

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

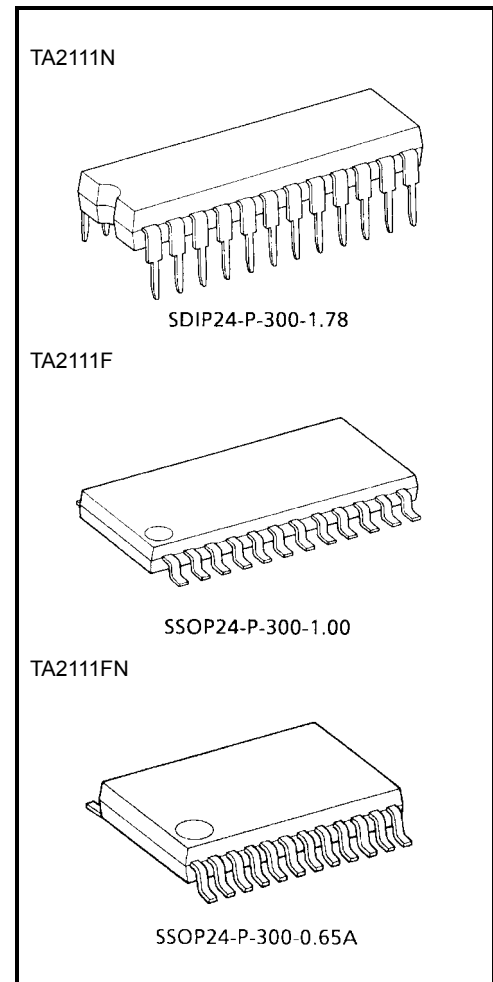
TA2111N, TA2111F, TA2111FN

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. ($V_{CC} = 3\text{ V}$, $T_a = 25^\circ\text{C}$)
 ICC_q (FM) = 9.0 mA (typ.)
 ICC_q (AM) = 5.0 mA (typ.)
- Operating supply voltage range: $V_{CC} = 1.8\sim 7\text{ V}$ ($T_a = 25^\circ\text{C}$)

