

Silicon Carbide (SiC) MOSFET – EliteSiC, 16.8 mohm, 650 V, M3S, TO-247-3L

NTHL016N065M3S

Features

- Typical $R_{DS(on)} = 16.8 \text{ m}\Omega$ @ $V_{GS} = 18 \text{ V}$
- Ultra Low Gate Charge ($Q_{G(tot)} = 100 \text{ nC}$)
- High Speed Switching with Low Capacitance ($C_{oss} = 202 \text{ pF}$)
- 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

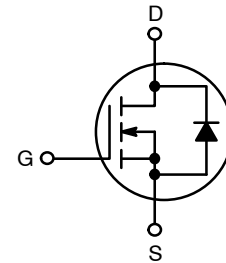
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	650	V
Gate-to-Source Voltage	V_{GS}	-10/+22.6	V
Continuous Drain Current	$T_C = 25^\circ\text{C}$	I_D	94
Power Dissipation		P_D	333
Continuous Drain Current	$T_C = 100^\circ\text{C}$	I_D	66
Power Dissipation		P_D	167
Pulsed Drain Current (Note 1)	$T_C = 25^\circ\text{C}$ $t_p = 100 \mu\text{s}$	I_{DM}	287
Continuous Source-Drain Current (Body Diode)	$T_C = 25^\circ\text{C}$ $V_{GS} = -3 \text{ V}$	I_S	52
	$T_C = 100^\circ\text{C}$ $V_{GS} = -3 \text{ V}$		30
Pulsed Source-Drain Current (Body Diode) (Note 1)	$T_C = 25^\circ\text{C}$ $V_{GS} = -3 \text{ V}$ $t_p = 100 \mu\text{s}$	I_{SM}	298
Single Pulse Avalanche Energy (Note 2)	$I_{LPK} = 60 \text{ A}$ $L = 0.1 \text{ mH}$	E_{AS}	180
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +175	$^\circ\text{C}$
Lead Temperature for Soldering Purposes (1/8" from case for 10 seconds)	T_L	268	$^\circ\text{C}$

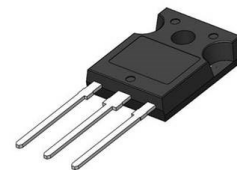
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Single pulse, limited by max junction temperature.
2. E_{AS} of 180 mJ is based on starting $T_J = 25^\circ\text{C}$, $L = 0.1 \text{ mH}$, $I_{AS} = 60 \text{ A}$, $V_{DD} = 100 \text{ V}$, $V_{GS} = 18 \text{ V}$.

$V_{(BR)DSS}$	$R_{DS(on)} \text{ TYP}$	$I_D \text{ MAX}$
650 V	16.8 m Ω @ 18 V	94 A

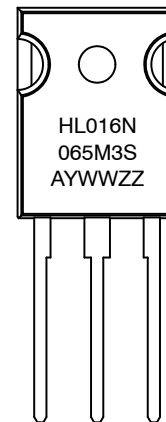


N-Channel MOSFET



TO-247-3LD
CASE 340CX

MARKING DIAGRAM



HL016N065M3S = Specific Device Code

A = Assembly Location

Y = Year

WW = Work Week

ZZ = Lot Traceability

ORDERING INFORMATION

Device	Package	Shipping
NTHL016N065M3S	TO-247-3L	30 Units / Tube

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Note 3)	$R_{\theta JC}$	0.45	$^{\circ}\text{C}/\text{W}$

3. 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}	-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 ($T_J = 25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_J = 25^{\circ}\text{C}$	650			V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 650\text{ V}, T_J = 25^{\circ}\text{C}$			10	μA
		$V_{DS} = 650\text{ V}, T_J = 175^{\circ}\text{C}$ (Note 5)			500	μA
Gate-to-Source Leakage Current	I_{GSS}	$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$	-1			μA
		$V_{GS} = +22.6\text{ V}, V_{DS} = 0\text{ V}$			1	

ON CHARACTERISTICS

Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 18\text{ V}, I_D = 30\text{ A}, T_J = 25^{\circ}\text{C}$		16.8	23.5	$\text{m}\Omega$
		$V_{GS} = 18\text{ V}, I_D = 30\text{ A}, T_J = 175^{\circ}\text{C}$ (Note 5)		26		
		$V_{GS} = 15\text{ V}, I_D = 30\text{ A}, T_J = 25^{\circ}\text{C}$		20.3		
		$V_{GS} = 15\text{ V}, I_D = 30\text{ A}, T_J = 175^{\circ}\text{C}$ (Note 5)		27.9		
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 15\text{ mA}, T_J = 25^{\circ}\text{C}$	2.0	2.7	4.0	V
Forward Transconductance	g_{FS}	$V_{DS} = 10\text{ V}, I_D = 30\text{ A}$ (Note 5)		27		S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ (Note 5)		2734		pF
Output Capacitance	C_{OSS}			208		
Reverse Transfer Capacitance	C_{RSS}			18		
Total Gate Charge	$Q_{G(TOT)}$	$V_{DD} = 400\text{ V}, I_D = 30\text{ A}, V_{GS} = -3/18\text{ V}$ (Note 5)		100		nC
Gate-to-Source Charge	Q_{GS}			19		
Gate-to-Drain Charge	Q_{GD}			25		
Gate Resistance	R_G	$f = 1\text{ MHz}$		3.2		Ω

