

MOSFET – SiC Power, Single N-Channel, D2PAK-7L

900 V, 20 mΩ, 112 A

NVBG020N090SC1

Features

- Typ. $R_{DS(on)} = 20 \text{ m}\Omega$
- Ultra Low Gate Charge (typ. $Q_{G(tot)} = 200 \text{ nC}$)
- Low Effective Output Capacitance (typ. $C_{oss} = 295 \text{ pF}$)
- 100% Avalanche Tested
- Qualified According to AEC-Q101
- 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}	900	V
Gate-to-Source Voltage			V _{GS}	+19/-10	V
Recommended Operation Values of Gate – Source Voltage		T _C < 175°C	V _{GSop}	+15/-5	V
Continuous Drain Current R _{θJC} (Note 2)	Steady State	T _C = 25°C	I _D	112	A
Power Dissipation R _{θJC} (Note 2)			P _D	477	W
Continuous Drain Current R _{θJA} (Notes 1, 2)	Steady State	T _A = 25°C	I _D	9.8	A
Power Dissipation R _{θJA} (Notes 1, 2)			P _D	3.7	W
Pulsed Drain Current (Note 3)		T _A = 25°C	I _{DM}	448	A
Single Pulse Surge Drain Current Capability (Note 4)	T _A = 25°C, t _p = 10 μs, R _G = 4.7 Ω		I _{DSC}	854	A
Operating Junction and Storage Temperature Range			T _J , T _{stg}	-55 to +175	°C
Source Current (Body Diode)			I _S	148	A
Single Pulse Drain-to-Source Avalanche Energy (I _L = 23 A _{pK} , L = 1 mH) (Note 5)			E _{AS}	264	mJ
Maximum Lead Temperature for Soldering, 1/8” from Case for 10 Seconds			T _L	245	°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.

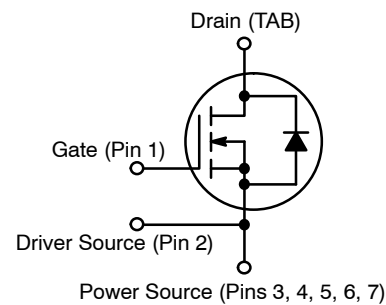
1. Surface mounted on a FR-4 board using 1 in2 pad of 2 oz copper.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
3. Repetitive rating, limited by max junction temperature.
4. Peak current might be limited by transconductance.
5. E_{AS} of 264 mJ is based on starting $T_J = 25^\circ\text{C}$; $L = 1 \text{ mH}$, $I_{AS} = 23 \text{ A}$, $V_{DD} = 100 \text{ V}$, $V_{GS} = 15 \text{ V}$.



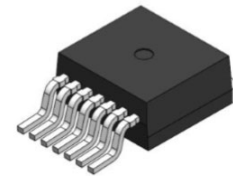
ON Semiconductor®

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$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
900 V	28 mΩ @ 15 V	112 A

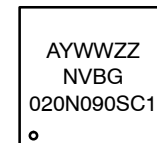


N-CHANNEL MOSFET



D2PAK-7L
CASE 418BJ

MARKING DIAGRAM



A = Assembly Location
Y = Year
WW = Work Week
ZZ = Lot Traceability
NVBG020N090SC1 = Specific Device Code

ORDERING INFORMATION

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

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Table 1. THERMAL CHARACTERISTICS

Parameter	Symbol	Max	Units
Thermal Resistance Junction-to-Case (Note 2)	$R_{\theta JC}$	0.31	°C/W
Thermal Resistance Junction-to-Ambient (Notes 1, 2)	$R_{\theta JA}$	41	°C/W

