

DESCRIPTION

The N10172B is a broadband helix travelling wave tube. It is capable of providing 100 W output power and operates over the frequency band 4.5 – 18 GHz. Saturation gain is typically 24 dB.

The TWT incorporates a dual stage collector, providing high overall efficiency. It also features a focus electrode grid switch that enables the TWT to be operated in either pulsed or CW mode.

The N10172B is small and lightweight. It has been designed to meet MIL-STD specifications for use in rugged environments.

This TWT is one out of a range of mini- and midi-types that have been designed by e2v technologies using the latest CAD methods to achieve optimised reliability and performance, whilst operating in the most demanding of environments.

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Min	Typ	Max	Units
Heater					
Voltage	V_f	-6.0	-6.3	-6.6	V
Current	I_f		0.7		A
Warm-up time		90			s
Surge current limit				1.5	A
Helix					
Voltage	V_{hx}	4.50	4.55	4.60	kV
Current	I_{hx}	0	6	20	mA
Collector					
Collector 1 voltage	V_{c1}	2.40	2.45	2.50	kV
Collector 2 voltage	V_{c2}	1.53	1.58	1.63	kV
Collector 1 current	I_{c1}	2		140	mA
Collector 2 current	I_{c2}	20	180	200	mA
Focus Electrode					
Beam-on voltage	V_{fe}	-12	0	0	V
Beam-off voltage	V_{feo}	-1.0	-1.1	-1.2	kV
Capacitance				20	pF
Prime power				440	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

The electrical and RF performance specified herein shall apply over the frequency range from 4.5 to 18 GHz.

Small Signal Gain

Small signal gain performance shall be as specified in the following table with straight-line approximations between frequency points.

Frequency (GHz)	Minimum Gain (dB)	Maximum Gain (dB)
4.5	25.5	32.5
5	29.5	36.5
6	35.0	42.0
7	38.5	45.5
8	41.0	48.0
9	44.0	51.0
10	45.0	52.0
11	45.0	52.0
12	44.5	51.5
13	43.5	50.5
14	42.0	49.0
15	40.0	47.0
16	38.0	45.0
17	35.0	42.0
18	32.5	39.5

RF Output Power

The RF output power shall meet the minimum and maximum values specified as a straight line approximation between the frequency points defined in the following table.

Frequency (GHz)	Minimum RF Output Power (W)
4.5	25
5	50
6	80
7	100
8	115
9	125
10	115
11	100
12	90
13	90
14	90
15	90
16	85
17	80
18	75

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e2v technologies (uk) limited, Waterhouse Lane, Chelmsford, Essex CM1 2QU United Kingdom Holding Company: e2v technologies plc

Telephone: +44 (0)1245 493493 Facsimile: +44 (0)1245 492492

Contact e2v by e-mail: enquiries@e2v.com or visit www.e2v.com for global sales and operations centres.

Maximum Drive for Rated Output Power

Frequency (GHz)	Maximum RF Input Power (dBm)
4.5	26.51
5	23.88
6	21.88
7	19.47
8	16.78
9	12.98
10	12.11
11	12.39
12	12.89
13	14.51
14	15.42
15	17.20
16	19.73
17	21.83
18	24.28

VSWR

Input VSWR 2.6:1 max
 Output VSWR 2.6:1 max

Harmonics

When operated at saturated output power and with the TWT terminated into a matched load, the second harmonics shall be less than specified in the following table.

Frequency (GHz)	Second Harmonic Level (dBc)
4.5	3.0
6	-2.0
8	-5.0
10	-10.0

Spurious Outputs

Spurious outputs from the TWT other than harmonic power and phase noise sidebands shall be no more than -30 dBc relative to the saturated fundamental level.

Noise Power Output

Frequency (GHz)	Maximum RF Noise Power Output (dBm/MHz)
4.5	-46
5	-45
6	-43
7	-40
8	-37
9	-35
10	-35
11	-35
12	-35
13	-35
14	-36
15	-38
16	-41
17	-44
18	-46

Beam 'OFF' Noise

Noise power output from the TWT in the beam 'off' condition (Vfe = -1100 V) shall be no more than -95 dBm/MHz.

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
Anode	Blue	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 350 g.

ENVIRONMENTAL CONDITIONS

The unit shall satisfy the specified performance requirements within the conditions or combination of the environments defined in the applicable documents.

Temperature Range

Operating

The TWT shall meet the RF Performance requirements specified on page 1 when the temperature of the TWT collector 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.

Applicable Documents

MIL-STD-202 Test Methods for Electronic and Electrical Component Parts.

MIL-STD-810 Environmental Test Methods.

MIL-HDK-454 Standard General Requirements for Electrical Equipment.

MIL-HDK-217 Reliability Prediction of Electronic Equipment

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 of 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 nominal and in millimetres)

