



# LA2232, 2232M

## RDS Decoder

### Overview

The LA2232 and LA2232M are RDS demodulator ICs that provide both a 57 kHz bandpass filter as well as ARI-SK and DK signal recognition functions on chip. Cost-effective RDS decoder systems can be constructed by using an LA2232 or 2232M in conjunction with a synchronization and error detection/correction LSI from the LC7070 series. The LA2232 and 2232M provide improved sensitivity LA2230 and 2230M.

### Applications

- RDS signal demodulation
- ARI signal demodulation and SK and DK recognition

### Functions

- 57 kHz bandpass filter
- RDS signal demodulation
- Bit rate clock regeneration
- RDS identification output
- ARI signal demodulation
- SK identification output
- DK identification output
- Adjustable ARI detection sensitivity

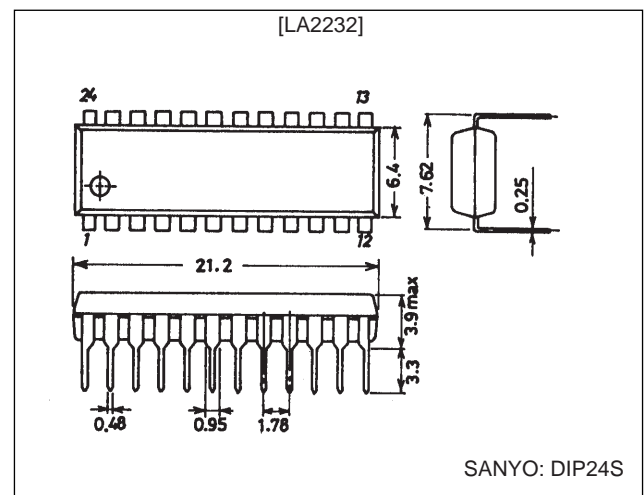
### Features

- High RDS demodulation sensitivity
- Reduced costs and PCB area due to the inclusion of an on-chip 57 kHz bandpass filter
- Supports improved interference rejection characteristics by providing ARI detection sensitivity adjustment
- Quick operation startup due to a built-in rapid charging circuit for use at power application.

### Package Dimensions

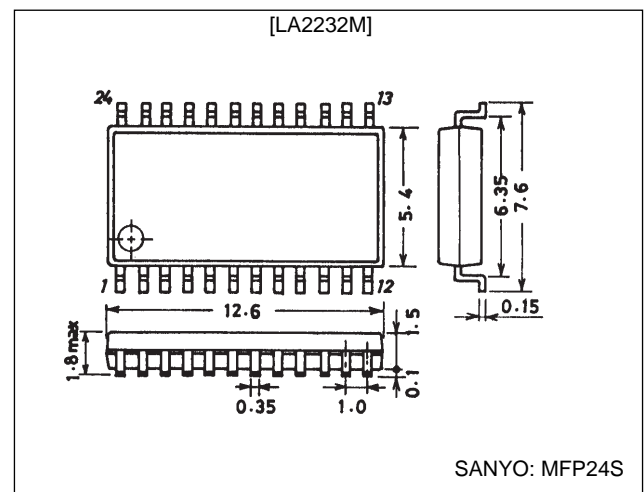
unit: mm

#### 3067-DIP24S



unit: mm

#### 3112-MFP24S



## Specifications

### Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC}$ max	Pins 13, 14, 15, 23	12	V
Allowable power dissipation	$P_d$ max	LA2232: $T_a \leq 80^\circ\text{C}$	450	mW
		LA2232M: $T_a \leq 37.5^\circ\text{C}$	450	mW
		LA2232M: $T_a = 80^\circ\text{C}$	280	mW
Entering current	$I_{LED}$	Pins 13, 14, 15	20	mA
Operating temperature	$T_{opr}$		-30 to +80	$^\circ\text{C}$
Storage temperature	$T_{stg}$	LA2232	-40 to +125	$^\circ\text{C}$
		LA2232M	-40 to +150	$^\circ\text{C}$

