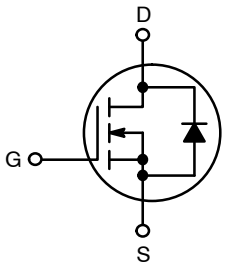
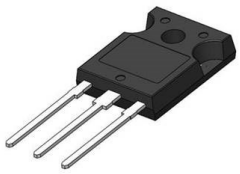
Silicon Carbide (SiC) MOSFET – EliteSiC, 16.8 mohm, 650 V, M3S, TO-247-3L

NTHL016N065M3S

$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	I_D MAX
650 V	16.8 mΩ @ 18 V	94 A



N-Channel MOSFET



TO-247-3LD
CASE 340CX

Features

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

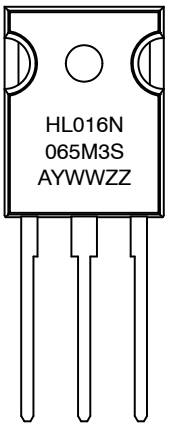
MAXIMUM RATINGS (T_J = 25 °C unless otherwise noted)

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		V_{DSS}	650	V
Gate-to-Source Voltage		V_{GS}	−10/+22.6	V
Continuous Drain Current	T_C = 25 °C	I_D	94	A
Power Dissipation		P_D	333	W
Continuous Drain Current	T_C = 100 °C	I_D	66	A
Power Dissipation		P_D	167	W
Pulsed Drain Current (Note 1)	T_C = 25 °C, t_p = 100 μs	I_{DM}	287	A
Continuous Source-Drain Current (Body Diode)	T_C = 25 °C, V_{GS} = −3 V	I_S	52	A
	T_C = 100 °C, V_{GS} = −3 V		30	
Pulsed Source-Drain Current (Body Diode) (Note 1)	T_C = 25 °C, V_{GS} = −3 V, t_p = 100 μs	I_{SM}	298	
Single Pulse Avalanche Energy (Note 2)	I_{LPK} = 60 A, L = 0.1 mH	E_{AS}	180	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 seconds)		T_L	268	°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 °C, L = 0.1 mH, I_{AS} = 60 A, V_{DD} = 100 V, V_{GS} = 18 V.

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	°C/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 °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
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 5)			500	μA
Gate-to-Source Leakage Current	I_{GSS}	V_{GS} = −10 V, V_{DS} = 0 V	−1			μA
		V_{GS} = +22.6 V, V_{DS} = 0 V			1	
ON CHARACTERISTICS						
Drain-to-Source On Resistance	$R_{DS(on)}$	V_{GS} = 18 V, I_D = 30 A, T_J = 25 °C		16.8	23.5	mΩ
		V_{GS} = 18 V, I_D = 30 A, T_J = 175 °C (Note 5)		26		
		V_{GS} = 15 V, I_D = 30 A, T_J = 25 °C		20.3		
		V_{GS} = 15 V, I_D = 30 A, T_J = 175 °C (Note 5)		27.9		
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 15 mA, T_J = 25 °C	2.0	2.7	4.0	V
Forward Transconductance	g_{FS}	V_{DS} = 10 V, I_D = 30 A (Note 5)		27		S
CHARGES, CAPACITANCES & GATE RESISTANCE						
Input Capacitance	C_{ISS}	V_{DS} = 400 V, V_{GS} = 0 V, f = 1 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 V, I_D = 30 A, V_{GS} = −3/18 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 MHz		3.2		Ω
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{d(ON)}$	V_{GS} = −3/18 V, V_{DD} = 400 V, I_D = 30 A, R_G = 4.7 Ω, L_{stray} = 18 nH, T_J = 25 °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		

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 = 30 A, R_G = 4.7 Ω, L_{stray} = 18 nH, T_J = 175 °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 A, V_{GS} = −3 V, T_J = 25 °C		4.6	6.0	V
		I_{SD} = 30 A, V_{GS} = −3 V, T_J = 175 °C (Note 5)		4.3		
Reverse Recovery Time	t_{RR}	V_{GS} = −3 V, I_S = 30 A, dI/dt = 1000 A/μs, V_{DS} = 400 V, T_J = 25 °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

