

# Preservo amplifier for CD players

## BA6387K

The BA6387K is a preservo amplifier for CD players. By using this paired with a ROHM DSP, a servo and main signal system can be configured with few external components and low power consumption.

### ●Applications

CD players

### ●Features

- 1) Internal RF and AGC circuits.
- 2) Internal APC circuit.
- 3) Internal auto asymmetry circuit.
- 4) Internal disc defect detector.
- 5) Internal focus protect function against disc defects.

### ●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V <sub>cc</sub>	9	V
Power dissipation	P <sub>d</sub>	400*	mW
Operating temperature	T <sub>opr</sub>	-25~+75	°C
Storage temperature	T <sub>stg</sub>	-55~+125	°C

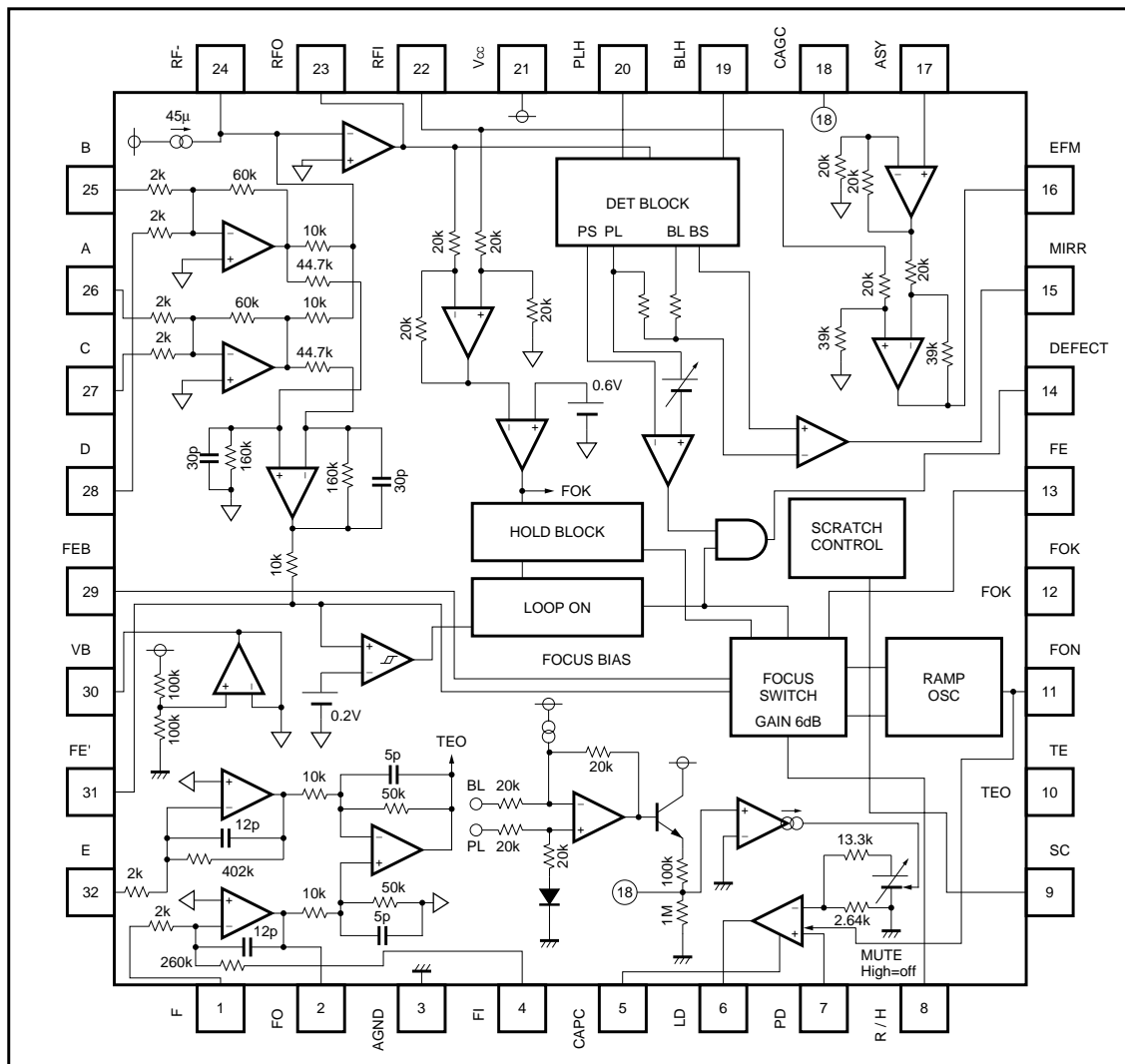
\* Reduced by 4mW for each increase in Ta of 1°C over 25°C.

