MOSFET – Power, N-Channel, Automotive, SUPERFET® III, Easy-Drive

650 V, 25 mΩ

NVCR8LS025N65S3A

Features

- Typical $R_{DS(on)}$ = 19.9 mΩ at V_{GS} = 10 V
- Typical $Q_{g(tot)}$ = 236 nC at V_{GS} = 10 V
- AEC−Q101 Qualified
- RoHS Compliant

ORDERING INFORMATION

Device	Package
NVCR8LS025N65S3A	Wafer Sawn on Foil

DIMENSION (μm)

Die Size	10830 x 7610
Die Size (Sawn)	10810 ±30 x 7590 ±30
Source Attach Area	(10155 x 3346) x 2
Gate Attach Area	406 x 618
Die Thickness	203.2 ± 25.4

RECOMMENDED STORAGE CONDITIONS

Temperature	22 to 28°C
RH	40% to 66%

Gate and Source : AlSiCu
Drain : Ti−NiV−Ag (back side of die)
Passivation : SiN
Wafer Diameter : 8 inch
Wafer sawn on UV Tape
Bad dice identified in Inking
Gross Die Count : 296

ELECTRICAL CHARACTERISTICS

The Chip is 100% Probed to Meet the Conditions and Limits Specified at T_J = 25°C

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 1 mA, V_{GS} = 0 V	650	–	–	V
I_{DSS}	Drain to Source Leakage Current	V_{DS} = 650 V, V_{GS} = 0 V	–	–	1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = +30 / −20 V, V_{DS} = 0 V	–	–	±100	nA
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 3 mA	2.5	–	4.5	V
*$R_{DS(on)}$	Bare Die Drain to Source On Resistance	I_D = 37.5 A, V_{GS} = 10 V	–	19.9	25	mΩ
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 37.5 V			1.2	V

*Accurate RDS(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 RDS(on) specification is defined from the historical performance of the die in package but is not guaranteed by test in production. The die RDS(on) performance depends on the Source wire/ribbon bonding layout.

ABSOLUTE MAXIMUM RATINGS

in Reference to the NVHL025N65S3 electrical data in TO−247−3LD (T_J = 25°C unless otherwise noted)

Symbol	Parameter		Ratings	Unit
V_{DSS}	Drain to Source Voltage		650	V
V_{GS}	Gate to Source Voltage	DC Positive	30	V
		AC Positive, (f > 1Hz)	30	V
		AC Negative, (f > 1Hz)	−20	V
I_D	Continuous Drain Current	T_C = 25°C	75	A
		T_C = 100°C	65.8	A
I_{DM}	Pulsed Drain Current	Pulsed (Note 1)	300	A
E_{AS}	Single Pulse Avalanche Energy (Note 2)		2025	mJ
E_{AR}	Repetitive Avalanche (Note 1)		5.95	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		20	V/ns
P_D	Power Dissipation $R_{\theta JC}$	T_C = 25°C	595	W
T_J, T_{STG}	Operating and Storage Temperature		−55 to +150	°C

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.

1. Repetitive rating: pulse−width limited by maximum junction temperature.
2. I_{AS} = 15 A, R_G = 25 Ω, Starting T_J = 25°C.
3. I_{SD} < 75 A, di/dt ≤ 200 A/ms, VDD ≤ BVDSS, starting T_J = 25°C

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta J\,C}$	Thermal Resistance, Junction to Case, Max	0.21	°C/W
$R_{\theta J\,A}$	Thermal Resistance, Junction to Ambient, Max	40	°C/W

ELECTRICAL CHARACTERISTICS

in Reference to the NVHL025N65S3 electrical data in TO−247−3LD (T_J = 25°C unless otherwise noted)

