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PNP Silicon Small Signal Transistor

Qualified per MIL-PRF-19500/382

Qualified Levels: JAN, JANTX, and **JANTXV**

DESCRIPTION

This 2N2944AUB through 2N2946AUB PNP silicon transistor device is military qualified up to a JANTXV level for high-reliability applications. Microsemi also offers numerous other products to meet higher and lower power voltage regulation applications.

Important: For the latest information, visit our website http://www.microsemi.com.

FEATURES

- Surface mount equivalent of JEDEC registered 2N2944A thru 2N2946A series.
- Low-profile ceramic surface mount package.
- JAN, JANTX, and JANTXV qualification per MIL-PRF-19500/382 available.
- RoHS compliant versions available (commercial grade only).

APPLICATIONS / BENEFITS

- Small lightweight package.
- ESD to Class 3 per MIL-STD-750, method 1020.

Also available in:

UB Package

TO-46 (TO-206AB) (axial leaded)

MAXIMUM RATINGS @ +25 °C unless otherwise noted

Parameters/Test Conditions	Symbol	Value	Unit	
Junction and Storage Temperature	T _J and T _{STG}	-65 to +200	°C	
Thermal Resistance Junction-to-Ambi	R _{eJA}	435	°C/W	
Thermal Resistance surface mount Ju Point	$R_{\Theta JSP}$	90	°C/W	
Collector Current (dc)	Ic	-100	mA	
Emitter to Base voltage (static),	2N2944AUB	V_{EBO}	-15	٧
collector open	2N2945AUB		-25	
	2N2946AUB		-40	
Collector to Base voltage (static),	2N2944AUB	V_{CBO}	-15	V
emitter open	2N2945AUB		-25	
	2N2946AUB		-40	
Collector to Emitter voltage (static),	2N2944AUB	$V_{\sf CEO}$	-10	V
base open	2N2945AUB		-20	
	2N2946AUB		-35	
Emitter to Collector voltage	2N2944AUB	$V_{\sf ECO}$	-10	V
	2N2945AUB		-20	
	2N2946AUB		-35	
Total Power Dissipation, all terminals @ $T_A = +25$ °C		P _T	400	mW
Total Power Dissipation, all terminals	P _T	800	mW	

Notes: 1. Derate linearly 2.30 mW $/^{\circ}$ C above $T_A = +25^{\circ}$ C.

2. T_A = +55°C for UB on printed circuit board (PCB), PCB = FR4 .0625 inch (1.59 mm) 1 - layer 1 Oz Cu, horizontal, still air, pads (UB) = .034 inch (0.86 mm) x .048 inch (1.22 mm), R_{BJA} with a defined thermal resistance condition included is measured at $P_T = 400 \text{ mW}$.

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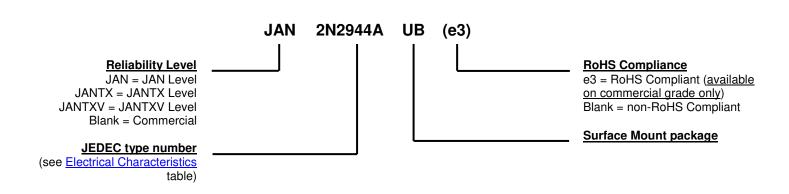
www.microsemi.com



MECHANICAL and PACKAGING

- CASE: Ceramic.
- TERMINALS: Gold plating over nickel under-plate. RoHS compliant matte/tin available on commercial grade only.
- MARKING: Part number, date code, manufacturer's ID.
- TAPE & REEL option: Standard per EIA-418D. Consult factory for quantities.
- WEIGHT: < 0.04 Grams.
- See <u>Package Dimensions</u> on last page.

PART NOMENCLATURE



SYMBOLS & DEFINITIONS						
Symbol	Definition					
Ι _Β	Base current (dc).					
Ι _Ε	Emitter current (dc).					
V_{CB}	Collector to base voltage (dc).					
$V_{\sf EB}$	Emitter to base voltage (dc).					
$V_{(BR)}$	Minimum Breakdown Voltage: The minimum voltage the device will exhibit at a specified current.					



ELECTRICAL CHARACTERISTICS @ 25 °C unless otherwise noted.

