

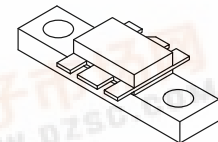
The RF Line NPN Silicon RF Power Transistor

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.

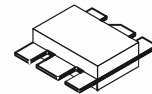
- Specified for $V_{CE} = 24$ Vdc, $I_C = 0.5$ Adc Characteristics
 - Output Power = 3.6 Watts CW
 - Minimum Power Gain = 11 dB
 - Minimum ITO = +44.5 dBm
 - Typical Noise Figure = 6 dB
- Characterized with Small-Signal S-Parameters and Series Equivalent Large-Signal Parameters from 800–960 MHz
- Silicon Nitride Passivated
- 100% Tested for Load Mismatch Stress at All Phase Angles with 30:1 VSWR @ 24 Vdc, $I_C = 0.5$ Adc and Rated Output Power
- Will Withstand RF Input Overdrive of 0.85 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.

MRF858
MRF858S

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



CASE 319-07, STYLE 2
MRF858



CASE 319A-02, STYLE 2
MRF858S

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	30	Vdc
Collector–Base Voltage	V_{CBO}	55	Vdc
Emitter–Base Voltage	V_{EBO}	4	Vdc
Total Device Dissipation @ $T_C = 50^\circ\text{C}$ Derate above 50°C	P_D	20 0.138	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 ($T_J = 150^\circ\text{C}$, $T_C = 50^\circ\text{C}$)	$R_{\theta JC}$	6.9	$^\circ\text{C/W}$

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage ($I_C = 20$ mA, $I_B = 0$)	$V_{(BR)CEO}$	28	35	—	Vdc
Collector–Emitter Breakdown Voltage ($I_C = 20$ mA, $V_{BE} = 0$)	$V_{(BR)CES}$	55	85	—	Vdc
Collector–Base Breakdown Voltage ($I_C = 20$ mA, $I_E = 0$)	$V_{(BR)CBO}$	55	85	—	Vdc
Emitter–Base Breakdown Voltage ($I_E = 1$ mA, $I_C = 0$)	$V_{(BR)EBO}$	4	5	—	Vdc
Collector Cutoff Current ($V_{CB} = 24$ V, $I_E = 0$)	I_{CES}	—	—	1	mA

(continued)

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ELECTRICAL CHARACTERISTICS — continued

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
DC Current Gain ($I_C = 0.1\text{ A}$, $V_{CE} = 5\text{ V}$)	h_{FE}	30	60	120	—
DYNAMIC CHARACTERISTICS					
Output Capacitance ($V_{CB} = 24\text{ V}$, $f = 1\text{ MHz}$)	C_{ob}	—	6.5	8	pF
FUNCTIONAL CHARACTERISTICS					
Common-Emitter Power Gain ($V_{CE} = 24\text{ V}$, $I_C = 0.5\text{ A}$, $f = 840\text{--}900\text{ MHz}$, Power Output = 3.6 W)	P_g	11	12	—	dB
Load Mismatch ($P_o = 3.6\text{ W}$) ($V_{CE} = 24\text{ V}$, $I_C = 0.5\text{ A}$, $f = 840\text{ MHz}$, Load VSWR = 30:1, All Phase Angles)	ψ	No Degradation in Output Power			
RF Input Overdrive ($V_{CE} = 24\text{ V}$, $I_C = 0.5\text{ A}$, $f = 840\text{ MHz}$) No degradation	$P_{in(over)}$	—	—	0.85	W
Third Order Intercept Point ($V_{CE} = 24\text{ V}$, $I_C = 0.5\text{ A}$) ($f_1 = 900\text{ MHz}$, $f_2 = 900.1\text{ MHz}$, Meas. @ IMD 3rd Order = -40 dBc)	ITO	+44.5	+45.5	—	dBm
Noise Figure ($V_{CE} = 24\text{ V}$, $I_C = 0.5\text{ A}$, $f = 900\text{ MHz}$)	NF	—	6	—	dB
Input Return Loss ($V_{CE} = 24\text{ V}$, $I_C = 0.5\text{ A}$, $f = 840\text{--}900\text{ MHz}$, Power Output = 3.6 W)	IRL	—	-12	-9	dB

