

## NPN SILICON TRANSISTOR

Qualified per MIL-PRF-19500/317

### DEVICES

2N2369A                      2N2369AUB                      2N4449  
 2N2369AU                      2N2369AUBC \*  
 2N2369AUA

### LEVELS

JAN  
 JANTX  
 JANTXV  
 JANS

\* Available to JANS quality level only.

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

Parameters / Test Conditions	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	15	Vdc
Emitter-Base Voltage	$V_{EBO}$	4.5	Vdc
Collector-Base Voltage	$V_{CBO}$	40	Vdc
Collector-Emitter Voltage	$I_{CES}$	40	Vdc
Total Power Dissipation @ $T_A = +25^\circ\text{C}$	2N2369A; 2N4449 UA, UB, UBC U	0.36 <sup>(1)</sup> 0.36 <sup>(1,3)</sup> 0.50 <sup>(2)</sup>	W
Operating & Storage Junction Temperature Range	$T_{op}, T_{stg}$	-65 to +200	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

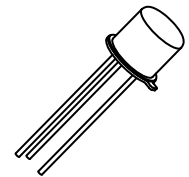
Parameters / Test Conditions	Symbol	Value	Unit
Thermal Resistance, Ambient-to-Case 2N2369A; 2N4449 UA, UB, UBC U	$R_{\theta JA}$	400 486 <sup>(3)</sup> 350	$^\circ\text{C}/\text{W}$

#### Note:

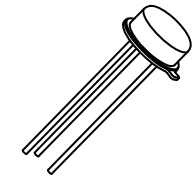
- Derate linearly 2.06 mW/ $^\circ\text{C}$  above  $T_A = +25^\circ\text{C}$ .
- Derate linearly 3.44 mW/ $^\circ\text{C}$  above  $T_A = +54.5^\circ\text{C}$ .
- Mounted on FR-4 PCB (10z. Cu) with contacts 20 mils larger than package pads.

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

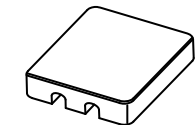
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Breakdown Voltage $I_C = 10\text{mA}$	$V_{(BR)CEO}$	15		Vdc
Collector-Base Cutoff Current $V_{CE} = 20\text{Vdc}$	$I_{CES}$		0.4	$\mu\text{A}$



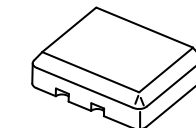
TO-18 (TO-206AA)  
2N2369A



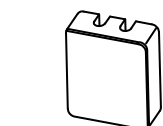
TO-46 (TO-206AB)  
2N4449



SURFACE MOUNT  
UA



SURFACE MOUNT  
UB & UBC  
(UBC = Ceramic Lid Version)



SURFACE MOUNT  
U (Dual Transistor)

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

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>OFF CHARACTERISTICS</b>				
Emitter-Base Cutoff Current $V_{EB} = 4.5\text{Vdc}$ $V_{EB} = 4.0\text{Vdc}$	$I_{EBO}$		10 0.25	$\mu\text{Adc}$
Collector- Base Cutoff Current $V_{CB} = 40\text{Vdc}$ $V_{CB} = 32\text{Vdc}$	$I_{CBO}$		10 0.2	$\mu\text{Adc}$
<b>ON CHARACTERISTICS <sup>(1)</sup></b>				
Forward-Current Transfer Ratio $I_C = 10\text{mAdc}$ , $V_{CE} = 0.35\text{Vdc}$ $I_C = 30\text{mAdc}$ , $V_{CE} = 0.4\text{Vdc}$ $I_C = 10\text{mAdc}$ , $V_{CE} = 1.0\text{Vdc}$ $I_C = 100\text{mAdc}$ , $V_{CE} = 1.0\text{Vdc}$	$h_{FE}$	40 30 40 20	120 120 120 120	
Collector-Emitter Saturation Voltage $I_C = 10\text{mAdc}$ , $I_B = 1.0\text{mAdc}$ $I_C = 30\text{mAdc}$ , $I_B = 3.0\text{mAdc}$ $I_C = 100\text{mAdc}$ , $I_B = 10\text{mAdc}$	$V_{CE(sat)}$		0.20 0.25 0.45	Vdc
Base-Emitter Saturation Voltage $I_C = 10\text{mAdc}$ , $I_B = 1.0\text{mAdc}$ $I_C = 30\text{mAdc}$ , $I_B = 3.0\text{mAdc}$ $I_C = 100\text{mAdc}$ , $I_B = 10\text{mAdc}$	$V_{BE(sat)}$	0.70 0.80	0.85 0.90 1.20	Vdc

