N- and P-Channel 40-V (D-S) MOSFET

PRODUCT SUMMARY

	V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)[a]	Q_g (Typ.)
N-Channel	40	0.060 at V_{GS} = 10 V	5.0	5.6
		0.070 at V_{GS} = 4.5 V	4.7	
N-Channel	- 40	0.085 at V_{GS} = - 10 V	- 4.4	6
		0.122 at V_{GS} = - 4.5 V	- 3.7	

FEATURES

- **Halogen-free According to IEC 61249-2-21 Available**
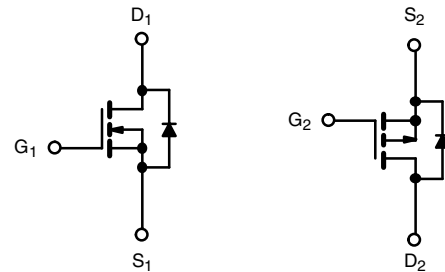- TrenchFET® Power MOSFET
- 100 % R_g Tested

APPLICATIONS

- CCFL Inverter

RoHS COMPLIANT

HALOGEN FREE Available

SO-8

S_1	1		8	D_1
G_1	2		7	D_1
S_2	3		6	D_2
G_2	4		5	D_2

Top View
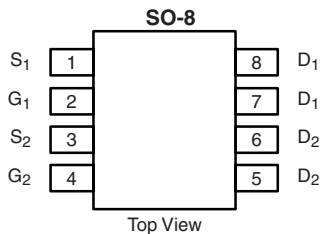
Ordering Information: Si4567DY-T1-E3 (Lead (Pb)-free)
Si4567DY-T1-GE3 (Lead (Pb)-free and Halogen-free)

N-Channel MOSFET

P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS T_A = 25 °C, unless otherwise noted

Parameter		Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage		V_{DS}	40	- 40	V
Gate-Source Voltage		V_{GS}	± 16		V
Continuous Drain Current (T_J = 150 °C)	T_C = 25 °C	I_D	5	- 4.4	A
	T_C = 70 °C		4.7	- 3.7	
	T_A = 25 °C		4.1[b, c]	- 3.6[b, c]	
	T_A = 70 °C		3.3[b, c]	- 2.9[b, c]	
Pulsed Drain Current (10 µs Pulse Width)		I_{DM}	20	- 20	
Source-Drain Current Diode Current	T_C = 25 °C	I_S	2.3	- 2.5	
	T_A = 25 °C		1.5[b, c]	- 1.6[b, c]	
Pulsed Source-Drain Current		I_{SM}	20	- 20	
Single Pulse Avalanche Current	L = 0.1 mH	I_{AS}	7	12	
Single Pulse Avalanche Energy		E_{AS}	2.5	7.2	mJ
Maximum Power Dissipation	T_C = 25 °C	P_D	2.75	2.95	W
	T_C = 70 °C		1.75	1.90	
	T_A = 25 °C		1.85[b, c]	1.95[b, c]	
	T_A = 70 °C		1.18[b, c]	1.25[b, c]	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150		°C

THERMAL RESISTANCE RATINGS

Parameter		Symbol	N-Channel		P-Channel		Unit
			Typ.	Max.	Typ.	Max.	
Maximum Junction-to-Ambient[b, d]	t ≤ 10 s	R_{thJA}	57	67.5	54	64	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	35	45	33	42	

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 120 °C/W (N-Channel) and 110 °C/W (P-Channel).

SPECIFICATIONS T_J = 25 °C, unless otherwise noted

Parameter	Symbol	Test Conditions		Min.	Typ.[a]	Max.	Unit
Static							
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	N-Ch	40			V
		V_{GS} = 0 V, I_D = - 250 µA	P-Ch	- 40			
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = 250 µA	N-Ch		40		
		I_D = - 250 µA	P-Ch		- 40		
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	I_D = 250 µA	N-Ch		- 4.6		
		II_D = - 250 µA	P-Ch		3.5		
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	N-Ch	0.8		2.2	
		V_{DS} = V_{GS}, I_D = - 250 µA	P-Ch	- 0.8		- 2.2	
Gate-Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 16 V	N-Ch			100	nA
			P-Ch			- 100	
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 40 V, V_{GS} = 0 V	N-Ch			1	µA
		V_{DS} = - 40 V, V_{GS} = 0 V	P-Ch			- 1	
		V_{DS} = 40 V, V_{GS} = 0 V, T_J = 55 °C	N-Ch			10	
		V_{DS} = - 40 V, V_{GS} = 0 V, T_J = 55 °C	P-Ch			- 10	
On-State Drain Current[b]	$I_{D(on)}$	V_{DS} = 5 V, V_{GS} = 10 V	N-Ch	20			A
		V_{DS} = - 5 V, V_{GS} = - 10 V	P-Ch	- 20			
Drain-Source On-State Resistance[b]	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 4.1 A	N-Ch		0.048	0.060	Ω
		V_{GS} = - 10 V, I_D = - 3.6 A	P-Ch		0.068	0.085	
		V_{GS} = 4.5 V, I_D = 3.8 A	N-Ch		0.056	0.070	
		V_{GS} = - 4.5 V, I_D = - 2.9 A	P-Ch		0.097	0.122	
Forward Transconductance[b]	g_{fs}	V_{DS} = 15 V, I_D = 4.1 A	N-Ch		15		S
		V_{DS} = - 15 V, I_D = - 3.6 A	P-Ch		7		
Dynamic[a]							
Input Capacitance	C_{iss}	N-Channel V_{DS} = 20 V, V_{GS} = 0 V, f = 1 MHz P-Channel V_{DS} = - 20 V, V_{GS} = 0 V, f = 1 MHz	N-Ch		355		pF
			P-Ch		480		
Output Capacitance	C_{oss}		N-Ch		50		
			P-Ch		80		
Reverse Transfer Capacitance	C_{rss}		N-Ch		29		
			P-Ch		56		
Total Gate Charge	Q_g	V_{DS} = 20 V, V_{GS} = 10 V, I_D = 5 A	N-Ch		8	12	nC
		V_{DS} = - 20 V, V_{GS} = - 10 V, I_D = - 5 A	P-Ch		12	18	
		N-Channel V_{DS} = 20 V, V_{GS} = 4.5 V I_D = 5 A P-Channel V_{DS} = - 20 V, V_{GS} = - 4.5 V, I_D = - 5 A	N-Ch		3.7	6	
			P-Ch		6	9	
Gate-Source Charge	Q_{gs}		N-Ch		1.1		
			P-Ch		1.5		
Gate-Drain Charge	Q_{gd}		N-Ch		1.4		
			P-Ch		2.7		
Gate Resistance	R_g	f = 1 MHz	N-Ch	1.6	3.4	5.2	Ω
			P-Ch	2.8	5.7	8.6	

