

Narrow-band tunable gas-filled TR switch for X-band microwave systems, using ignitor-assisted discharge to protect the receiver during transmitter pulses.

GENERAL CHARACTERISTICS

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

SECTION RATINGS

SECTION1	MicrowaveTRSwitch
No fixed ratings recorded.	
Gas switching TR section; specialized microwave data retained as parameters.	

1B24A — Tunable Gas TR Switch Tube

The **1B24A** (also designated as TR 1 B 24 A) is an integral-cavity, tunable narrow-band gas Transmit-Receive (TR) switch tube designed for operation in the X-band microwave frequency range. Its primary function is to provide receiver protection in pulsed radar systems during high-power transmitter pulses, while allowing low-attenuation transmission of weak echo signals during reception.

Principles of Operation and Applications

In pulsed microwave radar systems, a common antenna is typically shared between the transmitter and the receiver. The 1B24A is designed for use in duplexer circuits where a fixed electrical position for the short circuit is not required.

During high-power magnetron transmission, the gas within the tube ionizes, causing the device to act as a parallel short-circuit across the receiver's transmission line and in series with the antenna line. This effectively blocks high-power RF energy from reaching and damaging the sensitive receiver components. Once the transmission pulse ends, the gas deionizes rapidly. During the subsequent reception period, the tube presents low attenuation, allowing the weak incoming echo signals from the antenna to pass through to the receiver with minimal loss.

Electrical and Operating Characteristics

The 1B24A operates across the X-band frequency spectrum, covering a range from 8,490 to 9,600 MHz, with a nominal operating frequency of 9,375 MHz. The tube features an integral cavity with a maximum loaded Q of 350, measured at the nominal 9,375 MHz frequency.

To facilitate rapid ionization when the transmitter fires, the tube incorporates an ignitor (or igniter) electrode. The electrical parameters of this ignitor circuit are defined as follows:

- **Ignitor Supply Voltage (Open-Circuit):** -750 V to -1000 V (with a maximum starting voltage of -1000 V).
- **Ignitor Current:** 100 μ A minimum to 200 μ A maximum.
- **Ignitor Voltage Drop:** 325 V minimum to 450 V maximum, measured at an ignitor current of 100 μ A.
- **Ignitor Interaction:** 0.2 dB maximum at 100 μ A ignitor current.

Performance Under Test Conditions

The operating performance of the 1B24A is characterized under specific pulsed RF conditions: a peak power of 10 kW, a pulse width of 0.5 μ s, a pulse repetition frequency of 1,000 Hz (or pulses per second), and an operating frequency of 9,375 MHz, with the ignitor current set to 100 μ A. Under these conditions, the tube exhibits the following characteristics:

- **Maximum Leakage Power:** 30 mW.
- **Maximum Deionization (Recovery) Time:** 4 μ s (measured for 3 dB attenuation / 3 dB down).
- **Insertion Loss:** 0.85 dB minimum to 1.50 dB maximum at 9,375 MHz. At zero electrode current, the maximum insertion loss is specified up to 2 dB.

Mechanical, Tuning, and Environmental Specifications

The 1B24A is constructed with an integral cavity and is designed to allow physical tuning across its operating band.

Tuning Mechanism

Frequency tuning is accomplished via an onboard tuning screw. The tuning mechanism provides a range of 5 turns, which is sufficient to adjust the resonant frequency of the cavity across the entire 8,490 to 9,600 MHz operating band.

Physical Dimensions and Mounting

The tube is designed for flexible installation and can be mounted in any position (indifférente), both in terms of its physical orientation and its position within its support structure. Its physical outline is characterized by the following dimensions:

- **Maximum Height:** 3-1/4 inches (approximately 82.6 mm).
- **Maximum Body Diameter:** 1.760 inches (approximately 44.7 mm).
- **Top Cap Diameter:** 0.250 inches $\pm$ 0.005 inches.
- **Reservoir Projection:** Designed to fit within a 1-1/4 inch diameter cylinder co-linear with the tube's main axis.
- **Iris Assembly:** Does not extend beyond the outer surface of the body.
- **Exhaust Tabulation:** Does not extend beyond the outer periphery of the device.
- **Weight:** Approximately 150 grams (about 1/4 lb).

Environmental Limits

For storage and non-operating conditions, the 1B24A is rated to withstand ambient temperatures ranging from -40 °C to +100 °C.