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -3/18\text{ V}, V_{DD} = 400\text{ V}, I_D = 30\text{ A}, R_G = 4.7\text{ }\Omega, L_{stray} = 18\text{ nH}, T_J = 25^{\circ}\text{C}$ (Notes 4, 5)		39		ns
Turn-Off Delay Time	$t_{d(OFF)}$			46		
Rise Time	t_r			13		
Fall Time	t_f			13		
Turn-On Switching Loss	E_{ON}			288		μJ
Turn-Off Switching Loss	E_{OFF}			105		
Total Switching Loss	E_{TOT}			393		

NTHL016N065M3S

ELECTRICAL CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -3/18\text{ V}$, $V_{DD} = 400\text{ V}$, $I_D = 30\text{ A}$, $R_G = 4.7\text{ }\Omega$, $L_{stray} = 18\text{ nH}$, $T_J = 175\text{ }^{\circ}\text{C}$ (Notes 4, 5)		39		ns
Turn-Off Delay Time	$t_{d(OFF)}$			55		
Rise Time	t_r			11		
Fall Time	t_f			14		
Turn-On Switching Loss	E_{ON}			303		μJ
Turn-Off Switching Loss	E_{OFF}			135		
Total Switching Loss	E_{TOT}			438		

SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$I_{SD} = 30\text{ A}$, $V_{GS} = -3\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$		4.6	6.0	V
		$I_{SD} = 30\text{ A}$, $V_{GS} = -3\text{ V}$, $T_J = 175\text{ }^{\circ}\text{C}$ (Note 5)		4.3		
Reverse Recovery Time	t_{RR}	$V_{GS} = -3\text{ V}$, $I_S = 30\text{ A}$, $di/dt = 1000\text{ A}/\mu\text{s}$, $V_{DS} = 400\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ (Note 5)		44		ns
Charge Time	t_a			13		
Discharge Time	t_b			32		
Reverse Recovery Charge	Q_{RR}			203		nC
Reverse Recovery Energy	E_{REC}			32		μJ
Peak Reverse Recovery Current	I_{RRM}			10		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.

