



PIN CONFIGURATION
1. EMITTER
2. BASE
3. COLLECTOR

DIM	MIN	MAX
A	8,50	9,39
B	7,74	8,50
C	6,09	6,60
D	0,40	0,53
E	—	0,88
F	2,41	2,66
G	4,82	5,33
H	0,71	0,86
J	0,73	1,02
K	12,7	—
L	42 DEG	48 DEG

ALL DIMENSIONS ARE IN M.M.

TO-39 Metal-Can Package Transistors (NPN)

Maximum Ratings							Electrical Characteristics (Ta=25°C, Unless Otherwise Specified)																						
Type No.	V _{CB0} (V) Min	V _{CEO} (V) Min	V _{EB0} (V) Min	P _D (W) @ Tc=25°C	I _C (A)	I _{CM} (A)	I _{CB0} (μA) Max	V _{CB} (V) @ I _C	I _{CES} (μA) Max	V _{CE} (V) @ I _{CES}	h _{FE} Min	β Max	I _C & (mA) Min	V _{CE} (V) Max	V _{CE(SAT)} (V) Max	V _{BE(SAT)} (V) Min	V _{BE(SAT)} (V) Max	I _C (mA) @ V _{CE}	C _{ob} (pF) Min	C _{ob} (pF) Max	f _T (MHz) Min	f _T (MHz) Typ	f _T (MHz) Max	t _{off} (ns) Max	NF (dB) Max	β Max	Freq (MHz) Max		
2N656	60	60	8				10	30			30	90	200	10	4			200											
2N657	100	100	8	1	0.5		10	30			30	90	200	10	4			200											
2N696	60	40	5	0.8	0.5		1	30			20	60	150	10	1.5		1.3	150	35										
2N697	60	40	5	0.6	0.5		1	30			40	120	150	10	1.5		1.3	150	35										
2N699	120	80	5	0.8	0.5		2	60			40	120	150	10	5		1.3	150	20			50			50				
2N1507	60	30	5	0.6	1		1	30			100	300	150	10	1.5			150	35					50					
2N1613	75	50	7	0.8	0.5		0.01	60			20		500	10	1.5		1.3	150	25			60			50		12		0.001
											40	120	150	10															
											35		10	10															
											20		0.1	10															
2N1644	60		5	2			1	30			40		150	10	1.5		1.3	150											
2N1711	75	50	7	0.8	1		0.01	60			40		500	10	1.5		1.3	150	25			70			50		8		
											100	300	150	10															
											75		10	10															
											35		0.1	10															
											20		0.01	10															
2N1837	80	30	8	0.6	1	1	0.5	30			40	120	150	10	0.8		1.3	150	18										
2N1838	45	20	5	0.6	0.5		1.5	30			40	150	100	10	1.4		1.5	100	27										
2N1840	25	15	5	0.6		0.5	0.3	10			10		150	1.4	1.4		1.75	150	27										
											10	100	150	10															
2N1889	100	80	7	0.8			0.01	75			20		0.1	10	1.2		0.9	50	15			50			50				
											35		10	10	5		1.3	150											
											40	120	150	10															
2N1890	100	80	7	0.8			0.01	75			100	300	150	10	1.2		0.9	50	15			60			50				
															5		1.3	150											
2N1893	120	80	7	0.8	0.5	1	0.01	90			20		0.1	10	1.2		0.9	50	15			50			50				
											35		10	10	5		1.3	150											
											40	120	150	10															

