

Silicon Carbide (SiC) MOSFET - 19 mohm, 650 V, M2, D2PAK-7L NVBG025N065SC1

Features

- Typ. $R_{DS(on)} = 19 \text{ m}\Omega$ @ $V_{GS} = 18 \text{ V}$
Typ. $R_{DS(on)} = 25 \text{ m}\Omega$ @ $V_{GS} = 15 \text{ V}$
- Ultra Low Gate Charge ($Q_{G(tot)} = 164 \text{ nC}$)
- Low Output Capacitance ($C_{oss} = 278 \text{ pF}$)
- 100% Avalanche Tested
- AEC-Q101 Qualified and PPAP Capable
- RoHS Compliant

Typical Applications

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

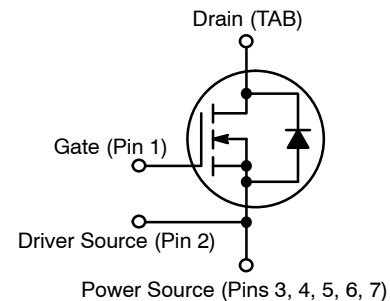
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V_{DSS}	650	V
Gate-to-Source Voltage			V_{GS}	-8/+22	V
Recommended Operation Values of Gate – Source Voltage		$T_C < 175^{\circ}\text{C}$	V_{GSop}	-5/+18	V
Continuous Drain Current (Note 2)	Steady State	$T_C = 25^{\circ}\text{C}$	I_D	106	A
Power Dissipation (Note 2)			P_D	395	W
Continuous Drain Current (Notes 1, 2)	Steady State	$T_C = 100^{\circ}\text{C}$	I_D	75	A
Power Dissipation (Notes 1, 2)			P_D	197	W
Pulsed Drain Current (Note 3)		$T_C = 25^{\circ}\text{C}$	I_{DM}	284	A
Operating Junction and Storage Temperature Range			T_J, T_{stg}	-55 to +175	$^{\circ}\text{C}$
Source Current (Body Diode)			I_S	83	A
Single Pulse Drain-to-Source Avalanche Energy ($I_L = 11.2\text{ A}_{pk}$, $L = 1\text{ mH}$) (Note 4)			E_{AS}	62	mJ
Maximum Lead Temperature for Soldering, 1/8" from Case for 10 Seconds			T_L	260	$^{\circ}\text{C}$

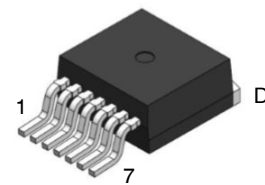
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

- Surface mounted on a FR-4 board using 1 in2 pad of 2 oz copper.
- The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
- Repetitive rating, limited by max junction temperature.
- E_{AS} of 62 mJ is based on starting $T_J = 25^\circ\text{C}$; $L = 1 \text{ mH}$, $I_{AS} = 11.2 \text{ A}$, $V_{DD} = 50 \text{ V}$, $V_{GS} = 18 \text{ V}$.

$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
650 V	28.5 m Ω @ 18 V	106 A



N-CHANNEL MOSFET



D2PAK-7L
CASE 418BJ

MARKING DIAGRAM



BG025N065SC1 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Lot Traceability

ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

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THERMAL CHARACTERISTICS

Parameter	Symbol	Typ	Max	Units
Thermal Resistance Junction-to-Case (Note 2)	$R_{\theta JC}$	0.38	–	°C/W
Thermal Resistance Junction-to-Ambient (Notes 1, 2)	$R_{\theta JA}$	–	40	°C/W

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	650			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 20\text{ mA}$, refer to 25°C (Note 5)		0.15		V/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}$ $V_{DS} = 650\text{ V}$	$T_J = 25^\circ\text{C}$		10	μA
			$T_J = 175^\circ\text{C}$ (Note 5)		1	mA
Gate-to-Source Leakage Current	I_{GSS}	$V_{GS} = +18/-5\text{ V}, V_{DS} = 0\text{ V}$			250	nA

