

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

COBHAM

Radiation Hardened NPN Silicon Switching Transistor

Revision Date: 6/30/2015

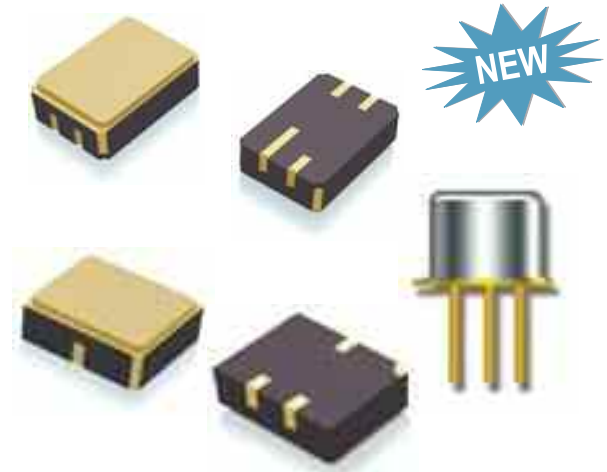
The most important thing we build is trust

Features

- Qualified to MIL-PRF-19500/255
- Levels

JANSM-3K Rads (Si)	JAN
JANSD-10K Rads (Si)	JANTX
JANSP-30K Rads (Si)	JANTXV
JANSL-50K Rads (Si)	JANS
JANSR-100K Rads (Si)	

- TO-18 (TO-206AA), Surface mount UA & UB Packages



Applications

- Switching and Linear Applications
- DC and VHF Amplifier Applications

Absolute Maximum Ratings

@ $T_c = +25\text{ }^{\circ}\text{C}$ (Unless Otherwise Defined)

Parameter	Symbol	Conditions	Absolute Maximum Value
Operating Temperature	T_{OP}		-65 $^{\circ}\text{C}$ to 200 $^{\circ}\text{C}$
Storage Temperature	T_{STG}		-65 $^{\circ}\text{C}$ to 200 $^{\circ}\text{C}$
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	P_T	$T_A = +25\text{ }^{\circ}\text{C}$	0.5 W
$R_{\theta JC}$ Thermal Resistance		Junction to Ambient	325 $^{\circ}\text{C}/\text{W}$

2N2221A, L, UA, UB / 2N2222A, L, UA, UB Electrical Specifications

OFF Characteristics @ $T_A = 15\text{ }^{\circ}\text{C}$ (Unless Otherwise Defined)

Parameter	Symbol	Test Conditions	Min. Value	Typ. Value	Max. Value	Units
Collector - Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\text{ mAdc}$	50	-	-	Vdc
Collector - Base Cutoff Current	I_{CBO1} I_{CBO2}	$V_{CB} = 75\text{ Vdc}$ $V_{CB} = 60\text{ Vdc}$	-	-	10 10	μAdc nAdc
Emitter - Base Cutoff Current	I_{EBO1} I_{EBO2}	$V_{EB} = 6.0\text{ Vdc}$ $V_{EB} = 4.0\text{ Vdc}$	-	-	10 10	μAdc nAdc
Collector - Emitter Cutoff Current	I_{CES}	$V_{CE} = 50\text{ Vdc}$	-	-	50	nAdc

2N2221A, L, UA, UB / 2N2222A, L, UA, UB Electrical Specifications

ON Characteristics⁽¹⁾ @ $T_A = 15\text{ }^{\circ}\text{C}$ (Unless Otherwise Defined)

