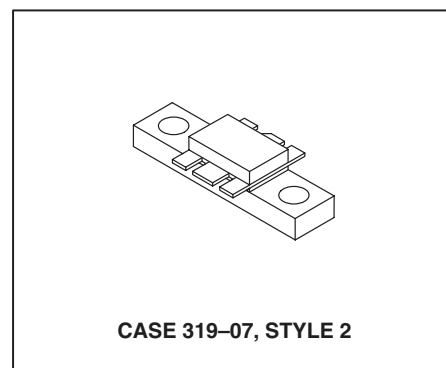
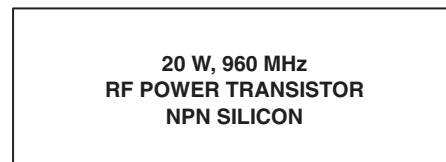


The RF Line NPN Silicon RF Power Transistor

The MRF6409 is designed for GSM base stations applications. It incorporates high value emitter ballast resistors, gold metallizations and offers a high degree of reliability and ruggedness.

- To be used in Class AB
- Specified 26 Volts, 960 MHz Characteristics
 Output Power — 20 Watts CW
 Gain — 11 dB Typ
 Efficiency — 60% Typ



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MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	24	Vdc
Collector-Emitter Voltage	V_{CES}	55	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector-Current — Continuous	I_C	5.0	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	45 0.26	Watts W/ $^\circ\text{C}$
Storage Temperature Range	T_{stg}	-65 to +150	$^\circ\text{C}$
Operating Junction Temperature	T_J	200	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (1)	$R_{\theta JC}$	3.8	$^\circ\text{C}/\text{W}$

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

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage ($I_C = 20 \text{ mAdc}$, $I_B = 0$)	$V_{(BR)CEO}$	24	30	—	Vdc
Emitter-Base Breakdown Voltage ($I_B = 5.0 \text{ mAdc}$, $I_C = 0$)	$V_{(BR)EBO}$	4.0	5.0	—	Vdc
Collector-Emitter Breakdown Voltage ($I_C = 20 \text{ mAdc}$, $V_{BE} = 0$)	$V_{(BR)CES}$	55	60	—	Vdc
Collector-Cutoff Current ($V_{CE} = 30 \text{ Vdc}$, $V_{BE} = 0$)	I_{CES}	—	—	6.0	mA

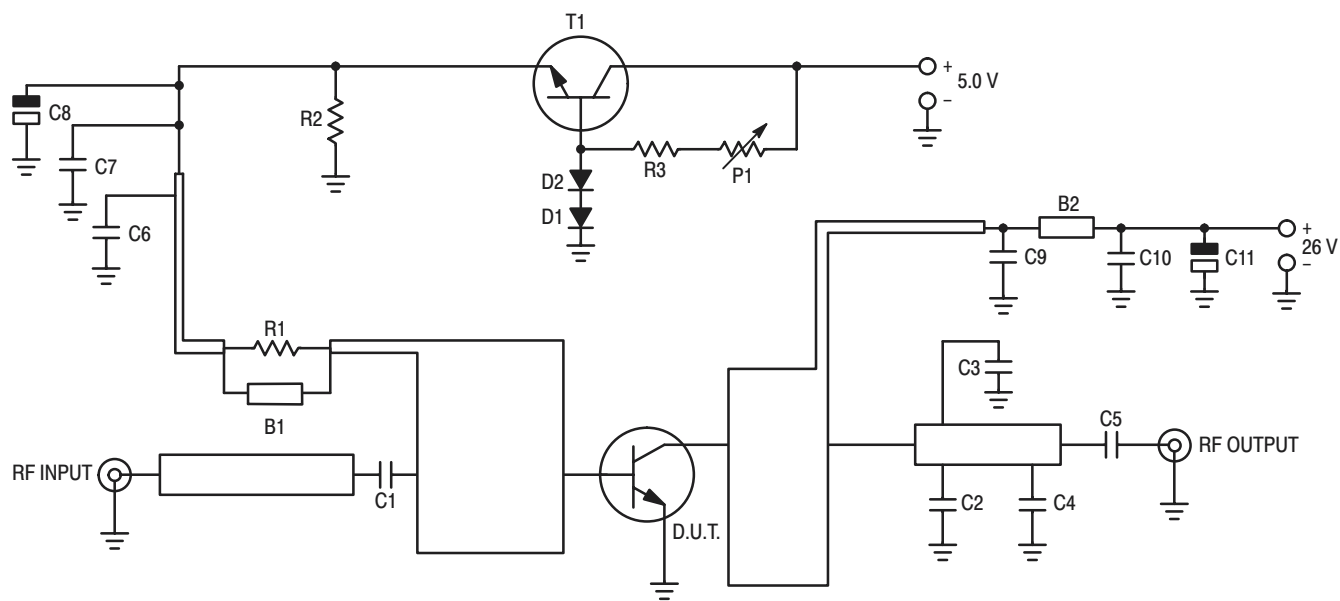
(1) Thermal resistance is determined under specified RF operating condition.

