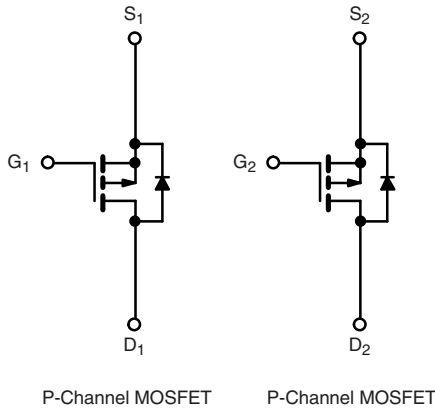


# AP9923GEO-HF-VB Datasheet

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

PRODUCT SUMMARY			
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>d</sup>	$Q_g$ (Typ.)
- 20	0.013 at $V_{GS} = - 4.5$ V	-7.5	20 nC
	0.018 at $V_{GS} = - 2.5$ V	-6.5	
	0.032 at $V_{GS} = - 1.8$ V	-5.0	



### FEATURES

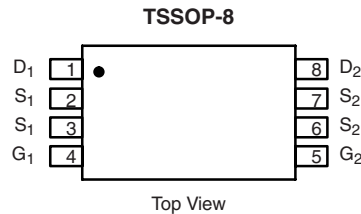
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET<sup>®</sup> Power MOSFET
- 100 %  $R_g$  Tested
- 100 % UIS Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### APPLICATIONS

- Adaptor Switch
- High Current Load Switch
- Notebook



ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)				
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	$V_{DS}$	- 20	V	
Gate-Source Voltage	$V_{GS}$	$\pm 12$		
Continuous Drain Current ( $T_J = 150$ °C)	$I_D$	$T_C = 25$ °C	- 7.5	A
		$T_C = 70$ °C	- 6.0	
		$T_A = 25$ °C	- 5.4 <sup>a, b</sup>	
		$T_A = 70$ °C	- 4.5 <sup>a, b</sup>	
Pulsed Drain Current	$I_{DM}$	- 30		
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25$ °C	- 4.1	
		$T_A = 25$ °C	- 2.1 <sup>a, b</sup>	
Avalanche Current	$I_{AS}$	- 15		
Single-Pulse Avalanche Energy	$E_{AS}$	11.25	mJ	
Maximum Power Dissipation	$P_D$	$T_C = 25$ °C	5	W
		$T_C = 70$ °C	3.2	
		$T_A = 25$ °C	2.5 <sup>a, b</sup>	
		$T_A = 70$ °C	1.6 <sup>a, b</sup>	
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 <sup>a, c</sup>	$R_{thJA}$	38	50	°C/W	
Maximum Junction-to-Foot	$R_{thJF}$	20	25		

Notes:

- Surface mounted on 1" x 1" FR4 board.
- $t = 10$  s.
- Maximum under steady state conditions is 85 °C/W.
- Based on  $T_C = 25$  °C.

