TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA2111N,TA2111F,TA2111FN

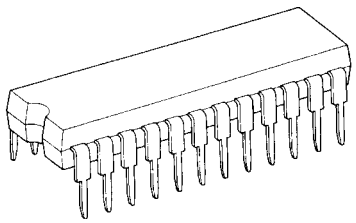
3 V AM/FM 1 Chip Tuner IC

TA2111N/F/FN are AM/FM 1 chip tuner ICs, which are designed for portable radios and 3 V Head phone radios.
FM local oscillation voltage is set up low relativity, for NEW FCC.

Features

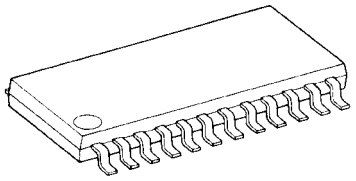
- For NEW FCC.
- AM Detector coil, FM IFT, IF coupling condenser are not needed.
- For adopting ceramic discriminator, it is not necessary to adjust the FM quad detector circuit.
- Built-in FM MPX VCO circuit.
- Built-in varactor diode for AFC.
- Built-in AM low cut circuit.
- Low supply current. (V_{CC} = 3 V, Ta = 25°C)
  I_{CCq} (FM) = 9.0 mA (typ.)
  I_{CCq} (AM) = 5.0 mA (typ.)
- Operating supply voltage range: V_{CC} = 1.8~7 V (Ta = 25°C)

TA2111N



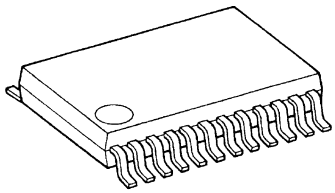
SDIP24-P-300-1.78

TA2111F



SSOP24-P-300-1.00

TA2111FN

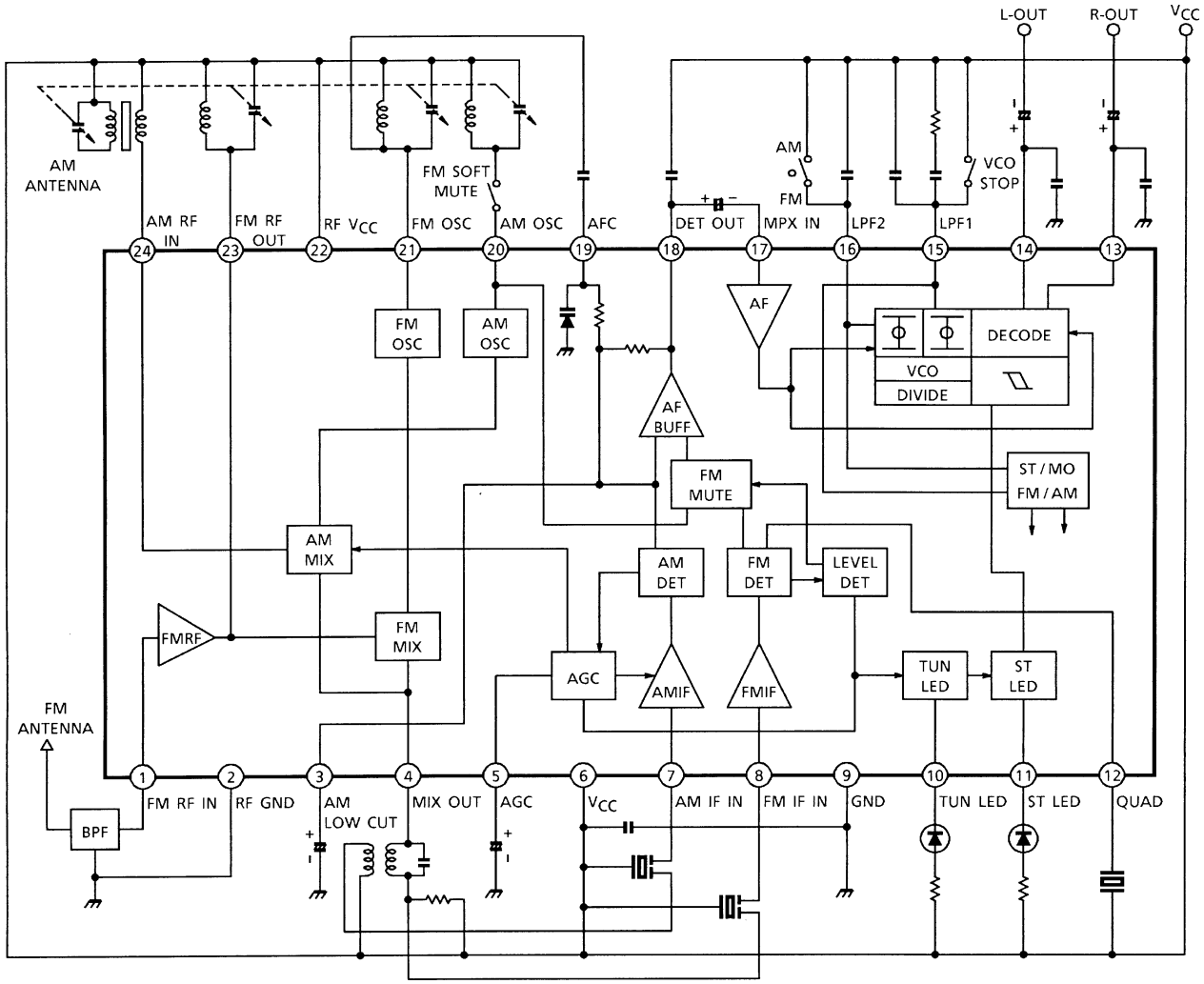


SSOP24-P-300-0.65A

Weight
SDIP24-P-300-1.78: 1.2 g (typ.)
SSOP24-P-300-1.00: 0.31 g (typ.)
SSOP24-P-300-0.65A: 0.14 g (typ.)

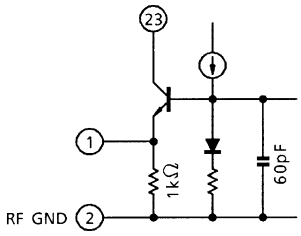
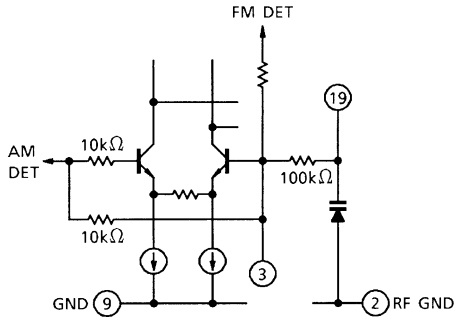
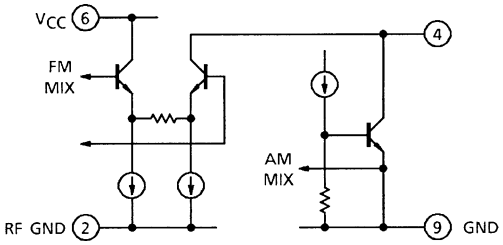
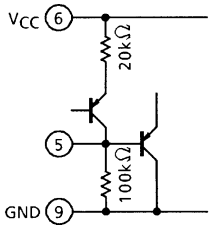
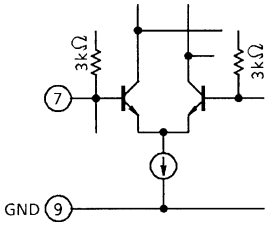
Note 1: Handle with care to prevent devices from deteriorations by static electricity.