Maximum Ratings						Electrical Characteristics (Ta=25°C, Unless Otherwise Specified)																									
Type No.	V _{CB0} (V) Min	V _{CE0} (V) Min	V _{EB0} (V) Min	P _D (W) @Tc=25°C	I _C (A)	I _{CM} (A)	I _{CB0} (μA) Max	V _{CB} (V) @	I _{CES} (μA) Max	V _{CE} (V) @	h _{FE} Min	β Max	I _C & (mA)	V _{CE} (V)	V _{CE(SAT)} (V) Max	V _{BE(SAT)} & (V) Min	V _{BE(SAT)} (V) Max	I _C (mA) @	C _{ob} (pF) Min	Max	Typ	f _t (MHz) Min	Typ	Max	I _C (mA)	t(off) (ns) Max	NF (dB) Max	β	Freq (MHz) Max		
2N1972	60	30	5	0.6			1	30			110	350	50	10	2				50	25											
2N1973	100	80	7	0.8			0.025	75			75		10	10	1.2				50	15											
2N1974	100	80	7	0.8			0.025	75			35		10	10	1.2				50	15											
2N1975	100	80	7	0.8			0.025	75			15		10	10	1.2				50	15											
2N1986	50	25	5	0.6	1		5	30			60		30	10	0.6	0.9		30	20	35											
											60	240	150	10	1.5	1.3		150													
2N1987	50	25	5	0.6	1		5	30			20		30	10	0.6	0.9		30	20	35											
											20	80	150	10	1.5	1.3		150													
2N1988	100	45	5	0.6		1	5	50			35	120	30	10	2	1		30		20											
2N1989	100	45	5	0.6		1	5	50			20	60	30	10	2	1		30		20											
2N1990	100		3	0.6							20		30	10	0.5	1		2													
2N2049	75	50	7	0.8	0.5		0.01	60			100	300	150	10	0.4			10		25											
2N2102	120	65	7	1	1		0.002	60			10		1000	10	0.5	1.1		150		15	60								6	0.001	
											25		500	10																	
											40	120	150	10																	
											35		10	10																	
											20		0.1	10																	
2N2192	60	40	5	0.8	1		0.01	30			15		0.1	10	0.35	1.3		150		20	50										
											75		10	10																	
											100	300	150	10																	
											35		500	10																	
											15		1000	10																	
											70		150	1																	
2N2193	80	50	8	0.8	1		0.01	60			15		0.1	10	0.35	1.3		150		20	50										
											30		10	10																	
											40	120	150	10																	
											20		500	10																	
											15		1000	10																	
											30		150	1																	
2N2194	60	40	5	0.8	1		0.01	30			15		10	10	0.35	1.3		150		20	50										
											20	60	150	10																	
											12		500	10																	
											15		150	1																	
2N2195	45	25	5	0.6		1	0.1	30			20		150	10	0.35	1.3		150		20	50										
											10		150	1																	
2N2218	60	30	5	0.8	0.8		0.01	50			20		500	10	0.4	0.6	1.3	150		8	250										
											20		150	1	1.6		2.6	500													
											40	120	150	10																	
											35		10	10																	
											25		1	10																	
											20		0.1	10																	
2N2218A	75	40	6	0.8	0.8		0.01	60	* 0.01	60	20		0.1	10	0.3	0.6	1.2	150		8	300										
											25		1	10	1		2	500													
											35		10	10																	
											40	120	150	10																	
											20		150	1																	
											25		500	1																	
2N2219	60	30	5	0.8	0.8		0.01	50			35		0.1	10	0.4	0.6	1.3	150		8	250										
											50		1	10	1.6		2.6	500													
											75		10	10																	
											100	300	150	10																	
											50		150	1																	
											30		500	1																	

