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# MOSFET - Power, Single N-Channel, D<sup>2</sup>PAK7

## 60 V, 3.7 mΩ, 127 A



ON Semiconductor®

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## NTBGS3D5N06C

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low  $Q_G$  and Capacitance to Minimize Driver Losses
- Lowers Switching Noise/EMI
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Typical Applications

- Power Tools, Battery Operated Vacuums
- UAV/Drones, Material Handling
- BMS/Storage, Home Automation

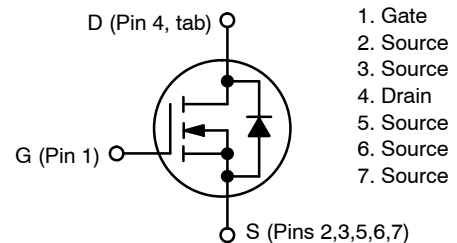
### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DS}$	60	V
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current $R_{\theta JC}$ (Note 2)	$I_D$	127	A
Power Dissipation $R_{\theta JC}$ (Note 2)			
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2)	$I_D$	22	A
Power Dissipation $R_{\theta JA}$ (Notes 1, 2)			
Pulsed Drain Current	$I_{DM}$	491	A
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +175	$^\circ\text{C}$
Source Current (Body Diode)	$I_S$	95	A
Single Pulse Drain-to-Source Avalanche Energy ( $I_L = 18.8 A_{pk}, L = 1 \text{ mH}$ )	$E_{AS}$	176	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	$T_L$	260	$^\circ\text{C}$

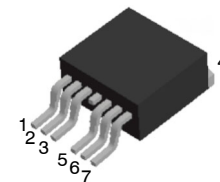
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Surface-mounted on FR4 board using a 1 in<sup>2</sup>, 1 oz. Cu pad.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

$V_{(BR)DSS}$	$R_{DS(ON) MAX}$	$I_D MAX$
60 V	3.7 mΩ @ 12 V	127 A
	4.1 mΩ @ 10 V	

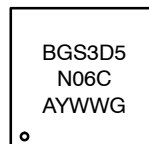


N-CHANNEL MOSFET



D<sup>2</sup>PAK7  
CASE 221BP

### MARKING DIAGRAM



BGS3D5N06C= Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

Device	Package	Shipping†
NTBGS3D5N06C	D <sup>2</sup> PAK7 (Pb-Free)	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.

# NTBGS3D5N06C

## THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case – Steady State (Note 2)	$R_{\theta JC}$	1.3	°C/W
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	40	

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

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

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 250\ \mu\text{A}$ , ref to $25^\circ\text{C}$		19.2		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$	$T_J = 25^\circ\text{C}$		10	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		100	$\mu\text{A}$
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA

### ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 122\ \mu\text{A}$	2.0		4.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$	$I_D = 122\ \mu\text{A}$ , ref to $25^\circ\text{C}$		-8		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 12\text{ V}, I_D = 24\text{ A}$		3.1	3.7	m $\Omega$
		$V_{GS} = 10\text{ V}, I_D = 12\text{ A}$		3.25	4.1	
Gate-Resistance	$R_G$	$T_A = 25^\circ\text{C}$		1.2		$\Omega$

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, V_{DS} = 30\text{ V}, f = 1\text{ MHz}$		2430		pF
Output Capacitance	$C_{OSS}$			1290		
Reverse Transfer Capacitance	$C_{RSS}$			21		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 30\text{ V}; I_D = 24\text{ A}$		39		nC
Threshold Gate Charge	$Q_{G(TH)}$			6.4		
Gate-to-Source Charge	$Q_{GS}$			9.5		
Gate-to-Drain Charge	$Q_{GD}$			4.5		
Output Charge	$Q_{OSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 50\text{ V}$		69		

### SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DS} = 30\text{ V}, I_D = 24\text{ A}, R_G = 6\ \Omega$		14.4		ns
Rise Time	$t_r$			6.9		
Turn-Off Delay Time	$t_{d(OFF)}$			28.9		
Fall Time	$t_f$			9.7		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 24\text{ A}$	$T_J = 25^\circ\text{C}$		0.81	1.2	V
			$T_J = 125^\circ\text{C}$		0.68		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, I_S = 12\text{ A}$			55		ns
Reverse Recovery Charge	$Q_{RR}$				52		nC

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.

3. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

4. Switching characteristics are independent of operating junction temperatures.

# NTBGS3D5N06C

## TYPICAL CHARACTERISTICS

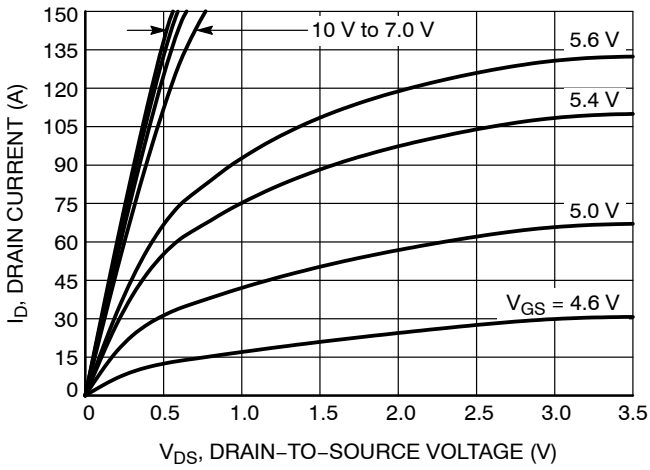


Figure 1. On-Region Characteristics

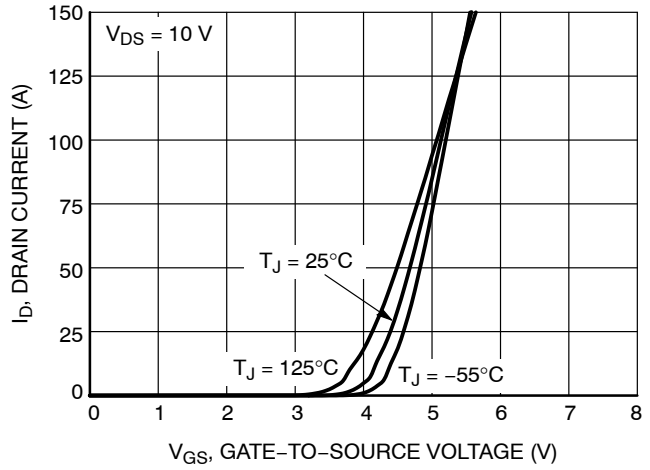


Figure 2. Transfer Characteristics

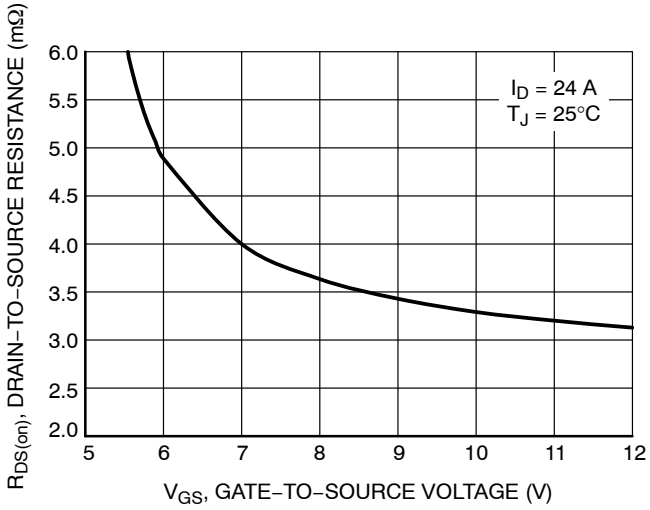


