Silicon Carbide (SiC) MOSFET – EliteSiC, 32 mohm, 650 V, M3S, TOLL

NTBL032N065M3S

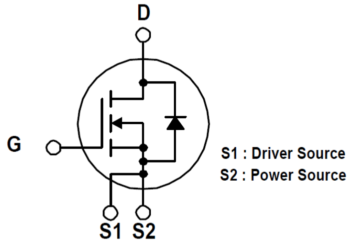
$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	I_D MAX
650 V	32 mΩ @ 18 V	55 A

Features

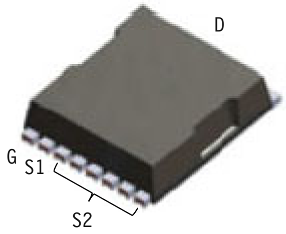
- Typical $R_{DS(on)} = 32$ mΩ @ $V_{GS} = 18$ V
- Ultra Low Gate Charge ($Q_{G(tot)} = 55$ nC)
- High Speed Switching with Low Capacitance (Coss = 113 pF)
- 100% Avalanche Tested
- This Device is Halide Free and RoHS Compliant with Exemption 7a, Pb−Free 2LI (on second level interconnection)

Applications

- SMPS (Switching Mode Power Supplies)
- Solar Inverters
- UPS (Uninterruptable Power Supplies)
- Energy Storage
- EV Charging Infrastructure

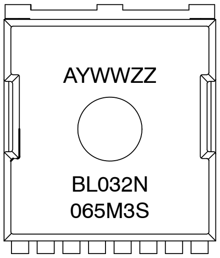


N−Channel MOSFET



H−PSOF8L
CASE 100DC

MARKING DIAGRAM



A = Assembly Location
Y = Year
WW = Work Week
ZZ = Assembly Lot Code
BL032N065M3S = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 9 of this data sheet.

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	T_C = 25°C	I_D	55	A
Power Dissipation		P_D	227	W
Continuous Drain Current	T_C = 100°C	I_D	39	A
Power Dissipation		P_D	113	W
Pulsed Drain Current (Note 1)	T_C = 25°C, t_p = 100 μs	I_{DM}	192	A
Continuous Source−Drain Current (Body Diode)	T_C = 25°C, V_{GS} = −3 V	I_S	33	A
	T_C = 100°C, V_{GS} = −3 V		19	
Pulsed Source−Drain Current (Body Diode) (Note 1)	T_C = 25°C, V_{GS} = −3 V, t_p = 100 μs	I_{SM}	173	A
Single Pulse Avalanche Energy (I_{LPK} = 16.7 A, L = 1 mH) (Note 2)		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 s)		T_L	260	°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, limited by max junction temperature.
2. 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.

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction−to−Case (Note 3)	$R_{\theta JC}$	0.66	°C/W
Thermal Resistance, Junction−to−Ambient (Note 3)	$R_{\theta JA}$	43	°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}	−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 stated)

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	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 5)			500	μA
Gate−to−Source Leakage Current	I_{GSS}	V_{GS} = −8/+22 V, V_{DS} = 0 V			±1	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 5)		47		
		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 5)		52		
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 7.5 mA	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_{GS} = 0 V, f = 1 MHz, V_{DS} = 400 V (Note 5)		1396		pF
Output Capacitance	C_{OSS}			113		
Reverse Transfer Capacitance	C_{RSS}			8.9		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −3/18 V, V_{DD} = 400 V, I_D = 15 A (Note 5)		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 4, 5)		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		
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 4, 5)		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}	V_{GS} = −3 V, I_{SD} = 15 A, T_J = 25°C		4.5	6.0	V
		V_{GS} = −3 V, I_{SD} = 15 A, T_J = 175°C		4.2		

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
SOURCE–TO–DRAIN DIODE CHARACTERISTICS						
Reverse Recovery Time	t_{RR}	V_{GS} = –3 V, I_S = 15 A, dI/dt = 1000 A/μs, V_{DS} = 400 V (Note 5)		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

4. EON/EOFF result is with body diode.
5. Defined by design, not subject to production test.

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.

