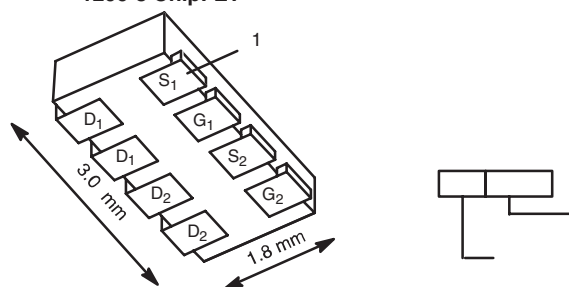


N- and P-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY

	V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A) ^a	Q _g (Typ.)
N-Channel	20	0.052 at V _{GS} = 4.5 V	6.1 ^a	3.9 nC
		0.084 at V _{GS} = 2.5 V	4.8 ^a	
P-Channel	- 20	0.090 at V _{GS} = - 4.5 V	- 4.8 ^a	3.8 nC
		0.160 at V _{GS} = - 2.5 V	- 3.6 ^a	

1206-8 ChipFET®



FEATURES

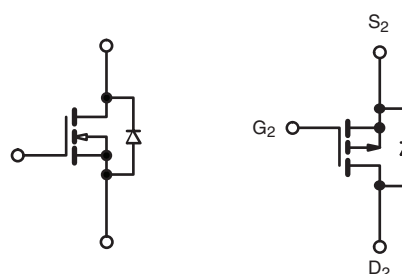
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFETs
- Compliant to RoHS Directive 2002/95/EC



RoHS
COMPLIANT
HALOGEN
FREE
Available

APPLICATIONS

- Complementary MOSFET for Portable Devices
- Ideal for Buck-Boost Circuits



Ordering Information: Si5509DC-T1-E3 (Lead (Pb)-free)
Si5509DC-T1-GE3 (Lead (Pb)-free and Halogen-free)

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}	20	- 20	V
Gate-Source Voltage		V _{GS}	± 12		
Continuous Drain Current (T _J = 150 °C)	T _C = 25 °C	I _D	6.1 ^a	- 4.8 ^a	A
	T _C = 70 °C		4.9 ^a	- 3.8 ^a	
	T _A = 25 °C		5.0 ^{b, c}	- 3.9 ^{b, c}	
	T _A = 70 °C		3.9 ^{b, c}	- 3.1 ^{b, c}	
Pulsed Drain Current		I _{DM}	10	- 15	
Source Drain Current Diode Current	T _C = 25 °C	I _S	3.7	- 3.7	
	T _A = 25 °C		1.7 ^{b, c}	- 1.7 ^{b, c}	
Maximum Power Dissipation	T _C = 25 °C	P _D	4.5	4.5	W
	T _C = 70 °C		2.88	2.88	
	T _A = 25 °C		2.1 ^{b, c}	2.1 ^{b, c}	
	T _A = 70 °C		1.33 ^{b, c}	1.33 ^{b, c}	
Operating Junction and Storage Temperature Range		T _J , T _{stg}	- 55 to 150		°C
Soldering Recommendations (Peak Temperature) ^{d, e}			260		

THERMAL RESISTANCE RATINGS

Parameter	Symbol	N-Channel		P-Channel		Unit
		Typ.	Max.	Typ.	Max.	
Maximum Junction-to-Ambient ^{b, f}	R _{thJA}	50	60	50	60	°C/W
Maximum Junction-to-Foot (Drain)	R _{thJF}	30	40	30	40	

Notes:

a. Based on T_C = 25 °C.

b. Surface mounted on 1" x 1" FR4 board.

c. t = 5 s.

d. See Reliability Manual for profile. The ChipFET is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.

e. Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.

f. Maximum under steady state conditions is 90 °C/W for both channels.