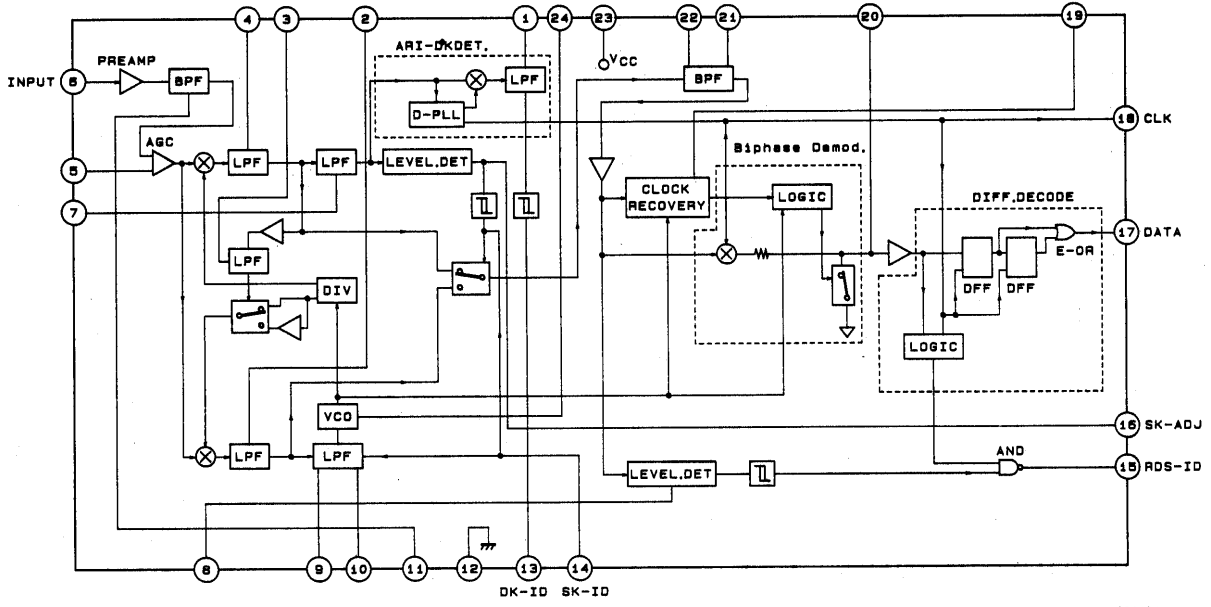
### Operating Conditions at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	$V_{CC}$	Pin 23	5.0	V
Operating voltage range	$V_{CC}$ op	Pin 23	4.7 to 5.5	V

### Operating Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC} = 5.0$ V

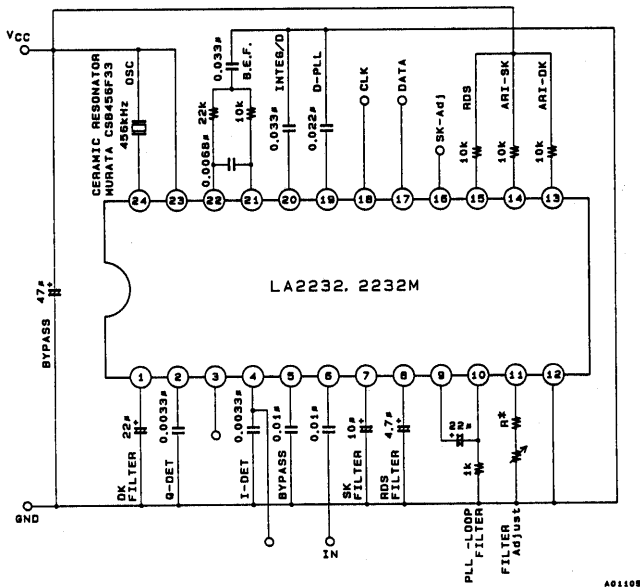
Parameter	Symbol	Ratings			Unit
		min	typ	max	
Quiescent current		14	22	28	mA
Band pass filter gain	$f = 57$ kHz	9	12.5	17	dB
Band pass filter selectivity	$f = 60$ kHz (57 kHz = 0 dB)	-6	-2.5	0	dB
	$f = 54$ kHz (57 kHz = 0 dB)	-6	-3.5	0	dB
	$f = 38$ kHz (57 kHz = 0 dB)		-39	-33	dB
PLL capture range	5 mVrms CW input		-0.5 +0.8		% %
RDS detection sensitivity	The pin 6 input when pin 15 goes low		0.4	1.0	mVrms
SK detection sensitivity	The pin 6 input when pin 14 goes low		1.0	2.0	mVrms
DK detection sensitivity	The pin 6 input when pin 13 goes low		1.1	2.0	mVrms
Input dynamic range	RDS	The maximum input on pin 6 for the (ARI + RDS) signal when pin 15 goes low	30	50	mVrms
		The maximum input on pin 6 for the RDS signal when pin 15 goes low	250		mVrms
	DK	The maximum input on pin 6 for the ARI signal when pin 15 goes low	75	100	mVrms
Bit rate clock jitter		$\pm 8$	$\pm 9$	$\pm 10$	$\mu\text{s}$
RDS lockup time	The time until pin 15 goes low following RDS becoming a 3 mV input		35		ms
SK lockup time	The time until pin 14 goes low following ARI becoming an 8 mV input		45		ms
SK + RDS lockup time	The time until pin 15 goes low following RDS + ARI becoming an 8.5 mV input		80		ms
Data output	The high level for pin 17	4.7	4.9	5.0	V
	The low level for pin 17	0	0.1	0.3	V
Bit rate clock output	The high level for pin 18	4.7	4.9	5.0	V
	The low level for pin 18	0	0.1	0.3	V
VCO free-running frequency		453	456	459	kHz

