

CA3013, CA3014

Wide-Band Amplifier Discriminators

Features & Applications:

- Exceptionally high gain: power gain at 4.5 MHz - 75 dB typ.
- Excellent limiting characteristics - input limiting voltage (knee) = 300 μ V typ. at 4.5 MHz
- Excellent AM rejection: > 50 dB at 4.5 MHz
- High audio-voltage recovery - 220 mV typ at 4.5 MHz, 25 kHz deviation
- Wide frequency capability - 100 kHz to > 20 MHz
- Comprehensive circuit functions: if amplifier, AM and noise limiter, FM detector, audio preamplifier

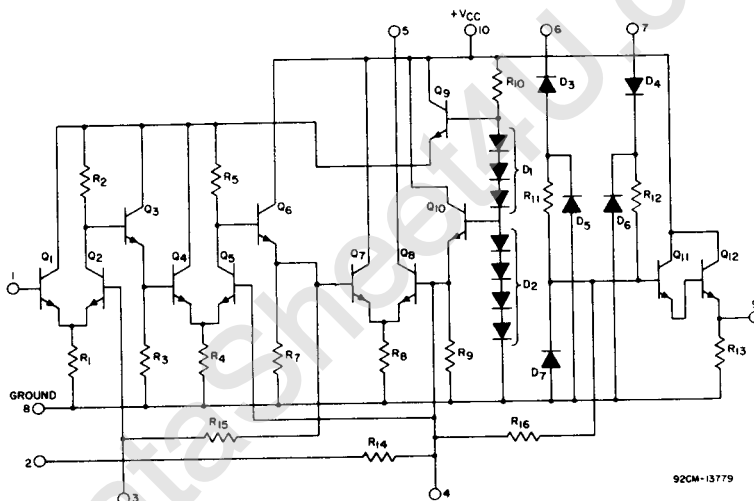


Fig. 1 — Schematic diagram for CA3013 and CA3014

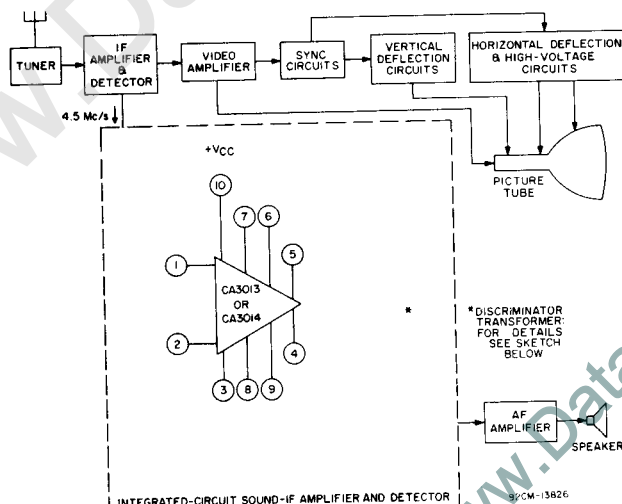


Fig. 2 — Block diagram of typical television receiver using RCA integrated-circuit sound-if amplifier and detector section

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ABSOLUTE-MAXIMUM VOLTAGE LIMITS AT $T_A = 25^\circ \text{C}$

Indicated voltage limits for each terminal can be applied under the specified voltage conditions for other terminals. All voltages are with respect to ground (Terminal 8).

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TERMINAL	VOLTAGE LIMITS		VOLTAGE CONDITIONS AT OTHER TERMINALS									
			1	2	3	4	5	6	7	8	9	10
1	-3	+3	-	Same as 1	Do Not Apply External Voltage	+2.5 to +7.5	+7.5	Same as 4	Same as 4	Ground	AF Output	+7.5
2	-3	+3	Same as 2	-		+2.5 to +7.5	+7.5	Same as 4	Same as 4	Ground	AF Output	+7.5
3	-3	+3	-3 to +3	Same as 1		+2.5 to +7.5	+7.5	Same as 4	Same as 4	Ground	AF Output	+7.5
4	+2.5	+7.5	-3 to +3	Same as 1		-	+7.5	Same as 4	Same as 4	Ground	AF Output	+7.5
5	0	+10	-3 to +3	Same as 1		+2.5 to +7.5	-	Same as 4	Same as 4	Ground	AF Output	+7.5
6	+2.5	+7.5	-3 to +3	Same as 1		Same as 6	+7.5	-	Same as 4	Ground	AF Output	+7.5
7	+2.5	+7.5	-3 to +3	Same as 1		+2.5 to +7.5	+7.5	Same as 4	-	Ground	AF Output	+7.5
8	-3	+7.5	-3 to +3	Same as 1		+2.5 to +7.5	+7.5	Same as 4	Same as 4	Ground	AF Output	+7.5
9	0	+7.5	-3 to +3	Same as 1		+2.5 to +7.5	+7.5	Same as 4	Same as 4	Ground	-	+7.5
10	0	+10	-3 to +3	Same as 1		+2.5 to +7.5	+7.5	Same as 4	Same as 4	Ground	AF Output	-
CASE	INTERNALLY CONNECTED TO TERMINAL No.8 (GROUND TERMINAL)											

