

Technical Information

CK6939

TWIN POWER
PENTODE

The CK6939 is a miniature heater-cathode type double pentode designed for use as a UHF power amplifier and frequency multiplier in communication equipment. For improved performance and greater stability, the CK6939 contains internal neutralization enabling high power gain at frequencies up to 500 megacycles. The frame grid construction, allowing close spacing between grid and cathode, reduces transit time, and reduces the chance of shorts due to rigid tolerances obtainable only with this type of construction. This type is characterized by long life and stable performance and is designed for service where conditions of high temperature and mechanical shock or vibration are encountered.

MECHANICAL RATINGS: (Maximum Ratings)

Impact Acceleration (Shock)	450 G
Fatigue (Vibrational Acceleration for Extended Periods)	2.5 G
Bulb Temperature	225 °C
Altitude	60,000 Ft.

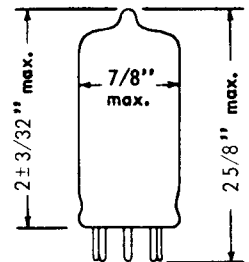
ELECTRICAL DATA

Ratings and Normal Operation:	MIL-E-1 Symbol	Test Limit or Absolute Minimum		Normal Test Conditions	Test Limit or Absolute Maximum		MIL-E-1 Units
		Absolute Minimum	Normal Operation		Absolute Maximum	Normal Test Conditions	
Ratings							
Heater Voltage	Ef:	5.7/11.3	6.3/12.6	6.3/12.6	6.9/13.9	V	
Plate Voltage							
C Telep. Intermittent	Eb:	----	----	150	200	Vdc	
C Telep. Continuous	Eb:	----	----	150	200	Vdc	
C Teleg. Intermittent	Eb:	----	----	150	250	Vdc	
C Teleg. Continuous	Eb:	----	----	150	250	Vdc	
Grid #1 Voltage	Ec1:	----	----	-3.0	-50	Vdc	
Grid #2 Voltage	Ec2:	----	----	150	200	Vdc	
Heater-Cathode Voltage	Ehk:	----	----	----	100	Vdc	
Cathode Current							
C Telep. Intermittent	Ik:	----	----	----	2X48	mAdc	
C Telep. Continuous	Ik:	----	----	----	2X40	mAdc	
C Teleg. Intermittent	Ik:	----	----	----	2X60	mAdc	
C Teleg. Continuous	Ik:	----	----	----	2X50	mAdc	
Plate Current							
C Telep. Intermittent	Ib:	----	----	----	2X40	mAdc	
C Telep. Continuous	Ib:	----	----	----	2X32	mAdc	
C Teleg. Intermittent	Ib:	----	----	----	2X50	mAdc	
C Teleg. Continuous	Ib:	----	----	----	2X45	mAdc	
Grid #1 Current							
C Telep. Intermittent	Ic1:	----	----	----	2X4	mAdc	
C Telep. Continuous	Ic1:	----	----	----	2X3	mAdc	
C Teleg. Intermittent	Ic1:	----	----	----	2X4	mAdc	
C Teleg. Continuous	Ic1:	----	----	----	2X3	mAdc	

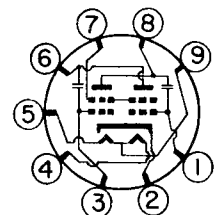
MECHANICAL DATA

ENVELOPE Glass T-6½
 OUTLINE 6-8
 BASE E9-1 9 Pin Min. Button
 CATHODE Oxide Coated Unipotential
 MOUNTING POSITION Any

PHYSICAL DIMENSIONS



BASING



BOTTOM VIEW

TERMINAL CONNECTIONS:

- Pin 1 Grid #1 Unit #1
- Pin 2 Cathode, Shield
- Pin 3 Grid #1 Unit #2
- Pin 4 Heater
- Pin 5 Heater
- Pin 6 Plate Unit #1
- Pin 7 Grid #2
- Pin 8 Plate Unit #2
- Pin 9 Heater Center Tap



CK6939

TWIN POWER PENTODE

ELECTRICAL DATA (cont'd.)

