

# MOSFET – Power, N-Channel

80 V, 3.6 mΩ

## NVCR4LS3D6N08M7A

### Features

- Typical  $R_{DS(on)}$  = 2.8 mΩ at  $V_{GS} = 10$  V
- Typical  $Q_{g(tot)}$  = 68 nC at  $V_{GS} = 10$  V
- AEC-Q101 Qualified
- RoHS Compliant

### DIMENSION (μm)

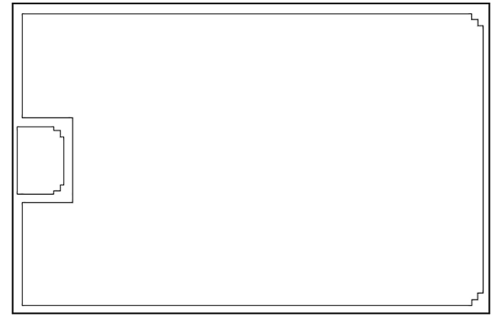
Die Size	3810 × 2463.8
Die Size (Sawn)	3790 ±15 × 2443.8 ±15
Source Attach Area	3606.3 × 2236.4
Gate Attach Area	359.9 × 517.5
Die Thickness	101.6 ±19.1

Gate and Source: AlSiCu  
Drain: Ti-NiV-Ag (back side of die)  
Passivation: Polyimide  
Wafer Diameter: 8 inch  
Wafer Sawn on UV Tape  
Bad Dice Identified in Inking  
Gross Die Counts: 2768

The Chip is 100% Probed to Meet the Conditions and Limits Specified at  $T_J = 25^\circ\text{C}$ .

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}$	80	-	-	V
$I_{DSS}$	Drain to Source Leakage Current	$V_{DS} = 80 \text{ V}, V_{GS} = 0 \text{ V}$	-	-	1	μA
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	-	-	±100	nA
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	2.0	-	4.0	V
* $R_{DS(on)}$	Bare Die Drain to Source On Resistance	$I_D = 5 \text{ A}, V_{GS} = 10 \text{ V}$	-	2.8	3.6	mΩ
$V_{SD}$	Source to Drain Diode Voltage	$I_{SD} = 5 \text{ A}, V_{GS} = 0 \text{ V}$	-	-	1.2	V
$E_{AS}$	Single Pulse Drain-to-Source Avalanche Energy	$L = 3 \text{ mH}, I_{AS} = 16.6 \text{ A}$	413	-	-	mJ

\*Accurate  $R_{DS(on)}$  test at die level is not feasible for this thin die as limited by the test contact precision attainable in a die form. The max  $R_{DS(on)}$  specification is defined from the historical performance of the die in package but is not guaranteed by test in production. The die  $R_{DS(on)}$  performance depends on the Source wire/ribbon bonding layout.



### ORDERING INFORMATION

Device	Package
NVCR4LS3D6N08M7A	Wafer Sawn on Foil

### RECOMMENDED STORAGE CONDITIONS

Temperature	22 to 28°C
RH	40 to 66%

# NVCR4LS3D6N08M7A

**MOSFET MAXIMUM RATINGS** in Reference to the FDDL86367–F085 electrical data in D–PAK  
( $T_J = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Ratings	Unit
$V_{DSS}$	Drain to Source Voltage	80	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Continuous Drain Current $R_{\theta JC}$ ( $V_{GS} = 10$ ) (Note 1) $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	164 116	A
$E_{AS}$	Single Pulse Avalanche Energy (Note 2)	82	mJ
$P_D$	Power Dissipation $R_{\theta JC}$	227	W
	Derate Above $25^\circ\text{C}$	1.5	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature	$-55$ to $+175$	$^\circ\text{C}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.66	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient (Note 3)	52	$^\circ\text{C}/\text{W}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

- Current is limited by silicon.
- Starting  $T_J = 25^\circ\text{C}$ ,  $L = 40 \mu\text{H}$ ,  $I_{AS} = 64 \text{ A}$ ,  $V_{DD} = 80 \text{ V}$  during inductor charging and  $V_{DD} = 0 \text{ V}$  during time in avalanche.
- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance, where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design, while  $R_{\theta JA}$  is determined by the board design. The maximum rating presented here is based on mounting on a  $1 \text{ in}^2$  pad of 2oz copper.