TYPICAL CHARACTERISTICS

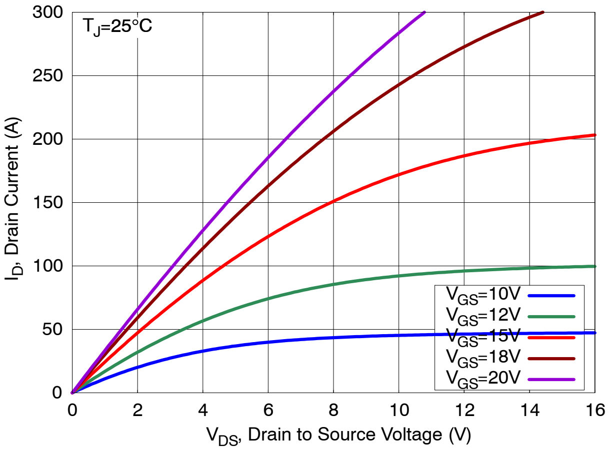


Figure 1. Output Characteristics

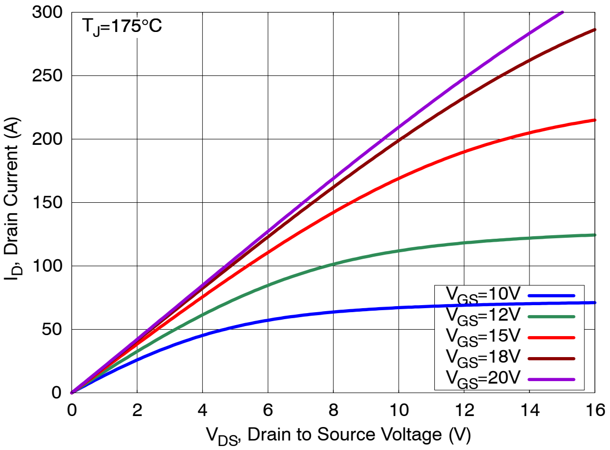


Figure 2. Output Characteristics

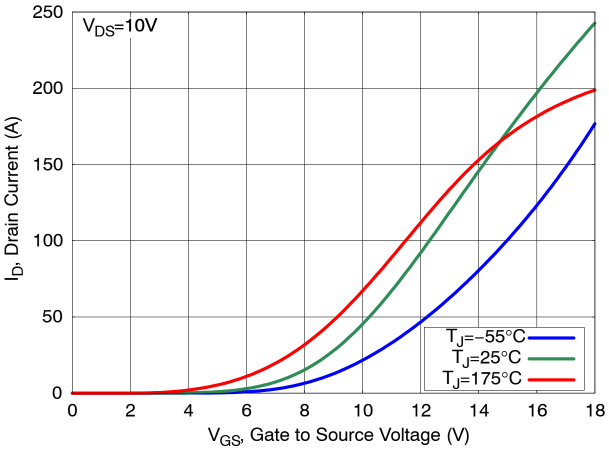


Figure 3. Transfer Characteristics

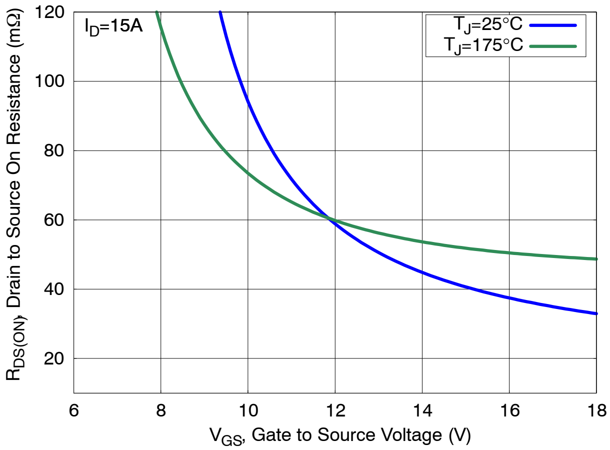


Figure 4. On−Resistance vs. Gate Voltage

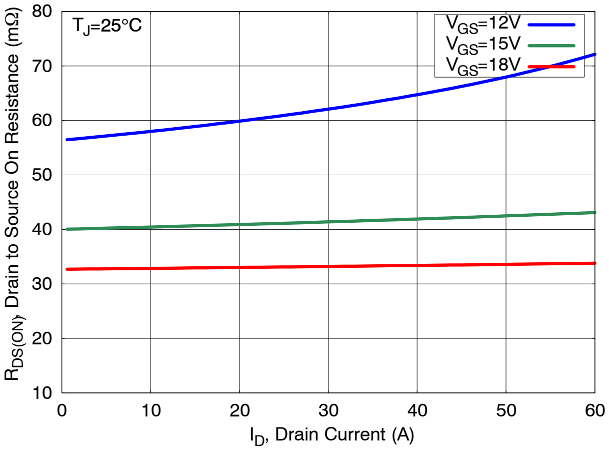


