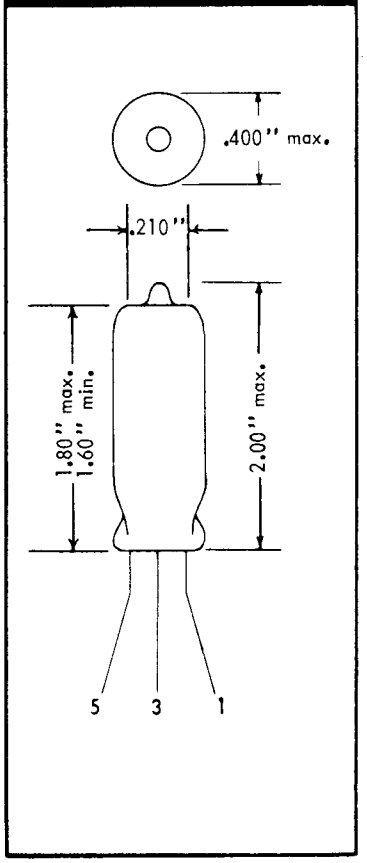
RAYTHEON

# TECHNICAL INFORMATION

RELIABLE SUBMINIATURE GAS DIODE

*Excellence in Electronics*

# TYPE CK5787WA




The CK5787WA is a cold cathode, gas-filled diode of subminiature construction designed for service as a voltage regulator. It has an operating current range of 5 to 25 milliamperes over which it maintains a substantially constant operating voltage of approximately 98 volts. Two cathode leads are provided which may be used to disconnect the load when the tube is removed from the socket. This type is characterized by long life and it is designed for service where severe conditions of high temperature and mechanical shock or vibration are encountered. The flexible terminal leads may be soldered, or welded directly to the terminals of circuit components without the use of sockets. Standard inline subminiature sockets may be used by cutting the leads to a suitable length.

## MECHANICAL DATA

ENVELOPE: T-3 Glass

BASE: None (0.016" tinned flexible leads. Length: 1.5" min. Spacing: 0.096" center-to-center)

TERMINAL CONNECTIONS:

Lead 1 Cathode
Lead 3 Anode
Lead 5 Cathode

MECHANICAL RATINGS:

| | |
|---|---|
| Maximum Impact Acceleration (Shock Test---Note 2) | 450 G |
| Maximum Uniform Acceleration (Centrifuge Test---Note 4) | 1000 G |
| Maximum Vibrational Acceleration (96 Hour Fatigue Test---Note 3) | 2.5 G |
| Maximum Bulb Temperature | 225 °C |

MOUNTING POSITION: Any

## ELECTRICAL DATA

CAUTION----- To Electronic Equipment Design Engineers. Special attention should be given to the temperature of the tubes. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions more severe than those specified for life are imposed on the tube and will be reduced appreciably if absolute ratings are exceeded. Attention should be given to the specified minimum supply voltage to insure operation in total darkness. Tube characteristics may deteriorate markedly if the tubes are stored at elevated ambient temperatures without drawing current.

**RATINGS**

| | Ebb Vdc | Total Darkness Starting Voltage Vdc | Ambient Light Starting Voltage Vdc | Operating Voltage Range Vdc | Operating Current Range mAdc (Note 6) | Ambient Temperature °C (Note 6) | Bulb Temperatu °C (Note 6) |
|---|---|---|---|---|---|---|---|
| Absolute: | | | | | | | |
| Maximum: | ---- | ---- | ---- | 103 | 25 | +150 | +225 |
| Minimum: | 155 | 150 | 135 | 95 | 5 | –55 | ---- |

**CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)**

| TEST | CONDITIONS | AQL % | MIL-E-1 SYMBOL | MIN. | LAL | AVERAGE | UAL | MAX. | ALD | MIL-E-1 UNITS |
|---|---|---|---|---|---|---|---|---|---|---|
| **MEASUREMENTS ACCEPTANCE TEST – PART 1** | | | | | | (Combined AQL = 1.0% excluding Mechanical and Inoperatives) | | | | |
| Ionization Voltage (1): | Rp/Ib = 5 – 25 mAdc Ambient Light | 0.65 | (1)Ez: | ---- | ---- | 122 | ---- | 135 | ---- | Vdc |
| Tube Voltage Drop (1): | Rp/Ib = 25 mAdc | 0.65 | (1)Etd: | 95 | ---- | 98 | ---- | 101 | ---- | Vdc |
| Tube Voltage Drop (2): | Rp/Ib = 5 mAdc | 0.65 | (2)Etd: | 95 | ---- | 97 | ---- | 101 | ---- | Vdc |
| Regulation: | (1)Etd – (2)Etd | 0.65 | Reg.: | ---- | ---- | 1.0 | ---- | 3.0 | ---- | Vdc |
| Continuity and Shorts: (Inoperatives) | | 0.4 | ----- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Mechanical: | Note 7 | | | | | | | | | |

