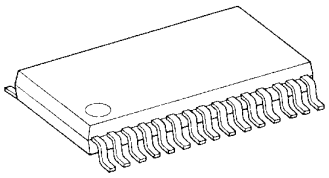
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA2151FN

RF Amplifier for Digital Servo CD System

TA2151FN 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.



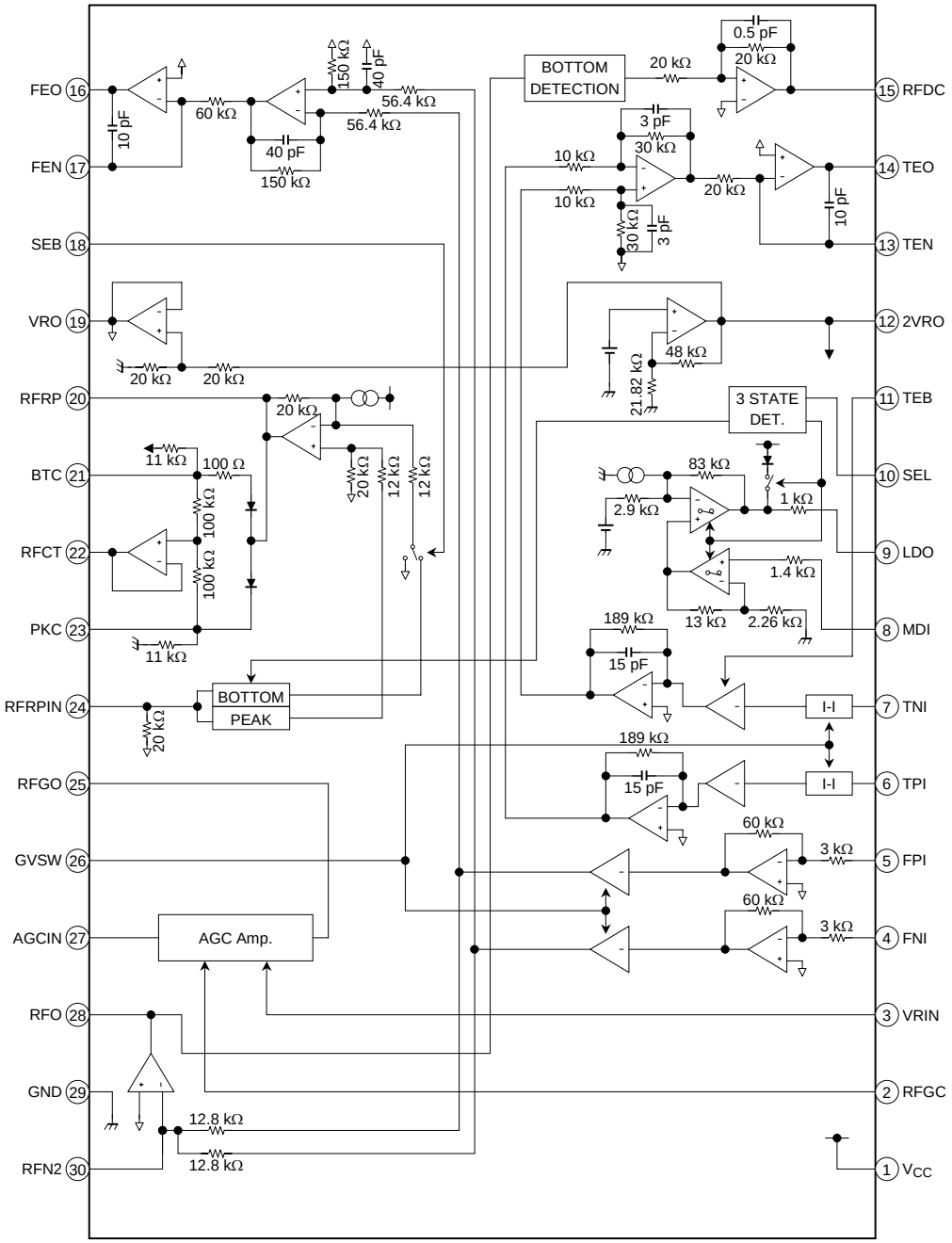
SSOP30-P-300-0.65

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 gain change circuit for CD-RW.
- Capable of tracking balance control 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	
V_{CC}				High

