Radiation Hardened NPN Silicon Switching Transistors

2N2221A, 2N2221AL, 2N2221AUA, 2N2221AUB
2N2222A, 2N2222AL, 2N2222AUA, 2N2222AUB

NEW

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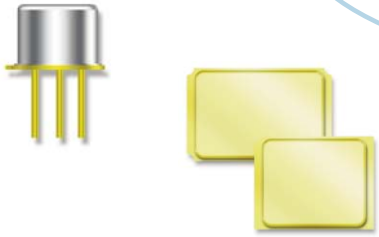
A passion for performance.

Features



- Qualified to MIL-PRF-19500/255
- Levels: JANSM-3K Rads (Si)
  JANSD-I0K Rads (Si)
  JANSP-30K Rads (Si)
  JANSL-50K Rads (Si)
  JANSR-I00K Rads (Si)
- TO-18 (TO-206AA), Surface mount UA & UB Packages

Absolute Maximum Ratings (T_C = +25 °C unless otherwise noted)

Ratings	Symbol	Value	Units
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 @ T_A = +25 °C 2N2221A, L 2N2222A, L 2N2221UA 2N2222UA 2N2221UB 2N2222UB	P_T	 0.5 0.5 0.5	W
Operating & Storage Temperature Range	T_{op}, T_{stg}	-65 to +200	°C

Thermal Characteristics

Characteristics	Symbol	Maximum	Units
Thermal Resistance, Junction-to-Ambient 2N2221A, L 2N2222A, L 2N2221UA 2N2222UA 2N2221UB 2N2222UB	$R_{\theta JC}$	 325 325 325	°C/W

Electrical Characteristics (T_A = +15°C, unless otherwise noted)

OFF Characteristics	Symbol	Mimimum	Maximum	Units
Collector - Emitter Breakdown Voltage I_C = 10 mAdc	$V_{(BR)CEO}$	50	- - -	Vdc
Collector - Base Cutoff Current V_{CB} = 75 Vdc V_{CB} = 60 Vdc	I_{CBO1} I_{CBO2}	- - -	10 10	µAdc nAdc
Emitter - Base Cutoff Current V_{EB} = 6.0 Vdc V_{EB} = 4.0 Vdc	I_{EBO1} I_{EBO2}	- - - - - -	10 10	µAdc nAdc
Collector - Emitter Cutoff Current V_{CE} = 60 Vdc, V_{BE} = 1.5 Vdc	I_{CES}	- - -	10	nAdc

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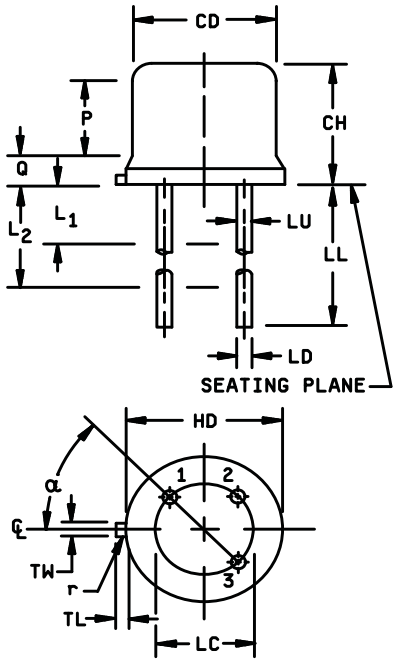
Electrical Characteristics (T_A = +15°C, unless otherwise noted)

ON Characteristics (1)		Symbol	Mimimum	Maximum	Units
Forward Current Transfer Ratio					
I_C = 0.1 mAdc, V_{CE} = 10 Vdc	2N2221A, L, UA, UB	H_{FE}	30		
	2N2222A, L, UA, UB		50		
I_C = 1.0 mAdc, V_{CE} = 10 Vdc	2N2221A, L, UA, UB		35	150	
	2N2222A, L, UA, UB		75	325	
I_C = 10 mAdc, V_{CE} = 10 Vdc	2N2221A, L, UA, UB		40		
	2N2222A, L, UA, UB		100		
I_C = 150 mAdc, V_{CE} = 10 Vdc	2N2221A, L, UA, UB		40	120	
	2N2222A, L, UA, UB		100	300	
I_C = 10 mAdc, V_{CE} = 10 Vdc	2N2221A, L, UA, UB		20		
	2N2222A, L, UA, UB		30		
Collector - Emitter Saturation Voltage					
I_C = 150 mAdc, I_B = 15 mAdc		$V_{CE(sat)1}$	- - -	0.3	Vdc
I_C = 500 mAdc, I_B = 50 mAdc		$V_{CE(sat)2}$	- - -	1.0	
Base - Emitter Saturation Voltage					
I_C = 150 Adc, I_B = 0.5 Vdc		$V_{BE(sat)1}$	0.6	1.2	Vdc
I_C = 500 Adc, I_B = 2.0 Vdc		$V_{BE(sat)2}$	- - -	2.0	
DYNAMIC Characteristics					
Small-Signal Short-Circuit Forward Current Transfer Ratio					
I_C = 1.0 Adc, V_{CE} = 10 Vdc, f = 1.0 MHz	2N2221A, L, UA, UB	h_{fe}	30		
	2N2222A, L, UA, UB		50		
Magnitude of Small-Signal Short-Circuit Forward Current Transfer Ratio					
I_C = 10 Adc, V_{CE}= 20 Vdc, f = 100 MHz		$\lvert h_{fe} \rvert$	2.5		
Output Capacitance					
V_{CB} = 10 Vdc, I_E = 0, 100 kHz ≤ f ≤ 1.0 MHz		C_{obo}	- - -	8.0	pF
Output Capacitance					
V_{CB} = 0.5 Vdc, I_E = 0, 100 kHz ≤ f ≤ 1.0 MHz		C_{ibo}	- - -	25	pF
Switching Characteristics					
Turn-On Time					
See figure 8 of MIL-PRF-19500/255		t_{on}		35	ns
Turn-Off Time					
See Figure 9 of MIL-PRF-19500/255		t_{off}		300	ns

(1) Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤2.0%.

