

LA2230, 2230M**SANYO****RDS Decoder****Overview**

The LA2230 and LA2230M are RDS demodulator ICs with an on-chip 57kHz 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.

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 57kHz bandpass filter on-chip results in lower-cost designs that use less PCB area.

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

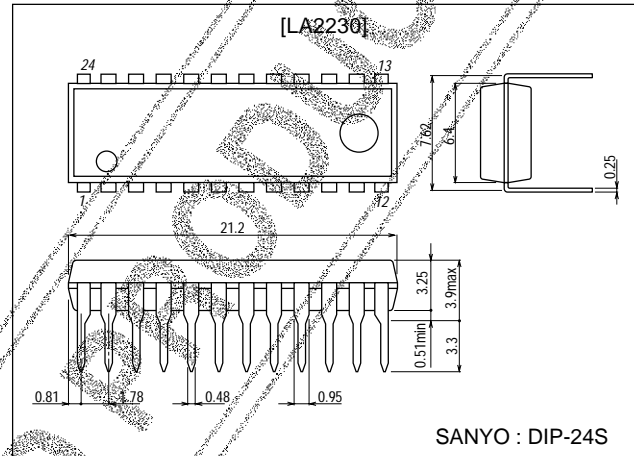
Features

- 57kHz 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.
- 5V supply.
- 24-pin DIP (LA2230) and 24-pin MFP (LA2230M)

Package Dimensions

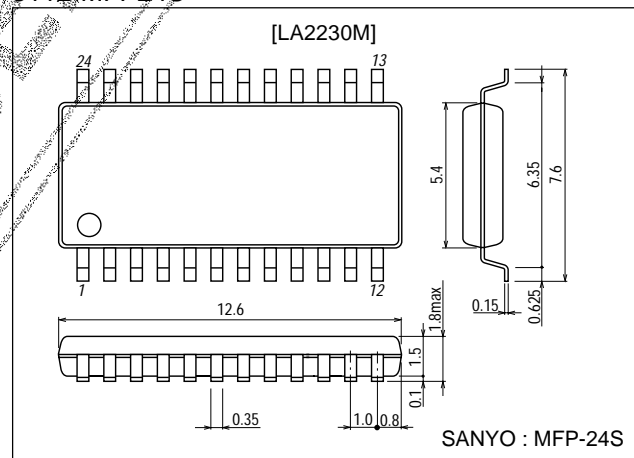
unit:mm

3067-DIP24S



unit:mm

3112-MFP24S



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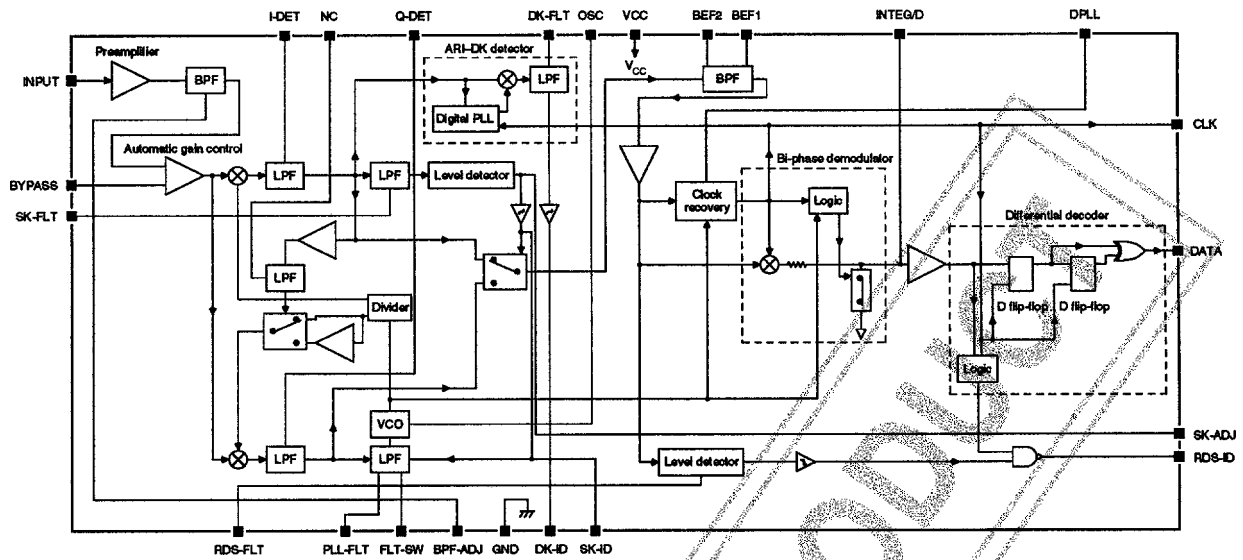
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LA2230, 2230M

