E2V Technologies
CX1191D
Deuterium Thyratron

The data to be read in conjunction with the Hydrogen Thyratron Preamble.

ABRIDGED DATA

Deuterium-filled tetrode thyratron of ruggedised construction, suitable for use in airborne or mobile military radar systems. It is used for switching peak powers up to 8.0 MW at high repetition rates under a wide range of operating conditions. It has a rugged, internally connected reservoir. Samples are subjected to extensive environmental test procedures including vibration at 2g from 50 to 200 Hz.

Peak forward anode voltage	35	kV max
Peak anode current	500	A max
Average anode current	0.5	A max
Anode heating factor	8.0×10^9	VApps max
Peak output power	8.0	MW max

GENERAL

Electrical

Cathode (connected internally to one end of heater)		oxide coated
Heater voltage	$6.3 \pm 7\,^1/_2\%$	V
Heater current	12.5	A
Tube heating time (minimum) (see note 1)	5.0	min
Inter-electrode capacitances (approximate):		
anode to grid 2 (grid 1 and cathode not connected)	9.0	pF
anode to grid 1 (grid 2 and cathode not connected)	4.5	pF
anode to cathode (grid 1 and grid 2 not connected)	18	pF

Mechanical

Overall length	223.8 mm (8.812 inches) max
Overall diameter	65.1 mm (2.562 inches) max
Net weight	340 g (12 ounces) approx
Mounting position (see note 2)	any
Base	B4D, bayonet
Top cap	BS448-CT3

Cooling (See note 3) . . . . . natural

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PULSE MODULATOR SERVICE MAXIMUM AND MINIMUM RATINGS (Absolute values)

	Min	Max	
Anode			
Peak forward anode voltage (see note 1)	–	35	kV
Peak inverse anode voltage (see note 4)	–	10	kV
Peak anode current	–	500	A
Average anode current	–	0.5	A
Rate of rise of anode current (see note 5)	–	2500	A/μs
Anode heating factor	–	8.0×10^9	VApps
Grid 2			
Unloaded grid 2 drive pulse voltage (see note 6)	200	750	V
Grid 2 pulse duration	1.0	–	μs
Rate of rise of grid 2 pulse (see note 5)	1.0	–	kV/μs
Grid 2 pulse delay	0.5	3.0	μs
Peak inverse grid 2 voltage	–	200	V
Loaded grid 2 bias voltage	−50	−120	V
Forward impedance of grid 2 drive circuit	100	1000	Ω
Grid 1 – DC Primed (See note 7)			
DC grid 1 unloaded priming voltage	75	150	V
DC grid 1 priming current	50	100	mA
Grid 1 – Pulsed			
Unloaded grid 1 drive pulse voltage (see note 6)	300	750	V
Grid 1 pulse duration	2.0	–	μs
Rate of rise of grid 1 pulse (see note 5)	1.0	–	kV/μs
Peak inverse grid 1 voltage	–	200	V
Loaded grid 1 bias voltage		see note 8	
Peak grid 1 drive current	0.3	1.0	A
Cathode			
Heater voltage	$6.3 \pm 7\,^1/_2\%$		V
Tube heating time (see note 1)	5.0	–	min
Environmental			
Environmental performance		see note 9	
Ambient temperature	−55	+90	°C
Altitude	–	3	km
	–	10 000	ft

CHARACTERISTICS

	Min	Typical	Max	
Critical DC anode voltage for conduction (see note 10)	–	0.3	1.0	kV
Anode delay time (see notes 10 and 11)	–	0.15	0.25	μs
Anode delay time drift (see notes 10, 12 and 13)	–	20	50	ns
Time jitter (see notes 10 and 13)	–	1.0	5.0	ns
Heater current (at 6.3 V)	11	12.5	13	A

RATINGS FOR SINGLE-SHOT OR CROWBAR SERVICE (See note 7)

DC forward anode voltage (see note 1)	35	kV max
Peak anode current	5000	A max
Product of peak current and pulse duration	0.2	A.s max
Repetition frequency	1 pulse per 10 s	max

NOTES

1. The maximum permissible peak forward voltage for instantaneous starting is 20 kV and there must be no overshoot.

   For single-shot and crowbar applications, each tube is tested to withstand 35 kV DC at 6.3 V heater voltage for 10 minutes, with 100 mA grid 1 drive current and −100 V grid 2 bias.
2. Clamping is only permissible by the base.
3. In some applications, air cooling may be necessary to prevent the base temperature from exceeding 200 °C.
4. The peak inverse voltage must not exceed 25 kV for the first 25 μs after the anode pulse.
5. The rate of rise refers to that part of the leading edge of the pulse between 25% and 75% of the pulse amplitude.
6. Measured with respect to cathode. In certain cases the maximum drive pulse voltage may be exceeded without damage to the tube; a maximum value of 2.5 kV is then recommended. When grid 1 is pulse driven, the last 0.25 μs of the top of the grid 1 pulse must overlap the corresponding first 0.25 μs of the top of the delayed grid 2 pulse.
7. When DC priming is used on grid 1, a negative bias of 100 to 200 V must be applied to grid 2 to ensure anode voltage hold-off. DC priming is recommended for pulse modulator and crowbar service.
8. DC negative bias voltages must not be applied to grid 1. When grid 1 is pulse driven, the potential of grid 1 may vary between −10 and +5 V with respect to cathode potential during the period between the completion of recovery and the commencement of the succeeding grid pulse.

