

Silicon Carbide (SiC) MOSFET - EliteSiC, 32 mohm, 650 V, M3S, D2PAK-7L

NVBG032N065M3S

Features

- Typical $R_{DS(ON)} = 32 \text{ m}\Omega$ @ $V_{GS} = 18 \text{ V}$
- Ultra Low Gate Charge $(Q_{G(tot)} = 55 \text{ nC})$
- High Speed Switching with Low Capacitance (Coss = 113 pF)
- 100% Avalanche Tested
- AEC-Q101 Qualified and PPAP Capable
- This Device is Halide Free and RoHS Compliant with Exemption 7a, Pb–Free 2LI (on Second Level Interconnection)

Applications

- Automotive On Board Charger
- Automotive DC-DC Converter for EV/HEV

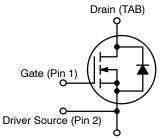
MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Value	Unit	
Drain-to-Source Voltage		V_{DSS}	650	V
Gate-to-Source Voltage		V_{GS}	-8/+22	
Continuous Drain Current	T _C = 25°C	I _D	52	Α
Power Dissipation		P_{D}	200	W
Continuous Drain Current	T _C = 100°C	I _D	32	Α
Power Dissipation		P_{D}	100	W
Pulsed Drain Current (Note 1)	$T_{C} = 25^{\circ}C,$ $t_{P} = 100 \ \mu s$	I _{DM}	156	Α
Continuous Source-Drain Current (Body Diode)	T _C = 25°C, V _{GS} = -3 V	I _S	30	
	$T_{C} = 100^{\circ}C,$ $V_{GS} = -3 \text{ V}$		17	
Pulsed Source-Drain Current (Body Diode) (Note 1)	$T_{C} = 25^{\circ}C,$ $V_{GS} = -3 \text{ V},$ $t_{P} = 100 \mu\text{s}$	I _{SM}	127	
Single Pulse Avalanche Energy (Note 2) I _{LPK} = 16.7 A, L = 1 mH		E _{AS}	139	mJ
Operating Junction and Storage Te	T _J , T _{stg}	–55 to 175	°C	
Lead Temperature for Soldering Po (1/8" from Case for 10 s)	T _L	270		

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 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	52 A



Power Source (Pins 3, 4, 5, 6, 7)

N-CHANNEL MOSFET



D2PAK-7L CASE 418BJ

MARKING DIAGRAM

BG032N 065M3S AYWWZZ

BG032N065M3S = Specific Device Code

A = Assembly Location

Y = Year WW = Work Week ZZ = Lot Traceability

ORDERING INFORMATION

Device	Package	Shipping [†]
NVBG032N065M3S	D2PAK-7L	800 / Tape & Reel

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

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Note 3)	$R_{ heta JC}$	0.75	°C/W
Thermal Resistance, Junction-to-Ambient (Note 3)	$R_{\theta JA}$	40	

^{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 specified)

Parameter	Symbol	Test Conditions	Min	Тур	Max	Unit
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
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	μΑ
		V _{DS} = 650 V, T _J = 175°C (Note 5)	-	-	500	μΑ
Gate-to-Source Leakage Current	I _{GSS}	V _{GS} = -8/+ 22 V, V _{DS} = 0 V	-	-	±1.0	μΑ
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)	-	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 5)	-	52	-	
Gate Threshold Voltage	V _{GS(TH)}	$V_{GS} = V_{DS}, I_D = 7.5 \text{ mA}, T_J = 25^{\circ}\text{C}$	2.0	2.7	4.0	V
Forward Trans-conductance	g _{FS}	V _{DS} = 10 V, I _D = 15 A (Note 5)	-	9.9	-	S
CHARGES, CAPACITANCES & GATE	RESISTANCI	E				
Input Capacitance	C _{ISS}	V _{DS} = 400 V, V _{GS} = 0 V, f = 1 MHz (Note 5)	-	1409	-	pF
Output Capacitance	C _{OSS}		-	113	-	
Reverse Transfer Capacitance	C _{RSS}		-	9.0	-	
Total Gate Charge	Q _{G(TOT)}	$V_{DD} = 400 \text{ V}, I_D = 15 \text{ A}, V_{GS} = -3/18 \text{ V}$	-	55	-	nC
Gate-to-Source Charge	Q_{GS}	(Note 5)	-	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)}	$V_{GS} = -3/18 \text{ V}, I_D = 15 \text{ A}, V_{DD} = 400 \text{ V},$	-	8.8	-	ns
Turn-Off Delay Time	t _{d(OFF)}	$R_G = 4.7 \ \Omega, T_J = 25^{\circ}C \ (Note 4, 5)$	-	31	-	
Rise Time	t _r		-	12	-	1
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}	1		49	-	

