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Monolithic Linear IC

SANYO No.855F

LA2110

FM Noise Canceller

The LA2110 has the capability to effectively remove external noise (pulse noise) caused by engine, etc. and is used in conjunction with a PLL FM multiplex stereo demodulator (such as LA3375) with pilot signal canceller.

Features

- Pilot signal compensation function.
- By using in conjunction with PLL FM multiplex stereo demodulator with pilot signal canceller, adverse effect caused by pilot signal can be compensated.
- Low distortion factor: THD = 0.02%, 300mV.
- Good space facator due to single end package.
- Variable input type noise AGC system. This system widens the noise detector's dynamic range, so that pulse noise can be satisfactorily detected even in a weak electric field, and pulse noise is removed without adversely affecting distortion factor.

Maximum Ratings at Ta = 25°C

				unit
Maximum Supply Voltage	$V_{CC}max$		16	V
Allowable Power Dissipation	Pdmax	Ta≦50°C	450	mW
Operating Temperature	Topr		−20 to +75	°C
Storage Temperajture	Tstg		−40 to +125	°C

Recommended Operating Conditions at Ta = 25°C

			unit
Recommended Supply Voltage	V_{CC}	12	V
Operating Voltage Range	V_{CC} op	8 to 15	V

Operating Conditions at Ta = 25°C, V_{CC} = 12V, See specified Test Circuit.

		(input pin)	(output pin)	min	typ	max	unit
Quiescent Current	Icco				16	25	mA
Voltage Gain	VG	V_7 = 300mV, f = 1kHz	Output	−0.2	0.8	1.8	dB
Input Signal Dynamic Range	V_D	V_7, f = 1kHz	Output, THD = 1%	1.3			V
Input Impedance	Z_{in}	V_7 = 300mV, f = 1kHz		36k	51k	67k	Ω
Total Harmonic Distortion	THD	V_7 = 300mV, f = 1kHz	Output		0.01	0.03	%
Low-pass Amp Gain	VG_L	V_5 = 300mV, f = 1kHz	V_4	1.0	1.1	1.2	times

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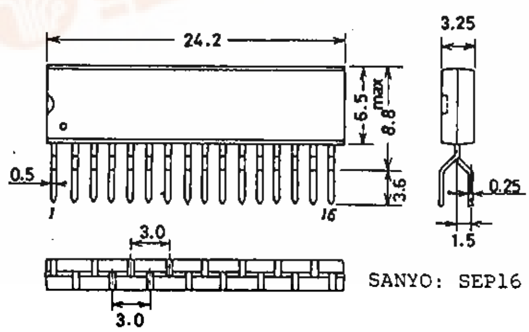
Package Dimensions (unit: mm)
3020A