SPECIFICATIONS T_J = 25 °C, unless otherwise noted

Parameter	Symbol	Test Conditions		Min.	Typ.[a]	Max.	Unit
Dynamic[a]							
Turn-On Delay Time	$t_{d(on)}$	N-Channel V_{DD} = 20 V, R_L = 4 Ω $I_D \cong$ 1 A, V_{GEN} = 10 V, R_g = 1 Ω	N-Ch		8	13	ns
			P-Ch		10	15	
Rise Time	t_r		N-Ch		20	30	
			P-Ch		16	25	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel V_{DD} = - 20 V, R_L = 4 Ω $I_D \cong$ - 1 A, V_{GEN} = - 10 V, R_g = 1 Ω	N-Ch		23	35	
			P-Ch		19	30	
Fall Time	t_f		N-Ch		27	42	
			P-Ch		10	15	
Turn-On Delay Time	$t_{d(on)}$	N-Channel V_{DD} = 20 V, R_L = 4 Ω $I_D \cong$ 1 A, V_{GEN} = 4.5 V, R_g = 1 Ω	N-Ch		74	110	
			P-Ch		23	35	
Rise Time	t_r		N-Ch		95	145	
			P-Ch		93	140	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel V_{DD} = - 20 V, R_L = 4 Ω $I_D \cong$ - 1 A, V_{GEN} = - 4.5 V, R_g = 16 Ω	N-Ch		31	48	
			P-Ch		30	45	
Fall Time	t_f		N-Ch		33	50	
			P-Ch		25	38	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	T_C = 25 °C	N-Ch			2.3	A
			P-Ch			- 2.5	
Pulse Diode Forward Current[a]	I_{SM}		N-Ch			20	
			P-Ch			- 20	
Body Diode Voltage	V_{SD}	I_S = 1.5 A	N-Ch		0.8	1.2	V
		I_S = - 1.6 A	P-Ch		- 0.8	- 1.2	
Body Diode Reverse Recovery Time	t_{rr}	N-Channel I_F = 2 A, dI/dt = 100 A/μs, T_J = 25 °C	N-Ch		26	40	ns
			P-Ch		26	40	
Body Diode Reverse Recovery Charge	Q_{rr}		N-Ch		26	40	nC
			P-Ch		22	35	
Reverse Recovery Fall Time	t_a	P-Channel I_F = - 2 A, dI/dt = - 100 A/μs, T_J = 25 °C	N-Ch		13		ns
			P-Ch		12		
Reverse Recovery Rise Time	t_b		N-Ch		13		
			P-Ch		14		

Notes:
a. Guaranteed by design, not subject to production testing.
b. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.

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.
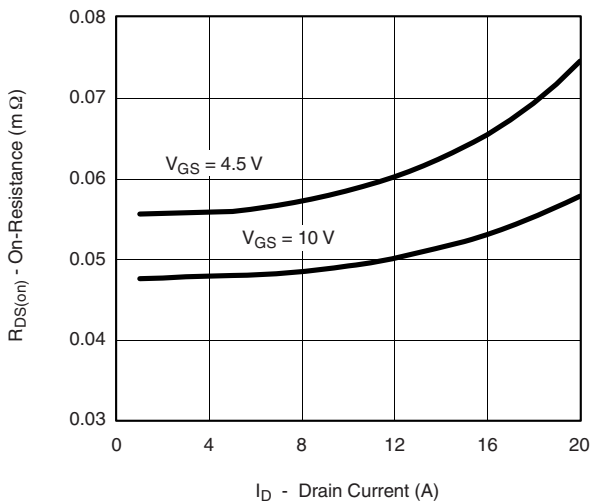
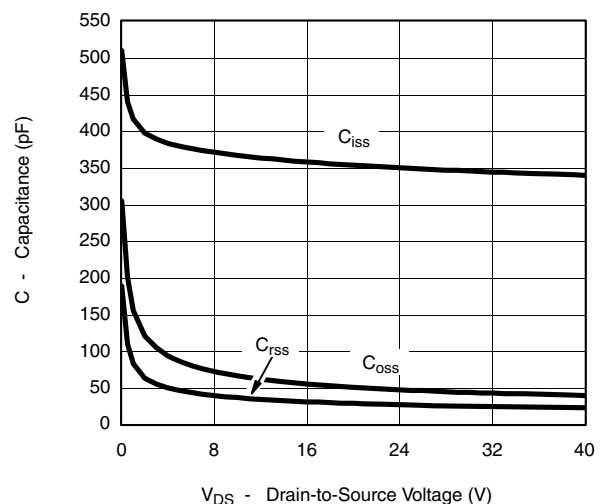## N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted
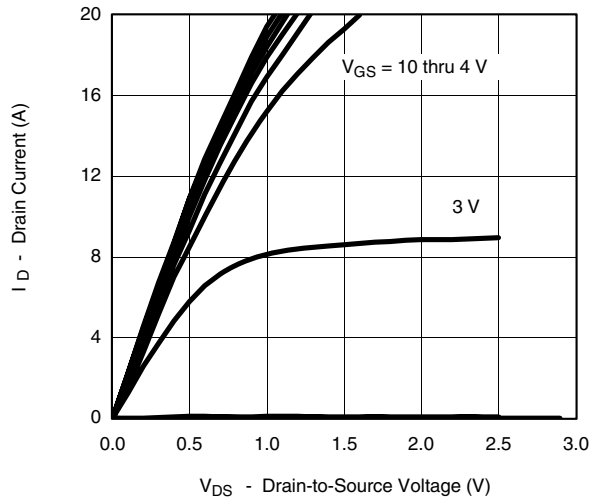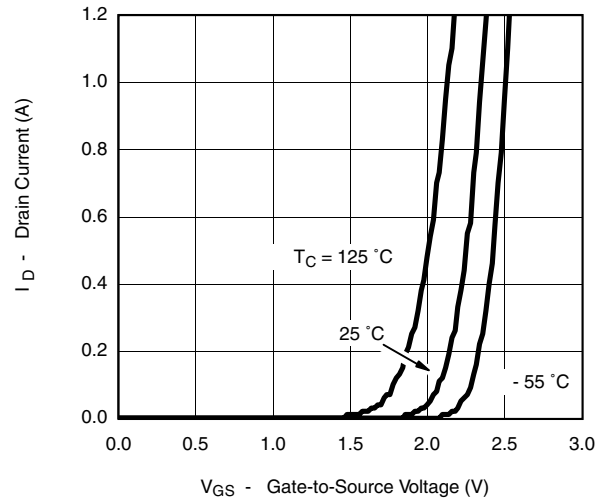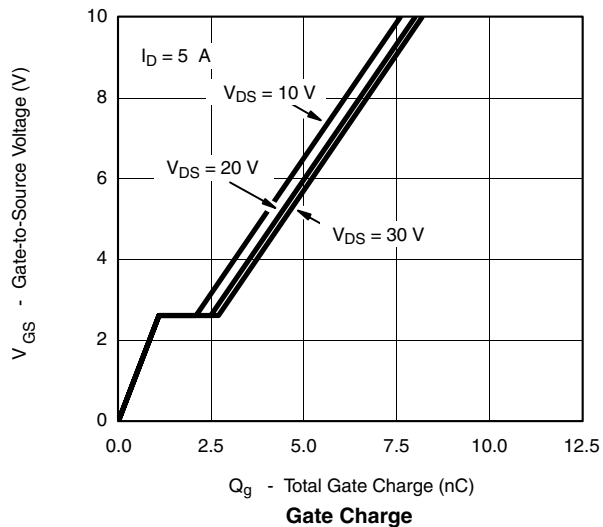