### ●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V <sub>cc</sub>	2.4~5.5	V

Optical disc ICs

●Block diagram



## Optical disc ICs

## ●Pin descriptions

Pin No.	Pin name	Function	Pin No.	Pin name	Function
1	F	F input	17	ASY	Auto-asymmetry control input
2	FO	F output	18	CAGC	For capacitor for AGC constant
3	AGND	Analog GND	19	BLH	For capacitor for bottom long
4	FI	F gain adjustment feedback	20	PLH	For capacitor for peak long
5	CAPC	For capacitor for APC phase compensation	21	V <sub>cc</sub>	Power supply
6	LD	APC amplifier output	22	RFI	RF output capacity coupling reinput
7	PD	APC amplifier input	23	RFO	RF summing amplifier output
8	R / H	For capacitor for ramp wave/loop off	24	RF-	RF summing amplifier feedback input
9	SC	For resistor for scratch depth adjustment	25	B	B input
10	TE	Tracking error output	26	A	A input
11	FON	Focus on control	27	C	C input
12	FOK	Focus OK comparator output	28	D	D input
13	FE	Focus error output 1	29	FEB	Focus error bias input
14	DEFECT	Defect signal output	30	VB	Bias amplifier output
15	MIRR	Mirror signal output	31	FE'	Focus error output 2
16	EFM	EFM signal output	32	E	E input

## Optical disc ICs

●Electrical characteristics (unless otherwise noted, Ta = 25°C and V<sub>CC</sub> = 2.5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current	I <sub>Q</sub>	-	8.7	12.7	mA	-
(Bias amplifier)						
Bias voltage	V <sub>B</sub>	1.12	1.25	1.38	V	-
Maximum output high level voltage	I <sub>OH</sub>	3.0	-	-	mA	Bias fluctuation below 200mV
Maximum output low level voltage	I <sub>OL</sub>	3.0	-	-	mA	Bias fluctuation below 200mV
(RF amplifier)						
Output offset voltage	V <sub>OFRF</sub>	-1.02	-0.90	-0.78	V	*
Voltage gain	G <sub>RF</sub>	21.0	24.0	27.0	dB	V <sub>B</sub> = 0.8V, SG5 = 30mV <sub>P-P</sub> , 1kHz
Maximum output high level amplitude	V <sub>OHRF</sub>	0.90	1.10	-	V	Simultaneous AC and BD input
Maximum output low level amplitude	V <sub>OLRF</sub>	-	-1.10	-0.90	V	V <sub>9</sub> = V <sub>B</sub> + 0.25V, V <sub>B</sub> -0.05V *
Cutoff frequency	F <sub>CRF</sub>	-	6	-	MHz	-3dB point
(FE amplifier)						
Output offset voltage	V <sub>OFFE</sub>	-80	0	80	mV	*
Voltage gain AC	G <sub>F<sub>EAC</sub></sub>	26	29	32	dB	SG5 = 30mV <sub>P-P</sub> , 1kHz
Voltage gain BD	G <sub>F<sub>EBD</sub></sub>	26	29	32	dB	SG6 = 30mV <sub>P-P</sub> , 1kHz
Voltage gain difference	ΔG <sub>FE</sub>	-3	0	3	dB	-
Maximum output high level amplitude	V <sub>O<sub>HFE</sub></sub>	0.90	1.10	-	V	Measurement with AC and BD input
Maximum output low level amplitude	V <sub>OLFE</sub>	-	-1.10	-0.90	V	V <sub>9</sub> (V <sub>10</sub> ) = V <sub>B</sub> ± 0.15V *
Frequency characteristics	F <sub>CFE</sub>	19	22	25	dB	SG5 (SG6) = 60mV <sub>P-P</sub> , 60kHz
(TE amplifier)						
Output offset voltage	V <sub>OFTE</sub>	-80	0	80	mV	*
Voltage gain E	G <sub>TEE</sub>	27	30	33	dB	SG1 = 30mV <sub>P-P</sub> , 1kHz
Voltage gain F	G <sub>TEF</sub>	27	30	33	dB	SG2 = 30mV <sub>P-P</sub> , 1kHz
Voltage gain difference	ΔG <sub>TE</sub>	-3	0	3	dB	-
Maximum output high level amplitude	V <sub>O<sub>HTE</sub></sub>	0.90	1.10	-	V	V <sub>1</sub> = V <sub>B</sub> + 0.1V *
Maximum output low level amplitude	V <sub>OLTE</sub>	-	-1.10	-0.90	V	V <sub>2</sub> = V <sub>B</sub> + 0.1V *
Frequency characteristics	F <sub>CTE</sub>	19	22	25	dB	SG1 (SG2) = 60mV <sub>P-P</sub> , 60kHz
(FOK comparator)						
Input pin 22						
Threshold voltage	V <sub>THFK</sub>	-0.42	-0.30	-0.18	V	*
Output high level voltage	V <sub>O<sub>HFK</sub></sub>	2.0	-	-	V	V <sub>7</sub> = V <sub>B</sub> -0.42V
Output low level voltage	V <sub>OLFK</sub>	-	-	0.5	V	V <sub>7</sub> = V <sub>B</sub> -0.18V
Maximum operating frequency	F <sub>MXFK</sub>	45	-	-	kHz	-
(Asymmetry amplifier)						
Output offset voltage	V <sub>OFAS</sub>	-60	-	60	mV	*
Voltage gain 1	G <sub>1AS</sub>	3	6	9	dB	Input pin 22, 80mV <sub>P-P</sub> , 1kHz
Voltage gain 2	G <sub>2AS</sub>	8.5	11.5	14.5	dB	Input pin 17, 80mV <sub>P-P</sub> , 1kHz
Maximum output high level amplitude	V <sub>O<sub>HAS</sub></sub>	0.90	1.10	-	V	V <sub>7</sub> = V <sub>B</sub> ± 0.8
Maximum output low level amplitude	V <sub>OLAS</sub>	-	-1.10	-0.90	V	V <sub>6</sub> = V <sub>B</sub> ± 0.4 *