Figure 5. On−Resistance vs. Drain Current

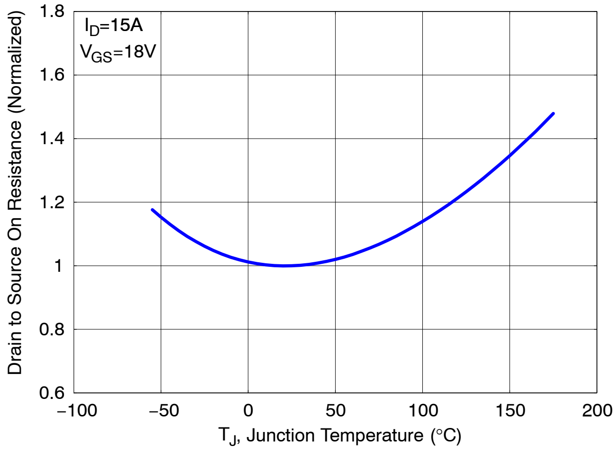


Figure 6. On−Resistance vs. Junction Temperature

TYPICAL CHARACTERISTICS

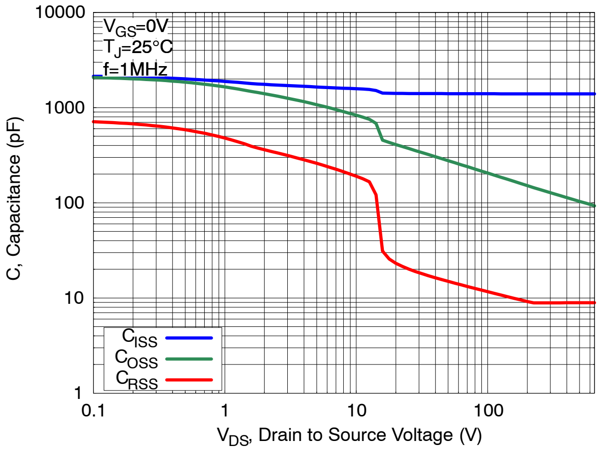


Figure 7. Capacitance Characteristics

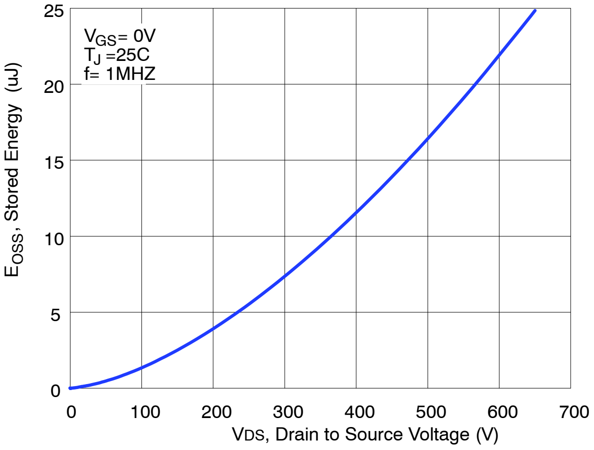


Figure 8. Stored Energy vs. Drain−to−Source Voltage

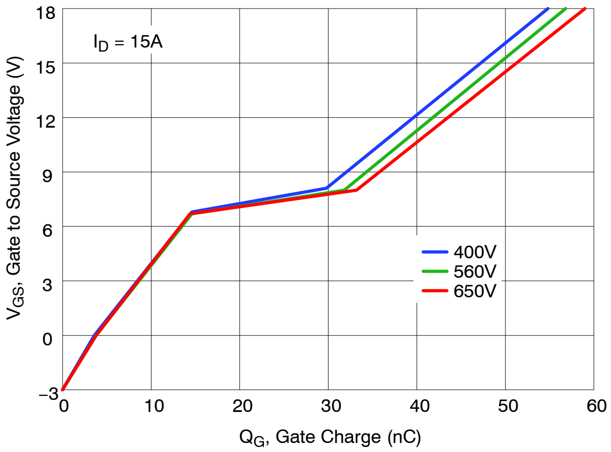


