Ordering number : EN3044A

Monolithic Linear IC

LA1061M

Antenna Switching Controller

Overview

The LA1061M is an antenna switching controller for mobile radio equipment.

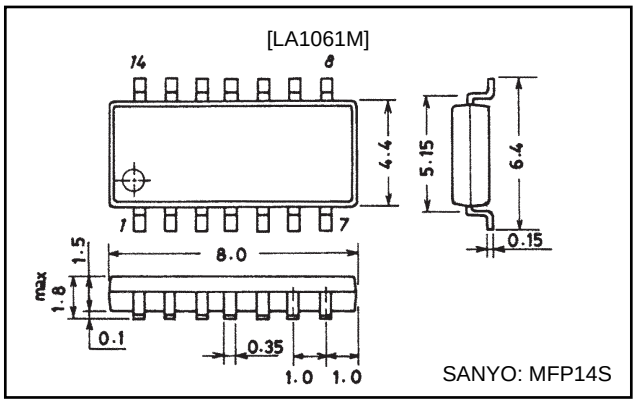
The LA1061M uses a number of inputs from the receiver circuitry to select the main antenna or sub-antenna according to signal strength and quality. Weak and strong signals are detected with the S-meter DC voltage and F.E. AGC voltage, respectively. Multi-path distortion is detected from the AC component of the IF output, using the same high-sensitivity counter circuit as in Sanyo's earlier LA1060 device. An auxiliary circuit keeps the main antenna selected for a fixed time period when reception conditions outside a moving vehicle are changing rapidly.

The LA1061M is available in surface-mount 8-pin DIPs, facilitating construction of compact equipment. It operates from a single 7 to 12V power supply.

Package Dimensions

unit: mm

3111-MFP14S



Features

- Uses Sanyo's proprietary AGC amplifier and detector, providing accurate detection of multi-path distortion.
- High-current Main and Sub-antenna switching outputs.
- Antenna switching frequency limiting circuit.
- On-board comparators for F.E AGC (strong signal) and S-meter DC (weak signal) detection.
- Surface-mount 14-pin MFP.

Specifications

Maximum Ratings at Ta=25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		14	V
Allowable power dissipation	Pd max		182	mW
Operating temperature	Topr		–30 to +80	°C
Storage temperature	Tstg		–40 to +125	°C
Maximum flow-out current	I_4	Pin 4	1	mA
	I_5	Pin 5	10	mA
	I_6	Pin 6	10	mA
	I_9	Pin 9	2	mA
	I_{10}	Pin 10	5	mA
	I_{12}	Pin 12	2	mA
Maximum apply voltage	V_{13}	Pin 13	V_{CC}	V
	V_{14}	Pin 14	V_{CC}	V

