

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

PRODUCT SUMMARY			
$V_{DS}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ)
30	0.0095 @ $V_{GS} = 10$ V	18.2	9.2 nC
	0.014 @ $V_{GS} = 4.5$ V	15	

### FEATURES

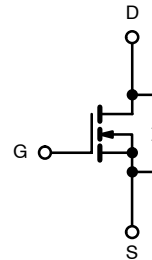
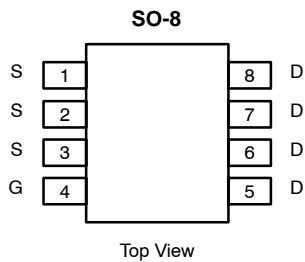
- Extremely Low  $Q_{gd}$  WFET® Technology for Low Switching Losses
- TrenchFET® Power MOSFET
- 100%  $R_g$  Tested



RoHS  
COMPLIANT

### APPLICATIONS

- High-Side DC/DC Conversion
  - Notebook
  - Server



Ordering Information: Si4686DY-T1—E3 (Lead (Pb)-Free)

N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)			
Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 150^\circ\text{C}$ )	$I_D$	$T_C = 25^\circ\text{C}$	18.2
		$T_C = 70^\circ\text{C}$	14.5
		$T_A = 25^\circ\text{C}$	13.8 <sup>b, c</sup>
		$T_A = 70^\circ\text{C}$	11 <sup>b, c</sup>
Pulsed Drain Current	$I_{DM}$	50	A
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	2.5 <sup>b, c</sup>
Maximum Power Dissipation	$P_D$	$T_C = 25^\circ\text{C}$	5.2
		$T_C = 70^\circ\text{C}$	3.3
		$T_A = 25^\circ\text{C}$	3.0 <sup>b, c</sup>
		$T_A = 70^\circ\text{C}$	1.9 <sup>b, c</sup>
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature)			

THERMAL RESISTANCE RATINGS					
Parameter	Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient <sup>b, d</sup>	$R_{thJA}$	35	42	$^\circ\text{C}/\text{W}$	
Maximum Junction-to-Foot (Drain)	$R_{thJF}$	20	24		

Notes:

- Based on  $T_C = 25^\circ\text{C}$ .
- Surface mounted on 1" x 1" FR4 board.
- $t = 10$  sec
- Maximum under steady state conditions is 80  $^\circ\text{C}/\text{W}$ .



SPECIFICATIONS (T <sub>J</sub> = 25 °C UNLESS OTHERWISE NOTED)						
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	30			V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA		31.3		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			-6		
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1		3	V
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V			±100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			10	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 5 V, V <sub>GS</sub> = 10 V	50			A
Drain-Source On-State Resistance <sup>a</sup>	r <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 13.8 A		0.0078	0.0095	Ω
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 11.4 A		0.011	0.014	
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 13.8 A		56		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	C <sub>iSS</sub>	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V, f = 1 MHz		1220		pF
Output Capacitance	C <sub>oss</sub>			230		
Reverse Transfer Capacitance	C <sub>rSS</sub>			98		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 13.8 A		17	26	nC
		V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 5 V, I <sub>D</sub> = 13.8 A		9.2	14	
Gate-Source Charge	Q <sub>gs</sub>			4.1		
Gate-Drain Charge	Q <sub>gd</sub>		2.8			
Gate Resistance	R <sub>g</sub>	f = 1 MHz		0.8	1.2	Ω
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 15 V, R <sub>L</sub> = 1.5 Ω I <sub>D</sub> ≅ 10 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω		20	30	ns
Rise Time	t <sub>r</sub>			20	30	
Turn-Off Delay Time	t <sub>d(off)</sub>			20	30	
Fall Time	t <sub>f</sub>			8	15	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 15 V, R <sub>L</sub> = 1.5 Ω I <sub>D</sub> ≅ 10 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω		13	20	
Rise Time	t <sub>r</sub>			16	25	
Turn-Off Delay Time	t <sub>d(off)</sub>			23	35	
Fall Time	t <sub>f</sub>			8	15	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			4.3	A
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				50	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = 2.6 A		0.8	1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 2.6 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C		25	50	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			15	30	nC
Reverse Recovery Fall Time	t <sub>a</sub>			12.5		ns
Reverse Recovery Rise Time	t <sub>b</sub>			12.5		