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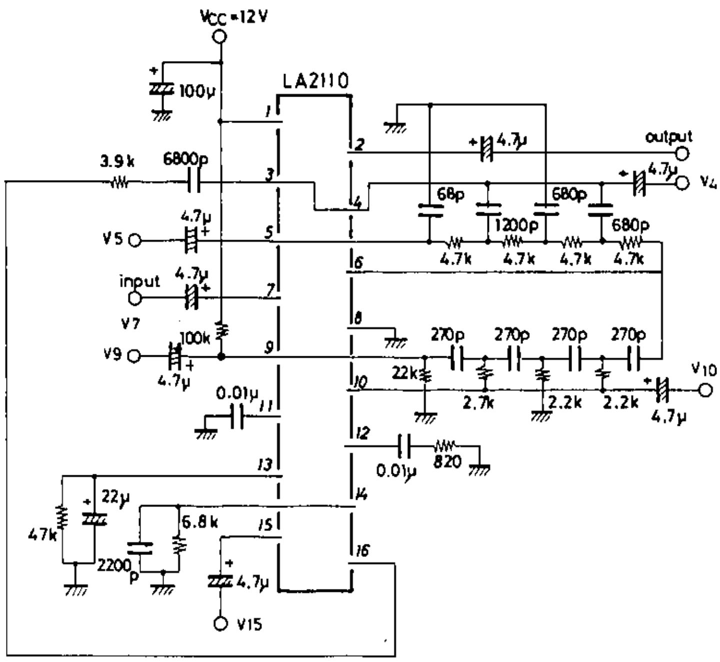
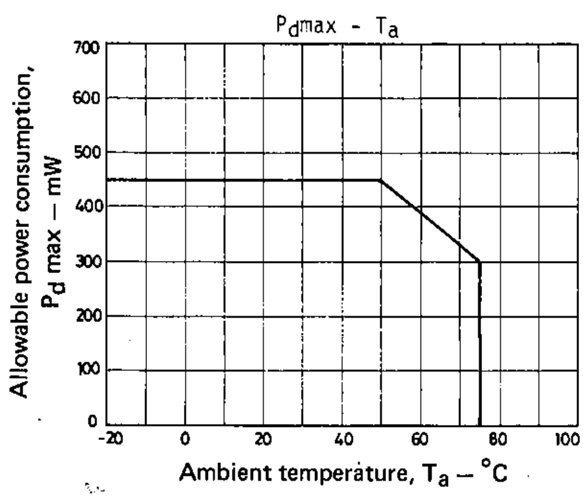
		(input pin)	(output pin)	min	typ	max	unit
High-pass Amp Gain	VG_H	V_9=100mV, f=200kHz	V_{10}	1.2	1.4	1.65	times
Inverting Amp Distortion Factor	THD_I	V_{15}=100mV, f=19kHz	Output			0.1	%
Inverting Amp Dynamic Range	VD_I	V_{15},f=19kHz	Output,THD=1%	300			mV
Inverting Amp Gain	VG_I	V_{15}=100mV, f=19kHz	Output	1.0	1.3	1.6	times
Output Noise Voltage	V_{NO}	V_7,V_{15} shorted to GND	Output,100kHz low-pass filter		30	60	µV
Gate Time	t_{gate}	V_7=100mVp-p, 1µs,f=1kHz	Output	13	21	30	µs
Noise Sensitivity	S_N	V_7,1µs,f=1kHz	Output			30	mVp-0

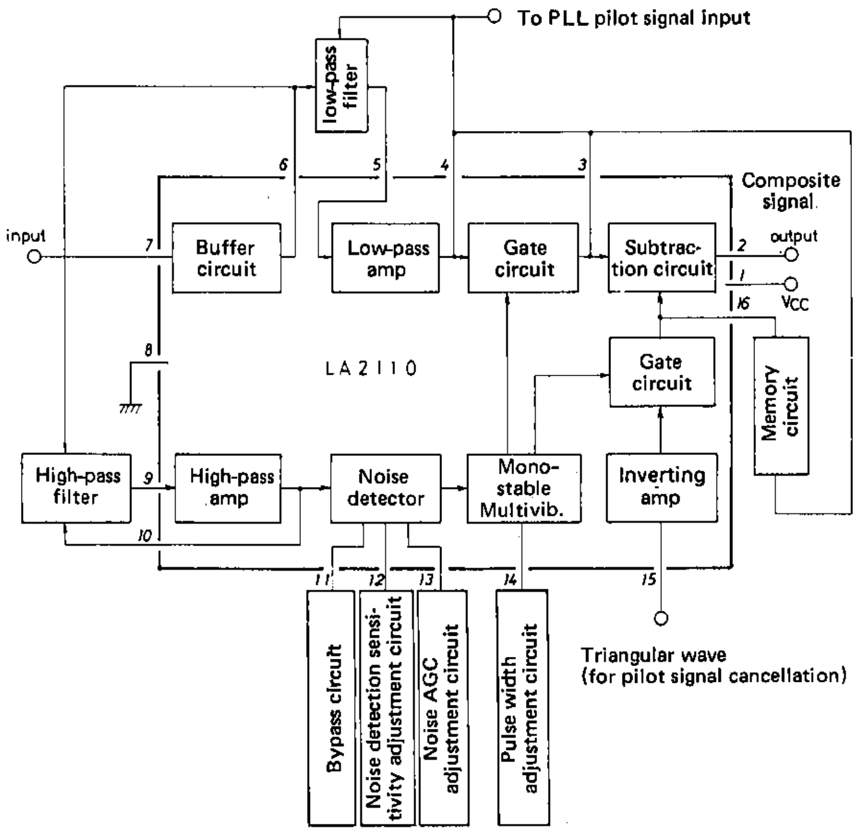
[Test Circuit]