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TERMINAL	VOLTAGE LIMITS		VOLTAGE CONDITIONS AT OTHER TERMINALS									
			1	2	3	4	5	6	7	8	9	10
1	-3	+3	-	Same as 1	Do Not Apply External Voltage	+2.5 to +10	+10	Same as 4	Same as 4	Ground	AF Output	+10
2	-3	+3	Same as 2	-		+2.5 to +10	+10	Same as 4	Same as 4	Ground	AF Output	+10
3	-3	+3	-3 to +3	Same as 1		+2.5 to +10	+10	Same as 4	Same as 4	Ground	AF Output	+10
4	+2.5	+10	-3 to +3	Same as 1		-	+10	Same as 4	Same as 4	Ground	AF Output	+10
5	0	+13	-3 to +3	Same as 1		+2.5 to +10	-	Same as 4	Same as 4	Ground	AF Output	+10
6	+2.5	+10	-3 to +3	Same as 1		Same as 6	+10	-	Same as 4	Ground	AF Output	+10
7	+2.5	+10	-3 to +3	Same as 1		+2.5 to +10	+10	Same as 4	-	Ground	AF Output	+10
8	-3	+10	-3 to +3	Same as 1		+2.5 to +10	+10	Same as 4	Same as 4	Ground	AF Output	+10
9	0	+10	-3 to +3	Same as 1		+2.5 to +10	+10	Same as 4	Same as 4	Ground	-	+10
10	0	+13	-3 to +3	Same as 1		+2.5 to +10	+10	Same as 4	Same as 4	Ground	AF Output	-
CASE	INTERNALLY CONNECTED TO TERMINAL No.8 (GROUND TERMINAL)											

OPERATING-TEMPERATURE RANGE -55 to $+125^\circ \text{C}$ STORAGE-TEMPERATURE RANGE -65 to $+150^\circ \text{C}$

MAXIMUM INPUT-SIGNAL VOLTAGE:

Between Terminals 1 and 2 $\pm 3 \text{ V}$ MAXIMUM DEVICE DISSIPATION 300 mW

RECOMMENDED MINIMUM DC

SUPPLY VOLTAGE (V_{CC}) 5.5 V

Example of use of LIMITS TABLE:

For RCA-CA3013, a maximum voltage of ± 3 volts may be applied to Terminal 1 under the following conditions:

Terminal 2 is at the same dc potential as Terminal 1

Terminal 3: do not apply external voltage

Terminal 4 is at any dc potential between $+2.5$ and $+7.5$ voltsTerminal 5 is at a dc potential of $+7.5$ volts

