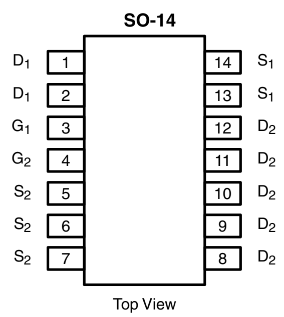
Dual N-Channel 20 V (D-S) MOSFET with Schottky Diode

PRODUCT SUMMARY

	V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)[a]	Q_g (Typ.)
Channel-1	20	0.0085 at V_{GS} = 10 V	14.8	8.1
		0.0115 at V_{GS} = 4.5 V	12.8	
Channel-2	20	0.0070 at V_{GS} = 10 V	22	8.4
		0.0095 at V_{GS} = 4.5 V	18.9	

SCHOTTKY PRODUCT SUMMARY

V_{DS} (V)	V_{SD} (V) Diode Forward Voltage	I_F (A)
20	0.55 V at 2.5 A	2



Ordering Information: Si4340DDY-T1-GE3 (Lead (Pb)-free and Halogen-free)

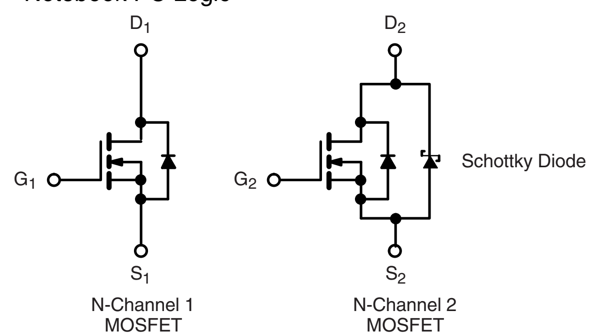
FEATURES

- **Halogen-free According to IEC 61249-2-21 Definition**
- TrenchFET® Power MOSFET
- 100 % R_g Tested
- 100 % UIS Tested
- Compliant to RoHS Directive 2002/95/EC

RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- DC/DC Converters, Synchronous Buck Converters
  - Game Stations
  - Notebook PC Logic



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

Parameter		Symbol	Channel-1	Channel-2	Unit
Drain-Source Voltage		V_{DS}	20		V
Gate-Source Voltage		V_{GS}	± 20		
Continuous Drain Current (T_J = 150 °C)	T_C = 25 °C	I_D	14.8	22	A
	T_C = 70 °C		11.8	17.6	
	T_A = 25 °C		12.1[b, c]	16.3[b, c]	
	T_A = 70 °C		9.7[b, c]	13[b, c]	
Pulsed Drain Current (t = 300 µs)		I_{DM}	50	60	
Source-Drain Current Diode Current	T_C = 25 °C	I_S	2.5	4.5	
	T_A = 25 °C		1.7[b, c]	2.5[b, c]	
Single Pulse Avalanche Current	L = 0.1 mH	I_{AS}	15		
Single Pulse Avalanche Energy		E_{AS}	11.25		mJ
Maximum Power Dissipation	T_C = 25 °C	P_D	3	5.4	W
	T_C = 70 °C		1.9	3.5	
	T_A = 25 °C		2[b, c]	3[b, c]	
	T_A = 70 °C		1.3[b, c]	1.9[b, c]	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150		°C

THERMAL RESISTANCE RATINGS

Parameter		Symbol	Channel-1		Channel-2		Unit
			Typ.	Max.	Typ.	Max.	
Maximum Junction-to-Ambient[b, d]	t ≤ 10 s	R_{thJA}	53	62.5	35	42	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	35	42	18	23	

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 for channel 1 is 110 °C/W and channel 2 is 87 °C/W.

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SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)							
Parameter	**Symbol**	**Test Conditions**		**Min.**	**Typ.**	**Max.**	**Unit**
Static							
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	Ch-1	20			V
		V_{GS} = 0 V, I_D = 250 µA	Ch-2	20			
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = 250 µA	Ch-1		20		mV/°C
		I_D = 25 mA	Ch-2		22		
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	I_D = 250 µA	Ch-1		- 4.4		
		I_D = 25 mA	Ch-2		- 4.6		
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, I_D = 250 µA	Ch-1	1		2.5	V
		$V_{DS} = V_{GS}$, I_D = 250 µA	Ch-2	1		2.5	
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 20 V	Ch-1			100	nA
		V_{DS} = 0 V, V_{GS} = ± 20 V	Ch-2			100	
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V	Ch-1			1	µA
		V_{DS} = 20 V, V_{GS} = 0 V	Ch-2			100	
		V_{DS} = 20 V, V_{GS} = 0 V, T_J = 85 °C	Ch-1			15	
		V_{DS} = 20 V, V_{GS} = 0 V, T_J = 85 °C	Ch-2			10 000	
On-State Drain Current[b]	$I_{D(on)}$	$V_{DS} \geq$ 5 V, V_{GS} = 10 V	Ch-1	20			A
		$V_{DS} \geq$ 5 V, V_{GS} = 10 V	Ch-2	30			
Drain-Source On-State Resistance[b]	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 11.5 A	Ch-1		0.0065	0.0085	Ω
		V_{GS} = 10 V, I_D = 15.2 A	Ch-2		0.0060	0.0070	
		V_{GS} = 4.5 V, I_D = 10 A	Ch-1		0.0091	0.0115	
		V_{GS} = 4.5 V, I_D = 14 A	Ch-2		0.0077	0.0095	
Forward Transconductance[b]	g_{fs}	V_{DS} = 10 V, I_D = 11.5 A	Ch-1		28		S
		V_{DS} = 10 V, I_D = 15.2 A	Ch-2		44		
Dynamic[a]							
Input Capacitance	C_{iss}	Channel-1 V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz Channel-2 V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	Ch-1		862		pF
			Ch-2		956		
Output Capacitance	C_{oss}		Ch-1		280		
			Ch-2		363		
Reverse Transfer Capacitance	C_{rss}		Ch-1		116		
			Ch-2		120		
Total Gate Charge	Q_g	V_{DS} = 10 V, V_{GS} = 10 V, I_D = 12 A	Ch-1		17.4	26	nC
		V_{DS} = 10 V, V_{GS} = 10 V, I_D = 12 A	Ch-2		17.8	27	
		Channel-1 V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 12 A Channel-2 V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 12 A	Ch-1		8.1	12.5	
			Ch-2		8.4	12.5	
Gate-Source Charge	Q_{gs}		Ch-1		2.2		
			Ch-2		2.6		
Gate-Drain Charge	Q_{gd}		Ch-1		2.4		
			Ch-2		2.5		
Gate Resistance	R_g	f = 1 MHz	Ch-1		2.2	4.4	Ω
			Ch-2		2.6	5.2	

