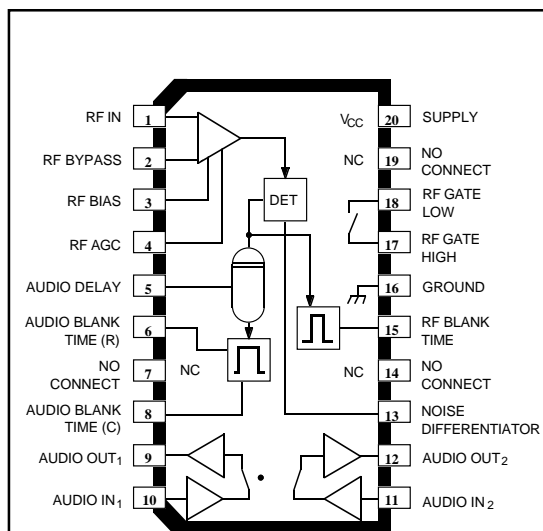


AM NOISE BLANKER



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 $T_A = +25^\circ\text{C}$

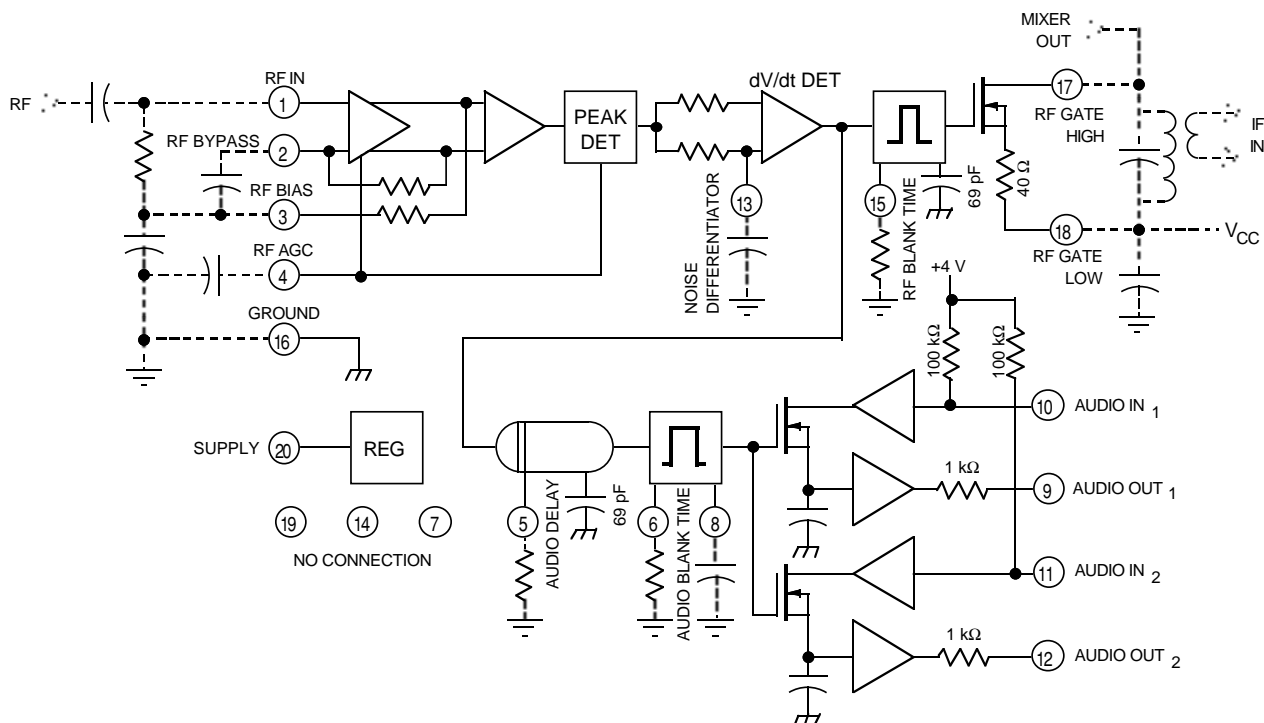
Supply Voltage, V_{CC}	12 V
Package Power Dissipation, P_D	1.78 W
Operating Temperature Range, T_A	
Suffix 'ELW'	-40°C to +85°C
Suffix 'SLW'	-20°C to +85°C
Storage Temperature Range, T_S	-55°C to +125°C

