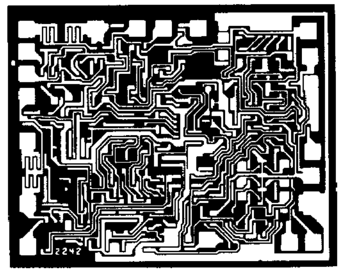
ULN-2242A/TDA1090
A-M/F-M SIGNAL PROCESSING SYSTEM

FEATURES

- Low External Parts Count
- D-C A-M/F-M Switching
- 12 μV Limiting Threshold
- 5 μV A-M Sensitivity
- Low Harmonic Distortion
- Balanced A-M Mixer
- Meter Drive
- Internal Regulator
- Self-Contained Muting (Squelch)



SUBSTANTIAL SIMPLIFICATION of A-M/F-M receiver design is possible with Type ULN-2242A signal processing system with improved system performance and a minimal external parts count. All F-M I-F functions and all A-M functions are provided by this monolithic integrated circuit.

The use of an analog multiplier as a balanced low-current mixer results in freedom from spurious responses, high tweet rejection, low feedthrough (I-F rejection), and low noise, as well as very low local oscillator radiation.

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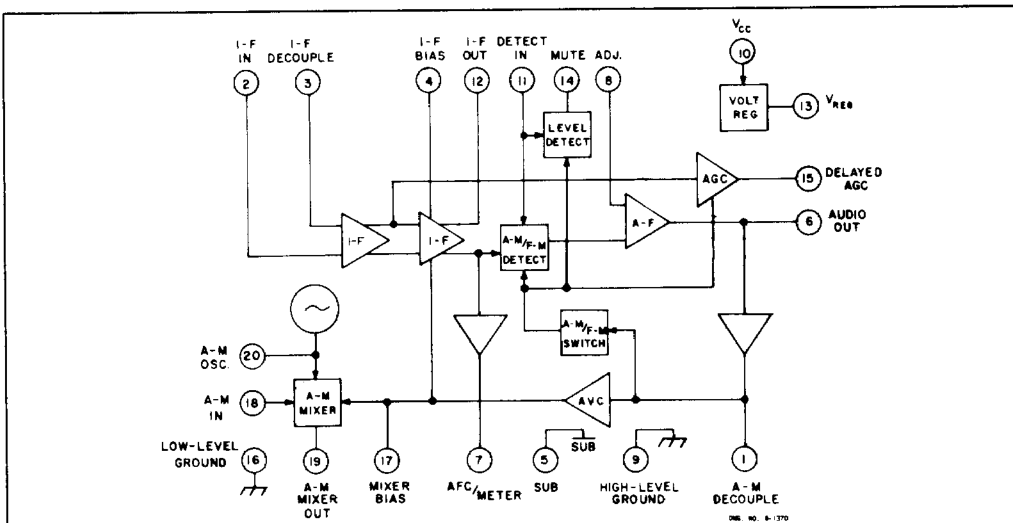

FUNCTIONAL BLOCK DIAGRAM

Although primarily intended for use in A-M broadcast reception, the A-M mixer is also suitable for use at long-wave or short-wave frequencies. Delayed AGC is available for use with an optional, discrete R-F stage.

A fully-balanced, four-stage differential I-F amplifier gives maximum gain with freedom from common-mode signals. It is used in both the A-M and F-M modes of operation with approximately 82 dB gain in the F-M mode and controlled AGC gain of 26 to 82 dB in the A-M mode.

The detector in the F-M mode is a four-quadrant analog multiplier operating in the high-level injection mode. Interference and noise are rejected. AFC and meter-drive signals (pin 7) are generated for use with any reference voltage between V_{CC} and ground, with AFC gain determined by the choice of load resistor.

The mute and delayed AGC outputs provide d-c voltages for control of signal-level-related functions. Both detectors are biased to a no-signal value of 4.7 V and approach zero with increasing signal input.

In the A-M mode of operation, the detector is configured as a balanced peak detector for low audio distortion. A-M gain control is achieved with AVC applied to the I-F and delayed AVC applied to the mixer.

Switching between modes can be accomplished with a simple single-pole d-c switch. The common low-level audio output can be used to drive any suitable audio power amplifier or stereo decoder (Sprague Type ULN-3703Z and ULN-3810A, respectively).

Internal voltage regulators and bias supplies assure premium performance despite variations in external supply voltage (8.5 to 16 V) or temperature (−20°C to +85°C). Separate ground leads minimize possible decoupling problems.

