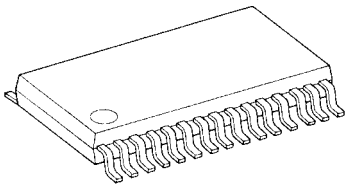
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA2153FN

RF Amplifier for Digital Servo CD System

TA2153FN 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 TC9462F/TC9495F, a CD system can be composed very simply.



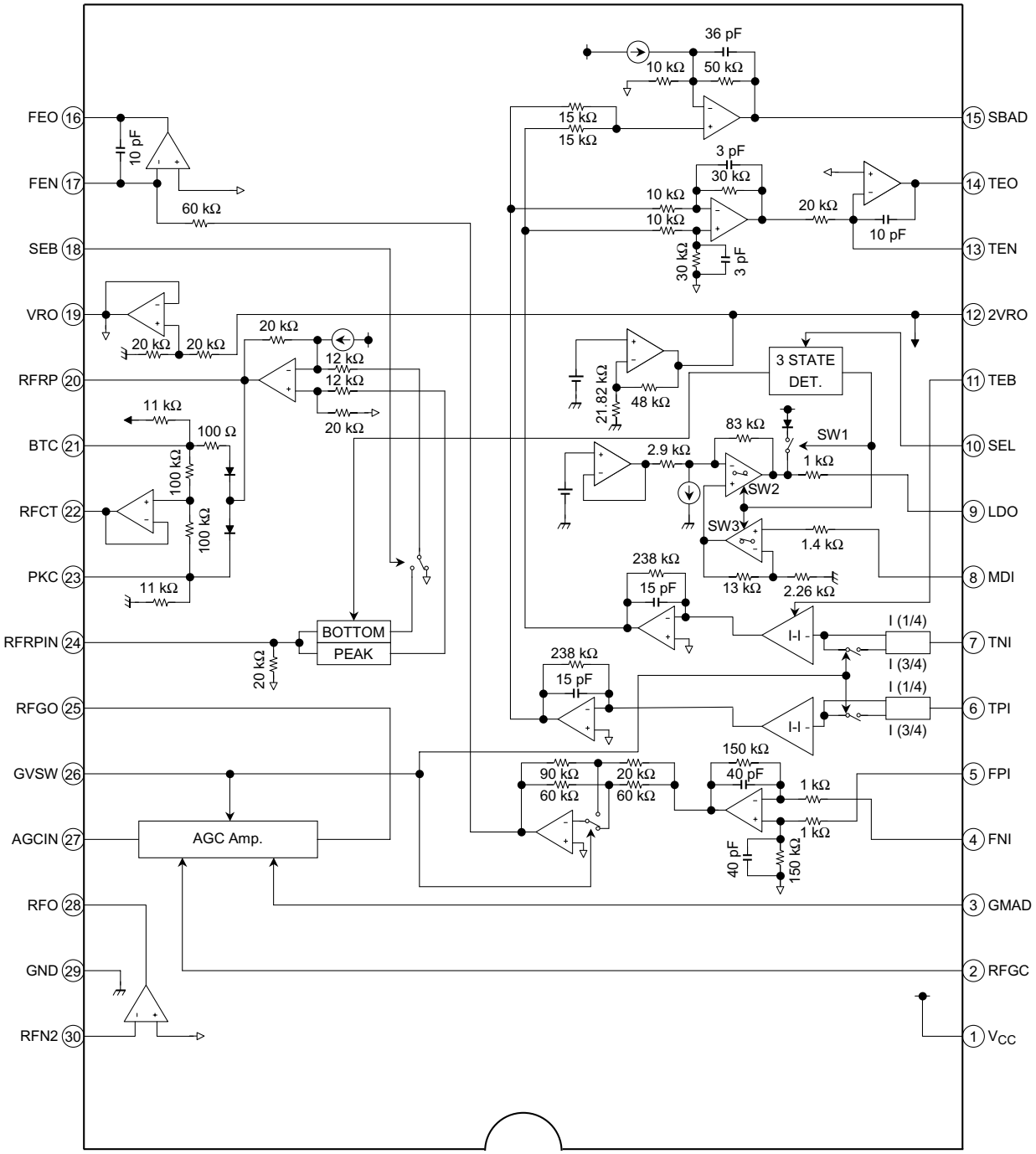
SSOP30-P-300-0.65

Weight: 0.17 g (typ.)

