



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

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)	Q_g (Typ.)
30	0.021 at $V_{GS} = 10$ V	12 ^a	3.7 nC
	0.033 at $V_{GS} = 4.5$ V	6	

FEATURES

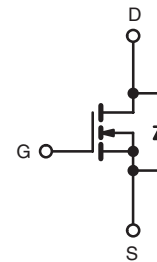
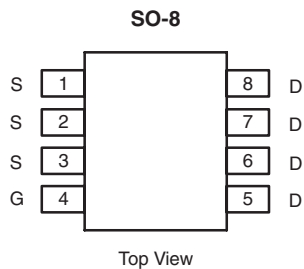
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET[®] Power MOSFET
- 100 % R_g and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Notebook System Power
- Low Current DC/DC



Ordering Information: Si4178DY-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}	30	V	
Gate-Source Voltage	V_{GS}	± 25		
Continuous Drain Current ($T_J = 150$ °C)	I_D	$T_C = 25$ °C	12 ^a	A
		$T_C = 70$ °C	9.7 ^a	
		$T_A = 25$ °C	8.3 ^{b, c}	
		$T_A = 70$ °C	6.7 ^{b, c}	
Pulsed Drain Current	I_{DM}	40		
Continuous Source-Drain Diode Current	I_S	$T_C = 25$ °C	4.2	
		$T_A = 25$ °C	2 ^{b, c}	
Single Pulse Avalanche Current	I_{AS}	10		
Single Pulse Avalanche Energy	E_{AS}	5	mJ	
Maximum Power Dissipation	P_D	$T_C = 25$ °C	5	W
		$T_C = 70$ °C	3.2	
		$T_A = 25$ °C	2.4 ^{b, c}	
		$T_A = 70$ °C	1.5 ^{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}	$t \leq 10$ s	R_{thJA}	42	53	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	19	25	

Notes:

- Package Limited.
- Surface Mounted on 1" x 1" FR4 board.
- $t = 10$ s.
- Maximum under Steady State conditions is 85 °C/W.

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	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		25		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			-6		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.4		2.8	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 25\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$			1	μA
		$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	20			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 8.4\text{ A}$		0.017	0.021	Ω
		$V_{GS} = 4.5\text{ V}, I_D = 2\text{ A}$		0.027	0.033	
Forward Transconductance ^a	g_{fs}	$V_{DS} = 15\text{ V}, I_D = 8.4\text{ A}$		22		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		405		pF
Output Capacitance	C_{oss}			110		
Reverse Transfer Capacitance	C_{rss}			56		
Total Gate Charge	Q_g	$V_{DS} = 15\text{ V}, V_{GS} = 10\text{ V}, I_D = 8.4\text{ A}$		7.5	12	nC
				3.7	5.6	
Gate-Source Charge	Q_{gs}	$V_{DS} = 15\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 8.4\text{ A}$		1.6		
Gate-Drain Charge	Q_{gd}			1.3		
Gate Resistance	R_g	$f = 1\text{ MHz}$	0.5	2.6	5.2	Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 15\text{ V}, R_L = 2.2\text{ }\Omega$ $I_D \cong 6.7\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		20	30	ns
Rise Time	t_r			15	25	
Turn-Off Delay Time	$t_{d(off)}$			11	20	
Fall Time	t_f			10	15	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 15\text{ V}, R_L = 2.2\text{ }\Omega$ $I_D \cong 6.7\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		7	15	
Rise Time	t_r			10	15	
Turn-Off Delay Time	$t_{d(off)}$			12	20	
Fall Time	t_f			10	15	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^\circ\text{C}$			4.2	A
Pulse Diode Forward Current	I_{SM}				40	
Body Diode Voltage	V_{SD}	$I_S = 6.7\text{ A}, V_{GS} = 0\text{ V}$		0.85	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 6.7\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		15	30	ns
Body Diode Reverse Recovery Charge	Q_{rr}			8	16	nC
Reverse Recovery Fall Time	t_a			8.5		ns
Reverse Recovery Rise Time	t_b			6.5		

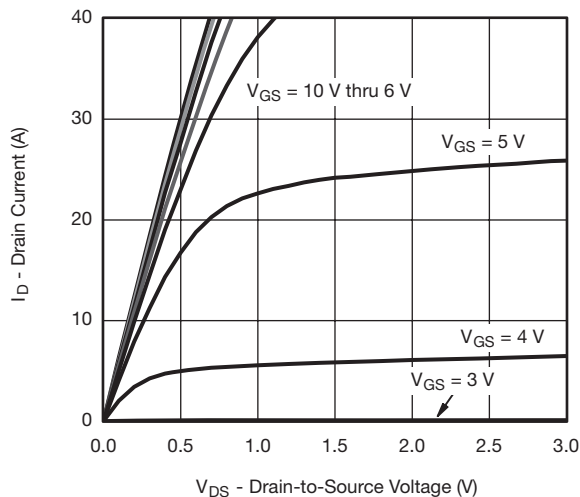
Notes:

- 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.

