Silicon Carbide (SiC) MOSFET - EliteSiC, 23 mohm, 650 V, M3S, TOLL

NTBL023N065M3S

V_{DSS}	$R_{DS(ON)}$ TYP	I_D MAX
650 V	23 mΩ @ 18 V	77 A

Features

- Typical $R_{DS(on)}$ = 23 mΩ @ V_{GS} = 18 V
- Ultra Low Gate Charge ($Q_{G(tot)}$ = 69 nC)
- High Speed Switching with Low Capacitance (C_{oss} = 152 pF)
- 100% Avalanche Tested
- This Device is Halide Free and RoHS Compliant with Exemption 7a, Pb-Free 2LI (on second level interconnection)

Applications

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

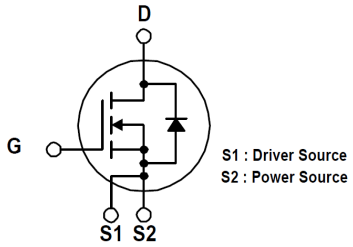
MAXIMUM RATINGS (T_J = 25 °C unless otherwise noted)

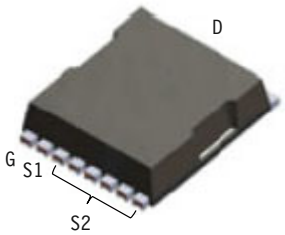
Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		V_{DSS}	650	V
Gate-to-Source Static Voltage		V_{GS}	−10/+22.6	V
Gate-to-Source Transient Voltage	t_p < 0.5 μs, Duty Cycle ≤ 1%	V_{GS}	−11/+25	V
Continuous Drain Current	T_C = 25 °C	I_D	77	A
Power Dissipation		P_D	312	W
Continuous Drain Current	T_C = 100 °C	I_D	54	A
Power Dissipation		P_D	156	W
Pulsed Drain Current (Note 1)	T_C = 25 °C, t_p = 100 μs	I_{DM}	280	A
Continuous Source-Drain Current (Body Diode)	T_C = 25 °C, V_{GS} = −3 V	I_S	46	A
	T_C = 100 °C, V_{GS} = −3 V		27	
Pulsed Source-Drain Current (Body Diode) (Note 1)	T_C = 25 °C, V_{GS} = −3 V, t_p = 100 μs	I_{SM}	274	A
Single Pulse Avalanche Energy (I_{LPK} = 19.6 A, L = 1 mH) (Note 2)		E_{AS}	192	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 192 mJ is based on starting T_J = 25 °C; L = 1 mH, I_{AS} = 19.6 A, V_{DD} = 100 V, V_{GS} = 18 V.

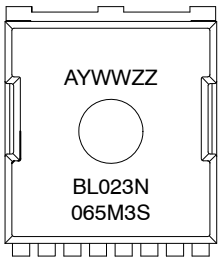
N-CHANNEL MOSFET





H-PSOF8L
CASE 100DC

MARKING DIAGRAM



A	= Assembly Location
Y	= Year
WW	= Work Week
ZZ	= Assembly Lot Code
BL023N065M3S	= Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

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THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Note 3)	$R_{\theta JC}$	0.48	°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...0/18	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.
Operation at 0 V turn-off requires consideration of system-level design trade-offs. Design guidance and application considerations are provided in Application Note AND90255/D.

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

Parameter	Symbol	Test Condition	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		89		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} = −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 = 20 A, T_J = 25 °C		23	32.6	mΩ
		V_{GS} = 18 V, I_D = 20 A, T_J = 175 °C		34		
		V_{GS} = 15 V, I_D = 20 A, T_J = 25 °C		29		
		V_{GS} = 15 V, I_D = 20 A, T_J = 175 °C		37		
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 10 mA	2	2.8	4	V
Forward Transconductance	g_{FS}	V_{DS} = 10 V, I_D = 20 A		14		S
CHARGES, CAPACITANCES & GATE RESISTANCE						
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = 400 V (Note 5)		1950		pF
Output Capacitance	C_{OSS}			152		
Reverse Transfer Capacitance	C_{RSS}			13		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −3/18 V, V_{DD} = 400 V, I_D = 20 A (Note 5)		69		nC
Gate-to-Source Charge	Q_{GS}			19		
Gate-to-Drain Charge	Q_{GD}			18		
Gate-Resistance	R_G	f = 1 MHz		4.0		Ω