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

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SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)

Parameter	Symbol	Test Conditions		Min.	Typ.	Max.	Unit
Dynamic[a]							
Turn-On Delay Time	$t_{d(on)}$	Channel-1 V_{DD} = 10 V, R_L = 1 Ω I_D ≅ 10 A, V_{GEN} = 4.5 V, R_g = 1 Ω Channel-2 V_{DD} = 10 V, R_L = 1 Ω I_D ≅ 10 A, V_{GEN} = 4.5 V, R_g = 1 Ω	Ch-1		18	35	ns
			Ch-2		20	40	
Rise Time	t_r		Ch-1		37	70	
			Ch-2		34	65	
Turn-Off Delay Time	$t_{d(off)}$		Ch-1		19	35	
			Ch-2		21	40	
Fall Time	t_f		Ch-1		10	20	
			Ch-2		10	20	
Turn-On Delay Time	$t_{d(on)}$	Channel-1 V_{DD} = 10 V, R_L = 1 Ω I_D ≅ 10 A, V_{GEN} = 10 V, R_g = 1 Ω Channel-2 V_{DD} = 10 V, R_L = 1 Ω I_D ≅ 10 A, V_{GEN} = 10 V, R_g = 1 Ω	Ch-1		9	18	
			Ch-2		9	18	
Rise Time	t_r		Ch-1		13	26	
			Ch-2		13	26	
Turn-Off Delay Time	$t_{d(off)}$		Ch-1		16	32	
			Ch-2		15	30	
Fall Time	t_f		Ch-1		8	16	
			Ch-2		8	16	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	T_C = 25 °C	Ch-1			2.5	A
			Ch-2			4.5	
Pulse Diode Forward Current[a]	I_{SM}		Ch-1			50	
			Ch-2			60	
Body Diode Voltage	V_{SD}	I_S = 5 A	Ch-1		0.76	1.2	V
		I_S = 2.5 A	Ch-2		0.43	0.55	
Body Diode Reverse Recovery Time	t_{rr}	Channel-1 I_F = 9.2 A, dI/dt = 100 A/µs, T_J = 25 °C Channel-2 I_F = 2.5 A, dI/dt = 100 A/µs, T_J = 25 °C	Ch-1		18	36	ns
			Ch-2		18	36	
Body Diode Reverse Recovery Charge	Q_{rr}		Ch-1		7	14	nC
			Ch-2		7	14	
Reverse Recovery Fall Time	t_a		Ch-1		8		ns
			Ch-2		10		
Reverse Recovery Rise Time	t_b		Ch-1		9		
			Ch-2		9		

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.

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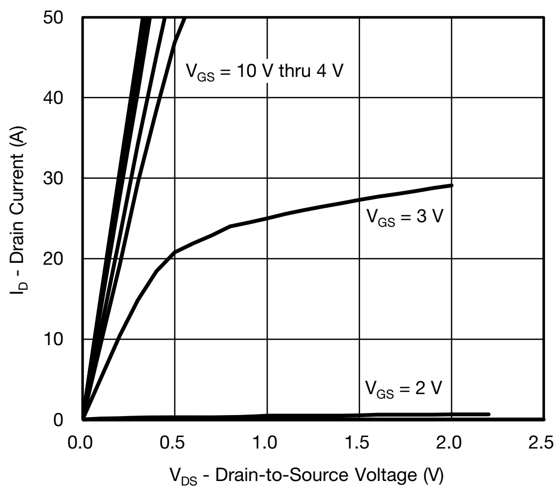
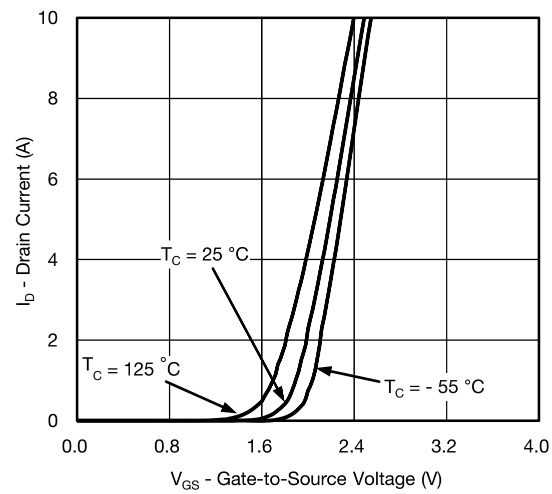
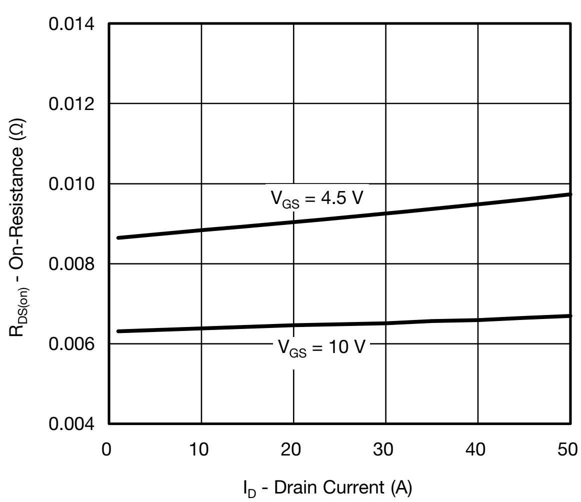
CHANNEL-1 TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



