

## PNP SILICON SWITCHING TRANSISTOR

Qualified per MIL-PRF-19500/512

### DEVICES

**2N4029**

**2N4033**

**2N4033UA**

**2N4033UB**

### LEVELS

**JAN**

**JANTX**

**JANTXV**

**JANS**

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

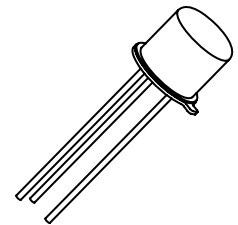
Parameters / Test Conditions	Symbol	Value	Unit	
Collector-Emitter Voltage	$V_{CEO}$	80	Vdc	
Collector-Base Voltage	$V_{CBO}$	80	Vdc	
Emitter-Base Voltage	$V_{EBO}$	5.0	Vdc	
Collector Current	$I_C$	1.0	A <sub>dc</sub>	
Total Power Dissipation @ $T_A = +25^\circ\text{C}$	$P_T$	2N4029 <sup>1</sup> 2N4033 <sup>2</sup> 2N4033UA, UB <sup>3</sup>	0.5 0.8 0.5	W
Operating & Storage Junction Temperature Range	$T_j, T_{stg}$	-65 to +200	$^\circ\text{C}$	
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	2N4029 2N4033	80 40	$^\circ\text{C/W}$

#### Note:

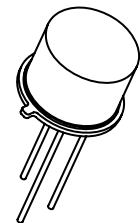
- Derate linearly 2.86mW/ $^\circ\text{C}$  for  $T_A > +25^\circ\text{C}$
- Derate linearly 4.56mW/ $^\circ\text{C}$  for  $T_A > +25^\circ\text{C}$
- For UB package and use  $R_{\theta JC}$  or see thermal curves in /512

### ELECTRICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)

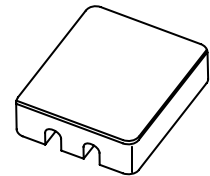
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Base Cutoff Current $V_{CB} = 80\text{Vdc}$ $V_{CB} = 60\text{Vdc}$ $V_{CB} = 60\text{Vdc}, T_A = +150^\circ\text{C}$	$I_{CBO}$		10 10 25	$\mu\text{A}_{dc}$ $\eta\text{A}_{dc}$ $\mu\text{A}_{dc}$
Emitter-Base Cutoff Current $V_{EB} = 5.0\text{Vdc}$ $V_{EB} = 3.0\text{Vdc}$	$I_{EBO}$		10 25	$\mu\text{A}_{dc}$ $\eta\text{A}_{dc}$
Collector-Emitter Cutoff Current $V_{BE} = 2.0\text{Vdc}, V_{CE} = 60\text{Vdc}$	$I_{CEX}$		25	$\eta\text{A}_{dc}$



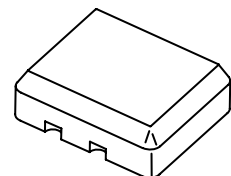
TO-18 (TO-206AA)  
2N4029



TO-39 (TO-205AD)  
2N4033



UA Package



UB Package

## ELECTRICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>ON CHARACTERISTICS <sup>(3)</sup></b>				
Forward-Current Transfer Ratio $I_C = 100\mu\text{A dc}$ , $V_{CE} = 5.0\text{V dc}$ $I_C = 100\text{mA dc}$ , $V_{CE} = 5.0\text{V dc}$ $I_C = 500\text{mA dc}$ , $V_{CE} = 5.0\text{V dc}$ $I_C = 1.0\text{A dc}$ , $V_{CE} = 5.0\text{V dc}$ $I_C = 500\text{mA dc}$ , $V_{CE} = 5.0\text{V dc}$ , $T_A = -55^\circ\text{C}$	$h_{FE}$	50 100 70 25 30	300	
Collector-Emitter Saturation Voltage $I_C = 150\text{mA dc}$ , $I_B = 15\text{mA dc}$ $I_C = 500\text{mA dc}$ , $I_B = 50\text{mA dc}$ $I_C = 1.0\text{A dc}$ , $I_B = 100\text{mA dc}$	$V_{CE(sat)}$		0.15 0.50 1.0	Vdc
Base-Emitter Voltage $I_C = 150\text{mA dc}$ , $I_B = 15\text{mA dc}$ $I_C = 500\text{mA dc}$ , $I_B = 50\text{mA dc}$	$V_{BE(sat)}$		0.9 1.2	Vdc