Ratings and Normal Operation:	MIL-E-1 Symbol	Test Limit or Absolute Minimum	Normal Operation	Normal Test Conditions	Test Limit or Absolute Maximum	MIL-E-1 Units
<u>Ratings</u>						
Grid #1 Power Dissipation						
C Teleg. Intermittent	Pg1:	----	----	----	2X0.12	watts
C Teleg. Continuous	Pg1:	----	----	----	2X0.1	watts
C Teleg. Intermittent	Pg1:	----	----	----	2X0.12	watts
C Teleg. Continuous	Pg1:	----	----	----	2X0.1	watts
Grid #2 Power Dissipation						
C Teleg. Intermittent	Pg2:	----	----	----	2X1.15	watts
C Teleg. Continuous	Pg2:	----	----	----	2X1.0	watts
C Teleg. Intermittent	Pg2:	----	----	----	2X1.75	watts
C Teleg. Continuous	Pg2:	----	----	----	2X1.5	watts
Plate Power Dissipation						
C Teleg. Intermittent	Pp:	----	----	----	2X2.5	watts
C Teleg. Continuous	Pp:	----	----	----	2X2.0	watts
C Teleg. Intermittent	Pp:	----	----	----	2X3.75	watts
C Teleg. Continuous	Pp:	----	----	----	2X3.0	watts
Power Input (Plate)						
C Teleg. Intermittent	Pi:	----	----	----	2X5.0	watts
C Teleg. Continuous	Pi:	----	----	----	2X4.0	watts
C Teleg. Intermittent	Pi:	----	----	----	2X7.0	watts
C Teleg. Continuous	Pi:	----	----	Note A	2X6.0	watts
<u>Tests</u>						
Heater Current Ef=6.3	If:	575	----	----	625	mAac
Plate Current (1) Ec1=0; Note A	Ib:	33	----	----	82	mAac
Plate Current (2) Note A	Ib:	7.5	----	----	31	mAac
Plate Current (3) Ec1=-11.0 Vdc; Note A	Ib:	----	----	----	125	μAac
Screen Current Note A	Ic2:	1.5	----	----	7.5	mAac
Heater-Cathode Leakage Ehk=±100 Vdc	Ihk:	----	----	----	40	μAac
Transconductance Ec1/Ib=25 mAac; Note A	Sm:	7800	----	----	13200	μmhos
Capacitance } Capacitance } Capacitance }	Note B	Cgp:	----	----	0.2	pf
		Cin:	5.1	----	7.7	pf
		Cout:	1.4	----	1.8	pf
Power Output (1): Push pull Class C Amplifier F=470-500 mc; Eb=Ec2=180 Vdc; Ic1=1.5 mAac; Rg1/g=27 kohms Rg2=0.1 kohm; Ib=65 mAac max. Ic2=15 mAac max.	Po:	4.1	----	----	----	W
Power Output (2) Ef=5.3 Vac; Note C		----	----	----	15	%



CK6939

TWIN POWER PENTODE

SPECIAL TESTS AND RATINGS TO INSURE RELIABILITY

Randomly selected statistical samples are subjected to the following tests.

- Shock Test – 450 G. 30° hammer angle in Navy High Impact Shock Machine. Sample subjected to five impact accelerations in each of four different positions.
- Fatigue Test – 2.5 G. Sample subjected to vibrational acceleration of 2.5 G for 32 hours minimum in each of three different positions. The sinusoidal vibration is applied at a fixed frequency of 50 c.p.s., $E_f = 6.3$ Vac.
- 1000 Hr. Life Test – Sample is operated for 1000 hours to assure electrical stability and freedom from in-operatives. Tubes are operated under Power Output (1) Test Conditions.
- Altitude – Sample is subjected to pressure of 55 ± 5 mmHg (60,000 ft.) to assure freedom from flashover or corona at the pins of the tube.

APPLICATION NOTES

- Note A: Each unit shall be read separately. Control grid of unit not under test shall be connected to -20 Vdc.
- Note B: Without external shield.
- Note C: $P_o(1)$ and $P_o(2)$ shall be recorded. The percentage difference shall not exceed the maximum percentage indicated.

CAUTION – – – To Electron Equipment Design Engineers. Special attention should be given to the temperature which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are closely related to the degree that regulation of the heater voltage is maintained at its center rated value.



CK6939

TWIN POWER PENTODE

ACCEPTANCE CRITERIA

The following tests shall be performed:

For the purpose of inspection, use applicable reliable paragraphs of Specification MIL-E-1.