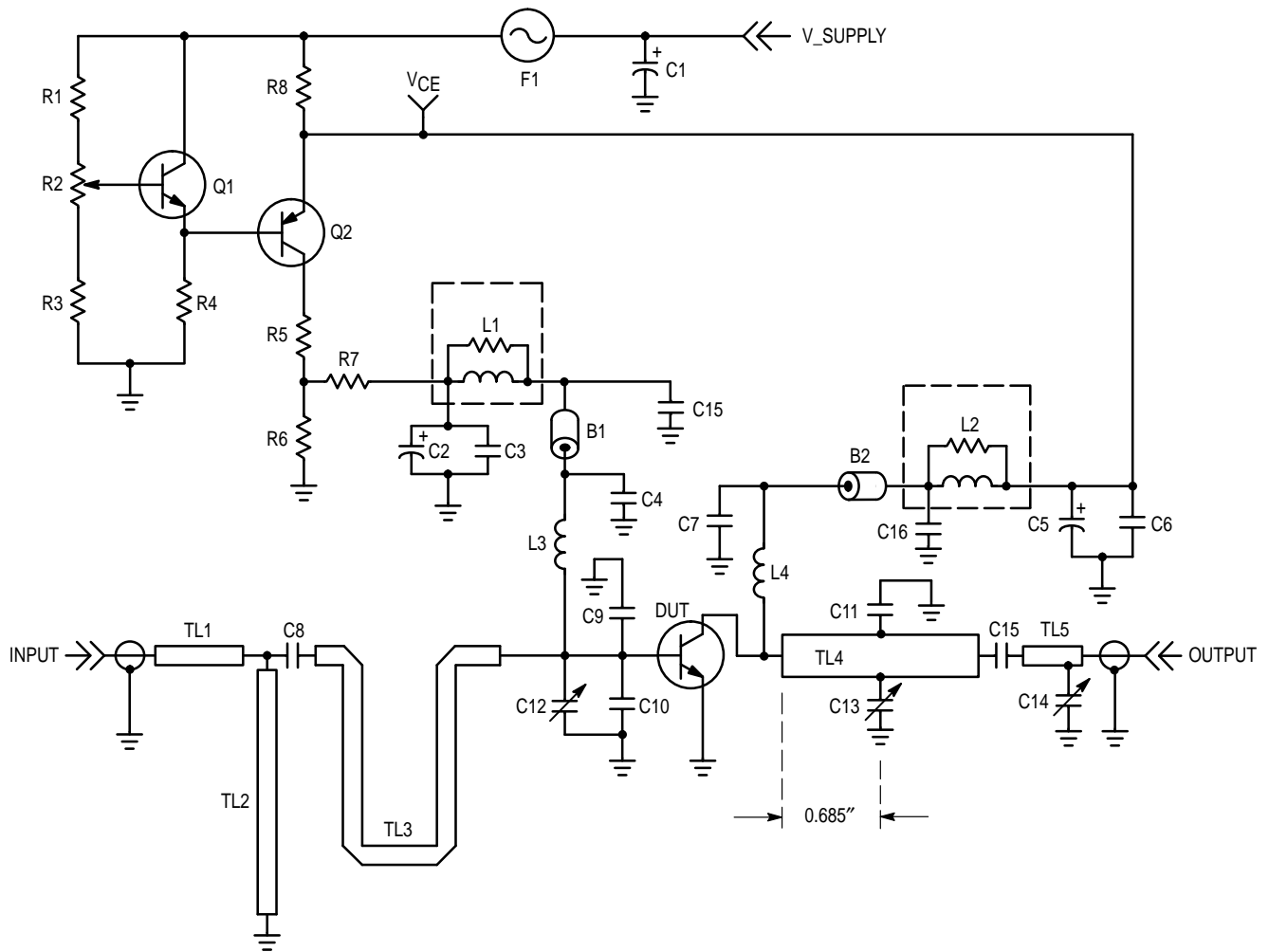
Table 1. MRF858 Common Emitter S-Parameters

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	0.5	800	0.942	167	1.493	50	0.027	58	0.538	-165
		820	0.942	166	1.453	50	0.027	58	0.541	-164
		840	0.941	166	1.415	49	0.028	59	0.545	-165
		860	0.940	166	1.379	48	0.028	59	0.550	-165
		880	0.941	165	1.351	47	0.029	59	0.553	-165
		900	0.940	165	1.320	46	0.030	59	0.557	-165
		920	0.940	165	1.289	45	0.030	59	0.562	-165
		940	0.940	164	1.252	44	0.031	59	0.566	-165
		960	0.940	164	1.222	43	0.031	59	0.570	-165

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

f (MHz)	Z_{in} (Ohms)		Z_{OL}^* (Ohms)	
840	1.1	2.9	9.9	-14.4
870	1.1	3.5	9.5	-14.6
900	1.2	3.5	9	-14.5

 $V_{CE} = 24\text{ V}$, $I_C = 0.5\text{ A}$, $P_o = 3.6\text{ W}$
 Z_{OL}^* = Conjugate of optimum load impedance into which the device operates at a given output power, voltage and frequency.



