

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

PRODUCT SUMMARY

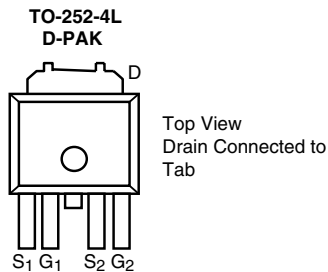
	V _{DS} (V)	r _{DS(on)} (Ω)	I _D (A) ^a	Q _g (Typ.)
N-Channel	40	0.037 at V _{GS} = 10 V	8	26
		0.046 at V _{GS} = 4.5 V	8	
P-Channel	- 40	0.040 at V _{GS} = - 10 V	- 8	25.5
		0.050 at V _{GS} = - 4.5 V	- 8	

FEATURES

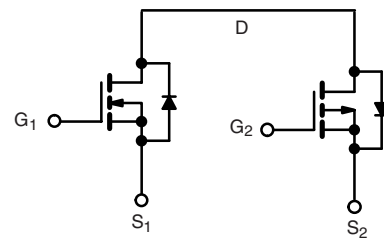
- TrenchFET® Power MOSFET
- 100 % UIS Tested

APPLICATIONS

- Backlight Inverter for LCD Display
- Full Bridge DC/DC Converter



Ordering Information: SUD50NP04-77P-T4-E3 (Lead (Pb)-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}	± 20		
Continuous Drain Current (T _J = 150 °C)	T _C = 25 °C	I _D	8 ^a	- 8 ^a	A
	T _C = 70 °C		8 ^a	- 8 ^a	
	T _A = 25 °C		8 ^{a, b, c}	- 8 ^{a, b, c}	
	T _A = 70 °C		7 ^{b, c}	- 7.4 ^{b, c}	
Pulsed Drain Current (10 μs Pulse Width)		I _{DM}	30	- 30	
Source-Drain Current Diode Current	T _C = 25 °C	I _S	8 ^a	- 8 ^a	
	T _A = 25 °C		4.3 ^{b, c}	- 4.6 ^{b, c}	
Pulsed Source-Drain Current		I _{SM}	30	- 30	
Single Pulse Avalanche Current	L = 0.1 mH	I _{AS}	7	15	
Single Pulse Avalanche Energy		E _{AS}	2.45	11.25	mJ
Maximum Power Dissipation	T _C = 25 °C	P _D	10.8	24	W
	T _C = 70 °C		6.9	15.3	
	T _A = 25 °C		5.2 ^{b, c}	5.6 ^{b, c}	
	T _A = 70 °C		3.3 ^{b, c}	3.6 ^{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}	20	24	18	22	°C/W
Maximum Junction-to-Case (Drain)	Steady State	R _{thJC}	9.4	11.5	4.3	5.2	

Notes:

a. Package Limited.

b. Surface Mounted on 1" x 1" FR4 Board.

c. t = 10 s.

d. Maximum under Steady State conditions is 60 °C/W (N-Channel) and 52 °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	ΔV _{DS} /T _J	I _D = 250 μA	N-Ch		44		mV/°C	
		I _D = - 250 μA	P-Ch		- 41			
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J	I _D = 250 μA	N-Ch		- 5.5			
		I _D = - 250 μA	P-Ch		4.3			
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	N-Ch	1.4		2.5	V	
		V _{DS} = V _{GS} , I _D = - 250 μA	P-Ch	- 1.4		- 2.7		
Gate-Body Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V	N-Ch P-Ch			100 - 100	nA	
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	10			A	
		V _{DS} = - 5 V, V _{GS} = - 10 V	P-Ch	- 10				
Drain-Source On-State Resistance ^b	r _{DS(on)}	V _{GS} = 10 V, I _D = 5 A	N-Ch		0.0305	0.037	Ω	
		V _{GS} = - 10 V, I _D = - 5 A	P-Ch		0.030	0.040		
		V _{GS} = 4.5 V, I _D = 4 A	N-Ch		0.037	0.046		
		V _{GS} = - 4.5 V, I _D = - 4 A	P-Ch		0.036	0.050		
Forward Transconductance ^b	g _{fs}	V _{DS} = 15 V, I _D = 5 A	N-Ch		22		S	
		V _{DS} = - 15 V, I _D = - 5 A	P-Ch		20			
Dynamic ^a								
Input Capacitance	C _{iss}	N-Channel V _{DS} = 20 V, V _{GS} = 0 V, f = 1 MHz	N-Ch P-Ch		640 1555		pF	
Output Capacitance	C _{oss}		N-Ch P-Ch		73 176			
Reverse Transfer Capacitance	C _{rss}	P-Channel V _{DS} = - 20 V, V _{GS} = 0 V, f = 1 MHz	N-Ch P-Ch		41 142			nC
			V _{DS} = 20 V, V _{GS} = 10 V, I _D = 5 A	N-Ch		11.7		
Total Gate Charge	Q _g	V _{DS} = - 20 V, V _{GS} = - 10 V, I _D = - 5 A	P-Ch		38.5	60		
		N-Channel V _{DS} = 20 V, V _{GS} = 4.5 V, I _D = 5 A	N-Ch P-Ch		5.3 17	9.0 27		
Gate-Source Charge	Q _{gs}		P-Channel V _{DS} = - 20 V, V _{GS} = - 4.5 V, I _D = - 5 A	N-Ch P-Ch		1.9 4.2		
		N-Ch P-Ch			1.7 7.0			
Gate-Drain Charge	Q _{gd}							
Gate Resistance	R _g	f = 1 MHz	N-Ch P-Ch		2.2 3.0		Ω	



