

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

PRODUCT SUMMARY			
	V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)
Channel-1	20	0.012 at V <sub>GS</sub> = 10 V	9.6
		0.0175 at V <sub>GS</sub> = 4.5 V	7.8
Channel-2		0.010 at V <sub>GS</sub> = 10 V	13.5
		0.0115 at V <sub>GS</sub> = 4.5 V	12.8

SCHOTTKY PRODUCT SUMMARY		
V <sub>DS</sub> (V)	V <sub>SD</sub> (V) Diode Forward Voltage	I <sub>F</sub> (A)
20	0.53 V at 3 A	2.0

### FEATURES

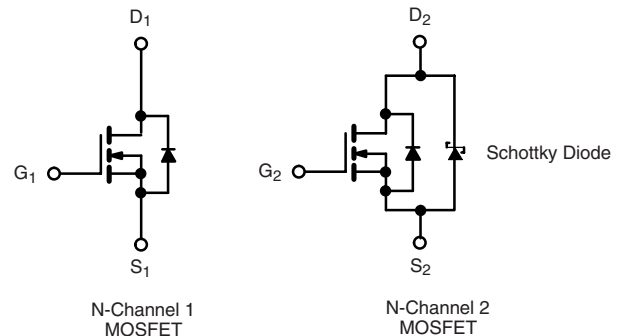
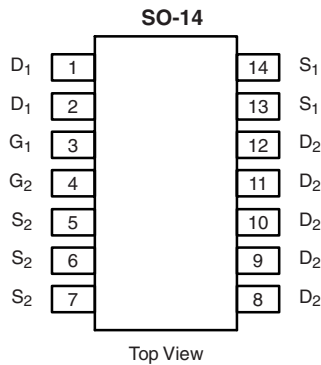
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- 100 % R<sub>g</sub> Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

### APPLICATIONS

- DC/DC Converters
- Game Stations
- Notebook PC Logic



**Ordering Information:** Si4340DY-T1-E3 (Lead (Pb)-free)  
Si4340DY-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted							
Parameter	Symbol	Channel-1		Channel-2		Unit	
		10 s	Steady State	10 s	Steady State		
Drain-Source Voltage	V <sub>DS</sub>	20				V	
Gate-Source Voltage	V <sub>GS</sub>	± 20		± 16			
Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup>	I <sub>D</sub>	T <sub>A</sub> = 25 °C	9.6	7.3	13.5	9.9	A
		T <sub>A</sub> = 70 °C	7.7	5.8	10.8	7.5	
Pulsed Drain Current	I <sub>DM</sub>	40		50		W	
Continuous Source Current (Diode Conduction) <sup>a</sup>	I <sub>S</sub>	1.8	1.04	2.73	1.30		
Maximum Power Dissipation <sup>a</sup>	P <sub>D</sub>	T <sub>A</sub> = 25 °C	2.0	1.14	3.0	1.43	W
		T <sub>A</sub> = 70 °C	1.28	0.73	1.9	0.91	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150				°C	

THERMAL RESISTANCE RATINGS									
Parameter	Symbol	Channel-1		Channel-2		Schottky		Unit	
		Typ.	Max.	Typ.	Max.	Typ.	Max.		
Maximum Junction-to-Ambient <sup>a</sup>	R <sub>thJA</sub>	t ≤ 10 s	53	62.5	35	42	40	48	°C/W
		Steady State	92	110	72	87	76	93	
Maximum Junction-to-Foot (Drain)	R <sub>thJF</sub>	35	42	18	23	21	25		

Notes:

a. Surface Mounted on 1" x 1" FR4 board.

MOSFET SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted							
Parameter	Symbol	Test Conditions	Min.	Typ. <sup>a</sup>	Max.	Unit	
<b>Static</b>							
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	Ch-1	0.8		2.00	V
			Ch-2	0.8		1.90	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$	Ch-1			100	nA
		$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 12\text{ V}$	Ch-2			100	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 20\text{ V}$ , $V_{GS} = 0\text{ V}$	Ch-1			1	$\mu\text{A}$
			Ch-2			100	
		$V_{DS} = 20\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 85\text{ }^\circ\text{C}$	Ch-1			15	
			Ch-2			4000	
On-State Drain Current <sup>b</sup>	$I_{D(on)}$	$V_{DS} = 5\text{ V}$ , $V_{GS} = 10\text{ V}$	Ch-1	20			A
			Ch-2	30			
Drain-Source On-State Resistance <sup>b</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$ , $I_D = 9.6\text{ A}$	Ch-1		0.0095	0.012	$\Omega$
		$V_{GS} = 10\text{ V}$ , $I_D = 13.5\text{ A}$	Ch-2		0.007	0.010	
		$V_{GS} = 4.5\text{ V}$ , $I_D = 7.8\text{ A}$	Ch-1		0.0135	0.0175	
		$V_{GS} = 4.5\text{ V}$ , $I_D = 12.8\text{ A}$	Ch-2		0.0085	0.0115	
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}$ , $I_D = 9.6\text{ A}$	Ch-1		25		S
		$V_{DS} = 15\text{ V}$ , $I_D = 13.5\text{ A}$	Ch-2		38		
Diode Forward Voltage <sup>b</sup>	$V_{SD}$	$I_S = 1.8\text{ A}$ , $V_{GS} = 0\text{ V}$	Ch-1		0.74	1.1	V
		$I_S = 2.73\text{ A}$ , $V_{GS} = 0\text{ V}$	Ch-2		0.485	0.53	
<b>Dynamic<sup>a</sup></b>							
Total Gate Charge	$Q_g$	Channel-1 $V_{DS} = 10\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 9.6\text{ A}$	Ch-1		10	15	nC
			Ch-2		17	25	
Gate-Source Charge	$Q_{gs}$	Channel-2 $V_{DS} = 10\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = -13.5\text{ A}$	Ch-1		3.3		nC
			Ch-2		4.5		
Gate-Drain Charge	$Q_{gd}$	Channel-2 $V_{DS} = 10\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = -13.5\text{ A}$	Ch-1		3.1		nC
			Ch-2		4.5		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$	Ch-1	0.45	0.9	1.35	$\Omega$
			Ch-2	0.7	1.4	2.1	
Turn-On Delay Time	$t_{d(on)}$	Channel-1 $V_{DD} = 10\text{ V}$ , $R_L = 10\text{ }\Omega$ $I_D \cong 1\text{ A}$ , $V_{GEN} = 10\text{ V}$ , $R_g = 6\text{ }\Omega$	Ch-1		15	25	ns
Rise Time	$t_r$	Channel-1 $V_{DD} = 10\text{ V}$ , $R_L = 10\text{ }\Omega$ $I_D \cong 1\text{ A}$ , $V_{GEN} = 10\text{ V}$ , $R_g = 6\text{ }\Omega$	Ch-2		24	35	
			Ch-1		16	25	
Turn-Off Delay Time	$t_{d(off)}$	Channel-2 $V_{DD} = 10\text{ V}$ , $R_L = 10\text{ }\Omega$ $I_D \cong 1\text{ A}$ , $V_{GEN} = 10\text{ V}$ , $R_g = 6\text{ }\Omega$	Ch-1		42	65	
			Ch-2		68	100	
Fall Time	$t_f$	Channel-2 $V_{DD} = 10\text{ V}$ , $R_L = 10\text{ }\Omega$ $I_D \cong 1\text{ A}$ , $V_{GEN} = 10\text{ V}$ , $R_g = 6\text{ }\Omega$	Ch-1		16	25	
Source-Drain Reverse Recovery Time	$t_{rr}$	$I_F = 1.8\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}$	Ch-1		35	60	
		$I_F = 2.73\text{ A}$ , $dI/dt = 100\text{ }\mu\text{A}/\mu\text{s}$	Ch-2		38	65	