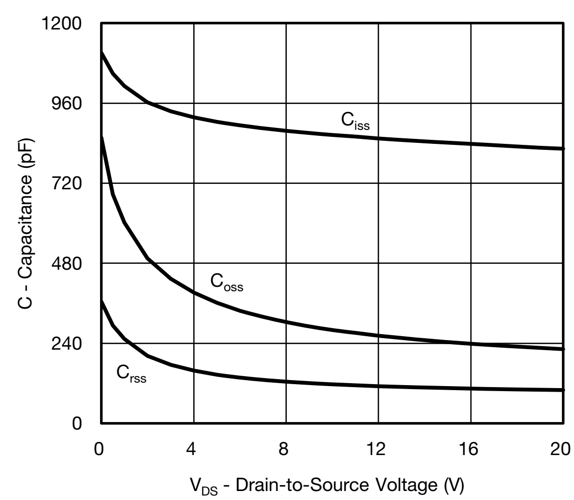
Output Characteristics



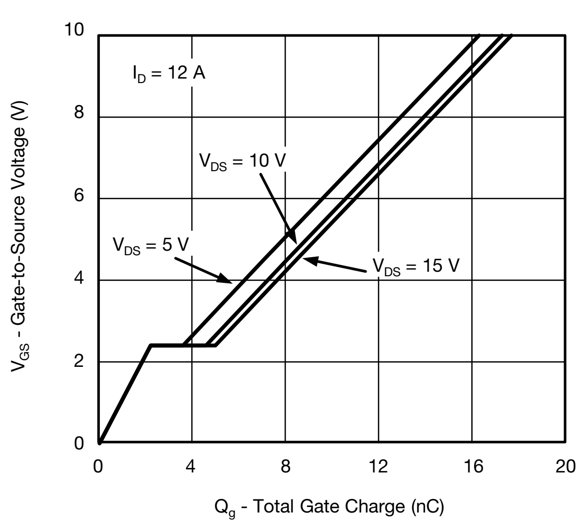
Transfer Characteristics



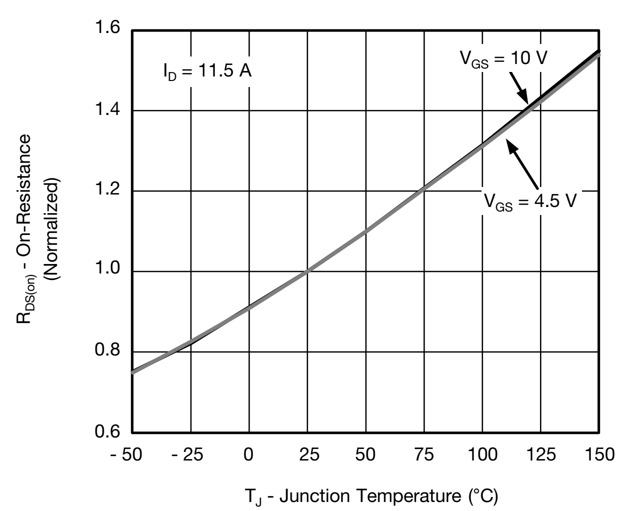
On-Resistance vs. Drain Current



Capacitance



Gate Charge



On-Resistance vs. Junction Temperature

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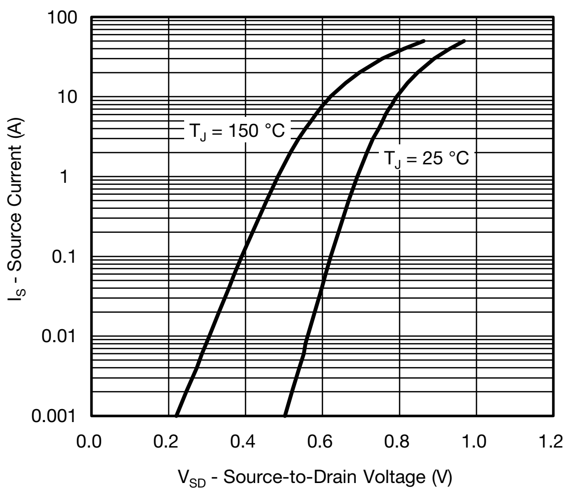
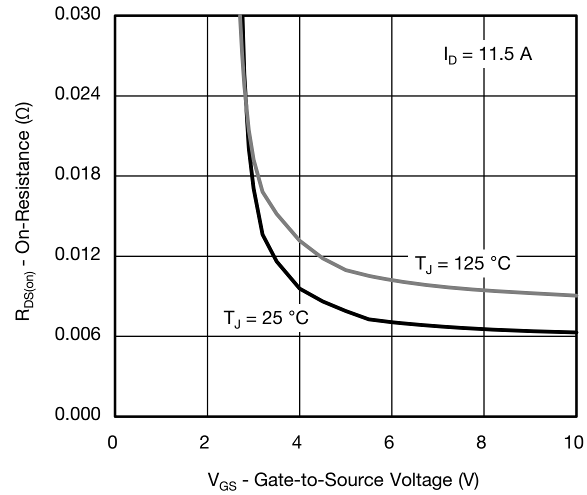
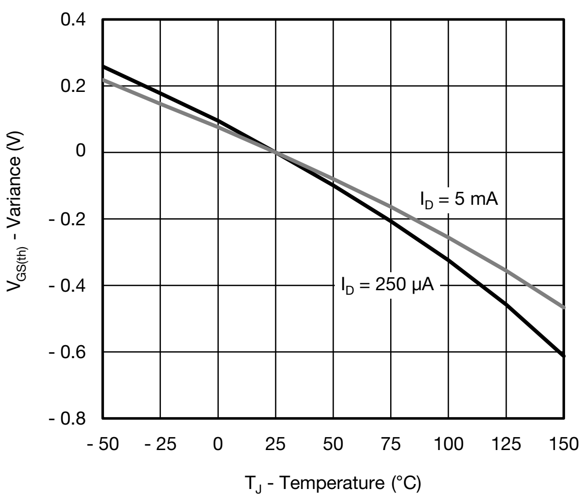