4. E_{ON}/E_{OFF} result is with body diode.

5. Defined by design, not subject to production test.



TYPICAL CHARACTERISTICS

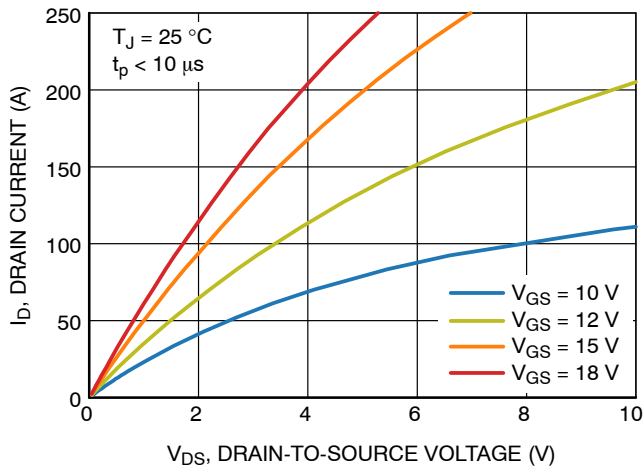


Figure 1. Output Characteristics

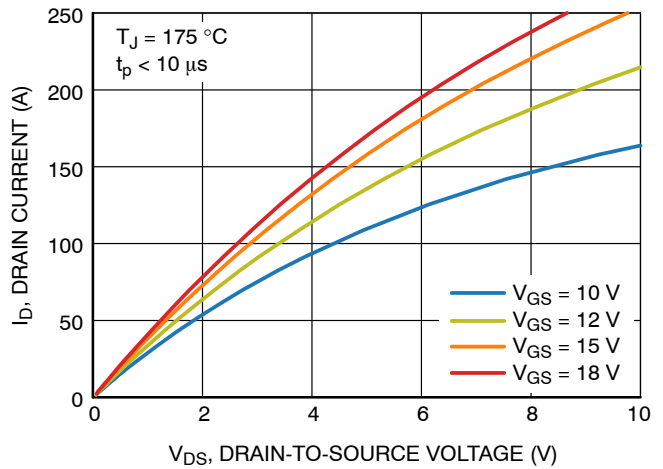


Figure 2. Output Characteristics

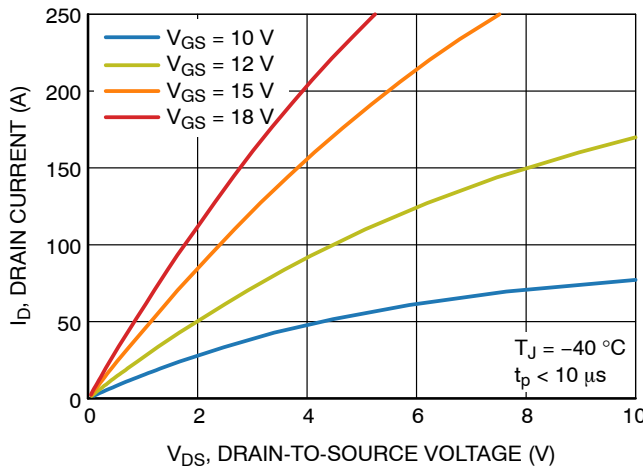


Figure 3. Output Characteristics

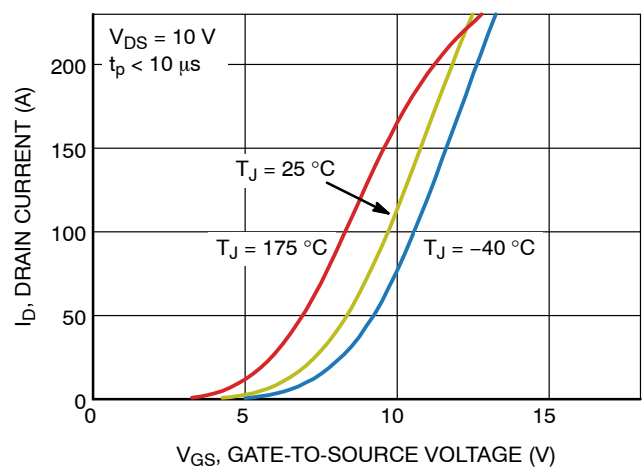


Figure 4. Transfer Characteristics

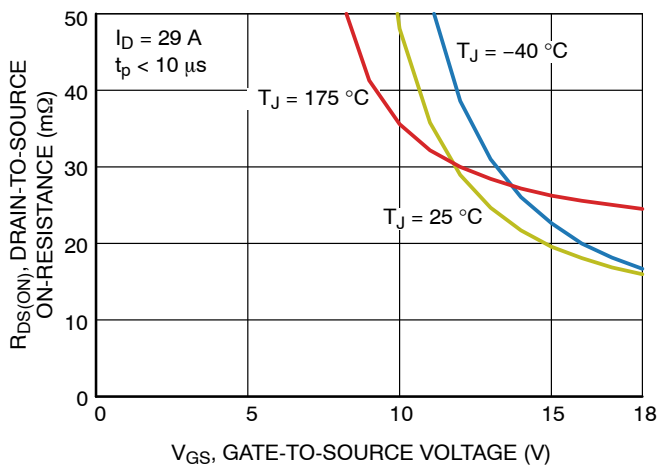


Figure 5. On-Resistance vs. Gate Voltage

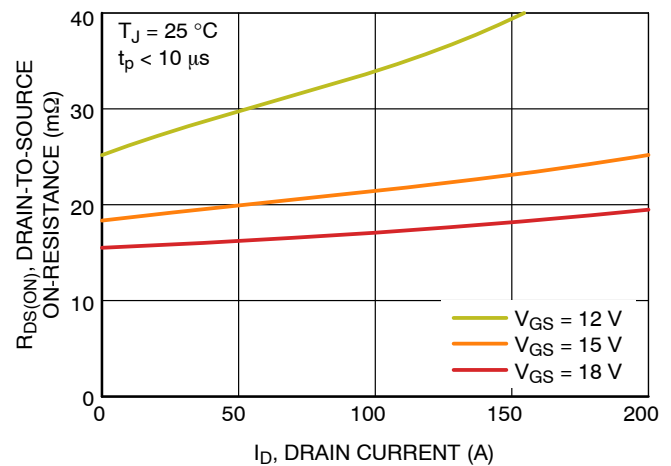


Figure 6. On-Resistance vs. Drain Current

TYPICAL CHARACTERISTICS (continued)