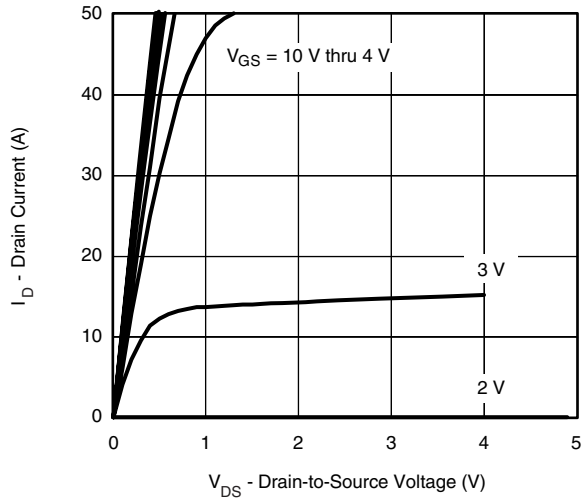
## Notes:

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

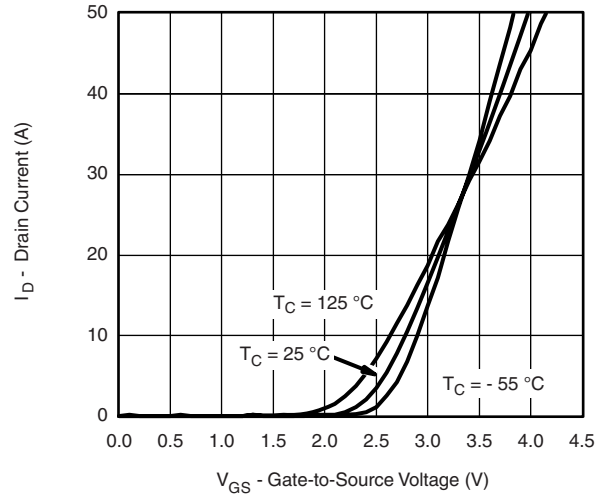
SCHOTTKY SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Forward Voltage Drop	$V_F$	$I_F = 3\text{ A}$		0.485	0.53	V
		$I_F = 3\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$		0.42	0.42	
Maximum Reverse Leakage Current	$I_{rm}$	$V_R = 20\text{ V}$		0.008	0.100	mA
		$V_R = 20\text{ V}$ , $T_J = 75\text{ }^\circ\text{C}$		0.4	5	
		$V_R = -20\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$		6.5	20	
Junction Capacitance	$C_T$	$V_R = 15\text{ V}$		102		pF

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.

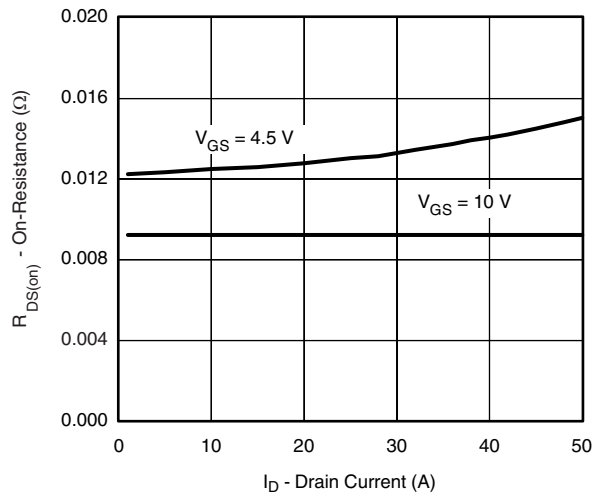
## CHANNEL-1 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



