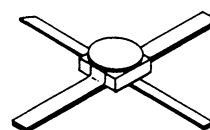


**MRF942**

$I_C = 40$  mA  
 LOW NOISE  
 HIGH FREQUENCY  
 TRANSISTOR



CASE 303-01

**The RF Line**  
**NPN Silicon**  
**Low Noise, High-Frequency**  
**Transistor**

... designed for use in high gain, low noise small-signal amplifiers. This device features excellent broadband linearity and is offered in a metal-ceramic hermetic package suitable for high-reliability applications.

- Low Noise Figure — 1.3 dB Typ ( $\alpha$  f = 1.0 GHz)
- Associated Gain — 16 dB Typ ( $\alpha$  f = 1.0 GHz)
- Fully Implanted Base and Emitter Structure
- 9 Finger, 1.25 Micron Geometry with Gold Top Metal
- High Reliability Processing Available

**MAXIMUM RATINGS**

Ratings	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	10	Vdc
Collector-Base Voltage	$V_{CBO}$	20	Vdc
Emitter-Base Voltage	$V_{EBO}$	1.5	Vdc
Power Dissipation (1) ( $\alpha$ $T_C = 125^\circ\text{C}$ Derate above $125^\circ\text{C}$ )	$P_D$	300 4.0	mWatts mW/ $^\circ\text{C}$
Collector Current — Continuous (2)	$I_C$	40	mA
Junction Temperature	$T_J$	200	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	- 65 to + 200	$^\circ\text{C}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	250	$^\circ\text{C}/\text{W}$

**ELECTRICAL CHARACTERISTICS** ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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**OFF CHARACTERISTICS (3)**

Collector-Emitter Breakdown Voltage ( $I_C = 0.1$ mA, $I_B = 0$ )	$V_{(BR)CEO}$	10	13	—	Vdc
Collector-Base Breakdown Voltage ( $I_C = 0.1$ mA, $I_E = 0$ )	$V_{(BR)CBO}$	20	25	—	Vdc
Emitter Cutoff Current ( $V_{EB} = 1.0$ V, $I_C = 0$ )	$I_{EBO}$	—	—	0.1	$\mu\text{Adc}$
Collector Cutoff Current ( $V_{CB} = 10$ V, $I_E = 0$ )	$I_{CBO}$	—	—	0.1	$\mu\text{Adc}$

**ON CHARACTERISTICS (3)**

DC Current Gain ( $V_{CE} = 8.0$ V, $I_C = 5.0$ mA)	$h_{FE}$	50	—	200	—
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**DYNAMIC CHARACTERISTICS**

Collector-Base Capacitance ( $V_{CB} = 10$ V, $I_E = 0$ , f = 1.0 MHz)	$C_{cb}$	—	0.2	—	pF
Current Gain — Bandwidth Product ( $V_{CE} = 6.0$ V, $I_C = 15$ mA)	$f_T$	—	8.0	—	GHz

- NOTES: 1. Case Temperature is measured on the collector lead where it first contacts the printed circuit board closest to the package. To calculate the junction temperature use  $T_J = P_D \times R_{\theta JC} + T_{CASE}$ .  
 2.  $I_C$  — Continuous (MTBF  $\approx$  10 years)  
 3. Pulse width  $\leq$  300  $\mu\text{s}$ , duty cycle  $\leq$  2.0% pulsed.



### PERFORMANCE CHARACTERISTICS

Conditions	Symbol	Min	Typ	Max	Units
Insertion Gain $ S_{21} ^2$ ( $V_{CE} = 6.0$ V, $I_C = 15$ mA) f = 1.0 GHz f = 2.0 GHz f = 4.0 GHz	$ S_{21} ^2$	— — —	18 12 6.0	— — —	dB
Output Power P1 dB ( $V_{CE} = 6.0$ V, $I_C = 15$ mA) f = 1.0 GHz	P1 dB	—	16	—	dBm
1.0 dB Compressed Gain G1 dB ( $V_{CE} = 6.0$ V, $I_C = 15$ mA) f = 1.0 GHz	G1 dB	—	21	—	dB
Minimum Noise Figure NF <sub>min</sub> ( $V_{CE} = 6.0$ V, $I_C = 3.0$ mA) f = 1.0 GHz f = 2.0 GHz f = 4.0 GHz	NF <sub>min</sub>	— — —	1.3 2.0 2.9	1.8 — —	dB
Associated Gain GNF ( $V_{CE} = 8.0$ V, $I_C = 5.0$ mA) f = 1.0 GHz f = 2.0 GHz f = 4.0 GHz	GNF	14 — —	16 11 8.0	— — —	dB