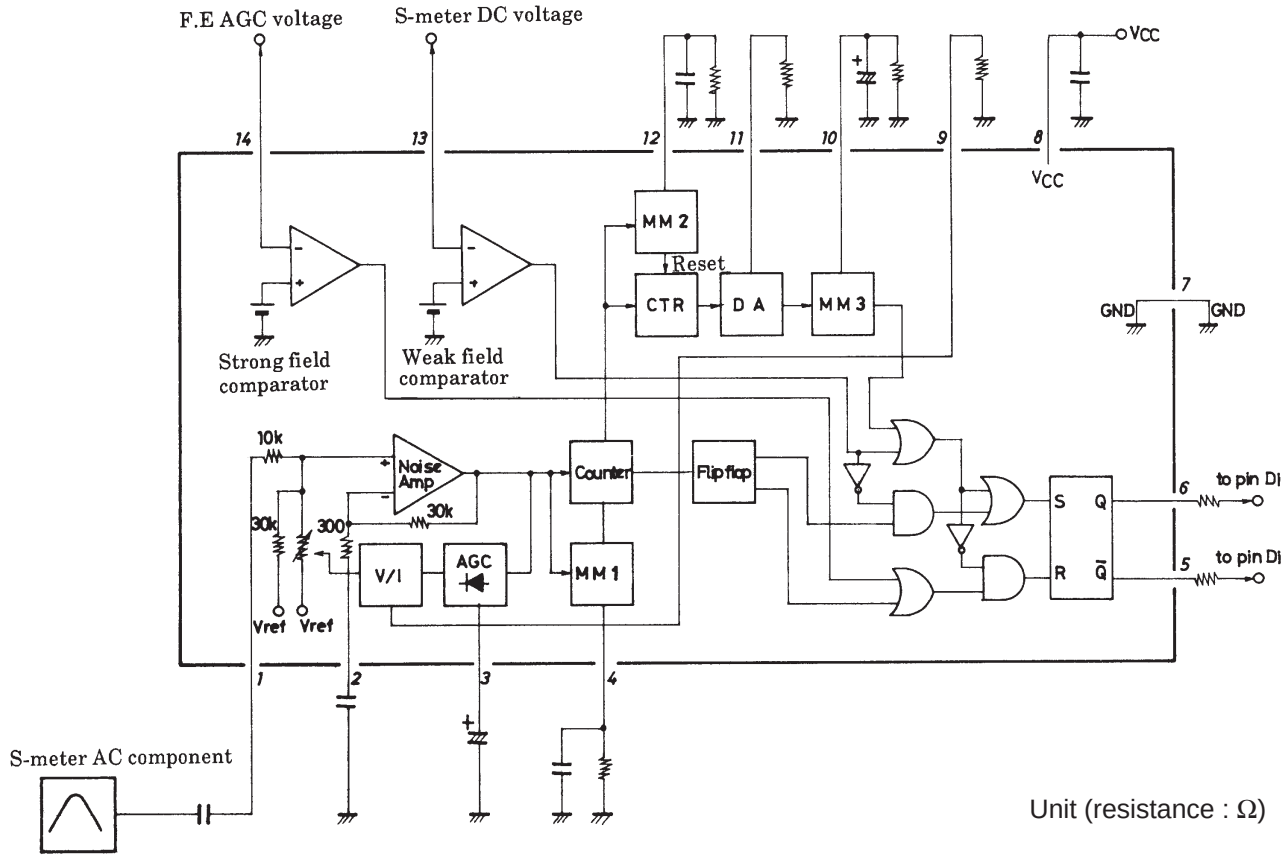
Operating Conditions at Ta=25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		8	V
Operating voltage range	V_{CC} op		7 to 12	V