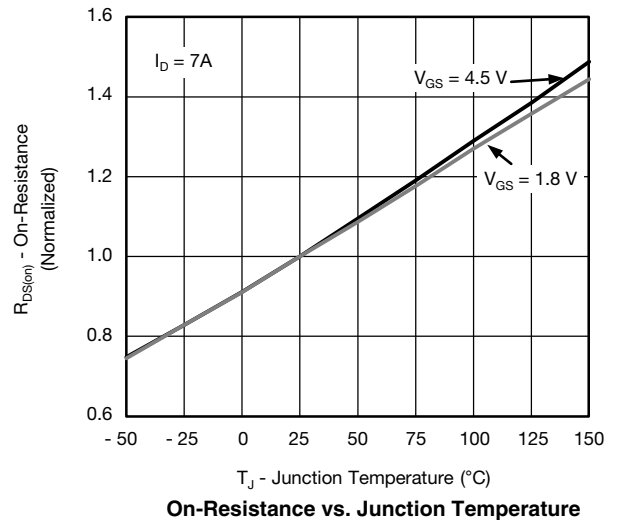
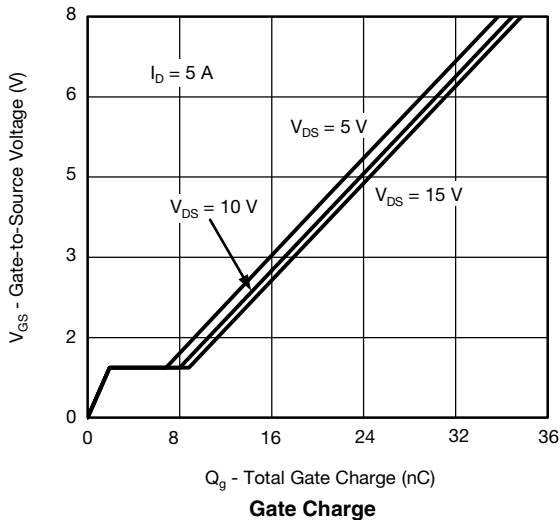
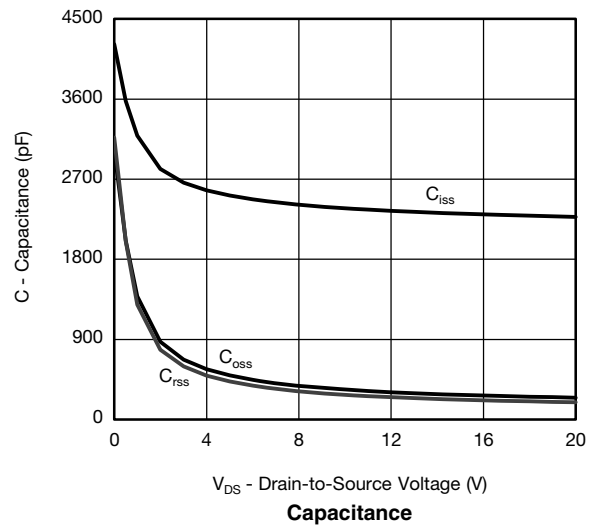
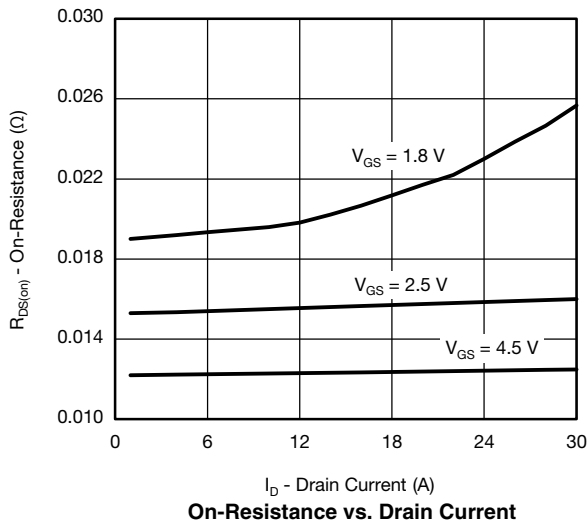
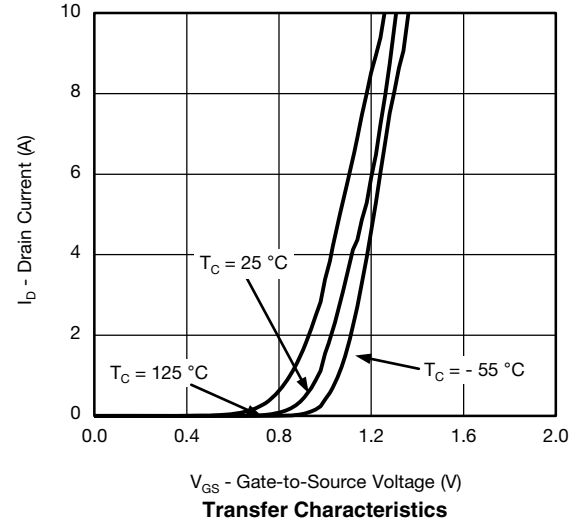
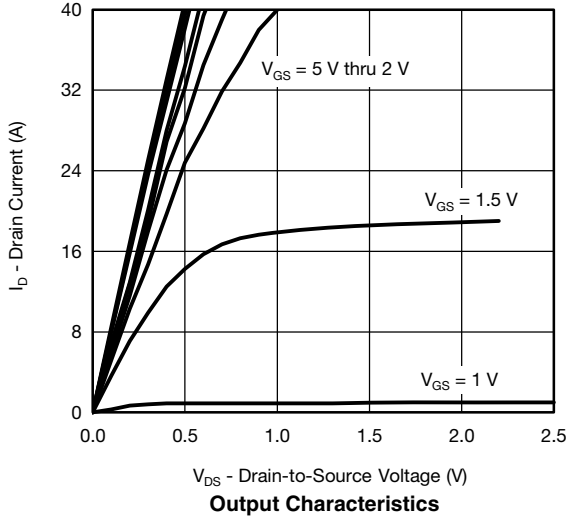
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	- 20			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		- 14.5		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			2.8		
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	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$			- 1	$\mu\text{A}$
		$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}, T_J = 70\text{ }^\circ\text{C}$			- 10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq -10\text{ V}, V_{GS} = -5\text{ V}$	- 20			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -7\text{ A}$		0.013		$\Omega$
		$V_{GS} = -2.5\text{ V}, I_D = -6\text{ A}$		0.018		
		$V_{GS} = -1.8\text{ V}, I_D = -3\text{ A}$		0.032		
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -10\text{ V}, I_D = -9\text{ A}$		40		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		2380		pF
Output Capacitance	$C_{oss}$			340		
Reverse Transfer Capacitance	$C_{rss}$			280		
Total Gate Charge	$Q_g$	$V_{DS} = -10\text{ V}, V_{GS} = -8\text{ V}, I_D = -5\text{ A}$		45	70	nC