Equivalent Circuit Block Diagram



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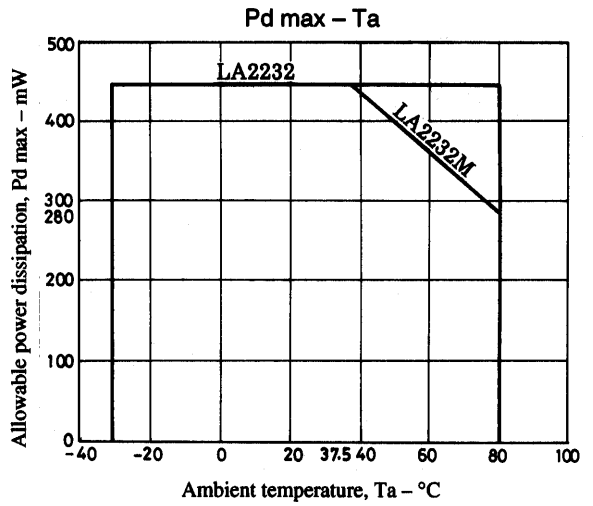
Test Circuit



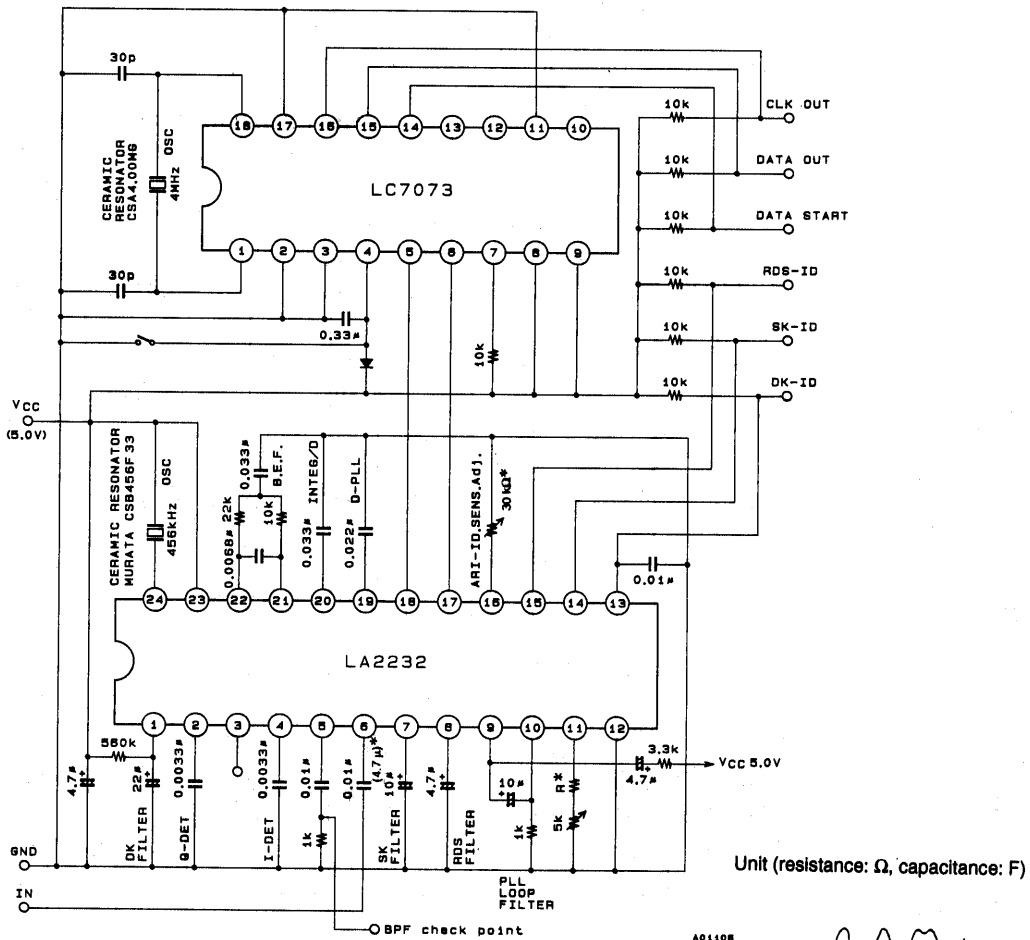
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\*R = 6.8 kΩ (for the LA2232)  
 R = 5.6 kΩ (for the LA2232M)