Operation Characteristics at Ta=25°C, V_{CC}=8V, f=100kHz sine wave

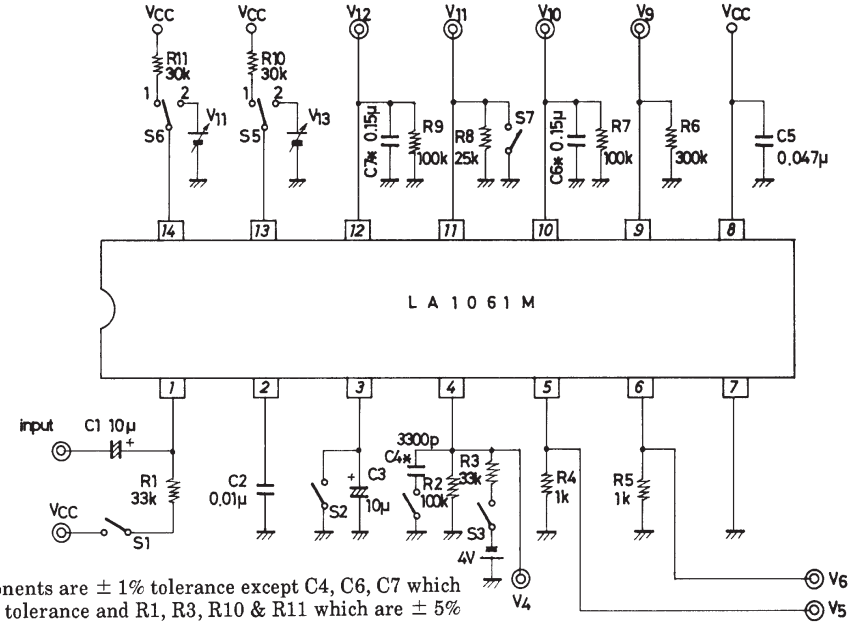
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	I_{CC}	No input, I_5 and I_6 are not included.	4.5	7	12	mA
Pin 5 'H'-level voltage	V_5	1kΩ to ground	5.0	6.0	7.0	V
Pin 6 'H'-level voltage	V_6	1kΩ to ground	5.0	6.0	7.0	V
Noise amp gain	G_V1	V_{IN}=3mVrms, f=100kHz	33	36	39	dB
	G_V2	V_{IN}=100mVrms, f=100kHz	10	13	16	dB
Noise detection sensitivity	NDS	Noise AGC off	9	12	15	mVrms
Noise count number	NCN	V_{IN}=30mVrms, f=100kHz, sine wave		10		
Gate time 1	t_G1	Noise AGC off	120	150	180	μs
Pin 9 voltage	V_9	V_{IN}=100mVrms, f=100kHz, R_9=300kΩ	7.0	7.7	8.0	V
Strong signal comparator threshold	V_{th14}		0.8	1.0	1.2	V
Weak signal comparator threshold	V_{th13}		1.8	2.0	2.2	V
Gate time 2	t_G2		2	4	6	ms
Gate time3	t_G3		13	23	40	ms
Switching frequency limit maximum count	HCN			15		

Equivalent Circuit Block Diagram



Unit (resistance : Ω)

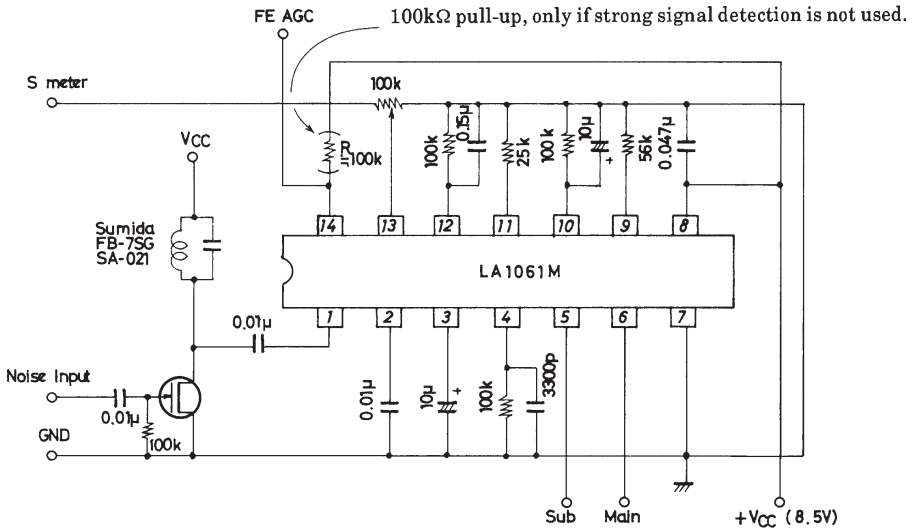
Operating Characteristic Test Circuit



※ All components are ± 1% tolerance except C4, C6, C7 which are ± 2% tolerance and R1, R3, R10 & R11 which are ± 5% tolerance.