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

Parameter	Symbol	Test Conditions	Min	Тур	Max	Unit
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	t _{d(ON)}	$V_{GS} = -3/18 \text{ V}, I_D = 15 \text{ A}, V_{DD} = 400 \text{ V},$ $R_G = 4.7 \Omega, T_J = 175^{\circ}\text{C} \text{ (Note 4, 5)}$	_	7.8	-	ns
Turn-Off Delay Time	t _{d(OFF)}	$H_G = 4.7 \Omega$, $I_J = 175^{\circ}C$ (Note 4, 5)	-	37	-	
Rise Time	t _r		-	12	-	
Fall Time	t _f		-	11	-	
Turn-On Switching Loss	E _{ON}		-	31	-	μЈ
Turn-Off Switching Loss	E _{OFF}		-	25	-	
Total Switching Loss	E _{TOT}		_	56	-	
SOURCE-TO-DRAIN DIODE CHARA	CTERISTICS					
Forward Diode Voltage		$I_{SD} = 15 \text{ A}, V_{GS} = -3 \text{ V}, T_{J} = 25^{\circ}\text{C}$	_	4.5	6.0	٧
	V _{SD}	I _{SD} = 15 A, V _{GS} = -3 V, T _J = 175°C (Note 5)	-	4.2	_	
Reverse Recovery Time	t _{RR}	$V_{GS} = -3 \text{ V}, I_S = 15 \text{ A}, dI/dt = 1000 \text{ A}/\mu\text{s},$	-	15.5	-	ns
Charge time	t _a	V _{DS} = 400 V, T _J = 25°C (Note 5)	_	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	-	Α

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.} EON/EOFF result is with body diode.

^{5.} Defined by design, not subject to production test.

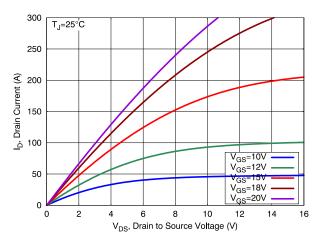


Figure 1. Output Characteristics

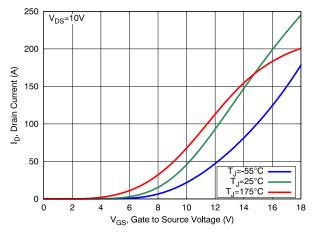


Figure 3. Transfer Characteristics

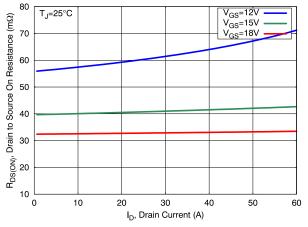


Figure 5. On-Resistance vs. Drain Current

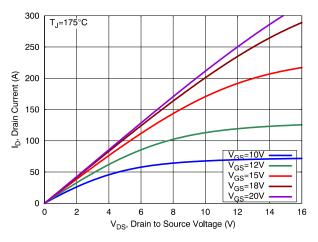


Figure 2. Output Characteristics

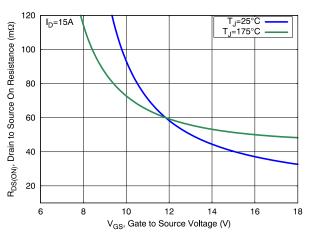


Figure 4. On-Resistance vs. Gate Voltage

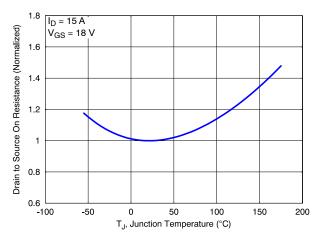


Figure 6. On-Resistance vs. Junction Temperature

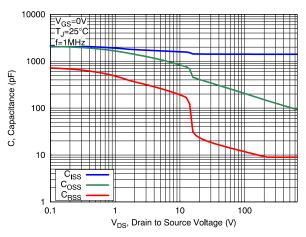


Figure 7. Capacitance Characteristics

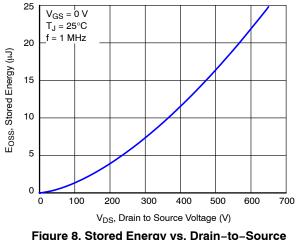


Figure 8. Stored Energy vs. Drain-to-Source Voltage

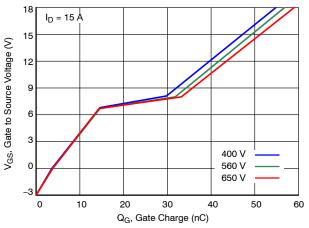


Figure 9. Gate Charge Characteristics

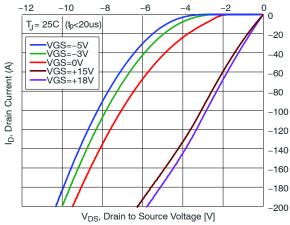


Figure 10. Reverse Conduction Characteristics

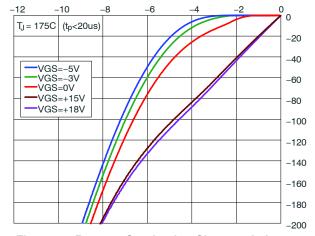


Figure 11. Reverse Conduction Characteristics

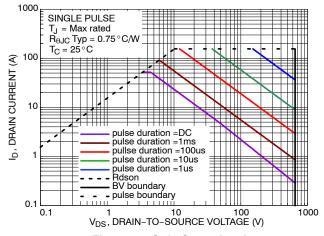


Figure 12. Safe Operating Area

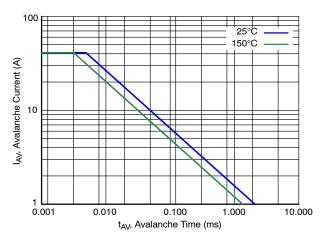


Figure 13. Avalanche Current vs. Pulse Time (UIS)

