

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA2109F

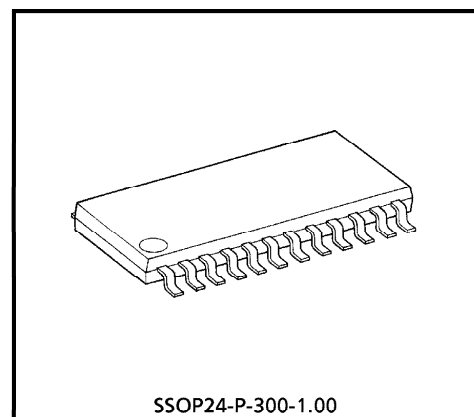
RF AMPLIFIER FOR DIGITAL SERVO CD SYSTEM

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 a CD system can be composed very simply.

FEATURES

- Built in amplifier for reference (V_{REF} , $2V_{REF}$) 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.
- Capable of RF gain adjustment circuit with TC9432AF.
- Built in signal amplifier for track counter.
- Capable of 4 times speed operation.
- 24 pin mini flat package.

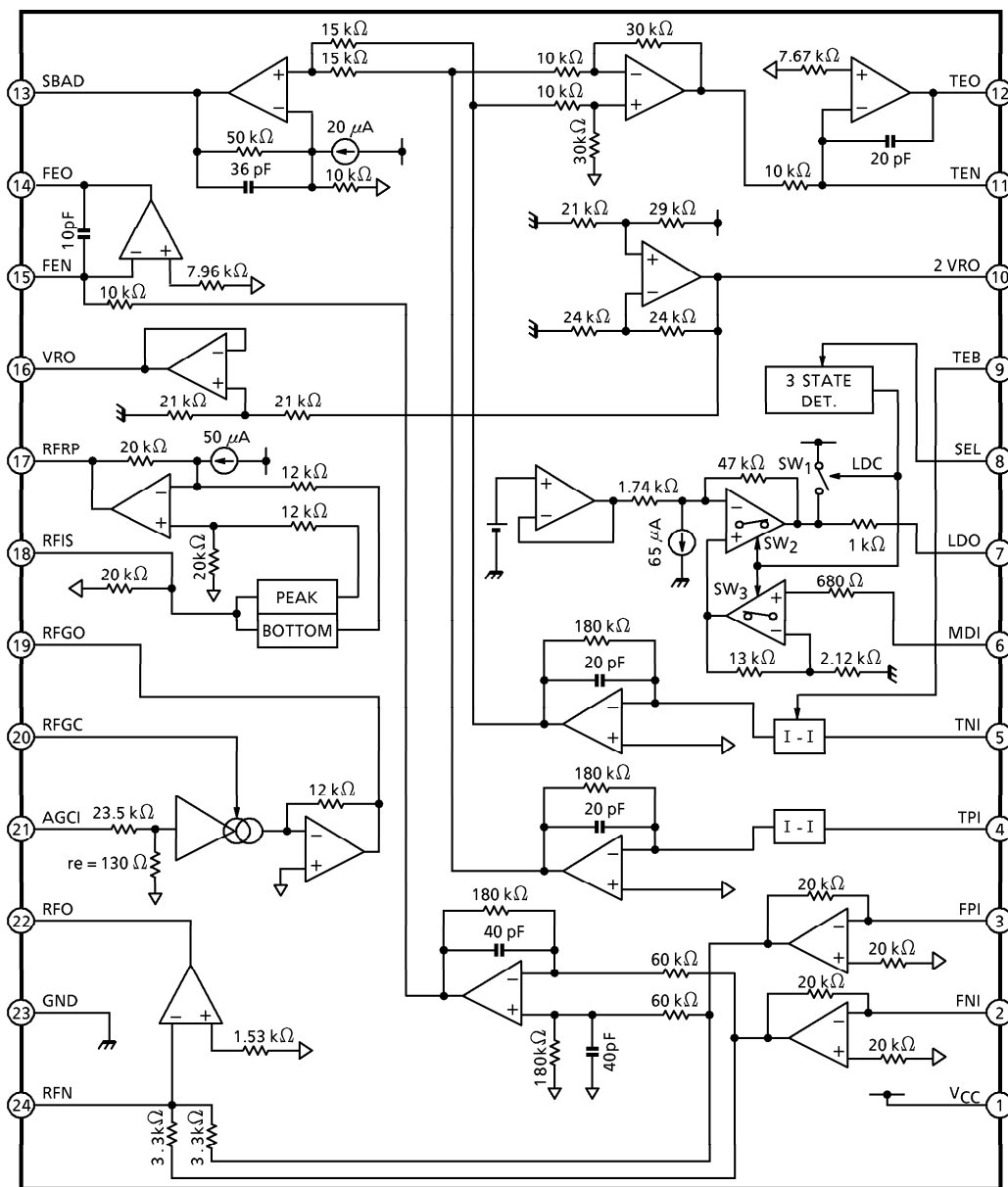


Weight : 0.3 g (Typ.)

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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	VCC	—	