

SANYO**LA2230, 2230M****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.

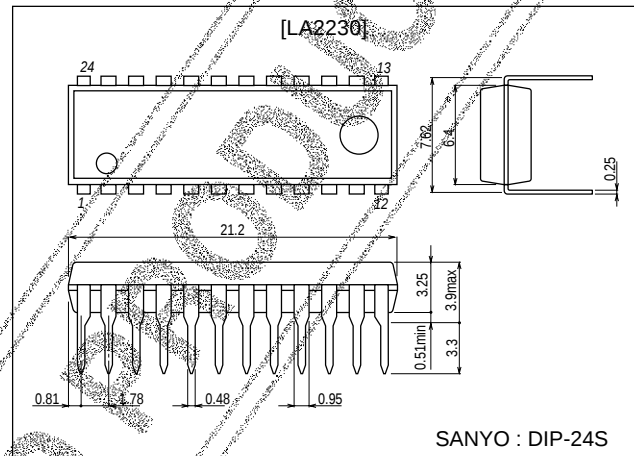
Features

- 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

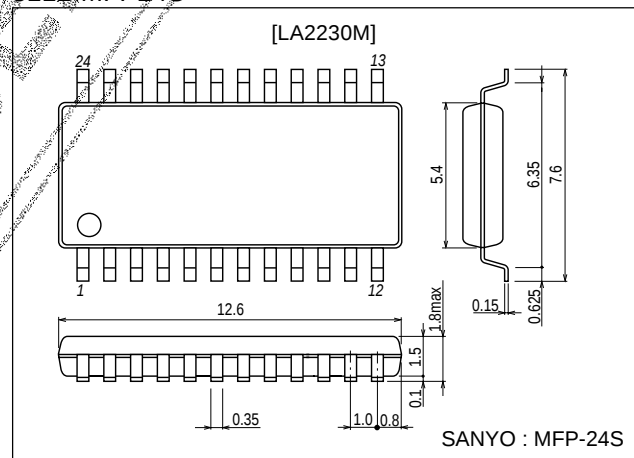
unit:mm

3067-DIP24S



unit:mm

3112-MFP24S



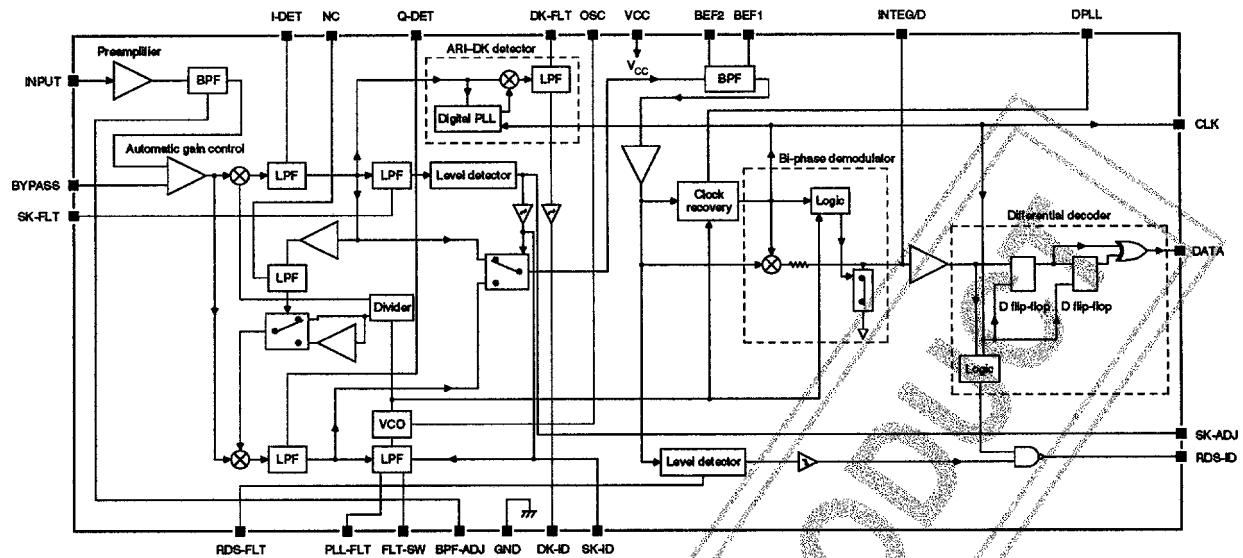
■ Any and all SANYO products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your SANYO representative nearest you before using any SANYO products described or contained herein in such applications.

■ SANYO assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO products described or contained herein.