ON CHARACTERISTICS

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 15.5\text{ mA}$	1.8	2.8	4.3	V
Recommended Gate Voltage	V_{GOP}		–5		+18	V
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 15\text{ V}, I_D = 45\text{ A}, T_J = 25^\circ\text{C}$		25		m Ω
		$V_{GS} = 18\text{ V}, I_D = 45\text{ A}, T_J = 25^\circ\text{C}$		19	28.5	
		$V_{GS} = 18\text{ V}, I_D = 45\text{ A}, T_J = 175^\circ\text{C}$ (Note 5)		24		
Forward Transconductance	g_{FS}	$V_{DS} = 10\text{ V}, I_D = 45\text{ A}$ (Note 5)		27		S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz},$ $V_{DS} = 325\text{ V}$ (Note 5)		3480		pF
Output Capacitance	C_{OSS}			278		
Reverse Transfer Capacitance	C_{RSS}			25		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -5/18\text{ V}, V_{DS} = 520\text{ V},$ $I_D = 45\text{ A}$ (Note 5)		164		nC
Gate-to-Source Charge	Q_{GS}			48		
Gate-to-Drain Charge	Q_{GD}			48		
Gate-Resistance	R_G	$f = 1\text{ MHz}$		1.5		Ω

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -5/18\text{ V}, V_{DS} = 400\text{ V},$ $I_D = 45\text{ A}, R_G = 2.2\text{ }\Omega,$ Inductive Load (Note 5)		17		ns
Rise Time	t_r			19		
Turn-Off Delay Time	$t_{d(OFF)}$			32		
Fall Time	t_f			8		
Turn-On Switching Loss	E_{ON}			93		μJ
Turn-Off Switching Loss	E_{OFF}			84		
Total Switching Loss	E_{TOT}			177		

SOURCE-DrAIN DIODE CHARACTERISTICS

Continuous Source-Drain Diode Forward Current	I_{SD}	$V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$ (Note 5)			83	A
Pulsed Source-Drain Diode Forward Current (Note 3)	I_{SDM}	$V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$ (Note 5)			284	A
Forward Diode Voltage	V_{SD}	$V_{GS} = -5\text{ V}, I_{SD} = 45\text{ A}, T_J = 25^\circ\text{C}$		4.7		V

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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SOURCE-DRAIN DIODE CHARACTERISTICS

Reverse Recovery Time	t _{RR}	V _{GS} = -5/18 V, I _{SD} = 45 A, dI _S /dt = 1000 A/μs (Note 5)		25		ns
Reverse Recovery Charge	Q _{RR}			171		nC
Reverse Recovery Energy	E _{REC}			15.8		μJ
Peak Reverse Recovery Current	I _{RRM}			13.7		A
Charge time	T _a			14.9		ns
Discharge time	T _b			10.6		ns

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.

