



ELECTRONIC TUBE REFERENCE

12BW4

Rectifier - Full Wave electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

RECTIFIER-RECTIFIER

Miniature cathode-type full-wave rectifier designed for relatively high output-current power supplies. Its two rectifier sections provide substantial inverse-voltage and peak-current capability from a 12.6 V heater.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	7
NOMINAL HEATER	12.6 V / 450 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Rectifier	
PEAK INVERSE VOLTAGE	1275 V
NOMINAL OUTPUT CURRENT	100 mA
PEAK FORWARD CURRENT	350 mA
Two identical rectifier sections; represented once under identical-section compression.	

SECTION2 Rectifier	
PEAK INVERSE VOLTAGE	1275 V
NOMINAL OUTPUT CURRENT	100 mA
PEAK FORWARD CURRENT	350 mA
Physical rectifier section 2; electrical properties populated from the same published ratings applicable to the identical rectifier path.	

12BW4 — Miniature Full-Wave Vacuum Rectifier

A miniature, cathode-type full-wave rectifier tube designed for power supply applications requiring relatively high output current capabilities.

Overview

The **12BW4** is a miniature double-diode vacuum tube designed for full-wave rectifier service. It features a coated unipotential cathode and is housed in a T-6 1/2 glass envelope with a 9-pin miniature button base. The tube is engineered to deliver high output currents in compact electronic equipment. Except for its heater ratings, the 12BW4 is electrically identical to the [6BW4](#).

Construction, Physical Dimensions, and Pinout

The 12BW4 is constructed with a coated unipotential cathode, which allows for a high heater-to-cathode voltage rating and isolates the heater circuit from the high-voltage DC output. The tube is enclosed in a standard T-6 1/2 glass bulb and utilizes a 9-pin miniature button base (designated **9DJ**). It is designed to operate reliably in any mounting position.

Physical Dimensions

- **Maximum overall length:** 2 5/8 inches
- **Maximum seated height:** 2 3/8 inches
- **Maximum diameter:** 7/8 inch

Pin Connections (9DJ Base)

Viewed from the underside of the base, the 9-pin connection layout is as follows:

- **Pin 1:** Plate 2 (P_2)
- **Pin 2:** No Connection (NC)
- **Pin 3:** No Connection (NC)
- **Pin 4:** Heater (H)
- **Pin 5:** Heater (H)
- **Pin 6:** No Connection (NC)
- **Pin 7:** Plate 1 (P_1)
- **Pin 8:** No Connection (NC)
- **Pin 9:** Cathode (K)

Heater Characteristics

The heater is designed for operation from either AC or DC power supplies.

- **Nominal heater voltage:** 12.6 Volts
- **Nominal heater current:** 450 mA (0.45 A)

- **Heating method:** Indirectly heated, coated unipotential cathode

Heater Power Calculation: Using the nominal heater voltage ($V_h = 12.6 \text{ V}$) and heater current ($I_h = 0.45 \text{ A}$), the nominal heater power consumption is calculated as: $\text{Heater Power} = V_h \times I_h = 12.6 \text{ V} \times 0.45 \text{ A} = 5.67 \text{ Watts}$

Maximum Ratings

The maximum ratings for the 12BW4 are established under the **Design Center System** for rectifier service. These limits must not be exceeded under the worst-case operating conditions:

Parameter	Rating
Heater Voltage	12.6 Volts
Maximum Peak Inverse Plate Voltage	1275 Volts
Maximum AC Plate Supply Voltage Each Plate (RMS)	450 Volts
Maximum DC Output Current	<i>Subject to Rating Chart I</i>
Maximum Steady State Peak Plate Current Each Plate	350 mA
Maximum Transient Peak Plate Current Each Plate	2.0 Amperes
Maximum Heater-Cathode Voltage (Heater Negative, DC)	450 Volts

Typical Operating Conditions

The 12BW4 can be configured with either a capacitor-input filter or a choke-input filter. Typical operating parameters for full-wave rectifier service are detailed below:

Parameter	Capacitor Input Filter	Choke Input Filter
Heater Voltage	12.6 V	12.6 V
Heater Current	450 mA	450 mA
AC Plate Supply Voltage Each Plate (RMS)*	325 V	450 V
Filter Input Capacitor	40 μF	—
Filter Input Choke	—	10 Henrys

Parameter	Capacitor Input Filter	Choke Input Filter
Effective Plate Supply Resistance Each Plate	82 Ω	—
DC Output Current	100 mA	100 mA
DC Output Voltage at Filter Input	330 V	360 V
Tube Voltage Drop (conducting 100 mA each plate)	40 V	40 V

**Note: AC plate voltage is measured under no-load conditions.*

Performance and Rating Charts Analysis

The safe operating boundaries of the 12BW4 are defined by three distinct rating charts, which govern the relationships between plate supply voltage, output current, rectification efficiency, and circuit resistance.

Rating Chart I: DC Output Current vs. AC Plate Supply Voltage

This chart defines the maximum allowable DC output current per plate as a function of the unloaded AC plate supply voltage (RMS) per plate:

- **Choke Input Filter:** Under choke-input conditions, the maximum operating boundary allows a constant DC output current of 62.5 mA per plate from 0 V up to approximately 320 V RMS. Above this voltage, the maximum current limit decreases linearly, reaching 50 mA per plate at the maximum rated AC plate supply voltage of 450 V RMS.
- **Capacitor Input Filter:** Under capacitor-input conditions, the maximum operating boundary allows 62.5 mA per plate up to approximately 60 V RMS. Beyond this point, the maximum allowable DC output current decreases steadily as the AC plate supply voltage increases, dropping to approximately 30 mA per plate at 450 V RMS.