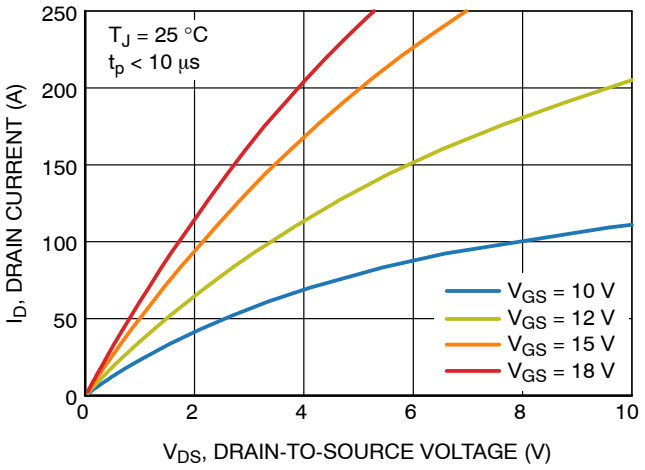


Figure 1. Output Characteristics

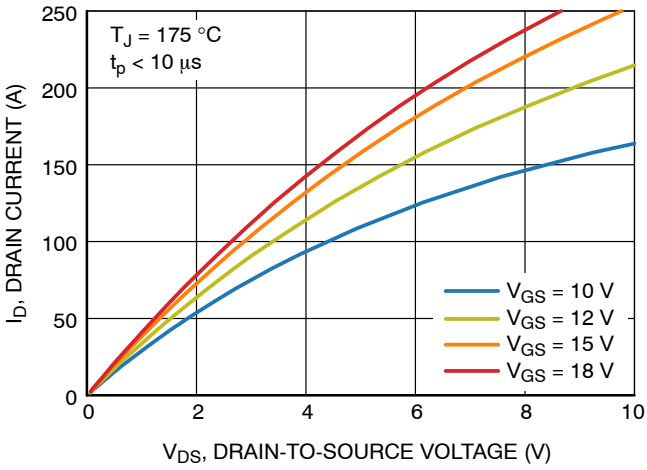


Figure 2. Output Characteristics

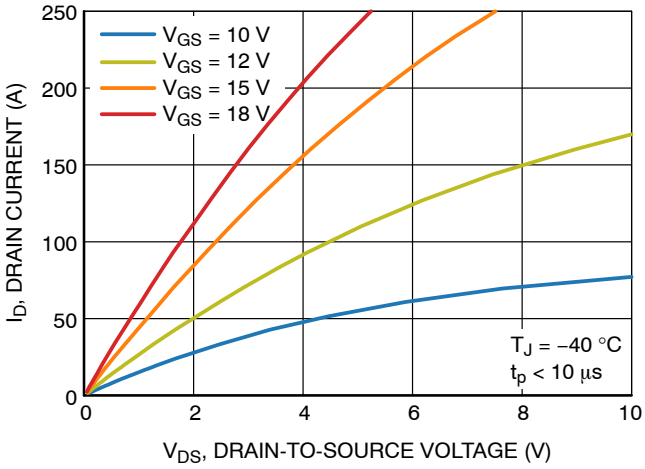


Figure 3. Output Characteristics

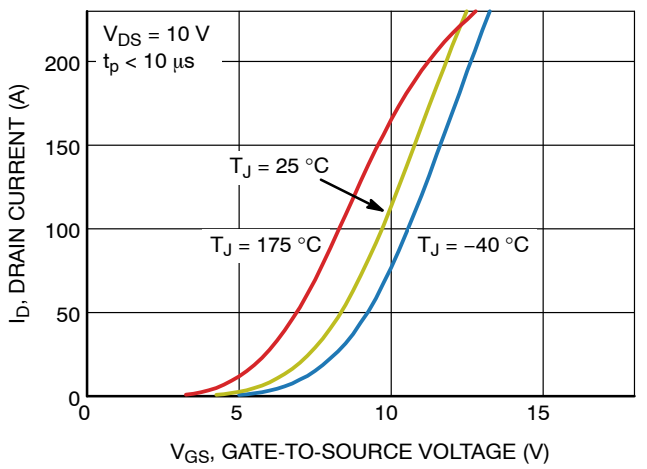


Figure 4. Transfer Characteristics

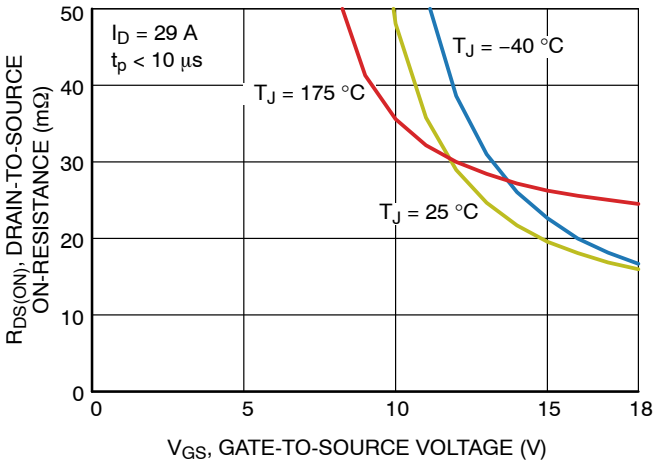


Figure 5. On-Resistance vs. Gate Voltage

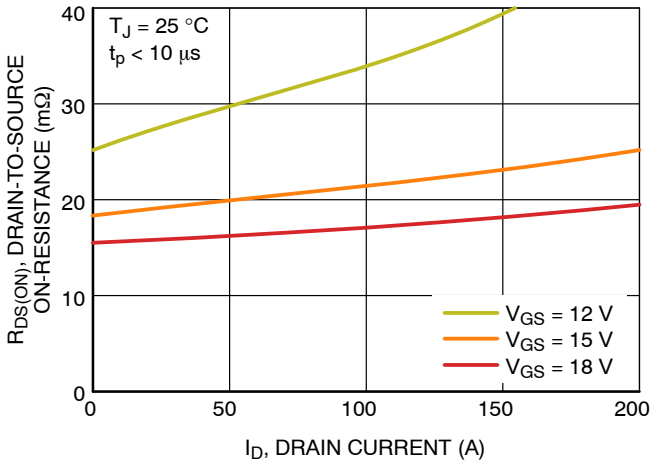


Figure 6. On-Resistance vs. Drain Current

TYPICAL CHARACTERISTICS (continued)