**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 V, I _D = 250 μA	N-Ch	20			V	
		V _{GS} = 0 V, I _D = - 250 μA	P-Ch	- 20				
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA	N-Ch		18.4		mV/°C	
		I _D = - 250 μA	P-Ch		- 15.1			
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J	I _D = 250 μA	N-Ch		- 3.4			
		I _D = - 250 μA	P-Ch		2.2			
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	N-Ch	0.7		2	V	
		V _{DS} = V _{GS} , I _D = - 250 μA	P-Ch	- 0.7		- 2		
Gate-Body Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 12 V	N-Ch P-Ch			100 - 100	nA	
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 20 V, V _{GS} = 0 V	N-Ch			1	μA	
		V _{DS} = - 20 V, V _{GS} = 0 V	P-Ch			- 1		
		V _{DS} = 20 V, V _{GS} = 0 V, T _J = 55 °C	N-Ch			10		
		V _{DS} = - 20 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} = 4.5 V	N-Ch	10			A	
		V _{DS} ≤ - 5 V, V _{GS} = - 4.5 V	P-Ch	- 15				
Drain-Source On-State Resistance ^b	R _{DS(on)}	V _{GS} = 4.5 V, I _D = 5.0 A	N-Ch		0.043	0.052	Ω	
		V _{GS} = - 4.5 V, I _D = - 3.9 A	P-Ch		0.074	0.090		
		V _{GS} = 2.5 V, I _D = 3.9 A	N-Ch		0.068	0.084		
		V _{GS} = - 2.5 V, I _D = - 2.9 A	P-Ch		0.128	0.160		
Forward Transconductance ^b	g _{fs}	V _{DS} = 10 V, I _D = 5.0 A	N-Ch		10.4		S	
		V _{DS} = - 10 V, I _D = - 3.9 A	P-Ch		8.2			
Dynamic ^a								
Input Capacitance	C _{iss}	N-Channel V _{DS} = 10 V, V _{GS} = 0 V, f = 1 MHz	N-Ch P-Ch		455 300		pF	
Output Capacitance	C _{oss}		N-Ch P-Ch		85 95			
Reverse Transfer Capacitance	C _{rss}	P-Channel V _{DS} = - 10 V, V _{GS} = 0 V, f = 1 MHz	N-Ch P-Ch		50 65			nC
Total Gate Charge	Q _g		V _{DS} = 10 V, V _{GS} = 5 V, I _D = 4.0 A	N-Ch		4.4		
		V _{DS} = - 10 V, V _{GS} = - 5 V, I _D = - 3.9 A	P-Ch		4.1	6.2		
Gate-Source Charge	Q _{gs}	N-Channel V _{DS} = 10 V, V _{GS} = 4.5 V, I _D = 4.0 A	N-Ch P-Ch		3.8 3.9	5.7 5.9		
			P-Channel V _{DS} = - 10 V, V _{GS} = - 4.5 V, I _D = - 3.9 A	N-Ch P-Ch		0.9 0.7		
Gate-Drain Charge	Q _{gd}		N-Ch P-Ch		0.95 1.25			
			Gate Resistance	R _g	f = 1 MHz	N-Ch P-Ch		1.9 8



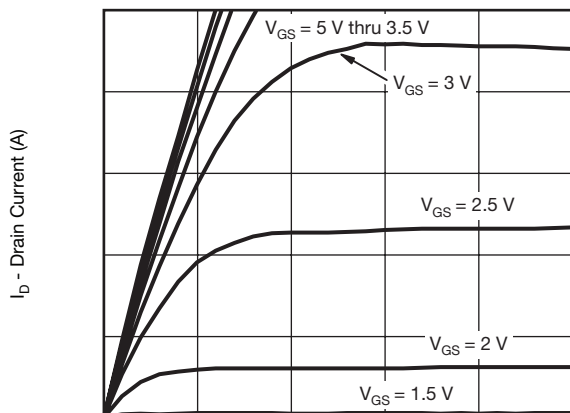
SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted								
Parameter	Symbol	Test Conditions		Min.	Typ. ^a	Max.	Unit	
Dynamic ^a								
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 10\text{ V}$, $R_L = 2.5\text{ }\Omega$ $I_D \cong 4.0\text{ A}$, $V_{GEN} = 4.5\text{ V}$, $R_g = 1\text{ }\Omega$	N-Ch		6	9	ns	
			P-Ch		8	12		
Rise Time	t_r		N-Ch		95	143		
			P-Ch		75	113		
Turn-Off Delay Time	$t_{d(off)}$	P-Channel $V_{DD} = -10\text{ V}$, $R_L = 3.2\text{ }\Omega$ $I_D \cong -3.14\text{ A}$, $V_{GEN} = -4.5\text{ V}$, $R_g = 1\text{ }\Omega$	N-Ch		12	18		
			P-Ch		25	38		
Fall Time	t_f		N-Ch		6	9		
			P-Ch		60	90		
Drain-Source Body Diode Characteristics								
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^{\circ}\text{C}$	N-Ch			3.75	A	
			P-Ch			- 3.75		
Pulse Diode Forward Current ^a	I_{SM}		N-Ch			10		
			P-Ch			- 15		
Body Diode Voltage	V_{SD}	$I_S = 2.4\text{ A}$, $V_{GS} = 0\text{ V}$	N-Ch		0.8	1.2	V	
		$I_S = -1.5\text{ A}$, $V_{GS} = 0\text{ V}$	P-Ch		- 0.8	- 1.2		
Body Diode Reverse Recovery Time	t_{rr}	N-Channel $I_F = 2.4\text{ A}$, $dl/dt = 100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^{\circ}\text{C}$	N-Ch		12	18	ns	
			P-Ch		18	27		
Body Diode Reverse Recovery Charge	Q_{rr}		P-Channel $I_F = -1.5\text{ A}$, $dl/dt = -100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^{\circ}\text{C}$	N-Ch		5	8	nC
				P-Ch		8	12	
Reverse Recovery Fall Time	t_a			N-Ch		7.5		ns
				P-Ch		14		
Reverse Recovery Rise Time	t_b		N-Ch		4.5			
			P-Ch		4			

