

## P-Channel 20-V (D-S) MOSFET

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	r <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)	Q <sub>g</sub> (Typ)
- 20	0.022 at V <sub>GS</sub> = - 4.5 V	- 12 <sup>a</sup>	20 nC
	0.029 at V <sub>GS</sub> = - 2.5 V	- 12 <sup>a</sup>	
	0.041 at V <sub>GS</sub> = - 1.8 V	- 12 <sup>a</sup>	

### FEATURES

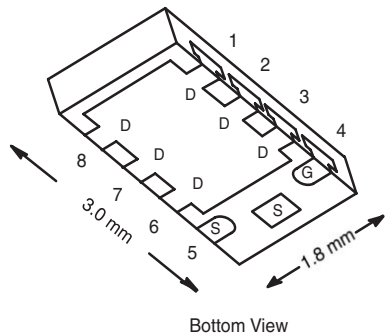
- TrenchFET<sup>®</sup> Power MOSFET
- New thermally Enhanced PowerPAK<sup>®</sup> ChipFET<sup>®</sup> Package
  - Small Footprint Area
  - Low On-Resistance
  - Thin 0.8 mm Profile



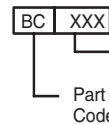
### APPLICATIONS

- Load Switch, Battery Switch, PA Switch and Charger Switch for Portable Devices

PowerPAK<sup>®</sup> ChipFET<sup>®</sup> Single

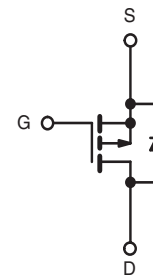


Marking Code



Lot Traceability and Date Code

Part # Code



P-Channel MOSFET

Ordering Information: Si5481DU-T1-E3 (Lead (Pb)-free)

ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted			
Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V <sub>DS</sub>	- 20	V
Gate-Source Voltage	V <sub>GS</sub>	± 8	
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	- 12 <sup>a</sup>
		T <sub>C</sub> = 70 °C	- 12 <sup>a</sup>
		T <sub>A</sub> = 25 °C	- 9.7 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	- 7.8 <sup>b, c</sup>
Pulsed Drain Current	I <sub>DM</sub>	- 20	A
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	
		T <sub>A</sub> = 25 °C	- 2.6 <sup>b, c</sup>
Maximum Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	17.8
		T <sub>C</sub> = 70 °C	11.4
		T <sub>A</sub> = 25 °C	3.1 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	2 <sup>b, c</sup>
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>		260	

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b, f</sup>	R <sub>thJA</sub>	30	40	°C/W
Maximum Junction-to-Case (Drain)	R <sub>thJC</sub>	5.5	7	

Notes:

- Package limited.
- Surface mounted on 1" x 1" FR4 board.
- t = 5 s.
- See Solder Profile (<http://www.vishay.com/ppg?73257>). The PowerPAK ChipFET is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.
- Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.
- Maximum under steady state conditions is 90 °C/W.



SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$	-20			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		-15.5		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		2.5			
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$	-0.4		-1	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 8\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -20\text{ V}$ , $V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
		$V_{DS} = -20\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 55\text{ }^\circ\text{C}$			-10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \leq 5\text{ V}$ , $V_{GS} = -4.5\text{ V}$	20			A
Drain-Source On-State Resistance <sup>a</sup>	$r_{DS(on)}$	$V_{GS} = -4.5\text{ V}$ , $I_D = -6.5\text{ A}$		0.018	0.022	$\Omega$
		$V_{GS} = -2.5\text{ V}$ , $I_D = -5.7\text{ A}$		0.024	0.029	
		$V_{GS} = -1.8\text{ V}$ , $I_D = 2.4\text{ A}$		0.033	0.041	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -10\text{ V}$ , $I_D = -6.5\text{ A}$		25		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = -10\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		1610		pF
Output Capacitance	$C_{oss}$		300			
Reverse Transfer Capacitance	$C_{rss}$		200			
Total Gate Charge	$Q_g$	$V_{DS} = -10\text{ V}$ , $V_{GS} = -8\text{ V}$ , $I_D = -9.7\text{ A}$		33	50	nC
				20	30	
Gate-Source Charge	$Q_{gs}$	$V_{DS} = -10\text{ V}$ , $V_{GS} = -4.5\text{ V}$ , $I_D = -9.7\text{ A}$		2.8		
Gate-Drain Charge	$Q_{gd}$			5.1		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		8		$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}$ , $R_L = 1.3\text{ }\Omega$ $I_D \cong -7.8\text{ A}$ , $V_{GEN} = -4.5\text{ V}$ , $R_g = 1\text{ }\Omega$		13	20	ns
Rise Time	$t_r$			50	75	
Turn-Off Delay Time	$t_{d(off)}$			90	135	
Fall Time	$t_f$			167	250	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}$ , $R_L = 1.3\text{ }\Omega$ $I_D \cong -7.8\text{ A}$ , $V_{GEN} = -8\text{ V}$ , $R_g = 1\text{ }\Omega$		6	15	
Rise Time	$t_r$			25	40	
Turn-Off Delay Time	$t_{d(off)}$			90	135	
Fall Time	$t_f$			167	250	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			-14.8	A
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$				20	
Body Diode Voltage	$V_{SD}$	$I_S = -7.8\text{ A}$ , $V_{GS} = 0\text{ V}$		-0.8	-1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = -7.8\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $T_J = 25\text{ }^\circ\text{C}$		30	60	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			17	30	nC
Reverse Recovery Fall Time	$t_a$			14		ns
Reverse Recovery Rise Time	$t_b$			16		