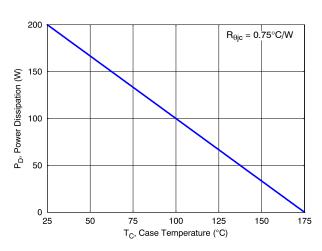


Figure 14. Maximum Power Dissipation vs.

Case Temperature

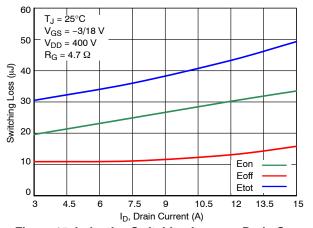


Figure 15. Inductive Switching Loss vs. Drain Current

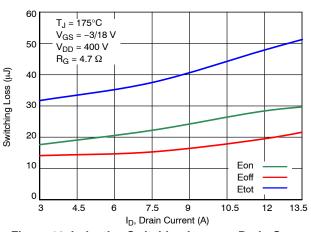


Figure 16. Inductive Switching Loss vs. Drain Current

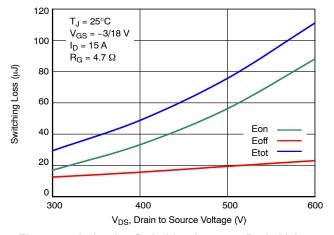


Figure 17. Inductive Switching Loss vs. Drain Voltage

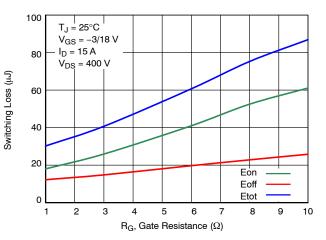


Figure 18. Inductive Switching Loss vs.
Gate Resistance

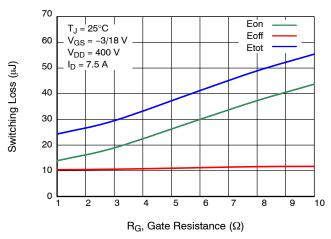


Figure 19. Inductive Switching Loss vs. Gate Resistance

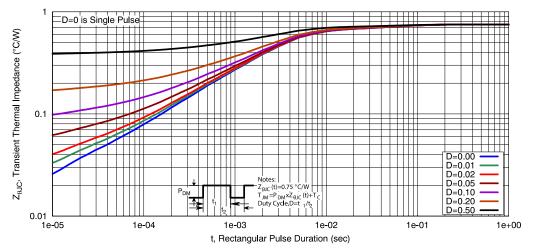


Figure 20. Thermal Response Characteristics



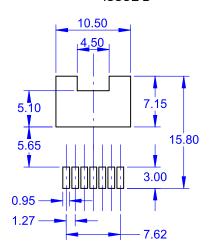
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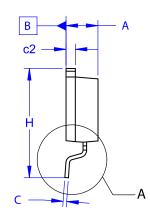
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3.20 MIN

D²PAK7 (TO-263-7L HV) CASE 418BJ **ISSUE B**



LAND PATTERN RECOMMENDATION



DATE 16 AUG 2019

NOTES:

A. PACKAGE CONFORMS TO JEDEC TO-263 VARIATION CB EXCEPT WHERE NOTED. B. ALL DIMENSIONS ARE IN MILLIMETERS.

OUT OF JEDEC STANDARD VALUE.
D. DIMENSION AND TOLERANCE AS PER ASME
Y14.5-2009.

E. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.

DIM	MILLIMETERS				
DIM	MIN	NOM	MAX		
Α	4.30	4.50	4.70		
A 1	0.00	0.10	0.20		
b2	0.60	0.70	0.80		
b	0.51	0.60	0.70		
С	0.40	0.50	0.60		
c2	1.20	1.30	1.40		
D	9.00	9.20	9.40		
D1	6.15	6.80	7.15		
Е	9.70	9.90	10.20		
E1	7.15	7.65	8.15		
е	~	1.27	~		
Н	15.10	15.40	15.70		
L	2.44	2.64	2.84		
L1	1.00	1.20	1.40		
L3	~	0.25	~		
aaa	~	~	0.25		

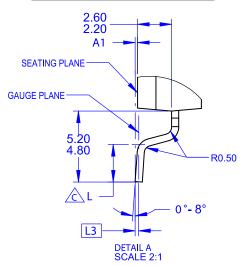
GENERIC MARKING DIAGRAM* XXXXXXXX **AYWWG**

D₁

XXXX = Specific Device Code = Assembly Location Α

Υ = 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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