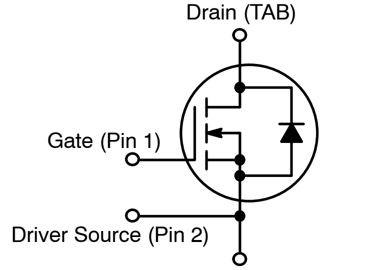
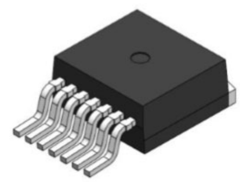
Silicon Carbide (SiC) MOSFET – 31 mohm, 650 V, M2, D2PAK-7L

NVBG045N065SC1

$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
650 V	50 mΩ @ 18 V	62 A



N−CHANNEL MOSFET



D2PAK−7L
CASE 418BJ

Features

- Typ. $R_{DS(on)}$ = 31 mΩ @ V_{GS} = 18 V
  Typ. $R_{DS(on)}$ = 45 mΩ @ V_{GS} = 15 V
- Ultra Low Gate Charge ($Q_{G(tot)}$ = 105 nC)
- Low Effective Output Capacitance (C_{oss} = 168 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)

Typical 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	V
Recommended Operation Values of Gate − Source Voltage		T_C < 175°C	V_{GSop}	−5/+18	V
Continuous Drain Current (Note 2)	Steady State	T_C = 25°C	I_D	62	A
Power Dissipation (Note 2)			P_D	242	W
Continuous Drain Current (Notes 1, 2)	Steady State	T_C = 100°C	I_D	44	A
Power Dissipation (Notes 1, 2)			P_D	121	W
Pulsed Drain Current (Note 3)		T_C = 25°C	I_{DM}	184	A
Single Pulse Surge Drain Current Capability	T_A = 25°C, t_p = 10 μs, R_G = 4.7 Ω		I_{DSC}	315	A
Operating Junction and Storage Temperature Range			T_J, T_{stg}	−55 to +175	°C
Source Current (Body Diode)			I_S	56	A
Single Pulse Drain−to−Source Avalanche Energy (I_L = 12 A_{pk}, L = 1 mH) (Note 4)			E_{AS}	72	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 using1 in^2 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.

MARKING DIAGRAM

BG045N
065SC1
AYWWZZ

BG045N065SC1 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Lot Traceability

ORDERING INFORMATION

Device	Package	Shipping†
NVBG045N065SC1	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.

4. E_{AS} of 72 mJ is based on starting T_J = 25°C; L = 1 mH, I_{AS} = 12 A, V_{DD} = 50 V, V_{GS} = 18 V.

THERMAL CHARACTERISTICS

Parameter	Symbol	Max	Unit
Thermal Resistance Junction−to−Case (Note 2)	$R_{θJC}$	0.62	°C/W
Thermal Resistance Junction−to−Ambient (Notes 1, 2)	$R_{θJA}$	40	°C/W

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	$V_{(BR)DSS}/T_J$	I_D = 20 mA, refer to 25°C			0.13		V/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 650 V	T_J = 25°C			10	μA
			T_J = 175°C			1	mA
Gate−to−Source Leakage Current	I_{GSS}	V_{GS} = +18/−5 V, V_{DS} = 0 V				250	nA
ON CHARACTERISTICS							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS} , I_D = 8 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 V, I_D = 25 A, T_J = 25°C			45		mΩ
		V_{GS} = 18 V, I_D = 25 A, T_J = 25°C			31	50	
		V_{GS} = 18 V, I_D = 25 A, T_J = 175°C			40		
Forward Transconductance	g_{FS}	V_{DS} = 10 V, I_D = 25 A			16		S
CHARGES, CAPACITANCES & GATE RESISTANCE							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = 325 V			1890		pF
Output Capacitance	C_{OSS}				168		
Reverse Transfer Capacitance	C_{RSS}				15		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −5/18 V, V_{DS} = 520 V, I_D = 25 A			105		nC
Gate−to−Source Charge	Q_{GS}				27		
Gate−to−Drain Charge	Q_{GD}				30		
Gate−Resistance	R_G	f = 1 MHz			3.1		Ω
SWITCHING CHARACTERISTICS							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = −5/18 V, V_{DS} = 400 V, I_D = 25 A, R_G = 2.2 Ω, Inductive Load			13		ns
Rise Time	t_r				14		
Turn−Off Delay Time	$t_{d(OFF)}$				26		
Fall Time	t_f				7		
Turn−On Switching Loss	E_{ON}				47		μJ
Turn−Off Switching Loss	E_{OFF}				33		
Total Switching Loss	E_{TOT}				80		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Continuous Drain−Source Diode Forward Current	I_{SD}	V_{GS} = −5 V, T_J = 25°C				56	A
Pulsed Drain−Source Diode Forward Current (Note 3)	I_{SDM}	V_{GS} = −5 V, T_J = 25°C				184	A
Forward Diode Voltage	V_{SD}	V_{GS} = −5 V, I_{SD} = 25 A, T_J = 25°C			4.4		V