## Optical disc ICs

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
(APC)						
Output voltage 1	V <sub>O1AP</sub>	1.90	2.30	-	V	230mV input at pin 7
Output voltage 2	V <sub>O2AP</sub>	-	1.0	1.4	V	170mV input at pin 7, I <sub>2</sub> = 1mA
Reference voltage	V <sub>APR</sub>	190	200	210	mV	-
Frequency characteristics	F <sub>AP</sub>	-5	-1	3	dB	SG7 = 40mV <sub>P-P</sub> , 500Hz
(AGC)						
Reference voltage 1	V <sub>AGC1</sub>	0	-	100	mV	V <sub>8</sub> = 0.8V, RFO = 1.2V <sub>P-P</sub>
Reference voltage 2	V <sub>AGC2</sub>	180	195	210	mV	V <sub>8</sub> = 0.8V, RFO = 0.7V <sub>P-P</sub>
Attack time	R <sub>ATT</sub>	70	100	130	kΩ	Measurement of internal R
Recovery time	R <sub>RCV</sub>	0.7	1.0	1.3	MΩ	
(Mirror detector)						
Output high level voltage	V <sub>OHR</sub>	2.0	-	-	V	R <sub>L</sub> = 15kΩ
Output low level voltage	V <sub>OLMR</sub>	-	-	0.5	V	-
Minimum operating frequency	F <sub>MNMR</sub>	-	-	600	Hz	-
Maximum operating frequency	F <sub>MXMR</sub>	30	-	-	kHz	-
Minimum input operating voltage	V <sub>MNMR</sub>	-	-	0.2	V <sub>P-P</sub>	-
Maximum input operating voltage	V <sub>MXMR</sub>	1.2	-	-	V <sub>P-P</sub>	-
(Defect detector)						
Output high level voltage	V <sub>OHRDF</sub>	2.0	-	-	V	R <sub>L</sub> = 15kΩ
Output low level voltage	V <sub>OLDF</sub>	-	-	0.5	V	-
Minimum operating frequency	F <sub>MNDF</sub>	-	-	1	kHz	-
Maximum operating frequency	F <sub>MXDF</sub>	2	-	-	kHz	-
Minimum input operating voltage	V <sub>MNDF</sub>	-	-	0.5	V <sub>P-P</sub>	-
Maximum input operating voltage	V <sub>MXDF</sub>	1.2	-	-	V <sub>P-P</sub>	-
Scratch depth	V <sub>SC</sub>	0.13	0.20	0.27	V	-
(Ramp wave generator circuit)						
Period	I <sub>SIRA</sub>	220	340	460	ms	-
High level limit voltage	V <sub>LHRA</sub>	80	124	168	mV	FEO output value *
Low level limit voltage	V <sub>LLRA</sub>	-168	-124	-80	mV	
(FON pin)						
Inflow current	I <sub>IFON</sub>	10.4	13.5	16.6	μA	-
Input threshold voltage	V <sub>THFO</sub>	1.10	1.45	1.80	V	-
(Loop on unit)						
Loop off delay time	t <sub>OFLO</sub>	4.0	6.6	10.0	ms	-
(FZC comparator)						
Input sensitivity level	V <sub>FZH</sub>	320	400	480	mV	-
Zero cross sensitivity level	V <sub>FZL</sub>	120	200	280	mV	-

\* Standards are with V<sub>B</sub> reference.

\*\* When FON is LOW, 8 voltage is V<sub>B</sub>.

\*\* The ramp wave begins at the bottom.

\*\* The loop will not turn on when the ramp wave is at the bottom.

\*\* Pin 8 is charged rapidly when the loop turns on.

