800W HIGH MU POWER TRIODE

3CX800A7

The EIMAC 3CX800A7 is a compact ceramic/metal, air-cooled, high-mu power triode intended for use as a cathode-driven Class AB_2 or Class B amplifier in rf applications including the VHF band. As a linear amplifier, high power gain may be obtained without sacrifice of low intermodulation distortion characteristics. Low grid interception and high amplification factor combine to make the 3CX800A7 drive power low for a tube of this power capacity. A single 3CX800A7 will deliver 750 watts PEP and 750 watts key-down CW output power to 350 MHz. The 3CX800A7 is useful to 600 MHz. A pulse rated version (3CPX800A7) is also available.

The anode is forced-air cooled for 800 watts of dissipation.

CHARACTERISTICS[1]

ELECTRICAL:

Cathode: Oxide Coated, Unipotential

Heater Voltage	13.5 ± 0.6	V
Heater Current at 13.5 Volts	1.5	A
Cathode-Heater Potential (Max.)	±150	V
Minimum Warm-up Time (before application of rf drive and high voltage)	3	Min.
Amplification Factor (approximate)	200	
Direct Interelectrode Capacitances (grounded grid)[2]		
Cin	26.0	pF
Cout	6.1	pF
Cpk	0.05	pF
Frequency of Maximum Ratings	350	MHz

MECHANICAL:

Overall Dimensions:	
Length	2.52 in: 64.01 mm
Diameter	2.53 in; 64.26 mm
Net Weight	11.5 oz; 326 gm
Operating Position	Any
Maximum Operating Temperature: Ceramic/Metal Seals or Anode Core	250° C
Cooling	Forced Air
Base	Large Wafer Elevenar 11-pin with Ring (EIA No. E11-81)
Recommended Socket	Special
Recommended Air Chimney	Eimac SK-1906
Recommended Chimney Clamp	Eimac SK-1916

[1] Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. CPI MPP Eimac Operation should be consulted before using this information for final equipment design.

[2] Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

TYPICAL OPERATION

NOTE: TYPICAL OPERATION data are obtained from direct measurement or by calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified anode current at the specified bias and anode voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid current. The grid current which results when the desired anode current is obtained is incidental and varies from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

RADIO FREQUENCY LINEAR AMPLIFIER
CATHODE DRIVEN Class AB_2

ABSOLUTE MAXIMUM RATINGS: (to 350 MHz)

DC ANODE VOLTAGE[1]	2.25 kV
DC ANODE CURRENT	0.6 A
ANODE DISSIPATION	800 W
GRID CURRENT	0.06 A
GRID DISSIPATION	4.0 W

[1] Anode voltage may rise to 2500 volts maximum under no-signal conditions to account for power supply regulation.

[2] Approximate value.

[3] Value will be lower with voice modulation for the same PEP level.

[4] Measured at the load.

[5] Ref. against one tone of a 2-equal-tone signal.

PULSED MODULATOR OR REGULATOR

ABSOLUTE MAXIMUM RATINGS (See Figure 2 PULSE DERATING CHART for pulse durations over 100 microseconds)

DC ANODE VOLTAGE	3.50 kV
AVERAGE ANODE DISSIPATION	800 W
PEAK ANODE DISSIPATION (average during pulse)	8.0 A
AVERAGE ANODE CURRENT	0.6 A
AVERAGE GRID CURRENT	0.06 A
GRID DISSIPATION (Avg)	4.0 W

TYPICAL OPERATION - (Measured Data (to 150 MHz) Class AB^2 Cathode Driven

	CW/SSB
ANODE VOLTAGE	2.2 kVdc
CATHODE BIAS VOLTAGE	+8.2 Vdc
ZERO-SIGNAL ANODE CURRENT[2]	15 mAdc
CW ANODE CURRENT	500 mAdc
CW POWER INPUT	1100 W
PEAK ENVELOPE POWER INPUT	1100 w
TWO-TONE ANODE CURRENT[3]	313 mAdc
CW GRID CURRENT[2]	36 mAdc
TWO-TONE GRID CURRENT[2,3]	16 mAdc
PEAK RF CATHODE VOLTAGE[2]	64 v
PEAK DRIVING POWER[2]	23 w
USEFUL OUTPUT POWER[4]	750 W
USEFUL OUTPUT POWER, PEP[4]	750 w
CATHODE INPUT IMPEDANCE	54 Ohms
RESONANT LOAD IMPEDANCE	2700 Ohms
INTERMODULATION DISTORTION[5]:	
3rd ORDER PRODUCTS	-36 dB
5th ORDER PRODUCTS	-32 dB