Type ULN-2242A A-M/F-M signal processing system is housed in a 20-pin dual in-line plastic package. Parts are marked with the Sprague Electric part number (ULN-2242A) unless the Pro-Electron marking (TDA1090) is requested.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V_{CC} . . . . 18 V
Mute Input Voltage, V_8 . . . . 5.0 V
Package Power Dissipation, P_D (see note) . . . . 750 mW
Operating Temperature Range, T_A . . . . −20°C to +85°C
Storage Temperature Range, T_S . . . . −65°C to +150°C

Note: P_D is derated at the rate of 9.4 mW/°C above T_A = +70°C.

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$, $V_{CC} = 12.8$ V

Characteristic	Symbol	Test Pin	Test Conditions	Limits Min.	Typ.	Max.	Units
Operating Voltage Range	V_{CC}	10		8.5	12.8	16	V
Audio Output Voltage	V_6	6	No Signal	—	5.8	—	V
Regulator Output Voltage	V_{REG}	13	No Signal	—	6.4	—	V
Regulator Output Current	I_{REG}	13		2.0	—	—	mA
F-M MODE: f_o = 10.7 MHz, f_m = 400 Hz, f_d = ±75 kHz, V_{in} = 10 mVrms, Non-Muted (unless otherwise specified)							
Input Limiting Threshold	V_{TH}	2		—	12	25	μV
Recovered Audio	V_{out}	6		350	425	600	mV
Output Distortion	THD	6		—	0.3	0.7	%
A-M Rejection	AMR	6	See Note	40	>55	—	dB
Mute	ΔV_{out}	6	V_{in} = 100 μV, max. mute	—	—	−1.0	dB
			V_{in} = 5 μV, max. mute	−45	—	—	dB
AFC Output Voltage	V_{afc}	7		220	—	600	mV
I-F Input Voltage	V_2	2	No Signal	—	3.5	—	V
Mute Output Voltage	V_{14}	14	No Signal	3.6	4.2	—	V
AGC Output Voltage	V_{15}	15	No Signal	4.2	4.8	5.5	V
			V_{in} = 10 mVrms	—	—	0.5	V
Mute Output Current	I_{14}	14	No Signal	0.5	—	—	mA
AGC Output Current	I_{15}	15	No Signal	1.0	—	—	mA
Supply Current	I_{CC}		No Signal	—	23	35	mA
A-M MODE: f_o = 1MHz, f_{if} = 455 kHz, f_m = 400 Hz, 30% A-M, V_{in} = 1.0 mVrms (unless otherwise specified)							
Sensitivity	V_{in}	18	V_{out} = 50 mVrms	—	5.0	8.5	μV
Usable Sensitivity		18	20 dB S+N/N	—	6.0	—	μV
Recovered Audio	V_{out}	6	80% A-M	250	325	600	mV
Input Overload	V_{in}	18	80% A-M, THD = 10%	25	50	—	mV
A-M Decoupling Voltage	V_1	1	No Signal	—	1.0	—	V
I-F Input Voltage	V_2	2	No Signal	—	3.7	—	V
Mute Output Voltage	V_{14}	14	No Signal	—	—	0.5	V
AGC Output Voltage	V_{15}	15	No Signal	—	—	0.5	V
A-M Input Voltage	V_{17}	17	No Signal	1.6	1.8	2.1	V
Supply Current	I_{CC}		No Signal	—	16	30	mA

Note:
Amplitude Modulation Rejection is specified as $20 \log \frac{V_{out} V_{out} \text{ for } 100\% \text{ F-M } V_{in}}{V_{out} \text{ for } 30\% \text{ A-M } V_{in}}$