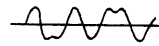
Unit (resistance: Ω, capacitance: F)



Sample Application Circuit Using the LA2232/M and the LC7073/M



Unit (resistance: Ω, capacitance: F)



↑  
Bi-phase signal

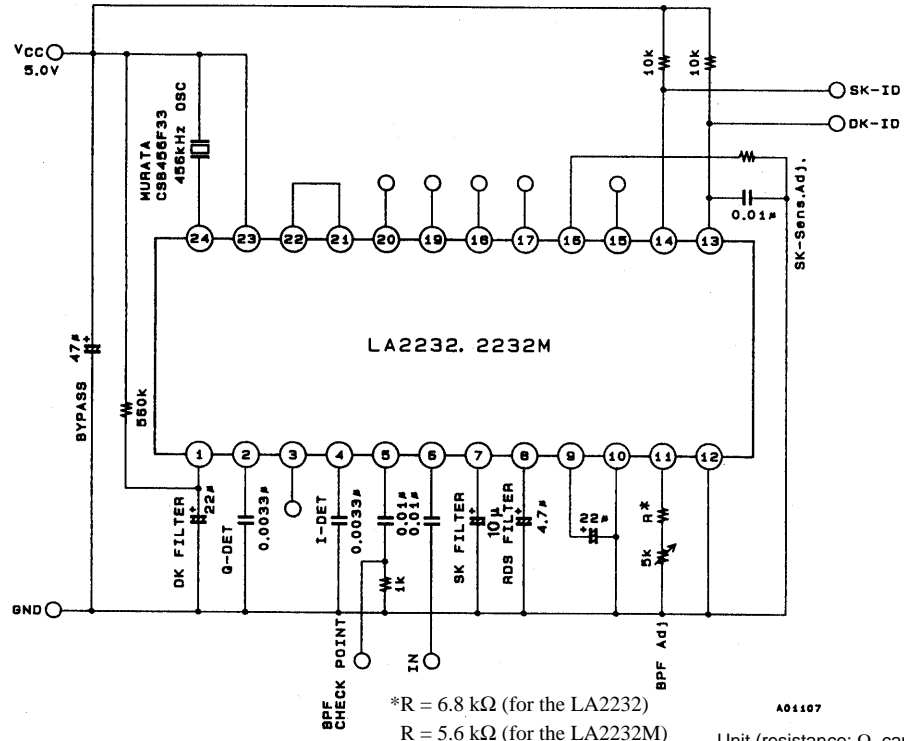
3 to 6 mVrms  
Recommended input signal level  
(when RDS Δf = ±2.0 kHz)

\*R = 6.8 kΩ (for the LA2232)  
R = 5.6 kΩ (for the LA2232M)

Adjusting the 57 kHz BPF

- (A) Check the output level of the bi-phase signal from pin 4 or pin 22 (with the pin 6 RDS input at about 1 mVrms and the ALC circuit not operating).
- (B) Check the signal level of the BPF checkpoint (with the pin 6 RDS input in the range 3 to 6 mVrms or higher).

