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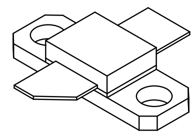
The RF Line
NPN Silicon RF Power Transistor

MRF6408

**12 W, 2.0 GHz
RF POWER TRANSISTOR
NPN SILICON**

Designed for PCN and PCS base station applications, the MRF6408 incorporates high value emitter ballast resistors, gold metallizations and offers a high degree of reliability and ruggedness.

- To be used in class AB for PCN–PCS / Cellular Radio
- Specified 26 Volts, 1.88 GHz Characteristics
  Output Power = 12 Watts CW
  Typical Gain = 8.8 dB
  Typical Efficiency = 42%
- Specified 26 Volts, 1.99 GHz Characteristics
  Output Power = 12 Watts CW
  Typical Gain = 8.3 dB
  Typical Efficiency = 39%
- Circuit Board Photomaster Available by Ordering Document MRF6408PHT/D from Motorola Literature Distribution.



CASE 395C–01, STYLE 1

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	24	Vdc
Collector–Emitter Voltage	V_{CES}	60	Vdc
Emitter–Base Voltage	V_{EBO}	4	Vdc
Collector–Current — Continuous	I_C	5	Adc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	60 0.35	Watts W/°C
Storage Temperature Range	T_{stg}	–65 to +150	°C
Operating Junction Temperature	T_J	200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (1)	$R_{\theta JC}$	2.8	°C/W

ELECTRICAL CHARACTERISTICS (T$_C$ = 25°C unless otherwise noted)

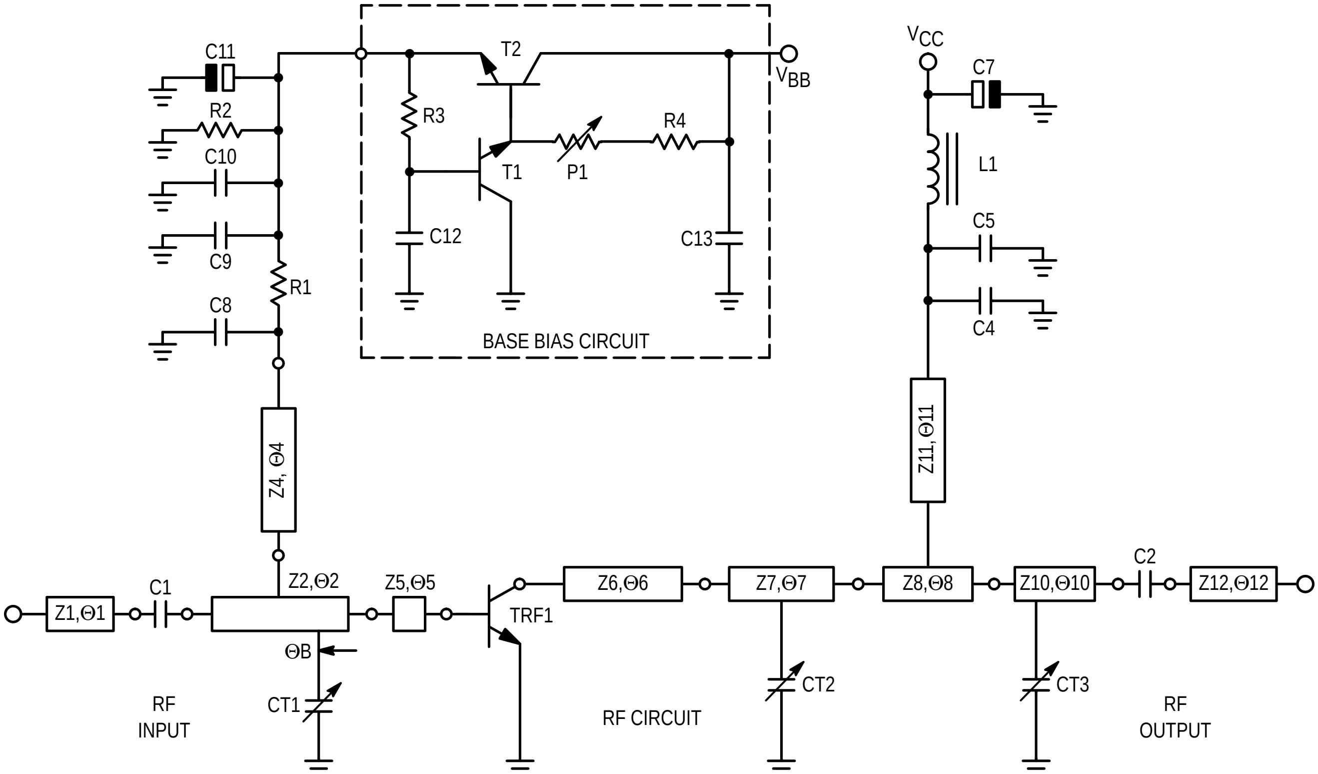
Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Breakdown Voltage (I_C = 20 mAdc, I_B = 0)	$V_{(BR)CEO}$	24	30	—	Vdc
Emitter–Base Breakdown Voltage (I_B = 5.0 mAdc, I_C = 0)	$V_{(BR)EBO}$	4	5	—	Vdc
Collector–Emitter Breakdown Voltage (I_C = 20 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	55	64	—	Vdc
Collector Cutoff Current (V_{CE} = 30 Vdc, V_{BE} = 0)	I_{CES}	—	—	6	mA

