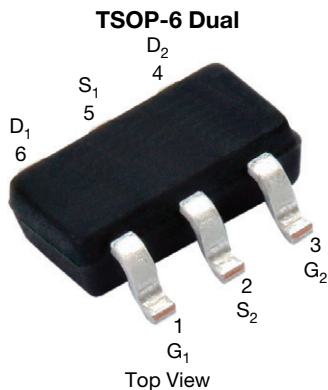


Automotive N- and P-Channel 20 V (D-S) MOSFET



Marking Code: 9U

PRODUCT SUMMARY		
	N-CHANNEL	P-CHANNEL
V_{DS} (V)	20	-20
$R_{DS(on)}$ (Ω) at $V_{GS} = \pm 4.5$ V	0.077	0.166
$R_{DS(on)}$ (Ω) at $V_{GS} = \pm 2.5$ V	0.120	0.318
I_D (A)	3.57	-2.5
Configuration	N- and p-pair	

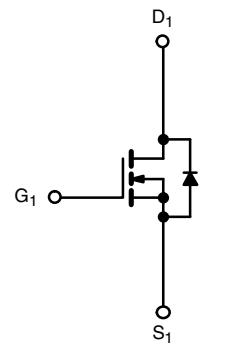
FEATURES

- TrenchFET® power MOSFET
- AEC-Q101 qualified
- 100 % R_g and UIS tested
- Material categorization:
for definitions of compliance please see
www.vishay.com/doc?99912

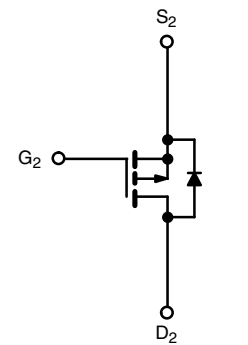
AUTOMOTIVE
GRADE



RoHS
COMPLIANT
HALOGEN
FREE



N-Channel MOSFET



P-Channel MOSFET

ORDERING INFORMATION

Package	TSOP-6 Dual
Lead (Pb)-free and halogen-free	SQ3585CEV (for detailed order number please see www.vishay.com/doc?79771)

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	N-CHANNEL	P-CHANNEL	UNIT
Drain-source voltage	V_{DS}	20	-20	V
Gate-source voltage	V_{GS}	± 12	± 12	
Continuous drain current	I_D	3.57	-2.5	A
		2	-1.45	
Pulsed drain current	I_{DM}	12	-10	
Continuous source current (diode conduction)	I_S	2.1	-2.1	
Maximum power dissipation	P_D	1.67	1.67	W
		0.56	0.56	
Unclamped inductive surge UIS	I_{AV}	3.3	3	A
Operating junction and storage temperature range	T_J, T_{stg}	-55 to +175		$^\circ\text{C}$

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	N-CHANNEL MAX.	P-CHANNEL MAX.	UNIT
Maximum junction-to-ambient ^a	R_{thJA}	150	150	$^\circ\text{C}/\text{W}$
Maximum junction-to-foot (drain)	R_{thJF}	90	90	