## DYNAMIC CHARACTERISTICS

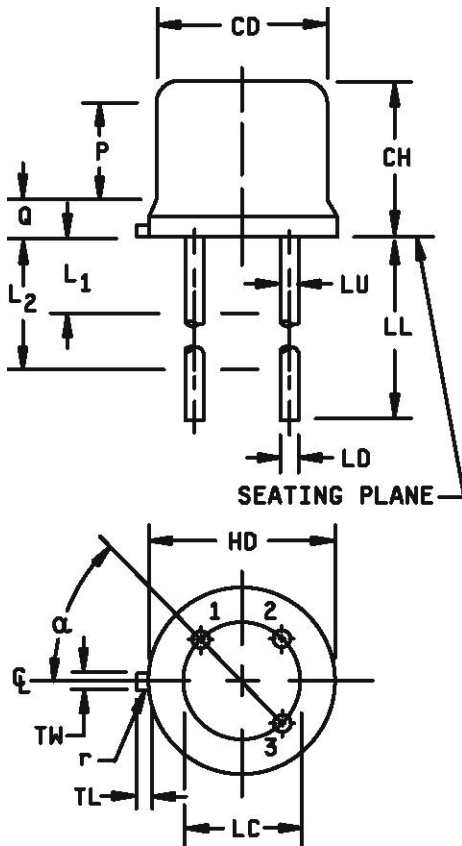
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = 50\text{mA dc}$ , $V_{CE} = 10\text{V dc}$ , $f = 100\text{MHz}$	$ h_{fe} $	1.5	6.0	
Output Capacitance $V_{CB} = 10\text{V dc}$ , $I_E = 0$ , $100\text{kHz} \leq f \leq 1.0\text{MHz}$	$C_{obo}$		20	pF
Input Capacitance $V_{EB} = 0.5\text{V dc}$ , $I_C = 0$ , $100\text{kHz} \leq f \leq 1.0\text{MHz}$	$C_{ibo}$		80	pF

## SWITCHING CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
On-Time $V_{CC} = 31.9\text{V dc}$ ; $I_C = 500\text{mA dc}$ ; $I_{B1} = 50\text{mA dc}$	$t_d$		15	ns
Rise Time $V_{CC} = 31.9\text{V dc}$ ; $I_C = 500\text{mA dc}$ ; $I_{B1} = 50\text{mA dc}$	$t_r$		25	ns
Storage Time $V_{CC} = 31.9\text{V}$ , $I_C = 500\text{mA dc}$ , $I_{B1} = 50\text{mA dc}$	$t_s$		175	ns
Fall Time $V_{CC} = 31.9\text{V}$ , $I_C = 500\text{mA dc}$ , $I_{B1} = 50\text{mA dc}$	$t_f$		35	ns

(4) Pulse Test: Pulse Width = 300 $\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

## PACKAGE DIMENSIONS

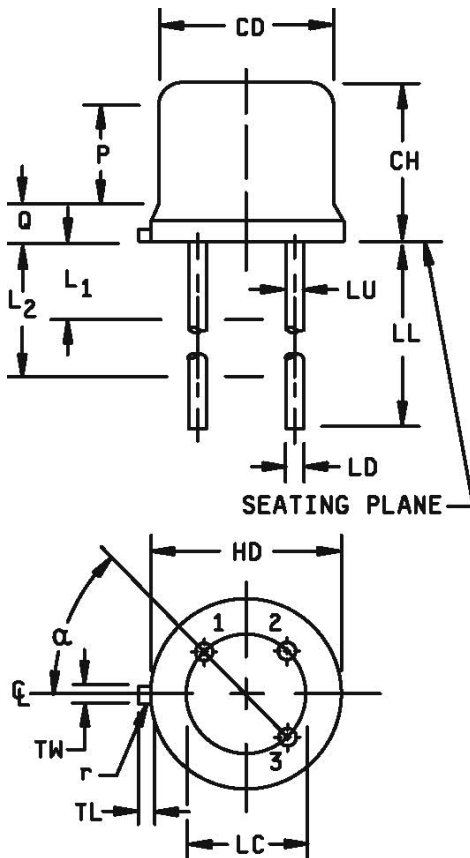


Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	
CH	.170	.210	4.32	5.34	
HD	.209	.230	5.31	5.84	
LC	.100 TP		2.54 TP		6
LD	.016	.021	0.41	0.53	7, 8
LL	.500	.750	12.70	19.05	7, 8, 12
LU	.016	.019	0.41	0.48	7, 8
L <sub>1</sub>		.050		1.27	7, 8
L <sub>2</sub>	.250		6.35		7, 8
Q		.040		1.02	5
TL	.028	.048	0.71	1.22	3, 4
TW	.036	.046	0.91	1.17	3
r		.010		0.25	10
P	.100		2.54		
α	45° TP				6

