CA2111AE, CA2111AQ

FM IF Amplifier-Limiter and Quadrature Detector

For FM IF and TV Sound IF Applications

The CA2111A, on a single monolithic chip, provides a multi-stage wideband amplifier-limiter, a quadrature detector, and an emitter-follower output stage. This device is designed for use in FM receivers and in the sound IF sections of TV receivers. In addition, an output terminal is provided which allows the use of the amplifier-limiter as a straight 60-dB wideband amplifier.

The amplifier-limiter features the excellent limiting characteristics of 3 cascaded differential amplifiers.

The quadrature detector requires only one coil in the associated outboard circuit and therefore, tuning is a simple procedure.

A unique feature of the CA2111A is its exceptionally low AFC voltage drift over the full operating-temperature range.

This device can be supplied in either dual-in-line or quad-in-line 14-lead plastic packages (CA2111AE and CA2111AQ, respectively).

Features:

- **Direct replacement for ULN2111A and MC1357**
- **Good sensitivity: Input limiting voltage (knee) (400 μV typ. at 10.7 MHz; 250 μV typ. at 4.5 MHz and 5.5 MHz)**
- **Excellent AM rejection (45 dB typ. at 10.7 MHz)**
- **Provision for output from 3-stage IF amplifier section**
- **Low harmonic distortion**
- **Quadrature detection permits simplified single-coil tuning**
- **Extremely low AFC voltage drift over full operating-temperature range**
- **Minimum number of external parts required**

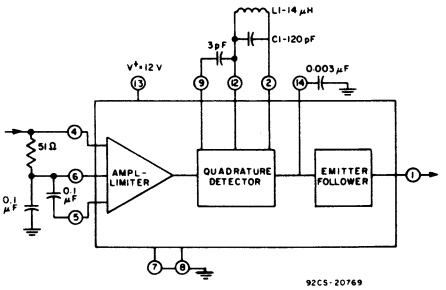

Fig. 1—Block diagram of CA2111A and associated outboard components.

MAXIMUM RATINGS, *Absolute-Maximum Values at T_A=25°C*

DC Supply Voltage [between terminals 13 (V^+) and 7 (V^-)]	16	V
Device Dissipation:		
Up to T_A = 60°C	600	mW
Above T_A = 60°C	derate linearly 6.7 mW/°C	
Ambient Temperature Range:		
Operating	−55 to +125	°C
Storage	−65 to +150	°C
Lead Temperature (During Soldering):		
At distance 1/16 ± 1/32 in. (1.59 ± 0.79 mm) from case for 10s max.	+265	°C

ELECTRICAL CHARACTERISTICS at T_A = 25°C

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	LIMITS MIN.	LIMITS TYP.	LIMITS MAX.	UNITS
DC Voltage:						
At Terminal 1	V_1	V^+ = 12V	–	5.4	–	V
		= 8V	–	3.7	–	
At Terminals 4, 5, 6, 10	$V_{4,5,6,10}$	V^+ = 8V	–	1.35	–	
At Terminals 2, 12	$V_{2,12}$		–	3.5	–	
DC Current (into Terminal 13)						
At V^+ = 8V			–	14	–	mA
At V^+ = 12V	I_{13}		–	16	–	
Amplifier Input Resistance	R_4	f_o = 10.7 MHz	–	7	–	kΩ
Amplifier Input Capacitance	C_4		–	11	–	pF
Detector Input Resistance	R_{12}		–	70	–	kΩ
Detector Input Capacitance	C_{12}		–	2.7	–	pF
Amplifier Output Resistance	R_{10}		–	60	–	Ω
Detector Output Resistance	R_1		–	200	–	Ω
De-Emphasis Resistance	R_{14}		–	8.8	–	kΩ

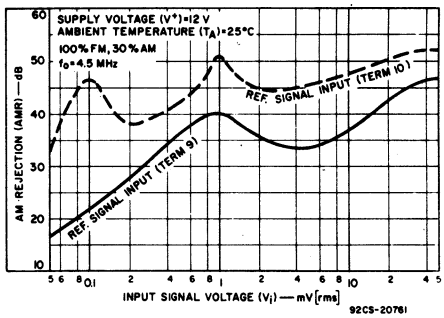

Fig. 2—AM rejection vs input voltage (4.5 MHz).