Note

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



SPECIFICATIONS (T _J = 25°C, unless otherwise noted)									
PARAMETER	SYMBOL	TEST CONDITIONS			MIN.	TYP.	MAX.	UNIT	
Static									
Gate threshold voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		N-Ch	0.6	-	1.5	V	
		V _{DS} = V _{GS} , I _D = -250 μA		P-Ch	-0.6	-	-1.5		
Gate-body leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 12 V		N-Ch	-	-	± 100	nA	
				P-Ch	-	-	± 100		
Zero gate voltage drain current	I _{DSS}	V _{GS} = 0 V	V _{DS} = 20 V	N-Ch	-	-	1	μA	
		V _{GS} = 0 V	V _{DS} = -20 V	P-Ch	-	-	-1		
		V _{GS} = 0 V	V _{DS} = 20 V, T _J = 55 °C	N-Ch	-	-	5		
		V _{GS} = 0 V	V _{DS} = -20 V, T _J = 55 °C	P-Ch	-	-	-5		
On-state drain current ^a	I _{D(on)}	V _{GS} = 4.5 V	V _{DS} ≥ 5 V	N-Ch	5	-	-	A	
		V _{GS} = -4.5 V	V _{DS} ≤ -5 V	P-Ch	-5	-	-		
Drain-source on-state resistance ^a	R _{DS(on)}	V _{GS} = 4.5 V	I _D = 1 A	N-Ch	-	0.049	0.077	Ω	
		V _{GS} = -4.5 V	I _D = -1 A	P-Ch	-	0.140	0.166		
		V _{GS} = 2.5 V	I _D = 1 A	N-Ch	-	0.066	0.120		
		V _{GS} = -2.5 V	I _D = -1 A	P-Ch	-	0.265	0.318		
Forward transconductance ^a	g _{fs}	V _{DS} = 5 V, I _D = 1 A		N-Ch	-	7	-	S	
		V _{DS} = -5 V, I _D = -1 A		P-Ch	-	3	-		
Diode forward voltage ^a	V _{SD}	I _S = 1.05 A, V _{GS} = 0 V		N-Ch	-	0.80	1.10	V	
		I _S = -1.05 A, V _{GS} = 0 V		P-Ch	-	-0.83	-1.10		
Dynamic ^b									
Total gate charge	Q _g	V _{GS} = 4.5 V	V _{DS} = 10 V, I _D = 1 A	N-Ch	-	2.0	3.0	nC	
		V _{GS} = -4.5 V	V _{DS} = -10 V, I _D = -1 A	P-Ch	-	3.0	5.0		
Gate-source charge	Q _{gs}	V _{GS} = 4.5 V	V _{DS} = 10 V, I _D = 1 A	N-Ch	-	1.0	-		
		V _{GS} = -4.5 V	V _{DS} = -10 V, I _D = -1 A	P-Ch	-	1.0	-		
Gate-drain charge	Q _{gd}	V _{GS} = 4.5 V	V _{DS} = 10 V, I _D = 1 A	N-Ch	-	1.0	-	nC	
		V _{GS} = -4.5 V	V _{DS} = -10 V, I _D = -1 A	P-Ch	-	1.0	-		
Gate resistance	R _g	f = 1 MHz		N-Ch	3.4	-	9.1	Ω	
				P-Ch	3.4	-	9.1		
Turn-on delay time	t _{d(on)}	N-Channel V _{DD} = 10 V, R _L = 10 Ω I _D ≅ 1 A, V _{GEN} = 10 V, R _g = 1 Ω		N-Ch	-	11	17	ns	
Rise time	t _r			P-Ch	-	9	14		
				N-Ch	-	15	23		
				P-Ch	-	18	27		
Turn-off delay time	t _{d(off)}			N-Ch	-	19	29		
				P-Ch	-	14	21		
Fall time	t _f	P-Channel V _{DD} = -10 V, R _L = 10 Ω I _D ≅ -1 A, V _{GEN} = -10 V, R _g = 1 Ω		N-Ch	-	8	12	ns	
				P-Ch	-	5	9		

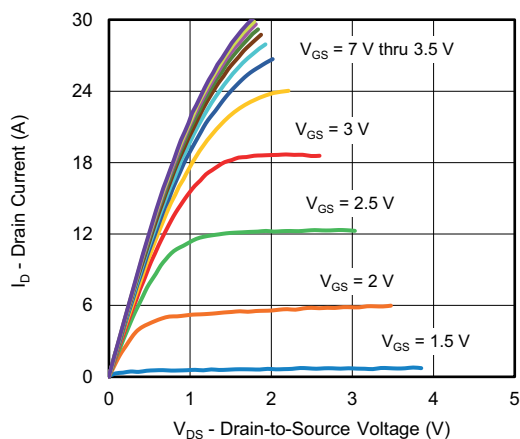
Notes

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

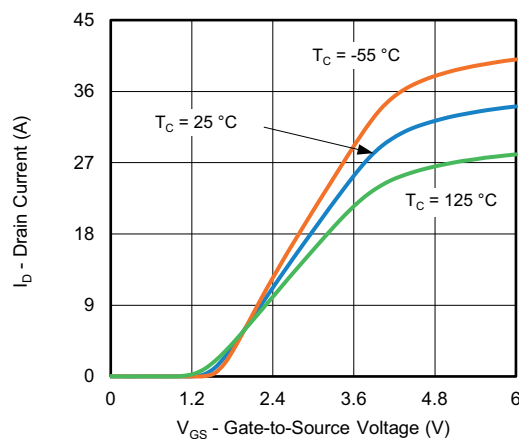
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



