E2V Technologies
CX1135
Hydrogen-Filled Ceramic Thyratron

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

ABRIDGED DATA

Hydrogen-filled tetrode thyratron with ceramic/metal envelope, featuring low jitter, firing time and drift. Suitable for switching high power at very high pulse repetition rates or for switching long pulses. A hydrogen reservoir operating from a separate supply is incorporated.

Peak forward anode voltage	25	kV max
Peak anode current	1500	A max
Average anode current	1.25	A max

GENERAL

Electrical

Cathode (connected internally to one end of heater)	oxide coated	
Cathode heater voltage	6.3 ± 5%	V
Cathode heater current	22	A
Reservoir heater voltage (see note 1)	6.3 ± 5%	V
Reservoir heater current	2.5	A
Tube heating time (minimum)	10.0	min
Anode to grid 2 capacitance	15 to 20	pF

Mechanical

Seated height	157 mm (6.181 inches) max
Clearance required below mounting flange	38.1 mm (1.500 inches) min
Overall diameter (mounting flange)	88.9 mm (3.500 inches) nom
Net weight	1.5 kg (3.3 pounds) approx
Mounting position (see note 2)	any
Tube connections	see outline

Cooling . . . . . forced-air or liquid
Liquid . . . . . oil or coolant immersion
Forced-air . . . . . see below

The tube may be cooled by forced-air directed mainly onto the base, and the ceramic envelope should be maintained below the maximum rated temperature. An air flow of at least 1.41 m^3/min (50 ft^3/min), depending on the mechanical layout, will be necessary to keep the tube operating temperatures under the limits specified below.

In addition to 160 W of heater power, the tube dissipates from 50 W per ampere average anode current, rising to 150 W/A at the highest rates of rise and fall of anode current.

The cathode end of the tube must be cooled whenever heater voltages are applied, since the cathode flange will reach a temperature of 120 °C above ambient in the absence of cooling.

Envelope temperature:		
ceramic, anode and grid	150	°C max
cathode flange and base	120	°C max

E2V Technologies Limited, Waterhouse Lane, Chelmsford, Essex CM1 2QU England Telephone: +44 (0)1245 493493 Facsimile: +44 (0)1245 492492
e-mail: enquiries@e2vtechnologies.com Internet: www.e2vtechnologies.com Holding Company: Redwood 2002 Limited

E2V Technologies Inc. 4 Westchester Plaza, PO Box 1482, Elmsford, NY10523-1482 USA Telephone: (914) 592-6050 Facsimile: (914) 592-5148
e-mail: enquiries@e2vtechnologies.us

MAXIMUM AND MINIMUM RATINGS
(Absolute values)

These ratings cannot necessarily be used simultaneously, and no individual rating must be exceeded.

	Min	Typical	Max	
Anode (Pulse Modulator Service)				
Peak forward anode voltage	–	–	25	kV
Peak inverse anode voltage (see note 3)	–	–	25	kV
Peak anode current	–	1500	–	A
Average anode current	–	–	1.25	A
Rate of rise of anode current (see notes 4 and 5)	–	5000	–	A/μs
Pulse repetition rate	–	–	25	kHz

	Min	Max	
Grid 2			
Unloaded grid 2 drive pulse voltage (see note 6)	200	1000	V
Grid 2 pulse duration	1.0	–	μs
Rate of rise of grid 2 pulse (see note 5)	10	–	kV/μs
Grid 2 pulse delay	0.5	3.0	μs
Peak inverse grid 2 voltage	–	450	V
Loaded grid 2 bias voltage	−50	−200	V
Forward impedance of grid 2 drive circuit	50	1000	Ω
Grid 1 - Pulsed			
Unloaded grid 1 drive pulse voltage (see note 6)	300	1000	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	–	450	V
Loaded grid 1 bias voltage	see note 7		
Peak grid 1 drive current	1.0	10.0	A
Grid 1 - DC Primed (See note 8)			
DC grid 1 unloaded priming voltage	75	150	V
DC grid 1 priming current	50	150	mA
Cathode			
Heater voltage	6.3 ± 5%		V
Heating time	10.0	–	min
Reservoir			
Heater voltage (see note 1)	6.3 ± 5%		V
Heating time	10.0	–	min
Environmental			
Ambient temperature	−50	+90	°C
Altitude	–	3	km
	–	10 000	ft