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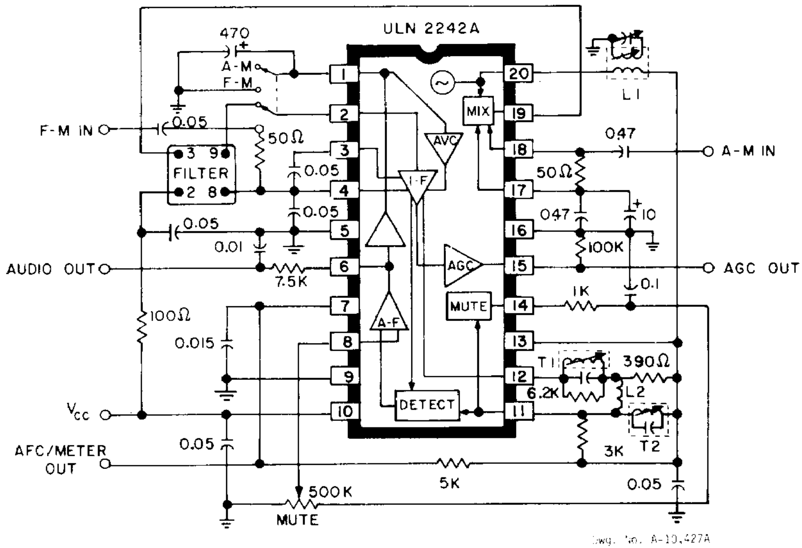
SMALL-SIGNAL A-C CHARACTERISTICS at T_A = +25°C

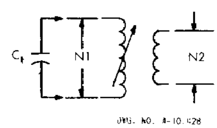
Characteristic	Symbol	Test Pin	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
I-F Input Capacitance	C_2	2		—	6.0	—	pF
I-F Output Resistance	R_{12}	12		—	250	—	kΩ
I-F Output Capacitance	C_{12}	12		—	2.5	—	pF
Audio Output Impedance	Z_6	6		—	860	—	Ω
F-M MODE: f_o = 10.7 MHz							
I-F Input Resistance	R_2	2		—	10	—	kΩ
I-F Transconductance	g_m	2-12		—	18	—	mho*
Detector Input Resistance	R_{11}	11		—	100	—	kΩ
Detector Input Capacitance	C_{11}	11		—	1.5	—	pF
A-M MODE: f_o = 1 MHz, f_{if} = 455 kHz							
A-M Input Resistance	R_{18}	18		—	5.0	—	kΩ
A-M Input Capacitance	C_{18}	18		—	20	—	pF
Mixer Transconductance	g_m	18-19		—	15	—	mmho*
Mixer Output Resistance	R_{19}	19		—	500	—	kΩ
Mixer Output Capacitance	C_{19}	19		—	5.0	—	pF
I-F Input Resistance	R_2	2		—	15	—	kΩ
I-F Transconductance	g_m	2-12		—	300	—	mmho*
Detector Input Resistance	R_{11}	11		—	250	—	kΩ
Detector Input Capacitance	C_{11}	11		—	1.0	—	pF

*The International Electrotechnical Commission recommends the use of siemens (S) as the standard international unit of conductance, admittance and susceptance.

