

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

T-33-05

The RF Line**UHF Power Transistors****2**

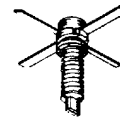
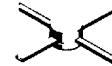
The TP3019 and TP3019S are designed for 24 V common emitter base station amplifiers. Operating in the 820–960 MHz bandwidth, they have been specifically designed for use in analog and digital (GSM) systems. The studless package version offers a good possibility for surface mounting.

- Specified 24 Volts, 960 MHz Characteristics

Output Power = 2.0 Watts

Minimum Gain = 9.0 dB

Class AB

 $I_Q = 20$ mA
TP3019
TP3019S
2.0 W-960 MHz
UHF POWER
TRANSISTORS
NPN SILICON

CASE 305A-01, STYLE 1
TP3019S

CASE 305-01, STYLE 1
TP3019
MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CE}	40	Vdc
Collector Base Voltage	V_{CB}	50	Vdc
Emitter-Base Voltage	V_{EB}	4.0	Vdc
Collector Current — Continuous	I_C	1.0	Adc
Total Device Dissipation in $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	12.5 0.15	Watts W/°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) at 70°C Case	$R_{\theta JC}$	14	$^\circ\text{C/W}$

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 ($I_C = 5.0$ mA, $I_B = 0$)	$V_{(BR)CER}$	28	—	—	Vdc
Emitter-Base Breakdown Voltage ($I_C = 1.0$ mA, $I_E = 0$)	$V_{(BR)EBO}$	3.5	—	—	Vdc
Collector-Base Breakdown Voltage ($I_E = 5.0$ mA, $I_C = 0$)	$V_{(BR)CBO}$	50	—	—	Vdc
Collector-Emitter Leakage ($V_{CE} = 20$ V)	I_{CES}	—	—	2.0	mA

NOTE 1: Thermal resistance is determined under specified RF operating condition.

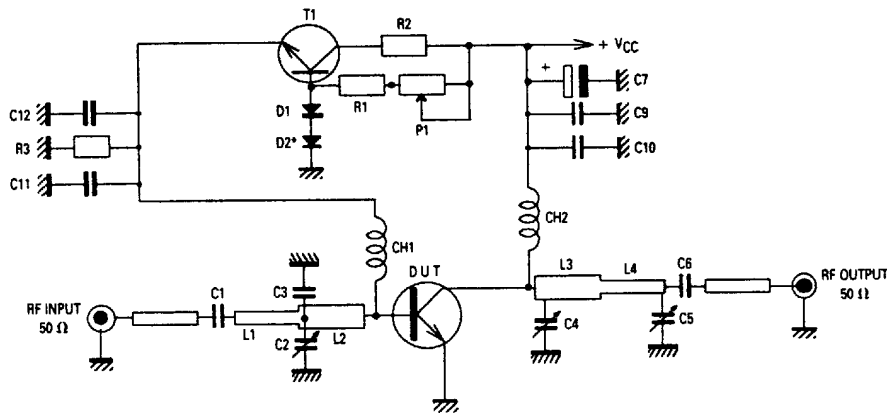
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ELECTRICAL CHARACTERISTICS — continued (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
DC Current Gain (I _C = 10 Adc, V _{CE} = 5.0 Vdc)	h _{FE}	15	—	150	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V _{CB} = 25 V, I _E = 0, f = 10 MHz)	C _{ob}	—	—	4.0	pF
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain (V _{CC} = 24 V, P _{out} = 2.0 W, I _{CQ} = 20 mA) (f = 960 MHz)	G _p	9.0	—	—	dB
Load Mismatch at all Phase Angles (V _{CC} = 24 V, P _{out} = 2.0 W, I _{CQ} = 20 mA) No degradation in Output Power	ψ	20:1	—	—	VSWR
Collector Efficiency (V _{CC} = 24 V, P _{out} = 2.0 W, f = 960 MHz)	η _c	50	55	—	%



- *Contact with RF Transistor
- C2, C4, C5 — Trimmer Capacitor 0.5–4.0 pF
 - C1, C6, C10, C11 — Capacitor Chip 0805 330 pF 5%
 - C9, C12 — Capacitor Chip 0805 15 nF 5%
 - C3 — Capacitor Chip 0805 3.9 pF 5%
 - C7 — Capacitor Chip 0805 6.0, 8.0 μF 35 V
 - R1 — Resistor 1.0 kΩ 5%
 - L1 — Microstrip Line 50 Ω L = 12 mm
 - L2 — Microstrip Line 25 Ω L = 6 mm
 - R2 — Resistor 100 Ω 2.0 W
 - R3 — Chip Resistor 75 Ω 0805 5%
 - P1 — Trimmer 5.0 kΩ
 - T1 — Transistor BD135 or Similar
 - CH1 — Microstrip Line 80 Ω L = 23 mm
 - CH2 — 3 Turns Wire 8/10 ID 4 mm
 - D1, D2 — Diode 1N4148
 - L3 — Microstrip Line 25 Ω L = 6 mm
 - L4 — Microstrip Line 50 Ω L = 28 mm
 - Board Material — 1 50", Teflon Glass, Cu Clad 2 Sides, 35 μm Thick

