



ELECTRONIC TUBE REFERENCE

0B2WA

Voltage Regulator electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

VOLTAGEREGULATOR

Ruggedized special-quality 108 V gas regulator for dependable military and industrial voltage stabilization over approximately 5-30 mA.

GENERAL CHARACTERISTICS

BASE DESIGNATION	5B0	BASE PINS	7
NOMINAL HEATER	0 V / 0 mA	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	130 V
MAINTAINING VOLTAGE	108 V
<i>Published ratings and characteristics promoted semantically from the approved source; repeated identical sections compressed where applicable.</i>	

0B2WA — Reliable Miniature Cold-Cathode Voltage Regulator

The **0B2WA** (also designated as **6627/0B2WA**) is a high-reliability, miniature, cold-cathode, gas-filled diode designed for voltage regulation. It maintains a substantially constant operating voltage of approximately **108 V** over a wide current range of **5 to 30 mA**.

The tube is engineered for critical industrial and military applications where severe environmental conditions, such as high temperatures, high altitude, and extreme mechanical shock and vibration, are encountered. It features controlled manufacturing processes to ensure extremely small voltage drift and excellent repeatability throughout its operating life.

Mechanical Design and Pin Configuration

The 0B2WA is housed in a **T-5 1/2** glass envelope with a small-button miniature **7-pin base** (JEDEC **E7-1** or **7C10**). It can be mounted in **any position**.

Physical Dimensions

- **Maximum Overall Length:** 2 5/8 inches (66.7 mm)
- **Maximum Seated Length:** 2 3/8 inches (60.3 mm)
- **Maximum Diameter:** 3/4 inch (19 mm)
- **Approximate Weight:** 0.3 ounces (11 g)

Basing and Terminal Connections

The tube utilizes the **5BO** (or **7C10**) basing arrangement. The pin connections, viewed from the bottom of the base, are as follows:

Pin	Connection	Description
1	Anode	Internally connected to Pin 5
2	Cathode	Internally connected to Pins 4 and 7
3	Internal Connection	Do not use for active circuitry
4	Cathode	Internally connected to Pins 2 and 7
5	Anode	Internally connected to Pin 1
6	Internal Connection	Do not use for active circuitry
7	Cathode	Internally connected to Pins 2 and 4

The redundant anode (Pins 1 and 5) and cathode (Pins 2, 4, and 7) connections are designed to provide a safety feature: the load circuit can be wired through the socket terminals such that removing the tube from its socket automatically opens the load circuit, preventing unregulated high voltage from damaging downstream components.

Electrical Characteristics and Operating Parameters

The 0B2WA operates by establishing a stable glow discharge (cold cathode) in an inert gas atmosphere.

Key Electrical Specifications

- **Nominal Tube Voltage Drop:** 108 V (typically ranging from 105 V to 111 V over the full current range).
- **Operating Current Range:** 5 to 30 mA DC.
- **Regulation (5 to 30 mA):** Typically 1.0 V to 1.1 V, with a maximum limit of 2.5 V (or 3.0 V at end of life).
- **Anode Breakdown Voltage (Ignition Voltage):**
 - In ambient light (5 to 50 foot-candles / 50 to 500 lux): Typically 118 V to 123 V, maximum 130 V.
 - In total darkness: Maximum 130 V to 210 V depending on the specific test standard.
- **Voltage Jump (6 to 10 mA):** Typically less than 10 mV, maximum 100 mV.
- **Voltage Repeatability (10 mA):** Typically 0.1 V to 0.3 V, maximum 0.4 V to 0.6 V.
- **Noise Output (30 mA):** Typically less than 1 mV, maximum 5 mV.
- **Leakage Current (at 50 V DC):** Typically less than 1 μ A, maximum 5 μ A.

Reference Tube Characteristics

When operated in the narrow current range of **6 to 10 mA**, the 0B2WA exhibits highly stable characteristics comparable to a dedicated voltage reference tube, with minimal voltage drift.