Features

- Built-in amplifier for reference (VRO, 2VRO) supply.
- Built-in auto laser power control circuit.
- Built-in RF amplifier.
- Built-in AGC amplifier.
- Built-in focus error amp and tracking error amp.
- Built-in sub-beam adder signal amplifier.
- Built-in gain change circuit for CD-RW.
- Capable of tracking balance control with TC9462F/TC9495F.
- Capable of RF gain adjustment circuit with TC9462F/TC9495F.
- Built-in signal amplifier for track counter.
- Capable of 4 times speed operation.
- 30 pin mini flat package.

Block Diagram



SEL	LDC			RFRP Detect Frequency
	SW1	SW2	SW3	
GND	ON	OFF	OFF	Low
HiZ	OFF	ON	ON	Low
V_{CC}	OFF	ON	ON	High

GVSW	Mode
GND	CD-RW
HiZ	Normal
V_{CC}	

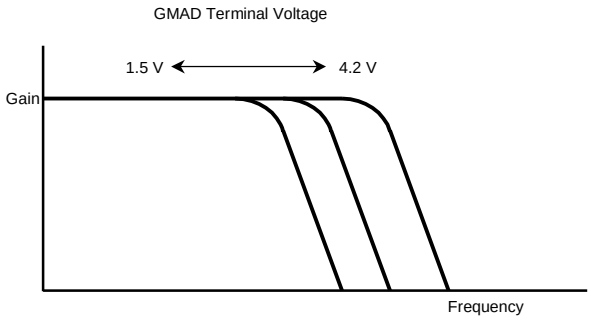
SEB	Bottom Detect	Peak Detect
GND	ON	ON
HiZ	ON	ON
V_{CC}	OFF	ON

