

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	0.016 at V _{GS} = 10 V	8	56
		0.019 at V _{GS} = 4.5 V	8	
P-Channel	- 40	0.025 at V _{GS} = - 10 V	- 8	6
		0.032 at V _{GS} = - 4.5 V	- 7.5	

FEATURES

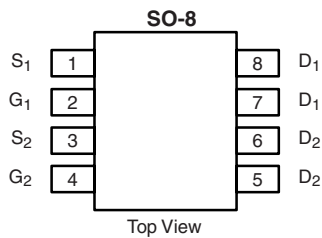
- Halogen-free According to IEC 61249-2-21 Available
- TrenchFET[®] Power MOSFET
- 100 % R_g Tested



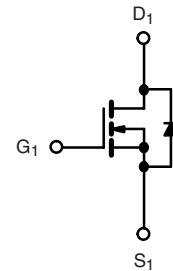
RoHS
COMPLIANT
HALOGEN
FREE
Available

APPLICATIONS

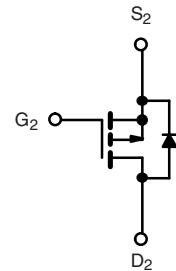
- CCFL Inverter



Ordering Information: Si4563DY-T1-E3 (Lead (Pb)-free)
Si4563DY-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			
Continuous Drain Current (T _J = 150 °C)	I _D	T _C = 25 °C	8	- 8	A
		T _C = 70 °C	8	- 6.5	
		T _A = 25 °C	8 ^{b, c}	- 6.6 ^{b, c}	
		T _A = 70 °C	6.5 ^{b, c}	- 5.2 ^{b, c}	
Pulsed Drain Current (10 μs Pulse Width)	I _{DM}	20	- 20	A	
Source-Drain Current Diode Current	I _S	T _C = 25 °C	2.7		- 2.7
		T _A = 25 °C	1.6 ^{b, c}		- 1.6 ^{b, c}
Pulsed Source-Drain Current	I _{SM}	20	- 20	mJ	
Single Pulse Avalanche Current	I _{AS}	20	25		
Single Pulse Avalanche Energy	E _{AS}	20	31.2	W	
Maximum Power Dissipation	P _D	T _C = 25 °C	3.25		3.25
		T _C = 70 °C	2.10		2.10
		T _A = 25 °C	2.0 ^{b, c}		2.0 ^{b, c}
		T _A = 70 °C	1.25 ^{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}	45	62.5	45	62.5	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R _{thJF}	29	38	29	38	

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.

SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted							
Parameter	Symbol	Test Conditions	Min.	Typ. ^a	Max.	Unit	
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	N-Ch	40		V	
		$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	P-Ch	-40			
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$	N-Ch		40	mV/ $^\circ\text{C}$	
		$I_D = -250\text{ }\mu\text{A}$	P-Ch		-40		
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	$I_D = 250\text{ }\mu\text{A}$	N-Ch		-4.8		
		$I_D = -250\text{ }\mu\text{A}$	P-Ch		4.0		
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	N-Ch	0.8		2.0	
		$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	P-Ch	-0.8		-2.2	
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 16\text{ V}$	N-Ch			100	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$	N-Ch			1	
		$V_{DS} = -40\text{ V}, V_{GS} = 0\text{ V}$	P-Ch			-1	
		$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$	N-Ch				10
		$V_{DS} = -40\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$	P-Ch				-10
On-State Drain Current ^b	$I_{D(on)}$	$V_{DS} = 5\text{ V}, V_{GS} = 10\text{ V}$	N-Ch	20		A	
		$V_{DS} = -5\text{ V}, V_{GS} = -10\text{ V}$	P-Ch	-20			
Drain-Source On-State Resistance ^b	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 5\text{ A}$	N-Ch		0.013	0.016	
		$V_{GS} = -10\text{ V}, I_D = -5\text{ A}$	P-Ch		0.020	0.025	
		$V_{GS} = 4.5\text{ V}, I_D = 4\text{ A}$	N-Ch		0.015	0.019	
		$V_{GS} = -4.5\text{ V}, I_D = -4\text{ A}$	P-Ch		0.025	0.032	
Forward Transconductance ^b	g_{fs}	$V_{DS} = 15\text{ V}, I_D = 5\text{ A}$	N-Ch		23	S	
		$V_{DS} = -15\text{ V}, I_D = -5\text{ A}$	P-Ch		18		
Dynamic^a							
Input Capacitance	C_{iss}	N-Channel $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	N-Ch		2390	pF	
Output Capacitance	C_{oss}		P-Ch		2120		
Reverse Transfer Capacitance	C_{rss}	P-Channel $V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	N-Ch		270		
			P-Ch		310		
Total Gate Charge	Q_g	$V_{DS} = 20\text{ V}, V_{GS} = 10\text{ V}, I_D = 5\text{ A}$	N-Ch		56	85	
		$V_{DS} = -20\text{ V}, V_{GS} = -10\text{ V}, I_D = -5\text{ A}$	P-Ch		52	80	
		N-Channel $V_{DS} = 20\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 5\text{ A}$	N-Ch		26	40	
			P-Ch		25.5	39	
Gate-Source Charge	Q_{gs}	P-Channel $V_{DS} = -20\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -5\text{ A}$	N-Ch		5.5	nC	
Gate-Drain Charge	Q_{gd}		P-Ch		5.1		
Gate Resistance	R_g	$f = 1\text{ MHz}$	N-Ch		2.6		4.0
			P-Ch		5.8		9.0