**ELECTRICAL CHARACTERISTICS** in Reference to the FDDL86367–F085 electrical data in D–PAK  
( $T_J = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
<b>OFF CHARACTERISTICS</b>							
$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}$ , $V_{GS} = 0 \text{ V}$	80	–	–	V	
$I_{DSS}$	Drain to Source Leakage Current	$V_{DS} = 80 \text{ V}$ , $V_{GS} = 0 \text{ V}$	$T_J = 25^\circ\text{C}$	–	–	1	$\mu\text{A}$
			$T_J = 175^\circ\text{C}$ (Note 4)	–	–	1	mA
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20 \text{ V}$	–	–	$\pm 100$	nA	

### ON CHARACTERISTICS

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250 \mu\text{A}$	2.0	3.0	4.0	V	
$R_{DS(on)}$	Drain to Source on Resistance	$I_D = 80 \text{ A}$ , $V_{GS} = 10 \text{ V}$	$T_J = 25^\circ\text{C}$	–	3.3	4.2	$\text{m}\Omega$
			$T_J = 175^\circ\text{C}$ (Note 4)	–	6.6	8.4	$\text{m}\Omega$

### DYNAMIC CHARACTERISTICS

$C_{iss}$	Input Capacitance	$V_{DS} = 40 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	–	4840	–	pF
$C_{oss}$	Output Capacitance		–	814	–	pF
$C_{rss}$	Reverse Transfer Capacitance		–	31	–	pF
$R_g$	Gate Resistance	$f = 1 \text{ MHz}$	–	2.3	–	$\Omega$
$Q_{g(ToT)}$	Total Gate Charge	$V_{GS} = 0$ to $10 \text{ V}$ , $V_{DD} = 40 \text{ V}$ , $I_D = 80 \text{ A}$	–	68	–	nC
$Q_{g(th)}$	Threshold Gate Charge	$V_{GS} = 0$ to $2 \text{ V}$ , $V_{DD} = 40 \text{ V}$ , $I_D = 80 \text{ A}$	–	8.8	–	nC
$Q_{gs}$	Gate to Source Gate Charge	$V_{DD} = 40 \text{ V}$ , $I_D = 80 \text{ A}$	–	22	–	nC
$Q_{gd}$	Gate to Drain “Miller” Charge		–	14	–	nC

### SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay	$V_{DD} = 40 \text{ V}$ , $I_D = 80 \text{ A}$ , $V_{GS} = 10 \text{ V}$ , $R_{GEN} = 6 \Omega$	–	20	–	ns
$t_r$	Rise Time		–	49	–	ns
$t_{d(off)}$	Turn-Off Delay		–	36	–	ns
$t_f$	Fall Time		–	16	–	ns

### DRAIN-SOURCE DIODE CHARACTERISTIC

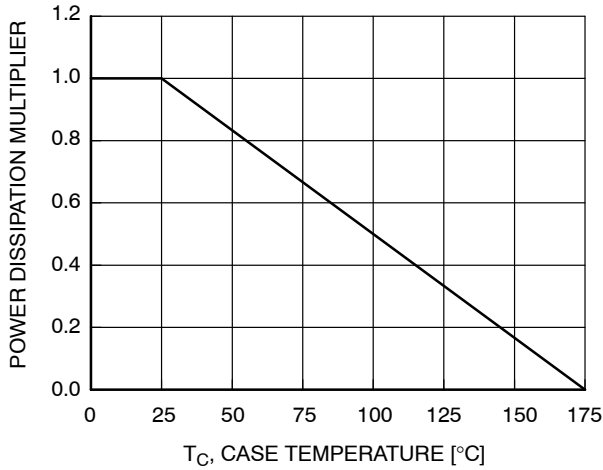
$V_{SD}$	Source to Drain Diode Voltage	$I_{SD} = 80 \text{ A}$ , $V_{GS} = 0 \text{ V}$	–	–	1.3	V
		$I_{SD} = 40 \text{ A}$ , $V_{GS} = 0 \text{ V}$	–	–	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 80 \text{ A}$ , $dI_{SD}/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 64 \text{ V}$	–	68	–	ns
$Q_{rr}$	Reverse Recovery Charge		–	66	–	nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

