

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

T-33-11

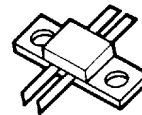
The RF Line**UHF Power Transistor**

... designed for 24 Volt UHF large-signal common emitter amplifier applications in industrial and commercial FM equipment operating in the 380 to 512 MHz frequency range, i.e., cellular radio base stations.

- 380-512 MHz
- 40 W — P_{out}
- 24 V — V_{CC}
- High Gain — 9 dB Min, Class AB
- Gold Metallization for Reliability

TP5040'

40 W — 380 to 512 MHz
 UHF POWER
 TRANSISTOR
 NPN SILICON

2

CASE 395-01, STYLE 1
 (BMA-2)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	28	Vdc
Collector-Base Voltage	V_{CBO}	45	Vdc
Emitter-Base Voltage	V_{EBO}	4	Vdc
Total Device Dissipation (@ $T_C = 70^\circ\text{C}$ (Note 1) Derate above 70°C	P_D	65 0.5	Watts W/ $^\circ\text{C}$
Operating Junction Temperature	T_J	200	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	-65 to +200	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case ($T_C = 70^\circ\text{C}$)	$R_{\theta JC}$	2	$^\circ\text{C/W}$

Note 1. These devices are designed for RF operation. The total dissipation rating applies only when the device is operated in an RF push-pull amplifier

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS (Note 1)

Collector-Emitter Breakdown Voltage ($I_C = 40\text{ mA}$, $I_E = 0$)	$V_{(BR)CEO}$	28	—	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 40\text{ mA}$, $I_E = 0$)	$V_{(BR)CBO}$	45	—	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 6\text{ mA}$, $I_C = 0$)	$V_{(BR)EBO}$	4	—	—	Vdc
Collector-Emitter Breakdown Voltage ($I_C = 20\text{ mA}$, $R_{BE} = 47\ \Omega$)	$V_{(BR)CER}$	40	—	—	Vdc

ON CHARACTERISTICS (Note 1)

DC Current Gain ($I_C = 500\text{ mA}$, $V_{CE} = 10\text{ V}$)	h_{FE}	15	120	—	—
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DYNAMIC CHARACTERISTICS (Note 1)

Output Capacitance ($V_{CB} = 28\text{ V}$, $I_E = 0$, $f = 1\text{ MHz}$)	C_{ob}	—	—	40	pF
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Note 1 Each transistor chip measured separately

(continued)

MOTOROLA RF DEVICE DATA

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ELECTRICAL CHARACTERISTICS — continued

Characteristic	Symbol	Min	Typ	Max	Unit
FUNCTIONAL TESTS (Note 2)					
Common-Emitter Amplifier Power Gain ($V_{CE} = 24\text{ V}$, $P_{out} = 40\text{ W}$, $f = 470\text{ MHz}$, $I_Q = 2 \times 50\text{ mA}$)	G_{PE}	9	—	—	dB
Collector Efficiency ($V_{CE} = 24\text{ V}$, $P_{out} = 40\text{ W}$, $f = 470\text{ MHz}$, $I_Q = 2 \times 50\text{ mA}$)	η_c	45	50	—	%