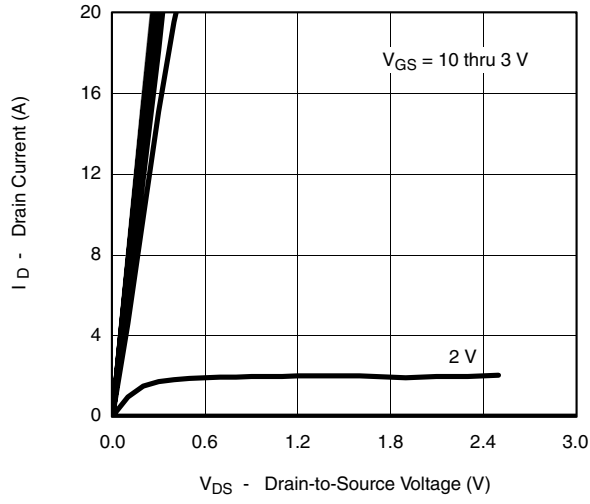
SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted							
Parameter	Symbol	Test Conditions	Min.	Typ. ^a	Max.	Unit	
Dynamic^a							
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 20\text{ V}, R_L = 4\ \Omega$ $I_D \cong 5\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\ \Omega$	N-Ch		15	23	ns
			P-Ch		13	20	
Rise Time	t_r		N-Ch		20	30	
			P-Ch		16	25	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel $V_{DD} = -20\text{ V}, R_L = 4\ \Omega$ $I_D \cong -5\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\ \Omega$	N-Ch		56	85	
			P-Ch		75	115	
Fall Time	t_f		N-Ch		10	15	
			P-Ch		68	105	
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 20\text{ V}, R_L = 4\ \Omega$ $I_D \cong 5\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\ \Omega$	N-Ch		88	135	
			P-Ch		33	50	
Rise Time	t_r		N-Ch		117	180	
			P-Ch		93	140	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel $V_{DD} = -20\text{ V}, R_L = 4\ \Omega$ $I_D \cong -5\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 16\ \Omega$	N-Ch		62	95	
			P-Ch		80	120	
Fall Time	t_f		N-Ch		19	30	
			P-Ch		69	105	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^\circ\text{C}$	N-Ch			2.7	A
			P-Ch			-2.7	
Pulse Diode Forward Current ^a	I_{SM}		N-Ch			20	
			P-Ch			-20	
Body Diode Voltage	V_{SD}	$I_S = 1.5\text{ A}$	N-Ch		0.69	1.2	V
		$I_S = -1.6\text{ A}$	P-Ch		-0.72	-1.2	
Body Diode Reverse Recovery Time	t_{rr}	N-Channel $I_F = 2\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$	N-Ch		62	95	ns
			P-Ch		49	75	
Body Diode Reverse Recovery Charge	Q_{rr}	P-Channel $I_F = -2\text{ A}, di/dt = -100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$	N-Ch		62	95	nC
			P-Ch		42	65	
Reverse Recovery Fall Time	t_a		N-Ch		26		ns
			P-Ch		19		
Reverse Recovery Rise Time	t_b		N-Ch		36		
			P-Ch		30		

Notes:

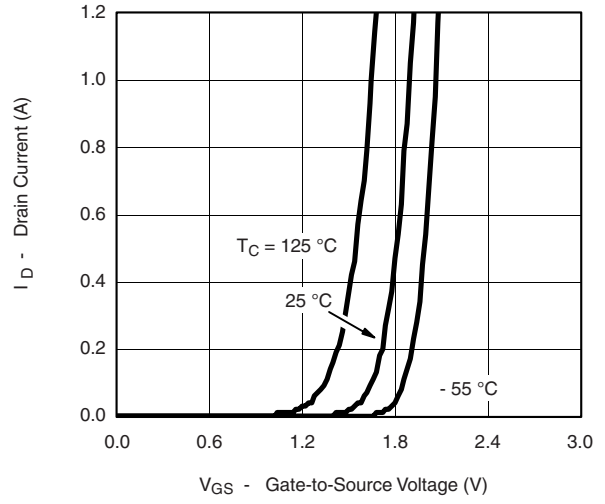
- a. Guaranteed by design, not subject to production testing.
- b. Pulse test; pulse width $\leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$.

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.

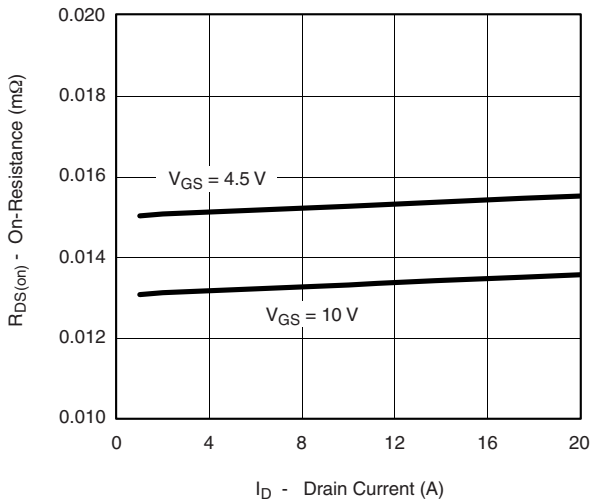
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



