DATA SHEET
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Silicon Carbide (SiC) MOSFET - EliteSiC, 32 mohm, 650 V, M3S, TO247-4L

NTH4L032N065M3S

Features

- Typical $R_{DS(ON)} = 32\ m\Omega$ @ $V_{GS} = 18\ V$
- Ultra Low Gate Charge ($Q_{G(tot)} = 55\ nC$)
- High Speed Switching with Low Capacitance ($C_{oss} = 114\ pF$)
- 100% Avalanche Tested
- This Device is Halide Free and RoHS Compliant with exemption 7a, Pb−Free 2LI (on second level interconnection)

Applications

- SMPS, Solar Inverters, UPS, Energy Storage, EV Charging Infrastructure

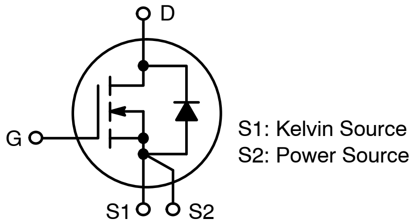
MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter		Symbol	Value	Unit
Drain−to−Source Voltage		V_{DSS}	650	V
Gate−to−Source Voltage		V_{GS}	−8/+22	V
Continuous Drain Current (Note 1)	T_C = 25°C	I_D	23	A
Power Dissipation		P_D	187	W
Continuous Drain Current (Note 2)	T_C = 100°C	I_D	23	A
Power Dissipation		P_D	94	W
Pulsed Drain Current (Note 3)	T_C = 25°C, t_p = 100 μs	I_{DM}	163	A
Continuous Source−Drain Current (Body Diode) (Note 4)	T_C = 25°C, V_{GS} = −3 V	I_S	23	A
	T_C = 100°C, V_{GS} = −3 V		16	
Pulsed Source−Drain Current (Body Diode) (Note 3)	T_C = 25°C, V_{GS} = −3 V, t_p = 100 μs	I_{SM}	121	A
Single Pulse Avalanche Energy (I_{LPK} = 16.7 A, L = 1 mH) (Note 5)		E_{AS}	139	mJ
Operating Junction and Storage Temperature Range		T_J, T_{stg}	−55 to +175	°C
Lead Temperature for Soldering Purposes (1/8″ from case for 10 secs)		T_L	270	°C

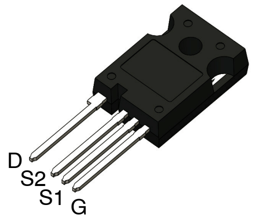
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. 23 A is limited by package. Power chip max drain current is 50 A if limited by max junction temperature.
2. 23 A is limited by package. Power chip max drain current is 35 A if limited by max junction temperature.
3. Repetitive rating, limited by max junction temperature.
4. 23 A is limited by package. Power chip max drain current is 27A if limited by max junction temperature
5. E_{AS} of 139 mJ is based on starting T_J = 25°C, L=1 mH, I_{AS}=16.7 A, V_{DD} = 100 V, V_{GS} = 18 V.

$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	I_D MAX
650 V	32 mΩ @ 18 V	23 A



N−CHANNEL MOSFET



TO−247−4L
CASE 340CJ

MARKING DIAGRAM

H4L032065M3S = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Lot Traceability

ORDERING INFORMATION

Device	Package	Shipping
NTH4L032N065M3S	TO−247−4L	30 Units / Tube

July, 2024 − Rev. 0

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction−to−Case (Note 6)	$R_{\theta JC}$	0.80	°C/W
Thermal Resistance, Junction−to−Ambient (Note 6)	$R_{\theta JA}$	40	

6. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value	Unit
Operation Values of Gate−to−Source Voltage	V_{GSop}	−5...−3/+18	V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 1 mA, T_J = 25°C	650	–	–	V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$\Delta V_{(BR)DSS}/\Delta T_J$	I_D = 1 mA, Referenced to 25°C	–	90	–	mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 650 V, T_J = 25°C	–	–	10	μA
		V_{DS} = 650 V, T_J = 175°C (Note 8)	–	–	500	μA
Gate−to−Source Leakage Current	I_{GSS}	V_{GS} = −8/+22 V, V_{DS} = 0 V	–	–	±1.0	μA
ON CHARACTERISTICS						
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 18 V, I_D = 15 A, T_J = 25°C	–	32	44	mΩ
		V_{GS} = 18 V, I_D = 15 A, T_J = 175°C (Note 8)	–	49	–	
		V_{GS} = 15 V, I_D = 15 A, T_J = 25°C	–	41	–	
		V_{GS} = 15 V, I_D = 15 A, T_J = 175°C (Note 8)	–	52	–	
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 7.5 mA, T_J = 25°C	2.0	2.9	4.0	V
Forward Transconductance	g_{FS}	V_{DS} = 10 V, I_D = 15 A	–	9.9	–	S
CHARGES, CAPACITANCES & GATE RESISTANCE						
Input Capacitance	C_{ISS}	V_{DS} = 400 V, V_{GS} = 0 V, f = 1 MHz (Note 8)	–	1410	–	pF
Output Capacitance	C_{OSS}		–	114	–	
Reverse Transfer Capacitance	C_{RSS}		–	9.2	–	
Total Gate Charge	$Q_{G(TOT)}$	V_{DD} = 400 V, I_D = 15 A, V_{GS} = −3/18 V (Note 8)	–	55	–	nC
Gate−to−Source Charge	Q_{GS}		–	15	–	
Gate−to−Drain Charge	Q_{GD}		–	14	–	
Gate Resistance	R_G	f = 1 MHz	–	5.0	–	Ω
SWITCHING CHARACTERISTICS						
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = −3/18 V, V_{DD} = 400 V, I_D = 15 A, R_G = 4.7 Ω, T_J = 25°C (Notes 7, 8)	–	8.8	–	ns
Turn−Off Delay Time	$t_{d(OFF)}$		–	31	–	
Rise Time	t_r		–	12	–	
Fall Time	t_f		–	9	–	
Turn−On Switching Loss	E_{ON}		–	33	–	μJ
Turn−Off Switching Loss	E_{OFF}		–	16	–	
Total Switching Loss	E_{TOT}		–	49	–	

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS						
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = −3/18 V, V_{DD} = 400 V, I_D = 15 A, R_G = 4.7 Ω, T_J = 175°C (Notes 7, 8)	–	7.8	–	ns
Turn−Off Delay Time	$t_{d(OFF)}$		–	37	–	
Rise Time	t_r		–	12	–	
Fall Time	t_f		–	11	–	
Turn−On Switching Loss	E_{ON}		–	31	–	μJ
Turn−Off Switching Loss	E_{OFF}		–	25	–	
Total Switching Loss	E_{TOT}		–	56	–	
SOURCE−TO−DRAIN DIODE CHARACTERISTICS						
Forward Diode Voltage	V_{SD}	I_{SD} = 15 A, V_{GS} = −3 V, T_J = 25°C	–	4.5	6.0	V
		I_{SD} = 15 A, V_{GS} = −3 V, T_J = 175°C (Note 8)	–	4.1	–	
Reverse Recovery Time	t_{RR}	V_{GS} = −3 V, I_S = 15 A, dI/dt = 1000 A/μs, V_{DS} = 400 V (Note 8)	–	15.5	–	ns
Charge Time	t_a		–	8.9	–	
Discharge Time	t_b		–	6.6	–	
Reverse Recovery Charge	Q_{RR}		–	72	–	nC
Reverse Recovery Energy	E_{REC}		–	4.6	–	μJ
Peak Reverse Recovery Current	I_{RRM}		–	9.3	–	A

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.