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
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	5V supply
24	OSC	Ceramic resonator connection

LA2230, 2230M

Specifications

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC} max	13, 14, 15, and 23 pin	12	V
Power dissipation	Pd max	LA2230 : $T_a \leq 80^\circ\text{C}$	450	mW
		LA2230M : $T_a \leq 37.5^\circ\text{C}$	450	
		LA2230M : $T_a = 80^\circ\text{C}$	280	
Operating temperature range	Topr		-30 to +80	$^\circ\text{C}$
Storage temperature range	Tstg		40 to +125 (LA2230)	C
			-40 to +150 (LA2230M)	

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

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC}	23 pin	5	V
Supply voltage range	V_{CC} op	23 pin	4.7 to 5.5	V

Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$

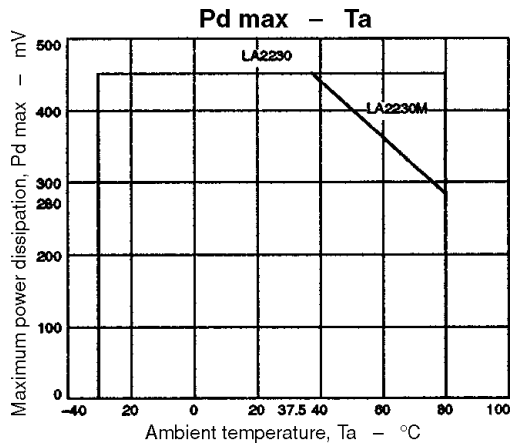
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent supply current	I_{CCO}		14	22	28	mA
RDS detection sensitivity	V_{I1}	V_{INPUT} =minimum signal for HIGH-to-Low transition on RDS-ID		0.4	1.0	mV
SK detection sensitivity	V_{I2}	V_{INPUT} =minimum signal for HIGH-to-Low transition on SK-ID		1.0	2.0	mV
DK detection sensitivity	V_{I3}	V_{INPUT} =minimum signal for HIGH-to-Low transition on SK-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	$f = 57\text{kHz}$	9.0	12.5	17.0	dB
		$f = 60\text{kHz}$. See note 1.	0	2.5	6.0	dB
		$f = 54\text{kHz}$. See note 1.	0	3.5	6.0	dB
Bandpass filter attenuation	α	$f = 38\text{kHz}$. See note 1.	33	39		dB
PLL capture range	CR	Low side, $V_{INPUT} = 5\text{mV}$ sine wave		-0.9		%
		High side, $V_{INPUT} = 5\text{mV}$ sine wave		1.5		
Bit-rate clock jitter	t_j		± 8	± 9	± 10	μs
RDS lock-up time	t_{RDS}	Period from $V_{INPUT} = 3\text{mV}$ RDS signal to HIGH-to-LOW transition on RDS-ID		35		ms
SK lock-up time	t_{SK}	Period from $V_{INPUT} = 8\text{mV}$ ARI signal to HIGH-to-LOW transition on SK-ID		45		ms
SK + RDS lock-up time	$t_{SK + RDS}$	Period from $V_{INPUT} = 8.5\text{mV}$ (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}	$V_{INPUT} = 100\text{mV}$ at 57kHz. See note 2.	5.6	8.0	10.6	k Ω

