

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

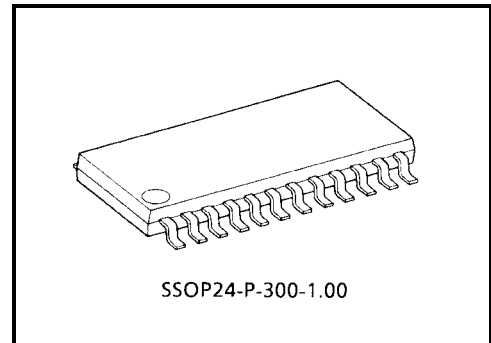
# TA2109F

## RF Amplifier for Digital Servo CD System

TA2109F is a 3-beam type PUH compatible RF Amplifier for Digital Servo to be used in the CD system.  
In combination with a CMOS single chip processor TC9432AF/TC9462F a CD system can be composed very simply.

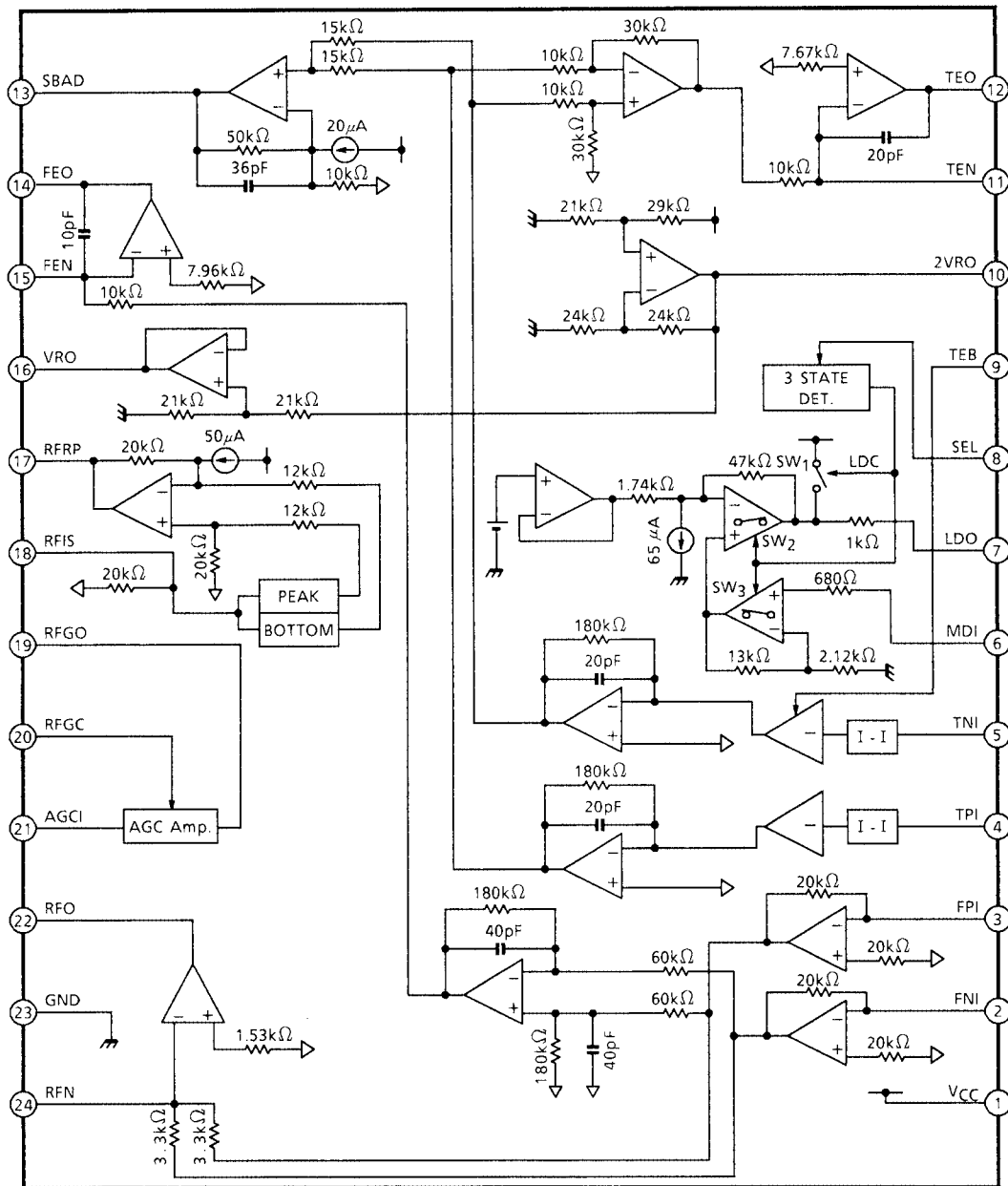
### Features

- Built in amplifier for reference ( $V_{REF}$ ,  $2 V_{REF}$ ) supply.
- Built in Auto Laser Power Control circuit.
- Built in RF amplifier.
- Built in focus error amp and tracking error amp.
- Built in sub-beam adder signal amplifier.
- Capable of tracking balance control with TC9432AF/TC9462F.
- Capable of RF gain adjustment circuit with TC9432AF/TC9462F.
- Built in signal amplifier for track counter.
- Capable of 4 times speed operation.
- 24 pin mini flat package.



Weight: 0.3 g (typ.)

## Block Diagram



SEL	LDC		
	SW1	SW2	SW3
L	ON	OFF	OFF
HiZ	OFF	ON	ON
H	OFF	ON	ON

## Pin Function

Pin No.	Symbol	I/O	Functional Description	Remark
1	V <sub>CC</sub>	—	Power supply input terminal	—
2	FNI	I	Main beam I-V amp input terminal	Connected to pin diode A, C
3	FPI	I	Main beam I-V amp input terminal	Connected to pin diode B, D
4	TPI	I	Sub beam I-V amp input terminal	Connected to pin diode F
5	TNI	I	Sub beam I-V amp input terminal	Connected to pin diode E
6	MDI	I	Monitor photo diode amp input terminal	Connected to monitor photo diode
7	LDO	O	Laser diode amp output terminal	Connected to laser control circuit
8	SEL	I	Laser diode control signal input terminal and APC circuit ON/OFF control signal input terminal	3 signal input (V <sub>CC</sub> , HiZ, GND)
