

# MOSFET - N-Channel Silicon Carbide

## 650 V, 43.5 mΩ, 74 A



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## Product Preview NTBG045N065SC1

### MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	650	V
Gate-to-Source Voltage	$V_{GS}$	+18/-8	V
Continuous Drain Current $R_{\theta JC}$	$I_{DC}$	73.7	A
Power Dissipation $R_{\theta JC}$			
Continuous Drain Current $R_{\theta JC}$	$I_{DC}$	57.2	A
Power Dissipation $R_{\theta JC}$			
Continuous Drain Current $R_{\theta JA}$	$I_{DA}$	TBD	A
Power Dissipation $R_{\theta JA}$			
Continuous Drain Current $R_{\theta JA}$	$I_{DA}$	TBD	A
Power Dissipation $R_{\theta JA}$			
Pulsed Drain Current $R_{\theta JC}$	$I_{DM}$	315	A
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +175	°C
Source Current (Body Diode)	$I_S$	95.4	A
Single Pulse Drain-to-Source Avalanche Energy ( $T_J = 25^\circ\text{C}$ , $V_{GS} = 18\text{ V}$ , $I_{L(pk)} = 1\text{ A}$ , $L = 0.1\text{ mH}$ , $R_G = 25\ \Omega$ )	$E_{AS}$	TBD	mJ
Lead Temperature for Soldering Purposes	$T_L$	TBD	°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.

### THERMAL RESISTANCE

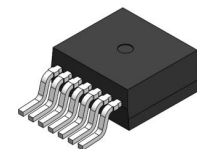
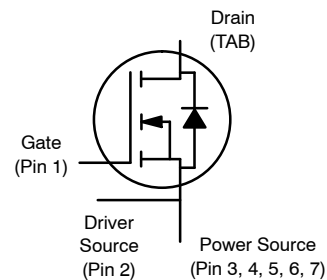
Parameter	Symbol	Value	Unit
Junction-to-Case (Note 1)	$R_{\theta JC}$	0.353	°C/W
Junction-to-Ambient (Note 1)	$R_{\theta JA}$	TBD	

- The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

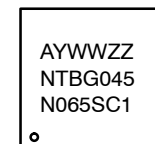
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX
650 V	43.5 mΩ @ $V_{GS} = 18\text{ V}$	74 A

### N-CHANNEL MOSFET



D2PAK-7L  
CASE 418BJ

### MARKING DIAGRAM



A = Assembly Location  
Y = Year  
WW = Work Week  
ZZ = Lot Traceability  
NTBG045N065SC1 = Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# NTBG045N065SC1

## ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 2.50\text{e} - 04\text{A}, T_C = 25^\circ\text{C}$	650			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$V_{GS} = 0\text{ V}, I_D = 2.50\text{e} - 04\text{A}, T_{Jmax} = 175^\circ\text{C}$		0.215		V/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 650\text{ V}, T_C = 25^\circ\text{C}$			100	$\mu\text{A}$
		$V_{DS} = 650\text{ V}, T_C = 175^\circ\text{C}$			1	mA
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{GS} = +18/-8\text{ V}, V_{DS} = 0\text{ V}$			$\pm 1$	$\mu\text{A}$

### ON CHARACTERISTICS

Drain-to-Source On Resistance	$R_{DS(on)}$	$V_G = 18\text{ V}, I_D = 20\text{ A}, T_C = 25^\circ\text{C}$		43.48		m $\Omega$
		$V_G = 18\text{ V}, I_D = 20\text{ A}, T_C = 175^\circ\text{C}$		52.4		
Gate Threshold Voltage	$V_{GS(th)}$	$V_G = V_D, I_D = 5.41\text{e} - 03\text{A}$		3.19		V
Gate Threshold Voltage Temperature Coefficient	$V_{GS(th)}/T_J$			-6.42		mV/°C
Forward Transconductance	$g_{FS}$	$V_D = 10\text{ V}, I_D = 20\text{ A}$		10.81		S