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 $V_{DD} = 20\text{ V}$, $R_L = 4\text{ }\Omega$ $I_D \cong 5\text{ A}$, $V_{GEN} = 10\text{ V}$, $R_g = 1\text{ }\Omega$	N-Ch		9	18	ns
			P-Ch		10	20	
Rise Time	t_r		N-Ch		11	20	
			P-Ch		14	25	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel $V_{DD} = -20\text{ V}$, $R_L = 4\text{ }\Omega$ $I_D \cong -5\text{ A}$, $V_{GEN} = -10\text{ V}$, $R_g = 1\text{ }\Omega$	N-Ch		14	25	
			P-Ch		36	60	
Fall Time	t_f		N-Ch		8	16	
			P-Ch		10	20	
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 20\text{ V}$, $R_L = 4\text{ }\Omega$ $I_D \cong 5\text{ A}$, $V_{GEN} = 4.5\text{ V}$, $R_g = 1\text{ }\Omega$	N-Ch		18	30	ns
			P-Ch		47	80	
Rise Time	t_r		N-Ch		14	25	
			P-Ch		60	110	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel $V_{DD} = -20\text{ V}$, $R_L = 4\text{ }\Omega$ $I_D \cong -5\text{ A}$, $V_{GEN} = -4.5\text{ V}$, $R_g = 1\text{ }\Omega$	N-Ch		14	25	
			P-Ch		35	60	
Fall Time	t_f		N-Ch		10	20	
			P-Ch		13	25	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^{\circ}\text{C}$	N-Ch			8	A
			P-Ch			- 8	
Pulse Diode Forward Current ^a	I_{SM}		N-Ch			30	
			P-Ch			- 30	
Body Diode Voltage	V_{SD}	$I_S = 2\text{ A}$	N-Ch		0.805	1.2	V
		$I_S = -2\text{ A}$	P-Ch		- 0.76	- 1.2	
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 2\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^{\circ}\text{C}$	N-Ch		19	30	ns
			P-Ch		22	40	
Body Diode Reverse Recovery Charge	Q_{rr}		N-Ch		14	25	nC
			P-Ch		22	40	
Reverse Recovery Fall Time	t_a	P-Channel $I_F = -2\text{ A}$, $di/dt = -100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^{\circ}\text{C}$	N-Ch		13		ns
			P-Ch		15		
Reverse Recovery Rise Time	t_b		N-Ch		6		
			P-Ch		7		

Notes:

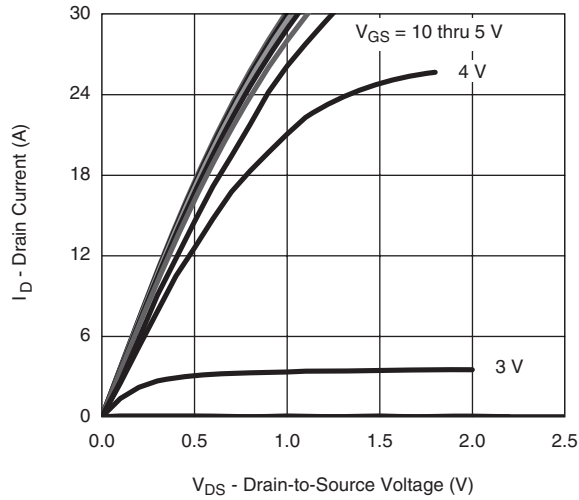
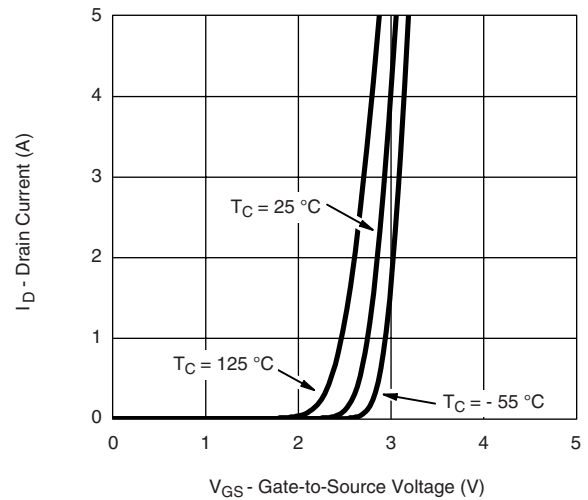
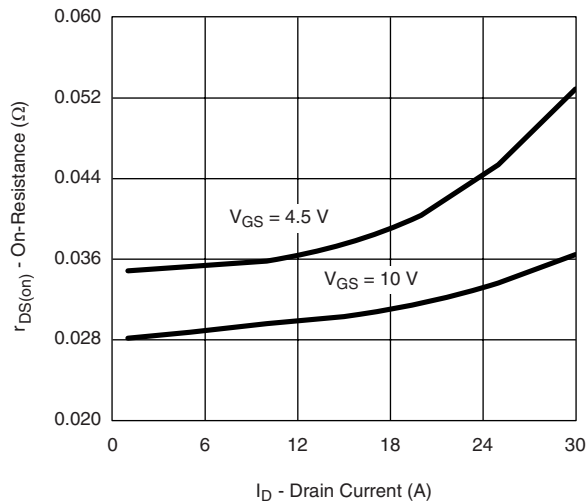
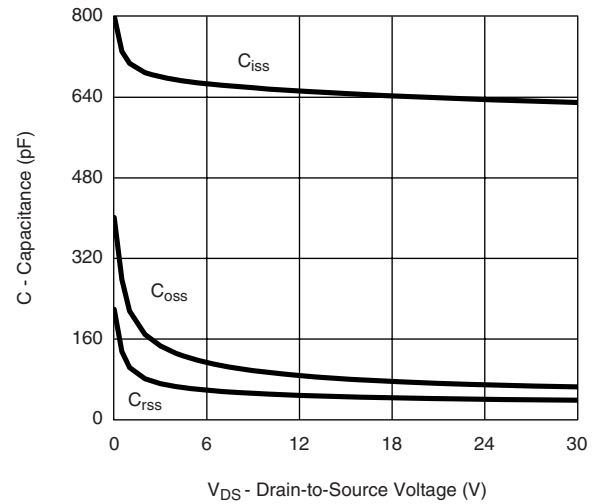
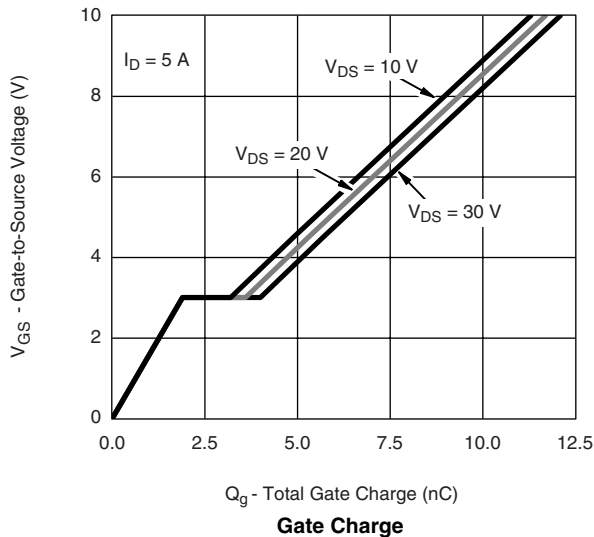
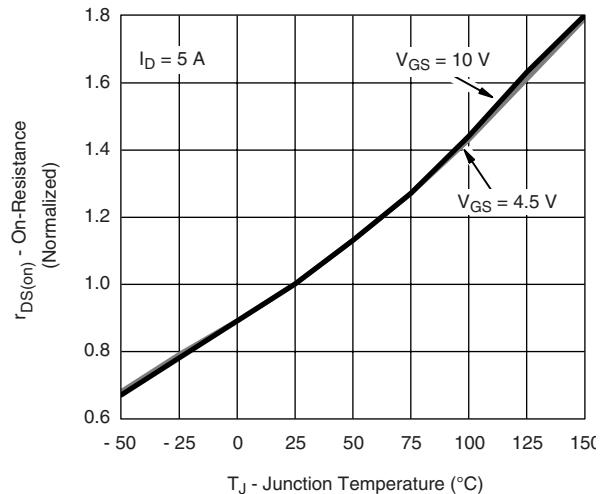
a. Guaranteed by design, not subject to production testing.

