

Post amplifier for Optical Fiber Communication Receiver

Description

The CXB1572Q achieves the 2R optical-fiber communication receiver functions (Reshaping and Regenerating) on a single chip. This IC is also equipped with the signal interruption alarm output function, which is used to discriminate the existence of data input.

Features

- Auto-offset canceler circuit
- Signal interruption alarm output
- 2-level switching function of identification maximum voltage amplitude for alarm block
- Single 3.3 V power supply

Applications

- FDDI : 125 Mb/s
- SONET/SDH : 155.52 Mb/s
- ESCON : 200 Mb/s
- Fiber channel : 265.625 Mb/s
- ATM : 155.52 Mb/s

Absolute Maximum Ratings

• Supply voltage	$V_{CC} - V_{EE}$	-0.3 to +7.0	V
• Storage temperature	T_{stg}	-65 to +150	°C
• Input voltage difference : $V_D - \bar{V}_D$	V_{dif}	0 to +2.5	V
• SW input voltage	V_i	V_{EE} to V_{CC}	V
• Output current (Continuous)	I_o	0 to 50	mA
(Surge current)		0 to 100	mA

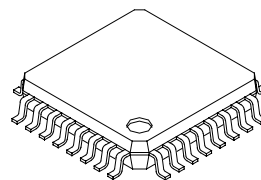
Recommended Operating Conditions

• Supply voltage	$V_{CC} - V_{EE}$	3.0 to 3.6	V
• Termination voltage (for data/alarm)	$V_{CC} - V_{T1}$	1.8 to 2.2	V
• Termination voltage (for alarm 2)	V_{T2}	V_{EE}	V
• Termination resistance (for data/alarm)	R_{T1}	46 to 56	Ω
• Termination resistance (for alarm 2)	R_{T2}	460 to 560	Ω
• Operating temperature	T_a	-40 to +85	°C

Structure

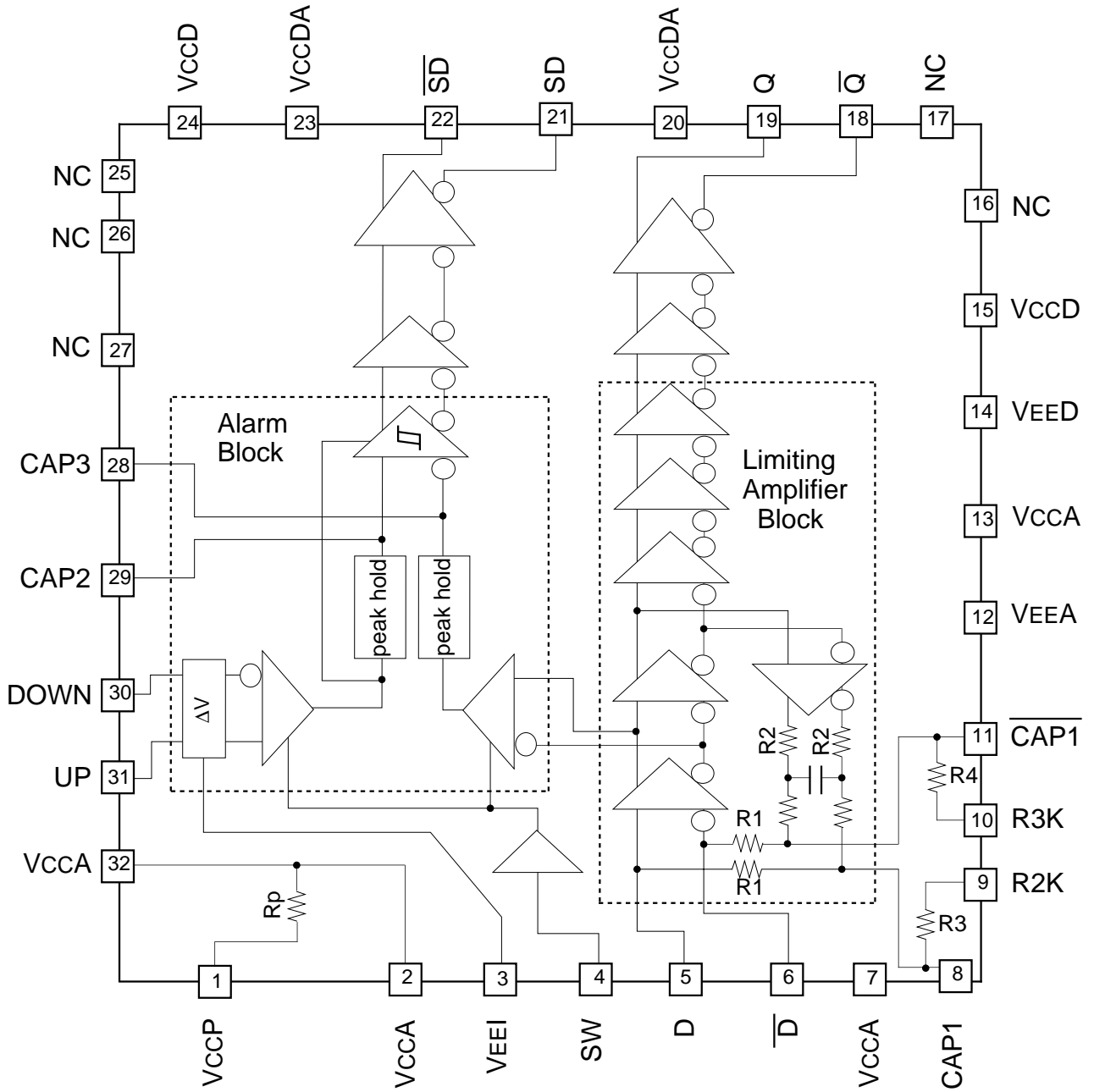
Bipolar silicon monolithic IC

32 pin QFP (Plastic)



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Block Diagram and Pin Configuration