Terminals 6 and 7 are at the same dc potential as Terminal 4

Terminal 8 is at dc ground potential

Terminal 9 is used as the af output terminal

Terminal 10 is at a dc potential of $+7.5$ volts

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ELECTRICAL CHARACTERISTICS (See Page 8 for Definitions of Terms)	SYMBOLS	TEST CONDITIONS				LIMITS						TYPICAL CHARACTERISTICS CURVES	
		SETUP & PROCEDURE	FREQUENCY f	DC SUPPLY VOLTAGE V _{CC}	AMBIENT TEMPERATURE T _A	RCA CA3013			RCA CA3014				UNITS
						Fig.	Mc/s	volts	°C	Min.	Typ.		
Total Device Dissipation *	P _T	3	-	6	-55	-	80	-	73	80	120	mW	4
					+25	60	90	133	73	90	110	mW	
					+125	-	70	-	60	70	110	mW	
		3	-	7.5	-55	-	130	-	106	130	170	mW	
					+25	87	120	187	106	120	150	mW	
					+125	-	100	-	90	100	150	mW	
		3	-	10	-55	-	-	-	165	210	250	mW	
					+25	-	-	-	165	190	230	mW	
					+125	-	-	-	150	160	230	mW	
Voltage Gain **	A	5	1	6	-55	-	55	-	50	55	-	dB	6
					+25	60	66	-	60	66	-	dB	
					+125	-	61	-	50	61	-	dB	
		5	1	7.5	-55	-	59	-	55	59	-	dB	6
					+25	65	70	-	65	70	-	dB	
					+125	-	65	-	55	65	-	dB	
		5	1	10	-55	-	-	-	55	61	-	dB	6
					+25	-	-	-	65	71	-	dB	
					+125	-	-	-	55	66	-	dB	
		5	4.5	7.5	+25	60	67	-	60	67	-	dB	7
					+25	55	60	-	55	60	-	dB	
		Input-Impedance Components: Parallel Input Resistance	R _{IN}	8	4.5	7.5	+25	-	3	-	-	3	-
C _{IN}	8		4.5	7.5	+25	-	7	-	-	7	-	pF	9
Output-Impedance Components: Parallel Output Resistance	R _{OUT}	10	4.5	7.5	+25	-	31.5	-	-	31.5	-	kΩ	11
	C _{OUT}	10	4.5	7.5	+25	-	4.2	-	-	4.2	-	pF	11
Noise Figure	NF	12	4.5	7.5	+25	-	8.7	-	-	8.7	-	dB	13
Input Limiting Voltage (Knee)	v _{i(lim)}	14	4.5	7.5	+25	-	300	450	-	300	400	μV	15
Recovered AF Voltage	v _{o(af)}	14	4.5	6	+25	-	155	-	-	155	-	mV	15
				7.5	+25	128	188	-	135	188	-	mV	
				10	+25	-	-	-	-	220	-	mV	
Amplitude-Modulation Rejection	AMR	16	4.5	7.5	+25	-	50	-	-	50	-	dB	-
Discriminator Output Resistance	R _{O(disc)}	-	4.5	7.5	+25	-	60	-	-	60	-	Ω	-
Total Harmonic Distortion	THD	14	4.5	7.5	+25	-	1.8	-	-	1.8	-	%	17

* Total current drain may be determined by dividing P_T by V_{CC}.** Recommended minimum dc supply voltage (V_{CC}) is 5.5 V. Nominal load current flowing into terminal 5 is 1.5 mA at 7.5 V.

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TYPICAL CHARACTERISTICS AND TEST SETUPS

DISSIPATION TEST SETUP

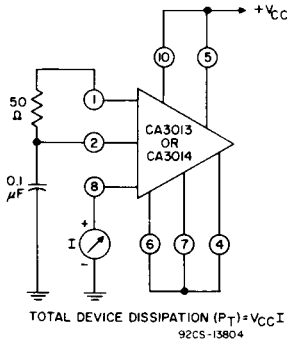


Fig.3

DISSIPATION vs. TEMPERATURE

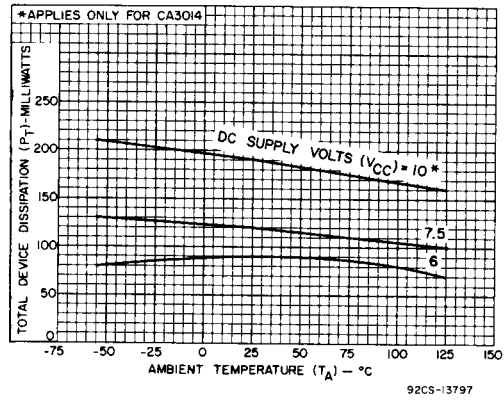
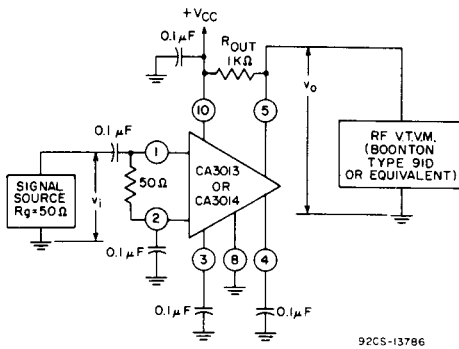


Fig.4

VOLTAGE-GAIN TEST SETUP



PROCEDURE:

- 1) Set input frequency at desired value, $v_i = 100 \mu V$ rms.
- 2) Record v_o .
- 3) Calculate Voltage Gain A from $A = 20 \log_{10} v_o/v_i$.
- 4) Repeat Steps 1, 2, and 3 for each frequency and/or temperature desired.

