3845

AM NOISE BLANKER

RF IN — 1
RF BYPASS — 2
RF BIAS — 3
RF AGC — 4
AUDIO DELAY — 5
AUDIO BLANK TIME (R) — 6
NO CONNECT — 7
AUDIO BLANK TIME (C) — 8
AUDIO OUT$_1$ — 9
AUDIO IN$_1$ — 10

DET
NC
NC

V_{CC} — 20 SUPPLY
NC — 19 NO CONNECT
18 RF GATE LOW
17 RF GATE HIGH
16 GROUND
15 RF BLANK TIME
14 NO CONNECT
13 NOISE DIFFERENTIATOR
12 AUDIO OUT$_2$
11 AUDIO IN$_2$
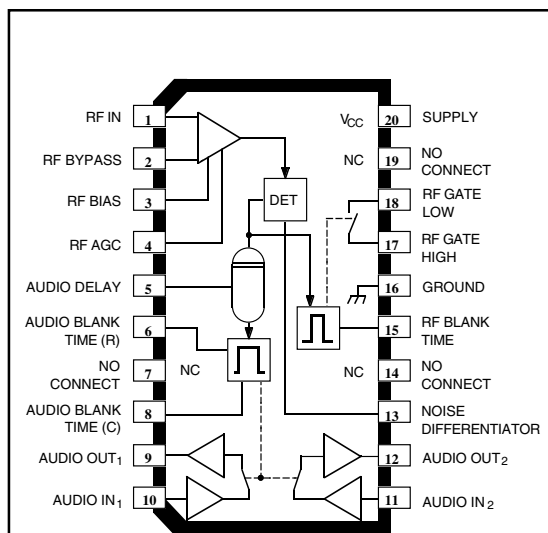
Dwg. PS-003-1A

This noise blanker integrated circuit contains all of the necessary circuitry for adding an extremely efficient (patented) noise-blanking technique to any type of AM tuner or receiver with RF input frequencies (or a first IF) to 30 MHz. The A3845ELW and A3845SLW feature dual audio channels and are intended for AM-stereo or independent sideband applications.

A high input impedance, high-gain, broadband RF amplifier permits these devices to be directly connected to the RF stage of a tuner. Internal AGC circuitry ensures that the noise detection threshold remains constant with changes in input signal level. The RF gate response time is sufficiently fast to blank the noise pulse at the output of the mixer before the IF filter. Short blanking times effectively suppress most of the interfering noise. Residual audio noise is removed by an audio sample-and-hold gate. The RF blanking time, audio gate delay time, and audio gate blanking time can all be independently adjusted to suit the particular application.

These AM noise blankers are packaged in plastic SOICs and are rated for operation over the a standard temperature range of -20°C to +85°C (suffix 'SLW') or an extended temperature range to -40°C (suffix 'ELW').

FEATURES
■ RF Blanking to 30 MHz
■ Single-Channel or Stereo Audio Blanking
■ Adjustable RF and Audio Blanking Time
■ Adjustable Audio Blanking Delay
■ Sample-and-Hold MOS Audio Gates
■ Internal Voltage Regulation
■ Minimum External Components

APPLICATIONS
■ AM and AM-Stereo Automotive Radios
■ CB Transmitter/Receivers
■ Short-Wave Receivers
■ Mobile Communications Equipment

ABSOLUTE MAXIMUM RATINGS
### at T_A = +25°C

Supply Voltage, V_{CC} . . . . **12 V**

Package Power Dissipation,
 P_D . . . . **1.78 W**

Operating Temperature Range, T_A
 Suffix 'ELW' . . . . **-40°C to +85°C**
 Suffix 'SLW' . . . . **-20°C to +85°C**

Storage Temperature Range,
 T_S . . . . **-55°C to +125°C**

Always order by complete part number:

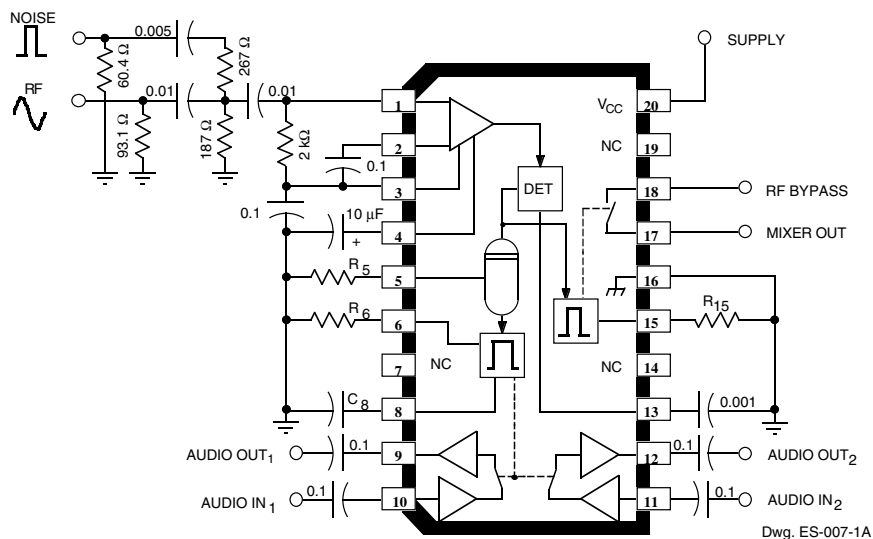| Part Number	Function
A3845ELW	Stereo Noise Blanker, Extended Temp. Range
A3845SLW	Stereo Noise Blanker, Standard Temp. Range

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FUNCTIONAL BLOCK DIAGRAM
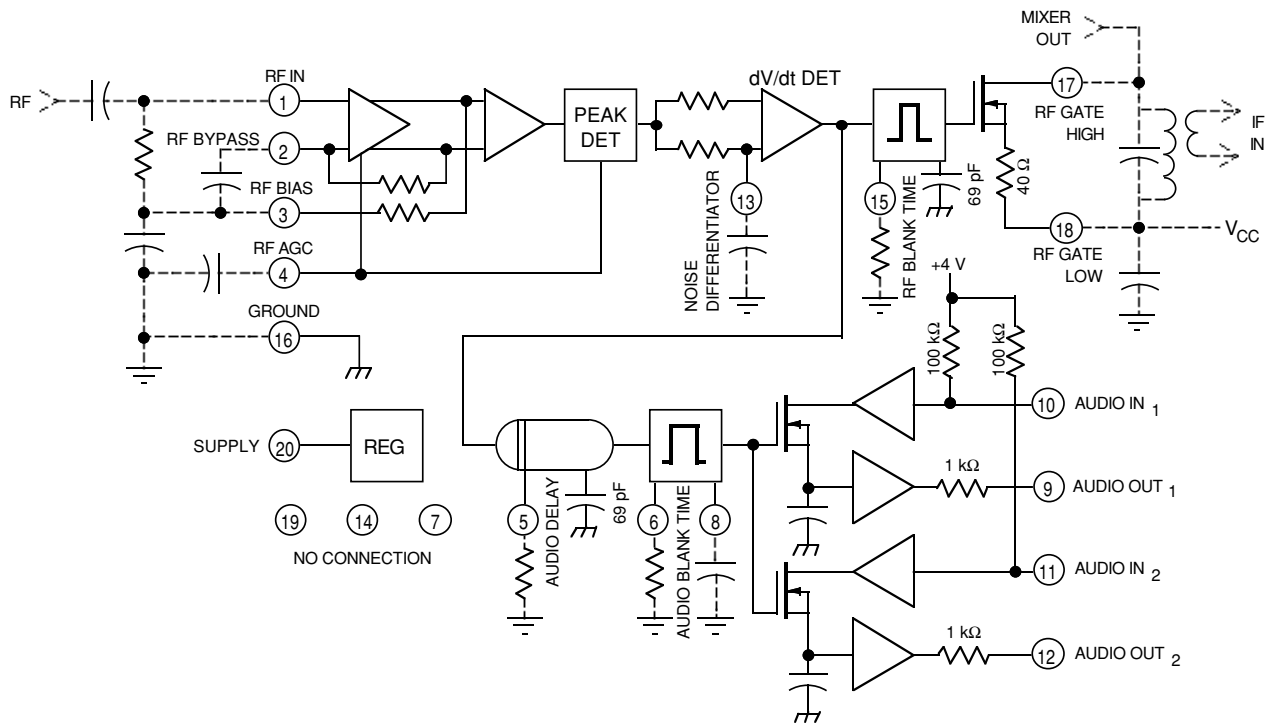
Dwg. FS-004-1A

TEST CIRCUIT

Dwg. ES-007-1A

Note that the noise-pulse input is attenuated 20 dB by the test circuit.