Output Characteristics
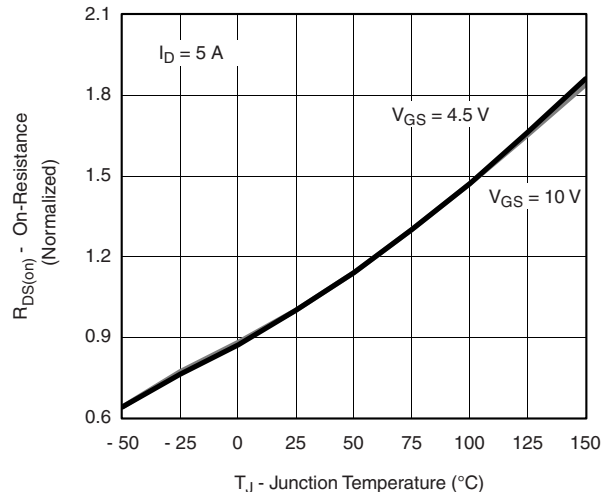

Transfer Characteristics

On-Resistance vs. Drain Current and Gate Voltage
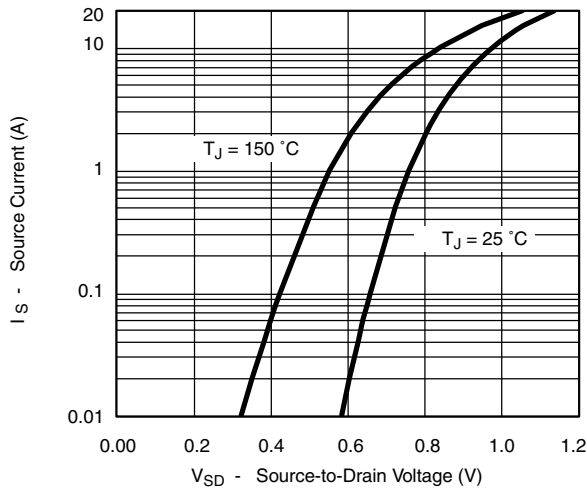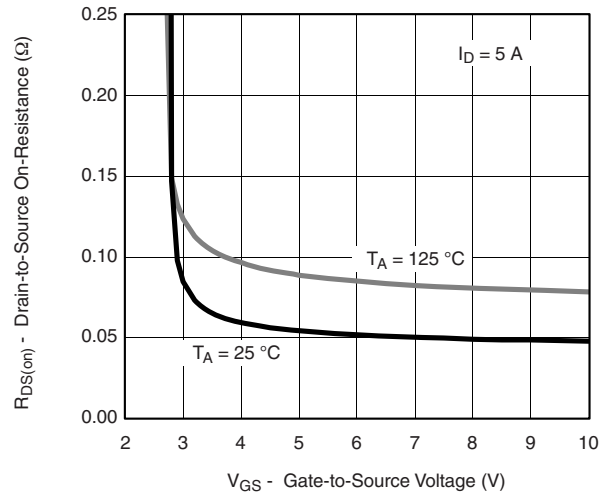

