



ELECTRONIC TUBE REFERENCE

12CS6

Heptode electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

HEPTODE

Pentagrid gated-amplifier tube designed as a combined television sync separator and sync clipper, using multiple control grids for pulse gating and synchronization processing.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	7
NOMINAL HEATER	12.6 V / 150 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Heptode	
PLATE RESISTANCE	700000 Ω
TRANSCONDUCTANCE	0.0015 S
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	1 W
MAXIMUM CATHODE CURRENT	14 mA
<i>Promoted from published maximum-ratings/characteristics tables; additional source values are retained in TUBE_SECTION_PARAMETER.</i>	

12CS6 — Pentagrid Gated Amplifier Tube

Overview

The **12CS6** is a miniature, dual-control heptode (pentagrid) vacuum tube designed primarily for use as a gated amplifier in color and black-and-white television receivers. In this service, it is commonly employed

as a combined sync separator and sync clipper. The 12CS6 features two independent control grids (Grid No. 1 and Grid No. 3) that allow separate signals to control the plate current, making it highly effective for gating and coincidence-detection circuits.

The 12CS6 belongs to a family of identical tubes that includes the [3CS6](#), [4CS6](#), and [6CS6](#), differing only in their heater voltage and current ratings.

Construction, Physical Specifications, and Pinout

The 12CS6 is constructed in a miniature T-5 1/2 glass envelope with a button 7-pin base (E7-1 designation). It requires a standard miniature 7-contact socket and can be mounted in any position.

Physical Dimensions

- **Maximum Diameter:** 0.750 inches
- **Maximum Seated Height:** 1.875 inches
- **Maximum Overall Height:** 2.125 inches

Pin Connections (7CH Basing)

The 7CH basing arrangement provides the following connections, viewed from the underside of the tube:

Pin Number	Electrode Connection
1	Grid No. 1 (g1)
2	Cathode (k) & Grid No. 5 (g5)
3	Heater (h)
4	Heater (h)
5	Plate (p)
6	Grid No. 2 (g2) & Grid No. 4 (g4)
7	Grid No. 3 (g3)

Grid No. 2 and Grid No. 4 are internally connected to form a screen grid structure, while Grid No. 5 is internally tied to the cathode.

Heater Ratings and Heater-Cathode Limits

The 12CS6 operates with a nominal heater voltage of **12.6 V** (AC or DC) and a heater current of **0.15 A** (150 mA). Unlike its lower-voltage siblings (such as the [3CS6](#) and [4CS6](#), which have a controlled 11-second warm-up time), the heater warm-up time for the 12CS6 is not formally specified.

To ensure reliable operation and prevent insulation breakdown, the voltage between the heater and the cathode must be kept within the following limits:

- **Heater Negative with Respect to Cathode:** 200 V maximum (total DC and peak)
- **Heater Positive with Respect to Cathode:** 100 V maximum DC, or 200 V maximum (total DC and peak)

Electrical Characteristics and Operating Points

The dual-control nature of the 12CS6 allows its plate current to be modulated independently by Grid No. 1 and Grid No. 3. Typical Class A1 amplifier characteristics vary depending on the bias applied to these control grids:

Parameter	Operating Point A	Operating Point B	Operating Point C
Plate Voltage	100 V	100 V	10 V
Grids No. 2 & 4 Voltage	30 V	30 V	30 V
Grid No. 3 Voltage	-1.0 V	0 V	0 V
Grid No. 1 Voltage	0 V	-1.0 V	0 V
Plate Resistance (Approx.)	0.7 M Ω	1.0 M Ω	—
Grid No. 3-to-Plate Transconductance	1250-1500 μ mhos	—	—
Grid No. 1-to-Plate Transconductance	—	950-1100 μ mhos	—
Plate Current	0.8 mA	0.75-1.0 mA	1.2 mA
Grids No. 2 & 4 Current	4.0-5.5 mA	1.1-1.3 mA	4.1 mA
Grid No. 3 Bias for plate current of 50 μA (Approx.)	-2.2 V	—	—
Grid No. 1 Bias for plate current of 50 μA (Approx.)	—	-2.5 to -2.6 V	—

These operating points demonstrate that Grid No. 3 has a slightly higher transconductance and a sharper cutoff characteristic than Grid No. 1 under comparable conditions.

Maximum Ratings and Circuit Values

The maximum ratings for the 12CS6 are established under the Design-Center Rating System for gated amplifier service. Operating the tube beyond these limits may impair performance and reduce service life.