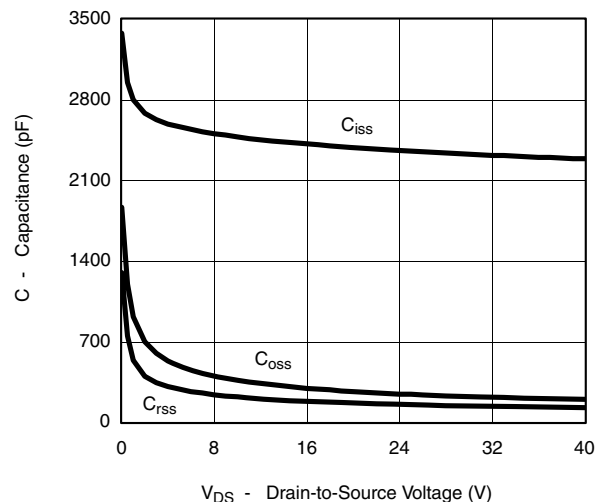
Output Characteristics



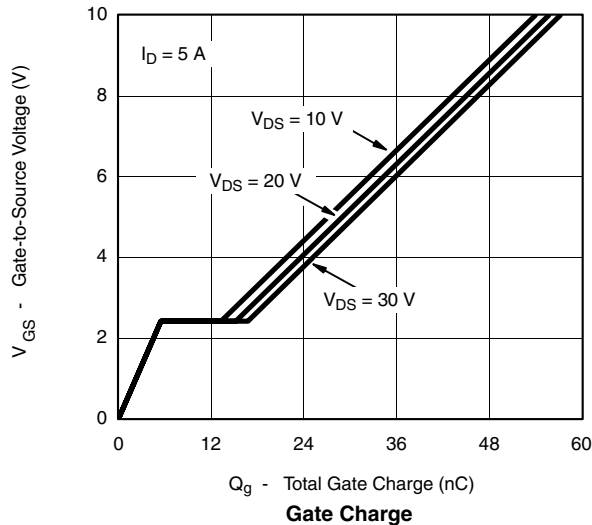
Transfer Characteristics



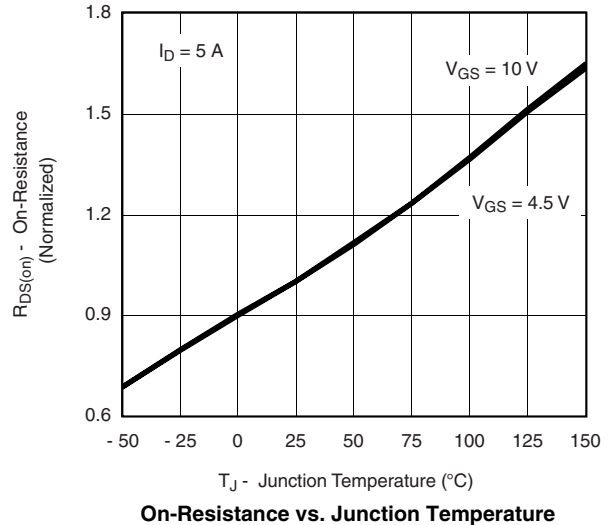
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

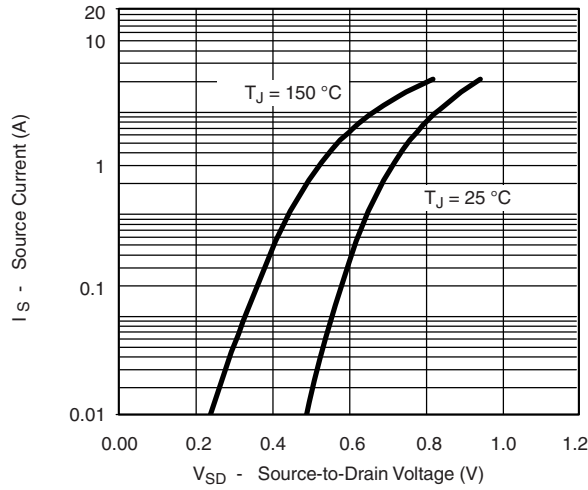


Gate Charge

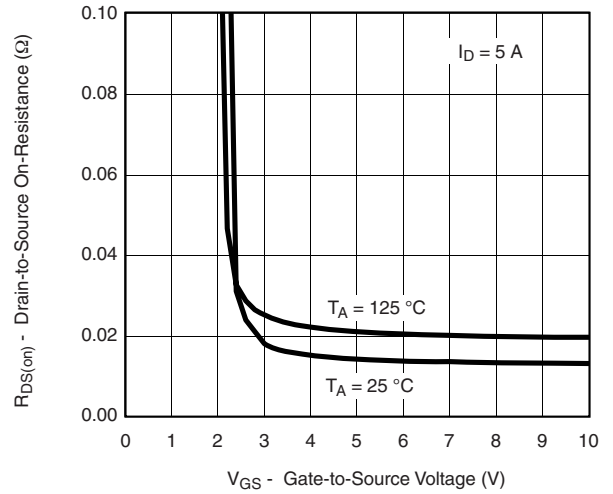


On-Resistance vs. Junction Temperature

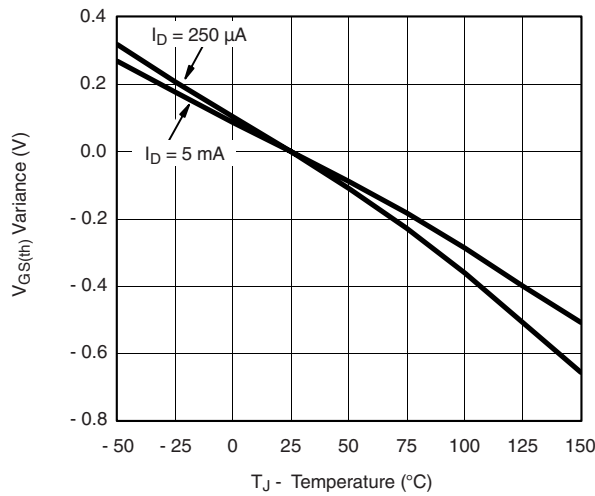
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