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{d(ON)}$	V_{GS} = −3/18 V, V_{DD} = 400 V, I_D = 20 A, R_G = 4.7 Ω, T_J = 25 °C, (Notes 4, 5)		11		ns
Turn-Off Delay Time	$t_{d(OFF)}$			35		
Rise Time	t_r			15		
Fall Time	t_f			9.6		
Turn-On Switching Loss	E_{ON}			51		μJ
Turn-Off Switching Loss	E_{OFF}			29		
Total Switching Loss	E_{TOT}			80		
Turn-On Delay Time	$t_{d(ON)}$	V_{GS} = −3/18 V, V_{DS} = 400 V, I_D = 20 A, R_G = 4.7 Ω, T_J = 175 °C, (Notes 4, 5)		9.6		ns
Turn-Off Delay Time	$t_{d(OFF)}$			41		
Rise Time	t_r			14		
Fall Time	t_f			12		
Turn-On Switching Loss	E_{ON}			51		μJ
Turn-Off Switching Loss	E_{OFF}			45		
Total Switching Loss	E_{TOT}			96		
SOURCE-TO-DRAIN DIODE CHARACTERISTICS						
Forward Diode Voltage	V_{SD}	V_{GS} = −3 V, I_{SD} = 20 A, T_J = 25 °C		4.5	6.0	V
		V_{GS} = −3 V, I_{SD} = 20 A, T_J = 175 °C		4.2		
Reverse Recovery Time	t_{RR}	V_{GS} = −3 V, I_S = 20 A, dI/dt = 1000 A/μs, V_{DS} = 400 V (Note 5)		19		ns
Charge Time	t_a			11		
Discharge Time	t_b			8		
Reverse Recovery Charge	Q_{RR}			97		nC
Reverse Recovery Energy	E_{REC}			8.7		μJ
Peak Reverse Recovery Current	I_{RRM}			11		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.