Table 2. ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise stated)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	900			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 1\text{ mA}$, refer to 25°C		440		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}$ $V_{DS} = 900\text{ V}$	$T_J = 25^\circ\text{C}$		100	μA
			$T_J = 175^\circ\text{C}$		250	μA
Gate-to-Source Leakage Current	I_{GSS}	$V_{GS} = +19/-10\text{ V}, V_{DS} = 0\text{ V}$			±1	μA
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 20\text{ mA}$	1.8	2.6	4.3	V
Recommended Gate Voltage	V_{GOP}		-5		+15	V
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 15\text{ V}, I_D = 60\text{ A}, T_J = 25^\circ\text{C}$		20	28	mΩ
		$V_{GS} = 15\text{ V}, I_D = 60\text{ A}, T_J = 175^\circ\text{C}$		27		mΩ
Forward Transconductance	g_{FS}	$V_{DS} = 20\text{ V}, I_D = 60\text{ A}$		49		S
CHARGES, CAPACITANCES & GATE RESISTANCE						
Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz},$ $V_{DS} = 450\text{ V}$		4415		pF
Output Capacitance	C_{OSS}			295		
Reverse Transfer Capacitance	C_{RSS}			25		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -5/15\text{ V}, V_{DS} = 720\text{ V},$ $I_D = 60\text{ A}$		200		nC
Threshold Gate Charge	$Q_{G(TH)}$			42		
Gate-to-Source Charge	Q_{GS}			76		
Gate-to-Drain Charge	Q_{GD}			56		
Gate-Resistance	R_G	$f = 1\text{ MHz}$		1.5		Ω
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -5/15\text{ V}, V_{DS} = 720\text{ V},$ $I_D = 60\text{ A}, R_G = 2.5\text{ }\Omega,$ Inductive Load		39		ns
Rise Time	t_r			52		
Turn-Off Delay Time	$t_{d(OFF)}$			58		
Fall Time	t_f			13		
Turn-On Switching Loss	E_{ON}			1551		μJ
Turn-Off Switching Loss	E_{OFF}			179		
Total Switching Loss	E_{TOT}			1730		
DRAIN-SOURCE DIODE CHARACTERISTICS						
Continuous Drain-Source Diode Forward Current	I_{SD}	$V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$			148	A
Pulsed Drain-Source Diode Forward Current (Note 3)	I_{SDM}	$V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$			448	A
Forward Diode Voltage	V_{SD}	$V_{GS} = -5\text{ V}, I_{SD} = 30\text{ A}, T_J = 25^\circ\text{C}$		3.7		V

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Table 2. ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise stated)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
DRAIN-SOURCE DIODE CHARACTERISTICS						
Reverse Recovery Time	t_{RR}	$V_{GS} = -5/15\text{ V}$, $I_{SD} = 60\text{ A}$, $dI_S/dt = 1000\text{ A}/\mu\text{s}$, $V_{DS} = 720\text{ V}$		28		ns
Reverse Recovery Charge	Q_{RR}			186		nC
Reverse Recovery Energy	E_{REC}			4		μJ
Peak Reverse Recovery Current	I_{RRM}			14		A
Charge time	T_a			17		ns
Discharge time	T_b			11		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.