ELECTRICAL CHARACTERISTICS over operating temperature range, at V_{CC} = 7.5 V to 11 V, f_{rf} = 1 MHz, Noise (f_{noise}) = 500 Hz Square Wave, f_{af} = 1 kHz, Test Figure.

Characteristic	Test Leads	Test Conditions	Limits			Units
			Min.	Typ.	Max.	
Supply Voltage Range	20	Operating	7.5	9.0	12	V
Quiescent Supply Current	20	V_{RF} = 0	—	15	22	mA

RF INPUT AMPLIFIER:

Characteristic	Test Leads	Test Conditions	Min.	Typ.	Max.	Units
Trigger Threshold	1	Noise Pulse Amplitude for V_{RF} = 0	45	100	240	µV
Modulation Threshold	1	Noise Pulse Modulation for V_{RF} = 1 mV	35	75	220	%
Detector Rise Time	13	C_{13} = 0	—	500	—	ns

RF SWITCH:

Characteristic	Test Leads	Test Conditions	Min.	Typ.	Max.	Units
ON Resistance	17-18		—	30	100	Ω
OFF Resistance	17-18		—	100	—	kΩ
Time Delay	1-17	From Beginning of RF Pulse to Beginning of RF Blanking	—	1.5	5.0	µs

AUDIO SWITCHES:

Characteristic	Test Leads	Test Conditions	Min.	Typ.	Max.	Units
Attenuation	10-9, 11-12		55	80	_	dB
Noise	9, 12		—	1.5	12	mVpp
Crosstalk	9, 12		40	60	—	dB
Gain	10-9, 11-12		-1.2	-0.3	0	dB
Total Harmonic Distortion	9, 12	V_{af} =700 mV, V_{noise} = 0	—	<0.1	1.0	%
Input Impedance	10, 11		—	100	—	kΩ
Output Impedance	9, 12		—	1.0	—	kΩ

BLANKING TIMERS:

Characteristic	Test Leads	Test Conditions	Min.	Typ.	Max.	Units
RF Blanking	17	R_{15} = 350 kΩ	35	60	75	µs
Audio Delay	9	R_5 = 350 kΩ	30	55	67	µs
Audio Blanking	9	R_6 = 110 kΩ, C_8 = 0.0012 µF	210	250	400	µs

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CIRCUIT DESCRIPTION

Previous attempts at suppression of impulse noise in AM receivers have used a variety of approaches ranging from gating the signal OFF at the antenna to simply clipping (limiting) any signal that was larger than the average modulation. Unfortunately, the former can generate as much noise as it removes while the latter only reduces the level of noise impulses and does not remove them.

A major problem in attempting to suppress impulse noise in an AM receiver can best be described by looking at the shape of a noise pulse as it passes through a typical tuner as shown in the Figure. Here, a typical 0.5 µs pulse is applied to the antenna input. The resulting waveforms are essentially the impulse response of the different selectivity sections as limited only by the dynamic range of the individual sections. Note that the signal remains quite narrow until the IF filter is reached. Because of the relatively narrow bandwidth of the IF filter, the limiting of the IF amplifier, and the filtering effect of the detector, the audio output resulting from the impulse is much wider than the original input pulse and is therefore much more objectionable.

One blanking scheme currently in use senses the noise pulse in the IF amplifier and blanks the audio output. This results in a long blanking time and poor performance at the higher frequencies where a short blanking time is needed most.

The A3845xLW takes a different approach to the noise suppression problem by sensing the noise pulse in the receiver's RF section and blanking the pulse before it reaches the IF. This requires a noise amplifier with a minimum propagation delay and high-speed gating.