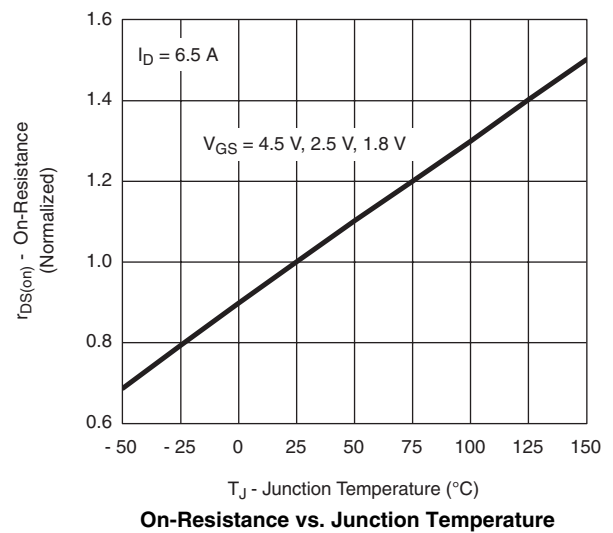
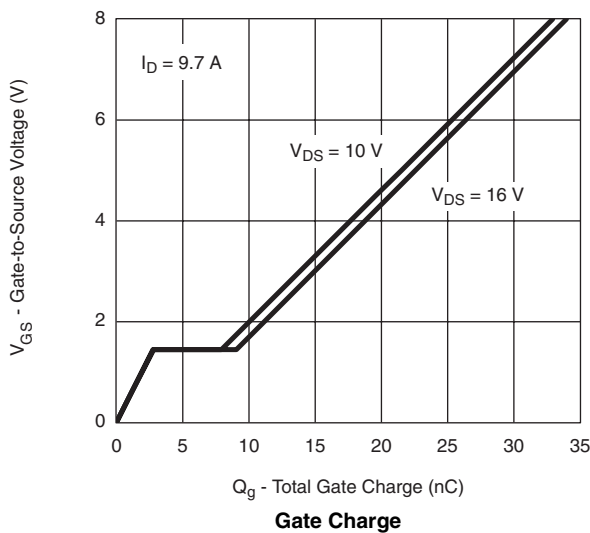
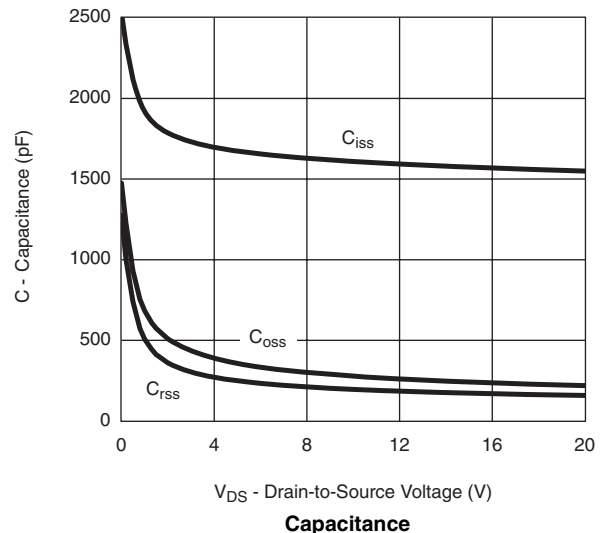
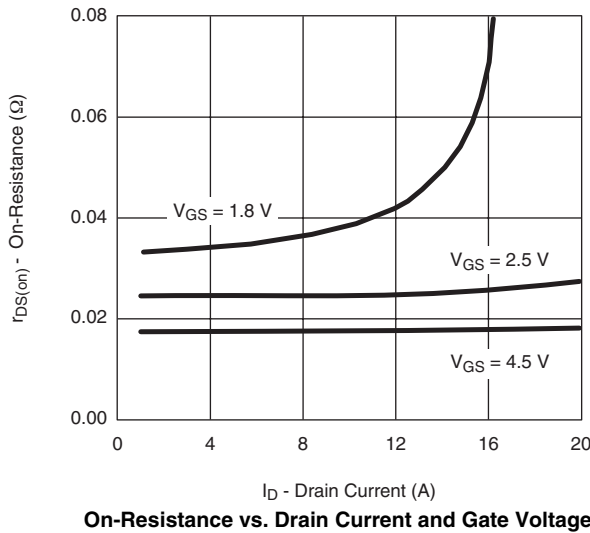
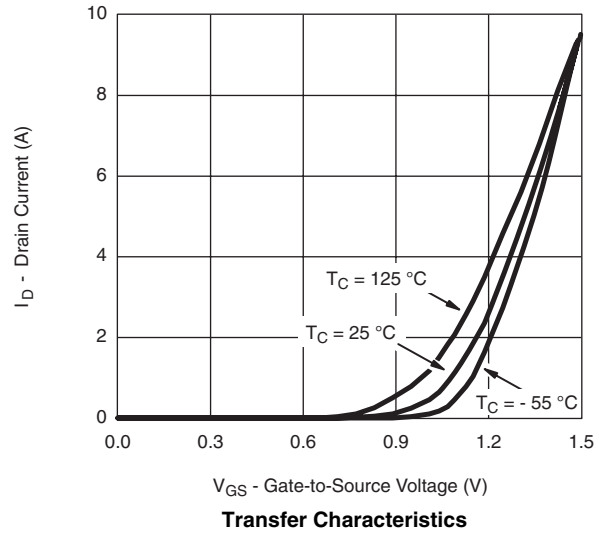
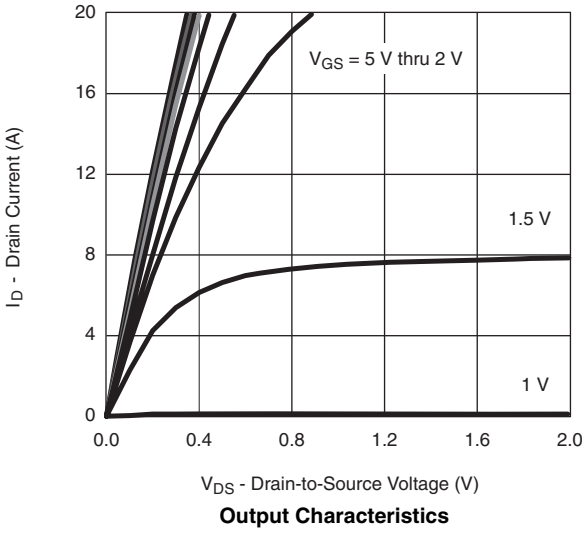
## Notes:

- 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.