### CHARGES, CAPACITANCES & GATE RESISTANCE

Gate Resistance	$R_G$	$V_D = 325\text{ V}, V_G = 0\text{ V}, f = 1\text{e}6$		4.94		$\Omega$	
Input Capacitance	$C_{ISS}$			1803			pF
Output Capacitance	$C_{OSS}$			156			
Reverse Transfer Capacitance	$C_{RSS}$			13.78			
Effective Output Capacitance	$C_{OSSef}$	$V_{DS} = 0\text{ to }325\text{ V}, V_G = 0\text{ V}, f = 1\text{e}6$		302		pF	
Energy Related Output Capacitance	$C_{OSSer}$			205			
Coss Stored Energy	$E_{OSS}$			10.87			$\mu\text{J}$
Total Gate Charge	$Q_{G(tot)}$	$V_D = 520\text{ V}, I_D = 20\text{ A}, V_G = -5/18\text{ V}$		85.1		nC	
Gate-to-Source Charge	$Q_{GS}$			26.11			
Gate-to-Drain Charge	$Q_{GD}$			27.04			

### SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = -5/18\text{ V}, V_D = 520\text{ V}, I_D = 20\text{ A}, R_G = 6\ \Omega$		26.29		ns
Turn-Off Delay Time	$t_{d(off)}$			38.49		
Rise Time	$t_r$			8.15		
Fall Time	$t_f$			10.03		mJ
Turn-On Switching Loss	$E_{ON}$			0.179		
Turn-Off Switching Loss	$E_{OFF}$			0.035		
Total Switching Loss	$E_{TOT}$			0.214		

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = -5\text{ V}, I_D = 20\text{ A}, T_C = 25^\circ\text{C}$		4.29		V
		$V_{GS} = -5\text{ V}, I_D = 20\text{ A}, T_C = 175^\circ\text{C}$		3.76		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = -5\text{ V}, I_S = 20\text{ A}, dl/dt = 1000\text{ A}/\mu\text{s}, V_{DS} = 520\text{ V}$		32.33		ns
Reverse Recovery Charge	$Q_{RR}$			177		A
Reverse Recovery Energy	$E_{REC}$			19.14		
Peak Reverse Recovery Current	$I_{RRM}$			9.56		

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.