OFF CHARACTERISTICS: Collector-Emitter Breakdown Voltage I _C = -10 μA 2N2945AUB 2N2946AUB -10 20 2N2946AUB V Emitter-Collector Breakdown Voltage I _E = -10 μA, I _B = 0 2N2946AUB 2N2946AUB V(BR)CCO -10 20 2N2946AUB V Collector-Base Cutoff Current V2E = -15 V 2N2944AUB 2N2946AUB 10 10 10 10 10 10 10 10 10 10 10 10 10 1	Characteristic		Symbol	Min.	Max.	Unit
Collector-Emitter Breakdown Voltage $I_{C} = -10 \mu A$			-,			
I _C = -10 μA						
2N2945AUB 2N2946AUB -20 -35		2N2944AUB	V(BB)CEO	-10		V
Emitter-Collector Breakdown Voltage $I_E = -10 \mu A$, $I_B = 0$			(BIT)OLO	-20		
	Emitter-Collector Breakdown Voltage					
2N2945AUB 20 -35 -35	1	2N2944AUB	V(BB)ECO	-10		V
Collector-Base Cutoff Current $2N2946AUB$ -35 0 0 0 0 0 0 0 0 0 0			(BH)EGO			-
Collector-Base Cutoff Current $V_{CB} = -15 \text{ V}$ $2N2944AUB$ $V_{CB} = -25 \text{ V}$ $2N2945AUB$ 10 10 $V_{CB} = -25 \text{ V}$ $2N2945AUB$ 10 10 $V_{CB} = -25 \text{ V}$ $2N2945AUB$ 10 10 $V_{CB} = -12 \text{ V}$ $2N2945AUB$ 10 10 $V_{CB} = -12 \text{ V}$ $2N2945AUB$ 10 10 $V_{CB} = -12 \text{ V}$ $2N2945AUB$ $2N2945AUB$ 10 0 0 0 0 0 0 0 0 0		2N2946AUB				
	Collector-Base Cutoff Current					
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		2N2944ALIR	lana	10		пΔ
			ICBO	_		μιν
Emitter-Base Cutoff Current $V_{EB} = -12 \text{ V}$ 2N2944AUB $V_{EB} = -20 \text{ V}$ 2N2945AUB $V_{EB} = -20 \text{ V}$ 2N2945AUB $V_{EB} = -32 \text{ V}$ 2N2946AUB $V_{EB} = -32 \text{ V}$ 2N2945AUB $V_{EB} = -0.5 \text{ V}$ 2N2946AUB $V_{EB} = -0.5 \text{ V}$ 2N2946AUB $V_{EB} = -0.5 \text{ V}$ 2N2946AUB $V_{EB} = -0.5 \text{ V}$ 2N2945AUB $V_{EB} = -0.5 \text{ V}$ 3N2945AUB $V_{EB} $	VcB = -40 V			_		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		21120107102				
VEB = -20 V		2N2944ALIB	l _{EBO}		-0.1	ηA
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	1		LBO		-0.2	'
ON CHARACTERISTICS: (1) Forward-Current Transfer Ratio 2N2944AUB 2N2945AUB 2N2946AUB hFE 100 70 50 Forward-Current Transfer Ratio (inverted connection) l _E = -200 μA, V _{EC} = -0.5 V 2N2944AUB 2N2945AUB 2N2946AUB hFE(inv) 50 30 Emitter-Collector Offset Voltage l _B = -200 μA, l _E = 0 2N2944AUB 2N2945AUB 20 VEC(ofs) -0.3 mV 2N2945AUB 2N2946AUB -1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0						
Forward-Current Transfer Ratio $2N2944AUB$ $C = -1.0 \text{ mA}$, $V_{CE} = -0.5 \text{ V}$ $2N2945AUB$ $2N2946AUB$ $2N$			•		ı	
$ \begin{array}{c} I_{C} = -1.0 \text{ mA, } V_{CE} = -0.5 \text{ V} & 2N2945 \text{AUB} \\ 2N2946 \text{AUB} & 70 \\ 50 & 70$		2N2944ALIR				
