

Product Overview

Qualified per MIL-PRF-19500/255.

Devices

2N2221A
2N2221AL
2N2221AUA
2N2221AUB
2N2221AUBC
2N2222A
2N2222AL
2N2222AUA
2N2222AUB
2N2222AUBC

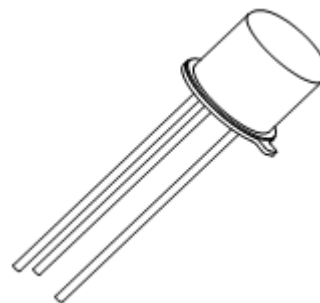
Levels

JANTXVM – 3K Rads (Si)
JANTXVD – 10K Rads (Si)
JANTXVP – 30K Rads (Si)
JANTXVL – 50K Rads (Si)
JANTXVR – 100K Rads (Si)
JANSE – 30K Rads (Si)¹
JANSK – 50K Rads (Si)¹
JANSU – 100K Rads (Si)¹
JANSM – 3K Rads (Si)
JANS D – 10K Rads (Si)
JANSP – 30K Rads (Si)
JANSL – 50K Rads (Si)
JANSR – 100K Rads (Si)
JANSF – 300K Rads (Si)
JANS G – 500K Rads (Si)
JANS H – 1MEG Rads (Si)

Note:

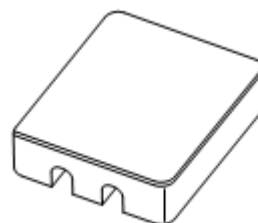
1. Tested to low dose rate

Figure 1. TO-18 (TO-206AA)



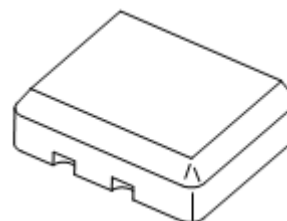
2N2221A, 2N2222A

Figure 2. 4 PIN



2N2221AUA, 2N2222AUA

Figure 3. 3 PIN



2N2221AUB, 2N2222AUB
2N2221AUBC, 2N2222AUBC
(UBC = Ceramic Lid Version)

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1. Maximum Ratings

Table 1-1. Maximum Ratings at 25 °C Unless Otherwise Noted

Parameters/Test Conditions	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	50	Vdc
Collector-base voltage	V_{CBO}	75	Vdc
Emitter-base voltage	V_{EBO}	6.0	Vdc
Collector current	I_C	800	mAdc
Total power dissipation at $T_A = +25^{\circ}\text{C}$			
2N2221A, L	2N2222A, L	0.5	W
2N2221AUA	2N2222AUA	0.65	
2N2221AUB, UBC	2N2222AUB, UBC	0.50	
Operating and storage junction temperature range	T_{op}, T_{stg}	–65 to +200	°C

1.1 Thermal Characteristics

Table 1-2. Thermal Characteristics¹⁻²

Parameters/Test Conditions	Symbol	Max.	Unit
Thermal resistance, junction-to-ambient			
2N2221A, L	2N2222A, L	325	°C/W
2N2221AUA	2N2222AUA	210	
2N2221AUB, UBC	2N2222AUB, UBC	325	

Notes:

- Derate linearly 3.08 mW/°C above $T_A > +37.5^{\circ}\text{C}$
- Derate linearly 4.76 mW/°C above $T_A > +63.5^{\circ}\text{C}$