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
OFF CHARACTERISTICS							
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 1 mA, V_{GS} = 0 V		650	–	–	V
I_{DSS}	Drain to Source Leakage Current	V_{DS} = 650 V, V_{GS} = 0 V, T_J = 25°C		–	–	1	μA
		V_{DS} = 520 V, V_{GS} = 0 V, T_J = 125°C		–	7.92	–	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = +30 V		–	–	+100	nA
		V_{GS} = −20 V				−100	nA
ON CHARACTERISTICS							
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 3.0 mA		2.5		4.5	V
$R_{DS(on)}$	Drain to Source On−Resistance	I_D = 37.5 A, V_{GS} = 10 V	T_J = 25°C	–	19.9	25	mΩ
			T_J = 100°C	–	34.6	–	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 75 A			78.5		S
DYNAMIC CHARACTERISTICS							
C_{iss}	Input Capacitance	V_{DS} = 400 V, V_{GS} = 0 V, f = 1 MHz		–	7330	–	pF
C_{oss}	Output Capacitance			–	197	–	pF
C_{rss}	Reverse Transfer Capacitance			–	33.6	–	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V			2062		pF
$C_{oss(er.)}$	Energy Related Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V			285		pF
$Q_{g(ToT)}$	Total Gate Charge	V_{GS} = 10 V, V_{DS} = 400 V, I_D = 75 A (Note 4)		–	236	–	nC
Q_{gs}	Gate to Source Gate Charge			–	59.3	–	nC
Q_{gd}	Gate to Drain “Miller” Charge			–	97.3	–	nC
RG	Gate Resistance	f = 1 MHz		–	0.818	–	Ω
SWITCHING CHARACTERISTICS							
$t_{d(on)}$	Turn−On Delay Time	V_{DD} = 400 V, I_D = 75 A, V_{GS} = 10 V, R_G = 2 Ω (Note 4)		–	43.3	–	ns
t_r	Rise Time			–	109	–	ns
$t_{d(off)}$	Turn−Off Delay Time			–	120	–	ns
t_f	Fall Time			–	107	–	ns
DRAIN − SOURCE DIODE CHARACTERISTICS							
I_S	Maximum Continuous Drain to Source Diode Forward Current					75	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current					300	A
V_{SD}	Source to Drain Diode Voltage	V_{GS} = 0 V, I_{SD} = 37.5 A, V_{GS} = 0 V		–	–	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 75 A, dI_{SD}/dt = 100 A/μs		–	714	–	ns
Q_{rr}	Reverse Recovery Charge			–	26.4	–	μC

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.