7. E_{ON}/E_{OFF} result is with body diode.
8. Defined by design, not subject to production test.

TYPICAL CHARACTERISTICS

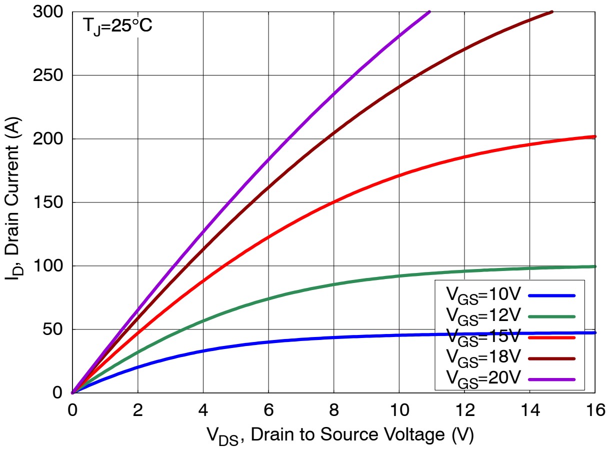


Figure 1. On−Region Characteristics

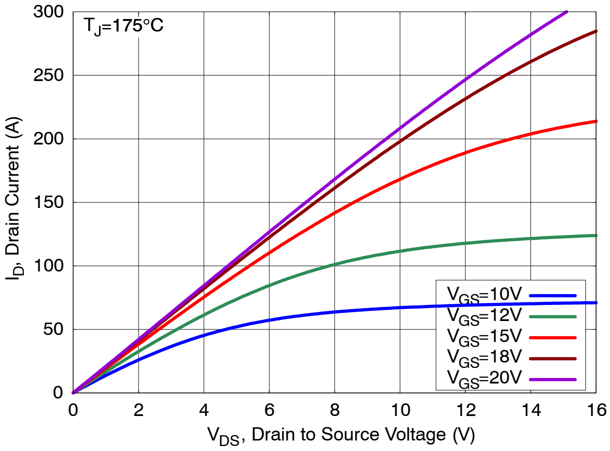


Figure 2. Output Characteristics

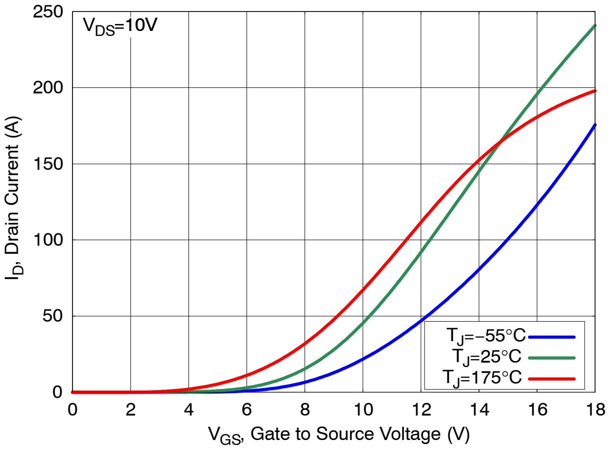


Figure 3. Transfer Characteristics

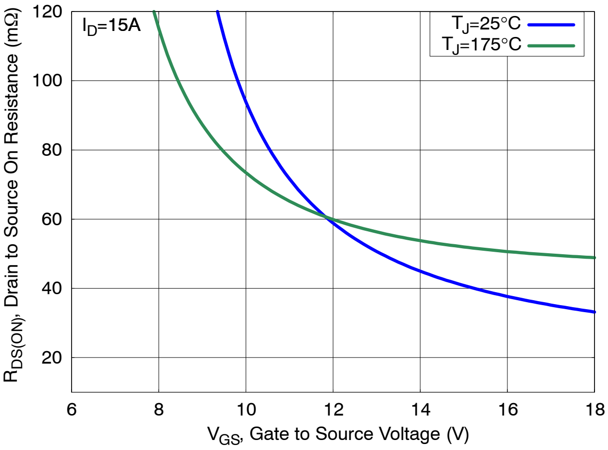


Figure 4. On−Resistance vs. Gate Voltage