TYPICAL CHARACTERISTICS

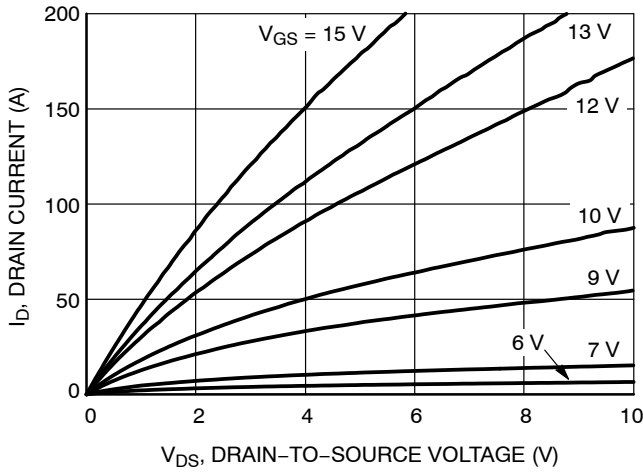


Figure 1. On-Region Characteristics

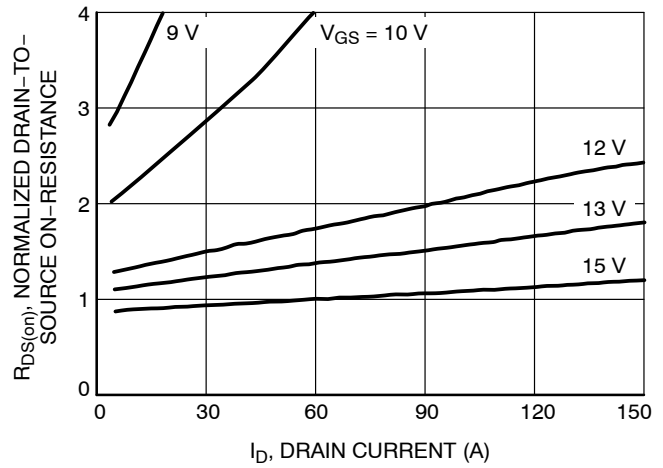


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

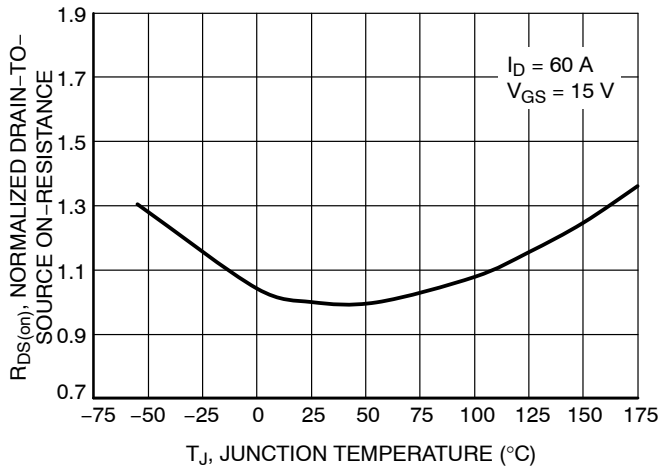


Figure 3. On-Resistance Variation with Temperature

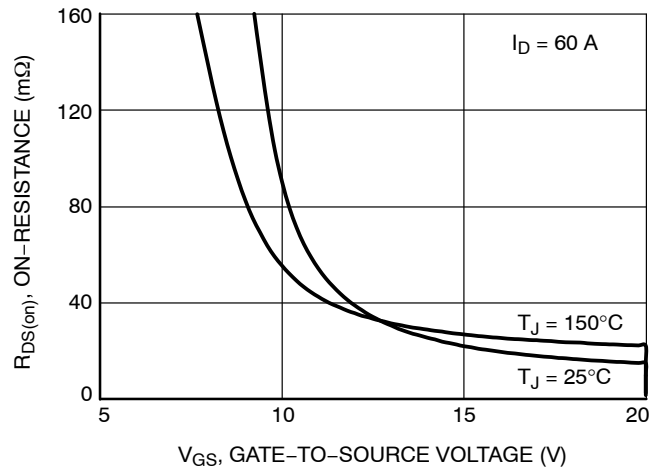


Figure 4. On-Resistance vs. Gate-to-Source Voltage

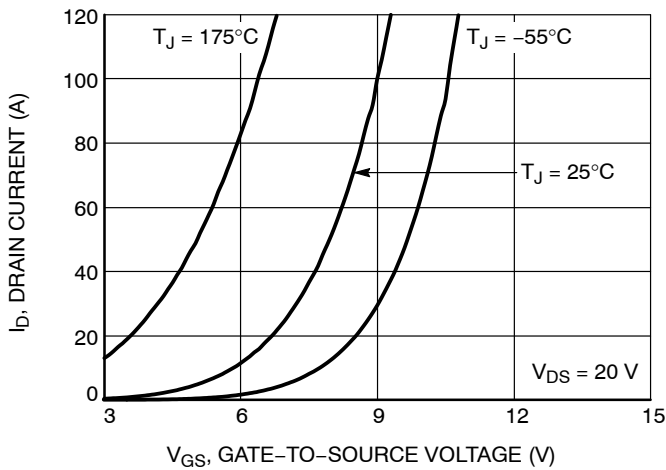