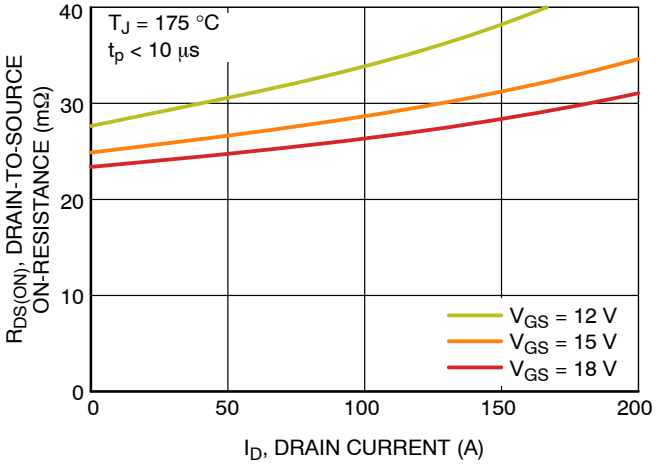


Figure 7. On-Resistance vs. Drain Current

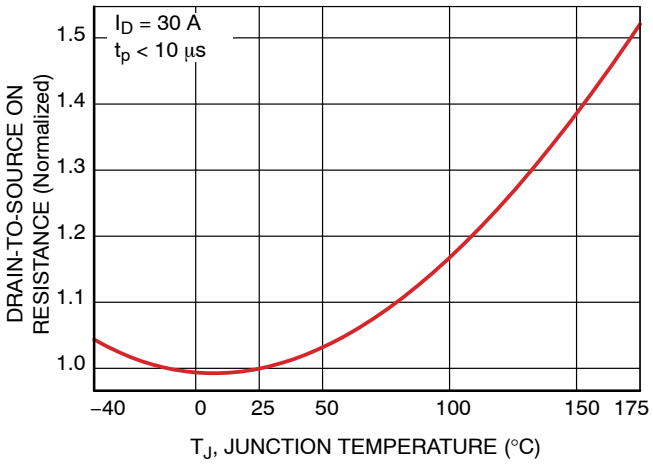


Figure 8. On-Resistance vs. Junction Temperature

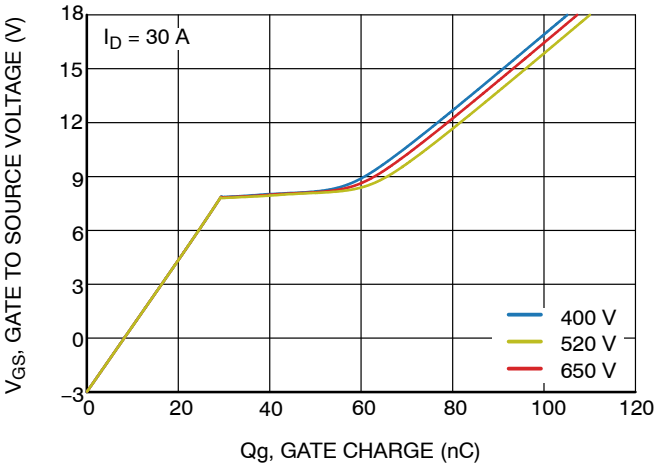


Figure 9. Gate Charge Characteristics

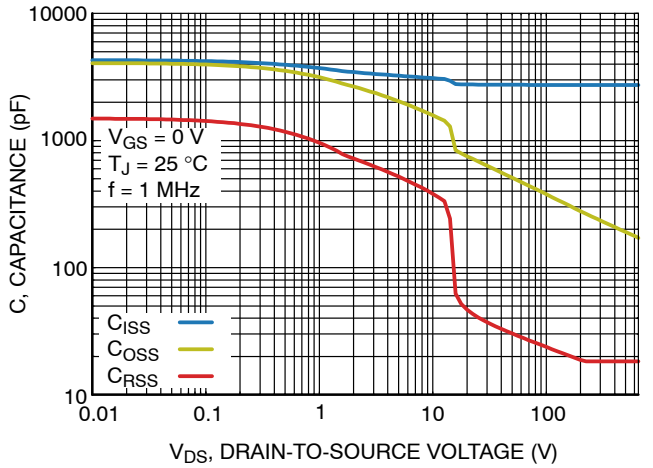


Figure 10. Capacitance Characteristics

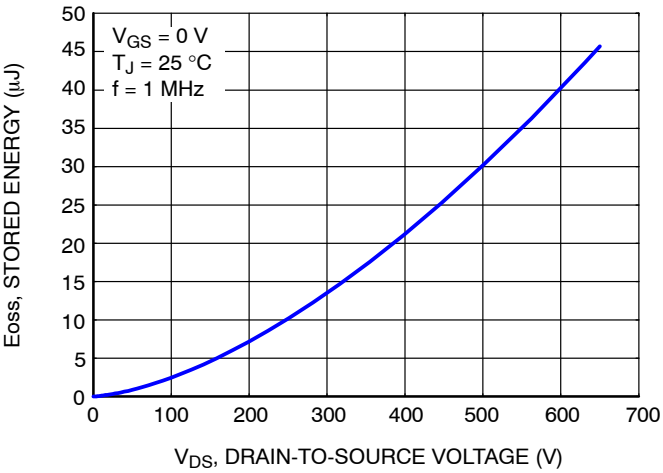


Figure 11. Stored Energy vs. Drain to Source Voltage

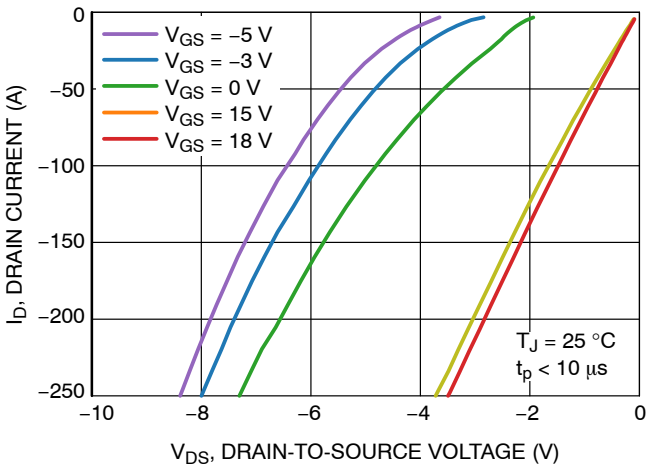


Figure 12. Reverse Conduction Characteristics

TYPICAL CHARACTERISTICS (continued)