Tentative Data

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INDUSTRIAL TUBE DIVISION
RAYTHEON MANUFACTURING COMPANY
55 CHAPEL ST., NEWTON 58, MASS.

## ELECTRICAL DATA (Cont'd.)

**CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd.)**

| TEST | CONDITIONS | AQL % | MIL-E-1 SYMBOL | MIN | LAL | AVERAGE | UAL | MAX | ALD | MIL-E-1 UNITS |
|---|---|---|---|---|---|---|---|---|---|---|
| **MEASUREMENTS ACCEPTANCE TESTS—PART 2** | | | **(Generally considered as Design Tests)** | | | | | | | |
| Ionization Voltage (2): | Rp/Ib=5—25 mAdc Total Darkness | 6.5 | (2)Ez: | ---- | ---- | 125 | ---- | 150 | ---- | Vdc |
| Leakage: | Eb=50 Vdc; Rp=3000 ohms | 6.5 | Llb: | ---- | ---- | <1 | ---- | 5 | ---- | μAdc |
| Noise: | Ebb/Ib=25 mAdc | 1.0 | Eb: | ---- | ---- | <1 | ---- | 5 | ---- | mVac |
| Oscillation: | Esig=5 mVac; RL=500 ohms; Rp/Ib=5—25 mAdc | 1.0 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Vibration: | Rp=10,000; Ebb/Ib=25 mAdc; F=40 cps; G=15 | 6.5 | Ep: | ---- | ---- | <1 | ---- | 20 | ---- | mVac |
| Repeatability: | Rp/Ib=10 mAdc (Note 5) | 6.5 | ΔEtd: | ---- | ---- | 0.1 | ---- | 1.0 | ---- | Vdc |
| **DEGRADATION RATE ACCEPTANCE TESTS** | | | | | | | | | | |
| Subminiature Lead Fatigue: | | 2.5 | ---- | 4.0 | ---- | ---- | ---- | ---- | ---- | arcs |
| Shock: | Hammer Angle=30°; (Note 2) | 20 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Fatigue: | G=2.5; Fixed Frequency F=25 min., 60 max. | 6.5 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Post Shock and Fatigue Test End Points: | | | | | | | | | | |
| Vibration: | F=40 cps; G=15; Ebb/Ib=25 mAdc; Rp=10,000 ohms | ---- | Ep: | ---- | ---- | <1 | ---- | 30 | ---- | mVac |
| Ionization Voltage (1): | Rp/Ib=5—25 mAdc | ---- | (1)Ez: | ---- | ---- | 122 | ---- | 135 | ---- | Vdc |
| Tube Voltage Drop (1): | Rp/Ib=25 mAdc | ---- | (1)Etd: | 95 | ---- | 99 | ---- | 105 | ---- | Vdc |
| Tube Voltage Drop (2): | Rp/Ib=5 mAdc | ---- | (2)Etd: | 95 | ---- | 98 | ---- | 105 | ---- | Vdc |
| Regulation: | (1) Etd—(2) Etd | ---- | Reg: | ---- | ---- | 1 | ---- | 4.0 | ---- | Vdc |
| Glass Strain (Thermal Shock): | | 2.5 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| **ACCEPTANCE LIFE TESTS** | | | | | | | | | | |
| 1 Hour Stability Life Test: | TA=Room; Rp/Ib=25 mAdc | 6.5 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| 1 Hour Stability Life Test End Points: | (Typical Sample Size=50 tubes) | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Change in Tube Voltage Drop (1) of individual tubes: | | ---- | $\Delta_t$(1)Etd: | ---- | ---- | 0.3 | ---- | 1.0 | ---- | Vdc |
| Change in Tube Voltage Drop (2) of individual tubes: | | ---- | $\Delta_t$(2)Etd: | ---- | ---- | 0.3 | ---- | 1.0 | ---- | Vdc |
| 100 Hour Survival Rate Life Test: | TA=Room: Rp/Ib=25 mAdc | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| 100 Hour Survival Rate Life Test End Points: | (Typical Sample Size=200 tubes) | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Continuity and Shorts (Inoperatives): | | 0.4 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Change in Tube Voltage Drop (1) of individual tubes: | | 6.5 | $\Delta_t$(1)Etd: | ---- | ---- | 0.3 | ---- | 1.0 | ---- | Vdc |
| Change in Tube Voltage Drop (2) of individual tubes: | | 6.5 | $\Delta_t$(2)Etd: | ---- | ---- | 0.3 | ---- | 1.0 | ---- | Vdc |
| 500 Hour Intermittent High Temperature Life Test: | T Bulb=225°C; Rp/Ib=25 mAdc | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |

## ELECTRICAL DATA (Cont'd.)

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd.)

| TEST | CONDITIONS | AQL % | MIL-E-1 SYMBOL | MIN | AVERAGE | MAX | MIL-E-1 UNITS | Allowable Defect per Characteristic 1st Sample | Combined Samples |
|---|---|---|---|---|---|---|---|---|---|
| **ACCEPTANCE LIFE TESTS (cont'd.)** | | | | | | | | | |
| 500 Hour Intermittent High Temperature Life Test End Points: | (Typical Sample Size= 20 tubes 1st sample, 40 tubes 2nd sample) | ---- | ---- | ---- | ---- | ---- | ---- | --- | --- |
| Inoperatives: | | ---- | ---- | ---- | ---- | ---- | ---- | 1 | 3 |
| Regulation: | | ---- | Reg.: | ---- | 2.0 | 4.0 | Vdc | 1 | 3 |
| Tube Voltage Drop (1): | | ---- | (1) Etd: | 95 | 99 | 103 | Vdc | 1 | 3 |
| Tube Voltage Drop (2): | | ---- | (2) Etd: | 95 | 97 | 103 | Vdc | 1 | 3 |
| Change in Tube Voltage Drop (1) of individual tubes: | | ---- | $\Delta_t$ (1) Etd: | ---- | 1.0 | 2.5 | Vdc | 1 | 3 |
| Change in Tube Voltage Drop (2) of individual tubes: | | ---- | $\Delta_t$ (2) Etd: | ---- | 1.0 | 2.5 | Vdc | 1 | 3 |
| Ionization Voltage (1): | | ---- | (1) EZ: | ---- | 122 | 135 | Vdc | 1 | 3 |
| Total Defectives: | | ---- | ---- | ---- | ---- | ---- | ---- | 2 | 3 |
| 1000 Hour Intermittent High Temperature Life Test End Points: | (Typical Sample Size= 20 tubes 1st sample, 40 tubes 2nd sample) | ---- | ---- | ---- | ---- | ---- | ---- | --- | --- |
| Inoperatives: | | ---- | ---- | ---- | <1 | ---- | ---- | 2 | 4 |
| Regulation: | | ---- | Reg.: | ---- | 2.5 | 4.0 | Vdc | 2 | 4 |
| Tube Voltage Drop (1): | | ---- | (1) Etd: | 95 | 99.5 | 103 | Vdc | 2 | 4 |
| Tube Voltage Drop (2): | | ---- | (2) Etd: | 95 | 97 | 103 | Vdc | 2 | 4 |
| Change in Tube Voltage Drop (1) of individual tubes: | | ---- | $\Delta_t$ (1) Etd: | ---- | 1.5 | 3.0 | Vdc | 2 | 4 |
| Change in Tube Voltage Drop (2) of individual tubes: | | ---- | $\Delta_t$ (2) Etd: | ---- | 1.5 | 3.0 | Vdc | 2 | 4 |
| Ionization Voltage (1): | | ---- | (1) EZ: | ---- | 122 | 135 | ---- | 2 | 4 |
| Total Defectives: | | ---- | ---- | ---- | ---- | ---- | ---- | 3 | 4 |

NOTES

Note 1: Characteristics, Quality Control Test Procedures, and Inspection Levels are made according to the appropriate paragraphs of MIL-E-1, "Inspection Instructions for Electron Tubes" and MIL-STD-105A.

Note 2: Test Conditions and Acceptance Criteria per Shock Test Procedures of MIL-E-1 Basic Specifications.