(1) Thermal resistance is determined under specified RF operating condition.

ELECTRICAL CHARACTERISTICS — continued (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
DC Current Gain (I_{CE} = 1 Adc, V_{CE} = 5 Vdc)	h_{FE}	20	35	80	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (2) (V_{CB} = 26 Vdc, I_E = 0, f = 1 MHz)	C_{ob}	—	18	—	pF
FUNCTIONAL TESTS					
Common–Emitter Amplifier Power Gain (V_{CC} = 26 Vdc, P_{out} = 12 W (CW), I_{CQ} = 100 mA, f = 1.88 GHz)	G_{pe}	7.8	8.8	—	dB
Common–Emitter Amplifier Power Gain (V_{CC} = 26 Vdc, P_{out} = 12 W (CW), I_{CQ} = 100 mA, f = 1.99 GHz)	G_{pe}	7.5	8.3	—	dB
Collector Efficiency (V_{CC} = 26 Vdc, P_{out} = 12 W (CW), I_{CQ} = 100 mA, f = 1.88 GHz)	η	37	42	—	%
Collector Efficiency (V_{CC} = 26 Vdc, P_{out} = 12 W (CW), I_{CQ} = 100 mA, f = 1.99 GHz)	η	34	39	—	%
Output Power at 1 dB Compression Point (V_{CC} = 26 Vdc, I_{CQ} = 100 mA, f = 1.88 GHz)	P @ 1 dB	15	—	—	W
Output Power at 1 dB Compression Point (V_{CC} = 26 Vdc, I_{CQ} = 100 mA, f = 1.99 GHz)	P @ 1 dB	14	—	—	W
Intermodulation Distortion (V_{CC} = 26 Vdc, P_{out} = 12 W (PEP), I_{CQ} = 100 mA, f1 = 1880 MHz, f2 = 1880.1 MHz)	IMD	—	–35	–30	dBc
Intermodulation Distortion (V_{CC} = 26 Vdc, P_{out} = 12 W (PEP), I_{CQ} = 100 mA, f1 = 1990 MHz, f2 = 1990.1 MHz)	IMD	—	–35	–30	dBc
Load Mismatch (V_{CC} = 26 Vdc, P_{out} = 12 W (CW), I_{CQ} = 100 mA, f = 1.99 GHz, Load VSWR = 3:1, All Phase Angles at Frequency of Test)	ψ	No Degradation in Output Power			

(2) For information only. This part is collector matched.



C4	47 pF, Chip Capacitor, ATC100A	P1	1 kΩ, Trimmer Resistor
C5, C9	330 pF, 0805 Chip Capacitor, Vitramon JXB	R1	1 Ω, 1206 Chip Resistor
C7	4.7 µF 63 V, Electrolytic Capacitor	R2	56 Ω, 1206 Chip Resistor
C10, C12, C13	15 nF, 0805 Chip Capacitor, Vitramon JXB	R3	47 Ω, 0805 Chip Resistor
C11	100 µF 16 V, Electrolytic Capacitor	R4	330 Ω, 0805 Chip Resistor
L1	SMD Ferrite Bead, Fair–Rite 2743021447	T1, T2	MJD31C, NPN Transistor, Motorola