				20	35	
Gate-Source Charge	$Q_{gs}$	$V_{DS} = -10\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -5\text{ A}$		3.1		nC
Gate-Drain Charge	$Q_{gd}$			8.4		
Gate Resistance	$R_g$		$f = 1\text{ MHz}$	1.0	4.8	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 2\text{ }\Omega$ $I_D \cong -5\text{ A}, V_{GEN} = -8\text{ V}, R_g = 1\text{ }\Omega$		7	14	ns
Rise Time	$t_r$			9	18	
Turn-Off DelayTime	$t_{d(off)}$			108	200	
Fall Time	$t_f$			41	80	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 2\text{ }\Omega$ $I_D \cong -5\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\text{ }\Omega$		14	28	ns
Rise Time	$t_r$			16	32	
Turn-Off DelayTime	$t_{d(off)}$			101	200	
Fall Time	$t_f$			40	80	
<b>Drain-Source Body Diode Characteristics</b>						
Continous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			- 4.1	A
Pulse Diode Forward Current	$I_{SM}$				- 40	
Body Diode Voltage	$V_{SD}$	$I_S = -3\text{ A}, V_{GS} = 0\text{ V}$		- 0.66	- 1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = -2.3\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		81	150	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			150	300	nC
Reverse Recovery Fall Time	$t_a$			43		ns
Reverse Recovery Rise Time	$t_b$			38		

