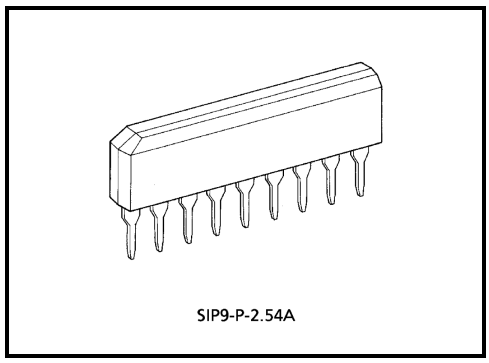
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA7376P

Audio Power Amplifier

The TA7376P is dual audio power amplifier for portable products.



Weight: 0.92g (typ.)

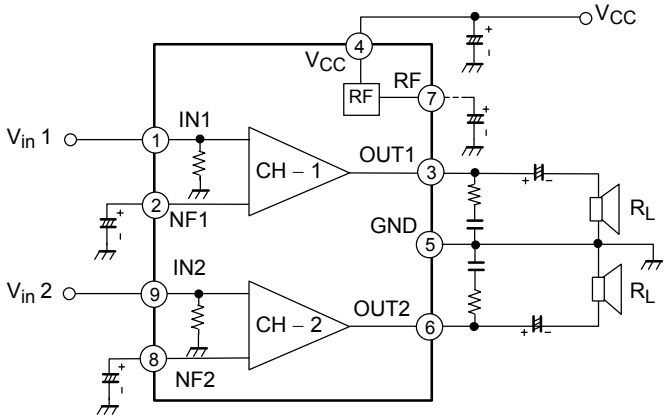
Features

- Low operating supply voltage: V_{CC} = 1.8~6V (Ta = 25°C)
- Low quiescent current: I_{CCQ} = 5.3mA (V_{CC} = 4.5V)
- Including ripple filter circuit: RR = −42dB (C_{RIP} = 10μF, f_r = 100Hz)
- Voltage gain: G_V = 39.5dB (typ.)
- Very few external parts and small package. (SIP−9pin)

Output Power Table (THD = 10%, f = 1kHz, Stereo, Typ. value)

Load / V_{CC}	R_L = 32Ω	R_L = 16Ω	R_L = 8Ω	R_L = 4Ω
3V	21mW	38mW	65mW	100mW
4.5V	56mW	100mW	180mW	300mW
6V	120mW	230mW	400mW	—

Block Diagram



Application Note

1. Input stage

The input stage of power amplifier (equivalent circuit) is comprised of a PNP differential pair (Q_2 and Q_3) preceded by a PNP emitter follower (Q_1) which allows DC referencing of the source signal to ground.
This eliminates the need for an input coupling condenser.
However, in case the brush noise of volume becomes a problem, provide serially a coupling condenser to the input side.

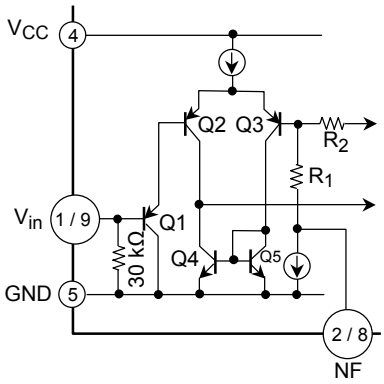


Fig.1

2. Adjustment of voltage gain

The voltage gain is fixed at $G_V \fallingdotseq 40$dB by the resistors (R_1 and R_2) in IC, however, its reduction is possible through adding R_f as shown in Fig.2.
In this case, the voltage gain is obtained by the following equation.

$$G_V \fallingdotseq 20\log\frac{R_1+R_2+R_f}{R_1+R_f}$$

It is recommended to use this IC with the voltage gain of $G_V \fallingdotseq 30$dB or over.

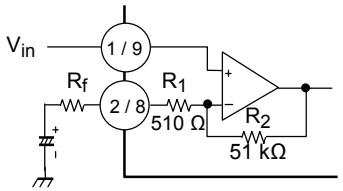


Fig.2

3. Ripple rejection ratio (RR)

If the TA7376P does not have the ripple filter condenser (C_{RIP}), the ripple rejection ratio is as follow.

RR = –25dB (typ.)
(C_{NF} = 22μF, f_r = 100Hz)
RR = –34dB (typ.)
(C_{NF} = 100μF, f_r = 100Hz)

If the ripple filter condenser is connected to the pin(7), the ripple rejection ratio is improved as following the DATA (RR–f_r).