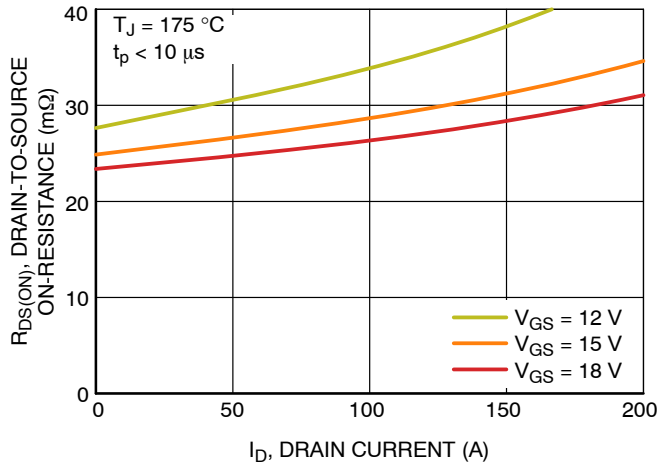


Figure 7. On-Resistance vs. Drain Current

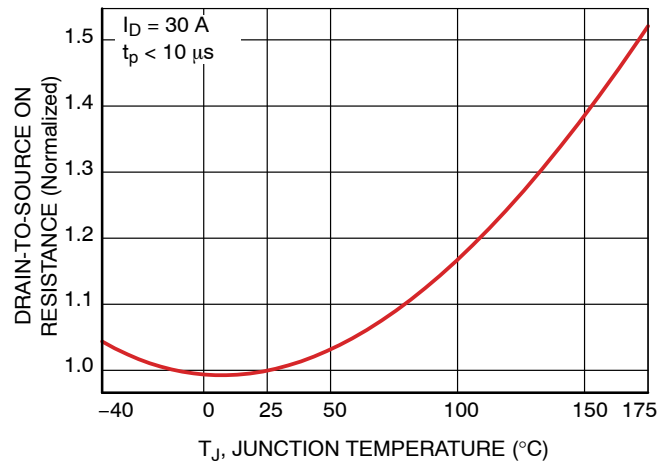


Figure 8. On-Resistance vs. Junction Temperature

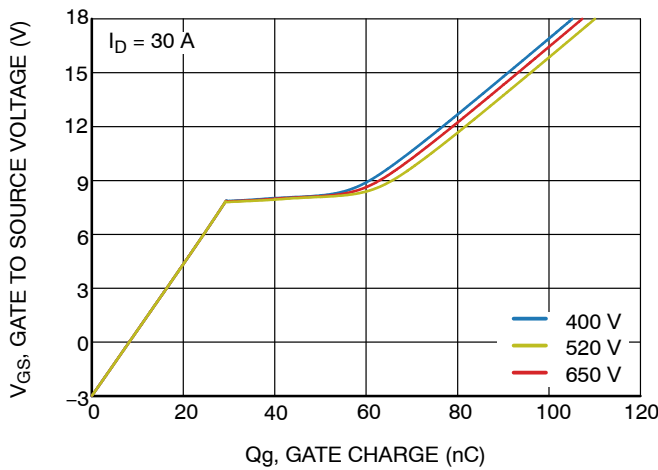


Figure 9. Gate Charge Characteristics

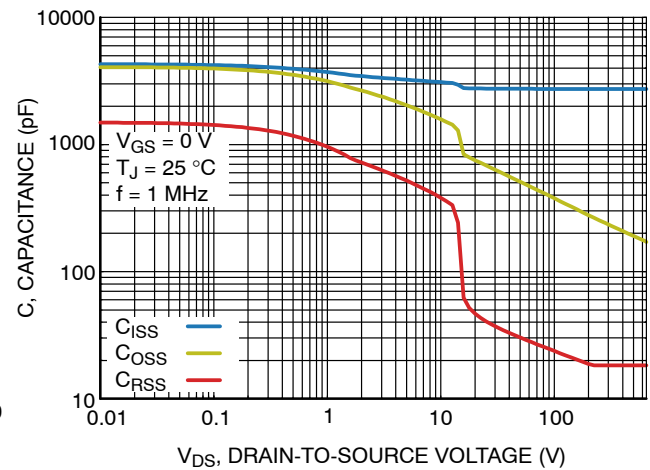


Figure 10. Capacitance Characteristics

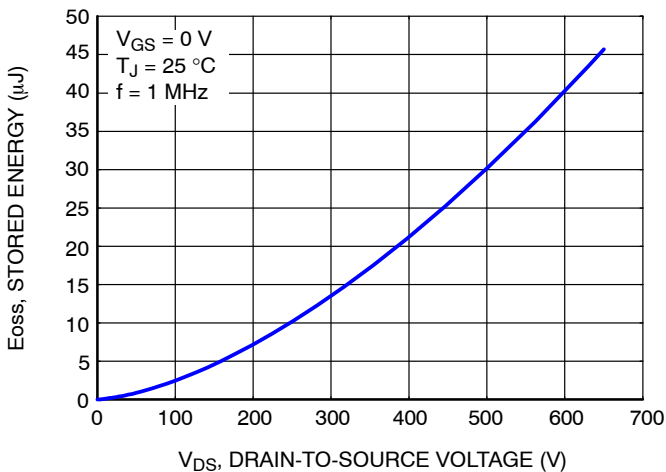


Figure 11. Stored Energy vs. Drain to Source Voltage

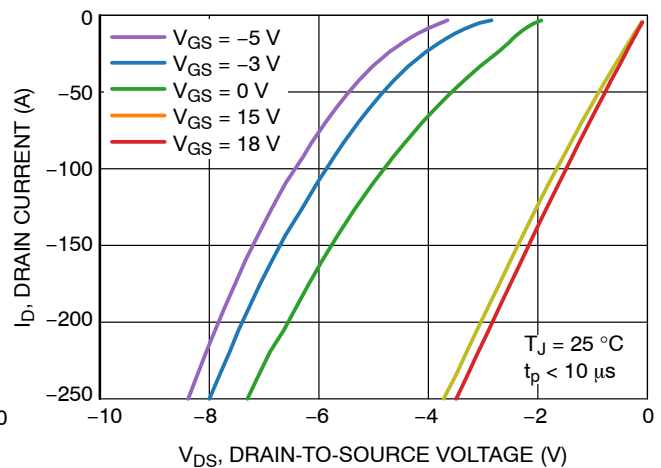


Figure 12. Reverse Conduction Characteristics

TYPICAL CHARACTERISTICS (continued)