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 (VCC, Hi-Z, 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 VREF, VR, GND)
10	2VRO	O	Reference voltage (2 VREF) output terminal 2 VREF = 4.2 V when VCC = 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 (VREF) output terminal VREF = 2.1 V when VCC = 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 VREF, 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)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Power Supply Voltage	V _{CC}	8	V
Power Dissipation	P _D	400	mW
Operating Temperature	T _{opr}	-40~85	°C
Storage Temperature	T _{stg}	-55~150	°C

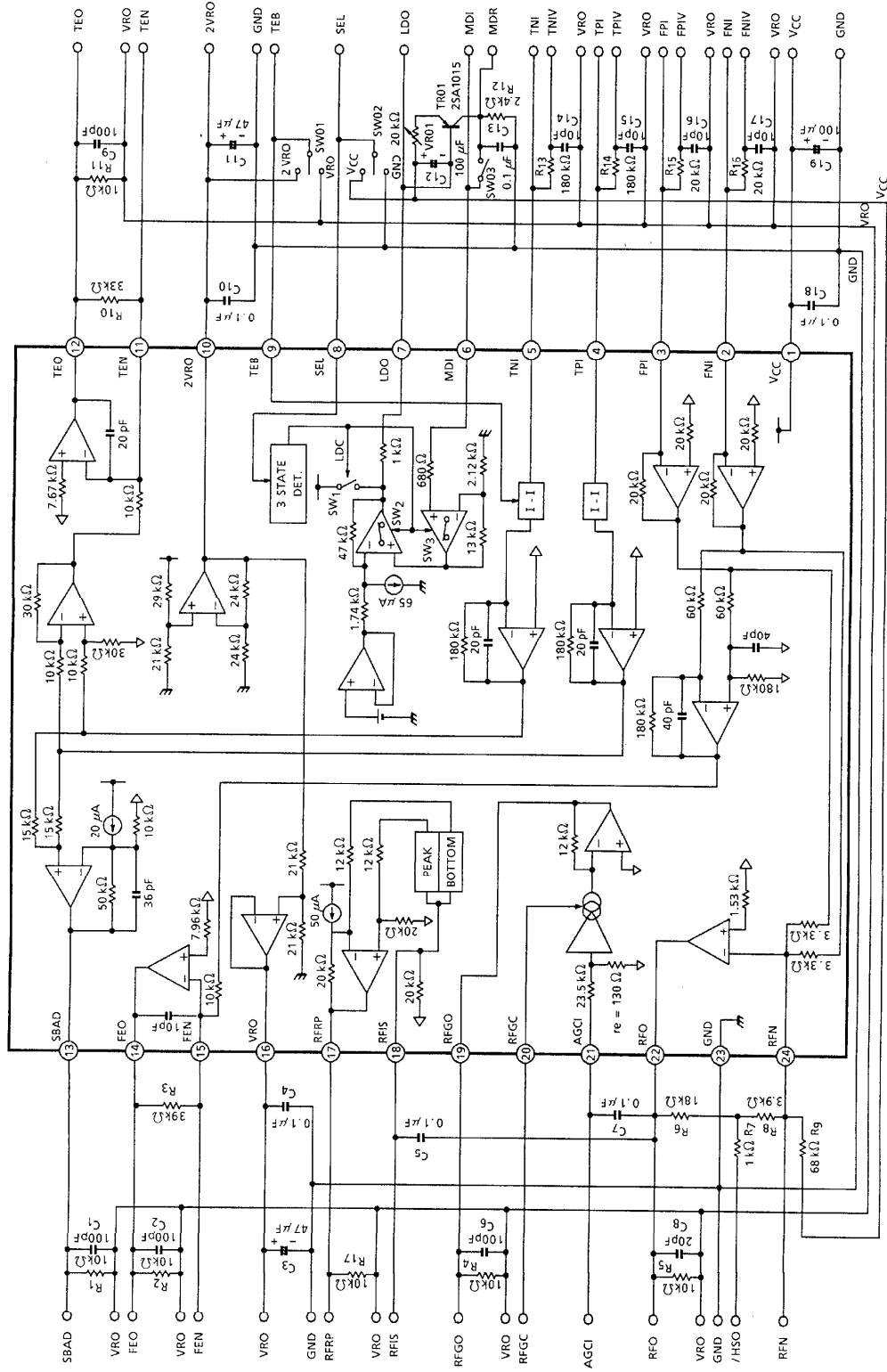
ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{CC} = 5 V, Ta = 25°C)