B1, B2	Short Ferrite Bead, Fair Rite (2743021447)	R1	390 Ω , 1/4 W
C1	250 μ F, 50 Vdc Electrolytic Capacitor	R2	500 Ω Potentiometer, 1/4 W
C2, C5	10 μ F, 50 Vdc Electrolytic Capacitor	R3	7.5K Ω , 1/4 W
C3, C6	0.1 μ F, Chip Capacitor	R4	2 x 4.7K Ω , 1/4 W
C4, C7	100 pF, Chip Capacitor	R5	56 Ω , 2 W
C8, C15	43 pF, 100 Mil Chip Capacitor	R6	75 Ω , 1/4 W
C9, C10	10 pF, Mini-Unelco	R7	4.7 Ω , 1/4 W
C11	5 pF, Mini-Unelco	R8	4 Ω , 10 W
C12, C13, C14	0.8–8.0 pF, Johanson Gigatrim	TL1, TL5	50 Ω , Microstrip Transmission Line
C15, C16	1000 pF, Chip Capacitor	TL2	Microstrip Transmission Line
F1	1 A Micro-Fuse	TL3	Microstrip Transmission Line
L1, L2	10 Turns, 20 AWG, 0.150" ID (10 Ω 1/2 W Resistor)	TL4	Microstrip Transmission Line
L3	4 Turns, 16 AWG, 0.101" ID	V_Supply	+26 Vdc \pm 0.5 Vdc Due to Resistor Tolerance
L4	0.5" 18 AWG Wire	VCE	+24 Vdc @ 0.5 A
Q1	MMBT2222ALT1, NPN Transistor	Board	0.030" Glass-Teflon [®] 2 oz. Cu, $\epsilon_r = 2.55$
Q2	BD136, PNP Transistor		

