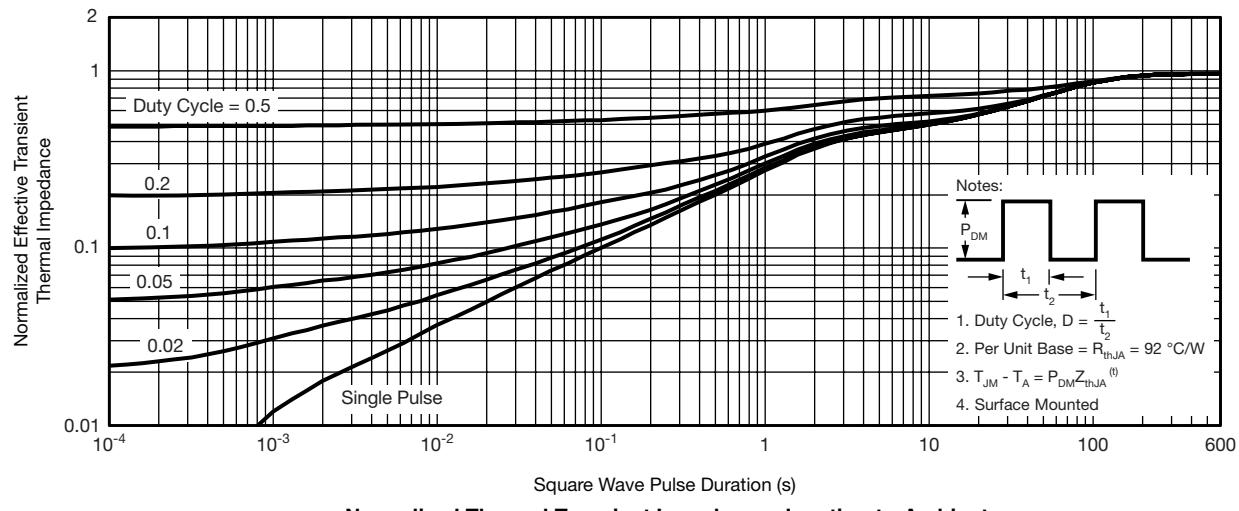


Power Derating, Junction-to-Ambient

* 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.

Si4004DY

Vishay Siliconix

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

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