



ELECTRONIC TUBE REFERENCE

108C1

Voltage Regulator electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

VOLTAGEREGULATOR

Gas-filled 108 V voltage stabilizer for accurate reference and shunt-regulator service over approximately 5-30 mA, with published long-term stability data.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	7
NOMINAL HEATER	— / —	PARALLEL HEATER	— / —
HEATING	Indirect; cold cathode	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Voltage Regulator	
REGULATOR VOLTAGE	108 V
MINIMUM REGULATOR CURRENT	5 mA
MAXIMUM REGULATOR CURRENT	30 mA
STARTING VOLTAGE	133 V
MAINTAINING VOLTAGE	108 V
DYNAMIC IMPEDANCE	100 Ω

Gas-discharge device.

108C1 — Gas-Filled Voltage Stabiliser Tube

The **108C1** (also known by the equivalent designation **OB2**) is a cold-cathode, gas-filled miniature tube designed for voltage stabilisation. It provides a highly stable nominal maintaining voltage of **108 V** over a wide operating current range of **5.0 to 30 mA**.

Overview

The 108C1 is a gas-discharge device used primarily for DC voltage regulation. It operates by maintaining a nearly constant voltage drop across its terminals despite variations in the current flowing through it. The tube is housed in a standard 7-pin miniature (B7G) glass envelope and can be operated in any mounting position.

In addition to standard DC shunt regulation, the 108C1 can be used in pairs in an antiparallel configuration to achieve AC voltage stabilisation. Its design features a low dynamic impedance and excellent long-term stability, making it a reliable reference and regulation element in electronic power supplies.

Construction, Base, and Pinout

The 108C1 is a cold-cathode device, meaning it does not contain a filament or heater. The electrical discharge is initiated and maintained solely by the potential difference between the anode and the cathode in the gas-filled envelope.

Physical Characteristics

- **Envelope:** Glass bulb (DIN 41537, Form A, Nenngröße 50)
- **Base:** 7-pin miniature (B7G)
- **Maximum Seated Height:** 60.3 to 60.5 mm
- **Maximum Overall Length:** 67.3 to 67.5 mm
- **Maximum Bulb Diameter:** 19 mm
- **Weight:** Approximately 11 g
- **Mounting Position:** Unrestricted (any position)

Pin Connections

The B7G base layout provides multiple redundant connections for both the anode and the cathode. These redundant pins are internally connected within the tube. This configuration allows designers to wire the load through the tube socket, ensuring that if the tube is unplugged, the load is safely disconnected from the unregulated supply voltage.

Pin	Connection	Description
1	Anode	Positive electrode
2	Cathode	Negative electrode
3	Internal Connection	Do not connect
4	Cathode	Negative electrode
5	Anode	Positive electrode
6	Internal Connection	Do not connect

Pin	Connection	Description
7	Cathode	Negative electrode

Electrical Characteristics and Operating Points

The 108C1 is designed to maintain a stable voltage across its terminals once ignition has occurred. The electrical characteristics are measured at an ambient temperature of 20 to 30 degrees C unless otherwise specified.

Ignition Voltage and Delay

Before the tube can stabilise, the applied voltage must exceed the ignition threshold to initiate the gas discharge.

- **Ignition Voltage in Ambient Light:** A minimum supply voltage of **133 V** is required to guarantee ignition. The nominal ignition delay time under these conditions is **1.3 seconds**.
- **Ignition Voltage in Complete Darkness:** In the absence of ambient light, the minimum voltage necessary for ignition increases significantly to **210 V** due to the lack of photo-ionization.
- **Dark Ignition Delay Probability:** The time required for the tube to ignite in darkness is statistical. At a supply voltage of 133 V, the probability of ignition within 10 ms is low, but it rises steadily, with a high probability of ignition occurring within 100 ms to 1000 ms. Increasing the supply voltage beyond the minimum threshold reduces this delay.

Maintaining and Regulation Voltage

Once ignited, the tube enters its normal operating glow-discharge region.

- **Nominal Maintaining Voltage:** 108 V (typically ranging between 106 V and 111 V at a current of 17.5 mA).
- **Initial Maintaining Voltage Limits:**
 - Maximum at 30 mA cathode current: 112 V
 - Minimum at 5.0 mA cathode current: 105 V
- **Regulation Voltage:** The change in maintaining voltage over the full current range (5.0 to 30 mA) is exceptionally low, with an average value of **1.5 V** and a maximum limit of **3.5 V** initially.
- **Dynamic AC Resistance:** Approximately 100 ohms.

Long-Term Stability and Life Performance

The 108C1 exhibits excellent stability over its operating life. Under continuous operation at an average current of 17.5 mA, the performance parameters are specified as follows:

- **Maintaining Voltage over Life (up to 3000 hours):**
 - Maximum at 30 mA cathode current: 113 V to 114 V
 - Minimum at 5.0 mA cathode current: 101 V to 104 V

- **Regulation Voltage over Life (5.0 to 30 mA):** Typically remains at **1.5 V**, with a maximum limit of **4.0 V**.
- **Voltage Drift:** The maximum variation in maintaining voltage at a constant current during 1000 hours of life is $\pm 3.0\%$, with a typical variation of $\pm 1.0\%$. The total change in maintaining voltage for any individual tube will not exceed +3 V or -4 V over its lifetime. Over a shorter interval of 500 operating hours, the maximum fluctuation is limited to 4 V.