Test Circuits Bias and Decoupling Components List

C1, C2	33 pF, Chip Capacitor, ATC100A		
CT1	Trimmer Capacitor, Gigatrim 37281		
CT2	Trimmer Capacitor, Gigatrim 37281		
CT3	Trimmer Capacitor, Gigatrim 37281		
Z1	50 Ω	Θ1 = 10°	
Z2	50 Ω	Θ2 = 74.5°	ΘB = 16.5°
Z4	74 Ω	Θ4 = 68°	
Z5	12.8 Ω	Θ5 = 21°	
Z6	10.4 Ω	Θ6 = 49.5°	
Z7	18 Ω	Θ7 = 36.5°	
Z8	45 Ω	Θ8 = 20°	
Z10	50 Ω	Θ10 = 10°	
Z11	74 Ω	Θ11 = 74.5°	
Z12	50 Ω	Θ12 = 10°	

1.88 GHz Test Circuit RF Components List

C1, C2	33 pF, Chip Capacitor, ATC100A		
CT1	Trimmer Capacitor, Gigatrim 37281		
CT2	Trimmer Capacitor, Gigatrim 37281		
CT3	Not Used		
Z1	50 Ω	Θ1 = 10°	
Z2	50 Ω	Θ2 = 74.5°	ΘB = 16.5°
Z4	74 Ω	Θ4 = 68°	
Z5	12.8 Ω	Θ5 = 21°	
Z6	10.4 Ω	Θ6 = 49.5°	
Z7	18 Ω	Θ7 = 36.5°	
Z8	45 Ω	Θ8 = 20°	
Z10	50 Ω	Θ10 = 10°	
Z11	74 Ω	Θ11 = 60°	
Z12	50 Ω	Θ12 = 10°	

1.99 GHz Test Circuit RF Components List

Electrical Lengths are referenced from I_G @ f = 1.9 GHz

Figure 1. Test Circuits Schematic

TYPICAL CHARACTERISTICS

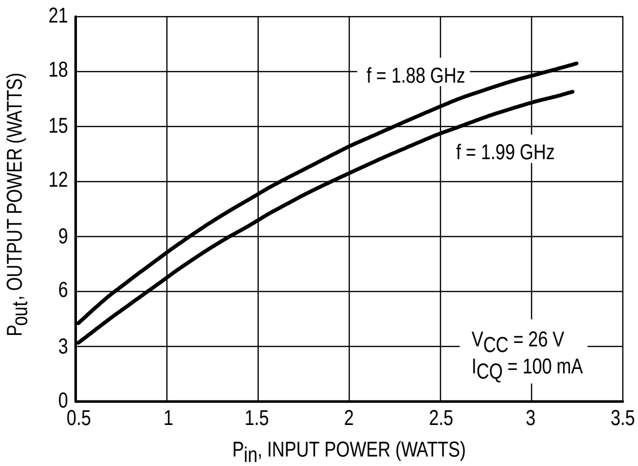


Figure 2. Output Power versus Input Power (CW)