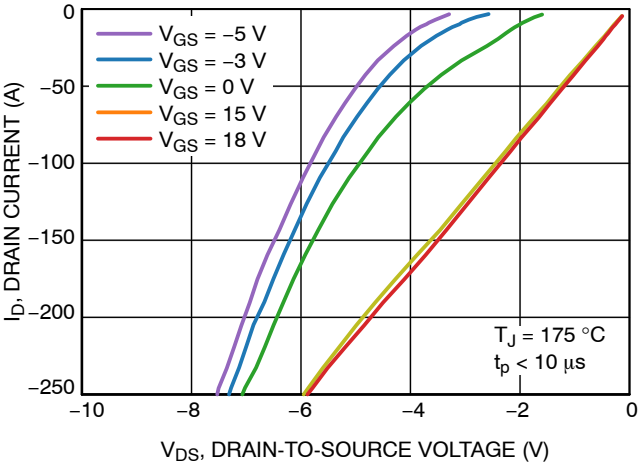


Figure 13. Reverse Conduction Characteristics

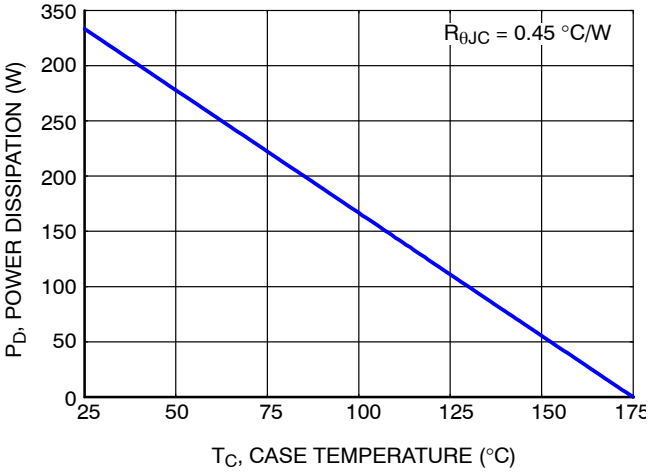


Figure 14. Maximum Power Dissipation vs. Case Temperature

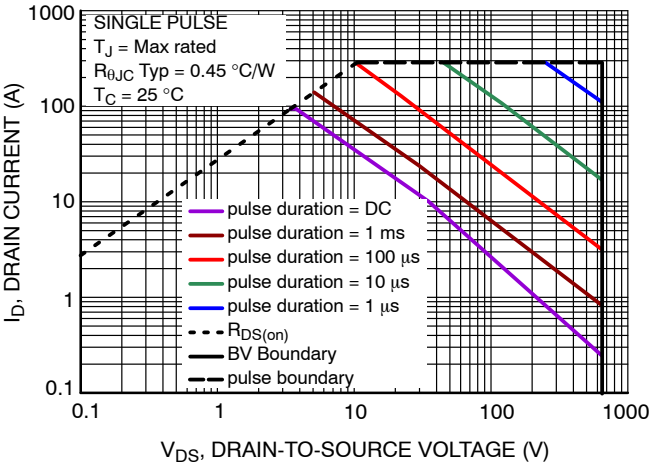


Figure 15. Safe Operating Area

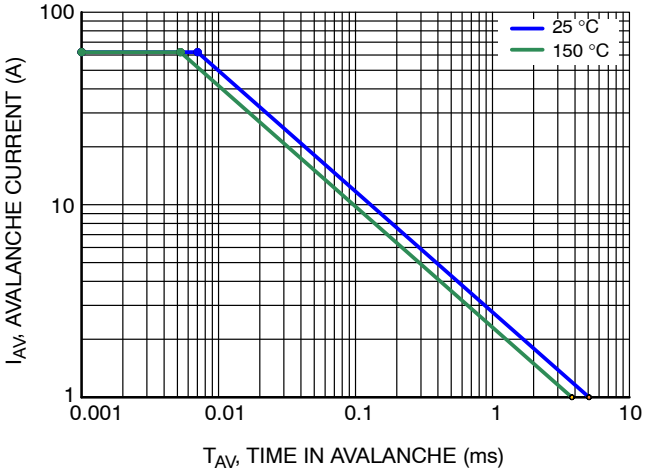


Figure 16. Avalanche Current vs. Pulse Time (UIS)

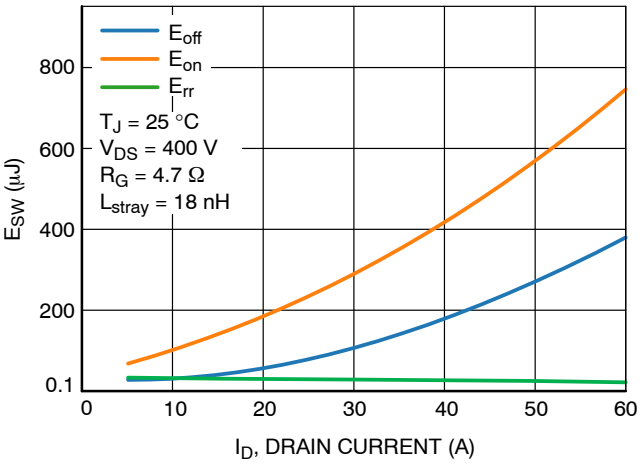


Figure 17. Inductive Switching Loss vs. Drain Current

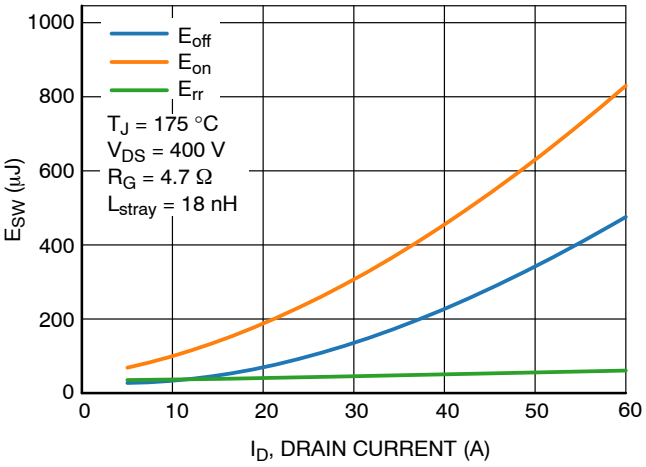


Figure 18. Inductive Switching Loss vs. Drain Current

TYPICAL CHARACTERISTICS (continued)