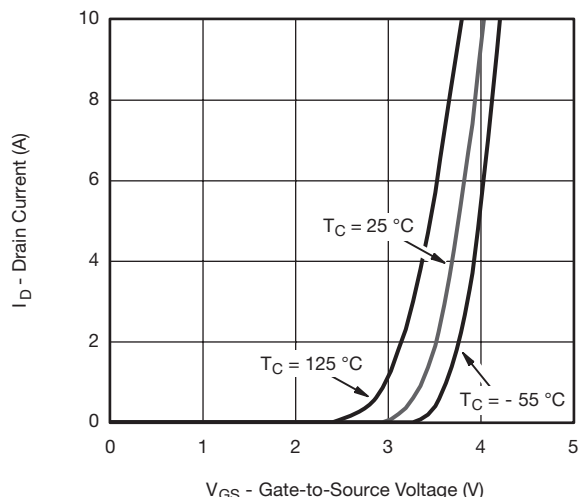


TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



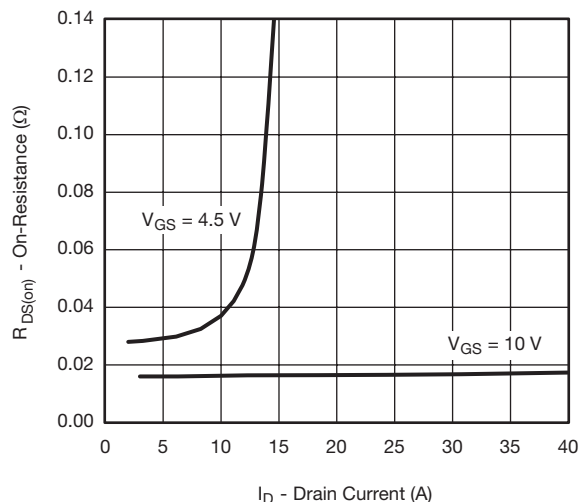
V_{DS} - Drain-to-Source Voltage (V)

Output Characteristics



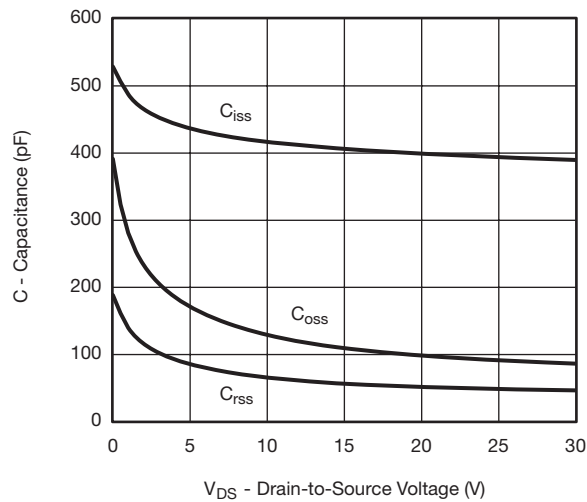
V_{GS} - Gate-to-Source Voltage (V)

Transfer Characteristics



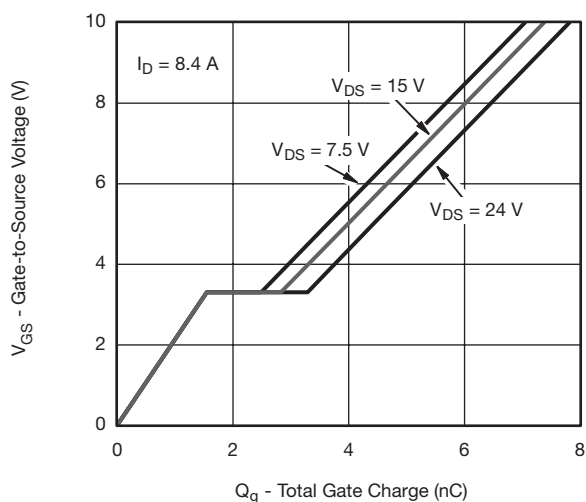
I_D - Drain Current (A)