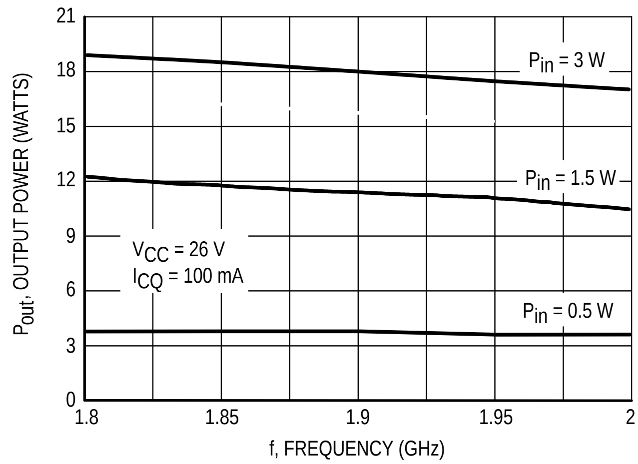


Figure 3. Output Power (CW) versus Frequency

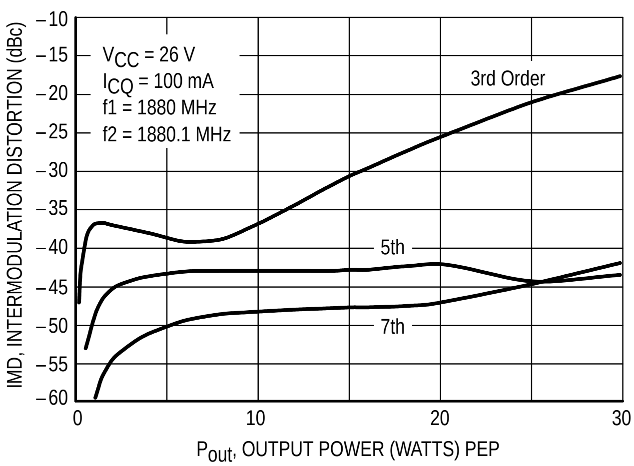


Figure 4. Intermodulation Distortion versus Output Power

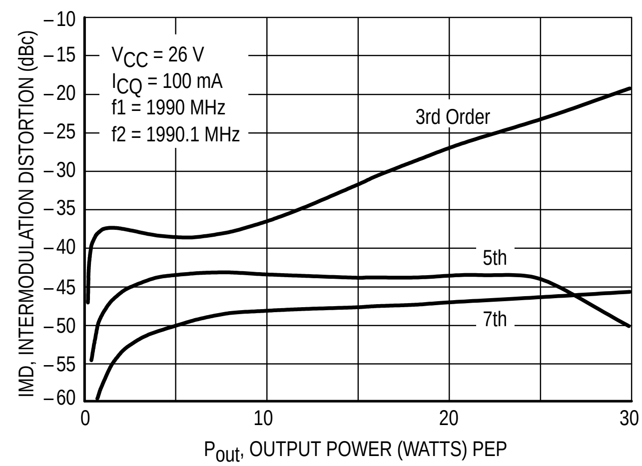


Figure 5. Intermodulation Distortion versus Output Power

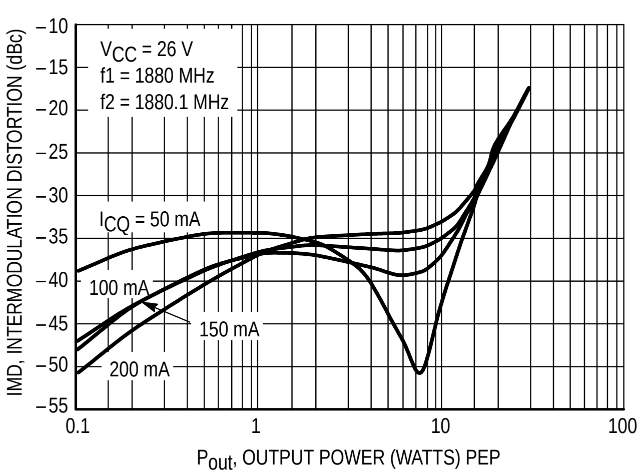


Figure 6. Intermodulation Distortion versus Output Power

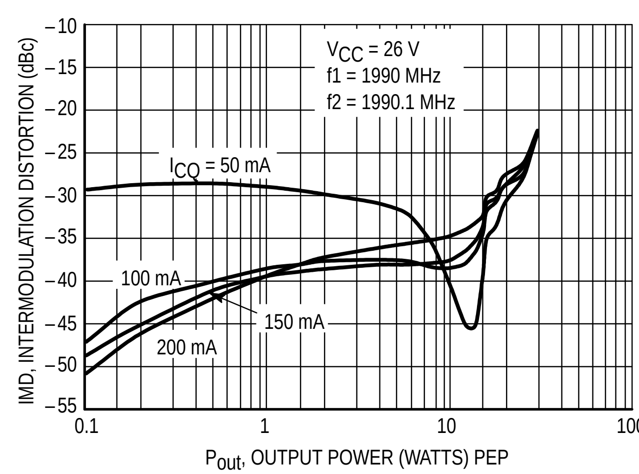
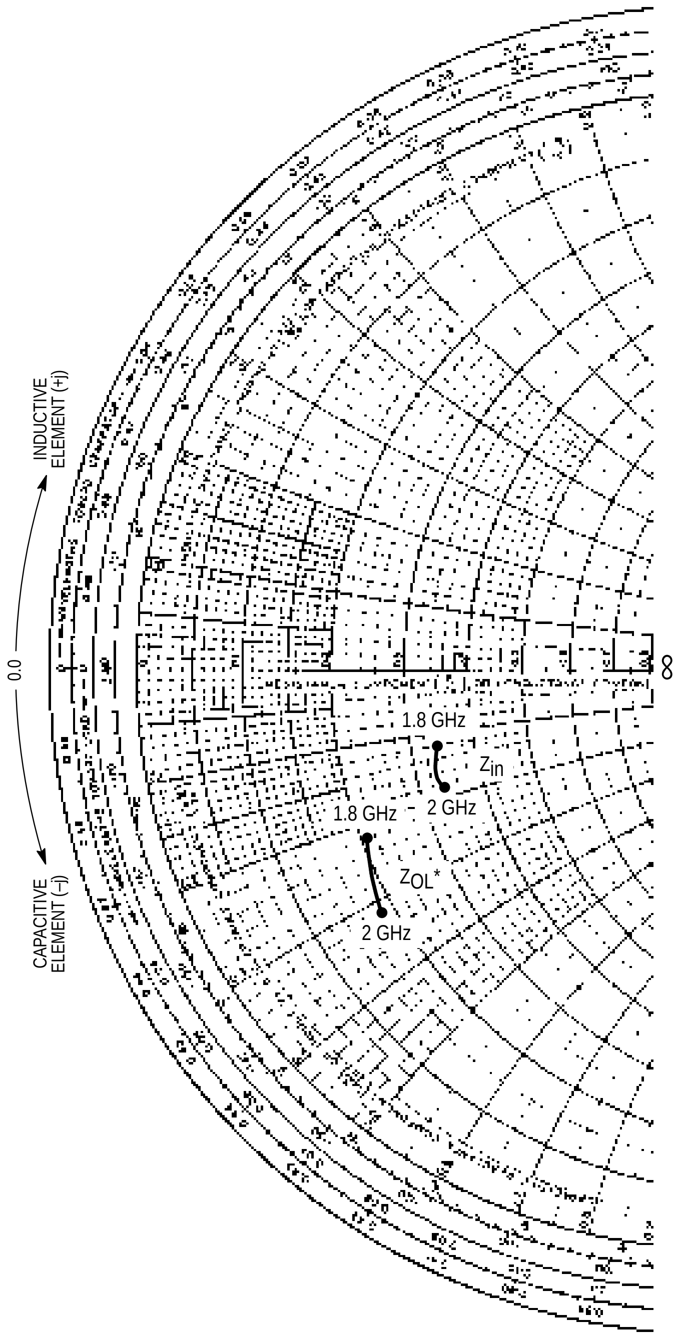


Figure 7. Intermodulation Distortion versus Output Power



Normalized to 20 Ω

f MHz	Z_{in} Ohms	Z_{OL}* Ohms
1800	7.5 – j2.5	5.1 – j4.5
1900	6.5 – j4	4.6 – j5.1
2000	4 – j5.9	4.1 – j6.4

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

Figure 8. Input and Output Impedances with Circuit Tuned for Maximum Gain @ V_{CC} = 26 V, I_{CQ} = 100 mA, P_{out} = 12 W (CW)

V_{CE} (Vdc)	I_C (Adc)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	∠ φ	$\|S_{21}\|$	∠ φ	$\|S_{12}\|$	∠ φ	$\|S_{22}\|$	∠ φ