Figure 1. MRF858 Class A RF Test Fixture Schematic

TYPICAL CHARACTERISTICS

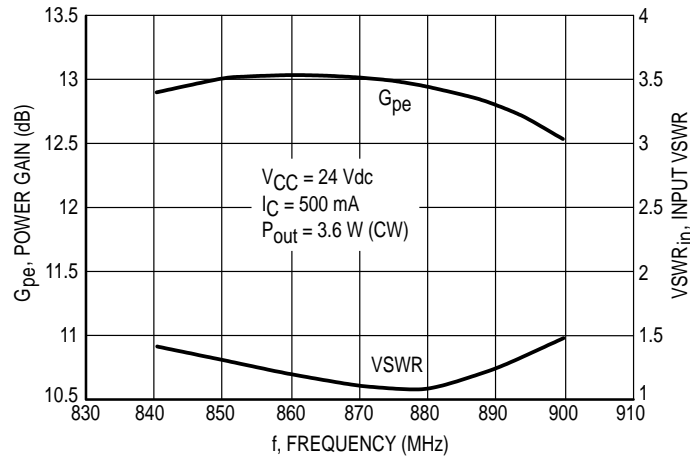


Figure 2. Performance in Broadband Circuit

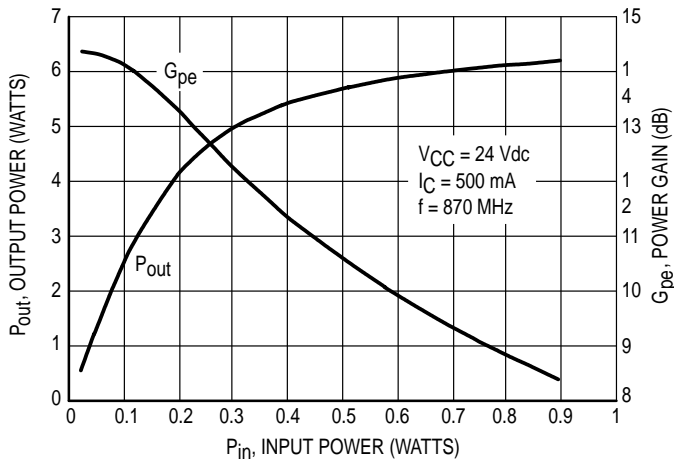


Figure 3. Output Power & Power Gain versus Input Power

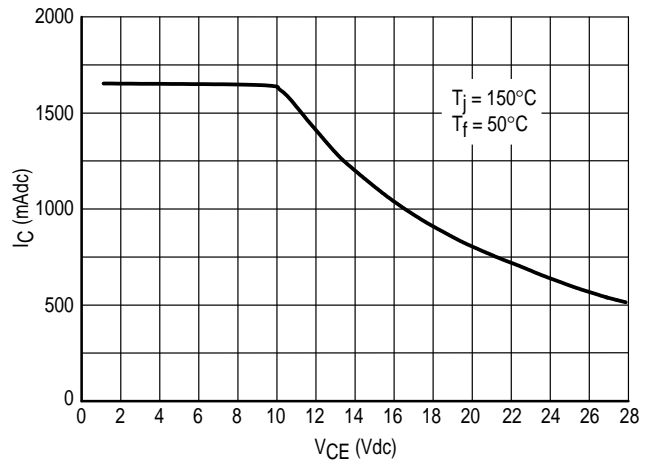


Figure 4. DC SOA

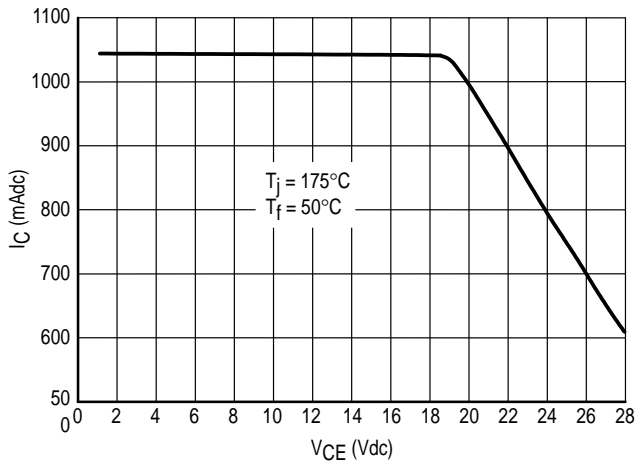


Figure 5. DC SOA
(This device is MTBF limited for $V_{CE} < 20$ Vdc.)