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

TYPICAL CHARACTERISTICS

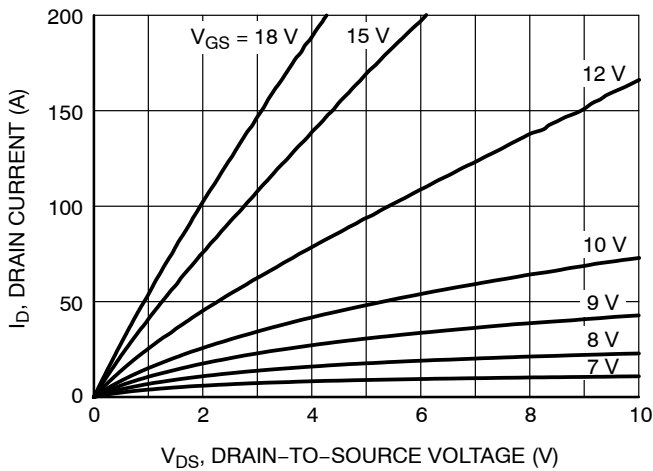


Figure 1. On-Region Characteristics

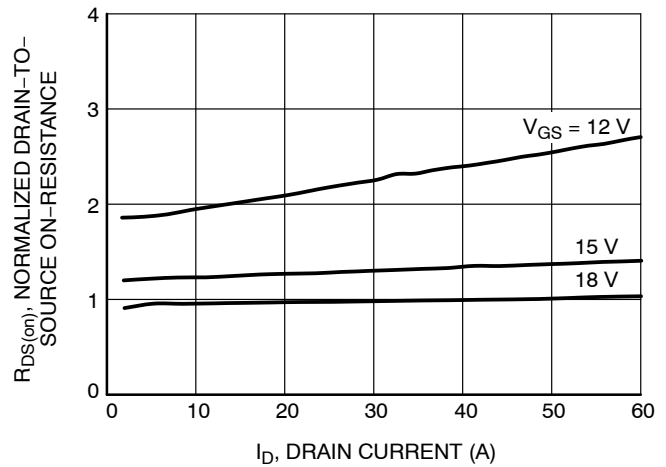


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

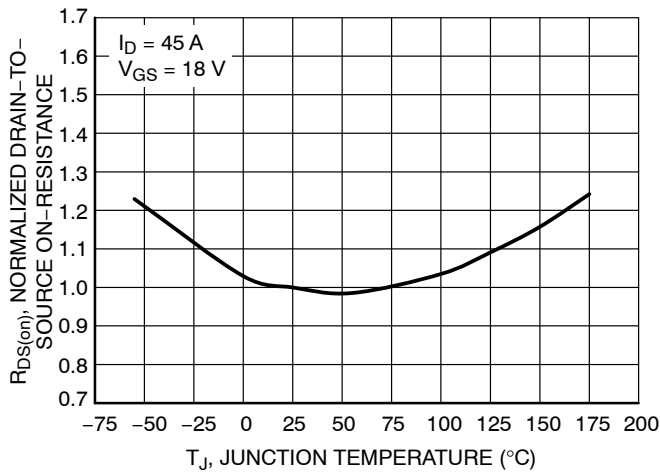


Figure 3. On-Resistance Variation with Temperature

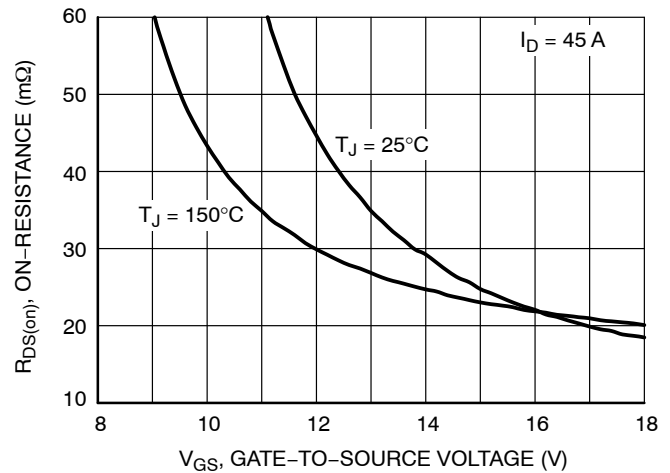


Figure 4. On-Resistance vs. Gate-to-Source Voltage

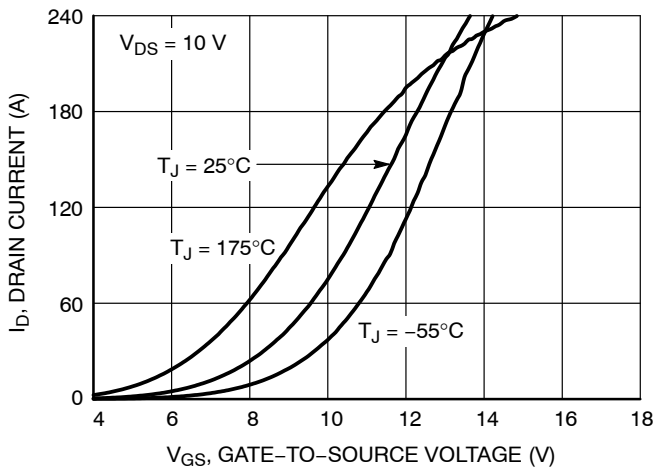


Figure 5. Transfer Characteristics