9. All tubes are subjected to an acceleration of 10 g at 50 Hz before testing. In addition, samples are tested under the following conditions:
   (a) **Linear Acceleration** 12 g (min) is applied and maintained for 1 minute at right angles to and in each direction along the major axis of the tube. A heater voltage of 6.3 V is applied during the test.
   (b) **Resonance Search** Vibration is applied in two mutually perpendicular directions, one of which is parallel to the longitudinal axis of the tube. The frequency is swept at a rate not exceeding one octave per minute between 10 and 200 Hz, with accelerations of 2 g (min). All resonances detectable visually or electrically are noted for information and also for use in test (c). Normal operating voltages are applied during the test.
   (c) **Vibration Fatigue** Each tube is subjected to vibration for two periods of ten hours. In one period the direction of vibration is parallel to the longitudinal axis of the tube, and in the other the direction is perpendicular to the longitudinal axis of the tube. An acceleration of 2 g is used and the frequency is that of the strongest resonance detected during the resonance search. If no resonances were detected in the search, then a frequency of 150 Hz is used. A heater voltage of 6.3 V is applied during the test.

   Tubes must pass operational tests after the above procedure has been completed.
10. Typical figures are obtained on test using conditions of minimum grid drive. Improved performance can be expected by increasing the grid drive.
11. The time interval between the instant at which the rising unloaded grid 2 pulse reaches 25% of its pulse amplitude and the instant when anode conduction takes place.
12. The drift in delay time over a period from 10 seconds to 10 minutes after reaching full voltage.
13. For equipment where jitter and anode delay time drift are not important, the tube may be triggered by applying a single pulse to grid 2 and connecting grid 1 to grid 2 via a 1000 pF capacitor shunted by a 0.1 MΩ resistor.
14. For screened grid operation, grid 2 may be connected to cathode provided that a low impedance grid drive pulse (say 50 Ω) is used. Under these conditions the critical DC anode voltage for conduction may be higher than normal.

HEALTH AND SAFETY HAZARDS

E2V Technologies hydrogen thyratrons 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 equipments incorporating E2V Technologies devices and in operating manuals.

High Voltage

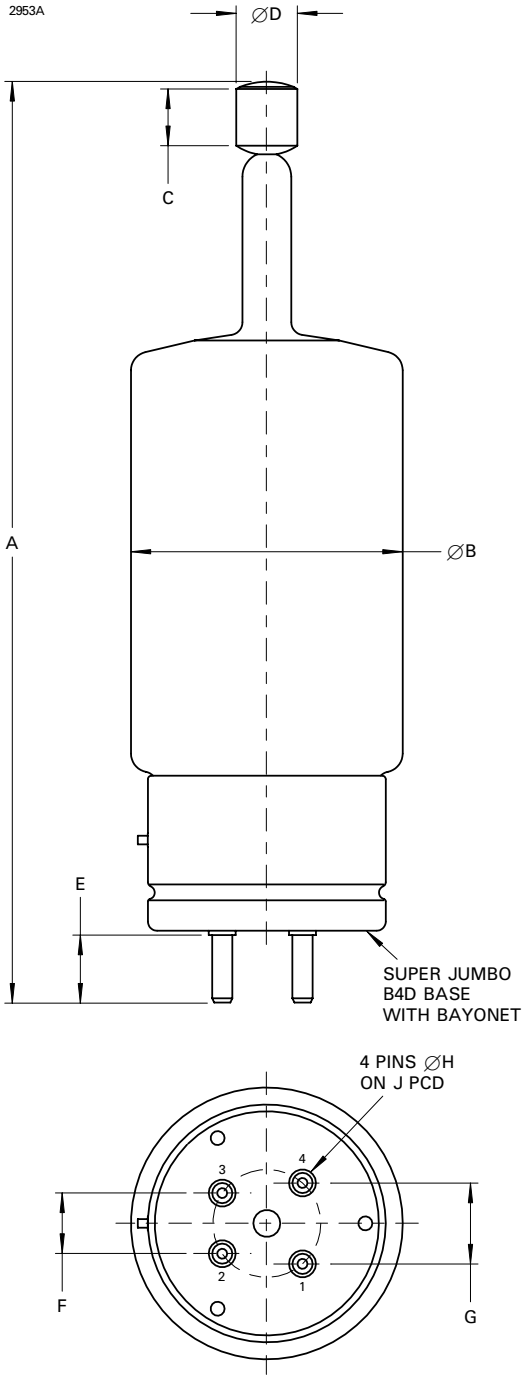
Equipment must be designed so that personnel cannot come into contact with high voltage circuits. All high voltage circuits and terminals must be enclosed and fail-safe interlock switches must be fitted to disconnect the primary power supply and discharge all high voltage capacitors and other stored charges before allowing access. Interlock switches must not be bypassed to allow operation with access doors open.

X-Ray Radiation

All high voltage devices produce X-rays during operation and may require shielding. The X-ray radiation from hydrogen thyratrons is usually reduced to a safe level by enclosing the equipment or shielding the thyratron with at least 1.6 mm ($^{1}/_{16}$ inch) thick steel panels.

Users and equipment manufacturers must check the radiation level under their maximum operating conditions.

OUTLINE
(All dimensions without limits are nominal)



Ref	Millimetres	Inches
A	217.5 ± 6.4	8.562 ± 0.250
B	65.08 max	2.562 max
C	12.7 min	0.500 min
D	14.38 ± 0.18	0.566 ± 0.007
E	15.88	0.625
F	14.28	0.562
G	19.05	0.750
H	4.750 ± 0.076	0.187 ± 0.003
J	25.4	1.000

Millimetre dimensions have been derived from inches.

Pin	Element
1	Grid 1
2	Heater, cathode
3	Heater
4	Grid 2
Top cap	Anode