## DYNAMIC CHARACTERISTICS

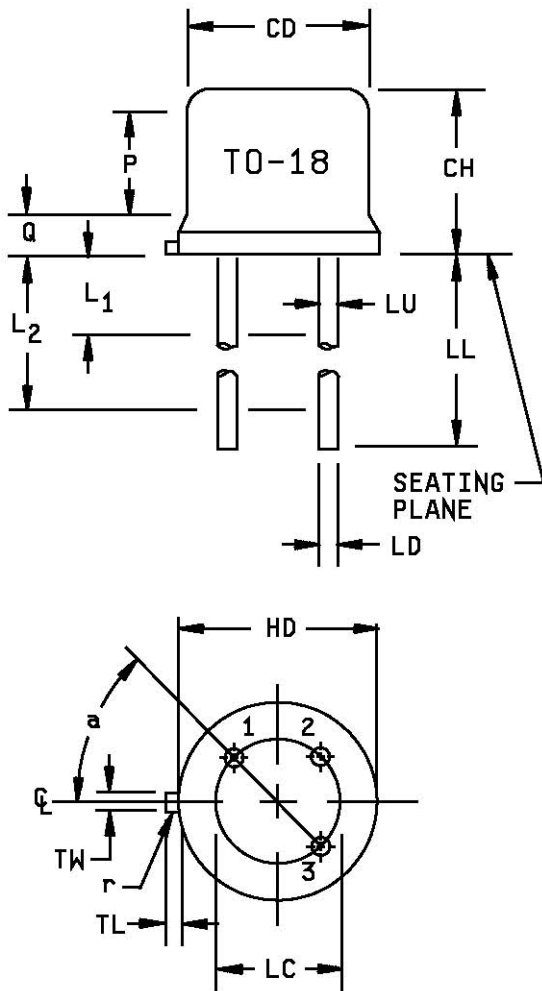
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Forward Current Transfer Ratio $I_C = 10\text{mAdc}$ , $V_{CE} = 10\text{Vdc}$ , $f = 100\text{MHz}$	$ h_{fe} $	5.0	10	
Output Capacitance $V_{CB} = 5.0\text{Vdc}$ , $I_E = 0$ , $100\text{kHz} \leq f \leq 1.0\text{MHz}$	$C_{obo}$		4.0	pF
Input Capacitance $V_{EB} = 0.5\text{Vdc}$ , $I_C = 0$ , $100\text{kHz} \leq f \leq 1.0\text{MHz}$	$C_{ibo}$		5.0	pF

## SWITCHING CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Turn-On Time $I_C = 10\text{mAdc}$ ; $I_{B1} = 3.0\text{mAdc}$ , $I_{B2} = -1.5\text{mAdc}$	$t_{on}$		12	$\eta\text{s}$
Turn-Off Time $I_C = 10\text{mAdc}$ ; $I_{B1} = 3.0\text{mAdc}$ , $I_{B2} = -1.5\text{mAdc}$	$t_{off}$		18	$\eta\text{s}$
Charge Storage Time $I_C = 10\text{mAdc}$ ; $I_{B1} = 10\text{mAdc}$ , $I_{B2} = 10\text{mAdc}$	$t_s$		13	$\eta\text{s}$

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

## PACKAGE DIMENSIONS

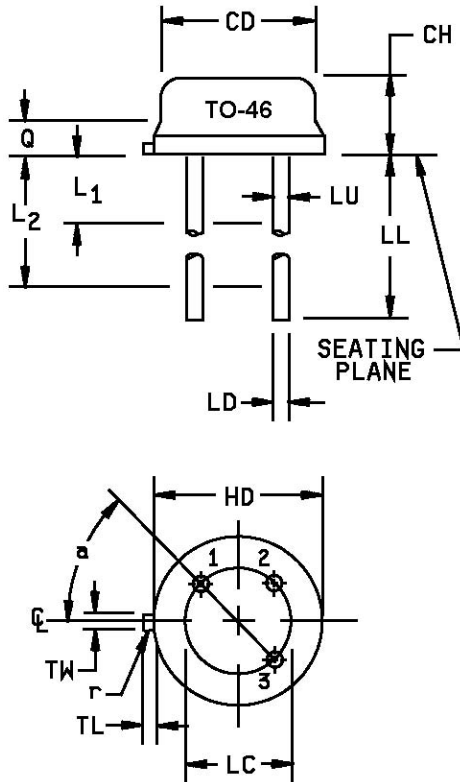


Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	
CH	.170	.210	4.32	5.33	
HD	.209	.230	5.31	5.84	
LC	.100 TP		2.54 TP		6
LD	.016	.021	0.41	0.53	7,8
LL	.500	.750	12.70	19.05	7,8,13
LU	.016	.019	0.41	0.48	7,8
L <sub>1</sub>		.050		1.27	7,8
L <sub>2</sub>	.250		6.35		7,8
P	.100		2.54		5
Q		.030		0.76	5
TL	.028	.048	0.71	1.22	3,4
TW	.036	.046	0.91	1.17	3
r		.010		0.25	10
α	45° TP		45° TP		6