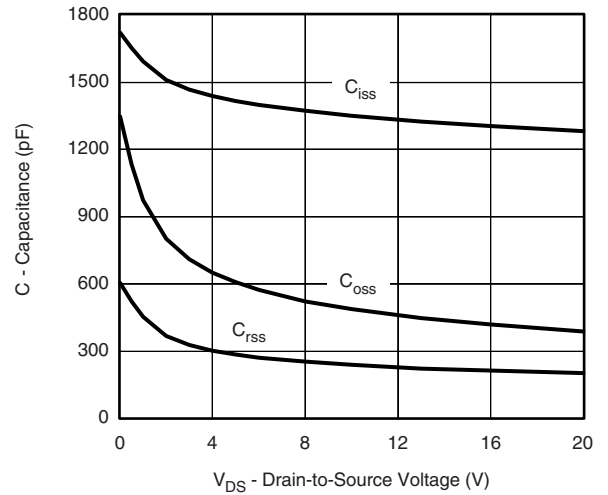
**Output Characteristics**



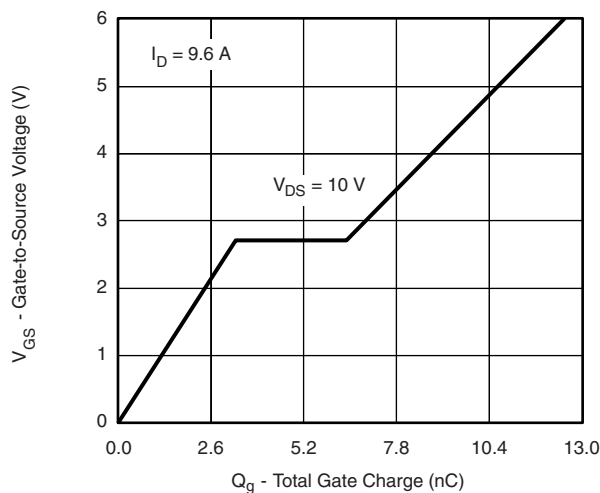
**Transfer Characteristics**



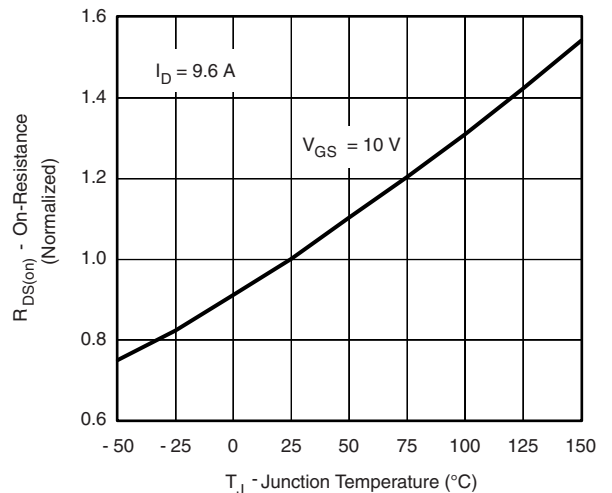
**On-Resistance vs. Drain Current**



**Capacitance**

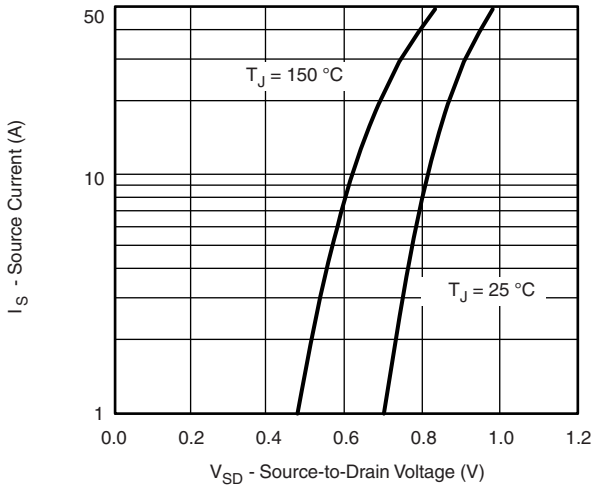


**Gate Charge**

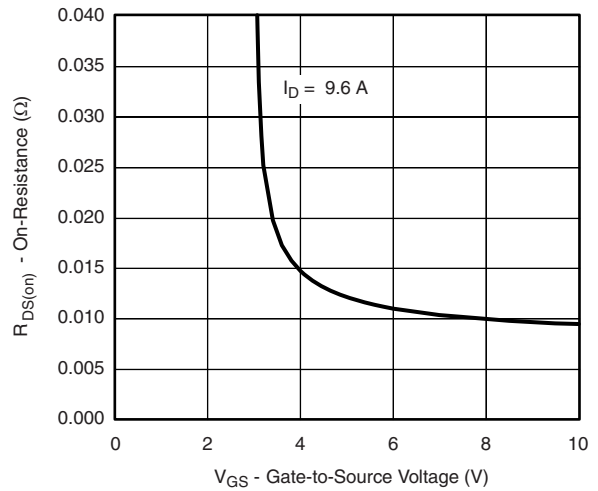


**On-Resistance vs. Junction Temperature**

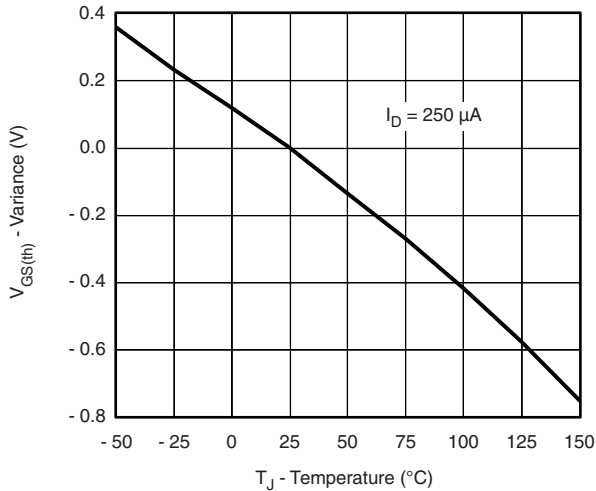
## CHANNEL-1 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