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

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
DC Current Gain ($I_{CE} = 1.0 \text{ Adc}$, $V_{CE} = 5.0 \text{ Vdc}$)	h_{FE}	20	35	80	—
DYNAMIC CHARACTERISTICS					
Output Capacitance ($V_{CB} = 26 \text{ Vdc}$, $I_E = 0$, $f = 1.0 \text{ MHz}$)	C_{ob}	—	18	—	pF
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain ($V_{CC} = 26 \text{ Vdc}$, $P_{out} = 20 \text{ W (CW)}$, $I_{CQ} = 50 \text{ mA}$, $f = 960 \text{ MHz}$)	G_{pe}	10	11	—	dB
Collector Efficiency ($V_{CC} = 26 \text{ Vdc}$, $P_{out} = 20 \text{ W (CW)}$, $I_{CQ} = 50 \text{ mA}$, $f = 960 \text{ MHz}$)	η	50	60	—	%
Load Mismatch ($V_{CC} = 26 \text{ Vdc}$, $P_{out} = 15 \text{ W (CW)}$, $I_{CQ} = 50 \text{ mA}$, $f = 960 \text{ MHz}$, Load VSWR = 3:1, All Phase Angles at Frequency of Test)	Ψ	No Degradation in Output Power			

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|---------|---|--------|---|
| B1, B2 | Ferrite Bead | C11 | 4.7 μF , 50 V, Tantalum Capacitor |
| C1 | 3.3 pF, Chip Capacitor, High Q | D1, D2 | Diode BAS16 Type or Equivalent |
| C2, C3 | 4.7 pF, Chip Capacitor, High Q | P1 | 1.0 k Ω , Trimmer |
| C4 | 2.2 pF, Chip Capacitor, High Q | R1 | 3.3 Ω , Chip Resistor |
| C5 | 82 pF, Chip Capacitor, High Q | R2 | 68 Ω , Chip Resistor |
| C6, C9 | 330 pF, Chip Capacitor, High Q | R3 | 2.2 k Ω , Resistor |
| C7, C10 | 0.1 μF , Chip Capacitor | T1 | NPN Transistor |
| C8 | 22 μF , 16 V, Tantalum Capacitor | Board | Glass Teflon [®] , $\epsilon_r = 2.55$, $H = 1/50$ inch |

