Monolithic Linear IC

SANYO

No. 3988A

LA2230, LA2230M

RDS Decoder

OVERVIEW

The LA2230 and LA2230M are RDS demodulator ICs with an on-chip 57 kHz bandpass filter and ARI-SK and DK signal identifiers. A high-performance, cost-effective RDS decoder system with group/block synchronization and error detection/correction can be built using an LC7070 series device with the LA2230 or LA2230M.

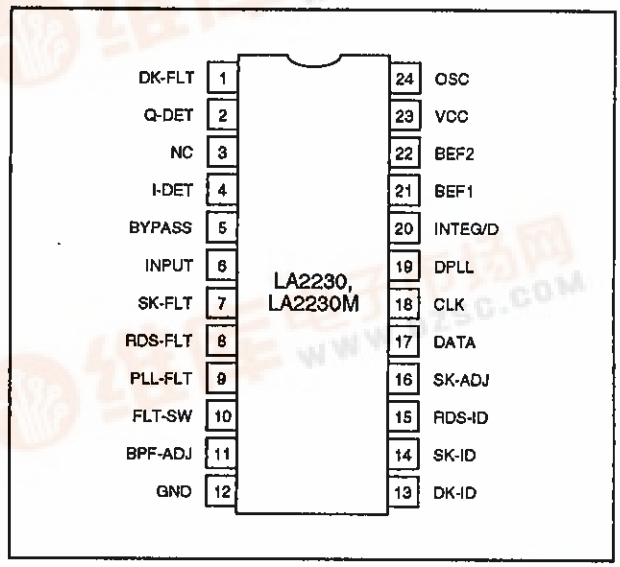
The LA2230 and LA2230M feature adjustable ARI detection sensitivity for improved interference rejection and a high-speed charging circuit for rapid power-on start-up. Including the 57 kHz bandpass filter on-chip results in lower-cost designs that use less PCB area.

The LA2230 and LA2230M operate from a 5 V supply and are available in 24-pin DIPs and 24-pin MFPs, respectively.

FEATURES

- 57 kHz bandpass filter
- Adjustable ARI detection sensitivity
- High-speed charging circuit
- ARI and RDS signal demodulation
- Bit-rate clock recovery
- RDS, DK and SK identification outputs
- 5 V supply
- 24-pin DIP (LA2230) and 24-pin MFP (LA2230M)