Capacitance

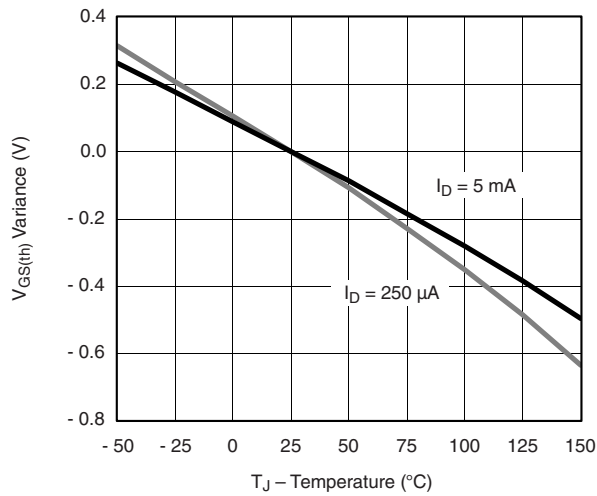**Gate Charge**

On-Resistance vs. Junction Temperature

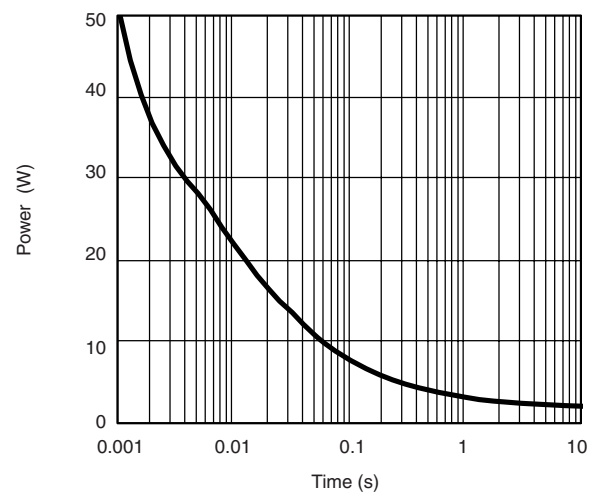**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted
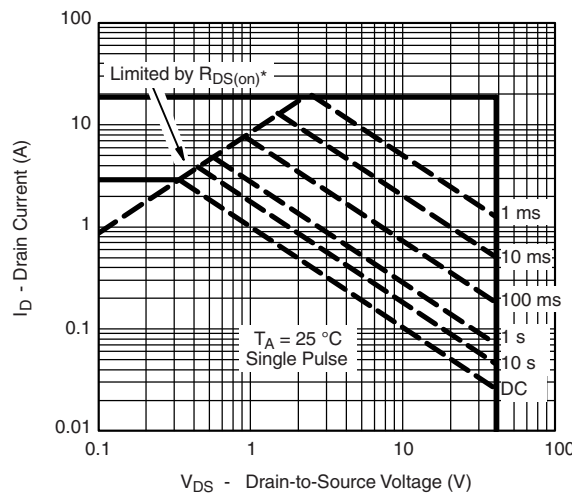

Source-Drain Diode Forward Voltage

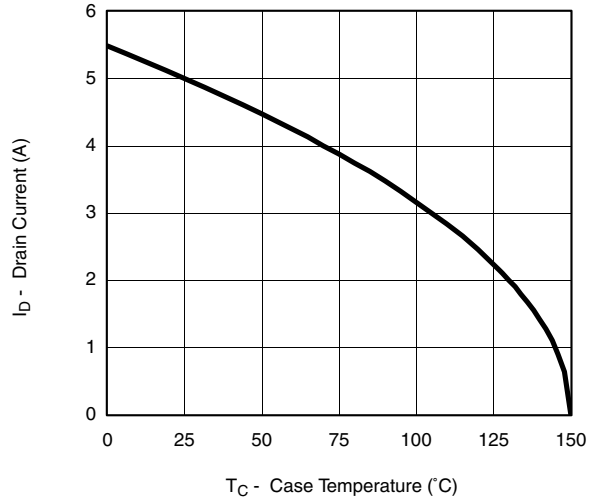**On-Resistance vs. Gate-to-Source Voltage**
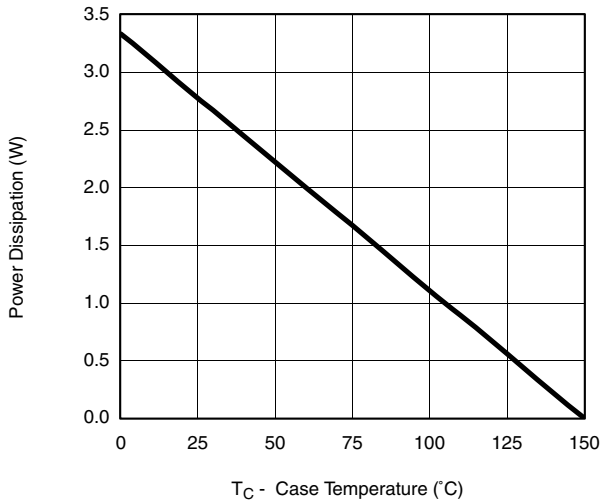

Threshold Voltage

Single Pulse Power, Junction-to-Ambient

* V_GS > minimum V_GS at which R_DS(on) is specified
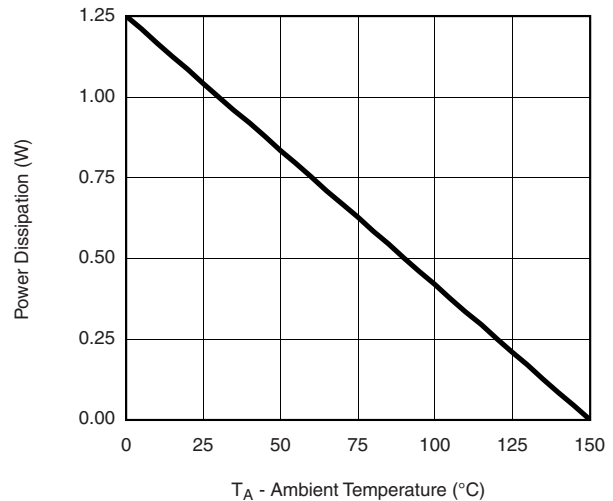**Safe Operating Area, Junction-to-Ambient**