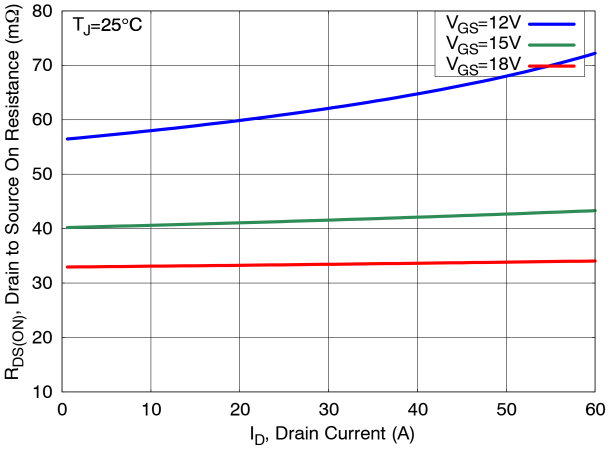


Figure 5. On−Resistance vs. Drain Current

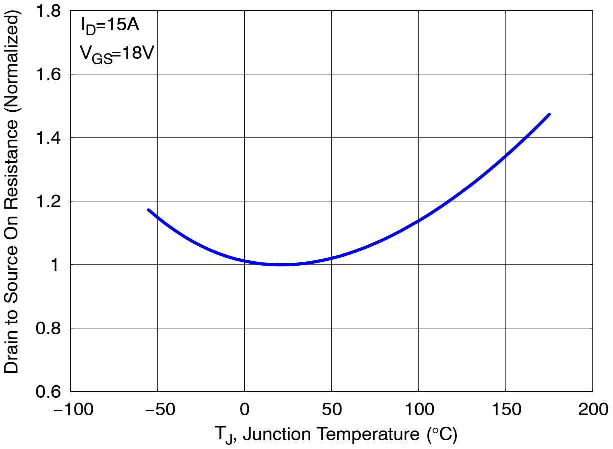


Figure 6. On−Resistance vs. Junction Temperature

TYPICAL CHARACTERISTICS

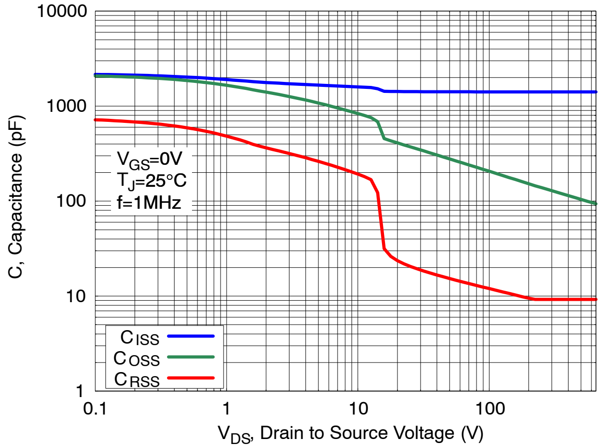


Figure 7. Capacitance Characteristics

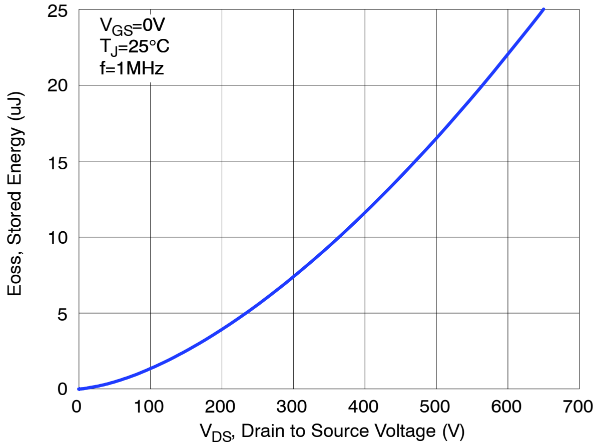


Figure 8. Stored Energy vs. Drain−to−Source Voltage

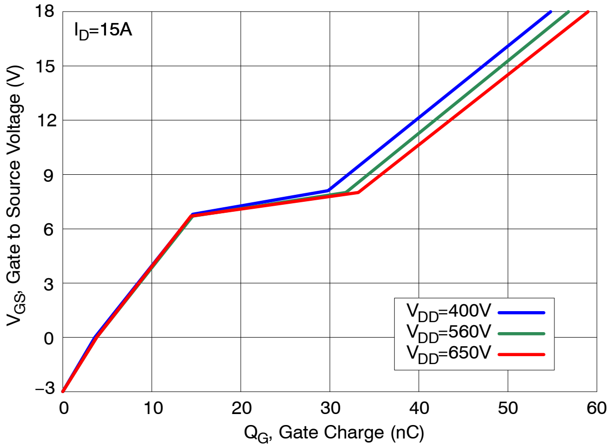