AC CHARACTERISTICS

CHARACTERISTIC		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 : 2 V _{REF}	Reference Voltage	2 VR	1		4.0	4.2	4.4	V
	Output Current	I _{OH2}	1	ΔV = -0.1 V	3.0	—	—	mA
	Input Current	I _{OL2}	1	ΔV = +0.1 V	0.1	—	—	mA
Reference Voltage : V _{REF}	Reference Voltage	VR	1		2.0	2.1	2.2	V
	Reference Voltage Limit	ΔVR	1	2 × VR / 2 VR - 1	-3.0	0.0	+3.0	%
	Output Current	I _{OH1}	1	ΔV = -0.1 V	5.0	—	—	mA
	Input Current	I _{OL1}	1	ΔV = +0.1 V	5.0	—	—	mA
RF1 FPI (FNI) →RFO	Transfer Resistance	R _T	1	f = 100 kHz, R _{NF} = 22 kΩ	117	130	143	kΩ
	Frequency Characteristic	f _c	1	-3 dB point	—	5.0	—	MHz
	Output Slew Rate	SR	1	C _{RFO} = 20 pF	10	20	—	V / μs
	Noise / Distortion Rate	THD	1	f = 100 kHz, V _{RFO} = 1.2 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	—	—	kΩ
RF2 (AGC) RFO →RFGO	Lower Limit Gain Voltage	G _{V1}	1	f = 100 kHz, R _{FGC} = 0.6 V	0.66	0.73	0.80	V / V
	Upper Limit Gain Voltage	G _{V2}	1	f = 100 kHz, R _{FGC} = 3.6 V	1.60	1.75	1.90	V / V
	Frequency Characteristic	f _c	1	-3 dB point	—	5.0	—	MHz
	Output Slew Rate	SR	1	C _{RFGO} = 20 pF	10	20	—	V / μs
	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 kHz, V _{RFGO} = 1.2 V _{p-p}	—	-40	—	dB
Permissive Load Resistance	R _{LM}	1		10	—	—	kΩ	
APC MDI →LDO	Gain Voltage	G _v	1	f = 1 kHz	—	200	—	V / V
	Operation Reference Voltage	V _{MDI}	1	V _{LDO} = 3.5 V _{DC}	170	178	192	mV
	LD Off Voltage	V _{LDO}	1	LDC = L, V _{CC} reference, SEL = L	-0.7	—	—	V
	Input Vias Current	I _I	1	V _{MDI} = 178 mV	-200	—	+200	nA