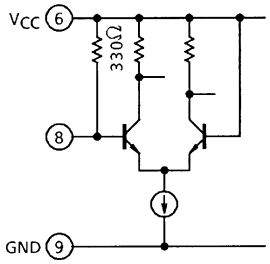
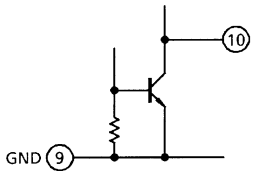
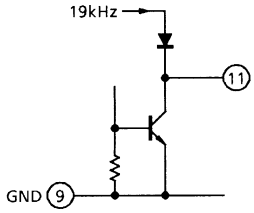
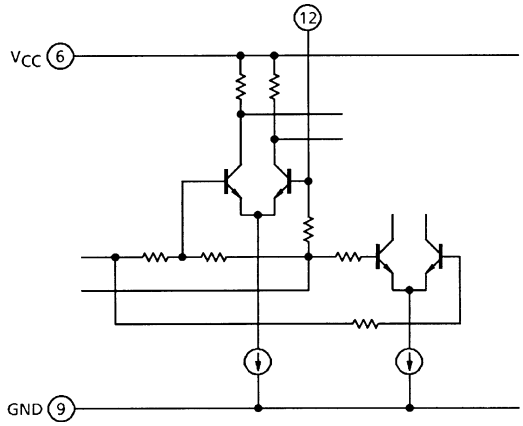
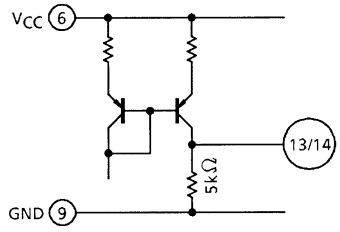
Block Diagram

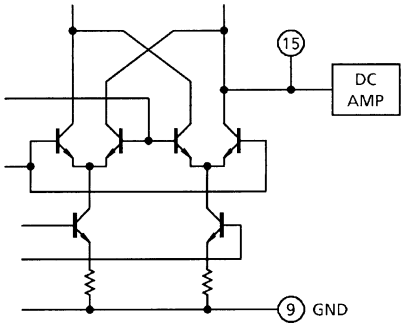
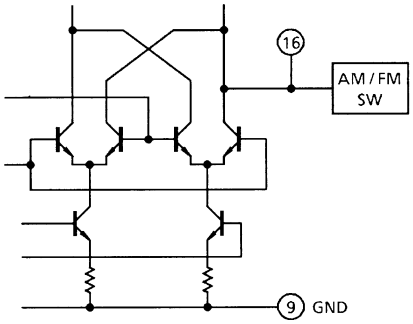
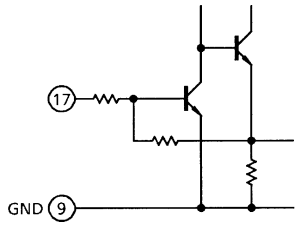
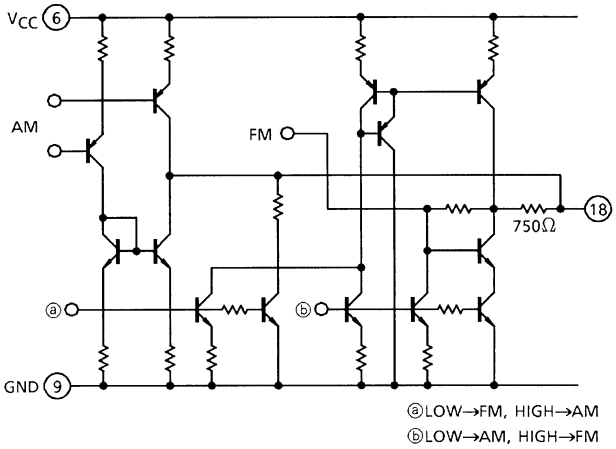


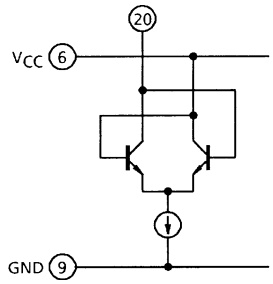
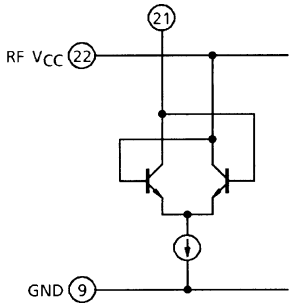
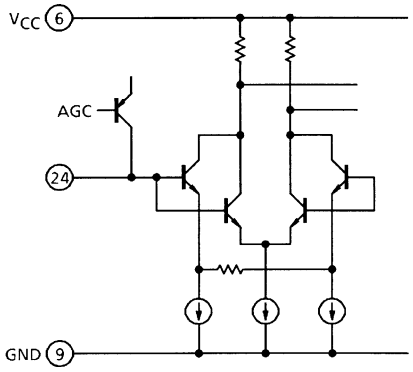
Explanation of Terminals

(Terminal voltage: Typical terminal voltage at no signal with test circuit, V_{CC} = 3 V, Ta = 25°C)

Pin No.	Characteristics	Internal Circuit	Terminal Voltage (Typ.) (V)	
			AM	FM
1	FM-RF IN		0	0.8
2	RF GND (GND for FM RF, FM OSC stage)	—	0	0
3	AM LOW CUT		1.0	0.8
4	MIX OUT		3.0	2.9
5	AGC (AM AGC)		0	0
6	V_{CC} (V_{CC} for AM, FM IF, FM MPX stage)	—	3.0	3.0
7	AM IF IN		2.3	2.6

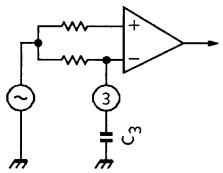
Pin No.	Characteristics	Internal Circuit	Terminal Voltage (Typ.) (V)	
			AM	FM
8	FM IF IN		3.0	3.0
9	GND (GND for AM, FM IF, FM MPX stage)	—	0	0
10	TUN LED (Tuning LED)		—	—
11	ST LED (Stereo LED)		—	—
12	QUAD (FM QUAD. Detector)		2.5	2.2
13 14	R-OUT (R-ch Output) L-OUT (L-ch Output)		1.2	1.2