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
DRAIN−SOURCE DIODE CHARACTERISTICS						
Reverse Recovery Time	t_{RR}	V_{GS} = −5/18 V, I_{SD} = 25 A, dI_S/dt = 1000 A/μs		20		ns
Reverse Recovery Charge	Q_{RR}			100		nC
Reverse Recovery Energy	E_{REC}			3.8		μJ
Peak Reverse Recovery Current	I_{RRM}			10		A
Charge Time	Ta			11		ns
Discharge Time	Tb			8.7		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

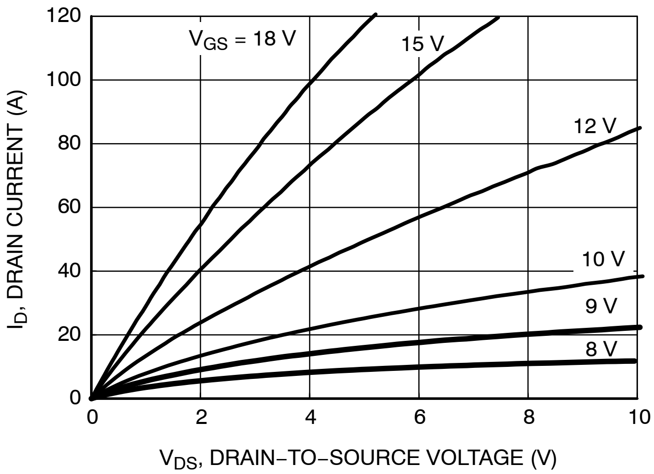


Figure 1. On−Region Characteristics