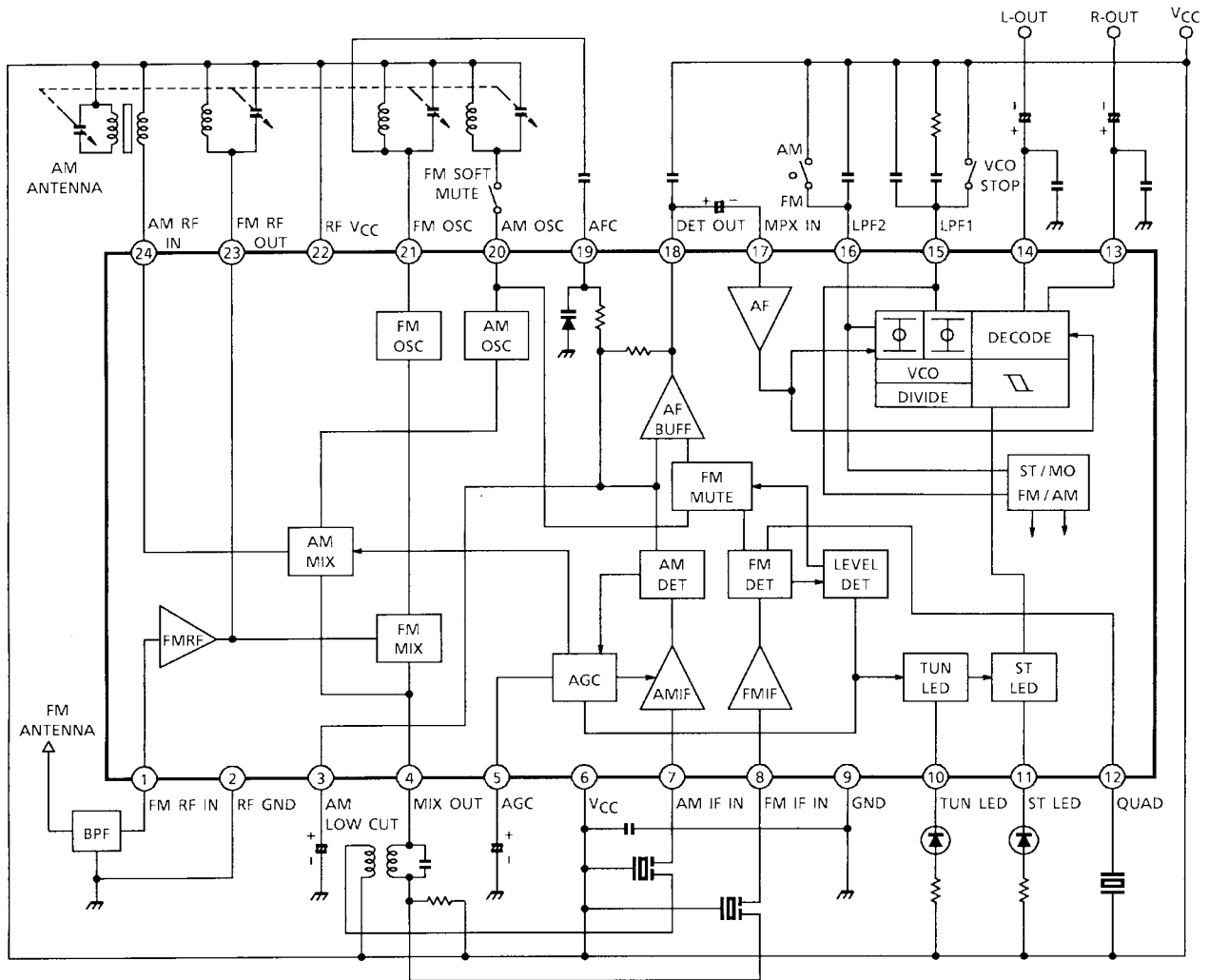


Weight

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, $V_{CC} = 3\text{ V}$, $T_a = 25^\circ\text{C}$)

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	<p>LPF1</p> <ul style="list-style-type: none"> • LPF terminal for synchronous Detector • VCO stop terminal <p>V15 = V_{CC} → VCO STOP</p>		2.3	2.3
16	<p>LPF2</p> <ul style="list-style-type: none"> • LPF terminal for phase Detector • Bias terminal for AM/FM SW circuit <p>V16 = V_{CC} → AM V16 = OPEN → FM</p>		3	2.2
17	MPX IN		0.7	0.7
18	DET OUT	<p>(A) LOW→FM, HIGH→AM (B) LOW→AM, HIGH→FM</p>	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

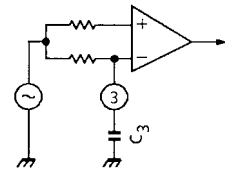
Application Note

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: C₃ by-passes this component.
- The cut-off frequency f_L is determined by the internal resistance 10 kΩ (typ.) and the external capacitor C₃ as following ;

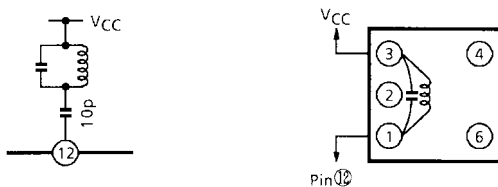
$$f_L = \frac{1}{2 \times \pi \times 10 \times 10^3 \times C_3} \text{ (Hz)}$$

- In the case of the AM Low-Cut function is not needed, set up the value of C₃ over 1 μF. In the condition of C₃ ≥ 1 μF, the frequency characteristic has flat response at the low frequency.
- In FM mode, C₃ 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	I _{LED}	10	mA
LED voltage	V _{LED}	8	V
Power dissipation	TA2111N	P _D (Note 2)	1200
	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, $T_a = 25^\circ\text{C}$, $V_{CC} = 3\text{ V}$,

F/E : $f = 98\text{ MHz}$, $f_m = 1\text{ kHz}$

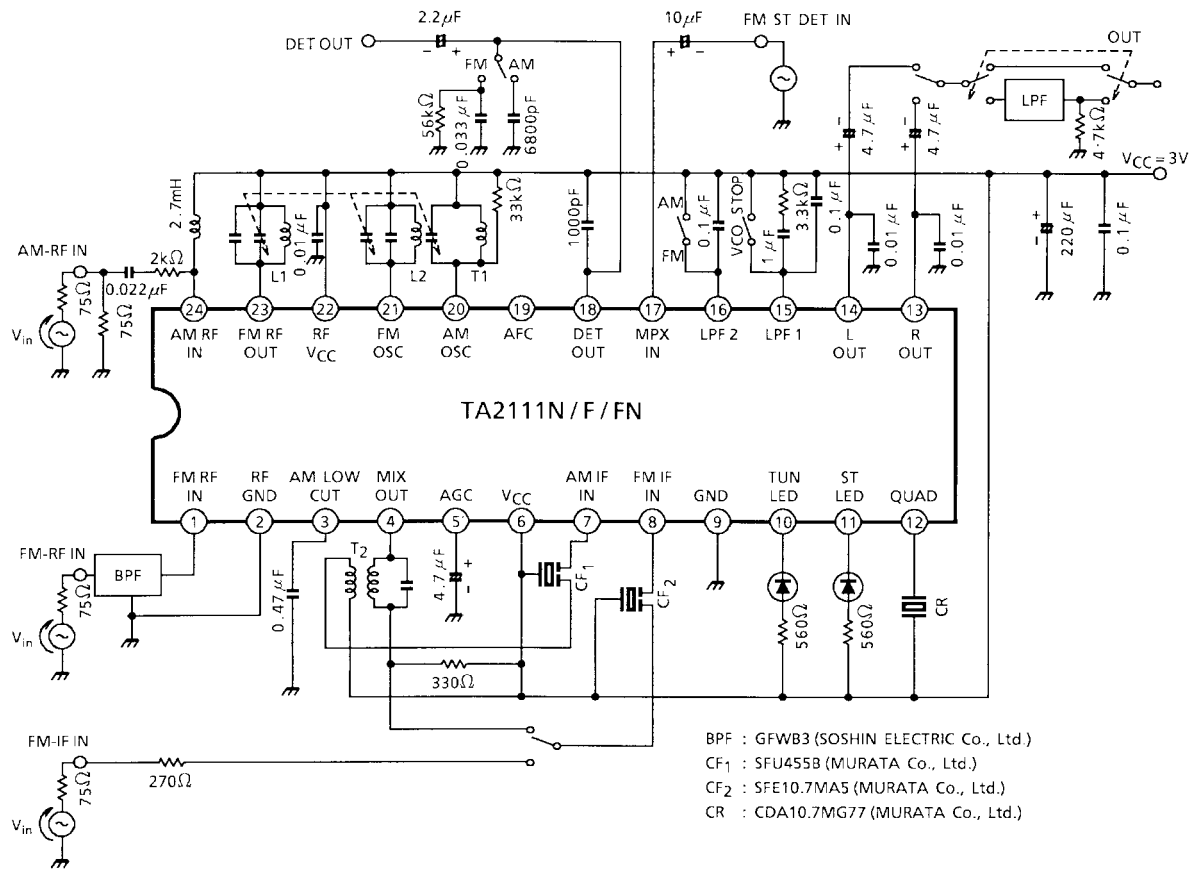
FM IF : $f = 10.7\text{ MHz}$, $\Delta f = \pm 22.5\text{ kHz}$, $f_m = 1\text{ kHz}$