2. Electrical Characteristics

Table 2-1. Electrical Characteristics at 25 °C Unless Otherwise Stated

Parameters/Test Conditions		Symbol	Min.	Max.	Unit
Off Characteristics					
Collector-emitter breakdown voltage					
I _C = 10 mAdc		V _{(BR)CEO}	50	—	Vdc
Collector-base cutoff current					
V _{CB} = 75 Vdc		I _{CBO}	—	10	μAdc
V _{CB} = 60 Vdc				10	ηAdc
Emitter-base cutoff current					
V _{EB} = 6.0 Vdc		I _{EBO}	—	10	μAdc
V _{EB} = 4.0 Vdc				10	ηAdc
Collector-emitter cutoff current					
V _{CE} = 50 VDC		I _{CES}	—	50	ηAdc
On Characteristics ¹					
Forward-current transfer ratio					
I _C = 0.1 mAdc, V _{CE} = 10 Vdc	2N2221A, L, UA, UB, UBC 2N2222A, L, UA, UB, UBC	h _{FE}	30 50	—	—
I _C = 1.0 mAdc, V _{CE} = 10 Vdc	2N2221A, L, UA, UB, UBC 2N2222A, L, UA, UB, UBC		35 75	150 325	—
I _C = 10 mAdc, V _{CE} = 10 Vdc	2N2221A, L, UA, UB, UBC 2N2222A, L, UA, UB, UBC		40 100	—	—
I _C = 150 mAdc, V _{CE} = 10 Vdc	2N2221A, L, UA, UB, UBC 2N2222A, L, UA, UB, UBC		40 100	120 300	—
I _C = 500 mAdc, V _{CE} = 10 Vdc	2N2221A, L, UA, UB, UBC 2N2222A, L, UA, UB, UBC		20 30	—	—
Collector-emitter saturation voltage					
I _C = 150 mAdc, I _B = 15 mAdc I _C = 500 mAdc, I _B = 50 mAdc		V _{CE(sat)}	—	0.3 1.0	Vdc
Base-emitter voltage					
I _C = 150 mAdc, I _B = 15 mAdc I _C = 500 mAdc, I _B = 50 mAdc		V _{BE(sat)}	0.6	1.2 2.0	Vdc

3. Dynamic Characteristics

Table 3-1. Dynamic Characteristics

Parameters/Test Conditions	Symbol	Min.	Max.	Unit
Small-signal short-circuit forward current transfer ratio				
$I_C = 1.0 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$ 2N2221A, L, UA, UB, UBC 2N2222A, L, UA, UB, UBC	h_{fe}	30 50	—	—
Magnitude of small-signal short-circuit Forward current transfer ratio				
$I_C = 20 \text{ mAdc}$, $V_{CE} = 20 \text{ Vdc}$, $f = 100 \text{ MHz}$	$ h_{fe} $	2.5	—	—
Output capacitance				
$V_{CB} = 10 \text{ Vdc}$, $I_E = 0$, $100 \text{ kHz} \leq f \leq 1.0 \text{ MHz}$	C_{obo}	—	8.0	pF
Input capacitance				
$V_{EB} = 0.5 \text{ VDC}$, $I_C = 0$, $100 \text{ kHz} \leq f \leq 1.0 \text{ MHz}$	C_{ibo}	—	25	pF

3.1 Switching Characteristics

Table 3-2. Switching Characteristics¹

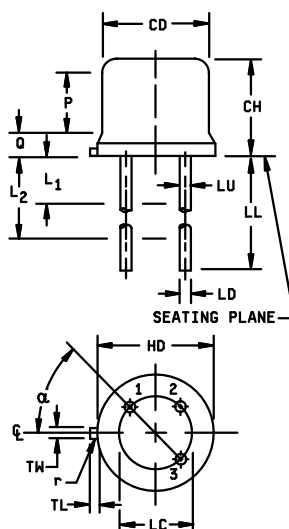
Parameters/Test Conditions	Symbol	Min.	Max.	Unit
Turn-on time See MIL-PRF-19500/255	t_{on}	—	35	ns
Turn-off time See MIL-PRF-19500/255	t_{off}	—	300	ns

Note:

1. Pulse test: pulse width = 300 μs , duty cycle $\leq 2.0\%$.

4. Package Dimensions

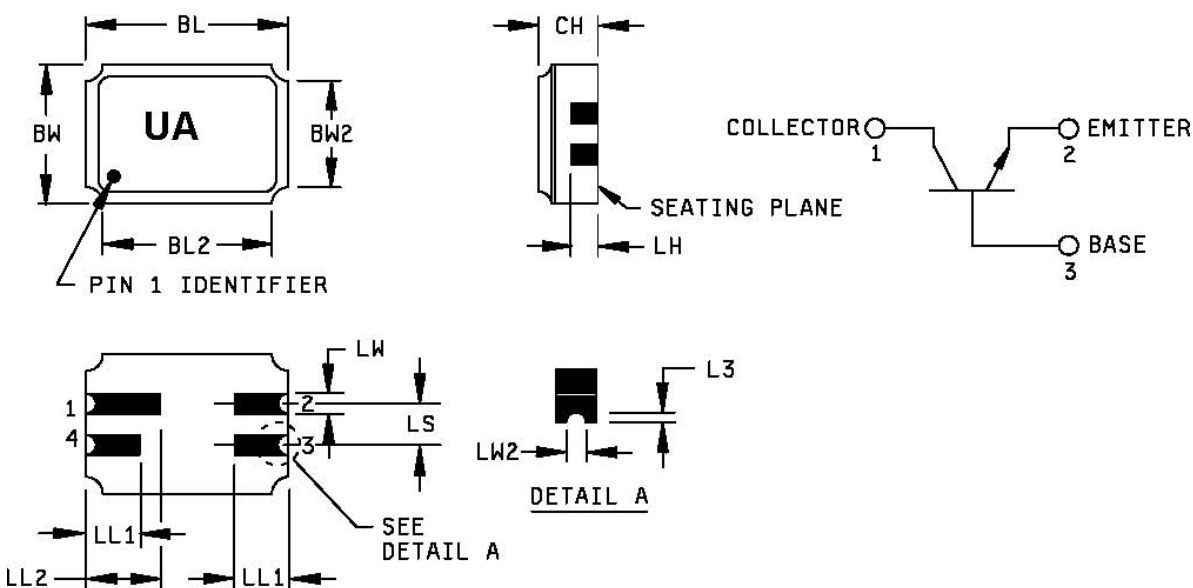
Figure 4-1. Physical Dimensions (Similar to TO-18)



Notes:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TL shall be held for a minimum length of 0.011 inch (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 0.054 +0.001 -0.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within 0.007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC.
7. Dimension LU applies between L1 and L2. Dimension LD applies between L2 and LL minimum. Diameter is uncontrolled in L1 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 Φ x symbology.
12. Lead 1 = emitter, lead 2 = base, lead 3 = collector
13. For L suffix devices, dimension LL = 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max.