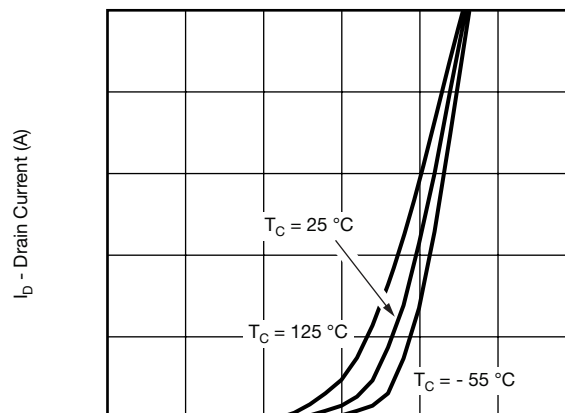
Notes:

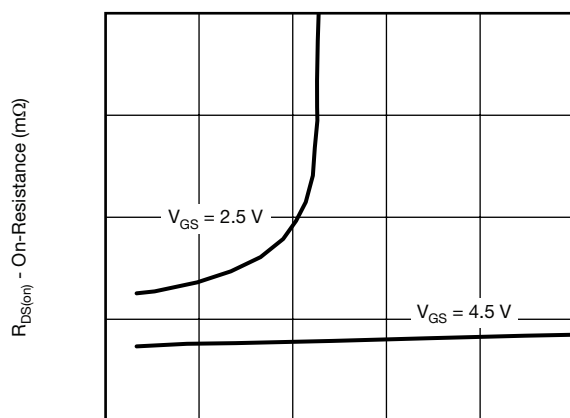
a. Guaranteed by design, not subject to production testing.

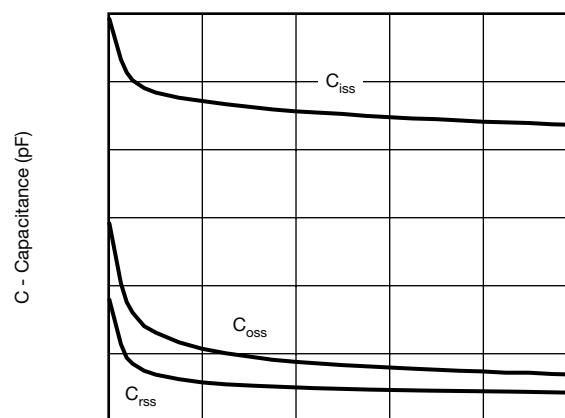
b. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

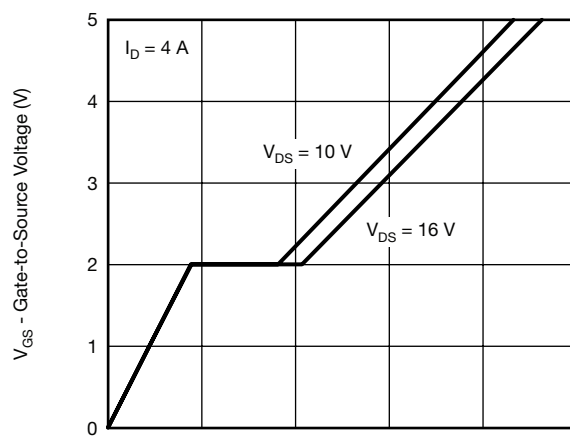
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

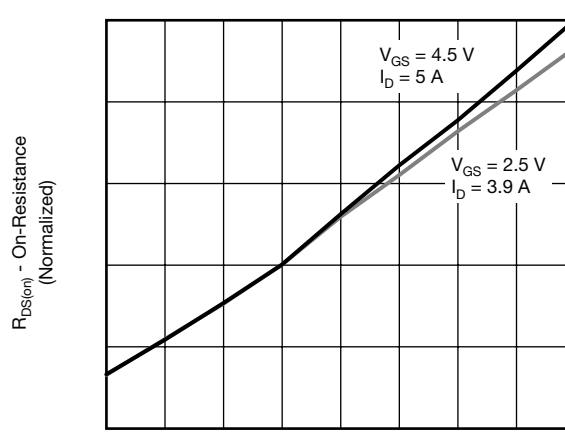

N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

 V_{DS} - Drain-to-Source Voltage (V)

Output Characteristics

 V_{GS} - Gate-to-Source Voltage (V)

Transfer Characteristics

 I_D - Drain Current (A)

On-Resistance vs. Drain Current and Gate Voltage

 V_{DS} - Drain-to-Source Voltage (V)