Figure 3. On-Resistance vs. Gate-to-Source Voltage

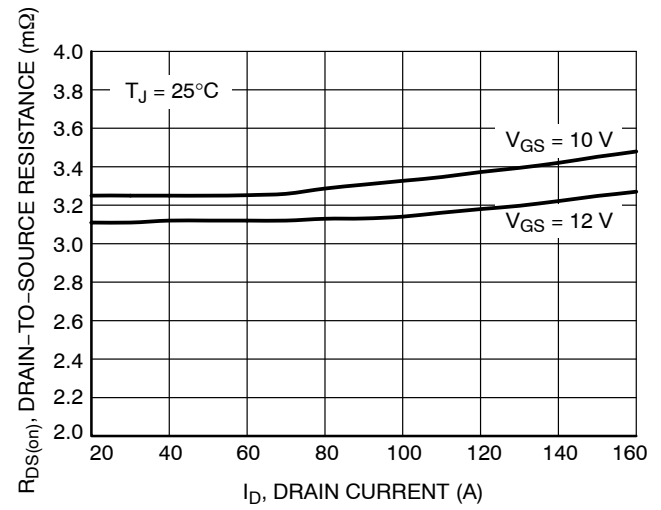


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

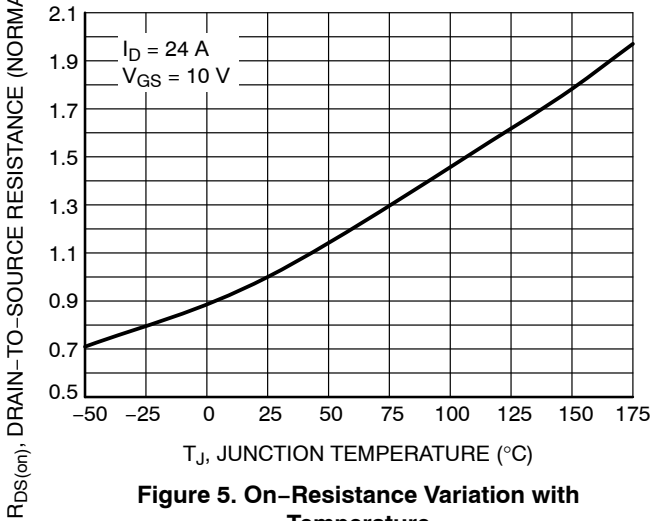


Figure 5. On-Resistance Variation with Temperature

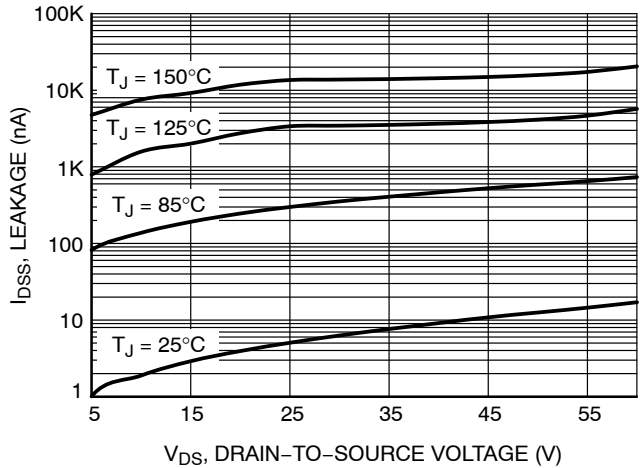


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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## TYPICAL CHARACTERISTICS

