AN8771NFH

Pre-amplifier IC for MD

■ Overview

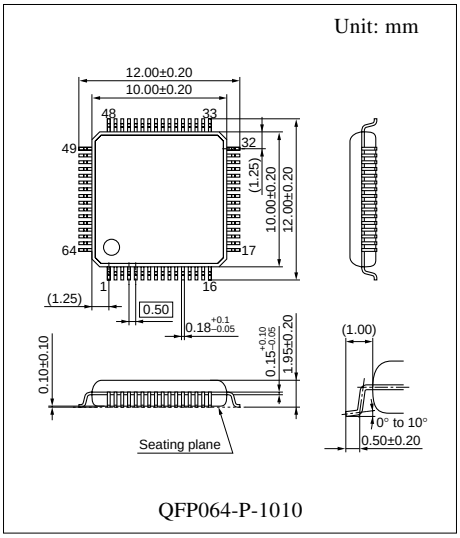
The AN8771NFH is an MD pre-amplifier IC of wide range of supply voltage (V_{CC} = 2.7 V to 5.5 V). This IC can form an MD system using 3-beam pick-up in combination with the MN66614 digital signal processing LSI.

■ Features

- Applicable for 3-beam pick-up
- RF signal processing
- Error signal generating function for servo
- Various status detection function
- Laser power control circuit