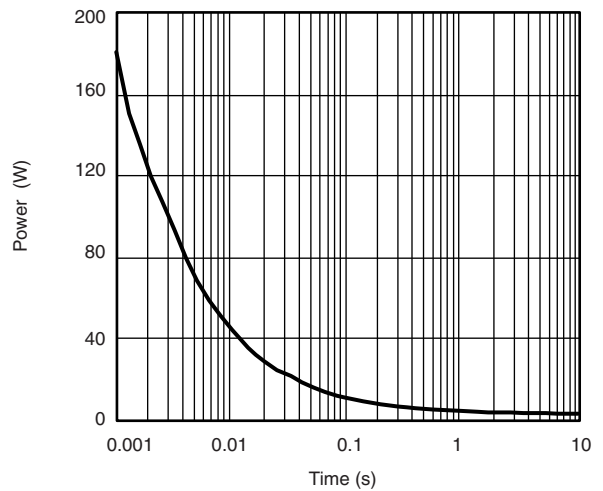
Source-Drain Diode Forward Voltage



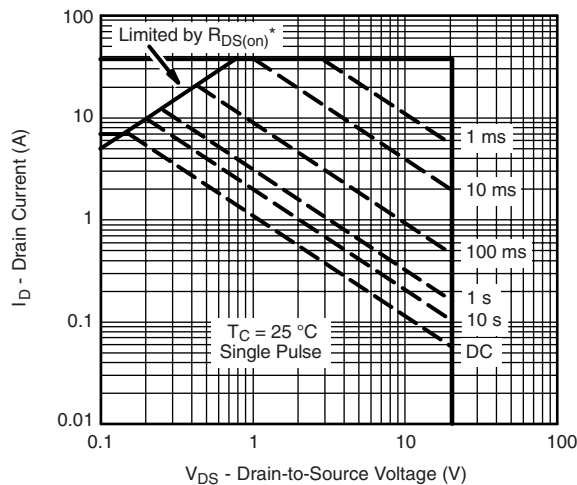
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



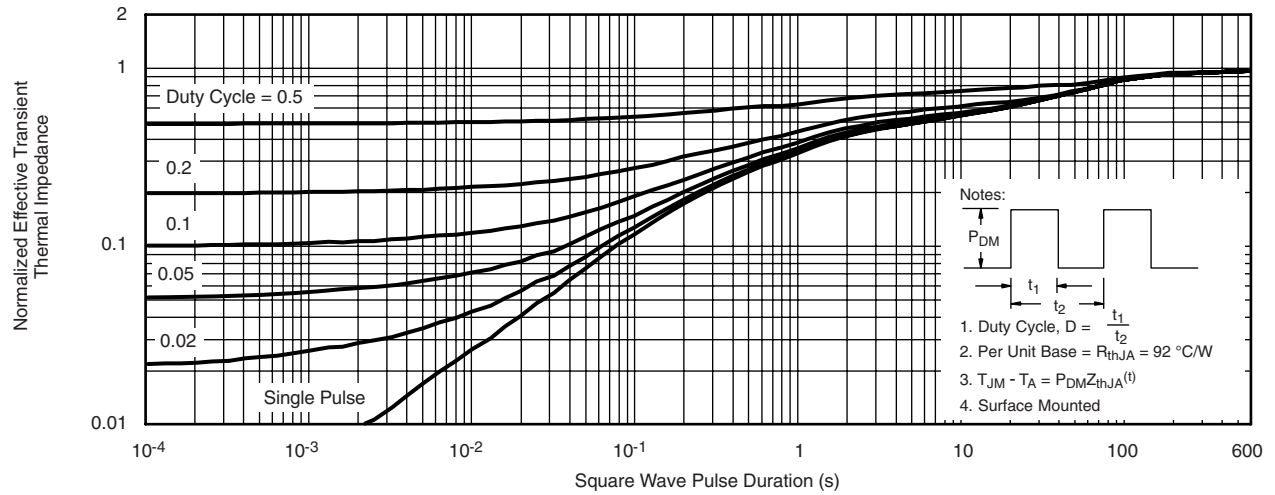
Single Pulse Power



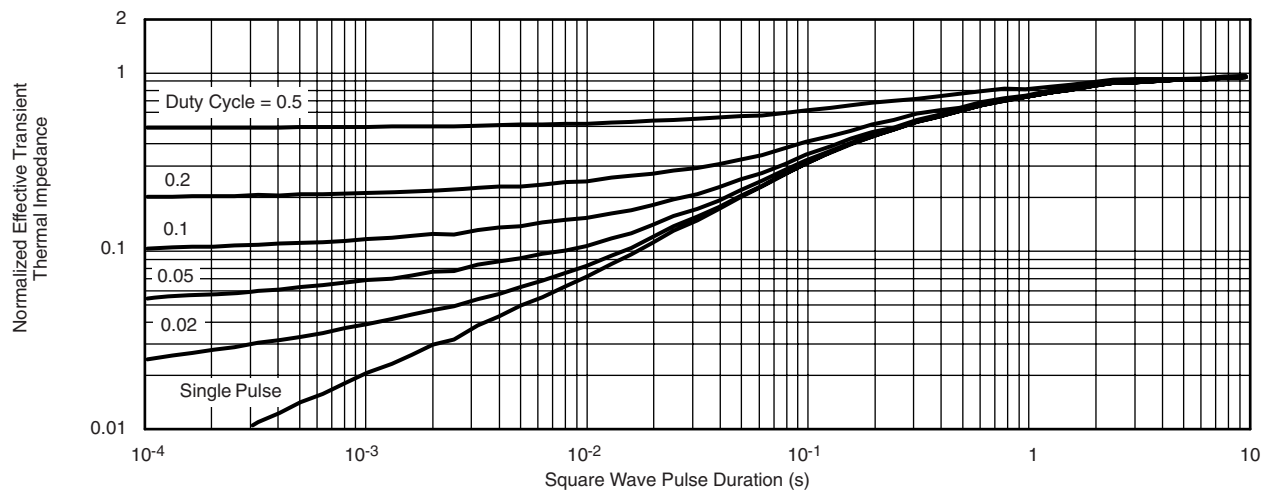
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