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TYPICAL CHARACTERISTICS

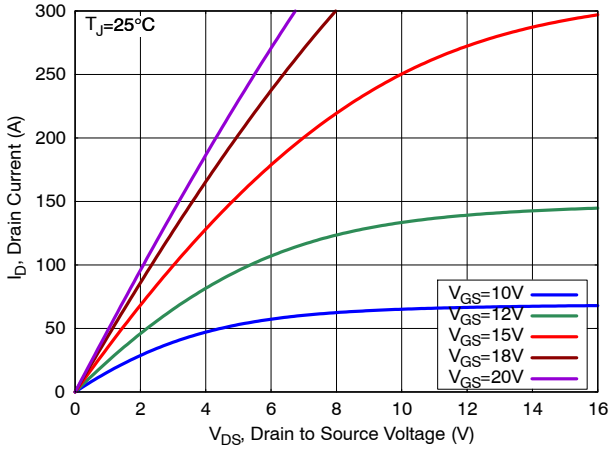


Figure 1. On-Region Characteristics

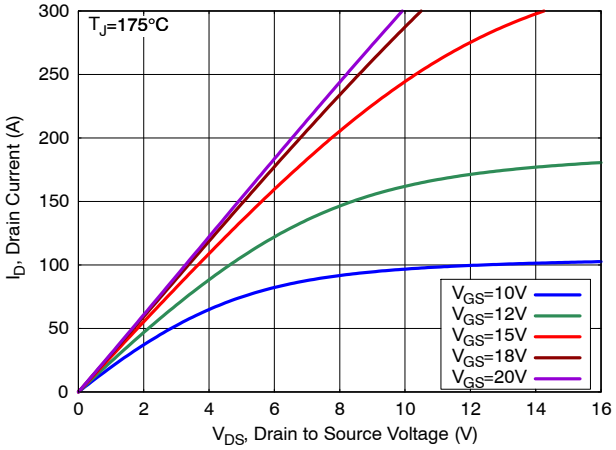


Figure 2. Output Characteristics

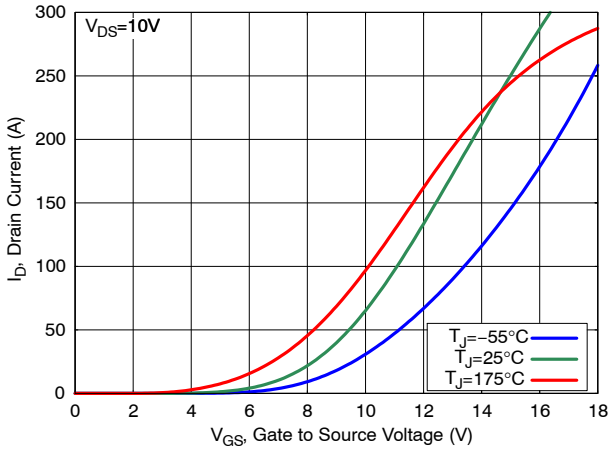


Figure 3. Transfer Characteristics

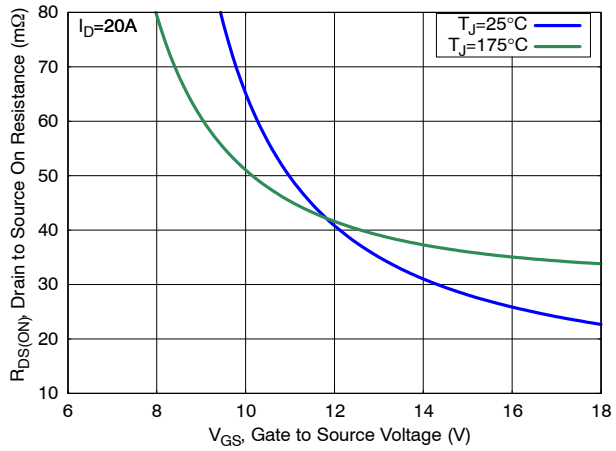


Figure 4. On-Resistance vs. Gate Voltage

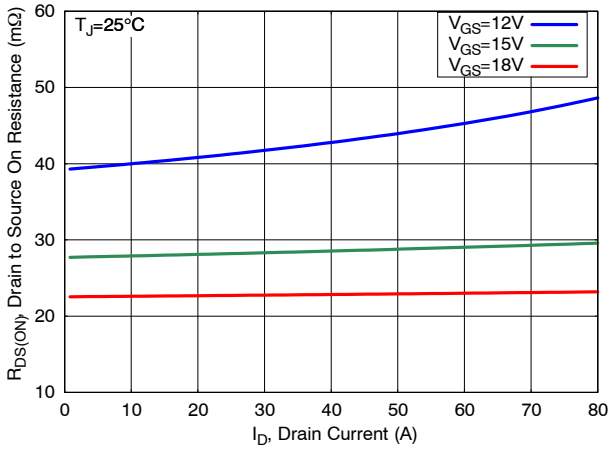