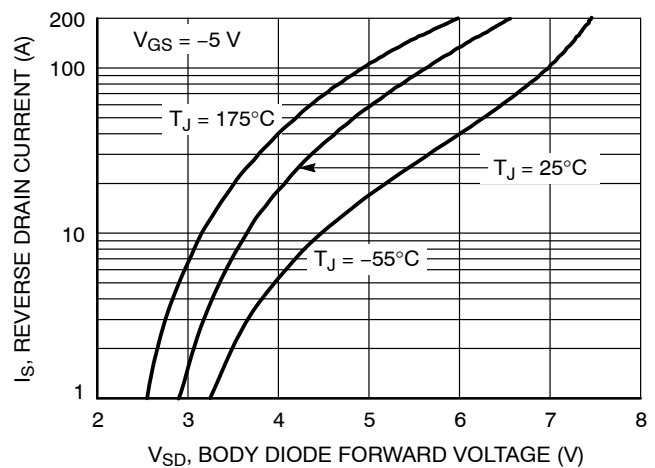


Figure 6. Diode Forward Voltage vs. Current

TYPICAL CHARACTERISTICS

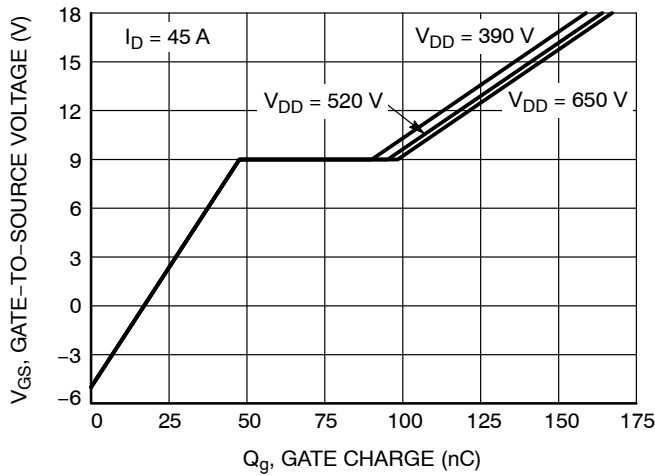


Figure 7. Gate-to-Source Voltage vs. Total Charge

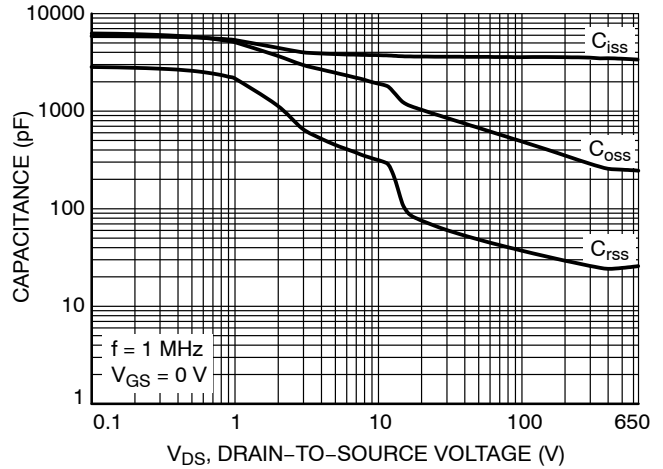


Figure 8. Capacitance vs. Drain-to-Source Voltage

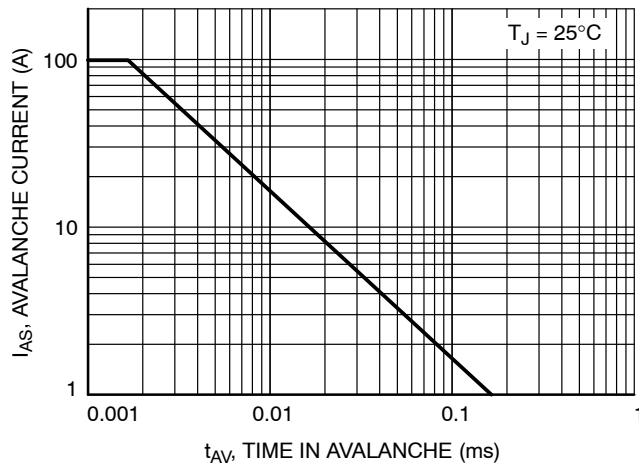


Figure 9. Unclamped Inductive Switching Capability

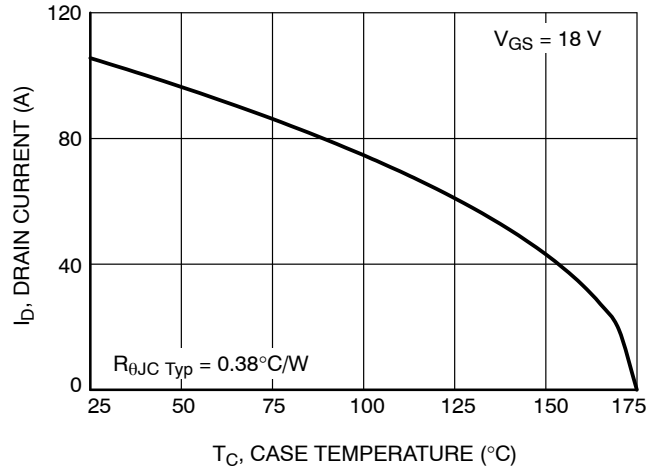


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

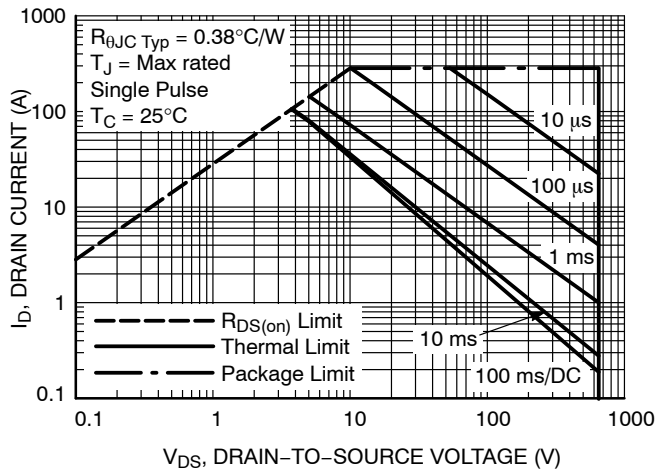