AM : $f = 1\text{ MHz}$, $\text{MOD} = 30\%$, $f_m = 1\text{ kHz}$

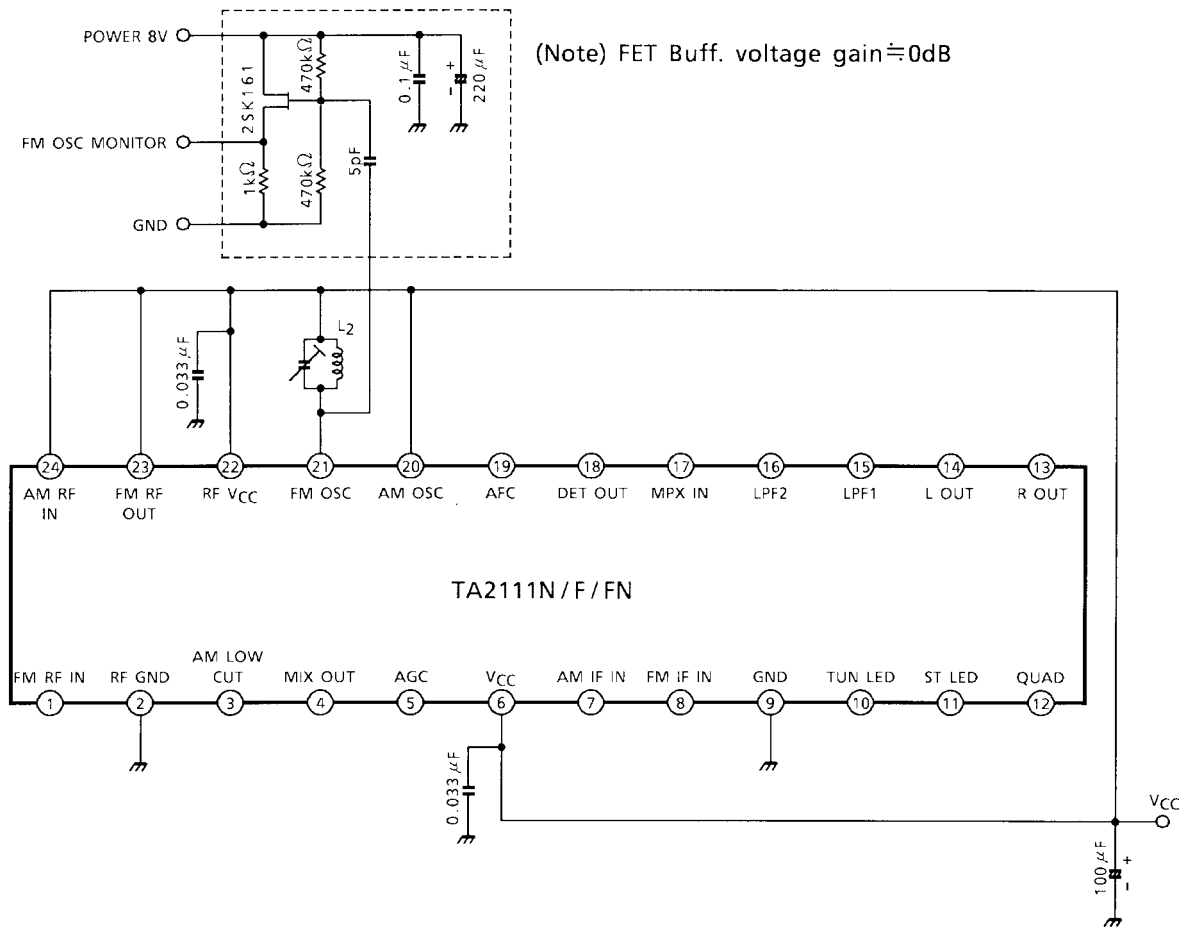
MPX : $f_m = 1\text{ kHz}$

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

Test Circuit 1



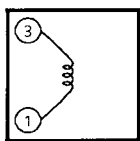
Test Circuit 2



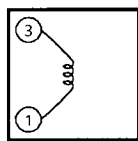
Coil Data

Coil No.	Test Freq.	L (μ H)	C_0 (pF)	Q_0	Turns					Wire (mm ϕ)	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