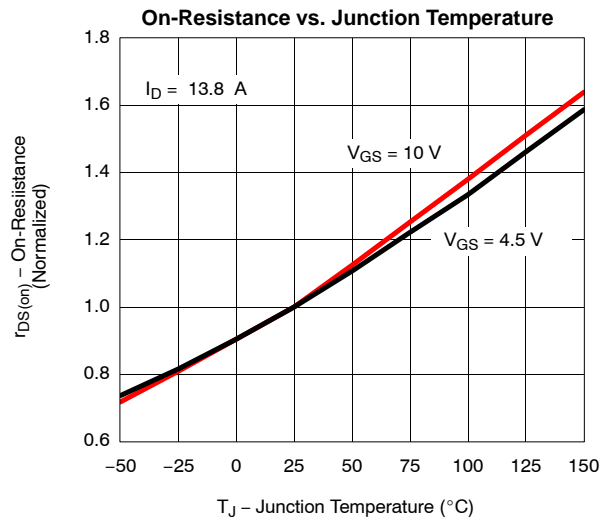
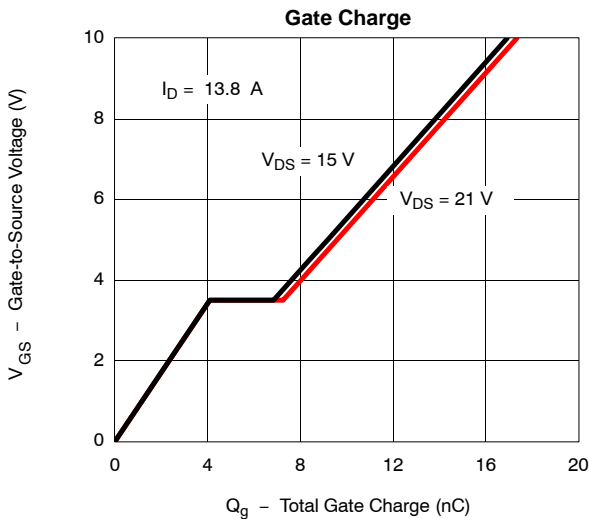
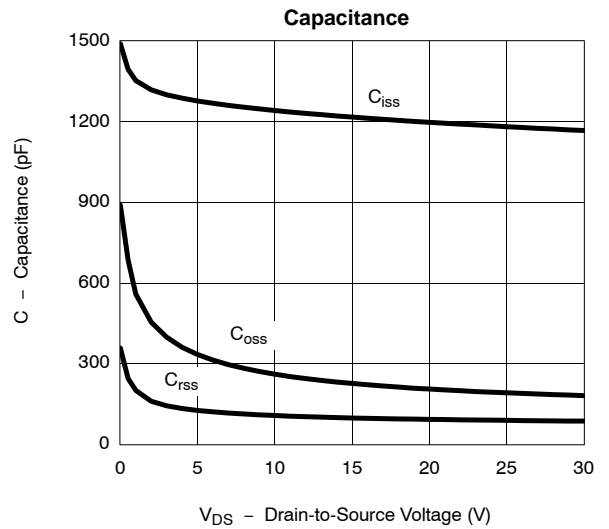
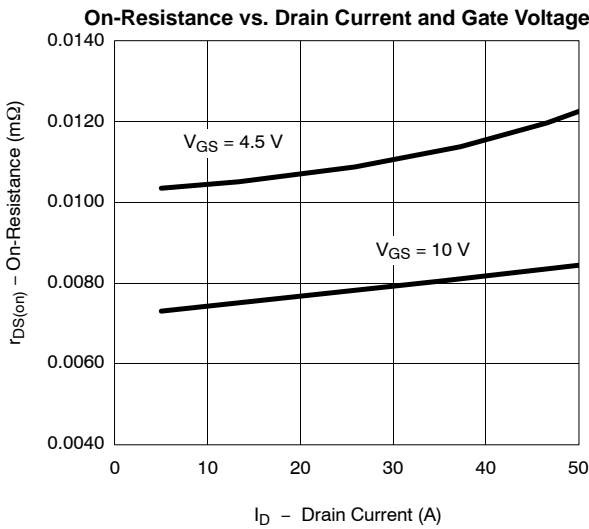
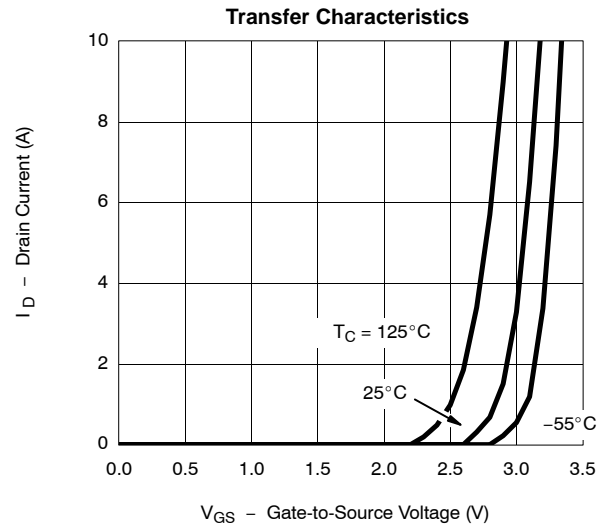
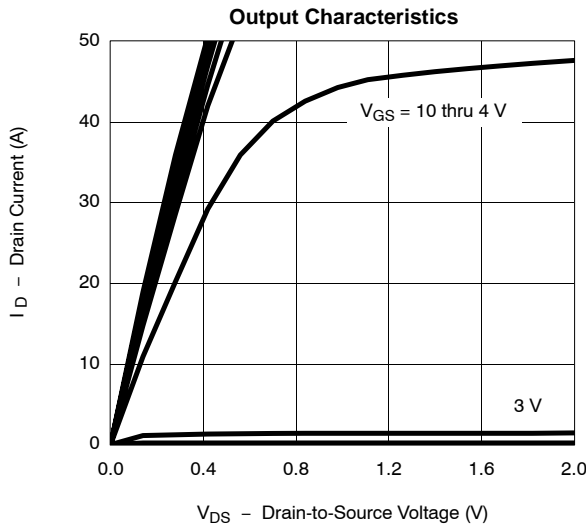
## Notes