CHARACTERISTICS

	Min	Typical	Max	
Critical DC anode voltage for conduction (see note 9)	–	0.3	1.0	kV
Anode delay time (see notes 9 and 10)	–	0.1	0.3	μs
Anode delay time drift (see notes 9 and 11)	–	20	50	ns
Time jitter (see note 9)	–	1.0	5.0	ns
Cathode heater current (at 6.3 V)	18	22	25	A
Reservoir heater current (at 6.3 V)	–	2.5	–	A

NOTES

1. The reservoir heater must be decoupled with a suitable capacitor to avoid damage by spike voltages.
2. The tube must be mounted by means of its mounting flange.
3. The peak inverse voltage including spike must not exceed 10 kV for the first 25 μs after the anode pulse. Amplitude and rate of rise of inverse voltage contribute greatly to tube dissipation and electrode damage; if these are not minimised in the circuit, tube life will be shortened considerably. The aim should be for an inverse voltage of 3 - 5 kV peak with a rise time of 0.5 μs.
4. For single shot or burst mode applications this parameter can exceed 100 kA/μs. The ultimate value which can be attained depends to a large extent upon the external circuit.
5. This 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. Pre-pulsing grid 1 is recommended. 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. 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 V and +5 V with respect to cathode potential during the period between the completion of recovery and the commencement of the succeeding grid pulse.
8. 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. Also the higher grid 1 is pulsed, the larger the grid 2 negative bias must be to prevent the tube firing on the grid 1 pulse.
9. Typical figures are obtained on test using conditions of minimum grid drive. Improved performance can be expected by increasing the grid drive.
10. The time interval between the instant when the unloaded grid 2 voltage passes cathode potential and the instant when anode conduction takes place.
11. The drift in delay time over a period from 10 seconds to 10 minutes after reaching full voltage.

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

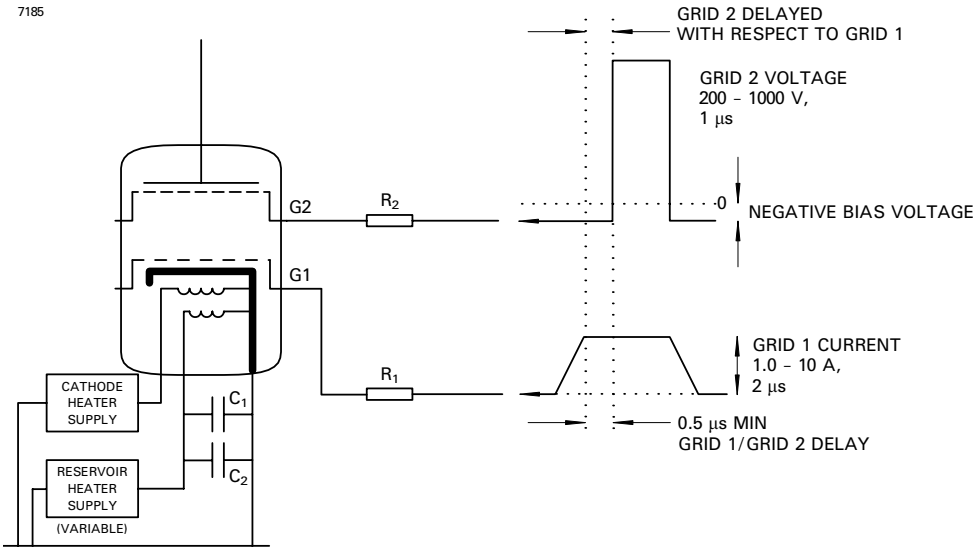
Equipment must be designed so that personnel cannot come into contact with high voltage circuits. All high voltage circuits and terminals must be enclosed and fail-safe interlock switches must be fitted to disconnect the primary power supply and discharge all high voltage capacitors and other stored 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.

SCHEMATIC DIAGRAM



RECOMMENDED GRID, CATHODE AND RESERVOIR HEATER CONNECTIONS

R_1 = Grid 1 series resistor. 12 W vitreous enamelled wirewound is recommended, of a total impedance to match the grid 1 drive pulse circuit.

R_2 = Grid 2 series resistor. 12 W vitreous enamelled wirewound is recommended, of an impedance to match the grid 2 drive pulse circuit.