■ Applications

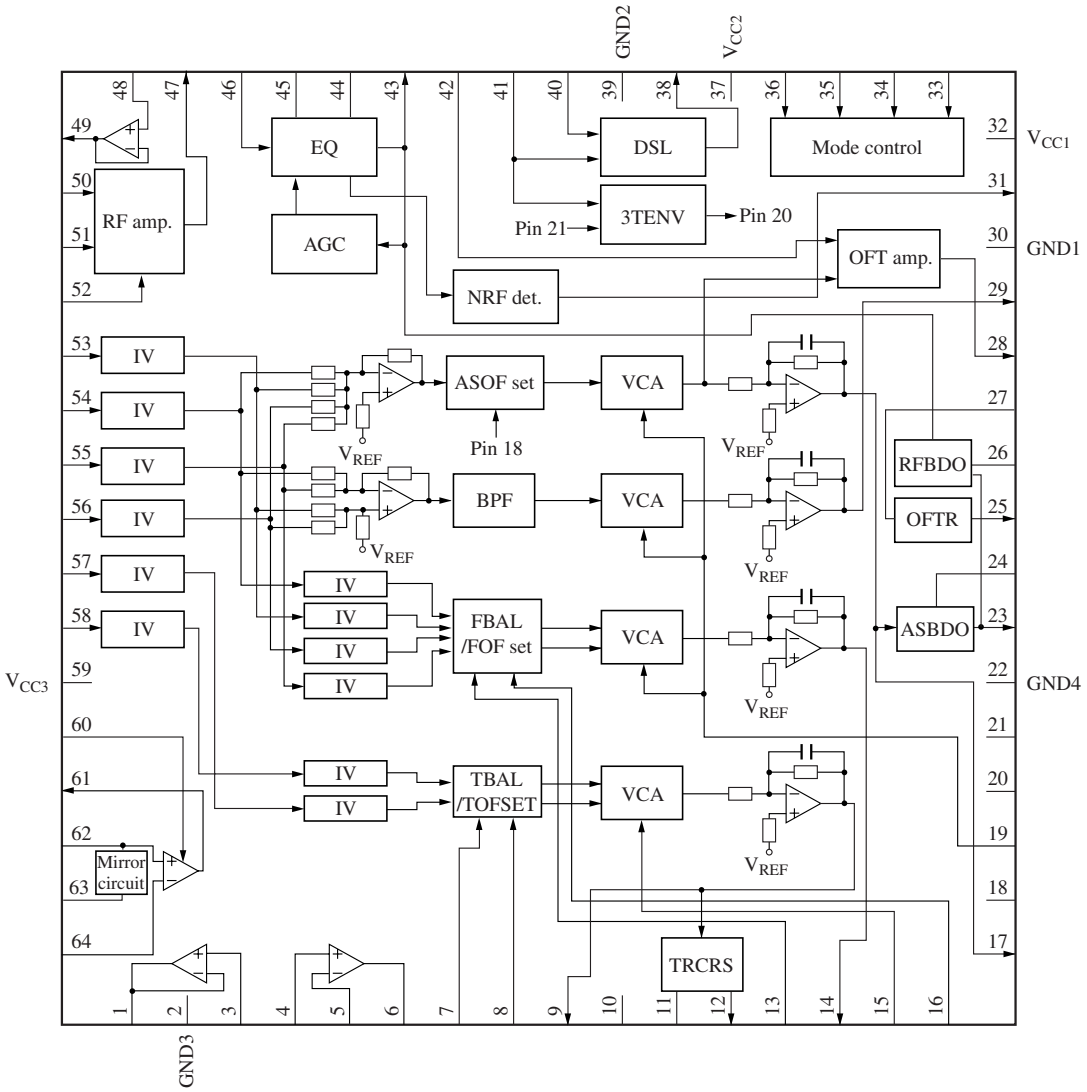
- MD



QFP064-P-1010

Note) The package of this product will be changed to lead-free type (QFP064-P-1010A). See the new package dimensions section later of this datasheet.

■ Block Diagram



■ Pin Descriptions

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	REFO	APC reference voltage buffer output pin	9	TE	Tracking error signal output pin
			10	N.C.	
2	GND3	APC circuit GND pin	11	CCRS	Capacitor connection pin for track cross circuit
3	APCREF	APC reference voltage input pin			
4	TEMPIN+	Temperature sensor amp. + input pin	12	TRCRS	Track cross output pin
5	TEMPIN–	Temperature sensor amp. – input pin	13	FBAL	Focus balance adjustment pin
6	TEMP	Temperature sensor amp. output pin	14	FE	Focus error signal output pin
7	TOFS	Tracking offset adjustment pin	15	TGAIN	TE amp. gain adjustment pin
8	TBAL	Tracking balance adjustment pin	16	FOFS	Focus offset adjustment pin

■ Pin Descriptions (continued)

Pin No.	Symbol	Description	Pin No.	Symbol	Description
17	AS	Main beam light quantity sum signal output pin	38	PEFMS	Data slice output pin
			39	GND2	Data slice circuit GND pin
18	ASOFS	AS offset adjustment pin	40	PEFM	Data slice level setting pin
19	ASGAIN	Amp. gain adjustment pin for main beam system	41	EFMIND	Data slice signal input pin
			42	EFMINS	EFM detection input pin
20	MON3T	3T envelope detection output pin	43	OUTRF	EFM output pin
21	CEA	Capacitor connection pin for 3T envelope detection	44	CRFAGC	RFAGC capacitor connection pin
			45	EQADJ	EQ setting pin
22	GND4	GND for FE/TE system	46	EQIN	EQ input pin
23	BDO	AS drop-out detection signal output pin	47	ARFO	RF amp. output pin
			48	SVREF	Reference signal input pin
24	CBDOG	BDO detection capacitor connection pin	49	VREF	Reference signal output pin
			50	RF1	RF1 signal input pin
25	OFTR	Off-track signal output pin	51	RF2	RF2 signal input pin
26	CBDOP	RFBDO detection capacitor connection pin	52	SWMS	Pit RF amp. polarity setting pin
			53	B	Main beam B signal input pin
27	OFTIN	Off-track detection signal input pin	54	A	Main beam A signal input pin
28	OFTO	Off-track detection signal output pin	55	D	Main beam D signal input pin
29	ADIP	ADIP FM signal output pin	56	C	Main beam C signal input pin
30	GND1	GND pin	57	F	Side beam F signal input pin
31	NRFDET	RF detection signal output pin	58	E	Side beam E signal input pin
32	V_{CC1}	V_{CC} pin	59	V_{CC3}	APC circuit V_{CC} pin
33	RFSWHL	Reflection factor changeover signal input pin	60	LDON	LD amp. on/off control signal input pin
34	RFSWPG	Pit/group changeover signal input pin	61	LDO	LD amp. output pin
			62	APCPD+	Photo diode light quantity detection pin
35	NREC	Recording/playback change over signal input pin			
			63	APCPD−	PD polarity reversing current input pin
36	NRFSTBY	Standby control signal input pin	64	REFIN	APC amp. reference voltage input pin
37	V_{CC2}	Data slice circuit V_{CC} pin			

■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	6.0	V
Supply current	I_{CC}	35	mA
Power dissipation *	P_D	210	mW
Operating ambient temperature *	T_{opr}	−30 to +85	°C
Storage temperature *	T_{stg}	−55 to +125	°C

Note) 1. Except for the operating ambient temperature and storage temperature, all ratings are for T_a = 25°C.
2. *: V_{CC1} , V_{CC2} , V_{CC3} are of same voltage.