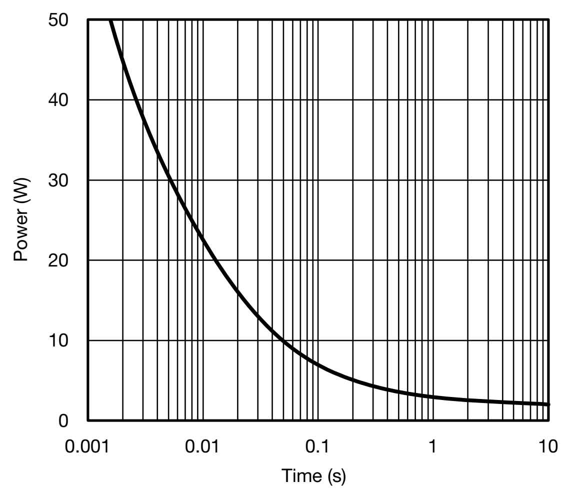
Source-Drain Diode Forward Voltage



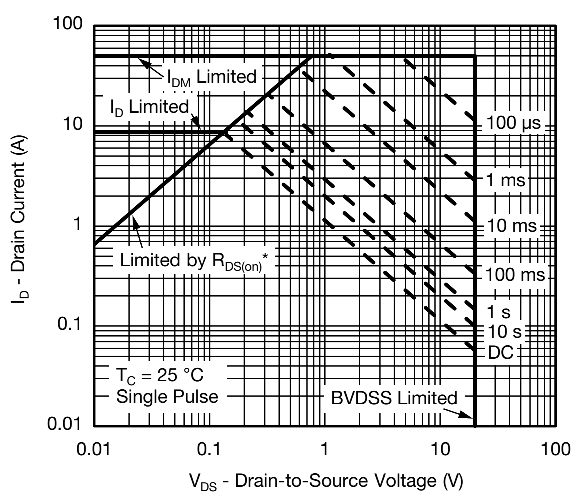
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power



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

Safe Operating Area, Junction-to-Ambient

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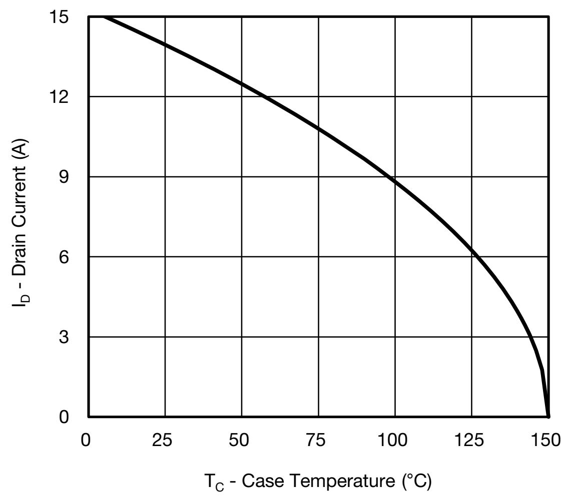
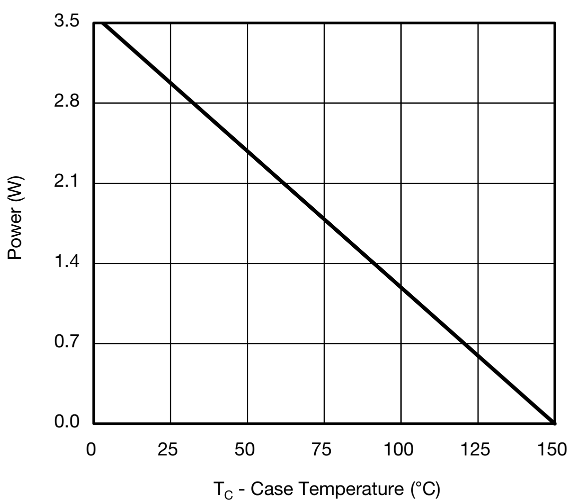
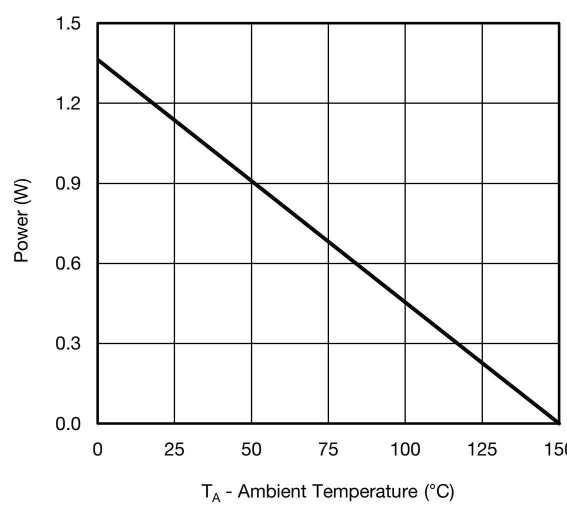
CHANNEL-1 TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



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.