Blanking the noise pulse in this way is very effective, but some of the interference can still reach the audio output due to the loss of carrier during the blanking interval. For this purpose, an additional delay, blanking interval, and audio gates are included to further suppress any residual signal. The result is almost 100% suppression of

QUIESCENT DC VOLTAGES
(for circuit design information only)

Lead Number	Function	Typical DC Voltage
1	RF In	3.1
2	RF Bypass	3.1
3	RFBias	3.1
4	RF AGC	0.9
5	Audio Delay	4.8
6	Audio Blank Time (R)	4.8
7	No Connection	0
8	Audio BlankTime (C)	4.8
9	Audio Out$_1$	4.75
10	Audio In$_1$	4.0
11	Audio In$_2$	4.75
12	Audio Out$_2$	4.0
13	Noise Differentiator	4.9
14	No Connection	0
15	RF Blank Time	4.8
16	Ground	Reference
17	RF Gate High	—
18	RF Gate Low	—
19	No Connection	0
20	Supply	V_{CC}

impulse noise including that from ignition systems and from sources producing interference at a power line rate such as light dimmers and fluorescent lamps.

Referring to the Functional Block Diagram, the RF input stage is a differential amplifier, so that the input impedance is high. The triggering threshold at the RF amplifier input is about 15 µV at 1 MHz. This means that a pulsed RF input signal of 15 µV will exceed the threshold and trigger the blanker. The external capacitor at the dV/dt detector circuit (C_{13}) is selected so that audio signals do not cause triggering. At high input levels, the threshold is internally set so that an RF burst of 50% modulation triggers the blanker. A resistor in parallel with C_{15} will increase the detection threshold level.
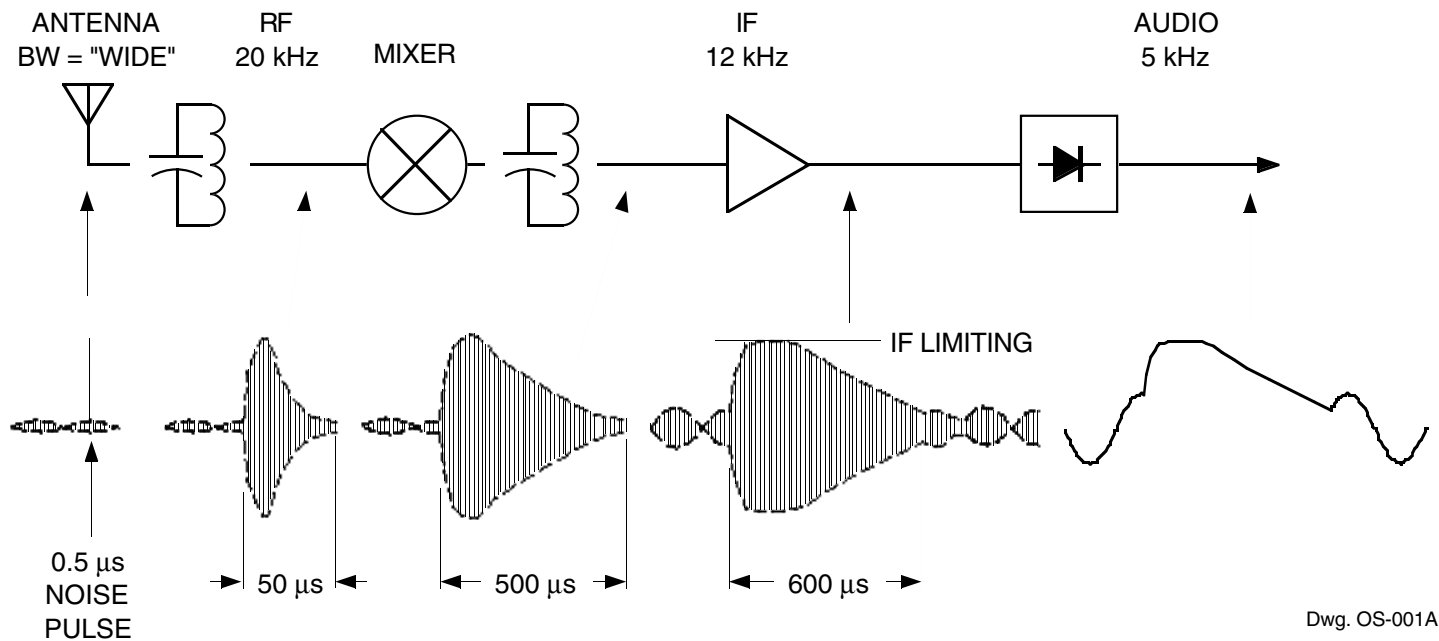
The RF-switching MOSFET (leads 17-18) is controlled by the RF one-shot whose gate time is determined by the value of R_{15}.