Figure 5. On-Resistance vs. Drain Current

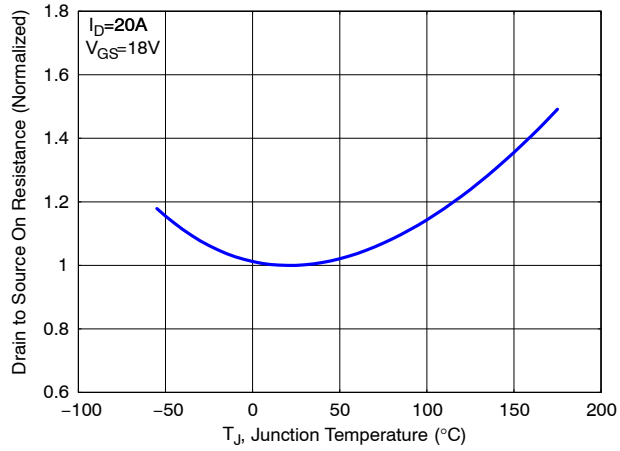


Figure 6. On-Resistance vs. Junction Temperature

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TYPICAL CHARACTERISTICS

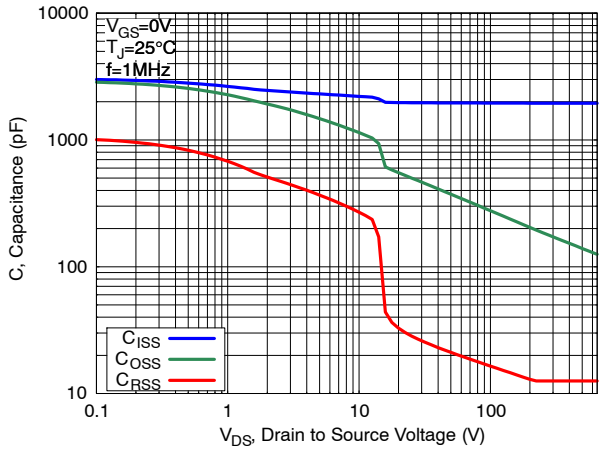


Figure 7. Capacitance Characteristics

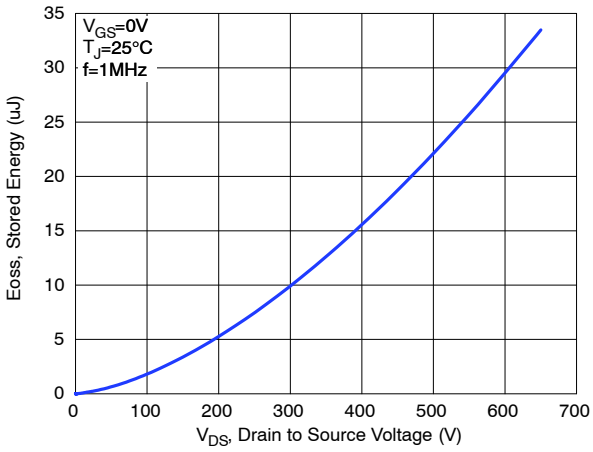


Figure 8. Stored Energy vs. Drain-to-Source Voltage

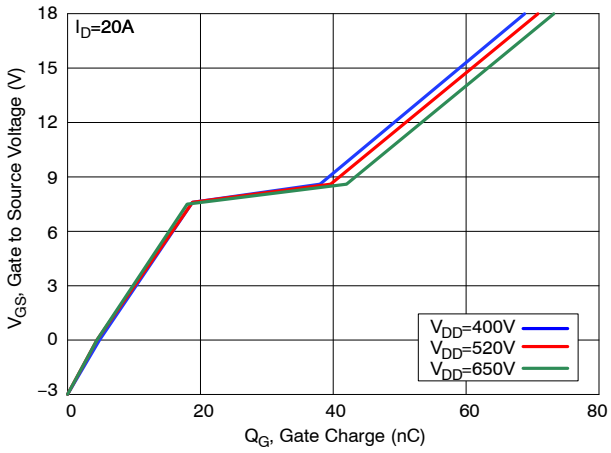