26	1.0	1000	0.987	176	0.502	–179	0.012	136	0.898	172
		1050	0.986	176	0.478	–177	0.012	136	0.886	172
		1100	0.984	175	0.570	179	0.014	138	0.874	172
		1150	0.982	175	0.553	–177	0.014	137	0.859	171
		1200	0.979	174	0.623	176	0.017	140	0.844	171
		1250	0.974	173	0.660	177	0.017	140	0.826	171
		1300	0.970	172	0.757	176	0.021	138	0.807	171
		1350	0.962	171	0.790	170	0.021	138	0.785	171
		1400	0.950	170	0.932	169	0.025	132	0.760	171
		1450	0.932	169	0.996	161	0.028	131	0.727	172
		1500	0.899	167	1.272	154	0.031	123	0.690	173
		1550	0.845	165	1.407	145	0.035	113	0.649	177
		1600	0.761	165	1.587	132	0.041	100	0.628	–176
		1650	0.670	170	1.763	109	0.041	076	0.672	–168
		1700	0.667	–179	1.671	092	0.039	055	0.776	–166
		1750	0.746	–173	1.390	069	0.030	035	0.861	–168
		1800	0.823	–173	1.184	061	0.024	013	0.897	–172
		1850	0.875	–174	0.901	046	0.018	001	0.911	–175
		1900	0.907	–176	0.755	044	0.015	–012	0.909	–177
		1950	0.928	–177	0.614	038	0.013	–022	0.921	–179
		2000	0.941	–178	0.484	036	0.010	–037	0.901	–179