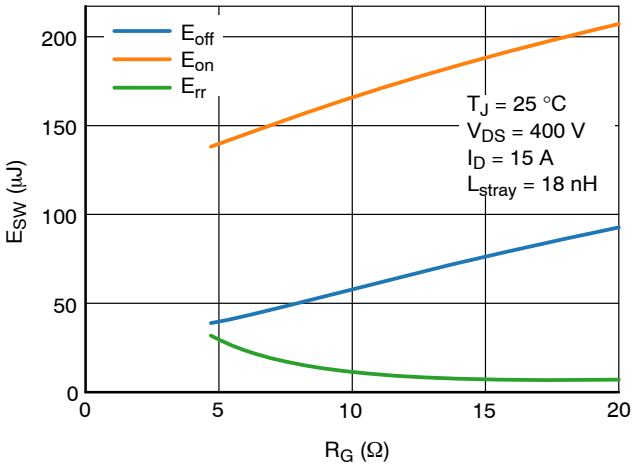


Figure 19. Inductive Switching Loss vs. Gate Resistance

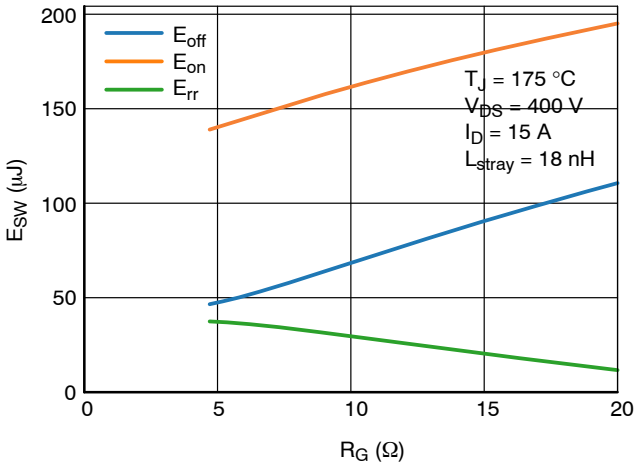


Figure 20. Inductive Switching Loss vs. Gate Resistance

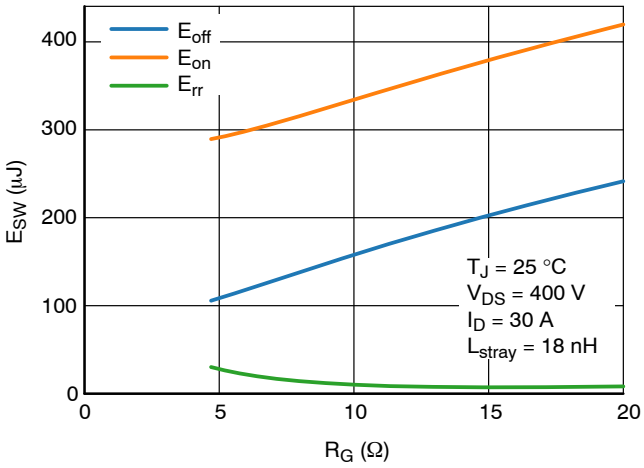


Figure 21. Inductive Switching Loss vs. Gate Resistance

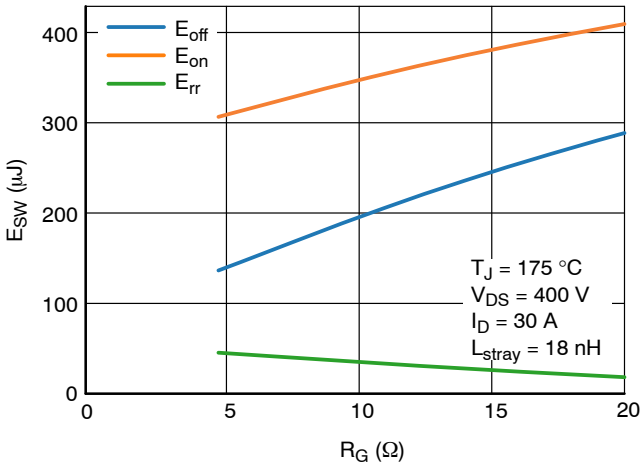


Figure 22. Inductive Switching Loss vs. Gate Resistance