9	TEB	I	Tracking error balance adjustment signal input terminal Controlled by 3 PWM signal (PWM carrier = 88.2 kHz)	3 signal input (2 V <sub>REF</sub> , VR, GND)
10	2VRO	O	Reference voltage (2 V <sub>REF</sub> ) output terminal 2 V <sub>REF</sub> = 4.2 V when V <sub>CC</sub> = 5 V	—
11	TEN	I	TE amp negative input terminal	Connected to TEO through feedback register
12	TEO	O	TE error signal output terminal	—
13	SBAD	O	Sub beam adder signal output terminal	—
14	FEO	O	Focus error signal output terminal	—
15	FEN	I	FE amp negative input terminal	Connected to FEO through feedback register
16	VRO	O	Reference voltage (V <sub>REF</sub> ) output terminal V <sub>REF</sub> = 2.1 V when V <sub>CC</sub> = 5 V	—
17	RFRP	O	Track count signal output terminal	—
18	RFIS	I	RFRP detect circuit input terminal	Connected to RFO through condenser
19	RFGO	O	RF gain signal output terminal	—
20	RFGC	I	RF amplitude adjustment control signal input terminal Controlled by 3 PWM signal (PWM carrier = 88.2 kHz)	3 signal input (2 V <sub>REF</sub> , VR, GND)
21	AGCI	I	RF signal amplitude adjustment amp input terminal	Connected to RFO through condenser
22	RFO	O	RF signal output terminal	—
23	GND	—	Ground terminal	—
24	RFN	I	RF amp negative input terminal	—

## Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Power supply voltage	V <sub>CC</sub>	8	V
Power dissipation	P <sub>D</sub>	400	mW
Operating temperature	T <sub>opr</sub>	-40~85	°C
Storage temperature	T <sub>stg</sub>	-55~150	°C

**Electrical Characteristics (unless otherwise specified,  $V_{CC} = 5\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )**