Table 1. Small Signal S–Parameters

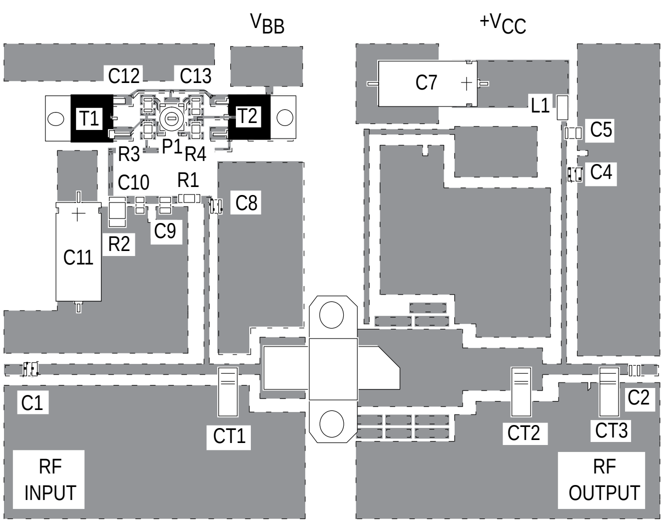


Figure 9. 1.88 GHz Test Circuit Components Layout

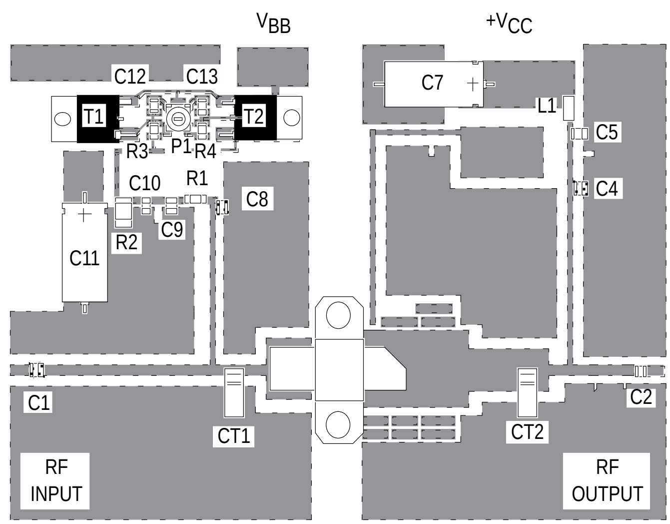
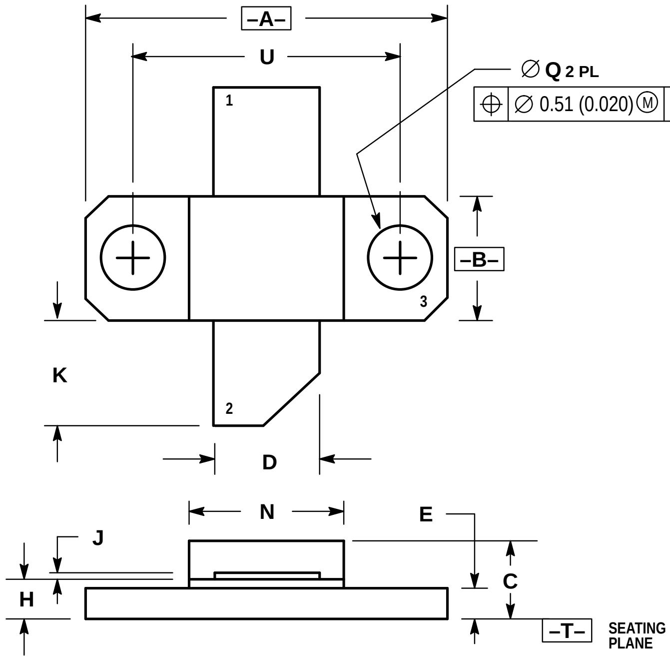


Figure 10. 1.99 GHz Test Circuit Components Layout

PACKAGE DIMENSIONS



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

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.739	0.750	18.77	19.05
B	0.240	0.260	6.10	6.60
C	0.165	0.198	4.19	5.03
D	0.215	0.225	5.46	5.72
E	0.055	0.070	1.40	1.78
H	0.079	0.091	2.01	2.31
J	0.004	0.006	0.10	0.15
K	0.210	0.240	5.33	6.10
N	0.315	0.330	8.00	8.38
Q	0.125	0.135	3.18	3.42
U	0.560 BSC		14.23 BSC	

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

CASE 395C–01
ISSUE A

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