Notes:

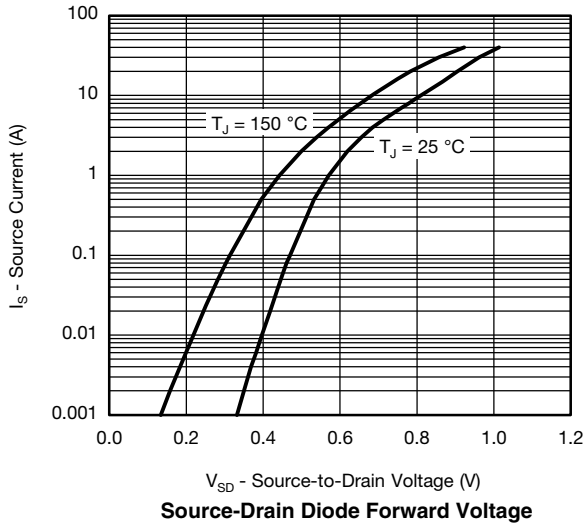
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- b. Guaranteed by design, not subject to production testing.

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.

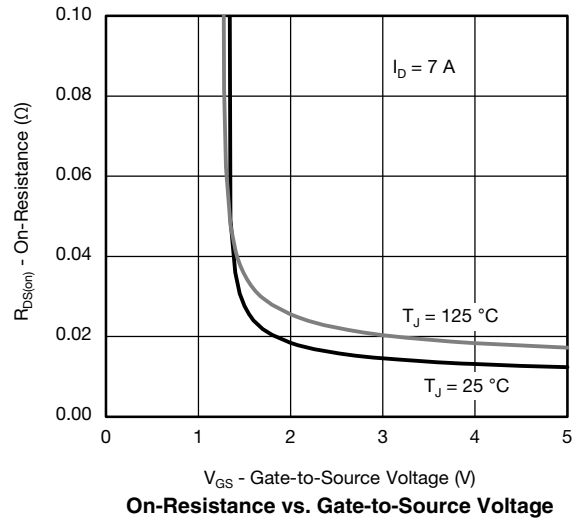
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



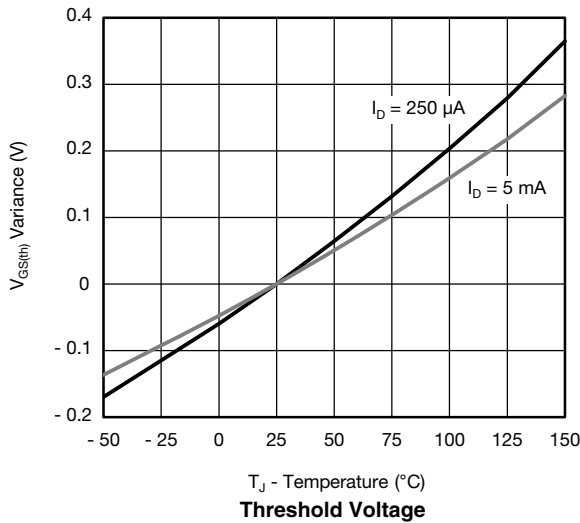
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



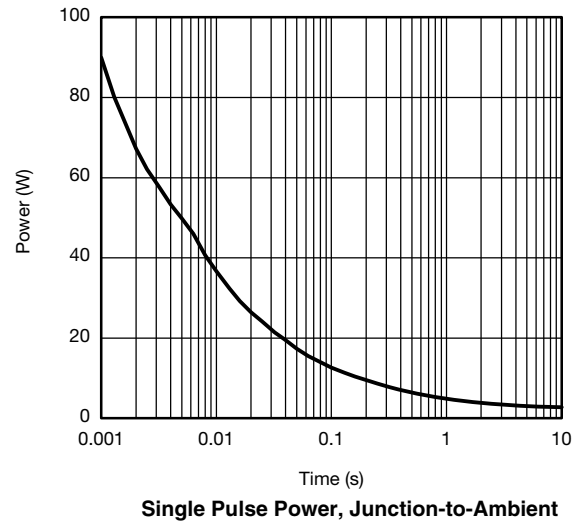
Source-Drain Diode Forward Voltage



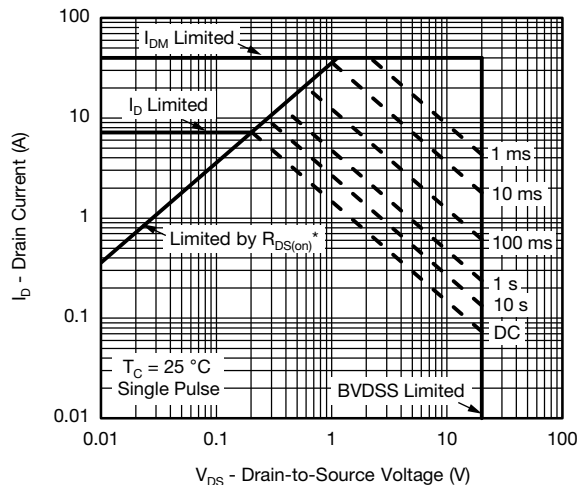
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