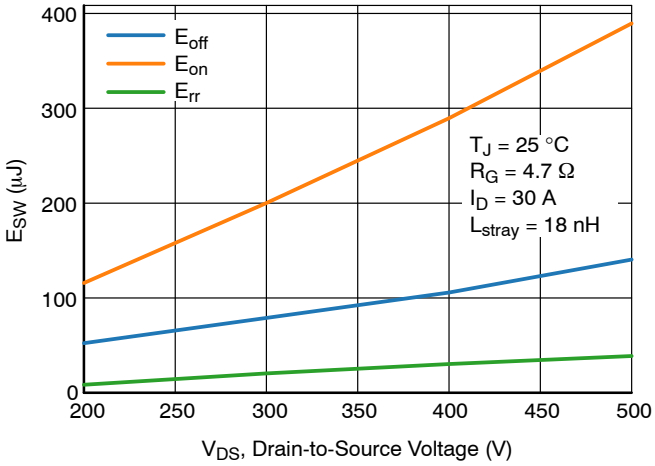


Figure 23. Inductive Switching Loss vs. Drain-to-Source Voltage

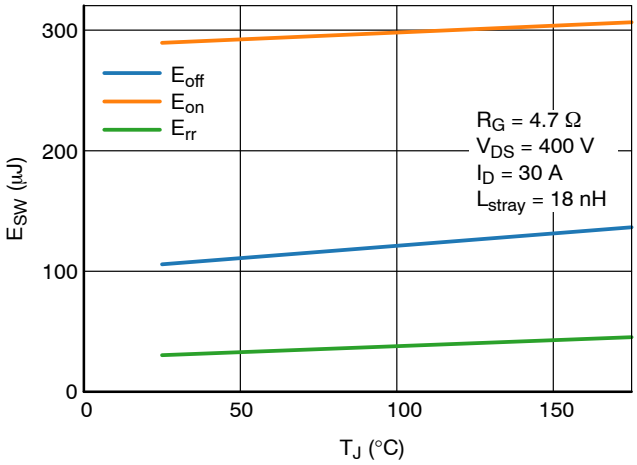


Figure 24. Inductive Switching Loss vs. Junction Temperature

TYPICAL CHARACTERISTICS (continued)

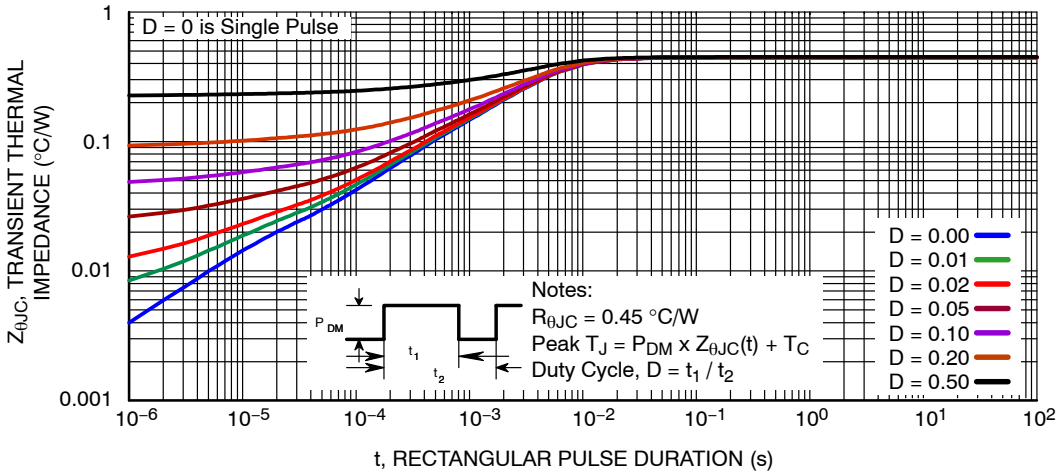


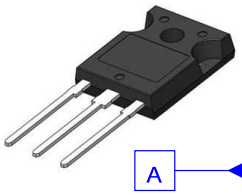
Figure 25. Thermal Response Characteristics