For miscellaneous requirements, see 3.6.

Test Conditions

$E_f = 6.3/12.6 V \pm 10\%$

$E_b = 150 V_{dc}$

$E_{c1} = -3.0 V_{dc}$

$E_{c2} = 150 V_{dc}$

Ref.	Test	Conditions	AQL %	Insp. Level or Code	Sym.	LIMITS						Units
						Min	LAL	Bogle	UAL	Max	ALD	
QUALIFICATION APPROVAL TESTS												
3.1	Qualification approval:	Required										
3.7	Marking:											
---	Cathode:	Coated unipotential										
3.4.3	Base connections:	E9-1										
4.9.18	Container drop:	Required										
MEASUREMENT ACCEPTANCE TESTS, PART 1, NOTE 2												
4.10.8	Heater current:	$E_f = 6.3$	0.65	II	I _f :	575	---	---	---	625	---	mA
4.9.1	Mechanical envelope Outline:		---	---	---	---	---	---	---	---	---	
4.10.4.1	Plate current (1):	$E_{c1} = 0 V_{dc}$; Note 3	0.65	II	I _b :	33	---	---	---	82	---	mAdc
4.10.4.1	Plate current (2):	Note 3	0.65	II	I _b :	7.5	---	---	---	31	---	mAdc
4.10.4.1	Plate current (3):	$E_{c1} = -11.0 V_{dc}$; Note 3	0.65	II	I _b :	---	---	---	---	125	---	μ Adc
4.10.6.1	Grid current:	$R_{c1} = 0.1$ meg; Note 3	0.65	II	I _{c1} :	---	---	---	---	1.0	---	μ Adc
4.10.4.3	Screen current:	Note 3	0.65	II	I _{c2} :	1.5	---	---	---	7.5	---	mAdc
4.10.1.3	Peak emission:	$E_b = E_{c2} = 200 V_{dc}$; Note 4 $e_{c1} = +25 V$; $E_f = 5.3 V$	0.65	II	i _s :	650	---	---	---	---	---	mA
MEASUREMENTS ACCEPTANCE TESTS, PART 2												
4.8	Insulation of Electrodes:	$E_g - \text{all} = -100 V_{dc}$ $E_p - \text{all} = -300 V_{dc}$ Notes 5 and 6	2.5	IA	R: R:	10 10	---	---	---	---	---	Meg. Meg.
4.10.15	Heater cathode leakage:	$E_{hk} = +100$ $E_{hk} = -100$	6.5	IA	I _{hk} : I _{hk} :	---	---	---	---	40 40	---	μ Adc μ Adc
4.10.9	Transconductance:	$E_{c1}/i_b = 25$ mAdc Note 3	6.5	IA	S _m :	7800	---	---	---	13200	---	μ mhos
4.10.14	Capacitance:		6.5	IA	C _{gp} : C _{in} : C _{out} :	---	---	---	---	0.2 7.7 1.8	---	ρf ρf ρf
4.10.6.6	Primary control grid emission:	$E_f = 7.0 V_{ac}$; Note 5 $P_{g1} = 0.15$ w $E_b = E_{c2} = 0 V_{dc}$	6.5	IA	I _{sg1} :	---	---	---	---	-10	---	μ Adc
4.10.6.6	Primary screen grid emission:	$E_f = 7.0 V_{ac}$ $P_{g2} = 3.5$ w $E_b = E_{c1} = 0$	6.5	IA	I _{sg2} :	---	---	---	---	-200	---	μ Adc
4.9.20.6	Fatigue test:	Apply 2.5 G $t = 96$ hrs $E_f = 6.3 V_{ac}$; F = 50 c.p.s. No other voltages	6.5	Note 9	---	---	---	---	---	---	---	---
4.9.20.5	Shock:	Hammer angle = 30° $E_f = 6.3 V_{ac}$ No other voltages	20	---	---	---	---	---	---	---	---	---



