

The RF Line

NPN Silicon

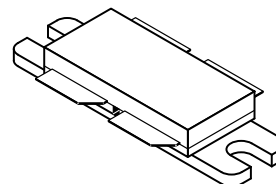
RF Power Transistor

Designed for 24 Volt UHF large-signal, common emitter, class A linear amplifier applications in industrial and commercial equipment operating in the range of 800–960 MHz.

- Specified for $V_{CE} = 24$ Vdc, $I_C = 5$ Adc Characteristics
 - Output Power = 36 Watts CW
 - Minimum Power Gain = 9 dB
 - Minimum ITO = +55 dBm
 - Typical Noise Figure = 6.5 dB
- Characterized with Small-Signal S-Parameters and Series Equivalent Large-Signal Parameters from 800–960 MHz
- Silicon Nitride Passivated
- 100% Tested for Load Mismatch Stress at All Phase Angles with 30:1 VSWR @ 24 Vdc, $I_C = 5$ Adc and Rated Output Power
- Will Withstand RF Input Overdrive of 13.6 W CW
- Gold Metallized, Emitter Ballasted for Long Life and Resistance to Metal Migration
- Circuit board photomaster available upon request by contacting RF Tactical Marketing in Phoenix, AZ.

MRF862

CLASS A
800–960 MHz
36 W (CW), 24 V
NPN SILICON
RF POWER TRANSISTOR



CASE 375A-01, STYLE 1

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	30	Vdc
Collector–Base Voltage	V_{CBO}	60	Vdc
Emitter–Base Voltage	V_{EBO}	4	Vdc
Total Device Dissipation @ $T_C = 70^\circ\text{C}$ Derate above 70°C	P_D	164 1.27	Watts W/ $^\circ\text{C}$
Operating Junction Temperature	T_J	200	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	–65 to +150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance ($T_J = 150^\circ\text{C}$, $T_C = 70^\circ\text{C}$)	$R_{\theta JC}$	0.75	$^\circ\text{C/W}$

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Collector–Emitter Breakdown Voltage ($I_C = 100$ mA, $I_B = 0$)	$V_{(BR)CEO}$	28	37	—	Vdc
Collector–Emitter Breakdown Voltage ($I_C = 50$ mA, $V_{BE} = 0$)	$V_{(BR)CES}$	60	75	—	Vdc
Collector–Base Breakdown Voltage ($I_C = 50$ mA, $I_E = 0$)	$V_{(BR)CBO}$	60	75	—	Vdc
Emitter–Base Breakdown Voltage ($I_E = 10$ mA, $I_C = 0$)	$V_{(BR)EBO}$	4	4.5	—	Vdc
Collector Cutoff Current ($V_{CB} = 24$ V, $I_E = 0$)	I_{CES}	—	—	10	mA

(1) All DC tests are per side.

(continued)

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ELECTRICAL CHARACTERISTICS — continued

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS (1)					
DC Current Gain ($I_C = 1\text{ A}$, $V_{CE} = 5\text{ V}$)	h_{FE}	30	75	120	—

DYNAMIC CHARACTERISTICS (1)

Output Capacitance ($V_{CB} = 24\text{ V}$, $f = 1\text{ MHz}$) (3)	C_{ob}	—	75	—	pF
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FUNCTIONAL CHARACTERISTICS (2)