Pin Description

Pin No.	Symbol	Typical pin voltage (V)		Equivalent circuit	Description
		DC	AC		
1	VccP				Positive power supply for external power supply.
2	VccA	0 V			
3	VEE1	-3.3 V			Generates the default voltage between UP and DOWN. The voltage (5.3 mV for input conversion) can be generated between UP and DOWN (Pins 30 and 31) as alarm setting level 1 by this pin to Open. The voltage (12 mV for input conversion) can be generated as alarm setting level 2 by connecting this pin to VEEA.
4	SW	0 V (OPEN) or -3.3 V			Switches the identification maximum voltage amplitude. High voltage when open; the identification maximum voltage amplitude becomes 50 mVp-p. Low voltage when connecting this pin to VEE; the amplitude becomes 20 mVp-p.
5	D	-1.3 V	-0.9 V to -1.7 V		Limiting amplifier block input. Be sure to make this input with AC coupled.
6	\bar{D}	-1.3 V	-0.9 V to -1.7 V		
7	VccA	0 V			Positive power supply for analog block.
8	CAP1	-1.8 V			Pins 8 and 11 connect a capacitor which determines the cut-off frequency for feedback block, and 2 kΩ is connected between Pins 8 and 9; 3 kΩ between Pins 10 and 11. A resistor which is to be inserted in parallel with a capacitor can be selected 5 ways by external wiring, and DC feedback gain can be varied due to compensate the input duty cycle distortion.
9	R2K				
10	R3K				
11	$\overline{CAP1}$	-1.8 V			

Pin No.	Symbol	Typical pin voltage (V)		Equivalent circuit	Description
		DC	AC		
12	V _{EEA}	-3.3 V			Negative power supply for analog block.
13	V _{CCA}	0 V			Positive power supply for analog block.
14	V _{EED}	-3.3 V			Negative power supply for digital block.
15	V _{CCD}	0 V			Positive power supply for digital block.
16	NC				No connected.
17					
18	\bar{Q}		-0.9 V to -1.7 V		Data signal output. Terminate this pin in 50 Ω at V _{TT} = -2 V.
19	Q		-0.9 V to -1.7 V		
20	V _{CCDA}	0 V			Positive power supply for output buffer.
21	SD		-0.9 V to -1.7 V		Alarm signal output. Terminate this pin in 50 Ω at V _{TT} = -2 V.
22	\bar{SD}		-0.9 V to -1.7 V		
23	V _{CCDA}	0 V			Positive power supply for digital block.
24	V _{CCD}	0 V			Positive power supply for digital block.
25	NC				No connected.
26					
27					

Pin No.	Symbol	Typical pin voltage (V)		Equivalent circuit	Description
		DC	AC		
28	CAP3	-1.8 V			<p>Connects a peak hold circuit capacitor for alarm block. 470 pF should be connected to VccA each.</p> <p>CAP2 pin → Peak hold capacitor connection for alarm level setting block. CAP3 pin → Peak hold capacitor connection for limiting amplifier signal.</p>
29	CAP2	-1.8 V			
30	DOWN	-1090 mV (for VEE1 = -3.3 V)			<p>Connects a resistor for alarm level setting. Default voltage can be generated without an external resistor. (Please refer to pin description of pin No. 3.)</p>
31	UP	-1020 mV (for VEE1 = -3.3 V)			
32	VccA	0 V			Positive power supply for analog block.

Electrical Characteristics

• DC characteristics

(V_{CC} = GND, V_{EE} = -3.0 V to -3.6 V, T_a = -40 to +85 °C, V_{CC} = V_{CCD}, V_{CCDA}, V_{CCA} V_{EE} = V_{VED}, V_{EEA})

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power supply	I _{EE}		-56	-40	-29	mA
Q/ \bar{Q} SD/ \bar{SD} High output voltage	V _{OH}	R _{T1} = 51 Ω , V _{T1} = V _{CC} -2 V termination, T _a =0 to 85 °C	-1025		-830	mV
Q/ \bar{Q} SD/ \bar{SD} Low output voltage	V _{OL}		-1810		-1550	
SD/ \bar{SD} High output voltage 2	V _{OHb}	R _{T2} = 510 Ω , V _{T2} =V _{EE} termination, T _a =0 to 85 °C	-1025		-700	
SD/ \bar{SD} Low output voltage 2	V _{OLb}		-1860		-1500	
SW High input voltage	V _{IH}		-500		0	
SW Low input voltage	V _{IL}		V _{EE}		V _{EE} +500	
SW High input current	I _{IH}				2	μ A
SW Low input current	I _{IL}		-60			
D/ \bar{D} input resistance	R _{in}		1109	1479	1849	Ω
Internal resistance 1 for alarm level setting	R _{a1}	Refer to Fig. 3.	739	986	1233	
Internal resistance 2 for alarm level setting	R _{a2A, B}	Refer to Fig. 3.	93	123	154	
Resistance between V _{CC} A and V _{CC} P	R _P		3.3	5	6.9	
Pare ratio of internal resistance 2 for alarm level setting	δ R _{a2}	R _{a2A} /R _{a2B}	0.97		1.03	
Resistance between CAP1 and R2K	R3		1470	1970	2470	Ω
Resistance between $\bar{CAP1}$ and R3K	R4		2210	2960	3700	

• AC characteristics

(V_{CC} = GND, V_{EE} = -3.0 V to -3.6 V, T_a = -40 to +85 °C, V_{CC} = V_{CCD}, V_{CCDA}, V_{CCA} V_{EE} = V_{EEED}, V_{EEEA})