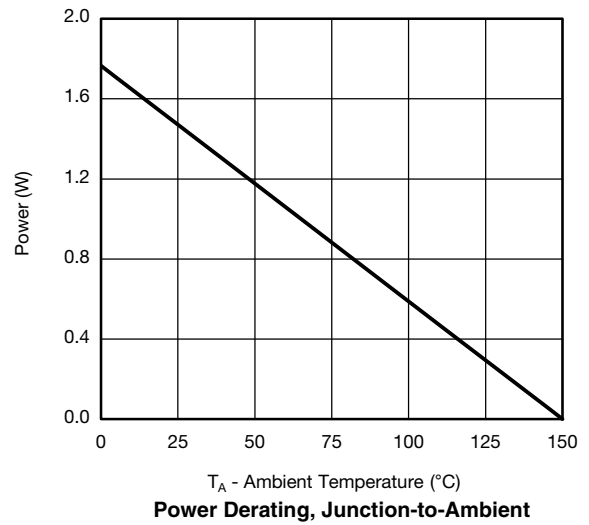
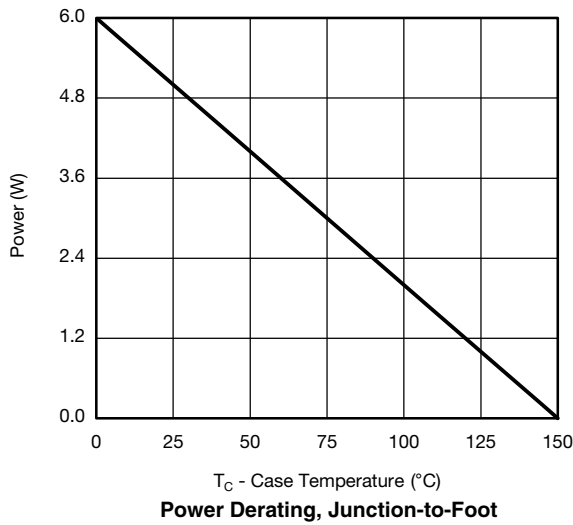
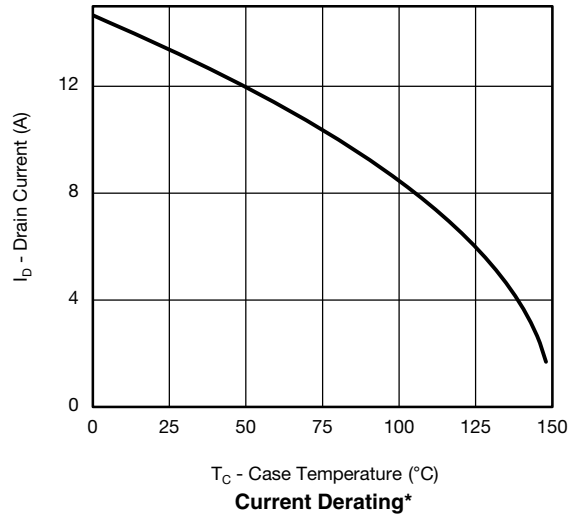
Single Pulse Power, Junction-to-Ambient