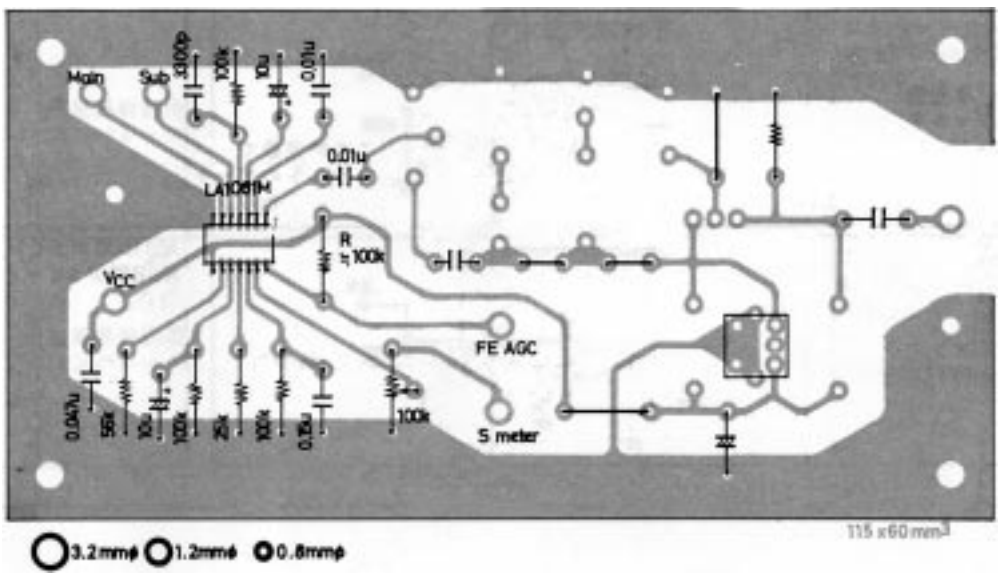
Unit (resistance : Ω, capacitance : F)

Sample Application Circuit



Unit (resistance : Ω, capacitance : F)

Sample Printed Circuit Pattern



Functional Description

General Operation

The LA1061M has two inputs for weak and strong signal detection, and one for multi-path distortion detection. It has two outputs for Main and Sub-antenna selection, one of which is selected according to the state of the inputs. Both outputs can directly drive an antenna switching pin diode.

Signal Strength Detection

Each signal strength detection input has a built-in comparator. The weak signal comparator (pin 13) is driven by the S-meter DC voltage and has a threshold of approximately 2V. The antenna switching logic selects the Main antenna when the voltage on this pin is lower than the threshold, regardless of the state of the other inputs.

The strong signal detector (pin 14) is driven by the F.E. AGC voltage and has a threshold of approximately 1V. The antenna switching logic selects the Sub-antenna if the voltage on this pin is lower than the threshold, the weak signal comparator is off, and the multi-path distortion detector is not already on.

Multi-path Distortion Detection

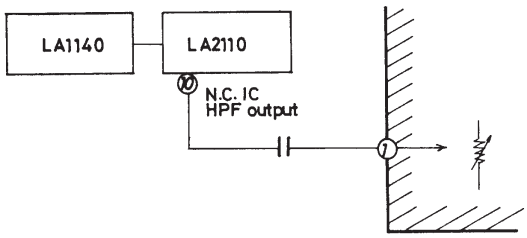
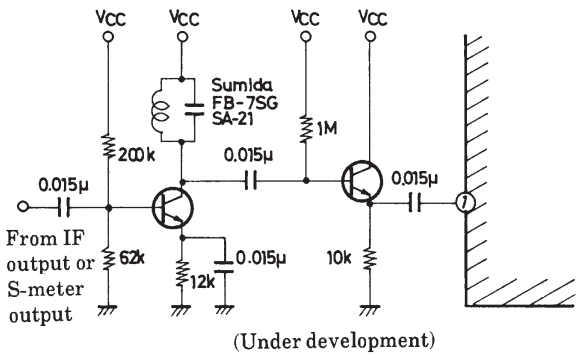
The IF output signal is high-pass filtered and the resulting noise signal input through a coupling capacitor to pin 1, the LA1061M amplifies this signal and applies AGC to it. The AGC amplifier is designed to detect multi-path distortion without amplifying noise due to a weak IF signal. The number of noise pulses within the period set by the time constant on pin 4 is counted. If it exceeds a certain limit, and the strong signal detector is not already on, the antenna switching logic selects the Main antenna.