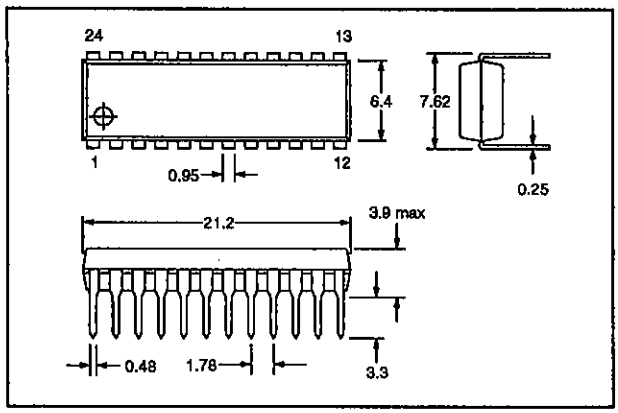
PINOUT



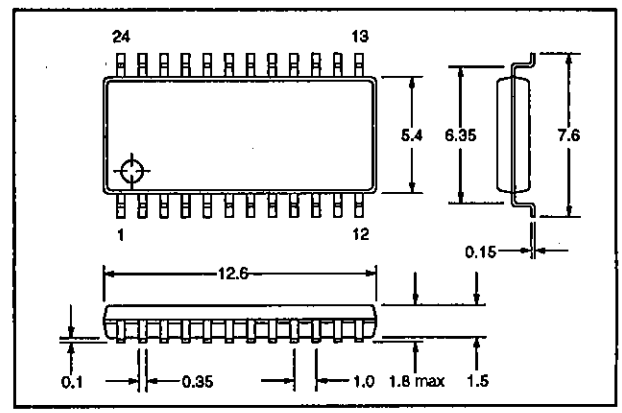
PACKAGE DIMENSIONS

Unit: mm

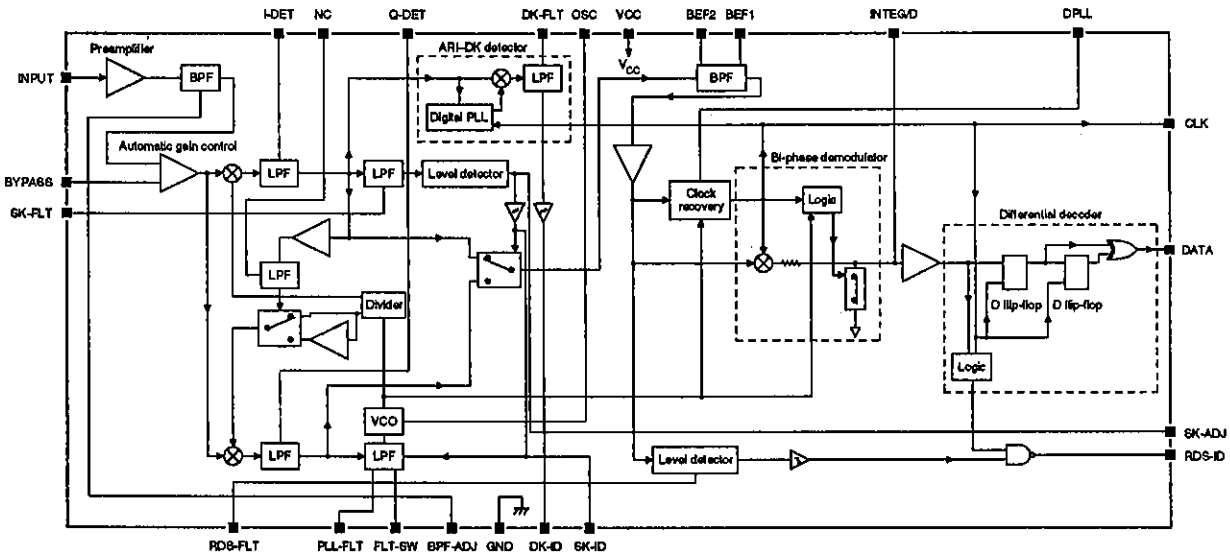
3067-DIP24S (LA2230)



3112-MFP24S (LA2230M)



BLOCK DIAGRAM



PIN DESCRIPTION

Number	Name	Description
1	DK-FLT	DK in-phase detector lowpass filter connection
2	Q-DET	Quadrature detection output
3	NC	No connection. Should be left open.
4	I-DET	In-phase detector output
5	BYPASS	Bandpass filter bypass capacitor connection
6	INPUT	ARI and RDS signal input
7	SK-FLT	SK lowpass filter capacitor connection
8	RDS-FLT	RDS lowpass filter capacitor connection
9	PLL-FLT	PLL loop filter connection
10	FLT-SW	PLL loop filter switch

Number	Name	Description
11	BPF-ADJ	Bandpass filter adjustment variable resistor connection
12	GND	Ground
13	DK-ID	ARI-DK signal identification output
14	SK-ID	ARI-SK signal identification output
15	RDS-ID	RDS signal identification output
16	SK-ADJ	ARI detection sensitivity adjustment variable resistor connection
17	DATA	Data output
18	CLK	Bit-rate clock output
19	DPLL	Digital PLL lowpass filter connection
20	INTEG/D	Integrator and dump capacitor connection
21	BEF1	Band-elimination filter connections
22	BEF2	
23	VCC	5 V supply
24	OSC	Ceramic resonator connection

SPECIFICATIONS

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	12	V
Power dissipation	P_D	450 (LA2230)	mW
		450 (LA2230M, $T_a \leq 37.5$ °C)	
		280 (LA2230M, $T_a = 80$ °C)	
Operating temperature range	Topr	−30 to 80	°C
Storage temperature range	T_{stg}	−40 to 125 (LA2230)	°C
		−40 to 150 (LA2230M)	

Recommended Operating Conditions

$T_a = 25$ °C

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	5	V
Supply voltage range	V_{CC}	4.7 to 5.5	V

Electrical Characteristics

$V_{CC} = 5$ V, $T_a = 25$ °C

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Quiescent supply current	I_{CCO}		14	22	28	mA
RDS detection sensitivity	V_{tt}	V_{INPUT} = minimum signal for HIGH-to-LOW transition on RDS-ID	–	0.4	1.0	mV