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## TYPICAL CHARACTERISTICS

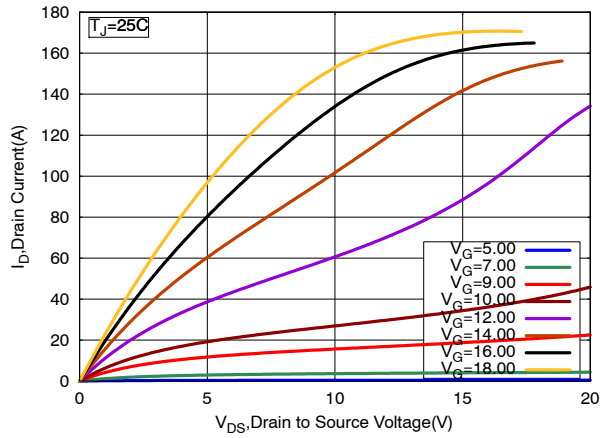


Figure 1. On-Region Characteristics

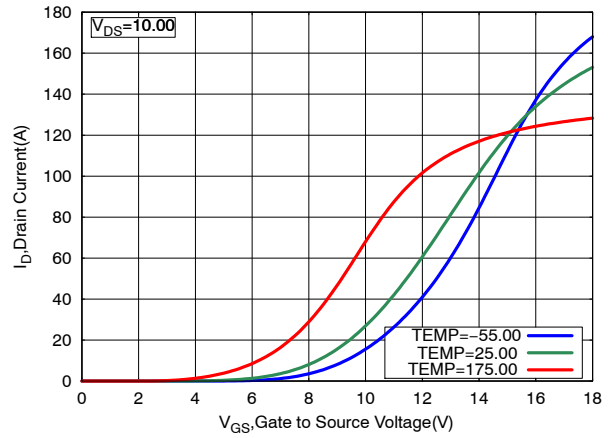


Figure 2. Transfer Characteristics

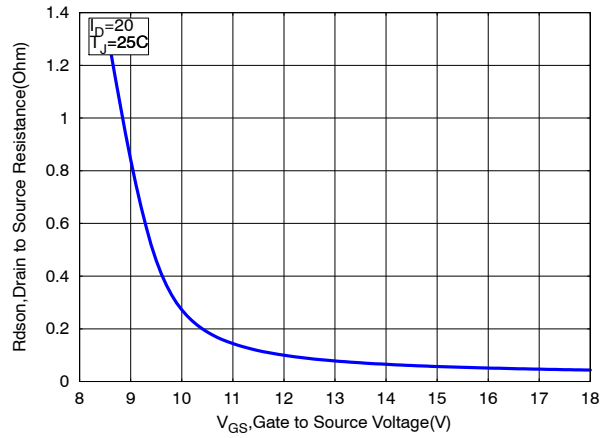


Figure 3. On-Resistance vs.  $V_{GS}$

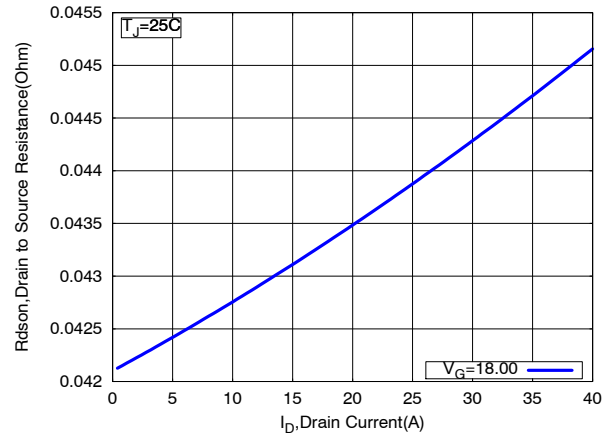


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

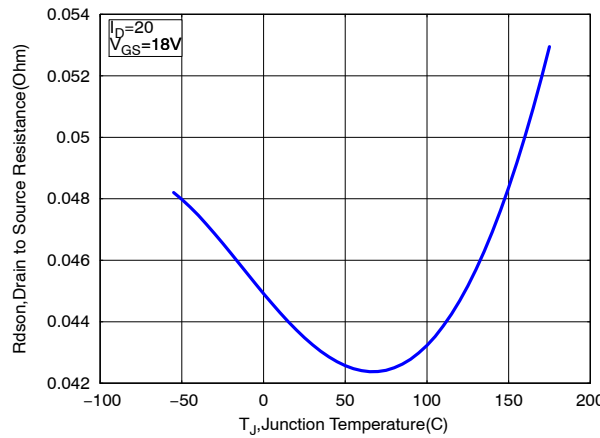


Figure 5. On-Resistance Variation with Temperature

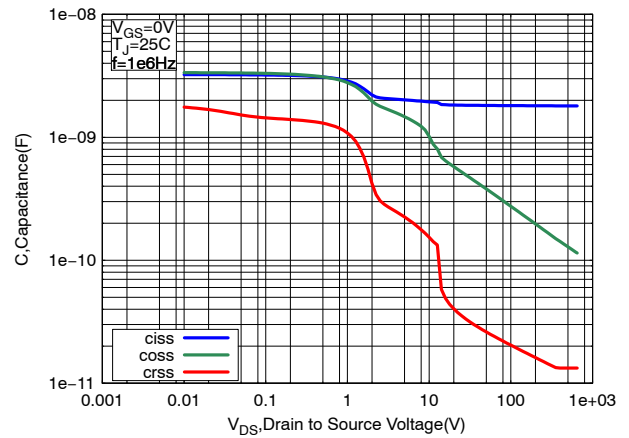


