

Gas-filled microwave TR/ATR switching tube for pulsed transmitter/receiver duplexer service, protecting or isolating receiver and transmitter paths during radar pulses.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	— / —	PARALLEL HEATER	— / —
HEATING	Indirect; cold cathode	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1MicrowaveTRSwitch

No fixed ratings recorded.

Published ratings and characteristics promoted where applicable; additional useful values retained as parameters.

1B42 Hydrogen-Argon Spark Gap Modulator

The **1B42** is a hydrogen-argon filled spark gap modulator tube designed for high-power pulse-switching applications. Featuring a mercury sponge cathode and a robust glass-to-metal construction, this device is engineered to operate as a triggered spark gap modulator in pulse-forming network (PFN) circuits. It is capable of series operation where multiple tubes are used to handle higher voltages.

Physical Construction and Cooling

The 1B42 utilizes a glass-to-metal envelope design integrated with radiator fins to facilitate heat dissipation. To ensure reliable operation and prevent mechanical stress, specific mounting and cooling guidelines must be followed:

- **Mounting Position:** The tube must be mounted vertically with the cathode end facing down. The longitudinal axis must not deviate by more than 30° from a true vertical position.
- **Mechanical Support:** The tube must be firmly supported by the threaded stud located at the cathode end. This cathode stud features a 3/8"-16 thread with an N.S.F. Class 2 fit, allowing a maximum of 1/2" to full thread depth.
- **Anode Connection:** Electrical connection to the anode must be made via a flexible lead to prevent physical strain on the anode terminal. The anode terminal has a specified diameter of 0.566" $\pm$ 0.007".
- **Cooling Requirements:** Under normal conditions, free circulation of air through the integrated radiator fins is sufficient. However, under high dissipation conditions or in high ambient temperatures, forced air cooling directed specifically over the radiator fins is required. Care must be taken to avoid directing cooling air onto the glass portion of the envelope. The cathode terminal temperature must never exceed 150°C.

Electrical Ratings and Operating Limits

The 1B42 operates within strict electrical and environmental limits to ensure stable triggering and prevent premature breakdown.

Voltage and Current Limits

Parameter	Value / Limit
Maximum Peak Voltage per Gap	5.7 kV (reduced to 5.0 kV for repetition rates > 1200 pps or peak currents > 200 A)
Nominal Peak Voltage per Gap	5.0 kV
Peak Current	80 A minimum to 300 A maximum
Average Current	0.250 A maximum
Maximum Inverse Current	5 A peak (must not exceed the duration of the forward pulse)
Maximum Coulombs per Pulse	0.00128
Maximum Duty Cycle	0.0012
Maximum Product of Repetition Rate and Peak Current	3×10^5
Operating Temperature Range	-40°C to +150°C

Triggering and Starting Characteristics

The starting and triggering requirements vary depending on whether a two-gap or three-gap series circuit configuration is employed:

- **Starting Voltage (d-c):** Maximum of 6.5 kVdc for a two-gap circuit; maximum of 8.5 kVdc for a three-gap circuit.
- **Minimum Peak Voltage (Intermittent Threshold):** Maximum of 9.0 kV for a two-gap circuit; maximum of 10.5 kV for a three-gap circuit.
- **Trigger Voltage:** Measured at the sockets with the tubes removed and equivalent capacities substituted, the nominal trigger voltage is 10.0 kV (8.0 kV minimum) for a two-gap circuit, and 15.0 kV nominal (13.0 kV minimum) for a three-gap circuit.
- **Trigger Frequency:** 0.1 Mc to 0.5 Mc.

Circuit Integration and Application

The 1B42 is primarily applied as a high-speed switch in pulse-forming networks. Its operation is highly dependent on the charging method and trigger pulse characteristics.

Charging Methods

- **Resonance Charging:** In resonance charging configurations, the peak voltage across the switching tubes reaches approximately twice the d-c supply voltage. Switching occurs at the peak of the first oscillation, which drops the gap voltage to approximately 150 V during the discharge phase.
- **Linear Charging:** This method is utilized when the pulse repetition rate is several times the resonance frequency. Under these conditions, the charging current behaves practically as direct current, resulting in a linear voltage rise.
- **Diode Charging:** Diode charging is explicitly not recommended for the 1B42. The tube is not designed to hold off steady d-c voltages and is rated only to withstand transient waveforms.

Triggering and Protection

The typical trigger pulse applied to the 1B42 is a damped oscillation characterized by a high decrement, with a fundamental frequency between 0.1 MHz and 0.5 MHz. While unidirectional trigger pulses may be used, they require higher starting voltages to initiate conduction.

To protect the tube from damage caused by continuous arcing, the d-c supply circuit must include an overload relay. This relay should be installed in the d-c supply lead and set to trip at approximately 50% above the normal operating current.

Technical Summary

The **1B42** is a specialized **hydrogen-argon filled spark gap modulator tube** featuring a **mercury sponge cathode** and a glass-to-metal envelope with integrated radiator fins. Designed for vertical mounting (within 30° of vertical) and supported by a threaded cathode stud, it serves as a high-power trigger switch in PFN applications. The tube supports peak currents up to **300 A**, peak voltages up to **5.7 kV** per gap, and repetition rates from **180 pps to 1500 pps**. It is optimized for transient wave hold-off via resonance or linear charging, while steady d-c diode charging is avoided. System protection is maintained via a supply-line overload relay set to 150% of normal current.

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