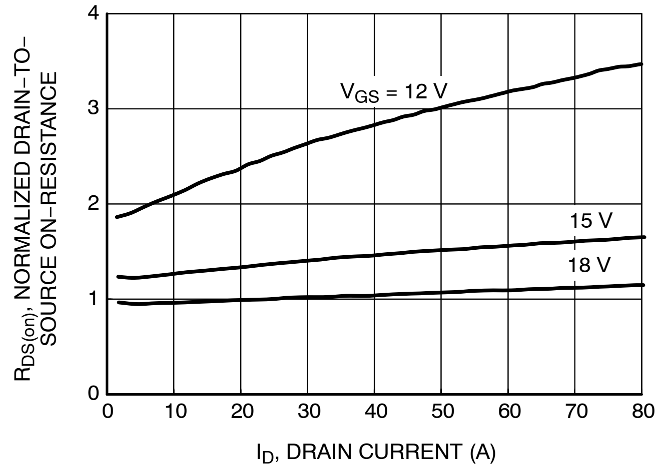


Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage

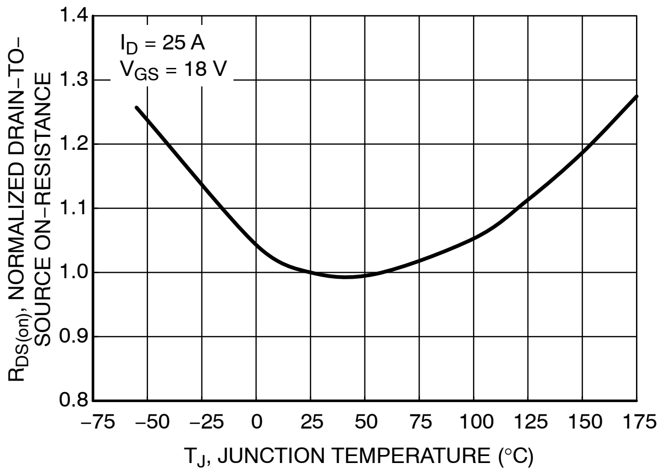


Figure 3. On−Resistance Variation with Temperature

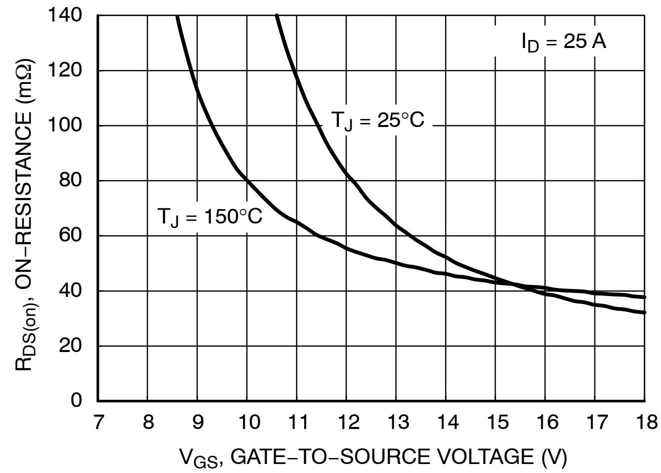


Figure 4. On−Resistance vs. Gate−to−Source Voltage

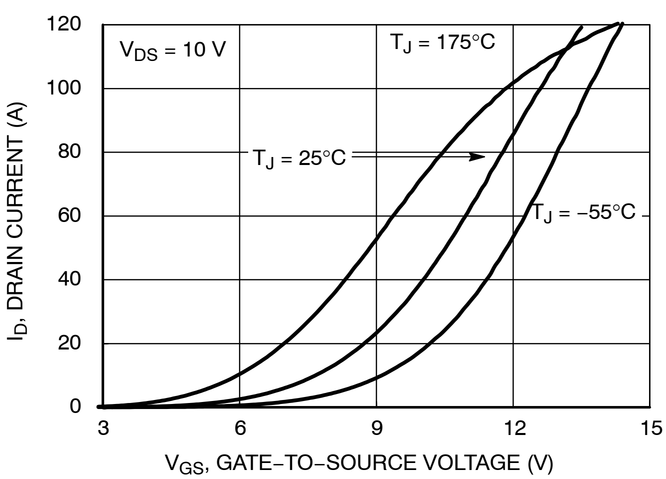


Figure 5. Transfer Characteristics

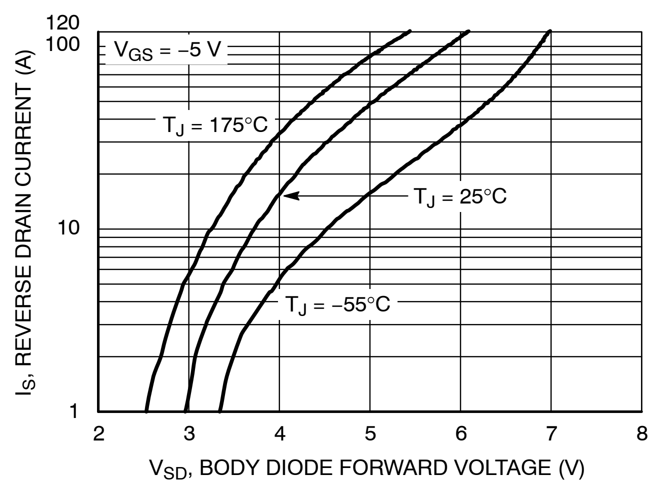


Figure 6. Diode Forward Voltage vs. Current

TYPICAL CHARACTERISTICS (continued)