Pin Function

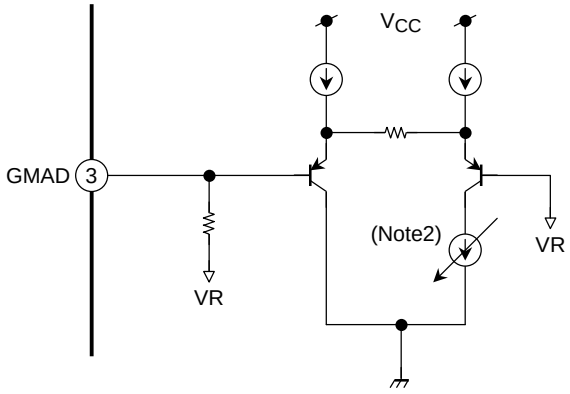
<table>
<tr><th>Pin No.</th><th>Symbol</th><th>I/O</th><th>Function Description</th><th>Remarks</th></tr>
<tr><td>1</td><td>V_{CC}</td><td>—</td><td>Power supply input terminal.</td><td>—</td></tr>
<tr><td>2</td><td>RFGC</td><td>I</td><td>RF amplitude adjustment control signal input terminal.
Controlled by 3-PWM signals.
(PWM carrier = 88.2 kHz)</td><td>3 signals input.
(2VRO, VRO, GND)</td></tr>
<tr><td>3</td><td>GMAD</td><td>I</td><td>Open loop gain adjustment terminal for AGC amp.</td><td>(Note1)</td></tr>
<tr><td>4</td><td>FNI</td><td>I</td><td>Main beam I-V amp input terminal.</td><td>Connected to pin diode output B + D (through resistor).</td></tr>
<tr><td>5</td><td>FPI</td><td>I</td><td>Main beam I-V amp input terminal.</td><td>Connected to pin diode output A + C (through resistor).</td></tr>
<tr><td>6</td><td>TPI</td><td>I</td><td>Sub beam I-V amp input terminal.</td><td>Connected to pin diode output F.</td></tr>
<tr><td>7</td><td>TNI</td><td>I</td><td>Sub beam I-V amp input terminal.</td><td>Connected to pin diode output E.</td></tr>
<tr><td>8</td><td>MDI</td><td>I</td><td>Monitor photo diode amp input terminal.</td><td>Connected to monitor photo diode.</td></tr>
<tr><td>9</td><td>LDO</td><td>O</td><td>Laser diode amp input terminal.</td><td>Connected to laser diode control circuit.</td></tr>
<tr><td>10</td><td>SEL</td><td>I</td><td>Laser diode control signal input terminal and APC circuit ON/OFF control signal terminal.
<table>
<tr><th>SEL Level</th><th>APC Circuit</th><th>LDO</th><th>Detect Frequency</th></tr>
<tr><td>GND</td><td>OFF</td><td>Connected to V_{CC} through resister (1 kΩ)</td><td>Low</td></tr>
<tr><td>HiZ</td><td>ON</td><td>Control signal output</td><td>Low</td></tr>
<tr><td>V_{CC}</td><td>ON</td><td>Control signal output</td><td>High</td></tr>
</table></td><td>3 signals input.
(V_{CC}, HiZ, GND)</td></tr>
<tr><td>11</td><td>TEB</td><td>I</td><td>Tracking error balance adjustment signal input terminal.
Controlled by 3-PWM signal.
(PWM carrier = 88.2 kHz)</td><td>3 signals input.
(2VRO, VRO, GND)</td></tr>
<tr><td>12</td><td>2VRO</td><td>O</td><td>Reference voltage (2VRO) output terminal.
2VRO = 4.2 V when V_{CC} = 5 V</td><td>—</td></tr>
<tr><td>13</td><td>TEN</td><td>I</td><td>TE amp negative input terminal.</td><td>Connected to TEO through feedback resistor.</td></tr>
<tr><td>14</td><td>TEO</td><td>O</td><td>TE error signal output terminal.</td><td>—</td></tr>
<tr><td>15</td><td>SBAD</td><td>O</td><td>Sub beam adder signal output terminal.</td><td>—</td></tr>
<tr><td>16</td><td>FEO</td><td>O</td><td>Focus error signal output terminal.</td><td>—</td></tr>
<tr><td>17</td><td>FEN</td><td>I</td><td>FE amp negative input terminal.</td><td>Connected to FEO through feedback resistor.</td></tr>
<tr><td>18</td><td>SEB</td><td>I</td><td>RFRP output circuit switching terminal.
<table>
<tr><th>SEB Level</th><th>Bottom Detection</th><th>Peak Detection</th></tr>
<tr><td>GND</td><td>ON</td><td>ON</td></tr>
<tr><td>V_{CC}</td><td>OFF</td><td>ON</td></tr>
</table></td><td>Low (GND) is for normal use.</td></tr>
<tr><td>19</td><td>VRO</td><td>O</td><td>Reference signal (VRO) output terminal.
VRO = 2.1 V when V_{CC} = 5 V</td><td>—</td></tr>
<tr><td>20</td><td>RFRP</td><td>O</td><td>Track count signal output terminal.</td><td>—</td></tr>
<tr><td>21</td><td>BTC</td><td>I</td><td>Time constant adjustment terminal for bottom detection.</td><td>Adjusted by capacitance.</td></tr>
</table>

Pin No.	Symbol	I/O	Function Description	Remarks
22	RFCT	O	RFRP signal center level output terminal.	—
23	PKC	I	Time constant adjustment terminal for peak detection.	Adjusted by capacitance.
24	RFRPIN	I	Input terminal for track count signal output amp.	—
25	RFGO	O	Output terminal for RF signal amplitude adjustment amp.	—
26	GVSW	I	Amp (AGC, FE, TE) gain switching terminal. GVSW: GND → Mode: CD-RW GVSW: HiZ → Mode: Normal GVSW: V_{CC} → Mode: Normal	Low (GND) is for 5 times gain.
27	AGCIN	I	Input terminal for RF signal amplitude adjustment amp.	Connected to RFO through capacitance.
28	RFO	O	Output terminal for RF signal amp.	—
29	GND	—	Ground terminal.	—
30	RFN2	I	Input terminal for RF signal amp.	Connected to pin-diode output A + B + C + D (through resistor).

Note 1: Pin3 (GMAD) is gm adjustment terminal for AGC amp by applying a voltage (between 1.5 V and 4.2 V). If pin3 (GMAD) is open, voltage of this terminal is fixed VR by IC interior. Characteristic of frequency (open-loop characteristic) and voltage is as below.



By changing a voltage (pin3) between 1.5 V and 4.2 V, frequency band width is changed.



Note 2: Current is changed by pin3 (GMAD) voltage.

Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Power supply voltage	V_{CC}	8	V
Power dissipation	P_D	500	mW
Operating temperature	T_{opr}	−40~85	°C
Storage temperature	T_{stg}	−55~150	°C

Electrical Characteristics (unless otherwise specified, V_{CC} = 5 V, Ta = 25°C)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Power supply	Assured power supply voltage	V_{CC}	—	—		4.5	5.0	5.5	V
	Power supply current	I_{CC}	—	SEL = HiZ		26	35	44	mA
Reference voltage (2VRO)	Reference voltage	2VR	—	—		4.0	4.2	4.4	V
	Output current	I_{OH2}	—	ΔV = −0.2 V		2.0	—	—	mA
	Input current	I_{OL2}	—	ΔV = +0.1 V		0.1	—	—	
Reference voltage (VRO)	Reference voltage	VR	—	—		2.0	2.1	2.2	V
	Reference voltage limit	ΔVR	—	2 × VR/2VR − 1		−3.0	0	3.0	%
	Output current	I_{OH1}	—	ΔV = −0.2 V		5.0	—	—	mA
	Input current	I_{OL1}	—	ΔV = +0.1 V		5.0	—	—	
RF1	Frequency band width	fc	—	−3dB point, R_{IN} = 6 kΩ Between RFO − RFN2: 33 kΩ		—	8	—	MHz
	Output slew rate	SR	—	C_{RFO} = 20 pF, R_{IN} = 6 kΩ Between RFO − RFN2: 33 kΩ		—	22	—	V/μs
	Output offset voltage	V_{OS}	—	VR Reference Between RFO − RFN2: 33 kΩ Input: VR short		—	−100	—	mV
	Upper limit output voltage	V_{OH}	—	GND Reference		3.8	—	—	V
	Lower limit output voltage	V_{OL}	—	GND Reference		—	—	0.9	
	Permissive load resistance	R_{LM}	—	—		10	—	—	kΩ
RF2 (AGC)	Lower limit voltage gain 1 (normal mode)	Gv1L	—	f = 1 MHz, RFGC = 0.6 V, GVSW = V_{CC}, GMAD = VR		0.6	0.7	0.8	V/V
	Upper limit voltage gain 1 (normal mode)	Gv1H	—	f = 1 MHz, RFGC = 3.6 V, GVSW = V_{CC}, GMAD = VR		1.3	1.5	1.7	
	Lower limit voltage gain 2 (CD-RW mode)	Gv2L	—	f = 1 MHz, RFGC = 0.6 V, GVSW = GND, GMAD = VR		2.7	3.2	3.6	
	Upper limit voltage gain 2 (CD-RW mode)	Gv2H	—	f = 1 MHz, RFGC = 3.6 V, GVSW = GND, GMAD = VR		5.8	6.8	7.7	
	Frequency band width (normal mode)	fc1	—	−0.5dB point, RFGC = 2.1 V, GVSW = V_{CC}, GMAD = VR		—	12	—	MHz
	Frequency band width (CD-RW mode)	fc2	—	−0.5dB point, RFGC = 2.1 V, GVSW = GND, GMAD = VR		—	12	—	
	Output slew rate	SR	—	C_{RFGO} = 20 pF		—	40	—	V/μs
	Output offset voltage 1 (normal mode)	V_{OS1}	—	VR Reference GMAD = VR Input: Open	GVSW = V_{CC}	—	−100	—	mV
	Output offset voltage 2 (CD-RW mode)	V_{OS2}	—		GVSW = GND	—	0	—	
	Upper limit output voltage	V_{OH}	—	GND Reference		3.7	—	—	V
	Lower limit output voltage	V_{OL}	—	GND Reference		—	—	0.9	
	Permissive load resistance	R_{LM}	—	—		10	—	—	kΩ
APC	Voltage gain	Gv	—	f = 1 kHz		—	200	—	V/V
	Operation ref. Voltage	V_{MDI}	—	V_{LDO} = 3.5 V_{DC}		170	178	192	mV
	LD off voltage	V_{LDOP}	—	SEL = GND, V_{CC} Reference		−0.7	—	—	V
	Input bias current	I_I	—	MDI = 178 mV		−200	—	200	nA