### TYPICAL NOISE PARAMETERS

V <sub>CE</sub> (Vdc)	I <sub>C</sub> (mA)	f (MHz)	NF <sub>min</sub> (dB)	GNF (dB)	Γ <sub>o</sub> (MAG, ANG)	R <sub>N</sub> (ohms)	NF <sub>50 Ω</sub> (dB)
6	3	1000	1.3	16	.36 ∠ 94	17.5	1.7
		2000	2.0	11	.37 ∠ -145	15.5	2.6
		4000	2.9	8.0	.50 ∠ -134	21.5	4.3
	15	1000	2.1	19	.25 ∠ 150	13	2.6
		2000	2.7	14	.26 ∠ -173	16.5	3.1
		4000	4.3	9.0	.48 ∠ -96	47	5.4

### TYPICAL CHARACTERISTICS

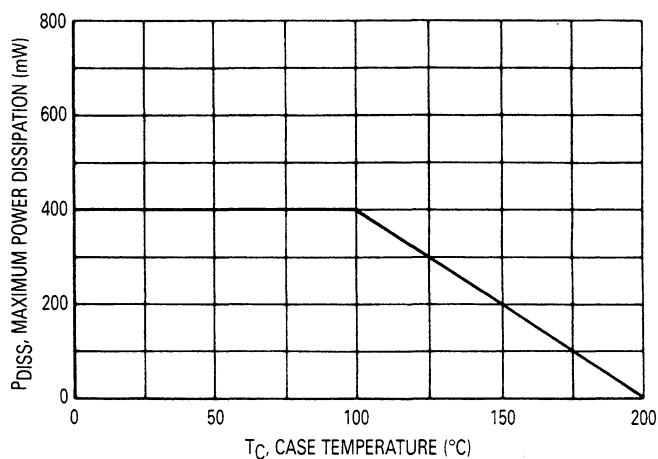


Figure 1. Maximum Power Dissipation versus Case Temperature

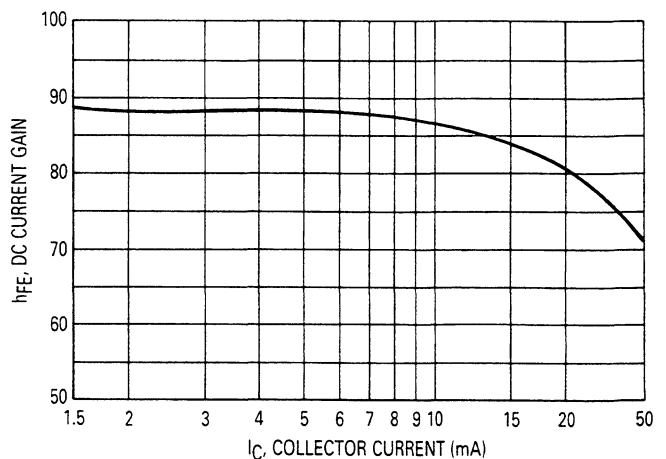


Figure 2. DC Current Gain versus Current

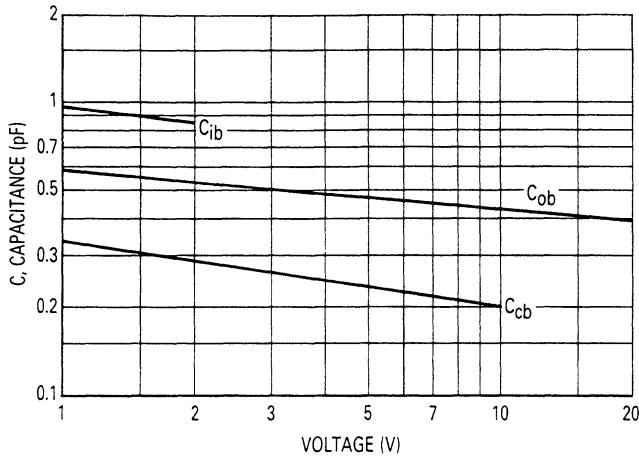


Figure 3. Capacitance versus Voltage

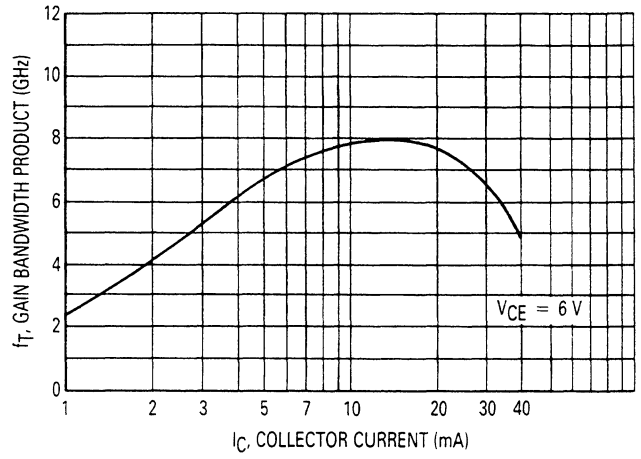


Figure 4. Gain-Bandwidth Product versus Collector Current

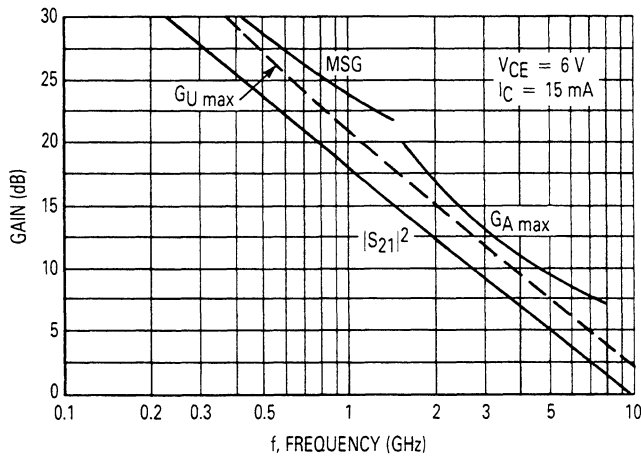