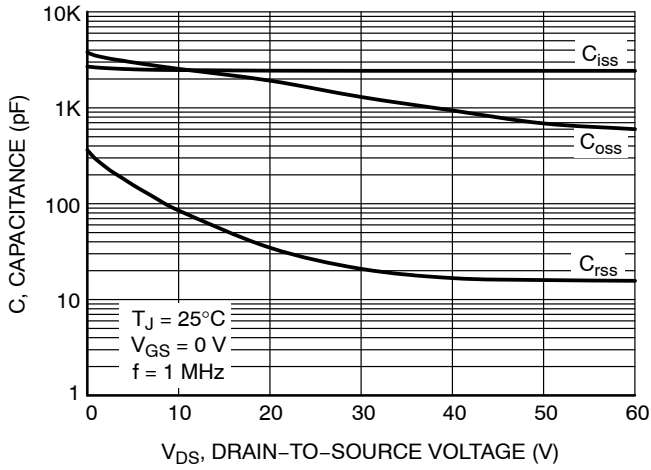


Figure 7. Capacitance Variation

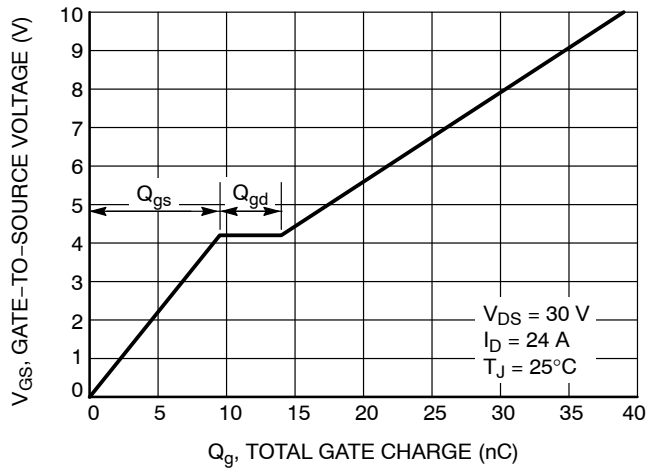


Figure 8. Gate-to-Source vs. Total Charge

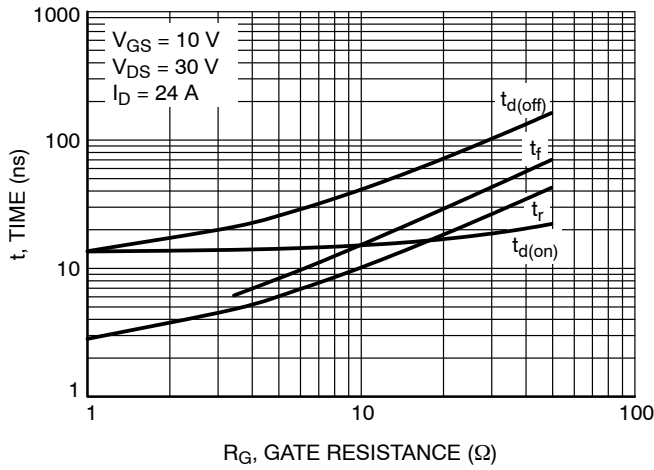


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

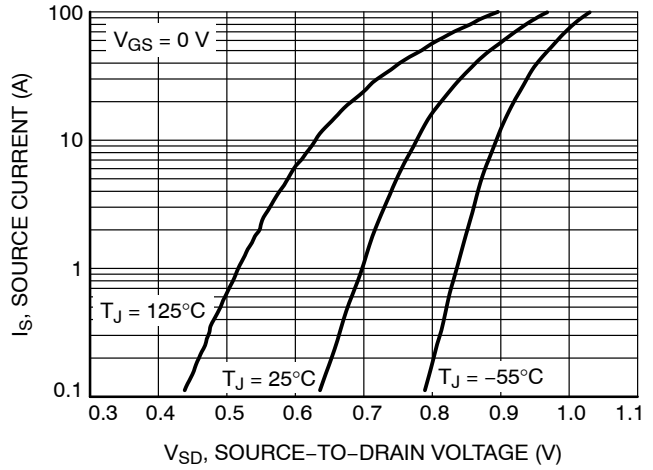


Figure 10. Diode Forward Voltage vs. Current