Pin No.	Characteristics	Internal Circuit	Terminal Voltage (Typ.) (V)	
			AM	FM
15	LPF1 ● LPF terminal for synchronous Detector ● VCO stop terminal V15 = V_{CC} → VCO STOP		2.3	2.3
16	LPF2 ● LPF terminal for phase Detector ● Bias terminal for AM/FM SW circuit V16 = V_{CC} → AM V16 = OPEN → FM		3	2.2
17	MPX IN		0.7	0.7
18	DET OUT		1.0	0.9

Pin No.	Characteristics	Internal Circuit	Terminal Voltage (Typ.) (V)	
			AM	FM
19	AFC	cf. pin 3	—	—
20	AM OSC		3.0	3.0
21	FM OSC		3.0	3.0
22	RF V_{CC} (V_{CC} for FM OSC stage)	—	3.0	3.0
23	FM RF OUT	cf. pin 1	3.0	3.0
24	AM RF IN		3.0	3.0

Application Note

1. AM low-cut circuit



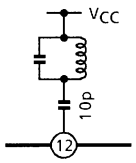
- The AM Low-Cut action is carried out by the bypass of the high frequency component of the positive-feedback signal at the AF AMP stage.
  The external capacitor: C_3 by-passes this component.
- The cut-off frequency f_L is determined by the internal resistance 10 kΩ (typ.) and the external capacitor C_3 as following ;

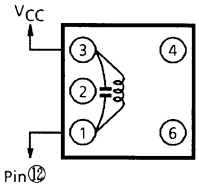
$$f_L = \frac{1}{2 \times \pi \times 10 \times 10^3 \times C_3} \text{ (Hz)}$$

- In the case of the AM Low-Cut function is not needed, set up the value of C_3 over 1 μF. In the condition of $C_3 \geq 1$ μF, the frequency characteristic has flat response at the low frequency.
- In FM mode, C_3 is a capacitor for AFC Low-Pass filter circuit.

2. FM detection circuit

For the FM detection circuit, detection coil is able to use instead of ceramic discriminator. Recommended circuit and recommended coil are as follows. In this case, please take care that V_{in} (lim.) falls a little.





Test Frequency	C_o (pF)	Q_o	Turns				Wire (mmφ)	Reference
			1-2	2-3	1-3	4-6		
10.7 MHz	51	45	—	—	30	—	0.08 UEW	TOKO Co., Ltd. 600BEAS-10018Z

Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Supply voltage		V_{CC}	8	V
LED current		ILED	10	mA
LED voltage		VLED	8	V
Power dissipation	TA2111N	P_D (Note 2)	1200	mW
	TA2111F		400	
	TA2111FN		500	
Operating temperature		T_{opr}	−25~75	°C
Storage temperature		T_{stg}	−55~150	°C

Note 2: Derated above Ta = 25°C in the proportion of 9.6 mW/°C for TA2111N, of 3.2 mW/°C for TA2111F and of 4 mW/°C for TA2111FN.

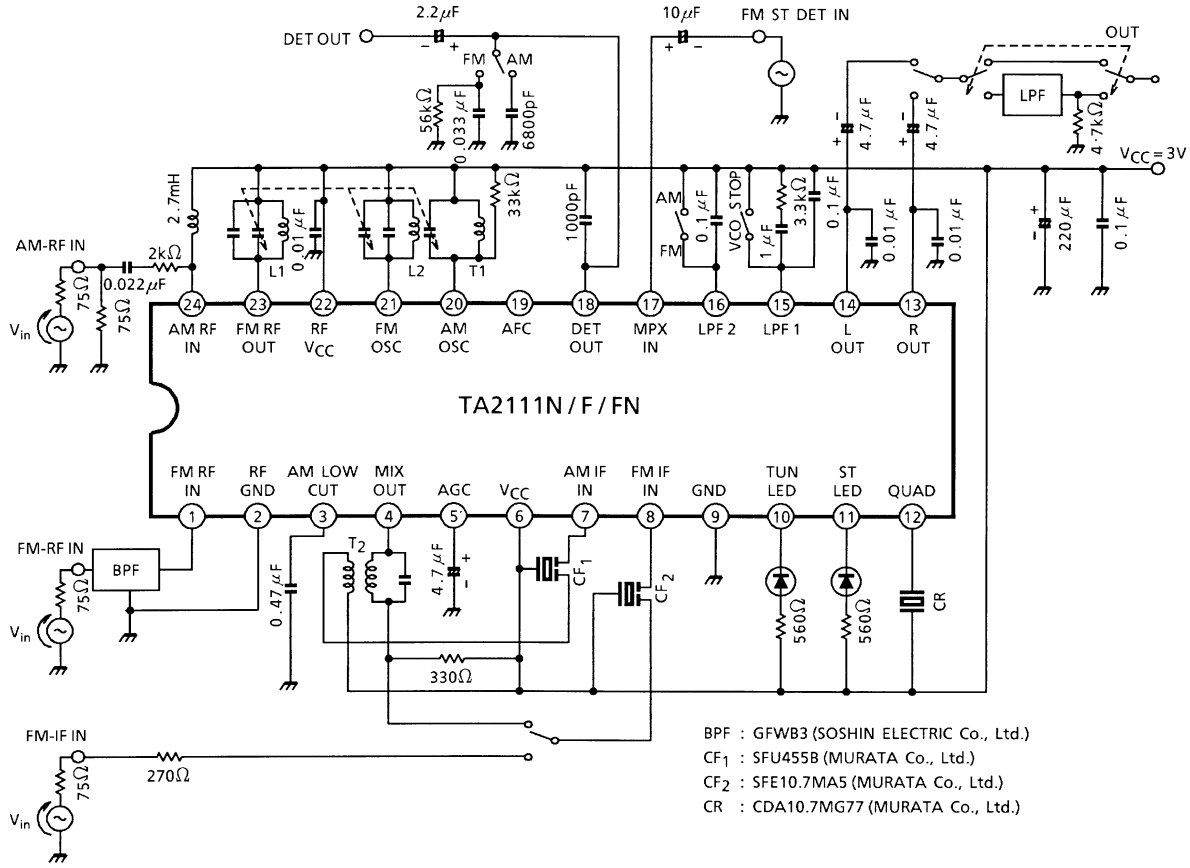
Electrical Characteristics

unless otherwise specified, Ta = 25°C, V_{CC} = 3 V,

F/E : f = 98 MHz, f_m = 1 kHz
FM IF : f = 10.7 MHz, Δf = ±22.5 kHz, f_m = 1 kHz
AM : f = 1 MHz, MOD = 30%, f_m = 1 kHz
MPX : f_m = 1 kHz

