

AN22011A

3-beam MD system pre-amplifier

■ Overview

The AN22011A incorporates such functions as RF signal processing, servo signal processing, ADIP signal processing and laser control. This is an RF IC that can constitute the MD system using 3-beam pick-up in combination with the digital signal processing LSI MN66621.

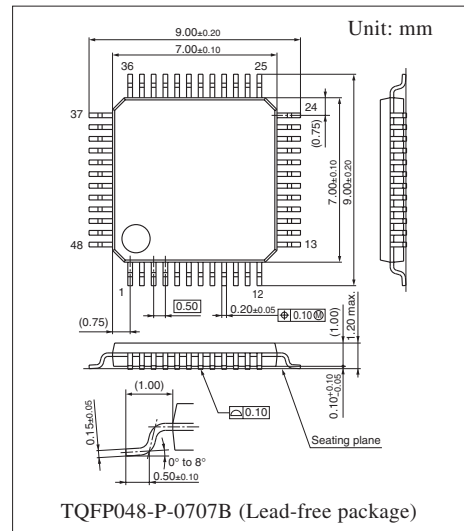
The IC allows us to achieve a considerable low power dissipation as well as its low supply voltage operation ($V_{CC} = 2.1 \text{ V}$ to 3.6 V) due to our introduction of digital matrix ($P_D = 11 \text{ mW}$ at $V_{CC} = 2.1 \text{ V}$). The IC can be used in a wide range of applications from a stand-alone system to a portable system.

■ Features

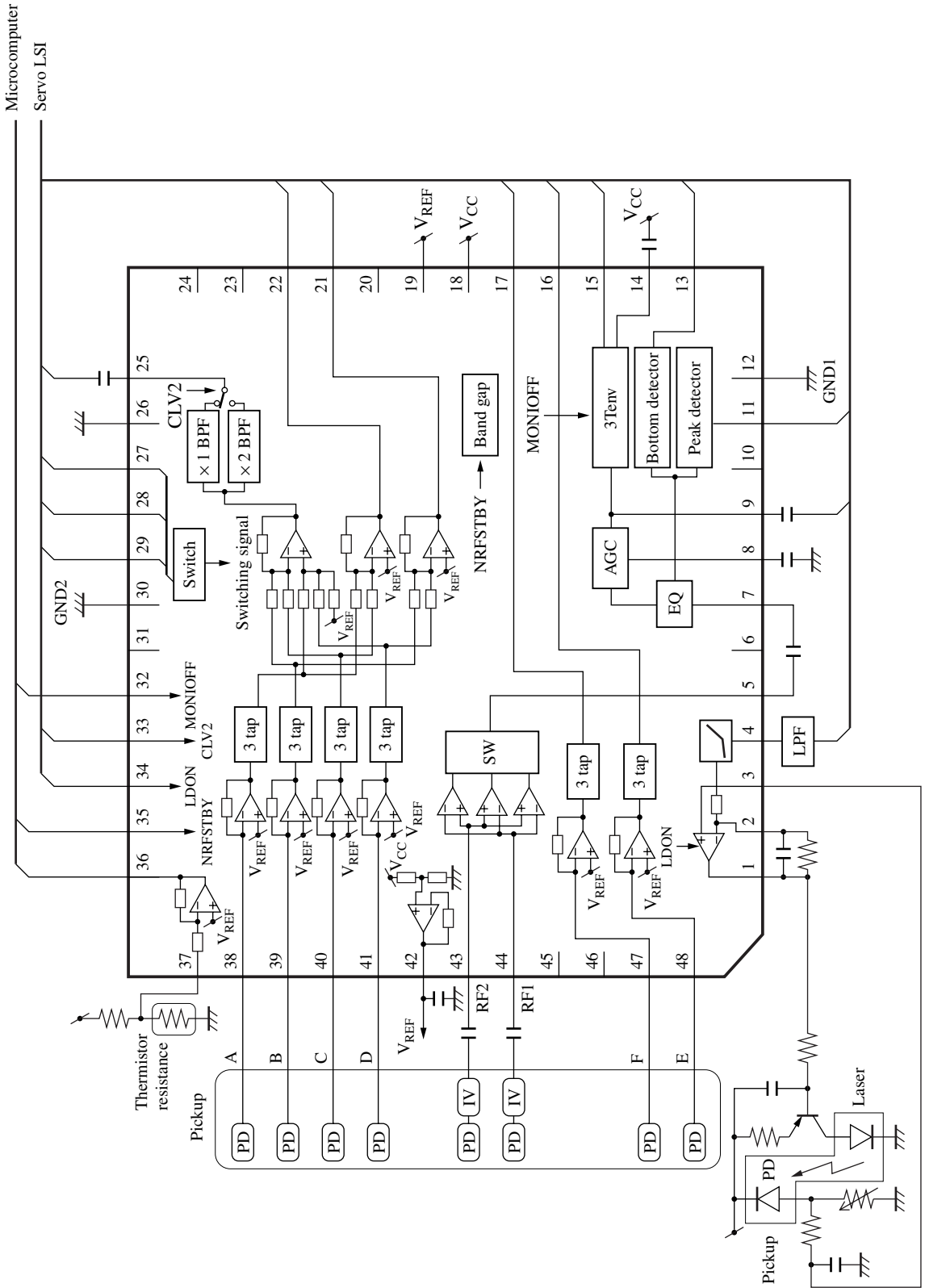
- 3-beam system pick-up
- RF signal processing
- Servo signal processing
- Laser power control function
- Low supply voltage operation (2.1 V to 3.6 V)
- Ultra low power consumption (min. 11 mW)
- Thin package adopted (Mold thickness: 1 mm)