$$\text{RF Gate Time (µs)} = 171 \times 10^{-12} \times R_{15}$$

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TYPICAL PULSE RESPONSE

ANTENNA BW = "WIDE"   RF 20 kHz   MIXER   IF 12 kHz   AUDIO 5 kHz

IF LIMITING

0.5 µs NOISE PULSE   50 µs   500 µs   600 µs

Dwg. OS-001A

where R_{15} should be greater than 33 kΩ. Smaller values for C_{13} will reduce the sensitivity to RF input pulses. The MOSFET turns ON within approximately 1.5 µs (shunting the RF signal to ground) after a noise pulse is detected and then turns OFF over a 15 µs period after the end of the RF gate time. The ON resistance of the MOSFET is about 30 Ω. The slow turn-OFF prevents any additional transients from being introduced into the receiver by the RF gate. The internal gate circuit also includes charge-balancing circuits so that switching transients are canceled and do not appear at the output. These features ensure transient-free switching even when the RF gate is connected to the low-level input stages of a receiver. Note that the RF gate must be connected to a supply to obtain the minimum ON-resistance of the MOSFET gate. This makes it convenient to connect the RF gate in parallel with the receiver mixer output transformer primary.

Blanking in the RF or mixer sections of the receiver removes most of the noise pulse but a small amount still remains due to the hole punched in the carrier. This residual noise is theoretically somewhere between the peak audio and 100% negative modulation but is significantly smaller and narrower than that which the impulse would normally produce without blanking. An audio delay, one-shot, and audio gates are included to eliminate this residual signal.

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The audio delay is determined by the value of R_5:

Audio Gate Delay (μs) = 157 x 10^{-12} x R_5

where R_5 should be greater than 33 kΩ. The amount of delay required will depend on the IF filtering characteristics of the particular receiver design. After the audio delay time, the audio one-shot is triggered. The audio switching MOSFETs (leads 9-10 and leads11-12) are controlled by the audio one-shot whose gate time is determined by the values of R_6 and C_8:

Audio Gate Time (μs) = 1.9 x R_6 x C_8

The MOSFET audio gates also include charge-balancing circuits to eliminate switching transients.
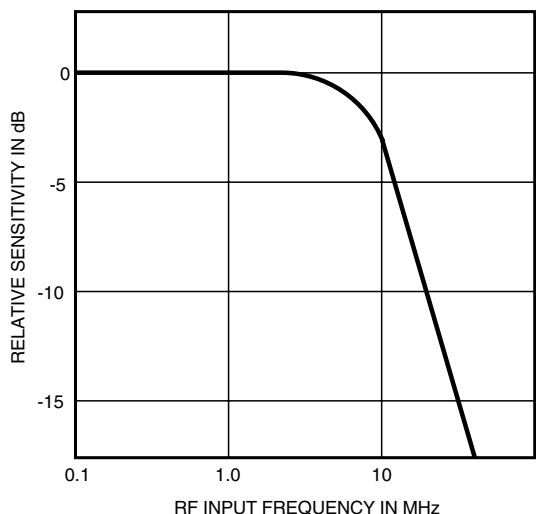
TYPICAL APPLICATION

A typical application uses the A3845xLW in a C-QUAM® AM stereo car-radio tuner with its input from between the RF tuned circuits and the mixer input. Although there is a 1.5 μs delay from the beginning of the noise pulse to the start of blanking, this is small compared with the impulse response time of the receiver. It takes almost 10 μs for the RF noise burst to reach 70% amplitude at the mixer input. The blanker RF input could be connected to the collector of the discrete RF amplifier, but the bandwidth is much wider there and false triggering from strong adjacent channel signals could occur.

The A3845xLW noise blanker can also be used in dual-conversion AM tuners. The blanker RF input would then be connected at the first IF amplifier input and the blanker RF gate connected at the second mixer output. Because the first IF band-width is usually relatively wide, the noise pulses are narrower, and the RF blanking time will be correspondingly less. In this case, it may be necessary to reduce the value of capacitor C_{13} so that the noise separator does not extend the RF blanking time.