Notes

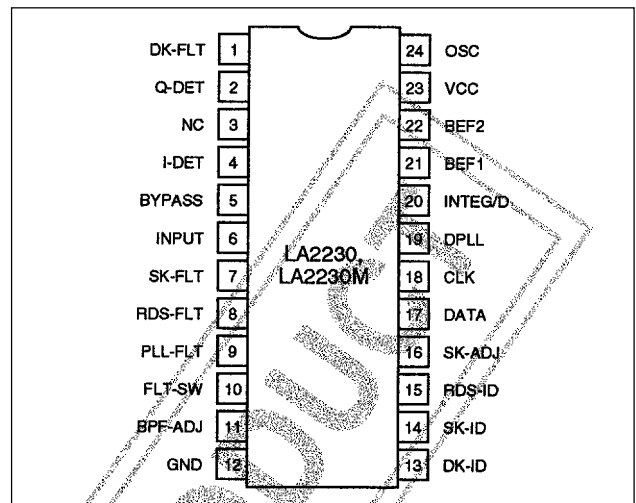
- 0dB is referenced to the filter output with $f = 57\text{kHz}$.
- Resistance between BPF-ADJ and GND when V_{BYPASS} is at its maximum.

Typical Performance Characteristics

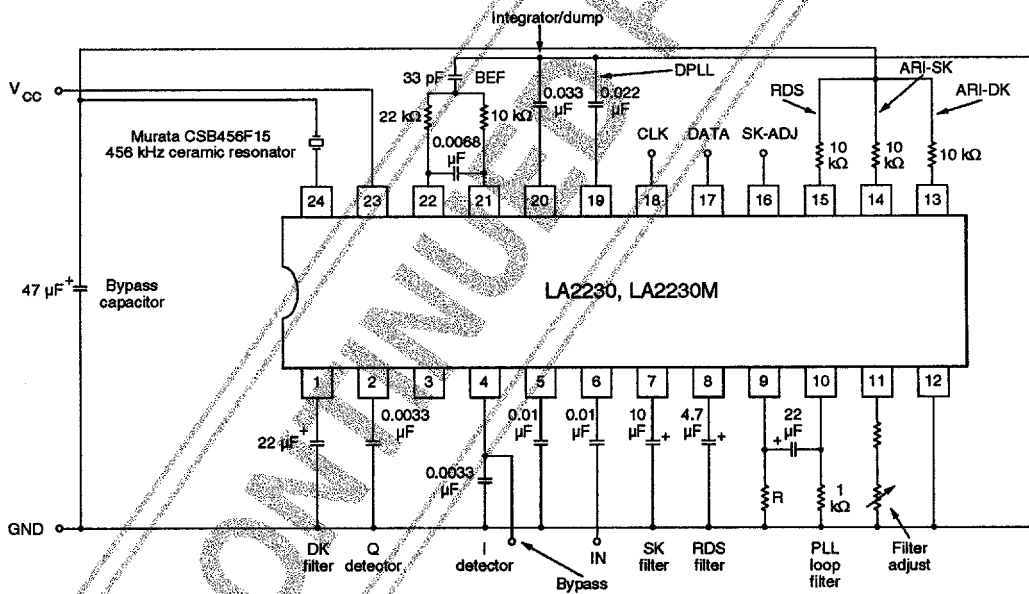
Maximum power dissipation vs. ambient temperature



Pin Assignment



Test Circuit



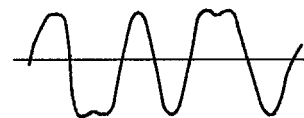
Notes

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

Operating Information

57kHz Bandpass Filter Adjustment

- Adjust the variable resistor connected to BPF-ADJ to obtain the maximum signal level measured at I-DET or BEF2.
- When $V_{INPUT}=1mV$ 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 $V_{INPUT} \leq 1mV$.