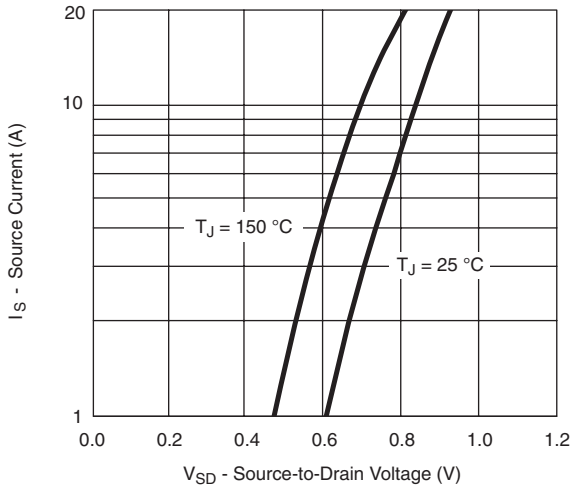


**TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted

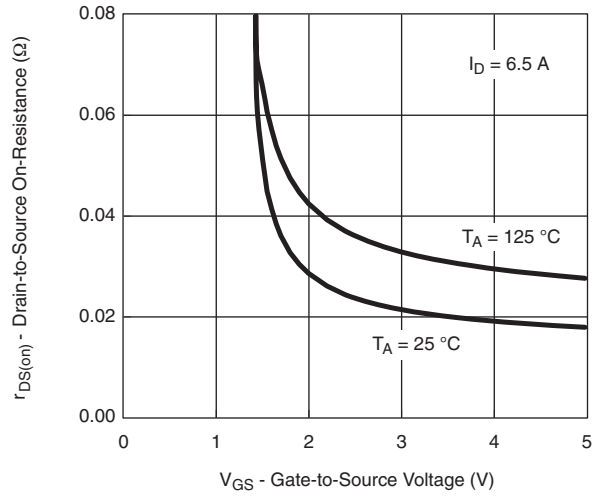




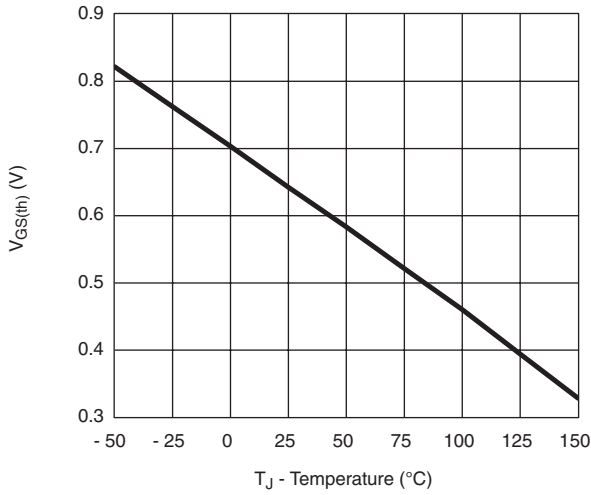
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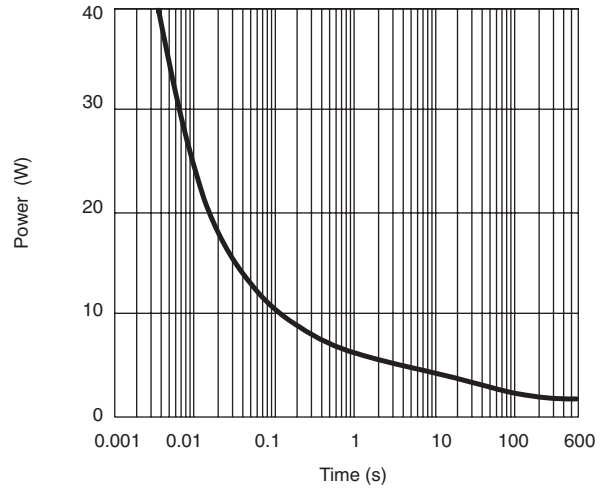
**Source-Drain Diode Forward Voltage**