Figure 9. Gate Charge Characteristics

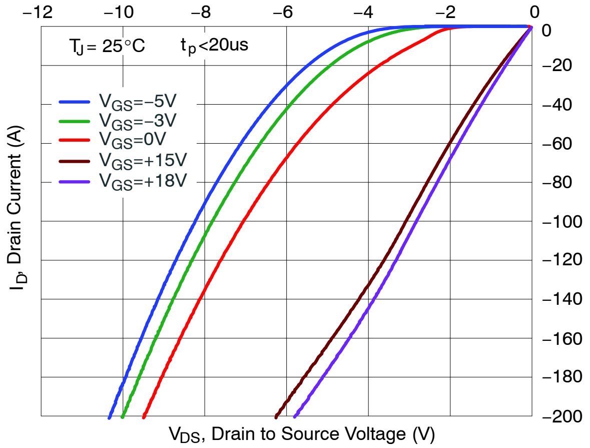


Figure 10. Reverse Conduction Characteristics

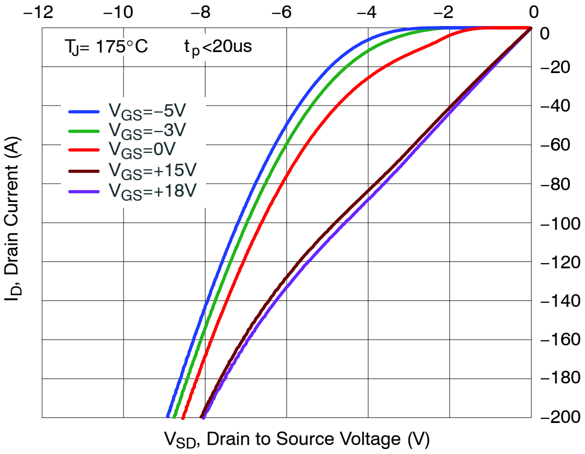


Figure 11. Reverse Conduction Characteristics

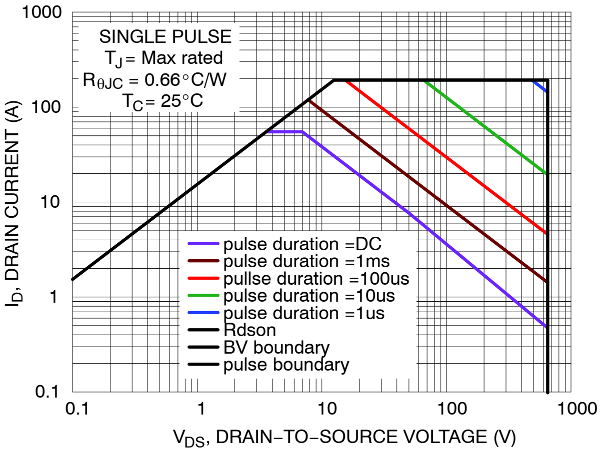


Figure 12. Safe Operating Area

TYPICAL CHARACTERISTICS

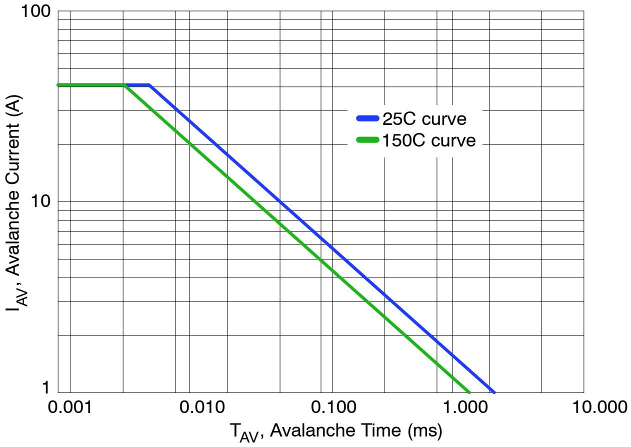


Figure 13. Avalanche Current vs. Pulse Time (UIS)