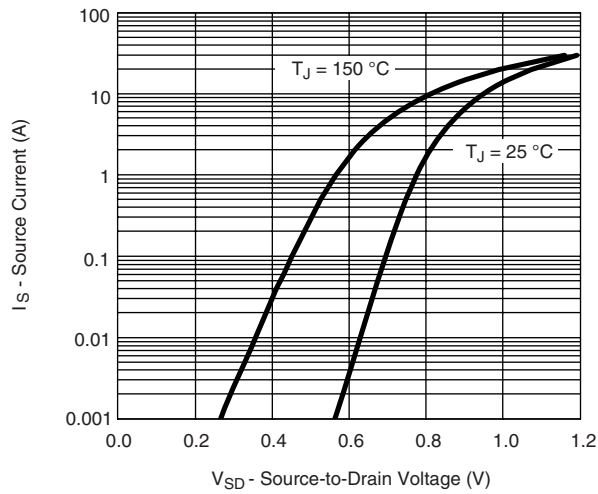
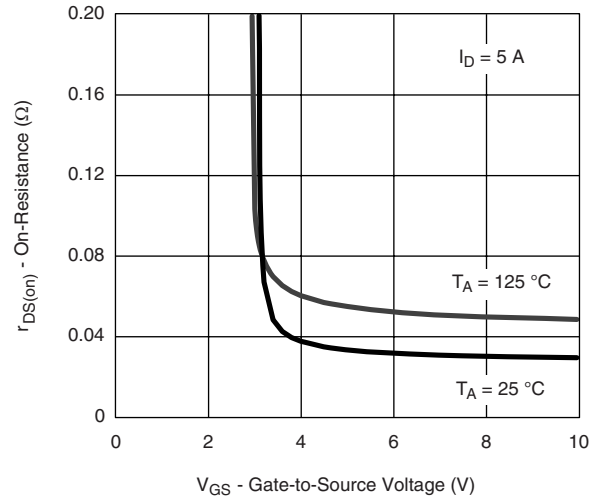
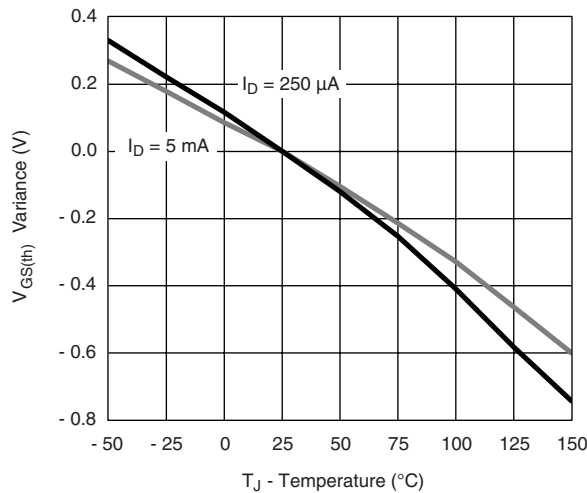
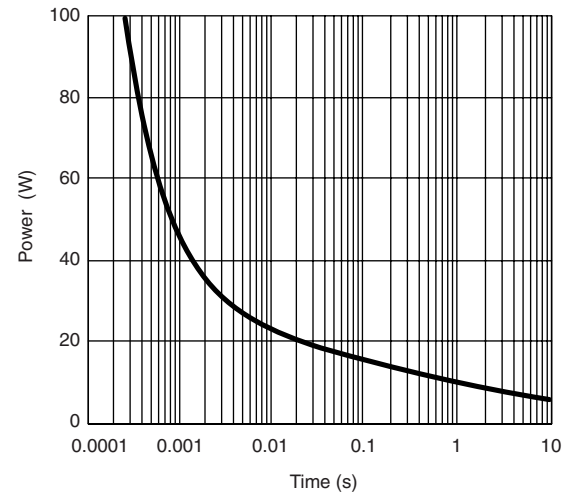
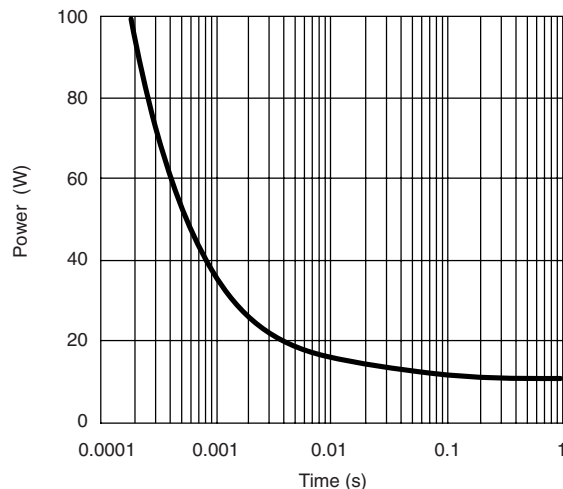
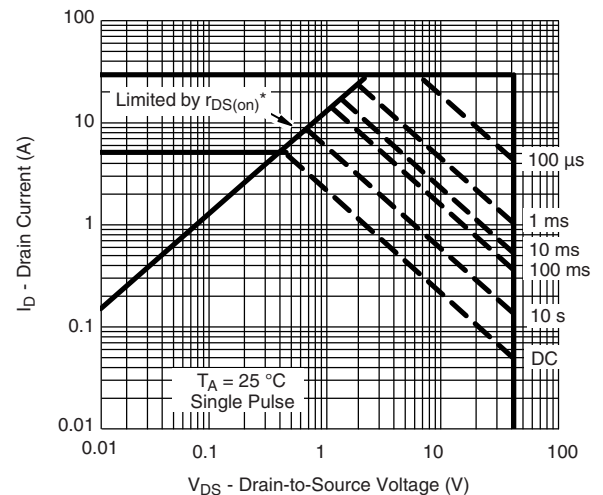
b. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

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.