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$I_{C} = -1.0 \text{ mA}$. $V_{CE} = -0.5 \text{ V}$		hFF	100		
Forward-Current Transfer Ratio (inverted connection) $I_E = -200 \ \mu\text{A}, \ V_{EC} = -0.5 \ V \qquad 2N2944\text{AUB} \\ 2N2945\text{AUB} \\ 2N2945\text{AUB} \\ 2N2946\text{AUB} \qquad 20 \end{aligned}$ Emitter-Collector Offset Voltage $I_B = -200 \ \mu\text{A}, \ I_E = 0 \qquad 2N2944\text{AUB} \\ 2N2945\text{AUB} \\ 2N2946\text{AUB} \qquad -0.5 \\ -0.8 \\ -0.8 \\ -0.6 \\ 2N2946\text{AUB} \qquad -0.6 \\ -0.8 \\ -0.6 \\ -0.8 \\ -0.6 \\ -0.6 \\ -0.8 \\ -0.6 \\ -0.6 \\ -0.8 \\ -0.6 \\ -0.6 \\ -0.8 \\ -0.6 \\ -0.6 \\ -0.8 \\ -0.6 \\ -0.6 \\ -0.8 \\ -0.6 \\ -0.6 \\ -0.6 \\ -0.8 \\ -0.6 \\ -0.6 \\ -0.6 \\ -0.6 \\ -0.10 \\ -0.6 \\ -0.6 \\ -0.6 \\ -0.6 \\ -0.6 \\ -0.6 \\ -0.6 \\ -0.6 \\ -0.6 \\ -0.7 \\ -0.8 \\ -0.6 \\ -0.8 $	i.g i.i. ii. ii, i.ge eie i		. –			
$ \begin{array}{c} I_E = -200 \; \mu \text{A}, \; V_{EC} = -0.5 \; \text{V} \\ 2N2945 \text{AUB} \\ 20 \\ 20 \\ \\ \end{array} $ $ \begin{array}{c} \text{Emitter-Collector Offset Voltage} \\ I_B = -200 \; \mu \text{A}, \; I_E = 0 \\ I_B = -200 \; \mu \text{A}, \; I_E = 0 \\ \\ 2N2945 \text{AUB} \\ 2N2946 \text{AUB} \\ 12 \\ 2N2946 \text{AUB} \\ 13 \\ 12 \\ 2N2945 \text{AUB} \\ 14 \\ 16 \\ 10 \; \text{MA}, \; I_E = 0, \; I_e = 100 \; \mu \text{A ac (rms)} \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 1$		2112010102		_		
$ \begin{array}{c} I_E = -200 \; \mu \text{A}, \; V_{EC} = -0.5 \; \text{V} \\ 2N2945 \text{AUB} \\ 20 \\ 20 \\ \\ \end{array} $ $ \begin{array}{c} \text{Emitter-Collector Offset Voltage} \\ I_B = -200 \; \mu \text{A}, \; I_E = 0 \\ I_B = -200 \; \mu \text{A}, \; I_E = 0 \\ \\ 2N2945 \text{AUB} \\ 2N2946 \text{AUB} \\ 12 \\ 2N2946 \text{AUB} \\ 13 \\ 12 \\ 2N2945 \text{AUB} \\ 14 \\ 16 \\ 10 \; \text{MA}, \; I_E = 0, \; I_e = 100 \; \mu \text{A ac (rms)} \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 1$	Forward-Current Transfer Batio (inverted co	nnection)				
	· ·	•	hFF(inv)	50		
Emitter-Collector Offset Voltage I _B = -200 μA, I _E = 0 2N2944AUB 2N2945AUB 2N2945AUB 2N2946AUB -0.5 -0.8 -0.6 -1.0 -0.6 -1.0 -1.0 -1.6 -2.5 -1.0 -1.0 -1.6 -2.5 -1.0 -1.6 -2.5 -1.0 -1.6 -2.5 -1.0 -1.6 -2.5 -1.0 -1.6 -2.5 -1.0 -1.6 -2.5 -1.0 -1.6 -2.5 -1.0 -1.6 -2.5 -1.0 -1.0 -1.6 -2.5 -1.0	ie = -200 μπ, Vec = -0.5 V		1 =(1114)			
Emitter-Collector Offset Voltage $I_B = -200 \mu A$, $I_E = 0$ 2N2944AUB 2N2945AUB 2N2945A						
	Emitter-Collector Offset Voltage					