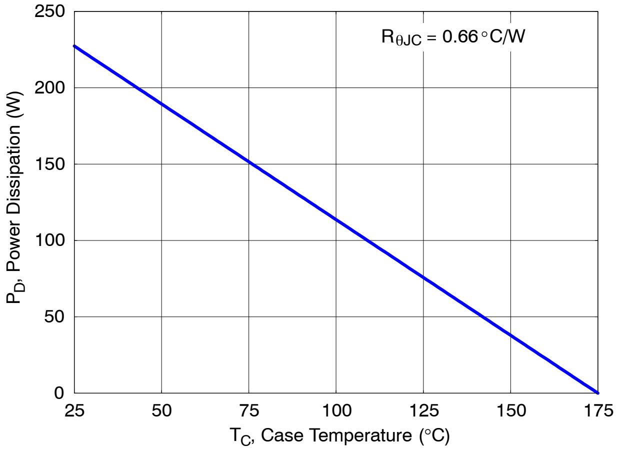


Figure 14. Maximum Power Dissipation vs. Case Temperature

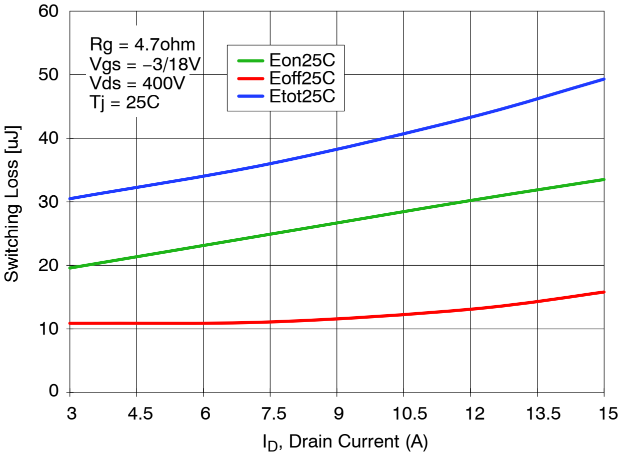


Figure 15. Inductive Switching Loss vs. Drain Current

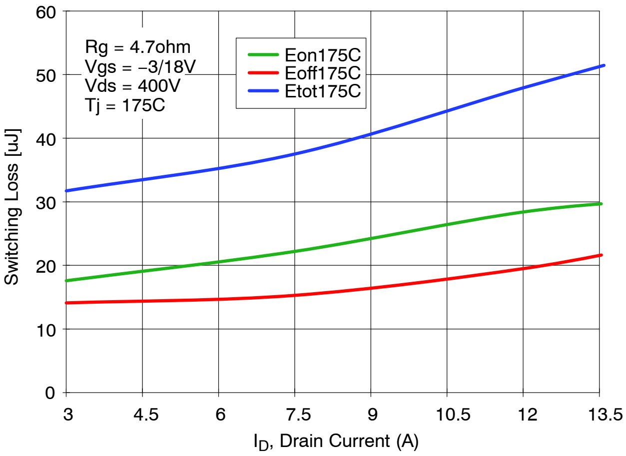


Figure 16. Inductive Switching Loss vs. Drain Current

TYPICAL CHARACTERISTICS

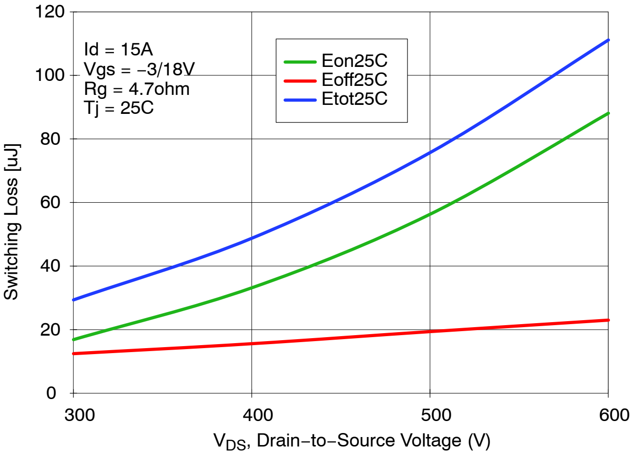


Figure 17. Inductive Switching Loss vs. Drain Voltage