Figure 6. Capacitance Variation

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## TYPICAL CHARACTERISTICS

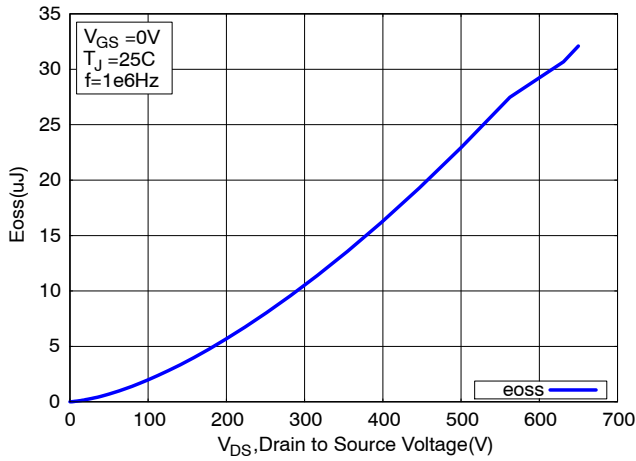


Figure 7. Eoss vs. Drain-to-Source Voltage

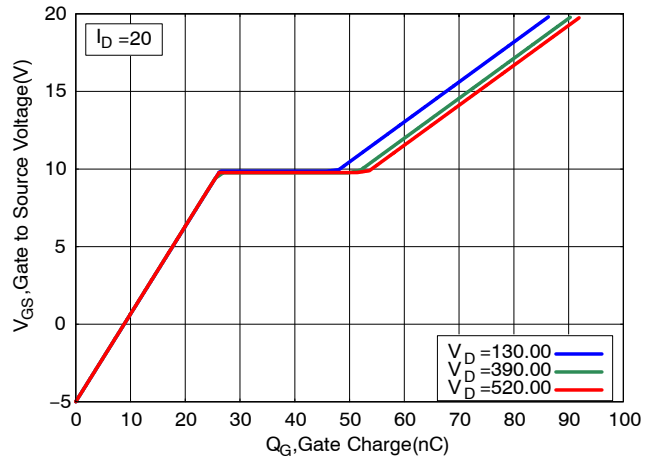


Figure 8. Gate-to-Source Voltage vs. Total Charge

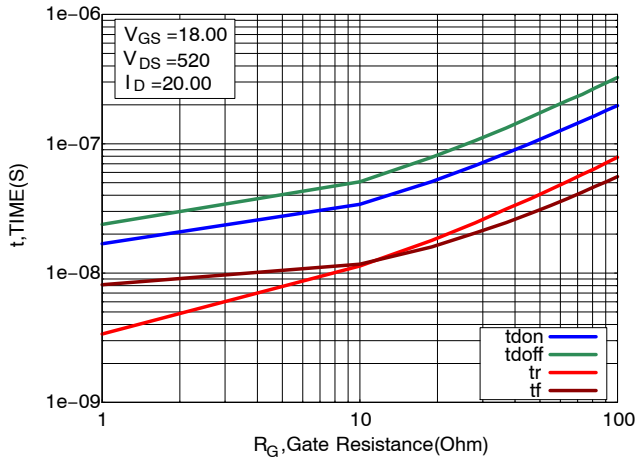


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

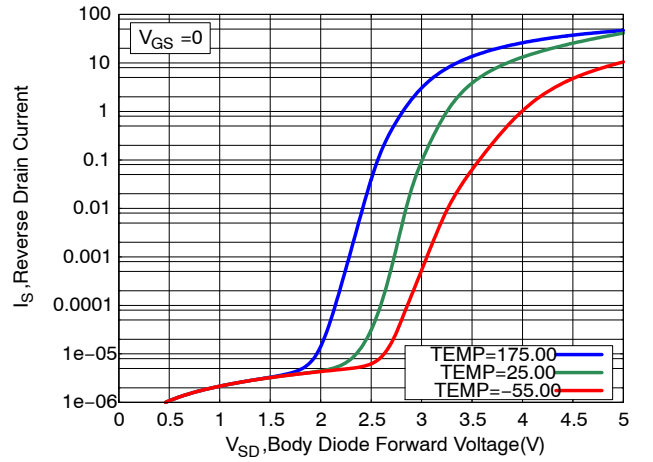


Figure 10. Diode Forward Voltage vs. Current

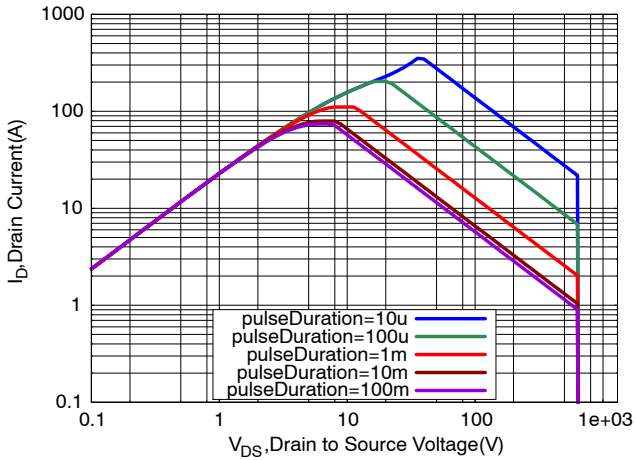


Figure 11. Maximum Rated Forward Biased Safe Operating Area