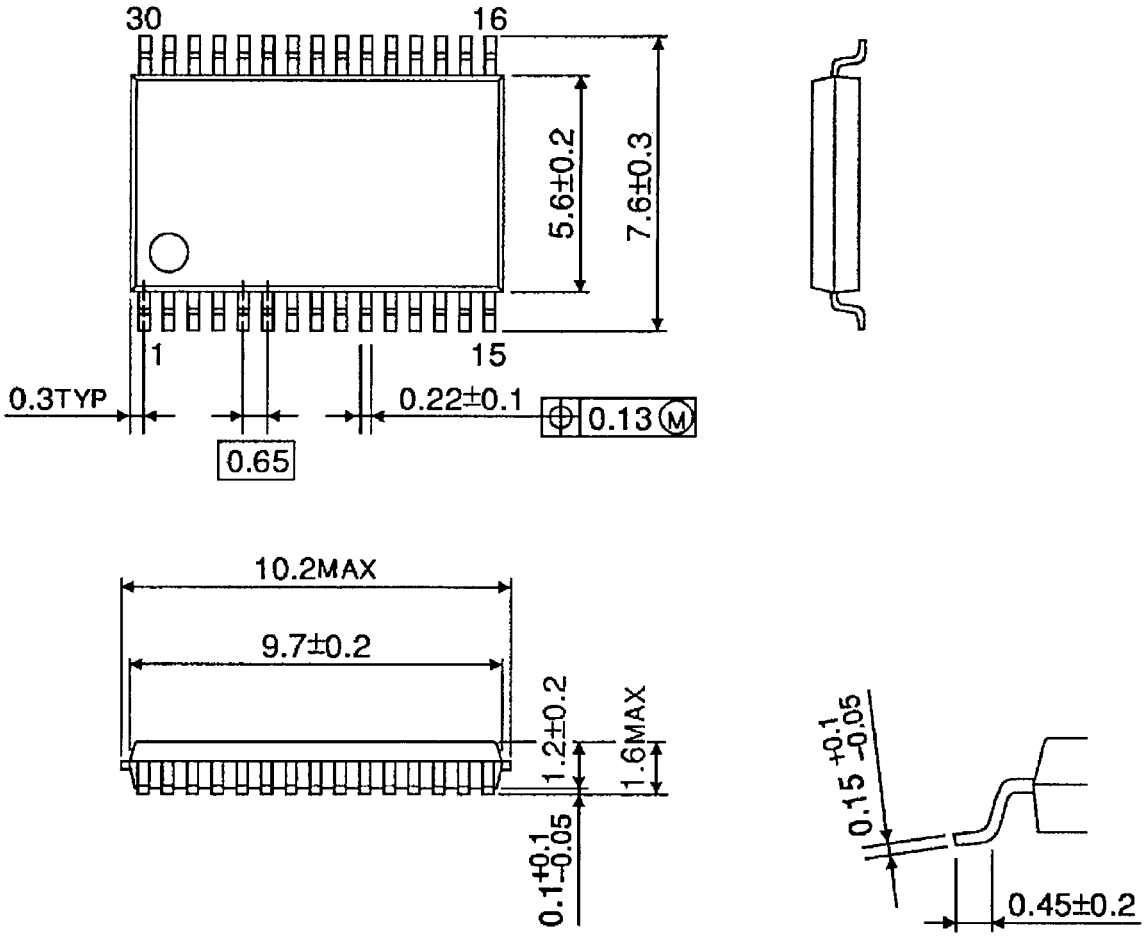
Characteristics			Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
FE	Voltage gain 1 (normal mode)		Gv1	—	f = 1 kHz R_{NF} = 91 kΩ R_{FI} = 47 kΩ	GVSW = V_{CC}	4.3	4.8	5.3	V/V
	Voltage gain 2 (CD-RW mode)		Gv2	—		GVSW = GND	19.3	21.6	23.9	
	Gain balance 1 (normal mode)		GB1	—	f = 1 kHz R_{NF} = 91 kΩ R_{FI} = 47 kΩ	GVSW = V_{CC}	−1.0	—	1.0	dB
	Gain balance 2 (CD-RW mode)		GB2	—		GVSW = GND	−1.0	—	1.0	
	Frequency band width		fc	—	−3dB point		—	26.5	—	kHz
	Output offset voltage 1 (normal mode)		V_{OS1}	—	R_{NF} = 91 kΩ R_{FI} = 47 kΩ VR Reference Input: VR short	GVSW = V_{CC}	−20	—	20	mV
	Output offset voltage 2 (CD-RW mode)		V_{OS2}	—		GVSW = GND	−50	—	50	
	Upper limit output voltage		V_{OH}	—	GND Reference		3.8	—	—	V
	Lower limit output voltage		V_{OL}	—	GND Reference		—	—	0.5	
	Permissive load resistance		R_{LM}	—	—		10	—	—	kΩ
TE	Voltage gain 1 (normal mode)		Gv1	—	f = 1 kHz R_{FN} = 100 KΩ R_{TI} = 47 kΩ	GVSW = V_{CC}	10.9	12.3	13.5	V/V
	Voltage gain 2 (CD-RW mode)		Gv2	—		GVSW = GND	50	56	60	
	Voltage gain adjustable range	max voltage ratio	ΔGv	—	T_{NI} input TEB = VR Reference	TEB = GND	40	45	50	%
		min voltage ratio				TEB = 2VR	−50	−45	−40	
	Gain balance 1 (normal mode)		GB1	—	f = 1 kHz R_{NF} = 100 kΩ R_{FI} = 47 kΩ TEB = VR	GVSW = V_{CC}	−1.0	—	1.0	dB
	Gain balance 2 (CD-RW mode)		GB2	—		GVSW = GND	−1.0	—	1.0	
	Frequency characteristic cut-off frequency		fc	—	RNF = 100 kΩ −3dB point		—	44	—	kHz
	Output offset voltage (normal mode)		V_{OS1}	—	R_{NF} = 100 kΩ R_{FI} = 47 kΩ VR Reference Input: VR short	GVSW = V_{CC}	−80	—	80	mV
	Output offset voltage (CD-RW mode)		V_{OS2}	—		GVSW = GND	−300	—	300	