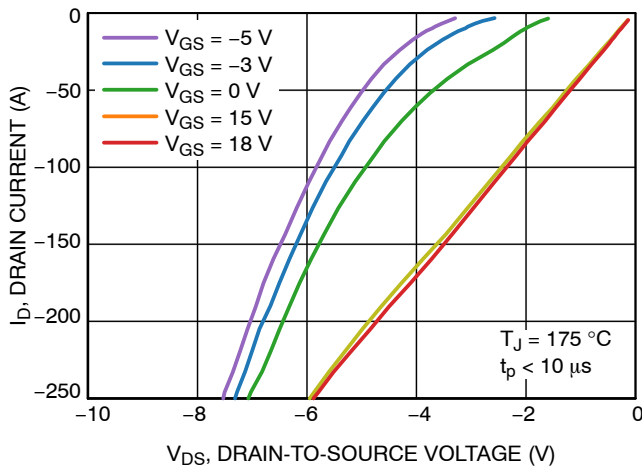


Figure 13. Reverse Conduction Characteristics

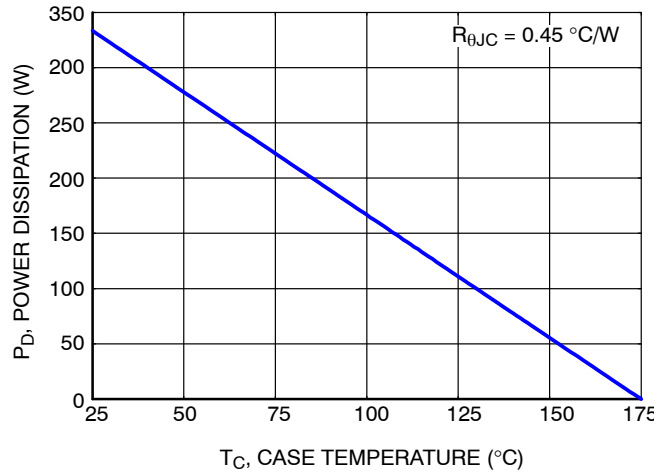


Figure 14. Maximum Power Dissipation vs. Case Temperature

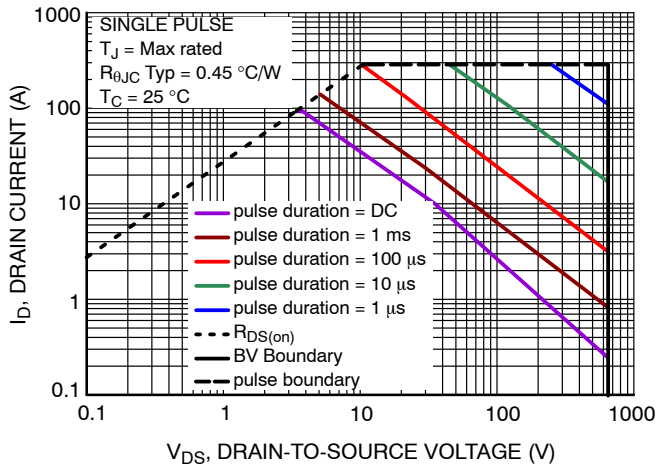


Figure 15. Safe Operating Area

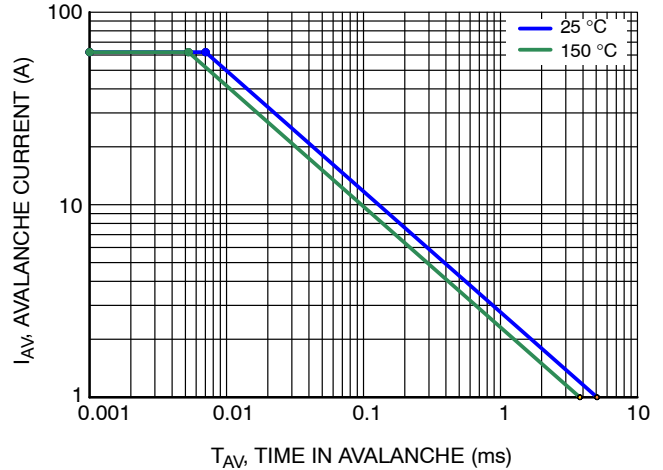


Figure 16. Avalanche Current vs. Pulse Time (UIS)