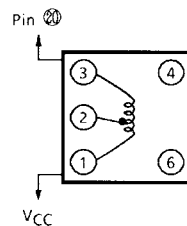
L₁ : FM RF



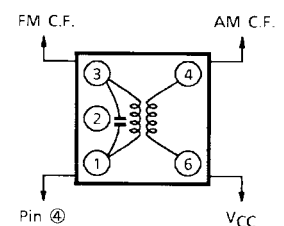
L₂ : FM OSC



T₁ : AM OSC

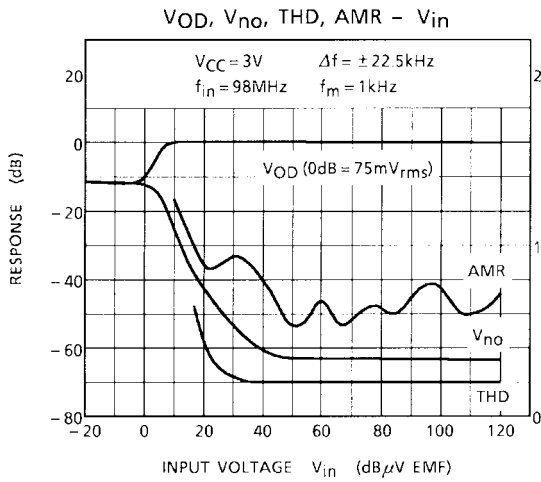


T₂ : AM IFT

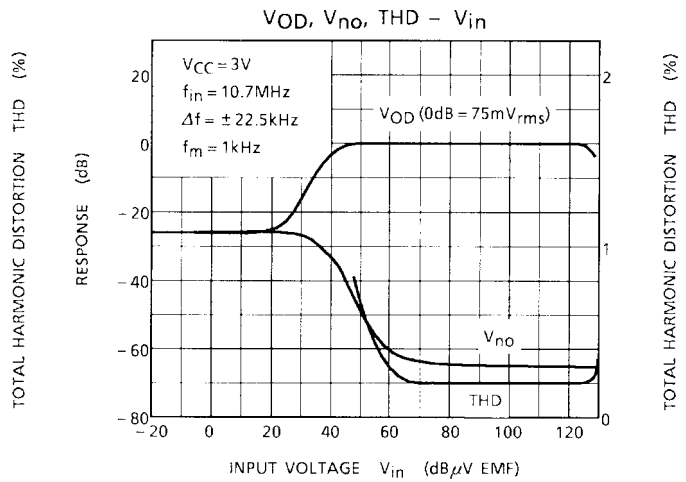


(BOTTOM VIEW)

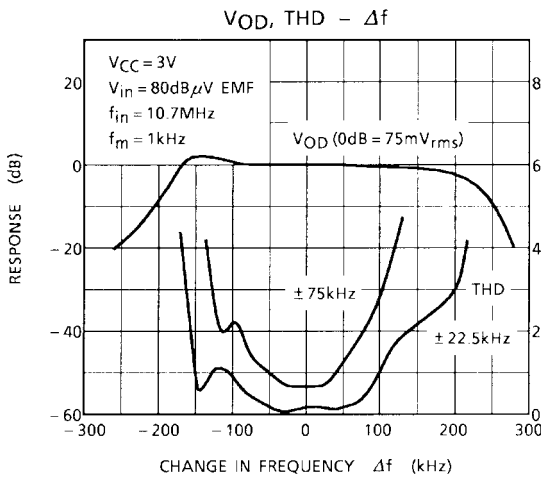
FM (F/E+IF)



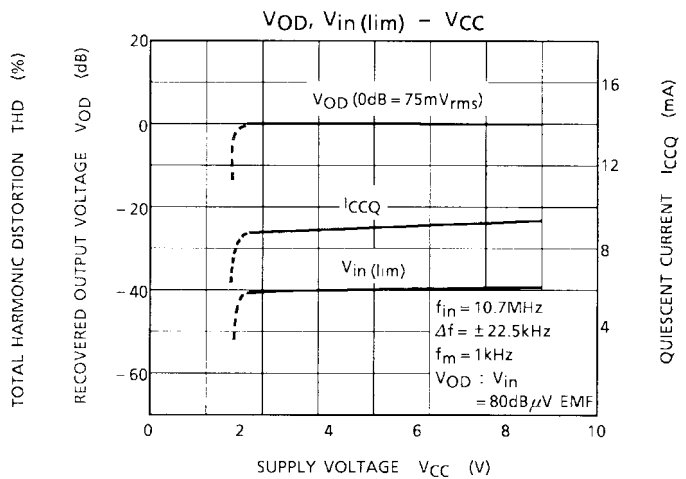
FM (IF)