Note 2 Both transistor chips operating in push-pull amplifier

TYPICAL CHARACTERISTICS

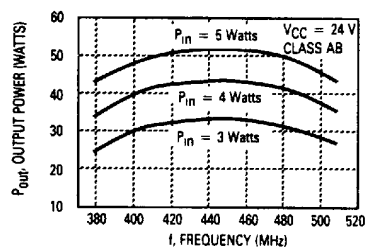


Figure 1. Output Power versus Frequency

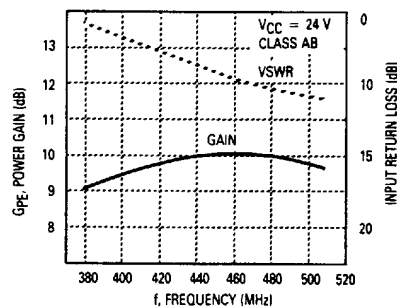


Figure 2. Gain versus Frequency

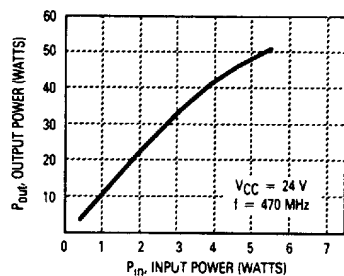
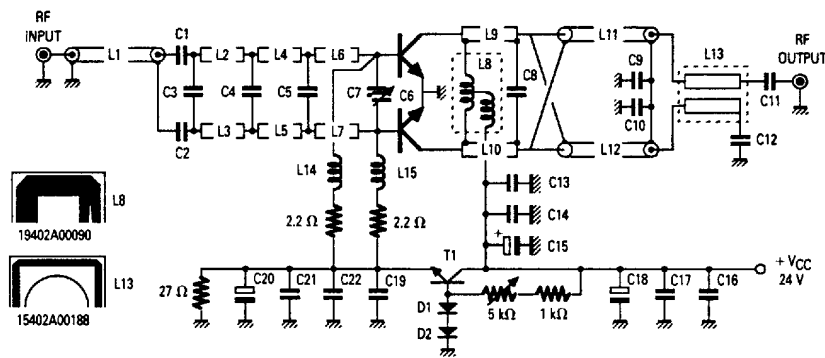


Figure 3. Output Power versus Input Power

F (MHz)	400	430	470	500
Input Impedance Ω	$2.5 + j1.0$	$2.75 + j2.0$	$3.0 + j3.1$	$3.25 + j4.25$
Output Impedance Ω	$8.5 - j6.5$	$7 - j6.5$	$6.0 - j6.25$	$4.75 - j6.0$

Figure 4. Series Equivalent Input/Output Impedances

CONDITIONS
 $V_{CE} = 24\text{ V}$
 $I_Q = 2 \times 50\text{ mA}$ — Class AB
 $P_{out} = 40\text{ W}$
 Collector-to-Collector



- | | |
|--|---|
| L1 – 50 Ω Coaxial Cable, 20% λ_g @ 470 MHz | C6 – 15 pF ATC100A150DP50 Capacitor |
| L2, L3 – Wire Dia 0.5 mm, λ_g = 5 mm | C8 – Trimmer 1–4 pF Johanson 9401-4 |
| L4, L5 – Microstrip Line 7.5 mm 1679 Ω , 1.7% λ_g @ 470 MHz | C8 – 12 pF ATC100A120DP50 Capacitor |
| L6, L7 – Microstrip Line 7.5 mm 39 Ω , 1.7% λ_g @ 470 MHz | C9 – 1 nF Chip 0805 Sprague/Vitramon Capacitor |
| L8 – Collector/Collector Inductor, 1/50 th Teflon Glass | C10 – 15 nF Chip 0805 Sprague/Vitramon Capacitor |
| L9, L10 – Microstrip Line 7 mm 50 Ω , 1.7% λ_g @ 470 MHz | C11, C12 – 100 pF ATC100A101KP50 Capacitor |
| L11, L12 – 25 Ω Coaxial Cable, 50 mm | C13, C17, C21 – 100 pF ATC100A101KP50 Capacitor |
| L13 – Balun 50 Ω , 12.5% λ_g @ 50 MHz | C14, C16, C18 – 10 nF 0805 Sprague/Vitramon Capacitor |
| L14, L15 – 3 Turns ID 3 mm Wire 1 mm | C19 – 0.1 nF 0805 Sprague/Vitramon Capacitor |
| C1, C2, C7 – 47 pF ATC100A47DP50 Capacitor | C18, C20 – 100 μ F 40 V Capacitor |
| C3 – 47 pF ATC100A47DP50 Capacitor | C15 – 10 μ F 63 V Capacitor |
| C4 – 5.6 pF ATC100A56RPD50 Capacitor | D1, D2 – 1N4007 Diode |
| | T1 – BD135 Transistor |

Figure 5. 380–512 MHz Broadband Test Circuit

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