4. Essentially independent of operating temperature typical characteristics.

TYPICAL CHARACTERISTICS

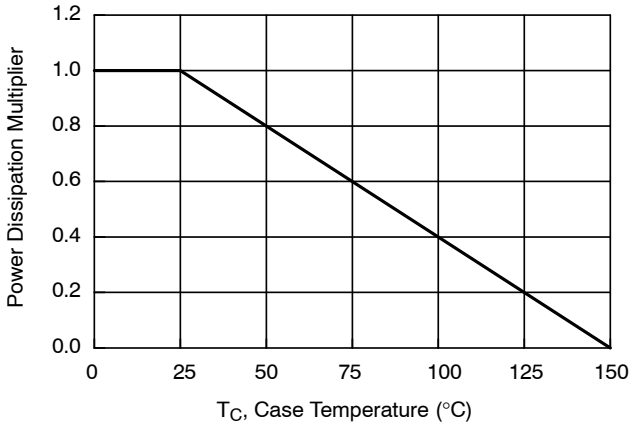

Figure 1. Normalized Power Dissipation vs. Case Temperature

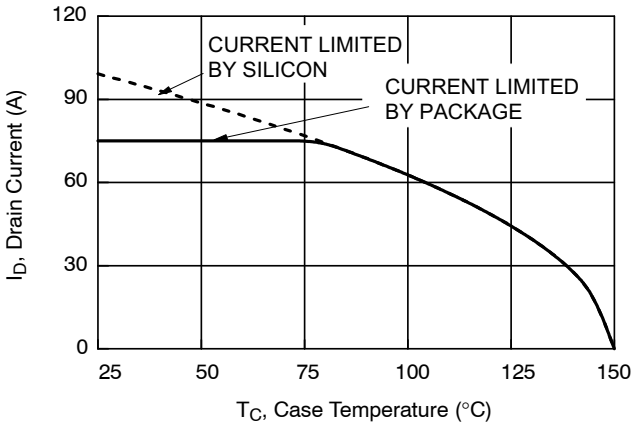

Figure 2. Maximum Continuous Drain Current vs. Case Temperature

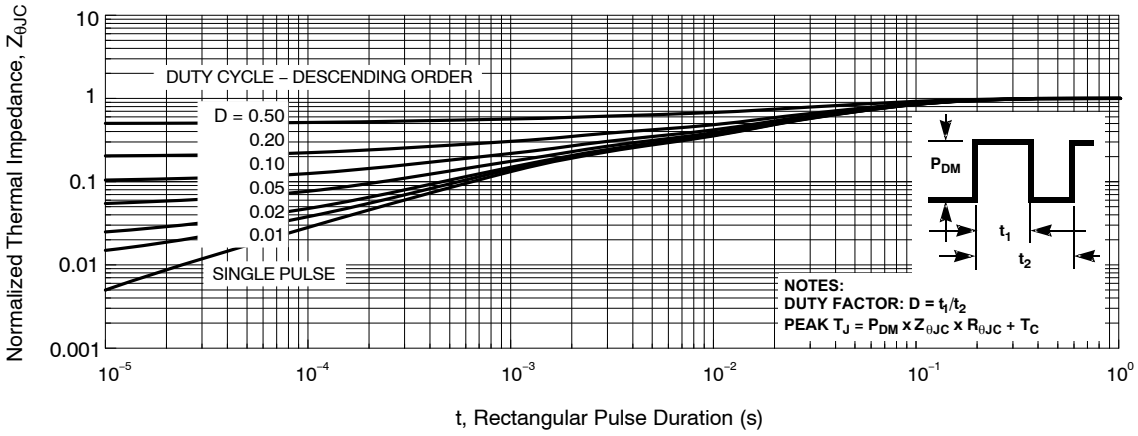

Figure 3. Normalized Maximum Transient Thermal Impedance

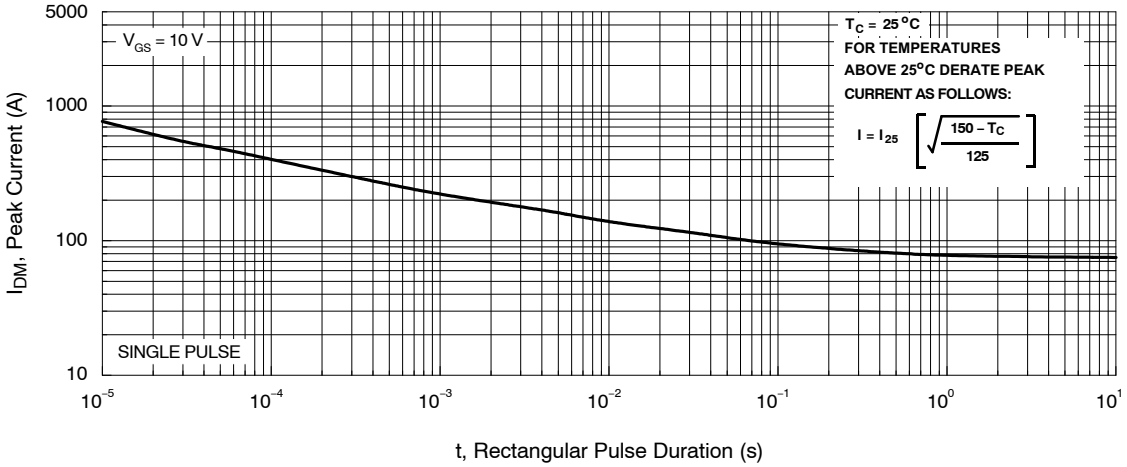

Figure 4. Peak Current Capability

TYPICAL CHARACTERISTICS (continued)