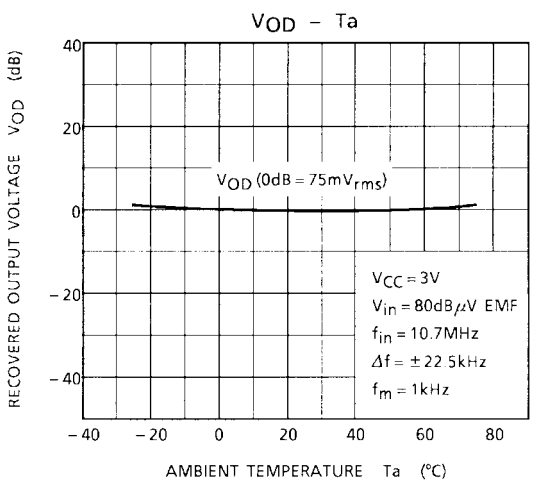
FM (IF)



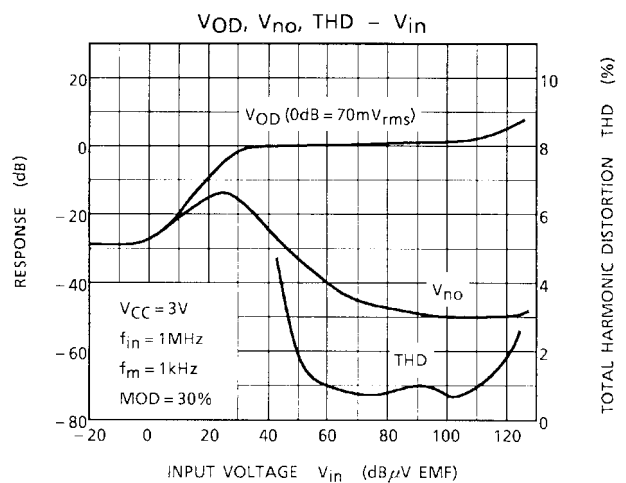
FM (IF)



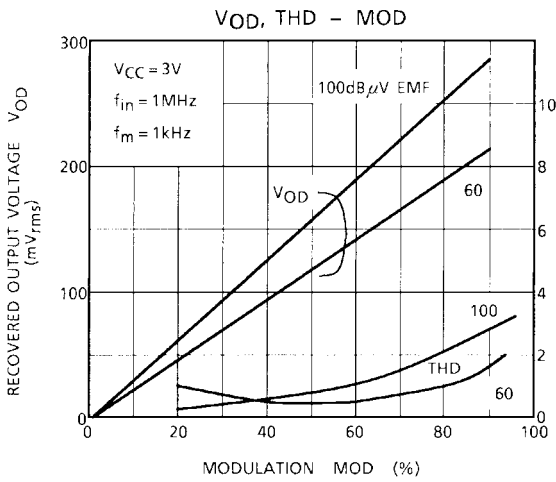
FM (IF)