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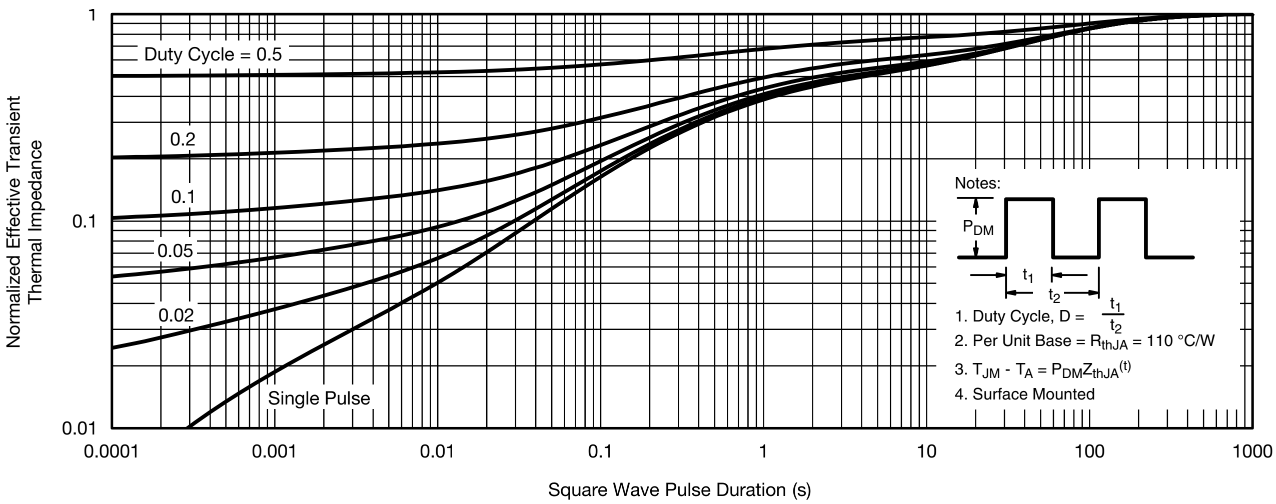
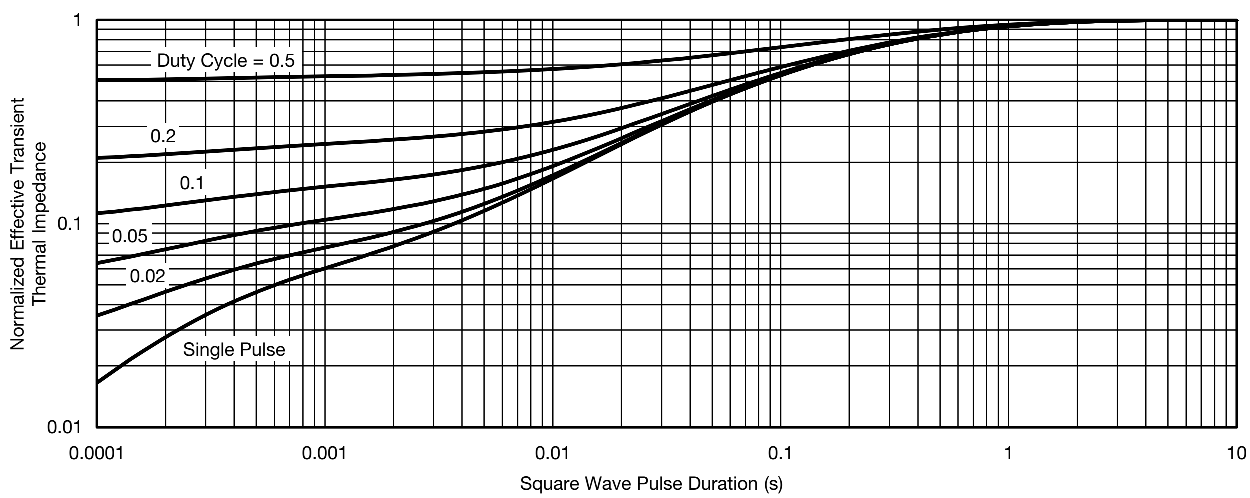


Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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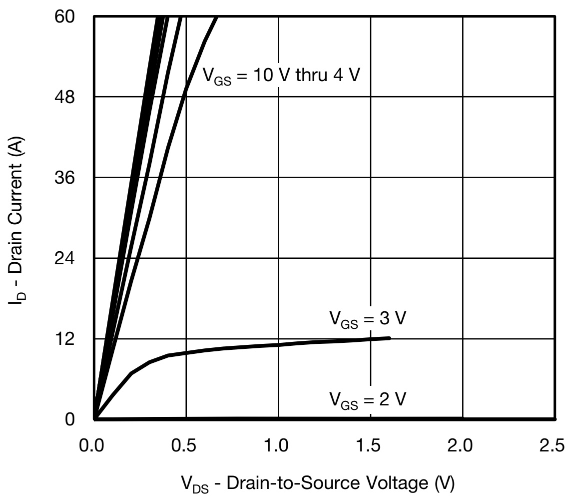
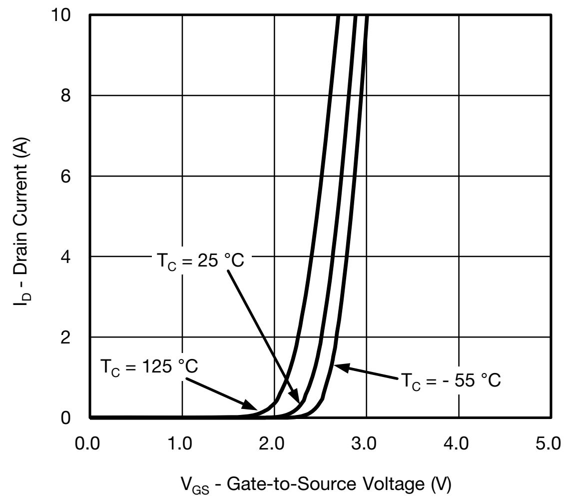
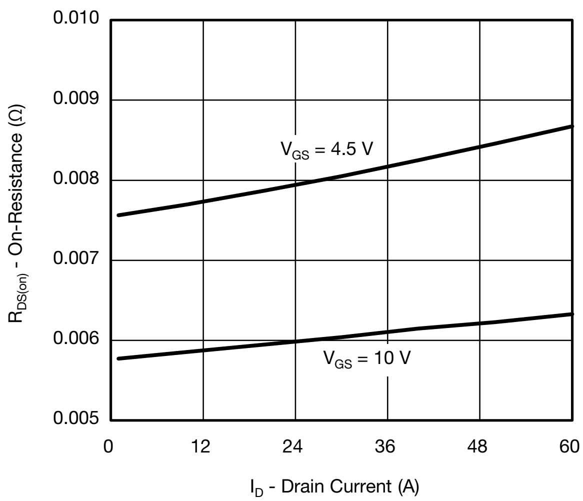
CHANNEL-2 TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