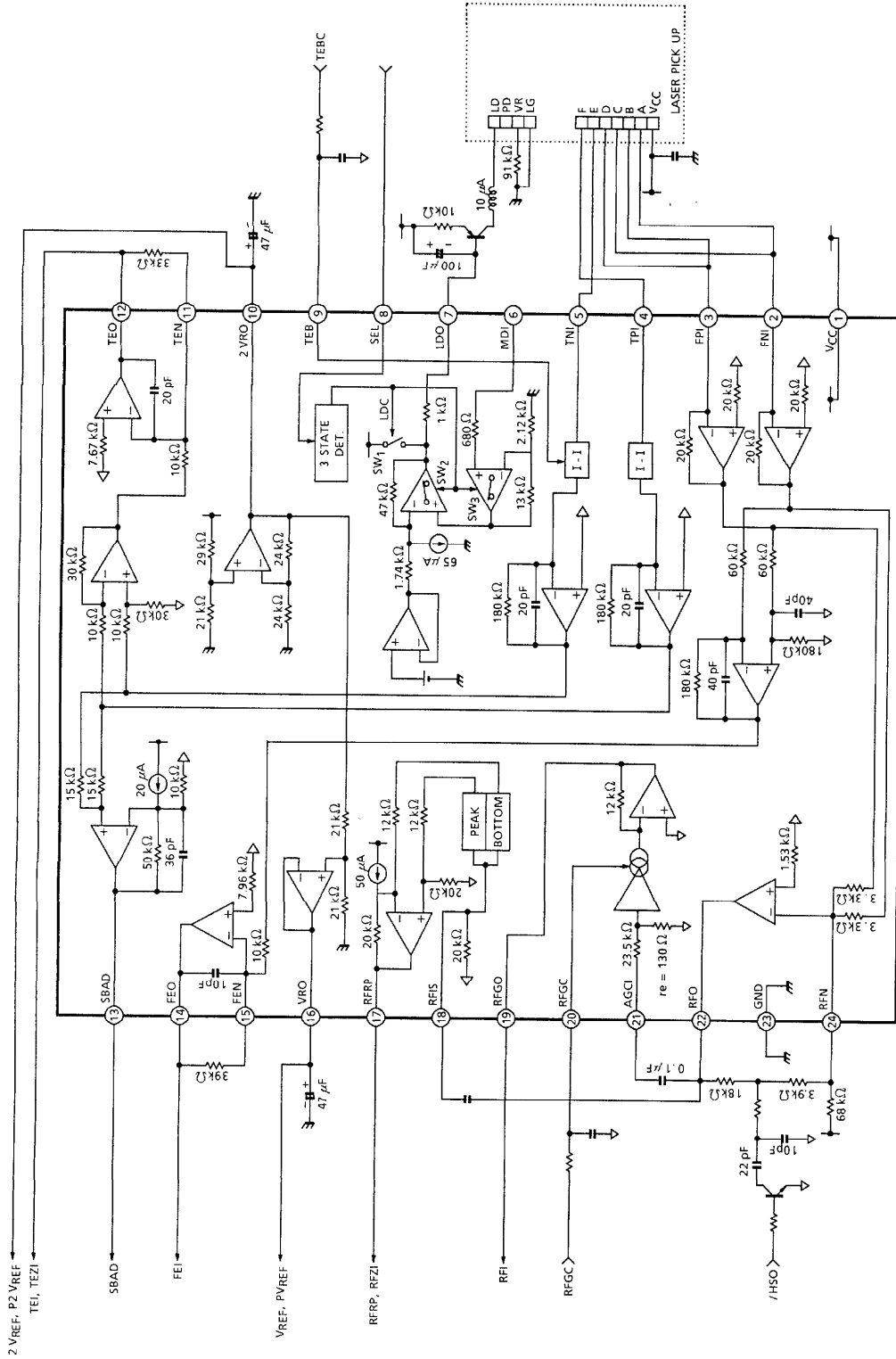
CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
FE FNI (FPI) →FEO	Transfer Resistance	R_T	1	$f = 1 \text{ kHz}, R_{NF} = 39 \text{ k}\Omega$	198	220	242	$\text{k}\Omega$
	Gain Balance	GB	1		-1.0	—	+1.0	dB
	Frequency Characteristic	f_c	1	-3 dB point	—	22	—	kHz
	Output Offset Voltage	V_{OS}	1	VR reference, input open	-30	—	+30	mV
	Noise/Distortion Rate	THD	1	$f = 1 \text{ kHz}, V_{FEO} = 2.4 V_{p-p}$	—	-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
	Permissible Load Resistance	R_{LM}	1		10	—	—	$\text{k}\Omega$
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	$\text{M}\Omega$
	Transfer Resistance Range	ΔR_T	1	TEB = VR reference				
	Max. Transfer Resistance			TEB = GND	35	45	55	%
	Max. Transfer Resistance			TEB = 2 VR	-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	
Permissible Load Resistance	R_{LM}	1		10	—	—	$\text{k}\Omega$	
SBAD TPI (TNI) →SBAD	Transfer Resistance	R_T	1	$f = 1 \text{ kHz}, TEB = VR$	416	520	624	$\text{k}\Omega$
	Frequency Characteristic	f_c	1	-3 dB 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
Permissible Load Resistance	R_{LM}	1		10	—	—	$\text{k}\Omega$	
RFRP RFIS→RFRP	Gain Voltage	G_v	1		1.37	1.46	1.54	V/V
	Detection Frequency Characteristic	f_c	—	SEL = VCC	—	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
	Permissible Load Resistance	R_{LM}	1		10	—	—	$\text{k}\Omega$