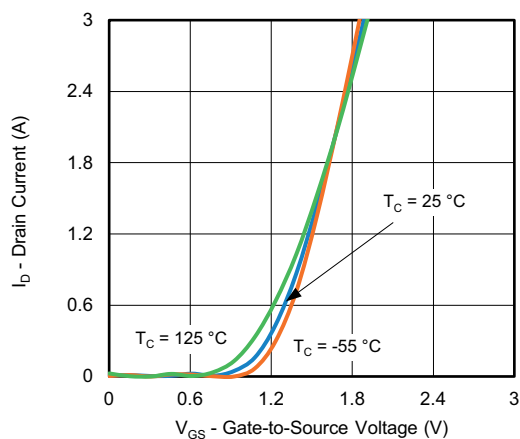
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C unless otherwise noted)



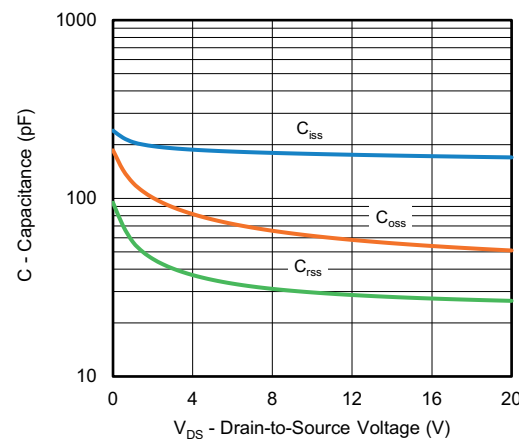
Output Characteristics



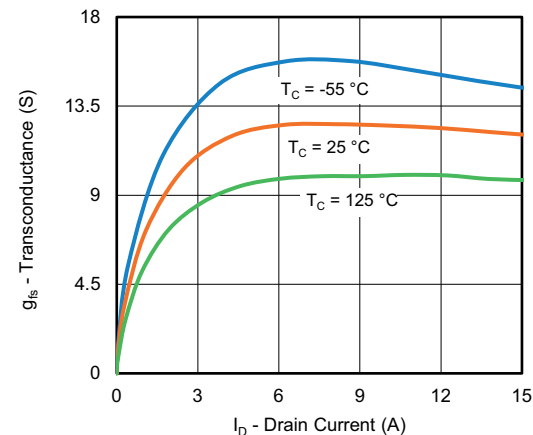
Transfer Characteristics



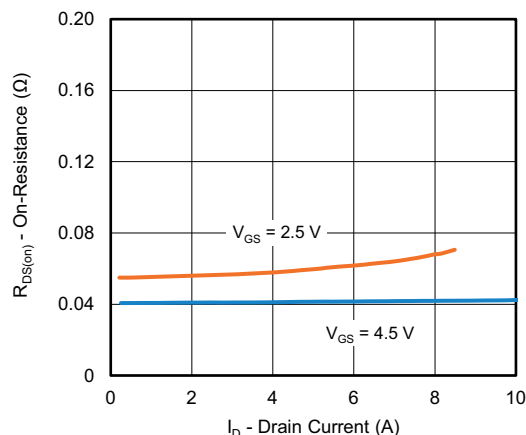
Transfer Characteristics



Capacitance



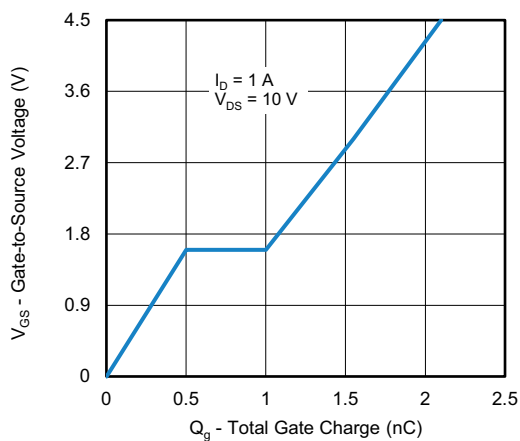
Transconductance



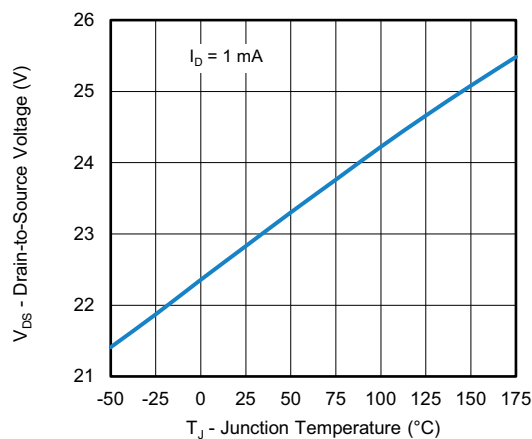
On-Resistance vs. Drain Current