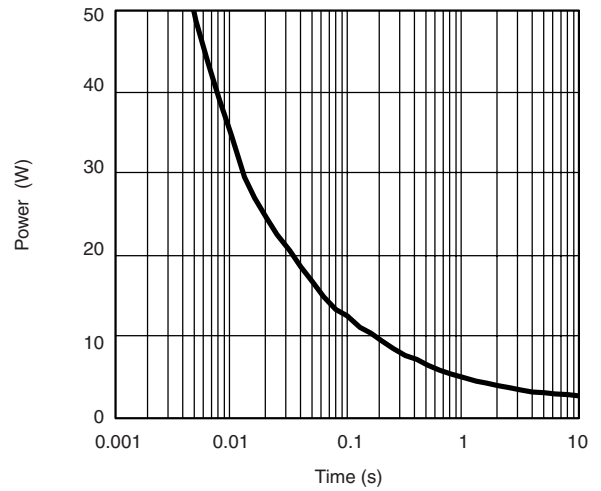
Source-Drain Diode Forward Voltage



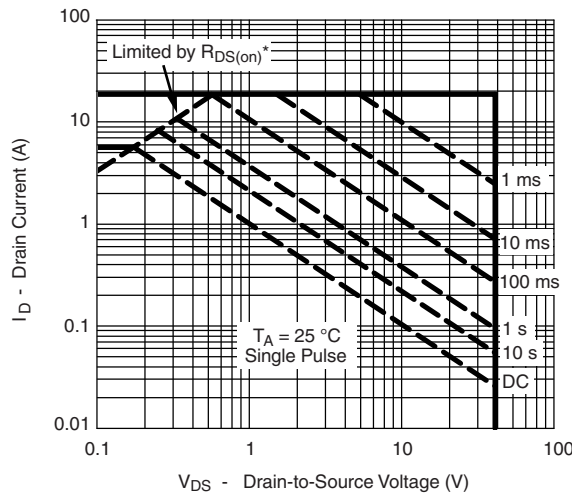
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

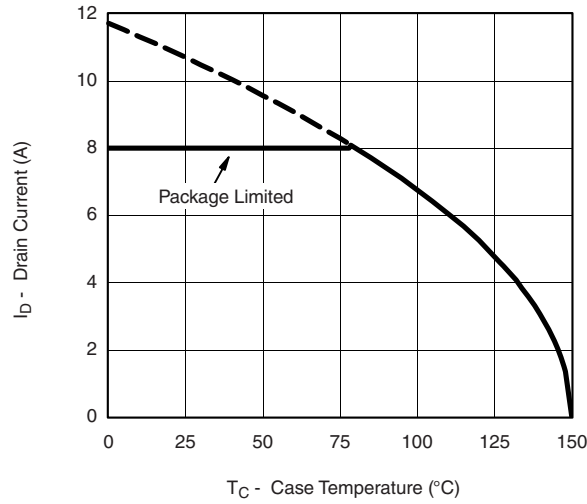


Single Pulse Power, Junction-to-Ambient

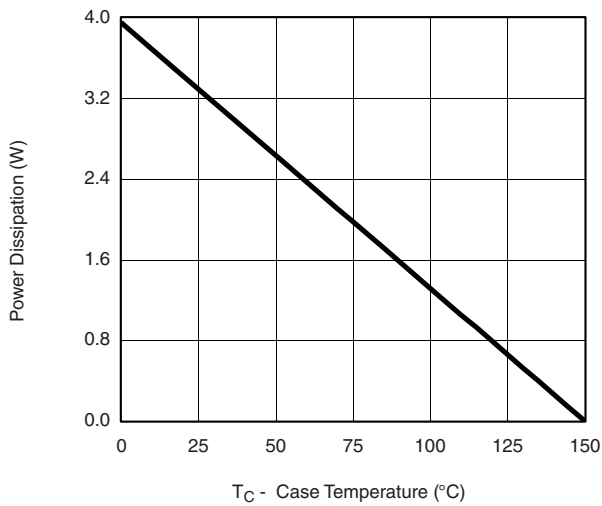


Safe Operating Area, Junction-to-Ambient
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

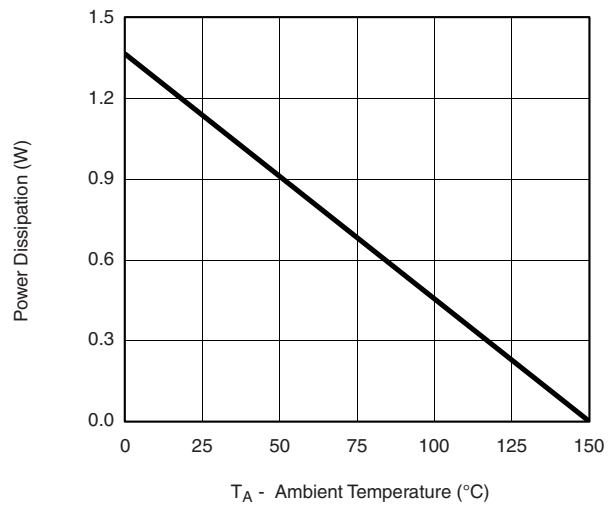
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Current Derating*