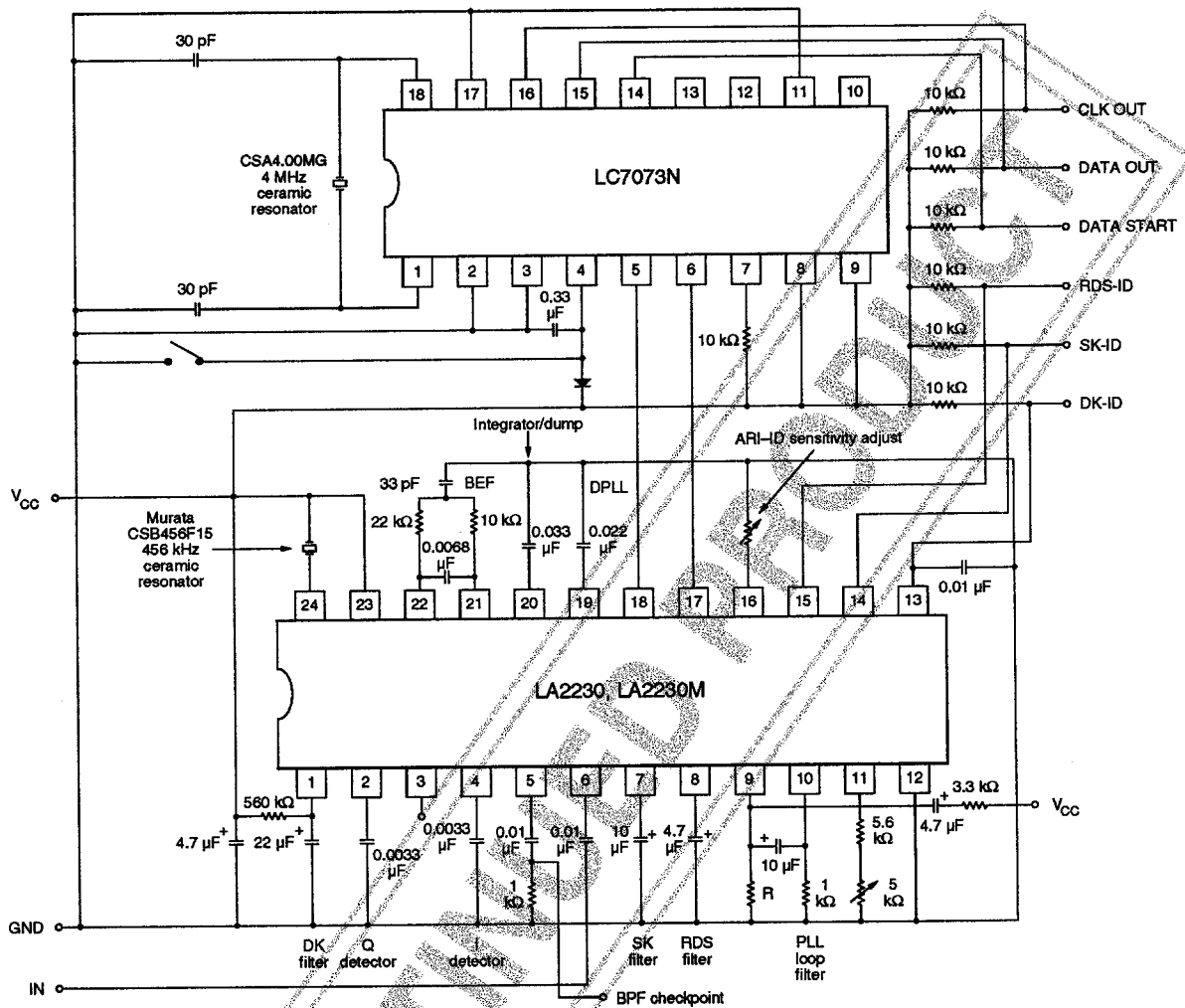


- Check the BPF checkpoint signal level when $V_{INPUT}=3$ to $6mV$ or greater RDS signal.