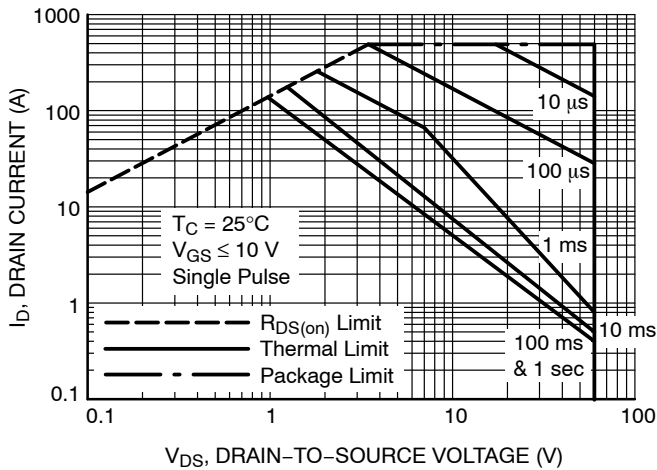


Figure 11. Maximum Rated Forward Biased Safe Operating Area

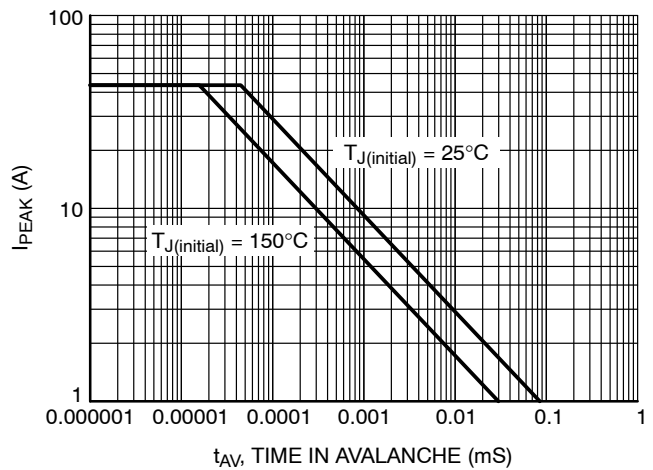


Figure 12. Maximum Drain Current vs. Time in Avalanche

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## TYPICAL CHARACTERISTICS

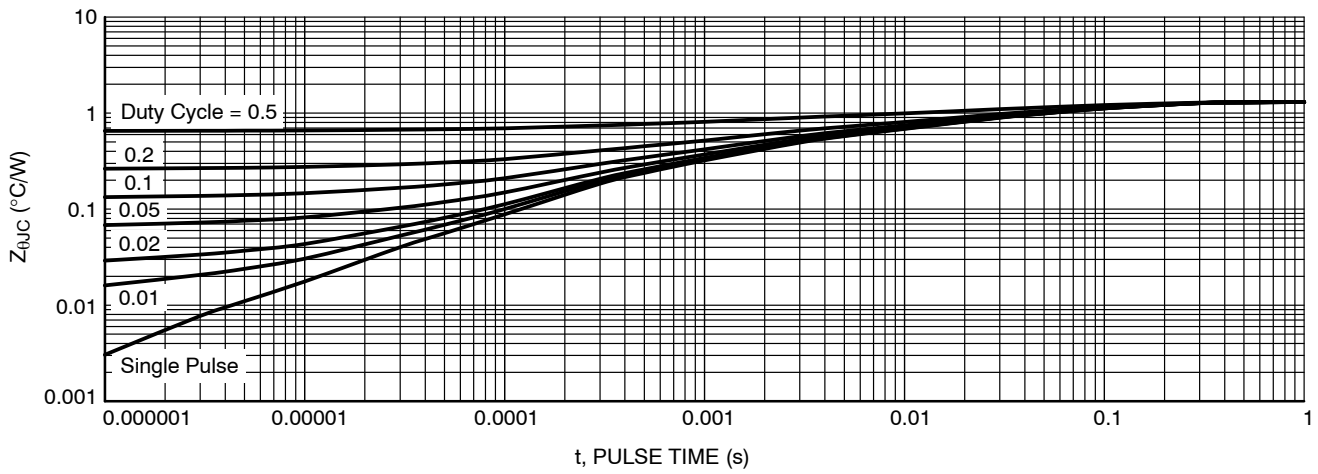
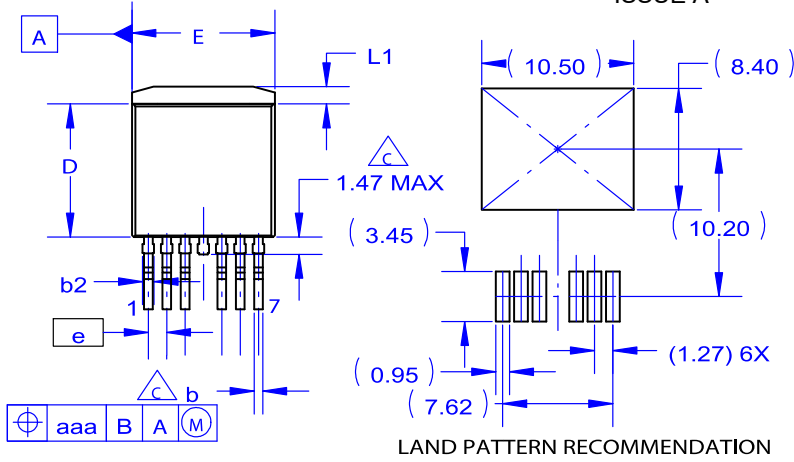