Common-Emitter Power Gain ($V_{CE} = 24\text{ V}$, $I_C = 5\text{ A}$, $f = 840\text{--}900\text{ MHz}$, $P_{out} = 36\text{ W}$)	P_g	9	10	—	dB
Load Mismatch ($V_{CE} = 24\text{ V}$, $I_C = 5\text{ A}$, $f = 840\text{ MHz}$, $P_{out} = 36\text{ W}$, Load VSWR = 30:1, All Phase Angles)	ψ	No Degradation in Output Power			
RF Input Overdrive ($V_{CE} = 24\text{ V}$, $I_C = 5\text{ A}$, $f = 840\text{ MHz}$) No degradation	$P_{in(over)}$	—	—	13.6	W
Third Order Intercept Point ($V_{CE} = 24\text{ V}$, $I_C = 5\text{ A}$, $f_1 = 900\text{ MHz}$, $f_2 = 900.1\text{ MHz}$, Meas. @ IMD 3rd Order = -40 dBc)	ITO	+55	+56	—	dBm
Noise Figure ($V_{CE} = 24\text{ V}$, $I_C = 5\text{ A}$, $f = 900\text{ MHz}$)	NF	—	6.5	—	dB
Input Return Loss ($V_{CE} = 24\text{ V}$, $I_C = 5\text{ A}$, $f = 840\text{--}900\text{ MHz}$, $P_{out} = 36\text{ W}$)	IRL	—	—	-8	dB

(1) All DC tests are per side.

(2) Operating bias point I_C is the total for both halves.

(3) C_{ob} measurement is for reference only. This device is collector matched.

Table 1. MRF862 Common Emitter S-Parameters (Per Side)

V_{CE} (V)	I_C (A)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$ S_{11} $	$\angle \phi$	$ S_{21} $	$\angle \phi$	$ S_{12} $	$\angle \phi$	$ S_{22} $	$\angle \phi$
24	2.5	800	0.934	161	0.679	55	0.021	44	0.883	169
		820	0.911	160	0.766	46	0.021	36	0.873	169
		840	0.877	160	0.852	34	0.020	26	0.867	170
		860	0.843	161	0.936	21	0.018	14	0.871	171
		880	0.813	163	0.971	4	0.015	-1	0.891	172
		900	0.807	166	0.942	-12	0.010	-15	0.920	173
		920	0.823	168	0.868	-28	0.005	-24	0.947	173
		940	0.847	169	0.769	-40	0.002	50	0.967	172
		960	0.873	169	0.671	-50	0.004	124	0.978	171

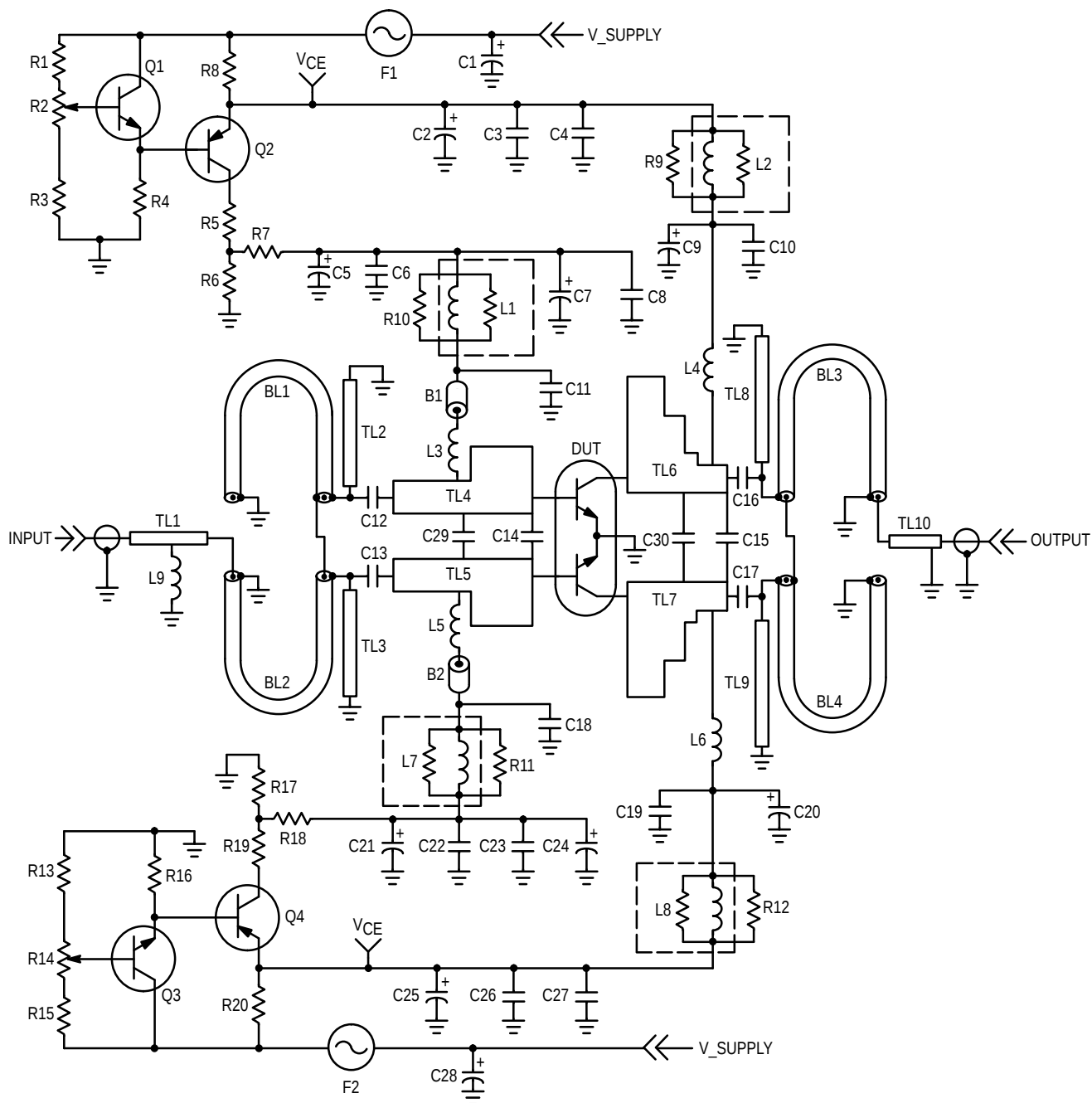
Table 2. Z_{in} and Z_{OL}^* versus Frequency