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Maximum input voltage amplitude	V _{max}	Single-ended input	1600			mVpp
Amplifier gain (except for output buffer)	GL		52			dB
Identification maximum voltage amplitude of alarm level	V _{minA1}	SW pin: Low, single-ended input	20			mVpp
	V _{minA2}	SW pin: Open High, single-ended input	50			
Hysteresis width	ΔP	Alarm level is default value	3	6	7	dB
SD response assert time	T _{as}	Low → High* ¹	0		100	μs
SD response deassert time	T _{das}	High → Low* ²	2.3		100	
SD response assert time for alarm level default	T _{asd}	Low → High* ³	0		100	
SD response deassert time for alarm level default	T _{dasd}	High → Low* ⁴	2.3		100	
Alarm setting level 1 for default	V _{def1}	UP,DOWN,V _{EE1} pins ;Open,connect SW pin to V _{EE}	4.3	5.3	6.3	mV
Alarm setting level 2 for default	V _{def2}	UP,DOWN,SW pins ;Open,connect V _{EE1} to V _{EE}	10.5	12.0	13.5	
Propagation delay time	T _{PD}	D to Q	1.2	1.7	2.6	ns
Q/Q̄ SD/SD̄ rise time	T _r	R _{T1} = 50 Ω, V _{T1} = V _{CC} -2 V termination, V _{EE} =-3.3 V, T _a =0 to 85 °C 20 % to 80 %	0.45	0.85	1.3	
Q/Q̄ SD/SD̄ fall time	T _f		0.45	0.85	1.3	

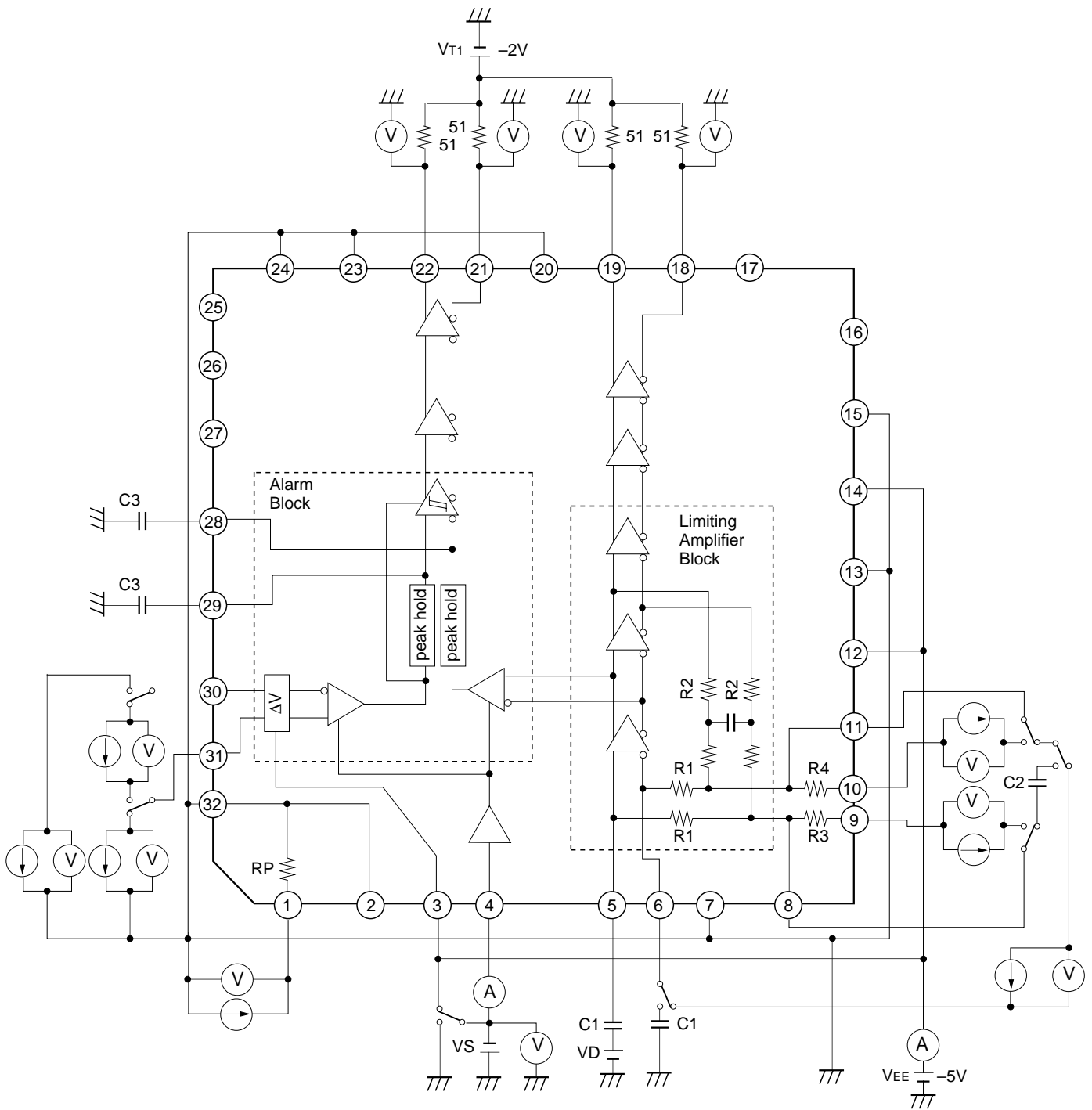
*¹ V_{UP} - V_{DOWN} = 100 mV, V_{in} = 100 mVpp (single ended), SW pin: High
Peak hold capacitance of 470 pF; connect V_{EE1} to V_{EE}.

*² V_{UP} - V_{DOWN} = 100 mV, V_{in} = 1 Vpp (single ended), SW pin: High
Peak hold capacitance of 470 pF; connect V_{EE1} to V_{EE}.