TEST CIRCUIT

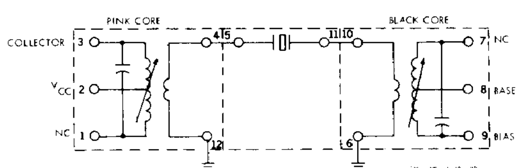


COIL WINDING INFORMATION

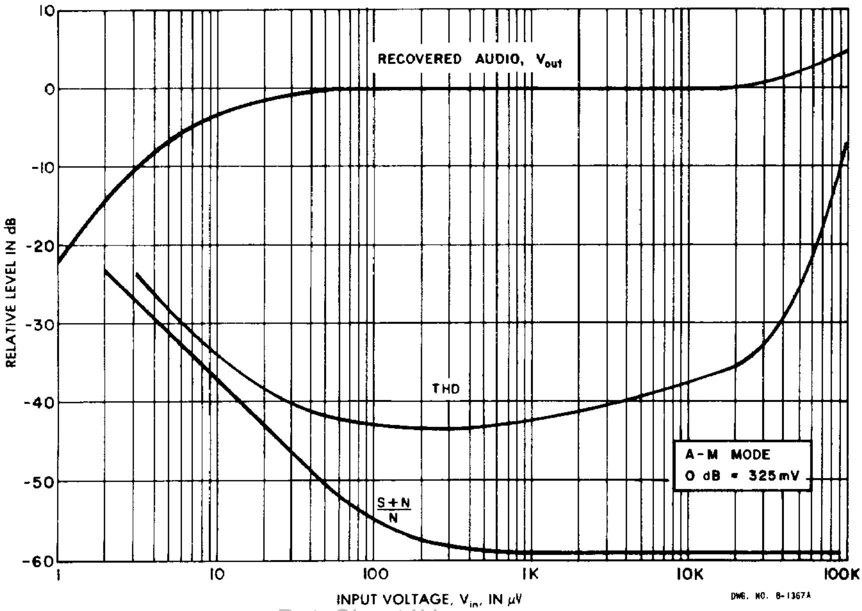


T1	A-M I-F 455 kHz	Qu = 45 Ct = 1000 pF	General Instrument Part No. EX 27765	Toko Part No. RXN-6A6909HM
T2	F-M Detector 10.7 MHz	Qu = 60 Ct = 82 pF	General Instrument Part No. EX 27975	Toko Part No. TKAC-17044Z
L1	A-M Oscillator 1455 kHz	Qu = 50 N1:N2 = 11:1 Ct = 39 pF	General Instrument Part No. EX 27641	Toko Part No. RWO-6A7640BM
L2	F-M Detector 10.7 MHz	L = 18 μH Qu = 55		Coilcraft Type V

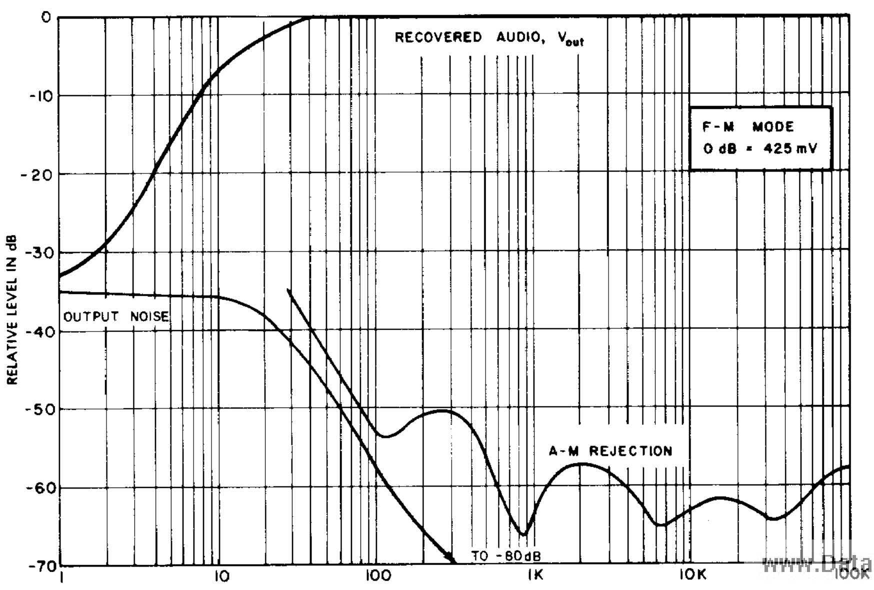
Filter Assembly:
Toko Part No. CFU455C-82BR



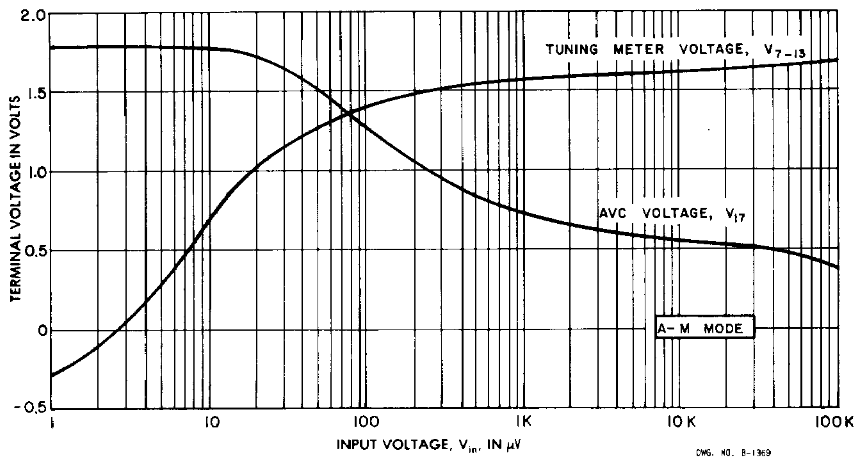
A-M CHARACTERISTICS AS FUNCTIONS OF INPUT VOLTAGE



F-M CHARACTERISTICS AS FUNCTIONS OF INPUT VOLTAGE



A-M CONTROL VOLTAGES AS FUNCTIONS OF INPUT VOLTAGE



F-M CONTROL VOLTAGES AS FUNCTIONS OF INPUT VOLTAGE