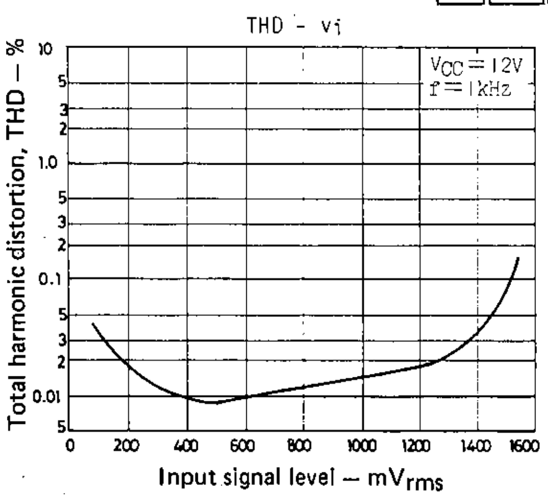


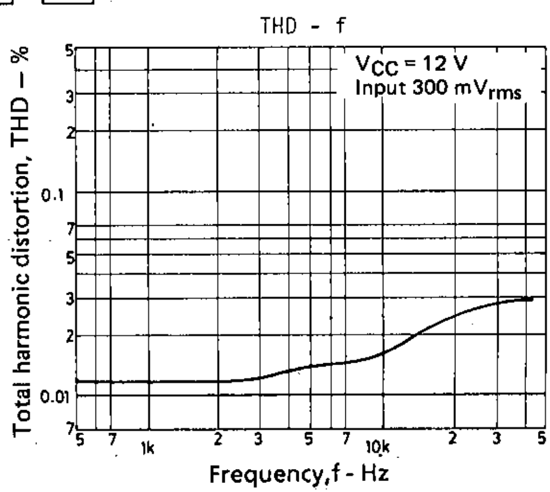
Unit (resistance: Ω, capacitance: F)

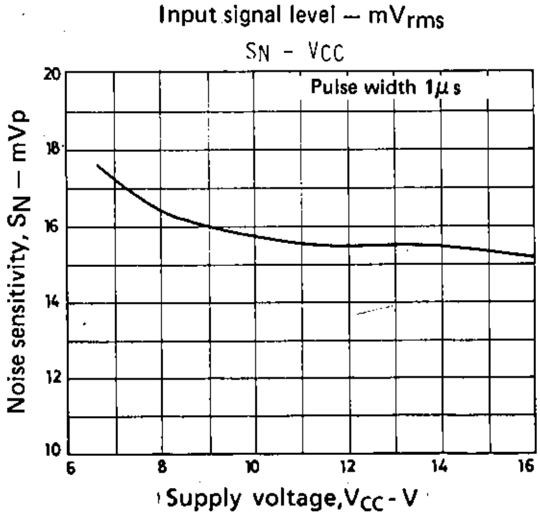


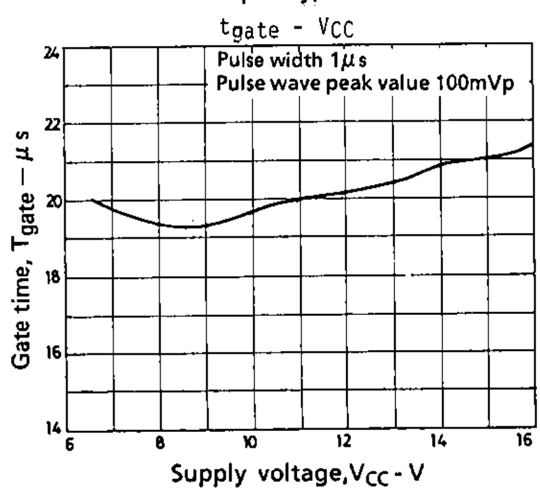
Equivalent Circuit Block Diagram



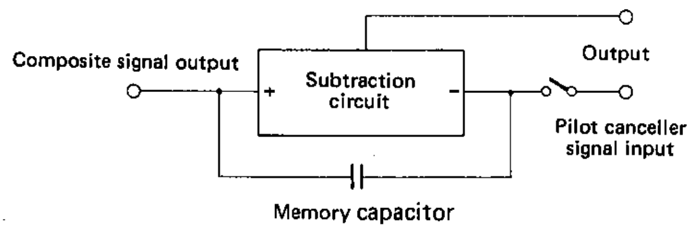








[Theory of LA2110 Noise Canceller]

