

# Traveling-Wave Tube

Frequency Range 1.7 to 2.7 GHz  
Integral Periodic-Permanent-Magnet Type

## ELECTRICAL

Heater, for Unipotential Cathode:

Voltage (ac or dc) . . . . .	6.3 ± 5%	V
Current at 6.3 volts . . . . .	1.75	A
Starting Current . . . . .	Must never exceed 4 amperes, even momentarily	
Minimum Cathode Heating Time . . . . .	3	minutes
Frequency Range . . . . .	1.7 to 2.7	GHz
Cold Insertion Loss . . . . .	60	dB
Input VSWR . . . . .	1.8:1 max.	
Output VSWR . . . . .	1.8:1 max.	
Noise Figure . . . . .	30 max.	dB
Gain (at 20 W output):		
1.8 to 2.4 GHz . . . . .	30 min.	dB
2.4 to 2.7 GHz . . . . .	29 min.	dB
Gain (at 16 W output)		
1.8 to 2.7 GHz . . . . .	30 min.	dB
Gain (at 17 W output)		
1.7 to 1.8 GHz . . . . .	29.5 min.	dB
Gain Compression (referenced to 5 W)		
at 10 W output . . . . .	1 max.	dB
at 20 W output		
1.8 to 2.4 GHz . . . . .	3 max.	dB
2.4 to 2.7 GHz . . . . .	4 max.	dB
at 17 W output		
1.7 to 1.8 GHz . . . . .	4 max.	dB
Phase Sensitivity (with Beam-Voltage Variation) . . . . .	2 max.	°/V
Bandwidth Flatness (over a 15-MHz segment) . . . . .	0.02 max.	dB/MHz

## MECHANICAL

Operating Position . . . . .		Any
Maximum Dimensions:		
Overall Length . . . . .	19	in
Height . . . . .	3.88	in
Width . . . . .	3.12	in
Shell Diameter . . . . .	3.62	in
Connectors:		
RF Input . . . . .	Type N Plug (UG-18 B/U)	
RF Output . . . . .	Type N Plug (UG-18 B/U)	
Terminal Leads . . . . .	See <i>Dimensional Outline</i>	
Weight (Approx.) . . . . .	6.5	lb

## RF POWER AMPLIFIER

## Absolute-Maximum Ratings

DC Collector Voltage . . . . .	3000 max.	V
DC Helix Voltage . . . . .	2500 max.	V
DC Grid-No.2 Voltage . . . . .	1700 max.	V
DC Collector Current . . . . .	80 max.	mA
DC Helix Current . . . . .	3 max.	mA
DC Grid-No.2 Current . . . . .	0.2 max.	mA
RF Power Input . . . . .	5 max.	W

## Typical Operation at 2.0 GHz

DC Collector Voltage . . . . .	2200	V
DC Helix Voltage . . . . .	2200	V
DC Grid-No.2 Voltage . . . . .	1500	V
DC Collector Current . . . . .	70	mA
DC Helix Current . . . . .	0.25	mA
DC Grid-No.2 Current . . . . .	0.25	mA
Input VSWR . . . . .	1.5:1	
Output VSWR . . . . .	1.5:1	
RF Power Input . . . . .	20	mW
Saturated Power Output . . . . .	20	W

## CHARACTERISTICS RANGE VALUES

	Note	Min.	Max.	
Heater Current . . . . .	1	—	2	A
DC Collector Voltage . . . . .	2,3	1800	2500	V
DC Helix Voltage . . . . .	2,3	1800	2500	V
DC Grid-No.2 Voltage . . . . .	3	1150	1600	V
DC Collector Current . . . . .	3	60	75	mA
DC Helix Current . . . . .	3	—	1.1	mA
DC Grid-No.2 Current . . . . .	—	—	1	mA

**Note 1:** With heater voltage of 6.3 volts.

**Note 2:** Normally the tube is operated with the helix voltage equal to the collector voltage.

**Note 3:** Specific operating value is supplied with each tube.

## OPERATING CONSIDERATIONS

The magnetic field required to focus the electron beam in the 4054 is supplied by integral periodic permanent magnets. Although the periodic-magnet structure is difficult to demagnetize, and has little stray field, care should be taken to prevent the presence of any appreciable external transverse magnetic field which might cause defocusing of the electron beam within

the tube. Magnetic material should be kept at least eight inches away from the tube.

Impedance match between the 4054 rf power output and the load should have a voltage standing wave ratio (VSWR) no greater than 2:1. With VSWR's in excess of 2:1, oscillations may occur causing permanent damage to the tube. Tubes should not be operated without a termination.

Forced-air cooling on the collector is necessary whenever collector current is flowing. Failure to observe this precaution may result in permanent damage to the tube. It is recommended that the forced-air cooling be applied when the heater power is applied.

The power supply should incorporate a helix-current overload protective device to prevent damage to the tube in the event of loss of collector voltage. Such a condition would cause the entire electron beam current to flow to the helix and thereby overheat that electrode. If it is desired to remove all voltages by a single control, the time-constant values of the power supply should be chosen so that the helix voltage decays faster than the collector voltage.

As the grid-No.2 voltage increases from zero to the operating value, the helix current may reach as high as 10 milliamperes with grid-No.2 voltage in the range of 200 to 600 volts, then will fall below 2 milliamperes at the proper operating grid-No.2 voltage. The helix supply should have adequate regulation to handle this transient during the turn-on procedure. To protect the tube, it is recommended that an interlock be incorporated in the helix supply to open the circuit if the helix current exceeds 3 milliamperes longer than a few milliseconds.

*Mounting.* The 4054 may be mounted in any position by means of bolts through either set of holes in the two mounting blocks.

*Electrical connections* are made to the 4054 by means of the five leads. These color-coded, flexible, insulated leads are identified on the *Dimensional*

*Outline.* The rf input and output connections are made to type N plugs (UG-18 B/U) on the tube (see *Dimensional Outline*). The collector is connected to the capsule and is normally grounded.

The rated values for collector voltage, helix voltage, and grid-No.2 voltage are high enough to be dangerous to the user. Care should be taken during adjustment of circuits, especially when exposed circuit parts are at a high dc potential.

#### Starting Procedure

Voltages should be applied to the 4054 in the following sequence: Apply the rated heater voltage and allow tube to warm-up for 3 minutes minimum. Then apply the collector voltage as specified on the tube label. Next, apply the helix voltage as specified on the tube label. Finally, increase the grid-No.2 voltage in a few milliseconds to obtain the collector current specified on the tube label. The three power supplies can be controlled by one switch provided there is a sufficient delay in application of the grid-No.2 voltage to allow the collector and helix voltages to stabilize first.

#### Turn-Off Procedure

To turn off the tube, remove the electrode voltages in the following sequence: First reduce the grid-No.2 voltage, then remove the helix voltage, collector voltage, and heater voltage in that order. The three power supplies can be controlled by one switch provided the grid-No.2 voltage decays faster than the collector and helix voltages.

#### FLEXIBLE LEAD COLOR CODE (See Dimensional Outline)

<b>Brown:</b>	Heater
<b>Yellow:</b>	Heater-Cathode
<b>Orange:</b>	Helix
<b>Blue:</b>	Grid No.2 (Anode)
<b>Black:</b>	Collector (Ground)

## DIMENSIONAL OUTLINE (Dimensions In Inches)