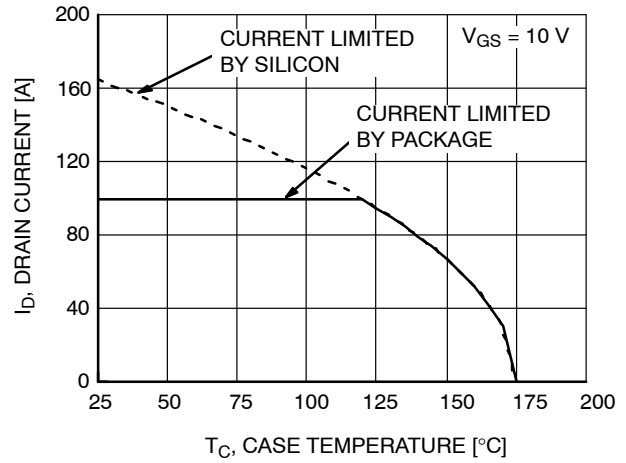
- The maximum value is specified by design at  $T_J = 175^\circ\text{C}$ . Product is not tested to this condition in production.

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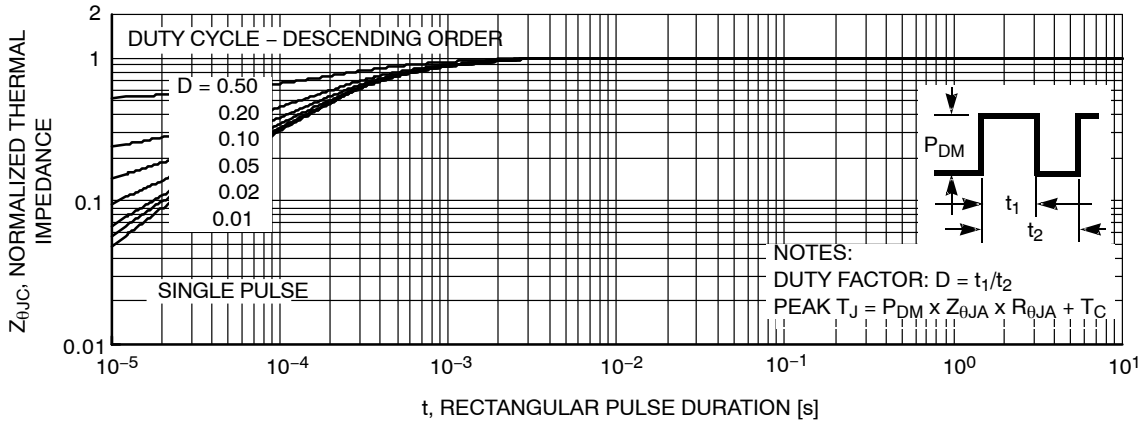
## TYPICAL CHARACTERISTICS



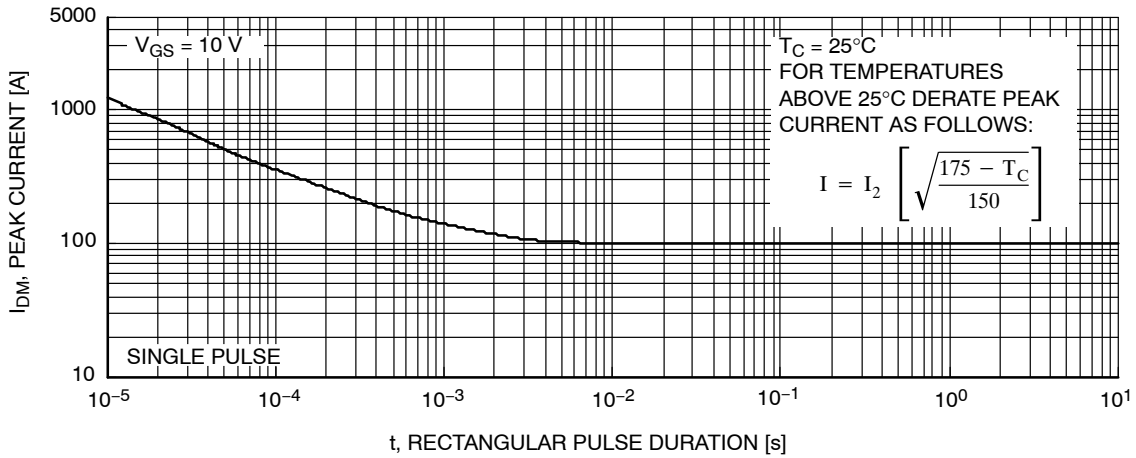
**Figure 1. Normalized Power Dissipation vs. Case Temperature**