f (MHz)	Z_{in} (Ohms)		Z_{OL}^* (Ohms)	
840	4.3	11.8	6.4	-1.3
870	5.7	12.4	5.1	-1.3
900	7.6	11.7	4.5	-1.1

$$V_{CE} = 24\text{ V}, I_C = 5\text{ A}, P_O = 36\text{ W}$$

Z_{in} is a balanced base-to-base measurement.

Z_{OL}^* = Conjugate of optimum load impedance, collector to collector, into which the device operates at a given output power, bias current, voltage and frequency.



B1, B2	Short Ferrite Bead, Fair Rite (2743019447)	Q1, Q3	MMBT2222ALT1, NPN Transistor
BL1 – BL4	2.20", 50 Ω , 0.085" OD, Semi-Rigid Coax	Q2, Q4	BD136, PNP Transistor
C1, C5, C21, C28	470 μ F, 50 Vdc Electrolytic Capacitor	R1, R15	330 Ω , 1/4 W
C2, C7, C9, C20, C24, C25	10 μ F, 50 Vdc Electrolytic Capacitor	R2, R14	500 Ω Potentiometer, 1/4 W
C3, C8, C23, C26	0.1 μ F, Chip Capacitor	R3, R13	5.6K Ω , 1/4 W
C4, C6, C22, C27	1000 pF Chip Capacitor	R4, R16	2 x 4.7K Ω , 1/4 W
C10, C11, C18, C19	100 pF, 100 Mil, Chip Capacitor	R5, R19	56 Ω , 2 W
C12, C13, C16, C17	43 pF, 100 Mil, Chip Capacitor	R6, R17	75 Ω , 1/4 W
C14	5.6 pF, 50 Mil, Chip Capacitor	R7, R18	3.3 Ω , 1/4 W
C15	0.8 pF, 100 Mil, Chip Capacitor	R8, R20	1 Ω , 10 W
C29	3.0 pF, 100 Mil, Chip Capacitor	R9, R10, R11, R12	4 x 39 Ω 1/8 W Chip Resistors in Parallel
C30	3.9 pF, 100 Mil, Chip Capacitor	TL1, TL10	50 Ω , Microstrip Transmission Line
F1, F2	5 A Micro-Fuse	TL2 – TL9	Microstrip Transmission Line
L1, L2, L7, L8	12 Turns, 22 AWG, 0.150" ID (Wrapped around 10 Ω , 1/2 W Resistor)	V_Supply	+26.5 Vdc $\pm$ 0.5 Vdc Due to Resistor Tolerance
L3, L4, L5, L6	4 Turns, 20 AWG, 0.163" ID	V_CE	+24 Vdc @ 2.5 A
L9	3 Turns, 20 AWG, 0.102" ID	Board	0.030" Glass-Teflon® 2 oz. Cu, ϵ_r = 2.55