Figure 1. Test Circuit Electrical Schematic

TYPICAL CHARACTERISTICS

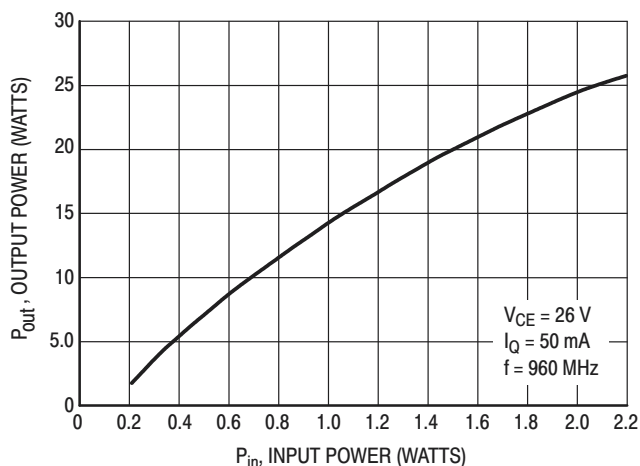


Figure 2. Output Power versus Input Power (CW)

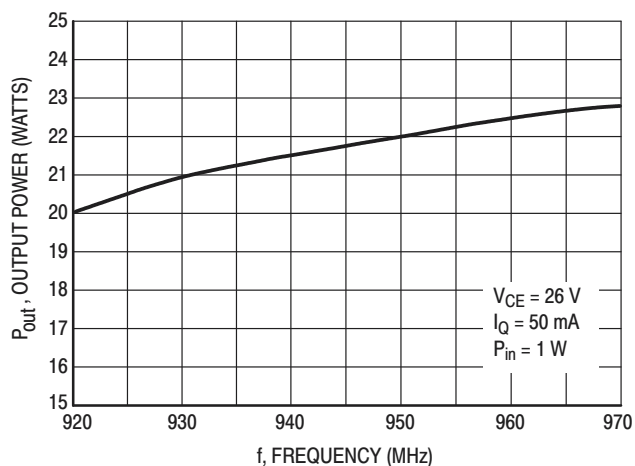


Figure 3. Output Power versus Frequency (CW)

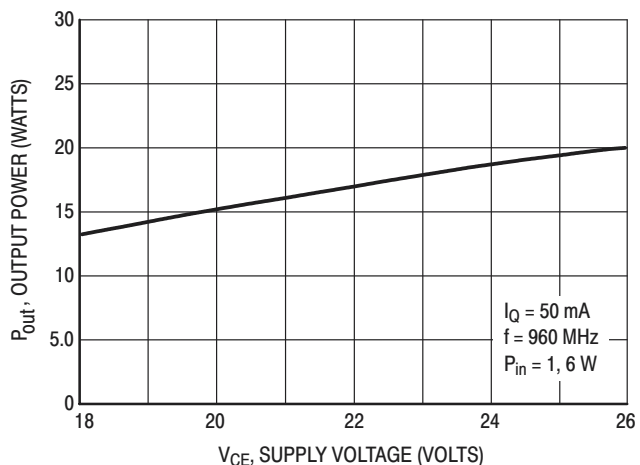


Figure 4. Output Power versus Supply Voltage (CW)