**Figure 2. Maximum Continuous Drain Current vs. Case Temperature**



**Figure 3. Normalized Maximum Transient Thermal Impedance**



**Figure 4. Peak Current Capability**

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## TYPICAL CHARACTERISTICS (continued)

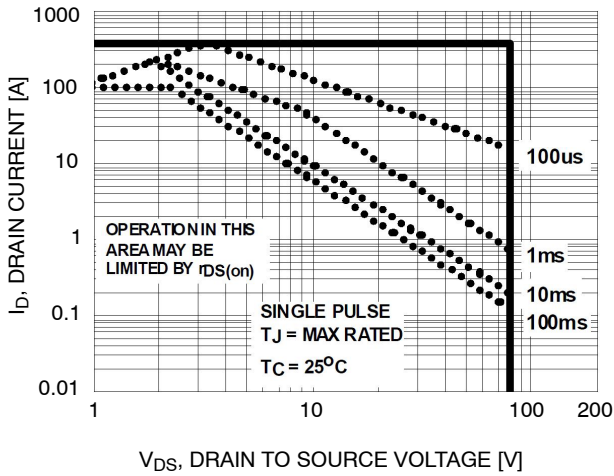
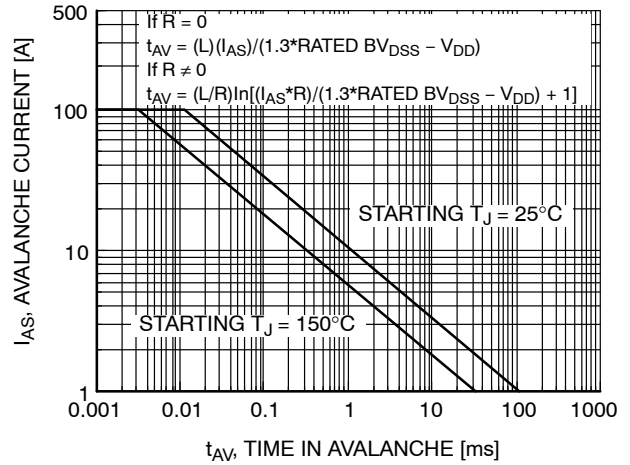


Figure 5. Forward Bias Safe Operating Area



(Note: Refer to onsemi Applications Notes [AN7514](#) and [AN7515](#))