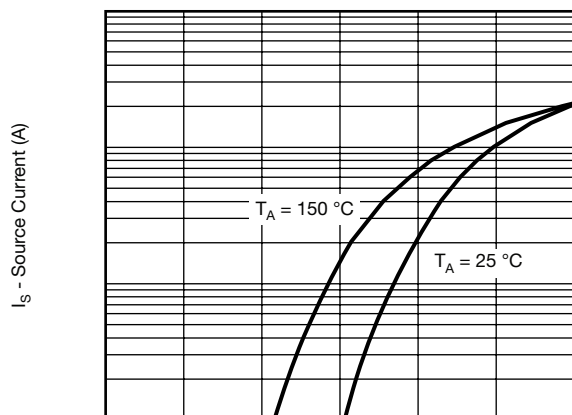
Capacitance

 Q_g - Total Gate Charge

Gate Charge

 T_J - Junction Temperature ($^\circ\text{C}$)

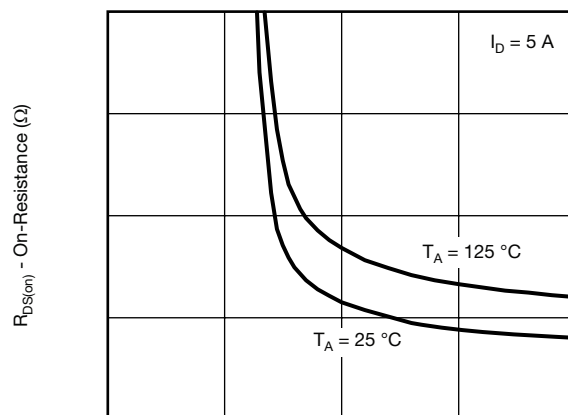
On-Resistance vs. Junction Temperature



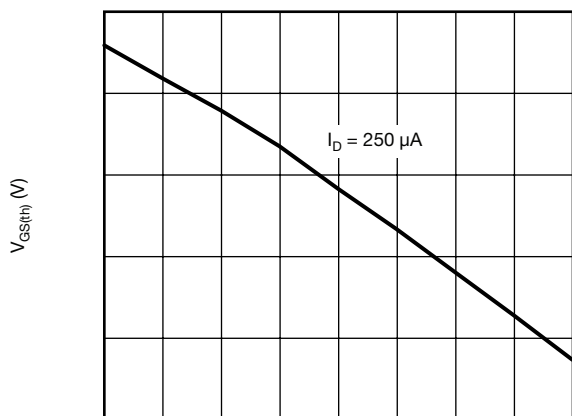
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



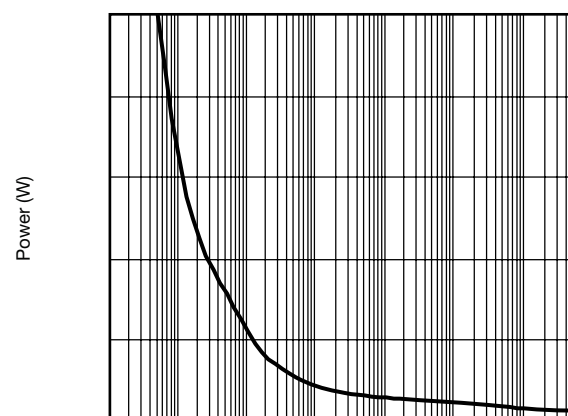
V_{SD} - Source-to-Drain Voltage (V)
Source-Drain Diode Forward Voltage



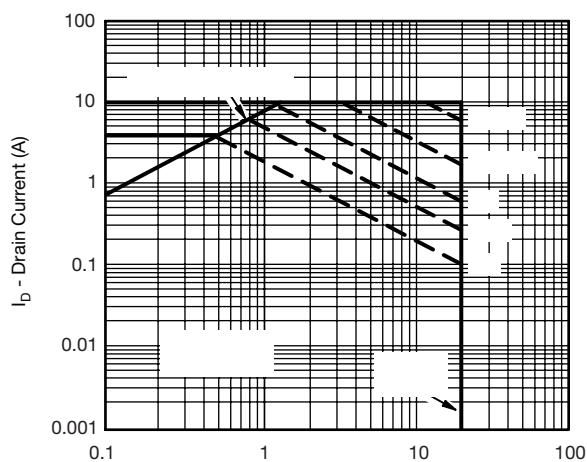
V_{GS} - Gate-to-Source Voltage (V)
On-Resistance vs. Gate-to-Source Voltage



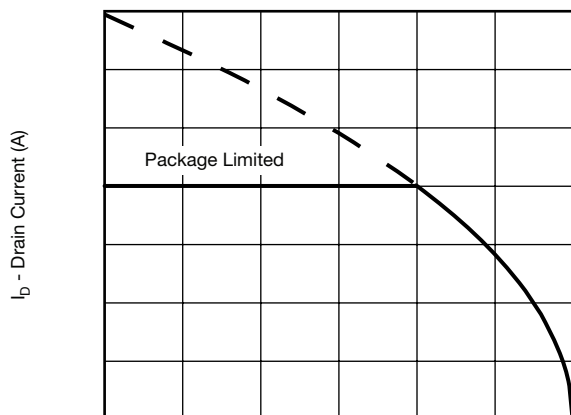
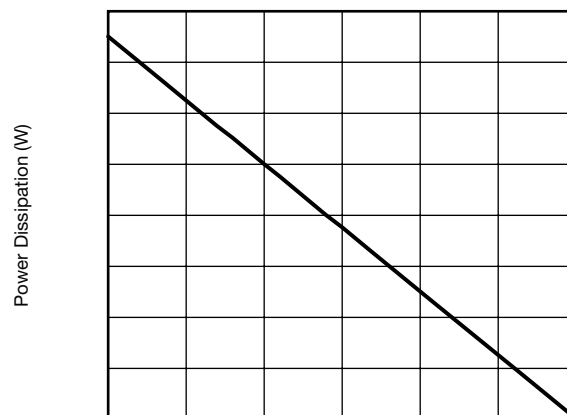
T_J - Junction Temperature ($^\circ\text{C}$)
Threshold Voltage