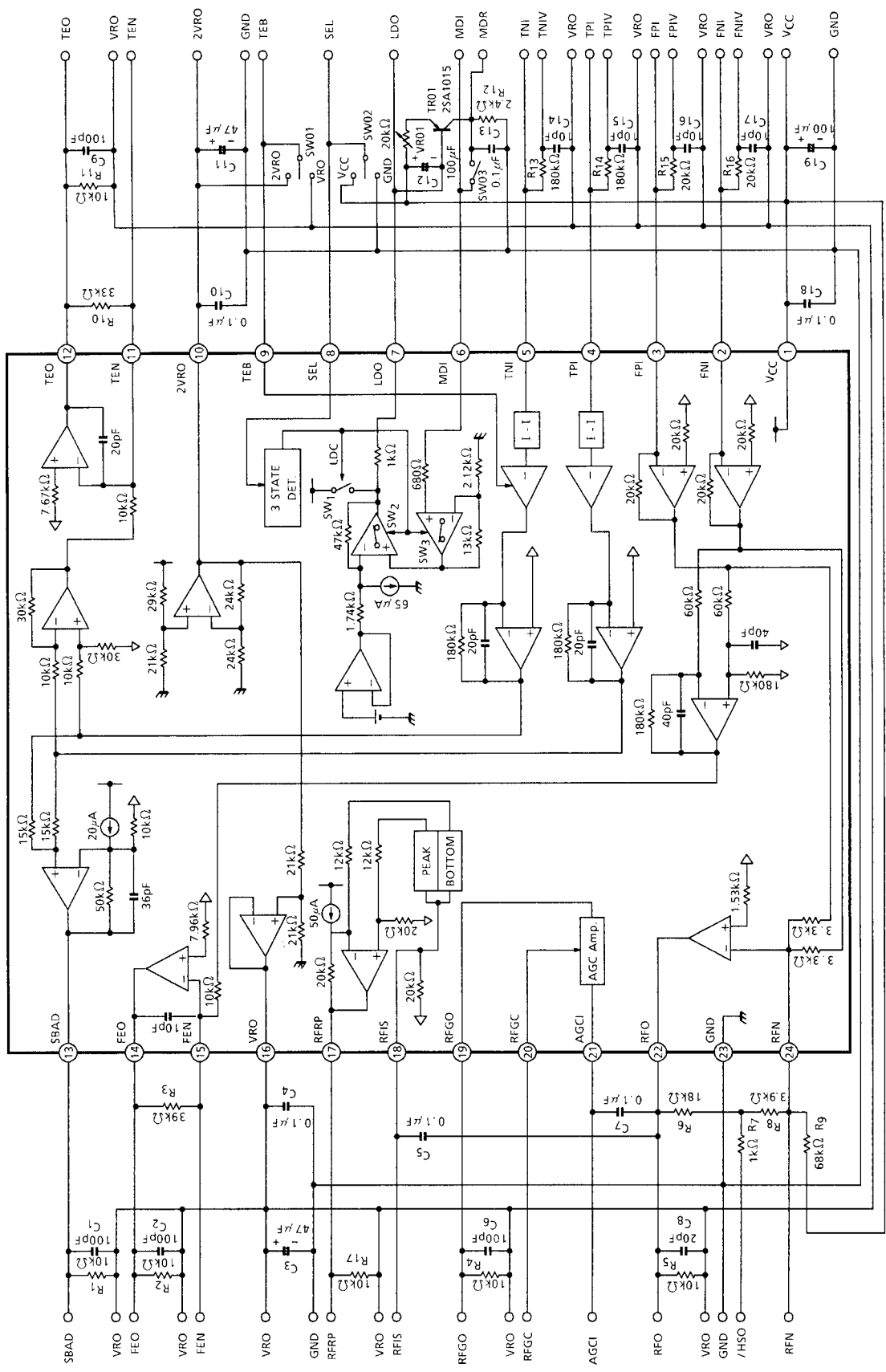
**AC Characteristics**

Characteristics		Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Power supply	Assured supply voltage	$V_{CC}$	1	—	4.5	5.0	5.5	V
	Power supply voltage	$I_{CC}$	1	SEL = $V_{CC}$	18	24	30	mA
Reference voltage: $2V_{REF}$	Reference voltage	$2V_R$	1	—	4.0	4.2	4.4	V
	Output current	$I_{OH2}$	1	$\Delta V = -0.1\text{ V}$	3.0	—	—	mA
	Input current	$I_{OL2}$	1	$\Delta V = +0.1\text{ V}$	0.1	—	—	mA
Reference voltage: $V_{REF}$	Reference voltage	$V_R$	1	—	2.0	2.1	2.2	V
	Reference voltage limit	$\Delta V_R$	1	$2 \times V_R/2\ V_R - 1$	-3.0	0.0	+3.0	%
	Output current	$I_{OH1}$	1	$\Delta V = -0.1\text{ V}$	5.0	—	—	mA
	Input current	$I_{OL1}$	1	$\Delta V = +0.1\text{ V}$	5.0	—	—	mA
RF1 FPI (FNI) → RFO	Transfer resistance	$R_T$	1	$f = 100\text{ kHz}$ , $R_{NF} = 22\text{ k}\Omega$	117	130	143	$\text{k}\Omega$
	Frequency characteristic	$f_c$	1	-3dB point	—	5.0	—	MHz
	Output slew rate	SR	1	$C_{RFO} = 20\text{ pF}$	10	20	—	$\text{V}/\mu\text{s}$
	Noise/Distortion rate	THD	1	$f = 100\text{ kHz}$ , $V_{RFO} = 1.2\text{ V}_{p-p}$	—	-40	—	dB
	Upper limit output voltage	$V_{OH}$	1	GND reference	3.6	—	—	V
	Lower limit output voltage	$V_{OL}$	1	GND reference	—	—	0.7	V
	Permissive load resistance	$R_{LM}$	1	—	10	—	—	$\text{k}\Omega$
RF2 (AGC) RFO → RFGO	Lower limit gain voltage	$G_{V1}$	1	$f = 100\text{ kHz}$ , $R_{FGC} = 0.6\text{ V}$	0.66	0.73	0.80	V/V
