



**E I M A C**  
 Division of Varian  
 S A N C A R L O S  
 C A L I F O R N I A

**8163**  
**3-400Z**

**HIGH-MU  
 POWER TRIODE**

The EIMAC 8163/3-400Z is a compact power triode intended to be used as a zero-bias Class-B amplifier in audio or radio-frequency applications. Operation with zero grid bias simplifies associated circuitry by eliminating the bias supply. In addition, grounded-grid operation is attractive since a power gain as high as twenty times can be obtained with the 8163/3-400Z in a cathode-driven circuit.

**GENERAL CHARACTERISTICS**

**ELECTRICAL**

Filament: Thoriated Tungsten

Voltage	- - - - -	5.0 volts
Current	- - - - -	14.5 amperes
Amplification Factor (Average)	- - - - -	200

Interelectrode Capacitances (Average):\*

Grid-Filament	- - - - -	7.4 pF
Grid-Plate	- - - - -	4.1 pF
Plate-Filament	- - - - -	0.07 pF

Frequency for Maximum Ratings - - - - - 110 MHz



**MECHANICAL**

Base	- - - - -	5 Pin Special
Basing	- - - - -	See Drawing
Mounting Position	- - - - -	Vertical, base down or up
Cooling	- - - - -	Radiation and Forced Air
Heat-Dissipating Plate Connector	- - - - -	Supplied mounted on tube
Recommended Socket	- - - - -	EIMAC SK-410
Recommended Chimney	- - - - -	EIMAC SK-416
Maximum Operating Temperatures:		
Plate Seal	- - - - -	225°C
Base Seals	- - - - -	200°C
Maximum Over-all Dimensions:		
Height	- - - - -	5.25 inches
Diameter	- - - - -	3.57 inches
Net Weight	- - - - -	7 ounces

\*In Shielded Fixture



## R-F LINEAR AMPLIFIER GROUNDED-GRID, CLASS-B

### MAXIMUM RATINGS

DC PLATE VOLTAGE - - - - -	3000 VOLTS
DC PLATE CURRENT - - - - -	0.400 AMP
PLATE DISSIPATION - - - - -	400 WATTS
GRID DISSIPATION - - - - -	20 WATTS

### TYPICAL OPERATION (Single-Tone Conditions)

DC Plate Voltage - - - - -	3000 volts
Zero-Sig DC Plate Current* - - - - -	100 ma
Max-Sig DC Plate Current - - - - -	333 ma
Max-Sig DC Grid Current - - - - -	120 ma
Driving Impedance - - - - -	122 ohms
Resonant Load Impedance - - - - -	4750 ohms
Max-Sig Driving Power - - - - -	32 watts
Peak Envelope Plate Output Power - - - - -	655 watts

### TYPICAL OPERATION (Minimum Distortion Products at 1 KW PEP Input)

DC Plate Voltage - - - - -	2500 volts
Zero-Sig DC Plate Current* - - - - -	73 ma
Single-Tone DC Plate Current - - - - -	400 ma
Single-Tone DC Grid Current - - - - -	142 ma
Two-Tone DC Plate Current - - - - -	274 ma
Two-Tone DC Grid Current - - - - -	82 ma
Peak Envelope Useful Output Power - - - - -	560 watts
Resonant Load Impedance - - - - -	3450 ohms
Intermodulation Distortion Products - - - - -	-35 db

### TYPICAL OPERATION (Minimum Distortion Products)

DC Plate Voltage - - - - -	2000 volts
Zero-Sig DC Plate Current* - - - - -	62 ma
Single-Tone DC Plate Current - - - - -	400 ma
Single-Tone DC Grid Current - - - - -	148 ma
Two-Tone DC Plate Current - - - - -	265 ma
Two-Tone DC Grid Current - - - - -	87 ma
Peak Envelope Useful Output Power - - - - -	445 watts
Resonant Load Impedance - - - - -	2750 ohms
Intermodulation Distortion Products - - - - -	-40 db