### NOTES:

- 1 Dimension are in inches.
- 2 Millimeters equivalents are given for general information only.
- 3 Beyond r (radius) maximum, TW shall be held for a minimum length of .011 (0.28 mm).
- 4 Dimension TL measured from maximum HD.
- 5 Body contour optional within zone defined by HD, CD, and Q.
- 6 Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within .007 inch (0.18mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC. The device may be measured by direct methods.
- 7 Dimension LU applies between L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and minimum. Diameter is uncontrolled in L<sub>1</sub> and beyond LL minimum.
- 8 All three leads.
- 9 The collector shall be internally connected to the case.
- 10 Dimension r (radius) applies to both inside corners of tab.
- 11 In accordance with ASME Y14.5M, diameters are equivalent to φx symbology.
- 12 For "L" suffix devices, dimension LL is 1.50 (38.10mm) minimum, 1.75 (44.45mm) maximum.

**FIGURE 1. Physical dimensions for 2N4029 (TO-18).**

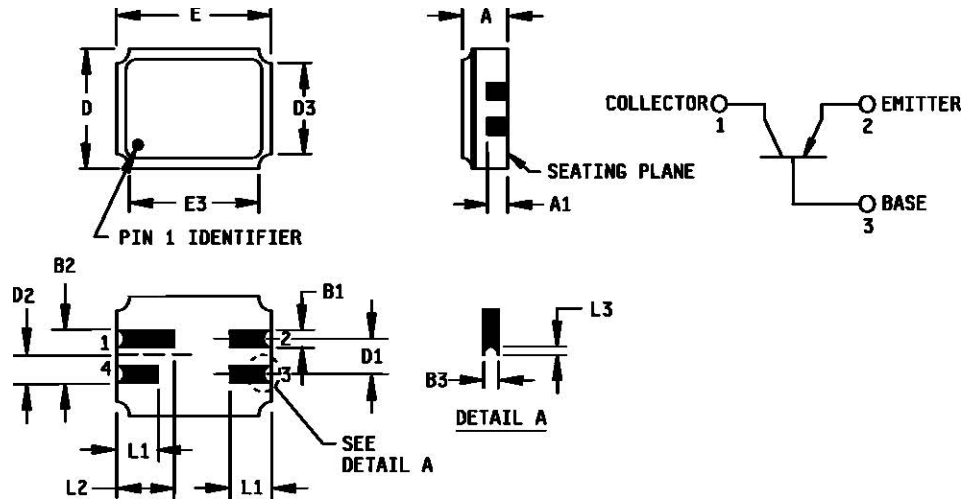


Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	7, 8
LL	.500	.750	12.70	19.05	7, 8, 12
LU	.016	.019	0.41	0.48	7, 8
L <sub>1</sub>		.050		1.27	7, 8
L <sub>2</sub>	.250		6.35		7, 8
Q		.050		1.27	5
TL	.029	.045	0.74	1.14	3, 4
TW	.028	.034	0.71	0.86	3
r		.010		0.25	10
P	.100		2.54		
α	45° TP				6

**NOTES:**

- 1 Dimension are in inches.
- 2 Millimeters equivalents are given for general information only.
- 3 Beyond r (radius) maximum, TW shall be held for a minimum length of .011 (0.28 mm).
- 4 Dimension TL measured from maximum HD.
- 5 Body contour optional within zone defined by HD, CD, and Q.
- 6 Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within .007 inch (0.18mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC. The device may be measured by direct methods.
- 7 Dimension LU applies between L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and minimum. Diameter is uncontrolled in L<sub>1</sub> and beyond LL minimum.
- 8 All three leads.
- 9 The collector shall be internally connected to the case.
- 10 Dimension r (radius) applies to both inside corners of tab.
- 11 In accordance with ASME Y14.5M, diameters are equivalent to φx symbology.
- 12 For "L" suffix devices, dimension LL is 1.50 (38.10mm) minimum, 1.75 (44.45mm) maximum.