Figure 11. Safe Operating Area

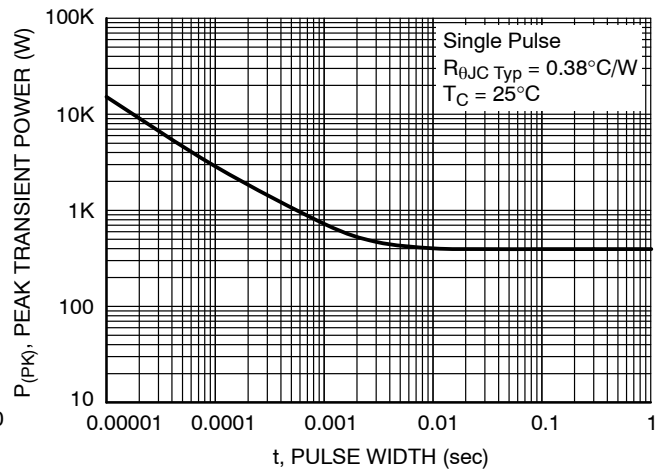


Figure 12. Single Pulse Maximum Power Dissipation

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TYPICAL CHARACTERISTICS

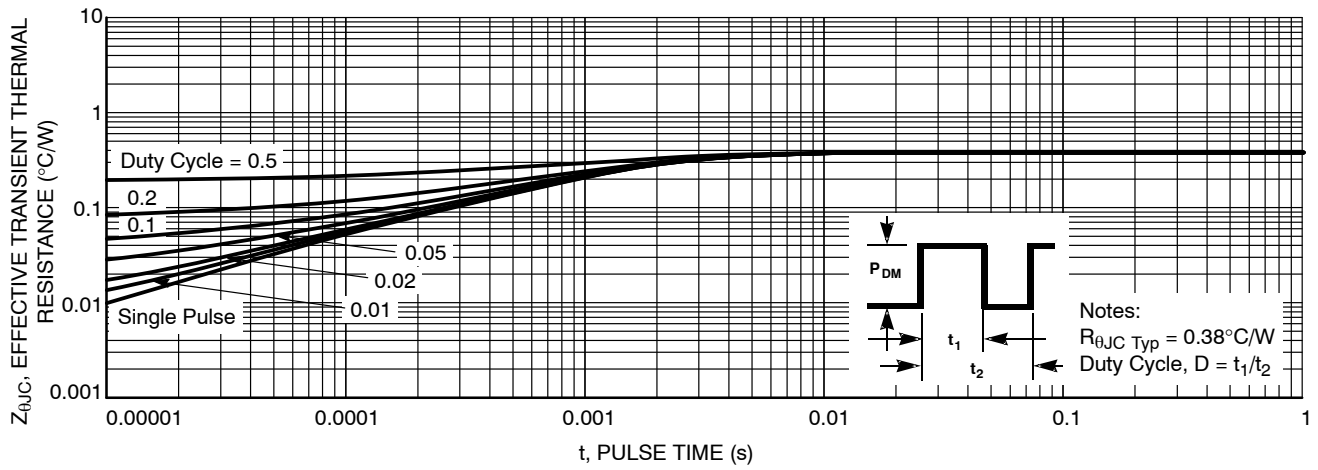


Figure 13. Junction-to-Case Transient Thermal Response

DEVICE ORDERING INFORMATION

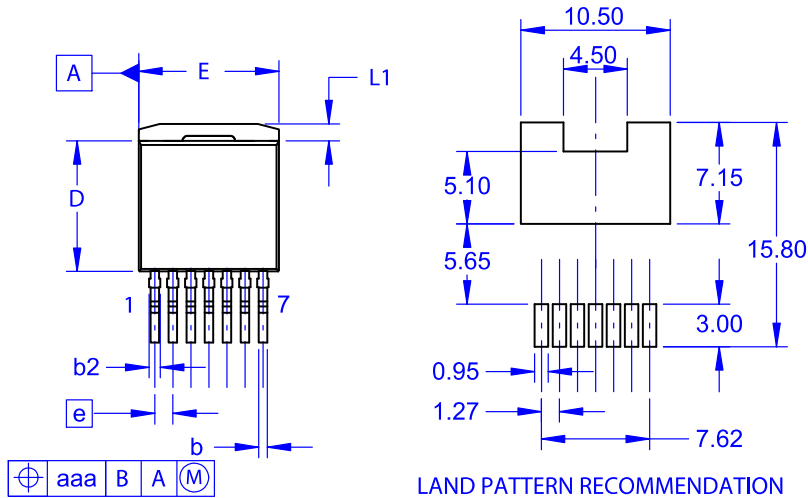
Device	Package	Shipping [†]
NVBG025N065SC1	D2PAK-7L	800 / Tape & Reel

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

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PACKAGE DIMENSIONS