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

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

Pin Function

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>I/O</th><th>Functional 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)
RFGC input voltage: VRO ± 1.5 V
AGC amplifier voltage again: ×0.7~1.5 (typ.)</td><td>—</td></tr>
<tr><td>3</td><td>VRIN</td><td>I</td><td>AGC amp. Reference voltage input terminal.</td><td>Connected to VRO</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 rowspan="2">Low</td></tr>
<tr><td>HiZ</td><td rowspan="2">ON</td><td rowspan="2">Control signal output</td></tr>
<tr><td>V_{CC}</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>RFDC</td><td>O</td><td>RF signal peak detect 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 rowspan="2">ON</td></tr>
<tr><td>V_{CC}</td><td>OFF</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 voltage (VRO) output terminal.
VRO = 2.1 V when V_{CC} = 5 V</td><td>—</td></tr>
</table>

Pin No.	Symbol	I/O	Functional Description	Remarks
20	RFRP	O	Track count signal output terminal.	—
21	BTC	I	Time constant adjustment terminal for bottom detection.	Adjusted by capacitance.
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 (FE, TE) gain switching terminal. GVSW: GND → CD-RW; HiZ → Normal; V_{CC} → 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.	—

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, RFGC = V_{CC}, GVSW = V_{CC})

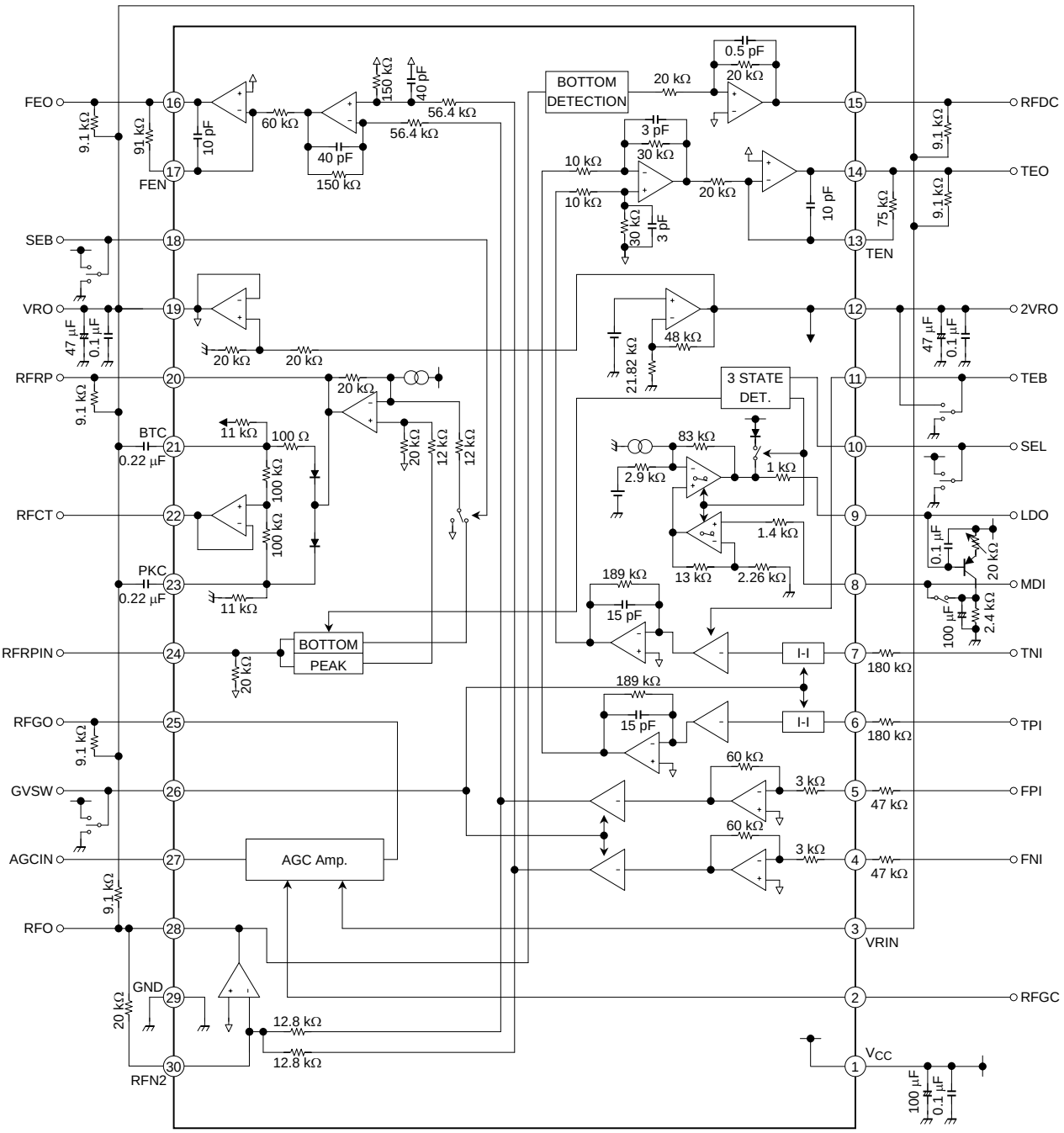
Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Power supply	Assured power supply voltage	V_{CC}	—	—		4.5	5.0	5.5	V
	Power supply current 1 (normal mode)	$I_{CC}1$	—	SEL = HiZ REGC = HiZ	GVSW = V_{CC}	23	33	43	mA
	Power supply current 2 (CD-RW mode)	$I_{CC}2$			GVSW = GVD				
Reference 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	0.0	—	%
	Output current	I_{OH1}	—	ΔV = −0.2 V		5.0	—	—	mA
	Input current	I_{OL1}		ΔV = +0.1 V		5.0	—	—	
RF1	Transfer resistance1 (normal mode)	R_{T1}	—	f = 100 kHz Rf = 20 kΩ	GVSW = V_{CC}	153	180	207	kΩ
	Transfer resistance2 (CD-RW mode)	R_{T2}			GVSW = GND	690	812	934	
	Frequency band width1 (normal mode)	fc1	—	−3dB point Rf = 20 kΩ	GVSW = V_{CC}	—	8	—	MHz
	Frequency band width2 (CD-RW mode)	fc2			GVSW = GND	—	8	—	
	Output slew rate	SR	—	C_{RFO} = 20 pF		—	20	—	V/μs
	Output offset voltage 1 (normal mode)	V_{OS1}	—	VR Reference Rf = 20 kΩ Input: Open	GVSW = V_{CC}	—	−50	—	mV
	Output offset voltage 2 (CD-RW mode)	V_{OS2}			GVSW = GND	—	−100	—	
	Upper limit output voltage	V_{OH}	—	GND Reference		3.8	—	—	V