Safe Operating Area, Junction-to-Case

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

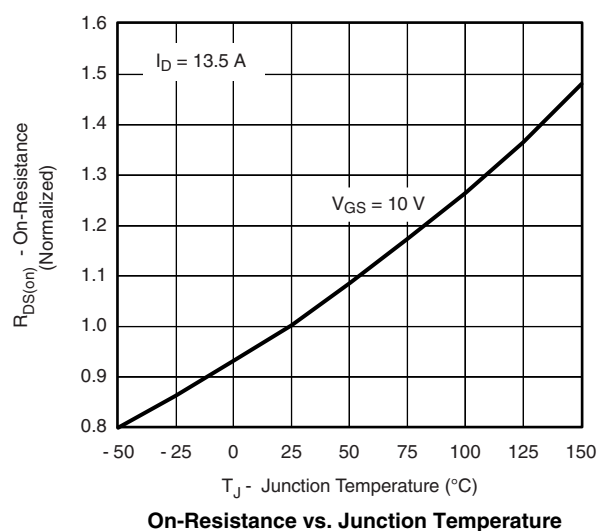
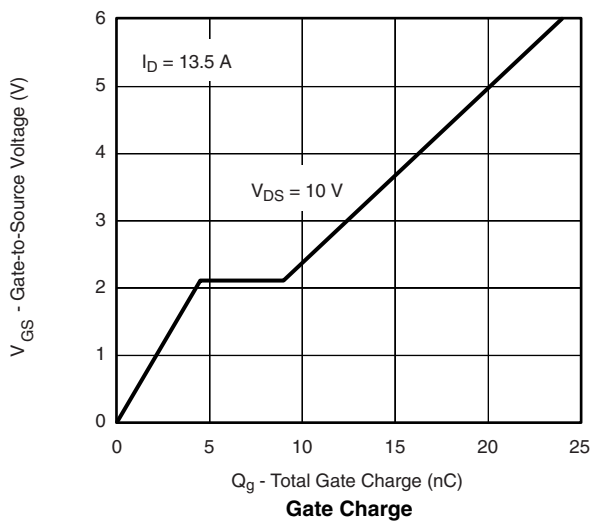
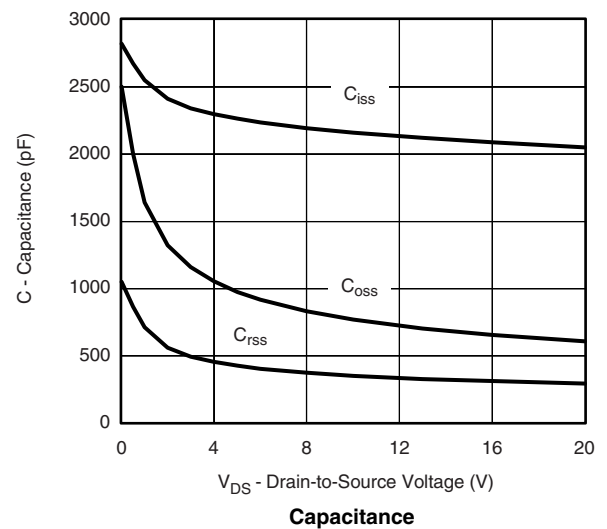
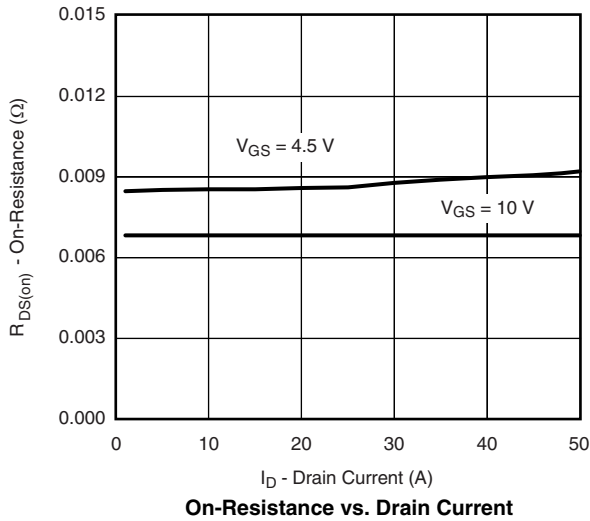
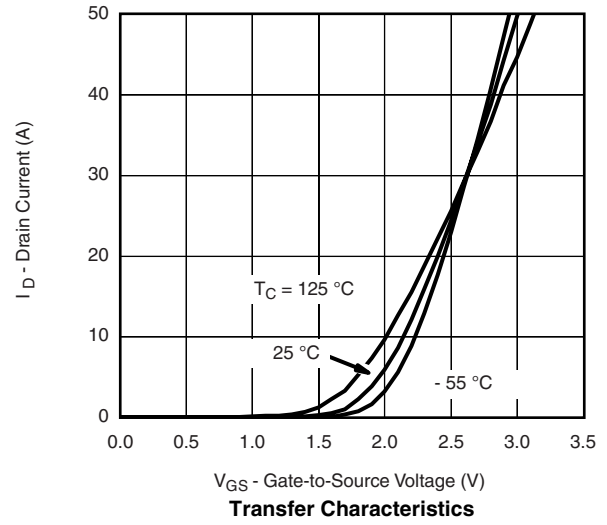
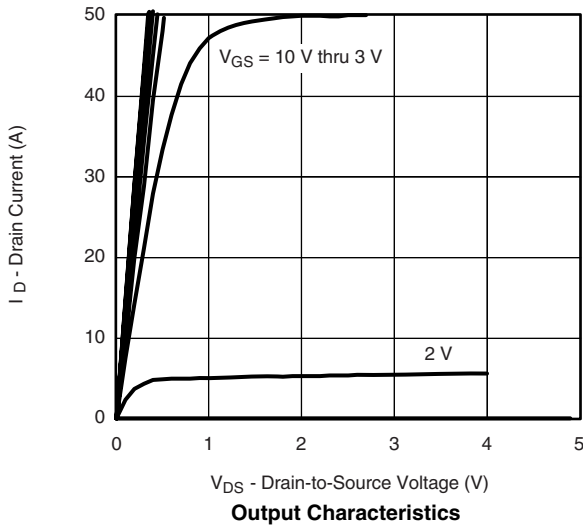