$ \begin{array}{c} 2N2945 \text{AUB} \\ 2N2946 \text{AUB} \\ 2N2946 \text{AUB} \\ 2N2945 \text{AUB} \\ 2N2945 \text{AUB} \\ 2N2945 \text{AUB} \\ 2N2945 \text{AUB} \\ 2N2946 \text{AUB} \\ 2N2945 \text{AUB} \\ 2N2945 \text{AUB} \\ 2N2946 \text{AUB} \\ 2N2946$	· ·	2N2944ALIR	VEC(ofs)		-0.3	mV
$\begin{array}{c} l_{B} = -1.0 \text{ mA, } l_{E} = 0 \\ l_{B} = -1.0 \text{ mA, } l_{E} = 0 \\ l_{B} = -2.0 \text{ mA, } l_{E} = 0 \\ l_{B} = -2.0 \text{ mA, } l_{E} = 0 \\ l_{B} = -2.0 \text{ mA, } l_{E} = 0 \\ l_{B} = -2.0 \text{ mA, } l_{E} = 0 \\ l_{B} = -2.0 \text{ mA, } l_{E} = 0 \\ l_{B} = -2.0 \text{ mA, } l_{E} = 0 \\ l_{B} = -2.0 \text{ mA, } l_{E} = 0 \\ l_{B} = -2.0 \text{ mA, } l_{E} = 0 \\ l_{B} = -2.0 \text{ mA, } l_{E} = 0, l_{E} = 100 \text{ mA ac (rms)} \\ l_{B} = -1.0 \text{ mA, } l_{E} = 0, l_{E} = 100 \text{ mA ac (rms)} \\ l_{B} = -1.0 \text{ mA, } l_{E} = 0, l_{E} = 100 \text{ mA ac (rms)} \\ l_{B} = -1.0 \text{ mA, } l_{E} = 0, l_{E} = 100 \text{ mA ac (rms)} \\ l_{B} = -1.0 \text{ mA, } l_{E} = 0, l_{E} = 100 \text{ mA ac (rms)} \\ l_{B} = -1.0 \text{ mA, } l_{E} = 0, l_{E} = 100 \text{ mA ac (rms)} \\ l_{E} = -1.0 \text{ mA, } l_{E} = 0, l_{E} = 100 \text{ mA ac (rms)} \\ l_{E} = -1.0 \text{ mA, } l_{E} = 0, l_{E} = 100 \text{ mA ac (rms)} \\ l_{E} = -1.0 \text{ mA, } l_{E} = 0, l_{E} = 100 \text{ mA ac (rms)} \\ l_{E} = -1.0 \text{ mA, } l_{E} = 0, l_{E} = 100 \text{ mA ac (rms)} \\ l_{E} = -1.0 \text{ mA, } l_{E} = 0, l_{E} = 100 \text{ mA ac (rms)} \\ l_{E} = -1.0 \text{ mA, } l_{E} = 0, l_{E} = 100 \text{ mA ac (rms)} \\ l_{E} = -1.0 \text{ mA, } l_{E} = 0, l_{E} = 100 \text{ mA ac (rms)} \\ l_{E} = -1.0 \text{ mA, } l_{E} = 0, l_{E} =$.Β = 200 μα ι, .Ε = 0		_ = ()		-0.5	
$\begin{array}{c} I_B = -1.0 \text{ mA, } I_E = 0 \\ I_B = -2.0 \text{ mA, } I_E = 0 \\ I_B = -2.0 \text{ mA, } I_E = 0 \\ \end{array} \begin{array}{c} 2N2944AUB \\ 2N2945AUB \\ 2N2945AUB \\ 2N2945AUB \\ 2N2945AUB \\ 2N2946AUB \\ \end{array} \begin{array}{c} -2.0 \\ -1.0 \\ -2.0 \\ -1.0 \\ -1.6 \\ -2.5 \\ \end{array} \\ \end{array}$						
$\begin{array}{c} I_B = -1.0 \text{ ImA, } I_E = 0 \\ I_B = -2.0 \text{ mA, } I_$	1 0 m\					
$\begin{array}{c} \text{l}_{\text{B}} = -2.0 \text{ mA, l}_{\text{E}} = 0 \\ \text{l}_{\text{B}} = -2.0 \text{ mA, l}_{\text{E}} = 0 \\ \text{2N2944AUB} \\ \text{2N2945AUB} \\ \text{2N2946AUB} \\ \text{2N2945AUB} \\ \text{2N2945AUB} \\ \text{2N2945AUB} \\ \text{2N2946AUB} \\ \text{3D2946AUB} \\ 3D2$	IB = 1.0 IIIA, IE = 0				-1.0	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$					-2.0	