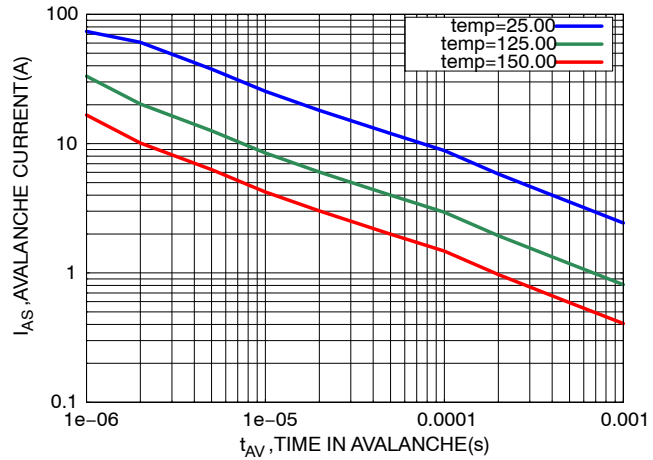


Figure 12. Ipeak vs. Time in Avalanche

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## TYPICAL CHARACTERISTICS

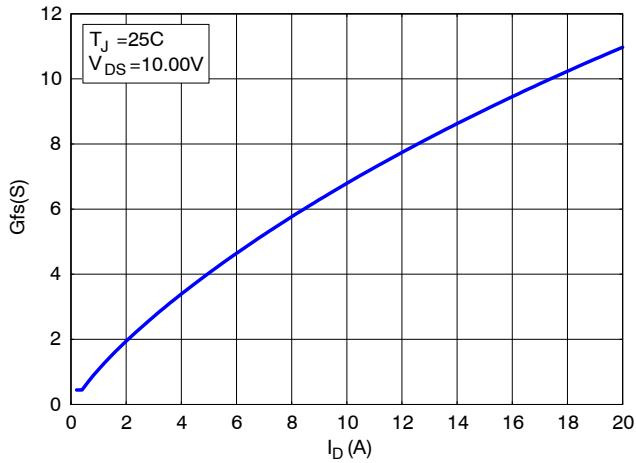


Figure 13. GFS vs. ID

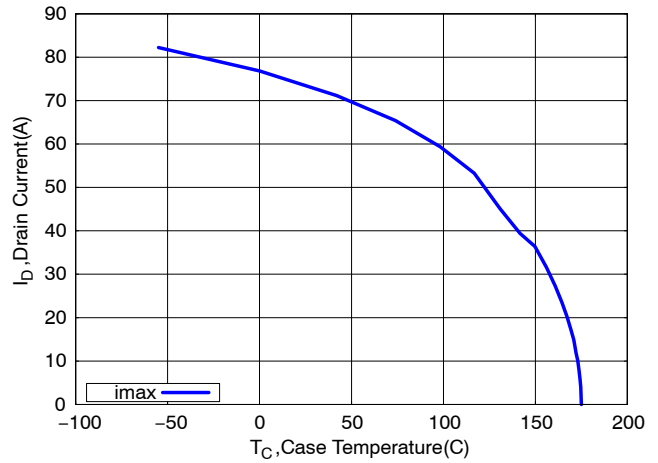


Figure 14. Maximum Current vs. Case Temperature

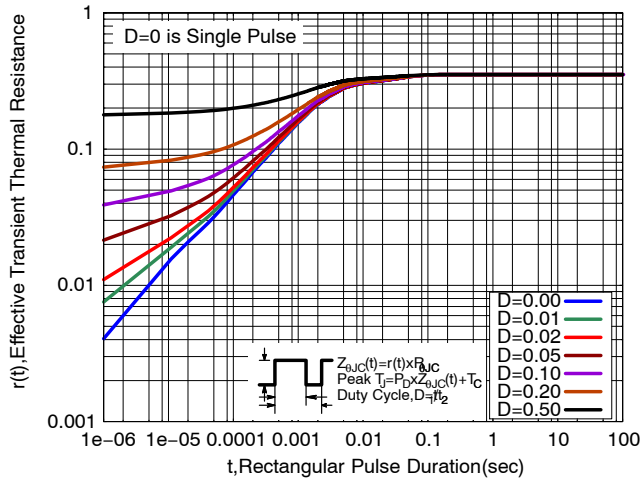


Figure 15. Thermal Response

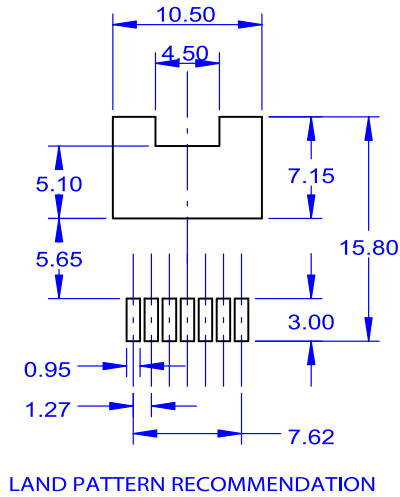
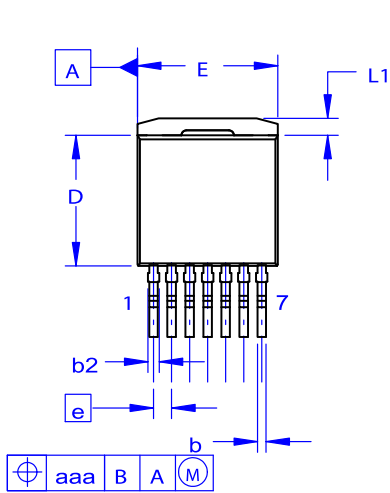
### PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Packing Method	Reel Size	Tape Width	Quantity
NTBG045N065SC1	NTBG045N065SC1	D2PAK	Tape & Reel	TBD	TBD	800 Units

# NTBG045N065SC1

## PACKAGE DIMENSIONS

**D<sup>2</sup>PAK7 (TO-263-7L HV)**  
CASE 418BJ  
ISSUE A

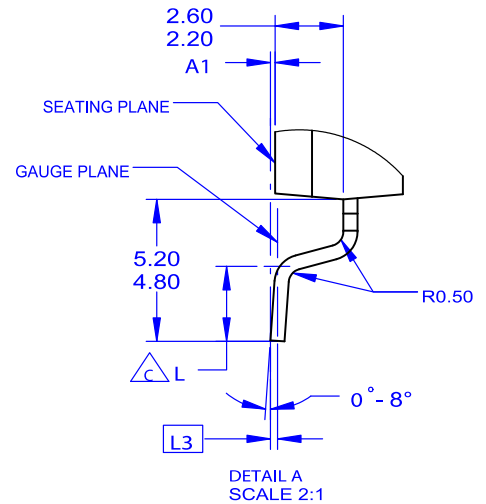
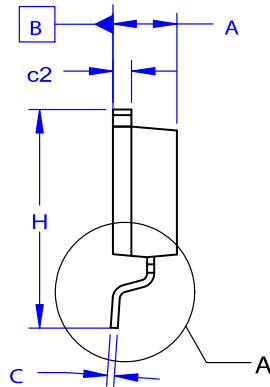
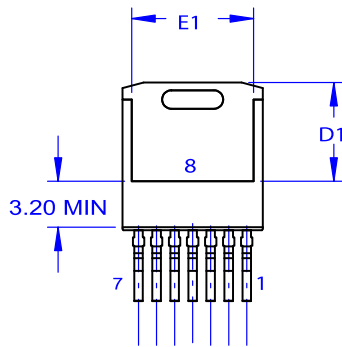


**NOTES:**

- 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	6.75	6.95	7.15
E	9.70	9.90	10.20
E1	7.70	7.90	8.10
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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