MECHANICAL

MOUNTING & SOCKETING – The tube may be mounted in any position. If it is to be operated in an inverted (anode down) or horizontal position, the available SK-1916 clamp assembly should be used for reliable retention. Also available is the SK-1906 chimney which has four 4-40 tapped holes at one end for chassis mounting and four more 4-40 tapped holes at the other end for optional SK-1916 mounting. The combination of the SK-1906 with the optional SK-1916 clamp makes a rigid mounting assembly for the 3CX800A7.

STORAGE – If a tube is to be stored as a spare it should be kept in its original shipping carton, with the original packing material, to minimize the possibility of handling damage. Before storage a new tube should be operated in the equipment for 100 to 200 hours to establish that it has not been damaged and operates properly. If the tube is still in storage 6 months later it should be operated in the equipment for 100 to 200 hours to make sure there has been no degradation. If operation is satisfactory the tube can again be stored with great assurance of being a known-good spare.

COOLING - Forced-air cooling must be provided to maintain the anode core and seal temperatures at a safe operating temperature. Cooling data are shown for incoming cooling air at 25°C and 50°C, and represent the minimum requirements to limit tube temperatures to 225°C. The pressure drop figures are approximate and are for the mounting plate, socket, tube and chimney combination as would be the case with pressurized-compartment mounting, where air is required to pass through the chassis slots and through the air chimney to reach the anode cooler.

Some air from the pressurized compartment passes by the socket for base cooling. This mounting technique is effective in the HF region but rf leakage through the slots may cause amplifier instability or regeneration in the VHF region. Screening the holes or use of "wave-guide-beyond-cutoff" (honeycomb) air vents may be required in the VHF region.

Cooling must be applied before or simultaneously with electrode voltages, including the heater, and may be removed simultaneously with them. In all cases temperature of the anode and the ceramic/metal seals is the limiting factor, and the designer is encouraged to use temperature-sensitive paint or other temperature sensing devices in connection with any equipment design before the layout is finalized. It should also be noted that it is not good practice to operate at, or close to, the absolute maximum temperature rating for the metal/ceramic seals. Where long life and consistent performance are factors cooling in excess of minimum requirements is normally beneficial.

Cooling Air at 25° C

	SEA LEVEL		5000 FEET	
Anode Dissipation (Watts)	Air Flow (CFM)	Pressure Drop (In. of Water)	Air Flow (CFM)	Pressure Drop (In. of Water)
400	6	0.09	7	0.10
600	11	0.20	14	0.23
800	19	0.50	23	0.57

Cooling Air at 50° C

	SEA LEVEL		5000 FEET	
Anode Dissipation (Watts)	Air Flow (CFM)	Pressure Drop (In. of Water)	Air Flow (CFM)	Pressure Drop (In. of Water)
400	8	0.10	10	0.12
600	16	0.31	19	0.35
800	27	0.79	33	0.88

ELECTRICAL

ABSOLUTE MAXIMUM RATINGS - Values shown for each type of service are based on the "absolute system" and are not to be exceeded under any service conditions. These ratings are limiting values outside which serviceability of the tube may be impaired. In order not to exceed absolute ratings the equipment designer has the responsibility of determining an average design value for each rating below the absolute value of that rating by a safety factor so that the absolute values will never be exceeded under any usual conditions of supply-voltage variation, load variation, or manufacturing variation in the equipment itself. It dœs not necessarily follow that combinations of absolute maximum ratings can be attained simultaneously.