Rating Chart II: Rectification Efficiency and Steady-State Limits

For capacitor-input filters, the maximum DC output current is also limited by the steady-state peak plate current rating of 350 mA per plate. This relationship is plotted against the rectification efficiency, which is calculated as: Rectification Efficiency = $\frac{\text{DC Output Voltage at Filter Input}}{\text{Peak AC Input Voltage Each Plate (Without Load)}}$

The permissible operating region allows a maximum DC output current of 62.5 mA per plate for rectification efficiencies up to approximately 0.55. For efficiencies higher than 0.55, the maximum allowable DC output current decreases rapidly, reaching 0 mA as the rectification efficiency approaches 1.00.

Rating Chart III: Minimum Effective Plate Supply Resistance

To prevent damage from transient surge currents during startup, a minimum effective plate supply resistance must be present in capacitor-input circuits. This chart defines the minimum resistance required per plate to limit the transient peak plate current to 2.0 Amperes:

- For unloaded AC plate supply voltages below approximately 215 V RMS, no additional external plate supply resistance is required ($0\ \Omega$).
- For voltages above 215 V RMS, the minimum required effective plate supply resistance increases linearly with the AC plate supply voltage, reaching approximately $160\ \Omega$ at the maximum rated AC plate supply voltage of 450 V RMS.

Technical Summary

The **12BW4** is a miniature 9-pin full-wave vacuum rectifier featuring relatively high output current capabilities. Operating with a 12.6 V, 450 mA heater, it is identical to the **6BW4** except for its heater ratings. With a maximum peak inverse plate voltage of 1275 V and a maximum heater-cathode voltage of 450 V (heater negative, DC), it is highly versatile for power supply designs. When configured as a full-wave rectifier, it can deliver a DC output current of 100 mA, yielding a DC output voltage of 330 V with a $40\ \mu\text{F}$ capacitor-input filter, or 360 V with a 10 Henry choke-input filter, while exhibiting a tube voltage drop of 40 V.

SOURCE OPERATING CONDITIONS

1950 Sylvania

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

1950 SYLVANIA

Section 1 · Rectifier

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
DC output current capacitor-input	100 mA	CapacitorInputFilter
DC output current choke-input	100 mA	ChokeInputFilter

1950 SYLVANIA

Section 2 · Rectifier

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
DC output current capacitor-input	100 mA	CapacitorInputFilter
DC output current choke-input	100 mA	ChokeInputFilter

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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 · Rectifier

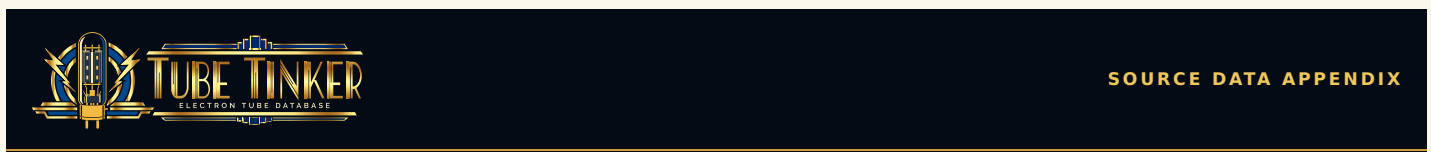
OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	12.6 V	Nominal

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater current	450 mA	Nominal
Plate voltage	1275 V	Typical operating conditions

1961 TUNG SOL

Section 2 · Rectifier

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	12.6 V	Nominal
Heater current	450 mA	Nominal
Plate voltage	1275 V	Typical operating conditions



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1966 Tung Sol Electronic Tubes 2 of 4

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

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 1 · Rectifier

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEATER VOLTAGE	12.6 V	Published datasheet
HEATER VOLTAGE	126 V	Published datasheet; operating column 2
HEATER CURRENT	450 mA	Published datasheet; operating column 1
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)A	325 V	Published datasheet; operating column 1
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)A	450 V	Published datasheet; operating column 2

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1275 V	Published datasheet
(SEE RATING CHART #1)	450 V	Published datasheet
(SEE RATING CHART #2)	350 mA	Published datasheet

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
(SEE RATING CHART #3)	2 A	Published datasheet
HEATER NEGATIVE S DC	450 V	Published datasheet
EFFECTIVE PLATE SUPPLY RESISTANCE EACHPLATE H2	0 ohm	Published datasheet
Maximum peak inverse voltage	1275 V	Published datasheet; promoted section value
Peak forward current	350 mA	Published datasheet; promoted section value

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 2 · Rectifier

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEATER VOLTAGE	12.6 V	Published datasheet
HEATER VOLTAGE	126 V	Published datasheet; operating column 2
HEATER CURRENT	450 mA	Published datasheet; operating column 1
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)A	325 V	Published datasheet; operating column 1
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)A	450 V	Published datasheet; operating column 2

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
M AX IMUM PEAK INVERSE PLATE VOLTAGE	1275 V	Published datasheet
(SEE RATING CHART #1)	450 V	Published datasheet
(SEE RATING CHART #2)	350 mA	Published datasheet
(SEE RATING CHART #3)	2 A	Published datasheet
HEATER NEGATIVE S DC	450 V	Published datasheet
EFFECTIVE PLATE SUPPLY RESISTANCE EACHPLATE H2	0 ohm	Published datasheet
Maximum peak inverse voltage	1275 V	Published datasheet; promoted section value
Peak forward current	350 mA	Published datasheet; promoted section value

TUBE TINKER

An independent reference for electronic tubes, vacuum tubes, and their source documents.