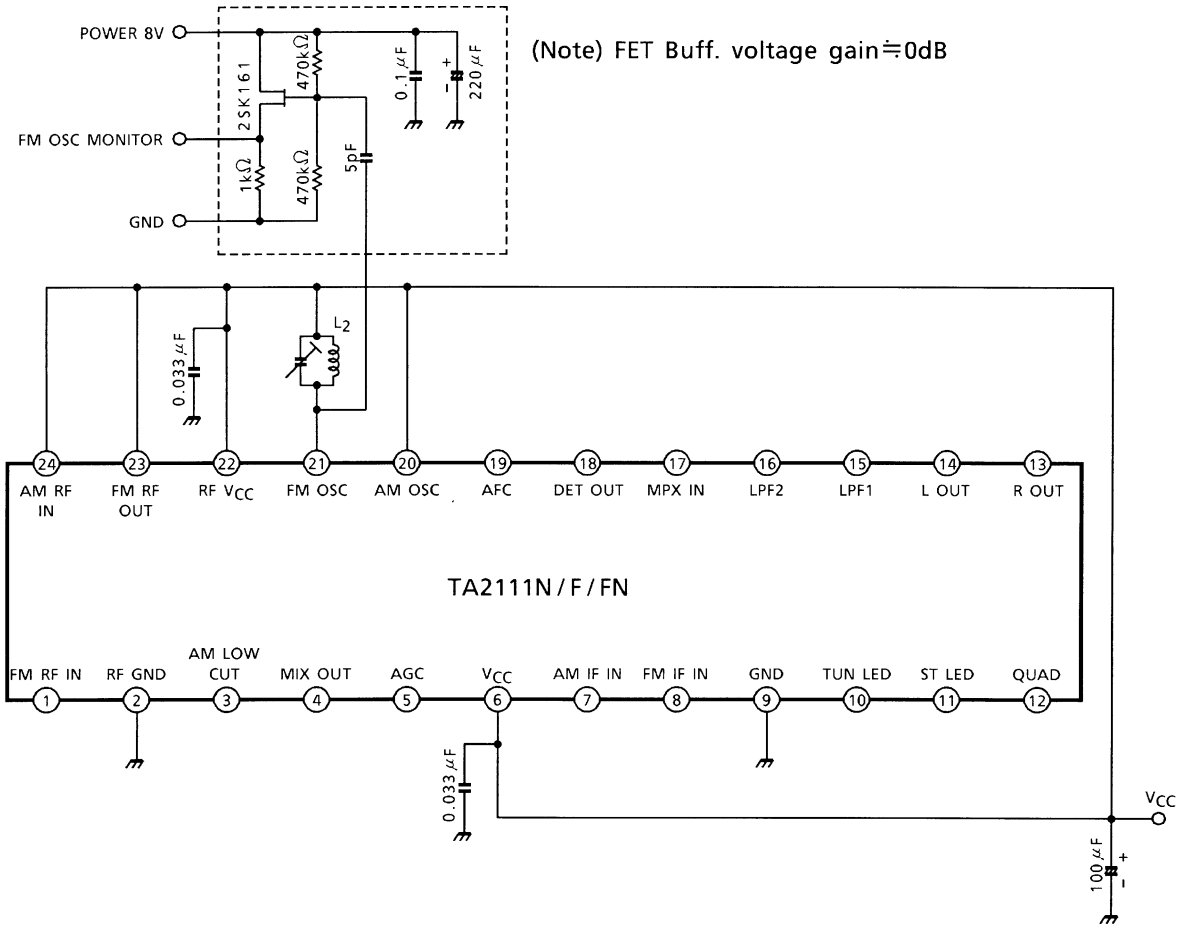
Characteristics			Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Supply current			$I_{CC\ (FM)}$	1	Vin = 0, FM mode		—	9	12.5	mA
			$I_{CC\ (AM)}$	1	Vin = 0, AM mode		—	5	7.5	
F/E	Input limiting voltage		Vin (lim)	1	−3dB limiting		—	7	—	dBμV EMF
	Local OSC voltage		V_{OSC}	2	f_{OSC} = 108.7 MHz		—	105	—	mVrms
FM IF	Input limiting voltage		Vin (lim) IF	1	−3dB limiting		35	40	45	dBμV EMF
	Recovered output voltage		V_{OD}	1	Vin = 80dBμV EMF		60	75	90	mVrms
	Signal to noise ratio		S/N	1	Vin = 80dBμV EMF		—	65	—	dB
	Total harmonic distortion		THD	1	Vin = 80dBμV EMF		—	0.2	—	%
	AM rejection ration		AMR	1	Vin = 80dBμV EMF		—	45	—	dB
	LED on sensitivity		V_L	1	I_L = 1 mA		40	45	50	dBμV EMF
	Soft mute attenuation		MUTE	1	Vin = 0		—	20	—	dB
AM	Gain		G_V	1	Vin = 25dBμV EMF		18	35	70	mVrms
	Recovered output voltage		V_{OD}	1	Vin = 60dBμV EMF		50	70	90	mVrms
	Signal to noise ratio		S/N	1	Vin = 60dBμV EMF		—	41	—	dB
	Total harmonic distortion		THD	1	Vin = 60dBμV EMF		—	0.7	—	%
	LED on sensitivity		V_L	1	I_L = 1 mA		23	28	33	dBμV EMF
Pin 18 output resistance			R_{18}	—	FM mode		—	0.75	—	kΩ
					AM mode		—	15.5	—	
MPX	Input resistance		R_{IN}	—	—		—	55	—	kΩ
	Output resistance		R_{OUT}	—	—		—	5	—	kΩ
	Max composite signal input voltage		Vin MAX (STEREO)	1	L + R = 90%, P = 10%, f_m = 1 kHz, THD = 3%		—	700	—	mVrms
	Separation		Sep	1	L + R = 180 mVrms, P = 20 mVrms	f_m = 100 Hz	—	45	—	dB
						f_m = 1 kHz		45	—	
						f_m = 10 kHz	—	45	—	
	Total harmonic distortion	Monaural	THD (MONAURAL)	1	Vin = 200 mVrms		—	0.3	—	%
		Stereo	THD (STEREO)	1	L + R = 180 mVrms, P = 20 mVrms		—	0.3	—	
	Voltage gain		G_V	1	Vin = 200 mVrms		−2.5	−1	0.5	dB
	Channel balance		C.B.	1	Vin = 200 mVrms		−1.5	0	1.5	dB
	Stereo LED sensitivity	ON	$V_{L\ (ON)}$	1	Pilot input		—	8	12	mVrms
		OFF	$V_{L\ (OFF)}$	1			3	6	—	
	Stereo LED hysteresis		V_H	1	To LED turn off from LED turn on		—	2	—	mVrms
	Capture range		C.R.	1	P = 20 mVrms		—	±8	—	%
	Signal to noise ratio		S/N	1	—		—	80	—	dB

Test Circuit 1



BPF : GFWB3 (SOSHIN ELECTRIC Co., Ltd.)
CF_1 : SFU455B (MURATA Co., Ltd.)
CF_2 : SFE10.7MA5 (MURATA Co., Ltd.)
CR : CDA10.7MG77 (MURATA Co., Ltd.)