■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	V_{CC1} V_{CC2} V_{CC3}	2.7 to 5.5	V

■ Electrical Characteristics at T_a = 25°C

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
No load current consumption 1	I_{TOTAL1}	Normal mode	19.6	24.5	29.4	mA
No load current consumption 2 (Power saving mode)	I_{TOTAL2}	Power saving mode	1.0	1.7	2.5	mA
V_{REF} offset	ΔV_{OVB}	$V_{48} = V_{32} / 2$	−7	0	7	mV
V_{REF} output impedance	Z_{VB}	I_{49} = ±3 mA	—	—	5	Ω
LD amp. off operation	V_{LDOFF}	LD amp. off mode	—	—	0.4	V
LD amp. gain	G_{LD}	V_{62}: 1 kHz sine wave (50 mV[p-p], DC offset voltage = V_{REF} − 25 mV)	18	20	22	dB
FE offset + adjustment	ΔV_{OFO+}	$V_{16} = V_{REF}$ − 0.5 V $V_{19} = V_{REF}$ − 0.5 V	100	—	—	mV
FE offset − adjustment	ΔV_{OFO-}	$V_{16} = V_{REF}$ + 0.5 V $V_{19} = V_{REF}$ − 0.5 V	—	—	−100	mV
FE gain 1	G_{FEA1}	V_{54}: 5 kHz sine wave (40 mV[p-p], DC offset voltage = V_{REF} − 25 mV) $V_{19} = V_{REF}$ − 0.5 V	20	23	26	dB
FE relative gain 2	G_{FEA2}	V_{54}: 5 kHz sine wave (300 mV[p-p], DC offset voltage = V_{REF} − 160 mV) $V_{19} = V_{REF}$ + 0.5 V	—	—	−18	dB
FE frequency characteristics A	ΔG_{FEACA}	V_{54}: 50 kHz sine wave (300 mV[p-p], DC offset voltage = V_{REF} − 160 mV) $V_{19} = V_{REF}$ − 0.5 V	−6	−3	0	dB
FBAL adjustment range 12	ΔG_{FB12}	$V_{13} = V_{REF}$ ± 0.5 V $V_{19} = V_{REF}$ + 0.5 V	—	−12	−9.6	dB