COIL INFORMATION FOR HIGH-PERFORMANCE ETR AM STEREO RECEIVER WITH NOISE BLANKING

	Symbol	Q	N1:N2	N1:N3	Toko Part Number
Antenna	T_1		1:1.6		7HN-60064CY
RF	T_2, T_3	120		10:1	RWOS-6A7894AO, L = 178 μH
Local Osc.	T_4	120		5:1	7TRS-A5609AO
Mixer	T_5		2:1	8.9:1	7LC-502112N4, C_T = 180 pF
Detector	L_2	100			A7BRS-T1041Z, C_T = 1000 pF

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TYPICAL RF FREQUENCY RESPONSE

RELATIVE SENSITIVITY IN dB

RF INPUT FREQUENCY IN MHz

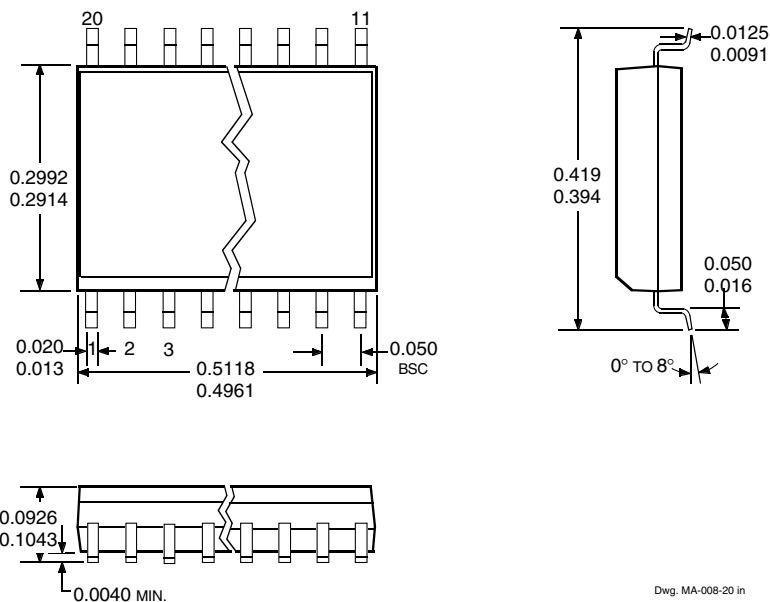Dwg. GS-006

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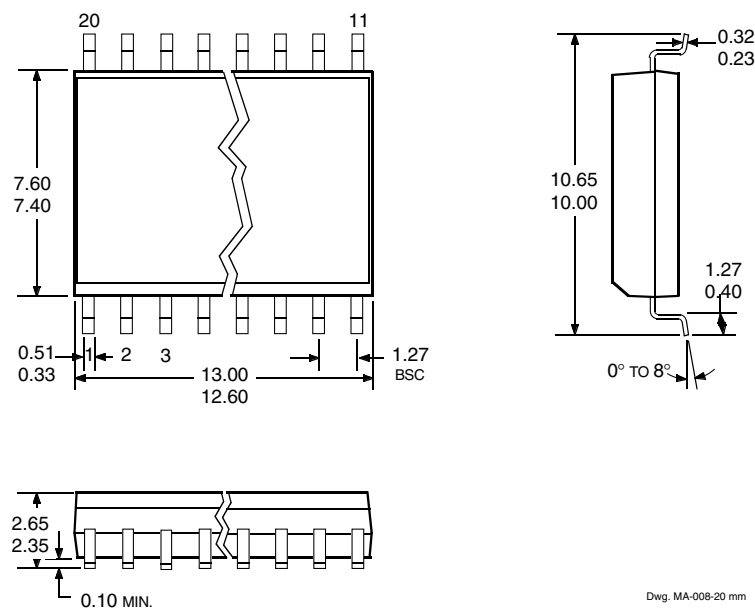
ETR AM-STEREO RECEIVER WITH NOISE BLANKING
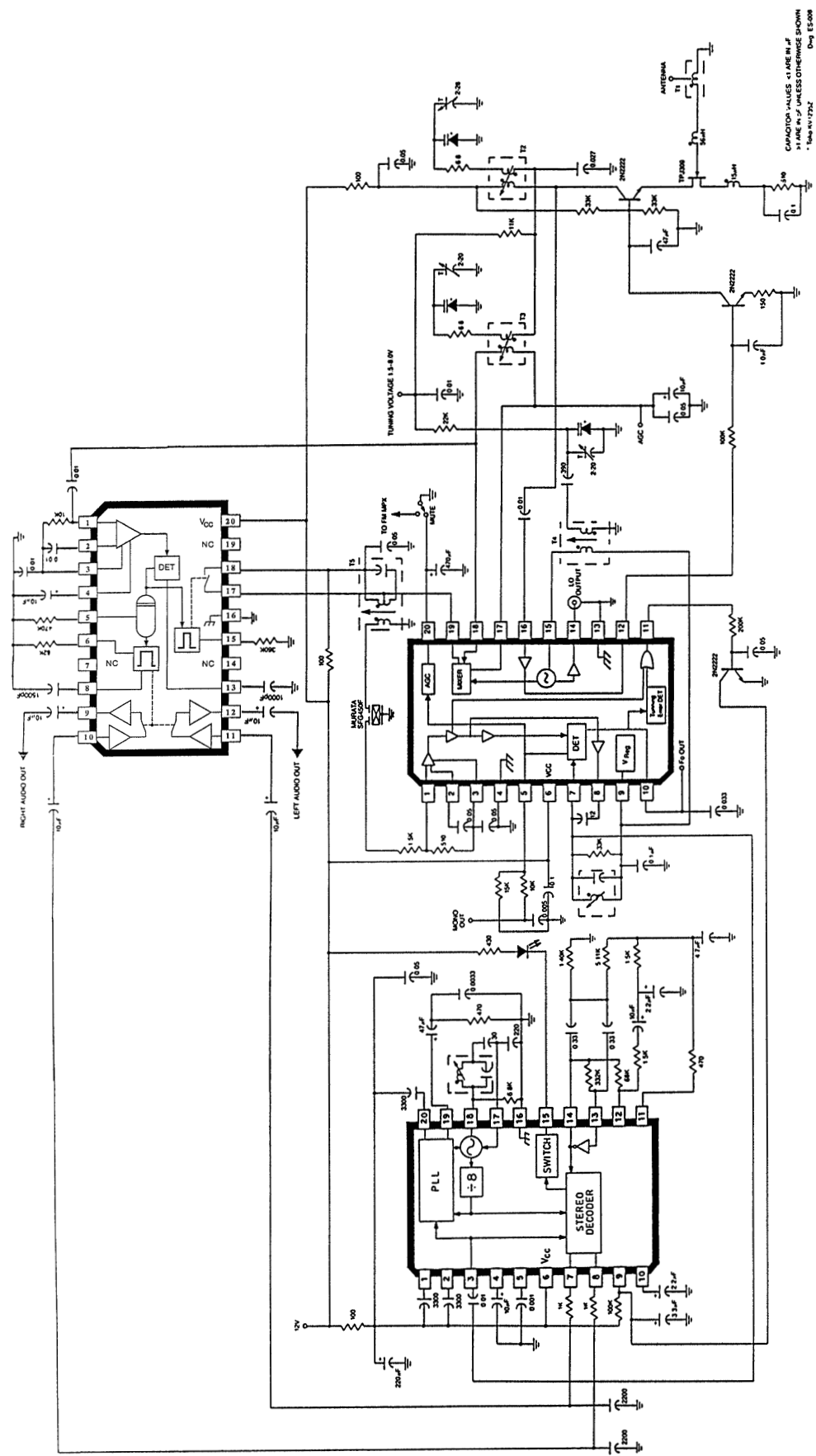
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Dimensions in Inches
(for reference only)

20   11

0.2992
0.2914

0.020   1   2   3   0.050
0.013   0.5118   BSC
              0.4961

0.0125
0.0091

0.419
0.394

0.050
0.016

0° TO 8°

0.0926
0.1043

0.0040 MIN.

Dwg. MA-008-20 in

Dimensions in Millimeters
(controlling dimensions)

20   11

7.60
7.40

0.51   1   2   3   1.27
0.33   13.00   BSC
             12.60

0.32
0.23

10.65
10.00

1.27
0.40

0° TO 8°

2.65
2.35

0.10 MIN.

Dwg. MA-008-20 mm

NOTES: 1. Exact body and lead configuration at vendor's option within limits shown.
        2. Lead spacing tolerance is non-cumulative.
        3. Supplied in standard sticks/tubes of 37 devices or add "TR" to part number for tape and reel.

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