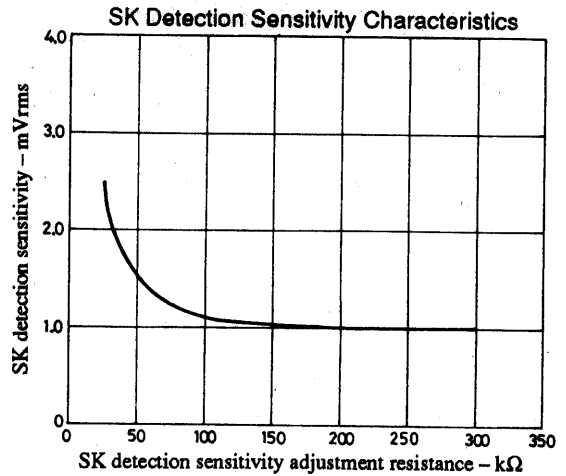
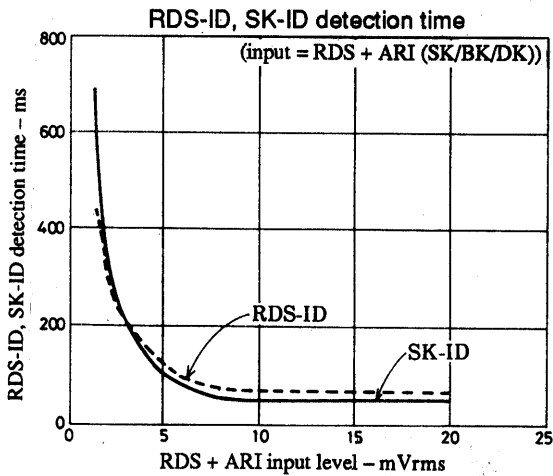
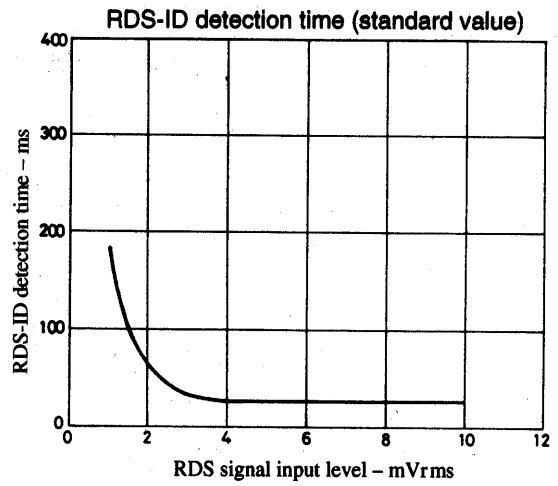
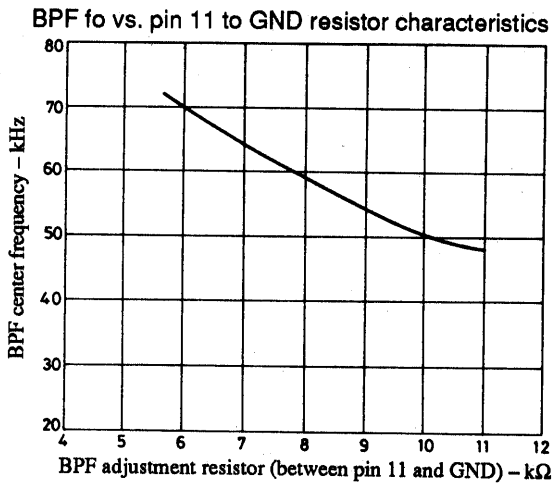
ARI Decoder Application Circuit

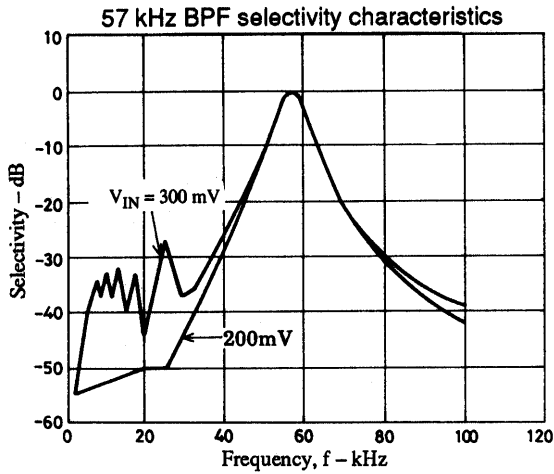


\*R = 6.8 kΩ (for the LA2232)  
R = 5.6 kΩ (for the LA2232M)

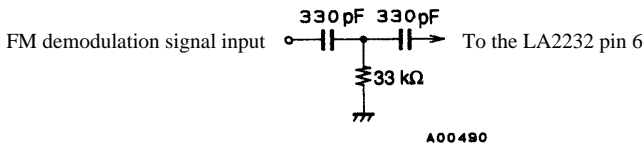
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Unit (resistance: Ω, capacitance: F)