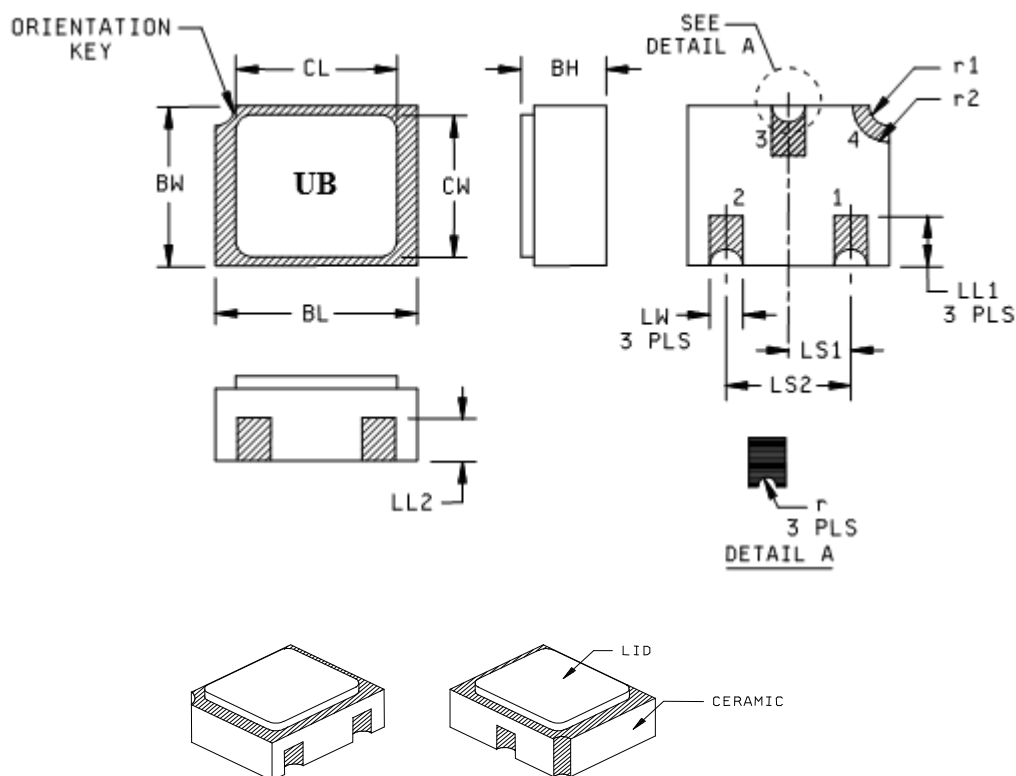
Symbol	Dimensions				Note
	Inches		Millimeters		
	Min.	Max.	Min.	Max.	
CD	0.178	0.195	4.52	4.95	—
CH	0.170	0.210	4.32	5.33	—
HD	0.209	0.230	5.31	5.84	—
LC	0.100 TP		2.54 TP		6
LD	0.016	0.021	0.41	0.53	7, 8
LL	0.500	0.750	12.70	19.05	7, 8, 13
LU	0.016	0.019	0.41	0.48	7, 8
L ₁	—	0.050	—	1.27	7, 8
L ₂	0.250	—	6.35	—	7, 8
P	0.100	—	2.54	—	—
Q	—	0.030	—	0.76	5
TL	0.028	0.048	0.71	1.22	3, 4
TW	0.036	0.046	0.91	1.17	3
r	—	0.010	—	0.25	10
α	45° TP		45° TP		6
1, 2, 9, 11, 12, 13					

Figure 4-2. Physical Dimensions, Surface Mount (UA Version).**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 0.010 inch (0.254 mm) and a maximum of 0.040 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 0.006 inch (0.15 mm) for solder dipped leadless chip carriers.
7. In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.

Symbol	Dimensions				Note
	Inches		Millimeters		
	Min.	Max.	Min.	Max.	
BL	0.215	0.225	5.46	5.71	—
BL2	—	0.225	—	5.71	—
BW	0.145	0.155	3.68	3.93	—
BW2	—	0.155	—	3.93	—
CH	0.061	0.075	1.55	1.90	3
L3	0.003	0.007	0.08	0.18	5
LH	0.029	0.042	0.74	1.07	—
LL1	0.032	0.048	0.81	1.22	—
LL2	0.072	0.088	1.83	2.23	—
LS	0.045	0.055	1.14	1.39	—
LW	0.022	0.028	0.56	0.71	—
LW2	0.006	0.022	0.15	0.56	5