Absolute Maximum Ratings

To ensure reliable operation and prevent premature failure, the following absolute maximum limits must be respected:

Parameter	Limit
Maximum DC Cathode Current	30 mA
Minimum DC Cathode Current	5 mA
Maximum Starting Current (for max 10 seconds)	75 mA
Maximum Bulb Temperature	150°C
Minimum Ambient Temperature	−55°C
Maximum Altitude	120,000 feet (approx. 36 km)
Maximum Inverse Voltage	−50 V to −75 V
Maximum Shunt Capacitor	0.1 μ F

Circuit Design and Application Guidelines

Series Resistor Calculation

A series current-limiting resistor (R1) must always be connected in series with the 0B2WA to prevent the current from exceeding the maximum rating of 30 mA and to ensure it does not drop below the minimum rating of 5 mA.

The value of R1 is calculated based on the unregulated supply voltage (V1) and the load current (IL):

1. **To limit maximum current:** $R1 > (V1_{\text{max}} - V2_{\text{min}}) / (IT_{\text{max}} + IL_{\text{min}})$ where V2 is the tube voltage drop (minimum 105 V) and IT_max is 30 mA.
2. **To maintain minimum current:** $R1 < (V1_{\text{min}} - V2_{\text{max}}) / (IT_{\text{min}} + IL_{\text{max}})$ where V2 is the tube voltage drop (maximum 111 V) and IT_min is 5 mA.

Additionally, the designer must verify that the minimum supply voltage (V1_min) is sufficient to initiate ionization (start the tube) under the worst-case load condition: $V1_{\text{min}} * [R2 / (R1 + R2)] > V_{\text{starting}}$ where R2 is the load resistance and V_starting is the anode breakdown voltage (typically 130 V).

Shunt Capacitance and Oscillation

If a shunt capacitor is placed in parallel with the 0B2WA, its value must be strictly limited to **0.1 µF**. Capacitance values larger than 0.1 µF can form a relaxation oscillator with the tube's negative resistance characteristic, causing unstable voltage regulation and severe oscillation.

Parallel and Series Operation

- **Parallel Operation:** Operating multiple 0B2WA tubes in parallel to handle higher load currents is generally **not recommended**. If parallel operation is necessary, a small equalizing resistor of approximately **100 Ω** must be placed in series with each tube to ensure equal current distribution. However, this significantly degrades the overall voltage regulation.
- **Series Operation:** Multiple tubes can be connected in series to obtain higher regulated voltages (e.g., two 0B2WA tubes in series provide approximately **216 V**). When operating in series, care must be taken to ensure that the unregulated supply voltage is high enough to start both tubes.

Warm-Up and Drift

To achieve minimum voltage drift, a warm-up period of at least **3 minutes** should be allowed after turning on the equipment. This allows the bulb temperature to reach thermal equilibrium. If the tube is subjected to high starting currents during turn-on, it may take up to **20 minutes** for the regulated voltage to stabilize to its normal operating value.

Reliability and Environmental Testing

The "WA" suffix denotes a premium, ruggedized construction designed to meet strict military specifications (such as MIL-E-1). Randomly selected samples are subjected to rigorous quality control tests:

- **Shock Resistance:** Designed to withstand impact accelerations of **450 G** (Navy flyweight high-impact machine, 30° hammer angle) or up to **900 G** (60° hammer angle) for 5 impact accelerations in each of four different positions.
- **Vibration Fatigue:** Subjected to sinusoidal vibrational acceleration of **2.5 G** at a fixed frequency (typically 25 to 60 Hz) for 32 hours minimum in each of three mutually perpendicular planes.
- **Glass Strain:** Immersed in boiling water (97–100°C) for 15 seconds and immediately plunged into cold water (not more than 5°C) to test envelope integrity.
- **Life Testing:** Evaluated over 100-hour (survival rate), 500-hour (intermittent), and 1000-hour life tests at a bulb temperature of 150°C. At the 1000-hour end point, the maximum allowable change in tube voltage drop is 4%, and the regulation must remain within 3.0 V to 4.0 V.