SANYO Electric Co.,Ltd. Semiconductor Company

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

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

Specifications

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC} max	13, 14, 15, and 23 pin	12	V
Power dissipation	P_d 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	T_{opr}		-30 to $+80$	$^\circ\text{C}$
Storage temperature range	T_{stg}		-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 $T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$

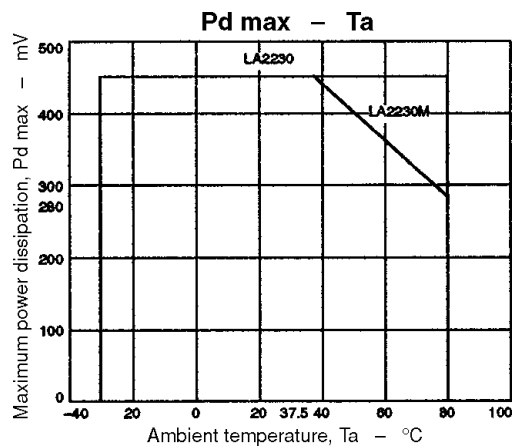
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent supply current	I_{CCO}		14	22	28	mA
RDS detection sensitivity	V_{I1}	V_{INPUT} =minimum signal for HIGH-to-Low transition on RDS-ID		0.4	1.0	mV
SK detection sensitivity	V_{I2}	V_{INPUT} =minimum signal for HIGH-to-Low transition on 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
Bandpass filter attenuation	α	$f=60\text{kHz}$. See note 1.	0	2.5	6.0	dB
		$f=54\text{kHz}$. See note 1.	0	3.5	6.0	dB
		$f=38\text{kHz}$. 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	RADJ	$V_{INPUT}=100\text{mV}$ at 57kHz . See note 2.	5.6	8.0	10.6	k Ω

Notes

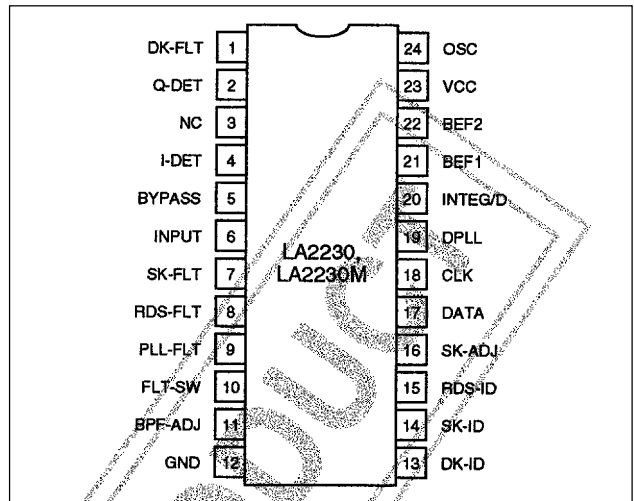
- 0dB is referenced to the filter output with $f=57\text{kHz}$.
- Resistance between BPF-ADJ and GND when V_{BYPASS} is at its maximum.

Typical Performance Characteristics

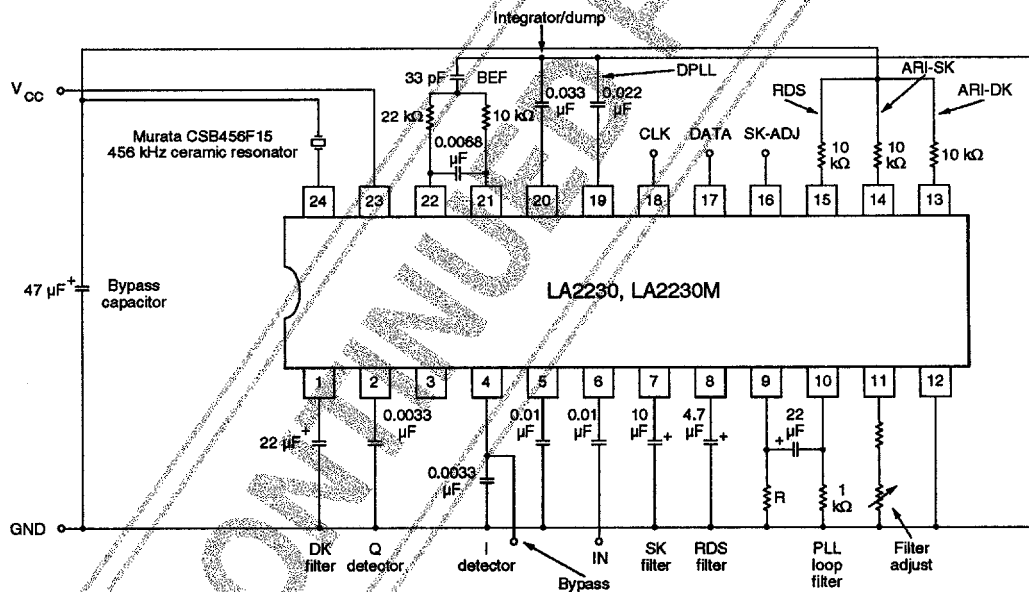
Maximum power dissipation vs. ambient temperature