On-Resistance vs. Drain Current



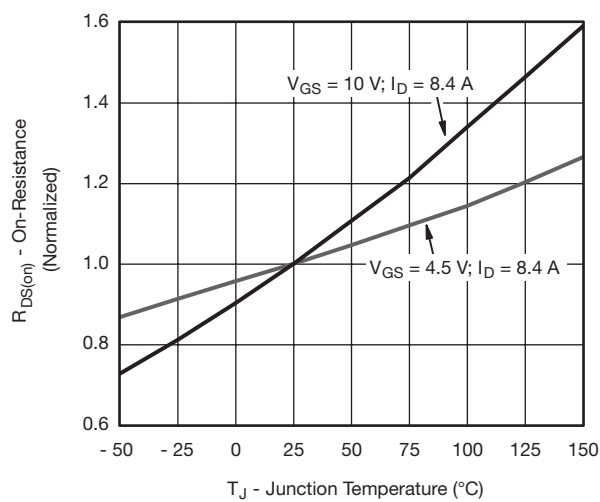
V_{DS} - Drain-to-Source Voltage (V)

Capacitance



Q_g - Total Gate Charge (nC)

Gate Charge



T_J - Junction Temperature (°C)

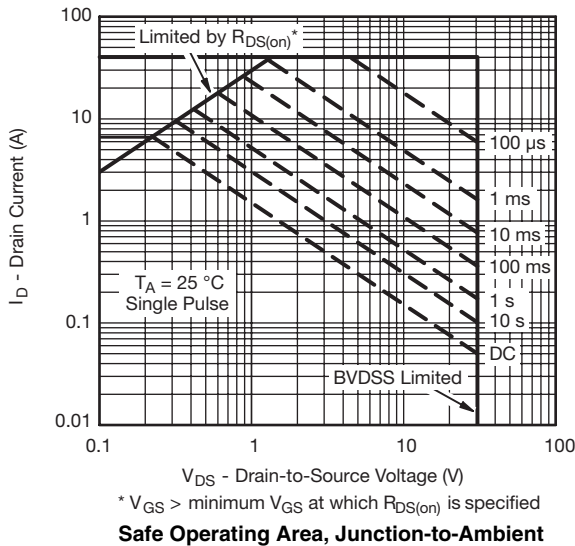
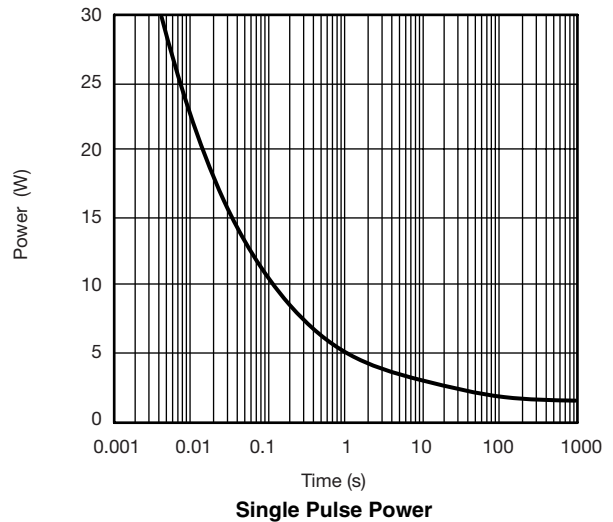
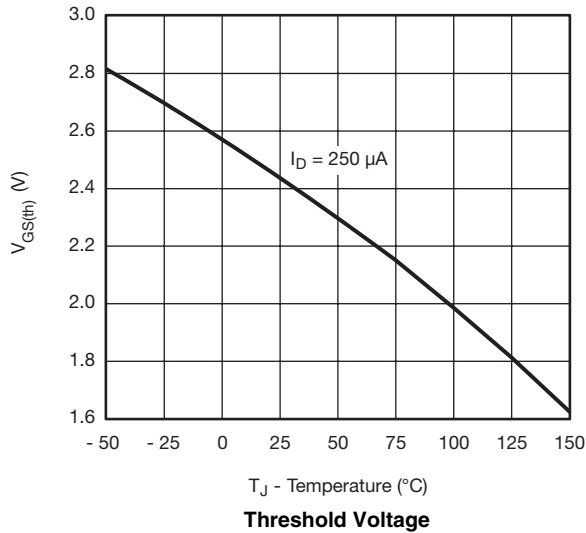
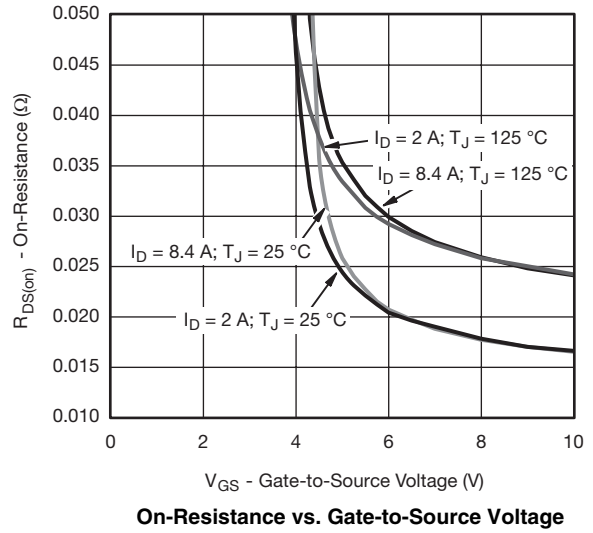
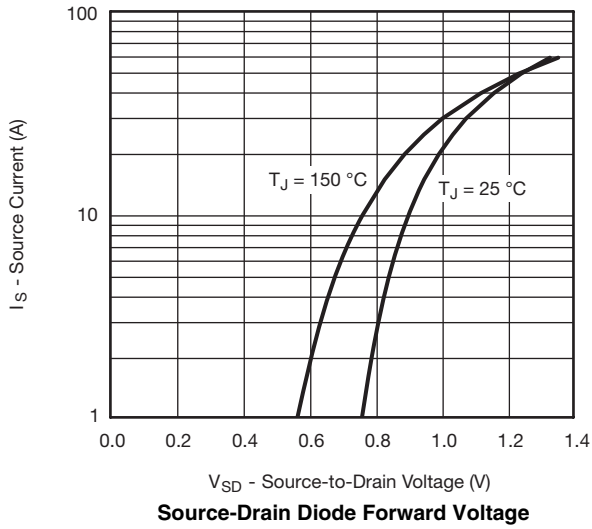
On-Resistance vs. Junction Temperature