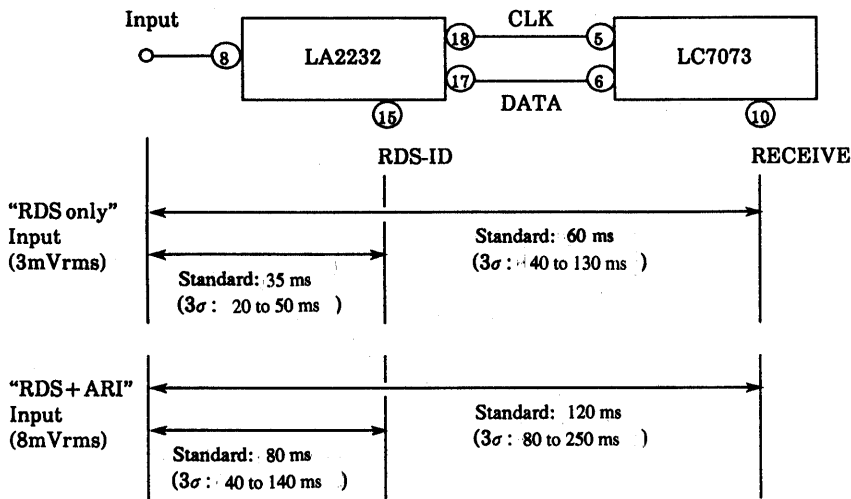




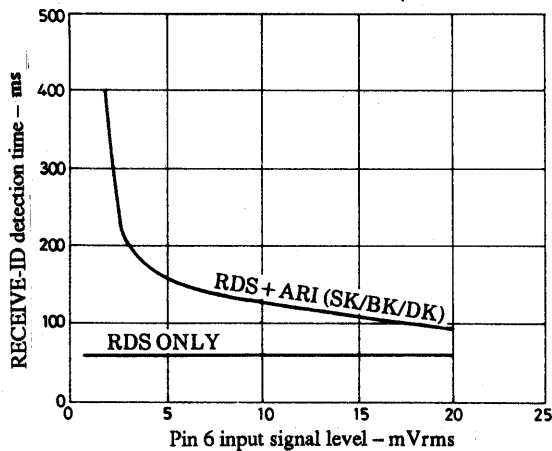
- For the LA2232, an input level of under 300 mVrms on pin 6 is desirable for a 100% FM demodulation output.
- We recommend the use of a pre-high pass filter as shown in the figure below if the 100% FM demodulation output level is over 300 mVrms.



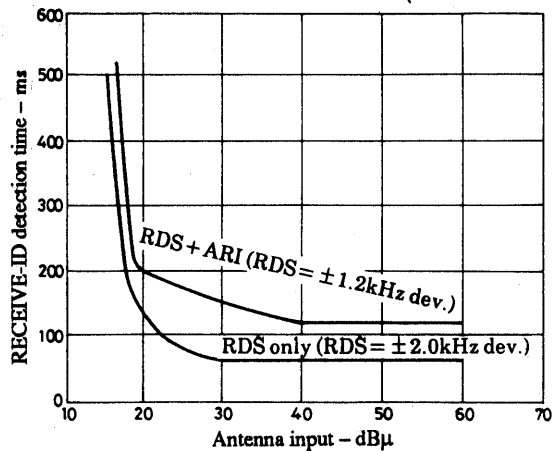
RDS-ID (LA2232), RECEIVE-ID (LC7073) Detection Time  
(the RECEIVE-ID indicates synchronization completion).