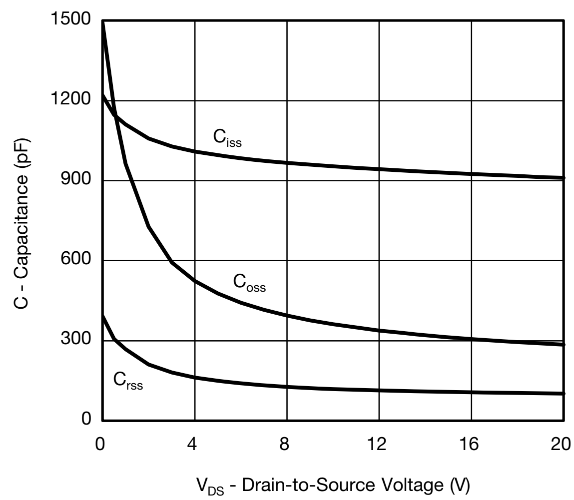
Output Characteristics



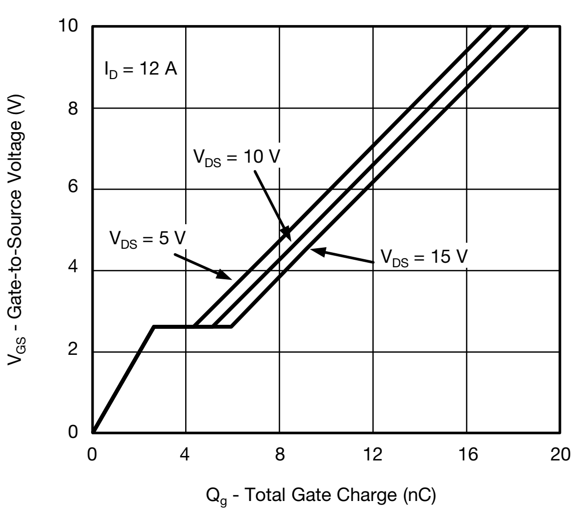
Transfer Characteristics



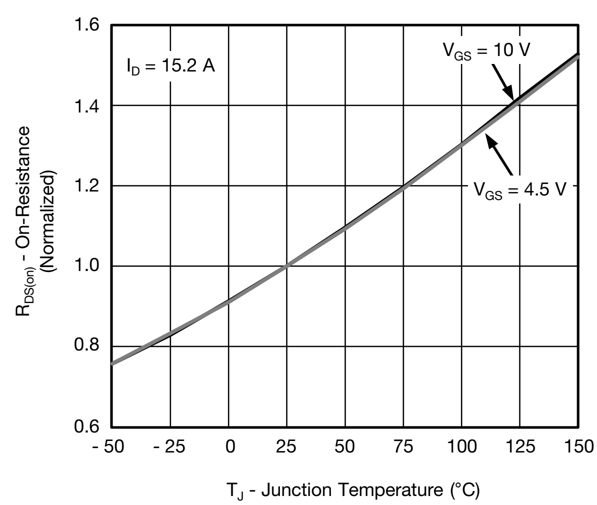
On-Resistance vs. Drain Current



Capacitance



Gate Charge



On-Resistance vs. Junction Temperature

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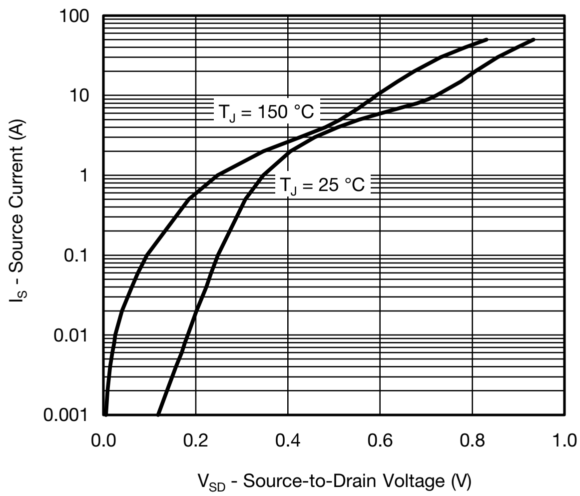
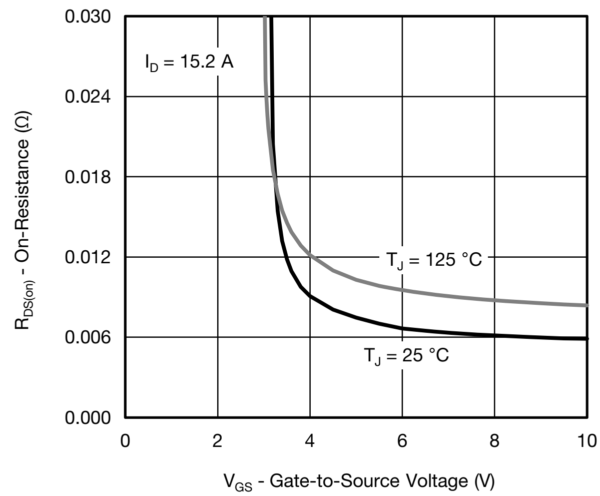
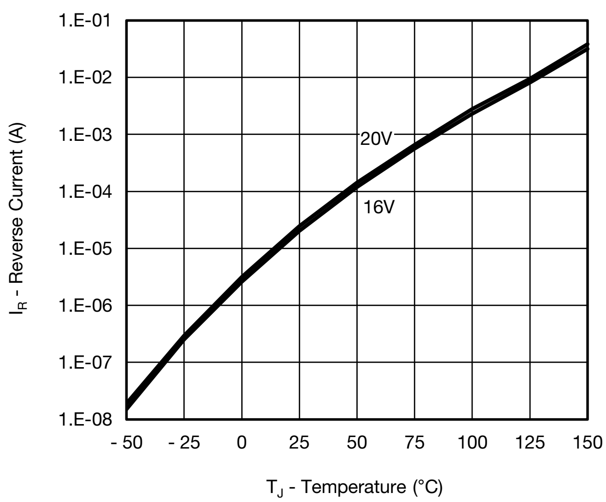
CHANNEL-2 TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



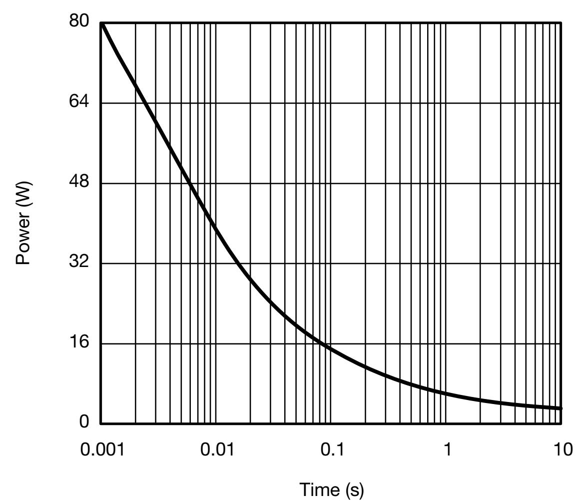
Source-Drain Diode Forward Voltage



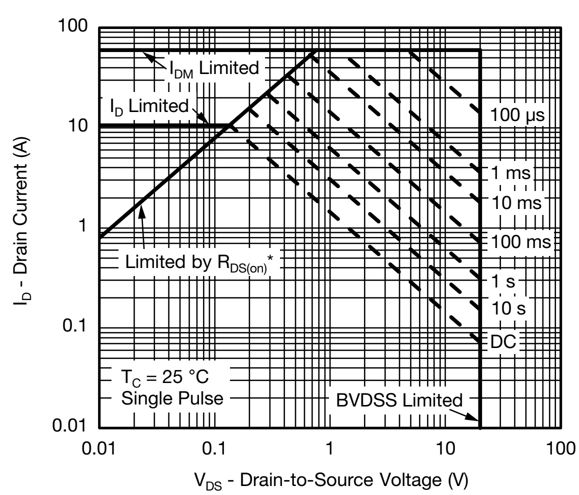
On-Resistance vs. Gate-to-Source Voltage



Reverse Current vs. Junction Temperature



Single Pulse Power



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

Safe Operating Area, Junction-to-Ambient

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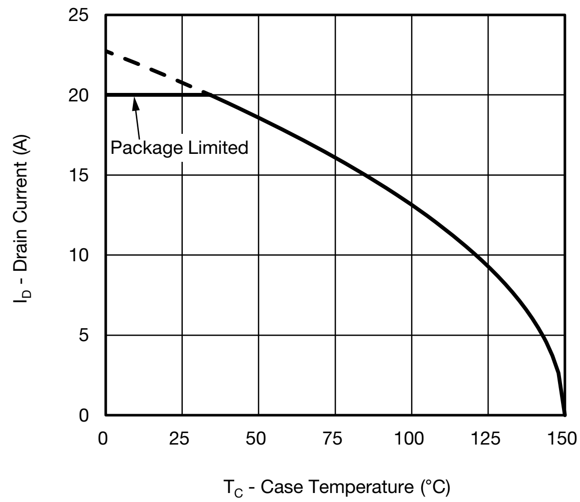
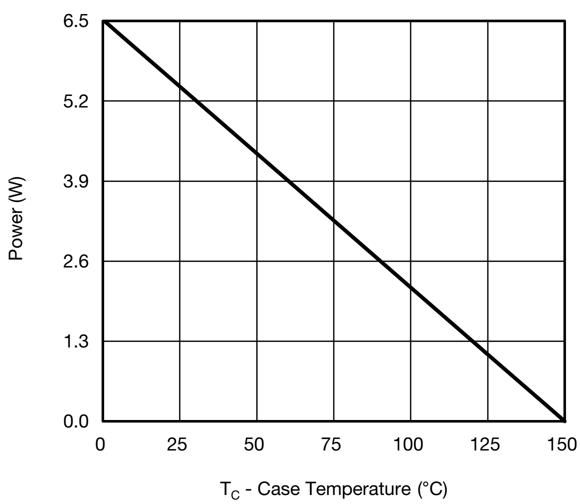
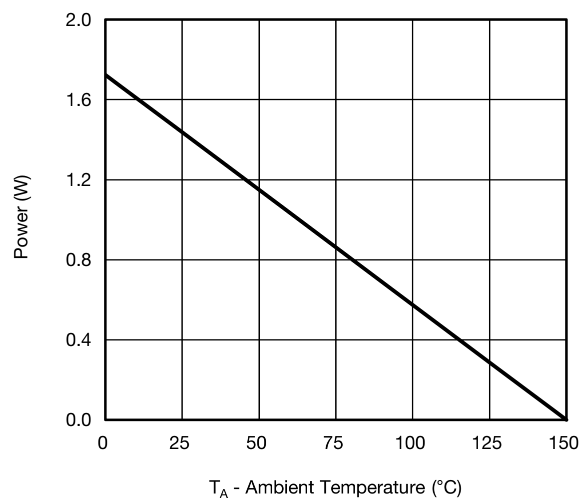
CHANNEL-2 TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating*