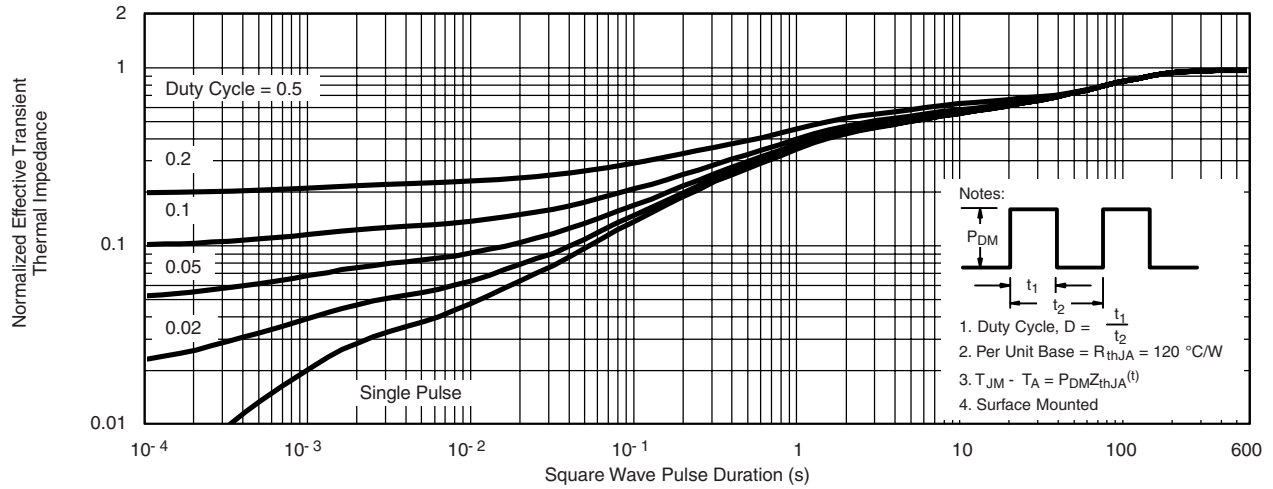## N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Current Derating*
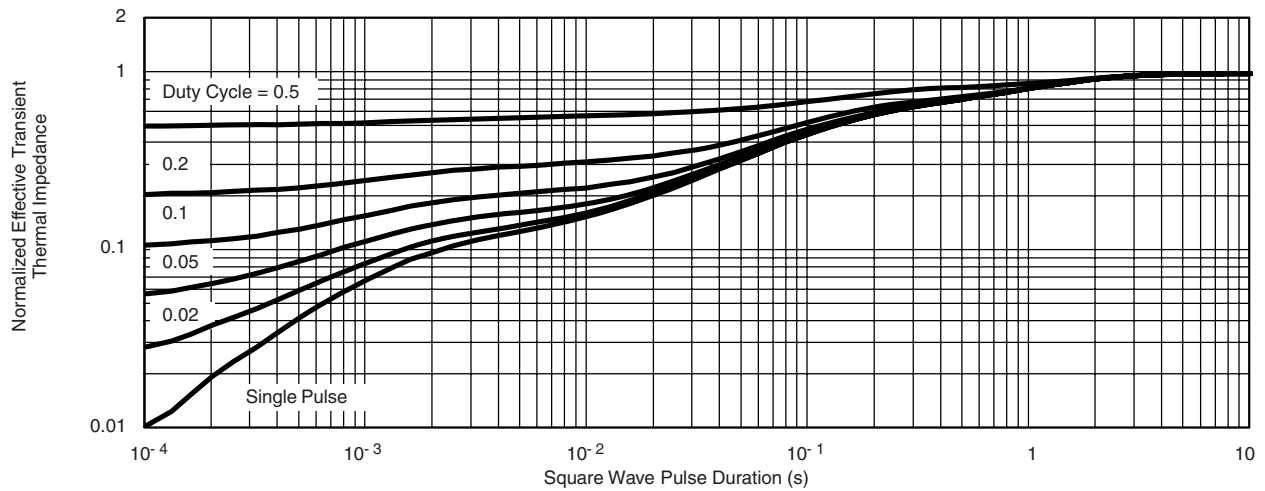
Power Derating, Junction-to-Foot

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.

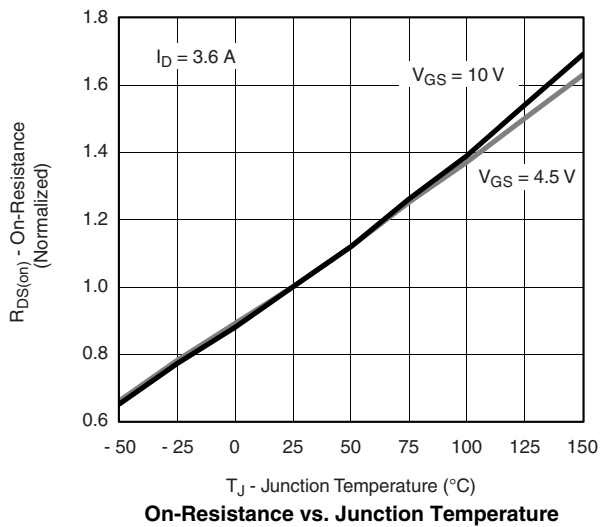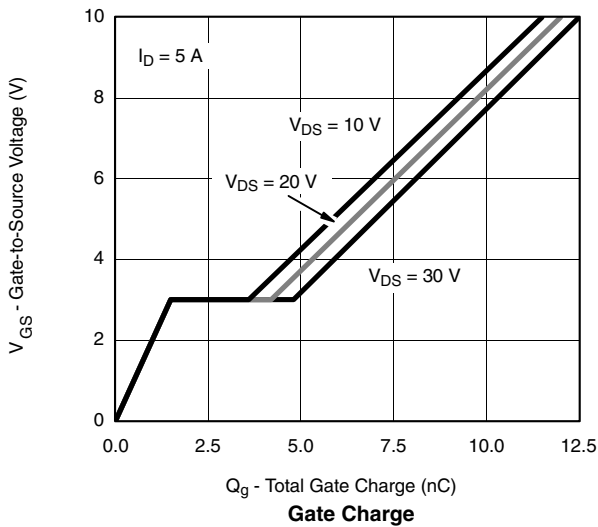## N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Notes:

1. Duty Cycle, D = $\dfrac{t_1}{t_2}$
2. Per Unit Base = R_{thJA} = 120 °C/W
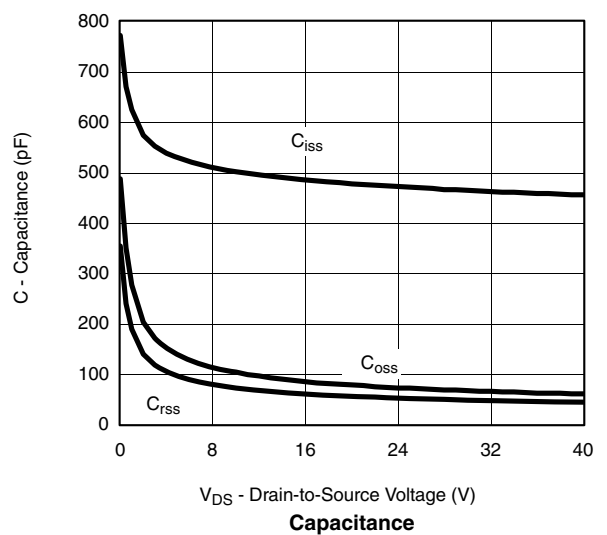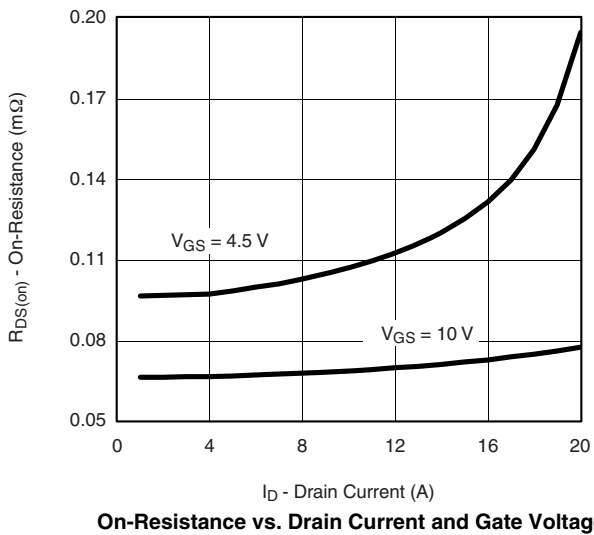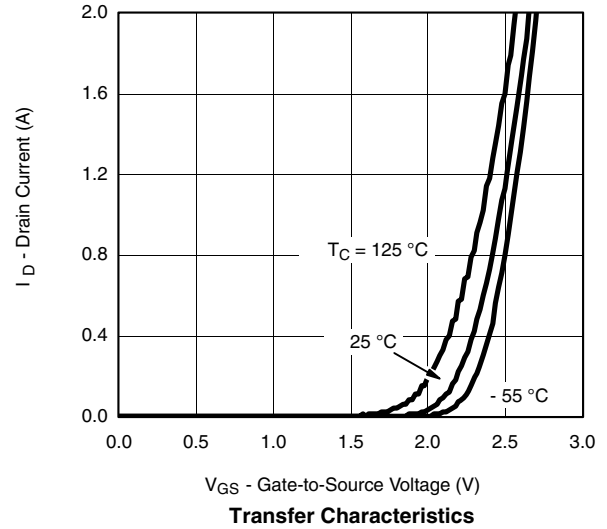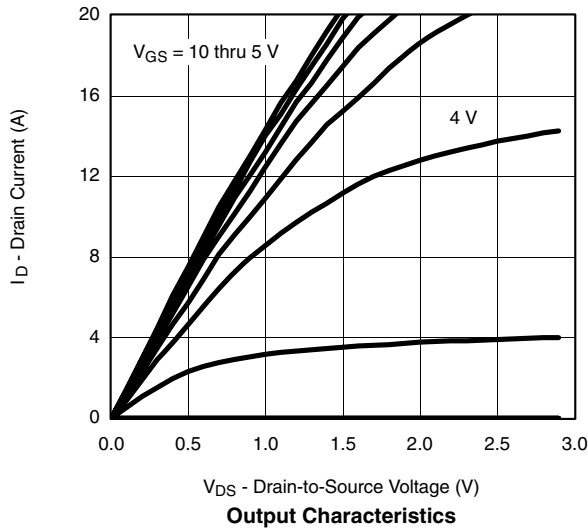3. $T_{JM} - T_A = P_{DM}Z_{thJA}^{(t)}$
4. Surface Mounted