Fig.5

1-Mc/s VOLTAGE GAIN vs. TEMPERATURE

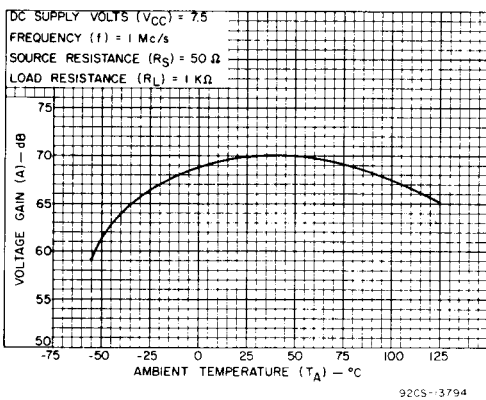


Fig.6

VOLTAGE GAIN vs. FREQUENCY

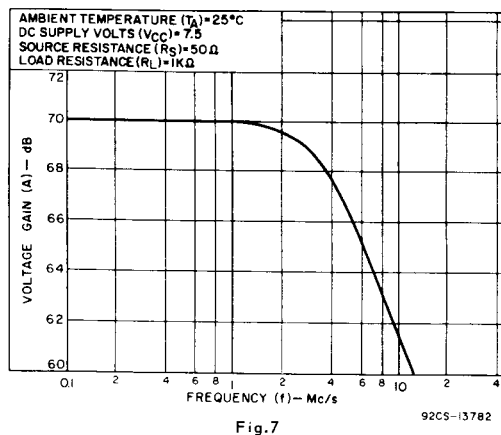


Fig.7

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TYPICAL CHARACTERISTICS AND TEST SETUPS

INPUT-IMPEDANCE COMPONENTS TEST SETUP

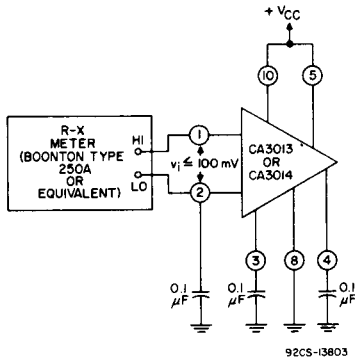


Fig. 8

INPUT-IMPEDANCE COMPONENTS vs. FREQUENCY

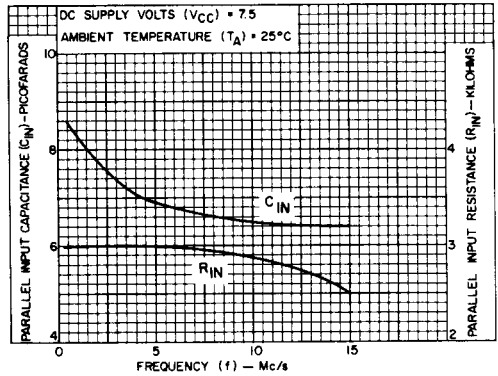


Fig. 9

OUTPUT-IMPEDANCE COMPONENTS TEST SETUP

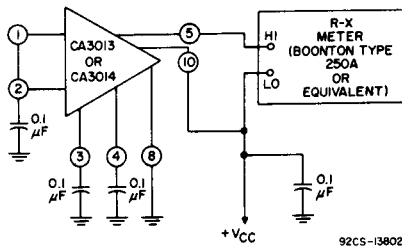


Fig. 10

OUTPUT-IMPEDANCE COMPONENTS vs. FREQUENCY

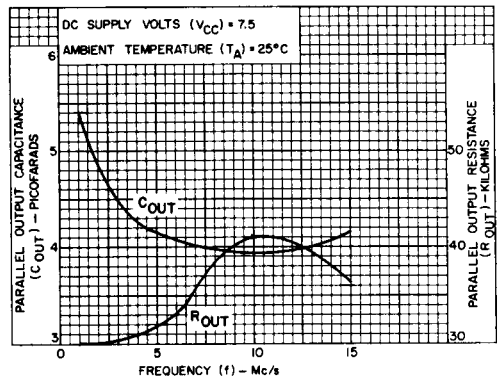
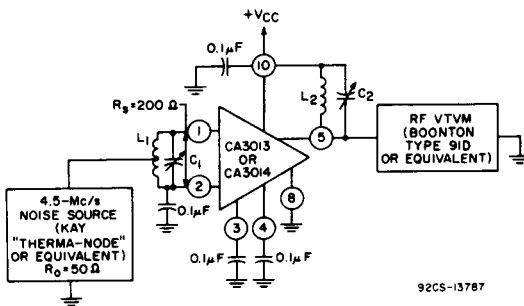