CK6939

TWIN POWER PENTODE

Ref.	Test	Conditions	AQL %	Insp. level or code	Allowable defectives per characteristics		Sym.	LIMITS		Units
					1st sample	combined samples		Min	Max	
----	Post shock and fatigue test end points:	Insulation of electrodes: Eg-all=-100; Notes 5 and 6 Ep-all=300	---	---	---	---	R:	10	---	Meg.
		Heater cathode leakage Ehk=+100 Vdc Ehk=-100 Vdc	---	---	---	---	R:	10	---	Meg.
		Power output (1): Peak emission:	---	---	---	---	lhk:	---	70	μ Adc
			---	---	---	---	lhk:	---	70	μ Adc
		Power output (1): Peak emission:	---	---	---	---	Po:	4.0	---	W
			---	---	---	---	is:	600	---	mA
4.10.2.2	Power output (1):	Push pull Class C amplifier, F=470-500 Mc Eb=Ec2=180 Vdc; Ic1=1.5 mA dc Rg1/g=27 Kohm Rc2=0.1 Kohm Ib=65 mA dc max Ic2= 15 mA dc max.	6.5	IA	---	---	Po:	4.1	---	W
4.10.2.2	Power output (2):	Power output (1): Ef=5.3 V; Note 8	6.5	IA	---	---	---	---	15	%
ACCEPTANCE LIFE TESTS										
4.11	Life test (1):	Group C Power Output (1)	---	---	---	---	t	1000	---	hrs
4.11.4	Life test (1) end points:	Power output (1) Power output (2): Peak emission Grid current Primary control grid emission Primary screen grid emission	---	---	---	---	Po(1): $\Delta_{Ef} Po$ is: Ic1: Isg1:	3.5 ---	---	W % mA μ Adc μ Adc
			---	---	---	---	Isg2:	---	-200	μ Adc
4.11	Life test(2):	Group C Power output (1) Ef=7.8 V Eb=200; Note 7	---	---	---	---	t:	100	---	hrs.
4.11.4	Life test (2) end points:	Power output (1) Power output (2) Peak emission Grid current Primary control grid emission Primary screen grid emission	---	---	---	---	Po(1): $\Delta_{Ef} Po$ is: Ic1: Isg1:	3.5 ---	---	W % mA μ Adc μ Adc
			---	---	---	---	Isg2:	---	-200	μ Adc
5.1	Preparation for delivery:	Package group 1, container drop test (d) in accordance with Specification MIL-E-75								

Note 1: Temperature of bulb shall be 225 °C. maximum.

Note 2: The AQL for the combined defectives for attributes in Measurements Acceptance Tests, Part 1, excluding Mechanical, shall be 1.0 percent. A tube having one or more defects shall be counted as one defective. Standard MIL-STD-105 inspection level II shall apply.