Figure 9. Gate Charge Characteristics

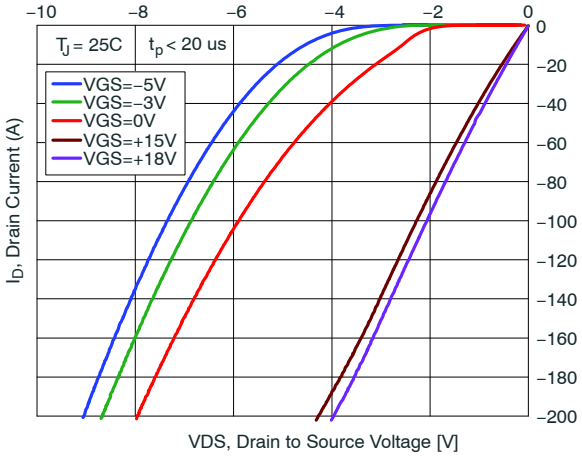


Figure 10. Reverse Conduction Characteristics

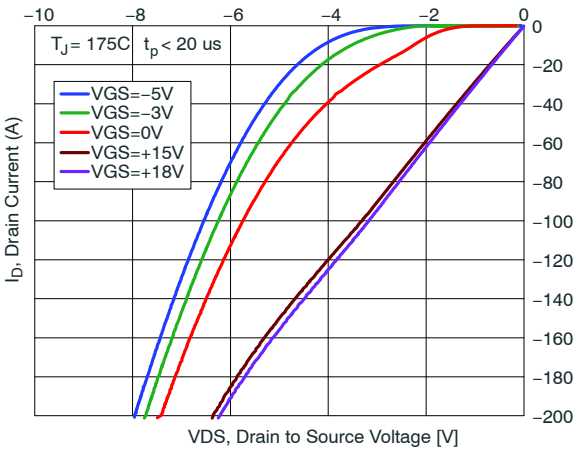


Figure 11. Reverse Conduction Characteristics

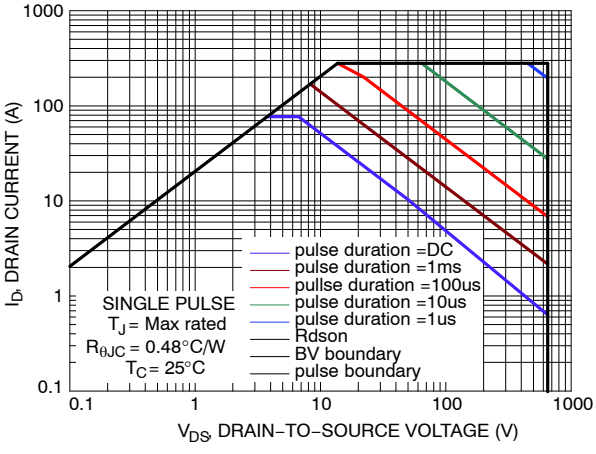


Figure 12. Safe Operating Area

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TYPICAL CHARACTERISTICS

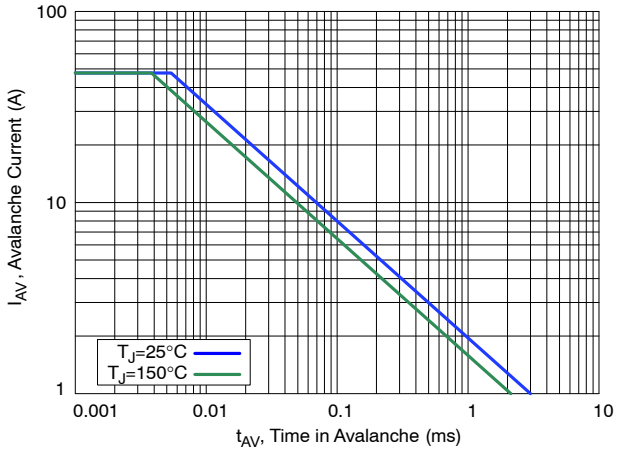


Figure 13. Avalanche Current vs. Pulse Time (UIS)