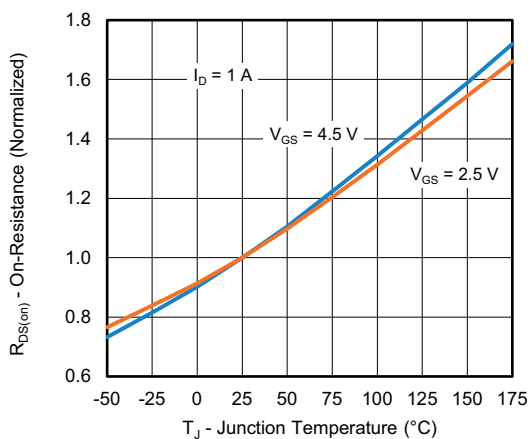
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C unless otherwise noted)



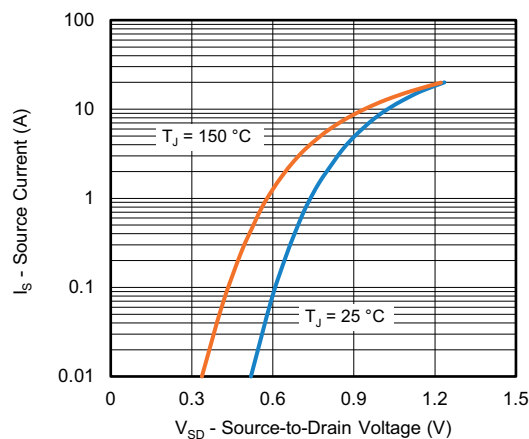
Gate Charge



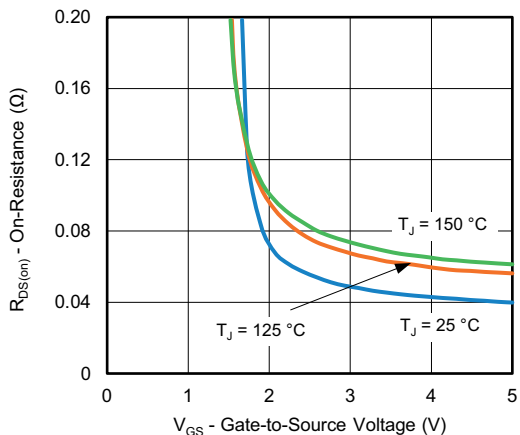
Drain Source Breakdown vs. Junction Temperature



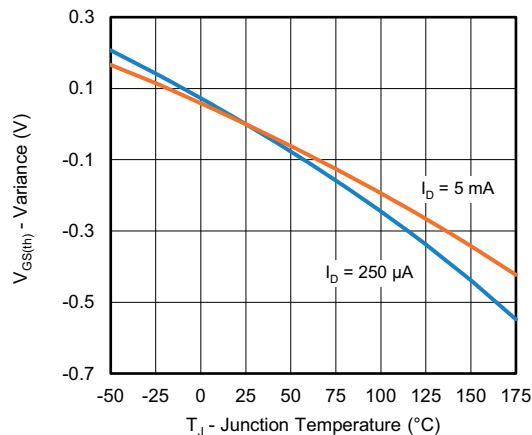
On-Resistance vs. Junction Temperature



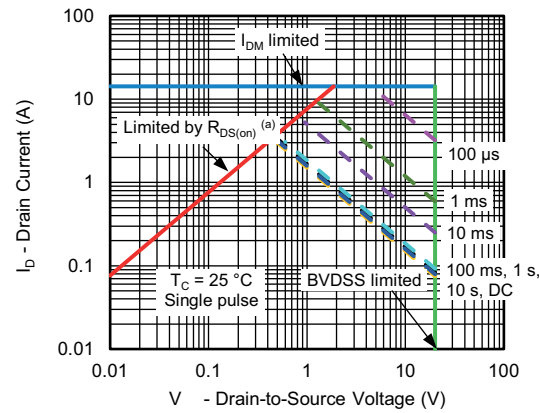
Source-Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