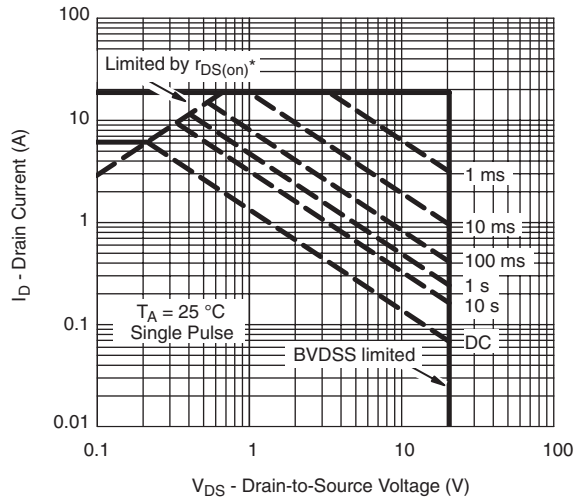
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



**Single Pulse Power, Junction-to-Ambient**

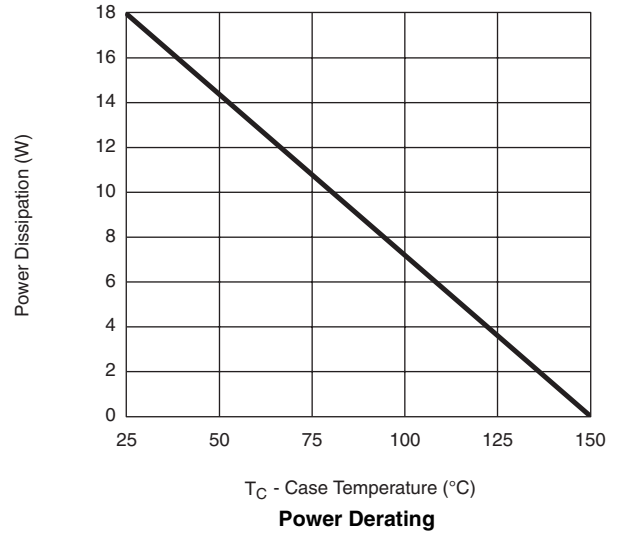
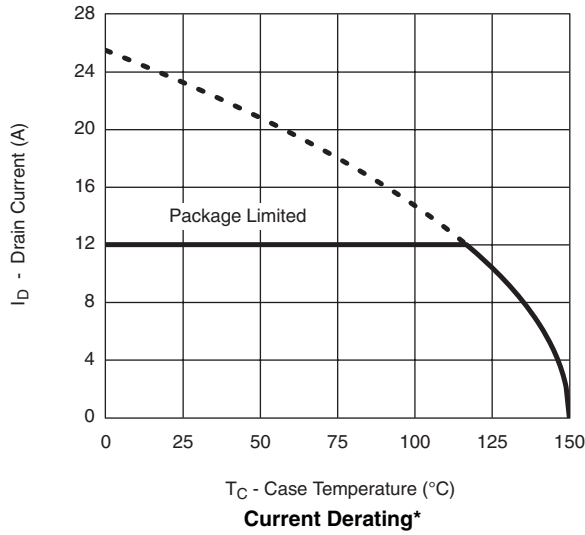