Switching Frequency Detection

The LA1061M counts the number of antenna changes within the time interval set by the time constant on pin 12. The internal D/A converter outputs a current on pin 11, which is converted to a voltage by the resistor connected to this pin. If this voltage exceeds a certain value, that is, the switching frequency is too high, the Main antenna is selected for the period set by the time constant on pin 10. The Main antenna is selected for this time regardless of the state of the other inputs.

Pin Description

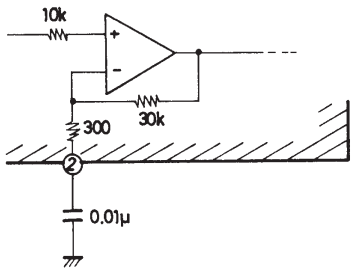
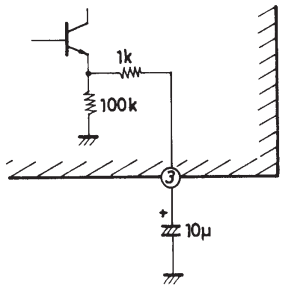
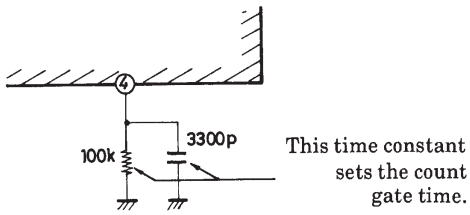
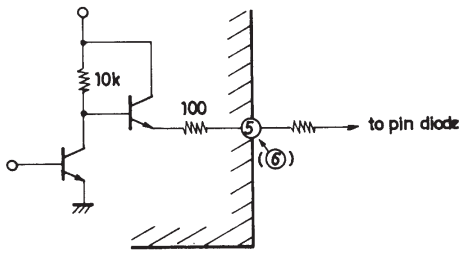
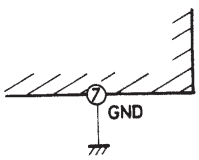
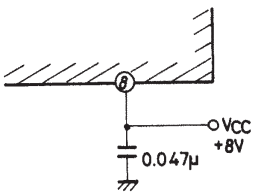
Unit (resistance : Ω, capacitance : F)

Pin No.	Function	External circuits	Notes
1	Noise input	Isolate noise components present in the IF output signal with a high-pass filter, and input via a decoupling capacitor.   (Under development)	The input impedance of the LA 1061M varies with input level. The minimum value is 10kΩ.

Continued on next page.

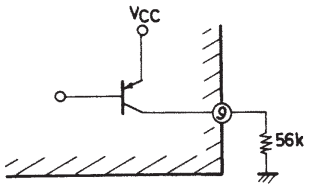
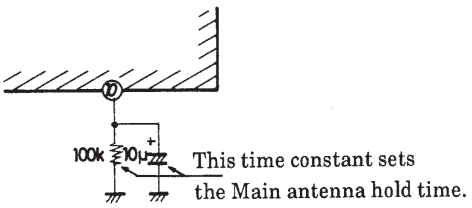
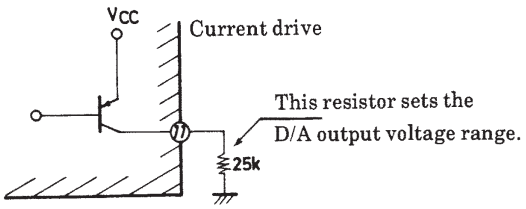
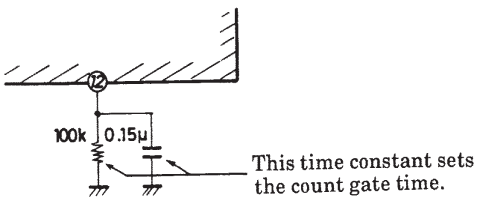
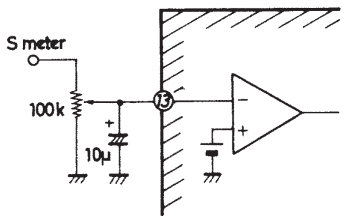
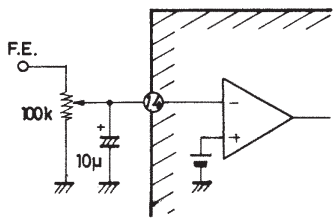
Continued from preceding page.