Figure 5. Transfer Characteristics

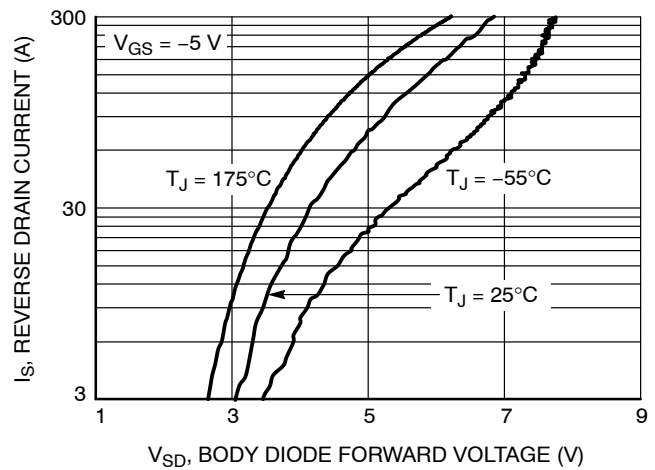


Figure 6. Diode Forward Voltage vs. Current

TYPICAL CHARACTERISTICS

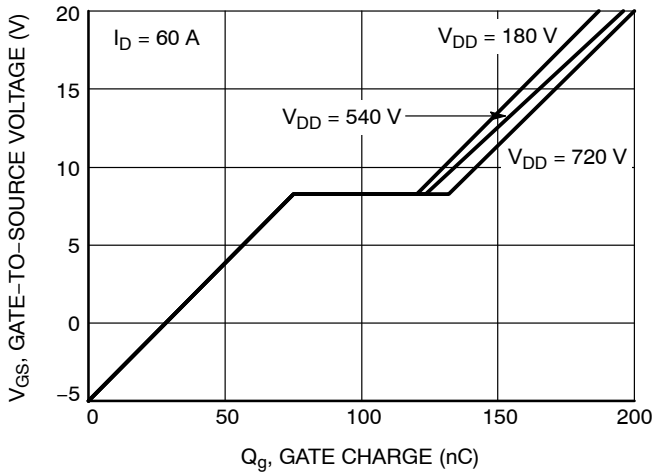


Figure 7. Gate-to-Source Voltage vs. Total Charge

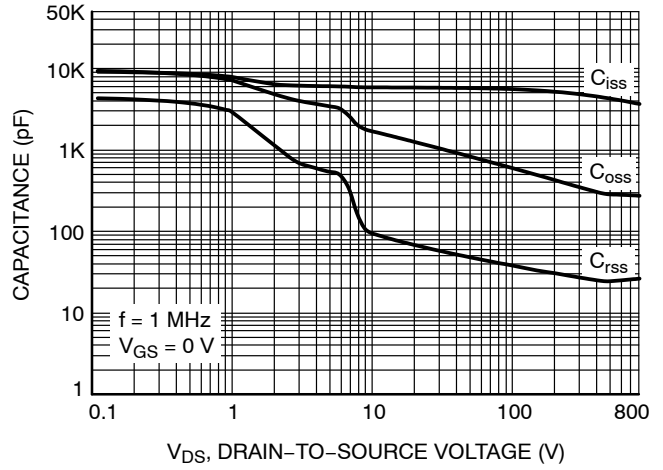


Figure 8. Capacitance vs. Drain-to-Source Voltage

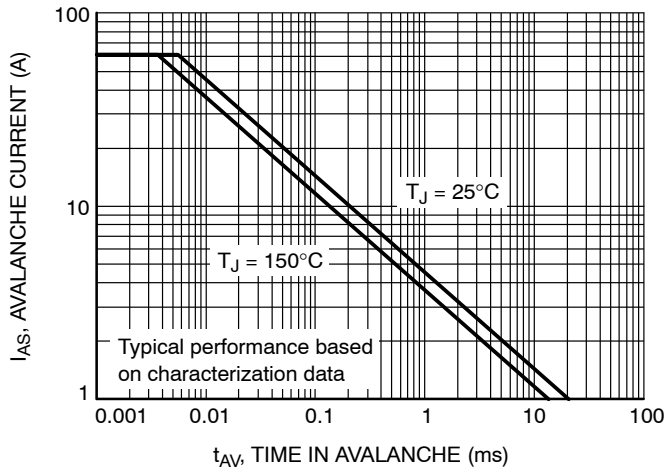


