Traveling-Wave Tube

HELIX-TRANSMISSION-LINE TYPE

FREQUENCY RANGE
1—2 Gc (L-Band)

INTEGRAL PERIODIC-PERMANENT-MAGNET TYPE

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 5%	volts
Current at heater volts = 6.3	1.75	amp
Starting Current . . . . . Must never exceed 4 amperes, even momentarily		
Minimum Cathode Heating Time	3	minutes
Frequency Range	1 to 2	Gc
Cold Insertion Loss	60	db
Thermostatic Switch:		
Current rating:		
At 125 volts ac		6 amp
At 240 volts ac		3 amp
Input VSWR	1.8:1 max.	
Output VSWR	1.8:1 max.	

Mechanical:

Operating Position	Any
Maximum Overall Length	20.50"
Maximum Height	3.875"
Maximum Width	3.125"
Maximum Shell Diameter	1.625"
Weight (Approx.)	6.5 pounds
Connectors:	
RF Input	Type N Plug (UG-18 B/U)
RF Output	Type N Plug (UG-18 B/U)
Terminal Leads	See accompanying *Dimensional Outline*

Thermal:

Collector Temperature[a]	225 max.	°C
Air Flow into Radiator	25 min.	cfm

RF POWER AMPLIFIER

Maximum Ratings, *Absolute-Maximum Values:*

DC Collector Voltage	3000	volts
DC Helix Voltage	2500	volts
DC Grid-No.2 Voltage	1700	volts
DC Collector Current	80	ma
DC Helix Current	3	ma
DC Grid-No.2 Current	1	ma
RF Power Input	5	watts

[a] The thermostatic switch will open when collector temperature exceeds 225°C.

Typical Operation at 1.4Gc:

DC Collector Voltage	2200	volts
DC Helix Voltage	2200	volts
DC Grid-No.2 Voltage	1500	volts
DC Collector Current	70	ma
DC Helix Current	0.25	ma
DC Grid-No.2 Current	0.25	ma
Gain at 10 Watts	28	db
Saturated Power Output	13	watts

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
Heater Current	1	–	2	amp
DC Collector Voltage	2,3	1800	2500	volts
DC Helix Voltage	2,3	1800	2500	volts
DC Grid-No.2 Voltage	3	1150	1600	volts
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 volts = 6.3.

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 4053 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 4053 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 this value, oscillations may occur causing permanent damage to the tube. Tubes should not be operated without a termination.

Forced-air cooling of 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.

A thermostatic switch is mounted on the collector of the 4053 which opens when the collector temperature exceeds a safe limit. It is recommended that the thermostatic switch be used in an interlock circuit in the power supply for the collector, helix, and grid-No.2 voltages. The thermostatic switch will carry 6 amperes at 125 volts ac or 3 amperes at 240 volts ac.

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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 ma in the vicinity of 200 to 600 volts on grid No.2, then will fall below 2 ma at the proper operating grid-No.2 voltage. The helix supply should have adequate regulation to handle this transient during the turn on procedure. In order to protect the tube, the helix supply should also have an interlock to open the circuit if the helix current exceeds 3 ma longer than a few milliseconds.

Mounting. The 4053 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 4053 by means of the seven leads. These color-coded, flexible, insulated leads are identified on the *Dimensional Outline.* 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.

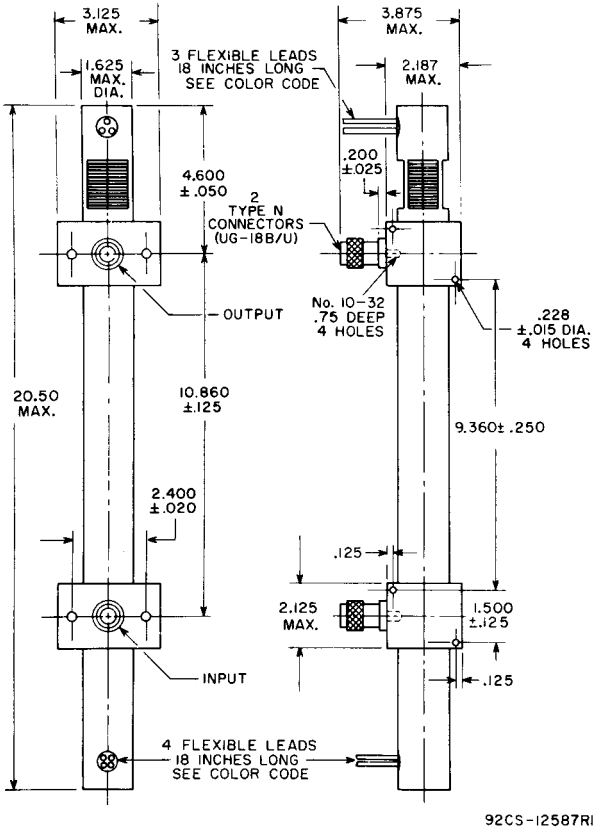
STARTING PROCEDURE

Voltages should be applied to the 4053 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.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

COLOR CODE OF LEADS

HEATER	Brown
HEATER, CATHODE, GRID No.1	Yellow
HELIX	Orange
GRID No.2	Blue
COLLECTOR, SHELL	Black
THERMOSTATIC SWITCH (2)	White

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