Optical disc ICs

● Measurement circuit

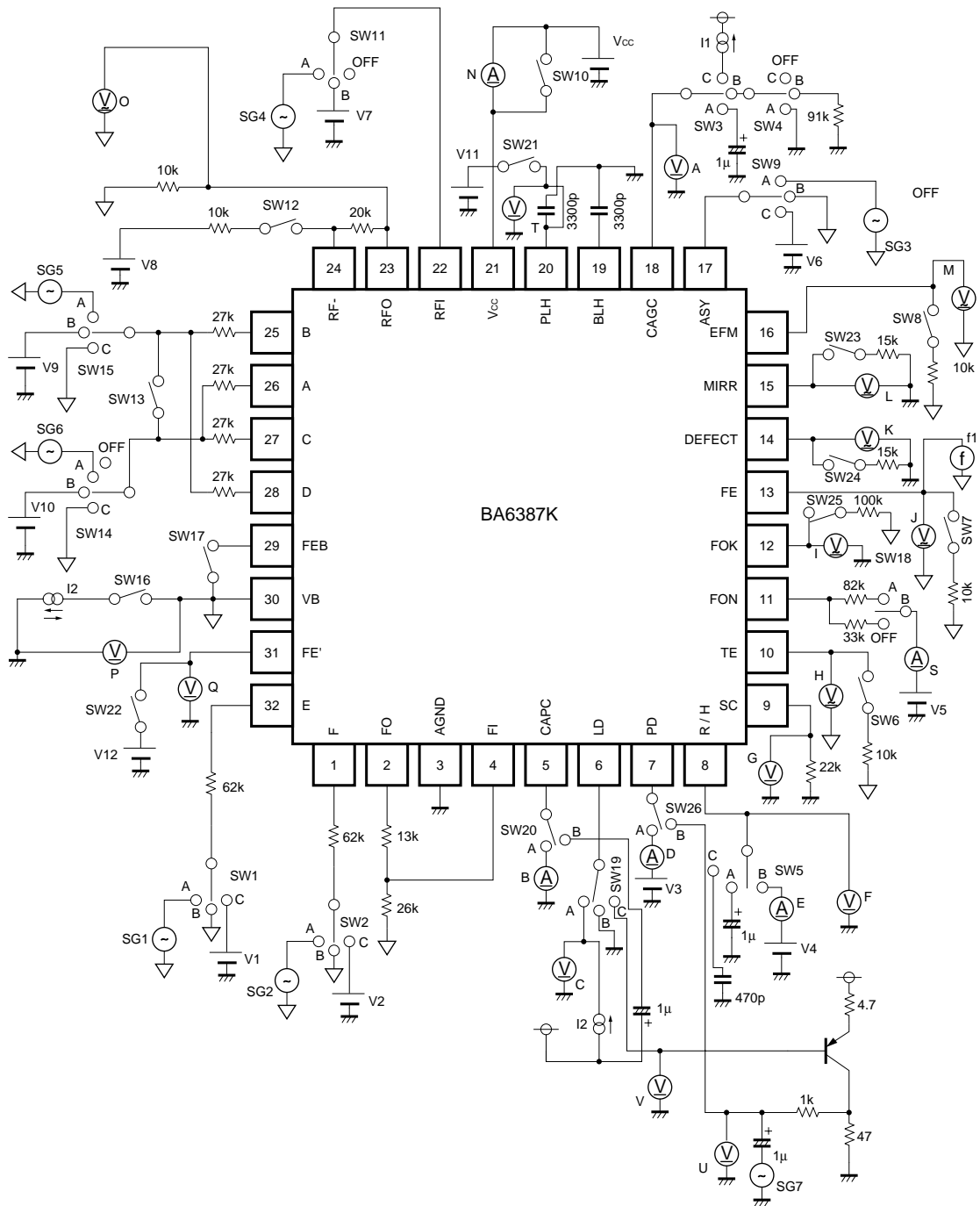


Fig.1

## Optical disc ICs

## ● Circuit operation

(1) RF amplifier, FOK comparator

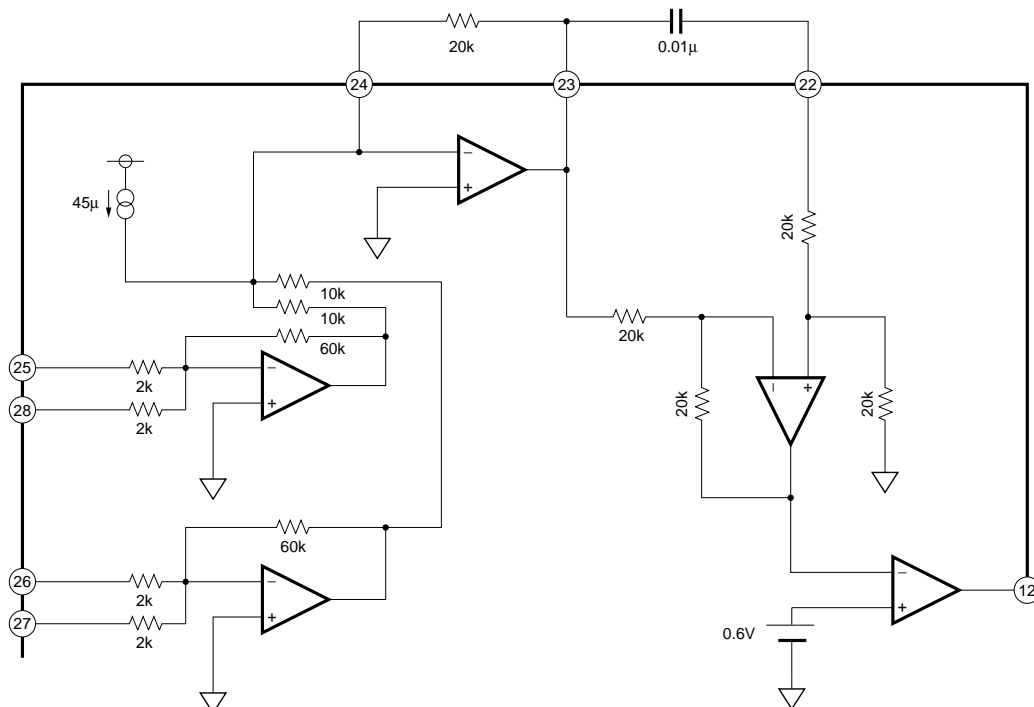


Fig.2 RF and FOK block

RFO is shifted downwards from  $V_B$  by 0.9V. However, the resistance between pins 23 and 24 is set to  $20k\Omega$  and if this resistance is changed use external components to adjust the shift back to 0.9V. Have the feedback resistance  $10k\Omega$  or greater. If the DC component of RF rises 0.3V, then FOK becomes high.

Optical disc ICs

(2) FE amplifier and focus search

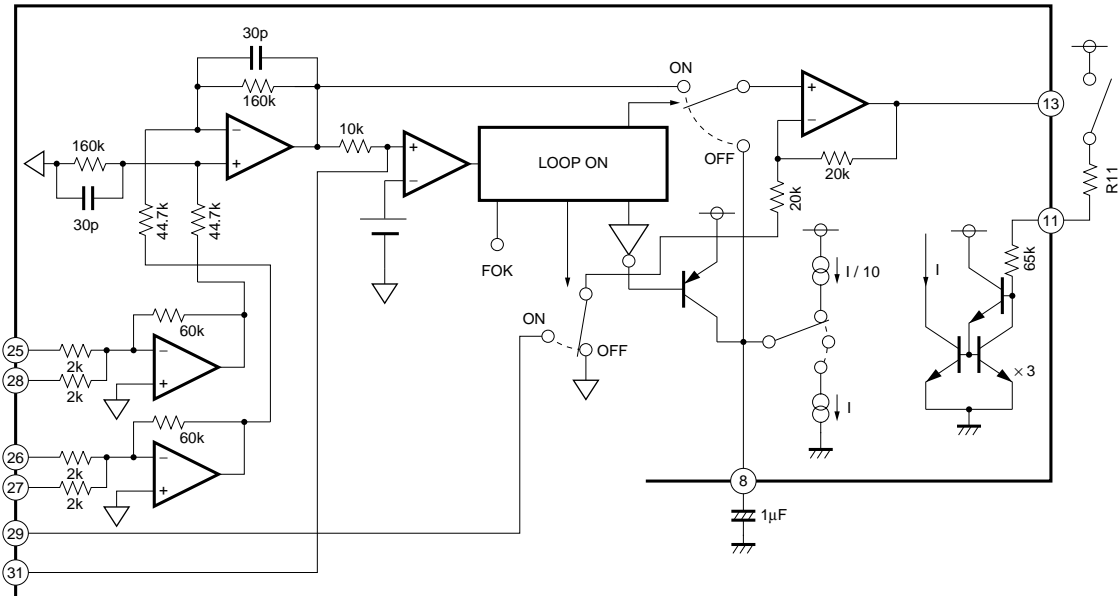


Fig.3 Focus error block

The voltage for focus search is obtained by the charging and discharging of the capacitor attached to pin 8. The charging current is  $I / 10$  and the discharging current is  $I$ . The FEO output amplitude ( $V_{SERCH}$ ) at this time is determined by the formula given below.