Unit (resistance : Ω, capacitance : F)

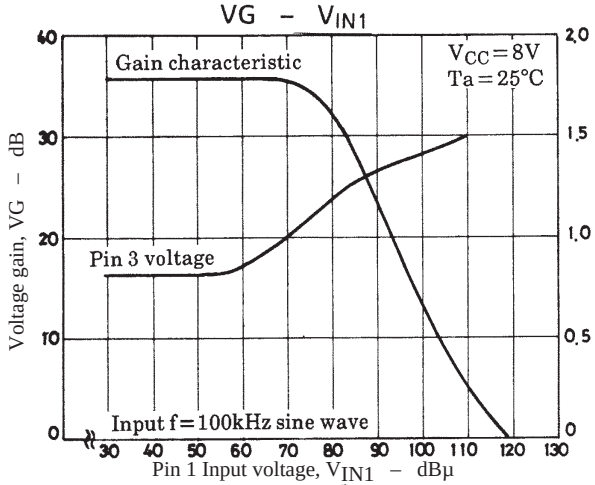
Pin No.	Function	External circuits	Notes
2	H.P.F		Highpass filter
3	AGC		
4	Mono-stable multi-vibrator 1		
5 6	Antenna switching outputs		Pin 6 is for MAIN, pin 5 is for SUB.
7	GND		
8	V_{CC}		

Continued on next page.

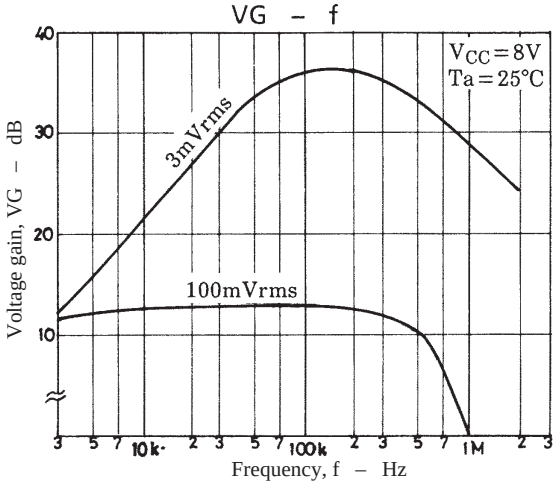
Continued from preceding page. Unit (resistance : Ω, capacitance : F)

Pin No.	Function	External circuits	Notes
9	AGC Voltage output		
10	Mono-stable multi-vibrator 3		The LA1061M counts antenna switches for the time interval generated by multi-vibrator 2. The internal D/A converter outputs a current on pin 11, which is converted to a voltage by the resistor connected to this pin. If this voltage exceeds a certain value, that is, the switching frequency is too high , multi-vibrator 3 operates to hold the antenna switching outputs at Main for the time set by multi-vibrator 3.
11	D/A converter		
12	Mono-stable multi-vibrator 2		
13	Weak signal comparator		The threshold level is set at approximately 2V.
14	Strong signal comparator		The threshold level is set at approximately 1V.