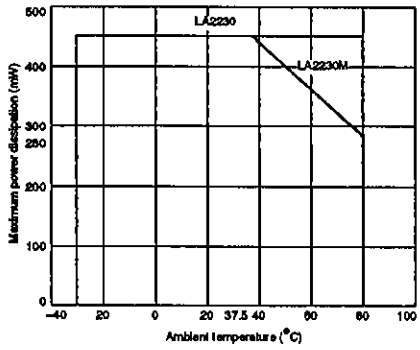
Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
SK detection sensitivity	V_{I2}	V_{INPUT} = minimum signal for HIGH-to-LOW transition on SK-ID	–	1.0	2.0	mV
DK detection sensitivity	V_{I3}	V_{INPUT} = minimum signal for HIGH-to-LOW transition on DK-ID	–	1.1	2.0	mV
RDS detection maximum input signal	V_{I4}	V_{INPUT} = maximum (ARI + RDS) signal for HIGH-to-LOW transition on RDS-ID	30	50	–	mV
	V_{I5}	V_{INPUT} = maximum RDS signal for RDS data correctly demodulated	250	–	–	mV
DK detection maximum input signal	V_{I6}	V_{INPUT} = maximum ARI signal for HIGH-to-LOW transition on DK-ID	75	100	–	mV
CLK and DATA LOW-level output voltage	V_{OL}		0	0.1	0.3	V
CLK and DATA HIGH-level output voltage	V_{OH}		4.7	4.9	5.0	V
Bandpass filter voltage gain	V_G	f = 57 kHz	9.0	12.5	17.0	dB
Bandpass filter attenuation	α	f = 60 kHz. See note 1.	0	2.5	6.0	dB
		f = 54 kHz. See note 1.	0	3.5	6.0	dB
		f = 38 kHz. See note 1.	33	39	–	dB
PLL capture range	CR	Low side, V_{INPUT} = 5 mV sine wave	–	–0.9	–	%
		High side, V_{INPUT} = 5 mV sine wave	–	1.5	–	
Bit-rate clock jitter	t_j		±8	±9	±10	µs
RDS lock-up time	t_{RDS}	Period from V_{INPUT} = 3 mV RDS signal to HIGH-to-LOW transition on RDS-ID	–	35	–	ms
SK lock-up time	t_{SK}	Period from V_{INPUT} = 8 mV ARI signal to HIGH-to-LOW transition on SK-ID	–	45	–	ms
SK + RDS lock-up time	$t_{SK + RDS}$	Period from V_{INPUT} = 8.5 mV (ARI + RDS) signal to HIGH-to-LOW transition on RDS-ID	–	80	–	ms
VCO free-running frequency	f_{VCO}		453	456	459	kHz
BPF adjustment resistance	R_{ADJ}	V_{INPUT} = 100 mV at 57 kHz. See note 2.	5.6	8.0	10.6	kΩ

Notes

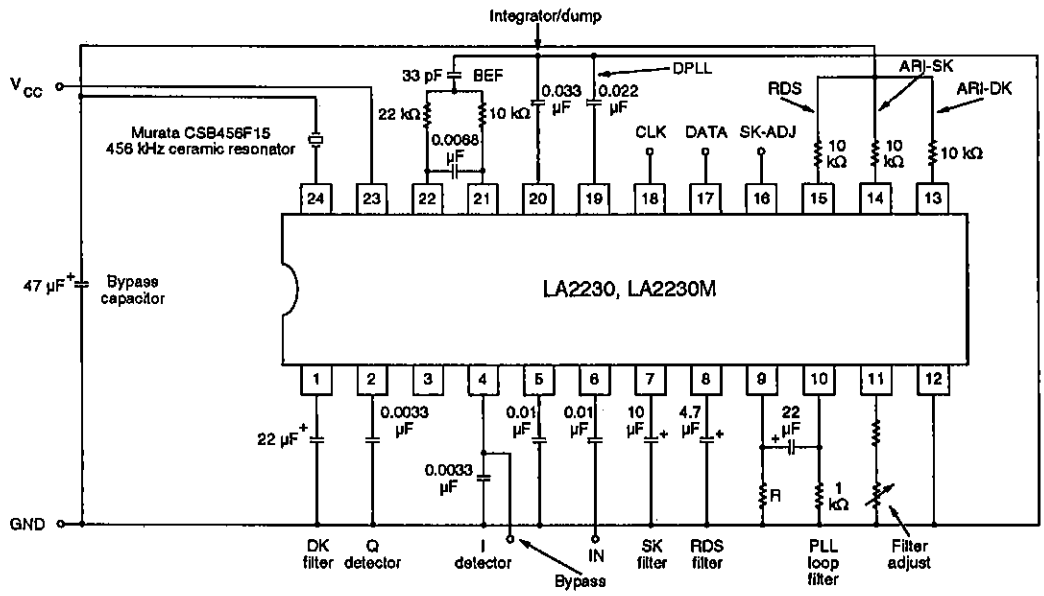
1. 0 dB is referenced to the filter output with f = 57 kHz.
2. Resistance between BPF-ADJ and GND when V_{BYPASS} is at its maximum.