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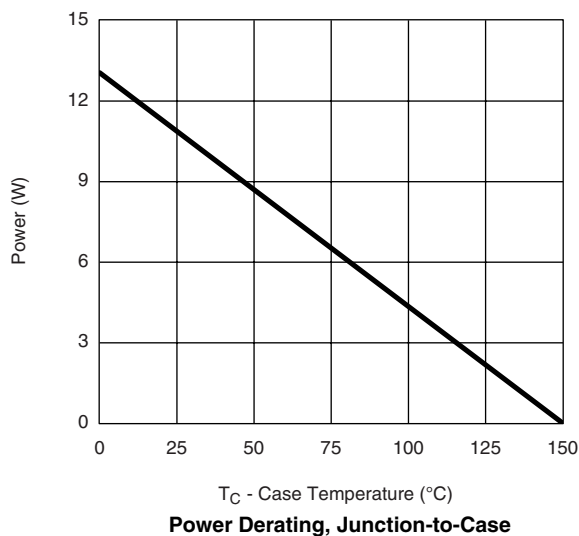
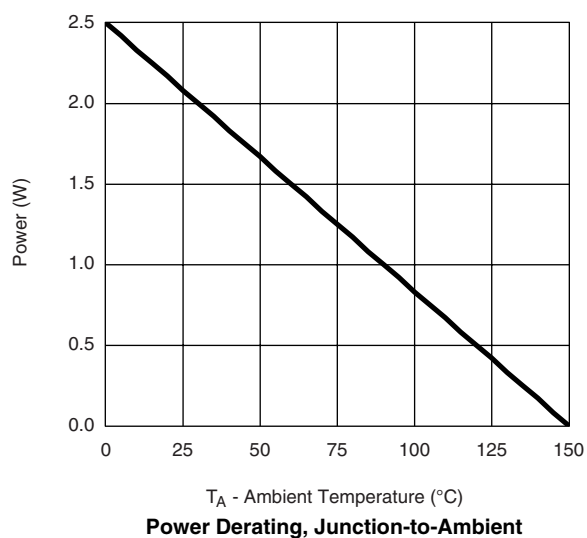
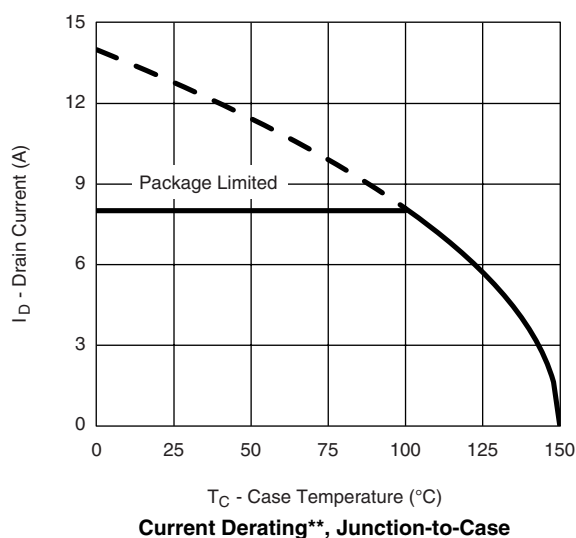
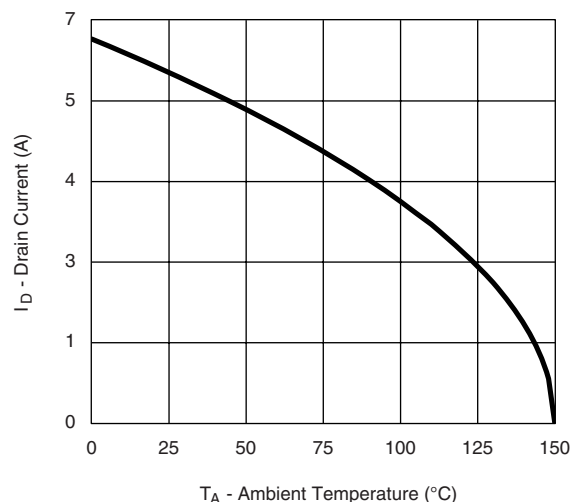
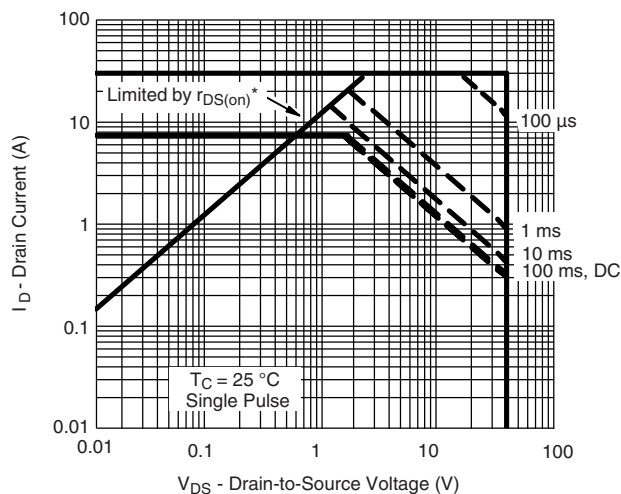
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**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Output Characteristics****Transfer Characteristics****On-Resistance vs. Drain Current****Capacitance****Gate Charge****On-Resistance vs. Junction Temperature**