HEATER/CATHODE OPERATION - The rated heater voltage for the 3CX800A7 is 13.5 volts, as measured at the base of the tube, and variations should be restricted to ± 0.6 volts for long life and consistent performance.

CATHODE WARM-UP TIME - In normal service it is recommended the heater voltage be applied for a minimum of three minutes before anode voltage and/or rf drive voltage are applied, to allow for proper conditioning of the cathode surface.

HIGH VOLTAGE - The 3CX800A7 operates at voltages which can be deadly, and the equipment must be designed properly and operating precautions must be followed. Equipment must be designed so that no one can

come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open the primary circuits of the power supplies and to discharge high-voltage capacitors whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

INPUT CIRCUIT - When the 3CX800A7 is operated as a grounded-grid rf amplifier, the use of a resonant tank in the cathode circuit is recommended to obtain greatest linearity and power output. For best results with a single-ended amplifier, it is suggested that the cathode tank circuit operate with a "Q" of two or more.

GRID AND ANODE CURRENT LIMITATIONS - Note that grid current is a function of drive power and amplifier loading and can vary widely during tuning and loading. Under no circumstances should grid current exceed 60 mAdc during tuning or operation of the tube.

The maximum anode current rating is 600 mAdc. Drive level should be restricted during tuning periods so this rating is not exceeded. For monitoring purposes, peak meter readings on voice (taking into account inertia of the meter) will be approximately 200 mAdc. Under no circumstances is the anode current meter reading to exceed the maximum anode current rating to 600 mAdc.

INTERMODULATION DISTORTION - Typical Operating Conditions, with distortion values included, are the result of data taken during actual operation at 2 MHz. Intermodulation values listed are those measured at the full peak-envelope power noted and are referenced against one tone of a two-equal-tone signal.

FAULT PROTECTION - All power tubes operate at voltages which can cause severe damage in the event of an arc, especially in cases where large amounts of power supply stored energy are involved. Some means of protection is advised in all cases, and it is recommended that a series resistor be used in the lead from the power supply to the anode circuit to limit peak current and help dissipate the energy in the event of a tube or circuit arc. A resistance of 10 to 50 ohms, depending on allowable voltage drop, with at least a 50W rating, in the positive anode power supply lead will help protect the tube in the event of an arc. Eimac application Bulletin #17, FAULT PROTECTION, contains considerable detail and is available upon request.

VHF OPERATION - The base pin connections to the grid may be used at frequencies to 30 MHz. Above 30 MHz the available contact collets or grid by-pass capacitor assembly are recommended. VHF driving power will be greater than the typical values shown on page 2 because of higher circuit losses.

INTERELECTRODE CAPACITANCE - The actual internal interelectrode capacitance of a tube is influenced by many variables in most applications, such as stray capacitance to the chassis, capacitance added by the socket used, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and the Military Services use a standard test procedure as described in Electronic Industries Association Standard RS-191. This requires the use of specially constructed test fixtures, which effectively shield all external tube leads from each other and eliminates any capacitance reading to 'ground'. The test is performed on a cold tube in a special shielded fixture.

Other factors being equal, controlling internal tube capacitance in this way normally assures good interchangeability of tubes over a period of time, even when the tube may be made by different manufacturers. The capacitance values shown in the manufacturer's technical data, or test specifications, normally are taken in accordance with Standard RS-191. The equipment designer is therefore cautioned to make allowance for the actual capacitance values which will exist in any normal application. Measurements should be taken with mounting which represents approximate final layout if capacitance values are highly significant in the design.

RF RADIATION - Avoid exposure to strong rf fields even at relatively low frequency. Absorption of rf energy by human tissue is dependent on frequency. Under 300 MHz most of the energy will pass completely through the human body with little attenuation or heating affect. Public health agencies are concerned with the hazard, and the published OSHA (Occupational Safety and Health Administration) or other local recommendations to limit prolonged exposure of rf radiation should be followed. It is worth noting that some commercial dielectric heating units actually operate at frequencies as low as the 13 and 27 MHz bands.