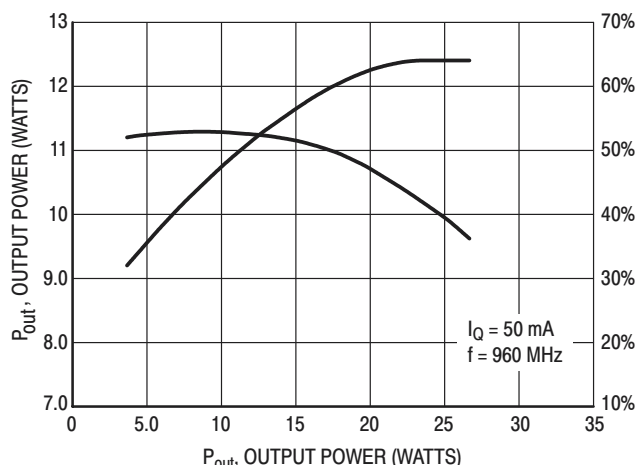


Figure 5. Power Gain and Efficiency versus Output Power

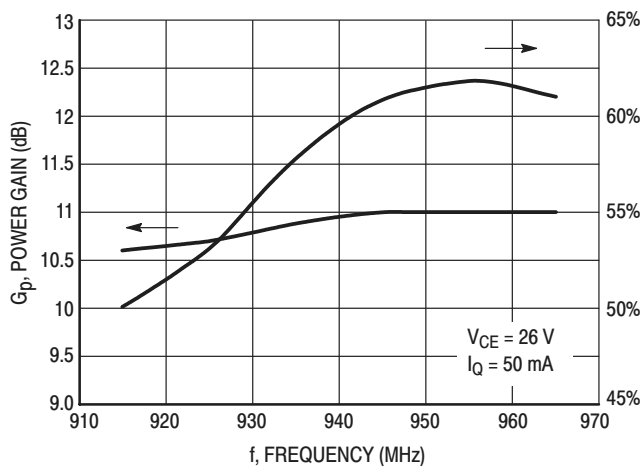


Figure 6. Typical Broadband Performances

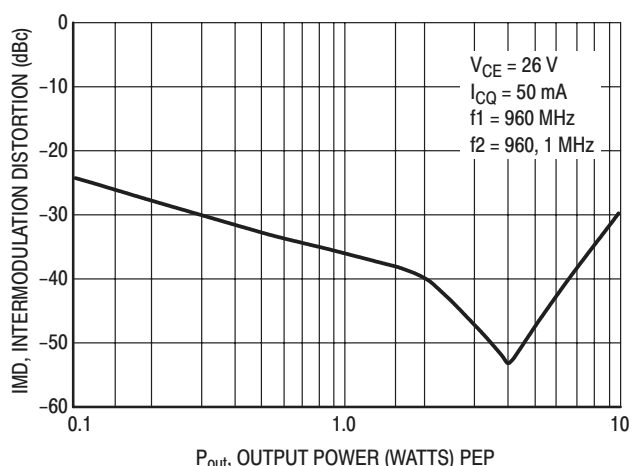
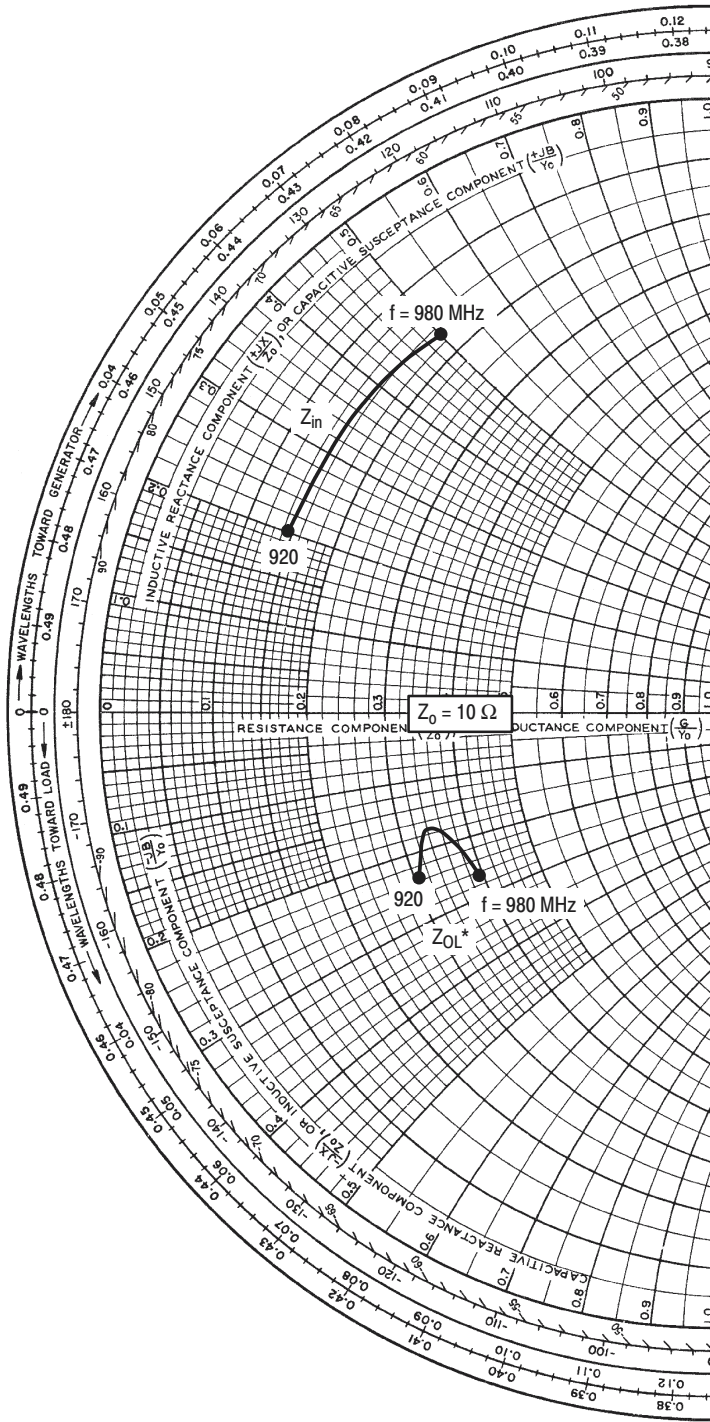