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

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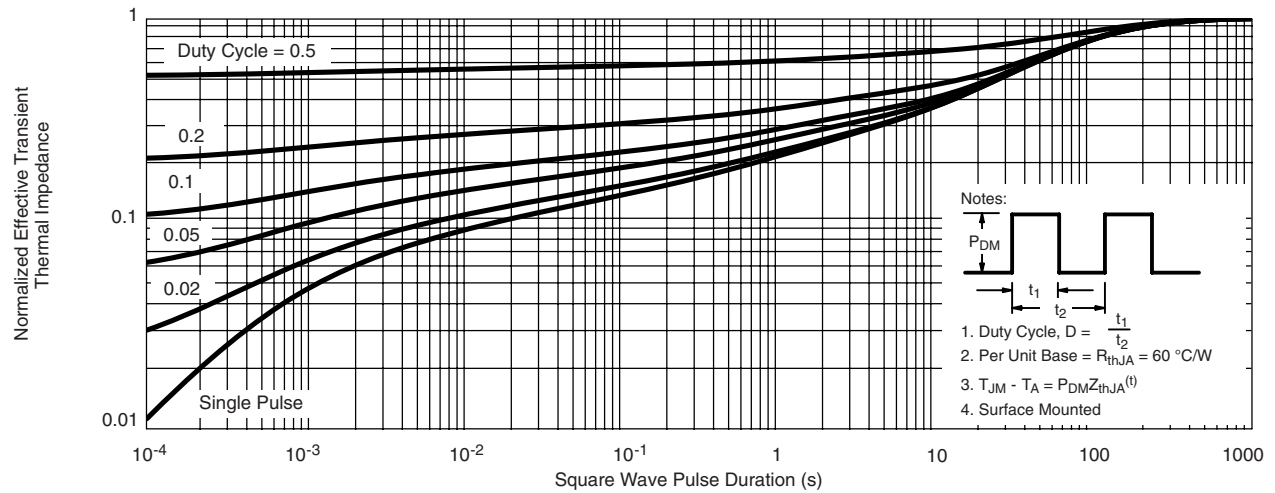
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**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

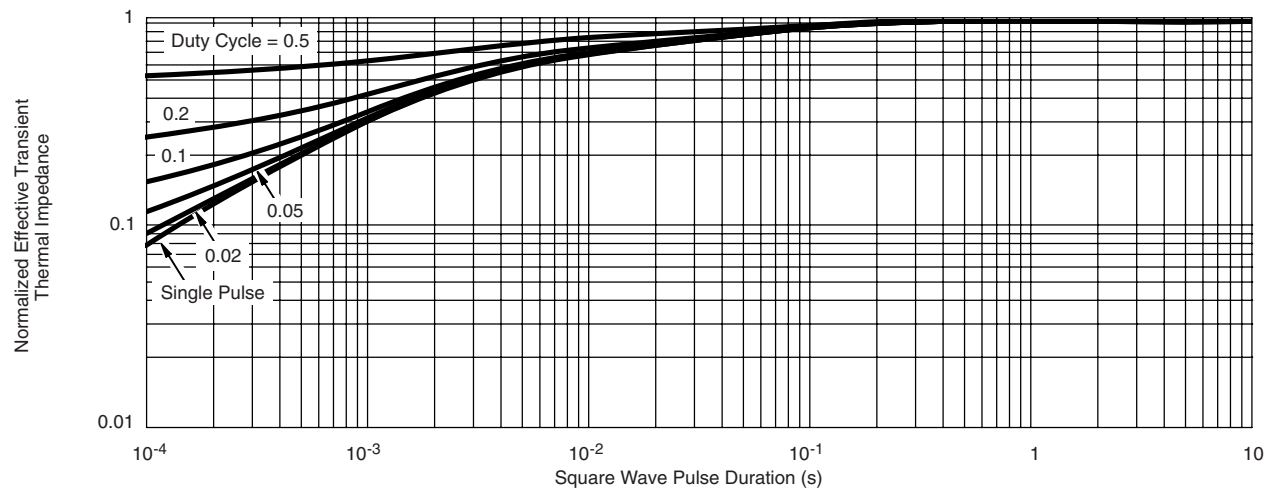
** The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