Many Eimac power tubes such as this are specifically designed to generate or amplify radio frequency power. There may be a relatively strong rf field in the general proximity of the power and its associated circuitry - the more power involved the stronger the rf field. Proper enclosure design and efficient coupling of rf energy to the load will minimize the rf field in the vicinity of the power amplifier itself.

HOT SURFACES - Air-cooled surfaces and other parts of tubes can reach temperatures of several hundred degrees C and cause serious burns if touched for several minutes after all power is removed.

SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different from those given here, contact the Application Engineering Dept., CPI MPP Eimac Operation for information and recommendations.

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OPERATING HAZARDS

Proper use and safe operating practices with respect to power tubes are the responsibility of equipment manufacturers and users of such tubes. All persons who work with and are exposed to power tubes, or equipment that utilizes such tubes, must take precautions to protect themselves against possible serious bodily injury. DO NOT BE CARELESS AROUND SUCH PRODUCTS.

The operation of this tube may involve the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel.

Please review the detailed Operating Hazards Sheet enclosed with each tube, or request a copy from CPI Microwave Power Products, Eimac Operation.

HIGH VOLTAGE – Normal operating voltages can be deadly. Remember the HIGH VOLTAGE CAN KILL.

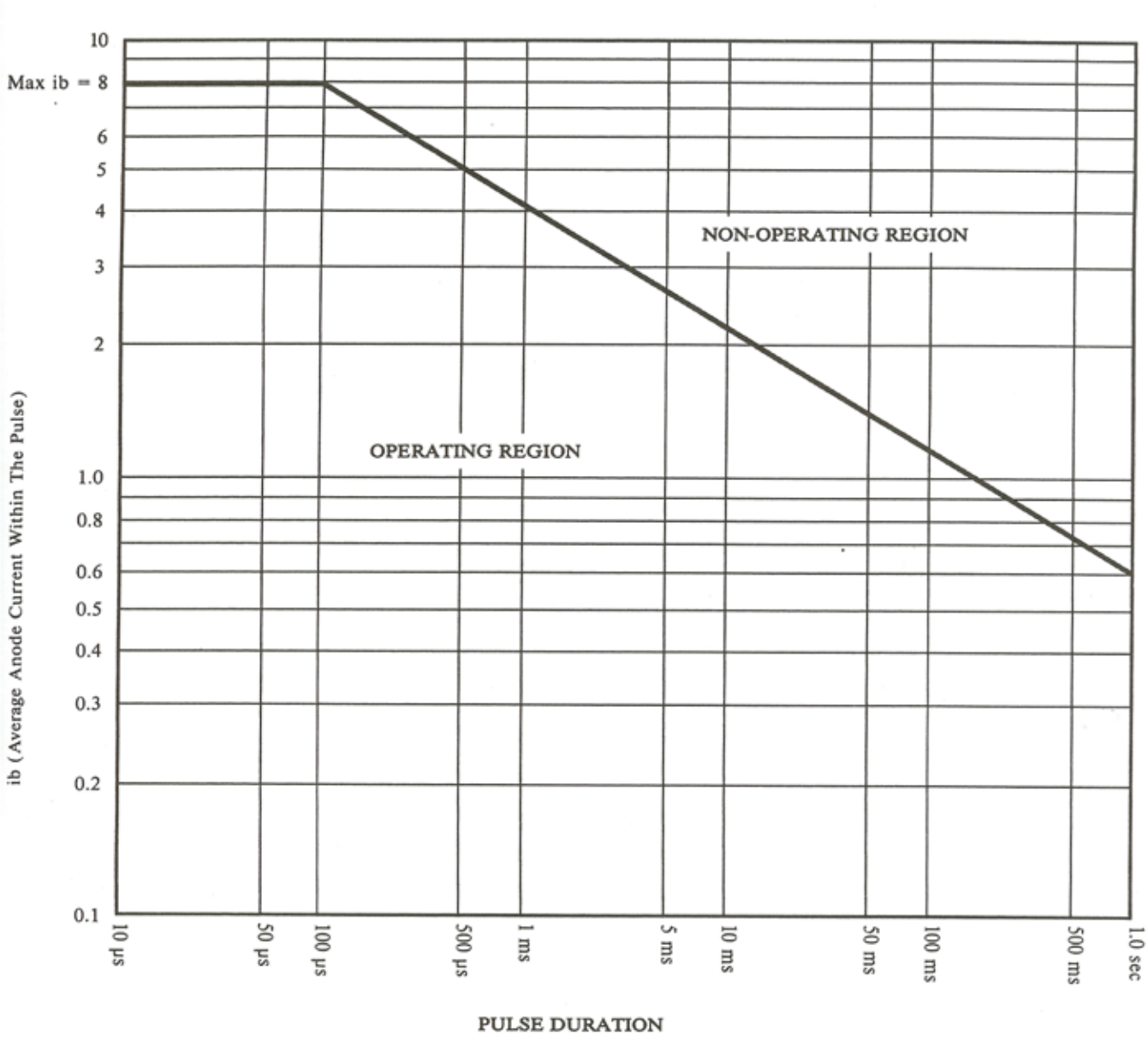
LOW-VOLTAGE HIGH-CURRENT CIRCUITS - Personal jewelry, such as rings, should not be worn when working with filament contacts or connectors as a short circuit can produce very high current and melting, resulting in severe burns.