Parameter	Symbol	Test Conditions	Part Series	Min. Value	Typ. Value	Max. Value	Units
Forward Current Transfer Ratio	h_{FE}	$I_C = 0.1\text{ mAdc}$ $V_{CE} = 10\text{ Vdc}$	2N2221A, L, UA, UB 2N2222A, L, UA, UB	30 50	- -	- -	
		$I_C = 1.0\text{ mAdc}$ $V_{CE} = 10\text{ Vdc}$	2N2221A, L, UA, UB 2N2222A, L, UA, UB	35 75	- -	150 325	
		$I_C = 10\text{ mAdc}$ $V_{CE} = 10\text{ Vdc}$	2N2221A, L, UA, UB 2N2222A, L, UA, UB	40 100	- -	- -	
		$I_C = 150\text{ mAdc}$ $V_{CE} = 10\text{ Vdc}$	2N2221A, L, UA, UB 2N2222A, L, UA, UB	40 100	- -	120 300	
		$I_C = 500\text{ mAdc}$ $V_{CE} = 10\text{ Vdc}$	2N2221A, L, UA, UB 2N2222A, L, UA, UB	20 30	- -	- -	
Collector - Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 150\text{ mAdc}, I_B = 15\text{ mAdc}$ $I_C = 500\text{ mAdc}, I_B = 50\text{ mAdc}$	- -	- -	- -	0.3 1.0	Vdc
Base - Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 150\text{ mAdc}, I_B = 15\text{ mAdc}$ $I_C = 500\text{ mAdc}, I_B = 50\text{ mAdc}$	- -	0.6 -	- -	1.2 2.0	Vdc

Dynamic Characteristics @ $T_A = 15\text{ }^{\circ}\text{C}$ (Unless Otherwise Defined)

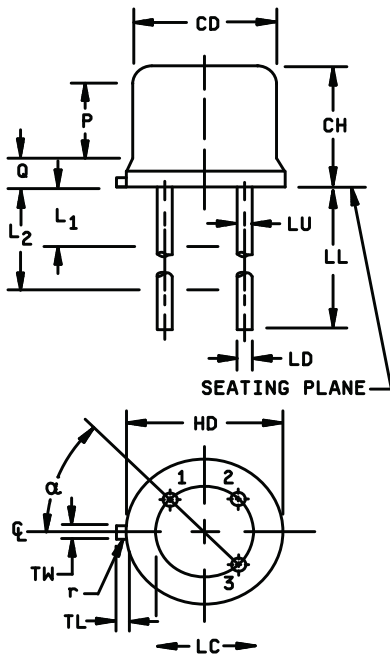
Parameter	Symbol	Test Conditions	Part Series	Min. Value	Typ. Value	Max. Value	Units
Small-Signal Short-Circuit Forward Current Transfer Ratio	h_{fe}	$I_C = 1.0\text{ mAdc}, V_{CE} = 10\text{ Vdc}$ $f = 1.0\text{ kHz}$	2N2221A, L, UA, UB 2N2222A, L, UA, UB	30 50	- -	- -	
Magnitude of Small-Signal Short-Circuit Forward Current Transfer Ratio	$ h_{fe} $	$I_C = 20\text{ mAdc}, V_{CE} = 20\text{ Vdc}$ $f = 100\text{ MHz}$		2.5	-	-	
Output Capacitance	C_{OBO}	$V_{CB} = 10\text{ Vdc}, I_E = 0,$ $100\text{ kHz} \leq f \leq 1.0\text{ MHz}$		-	-	8.0	pF
Output Capacitance	C_{IBO}	$V_{CB} = 0.5\text{ Vdc}, I_E = 0,$ $100\text{ kHz} \leq f \leq 1.0\text{ MHz}$		-	-	25	pF

Switching Characteristics @ $T_A = 15\text{ }^{\circ}\text{C}$ (Unless Otherwise Defined)

Parameter	Symbol	Test Conditions	Part Series	Min. Value	Typ. Value	Max. Value	Units
Turn-On Time See figure 17 of MIL-PRF-19500/255	t_{on}			-	-	35	ns
Turn-Off Time See Figure 18 of MIL-PRF-19500/255	t_{off}			-	-	300	ns