Power Derating, Junction-to-Foot



Power Derating, Junction-to-Ambient

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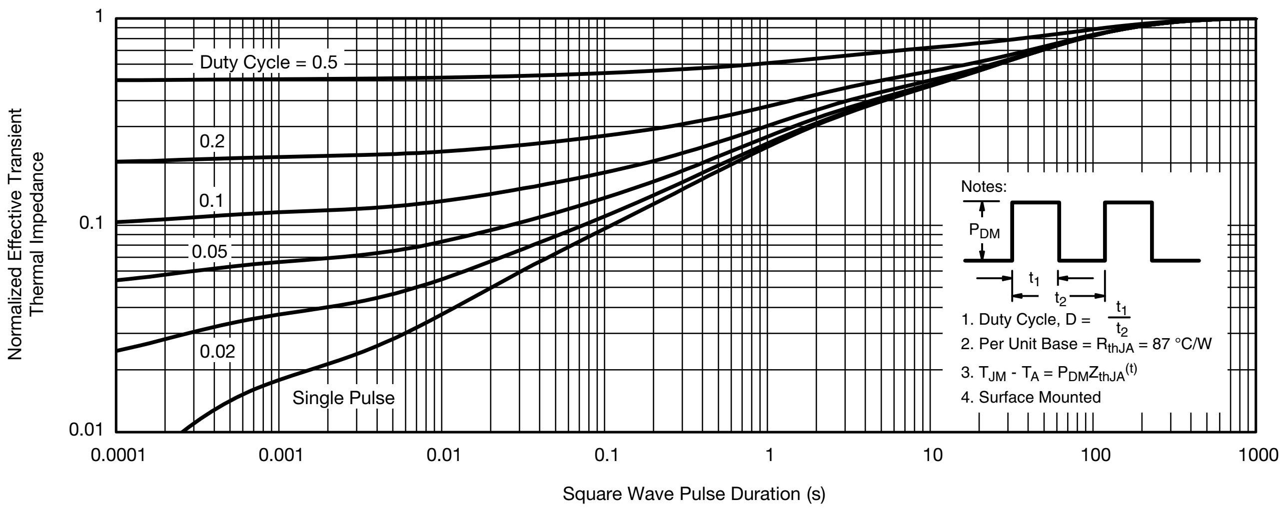
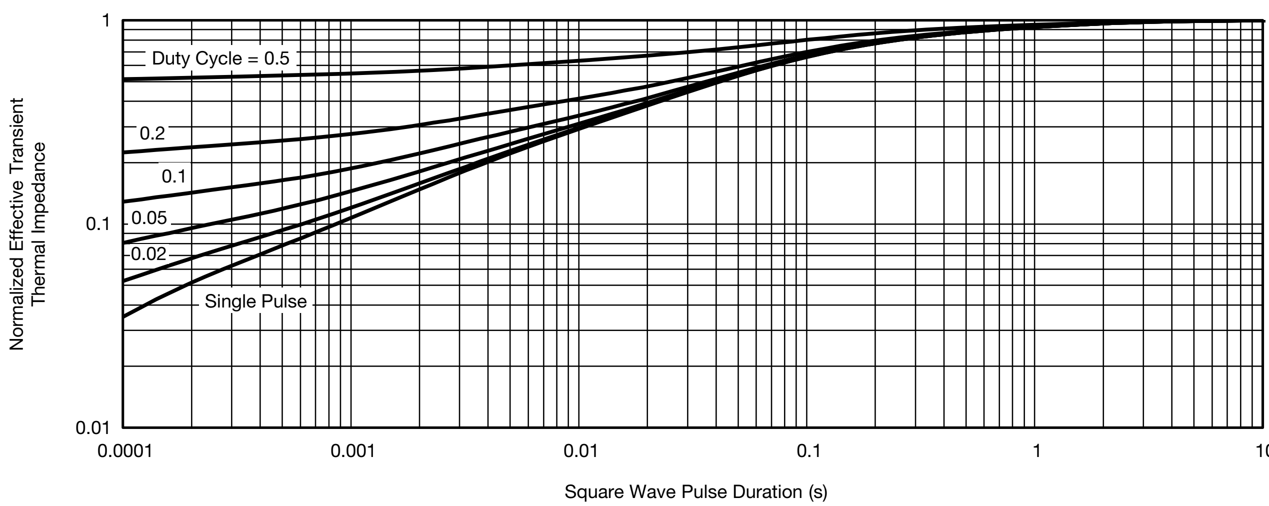


Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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