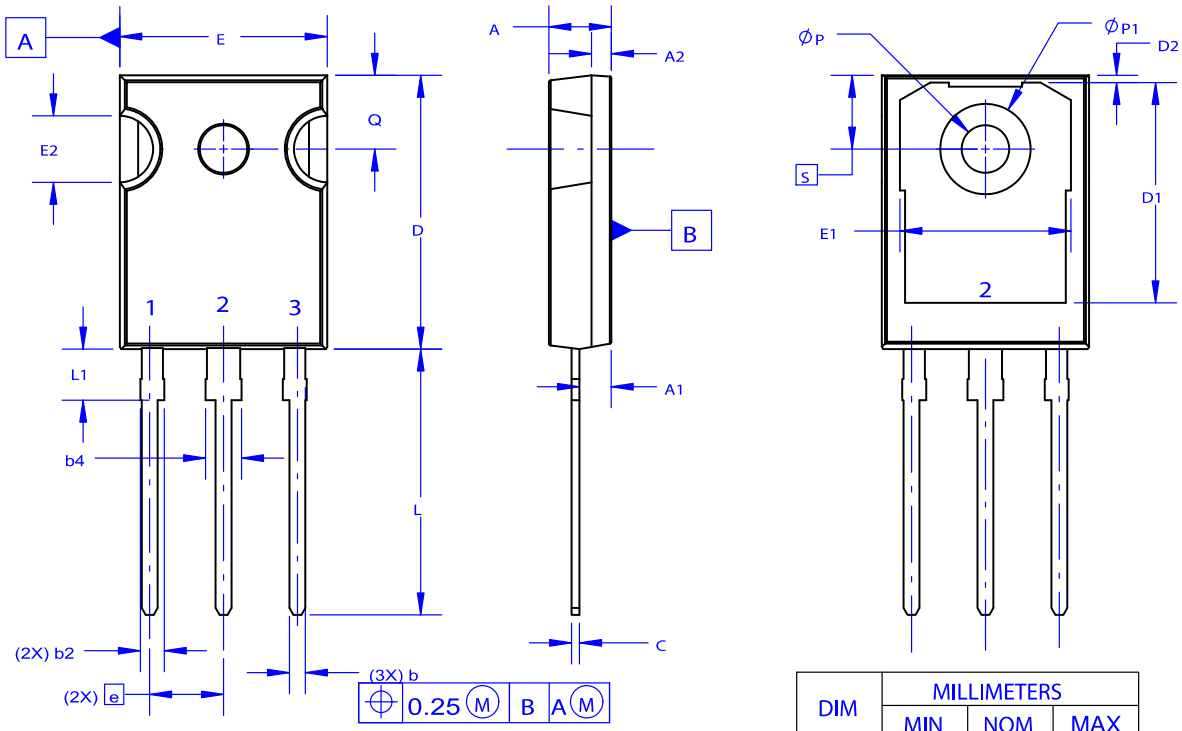
REVISION HISTORY

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.

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

GENERIC MARKING DIAGRAM*

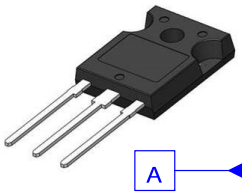
XXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
G = Pb−Free Package

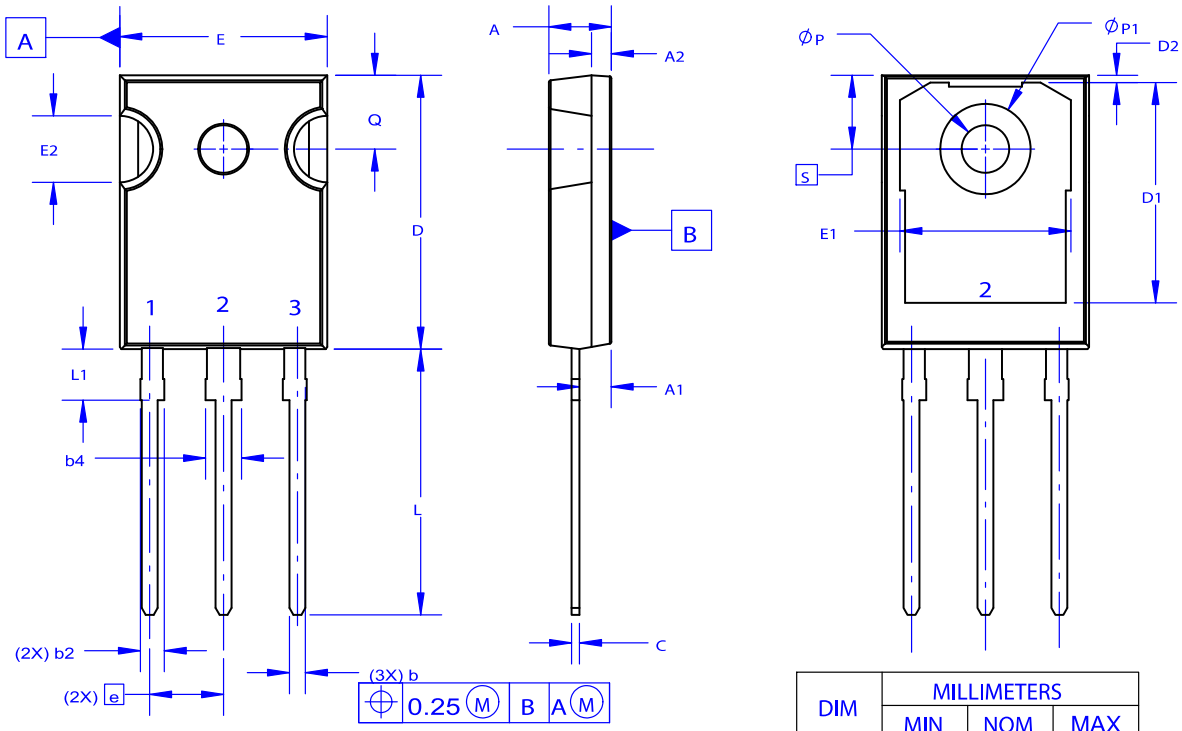
*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present. Some products may not follow the Generic Marking.

DOCUMENT NUMBER:	**98AON93302G**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	**TO−247−3LD**	**PAGE 1 OF 1**

TO−247−3LD
CASE 340CX
ISSUE A

DATE 06 JUL 2020





NOTES: UNLESS OTHERWISE SPECIFIED.

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B. ALL DIMENSIONS ARE IN MILLIMETERS.
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E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

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

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.

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