					-1.0	
	IB = -2.0 IIIA, IE = 0				-1.6	
DYNAMIC CHARACTERISTICS: Emitter-Collector On-State Resistance $I_B = -100 \mu A, I_E = 0, I_e = 100 \mu A$ ac (rms) 2N2944AUB $r_{ec}(on)$ 10 $I_B = -1.0 \text{ kHz}$ 2N2945AUB 12 $I_B = -1.0 \text{ mA}, I_E = 0, I_e = 100 \mu A$ ac (rms) 2N2946AUB 4.0 $I_B = -1.0 \text{ kHz}$ 2N2945AUB 6.0 $I_B = -1.0 \text{ kHz}$ 2N2945AUB 8.0 Magnitude of Small-Signal Forward Current Transfer Ratio 2N2944AUB $I_B = -1.0 \text{ mA}$, $I_B = 0.0 \text{ mB}$, $I_B = 0.$					-2.5	
Emitter-Collector On-State Resistance I _B = -100 μA, I _E = 0, I _e = 100 μA ac (rms) 2N2944AUB 12 12 12 14 Ω 14 Ω 15 15 10 10 10 10 10 10	DVNAMIC CHARACTERISTICS.	21120107102				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$					1	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		ONIOGAAALID	r (on)		10	
$\begin{array}{c} \text{ $I_B = -1.0 \text{ mA, } I_E = 0, I_e = 100 \mu\text{A ac (rms)}} \\ \text{ $I_B = -1.0 \text{ mA, } I_E = 0, I_e = 100 \mu\text{A ac (rms)}} \\ \text{ $I_C = -1.0 \text{ mA, } I_E = 0, I_e = 100 \mu\text{A ac (rms)}} \\ \text{ $I_C = -1.0 \text{ mA, } V_{CE} = -6.0V, $I_C = -6.0V, $I_C = -6.0V, $I_C = -1.0 I_C = -1.0 $			ec(OII)			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	I = 1.0 KΠZ					0
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ l_0 = -1.0 \text{ m} \Delta l_0 = 0.1 = 100 \text{ m} \Delta \approx (\text{rms})$					Ω
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	I = 1.0 KHZ					
	Magnitude of Congl. Circuit Familiard	LINZUTUAUD		-	0.0	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		20120440110	lht-l	15		
Output Capacitance $V_{CB} = -6.0 \text{ V}, I_E = 0, 100 \text{ kHz} \le f \le 1.0 \text{ MHz}$ Input Capacitance Cobo Cobo Cobo PF			l i i i e i			
Output Capacitance $V_{CB} = -6.0 \text{ V}, I_E = 0, 100 \text{ kHz} \le f \le 1.0 \text{ MHz}$ Input Capacitance Cobo Cobo Cobo DF	$I_C = -1.0 \text{ mA}, V_{CE} = -6.0 \text{ V}, T = 1.0 \text{ MHz}$					
$V_{CB} = -6.0 \text{ V}, I_E = 0, 100 \text{ kHz} \le f \le 1.0 \text{ MHz}$ Input Capacitance Cibs	Outrat Constitutes	2112010/100		5.0	55	
V _{CB} = -6.0 V, I _E = 0, 100 kHz ≤ f ≤ 1.0 MHz Input Capacitance C:bs 6.0 pE	1		Coho		10	ρF
		<u> </u>	- 000			I- ·
$V_{EB} = -6.0 \text{ V}, I_{C} = 0, 100 \text{ kHz} \le f \le 1.0 \text{ MHz}$	1 .		Ciba		6.0	n⊑
	$V_{EB} = -6.0 \text{ V}, I_{C} = 0, 100 \text{ kHz} \le f \le 1.0 \text{ MHz}$	2	Odio		0.0	ρι