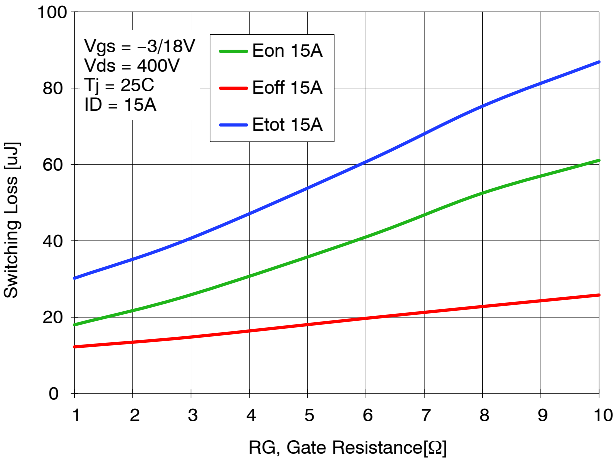


Figure 18. Inductive Switching Loss vs. Gate Resistance

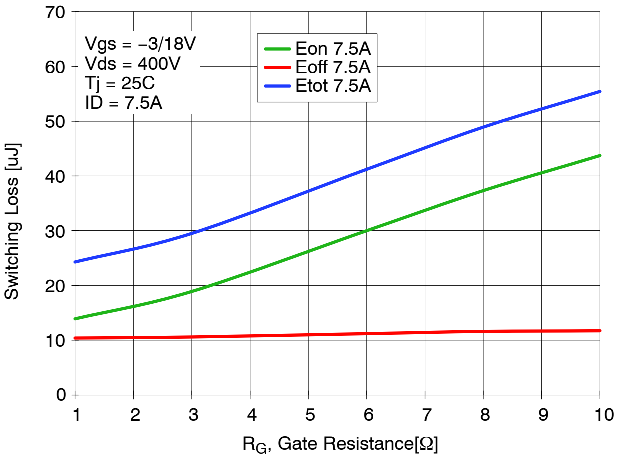


Figure 19. Inductive Switching Loss vs. Gate Resistance

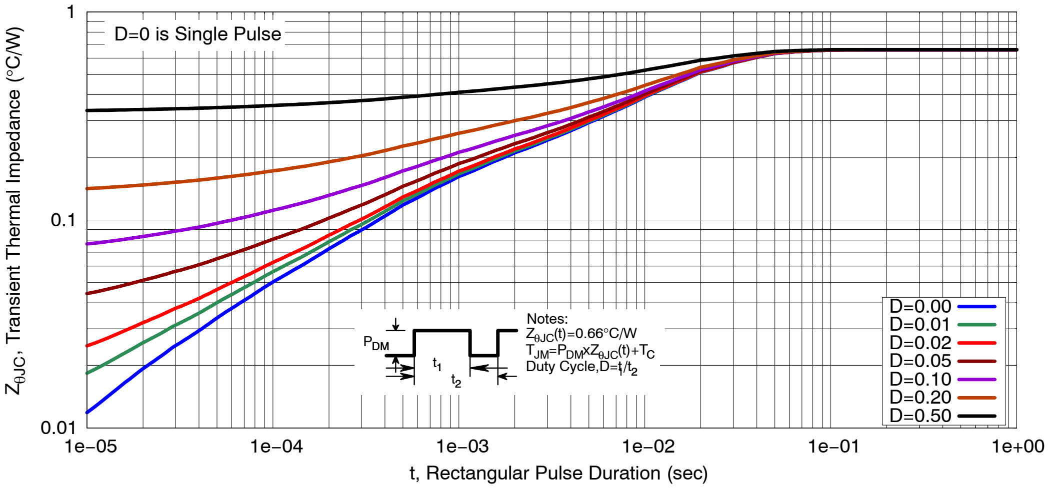
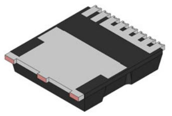


Figure 20. Thermal Response Characteristics

DEVICE ORDERING INFORMATION

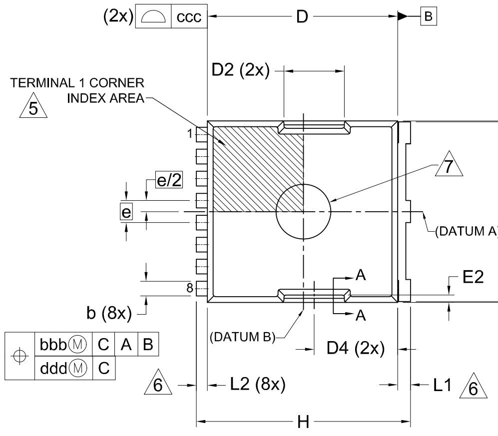
Device	Package	Shipping[†]
NTBL032N065M3S	H−PSOF8L	2000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

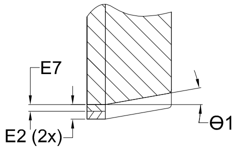


H−PSOF8L 9.90x10.38x2.30, 1.20P
CASE 100DC
ISSUE D

DATE 30 JUL 2024



TOP VIEW



SECTION "A-A"
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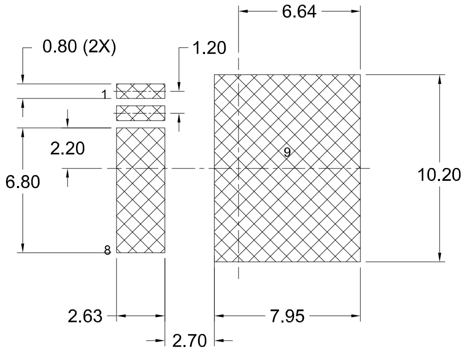
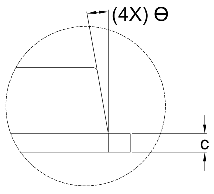


LAND PATTERN
RECOMMENDATION

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.