■ Electrical Characteristics at T_a = 25°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
FBAL adjustment range 34	ΔG_{FB34}	$V_{13} = V_{REF} \pm 0.5$ V $V_{19} = V_{REF} + 0.5$ V	9.6	12	—	dB
TE offset + adjustment	ΔV_{OTO+}	$V_7 = V_{REF} - 0.5$ V $V_{15} = V_{REF} - 0.5$ V Pit mode	100	—	—	mV
TE offset − adjustment	ΔV_{OTO-}	$V_7 = V_{REF} + 0.5$ V $V_{15} = V_{REF} - 0.5$ V Pit mode	—	—	−100	mV
TE gain 1	G_{TEE1}	V_{58}: 5 kHz sine wave (4 mV[p-p], DC offset voltage = $V_{REF} - 3$ mV) $V_{15} = V_{REF} - 0.5$ V, Pit mode	37.5	42.5	47.5	dB
TE relative gain 2	G_{TEE2}	V_{58}: 5 kHz sine wave (40 mV[p-p], DC offset voltage = $V_{REF} - 25$ mV) $V_{15} = V_{REF} + 0.5$ V, Pit mode	—	—	−18	dB
TE frequency characteristics E	ΔG_{TEACE}	V_{58}: 100 kHz sine wave (40 mV[p-p], DC offset voltage = $V_{REF} - 25$ mV) $V_{15} = V_{REF} + 0.5$ V, Pit mode	−6	−3	0	dB
TBAL adjustment range 12	ΔG_{TB12}	$V_8 = V_{REF} \pm 0.5$ V $V_{15} = V_{REF} + 0.5$ V, Pit mode	—	−3	−2.3	dB
TBAL adjustment range 34	ΔG_{TB34}	$V_8 = V_{REF} \pm 0.5$ V $V_{15} = V_{REF} + 0.5$ V, Pit mode	2.3	3	—	dB
AS offset + adjustment	ΔV_{OASO+}	$V_{18} = V_{REF} - 0.5$ V $V_{19} = V_{REF} - 0.5$ V	100	—	—	mV
AS offset − adjustment	ΔV_{OASO-}	$V_{18} = V_{REF} + 0.5$ V $V_{19} = V_{REF} - 0.5$ V	—	—	−100	mV
AS gain 1	G_{AS1}	V_{54}: 5 kHz sine wave (50 mV[p-p], DC offset voltage = $V_{REF} - 30$ mV) $V_{19} = V_{REF} - 0.5$ V	10.6	13.6	15.6	dB
AS relative gain 2	G_{AS2}	V_{54}: 5 kHz sine wave (300 mV[p-p], DC offset voltage = $V_{REF} - 160$ mV) $V_{19} = V_{REF} + 0.5$ V	—	—	−18	dB
AS OFTO amp. relative gain	ΔG_{ASOF}	V_{54}: 5 kHz sine wave (300 mV[p-p], DC offset voltage = $V_{REF} - 160$ mV) $V_{19} = V_{REF} + 0.5$ V, Group mode	5.8	6.8	7.8	dB
AS frequency characteristics	ΔG_{ASAC}	V_{54}: 50 kHz sine wave (300 mV[p-p], DC offset voltage = $V_{REF} - 160$ mV) $V_{19} = V_{REF} + 0.5$ V	−6	−3	0	dB
ADIP gain 1	G_{AD1}	V_{54}: 21.6 kHz sine wave (12 mV[p-p], DC offset voltage = $V_{REF} - 7$ mV) $V_{19} = V_{REF} - 0.5$ V	31	37	40	dB
ADIP relative gain 2	G_{ADVCA2}	V_{54}: 21.6 kHz sine wave (150 mV[p-p], DC offset voltage = $V_{REF} - 80$ mV) $V_{19} = V_{REF} + 0.5$ V	—	—	−18	dB