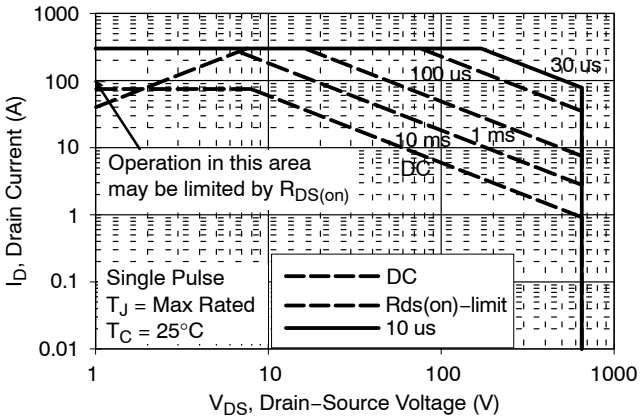

Figure 5. Forward Bias Safe Operating Area

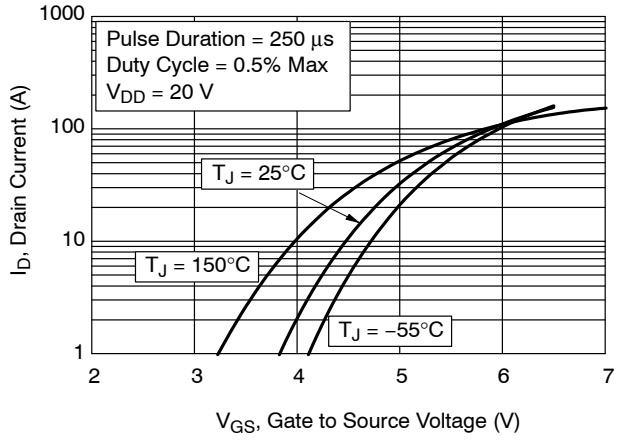

Figure 6. Transfer Characteristic

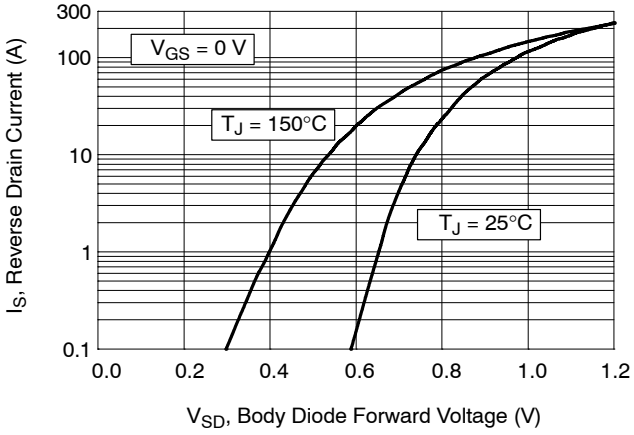

Figure 7. Forward Diode Characteristics

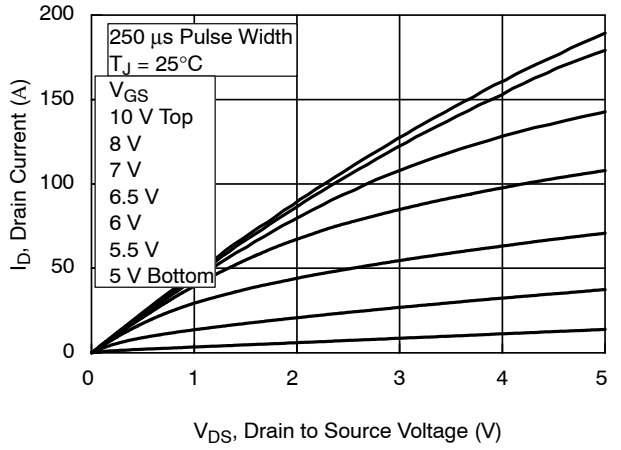

Figure 8. Saturation Characteristics

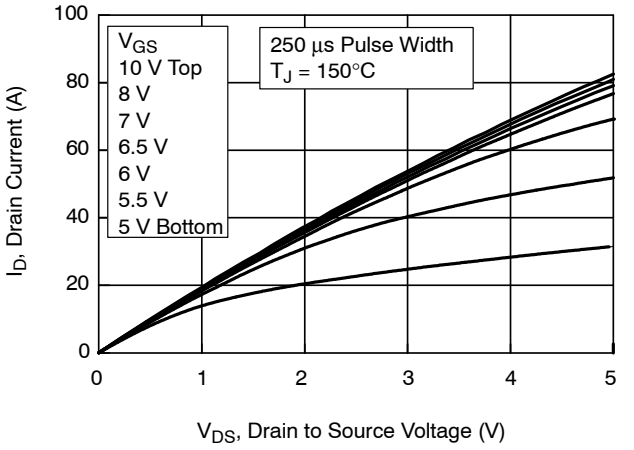

Figure 9. Saturation Characteristics

TYPICAL CHARACTERISTICS (continued)