■ Applications

- MD player/recorder
 - Home audio systems/mini systems
 - Portable audio
 - Car audio



■ Block Diagram



■ Pin Descriptions

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	LDO	LD amplifier output pin	26	OFSON	Te stray light canceling operation setting pin
2	LDIN	LD amplifier reverse input pin			
3	APCPD	Photo diode light quantity detector pin	27	NREC	Rec/playback switching signal input pin
4	APCREF	APC amplifier reference voltage input pin	28	RFSWHL	Reflection ratio H/L switching signal input pin
5	ARFO	RF amplifier output pin			
6	N.C.	—	29	RFSWPG	Pit/Grv switching signal input pin
7	EQIN	EQ input pin	30	GND2	GND pin 2
8	CRFAGC	RFAGC capacitor pin	31	N.C.	—
9	OUTRF	EFM output pin	32	MONIOFF	3TMON circuit control signal input pin
10	N.C.	—	33	CLV2	ADIP BPF switching signal input pin
11	PEAK	EFM bright level detection output pin	34	LDON	APC circuit control signal input pin
12	GND1	GND pin 1	35	NRFSTBY	Standby control signal input pin
13	BOTM	EFM dark level detection output pin	36	TEMP	Temperature sensor amplifier output pin
14	CEA	3T envelope detection capacitor pin	37	TEMPIN	Temperature sensor amplifier input pin
15	MON3T	3T envelope output pin	38	A	A signal input pin
16	EE	E signal I-V converting output pin	39	B	B signal input pin
17	FF	F signal I-V converting output pin	40	C	C signal input pin
18	V _{CC}	V _{CC} pin	41	D	D signal input pin
19	OFSIN	Te stray light canceling pin	42	V _{REF}	Reference signal output pin
20	N.C.	—	43	RF2	RF2 signal input pin
21	FF2	(A+C) signal I-V converting output pin	44	RF1	RF1 signal input pin
22	FF1	(B+D) signal I-V converting output pin	45	N.C.	—
23	N.C.	—	46	N.C.	—
24	N.C.	—	47	F	F signal input pin
25	ADIP	ADIP signal output pin	48	E	E signal input pin

■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V _{CC}	4.0	V
Supply current	I _{CC}	7.5	mA
Setting pin upper limit *2	V _{INH}	3.6	V
Power dissipation *1	P _D	30	mW
Operating ambient temperature *1	T _{opr}	−30 to +85	°C
Storage temperature *1	T _{stg}	−55 to +125	°C

Note) *1: Except for power dissipation, operating ambient temperature and storage temperature, all ratings are for T_a = 25°C.