■ Electrical Characteristics at T_a = 25°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
ADIP frequency characteristics 1	ΔG_{ADf1}	V_{54}: 18 kHz sine wave (150 mV[p-p], DC offset voltage = V_{REF} − 80 mV) $V_{19} = V_{REF} + 0.5$ V	—	−3	0	dB
ADIP frequency characteristics 2	ΔG_{ADf2}	V_{54}: 26 kHz sine wave (150 mV[p-p], DC offset voltage = V_{REF} − 80 mV) $V_{19} = V_{REF} + 0.5$ V	—	−3	0	dB
RF amp. gain in group mode (playback)	G_{RFG}	V_{54}: 100 kHz sine wave (18 mV[p-p]) Group mode	18.8	20.8	22.8	dB
RF amp. gain in low reflection factor (playback)	G_{RFPL}	V_{54}: 100 kHz sine wave (120 mV[p-p]) Pit low reflection factor mode	1.5	3.5	5.5	dB
RF amp. gain in high reflection factor (playback)	G_{RFPH}	V_{54}: 100 kHz sine wave (300 mV[p-p]) Pit high reflection factor mode	−8	−6	−4	dB
RF amp. frequency characteristics in group mode (playback)	ΔG_{RFG}	V_{54}: 4 MHz sine wave (18 mV[p-p]) Group mode	−3	—	—	dB
RF amp. frequency characteristics in low reflection factor (playback)	ΔG_{RFPL}	V_{54}: 4 MHz sine wave (120 mV[p-p]) Pit low reflection factor mode	−3	—	—	dB
RF amp. frequency characteristics in high reflection factor (playback)	ΔG_{RFPH}	V_{54}: 4 MHz sine wave (300 mV[p-p]) Pit high reflection factor mode	−3	—	—	dB
EQ gain adjustment 1	ΔG_{EQ1}	V_{54}: 200 Hz, 720 kHz sine wave (100 mV[p-p]) V_{45} = GND, $V_{44} = V_{REF}$ − 0.2 V	—	1.5	3.0	dB
EQ gain adjustment 2	ΔG_{EQ2}	V_{54}: 200 Hz, 720 kHz sine wave (100 mV[p-p]) V_{45} = 400 mV, $V_{44} = V_{REF}$ − 0.2 V	3.5	5.0	—	dB
AGC operation	V_{OMRFV}	V_{46}: 500 kHz sine wave (200 mV[p-p])	420	520	620	mV
DSL pulse output duty	T_{DSL}	V_{41}: 720 kHz sine wave (500 mV[p-p])	47	50	53	%
NRF detection operation	V_{RFD}	V_{46}: 500 kHz sine wave (Amplitude sweep)	58	83	108	mV
NRF detection high-level voltage	V_{RFDH}	V_{46}: 500 kHz sine wave (Amplitude sweep)	2.1	—	3.0	V
NRF detection low-level voltage	V_{RFDL}	V_{46} : 500 kHz sine wave (Amplitude sweep)	0	—	0.4	V
TRCRS detection voltage 1	V_{H1TCR}	V_7: Sweep + 0 to max. +150 mV in DC refering to V_6 as reference	63	90	120	mV
TRCRS detection voltage 2	V_{H2TCR}	V_7: Sweep + 0 to max. −150 mV in DC refering to V_6 as reference	−120	−90	−63	mV
TRCRS high-level voltage	V_{TCRH}	$V_7 = V_6 + 100$ mV	2.1	—	3.0	V
TRCRS low-level voltage	V_{TCRL}	$V_7 = V_6 - 100$ mV	0	—	0.4	V
ASBDO detection current 1	I_{CBDO1}	Apply to the pin 24 DC voltage which is 200 mV higher than that at open	0.7	1.0	1.5	µA
ASBDO detection current 2	I_{CBDO2}	Apply to the pin 24 DC voltage which is 1.1 V higher than that at open	17	26	39	µA

■ Electrical Characteristics at T_a = 25°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
BDO high-level voltage	V_{BDOH}	$V_{17} < V_{REF} + 50$ mV	2.1	—	3.0	V
BDO low-level voltage	V_{BDOL}	V_{54}: Apply voltage so as to get $V_{17} = V_{REF} + 200$ mV	0	—	0.4	V
RFBDO detection current 1	$I_{CRFBDO1}$	V_{26}: Apply voltage 100 mV higher than that of at open	0.33	0.50	0.75	µA
RFBDO detection current 2	$I_{CRFBDO2}$	$V_{26} = V_{REF} + 0.3$ V	6.7	10	15	µA
RFBDO detection operation	t_{RFB}	V_{46}: 500 kHz sine wave (200 mV[p-p] → 0 mV[p-p]) V_{26}: Fix to DC voltage at which 200 mV[p-p] is inputted to V_{46}	15	30	60	µs
3T component envelope extracting gain	G_{3TMON}	V_{41}: 720 kHz AM sine wave modulation (500 mV[p-p]) AM sine wave: 5.3 kHz 20%	15.5	18.5	21.5	dB
OFTO EFM detection gain	G_{EFMOF}	V_{41}: 720 kHz AM sine wave modulation (500 mV[p-p]) AM modulation: 5.3 kHz 20% EFM detection output mode	−6	−3	0	dB
OFTIN detection level	ΔV_{OFTI}	V_{27}: Sweep V_{REF} − 100 mV to V_{REF} + 100 mV in DC	35	50	65	mV
OFTR high-level voltage	V_{OFTH}	$V_{27} = V_{REF} - 100$ mV	2.1	—	3.0	V
OFTR low-level voltage	V_{OFTL}	$V_{27} = V_{REF} + 100$ mV	0	—	0.4	V
TEMP amp. gain	G_{TM}	$V_5 = V_{REF} \pm 0.5$ V	−2	0	2	dB
REFO gain	G_{REFO}	V_3: 20 kHz sine wave (0.5 V[p-p])	−2	0	2	dB