Figure 1. Class A RF Test Fixture Schematic

TYPICAL CHARACTERISTICS

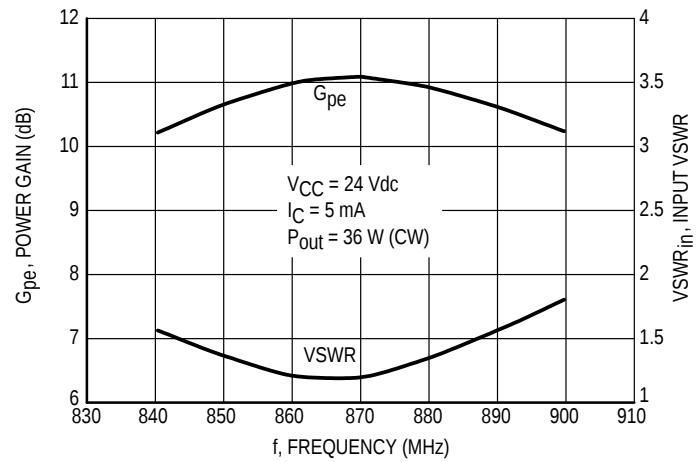


Figure 2. Performance in Broadband Circuit

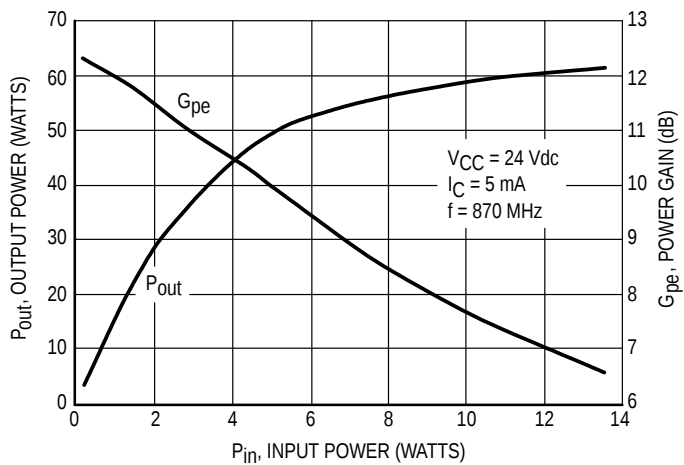


Figure 3. Output Power & Power Gain versus Input Power

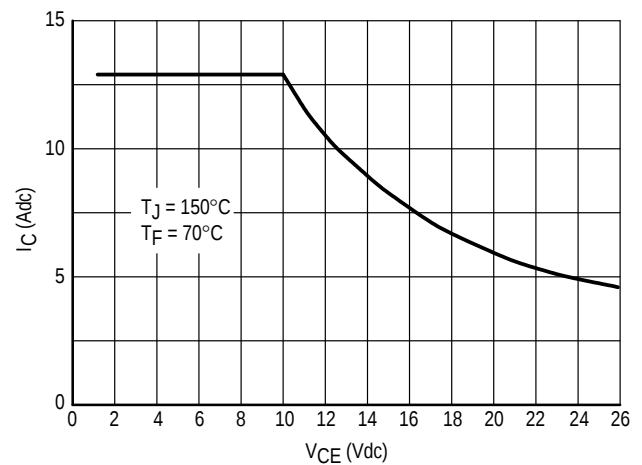


Figure 4. DC SOA
(Total I_C for both halves operating.)