Pin Assignment



Test Circuit



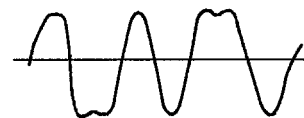
Notes

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

Operating Information

57kHz Bandpass Filter Adjustment

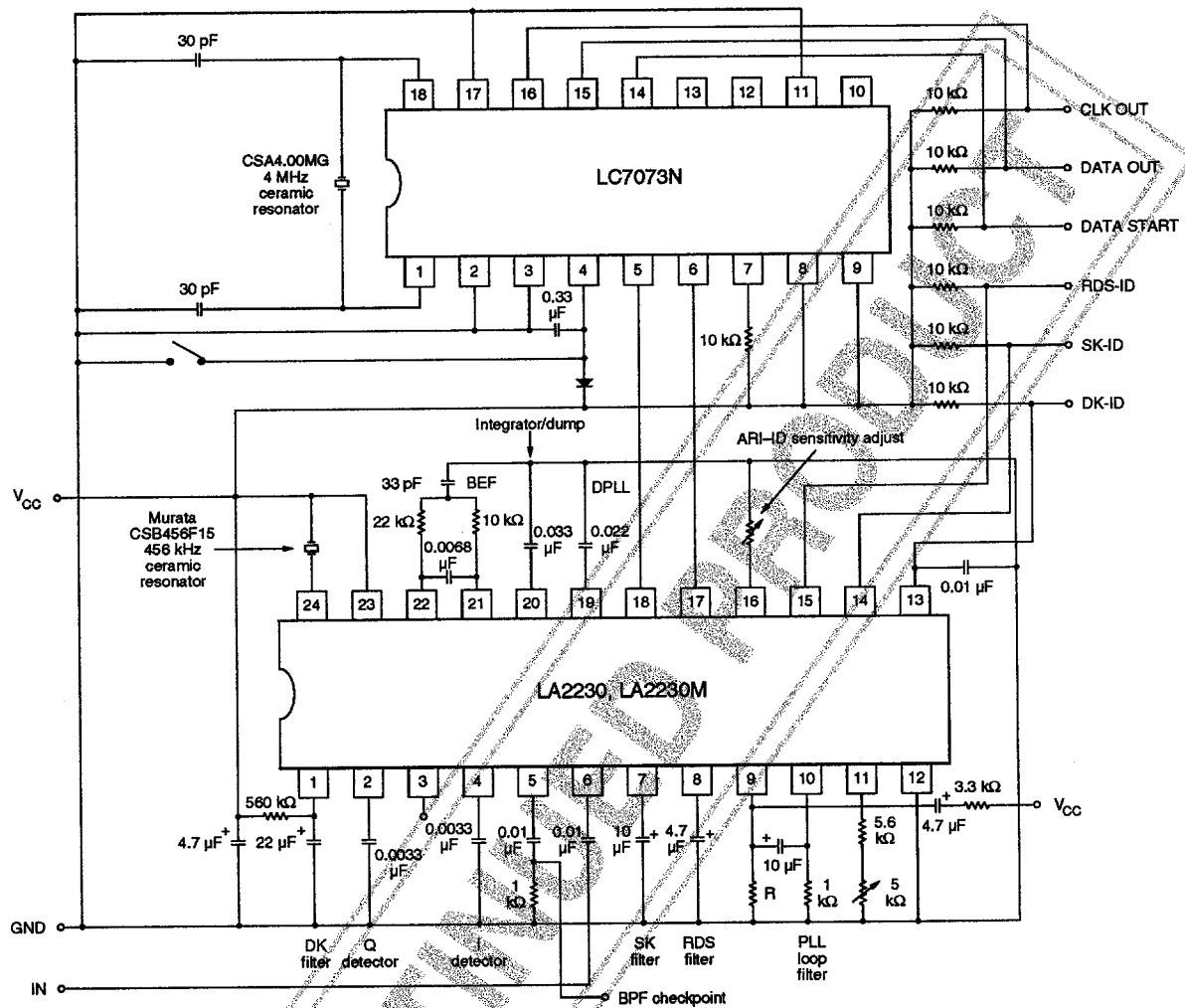
1. Adjust the variable resistor connected to BPF-ADJ to obtain the maximum signal level measured at I-DET or BEF2.
2. When $V_{\text{INPUT}}=1\text{mV}$ RDS signal, check I-DET or BEF2 for a bi-phase output signal as shown in the following figure. Note that the ALC circuit will not operate when $V_{\text{INPUT}}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