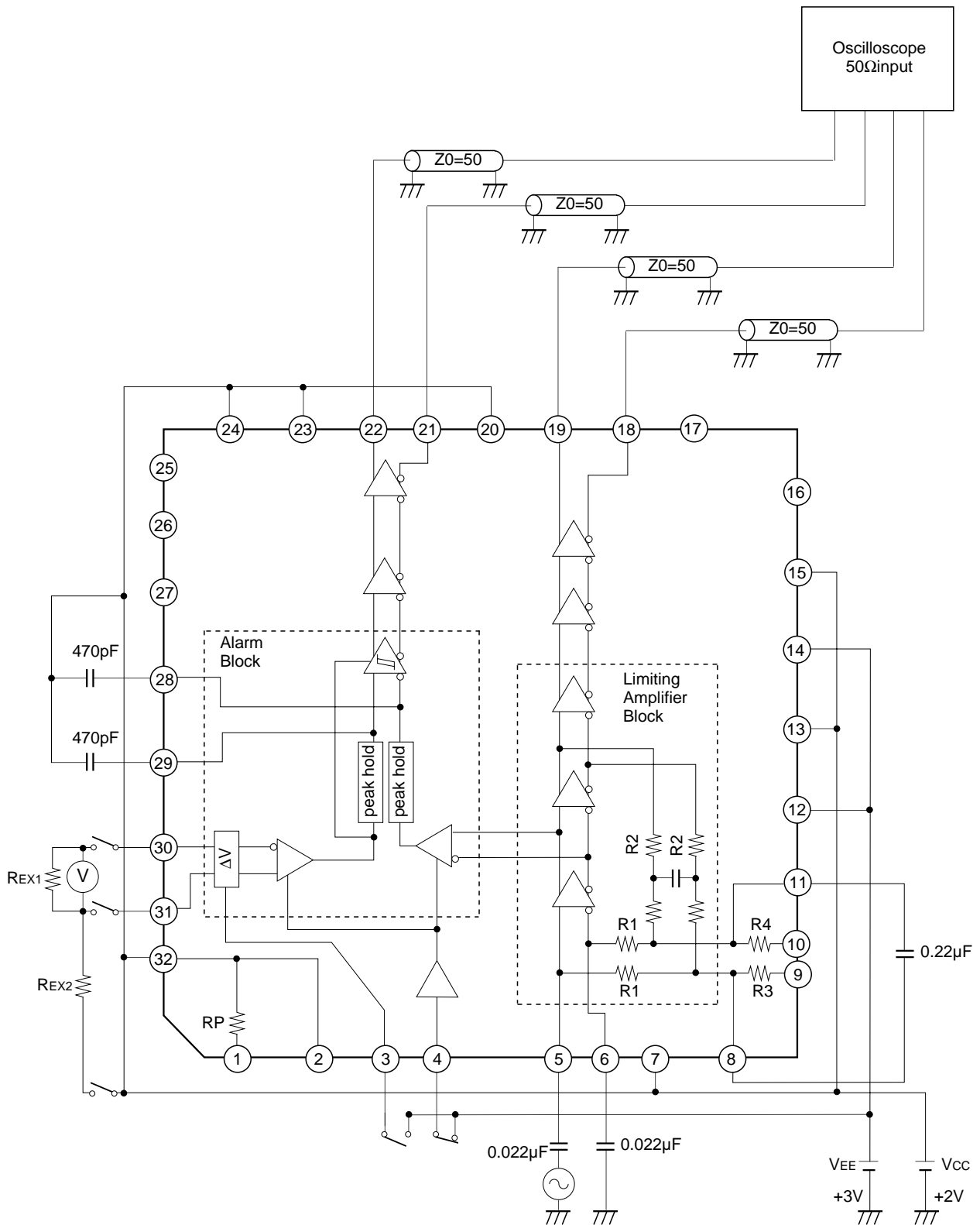
*³ V_{in} = 50 mVpp (single ended), SW pin: Low
Peak hold capacitance of 470 pF; connect V_{EE1} to V_{EE}.

*⁴ V_{in} = 1 Vpp (single ended), SW pin: Low
Peak hold capacitance of 470 pF; connect V_{EE1} to V_{EE}.

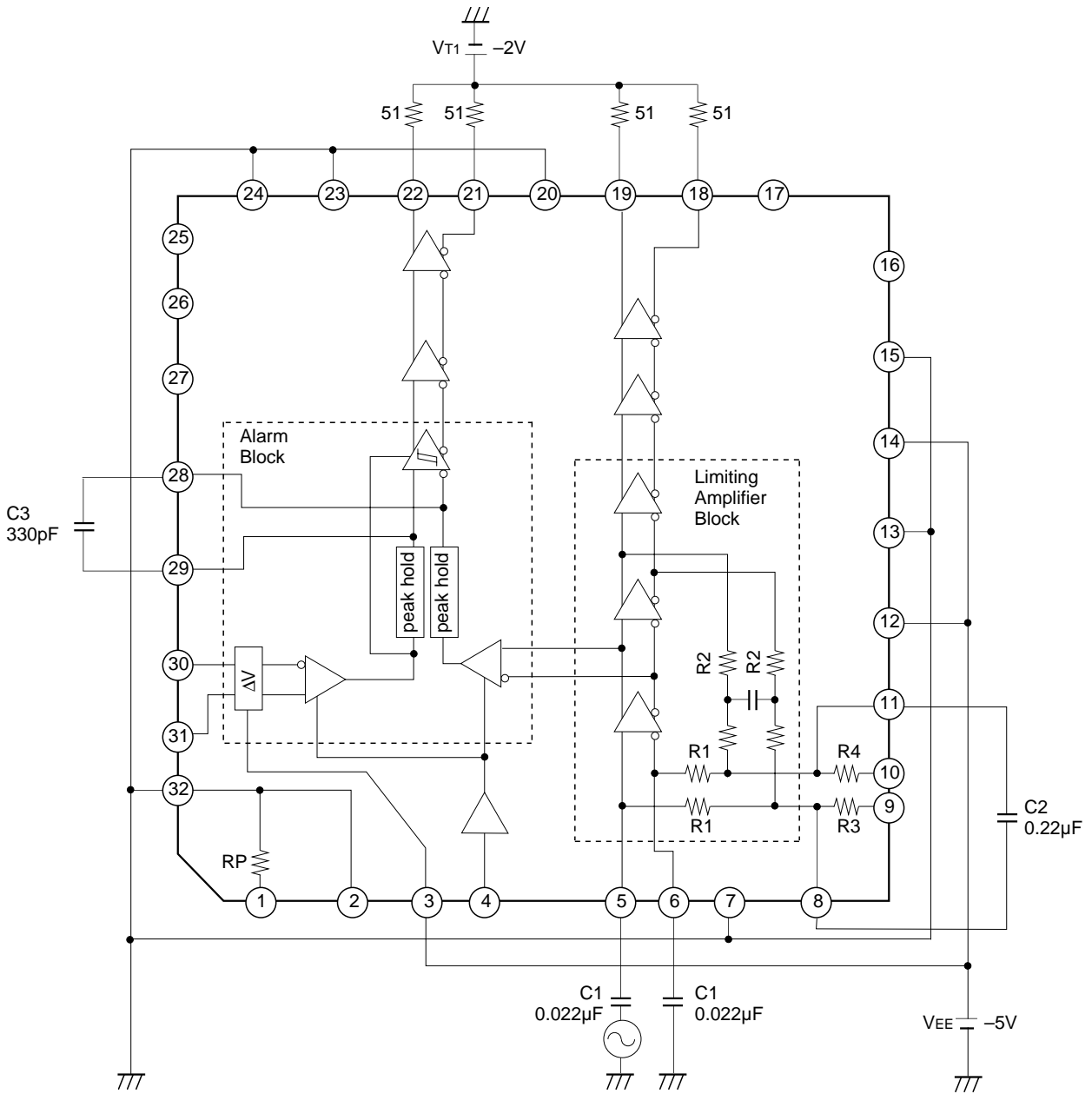
DC Electrical Characteristics Measurement Circuit