Technical Summary

The **0B2WA** is a ruggedized, cold-cathode, gas-filled miniature voltage regulator featuring a 7-pin base and a T-5 1/2 envelope. It provides a highly stable **108 V** output over an operating current range of **5 to 30 mA**. With its robust mechanical design, it is capable of reliable operation under extreme conditions of shock (up to 900 G), vibration (2.5 G), high altitude (120,000 feet), and high temperature (150°C). The tube's multiple internal connections allow for a load-disconnect safety configuration, making it an excellent choice for high-reliability military and industrial power supplies.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1938 Raytheon

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

1938 RAYTHEON

Section 1 · Voltage Regulator

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
a substantially constant operating voltage of	-1 volts	a substantially constant operating voltage of 108 volts. Three cathode pins are provided which may 3 P Mini E7-1
Ebb/Ib=	30 mAdc	Ebb/Ib=5=30 mAdc
Voltage Jump Ebb/Ib=	100 mAdc	--- Voltage Jump Ebb/Ib=6~10 mAdc; 2.5 Code Jump .- .- <10 .- 100 mVdc
Repeatability Ebb/Ib=	600 mAdc	.- Repeatability Ebb/Ib=10 mAdc; 2.5 Code Etd .- .- 300 .en 600 mVdc
Points: Tube Voltage Drop{(	113 Vdc	Points: Tube Voltage Drop{(1) --- .ee Etd 103 .- 109 .- 113 Vdc
Tube Voltage DropR)] --- .- Etd	113 Vdc	Tube Voltage DropR)] --- .- Etd 103 .- 108 113 Vdc
Regulation --- --- Reg .- .- t	3 Vdc	Regulation --- --- Reg .- .- t3 Vdc
Tube Voltage	113 Vdc	Tube Voltage 1 3 Etd 103 108 {113 Vdc
Ionization Volt—	1130 Volt	Ionization Volt— .- --- 1 3 Ez eee === 1130 Vdc
Regulation	4 Vdc	Regulation --- --- 2 5 Reg [--- £1.0} =4 Vdc
Tube Voltage	116 Vdc	Tube Voltage .- .- 2 5 Etd 103 [109 116 Vdc
Tube Voltage	116 Vdc	Tube Voltage .- .- 2 5 Etd 103 1108 116 Vdc
Change in Tube	5 Vdc	Change in Tube --- 2 5 AtE'rd R R 5.0 Vdc
Ionization Volt—	1130 Volt	Ionization Volt— --- 2 5 Ez --- 122 1130 Vdc
Note	10 mAdc	Note 2: Vary current from 6 mAdc to 10 mAdc and

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Supply Voltage	130 Vdc	Supply Voltage .. 130 --- .ee Vdc : _J_L[U_U_U],s
Ionization Voltage Ez	130 Vdc	Ionization Voltage Ez 123 .- 130 Vdc :
Ionization Voltage Ez	130 Vdc	Ionization Voltage Ez --- 118 .- 130 Vdc BASING
Tube Voltage Drop Etd	1 Vdc	Tube Voltage Drop Etd 105 109 --- 1 Vdc
Tube Voltage Drop Etd	108 Vdc	Tube Voltage Drop Etd 105 108 .- m Vdc . BOTTOM VIEW
Regulation (	2.5 mAdc	Regulation (5-30 mAdc) .- +1 .- +2.5 Vdc '
Noise (	5 mAdc	Noise (30 mAdc) .. <] 5 mVac
Repeatability (	4 mAdc	Repeatability (10 mAdc) --- 300 600 mVde * Lead4 Cathode
in water at not more than	48 °C	in water at not more than 5°C. The sample is then dried at room temperature for 48
trical stability (AEid ¢	2 Vdc	trical stability (AEid ¢ 2.0 Vdc max.).
life electrical stability (AEid <	3 Vdc	life electrical stability (AEid < 3.0 Vdc max.)
The voltage drop shall be read at	10 mAdc	The voltage drop shall be read at 10 mAdc drain.
Note	200 Vdc	Note 5: Place tube under test in o Bell jar with pressure maintained at 3.1+ 0.2 mm Hg. Apply a potential of 200 Vdc to the Vdc to the K
and A terminals through a variable series resistor. Adjust resistor to give a current of	20 mAdc	and A terminals through a variable series resistor. Adjust resistor to give a current of 20.0 mAdc. There shall be no evidence of