Figure 7. Intermodulation Distortion versus Output Power

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f (MHz)	Z _{in} (Ω)	Z _{OL} * (Ω)
920	1.4 + j3.0	3.2 - j2.5
940	1.5 + j3.9	3.5 - j1.88
960	1.5 + j4.2	3.9 - j2.5
980	1.6 + j4.4	4.0 - j2.8

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} = 50 mA, P_{out} = 20 W (CW)

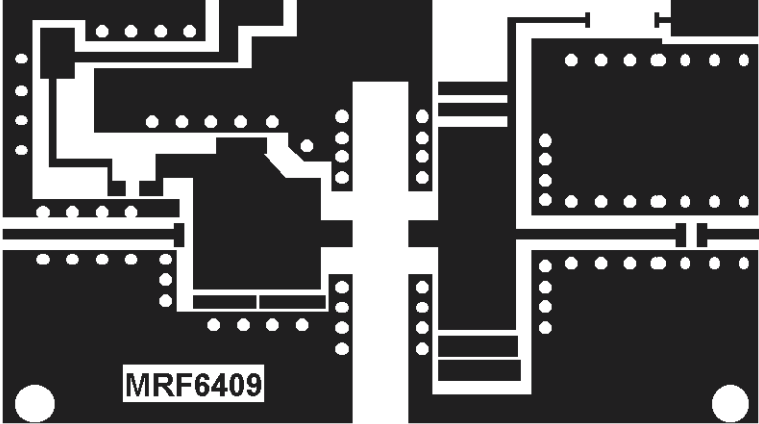


Figure 9. 960 MHz Test Circuit RF, Photomaster Scale 1:1
(Reduced 18% in printed data book, DL110/D)