**Normalized Thermal Transient Impedance, Junction-to-Ambient**

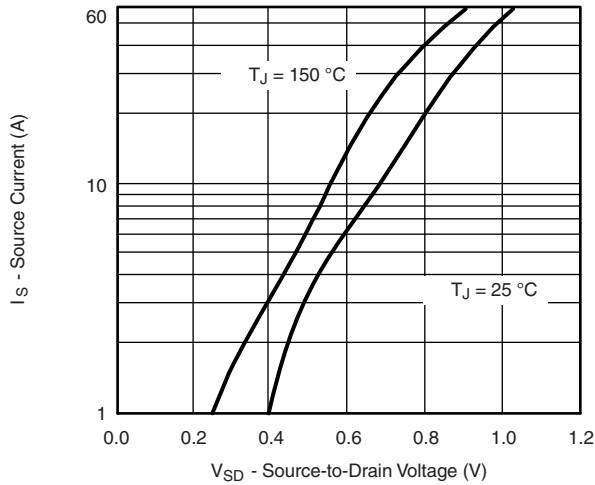


**Normalized Thermal Transient Impedance, Junction-to-Foot**

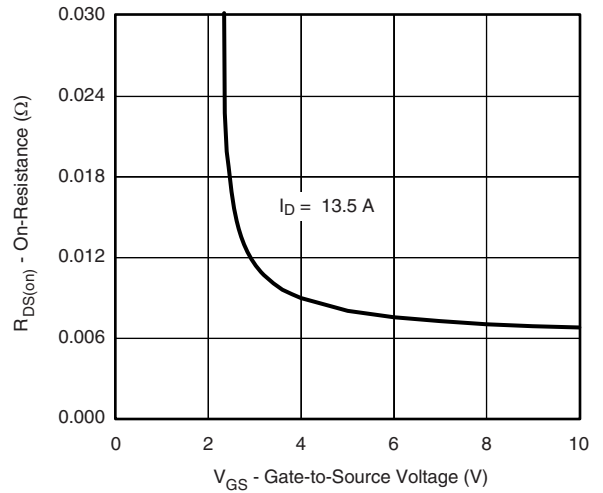
## CHANNEL-2 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



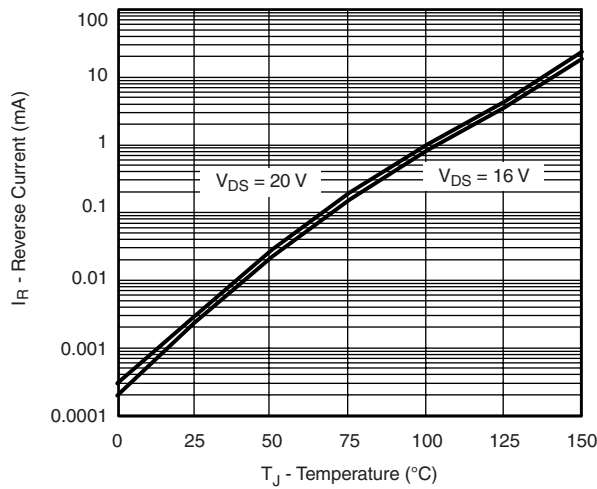
**CHANNEL-2 TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



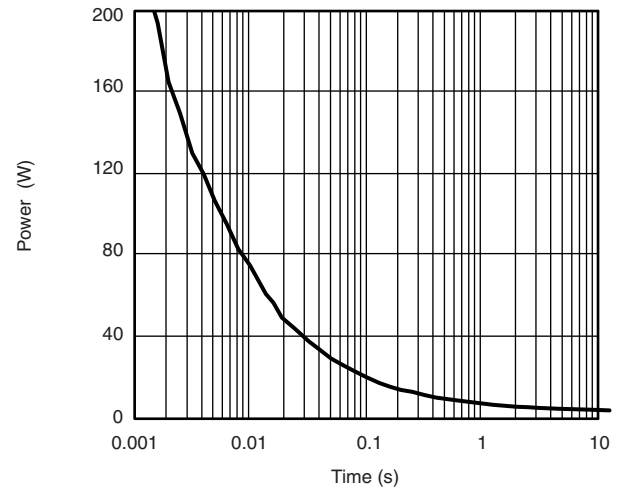
**Source-Drain Diode Forward Voltage**



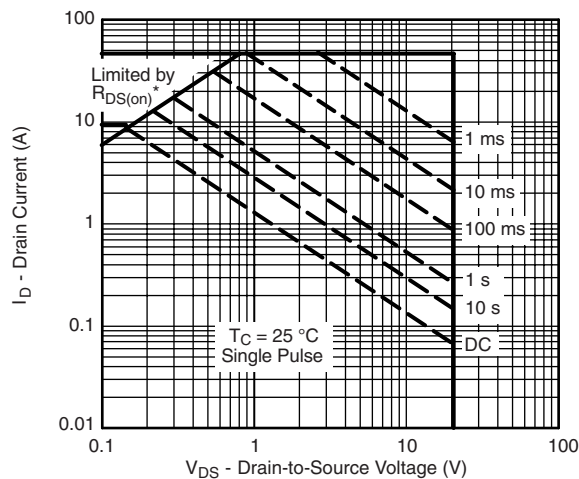
**On-Resistance vs. Gate-to-Source Voltage**