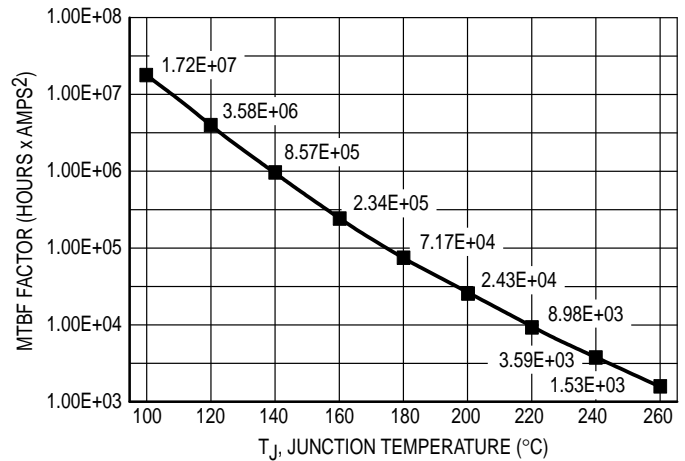


Figure 6. MTBF Factor versus Junction Temperature

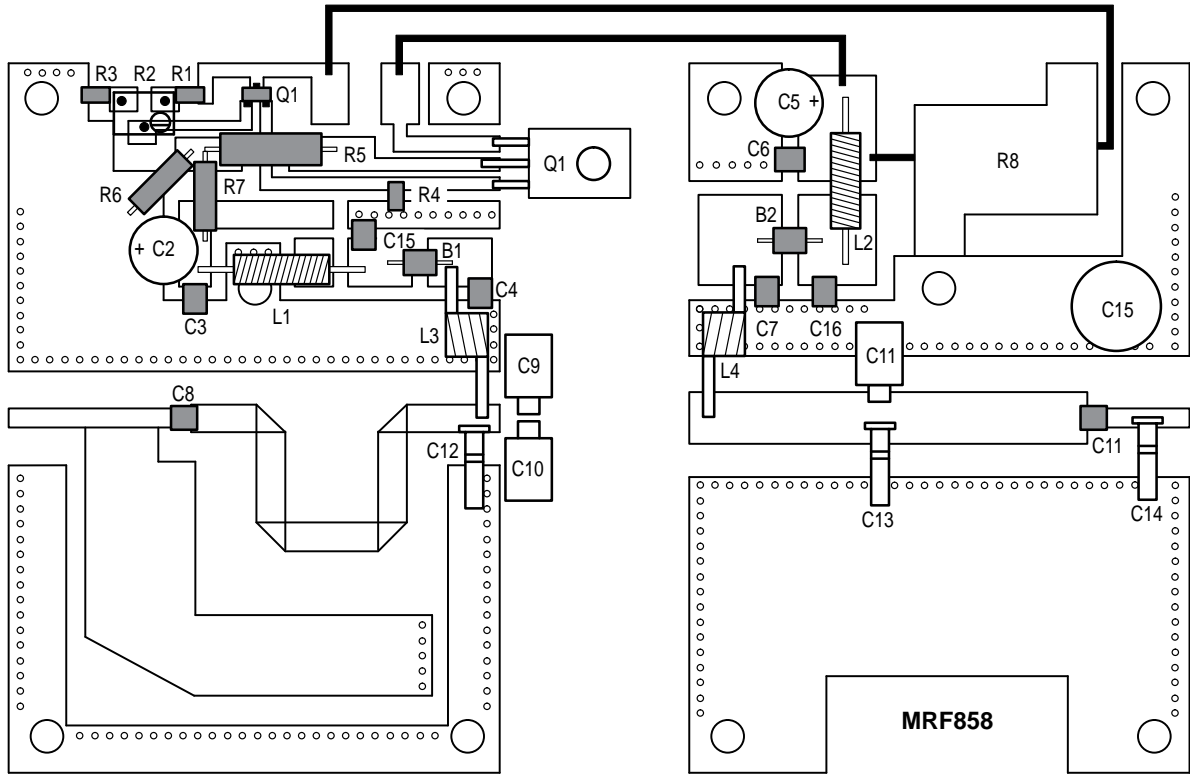
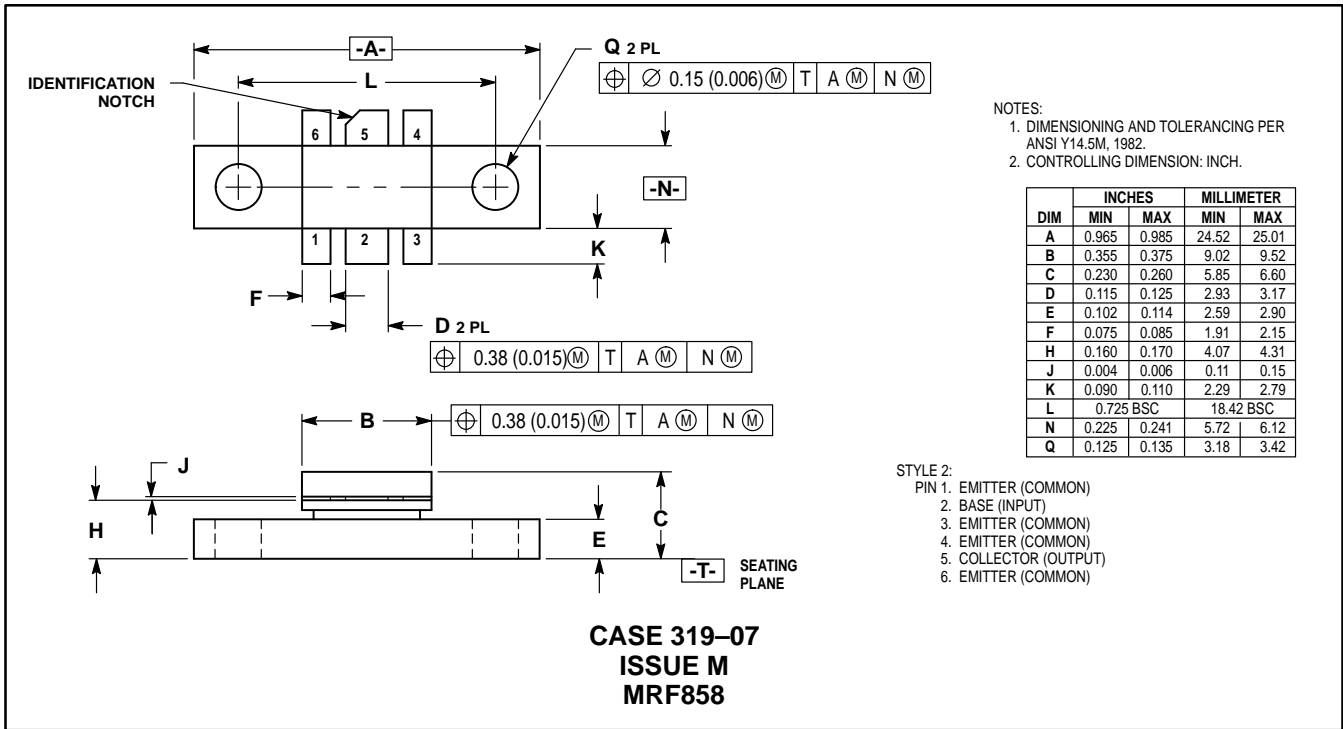