Always order by complete part number:

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

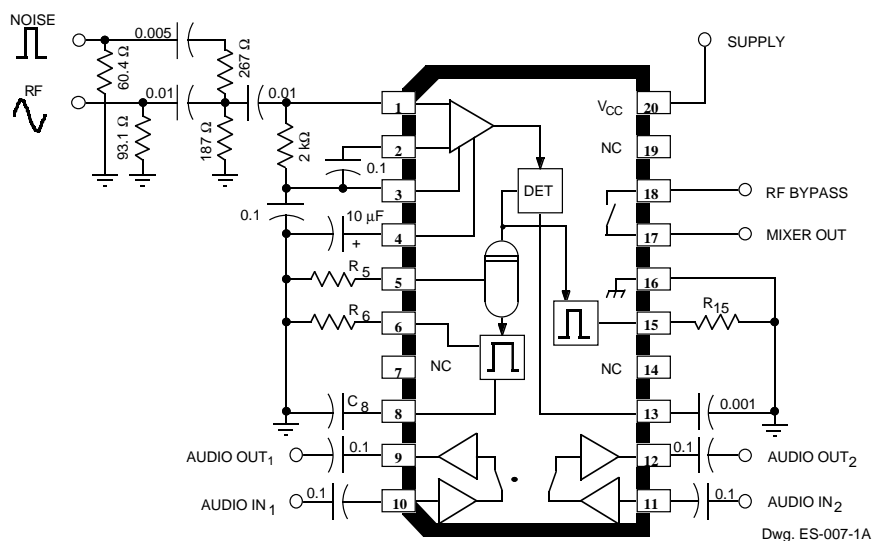
AM NOISE BLANKER

FUNCTIONAL BLOCK DIAGRAM



Dwg. FS-004-1A

TEST CIRCUIT



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

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

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

RF INPUT AMPLIFIER:

Trigger Threshold	1	Noise Pulse Amplitude for $V_{RF} = 0$	45	100	240	μV
Modulation Threshold	1	Noise Pulse Modulation for $V_{RF} = 1\text{ mV}$	35	75	220	%
Detector Rise Time	13	$C_{13} = 0$	—	500	—	ns

RF SWITCH:

ON Resistance	17-18		—	30	100	Ω
OFF Resistance	17-18		—	100	—	k Ω
Time Delay	1-17	From Beginning of RF Pulse to Beginning of RF Blanking	—	1.5	5.0	μs

AUDIO SWITCHES:

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	$V_{af} = 700\text{ mV}$, $V_{noise} = 0$	—	<0.1	1.0	%
Input Impedance	10, 11		—	100	—	k Ω
Output Impedance	9, 12		—	1.0	—	k Ω

BLANKING TIMERS:

RF Blanking	17	$R_{15} = 350\text{ k}\Omega$	35	60	75	μs
Audio Delay	9	$R_5 = 350\text{ k}\Omega$	30	55	67	μs
Audio Blanking	9	$R_6 = 110\text{ k}\Omega$, $C_8 = 0.0012\text{ }\mu\text{F}$	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 μ s 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}