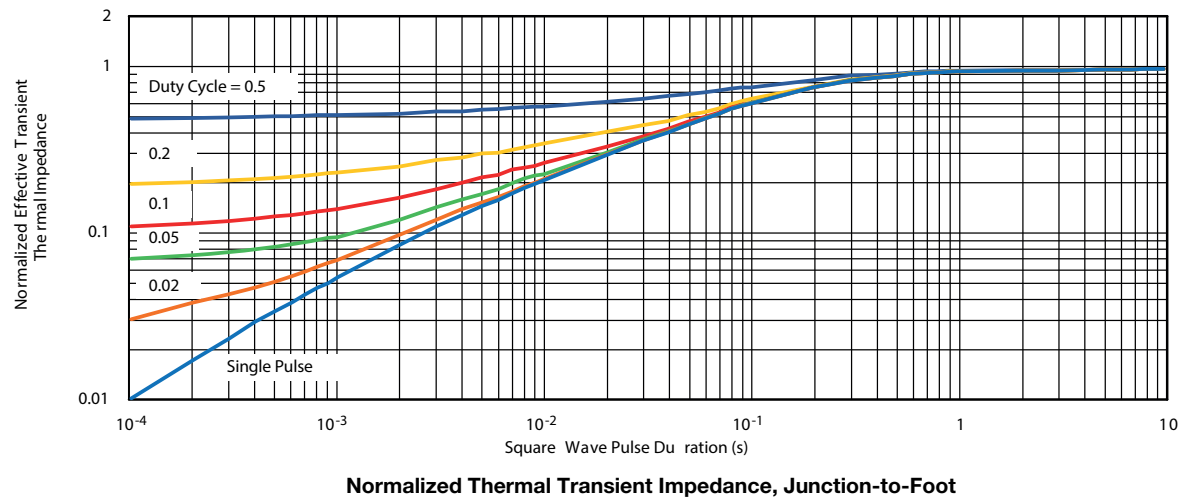
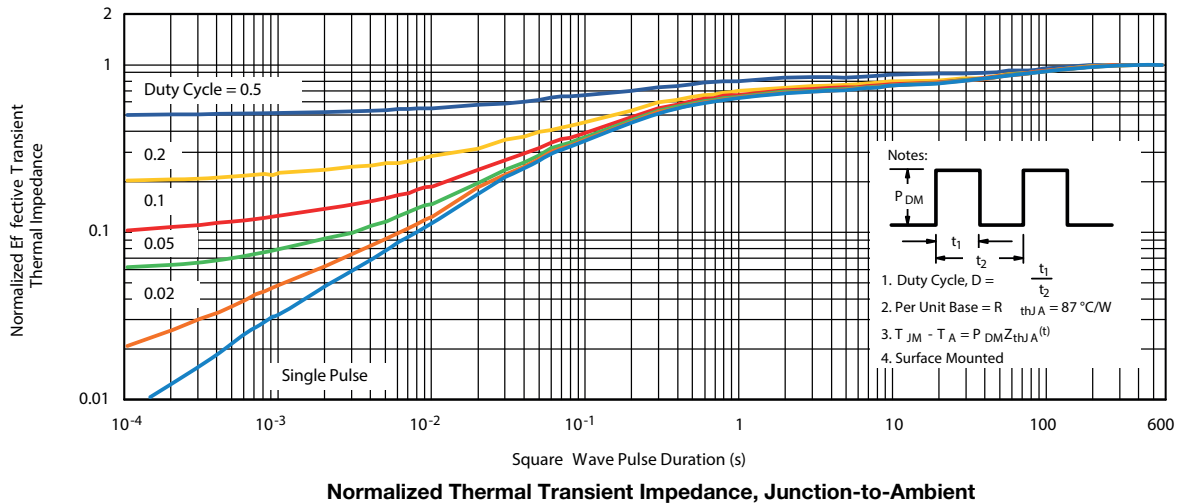
Safe Operating Area

