

**MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA**

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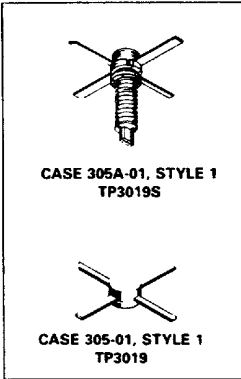
**The RF Line
UHF Power Transistors**

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**



MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V _{CER}	40	Vdc
Collector Base Voltage	V _{CBO}	50	Vdc
Emitter-Base Voltage	V _{EBO}	4.0	Vdc
Collector-Current — Continuous	I _C	1.0	Adc
Total Device Dissipation †† T _C = 25 C Derate above 25 C	P _D	12.5 0.15	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) at 70 C Case	R _{θJC}	14	C/W

ELECTRICAL CHARACTERISTICS (T_C = 25 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 _B = 0)	V _{(BR)EBO}	3.5	—	—	Vdc
Collector-Base Breakdown Voltage (I _E = 5.0 mA, I _B = 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

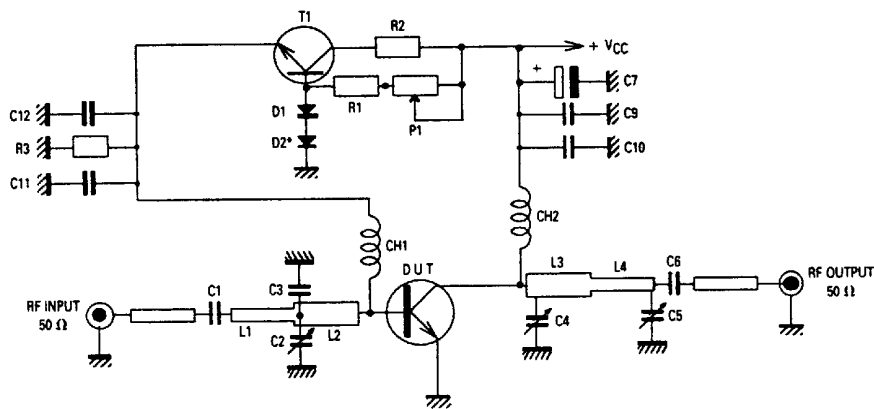
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ELECTRICAL CHARACTERISTICS — continued ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
DC Current Gain ($I_C = 1.0 \text{ A dc}, V_{CE} = 5.0 \text{ V dc}$)	h_{FE}	15	—	150	—
DYNAMIC CHARACTERISTICS					
Output Capacitance ($V_{CB} = 25 \text{ V}, I_E = 0, f = 1.0 \text{ MHz}$)	C_{ob}	—	—	4.0	pF
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain ($V_{CC} = 24 \text{ V}, P_{out} = 2.0 \text{ W}, I_{CQ} = 20 \text{ mA}$ ($f = 960 \text{ MHz}$))	G_p	9.0	—	—	dB
Load Mismatch at all Phase Angles ($V_{CC} = 24 \text{ V}, P_{out} = 2.0 \text{ W}, I_{CQ} = 20 \text{ mA}$) No degradation in Output Power	ψ	20:1	—	—	VSWR
Collector Efficiency ($V_{CC} = 24 \text{ V}, P_{out} = 2.0 \text{ W}, f = 960 \text{ MHz}$)	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 k Ω 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 k Ω
- T1 — Transistor BD135 or Similar
- CH1 — Microstrip Line 80 Ω L = 23 mm
- CH2 — 3 Turns Wire $\frac{8}{10}$ 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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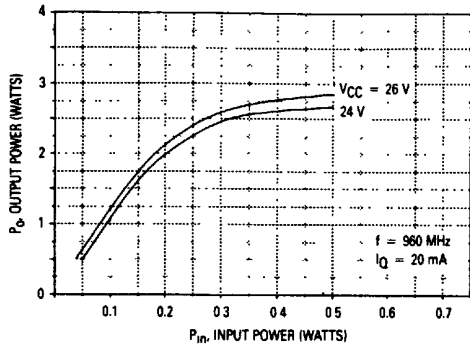
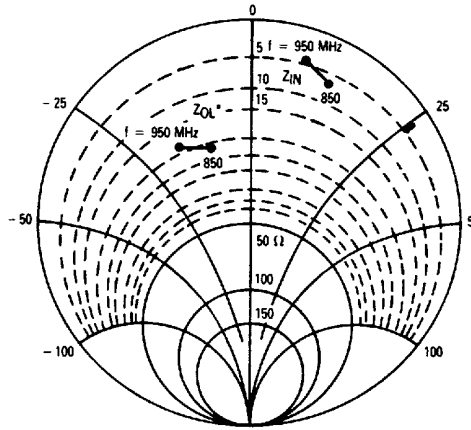


Figure 2. Output Power versus Input Power



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

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

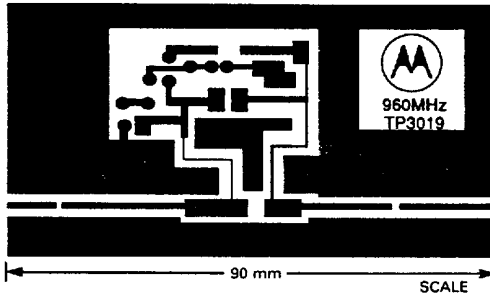


Figure 4. Test Circuit — Photomaster

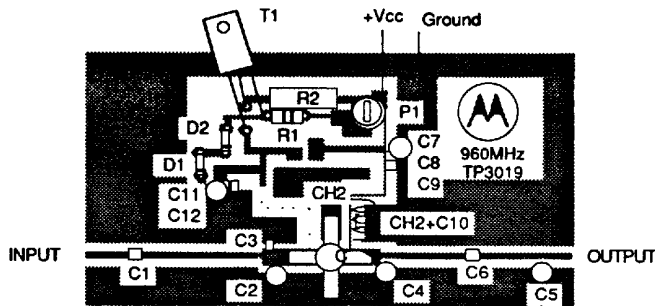


Figure 5. Test Circuit — Component Locations

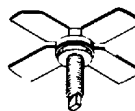
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TECHNICAL DATA

T-33-05

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
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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	mAdc

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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