- a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 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.



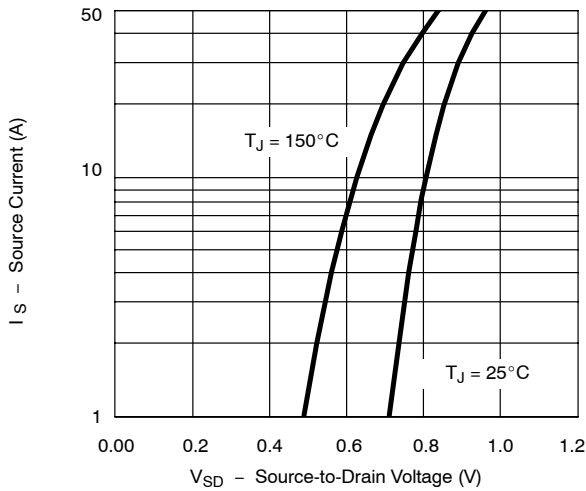
**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**



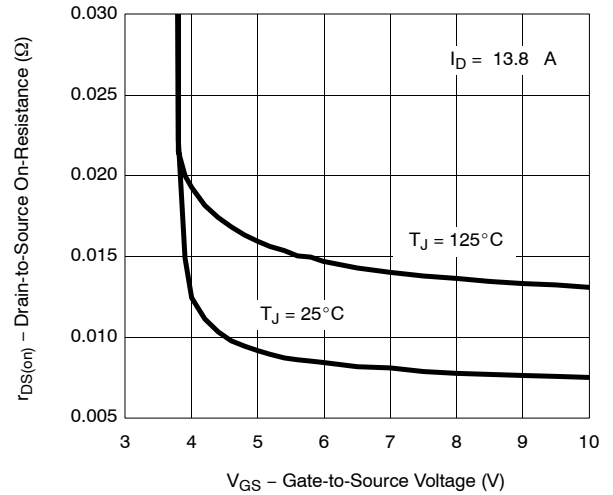


**TYPICAL CHARACTERISTICS (25 °C UNLESS NOTED)**

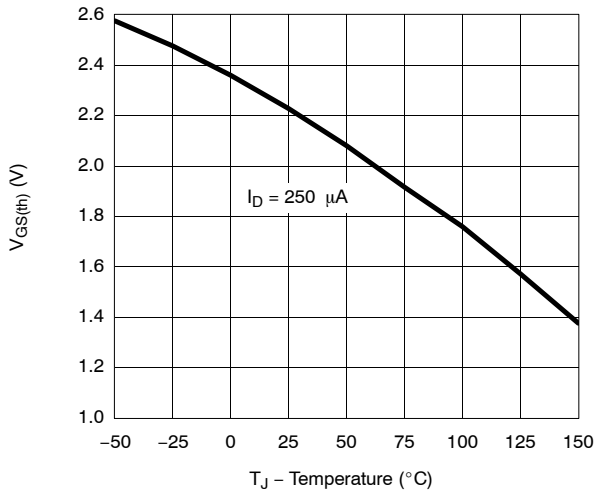