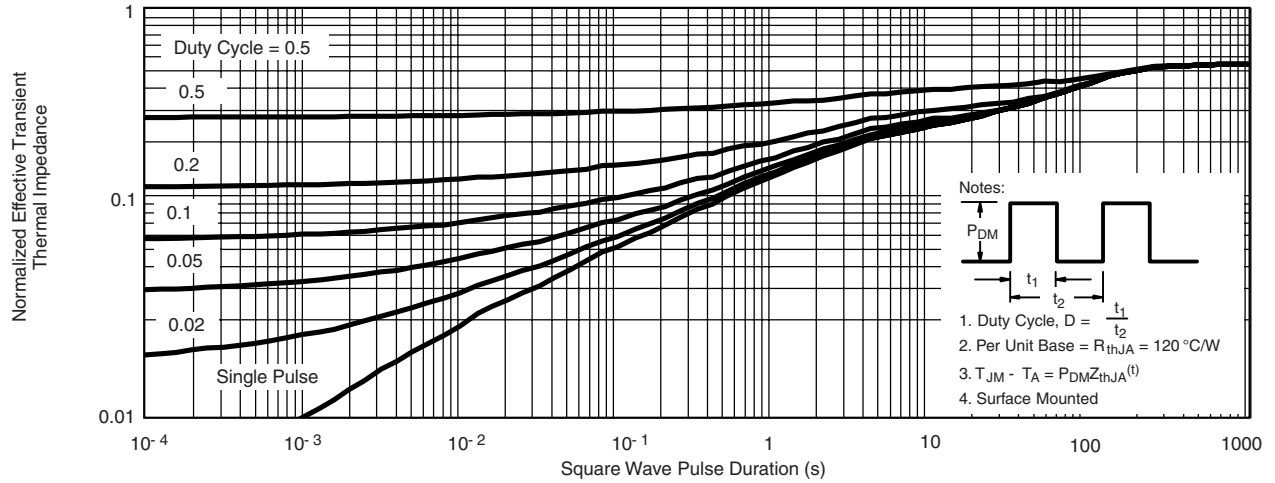
Power Derating, Junction-to-Foot



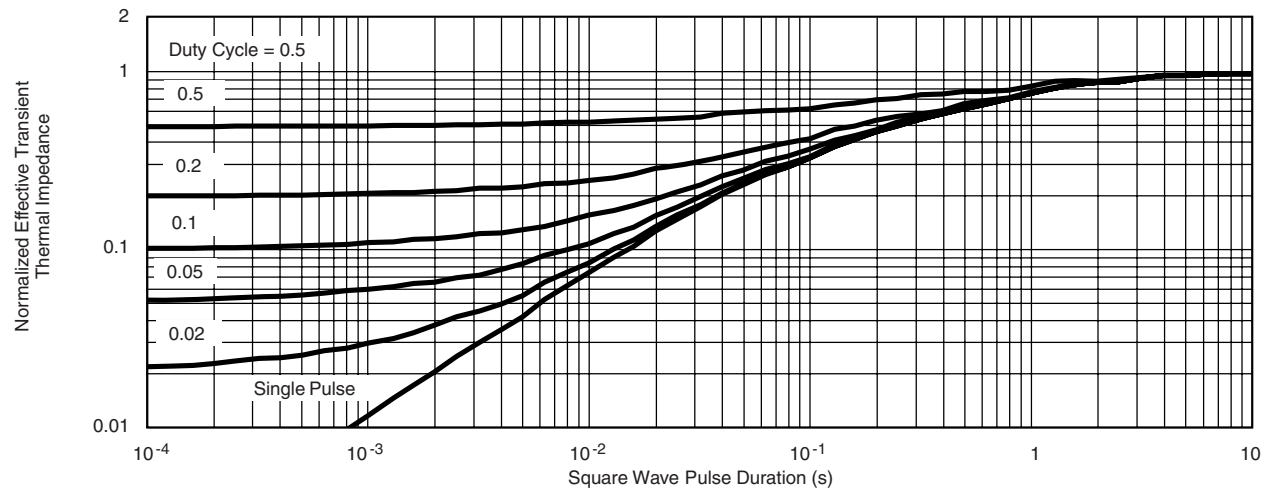
Power Derating, Junction-to-Ambient

* 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

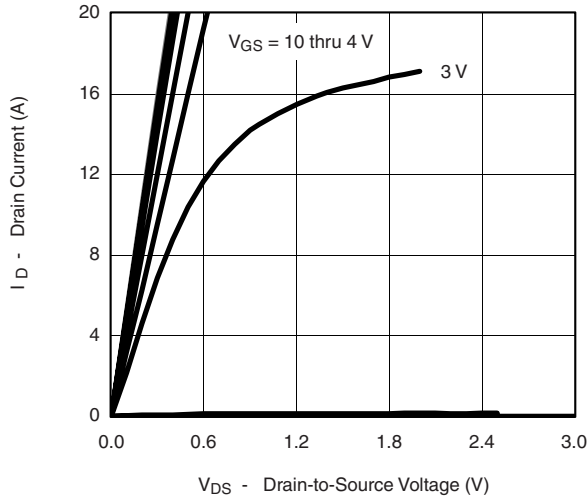


Normalized Thermal Transient Impedance, Junction-to-Ambient

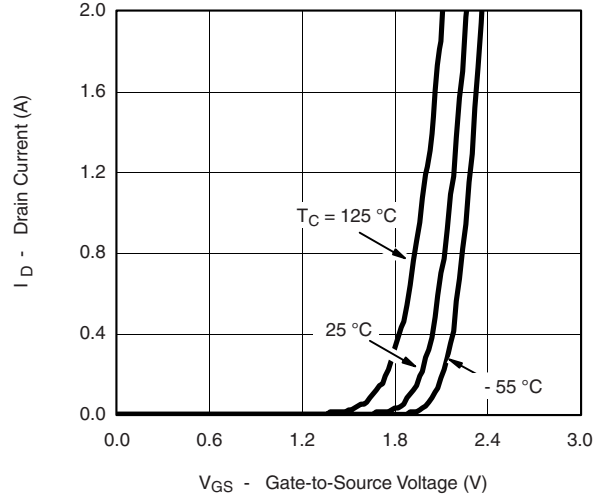