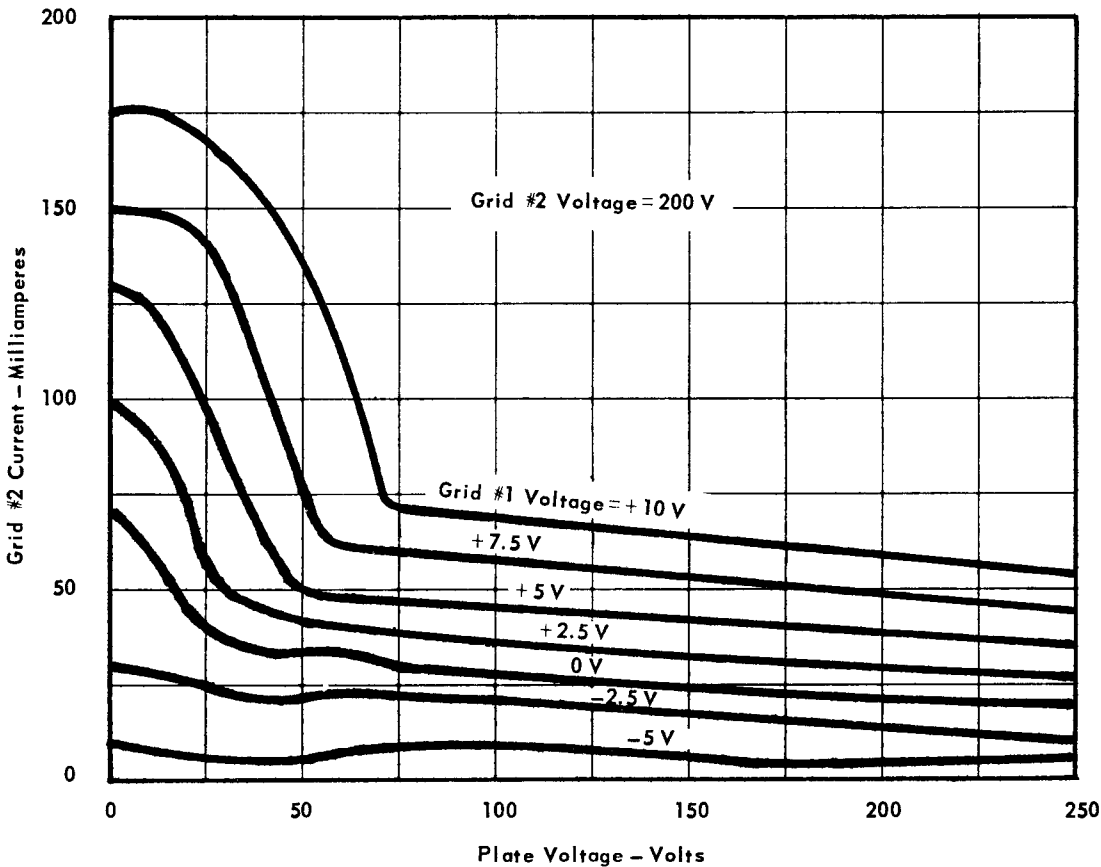
CK6939

TWIN POWER PENTODE

NOTES: (cont'd.)

- Note 3: Each unit shall be read separately. Control grid of unit not under test shall be connected to -20 Vdc.
- Note 4: Test both units in parallel. E_{c1} is a rectangular pulse voltage with a pulse width of $800 \mu\text{sec}$; this pulse voltage is superimposed on $E_{c1} = -100$ Vdc (total pulse voltage = 125 V). Duty cycle = 0.04 .
- Note 5: Each unit shall be tested separately.
- Note 6: Voltage shall be applied in series with 10 megohm resistor.
- Note 7: Plate voltage shall be applied intermittently, 2 minutes on, 8 minutes off.
- Note 8: $P_o(1)$ and $P_o(2)$ shall be recorded. The percentage difference shall not exceed the maximum percentage indicated.
- Note 9: The Fatigue test shall be conducted on the initial lot and thereafter on a lot approximately every 30 days. Once a lot has passed the 30 days rule shall apply. In the event of lot failure, the lot shall be rejected and the succeeding lot shall be subjected to this test. Standard MIL-STD-105, sample size code letter F shall apply.
- Note 10: If altitude rating is exceeded, a reduction of instantaneous voltage is required (filament voltage E_f is excluded).