⁽¹⁾ Pulse Test: Pulse Width = 300 s, duty cycle 2.0%.



GRAPHS

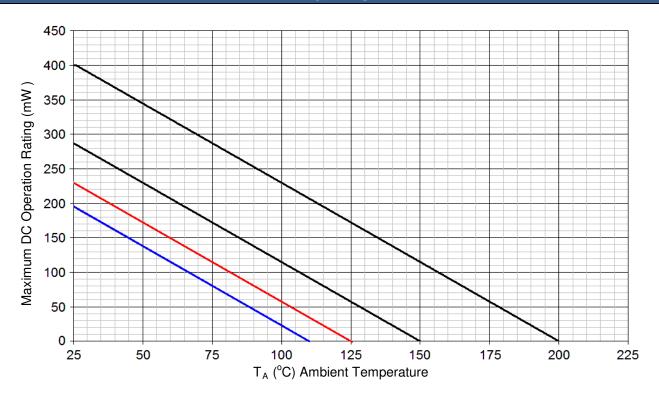


FIGURE 1 – Temperature-Power Derating Curve $(R_{\Theta JA})$

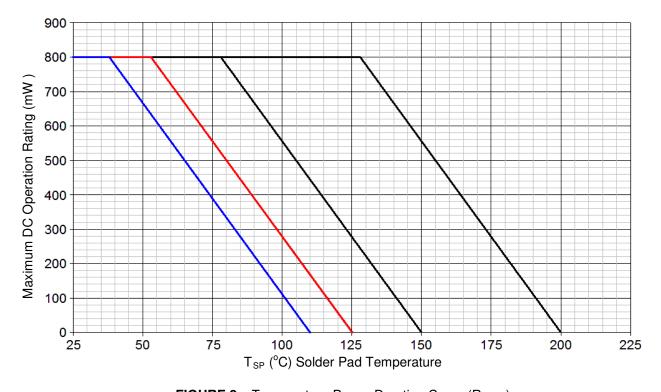
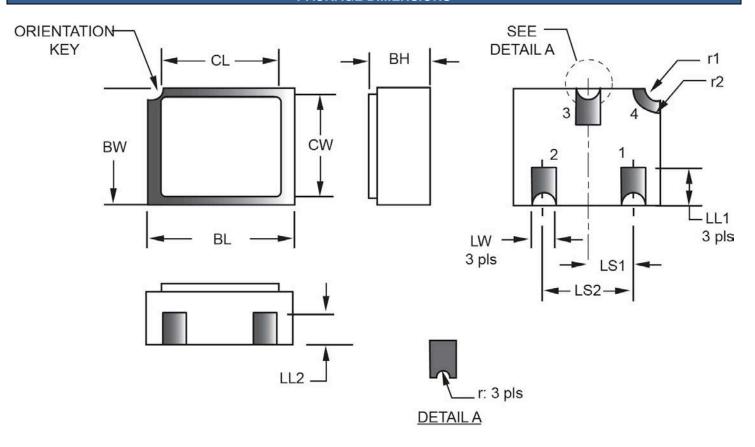


FIGURE 2 – Temperature-Power Derating Curve $(R_{\Theta JSP})$



PACKAGE DIMENSIONS



	Dimensions					Dimensions					
Symbol	inch		millimeters		Note	Symbol	inch		millimeters		Note
	Min	Max	Min	Max			Min	Max	Min	Max	
BH	.046	.056	1.17	1.42		LS1	.035	.039	0.89	0.99	
BL	.115	.128	2.92	3.25		LS2	.071	.079	1.80	2.01	
BW	.085	.108	2.16	2.74		LW	0.16	0.24	0.41	0.61	
CL		.128		3.25		r		.008		0.20	
CW		.108		2.74		r1		.012		0.31	
LL1	.022	.038	0.56	0.97		r2		.022		.056	
LL2	.017	.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 metallized 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.