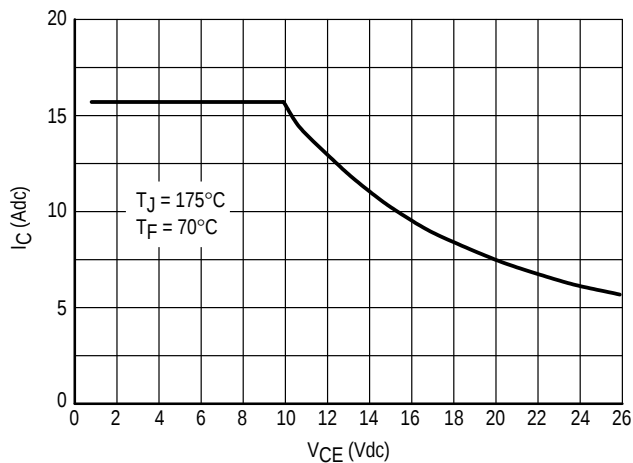


Figure 5. DC SOA
(Total I_C for both halves operating.)

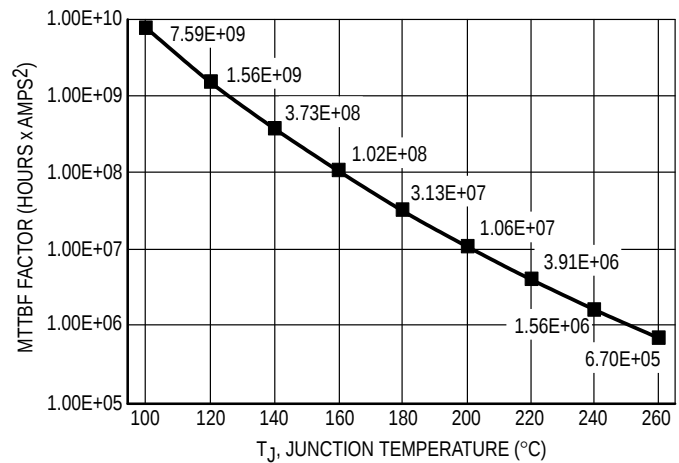


Figure 6. MTBF Factor versus Junction Temperature

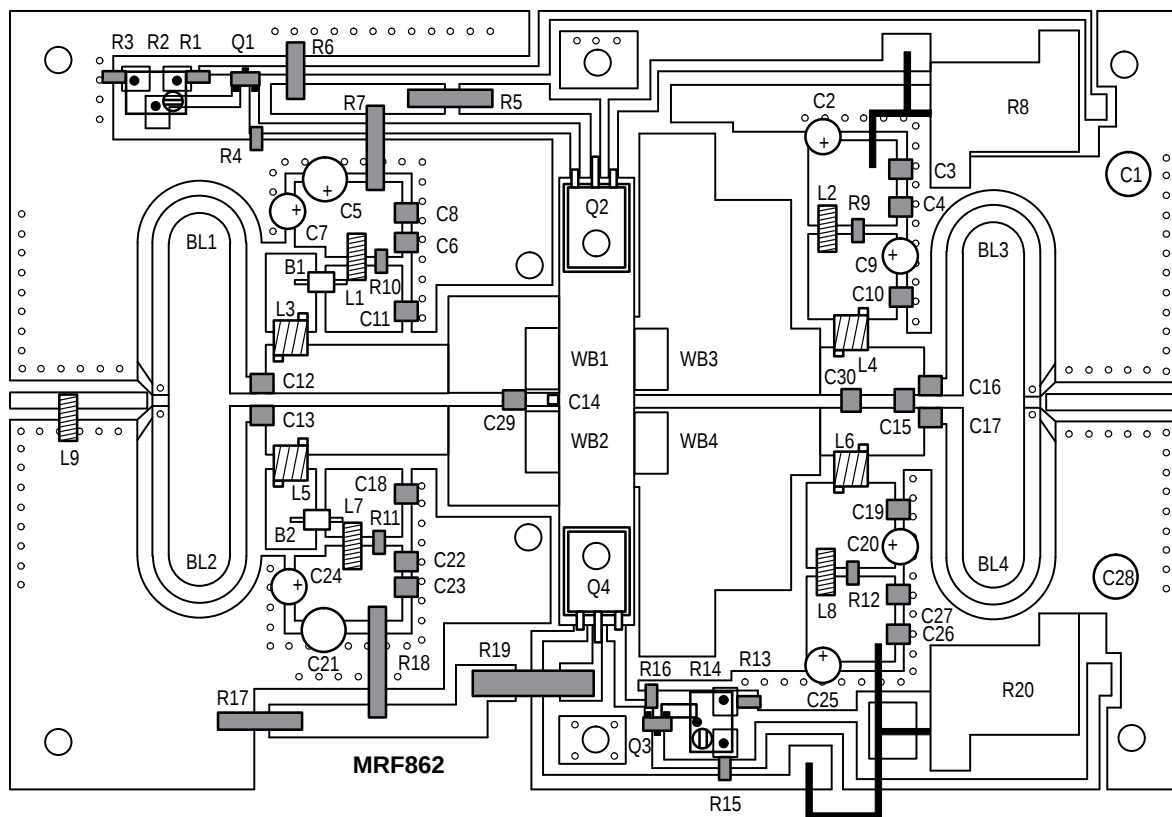
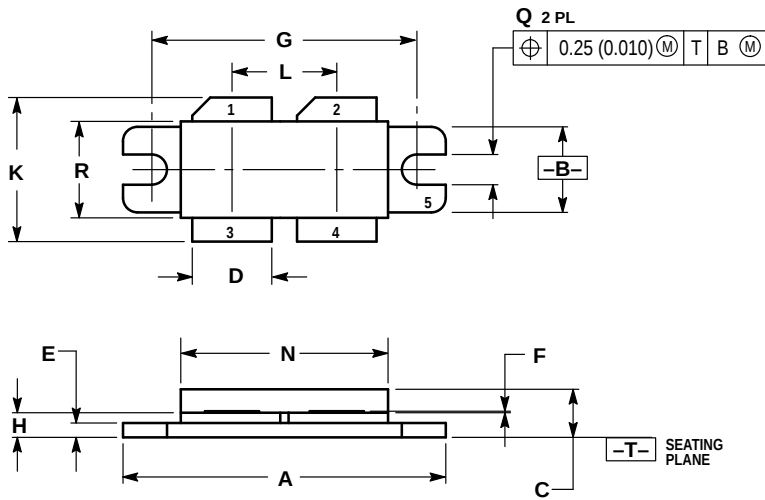


Figure 7. MRF862 Test Fixture Component Layout

PACKAGE DIMENSIONS



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.330	1.350	33.79	34.29
B	0.375	0.395	9.52	10.03
C	0.180	0.205	4.57	5.21
D	0.320	0.340	8.13	8.64
E	0.060	0.070	1.52	1.77
F	0.004	0.006	0.11	0.15
G	1.100 BSC		27.94 BSC	
H	0.082	0.097	2.08	2.46
K	0.580	0.620	14.73	15.75
L	0.435 BSC		11.05 BSC	
N	0.845	0.875	21.46	22.23
Q	0.118	0.130	3.00	3.30
R	0.390	0.410	9.91	10.41

STYLE 1:

- PIN 1: COLLECTOR
- COLLECTOR
- BASE
- BASE
- EMITTER

CASE 375A-01 ISSUE O

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