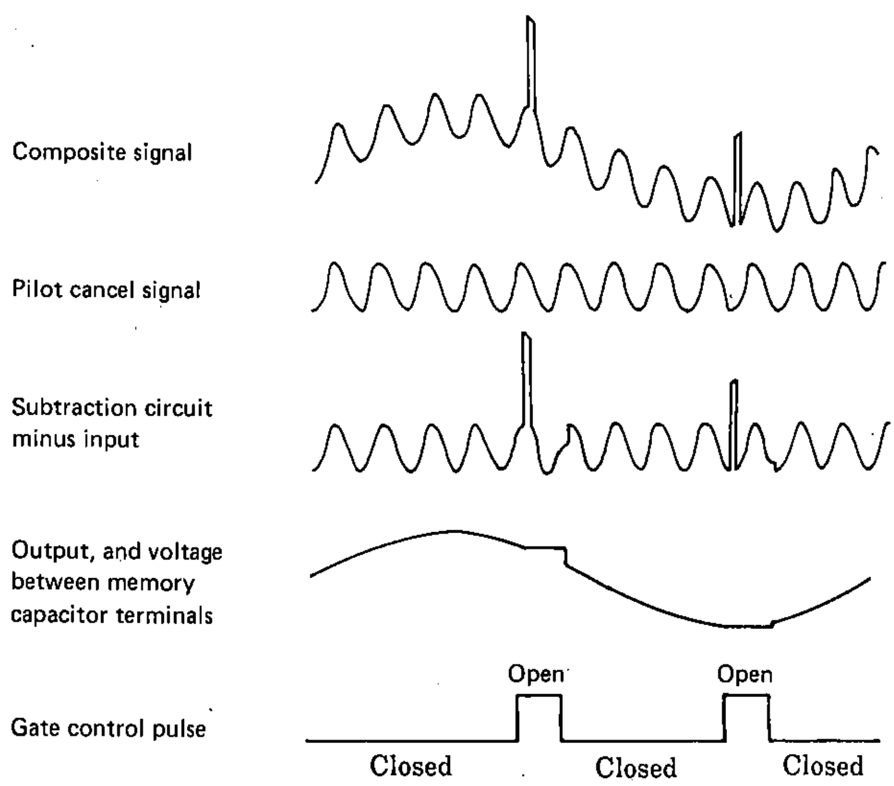


In order to simplify the operation theory, the composite signal component is given only as a low frequency signal and a pilot signal, and the pilot cancel signal has the same phase, same amplitude as the pilot signal in the composite signal.

Since the output voltage is the differential voltage of the plus and minus input of the subtraction circuit, it is equal to the voltage between the memory capacitor terminals. When the gate is closed, the composite signal is applied to the plus input terminal of the subtraction circuit, and the pilot cancel signal is applied to the minus input terminal. Thus the pilot signal is cancelled from the output and only the low frequency signal appears. In the same way, the voltage between the memory capacitor terminals is the differential voltage of the composite signal and the pilot cancel signal, so only the low frequency signal appears.

When pulse noise is generated and the gate opens, the plus input and minus input signal waveforms of the subtraction circuit become equal. This is because the input impedance of the subtraction circuit is extremely high, so the memory capacitor is considered AC-shorted. Thus, when pulse noise is generated in the composite signal, the same pulse noise appears in minus as well as plus input of the subtraction circuit. As a result, pulse noise does not appear in the output. The voltage in the output has a DC level difference of plus and minus input, and that is the voltage held by the memory capacitor. This voltage is that between the memory capacitor terminals just before the gate opens, so it is the low frequency signal voltage just before the gate opens. Because the subtraction circuit input impedance is high, no charge/discharge current flows in the memory capacitor while the gate is open, so the memory capacitor can hold the voltage between its terminals.