Figure 7. MRF858 Test Fixture Component Layout

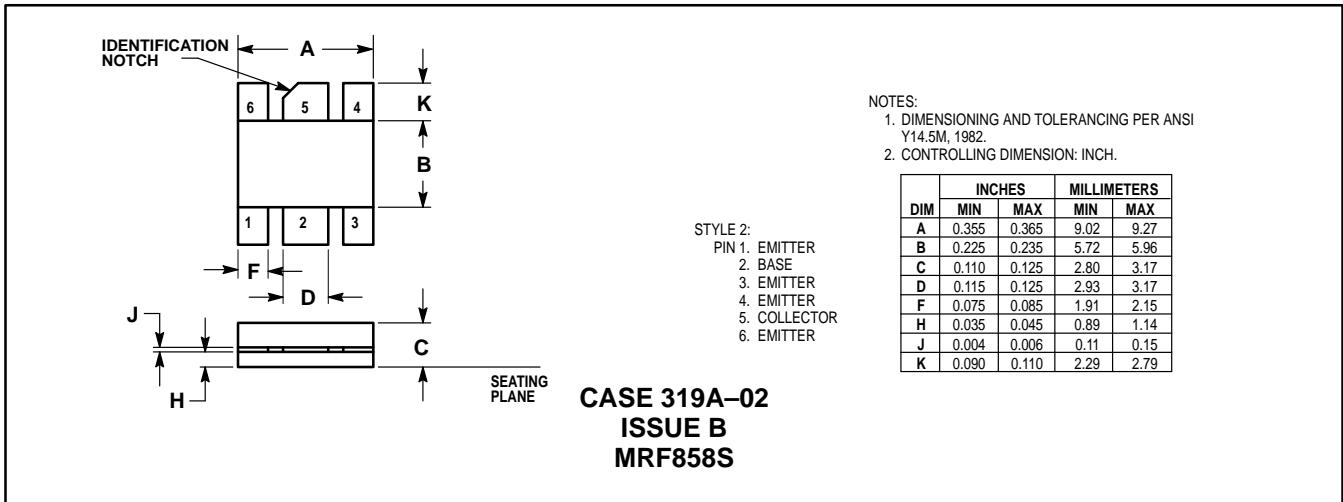
PACKAGE DIMENSIONS



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

DIM	INCHES		MILLIMETER	
	MIN	MAX	MIN	MAX
A	0.965	0.985	24.52	25.01
B	0.355	0.375	9.02	9.52
C	0.230	0.260	5.85	6.60
D	0.115	0.125	2.93	3.17
E	0.102	0.114	2.59	2.90
F	0.075	0.085	1.91	2.15
H	0.160	0.170	4.07	4.31
J	0.004	0.006	0.11	0.15
K	0.090	0.110	2.29	2.79
L	0.725 BSC		18.42 BSC	
N	0.225	0.241	5.72	6.12
Q	0.125	0.135	3.18	3.42

STYLE 2:
PIN 1. EMITTER (COMMON)
2. BASE (INPUT)
3. EMITTER (COMMON)
4. EMITTER (COMMON)
5. COLLECTOR (OUTPUT)
6. EMITTER (COMMON)



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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.355	0.365	9.02	9.27
B	0.225	0.235	5.72	5.96
C	0.110	0.125	2.80	3.17
D	0.115	0.125	2.93	3.17
F	0.075	0.085	1.91	2.15
H	0.035	0.045	0.89	1.14
J	0.004	0.006	0.11	0.15
K	0.090	0.110	2.29	2.79

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

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