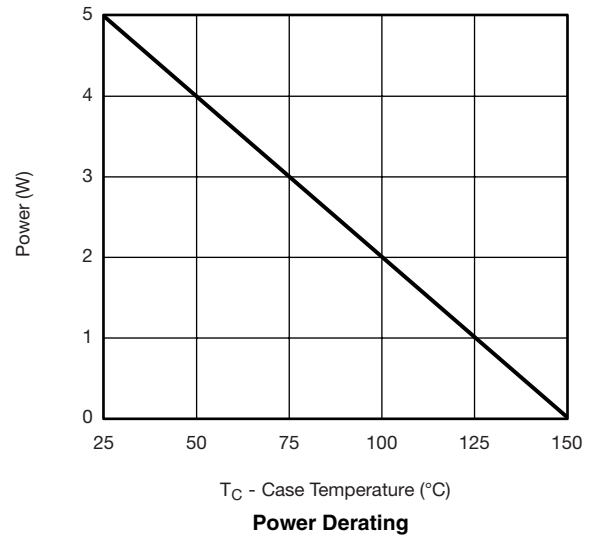
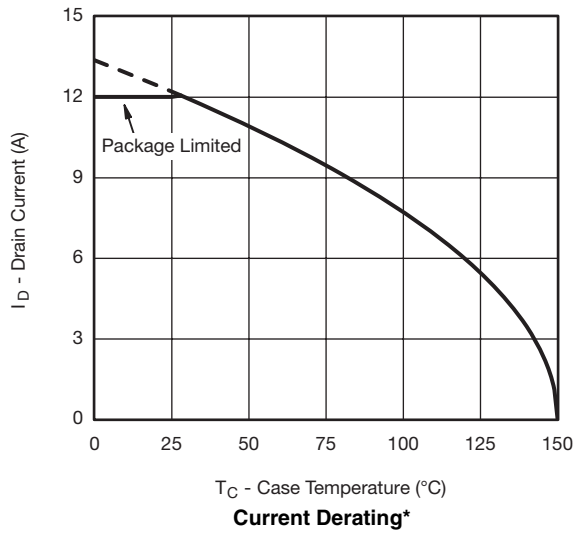
Si4178DY