*2: Setting pin refers to OFSON (pin 26), NREC (pin 27), RFSWHL (pin 28), RFSWPG (pin 29), MONIOFF (pin 32), CLV2 (pin 33), LDON (pin 34), NRFSTBY (pin 35).

■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	V_{CC}	2.1 to 3.6	V

■ Electrical Characteristics at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
No load consumption current 1	I_{TOTAL1}	Normal mode	4.5	5.5	6.5	mA
No load consumption current 2	I_{TOTAL2}	Sleep mode	200	300	400	μA
V_{REF} offset	ΔV_{OVb}	Normal mode	-50	0	50	mV
V_{REF} output impedance	Z_{VB}	$I_{42} = \pm 1.5 \text{ mA}$	—	—	5	Ω
LD amplifier OFF operation	V_{LDOFF}	APC OFF mode	—	—	0.2	V
LD amplifier gain playback mode	G_{LDP}	APC ON mode	-23	-20	-17	dB
LD amplifier gain recording mode	G_{LDR}	APC ON mode	-5.5	-2.5	0.5	dB
Temperature amplifier gain	G_{TM}	$V_{37} = V_{REF} \pm 0.75 \text{ V}$	-2	0	2	dB
FF1 offset	ΔV_{F1}	Pit high reflection ratio mode	-100	0	100	mV
FF2 offset	ΔV_{F2}	Pit high reflection ratio mode	-100	0	100	mV
FF1 gain pit high reflection ratio mode	Z_{FIRO}	Pit high reflection ratio mode	46.2	57.7	69.2	$\text{k}\Omega$
FF1 gain pit low reflection ratio mode	Z_{FIRA}	Pit low reflection ratio mode	197	250	303	$\text{k}\Omega$
FF1 gain record mode	Z_{FIRE}	Record mode	17.5	21.9	26.3	$\text{k}\Omega$
FF2 relative gain pit high reflection ratio mode	ΔZ_{F2RO}	Pit high reflection ratio mode	-2	0	2	dB
FF2 relative gain pit low reflection ratio mode	ΔZ_{F2RA}	Pit low reflection ratio mode	-2	0	2	dB
FF2 relative gain record mode	ΔZ_{F2RE}	Record mode	-2	0	2	dB
FF1 frequency characteristic	ΔG_{F1}	Pit high reflection ratio mode V_{38} : 3 kHz, 30 kHz Sine wave	-9	-6	-3	dB
FF2 frequency characteristic	ΔG_{F2}	Pit high reflection ratio mode V_{39} : 3 kHz, 30 kHz Sine wave	-9	-6	-3	dB
EE offset	ΔV_{EE}	Pit high reflection ratio mode	-750	-600	-450	mV
FF offset	ΔV_{FF}	Pit high reflection ratio mode	-750	-600	-450	mV
EE gain pit high reflection ratio mode	Z_{EERO}	Pit high reflection ratio mode	148	185	222	$\text{k}\Omega$
EE gain pit low reflection ratio mode	Z_{EERA}	Pit low reflection ratio mode	776	970	1164	$\text{k}\Omega$
EE gain record mode	Z_{EERE}	Record mode	88	110	132	$\text{k}\Omega$
FF relative gain pit high reflection ratio mode	ΔZ_{FFRO}	Pit high reflection ratio mode	-2	0	2	dB
FF relative gain pit low reflection ratio mode	ΔZ_{FFRA}	Pit low reflection ratio mode	-2	0	2	dB