Normalized Thermal Transient Impedance, Junction-to-Ambient

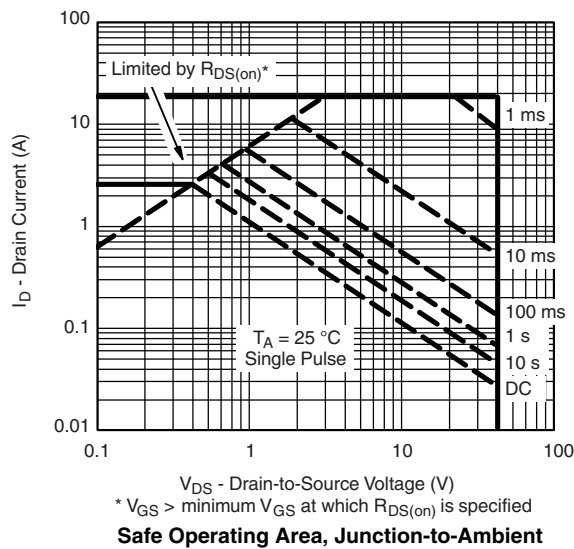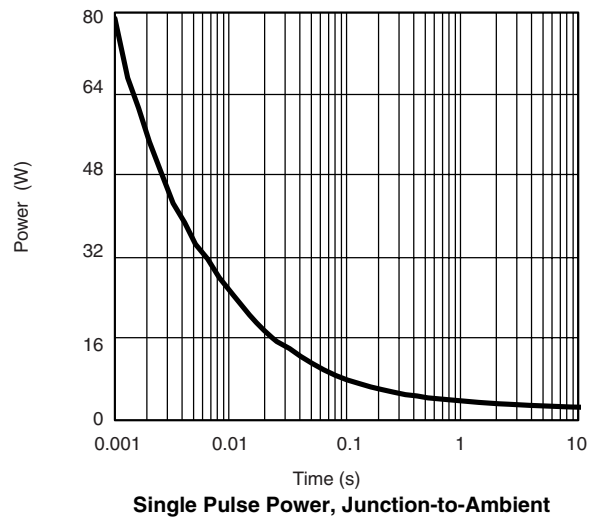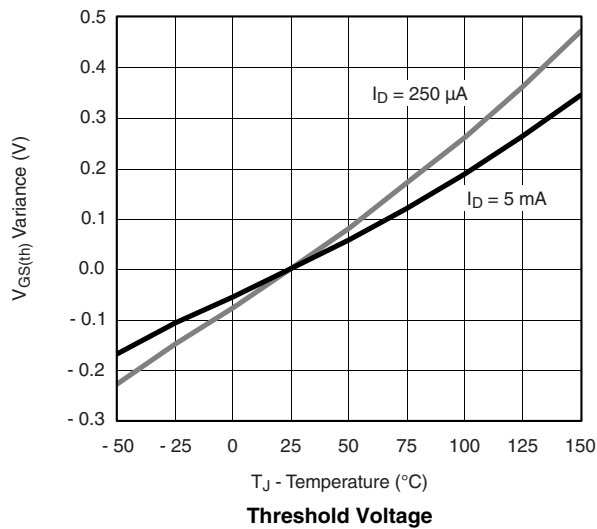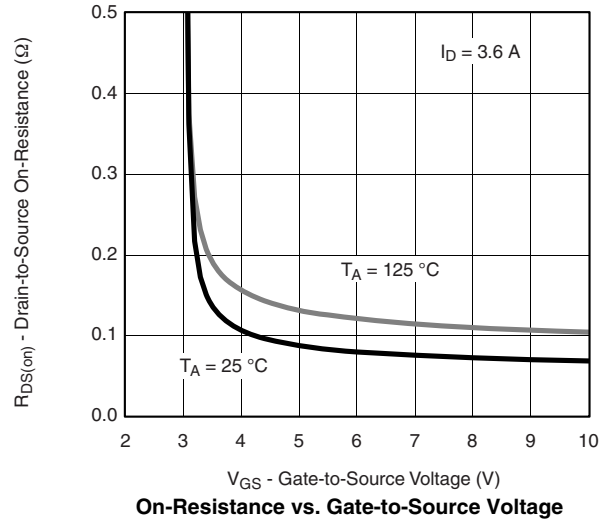**Normalized Thermal Transient Impedance, Junction-to-Case**

P-CHANNEL TYPICAL CHARACTERISTICS   25 °C, unless otherwise noted

Output Characteristics

Transfer Characteristics

On-Resistance vs. Drain Current and Gate Voltage

Capacitance

Gate Charge

On-Resistance vs. Junction Temperature

P-CHANNEL 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, Junction-to-Ambient

P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

T_C - Case Temperature (°C)
Current Derating*

T_C - Case Temperature (°C)
Power Derating, Junction-to-Foot

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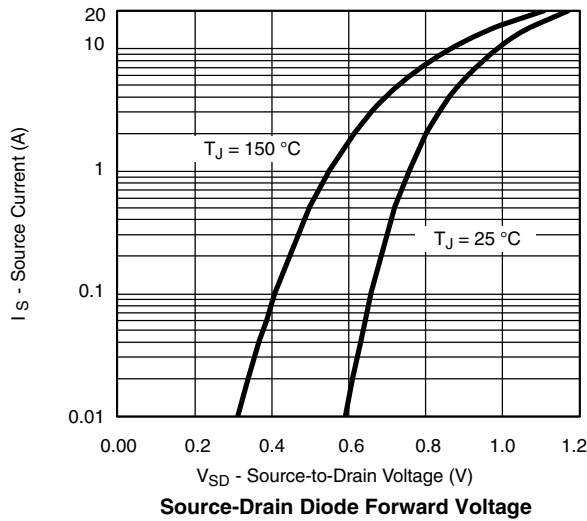
* The power dissipation P_D is based on $T_{J(max)}$ = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted
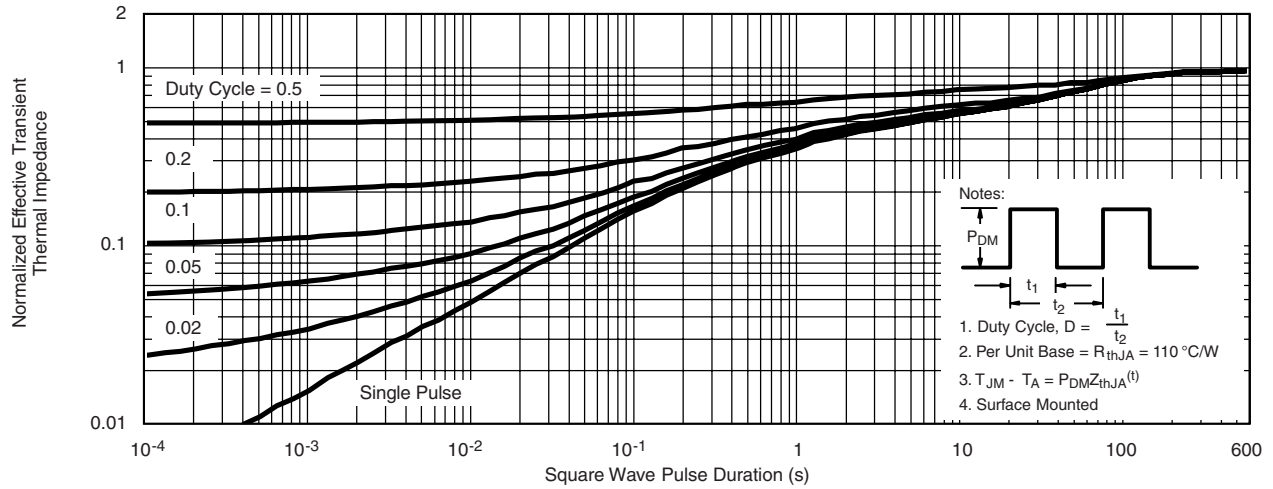
Notes:

1. Duty Cycle, $D = \dfrac{t_1}{t_2}$
2. Per Unit Base = $R_{thJA} = 110$ °C/W
3. $T_{JM} - T_A = P_{DM}Z_{thJA}(t)$
4. Surface Mounted

Normalized Thermal Transient Impedance, Junction-to-Ambient
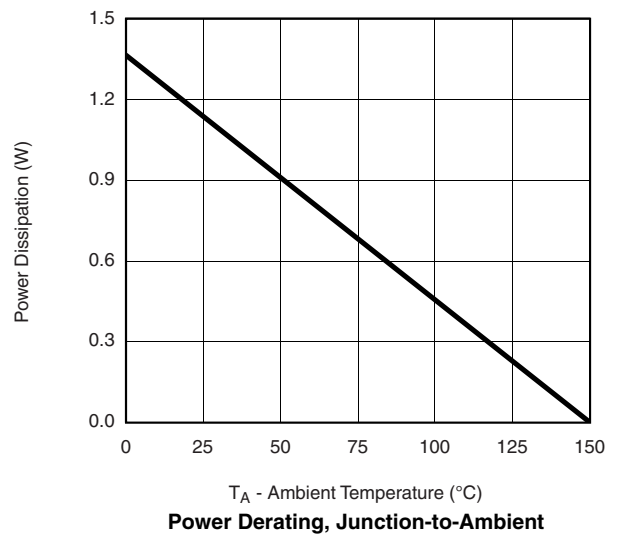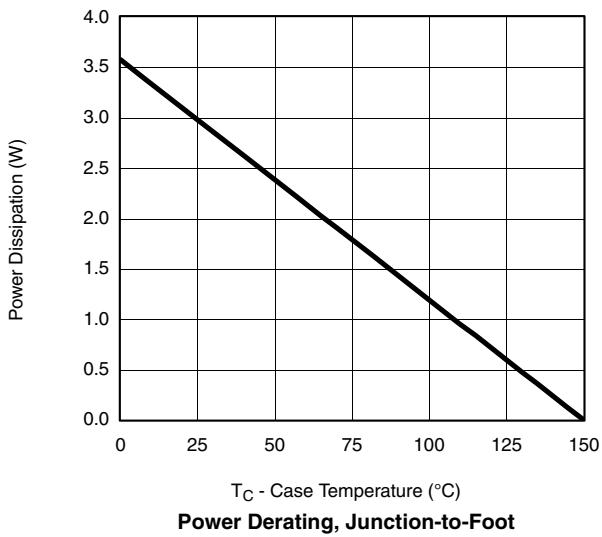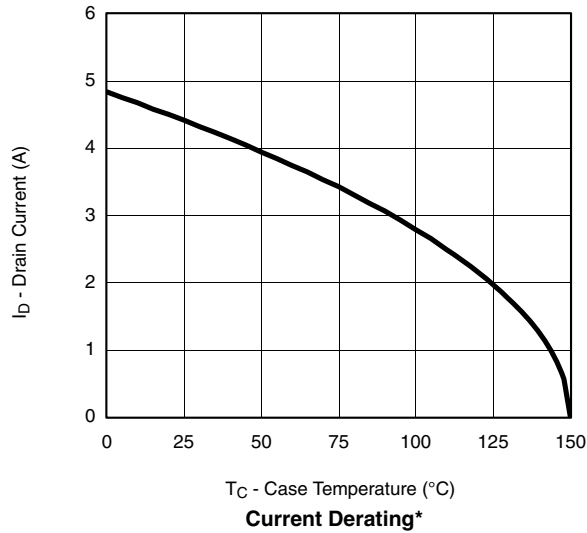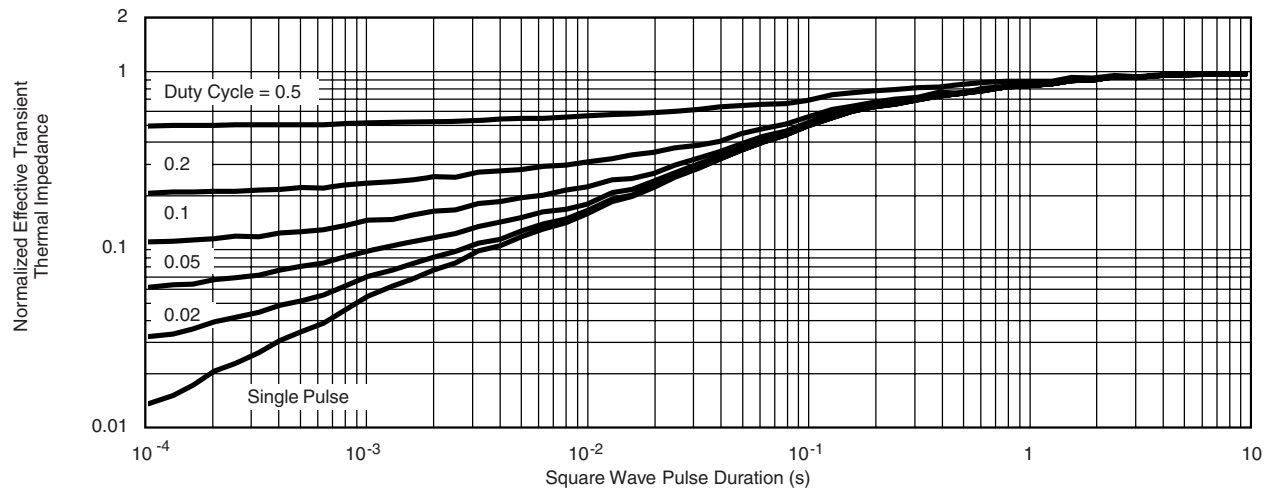

Normalized Thermal Transient Impedance, Junction-to-Case

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