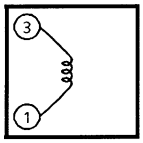
Test Circuit 2



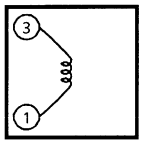
Coil Data

Coil No.	Test Freq.	L (μH)	C_o (pF)	Q_o	Turns					Wire (mmφ)	Reference
					1-2	2-3	1-3	1-4	4-6		
L_1 FM RF	100 MHz	—	—	79	—	—	—	$2\frac{1}{2}$	—	0.16UEW	TOKO Co., Ltd. 666SNF-305NK
L_2 FM OSC	100 MHz	—	—	76	—	—	—	2	—	0.16UEW	TOKO Co., Ltd. 666SNF-306NK
T_1 AM OSC	796 kHz	268	—	65	19	95	—	—	—	0.05UEW	TOKO Co., Ltd. 5PNR-5146Y
T_2 AM IFT	455 kHz	—	470	60	—	—	109	—	7	0.05UEW	TOKO Co., Ltd. 5PLG-5147X

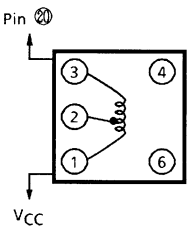
L_1 : FM RF



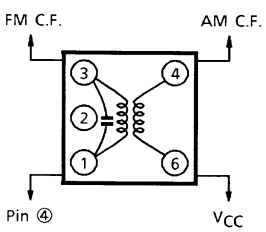
L_2 : FM OSC



T_1 : AM OSC

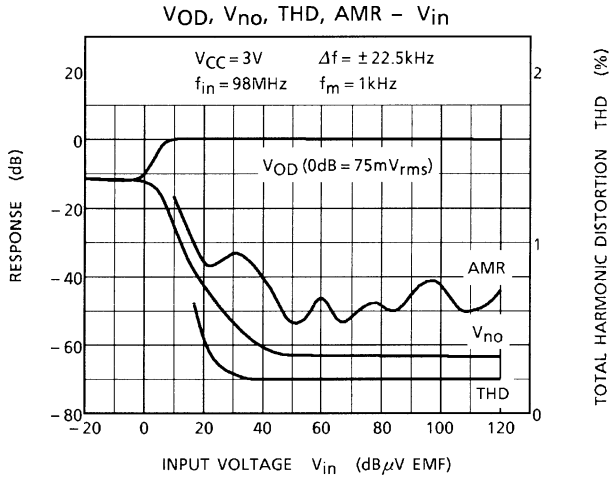


T_2 : AM IFT

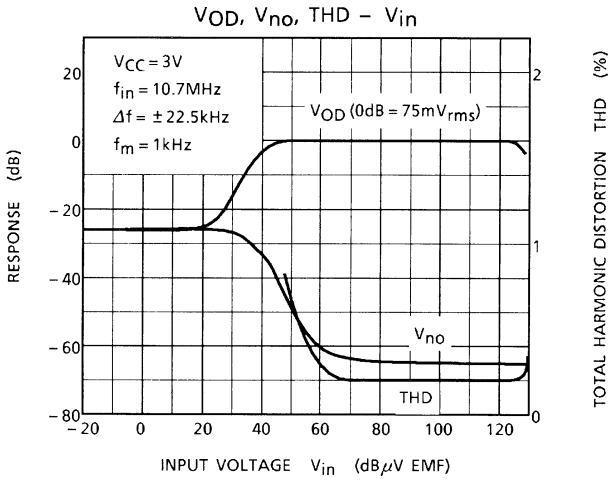


(BOTTOM VIEW)

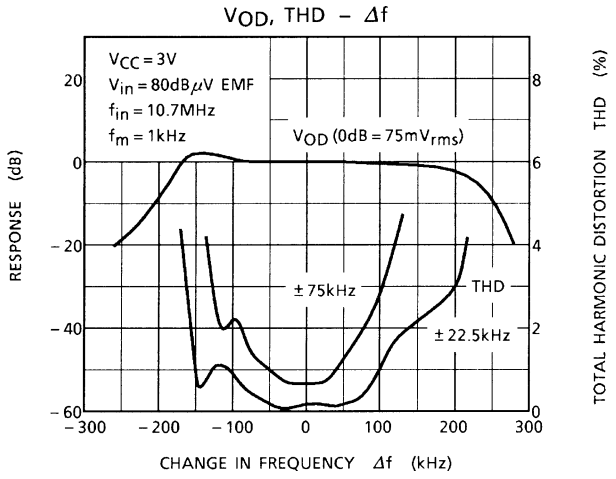
FM (F/E+IF)



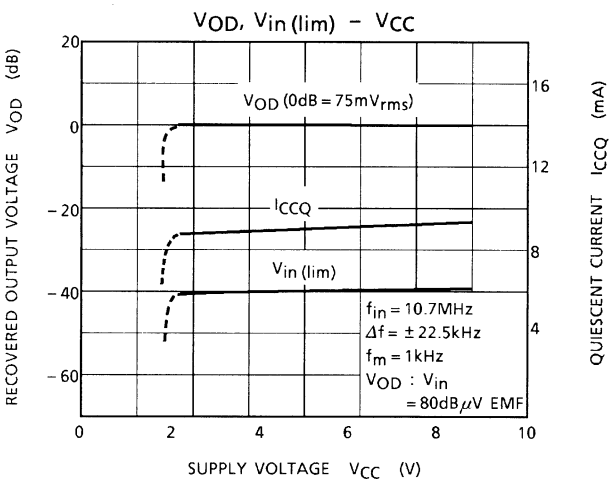
FM (IF)



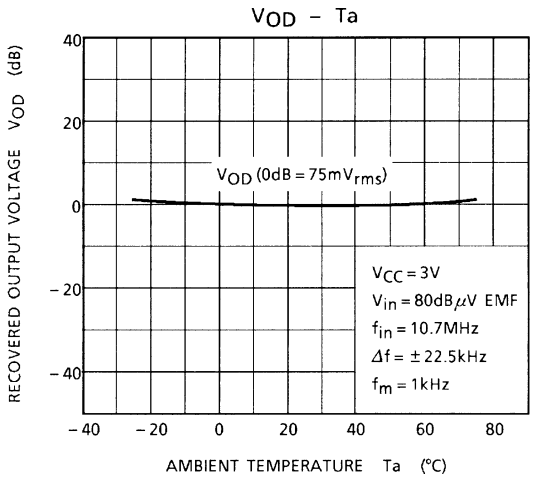
FM (IF)