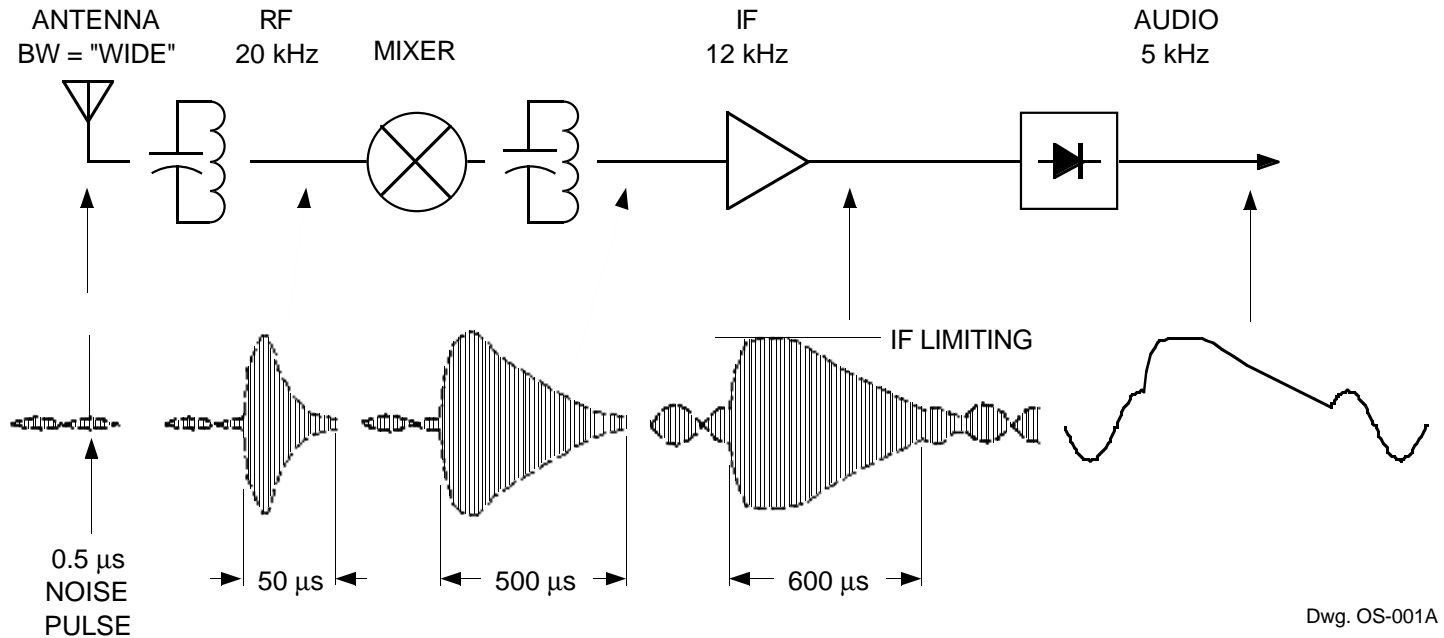
impulse noise including that from ignition systems and from sources producing interference at a power line rate such as light dimmers and fluorescent lamps.

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 μ V at 1 MHz. This means that a pulsed RF input signal of 15 μ V will exceed the threshold and trigger the blanker. The external capacitor at the dV/dt detector circuit (C₁₃) 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 C₁₅ 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 R₁₅.

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

TYPICAL PULSE RESPONSE



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where R_{15} should be greater than 33 k Ω . Smaller values for C_{13} will reduce the sensitivity to RF input pulses. The MOSFET turns ON within approximately 1.5 μ s (shunting the RF signal to ground) after a noise pulse is detected and then turns OFF over a 15 μ s 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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AM NOISE BLANKER

The audio delay is determined by the value of R_5 :

$$\text{Audio Gate Delay } (\mu\text{s}) = 157 \times 10^{-12} \times R_5$$

where R_5 should be greater than 33 k Ω . 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 leads 11-12) are controlled by the audio one-shot whose gate time is determined by the values of R_6 and C_8 :