$$V_{SERCH} = \pm I \times 15k\Omega \times 2 (V_B \text{ reference})$$

Moreover, from Fig.3,  $I$  can be approximated by the formula given below.

$$I = \frac{V_{CC} - 1.4}{65k + R11} \times \frac{1}{3}$$

Set R11 so that  $I$  becomes  $2\mu A$  or greater. Apply biasing to the focus error signal from pin 29. If no adjustment occurs, pin 29 =  $V_B$ .

The timing charts when the focus loop turns ON or OFF are given on the next page.

Optical disc ICs

(1) LOOP ON timing

When FOK turns high, the fall of FE' is detected and the FOCUS LOOP turns ON.

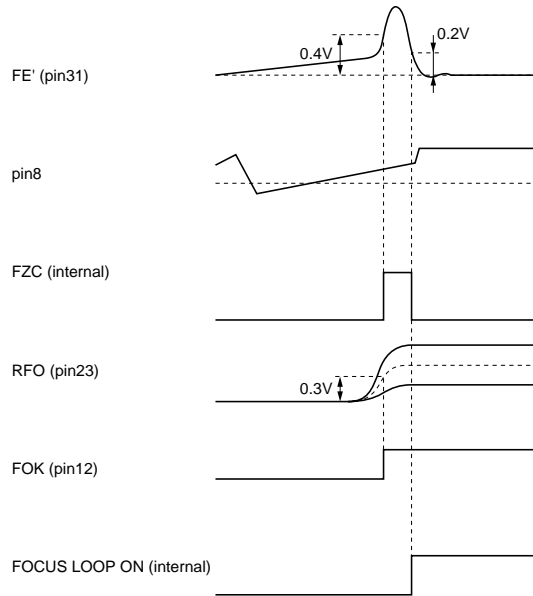


Fig.4 LOOP ON timing

(2) LOOP OFF timing

After FOK turns low, the FOCUS LOOP turns OFF after the delay T (s) shown in the figure below.