Time (s)
Single Pulse Power



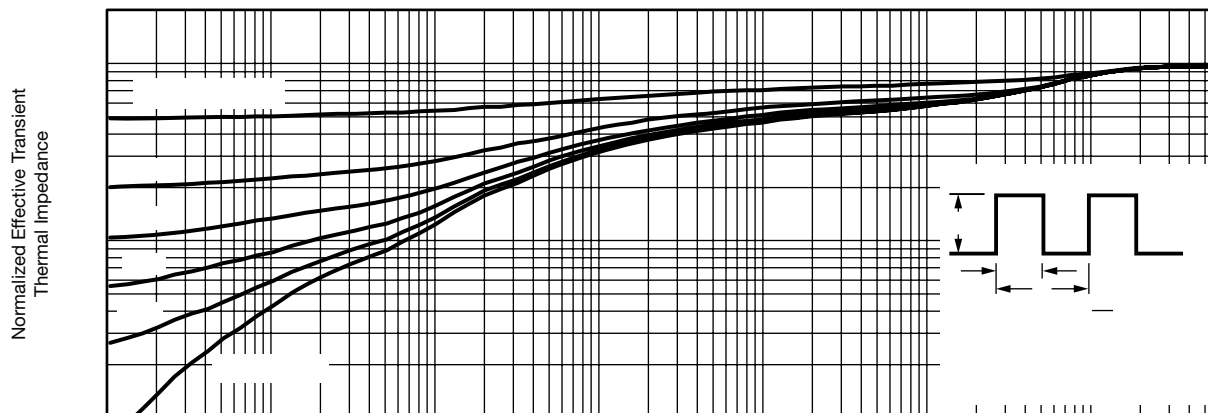
V_{DS} - Drain-to-Source Voltage (V)
* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified
Safe Operating Area, Junction-to-Case

**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted T_C - Case Temperature (°C)**Current Derating*** T_C - Case Temperature (°C)**Power Derating**

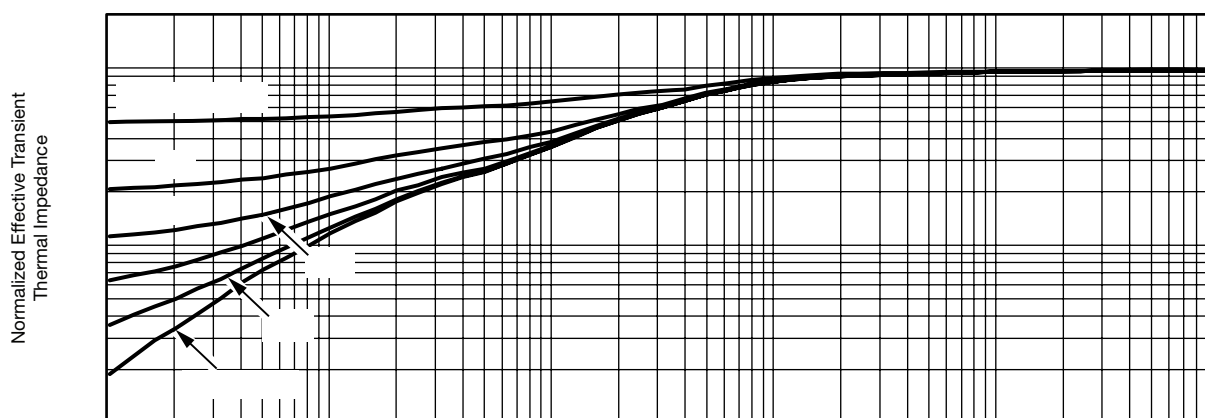
* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



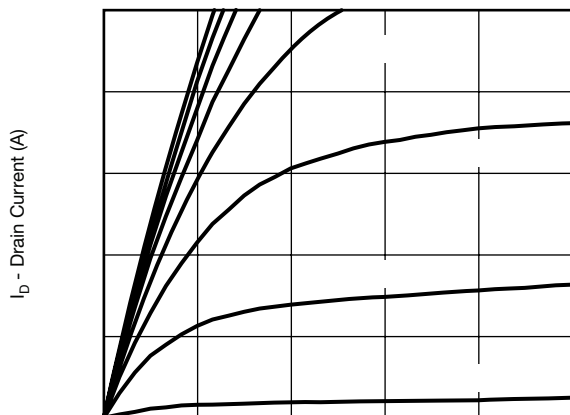
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