Figure 13. Transient Thermal Impedance

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## PACKAGE DIMENSIONS

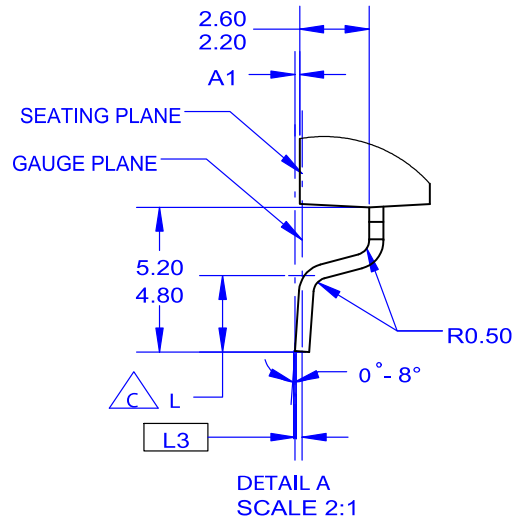
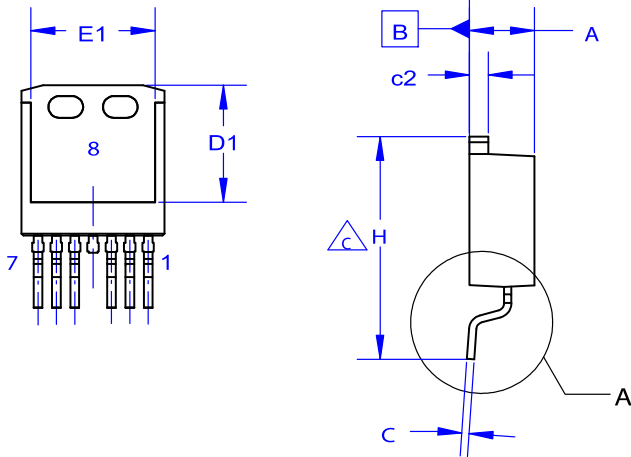
**D2PAK7 (TO-263-7LD) 15.4x9.9x4.5**  
 CASE 221BP  
 ISSUE A




**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.
- F. LAND PATTERN RECOMMENDATION PER IPC. TO127P1524X465-8N.

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	0.50	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	7.30	7.80	8.20
E	9.70	9.90	10.20
E1	7.15	8.05	8.55
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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