### TYPICAL OPERATION (Minimum Distortion Products at 1500 Volts Plate Voltage)

DC Plate Voltage - - - - -	1500 volts
Zero-Sig DC Plate Current* - - - - -	46 ma
Single-Tone DC Plate Current - - - - -	400 ma
Single-Tone DC Grid Current - - - - -	163 ma
Two-Tone DC Plate Current - - - - -	265 ma
Two-Tone DC Grid Current - - - - -	92 ma
Peak Envelope Useful Output Power - - - - -	300 watts
Resonant Load Impedance - - - - -	1620 ohms
Intermodulation Distortion Products - - - - -	-37 db

## A-F AMPLIFIER OR MODULATOR, CLASS-B

### MAXIMUM RATINGS (PER TUBE)

DC PLATE VOLTAGE - - - - -	3000 VOLTS
DC PLATE CURRENT - - - - -	0.400 AMP
PLATE DISSIPATION - - - - -	400 WATTS
GRID DISSIPATION - - - - -	20 WATTS

### TYPICAL OPERATION (Sinusoidal Wave, Two Tubes, Grid Driven)

DC Plate Voltage - - - - -	3000 volts
DC Grid Voltage - - - - -	0 volts
Zero-Sig DC Plate Current* - - - - -	200 ma
Max-Sig DC Plate Current - - - - -	666 ma
Max-Sig DC Grid Current - - - - -	240 ma
Driving Power - - - - -	26 watts
Peak A-F Driving Voltage (per tube) - - - - -	88 volts
Load Resistance, Plate-to-Plate - - - - -	9500 ohms
Max-Sig Plate Output Power - - - - -	1310 watts

## R-F POWER AMPLIFIER OR OSCILLATOR, CLASS-C

### MAXIMUM RATINGS

DC PLATE VOLTAGE - - - - -	4000 VOLTS
DC PLATE CURRENT - - - - -	0.350 AMP
PLATE DISSIPATION - - - - -	400 WATTS
GRID DISSIPATION - - - - -	20 WATTS

### TYPICAL OPERATION

DC Plate Voltage - - - - -	3000 volts
DC Plate Current - - - - -	333 ma
DC Grid Voltage - - - - -	-75 volts
DC Grid Current - - - - -	130 ma
Peak R-F Grid Voltage - - - - -	187 volts
Grid Driving Power - - - - -	25 watts
Plate Output Power - - - - -	730 watts

## R-F POWER AMPLIFIER PLATE-MODULATED

### MAXIMUM RATINGS

DC PLATE VOLTAGE - - - - -	3000 VOLTS
DC PLATE CURRENT - - - - -	0.275 AMP
PLATE DISSIPATION - - - - -	270 WATTS
GRID DISSIPATION - - - - -	20 WATTS

### TYPICAL OPERATION

DC Plate Voltage - - - - -	3000 volts
DC Plate Current - - - - -	245 ma
DC Grid Voltage - - - - -	-90 volts
DC Grid Current - - - - -	100 ma
Peak R-F Grid Voltage - - - - -	185 volts
Grid Driving Power - - - - -	18 watts
Plate Output Power - - - - -	550 watts

NOTE: In most cases, "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made. Exceptions are distinguished by a listing of "Useful" output power as opposed to "Plate" output power. Values appearing in these groups have been obtained from existing equipment(s) and the output power is that measured at the load.

## APPLICATION

**Mounting** — The 3-400Z must be operated vertically, base up or base down. A flexible connecting strap should be provided between the heat dissipating plate connector and the external plate circuit. The tube must be protected from severe vibration and shock.

**Cooling** — Forced-air cooling is required to maintain the base seals at a temperature below 200°C, and the plate seal at a temperature below 225°C. When using the EIMAC SK-410 Air-System Socket and SK-416 Chimney, a minimum air flow rate of 13 cubic feet per minute at a static pressure of approximately 0.13 inch of water at sea level is required to provide adequate cooling at an inlet air temperature of 55°C. At higher inlet air temperatures, higher altitudes, or at frequencies above 30 MHz, the air flow rate must be increased to give equivalent cooling. Cooling air must be supplied to the tube even when the filament alone is on during standby periods.