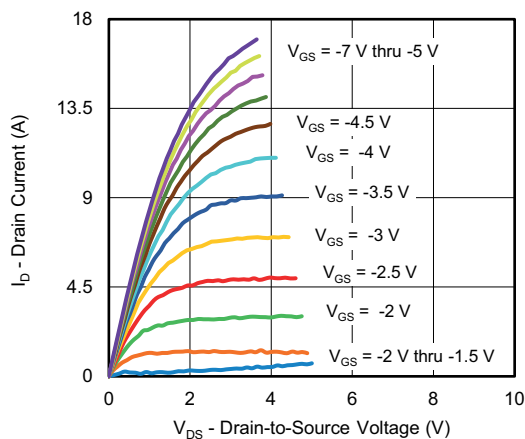
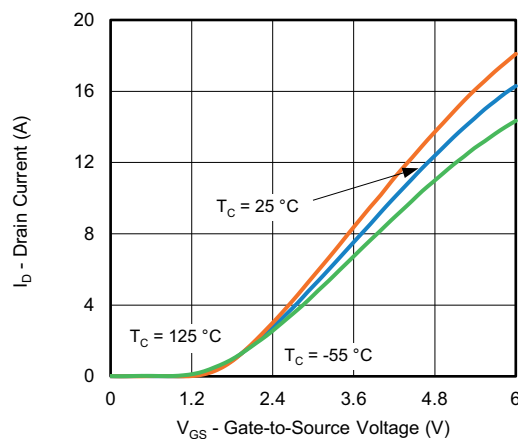
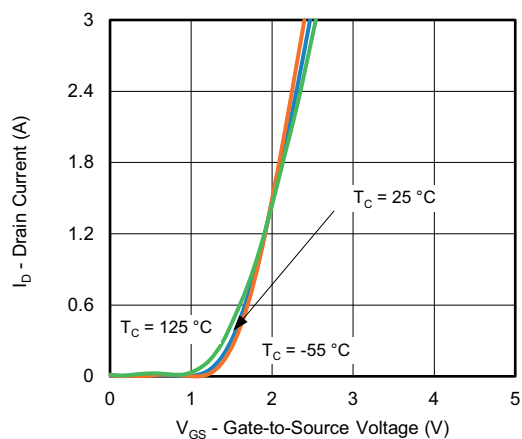
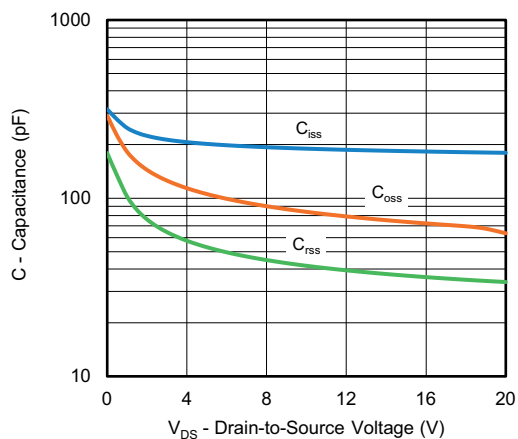
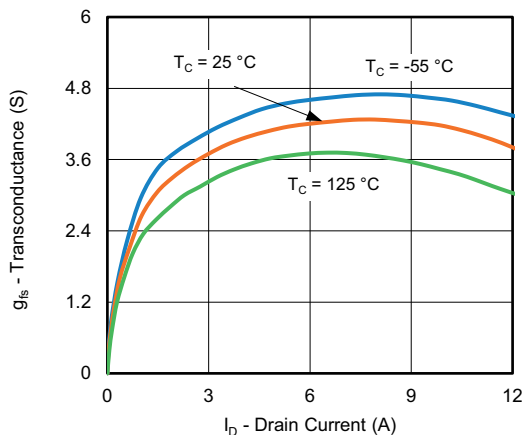
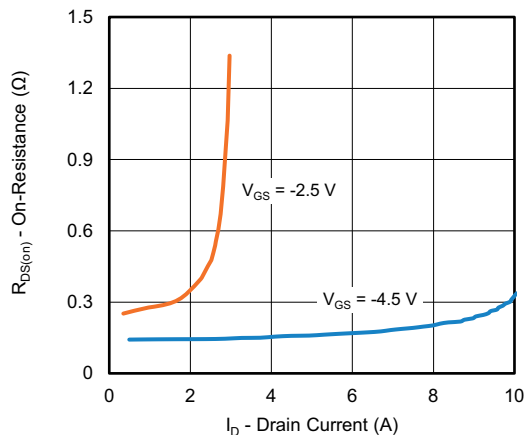
Note

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



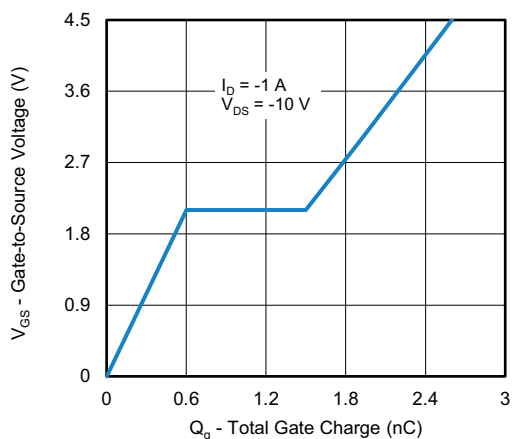
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C unless otherwise noted)