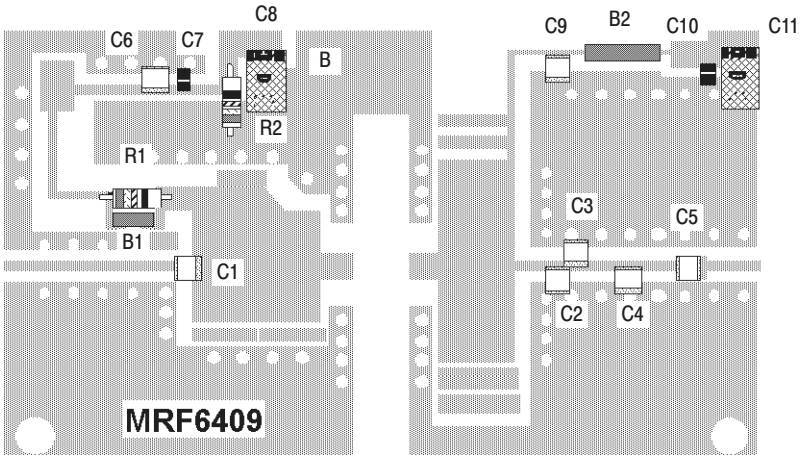
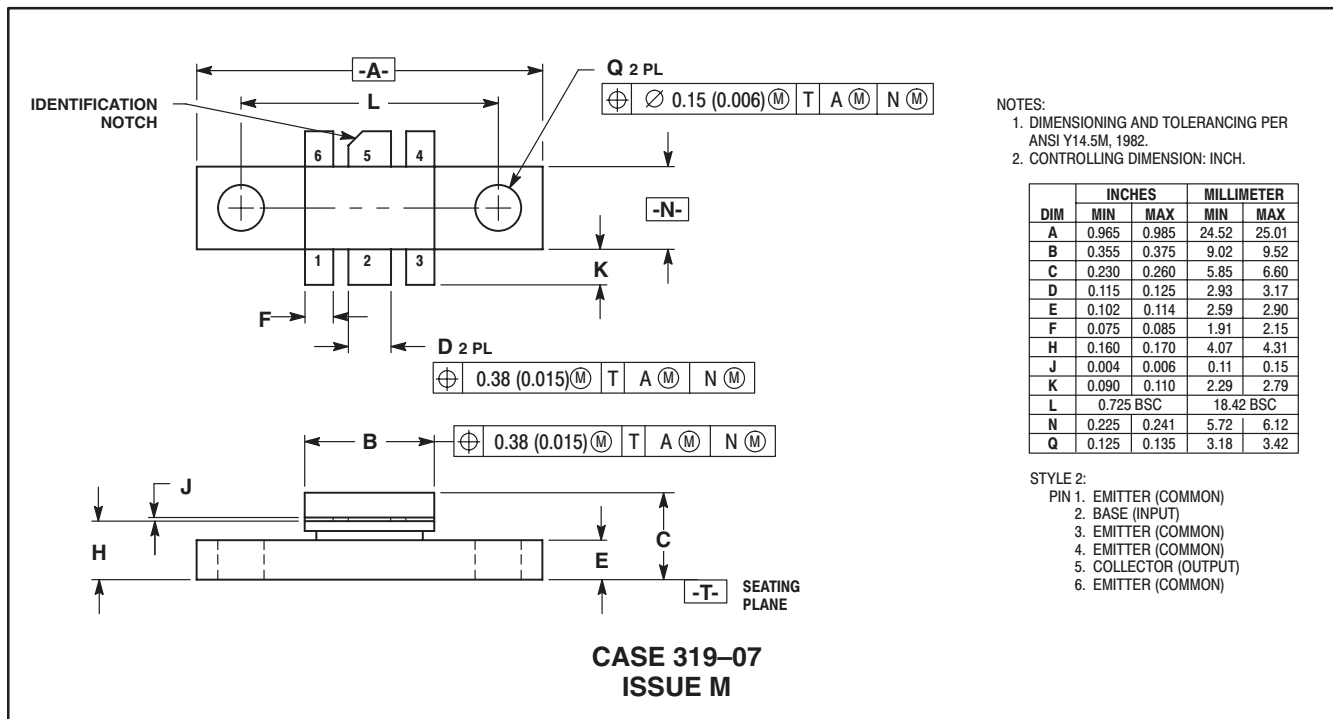


Figure 10. 960 MHz Test Circuit RF, Photomaster Scale 1:1
and Components Location
(Reduced 18% in printed data book, DL110/D)

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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)

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