Outline Drawing (TO-18):

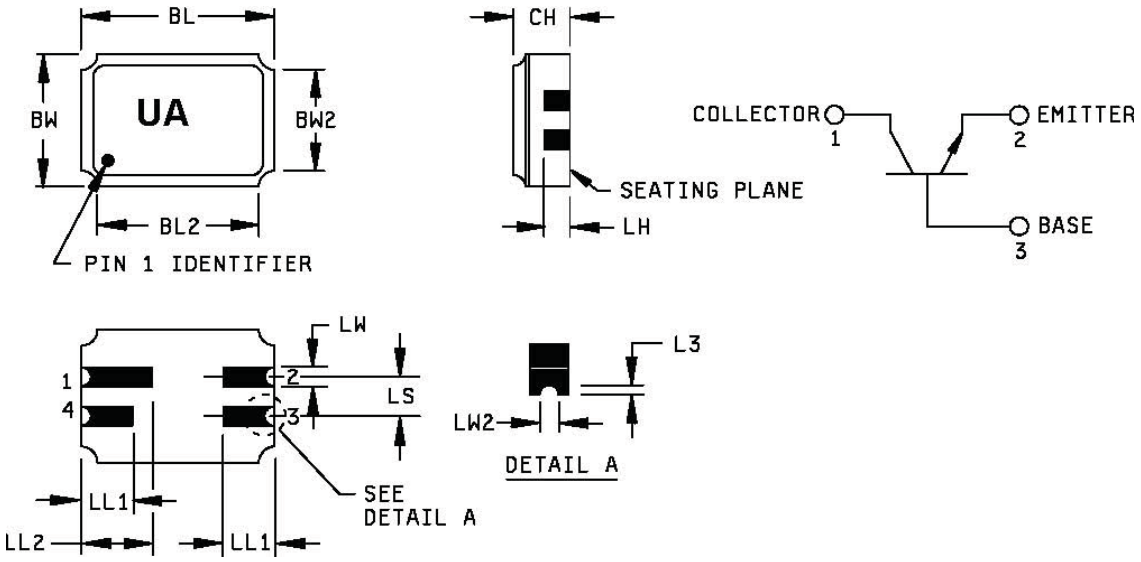


NOTES:

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 .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 .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.
7. Dimension LU applies between L_1 and L_2. Dimension LD applies between L_2 and LL minimum. Diameter is uncontrolled in L_1 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. 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	.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_1		.050		1.27	7,8
L_2	.250		6.35		7,8
P	.100		2.54		
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
1, 2, 9, 11, 12, 13					

Outline Drawing (UA surface mount):



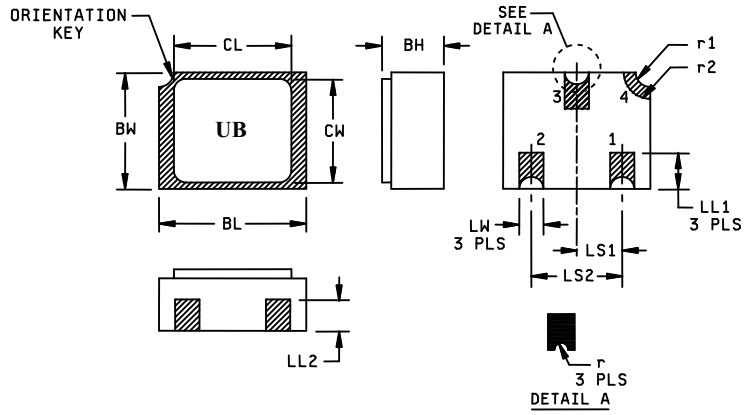
NOTES:

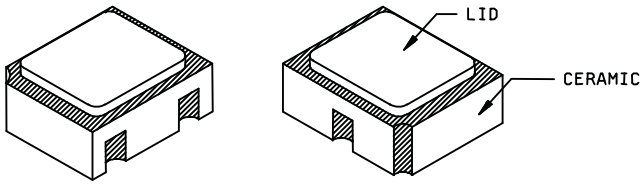
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimension CH controls the overall package thickness. When a window lid is used, dimension CH must increase by a minimum of .010 inch (0.254 mm) and a maximum of .040 inch (1.020 mm).
4. The corner shape (square, notch, 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 ϕx symbology.

Symbol	Dimensions				Note
	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	3
L3	.003	.007	0.08	0.18	5
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	5

Pin no.	1	2	3	4
Transistor	Collector	Emitter	Base	N/C

Outline Drawing (UB Surface mount):





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	
LS_1	.036	.040	0.91	1.02	
LS_2	.071	.079	1.81	2.01	
LW	.016	.024	0.41	0.61	
r		.008		.203	
r_1		.012		.305	
r_2		.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 ϕx symbology.

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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused.

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