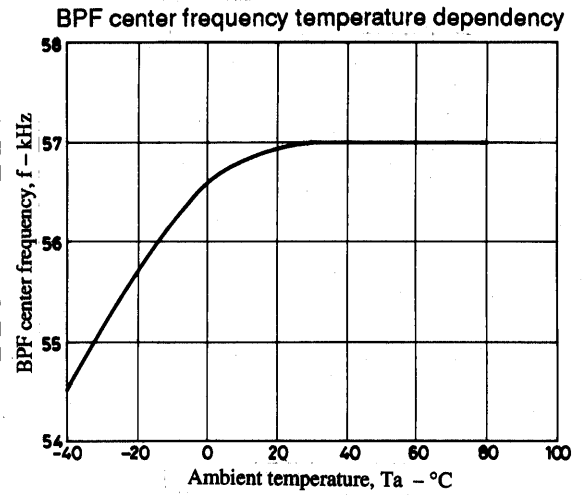
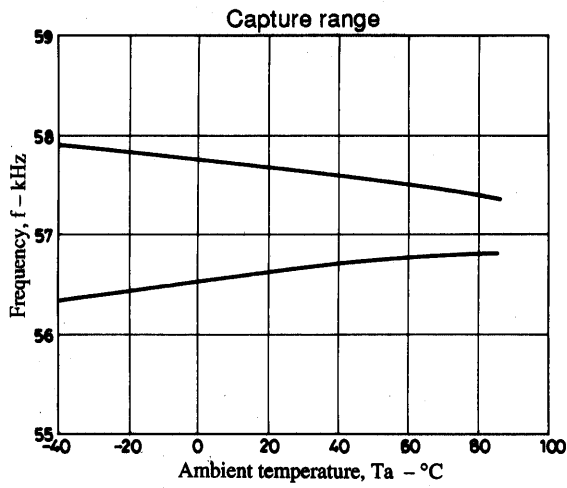
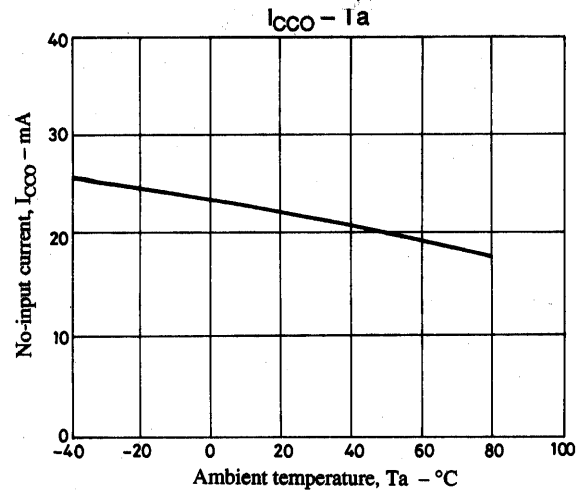
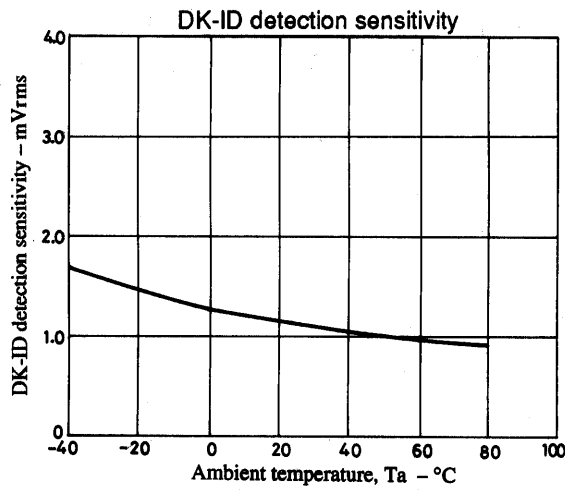
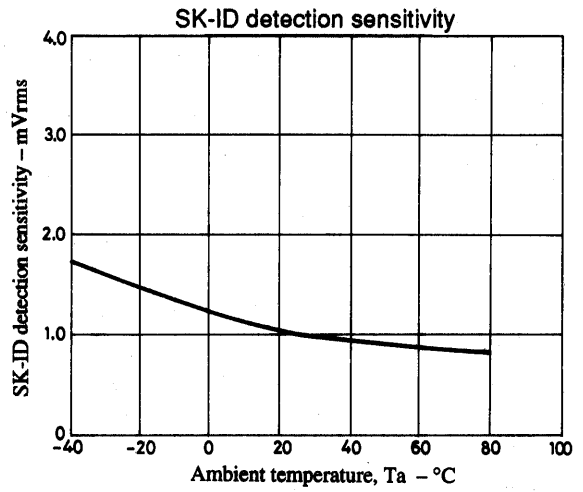
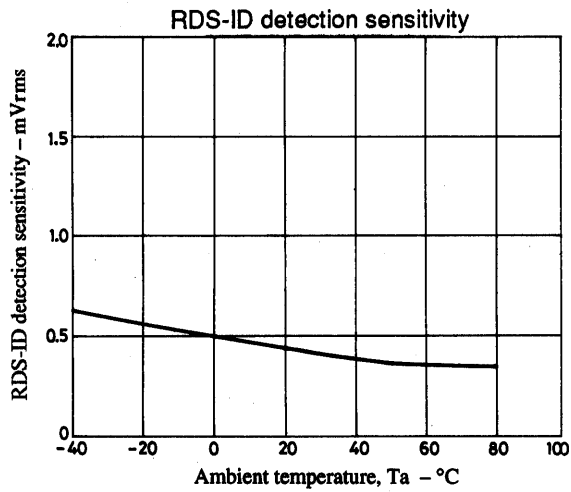


LC7073 RECEIVE-ID detection time (standard value)