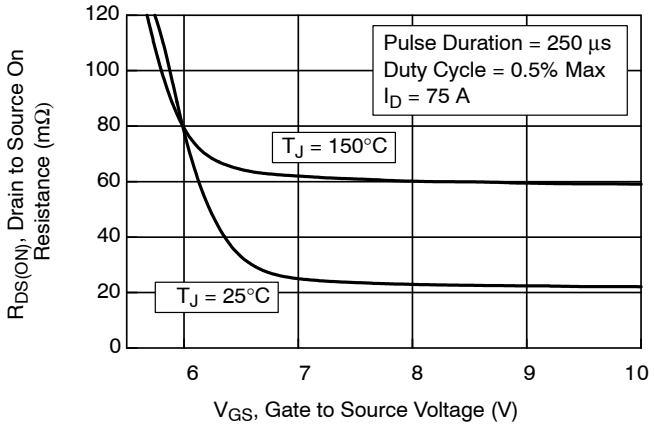

Figure 10. R_{DSON} vs. Gate Voltage

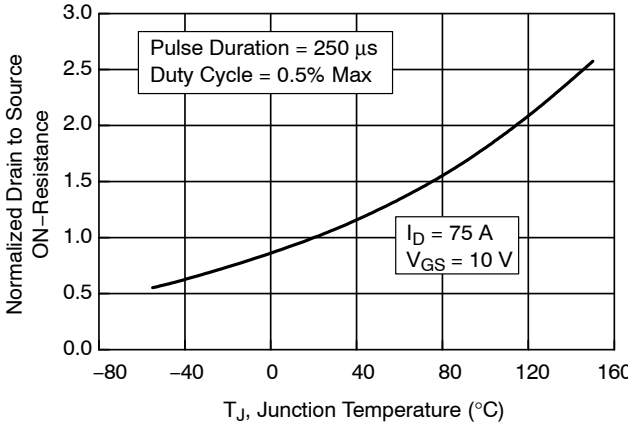

Figure 11. Normalized R_{DSON} vs. Junction Temperature

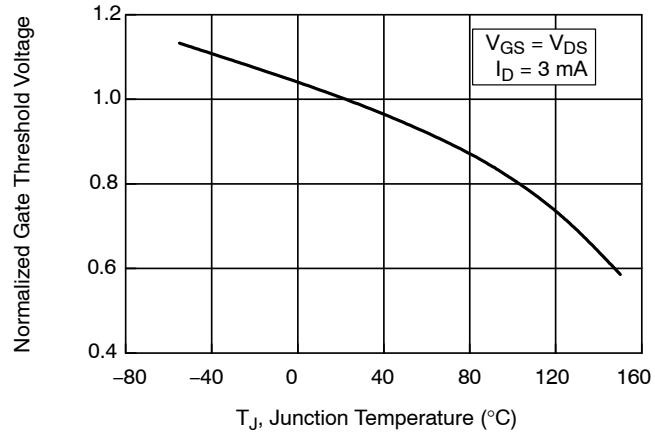

Figure 12. Normalized Gate Threshold Voltage vs. Temperature

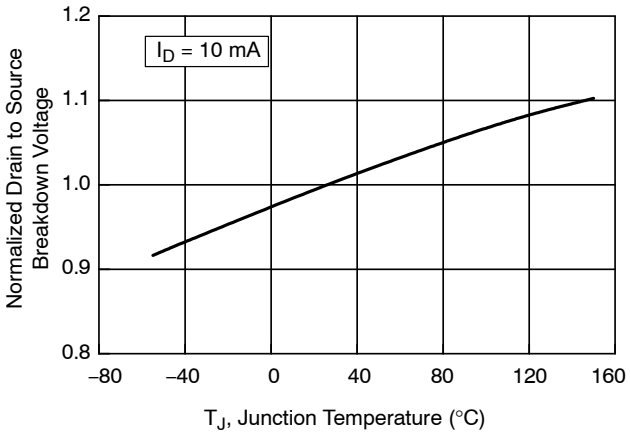

Figure 13. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

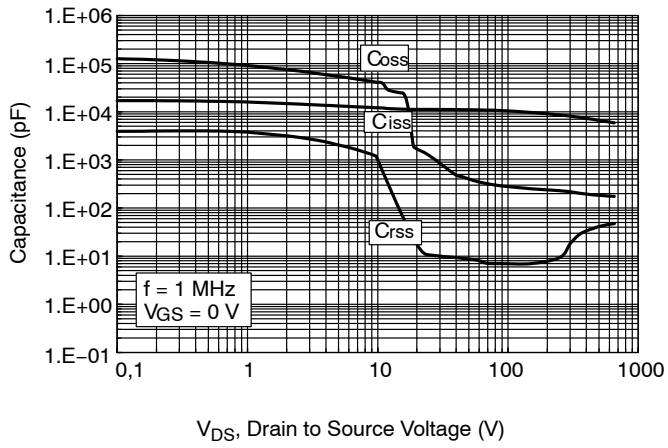