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



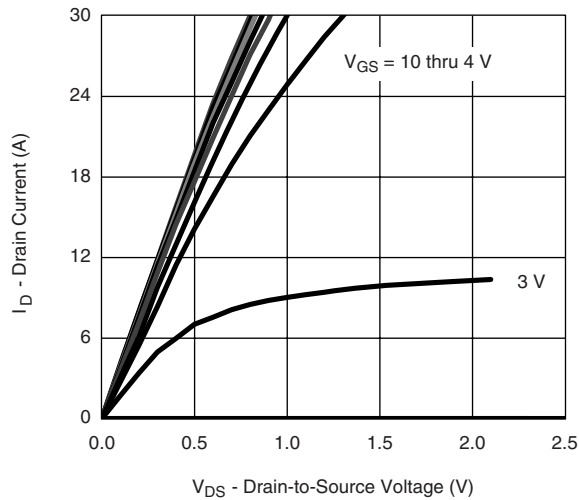
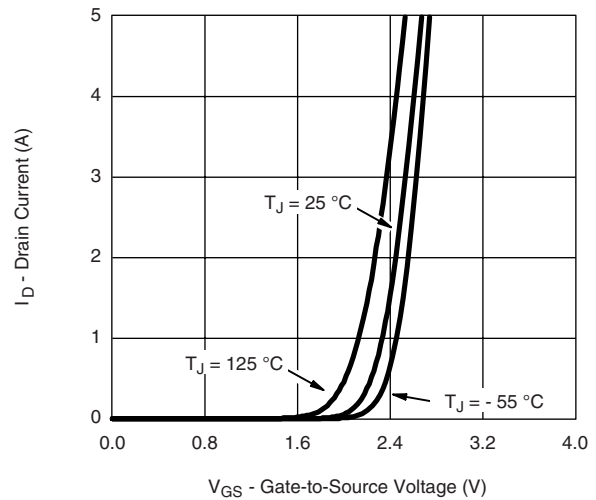
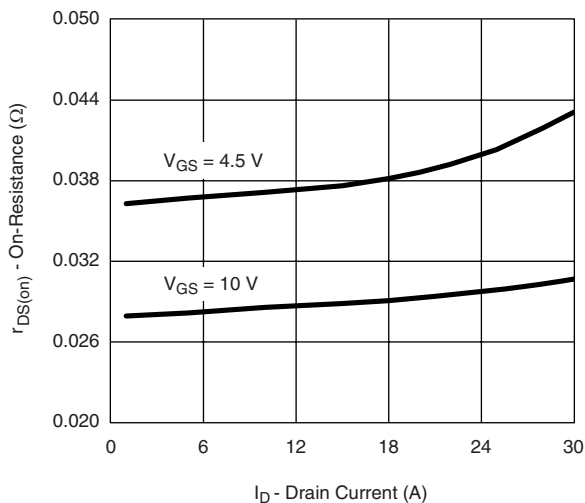
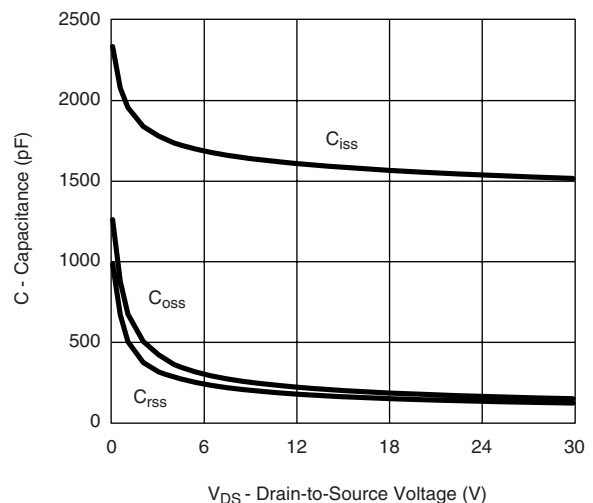
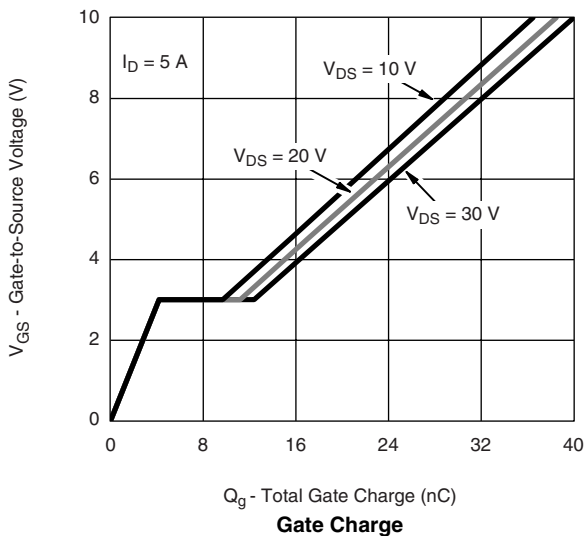
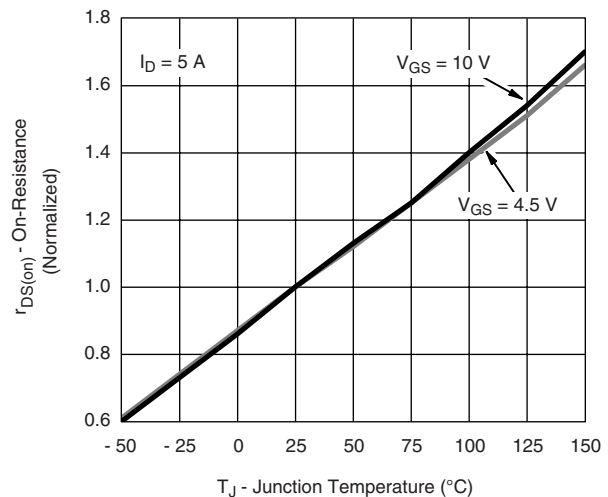
Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

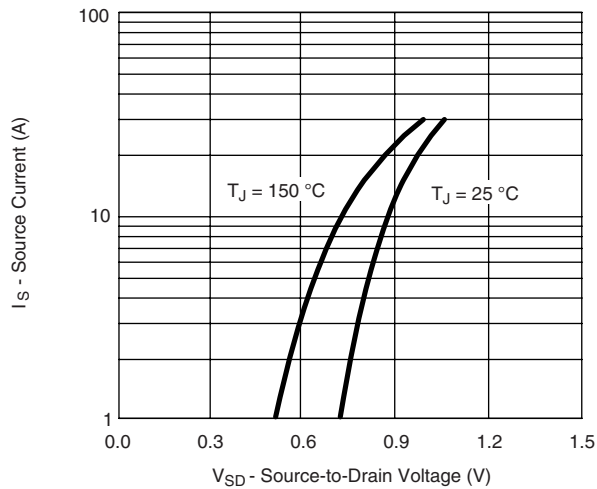
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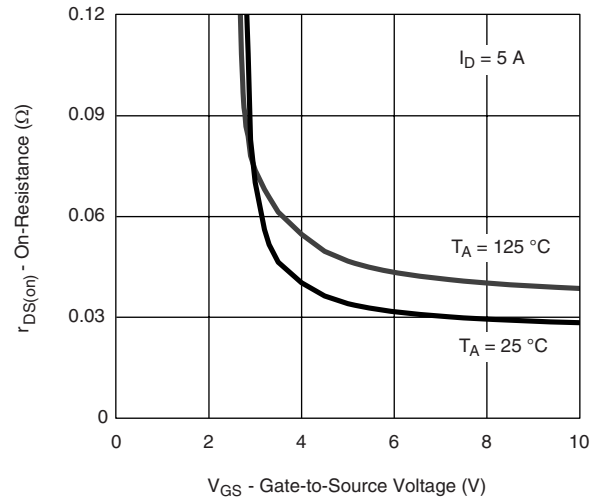
**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Output Characteristics****Transfer Characteristics****On-Resistance vs. Drain Current****Capacitance****Gate Charge****On-Resistance vs. Junction Temperature**



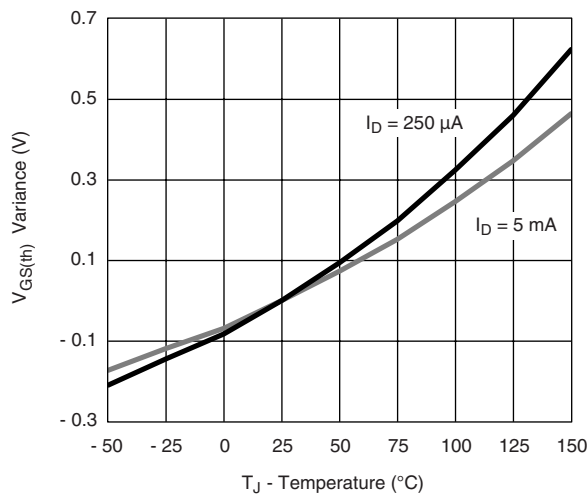
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