### NOTES:

- Dimensions are in inches.
- Millimeters are given for general information only.
- Beyond r (radius) maximum, TH shall be held for a minimum length of .011 (0.28 mm).
- Dimension TL measured from maximum HD.
- Body contour optional within zone defined by HD, CD, and Q.
- Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC.
- Dimension LU applies between L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum. Diameter is uncontrolled in L<sub>1</sub> and beyond LL minimum.
- All three leads.
- The collector shall be internally connected to the case.
- Dimension r (radius) applies to both inside corners of tab.
- In accordance with ASME Y14.5M, diameters are equivalent to φx symbology.
- Lead 1 = emitter, lead 2 = base, lead 3 = collector.

FIGURE 1. Physical dimensions TO-18 (2N2369A).

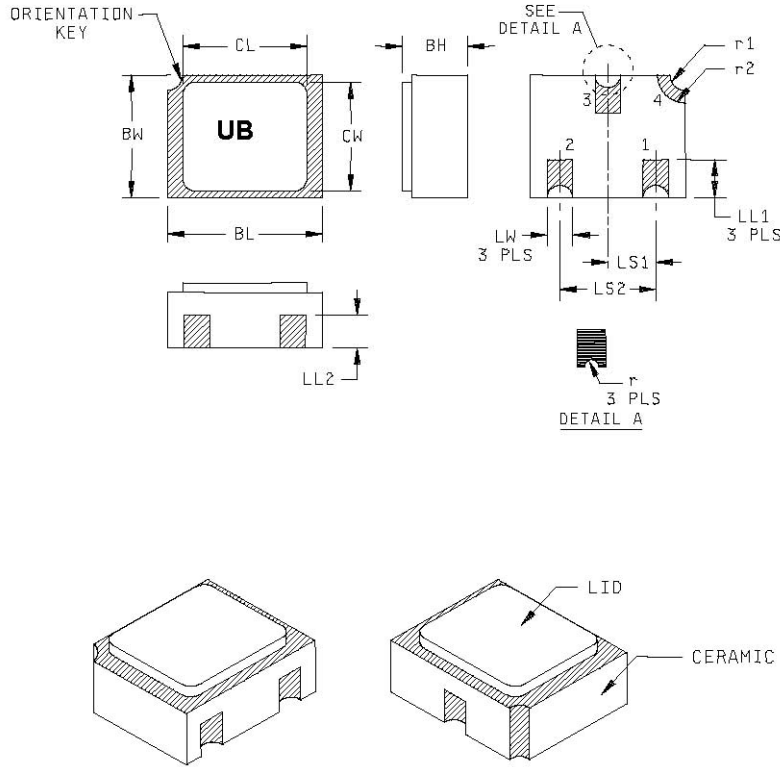


Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	
CH	.065	.085	1.65	2.16	
HD	.209	.230	5.31	5.84	
LC	.100 TP		2.54 TP		5
LD	.016	.021	0.41	0.53	
LL	.500	1.750	12.70	44.45	6
LU	.016	.019	0.41	0.48	6
L <sub>1</sub>		.050		1.27	6
L <sub>2</sub>	.250		6.35		6
Q		.040		1.02	3
TL	.028	.048	0.71	1.22	8
TW	.036	.046	0.91	1.17	4
r		.010		0.25	9
α	45° TP		45° TP		

## NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Symbol TL is measured from HD maximum.
4. Details of outline in this zone are optional.
5. Leads at gauge plane .054 inch (1.37 mm) +.001 inch (0.03 mm) -.000 inch (0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of TP relative to tab. Device may be measured by direct methods or by gauge.
6. Symbol LU applies between L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum.
7. Lead number three is electrically connected to case.
8. Beyond r maximum, TW shall be held for a minimum length of .011 inch (0.28 mm).
9. Symbol r applied to both inside corners of tab.
10. In accordance with ASME Y14.5M, diameters are equivalent to øx symbology.
11. Lead 1 is emitter, lead 2 is base, and lead 3 is collector.