	Lower limit output voltage	V_{OL}				—	—	0.9	
	Permissive load resistance	R_{LM}	—	—		10	—	—	kΩ
RF2 (AGC)	Lower limit voltage gain	G_{VL}	—	f = 100 kHz	RFGC = 0.6 V	0.6	0.7	0.8	V/V
	Upper limit voltage gain	G_{VH}			RFGC = 3.6 V	1.3	1.5	1.7	
	Frequency band width	fc	—	−3dB point		—	20	—	MHz
	Output slew rate	SR	—	C_{RFO} = 20 pF		—	20	—	V/μs
	Output offset voltage	V_{OS}	—	VR Reference, Input: Open		—	100	—	mV
	Upper limit output voltage	V_{OH}	—	GND Reference		3.8	—	—	V
	Lower limit output voltage	V_{OL}				—	—	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	Transfer resistance 1 (normal mode)		R_{T1}	—	f = 1 kHz R_{NF} = 91 kΩ	GVSW = V_{CC}	197	232	267	kΩ
	Transfer resistance 2 (CD-RW mode)		R_{T2}			GVSW = GND	0.89	1.05	1.20	MΩ
	Gain balance 1 (normal mode)		GB1	—	f = 1 kHz R_{NF} = 91 kΩ	GVSW = V_{CC}	−1.0	—	1.0	dB
	Gain balance 2 (CD-RW mode)		GB2			GVSW = GND	−1.0	—	1.0	
	Frequency band width1 (normal mode)		fc1	—	−3dB point R_{NF} = 91 kΩ	GVSW = V_{CC}	—	26.5	—	kHz
	Frequency band width2 (CD-RW mode)		fc2			GVSW = GND	—	26.5	—	
	Output offset voltage 1 (normal mode)		V_{OS1}	—	R_{NF} = 91 kΩ VR Reference	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}				—	—	0.5	
	Permissive load resistance		R_{LM}	—	—		10	—	—	kΩ
TE	Transfer resistance 1 (normal mode)		R_{T1}	—	f = 1 kHz R_{NF} = 75 kΩ TEB = HiZ	GVSW = V_{CC}	1.81	2.13	2.45	MΩ
	Transfer resistance 2 (CD-RW mode)		R_{T2}			GVSW = GND	8.15	9.59	11.02	
	Voltage gain adjustable range	max voltage ratio	ΔGv	—	T_{NI} input R_{NF} = 75 kΩ TEB = VR Reference	TEB = GND	—	45	—	%
		min voltage ratio				TEB = 2VR	—	−45	—	
	Gain balance 1 (normal mode)		GB1	—	f = 1 kHz R_{NF} = 75 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 band width1 (normal mode)		fc1	—	−3dB point R_{NF} = 75 kΩ	GVSW = V_{CC}	—	44	—	kHz
	Frequency band width2 (CD-RW mode)		fc2			GVSW = GND	—	44	—	
	Output offset voltage 1 (normal mode)		V_{OS1}	—	R_{NF} = 75 kΩ VR Reference	GVSW = V_{CC}	−80	—	80	mV
	Output offset voltage 2 (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}				—	—	0.5	
	Permissive load resistance		R_{LM}	—	—		10	—	—	kΩ
RFDC FNI (FPI) → RFDC	Detection frequency		f_C	—	—		—	40	—	kHz
	Upper limit output voltage		V_{OH}	—	GND Reference		3.3	—	—	V
	Lower limit output voltage		V_{OL}				—	—	0.9	
	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 RFRP →RFCT	Detection frequency characteristic 1	fc1	—	C_{BTC} = 0.22 μF	—	70	—	Hz
	Detection frequency characteristic 2	fc2		C_{PKC} = 0.22 μF	—	70	—	
	Output offset voltage	V_{OS}	—	RFRP Reference, RFCT	−50	—	50	mV