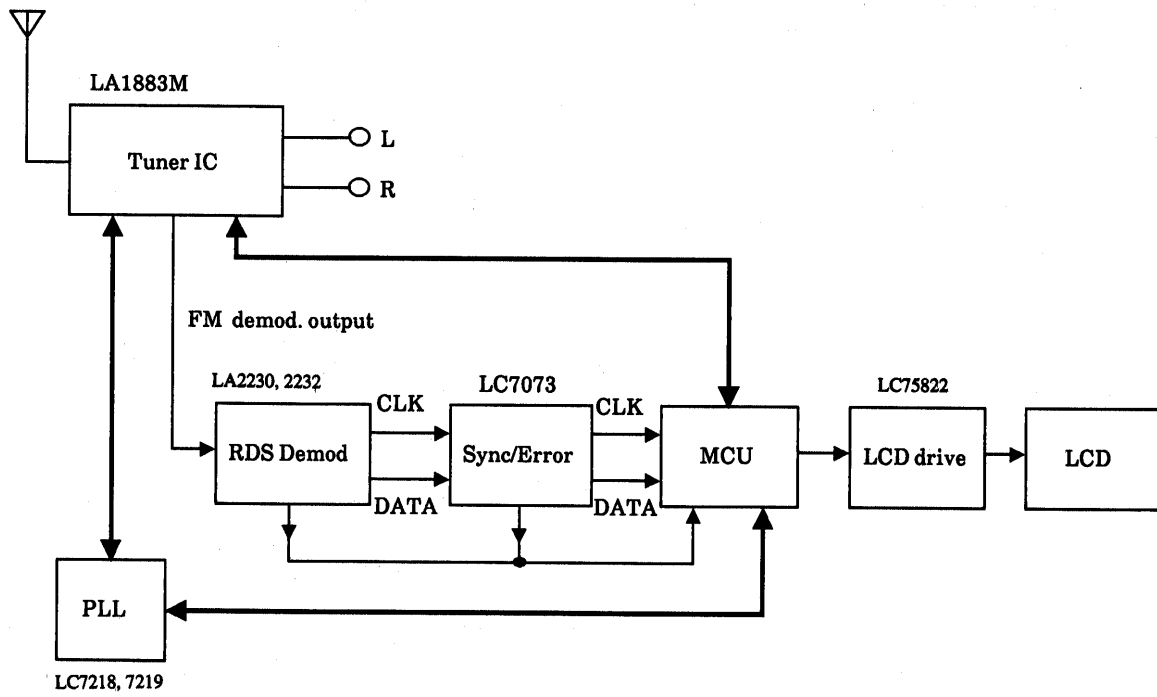
LC7073 RECEIVE-ID detection time (standard value)



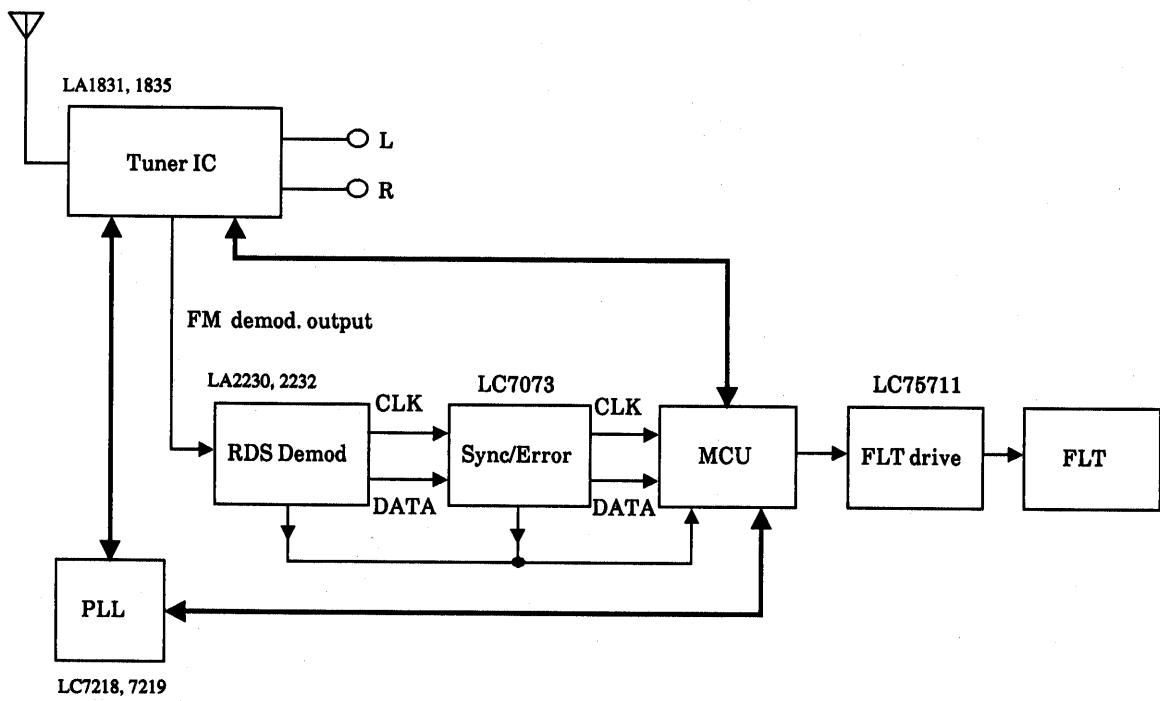


RDS Application IC Lineup

(1)



(2)





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