**FIGURE 2.** Physical dimensions - TO-46 (2N4449).

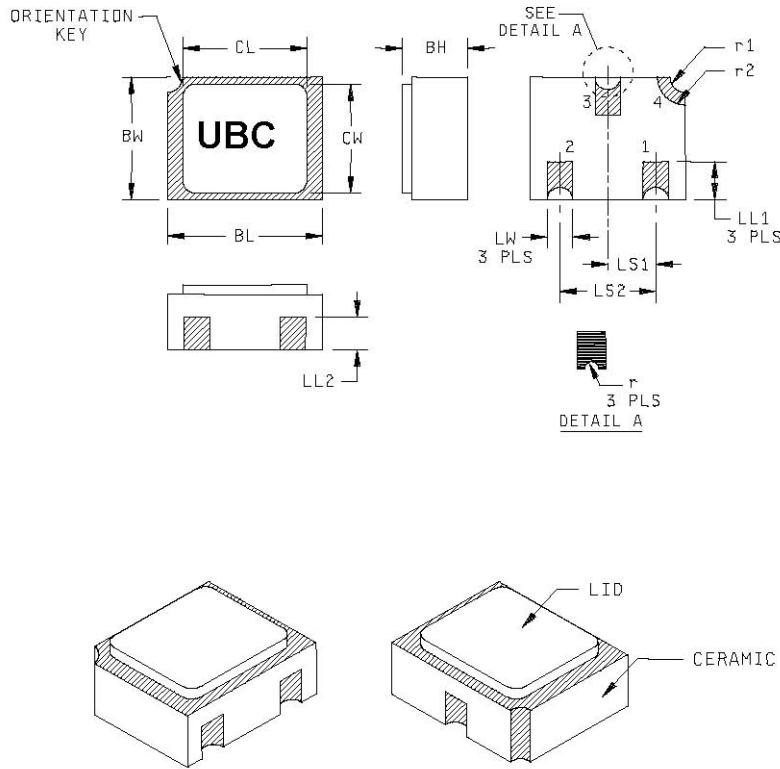


**NOTES:**

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

Ltr	Dimensions				Notes
	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	
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	

**FIGURE 3.** Physical dimensions - surface mount (UB version, 2N2369AUB).



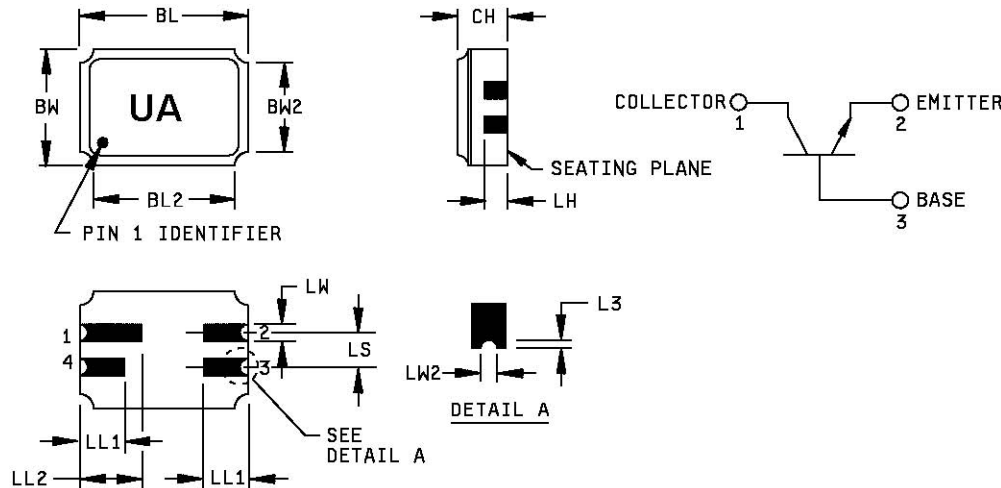
Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
BH	.046	.071	1.17	1.80	
BL	.115	.128	2.92	3.25	
BW	.085	.108	2.16	2.74	
CL		.128		3.25	
CW		.108		2.74	
LL1	.022	.038	0.56	0.96	
LL2	.017	.035	0.43	0.89	

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 metallized areas
4. Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Pad 4 = connected to the lid braze ring.
5. In accordance with ASME Y14.5M, diameters are equivalent to  $\phi x$  symbology.