**Reverse Current vs. Junction Temperature**



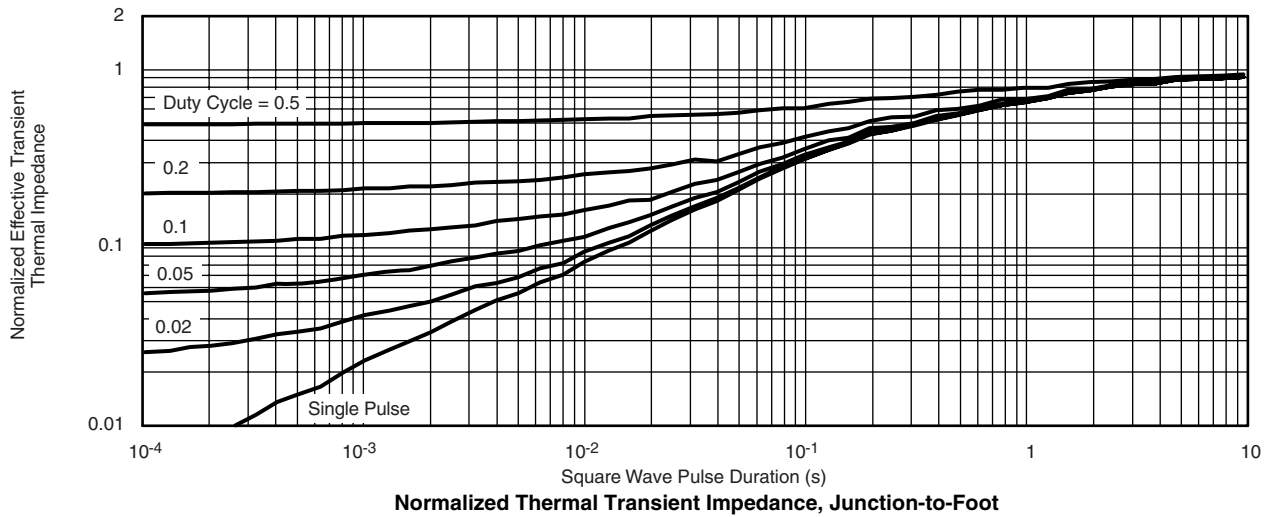
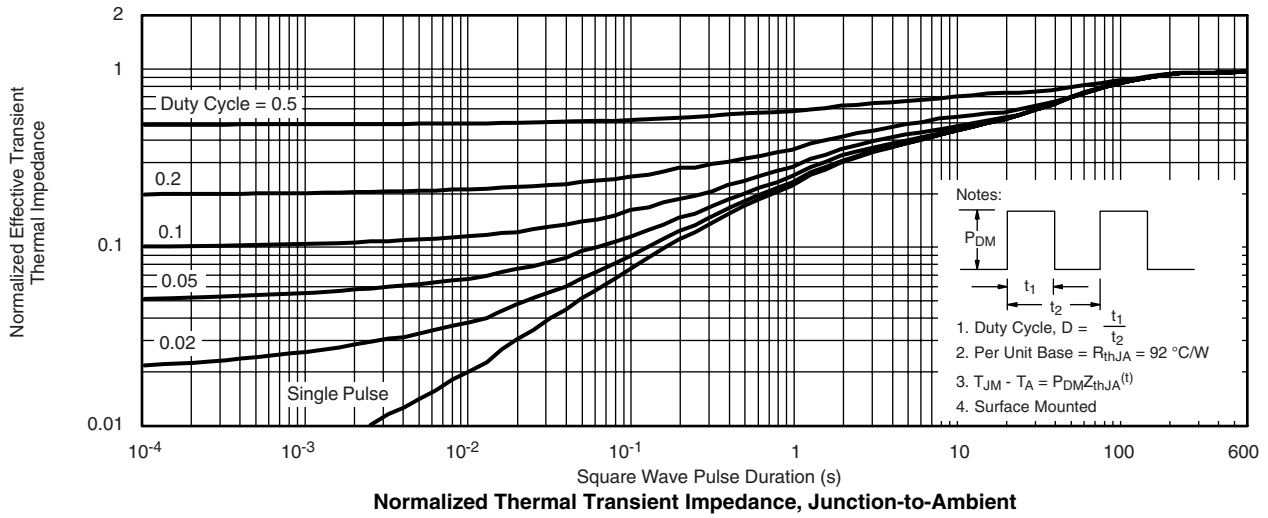
**Single Pulse Power**



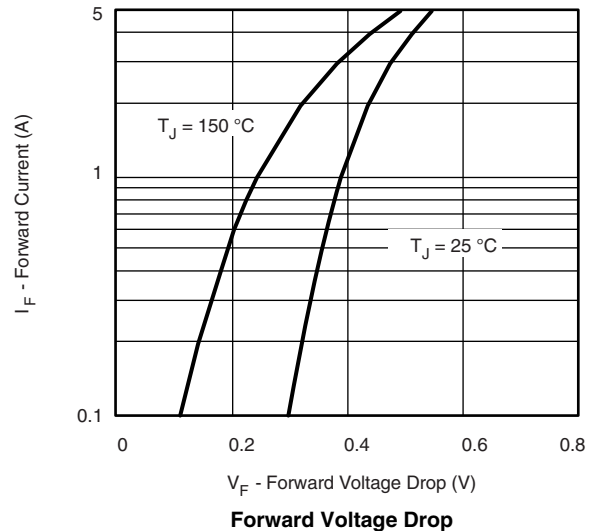
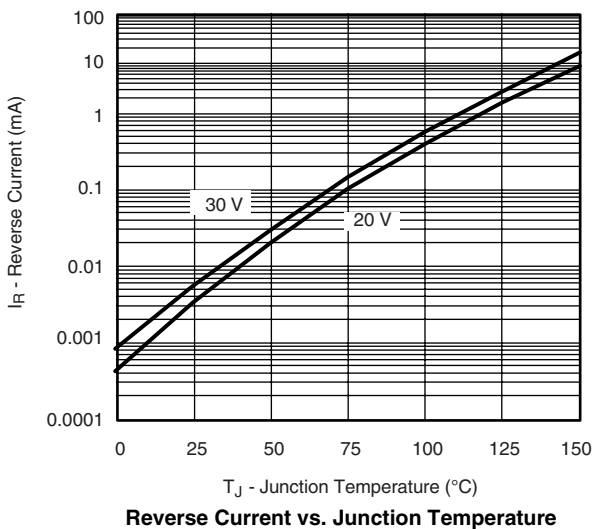
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

