

ELECTRONIC TUBE REFERENCE

CONSOLIDATED TECHNICAL DATA
1 SECTION
CONSTRUCTION
MICROWAVETR SWITCH

1B29

Specialized - Switching Tube electronic tube

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 1 MicrowaveTRSwitch
No fixed ratings recorded.
Published ratings and characteristics promoted where applicable; additional useful values retained as parameters.

1B29 — Hydrogen-Argon Filled Spark Gap Modulator Tube

The **1B29** is a hydrogen-argon filled spark gap modulator tube designed specifically for triggered gap operation in modulator circuits, such as pulse-forming networks. To constitute a functioning triggered gap, a minimum of two 1B29 tubes must be connected in series.

Physical Construction and Mounting

The 1B29 is constructed within a glass bulb envelope and features two coaxial terminals of unequal dimensions:

- **Large Terminal (Anode Side):** Measures 0.820 inches in diameter by 5/8 inches in length, with a terminal diameter specification of $0.800" \pm 0.007"$.
- **Small Terminal (Cathode Side):** Measures 0.580 inches in diameter by 7/16 inches in length, with a terminal diameter specification of $0.566" \pm 0.007"$.

The tube can be mounted in any position. However, standard spring-type fuse clips should be avoided for mounting. Instead, the use of custom brackets, such as those made from #25 B&S Gauge phosphor-bronze spring temper, is recommended. The installation must ensure free air circulation around the glass envelope for adequate cooling and must protect the tube from excessive mechanical shock.

Electrical Ratings and Operating Limits

The operating limits for the 1B29 are defined by minimum, nominal, and maximum ratings. Operating the tube outside these boundaries can lead to circuit malfunction or physical damage.

Parameter	Minimum	Nominal	Maximum	Conditions & Notes
Peak Voltage per Gap	—	1.4 kV	1.5 kV	Voltages exceeding 1.5 kV cause continuous arcing
Peak Voltage (Any Number of Gaps)	2.6 kV	—	—	Minimum threshold below which intermittent action or cessation occurs
Starting Voltage	—	—	1.9 kV	Measured in a two-tube circuit with a 2.8 kV peak trigger voltage
Peak Trigger Voltage	2.7 kV	3.0 kV	3.5 kV	Measured at the sockets with the tubes removed and equivalent capacities substituted
Fundamental Trigger Frequency	0.018 Mc	—	0.4 Mc	Applicable for a damped oscillation trigger pulse

Parameter	Minimum	Nominal	Maximum	Conditions & Notes
Peak Current	20 A	—	30 A	Permissible for short intervals
Repetition Rate	500 pps	2000 pps	2100 pps	Nominal rate is 2000 pps
Pulse Duration	0.4 usec	—	0.75 usec	
Interelectrode Capacitance	—	1.4 uuf	—	

Circuit-Specific Operation and Triggering

In a typical two-tube circuit configuration, the series combination stands off approximately 3 kV. This configuration typically employs resonance charging, which causes the peak voltage across the switching tubes to reach approximately twice the value of the d-c supply voltage. During the discharge of the pulse-forming network, the voltage across the gaps drops to approximately 150 V. In practical modulator circuits, the ratio of the peak load voltage to the d-c supply voltage ranges from 0.7 to 0.75.

To ensure reliable starting when returning to normal operating conditions, the d-c power supply must have a no-load voltage of at least 1.9 kV. Additionally, an overload relay should be installed in the d-c supply lead and set to trip at approximately 60 mA d-c to prevent damage to the tubes in the event of continuous arcing.

Triggering Requirements

The trigger pulse applied to the 1B29 should ideally be a damped oscillation characterized by a high decrement. A trigger amplitude of 2.8 kV or greater is sufficient to ionize both gaps, which effectively lowers the starting voltage of the system. If unidirectional trigger pulses are used instead of oscillatory pulses, a higher starting voltage is required.

Proper power-up sequencing is critical: the trigger voltage must be applied to the spark gap tubes before the d-c power supply is turned on. Failing to follow this sequence can result in over-voltage arcing on the second pulse.

Series Operation and Multi-Gap Configurations

For applications requiring higher operating voltages, multiple 1B29 tubes can be connected in series. This configuration increases the overall operating range of the system because the maximum peak voltage capability rises with each added tube, while the minimum peak voltage threshold remains constant at 2.6 kV. This relationship holds true provided that the voltage is divided equally across all gaps and that a sufficient trigger voltage is supplied to the junction points via coupling condensers.

However, using more than four gaps in series is not recommended. Beyond four gaps, difficulties arise regarding equal voltage division and the loading of the trigger circuit. Furthermore, care must be taken to

avoid reverse current resulting from impedance mismatch, as reverse current significantly shortens the operating life of the tubes.

Technical Summary

The **1B29** is a specialized hydrogen-argon filled spark gap modulator tube designed for high-power pulse-forming networks. It features a glass envelope with asymmetrical coaxial terminals and is rated for a nominal peak voltage of 1.4 kV per gap (1.5 kV maximum) and a peak current of up to 30 A for short intervals. Triggered operation requires a minimum of two tubes in series, utilizing a damped oscillation trigger pulse between 2.7 kV and 3.5 kV. While series operation allows higher voltage handling, configurations are practically limited to a maximum of four gaps to ensure reliable triggering and voltage division.

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