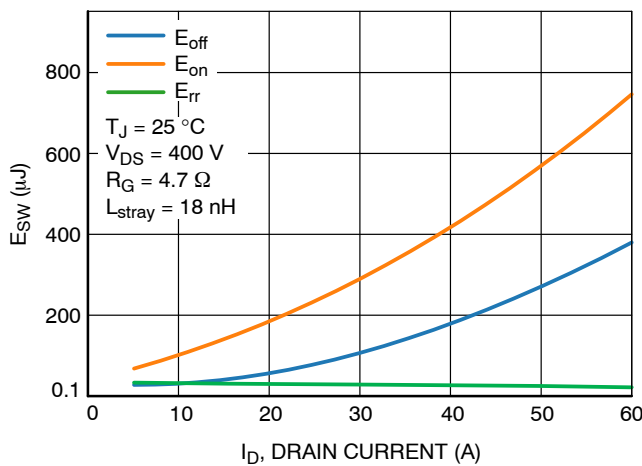


Figure 17. Inductive Switching Loss vs. Drain Current

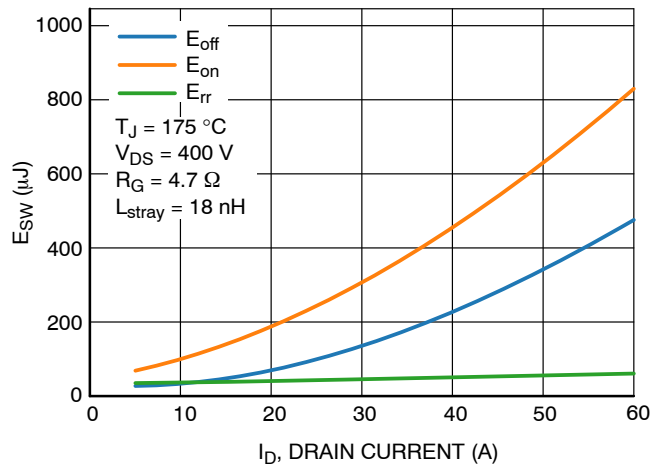


Figure 18. Inductive Switching Loss vs. Drain Current

TYPICAL CHARACTERISTICS (continued)