Vishay Siliconix



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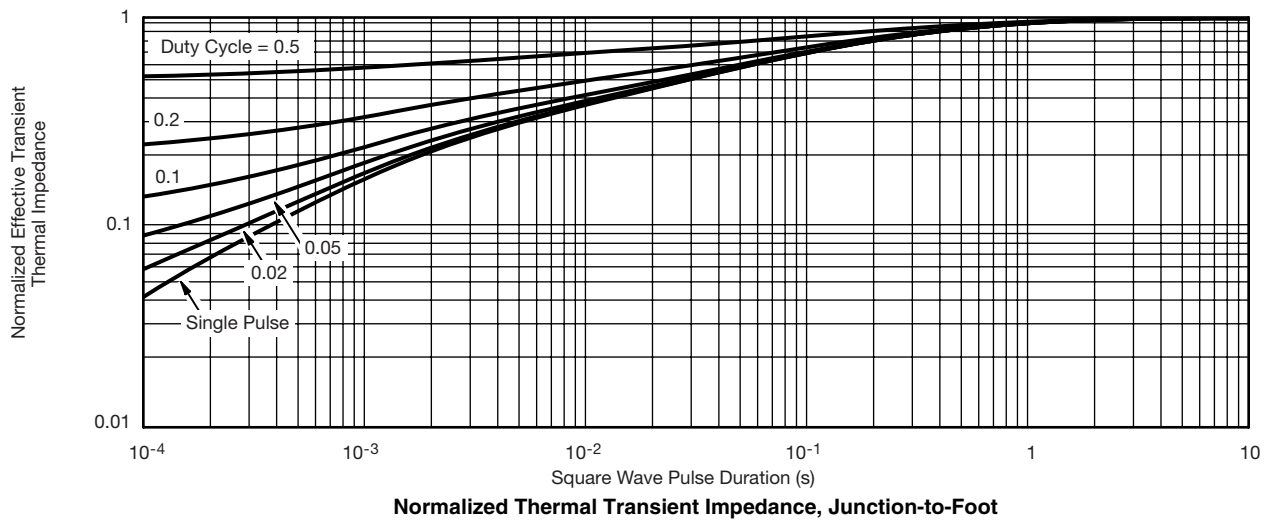
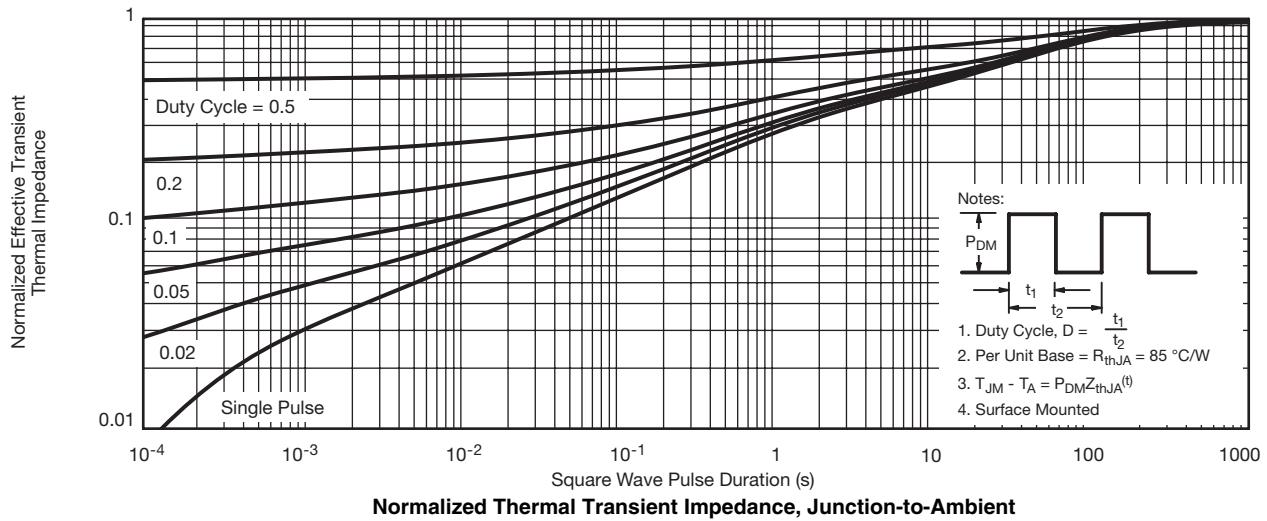
* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

Si4178DY

Vishay Siliconix



TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



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