Fig. 11

NOISE FIGURE TEST SETUP

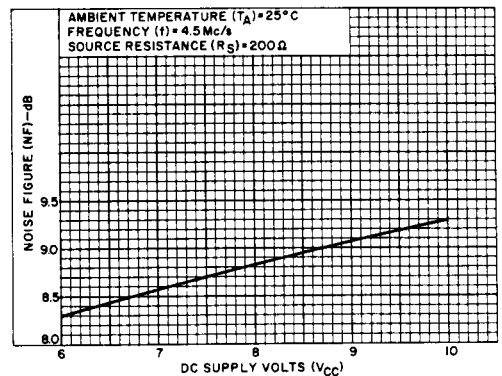


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- $L_1 = 82 \mu\text{H}$, center-tapped
- $L_2 = 2.36 \mu\text{H}$
- $C_1, C_2 = \text{Arco Type 423 padder, or equivalent}$

Fig. 12

NOISE FIGURE vs. DC SUPPLY VOLTAGE



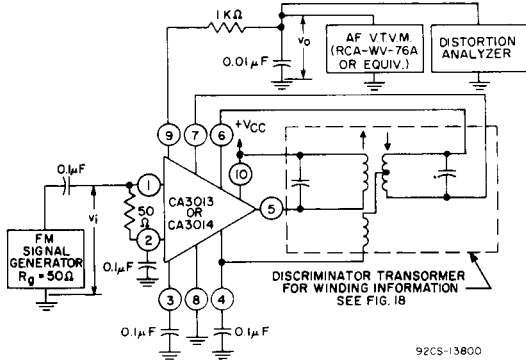
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Fig. 13

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TYPICAL CHARACTERISTICS AND TEST SETUPS

INPUT LIMITING VOLTAGE, RECOVERED AF VOLTAGE, AND TOTAL HARMONIC DISTORTION TEST SETUP



PROCEDURE:

A - Recovered-AF Voltage Output:

- 1) Set input frequency = 4.5 Mc/s, $v_i = 100$ mV rms, modulating frequency = 1 kc/s, frequency deviation = ± 25 kc/s.
- 2) Record v_o as Recovered-AF Voltage Output.

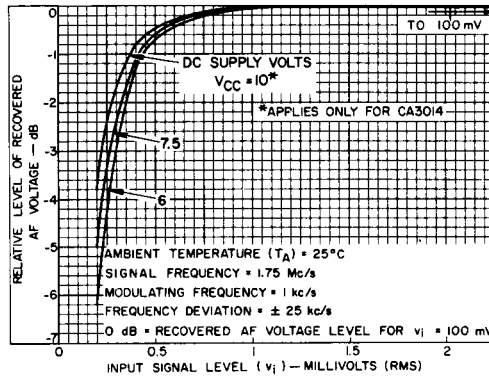
B - Input Limiting Voltage (Knee):

- 1) Repeat Steps A1 and A2, using $v_i = 100$ mV rms.
- 2) Decrease v_i to the level at which v_o is 3 dB below its value for $v_i = 100$ mV.
- 3) Record v_i as Input Limiting Voltage (Knee).