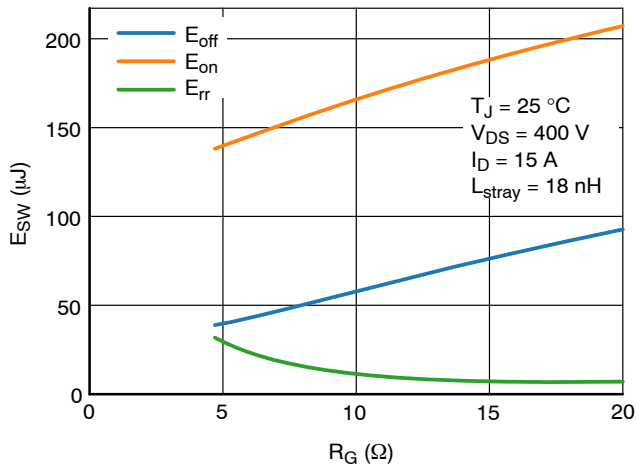


Figure 19. Inductive Switching Loss vs. Gate Resistance

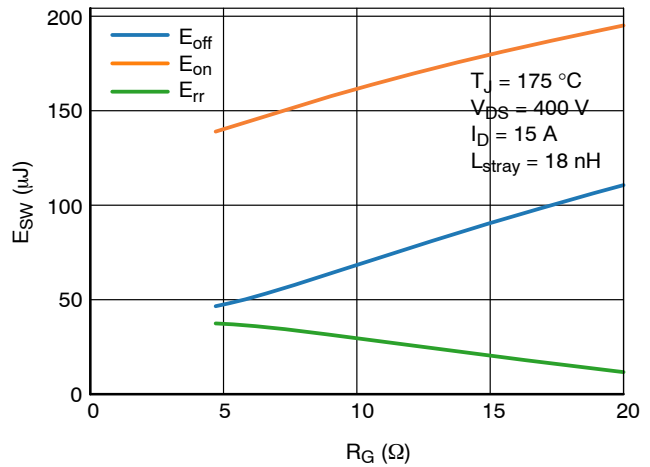


Figure 20. Inductive Switching Loss vs. Gate Resistance

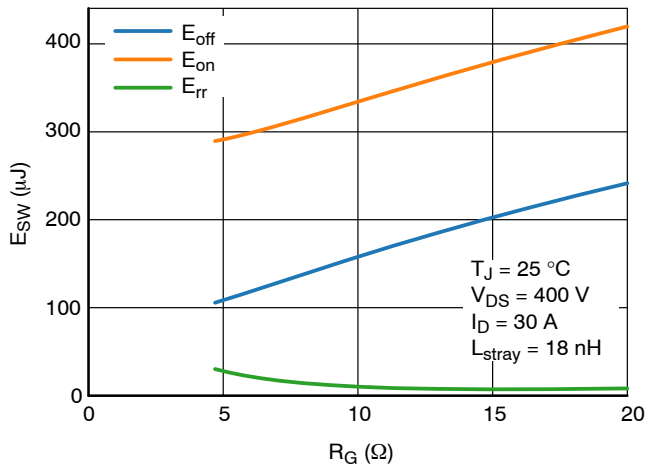


Figure 21. Inductive Switching Loss vs. Gate Resistance

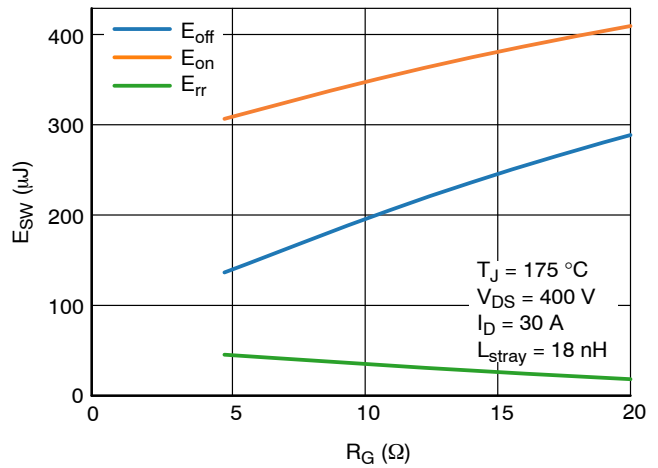


Figure 22. Inductive Switching Loss vs. Gate Resistance

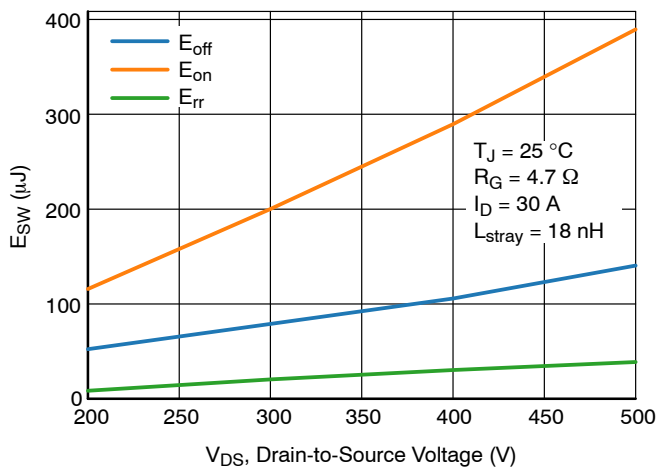


Figure 23. Inductive Switching Loss vs. Drain-to-Source Voltage

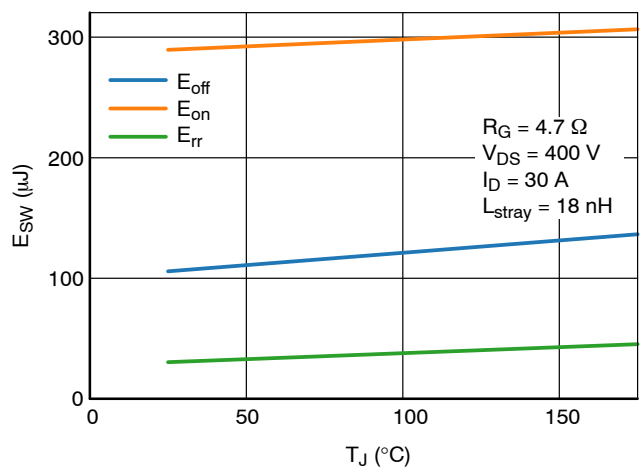


Figure 24. Inductive Switching Loss vs. Junction Temperature

TYPICAL CHARACTERISTICS (continued)