AC Electrical Characteristics Measurement Circuit



Application Circuit



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Notes on Operation

1. Limiting amplifier block

The limiting amplifier block is equipped with the auto-offset canceler circuit. When external capacitors C1 and C2 are connected as shown in Fig. 1, the DC bias is set automatically in this block. External capacitor C1 and IC internal resistor R1 determine the low input cut-off frequency f_2 as shown in Fig. 2. Similarly, external capacitor C2 and IC internal resistor R2 determine the high cut-off frequency f_1 for DC bias feedback. Since peaking characteristics may occur in the low frequency area of the amplifier gain characteristics depending on the f_1/f_2 combination, set the C1 and C2 so as to avoid the occurrence of peaking characteristics. The target values of R1 and R2 and the typical values of C1 and C2 are as indicated below. When a single-ended input is used, provide AC grounding by connecting Pin 6 to a capacitor which has the same capacitance as capacitor C1.

R1 (internal): 1.5 k Ω	} f_2 : 4.8 kHz	R2 (internal): 10 k Ω	} f_1 : 72 Hz
C1 (external): 0.022 μ F		C2 (external): 0.22 μ F	

2 k Ω is incorporated between Pins 8 and 9; 3 k Ω between Pins 10 and 11. A resistance value which is to be inserted in parallel with a capacitor C2 can be selected 5 ways (∞ , 5 k Ω , 3 k Ω , 2 k Ω , 2 k/3 k Ω) by external wiring, and DC feedback can be varied.

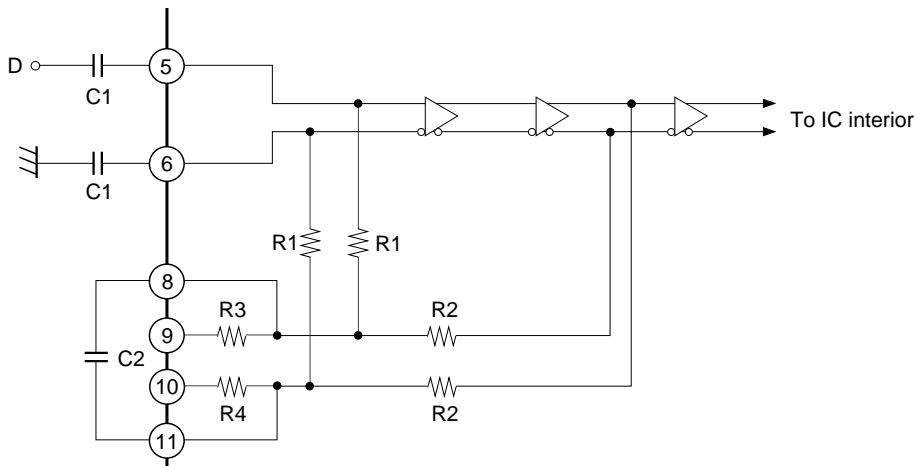


Fig. 1

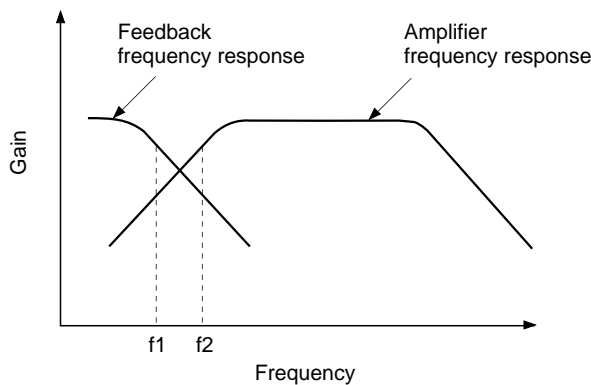


Fig. 2

2. Alarm block

In order to operate the alarm block, give the voltage difference between Pins 30 and 31 to set an alarm level and connect the peak hold capacitor C3 shown in Fig. 3.