DETAIL "B"
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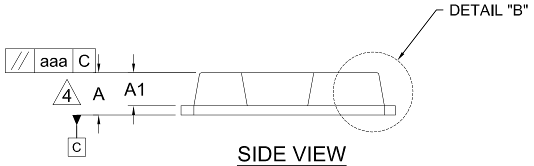
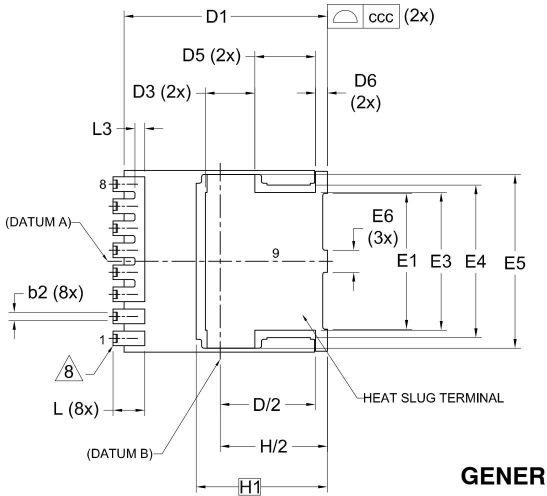


SIDE VIEW

NOTES:
1. PACKAGE STANDARD REFERENCE: JEDEC MO-299, ISSUE B.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
3. "e" REPRESENTS THE TERMINAL PITCH.
4. THIS DIMENSION INCLUDES ENCAPSULATION THICKNESS "A1", AND PACKAGE BODY THICKNESS, BUT DOES NOT INCLUDE ATTACHED FEATURES, e.g.,EXTERNAL OR CHIP CAPACITORS. AN INTEGRAL HEATSLUG IS NOT CONSIDERED AS ATTACHED FEATURE.
5. A VISUAL INDEX FEATURE MUST BE LOCATED WITHIN THE HATCHED AREA.
6. DIMENSIONS b1,L1,L2 APPLY TO PLATED TERMINALS.
7. THE LOCATION AND SIZE OF EJECTOR MARKS ARE OPTIONAL.
8. THE LOCATION AND NUMBER OF FUSED LEADS ARE OPTIONAL.

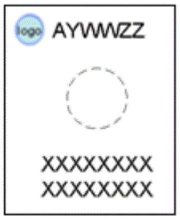


BOTTOM VIEW

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	2.20	2.30	2.40
A1	1.70	1.80	1.90
b	0.70	0.80	0.90
b1	9.70	9.80	9.90
b2	0.35	0.45	0.55
c	0.40	0.50	0.60
D	10.28	10.38	10.48
D/2	5.09	5.19	5.29
D1	10.98	11.08	11.18
D2	3.20	3.30	3.40
D3	2.60	2.70	2.80
D4	4.45	4.55	4.65
D5	3.20	3.30	3.40
D6	0.55	0.65	0.75
E	9.80	9.90	10.00
E1	7.30	7.40	7.50
E2	0.30	0.40	0.50
E3	7.40	7.50	7.60
E4	8.20	8.30	8.40

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
E5	9.36	9.46	9.56
E6	1.10	1.20	1.30
E7	0.15	0.18	0.21
e		1.20 BSC	
e/2		0.60 BSC	
H	11.58	11.68	11.78
H/2	5.74	5.84	5.94
H1		7.15 BSC	
L	1.63	1.73	1.83
L1	0.60	0.70	0.80
L2	0.50	0.60	0.70
L3	0.43	0.53	0.63
Θ		10° REF	
Θ1		10° REF	
aaa		0.20	
bbb		0.25	
ccc		0.20	
ddd		0.20	
eee		0.10	

GENERIC MARKING DIAGRAM*



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

*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:	**98AON80466G**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	**H−PSOF8L 9.90x10.38x2.30, 1.20P**	**PAGE 1 OF 1**

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onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support
For additional information, please contact your local Sales Representative at
www.onsemi.com/support/sales

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