Figure 9. Unclamped Inductive Switching Capability

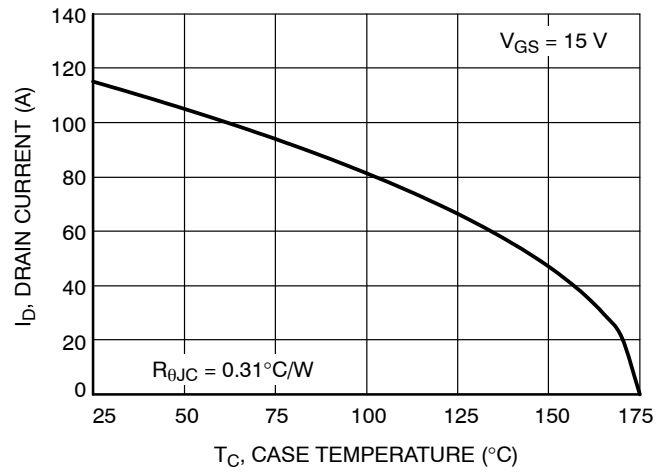


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

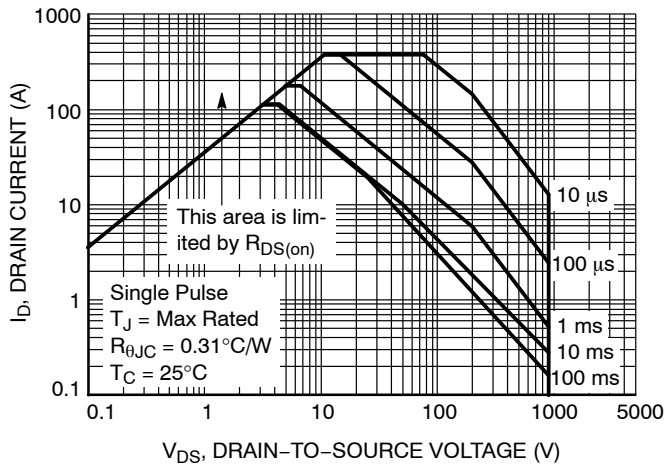


Figure 11. Safe Operating Area

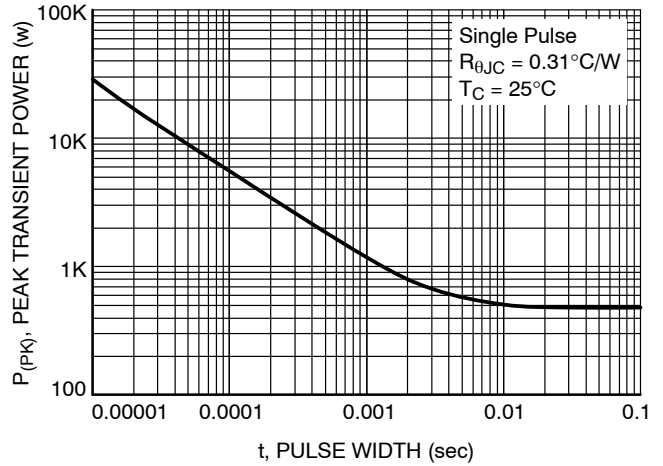


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS

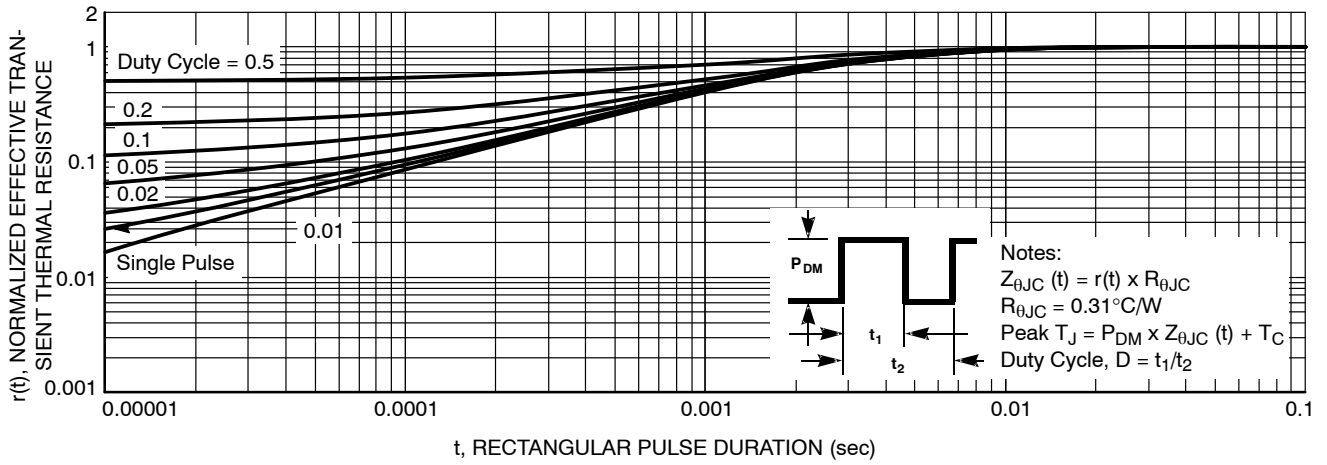


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

DEVICE ORDERING INFORMATION