This IC has two setting methods of alarm level; one is to leave Pins 30 and 31 open to set an alarm level default value (5.3 mV or 12 mV for input conversion). Default value of alarm level is 5.3 mV for input conversion by leaving Pin3 to open, 12 mV by connecting Pin3 to VEE. The other is to connect Pin 3 to VEE and set a desired alarm level using the external resistors REX1 and REX2 and REX3 shown in Fig. 3.

Connect REX1 between Pins 30 and 31, or connect REX3 between Pin 30 and VCC when less alarm level is desired to be set than its default value; connect REX2 between Pin 31 and VCC potential when more alarm level is desired to be set than its default value. However, the Pin 31 voltage must be higher than that of Pin 30. Refer to Figs. 7 to 9 for this alarm level setting.

This IC also features two-level setting of identification maximum voltage amplitude for the alarm function. The amplitude is set to 50 mVp-p when Pin 4 is left open (High level) and it is set to 20 mVp-p when Pin 4 is Low level. Therefore, noise margin can be increased by setting Pin 4 to Low level when small signal is input. The relation of input voltage and peak hold output voltage is shown in Fig. 5.

In the relation between the alarm setting level and hysteresis width, the hysteresis width is designed to maintain a constant gain (design target value: 6 dB) as shown in Fig. 4. The C3 capacitance value should be set so as to obtain desired assert time and deassert time settings for the alarm signal.

The electrical characteristics for the SD response assert and deassert times are guaranteed only when the waveforms are input as shown in the timing chart of Fig. 6.

The typical values of REX1, REX2, REX3 and C3 are as follows: (Approximately 10 pF capacitor is built in Pins 28 and 29 each.)

- REX1 : 400 Ω (when the alarm level is set to 3 mV for input conversion.Pin3; open,connect Pin4 to VEE)
- REX2 : 4k Ω (when the alarm level is set to 15 mV for input conversion.connect Pin3 to VEE, Pin4; open)
- REX3 : 6.2 kΩ (when the alarm level is set to 3 mV for input conversion.Pin3; open,connect Pin4 to VEE)
- C3 : 470 pF

The table below shows the alarm logic.

Optical signal input state	SD	\overline{SD}
Signal input	High level	Low level
Signal interruption	Low level	High level