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

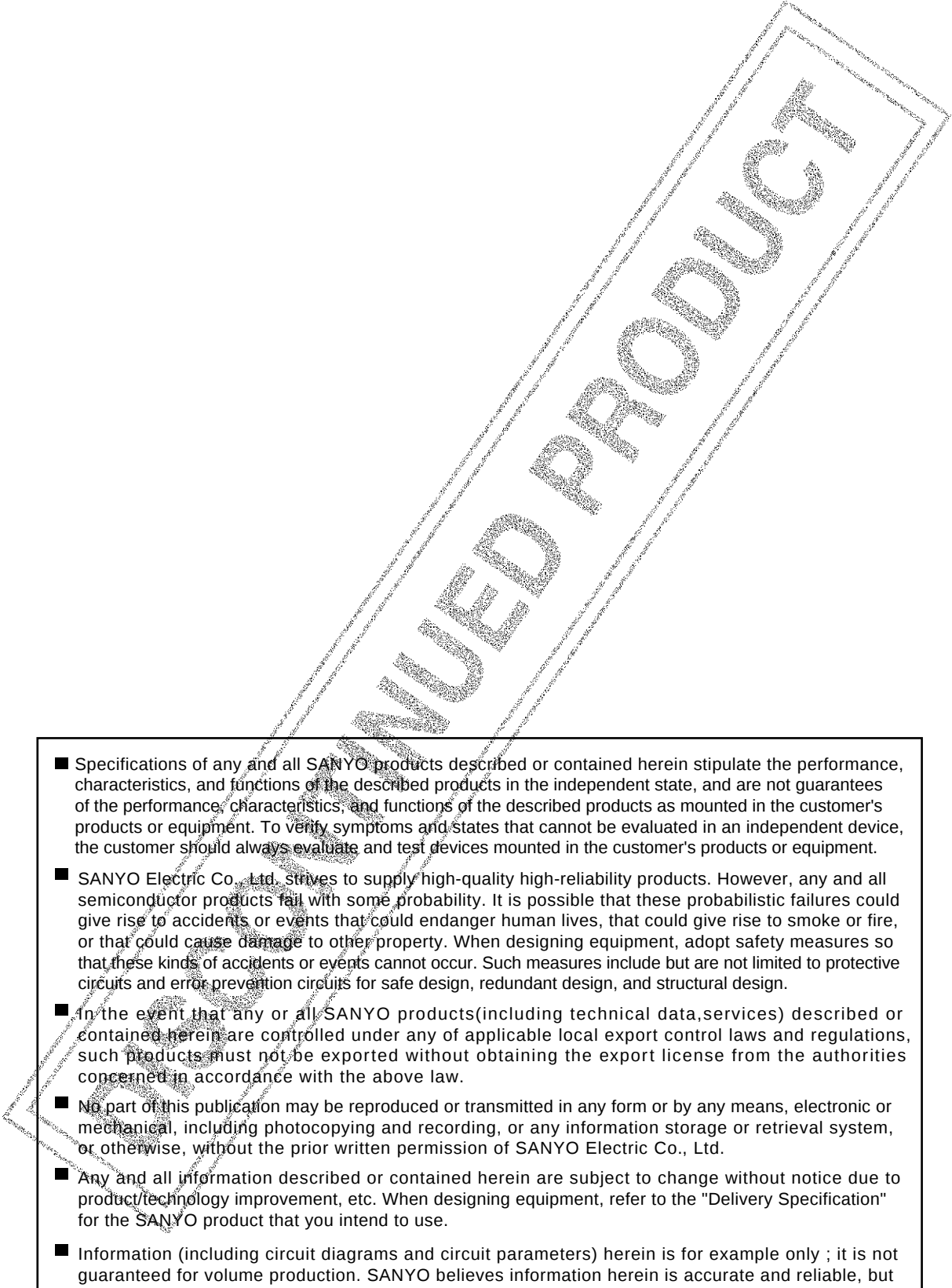
Typical Application

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.

- 
- Specifications of any and all SANYO products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
 - SANYO Electric Co., Ltd. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
 - In the event that any or all SANYO products(including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
 - No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of SANYO Electric Co., Ltd.
 - Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO product that you intend to use.
 - Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

This catalog provides information as of January, 2000. Specifications and information herein are subject to change without notice.