■ Technical Data

1. Operation mode set by mode setting

<RF amp. gain> <IV amp.>

Operation mode \ Setting pin		NREC	RFSWPG	RFSWHL
Pit high reflection factor mode	Pit mode	High-level	High-level	High-level
Pit low reflection factor mode	MO pit playback mode	High-level	High-level	Low-level
Group mode	MO group playback mode	High-level	Low-level	Low-level
Operation off mode	MO recording mode	Low-level	—	—

<OFTO output signal>

Operation mode \ Setting pin	RFSWPG
EFM detection output mode	High-level
AS output mode	Low-level

■ Technical Data (continued)

1. Operation mode set by mode setting (continued)

<TE polarity changeover>

Operation mode \ Setting pin	RFSWPG
Pit mode	High-level
Group mode	Low-level

<LD amp. operation>

Operation mode \ Setting pin	LDON
Operation on mode	High-level
Operation off mode	Low-level

<Total operation>

Operation mode \ Setting pin	NREC
Normal mode	High-level
Power saving mode	Low-level

2. Voltage to be applied to setting pin

Setting	Pin name	Lower limit	Upper limit	Condition
High-level	RFSWHL	V_{CC1} − 0.5 V	V_{CC1}	SVREF = V_{CC1} / 2
	RFSWPG			
	NREC			
	NRFSTBY			—
	LDON	V_{CC3} − 0.5 V	V_{CC3}	
Low-level	RFSWHL	0 V	0.5 V	SVREF = V_{CC1} / 2
	RFSWPG			
	NREC			
	NRFSTBY			—
	LDON			

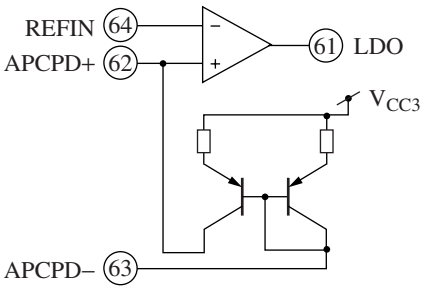
3. For SWMS (pin 52) setting

In the pit high reflection factor mode and low reflection factor mode, the polarity of ARFO (pin 47) through RF1 (pin 50)·RF2 (pin 51) is shown below by setting of SWMS:

SWMS	Polarity
High-level	Reverse
Low-level	Normal

■ Technical Data (continued)