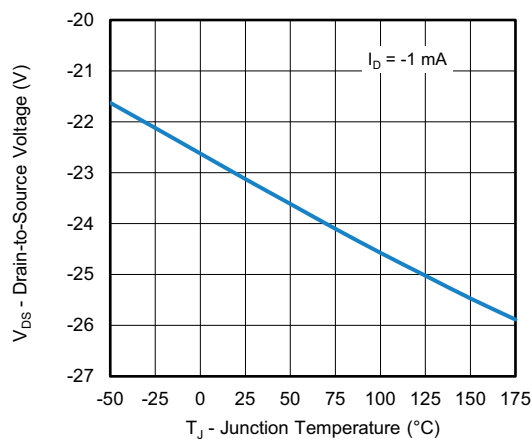
P-CHANNEL TYPICAL CHARACTERISTICS (25 °C unless otherwise noted)

Output Characteristics

Transfer Characteristics

Transfer Characteristics

Capacitance

Transconductance

On-Resistance vs. Drain Current



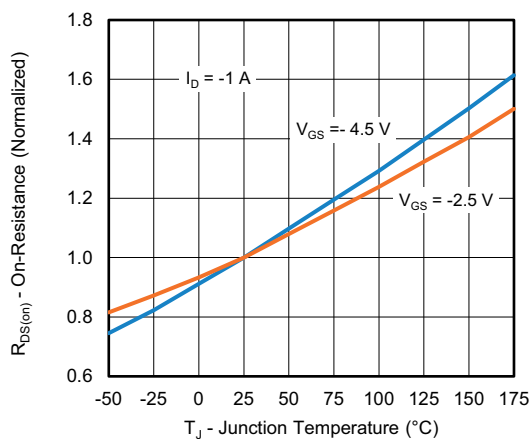
P-CHANNEL TYPICAL CHARACTERISTICS (25 °C unless otherwise noted)



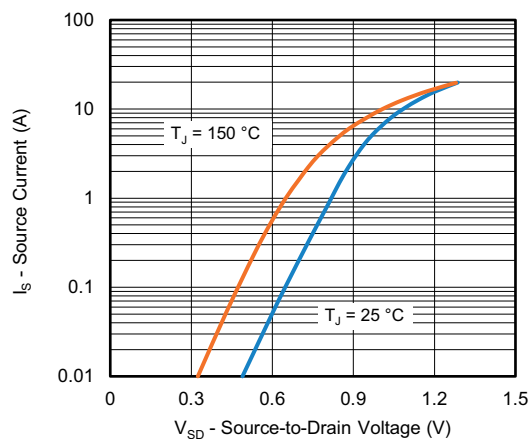
Gate Charge



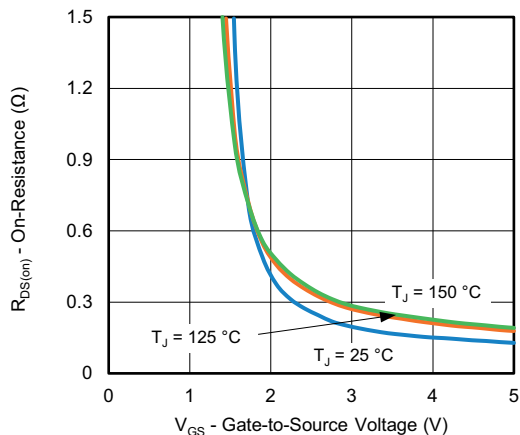
Drain Source Breakdown vs. Junction Temperature



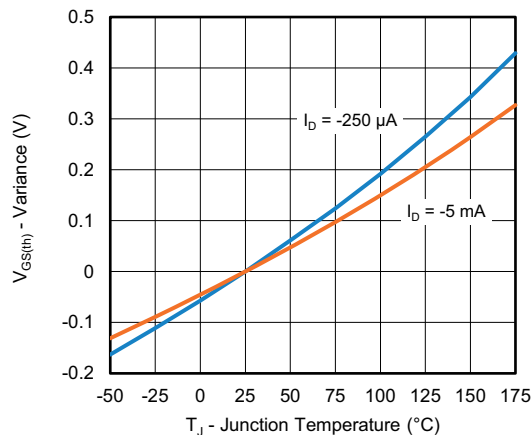
On-Resistance vs. Junction Temperature



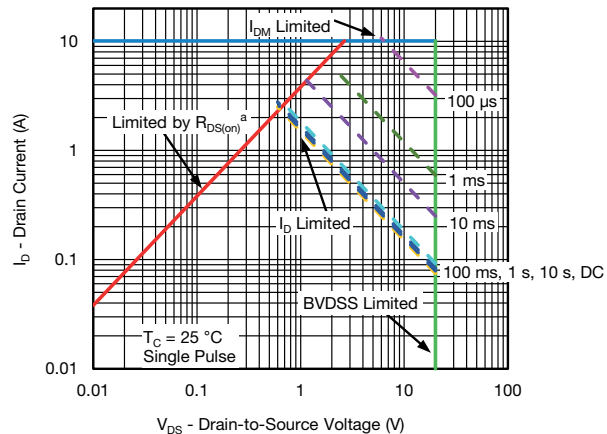
Source-Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