\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $r_{DS(on)}$  is specified

**Safe Operating Area, Junction-to-Ambient**



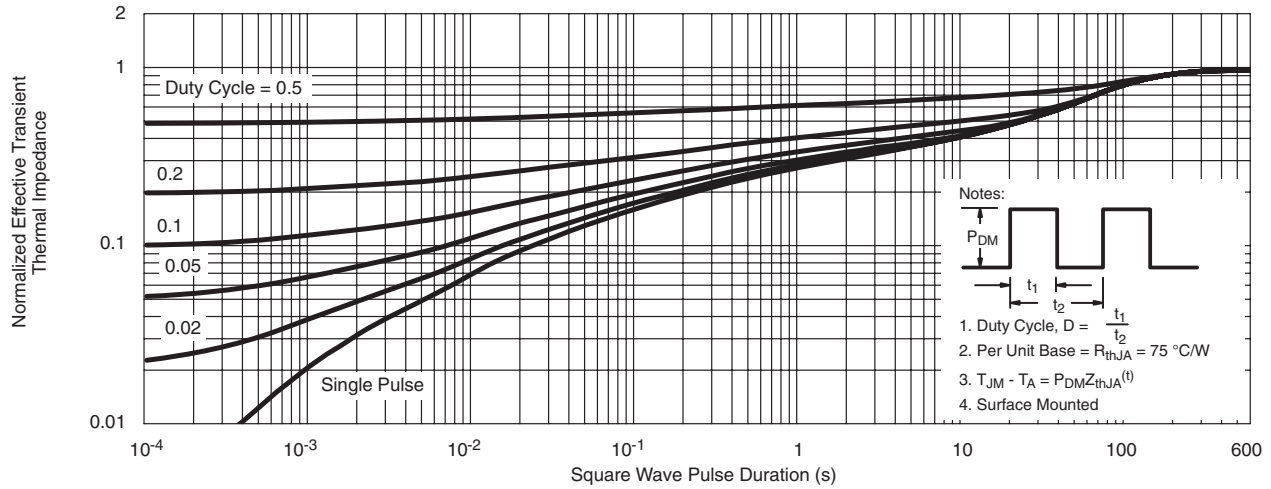
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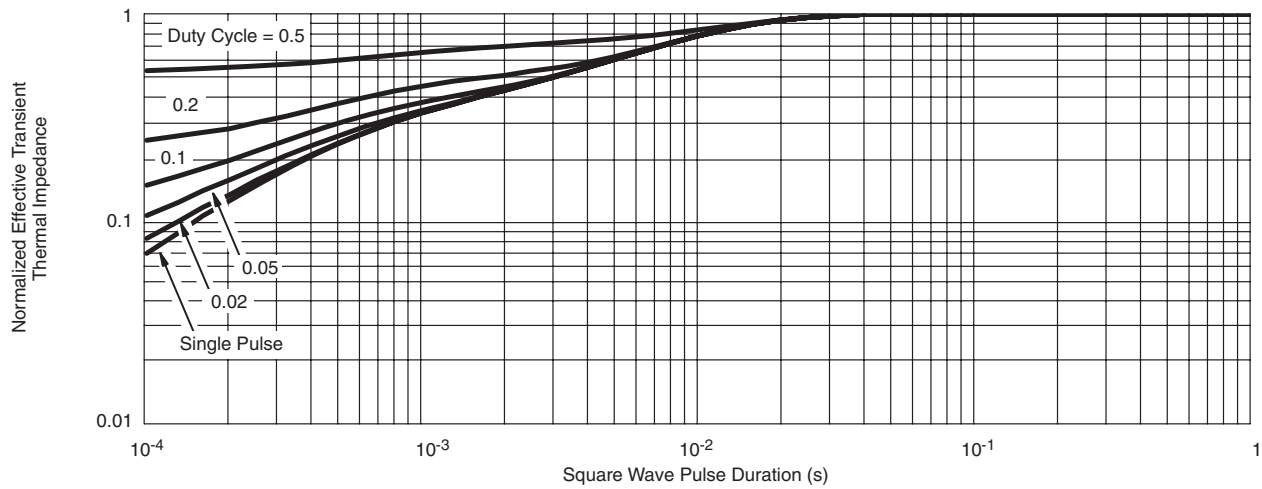
\* The power dissipation  $P_D$  is based on  $T_{J(\max)} = 150\text{ }^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating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



**TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



**Normalized Thermal Transient Impedance, Junction-to-Ambient**



**Normalized Thermal Transient Impedance, Junction-to-Case**

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