* NOTE: I_{CEX}

Maximum Ratings							Electrical Characteristics (Ta=25°C, Unless Otherwise Specified)																
Type No.	V _{CB0} (V) Min	V _{CE0} (V) Min	V _{EB0} (V) Min	P _D (W) @Tc=25°C	I _C (A)	I _{CM} (A)	I _{CB0} (μA) Max	V _{CB} (V) @	I _{CES} (μA) Max	V _{CE} (V) @	h _{FE} Min	β Max	I _C & (mA)	V _{CE} (V)	V _{CE(SAT)} (V) Max	V _{BE(SAT)} (V) Max	I _C (mA) @	C _{ob} (pF) Min Max Typ	f _t (MHz) Min Typ	I _C (mA) Max	t _{off} (ns) Max	NF (dB) Max	β Freq (MHz) Max
2N2219A	75	40	6	0.8	0.8		0.01	60	* 0.01	60	35 50 75 100 50 40		0.1 1 10 150 150 500	10 10 10 10 1 1	0.3 1	0.6 2	1.2 500	8	300	20			
2N2243	120	80	7	0.8	1		0.01	60			15 40 30 30 15		500 120 10 150 0.1	10 10 10 1 10	0.35	1.3	150	15	50	50			
2N2270	60	45	7	1	1		0.05	60			50 30	200	150 1	10 10	0.9	1.2	150	15	100	50		10	0.001
2N2440	120	80	7	0.8	0.5		0.001	90			35 100		0.1 300	10 10	0.4 3	0.9 1.3	50 150	15					
2N3019	140	80	7	0.8		1	0.01	90			50 90 100 50 15		0.1 10 300 500 1	10 10 10 10 10	0.2 0.5	1.1 500	150	12	100	400	50	4	0.001
2N3020	140	80	7	0.8		1	0.01	90			30 40 40 30 15	100 120 120 100 1000	0.1 10 150 500 10	10 10 10 10 10	0.2 0.5	1.1 500	150	12	80	50			
2N3053	60	40	5	5	0.7				* 0.25	30	50 25	250	150 150	10 2.5	1.4	1.7	150	15		100	50		
2N3300	60	30	5	0.8	0.5				0.01	50	50 50 100 75 50 35		500 150 300 10 1 0.1	10 1 10 10 10 10	0.22 0.6	1.1 1.5	150 500	8	250	50	150		
2N3440	300	250	7	1	1		20	360			40	160	20	10	0.5	1.3	50	10		15	10		
2N3498	100	100	6	1.0	0.5		0.05	50			20 25 35 40 15 95		0.1 1 10 150 500 300	10 10 10 10 10 10	0.6 0.2 0.25	1.4 0.8 0.9	300 10 50	10	150	20			
2N3499	100	100	6	1	0.5		0.05	50			35 50 75 100 20 20		0.1 1 10 150 500 300	10 10 10 10 10 10	0.2 0.25 0.6	0.8 0.9 1.4	10 50 300	10	150	20			
2N3500	150	150	6	1	0.3		0.05	75			20 25 35 40 15 15		0.1 1 10 150 300 500	10 10 10 10 10 10	0.2 0.25 0.4	0.8 0.9 1.2	10 50 150	8	150	20			