4. Internal circuit of APCPD– (pin 63)

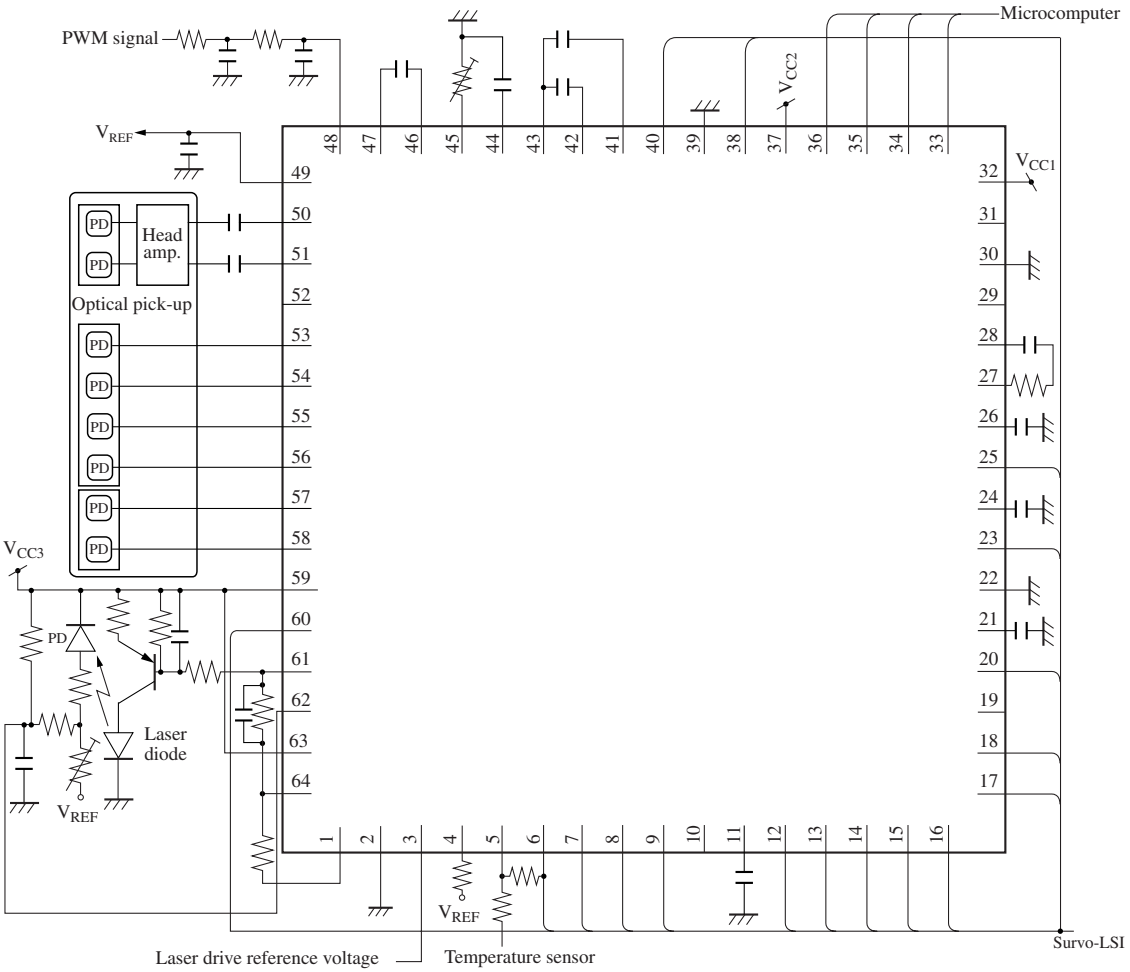


A current mirror circuit of which primary side is APCPD– is built-in. In case where output of secondary side is connected to APCPD+ and PD current for laser monitor is sunk to PD, the direction of current can be reversed by connecting the PD output to APCPD– .

Mirror ratio is 1 to 1 as the $h_{FE} = \infty$

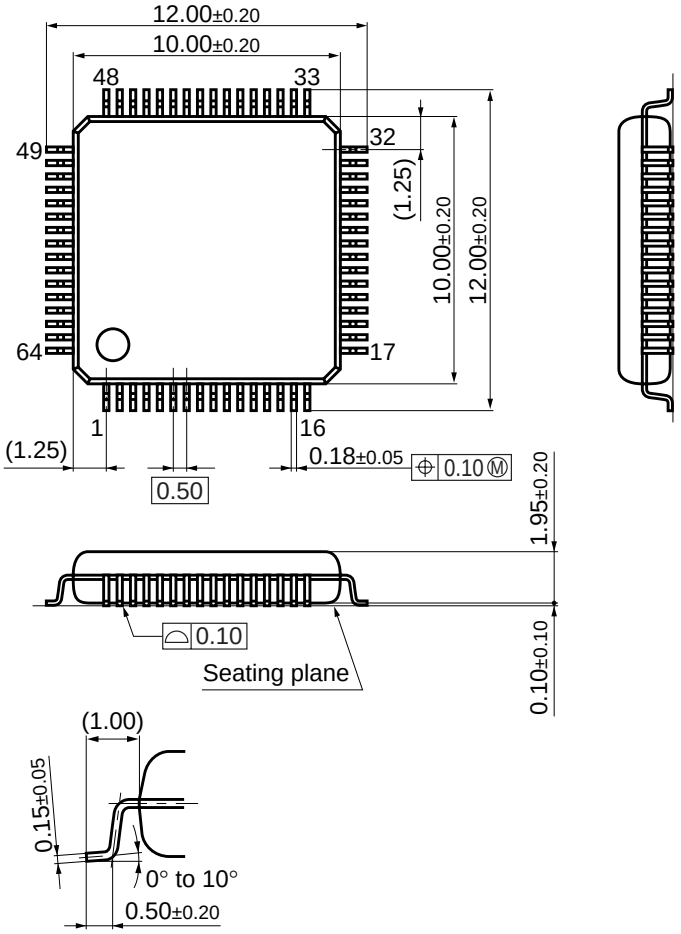
When using no current mirror, connect APCPD– to V_{CC3} .

■ Application Circuit Example



■ New Package Dimensions (Unit: mm)

• QFP064-P-1010A (Lead-free package)



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