Source-Drain Diode Forward Voltage



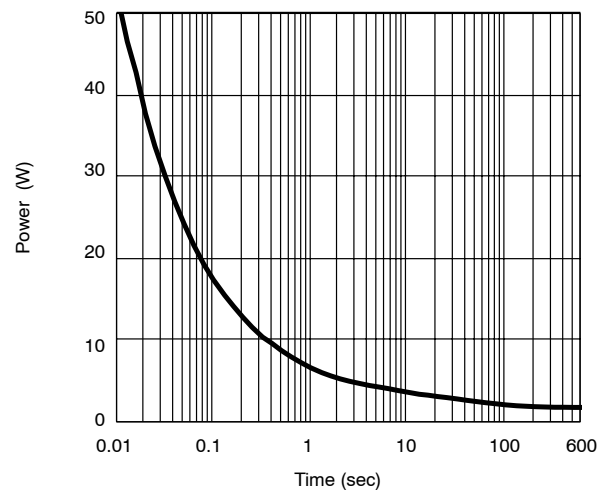
On-Resistance vs. Gate-to-Source Voltage



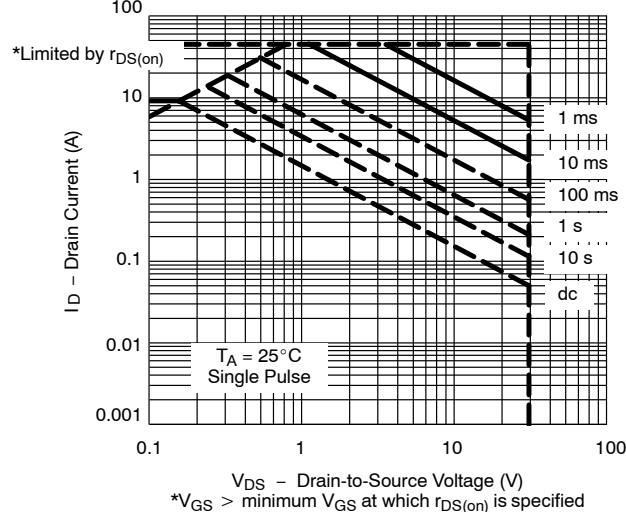
Threshold Voltage



Single Pulse Power, Junction-to-Ambient

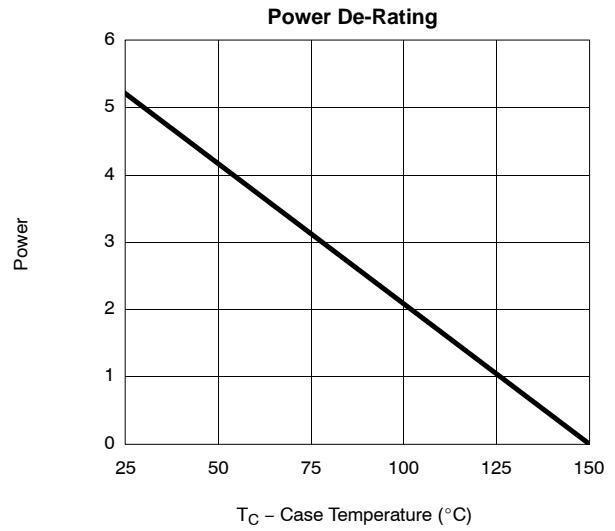
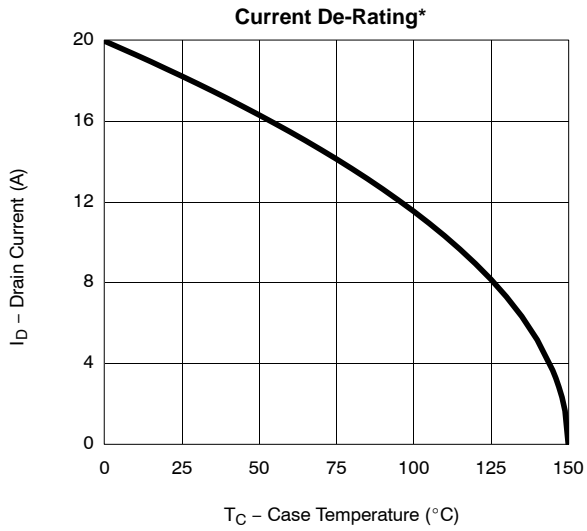