* NOTE: I_{CEX}

Maximum Ratings							Electrical Characteristics (T _a =25°C, Unless Otherwise Specified)																								
Type No.	V _{CB0} (V) Min	V _{CE0} (V) Min	V _{EB0} (V) Min	P _D (W) @ T _c =25°C	I _C (A)	I _{CM} (A)	I _{CB0} (μA) Max	V _{CB} (V) @	I _{CE0} (μA) Max	V _{CE} (V) @	h _{FE} @	I _C & (mA)	V _{CE} (V)	V _{CE(SAT)} (V) Max	V _{BE(SAT)} (V) Min	V _{BE(SAT)} (V) Max	I _C (mA) @	C _{ob} (pF) Min	Max	Typ	f _T (MHz) Min	Typ	Max	I _C (mA) Max	t _{off} (ns) Max	NF (dB) Max	β	Freq (MHz) Max			
2N3501	150	150	6	1	0.3		0.05	75			35	0.1	10	0.4	1.2	150		8	150												
											50	1	10	0.2	0.8	10															
											100	300	150	0.25	0.9	50															
											20		300																		
											75		10																		
											20		500																		
2N3678	75	55	6	0.8	0.8		0.01	60			25	500	10	0.4	.6	1.2	150								250						
											20	150	1	1	2	500															
											40	120	150																		
											35		10																		
											25		1																		
											20		0.1																		
2N3742	300	300	7	1	0.05		0.2	200			10	3	10	0.75	1	10		6	30					10							
											15		10	1	1.2	30															
											20	200	30																		
											20		50	20																	
2N4237	50	40	6	1	1		0.01	50			15	1000	1	0.6	1.5	1000		100													
											30	500	1	0.3		500															
											30	150	250																		
											30		50	1																	
2N4926	200	200	7	1	0.05		0.1	100			10	3	10	1	1.2	10			30			300	10								
											15		10	2		30															
											20	200	30		1.5	50															
											20		50	20																	
2N5320	100	75	7	10	2				*100	100	30	130	500	4	0.5	1.1	500							800							
											10		1000	2																	
2N5321	75	50	5	10	2				*100	75	40	250	500	4	0.8	1.4	500							800							
2N5681	100	100	4	1	1		1	100	* 1	100	5	1000	2	0.6		250		50	30				100								
											40	150	250	2	1	500															
														2	2	1															
2N5682	120	120	4	1	1		1	120	* 1	120	5	1000	2	0.6		250		50	30				100								
											40	150	250	2	1	500															
BC140	80	40	7	0.8	1				0.1	60	40	400	100	1	1		1000	25	50				50	850							
BC140-6	80	40	7	0.8	1				0.1	60	40	100	100	1	1		1000	25	50				50	850							
BC140-10	80	40	7	0.8	1				0.1	60	63	160	100	1	1		1000	25	50				50	850							
BC140-16	80	40	7	0.8	1				0.1	60	100	250	100	1	1		1000	25	50				50	850							
BC141	100	60	7	0.8	1				0.1	60	40	400	100	1	1		1000	25	50				50	850							
BC141-6	100	60	7	0.8	1				0.1	60	40	100	100	1	1		1000	25	50				50	850							
BC141-10	100	60	7	0.8	1				0.1	60	63	160	100	1	1		1000	25	50				50	850							
BC141-16	100	60	7	0.8	1				0.1	60	100	250	100	1	1		1000	25	50				50	850							
BC300	120	80	7	0.85	0.5		0.02	120			40	240	150	10	0.5		150		100	400	50										
BC300-4	120	80	7	0.85	0.5		0.02	120			40	80	150	10	0.5		150		100	400	50										
BC300-5	120	80	7	0.85	0.5		0.02	120			70	140	150	10	0.5		150		100	400	50										

* NOTE: IC EX



Maximum Ratings							Electrical Characteristics (Ta=25°C, Unless Otherwise Specified)																	
Type No.	V _{CBO} (V) Min	V _{CEO} (V) Min	V _{EB0} (V) Min	P _D (W) @ Tc=25°C	I _C (A)	I _{CM} (A)	I _{CBO} (μA) Max	V _{CE} (V) @ I _C	I _{CES} (μA) Max	V _{CE} (V) @ I _{CES}	h _{FE} Min	β Max	I _C & (mA)	V _{CE} (V)	V _{CE(SAT)} (V) Max	V _{BE(SAT)} (V) & Min	V _{BE(SAT)} (V) Max	I _C (mA) @ V _{BE(SAT)}	C _{ob} (pF) Min Max Typ	f _t (MHz) Min Typ Max	I _C (mA) @ f _t	t _{off} (ns) Max	NF (dB) Max	Freq (MHz) @ NF
BC300-6	120	80	7	0.85	0.5		0.02	120			120	240	150	10	0.5			150		100	400			
BC301	90	60	7	0.85	0.5		0.02	90			40	240	150	10	0.5			150		100	400	50		
BC301-4	90	60	7	0.85	0.5		0.02	90			40	80	150	10	0.5			150		100	400	50		
BC301-5	90	60	7	0.85	0.5		0.02	90			70	140	150	10	0.5			150		100	400	50		
BC301-6	90	60	7	0.85	0.5		0.02	90			120	240	150	10	0.5			150		100	400	50		
BC302	60	45	7	0.85	0.5		0.02	60			40	240	150	10	0.5			150		100	400	50		
BC302-4	60	45	7	0.85	0.5		0.02	60			40	80	150	10	0.5			150		100	400	50		
BC302-5	60	45	7	0.85	0.5		0.02	60			70	140	150	10	0.5			150		100	400	50		
BC302-6	60	45	7	0.85	0.5		0.02	60			120	240	150	10	0.5			150		100	400	50		
BD115	245	180	5	0.875	0.2						22		50	10	9			100						
BF257	160	160	5	1	0.1		0.05	100			25		30	10	1			30	3.5	110		30		3.5
BF258	250	250	5	1	0.1		0.05	200			25		30	10	1			30			110		30	
BF259	300	300	5	1	0.1		0.05	250			25		30	10	1			30			110		30	
BF336	185	180	5	0.8		0.2					20		30	10						80	130		30	
BF337	250	200	5	0.8		0.2					20		30	10						80			30	
BF338	300	225	5	0.8	0.2						20		30	10						80	130		30	
BFX84	45	45	6	0.8	1		0.5	100			15		1000	10	0.15		1.2	10	12	50		50		360
											20		500	10	0.35		1.3	150						
											30		150	10	1		1.5	500						
											20		10	10	1.6		2	1000						
BFX85	100	60	6	0.8	1		0.5	100			15		1000	10	0.15		1.2	10	12	50		50		
							0.05	80			30		500	10	0.35		1.3	150						
											70		150	10	1		1.5	500						
											50		10	10	1.6		2	1000						
BFX86	45	45	6	0.8	1		0.05	30			15		1000	10	0.15		1.2	10	12	50		50		360
											30		500	10	0.35		1.3	150						
											70		150	10	1		1.5	500						
											50		10	10	1.6		2	1000						
BFY50	80	35	6	0.8	1		0.05	60			20		10	6	0.2			150	12	60		50		
											30		150	6	1		2	1000						
											15		1000	6										
BFY51	60	30	6	0.8	1		0.05	40			30		10	6	0.35			150	12	50		50		
											40		150	6	1.6		2	1000						
											15		1000	6										
BFY52	40	20	6	0.8	1		0.05	30			30		10	6	0.35			150	12	50		50		
											60		150	6	1.6		2	1000						
											15		1000	6										
BFY56	85	45	7	0.8	1				0.02	50	15		0.1	10	0.3		1.5	150	25	40		50		
											20		500	10	1.2		2.3	1000						
											30	150	150	1										