Normalized Thermal Transient Impedance, Junction-to-Case

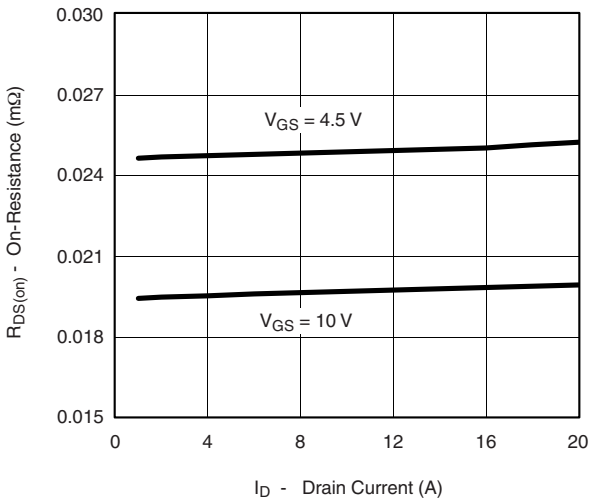
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



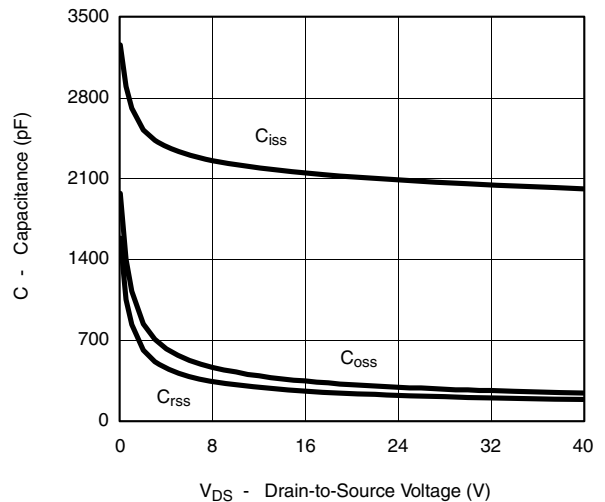
Output Characteristics



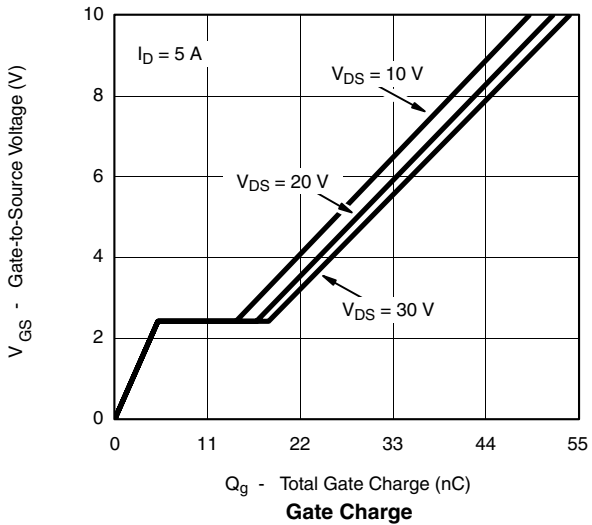
Transfer Characteristics



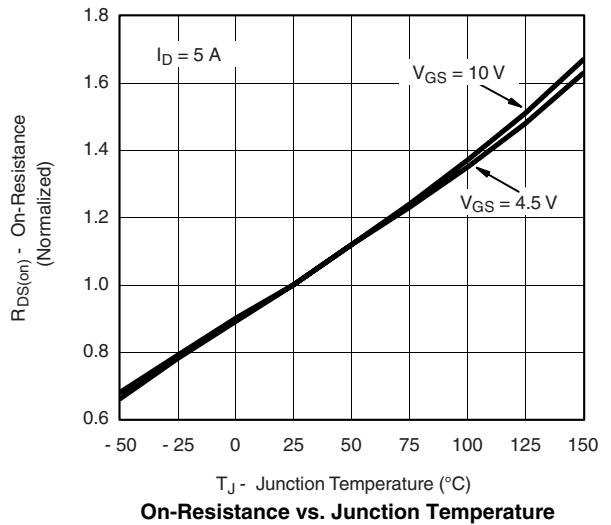
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