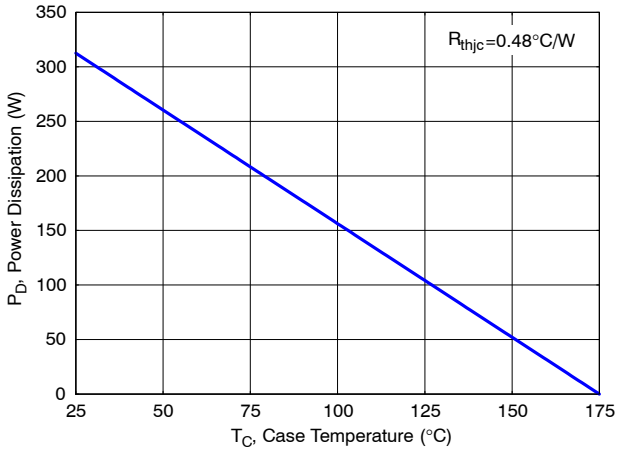


Figure 14. Maximum Power Dissipation vs. Case Temperature

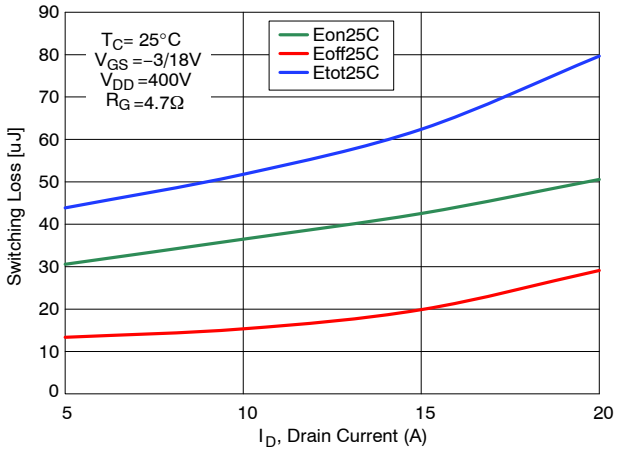


Figure 15. Switching Loss vs. Collector Current

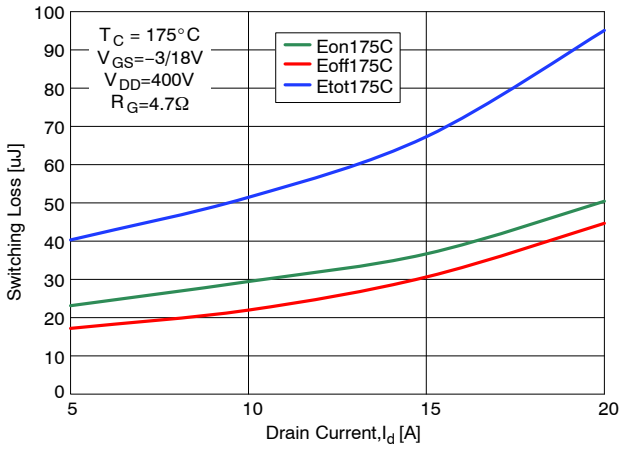


Figure 16. Switching Loss vs. Drain Current

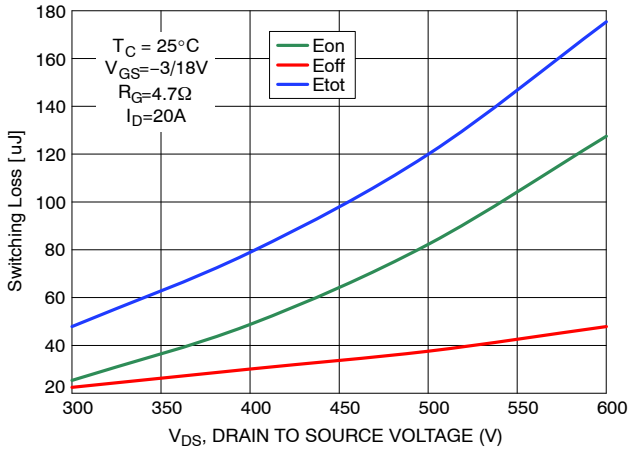


Figure 17. Switching Loss vs. Drain Voltage

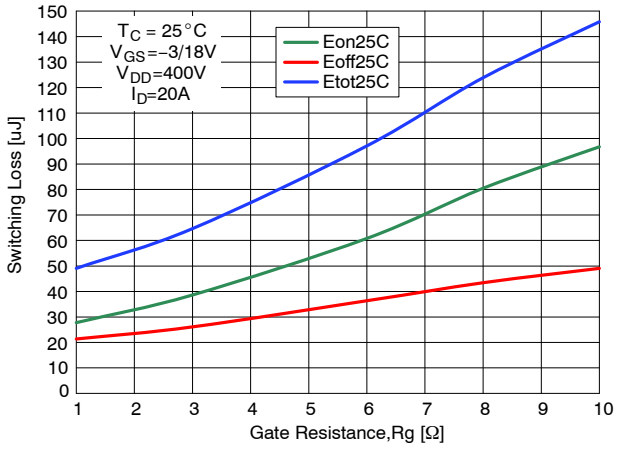