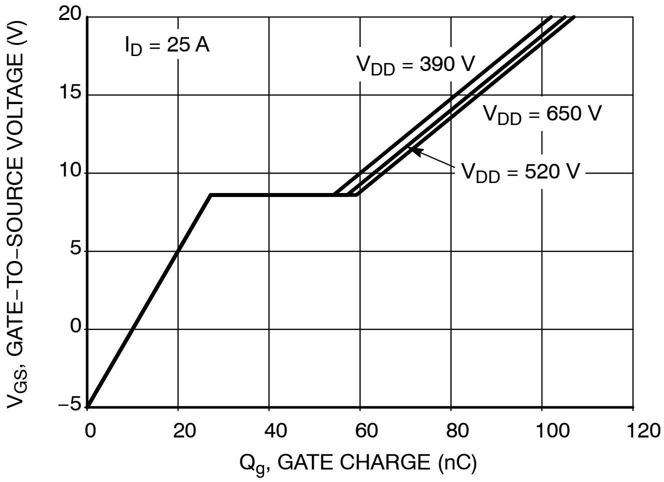


Figure 7. Gate−to−Source Voltage vs. Total Charge

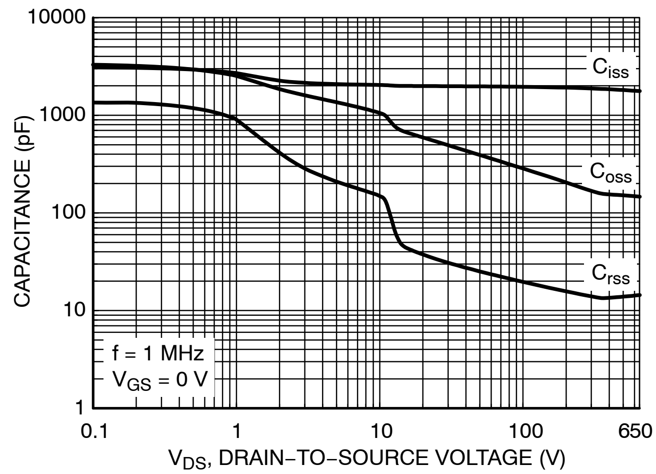


Figure 8. Capacitance vs. Drain−to−Source Voltage

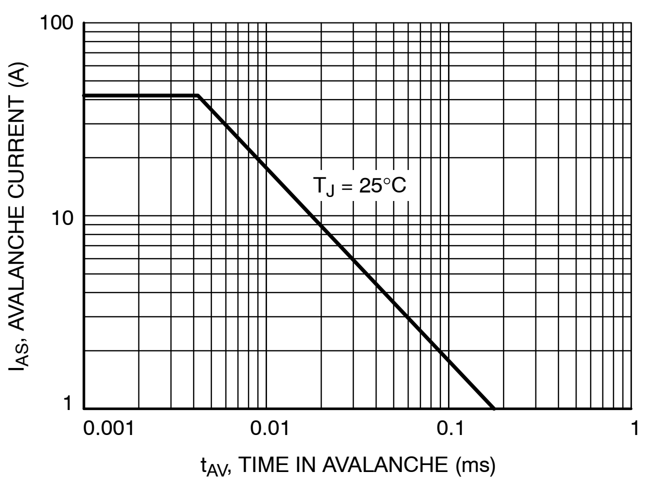


Figure 9. Unclamped Inductive Switching Capability