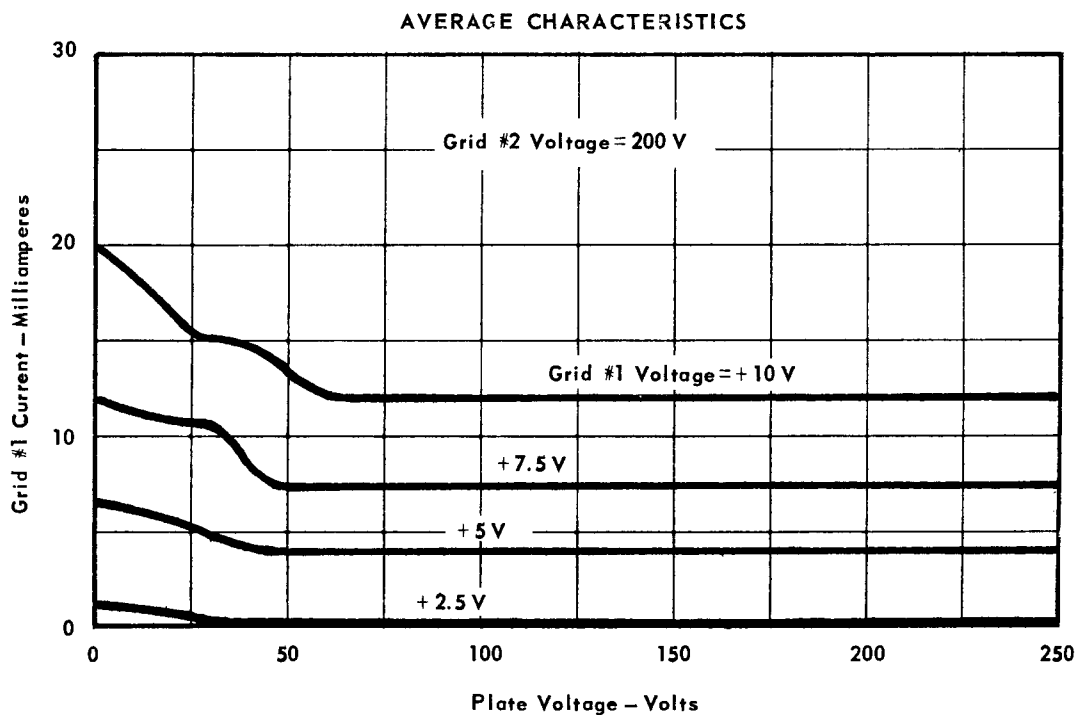
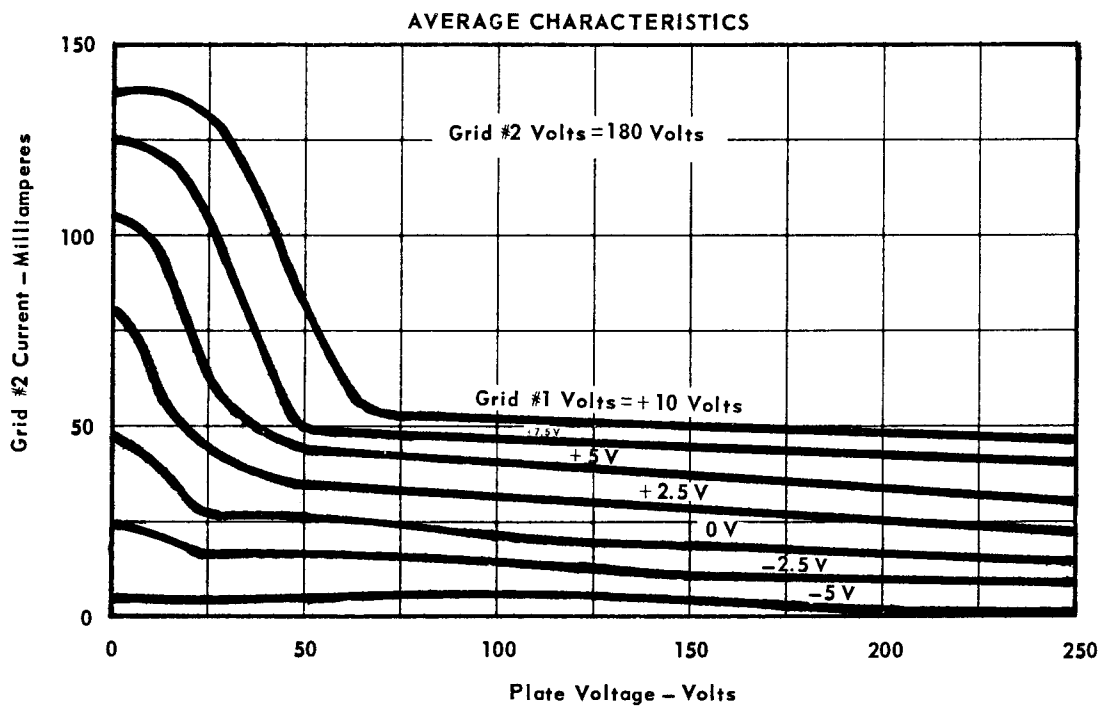
AVERAGE CHARACTERISTICS