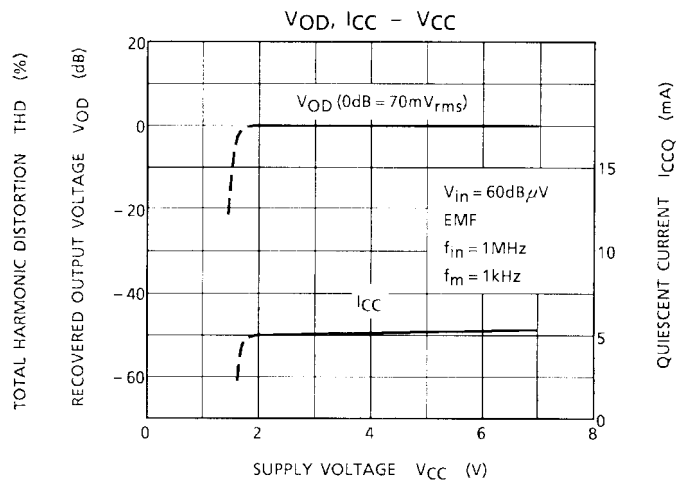
AM



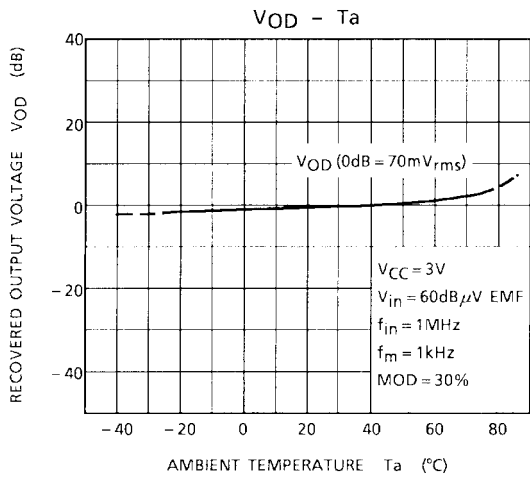
AM



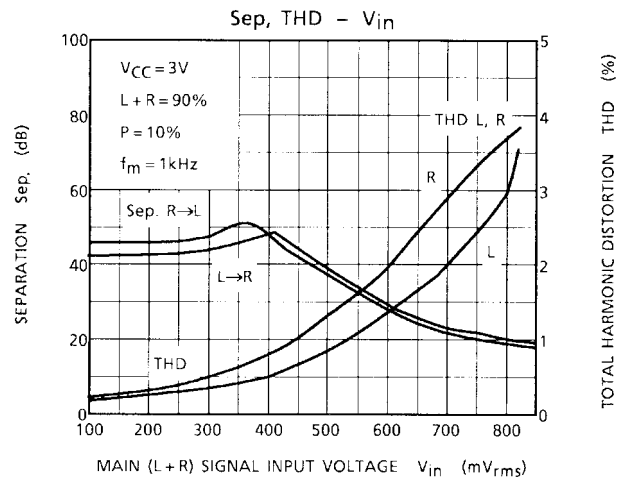
AM



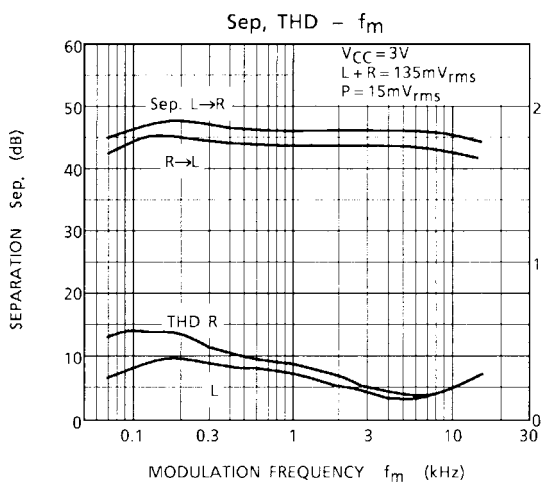
AM



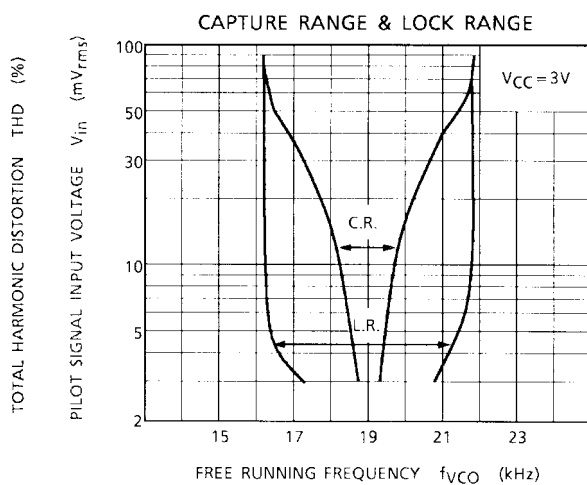
MPX



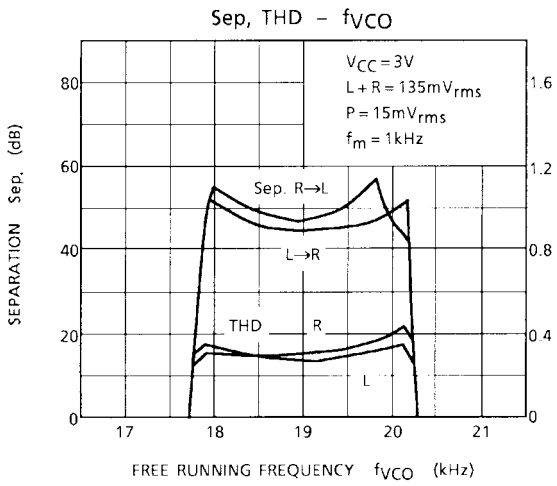