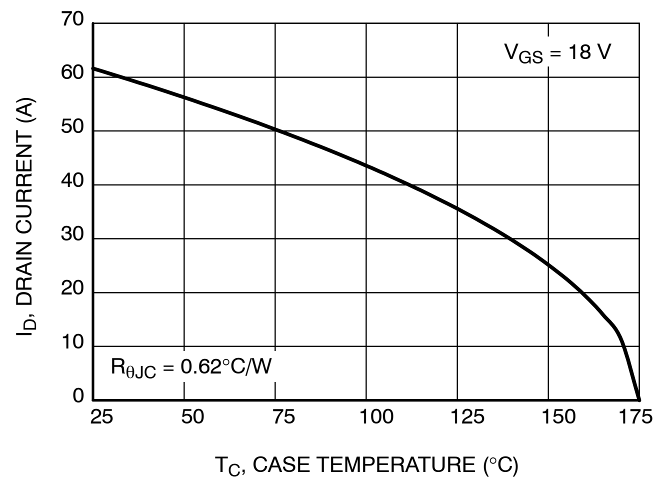


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

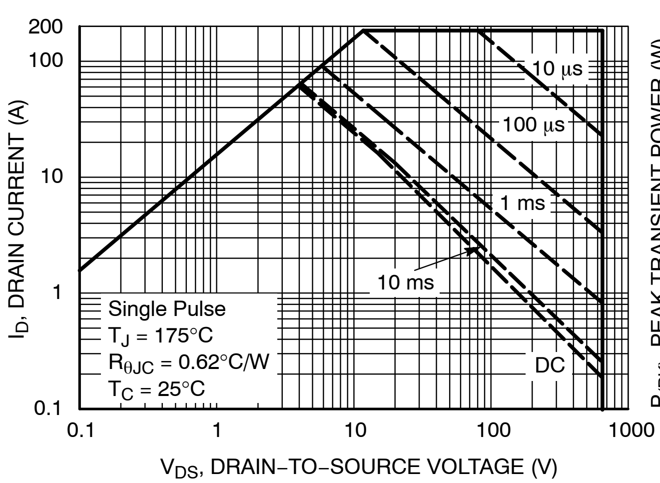


Figure 11. Safe Operating Area

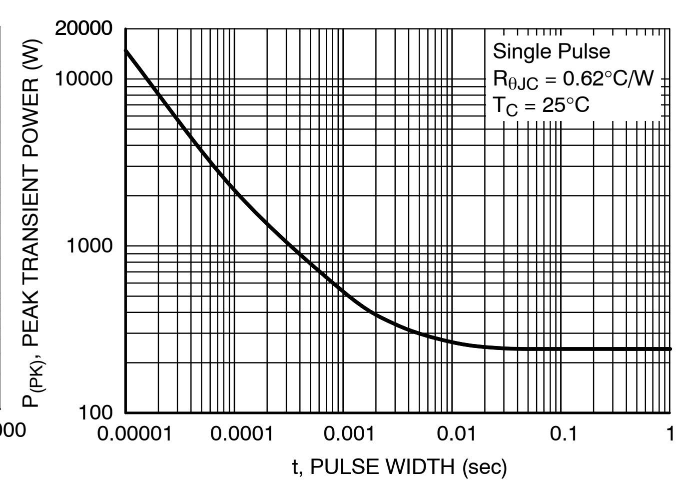


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (continued)