Fig.14

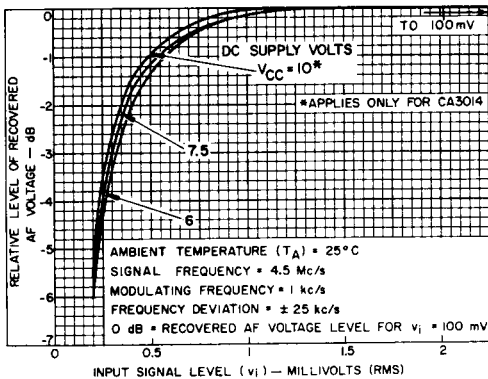
INPUT LIMITING VOLTAGE (KNEE) AND RECOVERED AF VOLTAGE

at 1.75 Mc/s



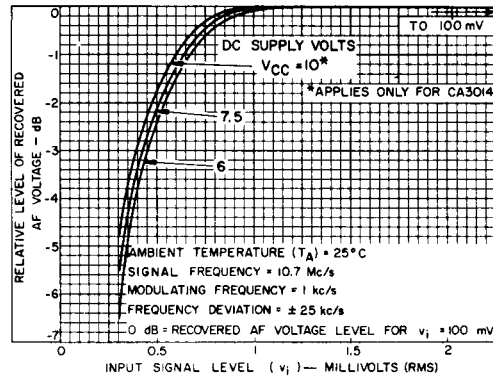
(a)

at 4.5 Mc/s



(b)

at 10.7 Mc/s



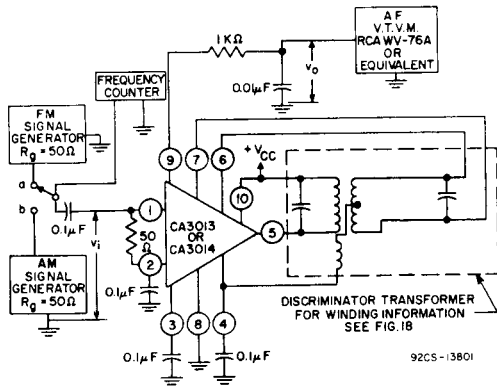
(c)

Fig.15

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TYPICAL CHARACTERISTICS AND TEST SETUPS

AM-REJECTION TEST SETUP

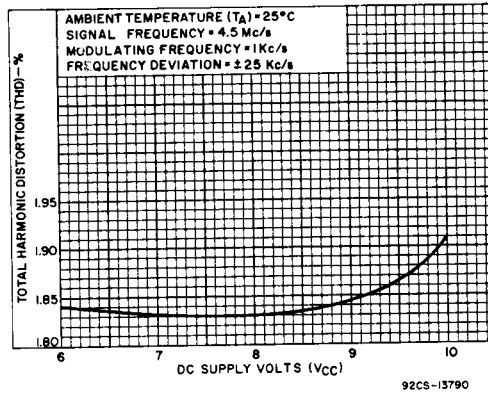


PROCEDURE:

- 1) With Switch S in position "a", set input frequency = 4.5 Mc/s, $V_i = 10$ mV rms, modulating frequency = 1 kc/s, frequency deviation = ± 25 kc/s.
- 2) Record v_o .
- 3) Place Switch S in position "b", and set input frequency = 4.5 Mc/s, $V_i = 10$ mV rms, modulating frequency = 1 kc/s, % modulation = 50.
- 4) Measure v_o , and record value in dB below value in Step 2 as AM Rejection.

Fig. 16

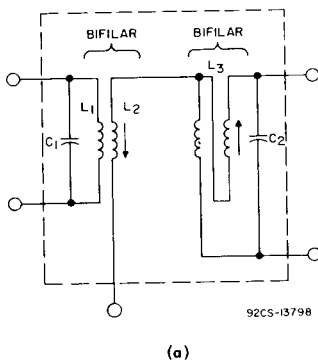
TOTAL HARMONIC DISTORTION vs. DC SUPPLY VOLTAGE



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Fig. 17

DISCRIMINATOR TRANSFORMER SCHEMATIC



CONSTRUCTION DETAILS OF DISCRIMINATOR TRANSFORMERS SHOWN IN FIGS. 2, 14 AND 16

Coil-Form Outside Diameter = 7/32 inch

Slugs: Radio Industries, Inc. Type "E" Material, or equivalent

Wire Type: "GRIZEPE"*, or equivalent

Operating Frequency Mc/s	Wire Size (AWG #)	Turns			C1 pF	C2 pF
		L1 [▲]	L2 [▲]	L3		
1.75	40	44	20	44 total (22 bifilar wound)	820	820
4.5	36	18	7	22 total (11 bifilar wound)	560	330
10.7	36	18	18	18 total (9 bifilar wound)	100	100

* Registered Trade Mark, Phelps-Dodge Copper Products.

[▲] wound bifilar.

NOTE: The mutual coupling between L1 and L3 is adjusted for the desired degree of linearity.

Fig. 18

(b)