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

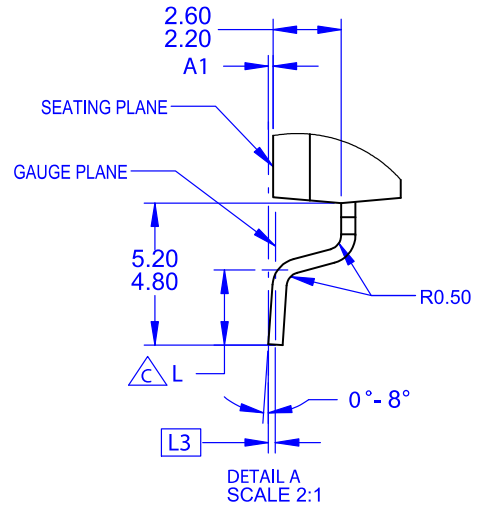
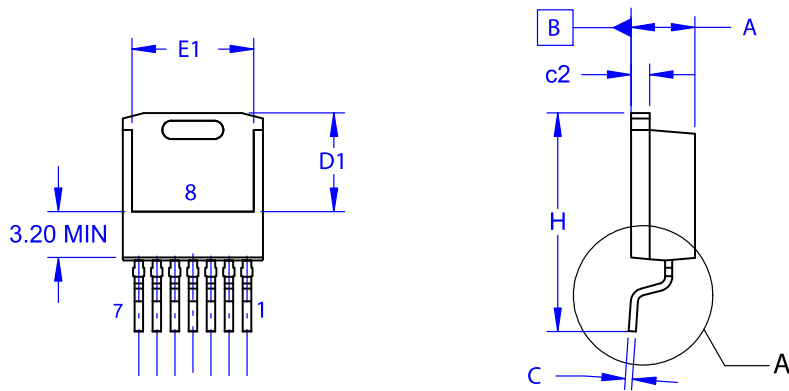


NOTES:

- 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		
	MIN	NOM	MAX
A	4.30	4.50	4.70
A1	0.00	0.10	0.20
b2	0.60	0.70	0.80
b	0.51	0.60	0.70
c	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
E	9.70	9.90	10.20
E1	7.15	7.65	8.15
e	~	1.27	~
H	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



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