	Upper limit gain voltage	$G_{V2}$	1	$f = 100\text{ kHz}$ , $R_{FGC} = 3.6\text{ V}$	1.60	1.75	1.90	V/V
	Frequency characteristic	$f_c$	1	-3dB point	—	5.0	—	MHz
	Output slew rate	SR	1	$C_{RFGO} = 20\text{ pF}$	10	20	—	$\text{V}/\mu\text{s}$
	Upper limit output voltage	$V_{OH}$	1	GND reference	3.6	—	—	V
	Lower limit output voltage	$V_{OL}$	1	GND reference	—	—	0.7	V
	Noise/Distortion rate	THD	1	$f = 100\text{ kHz}$ , $V_{RFGO} = 1.2\text{ V}_{p-p}$	—	-40	—	dB
	Permissive load resistance	$R_{LM}$	1	—	10	—	—	$\text{k}\Omega$
APC MDI → LDO	Gain voltage	$G_v$	1	$f = 1\text{ kHz}$	—	200	—	V/V
	Operation reference voltage	$V_{MDI}$	1	$V_{LDO} = 3.5\text{ V}_{DC}$	170	178	192	mV
	LD Off voltage	$V_{LDOP}$	1	LDC = L, $V_{CC}$ reference, SEL = L	-0.7	—	—	V
	Input bias current	$I_I$	1	$V_{MDI} = 178\text{ mV}$	-200	—	+200	nA
FE FNI (FPI) → FEO	Transfer resistance	$R_T$	1	$f = 1\text{ kHz}$ , $R_{NF} = 39\text{ k}\Omega$	198	220	242	$\text{k}\Omega$
	Gain balance	GB	1	—	-1.0	—	+1.0	dB
	Frequency characteristic	$f_c$	1	-3dB point	—	22	—	kHz
	Output offset voltage	$V_{OS}$	1	$V_R$ reference, input open	-30	—	+30	mV
	Noise/distortion rate	THD	1	$f = 1\text{ kHz}$ , $V_{FEO} = 2.4\text{ V}_{p-p}$	—	-40	—	dB
	Upper limit output voltage	$V_{OH}$	1	GND reference	3.8	—	—	V
	Lower limit output voltage	$V_{OL}$	1	GND reference	—	—	0.5	V
	Permissive load resistance	$R_{LM}$	1	—	10	—	—	$\text{k}\Omega$