**Safe Operating Area, Junction-to-Case**

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

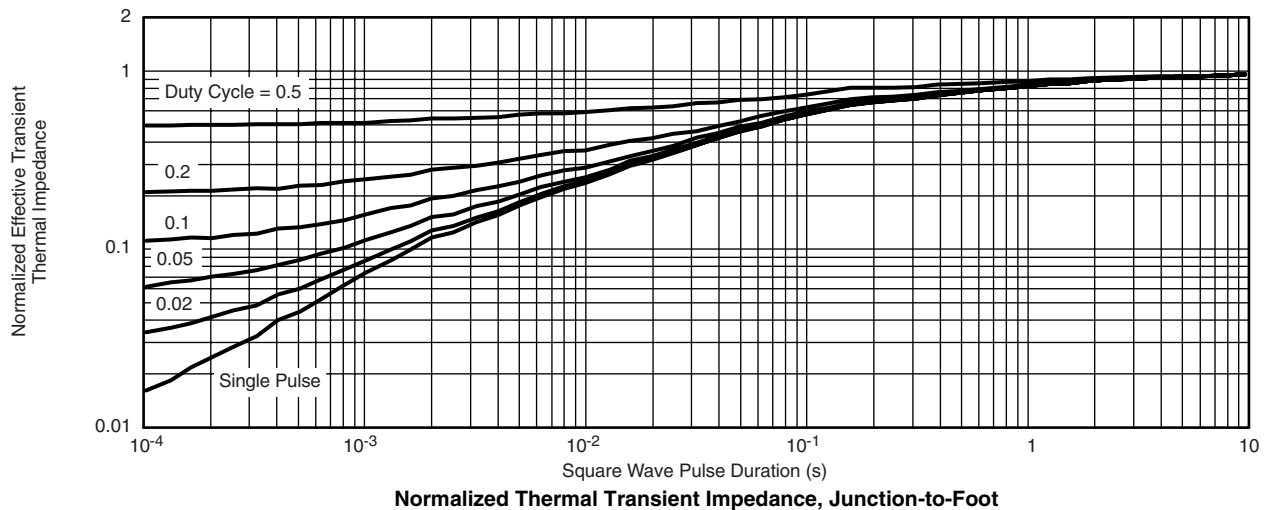
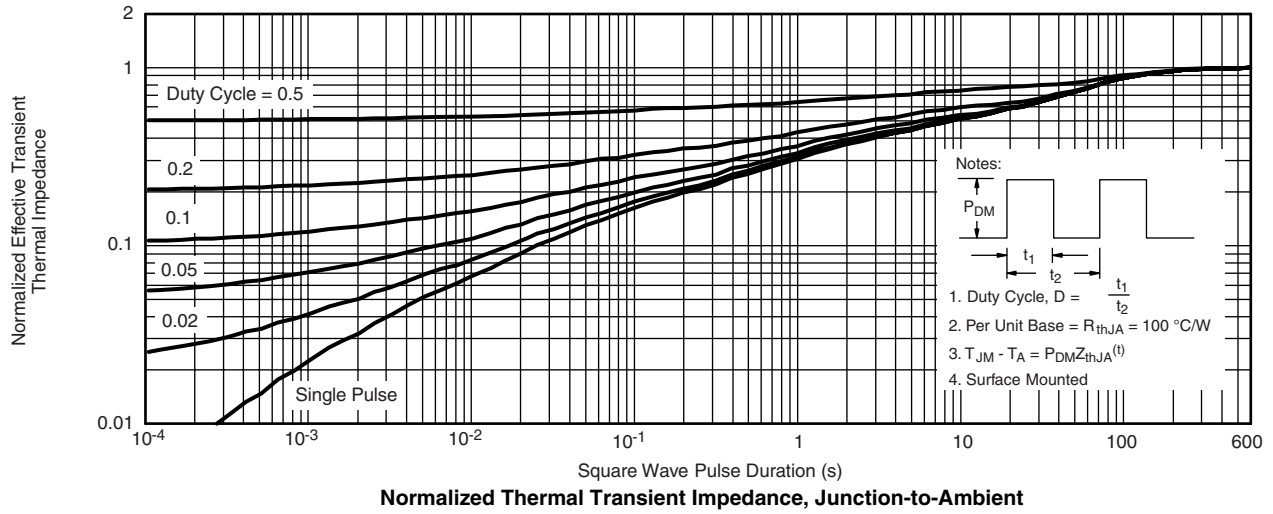
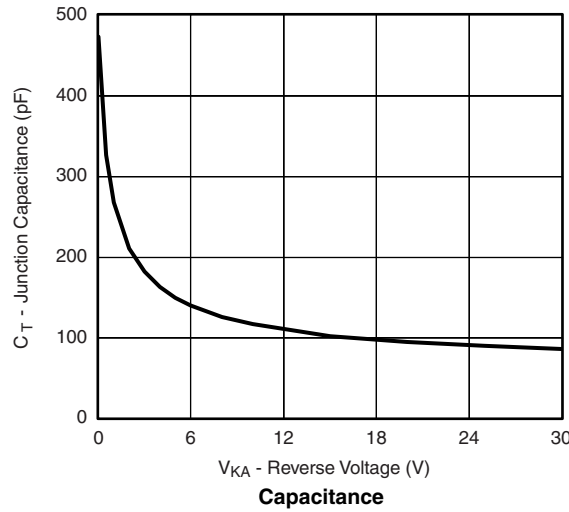


**SCHOTTKY TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted





**SCHOTTKY TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



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