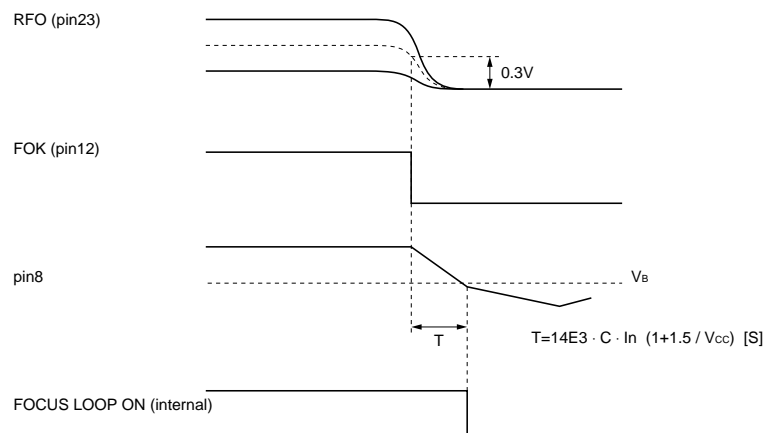


Fig.5 LOOP OFF timing

## Optical disc ICs

## (3) APC block and AGC block

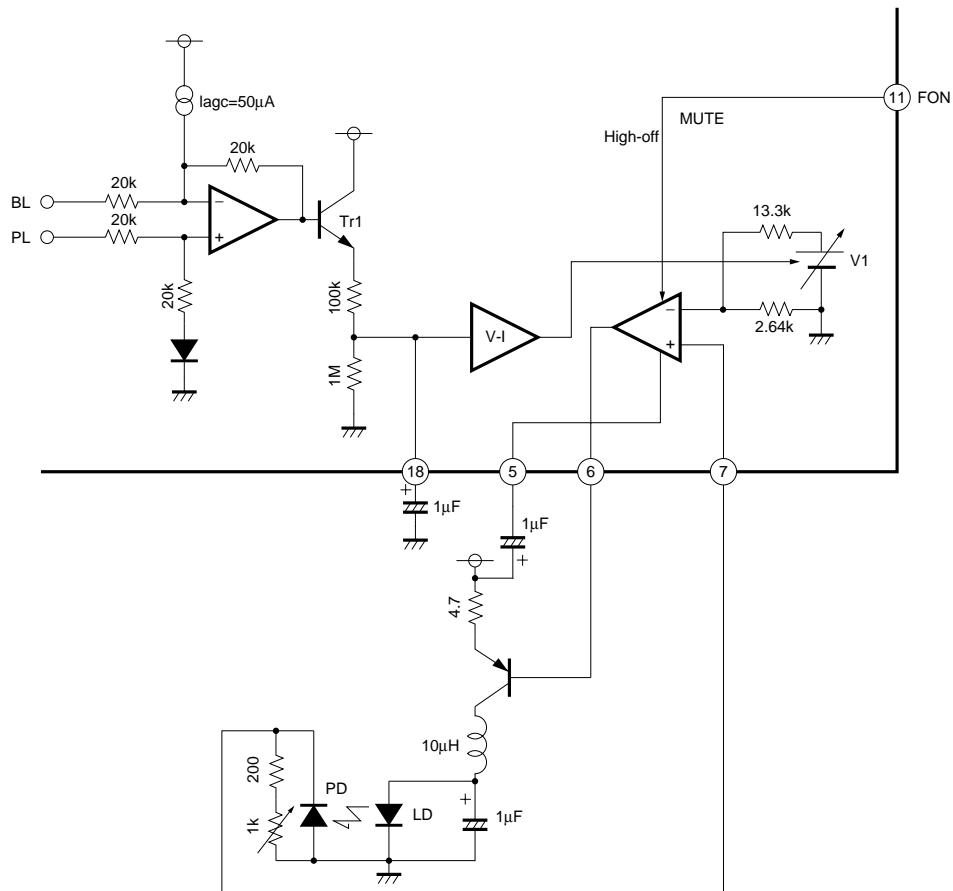


Fig.6 APC and AGC blocks

The initial setting for V1 is 1.2V. When PL-BL (the RF AC amplitude) exceeds a certain value ( $V_{AGC}$ ), then AGC lowers V1 and suppresses the laser power. The value of  $V_{AGC}$  is  $(50\mu A \times 20k) = 1V$ .

When defect turns high, Tr1 turns OFF. When FON (pin 11) is low, the LD output (pin 6) becomes high.