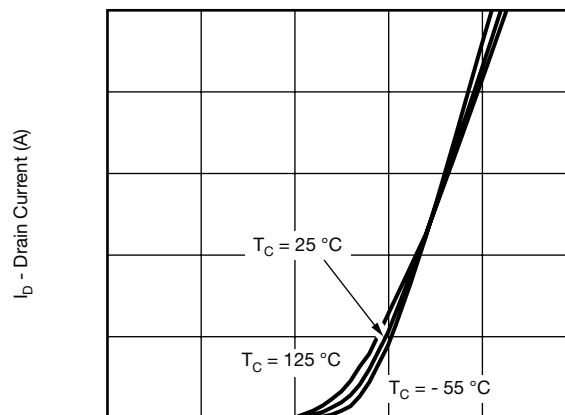


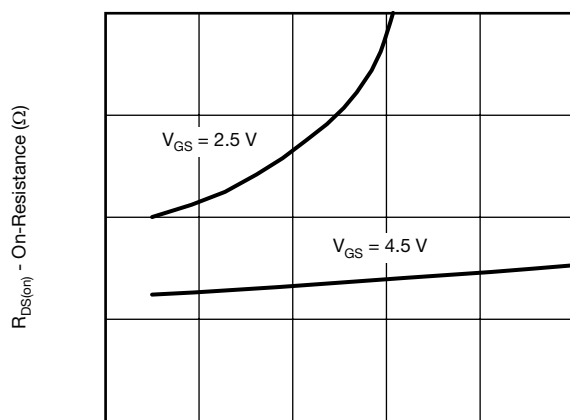
Square Wave Pulse Duration (s)
Normalized Thermal Transient Impedance, Junction-to-Ambient

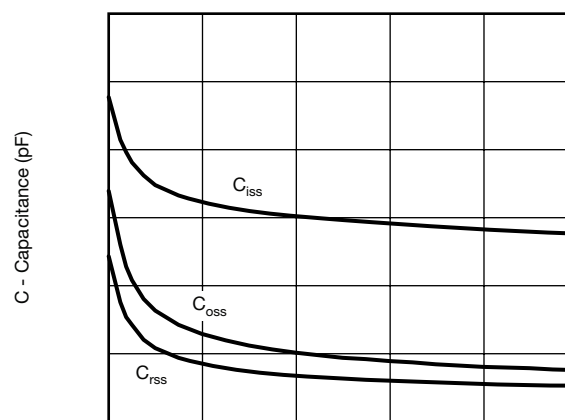


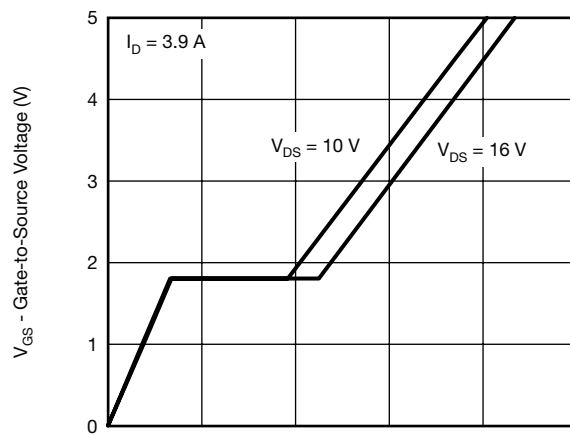
Square Wave Pulse Duration (s)
Normalized Thermal Transient Impedance, Junction-to-Foot

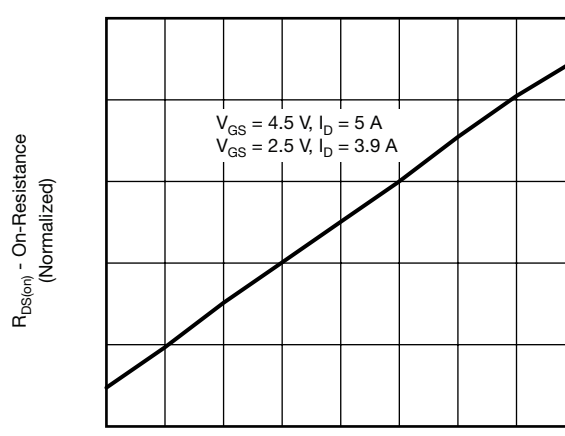

P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

 V_{DS} - Drain-to-Source Voltage (V)

Output Characteristics

 V_{GS} - Gate-to-Source Voltage (V)

Transfer Characteristics

 I_D - Drain Current (A)

On-Resistance vs. Drain Current and Gate Voltage

 V_{DS} - Drain-to-Source Voltage (V)