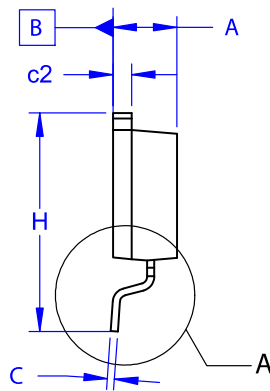
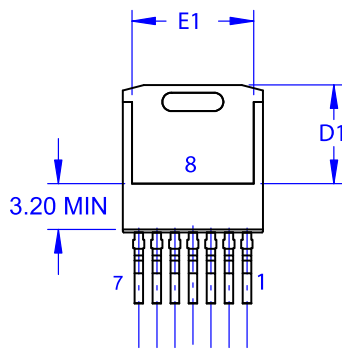
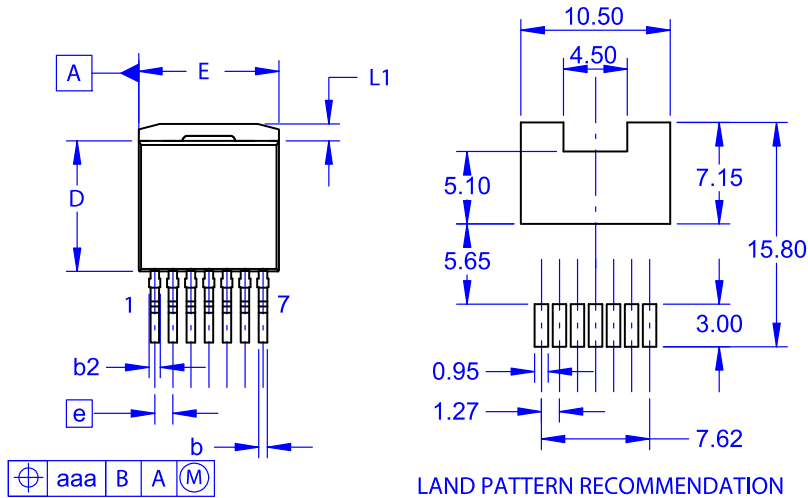
Device	Package	Shipping [†]
NVBG020N090SC1	D2PAK-7L	800 / Tape & Reel

[†]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



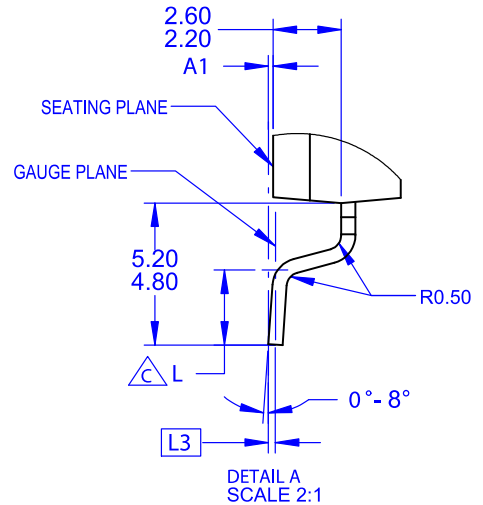
NOTES:


- 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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