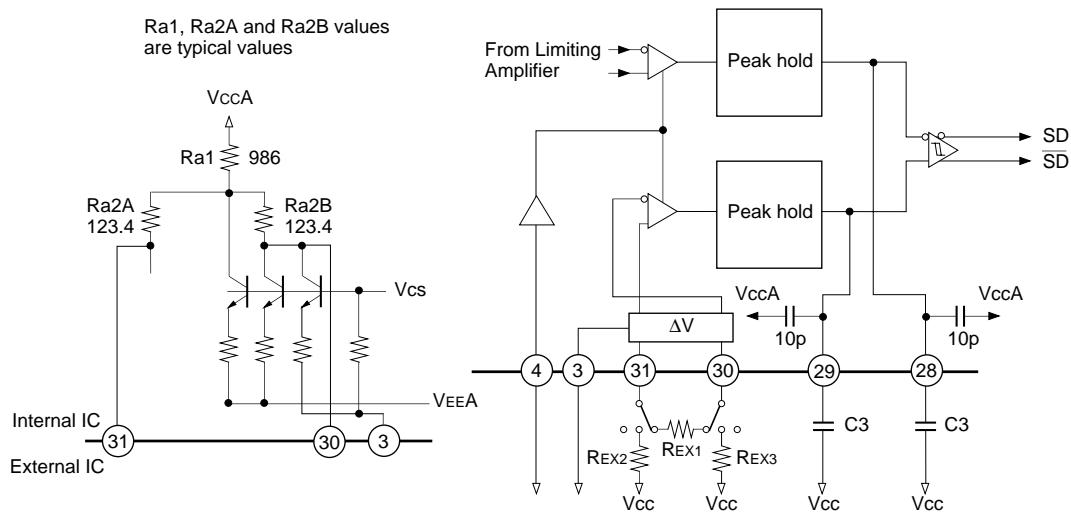


Fig. 3

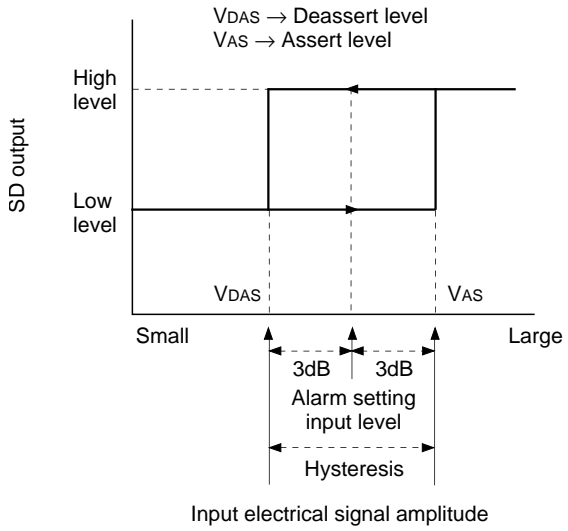


Fig. 4

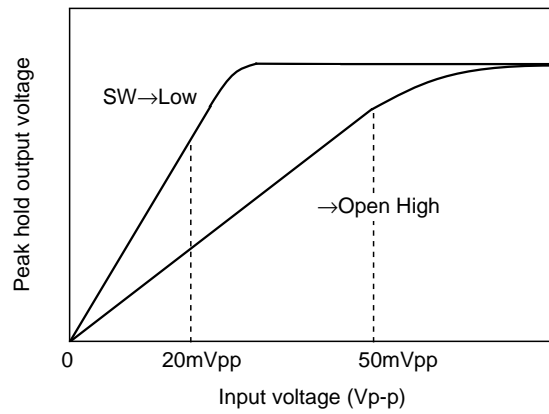


Fig. 5

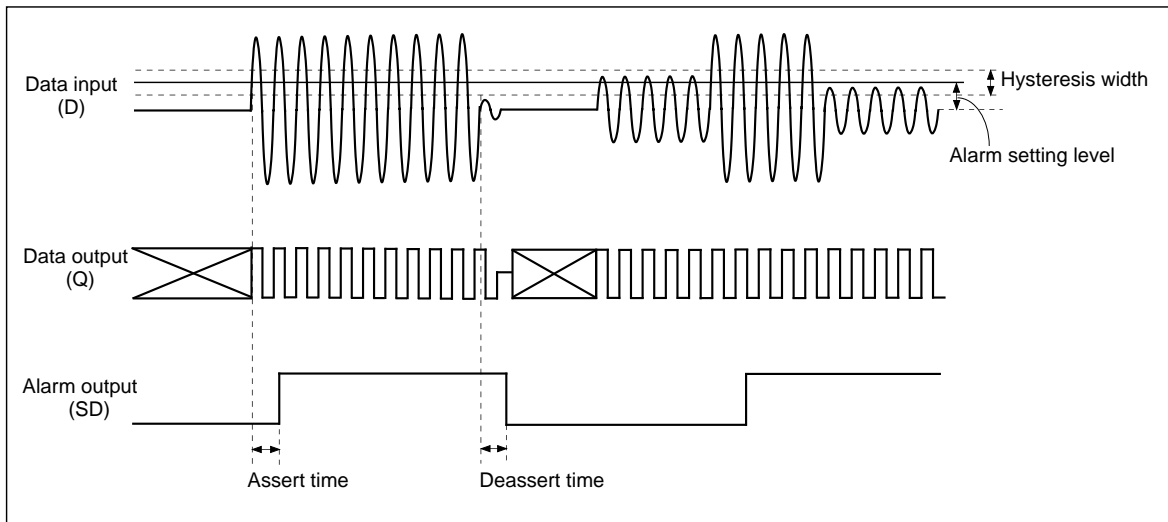


Fig. 6

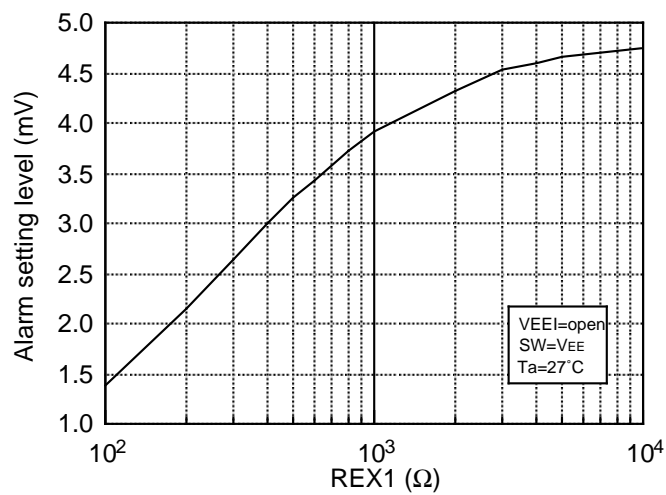


Fig. 7

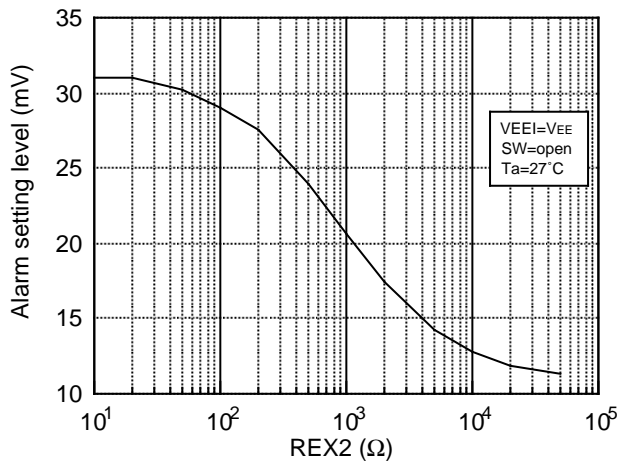


Fig. 8

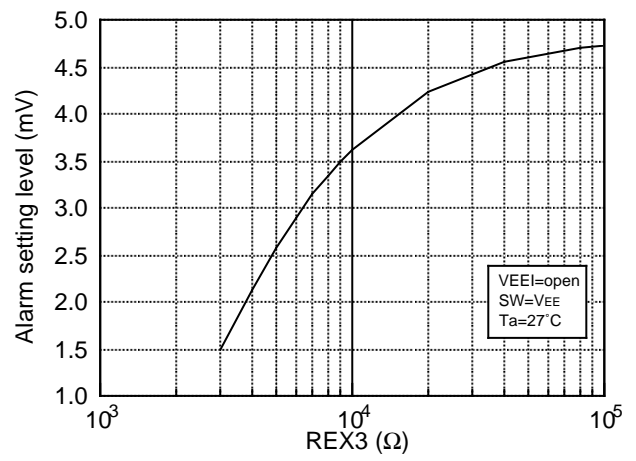


Fig. 9

3. Others

Pay attention to handling this IC because its electrostatic discharge strength is weak.