Figure 14. Capacitance vs. Drain to Source Volatage

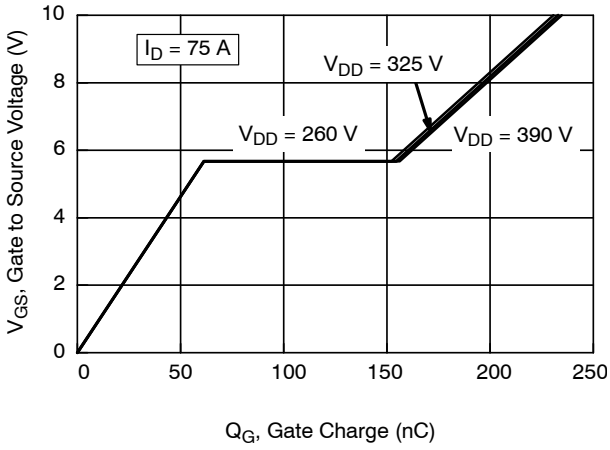

Figure 15. Gate Charge vs. Gate to Source Voltage

TYPICAL CHARACTERISTICS (continued)

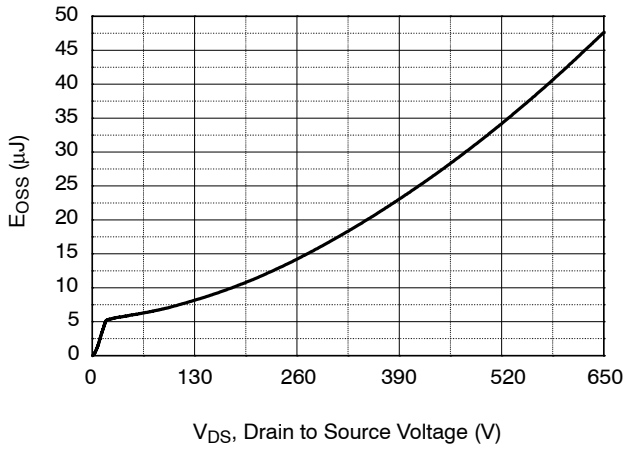

Figure 16. E_{OSS} vs. Drain to Source Voltage

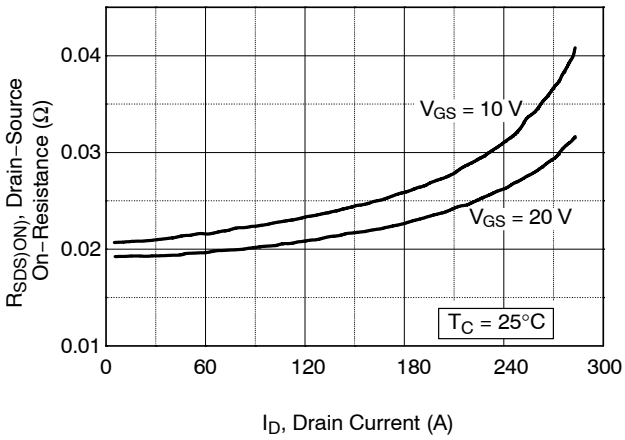

Figure 17. On−Resistance Variation vs. Drain Current and Gate Voltage

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