Figure 1. 960 MHz Test Circuit

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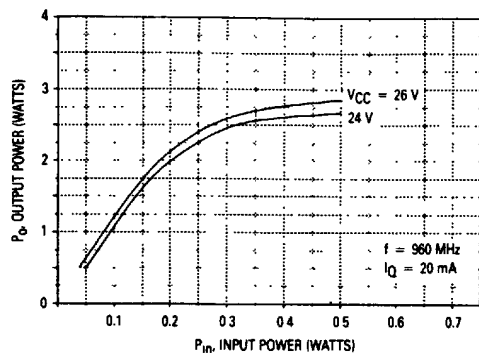
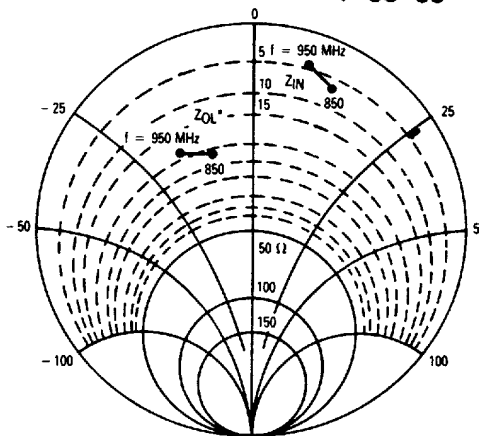


Figure 2. Output Power versus Input Power



$P_{out} = 2\text{ W}$ $V_{CE} = 24\text{ V}$

f MHz	Z_{IN} OHMS	Z_{OL}^* OHMS
850	$5.8 + j9.8$	$21.3 - j10$
900	$5.4 + j9$	$21 - j11$
950	$4.8 + j7.9$	$20 - j14$

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

Figure 3. Series Equivalent Input/Output Impedances

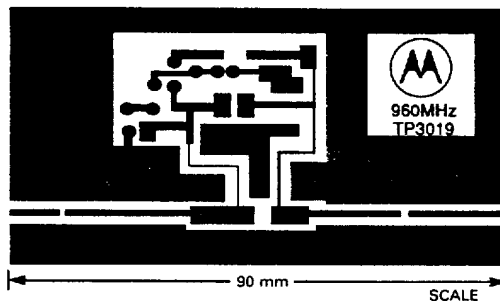


Figure 4. Test Circuit — Photomaster

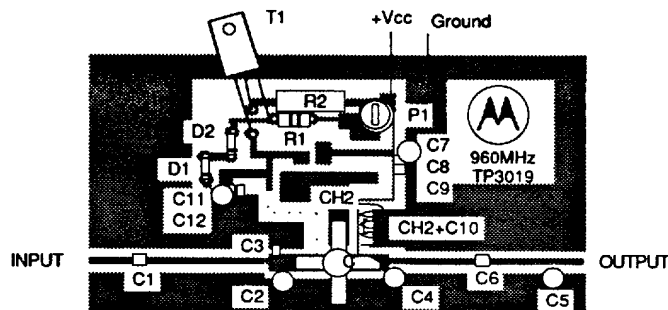


Figure 5. Test Circuit — Component Locations

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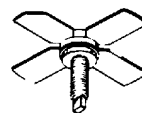
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*Advance Information***The RF Line****UHF Power Transistor**

The TP3020A is designed for use in the 900 MHz mobile radio band. Its high gain and ability to operate Class A makes it an ideal choice as a driver operating Class A, Class B or Class C.

- 960 MHz
- 2.2 W — P_{out}
- 26 V — V_{CC}
- High Gain — 9 dB, Class A

TP3020A
2.2 W — 960 MHz
UHF POWER
TRANSISTOR
NPN SILICON
2
CASE 244C-01, STYLE 1
(.280 SOE)
MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Emitter-Base Voltage	V_{EBO}	3.5	Vdc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	8.75 0.05	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 ($T_C = 70^\circ\text{C}$)	$R_{\theta JC}$	20	$^\circ\text{C/W}$

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

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Emitter-Base Breakdown Voltage ($I_E = 0.5\text{ mA}$, $I_C = 0$)	$V_{(BR)EBO}$	3.5	—	—	Vdc
Collector-Emitter Breakdown Voltage ($I_C = 10\text{ mA}$, $R_{BE} = 75\ \Omega$)	$V_{(BR)CER}$	40	—	—	Vdc
Collector Cutoff Current ($V_{CB} = 24\text{ V}$, $I_E = 0$)	I_{CBO}	—	—	0.5	mA _{dc}

ON CHARACTERISTICS

DC Current Gain ($I_C = 100\text{ mA}$, $V_{CE} = 5\text{ V}$)	h_{FE}	15	—	120	—
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DYNAMIC CHARACTERISTICS

Output Capacitance ($V_{CB} = 28\text{ V}$, $I_E = 0$, $f = 1\text{ MHz}$)	C_{ob}	—	—	5	pF
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FUNCTIONAL TESTS

Common-Emitter Amplifier Power Gain ($V_{CE} = 26\text{ V}$, $P_{out} = 2.2\text{ W}$, $f = 960\text{ MHz}$, $I_Q = 200\text{ mA}$)	G_{PE}	9.1	—	—	dB
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This document contains information on a new product. Specifications and information herein are subject to change without notice.

MOTOROLA RF DEVICE DATA

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