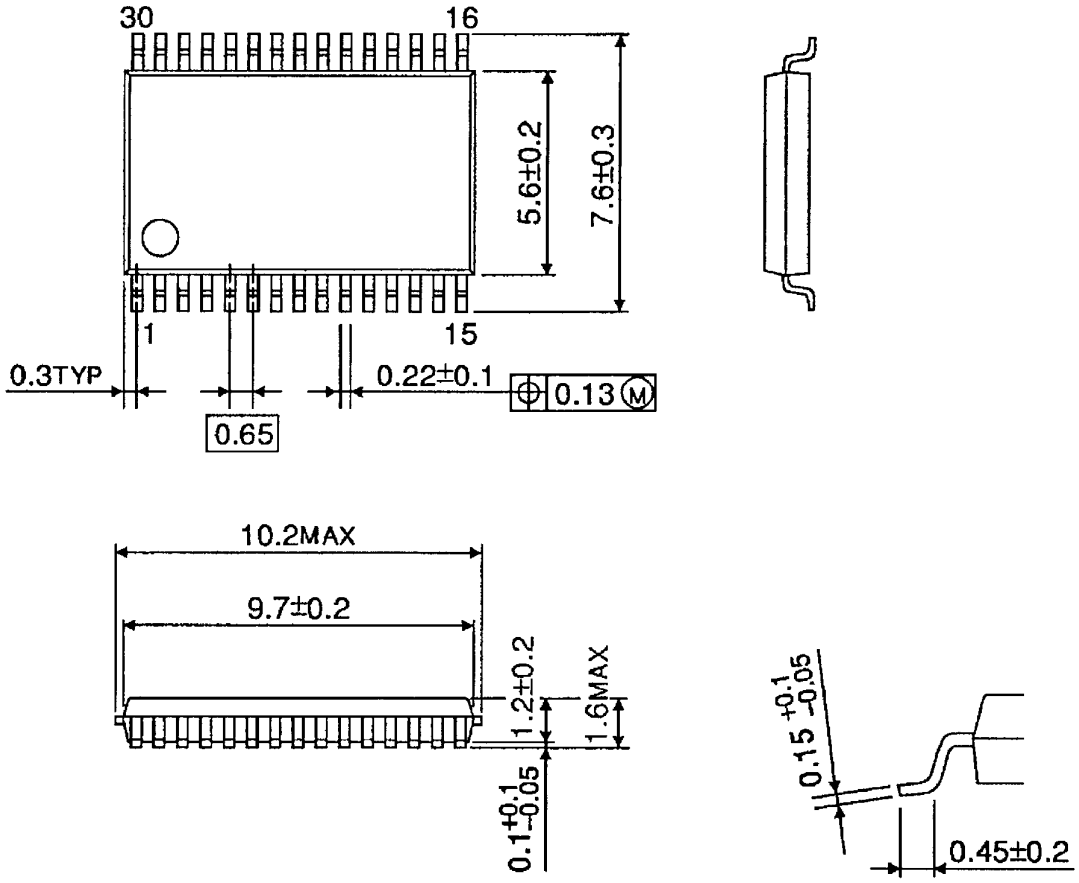
Note: If the IC is used abnormally (ex. wrongly mounted), it may be dameged or destroyed.

Test Circuit



Package Dimensions

SSOP30-P-300-0.65 Unit : mm



Weight: 0.17 g (typ.)

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