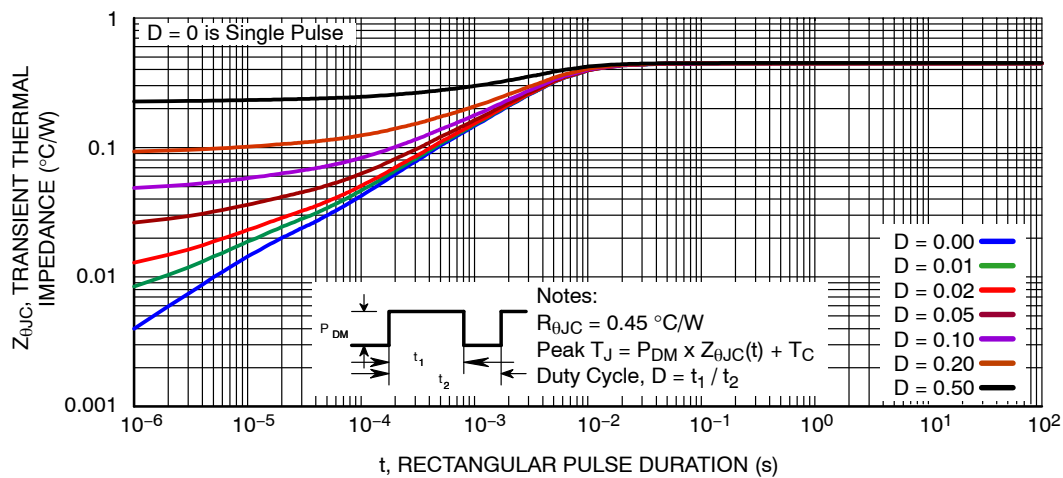


Figure 25. Thermal Response Characteristics

NTHL016N065M3S

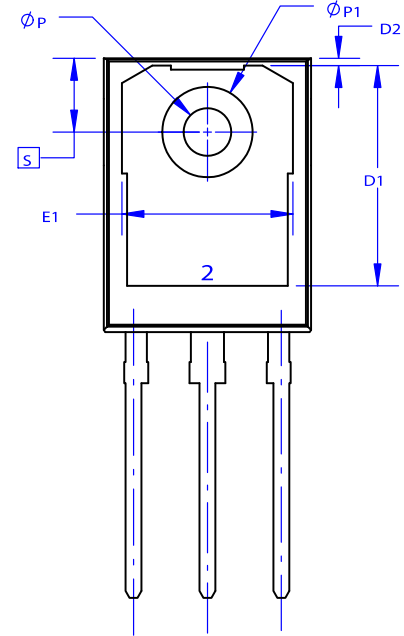
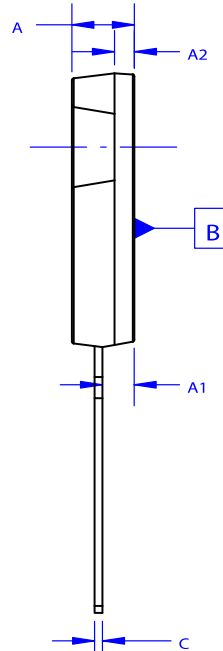
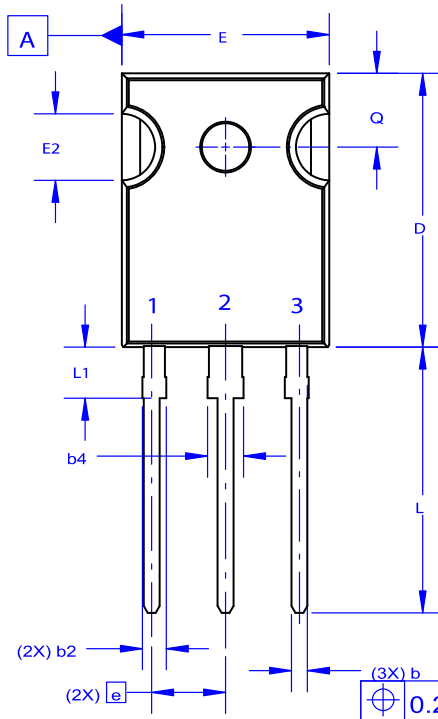
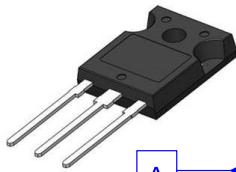
REVISION HISTORY

Revision	Description of Changes	Date
0	Initial Production Document version release.	2/10/2026



TO-247-3LD
CASE 340CX
ISSUE A

DATE 06 JUL 2020



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
B. ALL DIMENSIONS ARE IN MILLIMETERS.
C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

GENERIC
MARKING DIAGRAM*


XXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

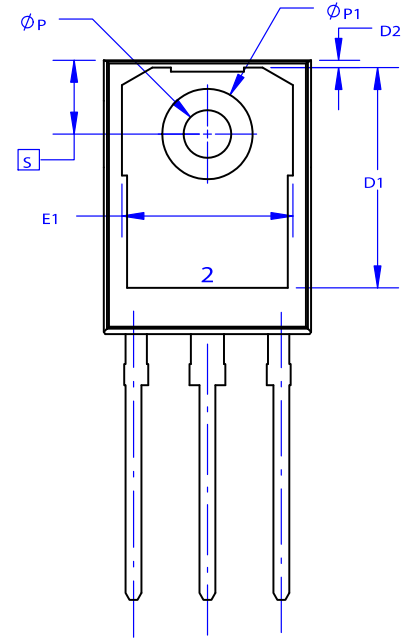
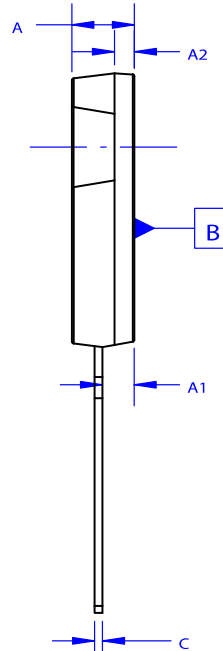
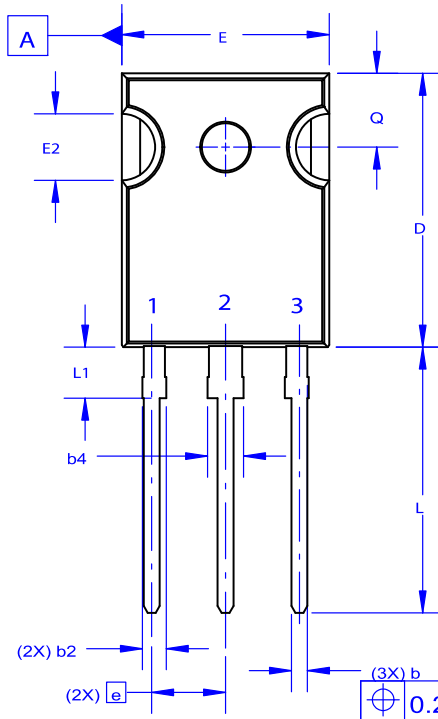
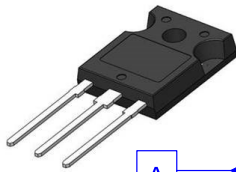
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
D	20.32	20.57	20.82
E	15.37	15.62	15.87
E2	4.96	5.08	5.20
e	~	5.56	~
L	19.75	20.00	20.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
Q	5.34	5.46	5.58
S	5.34	5.46	5.58
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D1	13.08	~	~
D2	0.51	0.93	1.35
E1	12.81	~	~
ØP1	6.60	6.80	7.00

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DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
D	20.32	20.57	20.82
E	15.37	15.62	15.87
E2	4.96	5.08	5.20
e	~	5.56	~
L	19.75	20.00	20.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
Q	5.34	5.46	5.58
S	5.34	5.46	5.58
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D1	13.08	~	~
D2	0.51	0.93	1.35
E1	12.81	~	~
ØP1	6.60	6.80	7.00

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DESCRIPTION:	TO-247-3LD	PAGE 1 OF 1

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