Figure 5. Gain versus Frequency

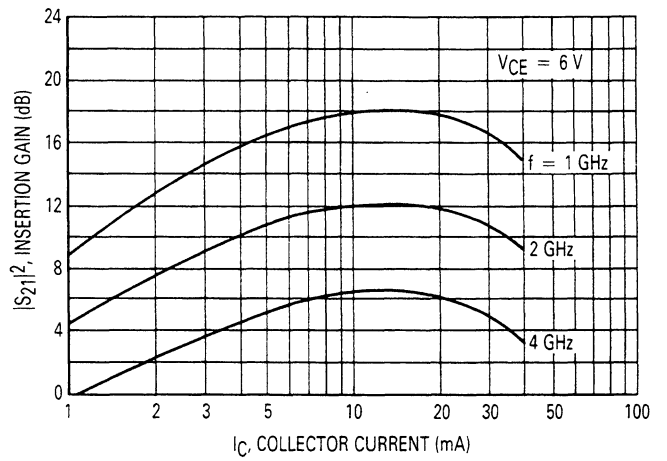


Figure 6. Insertion Gain versus Current

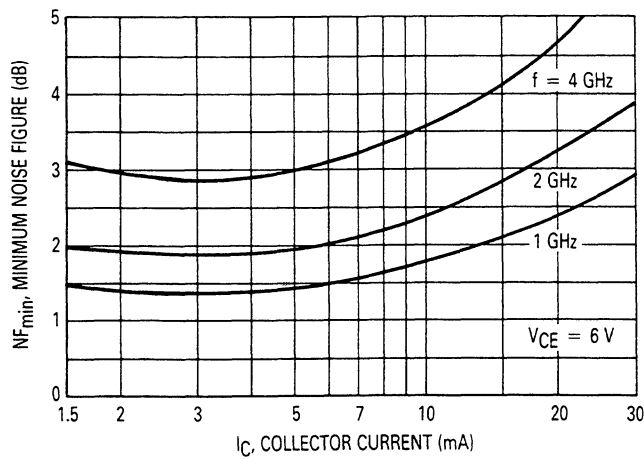


Figure 7. Minimum Noise Figure versus Current

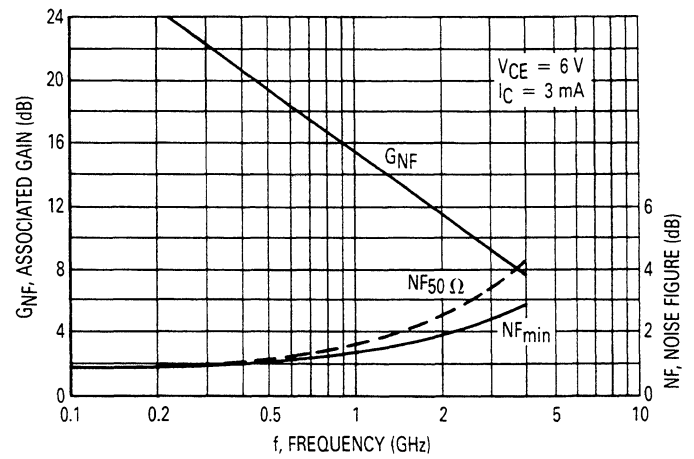
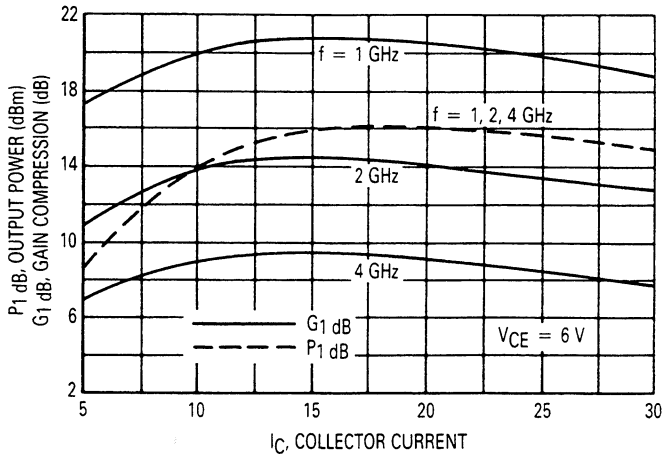
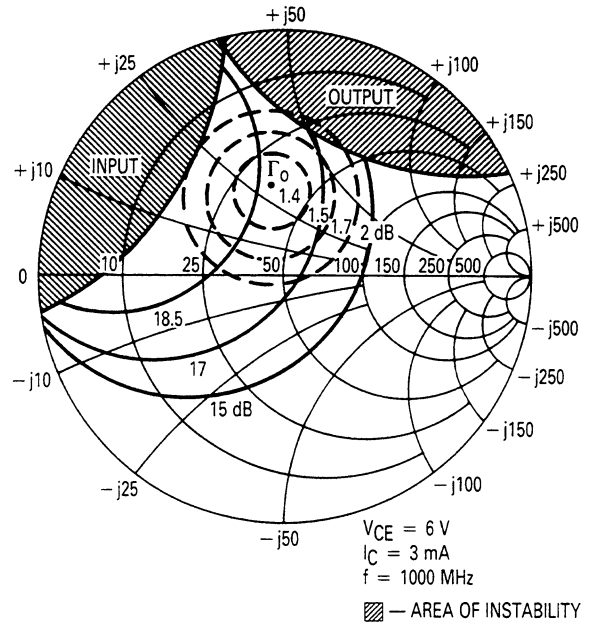


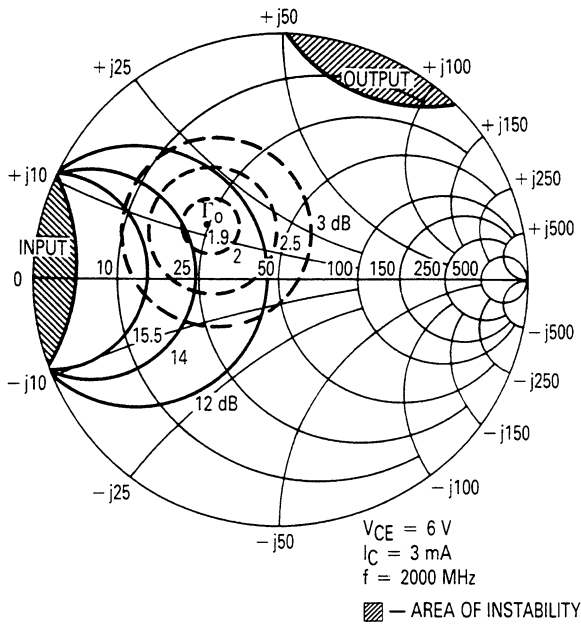
Figure 8. Noise Figure and Associated Gain versus Frequency