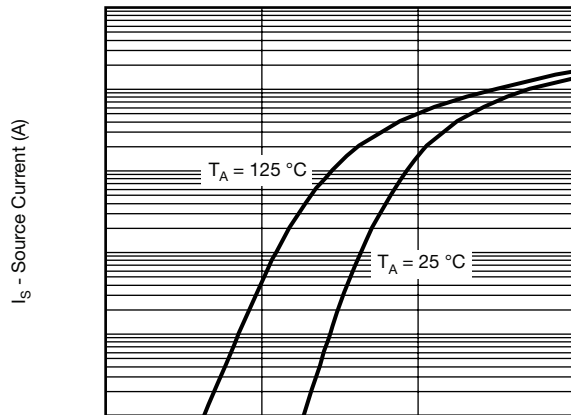
Capacitance

 Q_g - Total Gate Charge

Gate Charge

 T_J - Junction Temperature ($^{\circ}\text{C}$)

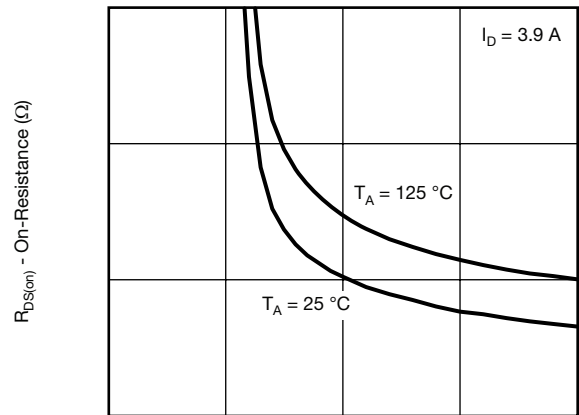
On-Resistance vs. Junction Temperature



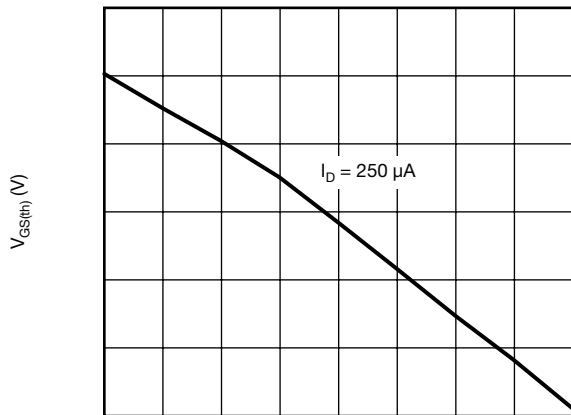
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



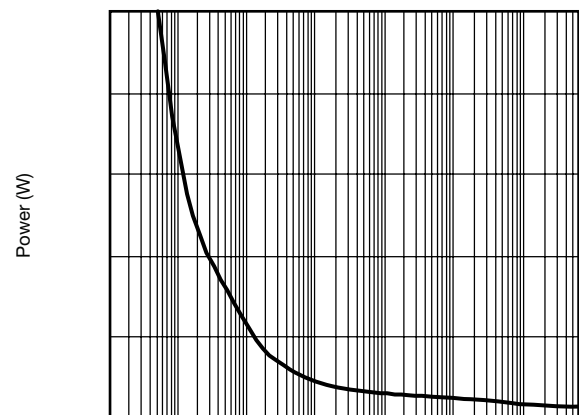
V_{SD} - Source-to-Drain Voltage (V)
Source-Drain Diode Forward Voltage



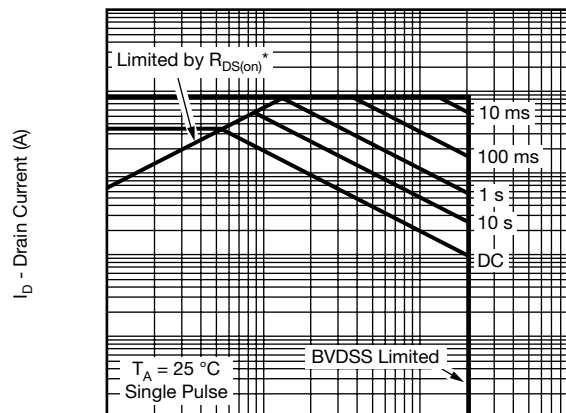
V_{GS} - Gate-to-Source Voltage (V)
On-Resistance vs. Gate-to-Source Voltage