$$\text{Audio Gate Time } (\mu\text{s}) = 1.9 \times R_6 \times C_8$$

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

TYPICAL APPLICATION

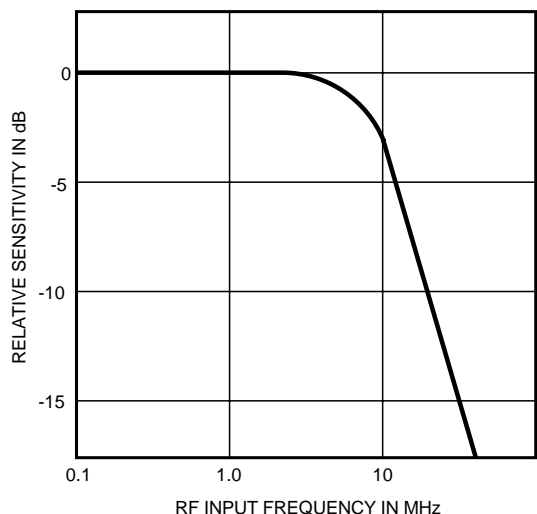
A typical application uses the A3845xLW in a C-QUAM® AM stereo car-radio tuner with its input from between the RF tuned circuits and the mixer input. Although there is a 1.5 μs delay from the beginning of the noise pulse to the start of blanking, this is small compared with the impulse response time 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, $L = 178 \mu\text{H}$
Local Osc.	T_4	120		5:1	7TRS-A5609AO
Mixer	T_5		2:1	8.9:1	7LC-502112N4, $C_T = 180 \text{ pF}$
Detector	L_2	100			A7BRS-T1041Z, $C_T = 1000 \text{ pF}$