Figure 9. Gate Charge Characteristics

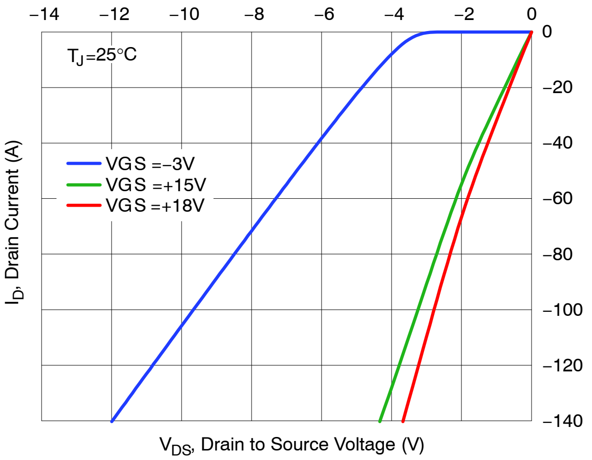


Figure 10. Reverse Conduction Characteristics

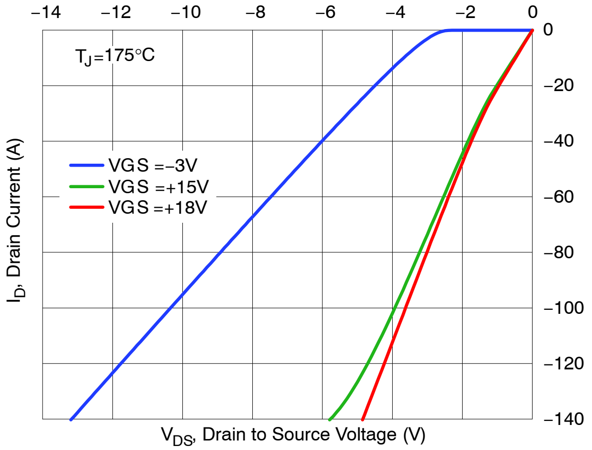


Figure 11. Reverse Conduction Characteristics

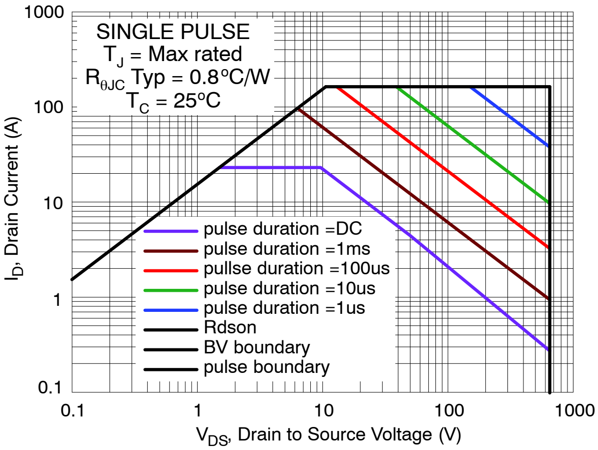


Figure 12. Safe Operating Area

TYPICAL CHARACTERISTICS

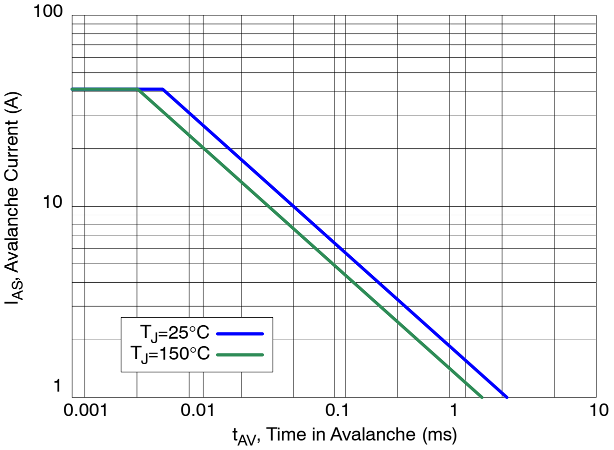


Figure 13. Avalanche Current vs. Pulse Time (UIS)

