T-33-05

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

TP3019
TP3019S

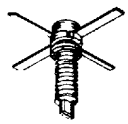
The RF Line
UHF Power Transistors

2

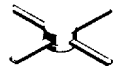
The TP3019 and TP3019S are designed for 24 V common emitter base station amplifiers. Operating in the 820–960 MHz bandwidth, they have been specifically designed for use in analog and digital (GSM) systems. The studless package version offers a good possibility for surface mounting.

- Specified 24 Volts, 960 MHz Characteristics
  Output Power = 2.0 Watts
  Minimum Gain = 9.0 dB
  Class AB
  I_Q = 20 mA

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_{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	$R_{\theta JC}$	14	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 = 5 0 mA, I_B 0)	$V_{(BR)CER}$	28	—	—	Vdc
Emitter-Base Breakdown Voltage (I_C 1 0 mAdc)	$V_{(BR)EBO}$	3 5	—	—	Vdc
Collector-Base Breakdown Voltage (I_E 5 0 mAdc)	$V_{(BR)CBO}$	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

(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
DC Current Gain (I_C = 1.0 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	15	—	150	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 25 V, I_E = 0, f = 1.0 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	—	%

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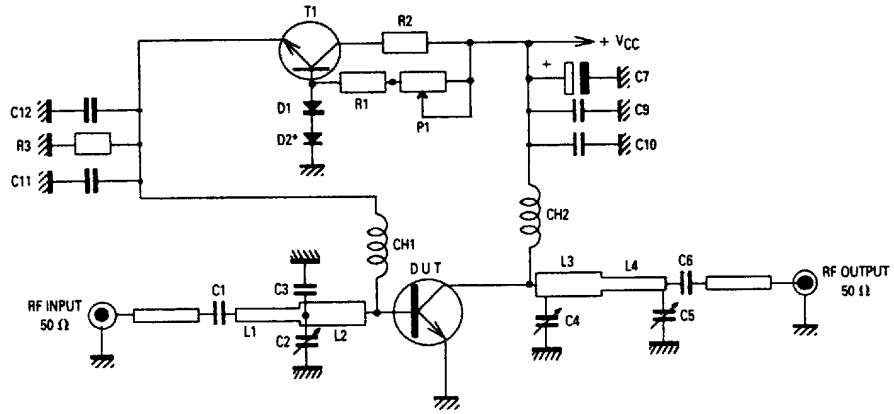


*Contact with RF Transistor

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

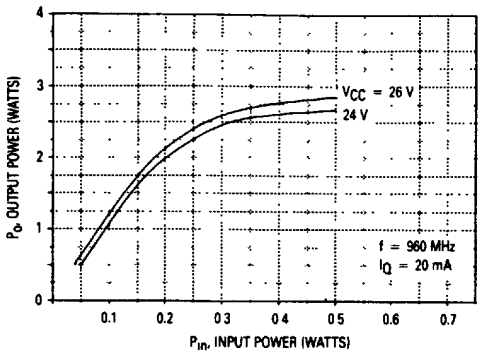
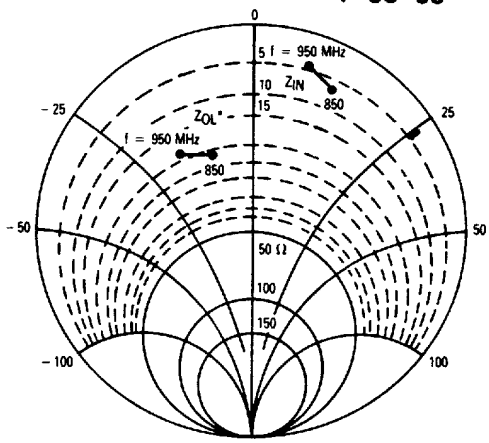


Figure 2. Output Power versus Input Power



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

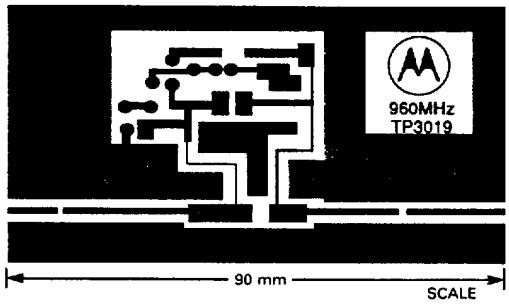


Figure 4. Test Circuit — Photomaster

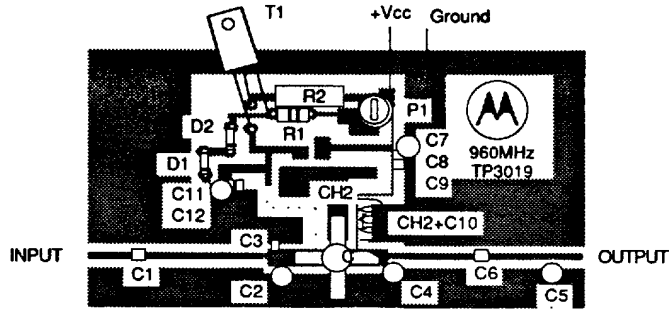


Figure 5. Test Circuit — Component Locations

MOTOROLA
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TECHNICAL DATA

T-33-05

TP3020A

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Advance Information

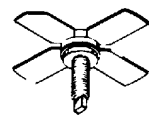
The RF Line

UHF Power Transistor

2.2 W — 960 MHz UHF POWER TRANSISTOR NPN SILICON

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



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°C Derate above 25°C	P_D	8.75 0.05	Watts W/°C
Operating Junction Temperature	T_J	200	°C
Storage Temperature Range	T_{stg}	−65 to +200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (T_C = 70°C)	$R_{\theta JC}$	20	°C/W

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Emitter-Base Breakdown Voltage (I_E = 0.5 mA, I_C = 0)	$V_{(BR)EBO}$	3.5	—	—	Vdc
Collector-Emitter Breakdown Voltage (I_C = 10 mA, R_{BE} = 75 Ω)	$V_{(BR)CER}$	40	—	—	Vdc
Collector Cutoff Current (V_{CB} = 24 V, I_E = 0)	I_{CBO}	—	—	0.5	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 100 mA, V_{CE} = 5 V)	h_{FE}	15	—	120	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 28 V, I_E = 0, f = 1 MHz)	C_{ob}	—	—	5	pF
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain (V_{CE} = 26 V, P_{out} = 2.2 W, f = 960 MHz, I_Q = 200 mA)	G_{PE}	9.1	—	—	dB

This document contains information on a new product. Specifications and information herein are subject to change without notice.