■ Electrical Characteristics at $T_a = 25^\circ\text{C}$ (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
FF relative gain record mode	ΔZ_{FFRE}	Record mode	-2	0	2	dB
EE frequency characteristics	ΔG_{EE}	Pit high reflection ratio mode V_{48} : 1.5 kHz, 15 kHz Sine wave	-6	-3	-0.5	dB
FF frequency characteristics	ΔG_{FF}	Pit high reflection ratio mode V_{47} : 1.5 kHz, 15 kHz Sine wave	-6	-3	-0.5	dB
Te stray light canceling operation	ΔTOFS	Ram mode Stray light canceling mode	0.4	0.5	0.6	—
ADIP gain	G_{AD1}	Record mode Line double speed mode	24.0	27.0	30.0	dB
ADIP center frequency	F_{AD1}	Record mode Line double speed mode	35.2	44.0	52.8	kHz
ADIP band width	ΔF_{AD1}	Record mode Line double speed mode	23.7	29.6	35.5	kHz
ADIP relative gain typical speed mode	ΔG_{AD2}	Record mode Typical speed mode	-3	0	3	dB
RF amplifier gain groove mode	G_{RFG}	V_{43} : 100 kHz Sine wave Groove mode	19	22	25	dB
RF amplifier gain pit low reflection ratio mode	G_{RFPL}	V_{43} : 100 kHz Sine wave Pit low reflection ratio mode	3	6	9	dB
RF amplifier gain pit high reflection ratio mode	G_{RFPH}	V_{43} : 100 kHz Sine wave Pit high reflection ratio mode	-11.5	-8.5	-5.5	dB
RF amplifier frequency characteristics groove mode	ΔG_{RFG}	V_{43} : 5 MHz Sine wave Groove mode	-3	—	—	dB
RF amplifier frequency characteristics pit low reflection ratio mode	ΔG_{RFPL}	V_{43} : 5 MHz Sine wave Pit low reflection ratio mode	-3	—	—	dB
RF amplifier frequency characteristics pit high reflection ratio mode	ΔG_{RFPH}	V_{43} : 5 MHz Sine wave Pit high reflection ratio mode	-3	—	—	dB
EQ boost gain	ΔG_{EQ}	V_7 : 400 kHz, 1.44 MHz Sine wave $V_8 = V_{\text{REF}}$	2.5	3.5	4.5	dB
AGC operation	V_{OMRFV}	V_7 : 500 kHz Sine wave	0.4	0.5	0.6	V[p-p]
AGC discharge current	I_{AGC1}	V_7 : sin 500 mV[p-p], 720 kHz $V_8 = V_{\text{REF}}$	-140	-110	-80	μA
AGC charging current	I_{AGC2}	$V_7 = V_{\text{REF}}$, $V_8 = V_{\text{REF}}$	0.1	0.4	0.7	μA
EFM Peak peak detecting offset	ΔV_{PE}	$V_7 = V_{\text{REF}}$	-200	0	200	mV
EFM Peak peak detecting level	V_{PEAK}	V_7 : 720 kHz AM modulation Sine wave (1 kHz, 30%)	80	110	140	mV[p-p]
EFM bottom detecting offset	ΔV_{BO}	$V_7 = V_{\text{REF}}$	-200	0	200	mV
EFM bottom detecting relative level	ΔV_{BOTM}	V_7 : 720 kHz AM modulation Sine wave (1 kHz, 30%)	-20	0	20	mV[p-p]
3T element envelope extracting level	$V_{3\text{TMON}}$	V_7 : 720 kHz AM modulation Sine wave (5 kHz, 5%)	125	185	245	mV[p-p]