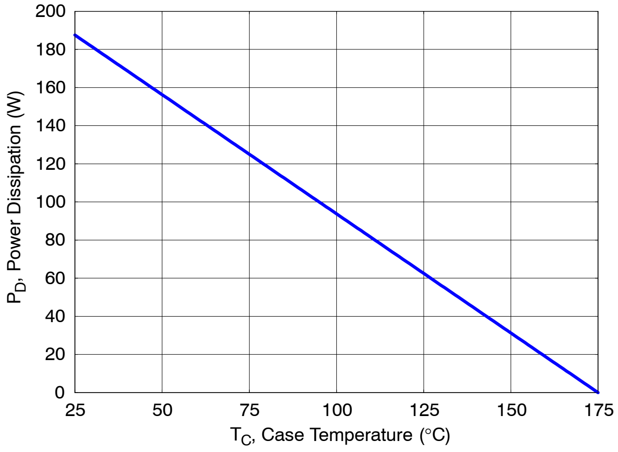


Figure 14. Maximum Power Dissipation vs. Case Temperature

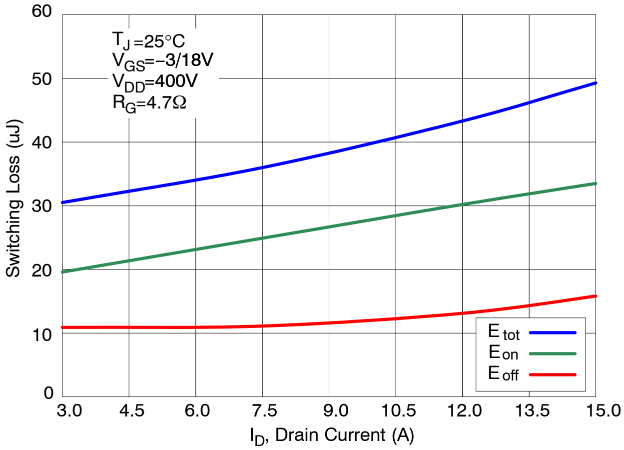


Figure 15. Inductive Switching Loss vs. Drain Current

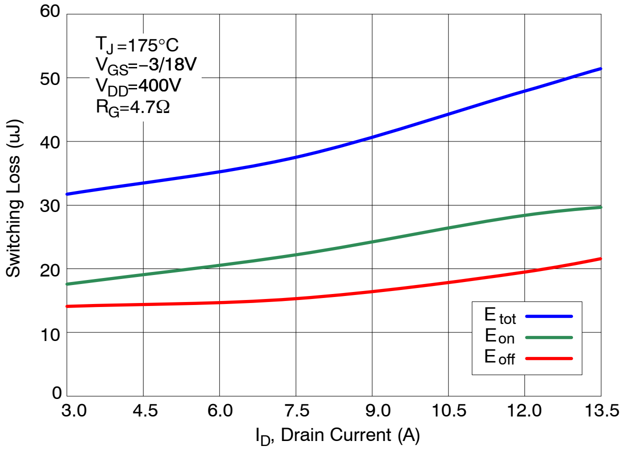


Figure 16. Inductive Switching Loss vs. Drain Current

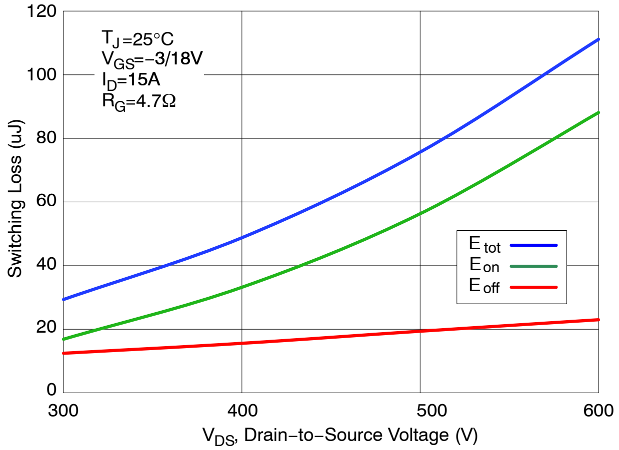