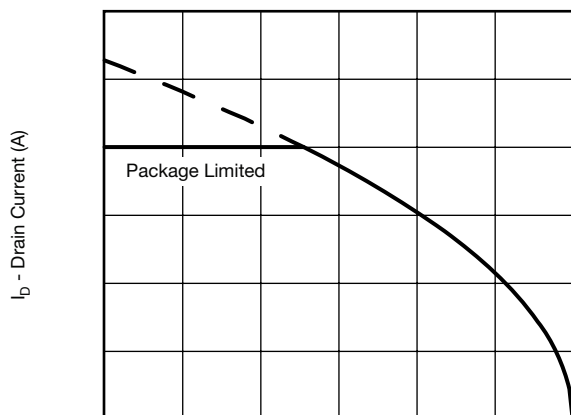
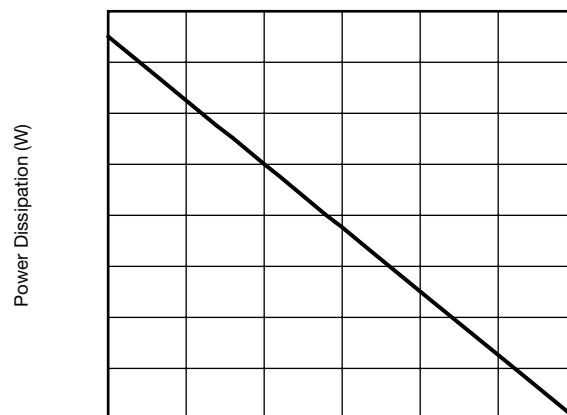
T_J - Junction Temperature (°C)
Threshold Voltage



Time (s)
Single Pulse Power



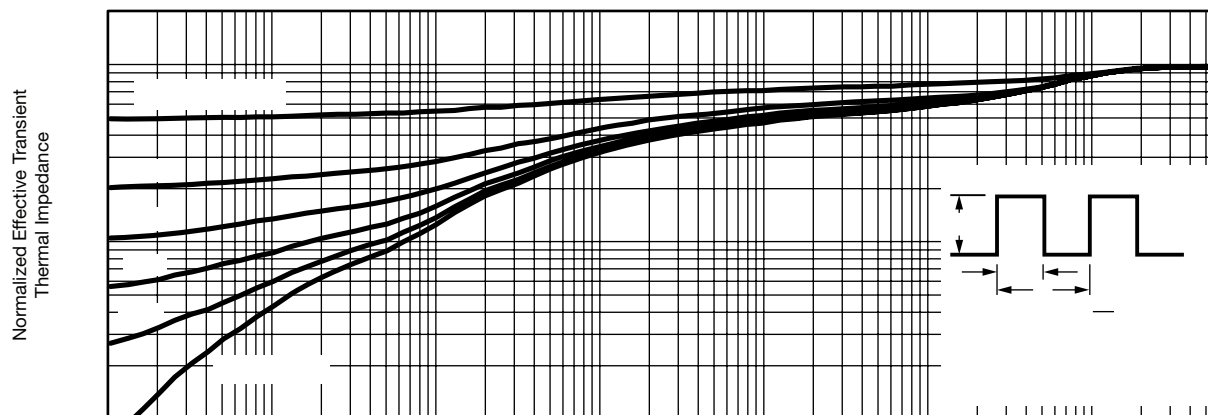
V_{DS} - Drain-to-Source Voltage (V)
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified
Safe Operating Area, Junction-to-Case

**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted T_C - Case Temperature (°C)**Current Derating*** T_C - Case Temperature (°C)**Power Derating**

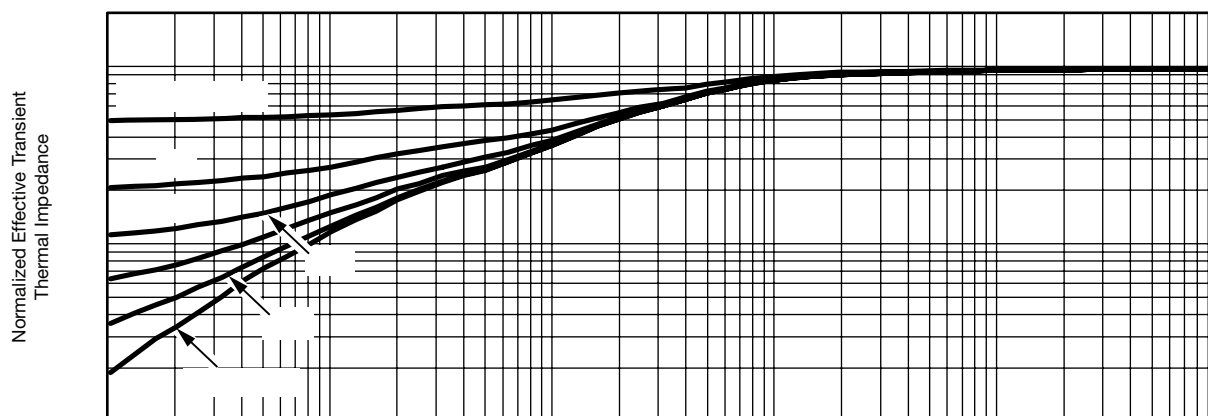
* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



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



Square Wave Pulse Duration (s)
Normalized Thermal Transient Impedance, Junction-to-Ambient



Square Wave Pulse Duration (s)
Normalized Thermal Transient Impedance, Junction-to-Foot

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