Maximum Ratings

- **Plate Voltage:** 300 V
- **Grids No. 2 & 4 Supply Voltage:** 300 V
- **Grids No. 2 & 4 Voltage:** 100 V
- **Cathode Current:** 14 mA
- **Plate Dissipation:** 1.0 W
- **Grids No. 2 & 4 Dissipation:** 1.0 W
- **Grid No. 2 Input (up to 150 V):** 0.7 to 1.0 W
- **Grid Input:** 0.55 W

Maximum Circuit Values

- **Grid No. 1 Circuit Resistance:** 0.47 MΩ
- **Grid No. 3 Circuit Resistance:** 2.2 MΩ

These resistance limits are critical to prevent thermal runaway and maintain stable bias conditions, particularly in high-impedance sync separator circuits.

Interelectrode Capacitances

Because the 12CS6 operates as a high-frequency gated amplifier, its internal capacitances are key design factors. The approximate unshielded interelectrode capacitances are:

- **Grid No. 1 to Plate:** 0.05 to 0.07 pF (maximum)
- **Grid No. 3 to Plate:** 0.36 pF (maximum)
- **Grid No. 1 to Grid No. 3 Coupling:** 0.15 to 0.22 pF (maximum)
- **Grid No. 1 Input** (g_1 to $k + h + g_2 + g_3 + g_5$): 5.5 pF
- **Grid No. 3 Input** (g_3 to $k + h + g_1 + g_2 + g_5$): 7.0 pF
- **Output** (p to $k + h + g_1 + g_2 + g_3 + g_5$): 7.5 pF

The extremely low coupling capacitance between Grid No. 1 and Grid No. 3 (0.15–0.22 pF) ensures excellent isolation between the two control signals, preventing unwanted crosstalk in sync-gating applications.

Technical Summary

The **12CS6** is a versatile **7-pin miniature pentagrid gated amplifier** featuring a **12.6 V, 0.15 A** heater. Designed specifically for television sync separator and clipper service, it utilizes two independent control grids to achieve precise gating action. With a maximum plate voltage rating of **300 V**, a cathode current

limit of **14 mA**, and low interelectrode coupling capacitances, the 12CS6 provides reliable coincidence detection and signal separation in television receiver circuits.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1975 RCA RC30

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

1975 RCA RC30

Section 1 · Heptode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage (ac/dc) 3.15 4.2 6.3	12.6 V	Published in approved 12CS6 target entry; Section1
Heater Current 0.6 0.45 0.3	150 mA	Published in approved 12CS6 target entry; Section1
Heater Warm-up Time (Average) 11 11	11 seconds	Published in approved 12CS6 target entry; Section1
Grid-No.3-to-Plate Transconductance	1500 μ S	Published in approved 12CS6 target entry; Section1
Grid-No.1-to-Plate Transconductance	1100 μ S	Published in approved 12CS6 target entry; Section1
Plate Current 0.8	1 mA	Published in approved 12CS6 target entry; Section1
Grids-No.2-and-No.-4 Current 5.5	1.3 mA	Published in approved 12CS6 target entry; Section1
50 iiA	2.2 V	Published in approved 12CS6 target entry; Section1
50 /l A –	-2.6 V	Published in approved 12CS6 target entry; Section1
Plate Voltage	300 V	Published in approved 12CS6 target entry; Section1
Grids-No.2-and-No.4 Supply Voltage	300 V	Published in approved 12CS6 target entry; Section1
Cathode Current	14 mA	Published in approved 12CS6 target entry; Section1
Plate Dissipation	1 W	Published in approved 12CS6 target entry; Section1
For grids-No. 2-and-No.4 voltages up to	150 V	Published in approved 12CS6 target entry; Section1

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
For grids-No. 2-and-No.4 voltages up to 150 volts	1 W	Published in approved 12CS6 target entry; Section1
For grids-No.2-and-No.4 voltages between 150 and	300 V	Published in approved 12CS6 target entry; Section1
Grid-No.1-Circuit Resistance	0.47 MΩ	Published in approved 12CS6 target entry; Section1
Grid-No. 3-Circuit Resistance	2.2 MΩ	Published in approved 12CS6 target entry; Section1

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid No.4, and Grid No.5	5.5 pF	Published in approved 12CS6 target entry; Section1
Grid No.4, and Grid No.5	7 pF	Published in approved 12CS6 target entry; Section1
Grid No.4, and Grid No.5	7.5 pF	Published in approved 12CS6 target entry; Section1

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage 100	100 V	Published in approved 12CS6 target entry; Section1
Plate Resistance (Approx.) 0.7	1 MΩ	Published in approved 12CS6 target entry; Section1

TUBE TINKER

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