Figure 17. Inductive Switching Loss vs. Drain Voltage

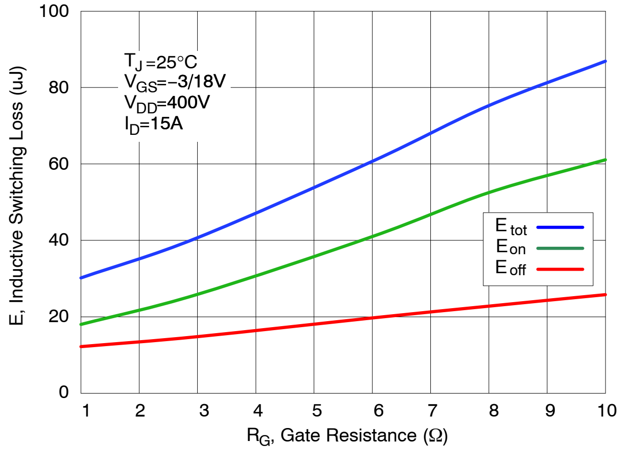


Figure 18. Inductive Switching Loss vs. Gate Resistance

TYPICAL CHARACTERISTICS

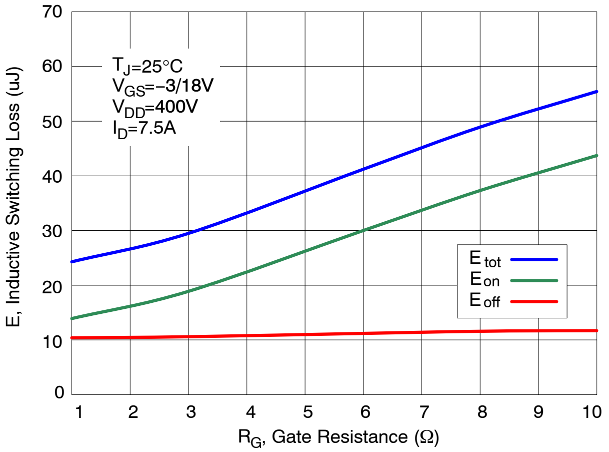


Figure 19. Inductive Switching Loss vs. Gate Resistance

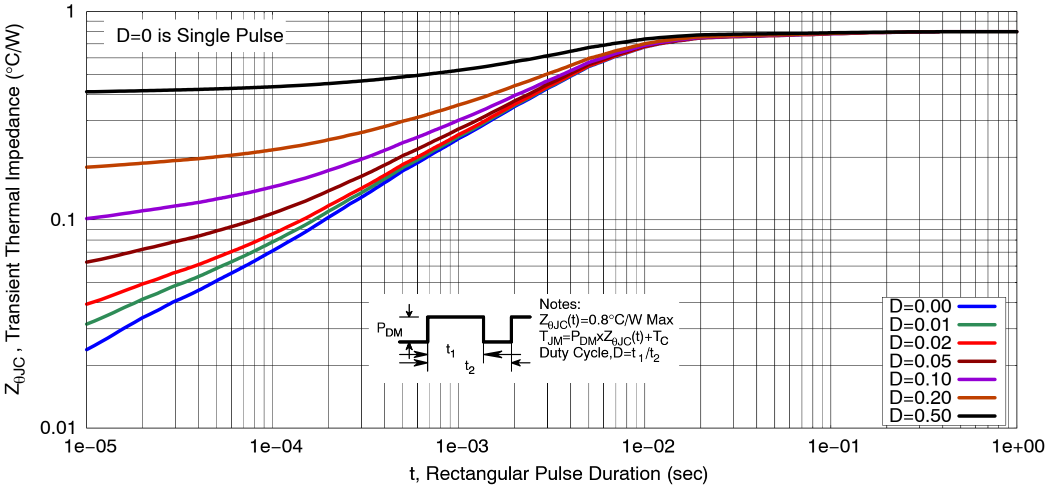


Figure 20. Thermal Response Characteristics