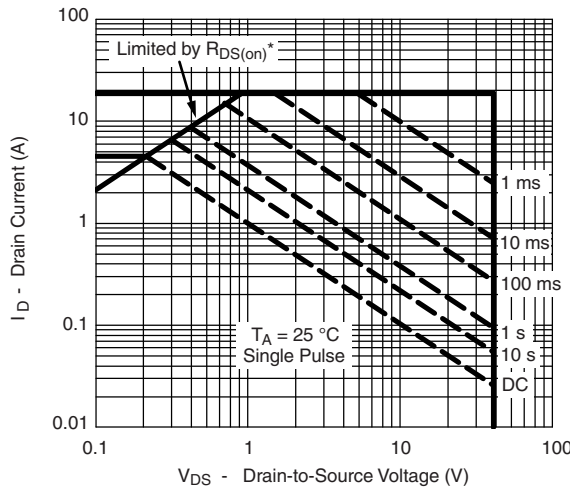
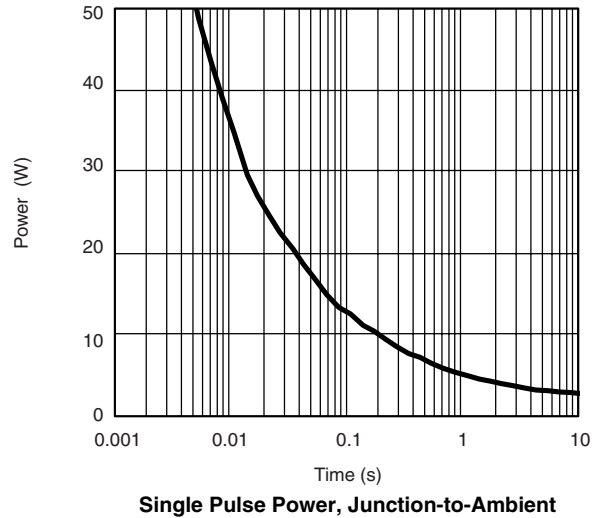
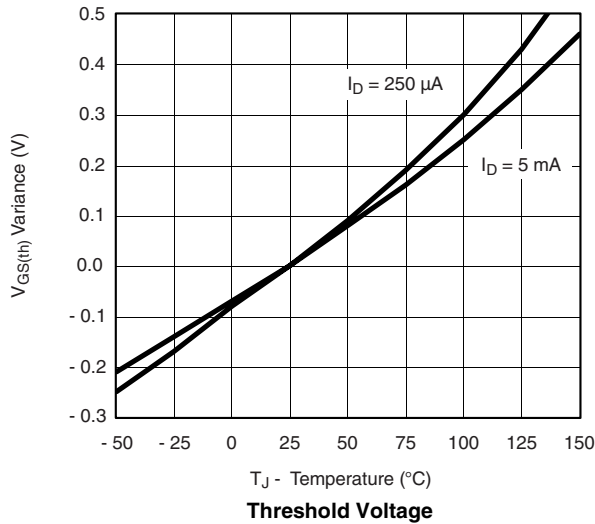
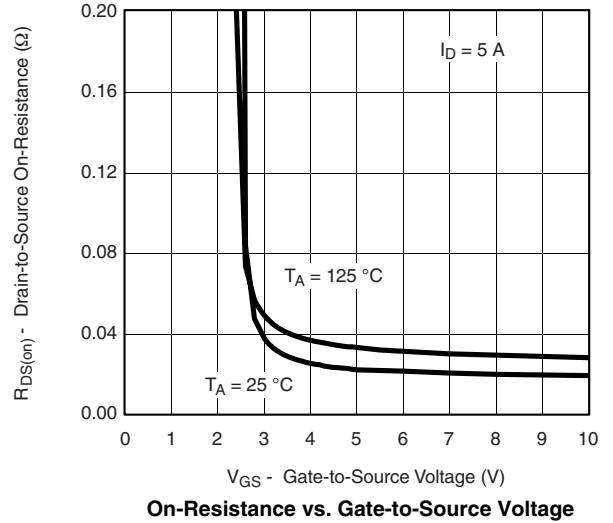
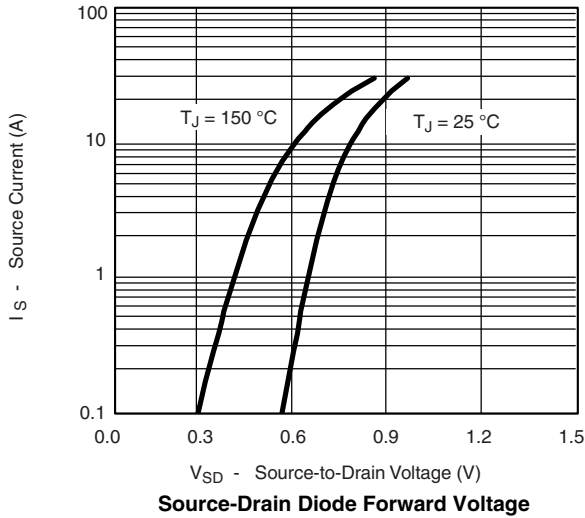


Gate Charge



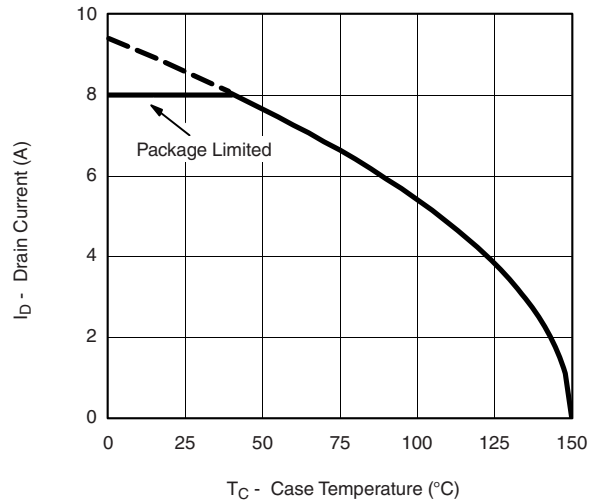
On-Resistance vs. Junction Temperature

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



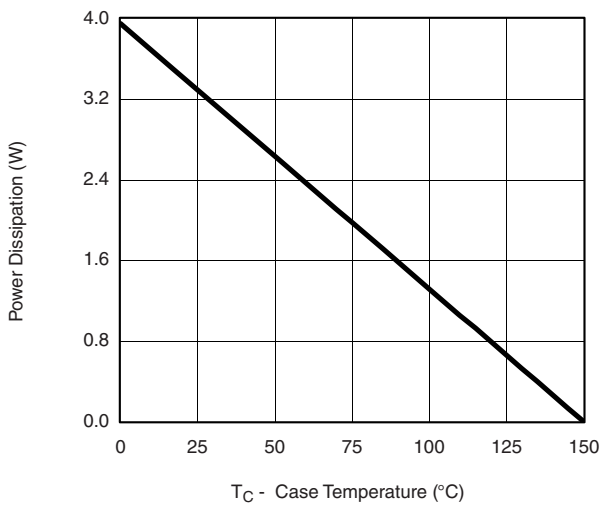
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