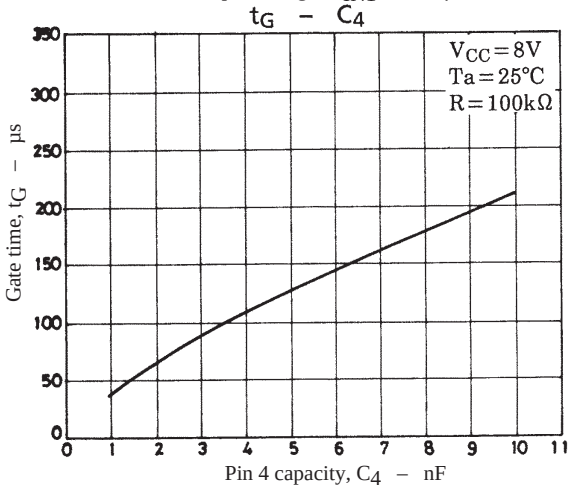
VG – V_{IN1}



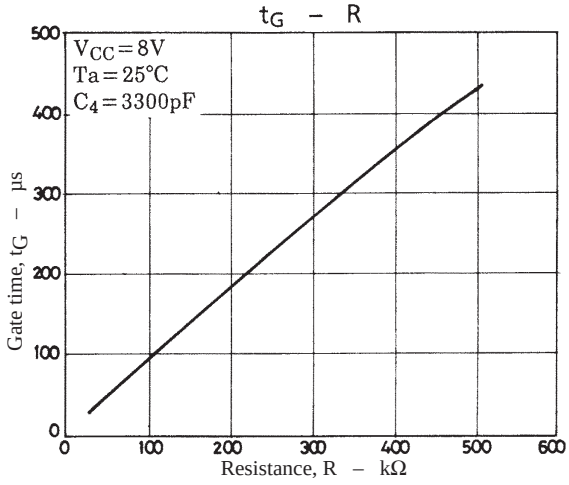
VG – f



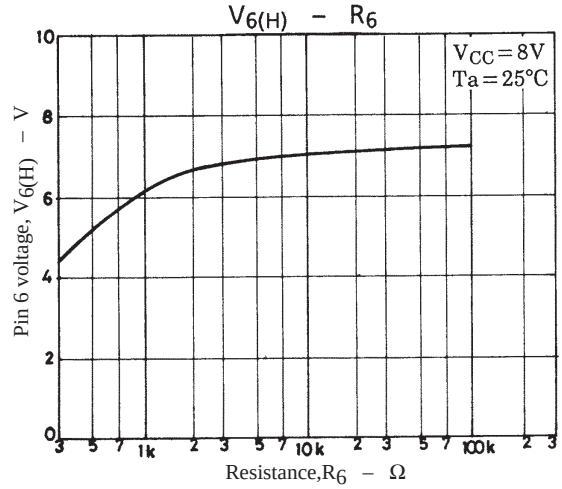
t_G – C_4



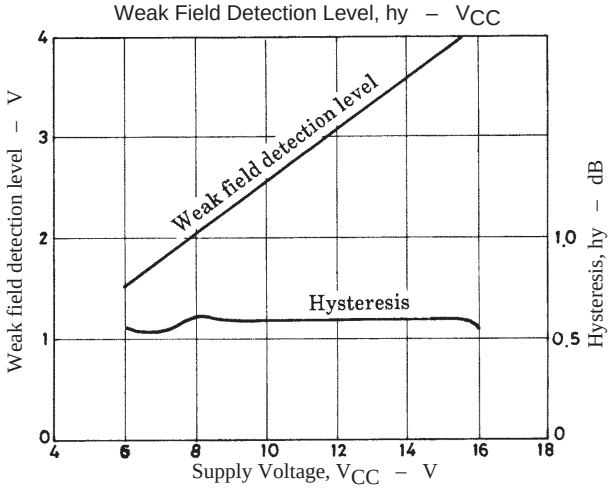
t_G – R



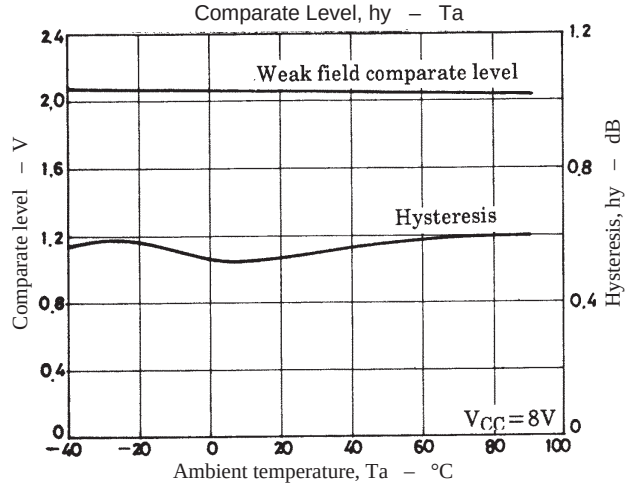
$V_{6(H)}$ – R_6



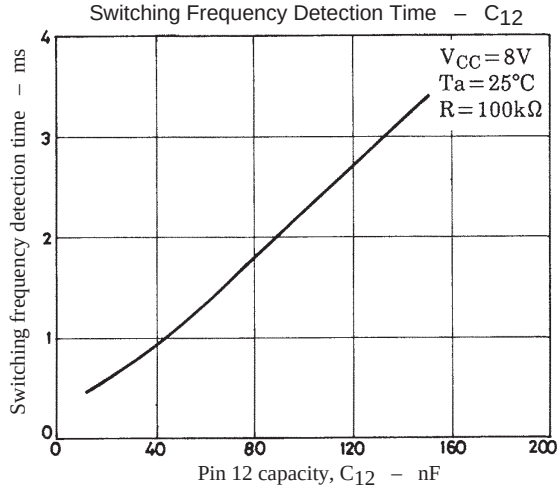