Note 3: Test Conditions and Acceptance Criteria per Fatigue Test Procedures of MIL-E-1 Basic Specifications.

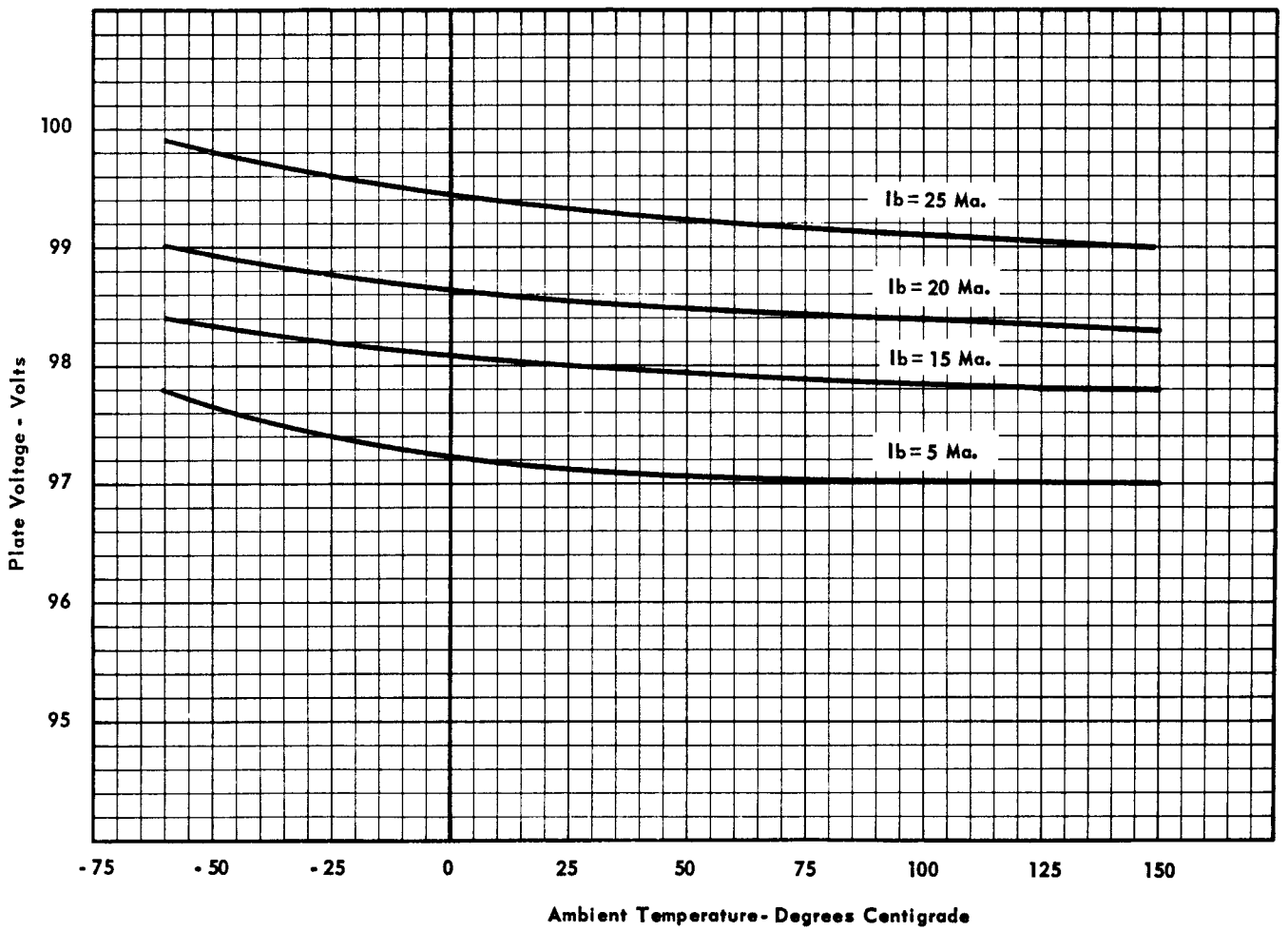
Note 4: Centrifuge Test with forces applied in any direction.

Note 5: Repeatability is the maximum shift in tube voltage drop between successive firings of the tube.

Note 6: Limits beyond which normal tube performance and tube life may be impaired.