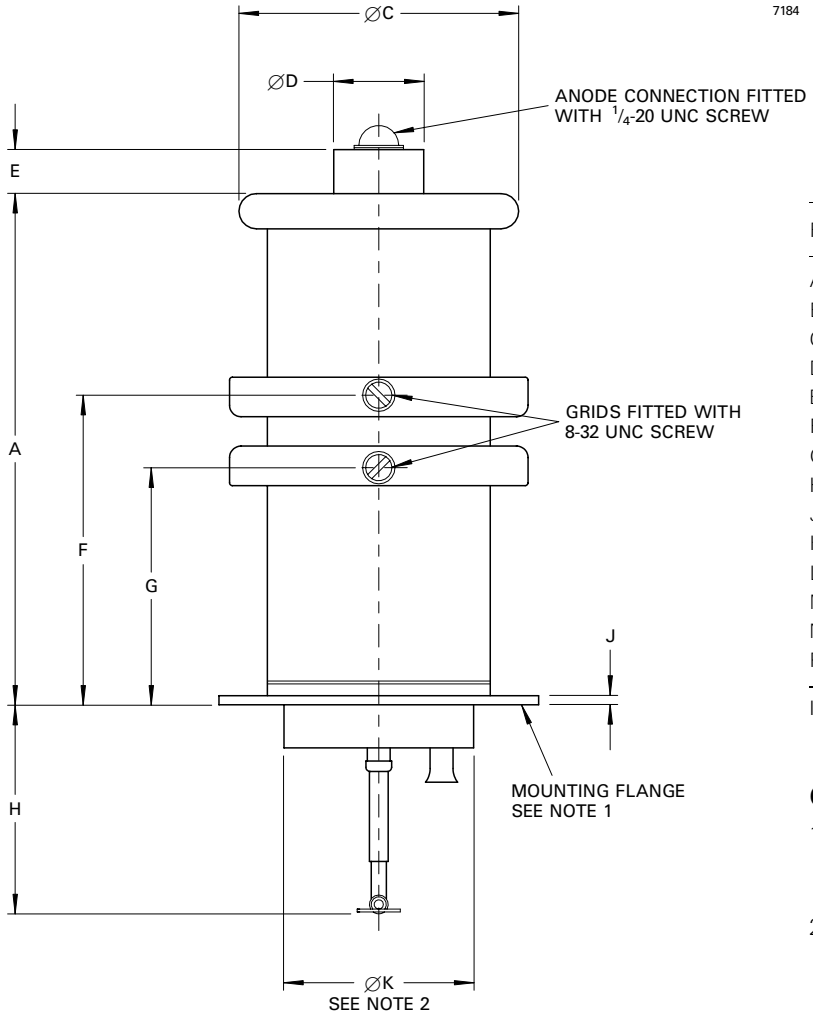
C_1, C_2 — reservoir protection capacitors with a voltage rating $\geqslant$500 V;

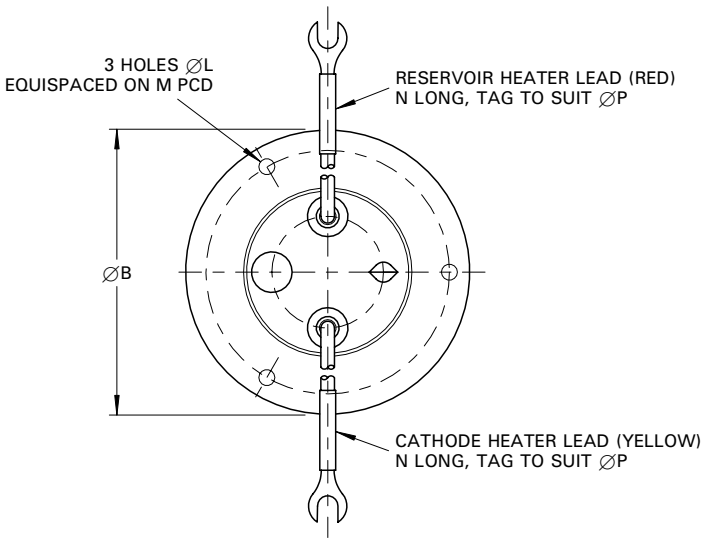
C_1 = 1000 pF low inductance (e.g. ceramic),

C_2 = 1 μF (e.g. polycarbonate or polypropylene).

Components R_1, R_2, C_1 and C_2 should be mounted as close to the tube as possible.

OUTLINE
(All dimensions without limits are nominal)





Ref	Millimetres	Inches
A	146.0 max	5.748 max
B	88.9	3.500
C	77.77	3.062
D	25.0	0.984
E	10.6	0.417
F	86.1	3.390
G	65.9	2.594
H	38.1 min	1.500 min
J	2.54	0.100
K	53.98 max	2.125 max
L	5.0	0.197
M	76.2	3.000
N	152.4	6.000
P	6.35	0.250

Inch dimensions have been derived from millimetres.

Outline Notes

1. The mounting flange is the connection for the cathode, cathode heater return and reservoir heater return.
2. The recommended mounting hole is 55.55 mm (2.187 inches) diameter.