Typical Performance Characteristics

Maximum power dissipation vs. ambient temperature



Measurement Circuit

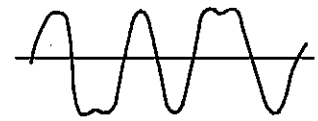


Note
R = 1.2 MΩ for the LA2230, and 1.5 MΩ for the LA2230M

OPERATING INFORMATION

57 kHz Bandpass Filter Adjustment

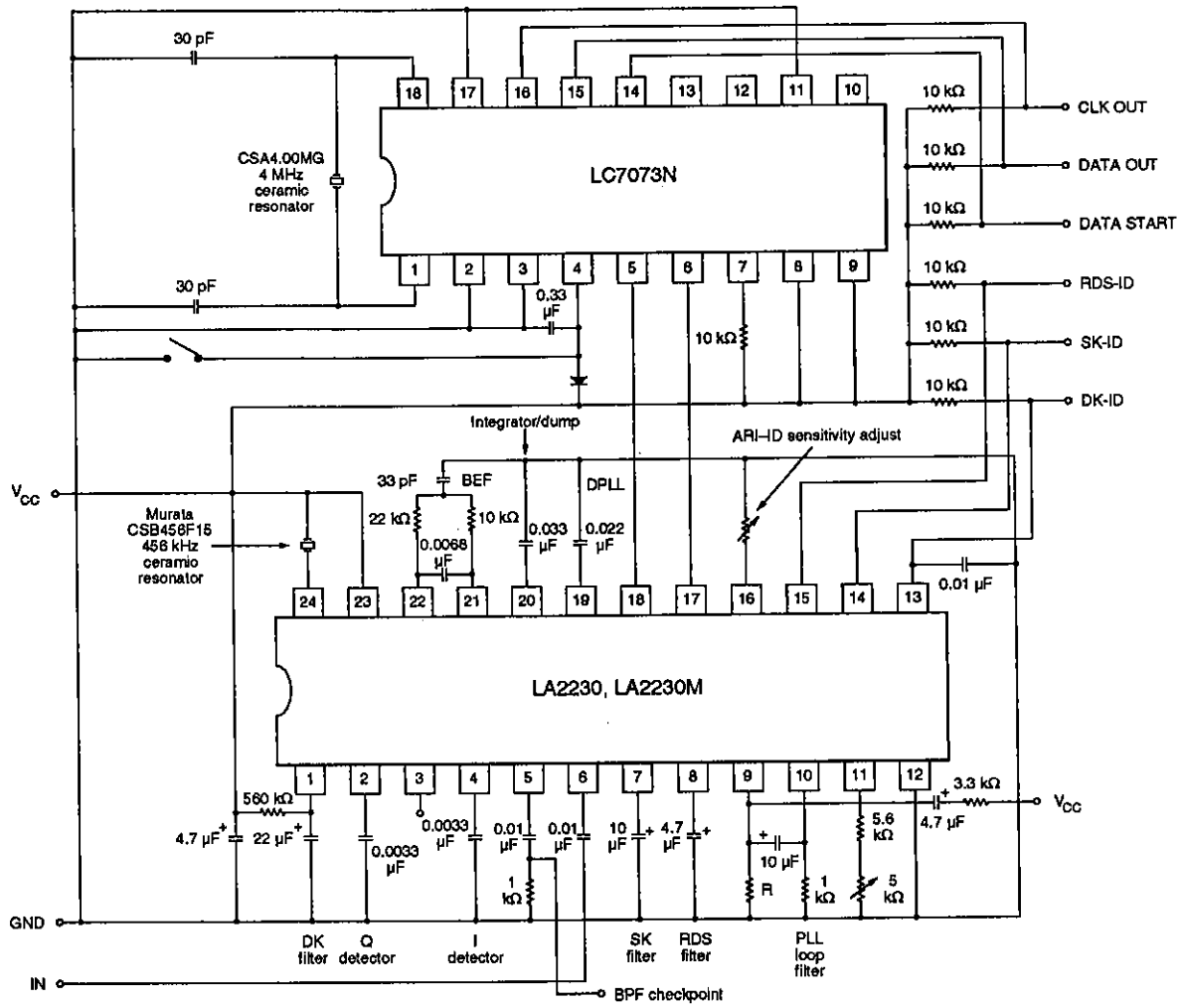
1. Adjust the variable resistor connected to BPF-ADJ to obtain the maximum signal level measured at I-DET or BEF2.
2. When V_{INPUT} = 1 mV RDS signal, check I-DET or BEF2 for a bi-phase output signal as shown in the following figure. Note that the ALC circuit will not operate when $V_{INPUT} \leq 1$ mV.



3. Check the BPF checkpoint signal level when V_{INPUT} = 3 to 6 mV or greater RDS signal.

TYPICAL APPLICATION

The recommended input is a 3 to 6 mV RDS signal with $\Delta f = \pm 2$ kHz.



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