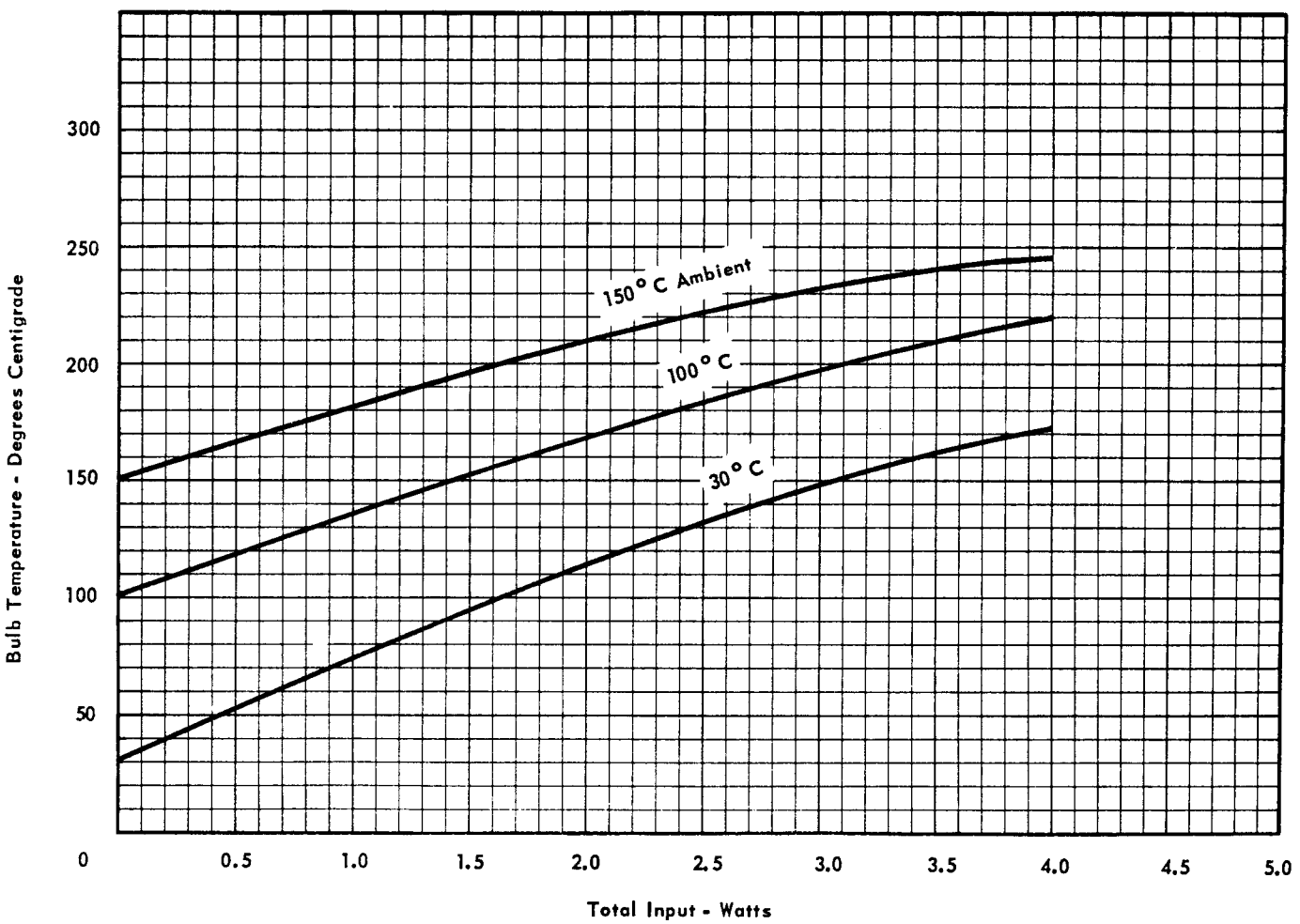
Note 7: In addition to meeting the tightened electrical, physical and mechanical tests described in this data sheet, these Raytheon Reliable tubes are now guaranteed to be free from "Potential" defects identifiable by microscopic inspection as described by appendix B of Inspection Instructions for Electron Tubes.

AVERAGE TUBE DROP vs. AMBIENT TEMPERATURE



## RELIABLE SUBMINIATURE GAS DIODE

BULB TEMPERATURE vs. TOTAL INPUT

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RAYTHEON MANUFACTURING COMPANY

RECEIVING TUBE AND SEMICONDUCTOR OPERATIONS

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