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SOURCE OPERATING CONDITIONS

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1958 Compagnie General

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

1958 COMPAGNIE GENERAL

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Nominal Maintaining Voltage	108 V	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Starting Voltage	210 V	Dark condition where applicable
Regulating Current Minimum	5 mA	—
Regulating Current Maximum	30 mA	—
Maximum Shunt Capacitance	0.1 uF	—



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1960 RCA Industrial and Communications Types

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

1960 RCA INDUSTRIAL AND COMMUNICATIONS TYPES

Section 1 · Voltage Regulator

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MilitarySpecificationDesign	1 boolean	PremiumTube



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1961 Tung Sol

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

1961 TUNG SOL

Section 1 · Voltage Regulator

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Regulator current minimum	5 mA	—
Regulator current maximum	30 mA	—



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1966 Tung Sol Electronic Tubes 4 of 4

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

1966 TUNG SOL ELECTRONIC TUBES 4 OF 4

Section 1 · Voltage Regulator

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MINIMUM DC CATHODE CURRENT	5 mA	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
MINIMUM AMBIENT TEMPERATURE	55 C	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
SHOCK IMPACT	4	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
VIBRATION FATIGUE	2.5	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
SHOCK:	30	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
IONIZATION VOLTAGE (MAX.)	130	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
TUBE VOLTAGE DROP (5. & 30. MA.) – published value 1	105	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
TUBE VOLTAGE DROP (5. & 30. MA.) – published value 2	111	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
REGULATION (5. TO 30. MA.) (MAX.)	2.5	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
C HAN6E	5 percent	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
VOLTAGE REPEATABILITY (MAX.)	4 V	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
CHANGE	3 mA	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
TUBE VOLTAGE DROP	113 V	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
REGULATION (MAX.)	3 V	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
IONIZATION VOLTAGE (MAX.)	1	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
CHANGE IN TUBE VOLTAGE DROP FROM	4 mA	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
TUBE VOLTAGE DROP	116 V	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
TUBE	1 V	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
TUBE – published value 1	2 V	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
TUBE – published value 2	30 V	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
REGULATION	2.5 V	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
LEAKAGE CURRENT (Eb)	5 A	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
Regulator voltage	108 V	Promoted section value from the supplied datasheet.
Regulator maintaining voltage	108 V	Promoted section value from the supplied datasheet.

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MAXIMUM BULB TEMPERATURE	150 C	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
MAXIMUM ALTITUDE – published value 1	120 ft	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
MAXIMUM ALTITUDE – published value 2	0 ft	Published datasheet table value; multiple values on a source row represent separate limits or operating conditions.
Regulator minimum current	5 mA	Promoted section value from the supplied datasheet.
Regulator maximum current	30 mA	Promoted section value from the supplied datasheet.
Regulator starting/breakdown voltage	130 V	Promoted section value from the supplied datasheet.


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1968 Mazda Belvu

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1968 MAZDA BELVU

Section 1 · Voltage Regulator

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
StrikingVoltage	133 V	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MaintainingCurrentMinimum	5 mA	—
MaintainingCurrentMaximum	30 mA	—



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1999 Philips 0-D

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

1999 PHILIPS 0-D

Section 1 · Voltage Regulator

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
StartingCurrent	75 mA	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Regulation	4 V	I _a =5-30 mA

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