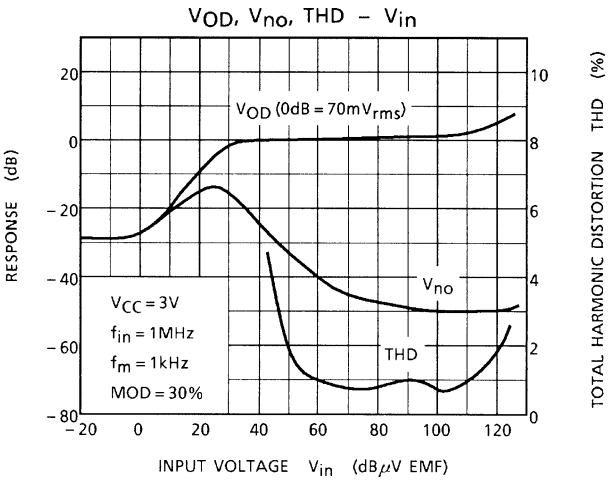
FM (IF)



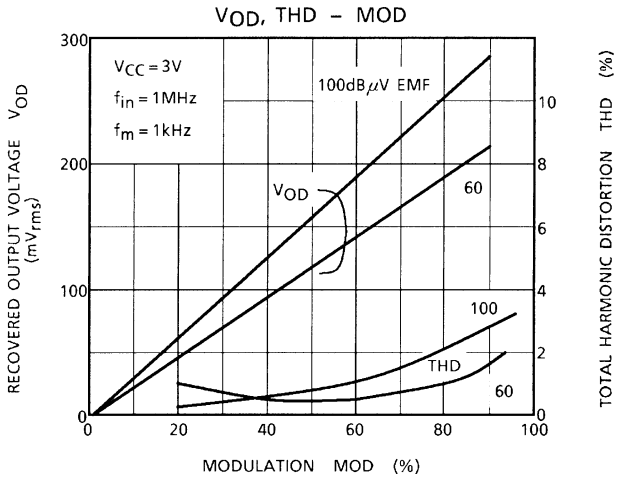
FM (IF)



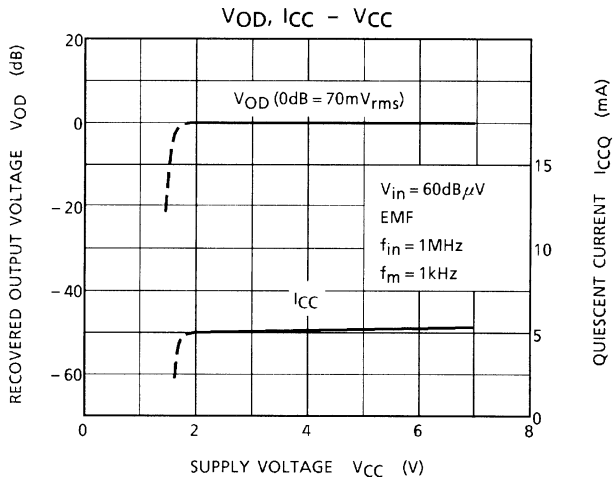
AM



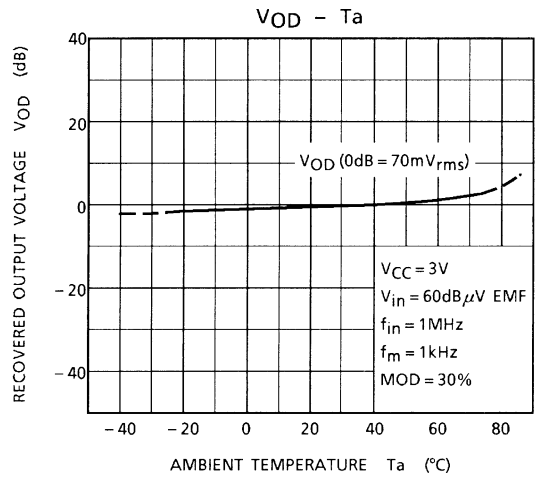
AM



AM



AM



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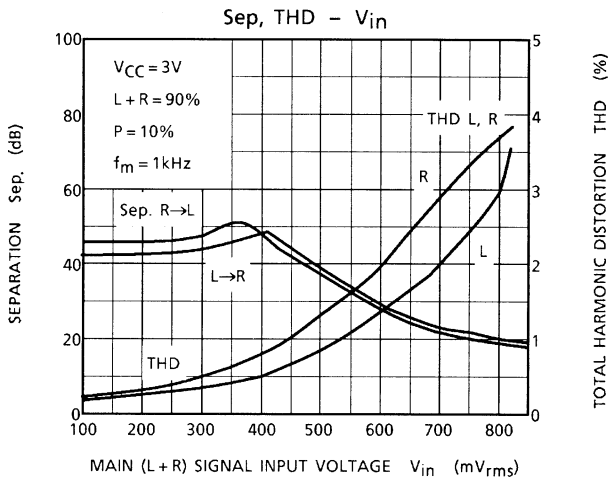

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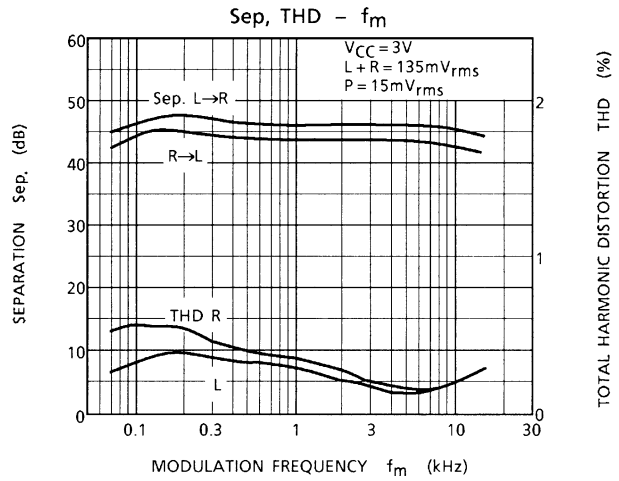

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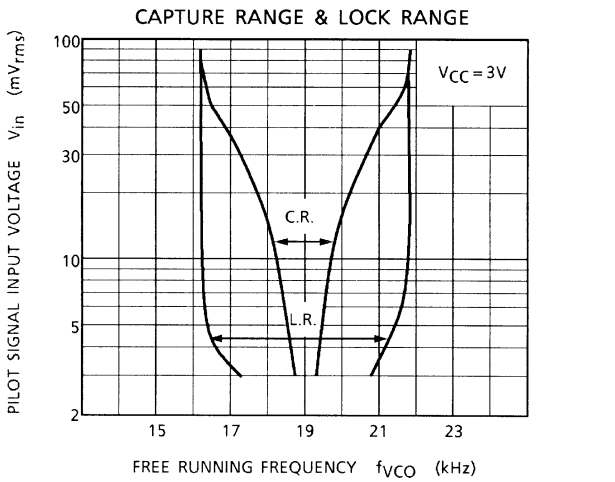