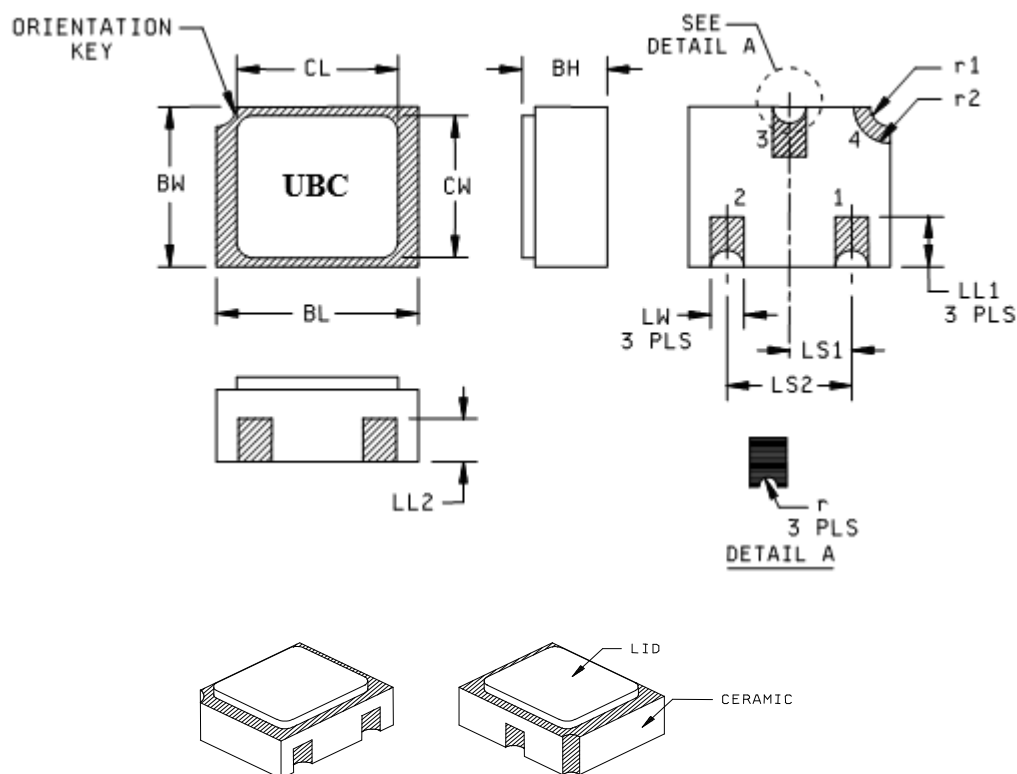
Figure 4-3. Physical Dimensions, Surface Mount (UB Version)¹⁻⁵



Symbol	Dimensions				Symbol	Dimensions			
	Inches		Millimeters			Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
BH	0.046	0.056	1.17	1.42	LS ₁	0.036	0.040	0.91	1.02
BL	0.115	0.128	2.92	3.25	LS ₂	0.071	0.079	1.81	2.01
BW	0.085	0.108	2.16	2.74	LW	0.016	0.024	0.41	0.61
CL	—	0.128	—	3.25	r	—	0.008	—	0.203
CW	—	0.108	—	2.74	r ₁	—	0.012	—	0.305
LL1	0.022	0.038	0.56	0.96	r ₂	—	0.022	—	0.559
LL2	0.017	0.035	0.43	0.89					

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 Φ x symbology.

Figure 4-4. Physical Dimensions, Surface Mount (UBC Version, Ceramic Lid)¹⁻⁵

Symbol	Inches		Millimeters		Symbol	Dimensions		Inches	Millimeters
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
BH	0.046	0.071	1.17	1.80	LS ₁	0.036	0.040	0.91	1.02
BL	0.115	0.128	2.92	3.25	LS ₂	0.071	0.079	1.81	2.01
BW	0.085	0.108	2.16	2.74	LW	0.016	0.024	0.41	0.61
CL	—	0.128	—	3.25	r	—	0.008	—	0.203
CW	—	0.108	—	2.74	r ₁	—	0.012	—	0.305
LL1	0.022	0.038	0.56	0.96	r ₂	—	0.022	—	0.559
LL2	0.017	0.035	0.43	0.89					

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 = connected to the lid braze ring
5. In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.

5. Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Revision	Date	Description
A	02/2024	Microsemi LDS-0042 Rev. 4 document was converted to Microchip template.

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