Maximum Ratings							Electrical Characteristics (Ta=25°C, Unless Otherwise Specified)																	
Type No.	V _{CBO} (V) Min	V _{CEO} (V) Min	V _{EB0} (V) Min	P _D (W) @Tc=25°C	I _C (A)	I _{CM} (A)	I _{CBO} (μA) Max	V _{CB} (V) @ I _C	I _{CES} (μA) Max	V _{CE} (V) @ I _C	h _{FE} @ Min Max	I _C & (mA)	V _{CE} (V)	V _{CE(SAT)} (V) Max	V _{BE(SAT)} (V) & Min	V _{BE(SAT)} (V) Max	I _C (mA) @ V _{CE}	C _{ob} (pF) Min Max Typ	f _T (MHz) Min Typ Max	t _{off} (ns) Max	NF (dB) Max	β @ Freq (MHz)		
BFY72	50	28	5	0.8	0.7		0.04	20			15 20 30 40 15	0.1 1 10 150 500	10 10 10 10 10	0.25 0.7	1.2 1.6	150 500		8	50		50			
BSX45	# 80	40	7	1	1				0.01	60	40	250	100	1	1		1000	25	50		50		850	
BSX45-6	# 80	40	7	1	1				0.01	60	10		0.1	1	1		1000	25	50		50		850	
											40	100	100	1										
											15		500	1										
BSX45-10	# 80	40	7	1	1				0.01	60	15		0.1	1	1		1000	25	50		50		850	
											63	160	100	1										
											25		500	1										
BSX45-16	# 80	40	7	1	1				0.01	60	25		0.1	1	1		1000	25	50		50		850	
											100	250	100	1										
											35		500	1										
BSX46	# 100	60	7	1	1				0.01	60	40	250	100	1	1		1000	20	50		50		850	
BSX46-6	# 100	60	7	1	1				0.01	60	10		0.1	1	1		1000	20	50		50		850	
											40	100	100	1										
											15		500	1										
BSX46-10	# 100	60	7	1	1				0.01	60	15		0.1	1	1		1000	20	50		50		850	
											63	160	100	1										
											25		500	1										
BSX46-16	# 100	60	7	1	1				0.01	60	25		0.1	1	1		1000	20	50		50		850	
											100	250	100	1										
											35		500	1										
BSX47	# 120	80	7	1	1				0.01	80	40	250	100	1	1		1000	15	50		50		850	
BSX47-6	# 120	80	7	1	1				0.01	80	1		0.1	1	1		1000	15	50		50		850	
											40	100	100	1										
											15		500	1										
BSX47-10	# 120	80	7	1	1				0.01	80	15		0.1	1	1		1000	15	50		50		850	
											63	160	100	1										
											25		500	1										
BSX47-16	# 120	80	7	1	1				0.01	80	25		0.1	1	1		1000	1	5		50		850	
											100	250	100	1										
											35		500	1										
BSX62	# 60	40	5	5	3				0.1	40	40	250	1000	1	0.8 0.7		1.3 1.2	2000 1000	70	30		300		
BSX62-6	# 60	40	5	5	3				0.1	40	30		100	1	0.8 0.7		1.3 1.2	2000 1000	70	30		200		
											40	100	1000	1										
											25		2000	5										
BSX62-10	# 60	40	5	5	3				0.1	40	30		100	1	0.8 0.7		1.3 1.2	2000 1000	70	30		200		
											63	160	1000	1										
											25		2000	5										
BSX62-16	# 60	40	5	5	3				0.1	40	30		100	1	0.8 0.7		1.3 1.2	2000 1000	70	30		200		
											100	250	1000	1										
											25		2000	5										
BSX63	# 80	60	5	5	3				0.1	60	4	250	1000	1	0.8 0.7		1.3 1.2	2000 1000	70	30		200		