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

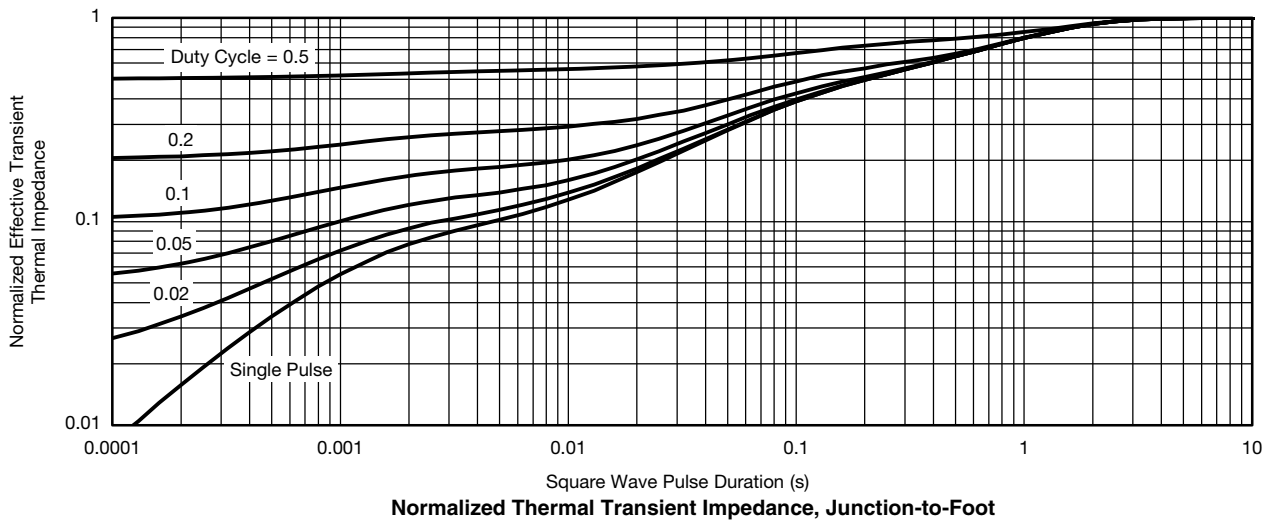
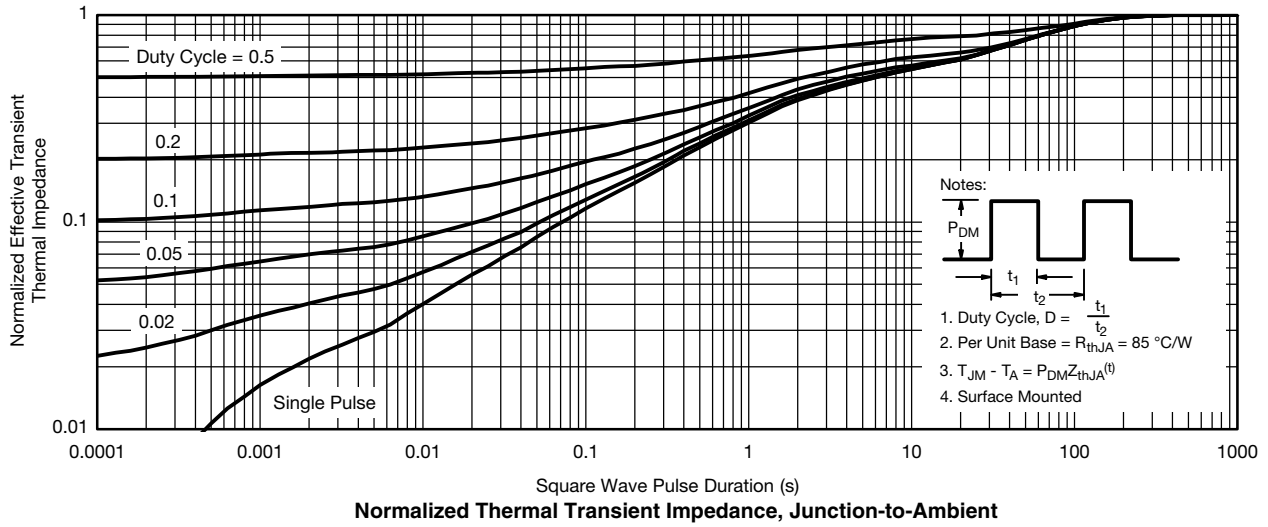
Safe Operating Area

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



\* The power dissipation P<sub>D</sub> is based on T<sub>J(max)</sub> = 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)



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