**FIGURE 4.** Physical dimensions, surface mount (UBC version, ceramic lid).



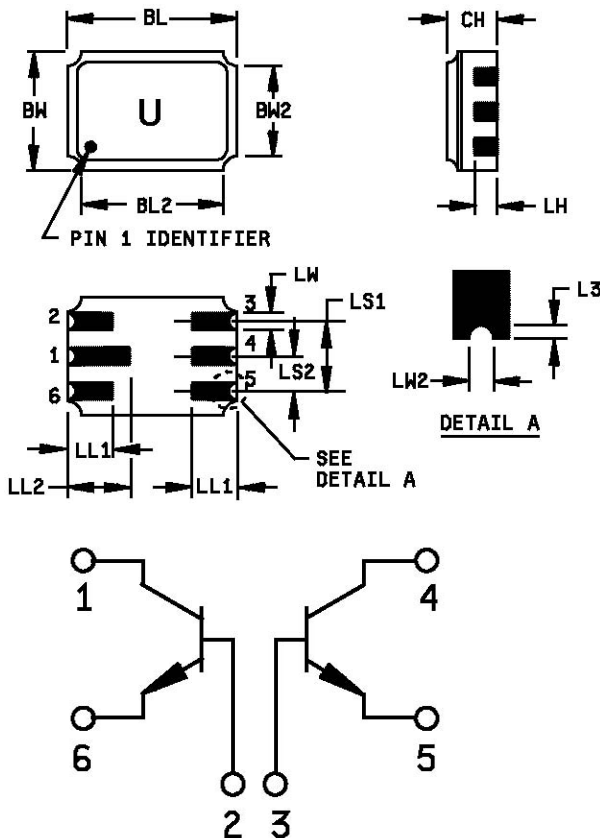
Ltr.	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.215	.225	5.46	5.71
BL2		.225		5.71
BW	.145	.155	3.68	3.93
BW2		.155		3.93
CH	.061	.075	1.55	1.90
L3	.003	.007	0.08	0.18
LH	.029	.042	0.74	1.07
LL1	.032	.048	0.81	1.22
LL2	.072	.088	1.83	2.23
LS	.045	.055	1.14	1.39
LW	.022	.028	0.56	0.71
LW2	.006	.022	0.15	0.56

Pin number.	1	2	3	4
Transistor	Collector	Emitter	Base	N/C

## NOTES:

- Dimensions are in inches.
- Millimeters are given for general information only.
- Dimension CH controls the overall package thickness. When a window lid is used, dimension CH must increase by a minimum of .010 inch (0.254 mm) and a maximum of .040 inch (1.020 mm).
- The corner shape (square, notch, radius) may vary at the manufacturer's option, from that shown on the drawing.
- Dimensions LW2 minimum and L3 minimum and the appropriate castellation length define an unobstructed three-dimensional space traversing all of the ceramic layers in which a castellation was designed. (Castellations are required on the bottom two layers, optional on the top ceramic layer.) Dimension LW2 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.
- The co-planarity deviation of all terminal contact points, as defined by the device seating plane, shall not exceed .006 inch (0.15mm) for solder dipped leadless chip carriers.
- In accordance with ASME Y14.5M, diameters are equivalent to  $\phi x$  symbology.

FIGURE 5. Physical dimensions - surface mount (UA version).



Ltr.	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.240	.250	6.10	6.35
BL2		.250		6.35
BW	.165	.175	4.19	4.44
BW2		.175		4.44
CH	.066	.080	1.68	2.03
L3	.003	.007	0.08	0.18
LH	.026	.039	0.66	0.99
LL1	.060	.070	1.52	1.78
LL2	.082	.098	2.08	2.49
LS1	.095	.105	2.41	2.67
LS2	.045	.055	1.14	1.39
LW	.022	.028	0.56	0.71
LW2	.006	.022	0.15	0.56

Pin number	1	2	3	4	5	6
Transistor	Collector no. 1	Base no. 1	Base no. 2	Collector no. 2	Emitter no. 2	Emitter no. 1

## NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimension CH controls the overall package thickness. When a window lid is used, dimension CH 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) may vary at the manufacturer's option, from that shown on the drawing.
5. Dimensions LW2 minimum and L3 minimum and the appropriate castellation length define an unobstructed three-dimensional space traversing all of the ceramic layers in which a castellation was designed. (Castellations are required on the bottom two layers, optional on the top ceramic layer.) Dimension LW2 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. The co-planarity deviation of all terminal contact points, as defined by the device seating plane, shall not exceed .006 inch (0.15mm) for solder dipped leadless chip carriers.
7. In accordance with ASME Y14.5M, diameters are equivalent to  $\phi$ x symbology.

**FIGURE 6.** Physical dimensions - surface mount (dual transistors, U version only, 2N2369AU).