CK6939

TWIN POWER PENTODE

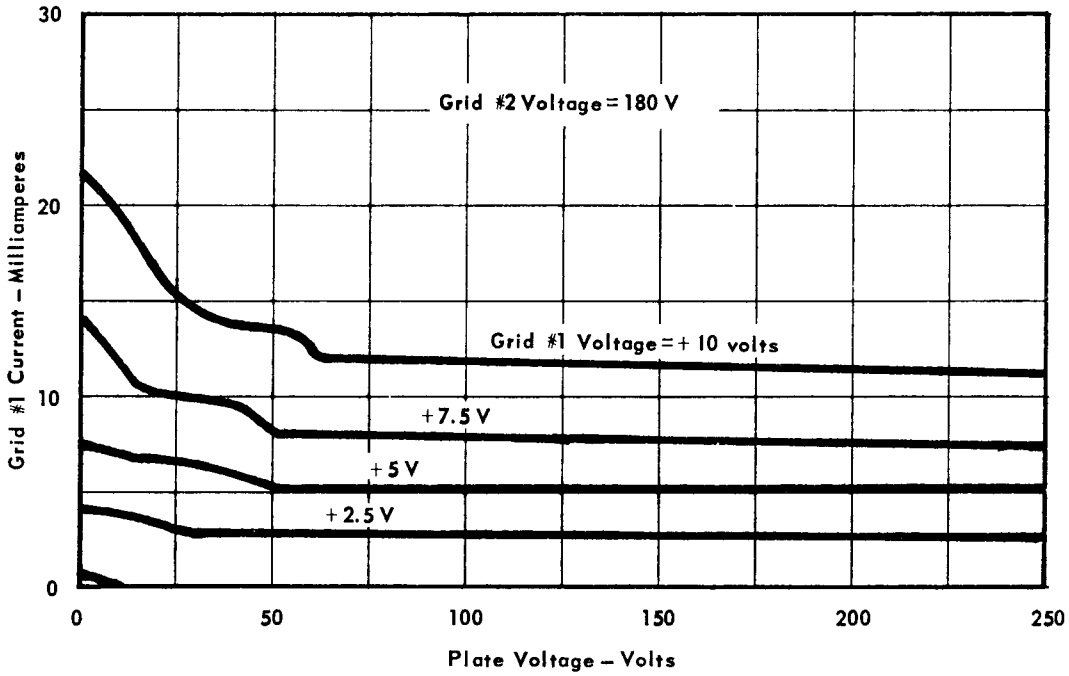




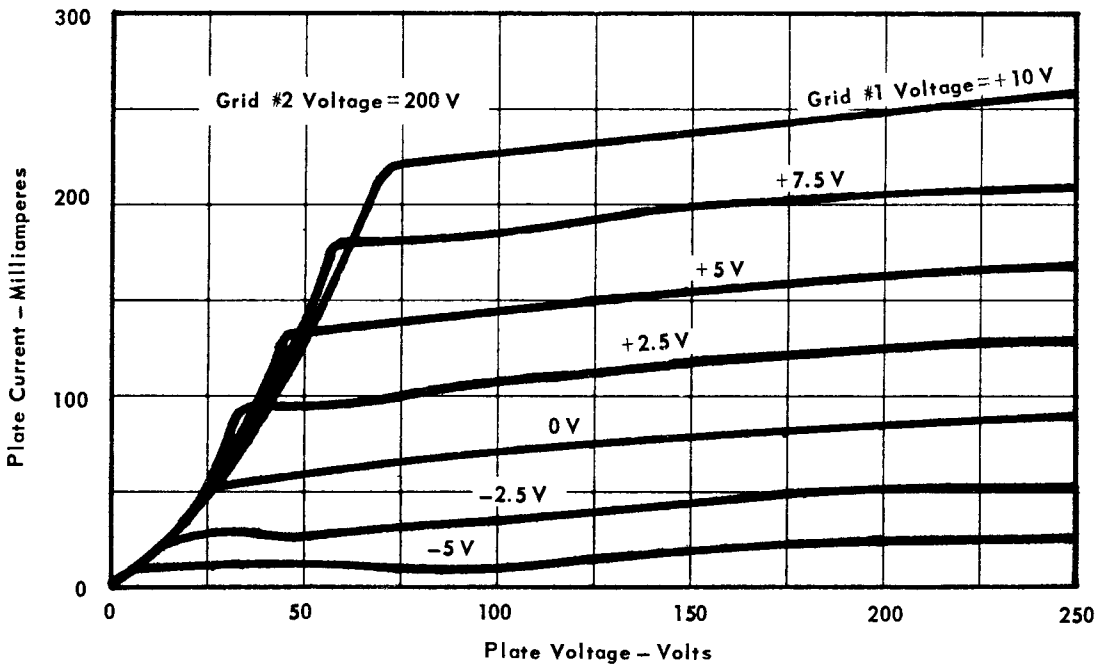
CK6939

TWIN POWER PENTODE

AVERAGE CHARACTERISTICS



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CK6939

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