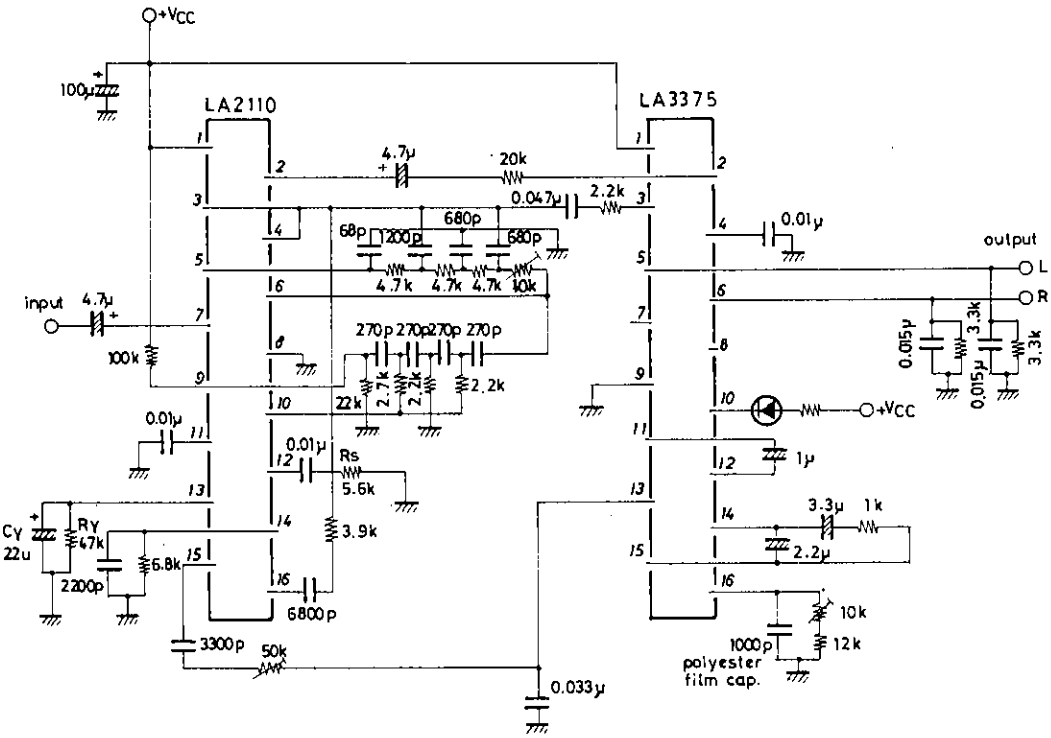
The voltage waveforms are illustrated below.



Note: The pilot cancel signal is given as sinusoidal in this explanation, but in the actual application circuit, pilot cancel is performed by a triangular wave.

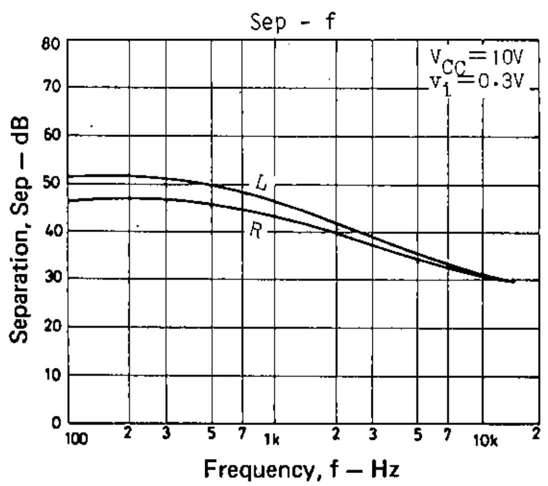
Sample Application Circuit: LA2110 & LA3375

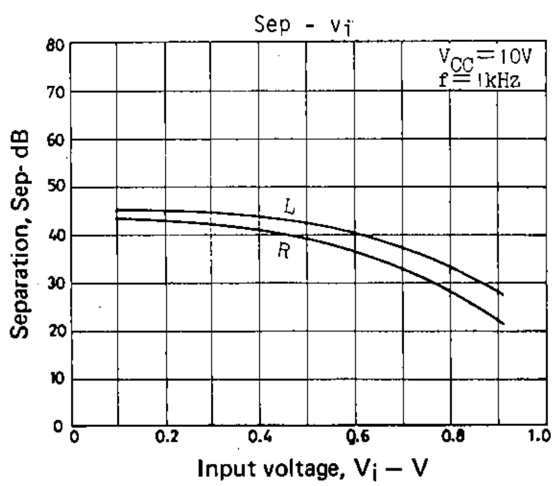
Unit (resistance: Ω, capacitance: F)