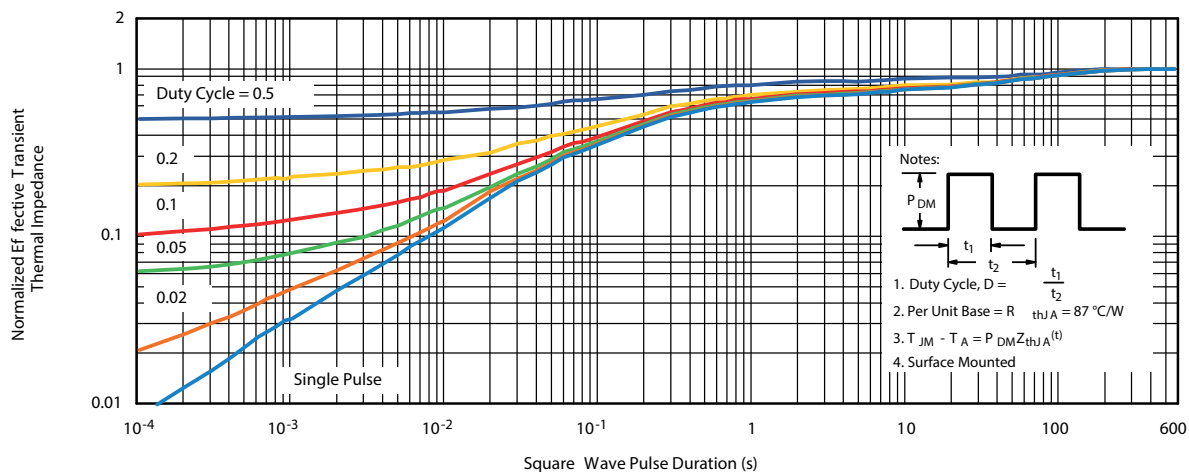
Threshold Voltage


Note

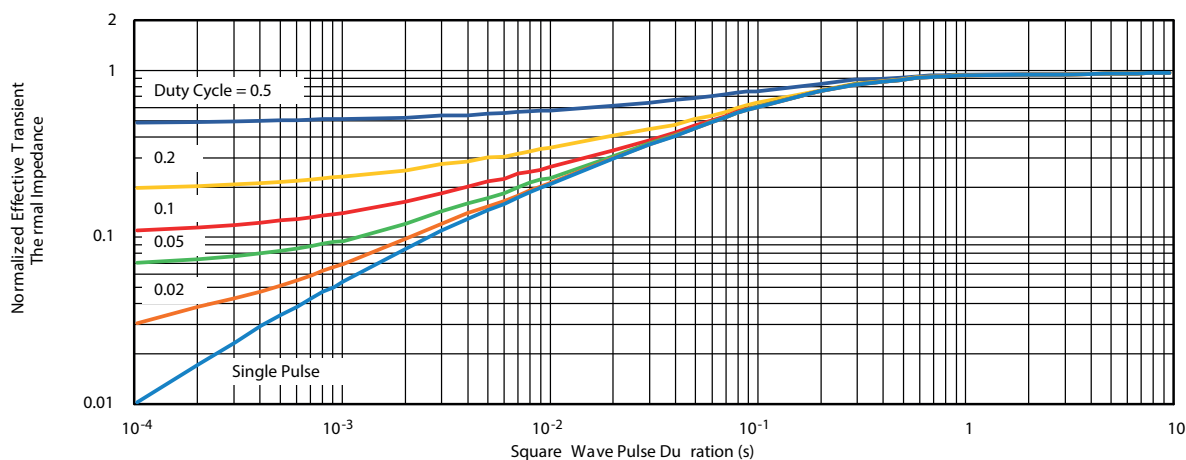
- a. $V_{GS} > \text{minimum } V_{GS} \text{ at which } R_{DS(on)} \text{ is specified}$



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



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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