Safe Operating Area, Junction-to-Ambient





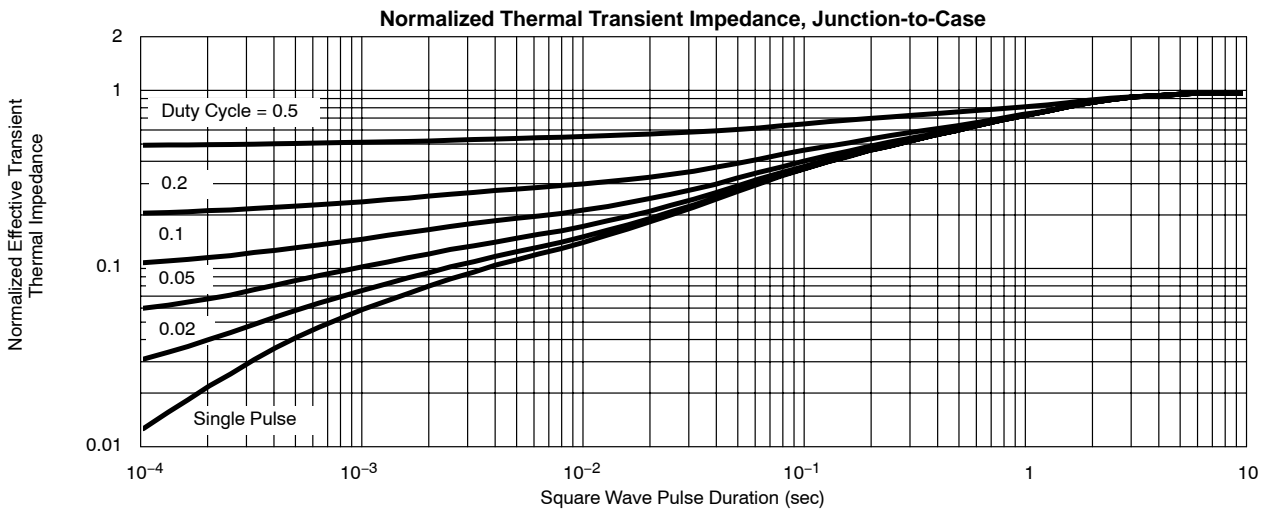
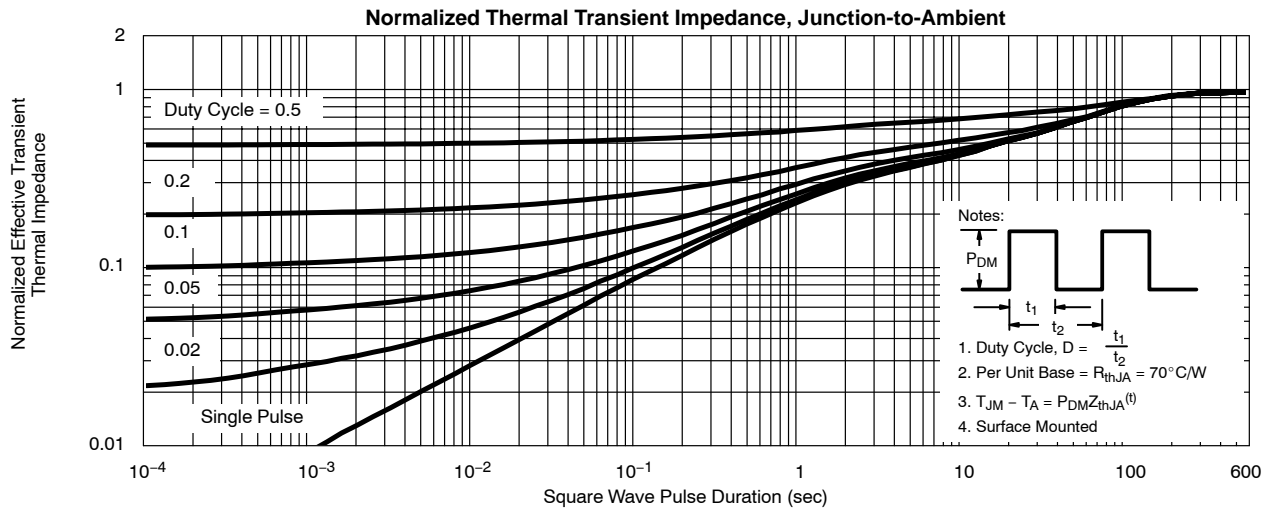
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\*The power dissipation  $P_D$  is based on  $T_{J(max)} = 150^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine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



**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**



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