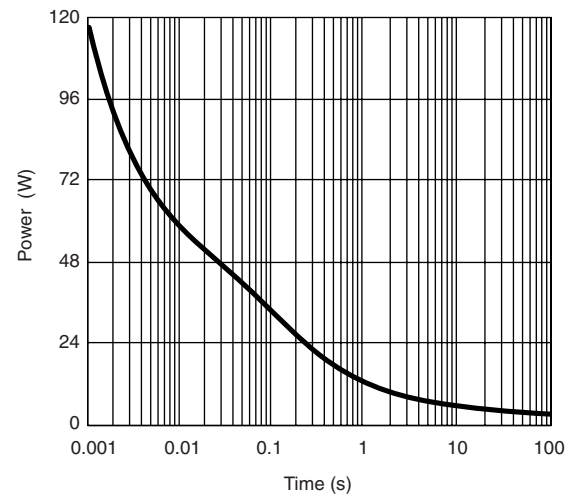
Source-Drain Diode Forward Voltage



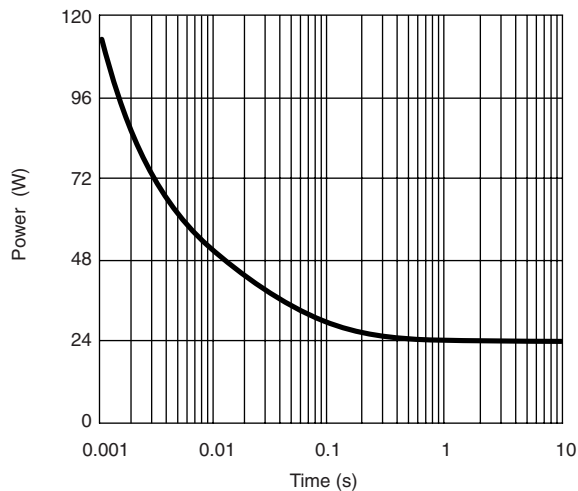
On-Resistance vs. Gate-to-Source Voltage



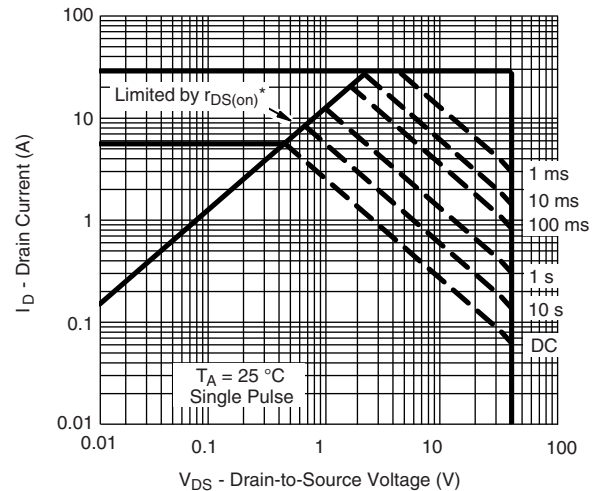
Threshold Voltage



Single Pulse Power, Junction-to-Ambient



Single Pulse Power, Junction-to-Case

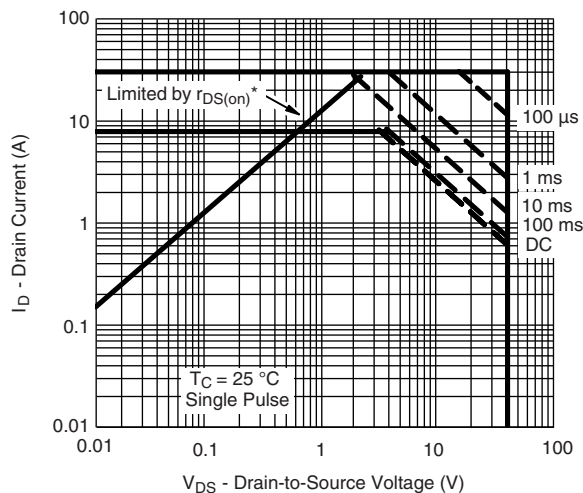
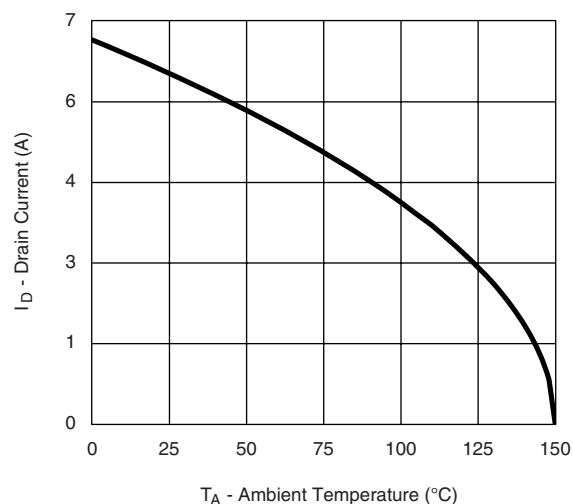
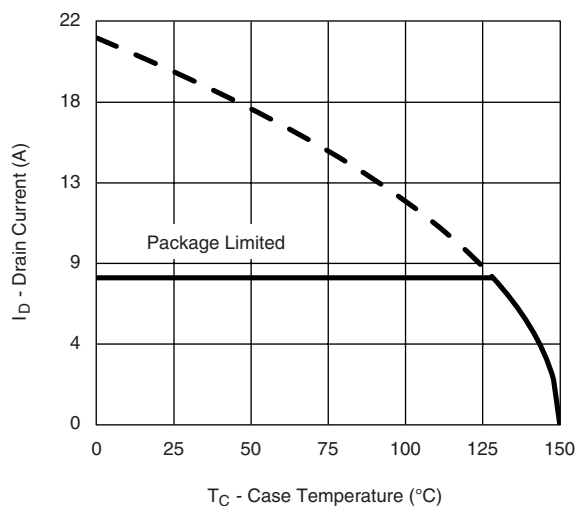
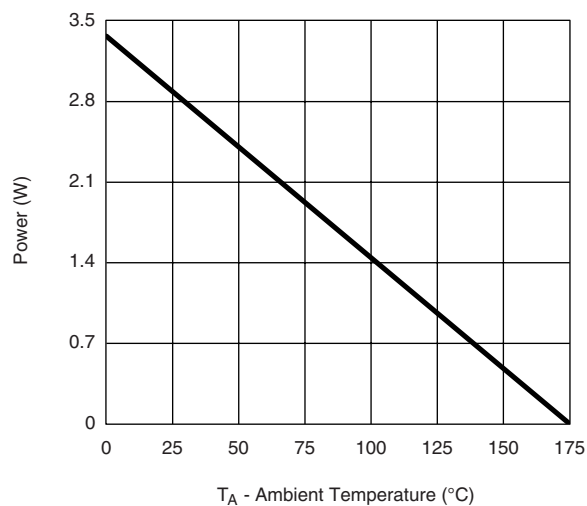
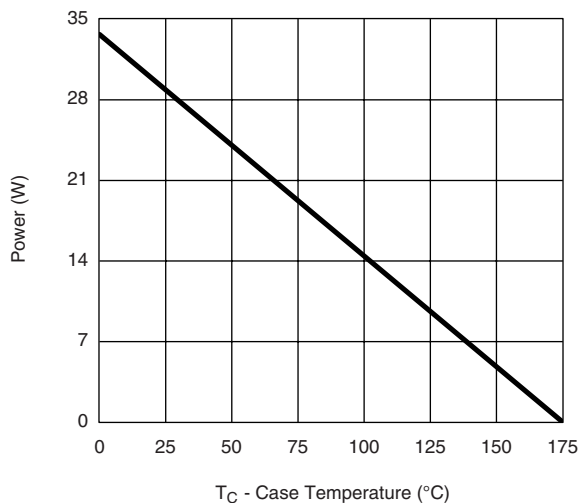