DYNAMIC ELECTRICAL CHARACTERISTICS at T_A = 25°C
FM Modulation Frequency = 400 Hz, Source Resistance = 50Ω

CHARACTERISTIC	SYMBOL	TEST CONDITIONS: f_o = 10.7 MHz, Δf = ± 75 KHz, V^+ = 12V		TEST CONDITIONS: f_o = 10.7 MHz, Δf = ± 75 KHz, V^+ = 8V		TEST CONDITIONS: f_o = 4.5 MHz, Δf = ± 25 KHz, V^+ = 12V		TEST CONDITIONS: f_o = 5.5 MHz, Δf = ± 50 KHz, V^+ = 12V		UNITS	TEST CIRCUIT OR CHARACTERISTIC CURVES FIG. NO.
		LIMITS TYP.	LIMITS MAX.	LIMITS TYP.	LIMITS MAX.	LIMITS TYP.	LIMITS MAX.	LIMITS TYP.	LIMITS MAX.		
AMPL-LIMITER											
Input Limiting Threshold Voltage (4)	V_i(lim)	400	600	400	600	250	400	250	400	V (RMS)	7, 6, 8, 9
AM Rejection‡ *	AMR(1)	45	–	37	–	36	–	40	–	dB	2, 7, 5, 6
Ampl. Voltage Gain▲	A_V(10)	55	–	55	–	60	–	60	–	dB	7
DETECTOR											
Recovered Audio‡ Output Voltage (1)	V_o(AF)	0.48	–	0.3	–	0.72	–	1.2	–	V (RMS)	6, 7, 8, 9
Total Harmonic‡ Distortion	THD(1)	1	–	1	–	1.5	–	3	–	%	7

‡V_i = 10 mV (RMS) ▲$V_i \leq 50$ μV (rms) *100% FM, 30% AM

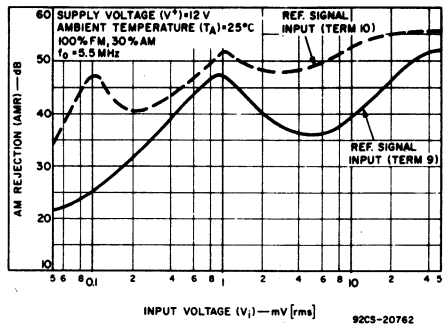

Fig. 3—AM rejection vs input voltage (5.5 MHz).

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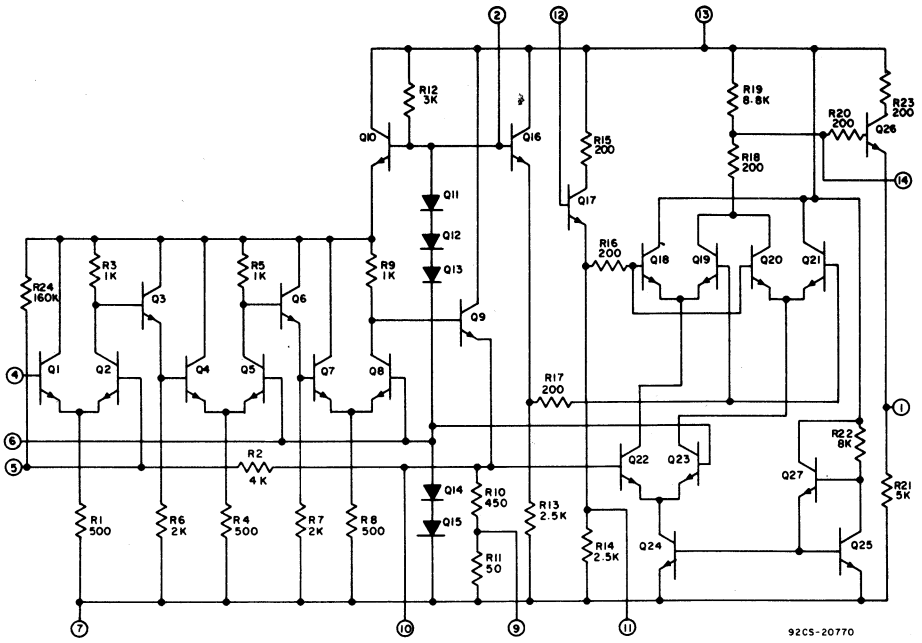


Fig. 4 –Circuit schematic–CA2111A

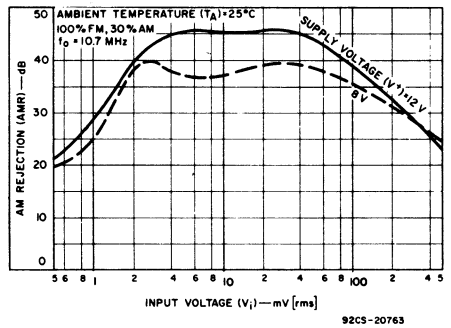


Fig. 5 –AM rejection vs input voltage (10.7 MHz).