When a socket other than the SK-410 is used, provisions must be made for equivalent cooling of the base, the envelope, and the plate lead. In all cases, air flow rates in excess of the minimum requirements will prolong tube life.

**Class-C Operation** — Although specifically designed for class-B service, the 3-400Z may be operated as a class-C power amplifier or oscillator or as a plate-modulated radio-frequency power amplifier. The zero-bias characteristic of the 3-400Z can be used to advantage in class-C amplifiers operating at plate voltages of 3000

volts or below by employing only grid-leak bias. If driving power fails, plate dissipation is then kept to a low value because the tube will be operating at the normal static zero-bias conditions.

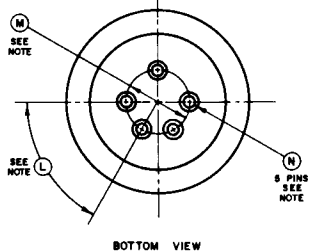
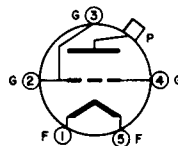
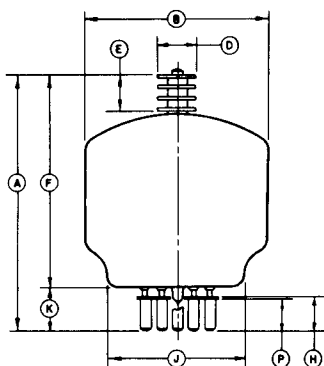
**Filament Operation**—The rated filament voltage for the 3-400Z is 5.0 volts. Filament voltage, as measured at the socket, must be maintained within the range of 4.75 to 5.25 volts to obtain maximum tube life.

**Intermodulation Distortion** — Typical Operating conditions with distortion values included are the result of data taken during actual operation at 2 megahertz. Intermodulation values listed are those measured at the full peak envelope power noted. As the driving signal level is reduced, distortion products remain at the listed value, or better, below original peak envelope power level.

**Input Circuit** — When the 3-400Z is operated as a grounded-grid r-f amplifier, the use of a resonant tank in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a “Q” of five or more.

**Special Applications**—If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, EIMAC, Division of Varian, 301 Industrial Way, San Carlos, California, for information and recommendations.

**3-400Z OUTLINE DRAWING AND PIN CONNECTIONS**



**NOTE:**  
BASE PINS (N) ARE SO ALIGNED THAT THEY CAN BE FREELY INSERTED INTO A GAUGE 1/4" THICK WITH HOLE DIAS. OF .204 LOCATED ON THE TRUE CENTERS BY THE GIVEN DIMS. (L) & (M).

DIMENSIONS IN INCHES			
DIMENSIONAL DATA			
REF.	MIN.	MAX.	NOM.
A	4-3/4	5-1/4	
B		3-9/16 D.	
D	.745 D.	.755 D.	
E	.640	.660	
F	3-15/16	4-7/16	
H	9/16	11/16	
J		2-1/2 D.	
K			13/16
L			60° TYP.
M			1-1/4 D. RC.
N	.185 D.	.191 D.	
P	1/2	5/8	