MPX



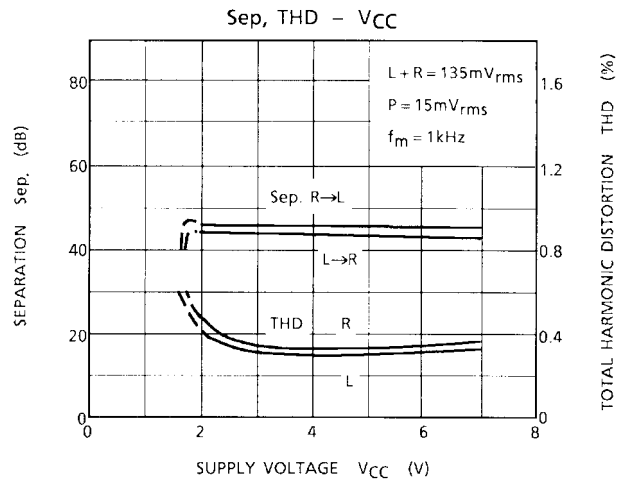
MPX



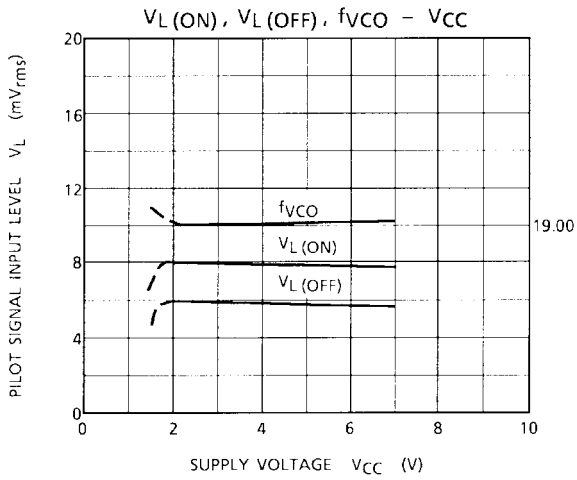
MPX



MPX



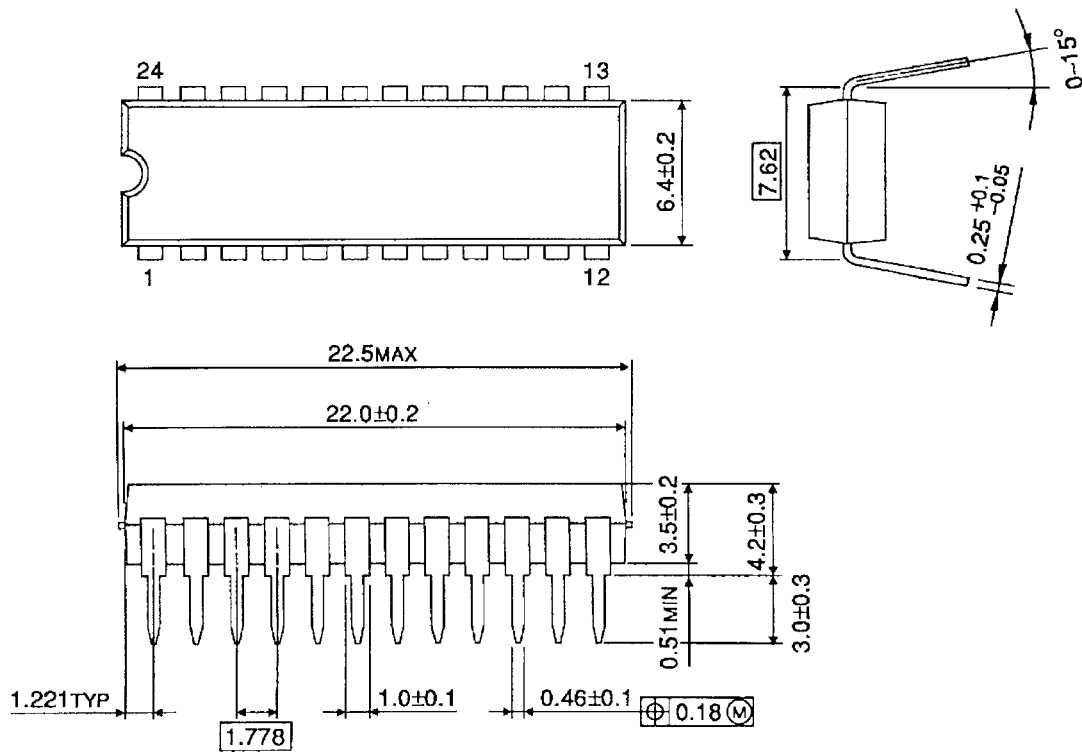
MPX



Package Dimensions

SDIP24-P-300-1.78

Unit : mm

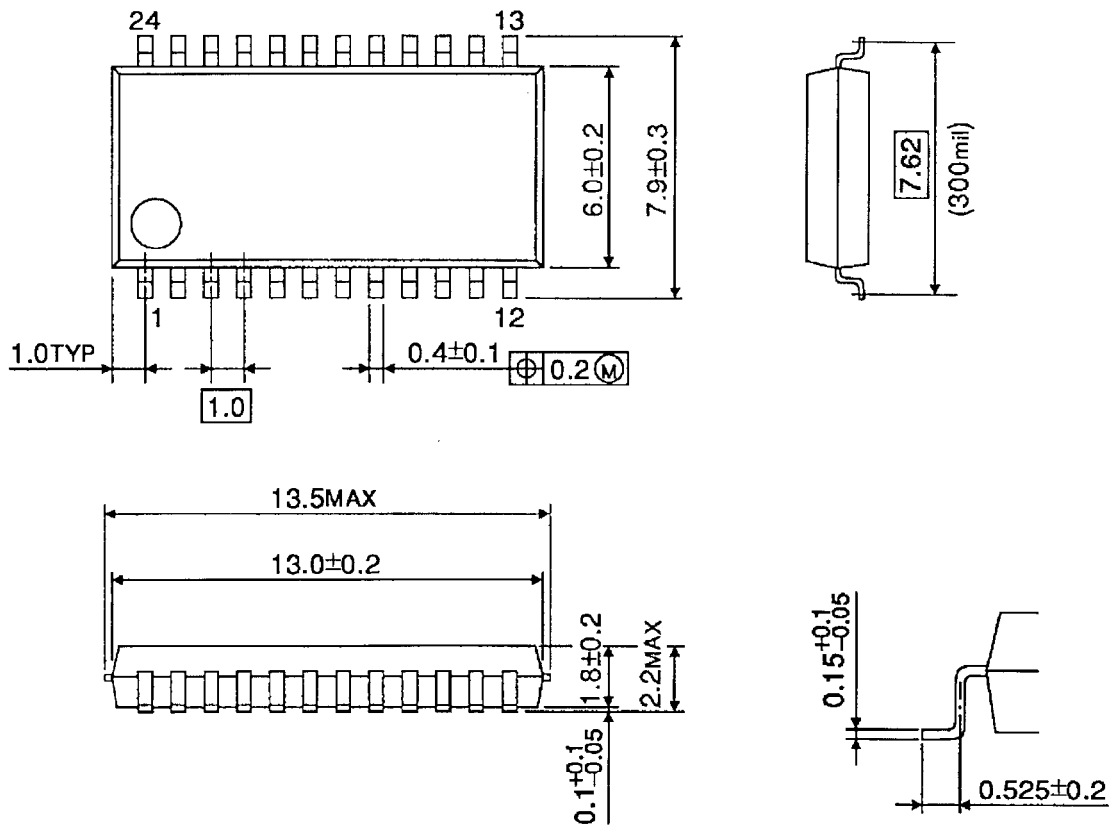