RF RADIATION – Exposure to strong rf fields should be avoided, even at relatively low frequencies. CARDIAC PACEMAKERS MAY BE AFFECTED.

HOT WATER – Water used to cool tubes may reach scalding temperatures. Touching or rupture of the cooling system can cause serious burns.

HOT SURFACES – Surfaces of tubes can reach temperatures of several hundred°C and cause serious burns if touched for several minutes after all power is removed.

MATERIALS COMPLIANCE - This product and package conforms to the conditions and limitations specified in 49CFR 173.424 for radioactive material, excepted package-instruments or articles, UN2910. In addition, this product and package contains no beryllium oxide (BeO).

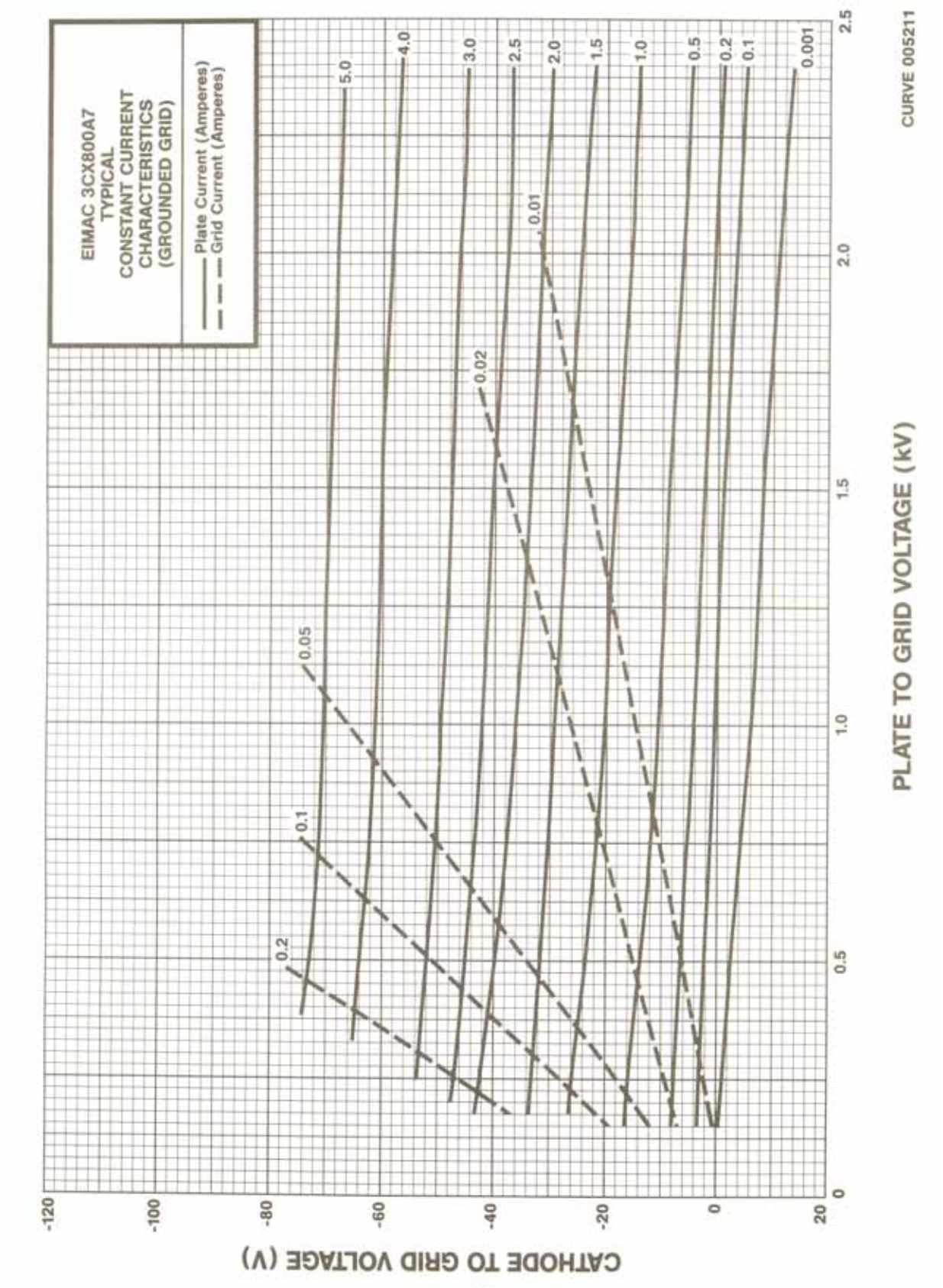


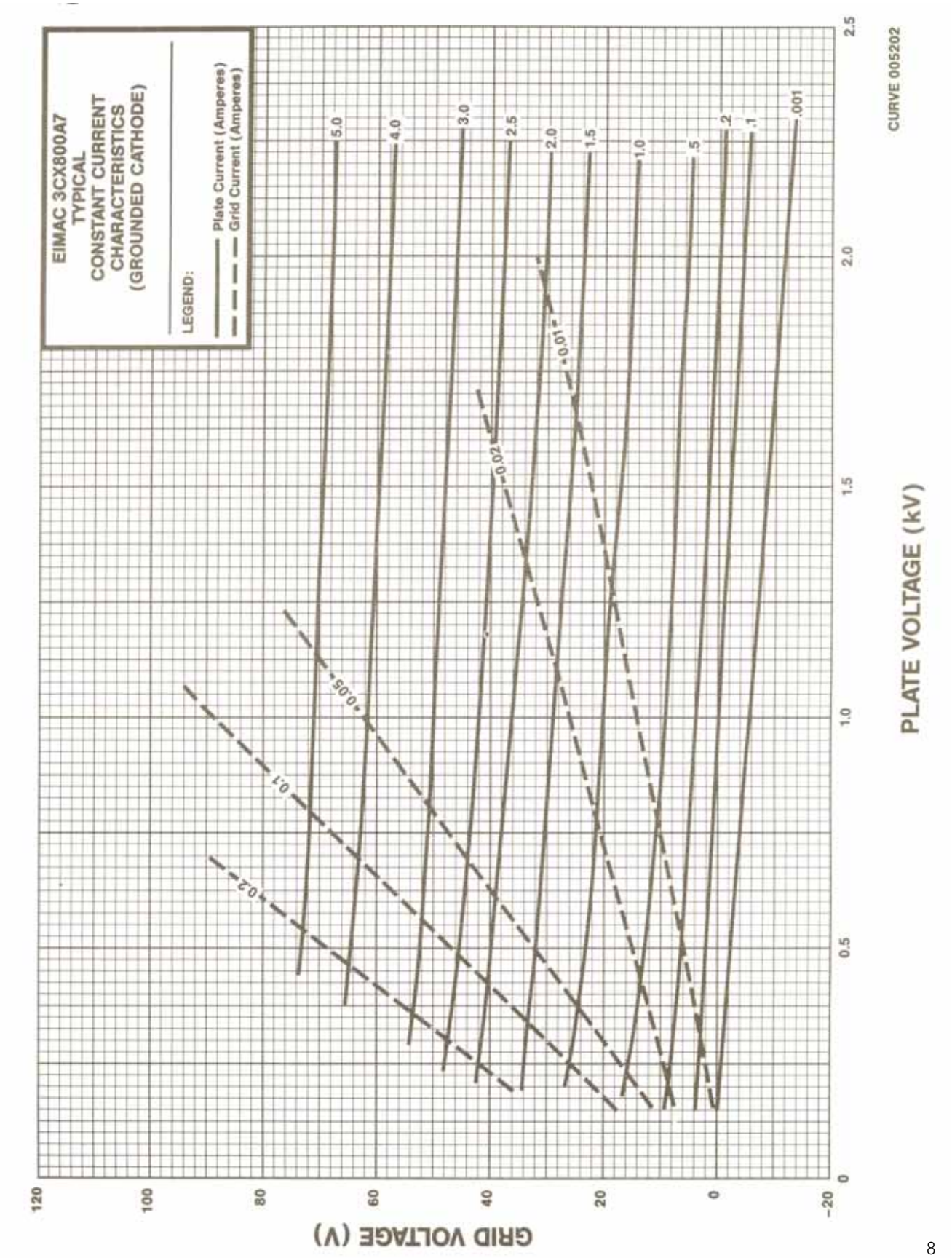
Pulse Derating Chart, 3CX800A7

Pulse Modulator or Regulator Service

Pulse anode current (Ib) capability is dependent on pulse duration (tp) and duty factor (Du). Maximum Ib for a given tp is shown; maximum Du may then be derived from the relationship:

$$0.6 = Ib\sqrt{Du}$$


EIMAC 3CX800A7
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
(GROUNDED GRID)
Plate Current (Amperes)
Grid Current (Amperes)
5.0
4.0
3.0
2.5
2.0
1.5
1.0
0.5
0.2
0.1
0.001
0.01
0.02
0.05
0.1
0.2
-120
-100
-80
-60
-40
-20
0
20
0
0.5
1.0
1.5
2.0
2.5
CATHODE TO GRID VOLTAGE (V)
PLATE TO GRID VOLTAGE (kV)
CURVE 005211


EIMAC 3CX800A7
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
(GROUNDED CATHODE)
LEGEND:
Plate Current (Amperes)
Grid Current (Amperes)
5.0
4.0
3.0
2.5
2.0
1.5
1.0
.5
.2
.1
.001
.05
.1
.2
.02
.01
120
100
80
60
40
20
0
-20
0
0.5
1.0
1.5
2.0
2.5
GRID VOLTAGE (V)
PLATE VOLTAGE (kV)
CURVE 005202

HIGH-MU POWER TRIODE

3CX800A7

NOTES:

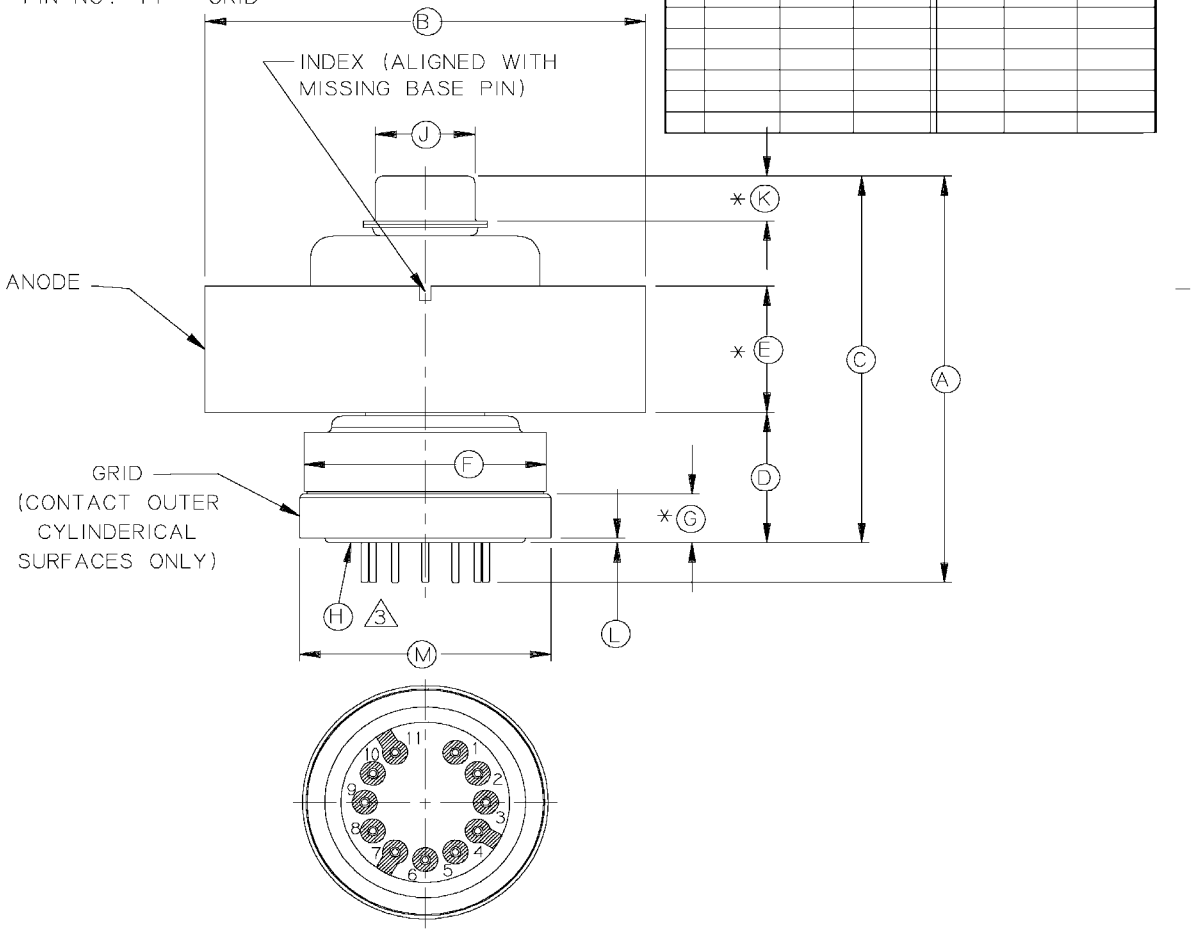
1. REFERENCE DIMENSIONS ARE FOR INFORMATION ONLY. AND ARE NOT REQUIRED FOR INSPECTION PURPOSES.
2. * CONTACT SURFACE.
3. BASE IS BASIC JEDEC EXCEPT CERAMIC WAFER IS INSIDE SHELL.

PIN CONNECTION

PIN NO. 1 – CATHODE
PIN NO. 2 – CATHODE
PIN NO. 3 – CATHODE
PIN NO. 4 – GRID
PIN NO. 5 – HEATER
PIN NO. 6 – HEATER
PIN NO. 7 – GRID
PIN NO. 8 – CATHODE
PIN NO. 9 – CATHODE
PIN NO. 10 – CATHODE
PIN NO. 11 – GRID

DIMENSIONAL DATA

DIM.	INCHES MIN.	INCHES MAX.	INCHES REF.	MILLIMETERS MIN.	MILLIMETERS MAX.	NOTES
A	2.326	2.526		59.08	64.16	
B	2.485	2.515		63.19	63.88	
C	2.084	2.284		52.93	58.01	
D	.718	.838		18.24	21.29	
E	.710	.790		18.03	20.07	
F		1.406			35.71	
G	.187			4.75		
H		BASE: E11-81				
		(JEDEC DESIGNATION)				
J	.559	.573		14.20	14.55	
K	.240			6.10		
L			.027			.69
M	1.417	1.433		35.99	36.40	



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