Figure 18. Switching Loss vs. Gate Resistance

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TYPICAL CHARACTERISTICS

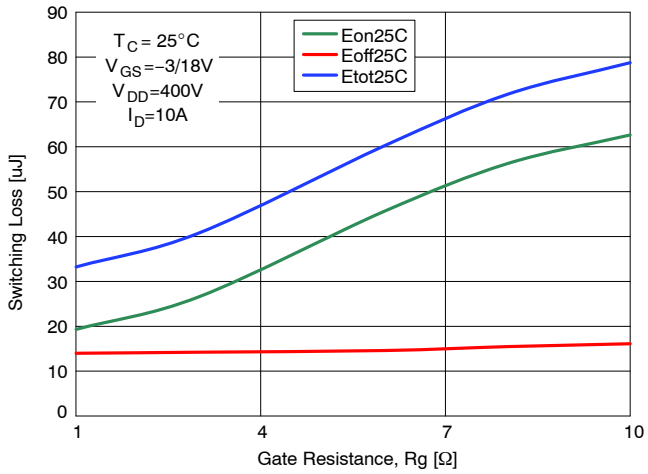


Figure 19. Switching Loss vs. Gate Resistance

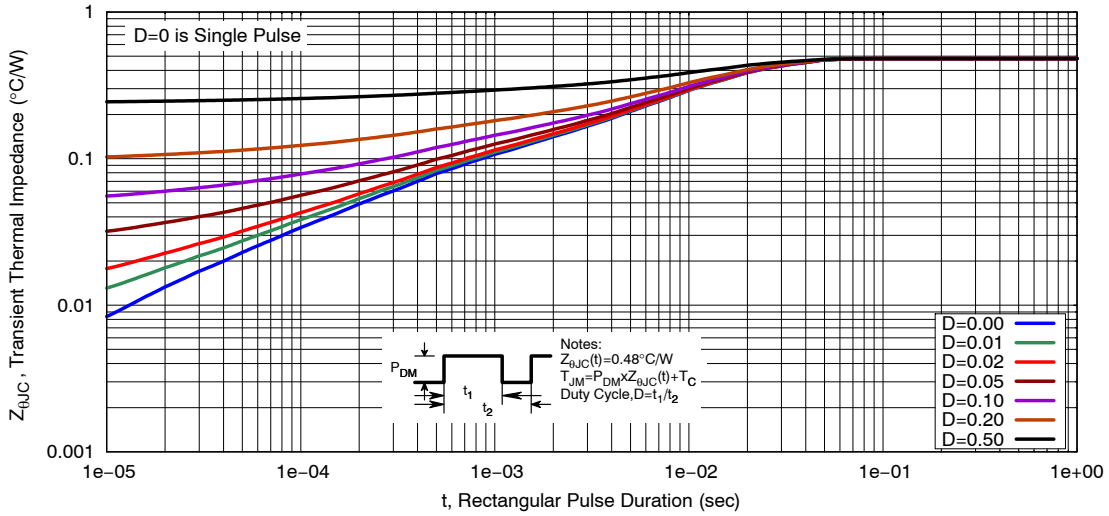


Figure 20. Thermal Response Characteristics

DEVICE ORDERING INFORMATION

Device	Package	Shipping†
NTBL023N065M3S	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.