Optical disc ICs

(4) DET block

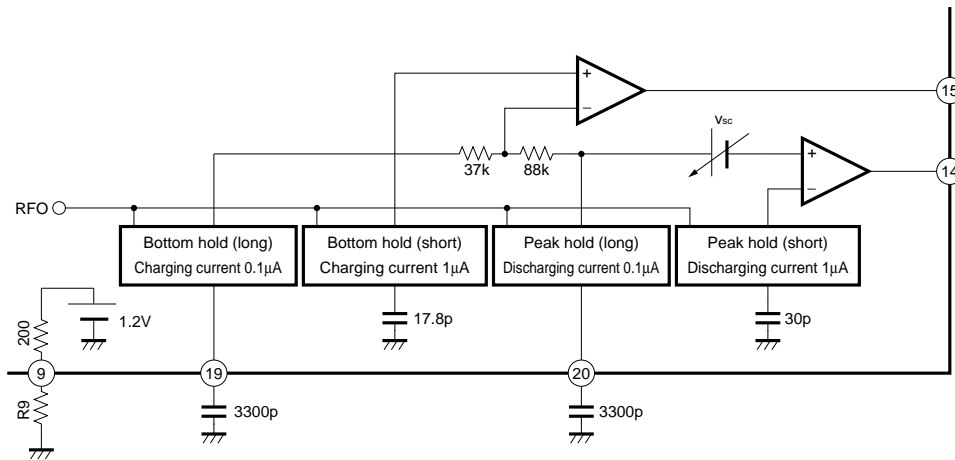


Fig.7 DET block

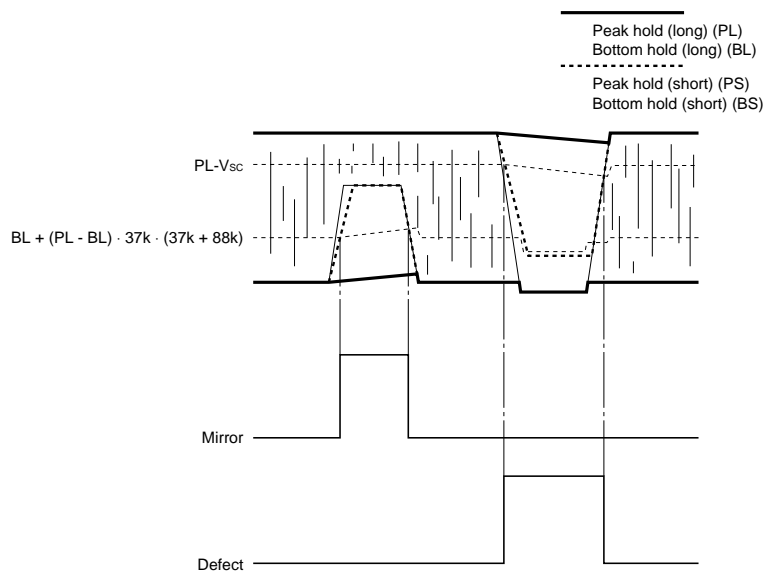


Fig.8 Defect and mirror generation

When defect is high, the bottom hold (long) charging current is 50μA. The scratch depth ( $V_{sc}$ ) can be adjusted by changing the resistance at pin 9.

$$V_{sc} = \frac{12}{R_9 + 200} \times 4k$$

The peak hold voltage will not go below (GND + 0.9V) and the bottom hold voltage will not go below ( $V_{cc} - 0.9V$ ).