Figure 6. Unclamped Inductive Switching Capability

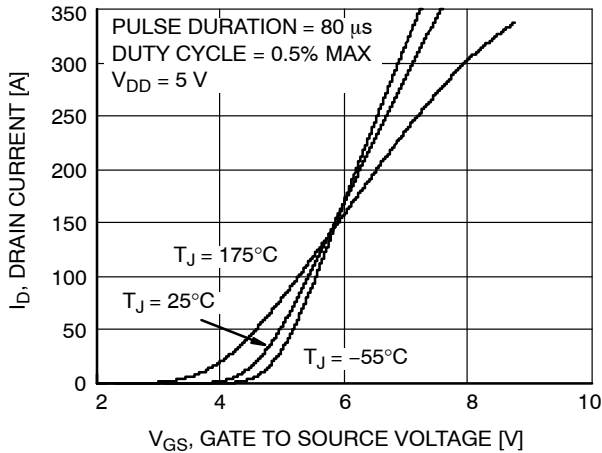


Figure 7. Transfer Characteristics

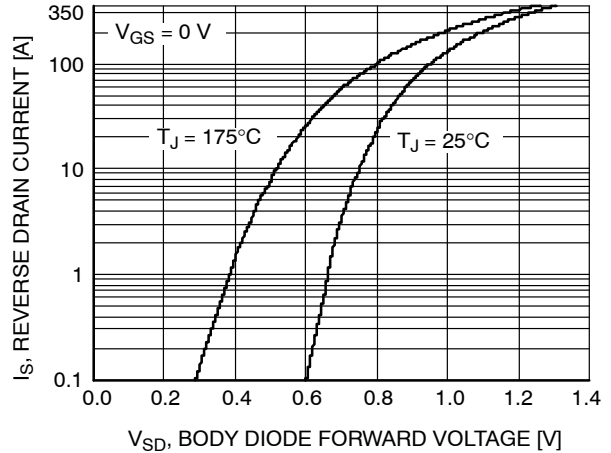


Figure 8. Forward Diode Characteristics

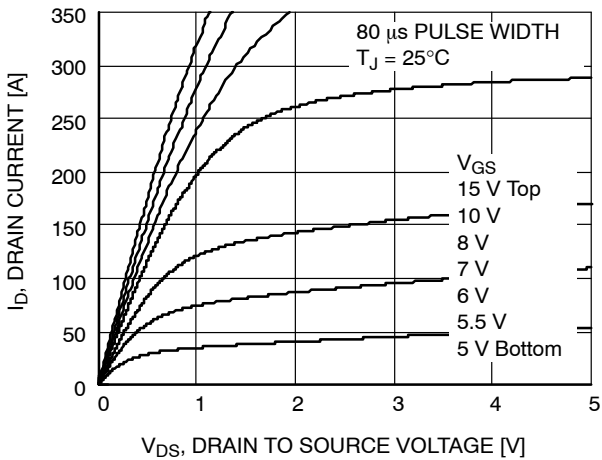


Figure 9. Saturation Characteristics

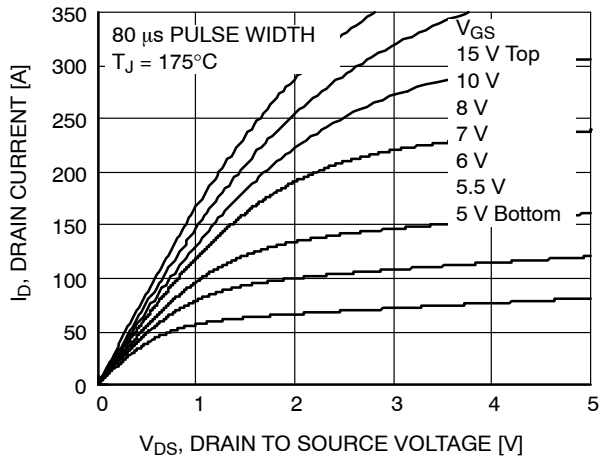


Figure 10. Saturation Characteristics

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## TYPICAL CHARACTERISTICS (continued)