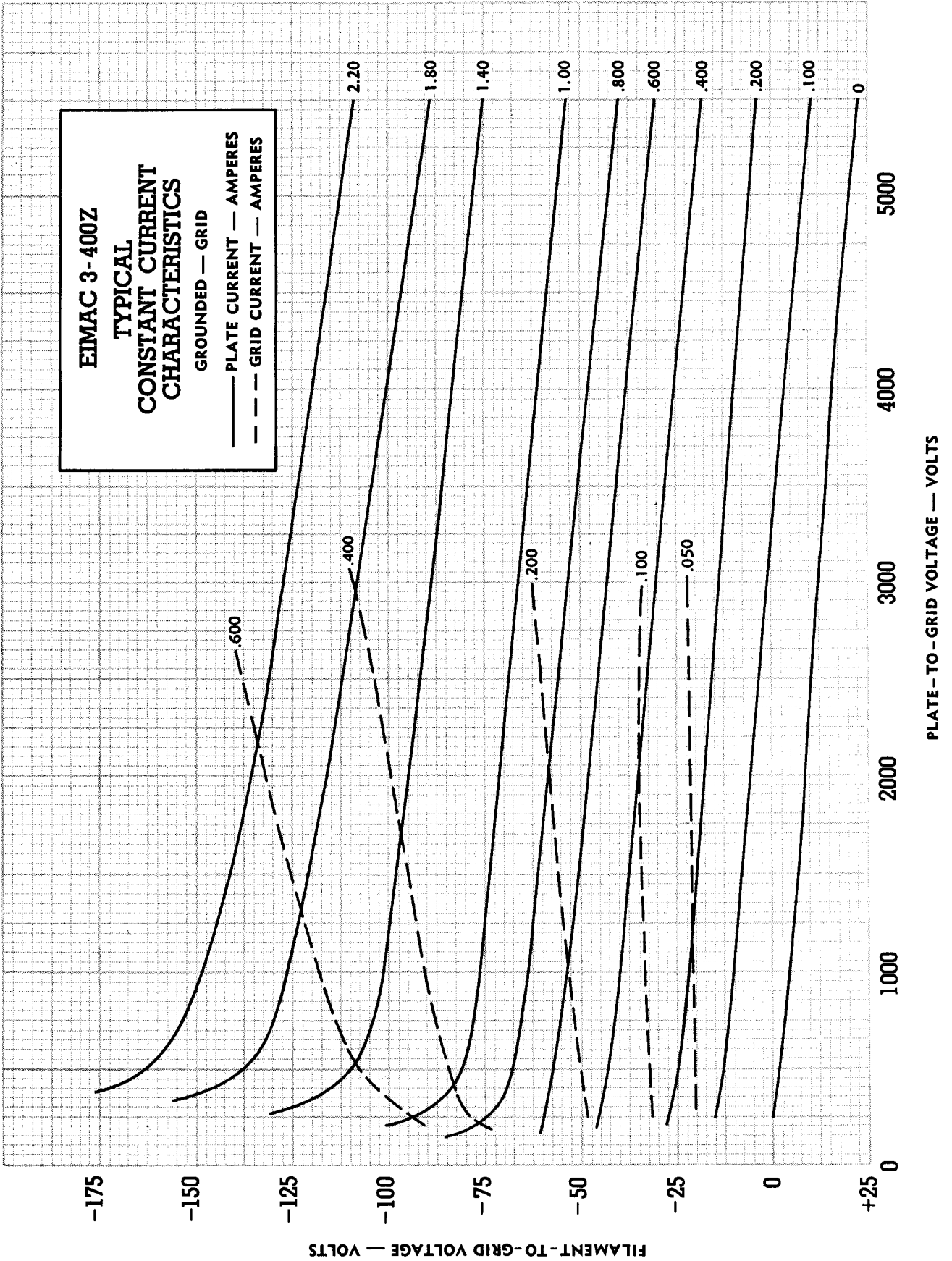
### EIMAC 3-400Z

### TYPICAL CONSTANT CURRENT CHARACTERISTICS

GROUNDING — GRID

— PLATE CURRENT — AMPERES

- - - GRID CURRENT — AMPERES





EIMAC 3-400Z

TYPICAL PLATE CHARACTERISTICS

— PLATE CURRENT  
- - - GRID CURRENT

GRID VOLTAGE = 120 VOLTS

GRID VOLTAGE = 120 VOLTS

PLATE VOLTAGE—VOLTS