* V_{GS} > minimum V_{GS} at which $r_{DS(on)}$ is specified

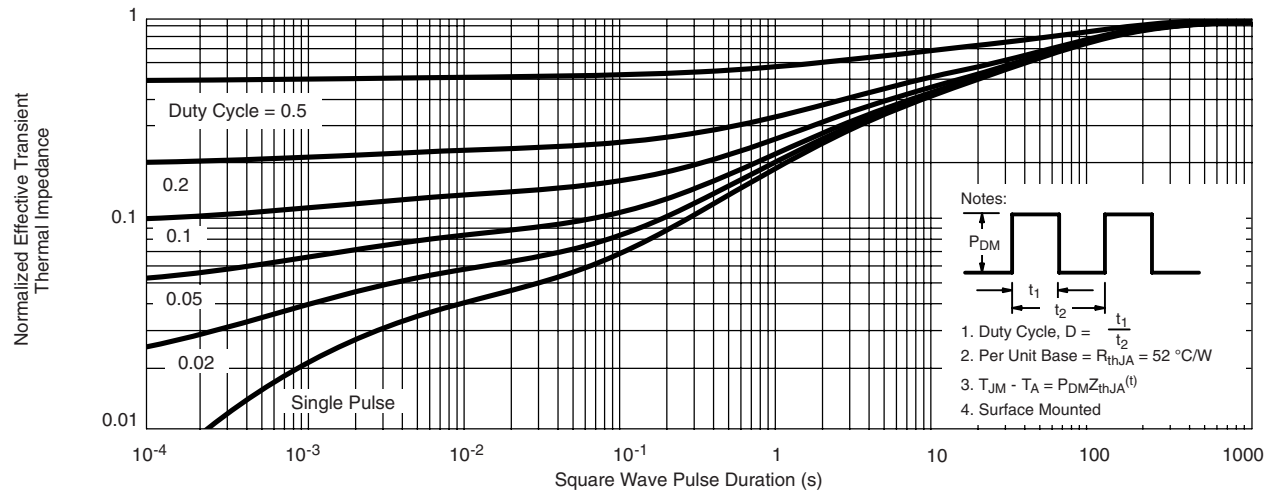
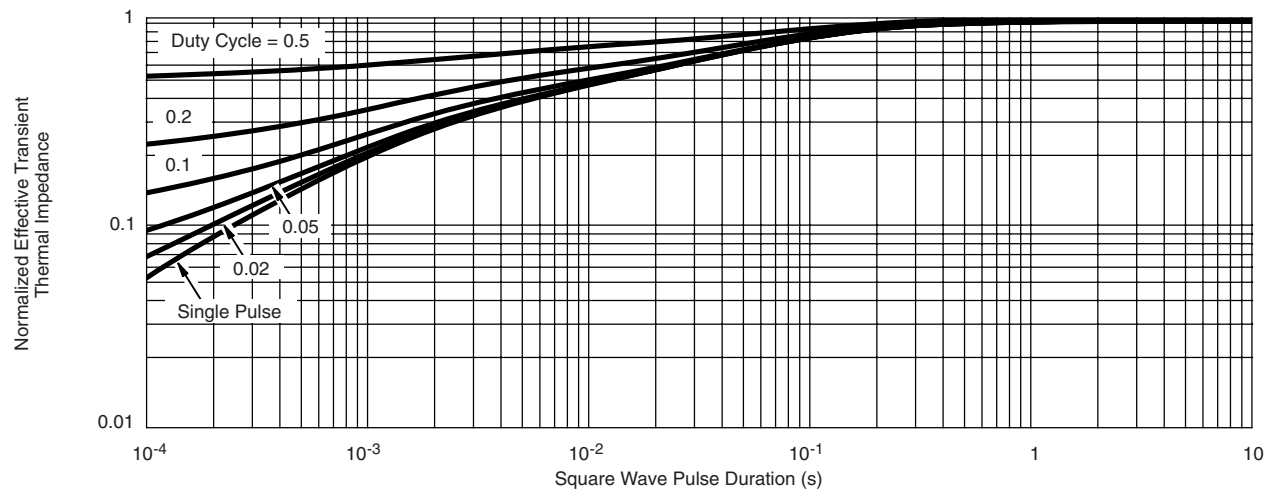
Safe Operating Area, Junction-to-Ambient

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**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Safe Operating Area, Junction-to-Case****Current Derating**, Junction-to-Ambient****Current Derating**, Junction-to-Case****Power Derating, Junction-to-Ambient****Power Derating, Junction-to-Case**

** 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.

**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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