TEST CIRCUIT



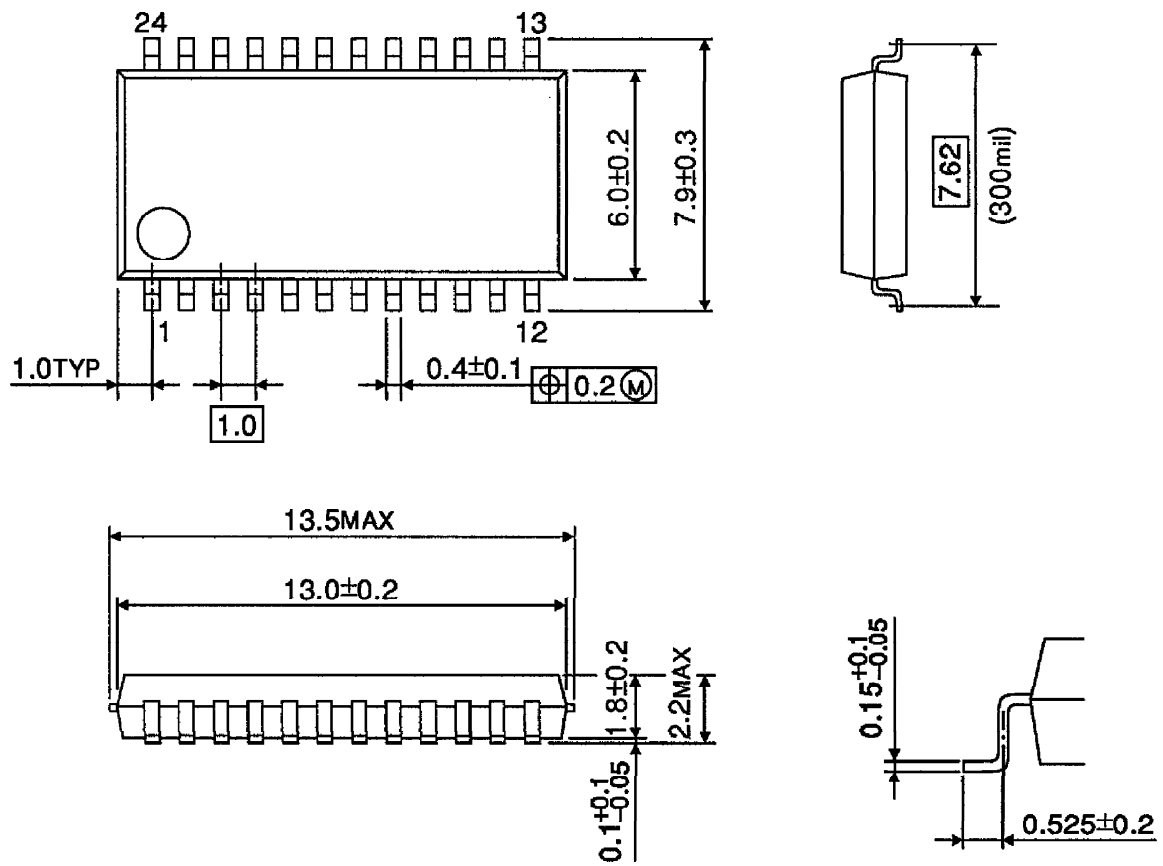
TA2109F-6

APPLICATION CIRCUIT



OUTLINE DRAWING
SSOP24-P-300-1.00

Unit : mm



Weight : 0.3 g (Typ.)