N20143
Travelling Wave Tube

DESCRIPTION

The N20143 is an X-band helix travelling wave tube. It is capable of providing a minimum of 80 W output power and operates over the frequency band 9 – 11 GHz. Saturation gain is typically 47 dB.

The TWT incorporates a dual stage collector, providing high overall efficiency and focus electrode grid switch that enables the TWT to be operated in either pulsed or CW mode. The design also includes convergent electron gun, PPM focusing and conduction cooling.

The N20143 is small and lightweight. It has been designed to meet the most demanding environmental conditions.

This TWT is one of a range of mini- and midi-types designed by e2v technologies using the latest CAD methods to achieve optimised reliability and performance.

Other devices in the range include multi-octave bandwidth, 3-stage and single-stage collectors, low gain power booster variants and air-cooled versions.

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Min	Typ	Max	Units
Heater					
Voltage	V_f	-6.0	-6.3	-6.6	V
Current	I_f			0.92	A
Warm-up time		90			s
Surge current				1.5	A
Helix					
Voltage	V_{hx}	4.45	4.50	4.55	kV
Current	I_{hx}	0	6	20	mA
Focus Electrode					
Beam-on voltage	V_{fe}	-12	0	0	V
Beam-off voltage	V_{feo}	-1000	-1100	-1200	V
Capacitance				20	pF
Collector					
Collector 1 voltage	V_{c1}	2.25	2.30	2.35	kV
Collector 2 voltage	V_{c2}	1.40	1.45	1.50	kV
Collector 1 current	I_{c1}	2		100	mA
Collector 2 current	I_{c2}	20	160	180	mA
Dissipation				300	W
Prime power				340	W

Note

All electrode voltages are referenced to cathode potential. The TWT is to be operated with the helix grounded and the collectors depressed.

RF PERFORMANCE

Frequency Range

9.0 to 11 GHz.

Small Signal Gain

Small signal gain performance shall be 52 dB min.

RF Output Power

The RF output power shall be 49 dBm minimum across the operating band.

Maximum Drive for Rated Output Power

Maximum drive required to achieve rated output power shall be +5 dBm.

VSWR

Input VSWR ..... 2.5:1 max
Output VSWR ..... 2.5:1 max

Harmonics

When operated at saturated output power and with the TWT terminated into a matched load, the second harmonics shall be less than –10 dBc.

Spurious Outputs

Spurious outputs from the TWT other than harmonic power and phase noise sidebands shall be no more than –50 dBc relative to the saturated fundamental level.

Noise Power Output

The noise power output, with the input terminated in 50 Ω and the beam on, shall not exceed –27 dBm/MHz.

Phase

Phase Pushing

Maximum phase variation with respect to electrode voltages and RF drive shall not exceed the figure specified in the following table.

Variable	Phase Pushing Figure
Heater voltage ±0.3 V	10 °/V
Focus electrode voltage ±2.5 V	3 °/V
Cathode voltage ±25 V	1.5 °/V
Collector voltage ±100 V	0.015 °/V
RF input power (P_{sat} –18 dB to P_{sat} + 2 dB)	3.5 °/dB

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MECHANICAL

RF Connectors

Input.....SMA male
Output.....TNC male

Wiring

Element	Colour	Wire Type
Heater	Brown	18 kV rated, silicone coated FEP
Cathode	Yellow	18 kV rated, silicone coated FEP
Focus Electrode	Green	18 kV rated, silicone coated FEP
Collector 1	Red	15 kV rated, lossy, FEP
Collector 2	White	15 kV rated, lossy, FEP

Weight

Total weight of the TWT shall not exceed 280 g.

ENVIRONMENTAL CONDITIONS

The unit shall satisfy the specified performance requirements under any combination of environmental conditions defined below.

Temperature Range

Operating
The TWT shall meet the RF Performance requirements specified on page 1 when the temperature of the TWT baseplate is within the range –54 °C to +140 °C.

Non-Operating
The TWT shall not be damaged after being subjected to a non-operational temperature range of –54 °C to +100 °C.

Altitude

The TWT shall operate in the range between sea level and 21,336 m (70,000 feet).

HEALTH AND SAFETY HAZARDS

e2v technologies electronic devices are safe to handle and operate provided that the relevant precautions stated herein are observed. e2v technologies does not accept responsibility for damage or injury resulting from the use electronic devices it produces. Equipment manufacturers and users must ensure that adequate precautions are taken. Appropriate warning labels and notices must be provided on equipment incorporating e2v technologies devices and in operating manuals.

High Voltage

Equipment must be designed so that operators cannot come into contact with high voltage circuits. Tube enclosures should have fail-safe interlocked switches to disconnect the primary power supply and discharge all high voltage capacitors before allowing access.

RF Radiation

Personnel must not be exposed to excessive RF radiation. All RF connectors must be correctly fitted before operation, so that no leakage of RF energy can occur, and the RF output must be correctly terminated.

X-Ray Radiation

The operating voltage of this device results in the emission of X-rays. The maximum penetrating ability of the X-rays may correspond to a voltage approximately twice the applied voltage. Shielding is required.

Beryllium Oxide Ceramics

This tube contains beryllium oxide ceramic parts, which are not accessible unless the metal casing of the tube is damaged or removed. *Beryllium oxide dust or fumes are highly toxic if inhaled, or if particles enter a cut or abrasion.* Consult e2v technologies regarding the disposal of damaged or life-expired tubes.

OUTLINE

(All dimensions in millimetres; dimensions without limits are nominal)