Absolute Maximum Ratings

Operating the tube outside the absolute maximum ratings can cause immediate failure or severely degrade its operating life.

- **Maximum Continuous Cathode Current:** 30 mA
- **Minimum Cathode Current:** 5.0 mA (current must not fall below this value, or the gas discharge will become unstable and extinguish)
- **Maximum Surge/Starting Current:** 75 mA. This peak current is permitted only during the turn-on phase and must be restricted to a maximum duration of 10 seconds (or up to 30 seconds in each 8 hours of use for long-life applications).
- **Maximum Negative Anode Voltage:** 75 V (the anode must not be biased negatively relative to the cathode beyond this limit)
- **Maximum Parallel Capacitance:** 0.1 μF
- **Ambient Temperature Range:** -55 to +90 degrees C
- **Maximum Bulb Temperature:** +150 degrees C (for operation)
- **Storage Temperature Range:** -55 to +70 degrees C

Relaxation Oscillations and Capacitive Loading

A critical design constraint is the maximum parallel capacitance limit of **0.1 μF** . If a capacitor exceeding this value is connected directly across the 108C1, the circuit can form a relaxation oscillator. The capacitor charges through the series resistor until the tube's ignition voltage is reached, at which point the tube ignites and rapidly discharges the capacitor until the maintaining voltage falls below the extinguishing threshold. This cycle repeats, causing severe voltage instability and potential damage to the tube.

Circuit Design and Calculations

In a typical shunt regulator circuit, the 108C1 is connected in parallel with the load, and a series resistor (R_s) is placed between the unregulated input voltage (V_{in}) and the tube's anode.

Series Resistor Calculation

To design a stable regulator, the series resistor must be calculated based on the minimum and maximum input voltages and the load current variations. The resistor must satisfy two conditions:

1. It must allow the anode voltage to rise above the minimum ignition voltage (133 V in light) when the tube is off.

2. It must limit the tube current to between 5.0 mA and 30 mA during normal operation.

Calculation Example: Assume an unregulated input voltage (V_{in}) of 200 V, a nominal load current (I_{load}) of 15 mA, and a nominal tube maintaining voltage (V_{out}) of 108 V. To set the tube current (I_{tube}) to its typical midpoint of 17.5 mA:

$$R_s = (V_{in} - V_{out}) / (I_{tube} + I_{load})$$

Input values:

- $V_{in} = 200 \text{ V}$
- $V_{out} = 108 \text{ V}$
- $I_{tube} = 17.5 \text{ mA} = 0.0175 \text{ A}$
- $I_{load} = 15 \text{ mA} = 0.015 \text{ A}$

Calculation: $R_s = (200 - 108) / (0.0175 + 0.015) = 92 / 0.0325 = 2830 \text{ ohms}$

The designer would select a standard resistor value close to 2.8 kohms with an appropriate power rating to handle the continuous dissipation.

Technical Summary

The **108C1** is a cold-cathode, gas-filled voltage stabiliser tube designed to provide a stable **108 V** reference or regulated output. Operating within a current range of **5.0 to 30 mA**, it features a low dynamic impedance of **100 ohms** and an average regulation voltage of **1.5 V**. Housed in a 7-pin miniature B7G envelope, it supports both DC shunt regulation and AC antiparallel stabilisation. Designers must ensure a minimum supply voltage of 133 V (or 210 V in darkness) for reliable ignition, limit parallel capacitance to 0.1 μF to prevent relaxation oscillations, and maintain the operating current strictly within the specified limits to guarantee long life and stable performance.



SOURCE OPERATING CONDITIONS

1953 RFT Rundfunk Technik

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

1953 RFT RUNDFUNK TECHNIK

Section 1 · Voltage Regulator

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
RegulatorVoltage	108 V	—
RegulatorCurrentMinimum	5 mA	—
RegulatorCurrentMaximum	30 mA	—
RegulatorStartingVoltage	132 V	—
RegulatorMaintainingVoltage	108 V	—
RegulatorDynamicImpedance	100 ohm	—



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1963 Mullard

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

1963 MULLARD

Section 1 · Voltage Regulator

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Ignition voltage minimum - ambient light	133 V	—
Ignition voltage minimum - complete darkness	210 V	—
Burning current maximum	30 mA	—
Burning current minimum	5 mA	—
Starting current maximum	75 mA	—

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Negative anode voltage maximum	75 V	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Burning voltage maximum at 30 mA initial	112 V	—
Burning voltage maximum at 30 mA over life	114 V	—
Burning voltage minimum at 5 mA initial	105 V	—
Burning voltage minimum at 5 mA over life	101 V	—
Burning-voltage difference maximum initial	3.5 V	—
Burning-voltage difference maximum over life	4 V	—
Burning-voltage difference typical	1.5 V	—
Burning-voltage life variation maximum	3 %	—
Burning-voltage life variation typical	1 %	—

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application	Gas-filled voltage stabilization	—


SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1971 Mullard Gas Filled Tubes

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

1971 MULLARD GAS FILLED TUBES

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maintaining voltage	108 V	—
Regulation voltage	1.5 V	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Ignition/striking voltage	133 V	—
Minimum cathode current	5 mA	—
Maximum cathode current	30 mA	—

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