■ Usage Notes

1. Operation mode setting

- Gain switch setting

NREC (Pin27)	RFSWHL (Pin28)	RFSWPG (Pin29)	Operation mode
H	H	H	Pit high reflection ratio mode
H	L	H	Pit low reflection ratio mode
H	L	L	Groove mode
L	L	L	Record mode

- 3T detection circuit mode switch setting

MONIOFF (Pin32)	Operation mode
H	3T detection circuit off
L	3T detection circuit on

- ADIP BPF mode switch setting

CLV2 (Pin33)	Operation mode	BPF center frequency
H	Typical speed mode	$f_0 = 22.0 \text{ kHz}$
L	Line double speed mode	$f_0 = 44.0 \text{ kHz}$

Note) The values shown on the list are for design purpose.

- APC mode setting

LDON (Pin34)	Operation mode
H	APC circuit on
L	APC circuit off

- Power saving mode setting

NRFSTBY (Pin35)	Operation mode
H	Normal operation
L	Power saving operation

- Te stray light cancellation setting

OFSON (Pin26)	Operation mode
H	Cancellation circuit on
L	Cancellation circuit off

Note) This function is valid only for reading on the writable disk.

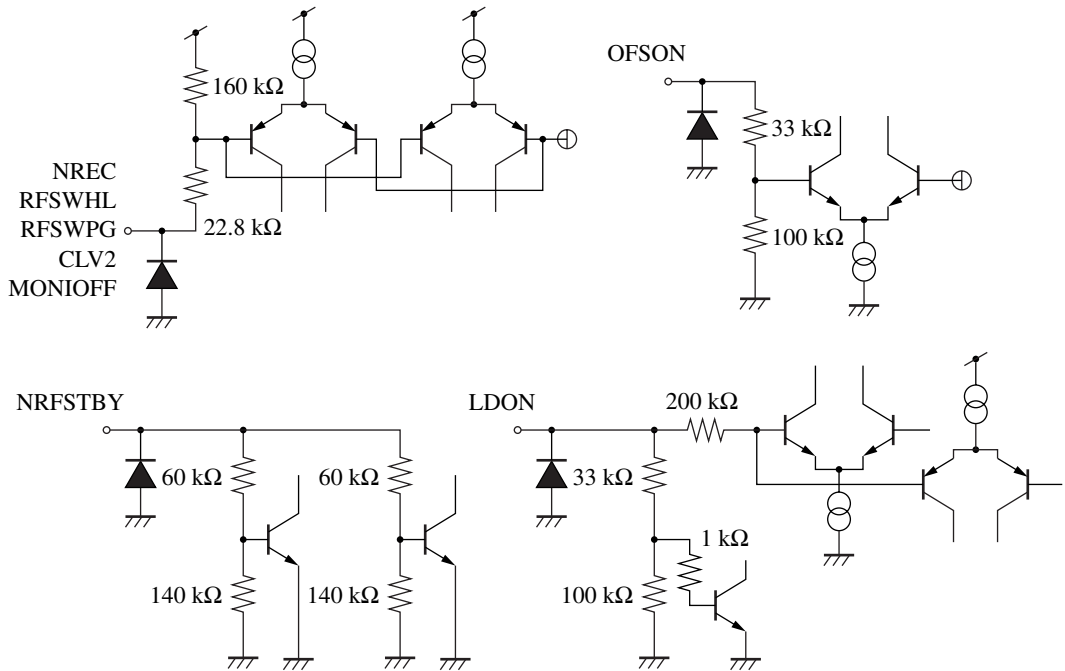
■ Usage Notes (continued)

2. Setting pin input voltage

Set the input voltages for OFSON (Pin26), NREC (Pin27), RFSWHL (Pin28), RFSWPG (Pin29), MONIOFF (Pin32), CLV2 (Pin33), LDON (Pin34) and NRFSTBY (Pin35). As listed below.

Setting	Input voltage
H	1.4 V to 3.6 V
L	0.7 V or less

The related equivalent circuits are as follows.



Note) The resistance values are for designing.

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