NOTE: V_{CEs}

Maximum Ratings							Electrical Characteristics (T _a =25°C, Unless Otherwise Specified)																		
Type No.	V _{CEO} (V) Min	V _{CE0} (V) Min	V _{EB0} (V) Min	P _D (W) @ T _c =25°C	I _C (A)	I _{CM} (A)	I _{CBO} (μA) Max	V _{CB} (V) @ (V)	I _{CES} (μA) Max	V _{CE} (V) @ (V)	h _{FE} Min	β Max	I _C & (mA)	V _{CE} (V)	V _{CE(SAT)} (V) Max	V _{BE(SAT)} (V) & Min	V _{BE(SAT)} (V) Max	I _C (mA) @ (mA)	C _{ob} (pF) Min Max Typ	f _T (MHz) Min Typ Max	I _C (mA)	t _{off} (ns) Max	NF (dB) Max	Freq (MHz) @ (MHz)	
BSX63-6	# 80	60	5	5	3				0.1	60	30	100	1	0.8	1.3	2000		70	30	200					
											40	100	1000	1	0.7	1.2	1000								
											25		2000	5											
BSX63-10	# 80	60	5	5	3				0.1	60	30	100	1	0.8	1.3	2000		70	30	200					
											63	160	1000	1	0.7	1.2	1000								
											25		2000	5											
BSX63-16	# 80	60	5	5	3				0.1	60	30	100	1	0.8	1.3	2000		70	30	200					
											100	250	1000	1	0.7	1.2	1000								
											25		2000	5											
BSY51	60	35	5	0.8	0.5				0.1	30	40	120	150	10	1	1.3	150	9	130	50					
BSY52	60	25	5	0.8	0.5				0.1	30	100	300	150	10	1	1.3	150	9	130	50					
BSY53	75	30	7	0.8	0.75				0.01	60	20		0.1	10	0.6	1.2	150		150	50					
											35		10	10	1.2		500								
											40	120	150	10											
											20		500	10											
BSY54	75	30	7	0.8	0.75				0.01	60	35		0.1	10	0.6	1.3	150		150	50					
											75		10	10											
											100	300	150	10											
											40		500	10											
CL21	20	20	5	0.75			0.5	15			150	350	100	3	0.6		150			80					
CL100	60	50	5	0.8		1	0.05	40			50	280	150	10	0.6		150								
CL150	35	30	5	0.8			0.05	25			50	280	150	1	0.6		150								

NOTE : V_{CES}