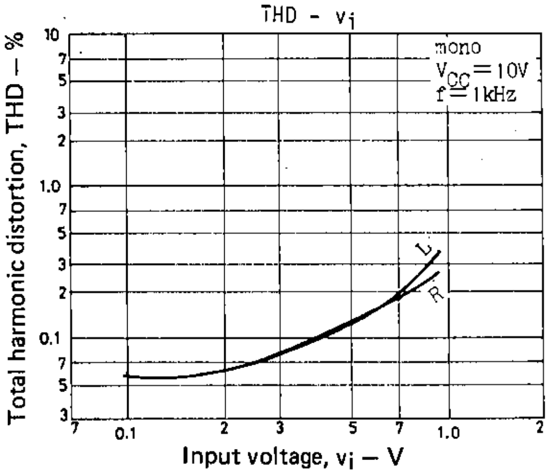


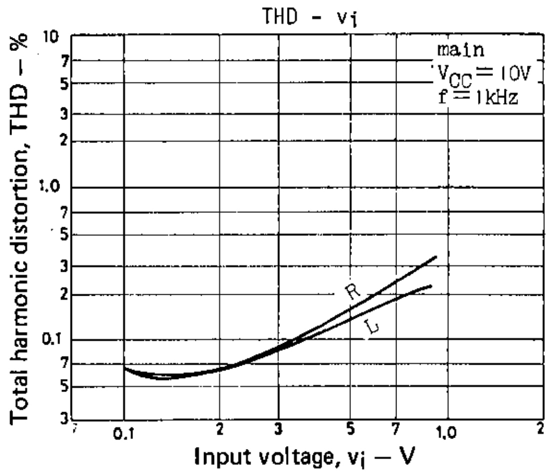
Note: When using the sample application circuit:

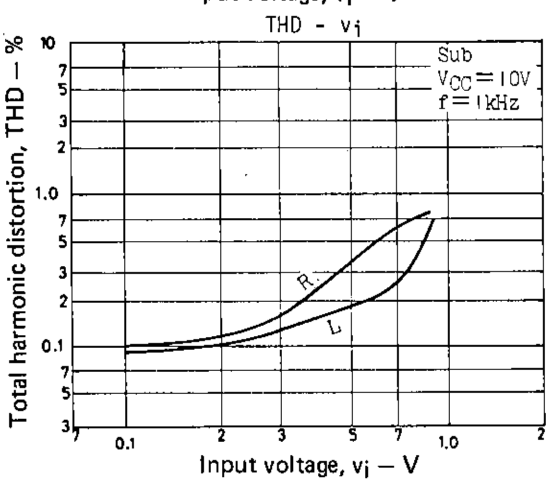
1. Separation adjustment is performed with 10kΩ variable resistance in low-pass filter.
2. Change noise detection sensitivity control R_S to an adequate value for strong or medium electric field.
3. Adjust noise AGC with C_Y, R_Y for effective noise suppression in a medium or weak electric field.
4. Adjust pilot cancel degree with variable resistance of 50kΩ connected to LA2110 pin 15.
5. By changing the 1μF capacitor between LA3375 pin 11 and 12, pilot cancel follow-up response time can be changed. But if the value is decreased, distortion factor, etc. will be adversely affected.

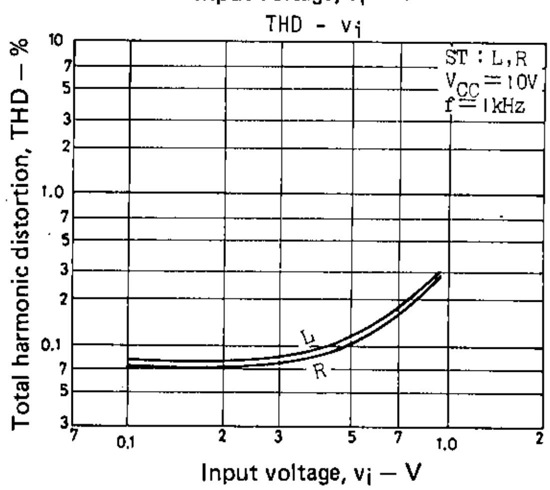












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