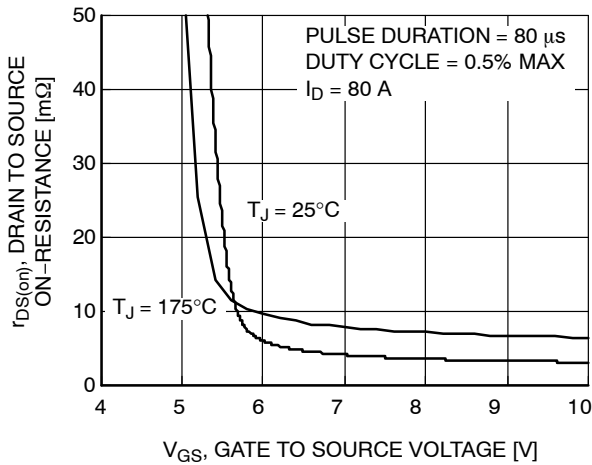


Figure 11.  $R_{DS(on)}$  vs. Gate Voltage

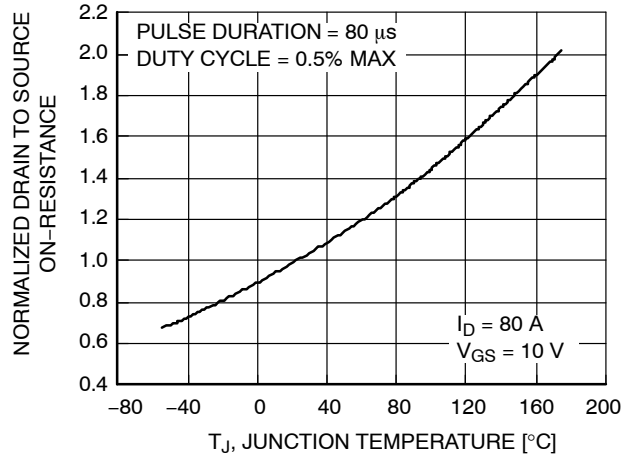


Figure 12. Normalized  $R_{DS(on)}$  vs. Junction Temperature

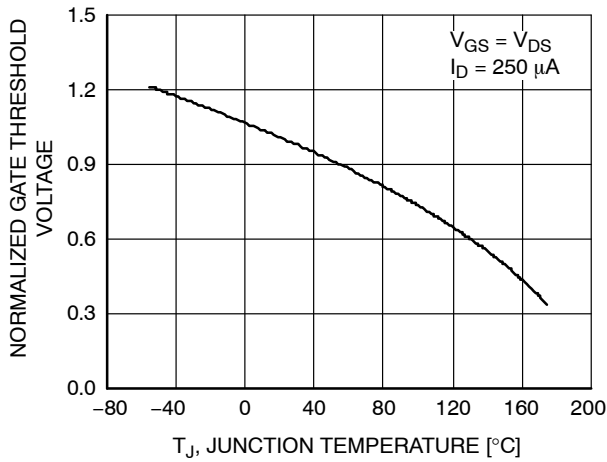


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

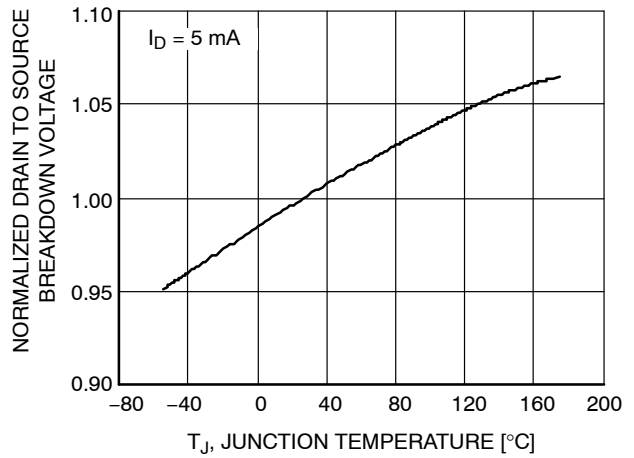


Figure 14. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

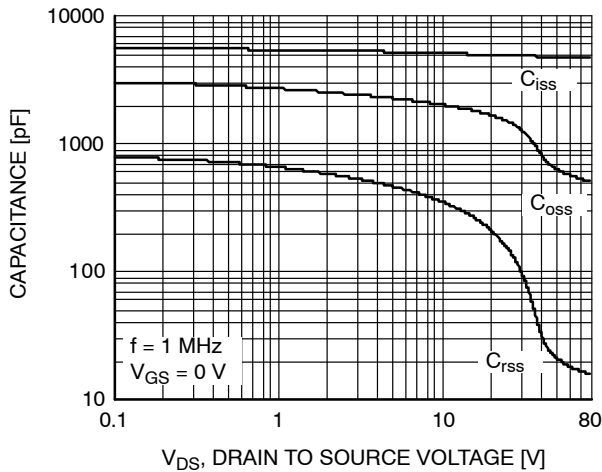


Figure 15. Capacitance vs. Drain to Source Voltage

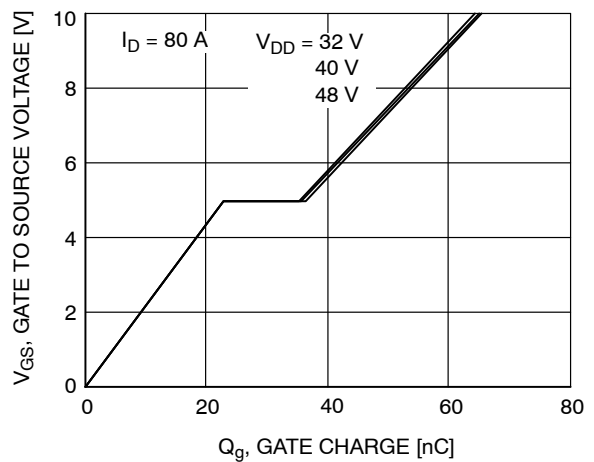


Figure 16. Gate Charge vs. Gate to Source Voltage

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