Optical disc ICs

●Application example

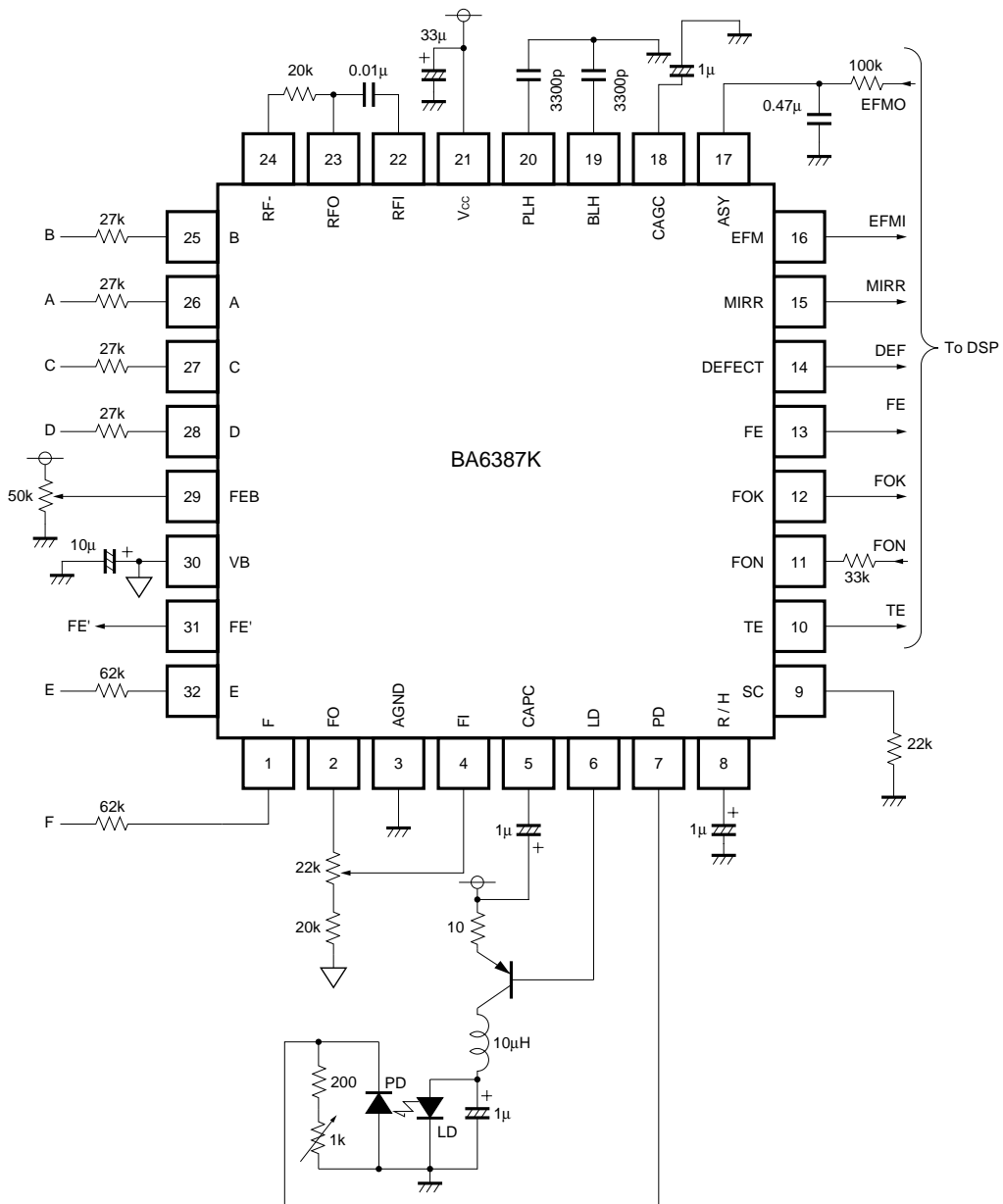


Fig.9

Optical disc ICs

●Electrical characteristics curves

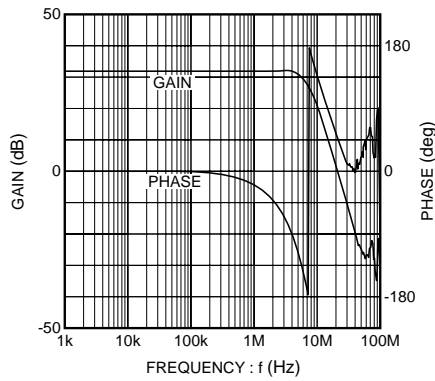


Fig.10 RF amplifier frequency characteristics

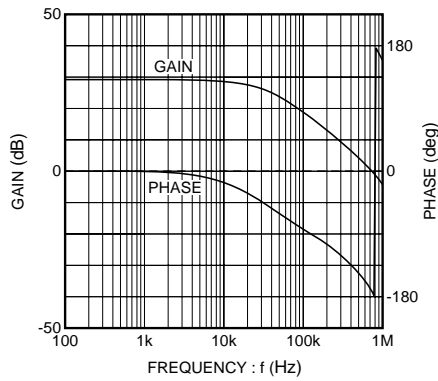


Fig.11 FE amplifier frequency characteristics

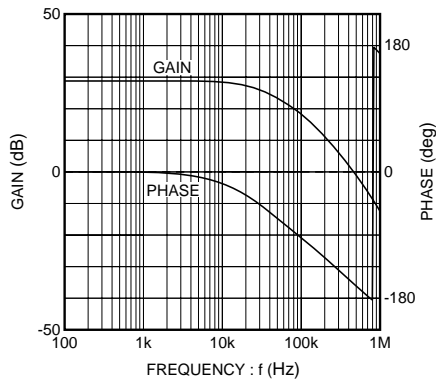
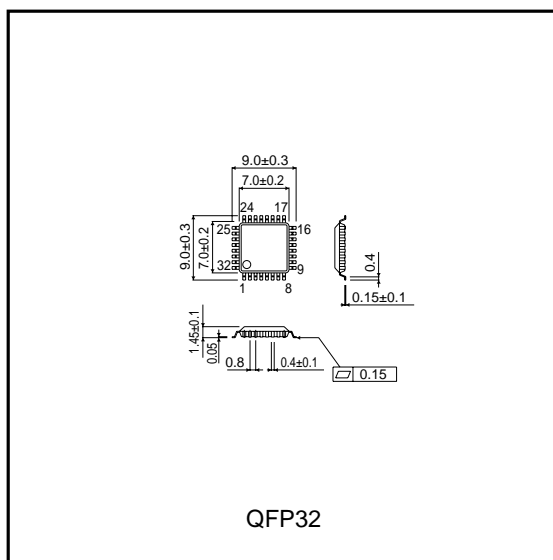


Fig.12 TE amplifier frequency characteristics

●External dimensions (Units : mm)



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