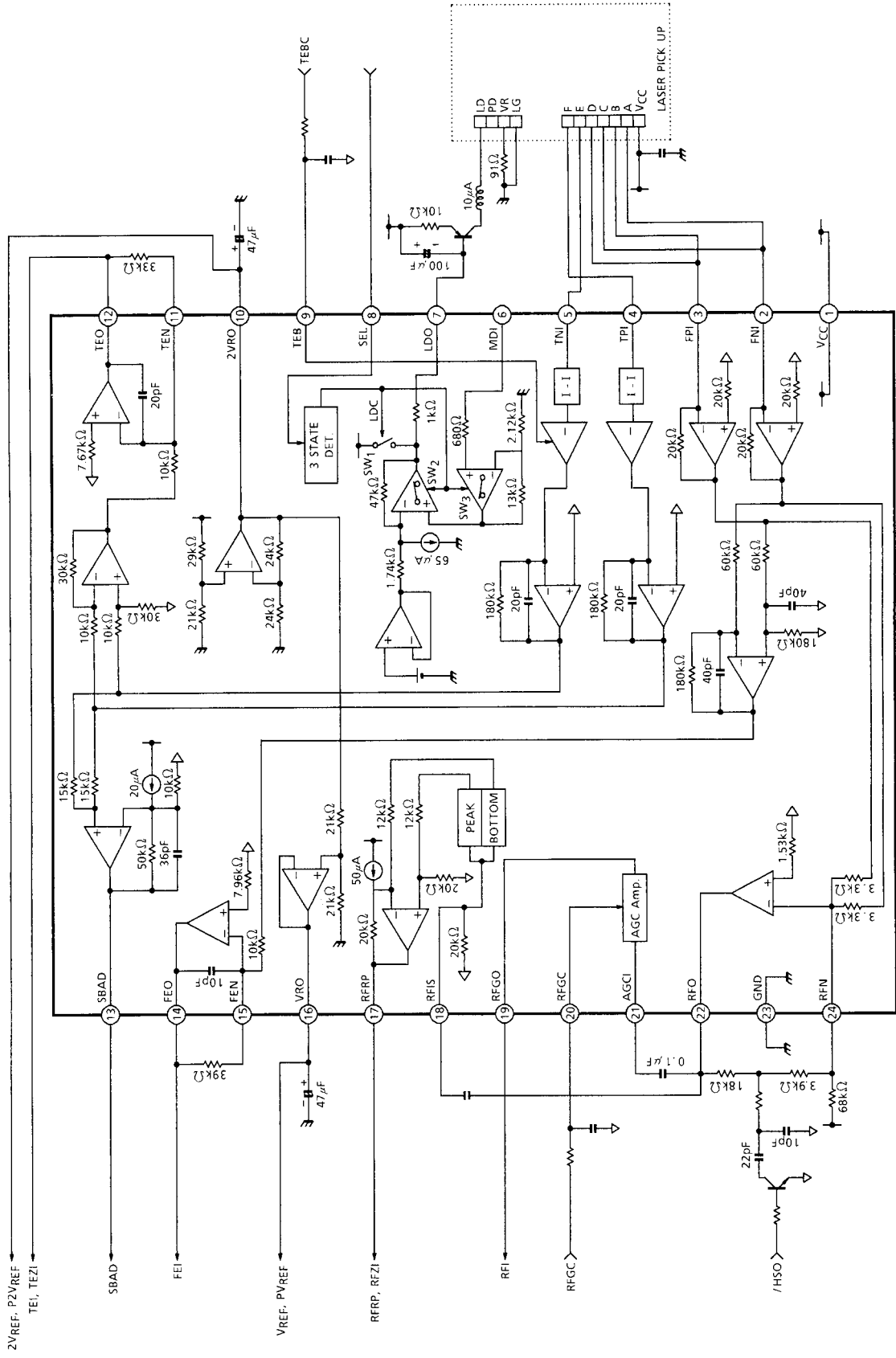
Characteristics		Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
TE TPI (TNI) → TEO	Transfer resistance	$R_T$	1	$f = 1 \text{ kHz}$ , $TEB = VR$ , $R_{NF} = 33 \text{ k}\Omega$	1.53	1.70	1.87	$M\Omega$
	Transfer resistance range	$\Delta R_T$	1	TEB = VR reference TEB = GND TEB = 2 VR				
	Max transfer resistance				35	45	55	%
	Min transfer resistance				-55	-45	-35	%
	Gain balance	GB	1	TEB = VR	-1.0	—	+1.0	dB
	Frequency characteristic		1	$R_{NF} = 33 \text{ k}\Omega$				
	Cut-Off frequency 1	$f_{c1}$			—	44	—	kHz
	Cut-Off frequency 2	$f_{c2}$			—	240	—	kHz
	Output offset voltage	$V_{OS}$	1	VR reference, input open	-80	—	+80	mV
	Noise/Distortion rate	THD	1	$f = 1 \text{ kHz}$ , $V_{TEO} = 2.0 V_{p-p}$	—	-40	—	dB
	Upper limit output voltage	$V_{OH}$	1	GND reference	3.8	—	—	V
Lower limit output voltage	$V_{OL}$	1	GND reference	—	—	0.5	V	
Permissive load resistance	$R_{LM}$	1	—	10	—	—	$k\Omega$	
SBAD TPI (TNI) → SBAD	Transfer resistance	$R_T$	1	$f = 1 \text{ kHz}$ , $TEB = VR$	416	520	624	$k\Omega$
	Frequency characteristic	$f_c$	1	-3dB point	—	44	—	kHz
	Noise/Distortion rate	THD	1	$f = 1 \text{ kHz}$ , $V_{SBAD} = 1.5 V_{p-p}$	—	-40	—	dB
	Operation reference voltage	$V_{OPR}$	1	TNI/TPI = VR, VR reference	-1.1	-1.0	-0.9	V
				TNI/TPI = HiZ, VR reference	-1.2	-1.1	-1.0	
	Upper limit output voltage	$V_{OH}$	1	GND reference	3.8	—	—	V
Permissive load resistance	$R_{LM}$	1	—	10	—	—	$k\Omega$	
RFRP RFIS → RFRP	Gain voltage	Gv	1	—	1.37	1.46	1.54	V/V
	Detection frequency characteristic	$f_c$	—	SEL = $V_{CC}$	—	100	—	kHz
	Operation reference voltage 1	$V_{OPR1}$	1	VR reference, No signal	-1.1	-1.0	-0.9	V
	Operation reference voltage 2	$V_{OPR2}$	1	VR reference, 700 kHz, $1.2 V_{p-p}$	+0.65	+0.75	+0.85	V
	Permissive load resistance	$R_{LM}$	1	—	10	—	—	$k\Omega$