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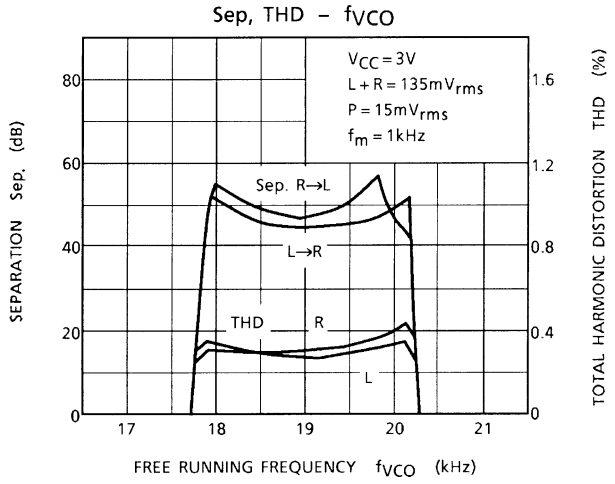
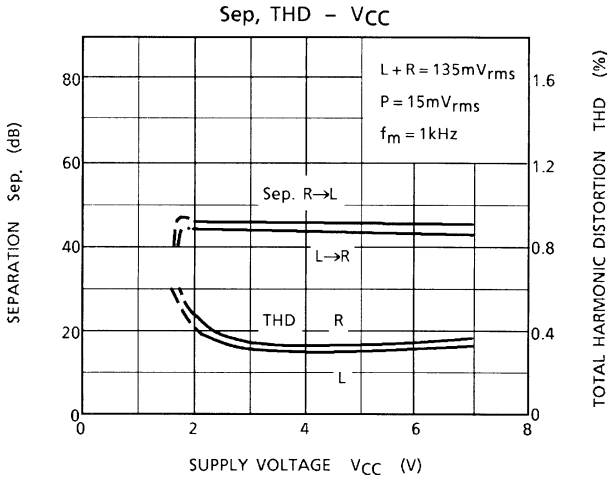
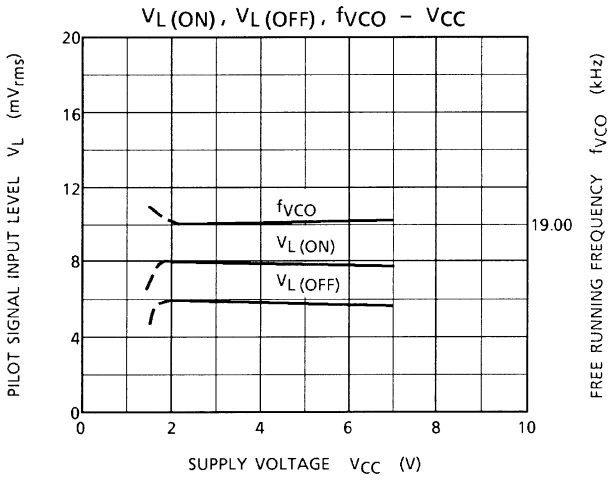

Sep, THD – fVCO
VCC = 3V
L + R = 135mVrms
P = 15mVrms
fm = 1kHz
Sep. R→L
L→R
THD
R
L
SEPARATION Sep. (dB)
TOTAL HARMONIC DISTORTION THD (%)
FREE RUNNING FREQUENCY fVCO (kHz)

MPX

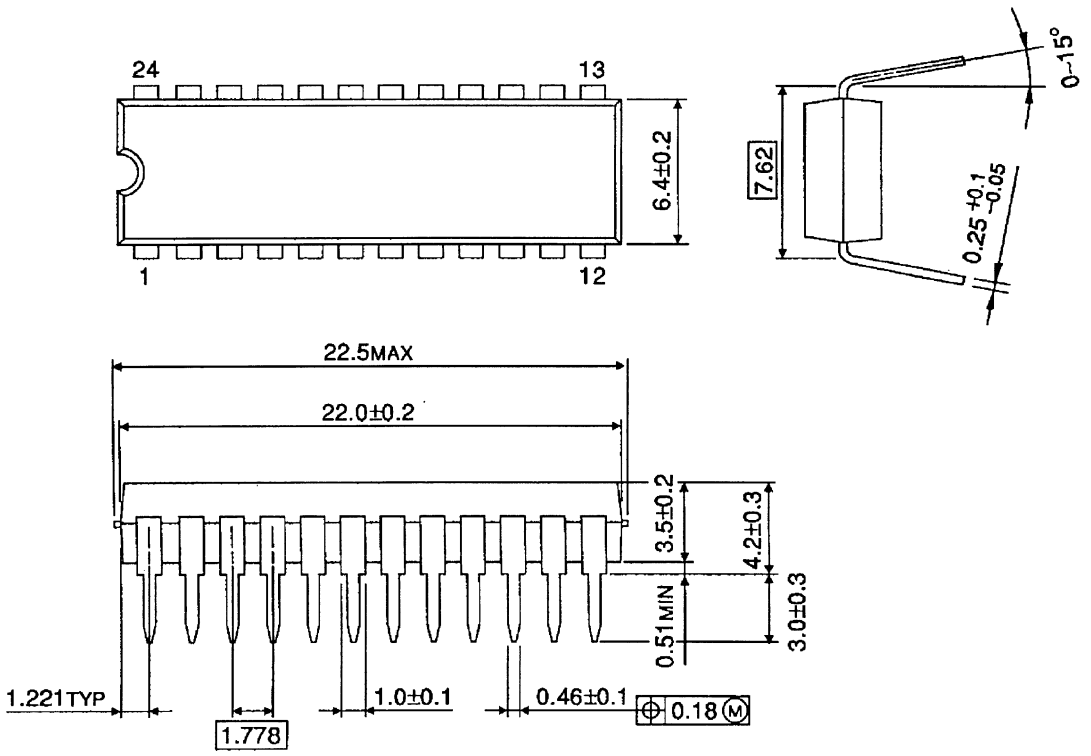

Sep, THD – VCC
L + R = 135mVrms
P = 15mVrms
fm = 1kHz
Sep. R→L
L→R
THD
R
L
SEPARATION Sep. (dB)
TOTAL HARMONIC DISTORTION THD (%)
SUPPLY VOLTAGE VCC (V)