**FIGURE 2. Physical dimensions for 2N4033 (TO-39).**

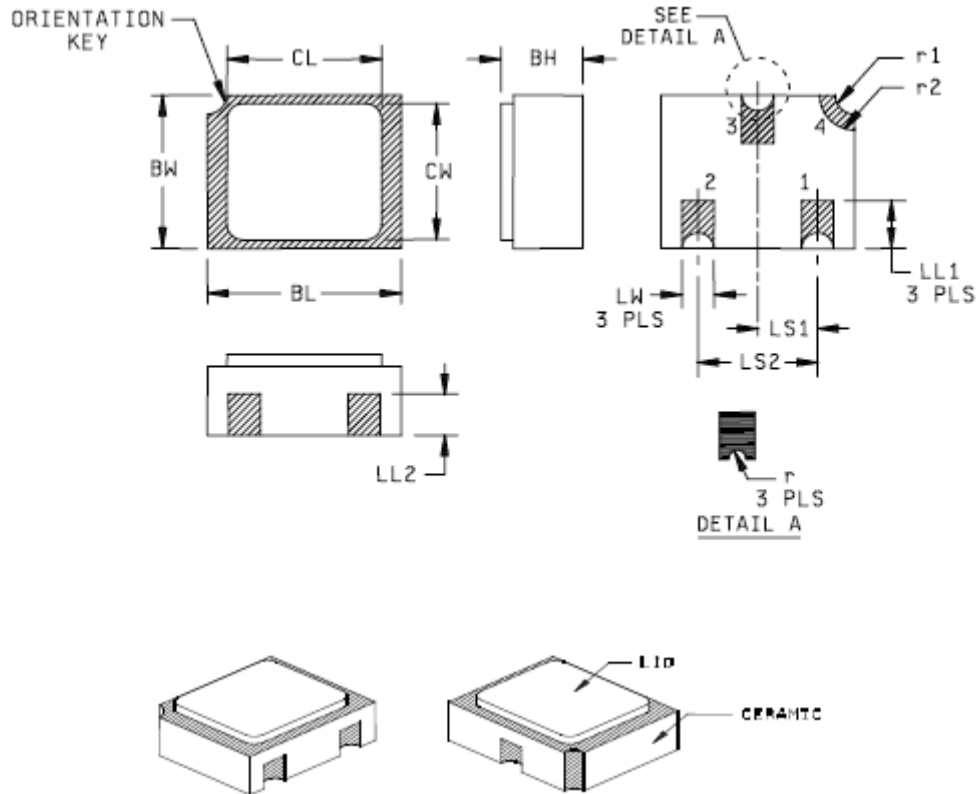


Ltr.	Dimensions				Note	Ltr.	Dimensions				Note
	Inches		Millimeters				Inches		Millimeters		
	Min	Max	Min	Max			Min	Max	Min	Max	
A	.061	.075	1.55	1.91	3	D <sub>2</sub>	.0375 BSC		0.952 BSC		
A <sub>1</sub>	.029	.041	0.74	1.04		D <sub>3</sub>		.155		3.94	
B <sub>1</sub>	.022	.028	0.56	0.71		E	.215	.225	5.46	5.72	
B <sub>2</sub>	.075 REF		1.91 REF			E <sub>3</sub>		.225		5.72	
B <sub>3</sub>	.006	.022	0.15	0.56	5	L <sub>1</sub>	.032	.048	0.81	1.22	
D	.145	.155	3.68	3.93		L <sub>2</sub>	.072	.088	1.83	2.24	
D <sub>1</sub>	.045	.055	1.14	1.39		L <sub>3</sub>	.003	.007	0.08	0.18	

**NOTES:**

- 1 Dimensions are in inches.
- 2 Millimeters equivalents are given for general information only.
- 3 Dimension "A" controls the overall package thickness. When a window lid is used, dimension "A" must increase by a minimum of .010 inch (0.254 mm) and a maximum of .040 inch (1.020 mm).
- 4 The corner shape (square, notch, radius, etc) may vary at the manufacturer's option, from that shown on the drawing.
- 5 Dimensions "B3" minimum and "L3" minimum and the appropriately castellation length define an unobstructed three-dimensional space traversing all of the ceramic layers in which a castellation was designed. (Castellations are required on bottom two layers, optional on top ceramic layer.) Dimension "B3" maximum and "L3" maximum define the maximum width and depth of the castellation at any point on its surface. Measurement of these dimensions may be made prior to solder dipping.
- 6 In accordance with ASME Y14.5M, diameters are equivalent to  $\phi$ x symbology.

**FIGURE 3. Physical dimensions, surface mount (UA version).**



Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
BH	.046	.056	1.17	1.42	
BL	.115	.128	2.92	3.25	
BW	.085	.108	2.16	2.74	
CL		.128		3.25	
CW		.108		2.74	
LL1	.022	.038	0.56	0.96	
LL2	.017	.035	0.43	0.89	

Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
LS1	.036	.040	0.91	1.02	
LS2	.071	.079	1.81	2.01	
LW	.016	.024	0.41	0.61	
r		.008		.203	
r1		.012		.305	
r2		.022		.559	

**NOTES:**

- 1 Dimensions are in inches.
- 2 Millimeters are given for general information only.
- 3 Hatched areas on package denote metalized areas.
- 4 Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Pad 4 = Shielding connected to the lid.
- 5 In accordance with ASME Y14.5M, diameters are equivalent to  $\phi x$  symbology.

**FIGURE 4. Physical dimensions, surface mount (UB version).**