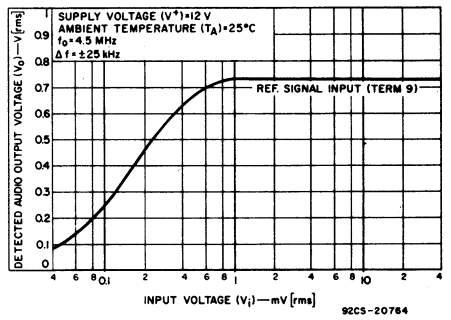
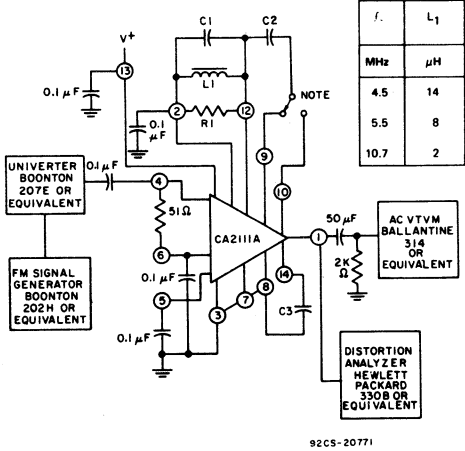


Fig. 6 –Detected audio output vs input voltage (4.5 MHz).



COMPONENT VALUES							DETECTOR TRANSFER CHARACTERISTICS	
f_o	L_1	C_1	R_1	Q	C_2	C_3	UPPER PEAK	LOWER PEAK
MHz	μH	pF	KΩ	–	pF	μF	MHz	MHz
4.5	14	120	20	30	3	0.003	4.58	4.42
5.5	8	100	20	30	3	0.003	5.63	5.37
10.7	2	120	3.9	20	4.7	0.01	10.9	10.5

NOTE:
Input to the quadrature coil can be from either terminal 9 or terminal 10. Terminal 9 is normally used because it lessens the possibility of overloads during tuning. The use of terminal 10 increases the limiting sensitivity significantly and has been used successfully in these tests.

Fig. 7 –Test circuit.

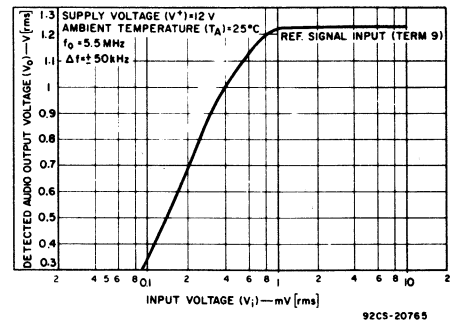


Fig. 8–Detected audio output vs input voltage (5.5 MHz).

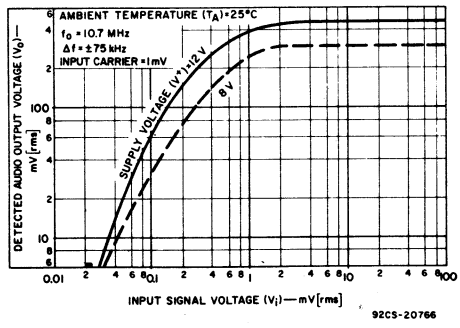


Fig. 9–Detected audio output voltage vs input voltage (10.7 MHz).

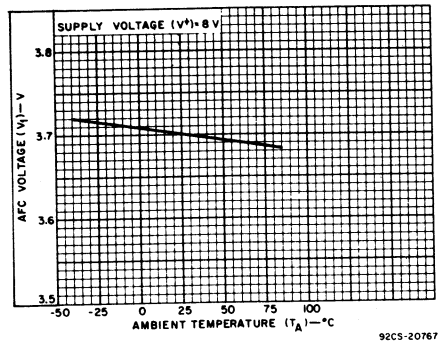


Fig. 10–AFC voltage vs ambient temp.

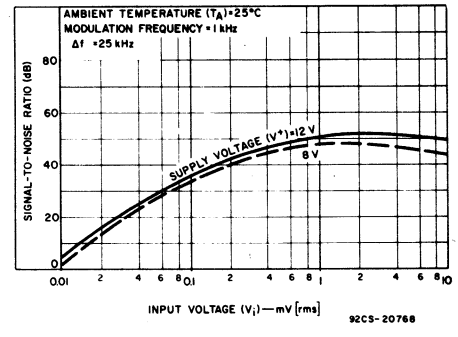


Fig. 11–Signal-to-noise ratio vs input voltage.