MPX


VL (ON), VL (OFF), fVCO – VCC
fVCO
VL (ON)
VL (OFF)
19.00
PILOT SIGNAL INPUT LEVEL VL (mVrms)
FREE RUNNING FREQUENCY fVCO (kHz)
SUPPLY VOLTAGE VCC (V)

Package Dimensions

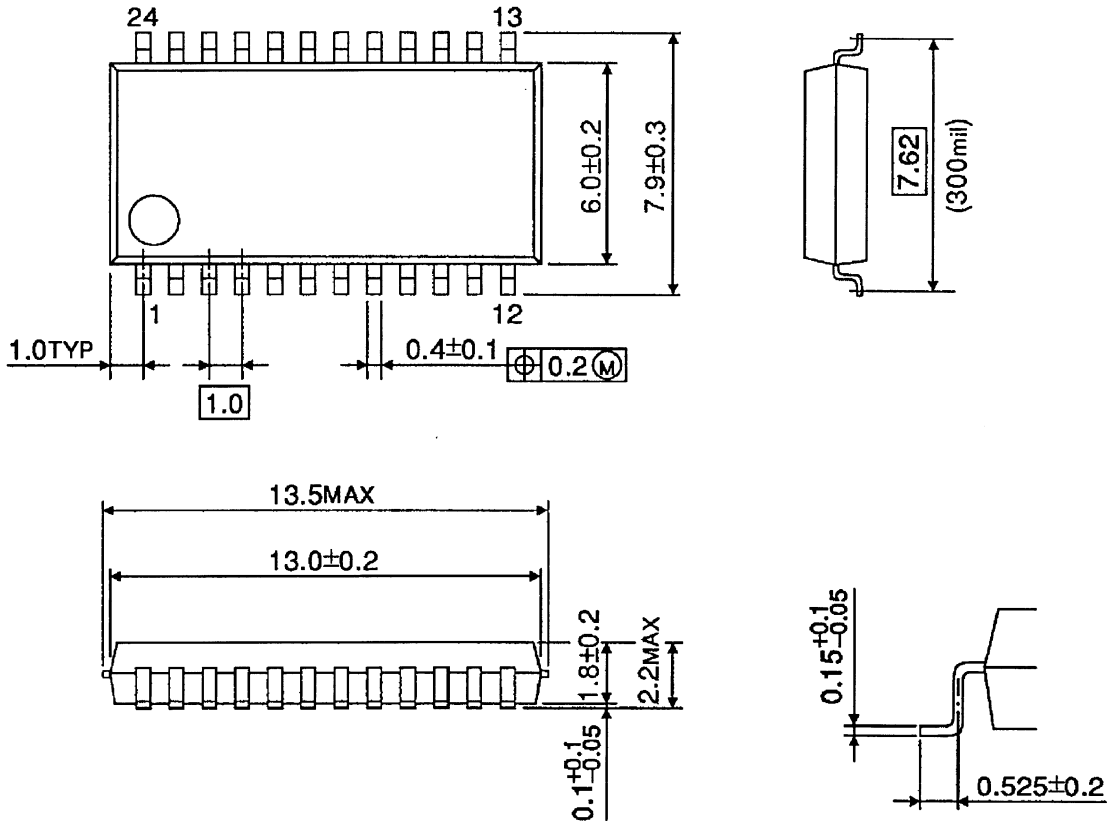
SDIP24-P-300-1.78 Unit : mm



Weight: 1.2 g (typ.)

Package Dimensions

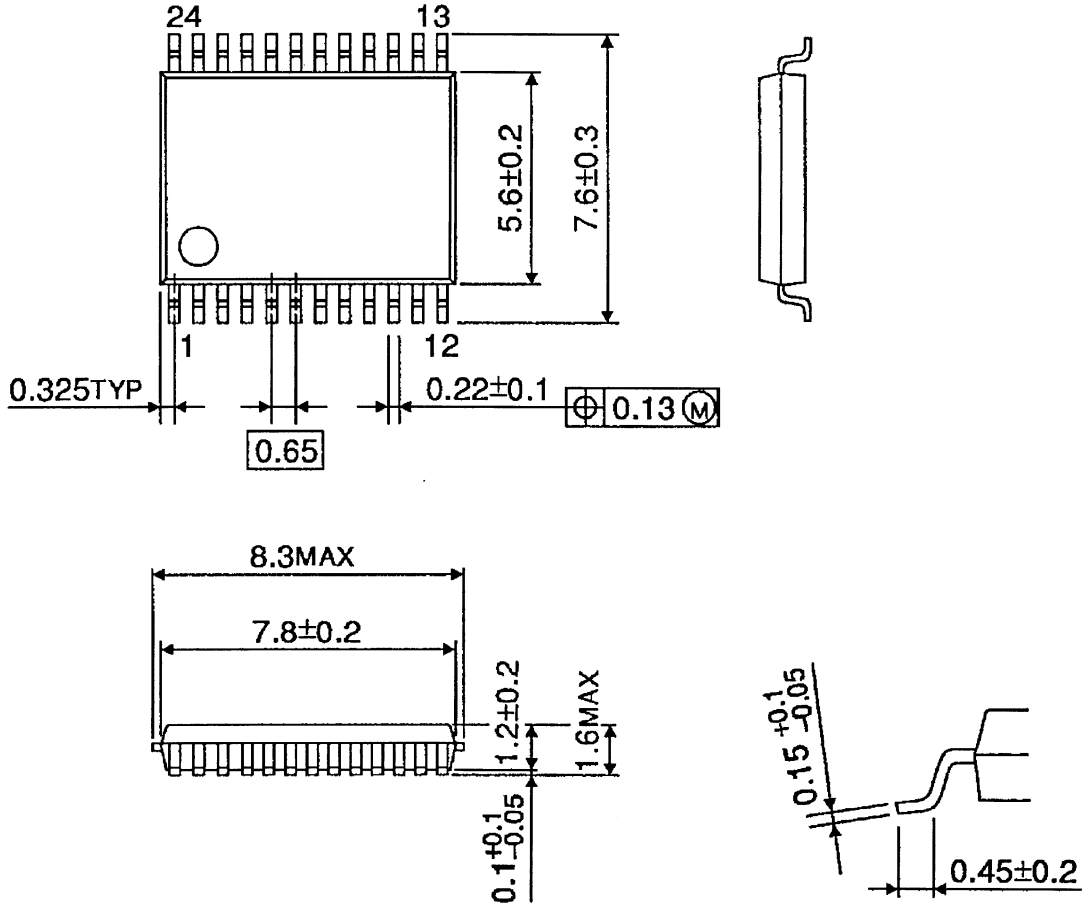
SSOP24-P-300-1.00 Unit : mm



Weight: 0.31 g (typ.)

Package Dimensions

SSOP24-P-300-0.65A Unit : mm



Weight: 0.14 g (typ.)

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000707EBA

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