	Upper limit output voltage		V_{OH}	—	GND Reference		3.8	—	—	V
	Lower limit output voltage		V_{OL}	—	GND Reference		—	—	0.5	
	Permissive load resistance		R_{LM}	—	—		10	—	—	kΩ
SBAD	Voltage gain 1 (normal mode)		Gv1	—	f = 1 kHz R_{TI} = 47 kΩ TEB = VR	GVSW = V_{CC}	2.0	2.7	3.4	V/V
	Voltage Gain 2 (CD-RW mode)		Gv2	—		GVSW = GND	9.0	12.2	15.3	
	Frequency Band Width		fc	—	−3dB point		—	44	—	kHz
	Operation reference voltage 1 (normal mode)		V_{OPR1}	—	VR Reference R_{TI} = 47 kΩ Input: VR short	GVSW = V_{CC}	−1.15	−1.05	−0.95	V
	Operation reference voltage 2 (CD-RW mode)		V_{OPR2}	—		GVSW = GND	−1.0	−0.9	−0.8	
	Upper limit output voltage		V_{OH}	—	GND Reference		3.8	—	—	V
	Lower limit output voltage		V_{OL}	—	GND Reference		—	—	1.3	
	Permissive load resistance		R_{LM}	—	—		10	—	—	kΩ

Characteristics		Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
RFRP	Voltage gain	Gv	—	—	—	1.7	—	V/V
	Detection frequency characteristic 1	fc1	—	SEL = HiZ	—	100	—	kHz
	Detection frequency characteristic 2	fc2	—	SEL = V_{CC}	—	200	—	
	Operation reference voltage 1	V_{OPR1}	—	VR Reference No Input	−1.1	−1.0	−0.9	V
	Operation reference voltage 2	V_{OPR2}	—	VR Reference 700 kHz, 1.2 Vp-p	0.7	0.8	0.9	
	Permissive load resistance	R_{LM}	—	—	10	—	—	kΩ
RFCT	Detection frequency characteristic 1	fc1	—	C_{BTC} = 0.22 μF	—	70	—	Hz
RFRP → RFCT	Detection frequency characteristic 2	fc2	—	C_{PKC} = 0.22 μF	—	70	—	
	Output offset voltage	V_{OS}	—	RFRP Reference, RFCT	−50	—	50	mV

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

Package Dimensions

SSOP30-P-300-0.65 Unit : mm



Weight: 0.17 g (typ.)

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