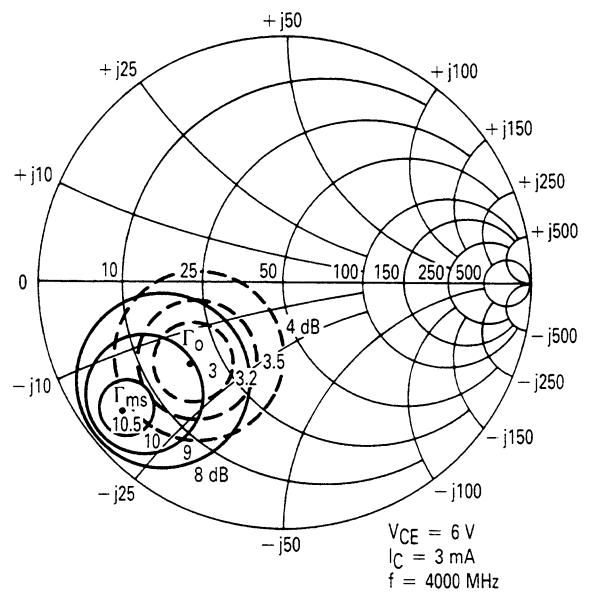
**Figure 9. Output Power and 1 dB Gain Compression versus Current**



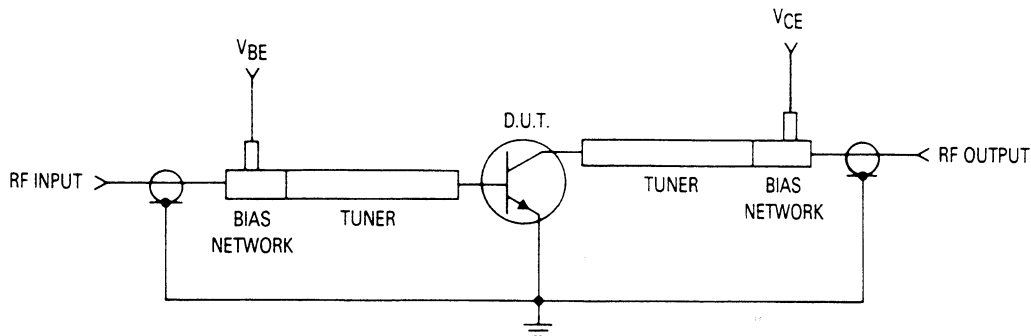
**Figure 10. Gain and Noise Figure Contours  
f = 1 GHz**



**Figure 11. Gain and Noise Figure Contours  
f = 2 GHz**



**Figure 12. Gain and Noise Figure Contours  
f = 4 GHz**



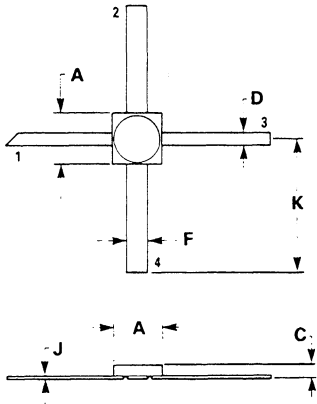
**Figure 13. Functional Circuit Schematic**