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



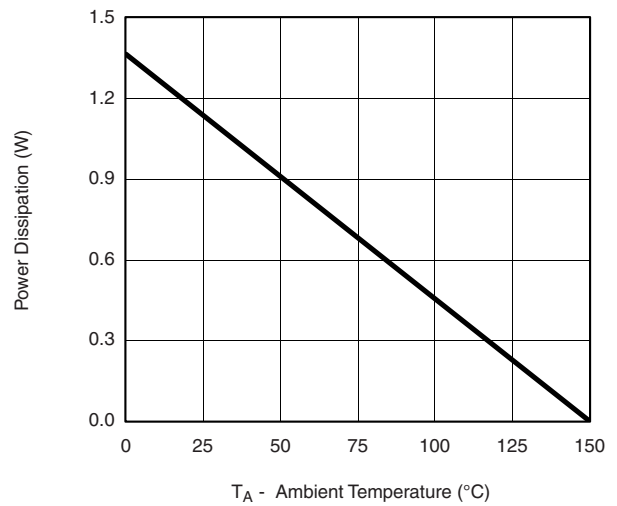
T_C - Case Temperature (°C)

Current Derating*



T_C - Case Temperature (°C)

Power Derating, Junction-to-Foot

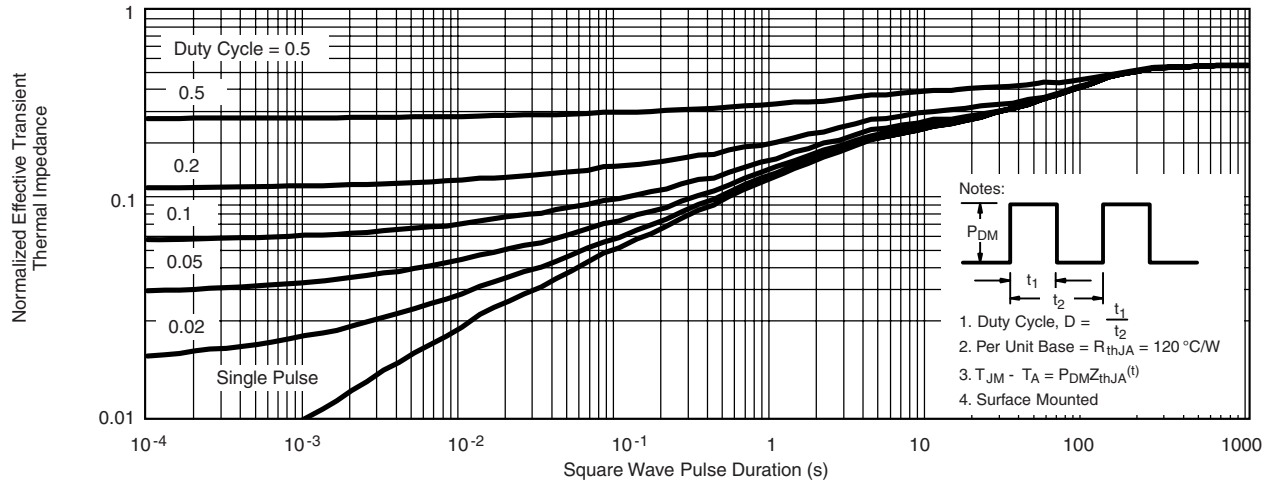


T_A - Ambient Temperature (°C)

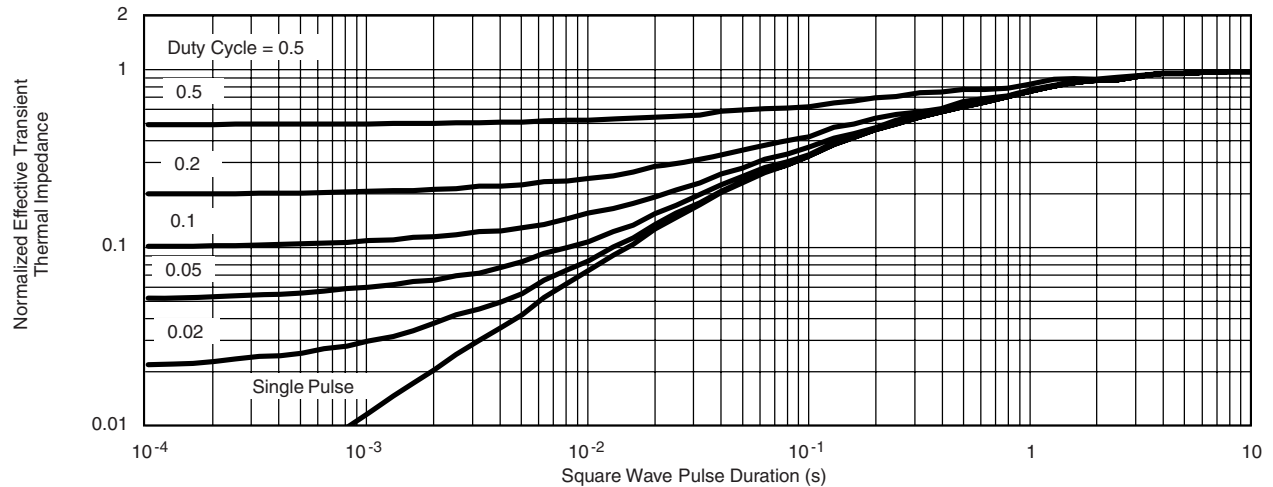
Power Derating, Junction-to-Ambient

* 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



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

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