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

TO-18 Outline

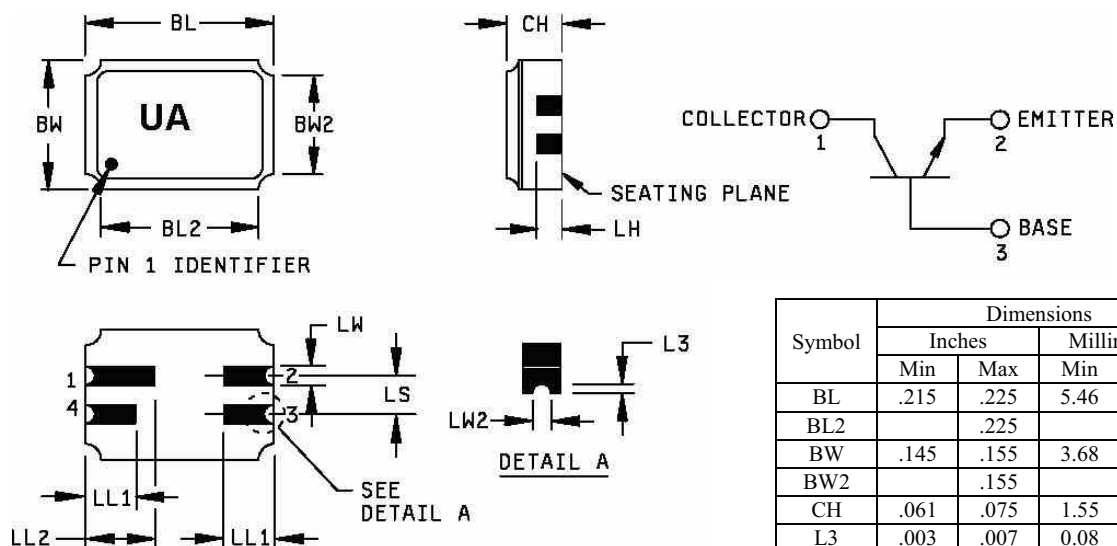


Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	
CH	.170	.210	4.32	5.33	
HD	.209	.230	5.31	5.84	
LC	.100 TP		2.54 TP		6
LD	.016	.021	0.41	0.53	7,8
LL	.500	.750	12.70	19.05	7,8,13
LU	.016	.019	0.41	0.48	7,8
L ₁		.050		1.27	7,8
L ₂	.250		6.35		7,8
P	.100		2.54		
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					

Notes:

- Dimensions are in inches.
- Millimeters are given for general information only.
- Beyond r (radius) maximum, TL shall be held for a minimum length of .011 inch (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 L₁ and L₂. Dimension LD applies between L₂ and LL minimum. Diameter is uncontrolled in L₁ 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.
- For L suffix devices, dimension LL = 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max.

UA Surface Mount Outline



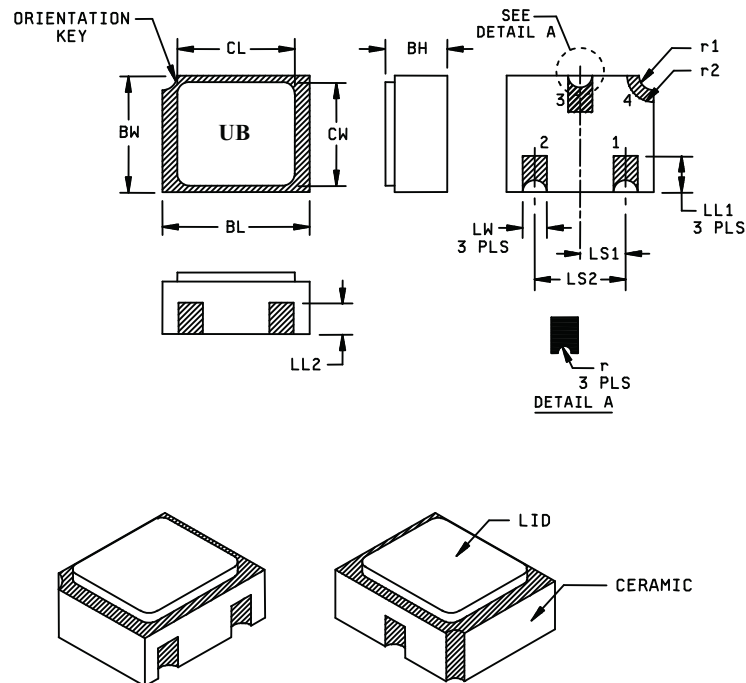
Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
BL	.215	.225	5.46	5.71	
BL2		.225		5.71	
BW	.145	.155	3.68	3.93	
BW2		.155		3.93	
CH	.061	.075	1.55	1.90	3
L3	.003	.007	0.08	0.18	5
LH	.029	.042	0.74	1.07	
LL1	.032	.048	0.81	1.22	
LL2	.072	.088	1.83	2.23	
LS	.045	.055	1.14	1.39	
LW	.022	.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

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 ϕ x symbology.

UB Surface Mount Outline



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 ϕ x symbology.

ISO 9001:2008 certified

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