Weight: 1.2 g (typ.)

Package Dimensions

SSOP24-P-300-1.00

Unit : mm

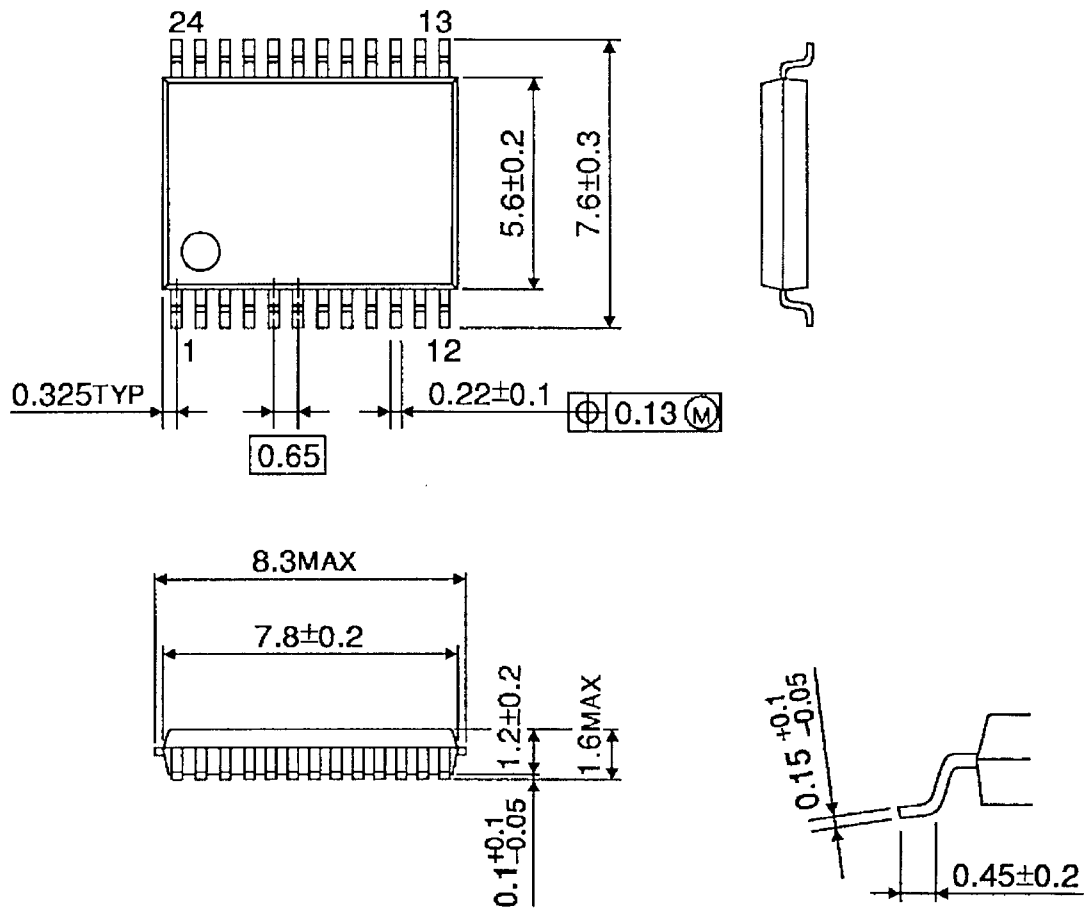


Weight: 0.31 g (typ.)

Package Dimensions

SSOP24-P-300-0.65A

Unit : mm



Weight: 0.14 g (typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.