Figure 14. Typical Common Emitter S-Parameters

VCE (Vdc)	IC (mA)	f (MHz)	S11		S21		S12		S22	
			S11	$\angle\phi$	S21	$\angle\phi$	S12	$\angle\phi$	S22	$\angle\phi$
6	3	100	0.89	-17	9.93	171	0.01	84	0.99	-7
		500	0.79	-72	7.71	134	0.05	52	0.86	-29
		1000	0.69	-122	5.31	102	0.07	35	0.72	-42
		1500	0.67	-145	3.96	87	0.07	27	0.66	-52
		2000	0.59	-166	2.90	73	0.08	25	0.65	-58
		3000	0.52	162	2.07	52	0.08	26	0.65	-73
		4000	0.55	135	1.56	32	0.09	30	0.65	-92
		5000	0.60	113	1.28	20	0.10	32	0.63	-112
		6000	0.69	92	1.17	1	0.11	34	0.62	-133
		7000	0.66	73	0.99	-15	0.13	32	0.69	-150
	8000	0.62	57	0.86	-38	0.16	32	0.76	-163	
	5	100	0.83	-23	15.04	168	0.01	79	0.98	-9
		500	0.71	-89	10.34	125	0.04	50	0.77	-33
		1000	0.63	-138	6.47	96	0.06	35	0.62	-44
		1500	0.60	-157	4.64	82	0.06	32	0.58	-53
		2000	0.54	-178	3.42	70	0.07	32	0.58	-58
		3000	0.49	152	2.41	50	0.08	37	0.59	-73
		4000	0.53	129	1.83	31	0.09	39	0.60	-90
		5000	0.57	107	1.50	19	0.11	38	0.58	-110
		6000	0.66	85	1.36	0	0.12	36	0.59	-132
		7000	0.64	70	1.13	-15	0.14	32	0.66	-148
	8000	0.60	52	0.99	-37	0.17	31	0.73	-162	
	10	100	0.69	-34	24.58	162	0.01	74	0.95	-13
		500	0.60	-116	13.41	114	0.03	45	0.64	-37
		1000	0.56	-157	7.54	89	0.04	42	0.52	-43
		1500	0.55	-173	5.23	77	0.05	45	0.50	-52
		2000	0.52	168	3.90	66	0.06	46	0.51	-56
		3000	0.47	141	2.68	47	0.06	49	0.54	-70
		4000	0.54	121	2.03	30	0.09	48	0.56	-88
		5000	0.57	102	1.68	18	0.12	43	0.54	-108
		6000	0.66	82	1.52	-1	0.13	39	0.55	-130
		7000	0.62	66	1.25	-16	0.15	34	0.63	-147
	8000	0.59	47	1.11	-39	0.17	32	0.70	-161	
	15	100	0.61	-45	30.33	157	0.01	71	0.92	-15
		500	0.57	-131	14.35	108	0.03	48	0.58	-37
		1000	0.56	-160	7.77	85	0.03	48	0.49	-41
		1500	0.54	179	5.32	74	0.04	51	0.48	-49
		2000	0.51	161	3.98	64	0.05	54	0.50	-54
		3000	0.48	137	2.72	45	0.07	54	0.54	-69
		4000	0.55	117	2.06	28	0.10	52	0.55	-87
5000		0.59	99	1.68	16	0.12	46	0.54	-107	
6000		0.67	81	1.52	-2	0.13	41	0.55	-129	
7000		0.63	64	1.25	-18	0.16	36	0.63	-146	
8000	0.63	45	1.10	-40	0.18	33	0.70	-161		
30	100	0.46	-77	36.83	148	0.01	66	0.86	-18	
	500	0.57	-156	13.51	100	0.02	53	0.55	-35	
	1000	0.58	-180	7.01	81	0.03	59	0.51	-35	
	1500	0.55	169	4.76	70	0.04	62	0.51	-45	
	2000	0.55	155	3.61	60	0.05	64	0.54	-51	
	3000	0.52	131	2.42	42	0.07	63	0.58	-67	
	4000	0.58	113	1.82	24	0.10	60	0.60	-86	
	5000	0.64	95	1.47	12	0.12	52	0.58	-109	
	6000	0.75	76	1.32	-6	0.14	46	0.59	-131	
	7000	0.69	57	1.08	-21	0.16	40	0.66	-147	
8000	0.66	39	0.94	-44	0.19	38	0.73	-161		

## OUTLINE DIMENSIONS


### CASE 303-01



STYLE 1:  
 PIN 1. COLLECTOR  
 2. EMITTER  
 3. BASE  
 4. EMITTER

NOTE:  
 1. DIMENSION "K" APPLIES TO ALL LEADS.  
 2. DIRECTION OF 45° CUT ON PIN 1 IS VENDOR OPTION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.29	2.67	0.090	0.105
C	0.89	1.40	0.035	0.055
D	0.41	0.61	0.016	0.024
F	0.89	1.09	0.035	0.043
J	0.08	0.15	0.003	0.006
K	4.45	5.84	0.175	0.230

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