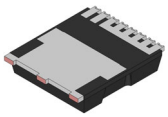
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REVISION HISTORY

Revision	Description of Changes	Date
2	Updated static and dynamic gate source voltage ratings in maximum ratings table.	6/15/2026
3	Edit to the ROC table on page 2 and add a new note.	9/2/2026

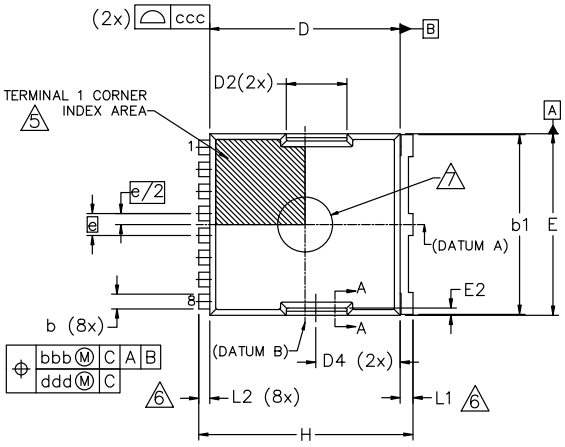
This document has undergone updates prior to the inclusion of this revision history table. The changes tracked here only reflect updates made on the noted approval dates.

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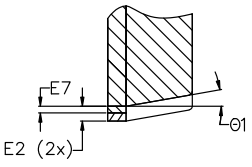


H−PSOF8L 10.38x9.90x2.30, 1.20P
CASE 100DC
ISSUE E

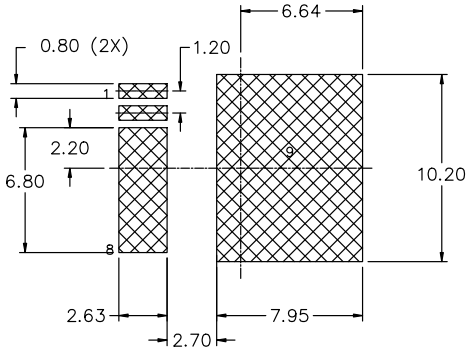
DATE 24 AUG 2026



TOP VIEW

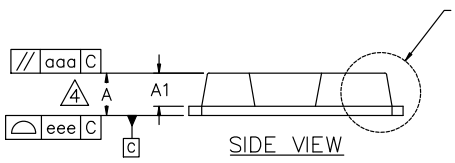


SECTION "A−A"
SCALE: 2X

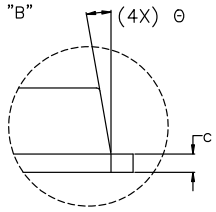


LAND PATTERN RECOMMENDATION

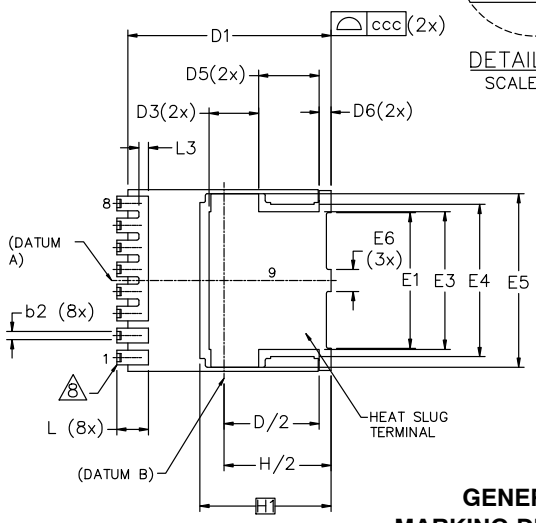
*FOR ADDITIONAL INFORMATION ON OUR PB−FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE onsemi SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.



SIDE VIEW



DETAIL "B"
SCALE: 2X



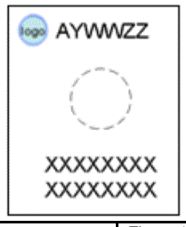
BOTTOM VIEW

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. COPLANARITY APPLIES TO EXPOSED PAD AND LEADS..
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.

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.

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