Weak Field Detection Level, hy – V_{CC}



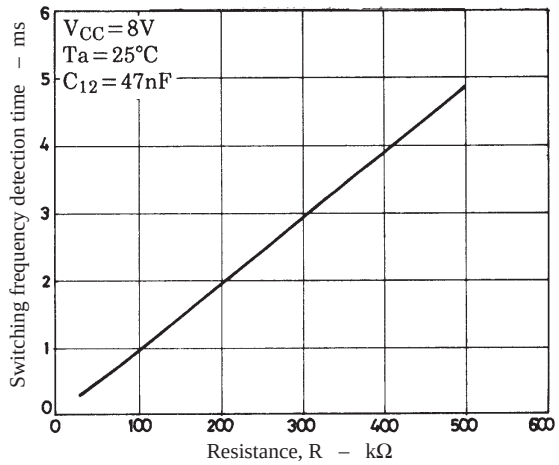
Comparate Level, hy – Ta



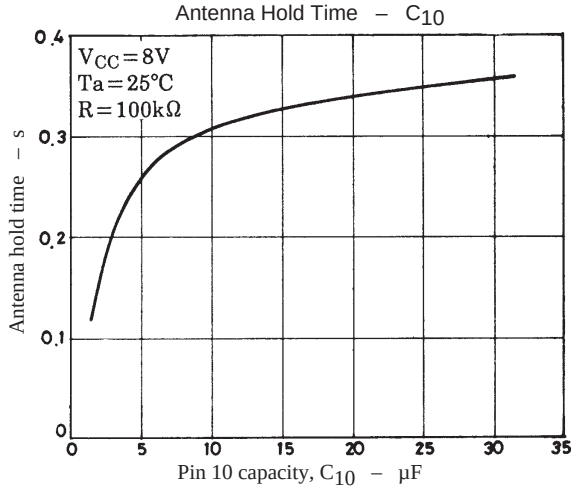
Switching Frequency Detection Time – C_{12}



Switching Frequency Detection Time – R



Antenna Hold Time – C_{10}



Antenna Hold Time – R