LA2230, 2230M

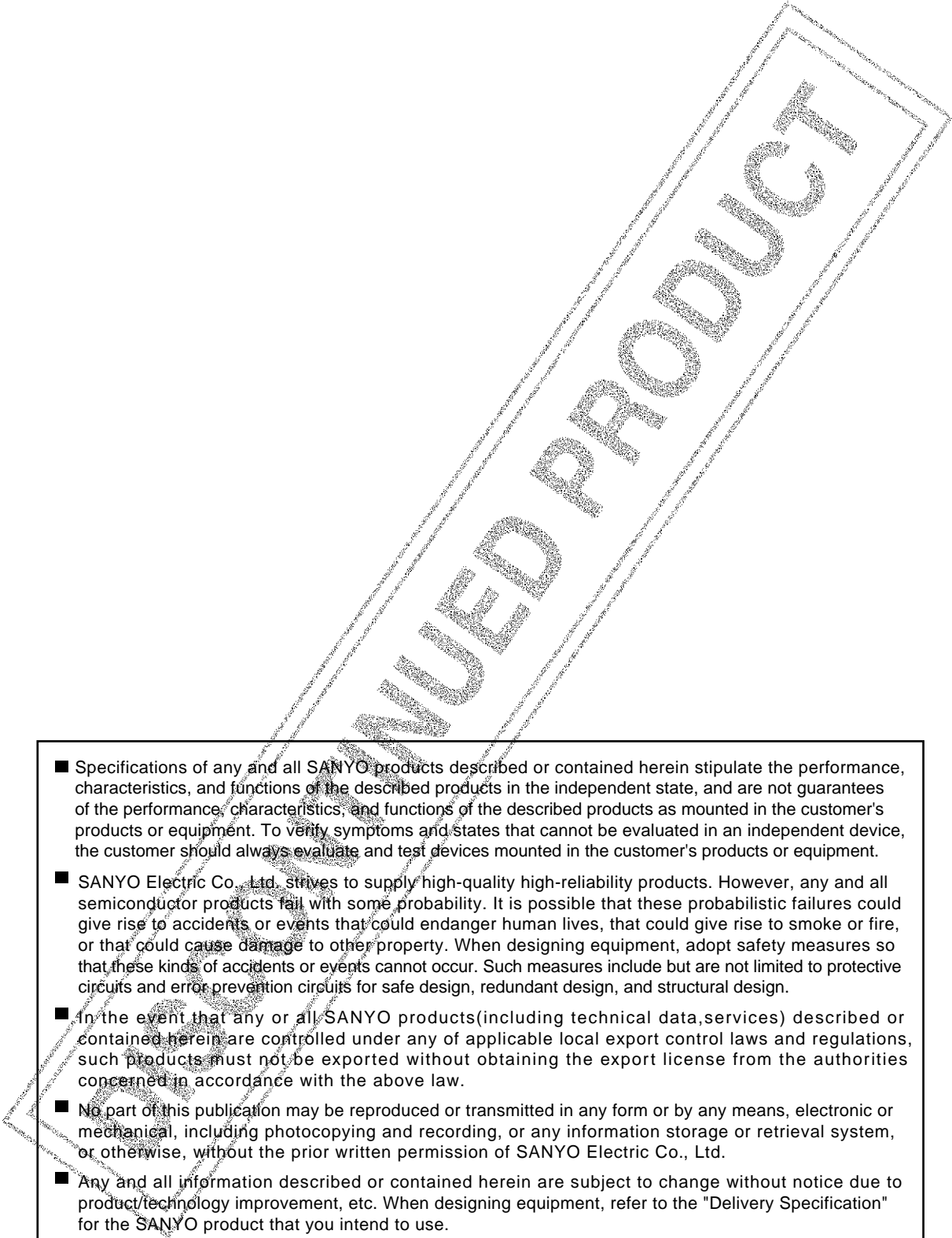
Typical Application

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



Notes

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

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