SOURCE OPERATING CONDITIONS

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1968 General Electric Co

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1968 GENERAL ELECTRIC CO

Section 1 · MicrowaveTRSwitch

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Operational Frequency Band	8490–9600 MHz	—
Loaded Q Maximum	350	—
Ignitor Voltage Drop	325–450 V	IgnitorCurrent=100uA

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Ignitor Starting Voltage Maximum	-1000 V	—
Leakage Power	30 mW	PeakPower=10kW; PRR=1000pps; PulseDuration=0.5us; IgnitorCurrent=100uA; Frequency=9375MHz
Ignitor Interaction Maximum	0.2 dB	IgnitorCurrent=100uA
Insertion Loss	0.85–1.5 dB	Frequency=9375MHz
Recovery Time Maximum	4 us	PeakPower=10kW; 3dB down
AmbientTemperatureRange	-40–100 C	Non-operating
Igniter Current Maximum	200 uA	—

SOURCE OPERATING CONDITIONS

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1972 Thomson CSF

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1972 THOMSON CSF

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
me provoque qu'une attenuation faible our	1	me provoque qu'une attenuation faible our 1'echo se
Frequence nominale [1]	9 MHz	Frequence nominale 9 375 MHz
Frequence nominale [2]	375 MHz	Frequence nominale 9 375 MHz
Gamme de frequence [1]	8 MHz	Gamme de frequence 8 490 a 9 600 MHz
Gamme de frequence [2]	490 MHz	Gamme de frequence 8 490 a 9 600 MHz
Gamme de frequence [3]	9 MHz	Gamme de frequence 8 490 a 9 600 MHz
Gamme de frequence [4]	600 MHz	Gamme de frequence 8 490 a 9 600 MHz
Courant de [1]	1 A	Courant de 1'igniteur 100 uA 200 uA
Courant de [2]	100 A	Courant de 1'igniteur 100 uA 200 uA
Courant de [3]	200 A	Courant de 1'igniteur 100 uA 200 uA
Tension d'alimentation de [1]	1 V	Tension d'alimentation de 1'electrode d'entretien en circuit ouvert — 1000 V — 750 V
Tension d'alimentation de [2]	1000 V	Tension d'alimentation de 1'electrode d'entretien en circuit ouvert — 1000 V — 750 V
Tension d'alimentation de [3]	750 V	Tension d'alimentation de 1'electrode d'entretien en circuit ouvert — 1000 V — 750 V
Temperatures limites de stockage – [1]	40	Temperatures limites de stockage — 40 eC + 100 eC
Temperatures limites de stockage – [2]	100	Temperatures limites de stockage — 40 eC + 100 eC
Puissance de fuite, maximum ([1]	2 W	Puissance de fuite, maximum (2) 30 mW
Puissance de fuite, maximum ([2]	30 W	Puissance de fuite, maximum (2) 30 mW
Temps de desionisation pour un affaiblissement de (	2	Temps de desionisation pour un affaiblissement de (2)
(Courant de l'igniteur	100 A	(Courant de l'igniteur 100 µA)
Chute de tension de [1]	1 V	Chute de tension de 1'igniteur minimum 325 V
Chute de tension de [2]	325 V	Chute de tension de 1'igniteur minimum 325 V
Chute de tension de [1]	1 V	Chute de tension de 1'igniteur maximum 450 V
Chute de tension de [2]	450 V	Chute de tension de 1'igniteur maximum 450 V

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
([1]	2 kW	(2) Dams les conditions suivantes: Puissance crete 10 kW — Duree d'impulsion 0,5 µs. Frequence de
([2]	10 kW	(2) Dams les conditions suivantes: Puissance crete 10 kW — Duree d'impulsion 0,5 µs. Frequence de
([3]	5 kW	(2) Dams les conditions suivantes: Puissance crete 10 kW — Duree d'impulsion 0,5 µs. Frequence de
repetition [1]	1 MHz	repetition 1 000 Hz — Frequence 9 375 MHz — Courant de 1'1Bniteur 100 p.A.
repetition [2]	0 MHz	repetition 1 000 Hz — Frequence 9 375 MHz — Courant de 1'1Bniteur 100 p.A.
repetition [3]	9 MHz	repetition 1 000 Hz — Frequence 9 375 MHz — Courant de 1'1Bniteur 100 p.A.
repetition [4]	375 MHz	repetition 1 000 Hz — Frequence 9 375 MHz — Courant de 1'1Bniteur 100 p.A.
repetition [5]	1 MHz	repetition 1 000 Hz — Frequence 9 375 MHz — Courant de 1'1Bniteur 100 p.A.
repetition [6]	1 MHz	repetition 1 000 Hz — Frequence 9 375 MHz — Courant de 1'1Bniteur 100 p.A.
repetition [7]	100 MHz	repetition 1 000 Hz — Frequence 9 375 MHz — Courant de 1'1Bniteur 100 p.A.

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