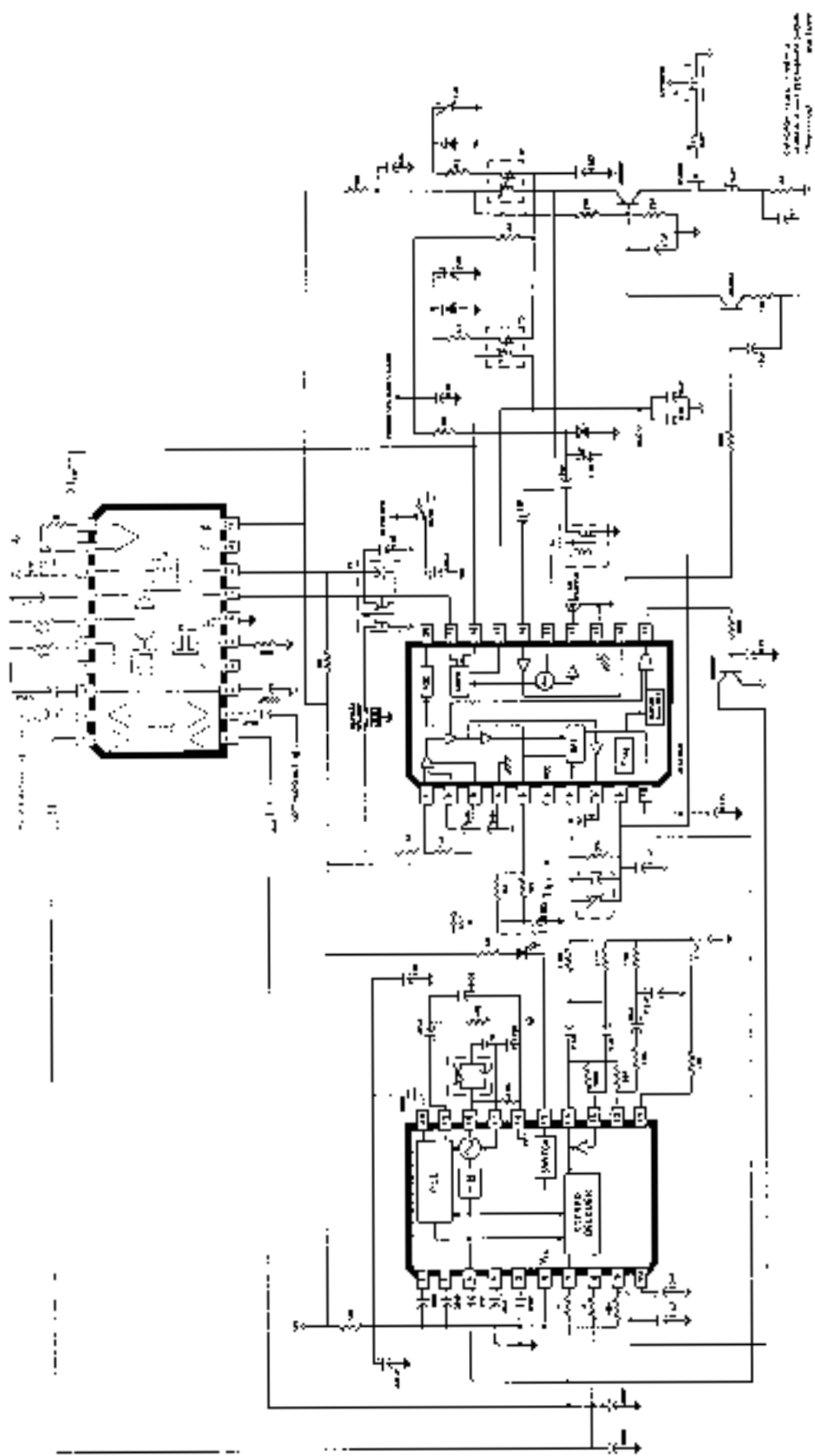
TYPICAL RF FREQUENCY RESPONSE



Dwg. GS-006

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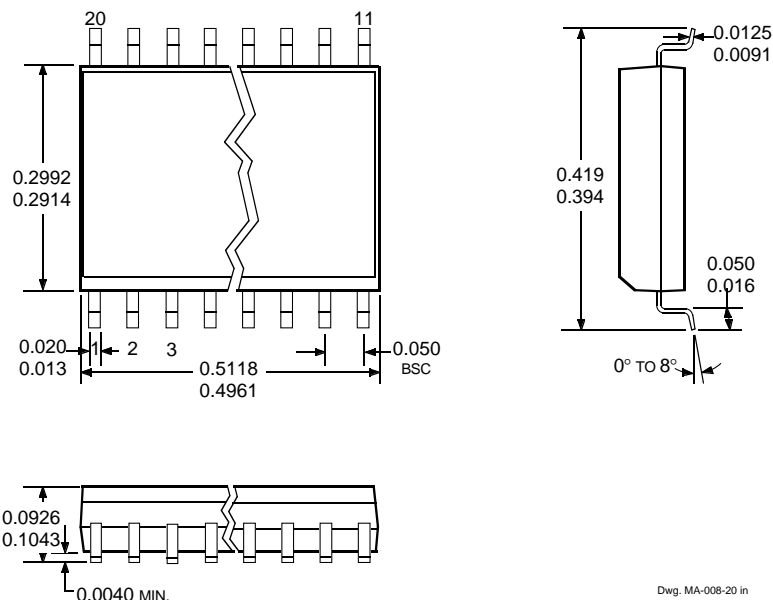
ETR AM-STEREO RECEIVER WITH NOISE BLANKING



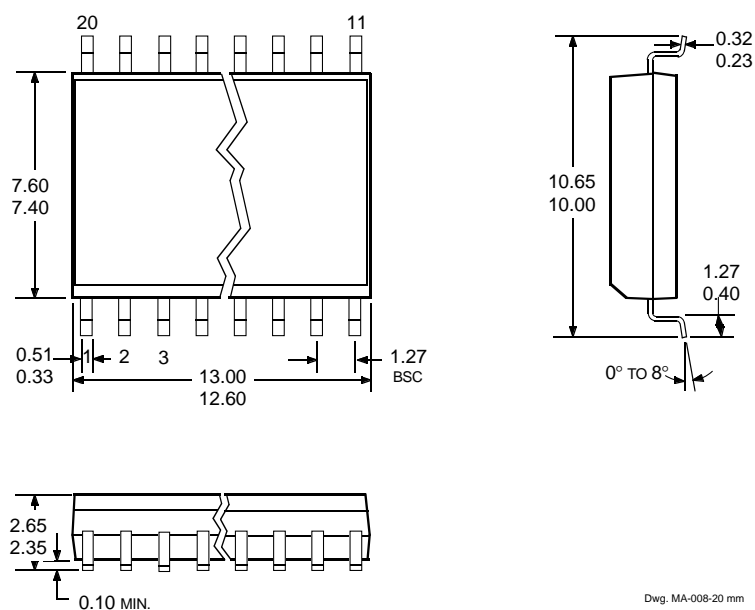
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AM NOISE BLANKER

Dimensions in Inches
(for reference only)



Dimensions in Millimeters
(controlling dimensions)



- 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.