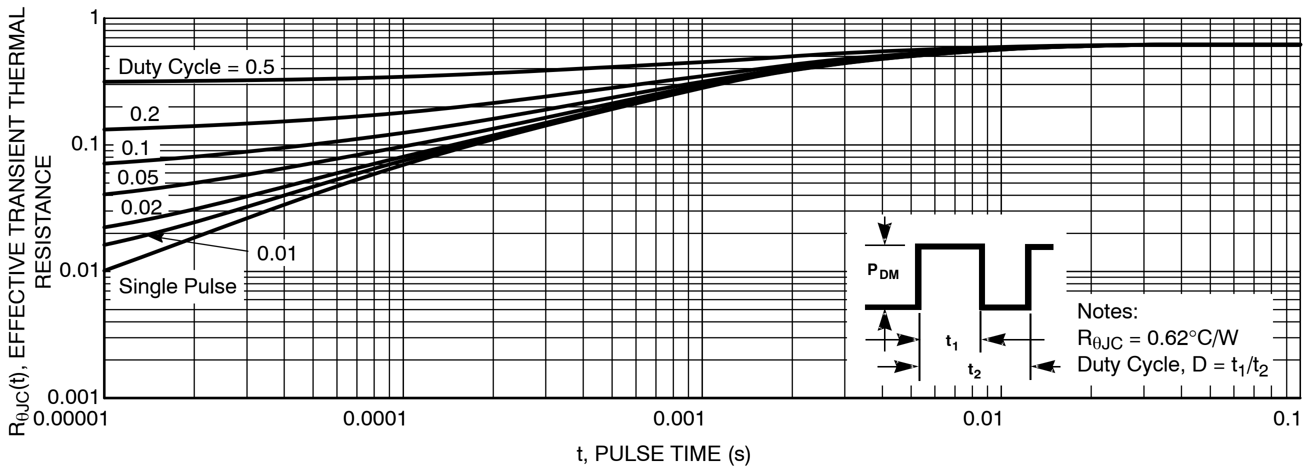
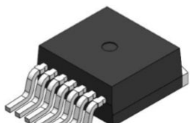
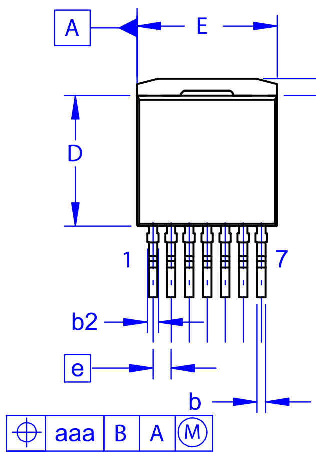


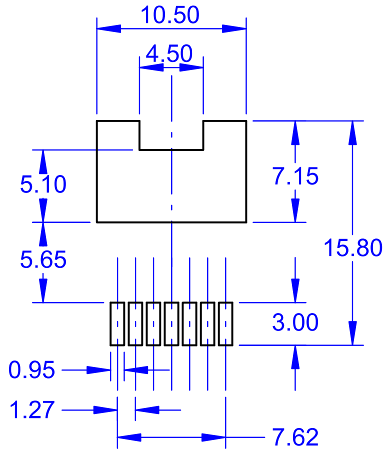
Figure 13. Junction−to−Case Transient Thermal Response

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

DATE 16 AUG 2019





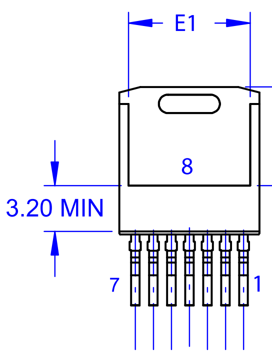


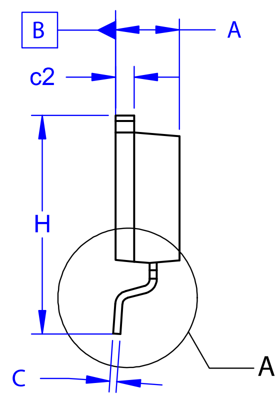
LAND PATTERN RECOMMENDATION

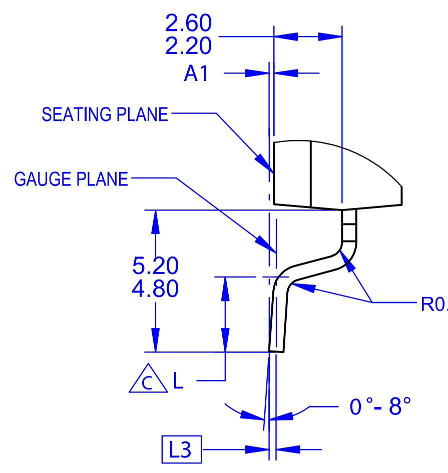
NOTES:

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

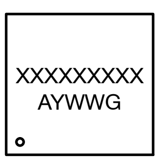






DETAIL A
SCALE 2:1

GENERIC MARKING DIAGRAM*



XXXX = Specific Device Code
A = Assembly Location
Y = 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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DESCRIPTION:	**D2PAK7 (TO−263−7L HV)**	**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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