Note: If the IC is used abnormally (ex. wrongly mounted), it may be damaged or destroyed.

**Test Circuit**



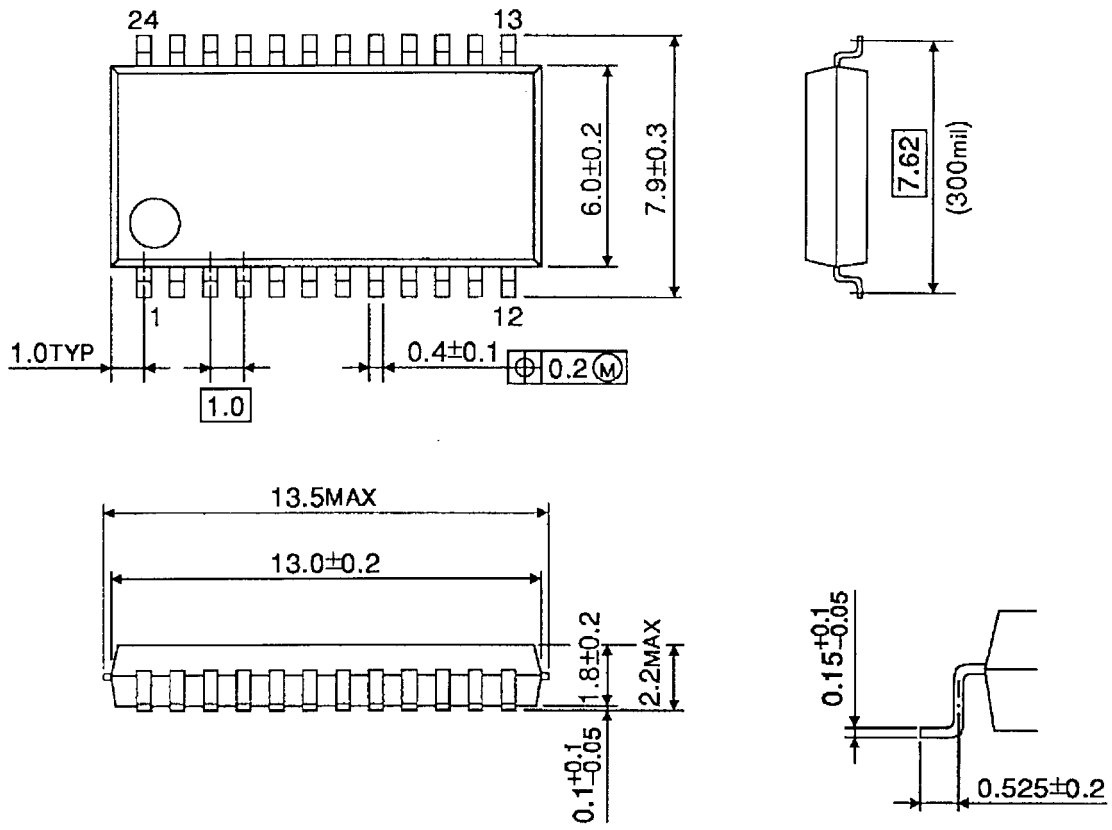
**Application Circuit**



**Package Dimensions**

SSOP24-P-300-1.00

Unit : mm



Weight: 0.3 g (typ.)



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