Example of Representative Characteristics

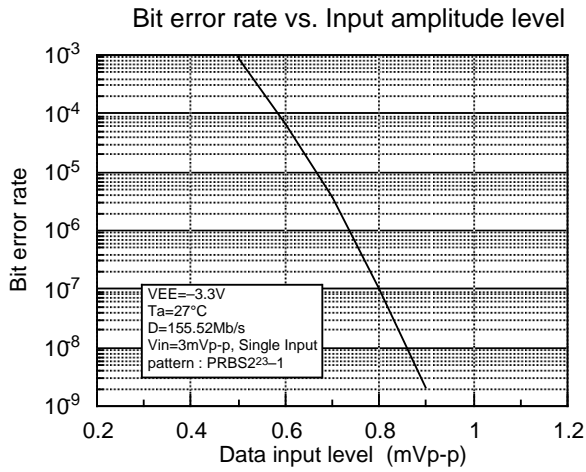


Fig. 10

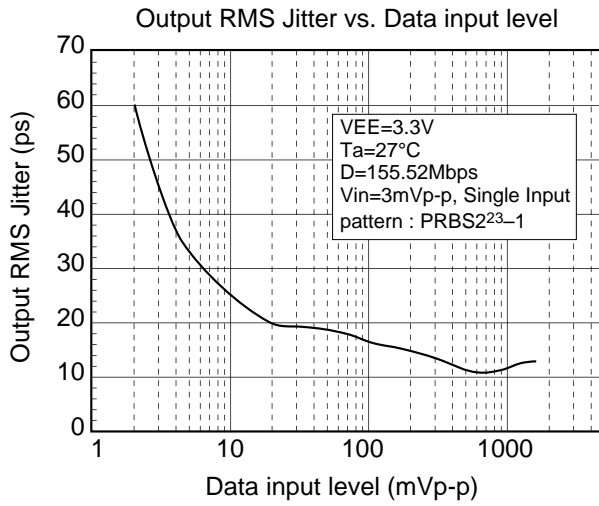
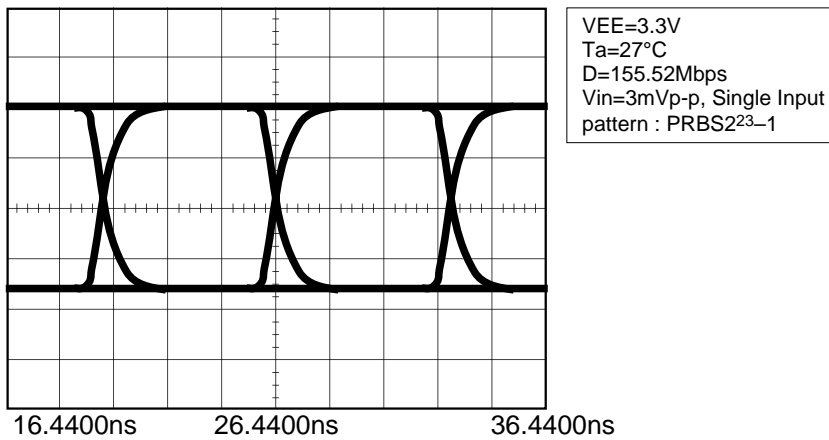


Fig. 11

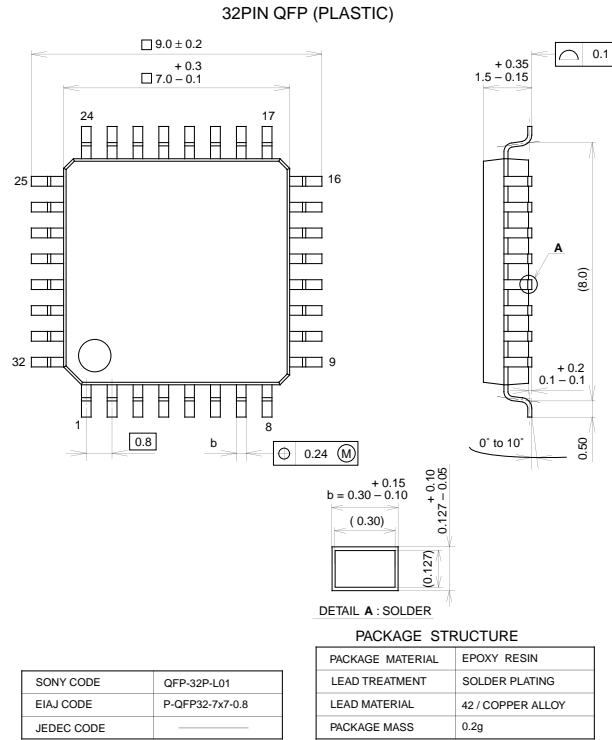
Q Output waveform



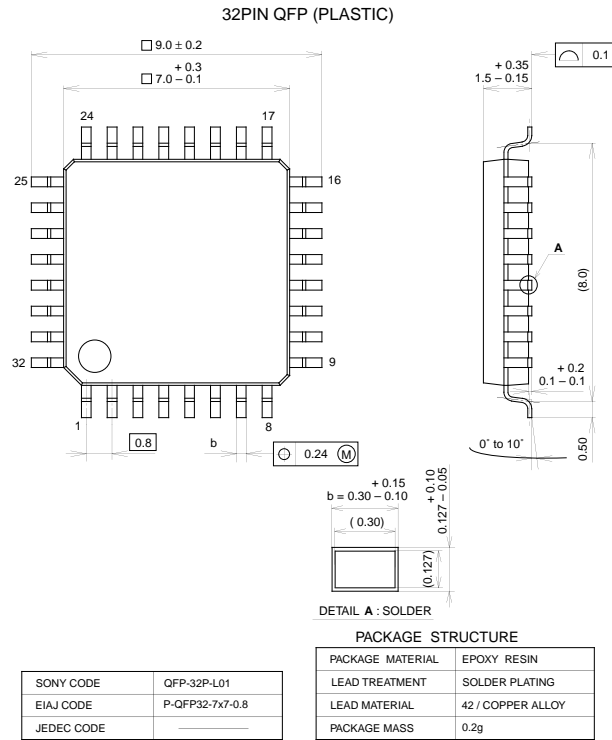
Ch. 1 = 200.0 mVolts/div
Timebase = 2.00 ns/div

Offset = 680.0 mVolts
Delay = 26.4400 ns

Package Outline Unit : mm



Kokubu Ass'y



LEAD PLATING SPECIFICATIONS

ITEM	SPEC.
LEAD MATERIAL	42 ALLOY
SOLDER COMPOSITION	Sn-Bi Bi:1-4wt%
PLATING THICKNESS	5-18µm



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