4. Pop sound

It must be connected the condenser (C_{RIP}) from pin(7) to GND, if the "Pop" sound is harshness.
In this case, the value is 10μF something.

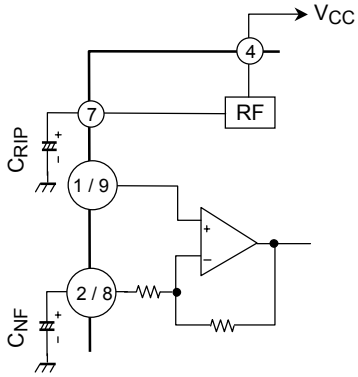


Fig.3

5. Phase–compensation

The purpose of condenser C_1 is to prevent oscillation.
These condenser need to be small temperature coefficient and excellent frequency characteristic. So ceramic condenser is unsuitable.
Condenser C_2 is rather large value than 10μF and GND line is better to short and wide lay–out so that the some common impedance are decreased.

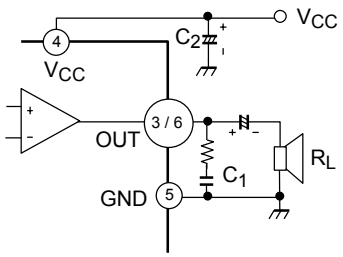


Fig.4

Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Supply voltage	V_{CC}	8	V
Power dissipation	P_D (Note)	950	mW
Operation temperature	T_{opr}	−25~75	°C
Storage temperature	T_{stg}	−55~150	°C

(Note) Derated above Ta = 25°C in the proportion of 7.6mW / °C.

Electrical Characteristics

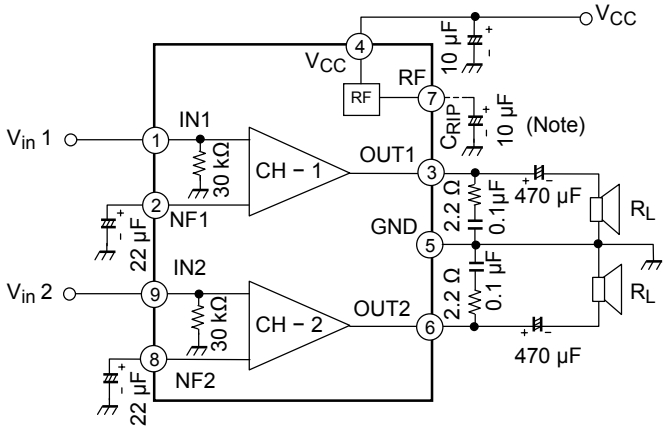
(unless otherwise specified, V_{CC} = 4.5V, f = 1kHz, R_g = 600Ω, R_L = 4Ω, Ta = 25°C)

Characteristic	Symbol	Test Cir–cuit	Test Condition	Min.	Typ.	Max.	Unit
Quiescent current	I_{CCQ}	—	V_{in} = 0, V_{CC} = 3V	—	4.9	8.0	mA
			V_{in} = 0	—	5.3	10.0	
			V_{in} = 0, V_{CC} = 6V	—	5.7	14.0	
Output power	P_{out}	—	V_{CC} = 3V, R_L = 4Ω, THD = 10%	84	100	—	mW
			V_{CC} = 3V, R_L = 32Ω, THD = 10%	—	21	—	
			V_{CC} = 4.5V, R_L = 4Ω, THD = 10%	250	300	—	
			V_{CC} = 4.5V, R_L = 8Ω, THD = 10%	—	180	—	
			V_{CC} = 6V, R_L = 8Ω, THD = 10%	—	400	—	
Total harmonic distortion	THD	—	P_{out} = 100mW	—	0.11	1.0	%
Voltage gain	G_V	—	V_{out} = 0.775V_{rms}	37.5	39.5	41.5	dB
Output noise voltage	V_{no}	—	R_g = 10Ω, BPF = 20Hz~20kHz	—	0.21	0.7	mV_{rms}
Ripple rejection ratio	RR	—	C_{RIP} = 10μF, C_{NF} = 22μF f_r = 100Hz, V_r = 0.38V_{rms}	—	−42	−30	dB
			C_{RIP} = OPEN, C_{NF} = 100μF f_r = 100Hz, V_r = 0.38V_{rms}	—	−34	—	
Cross talk	CT	—	V_{out} = 0.775 V_{rms}	—	−60	−40	dB
Input resistance	R_{IN}	—	—	—	30	—	kΩ

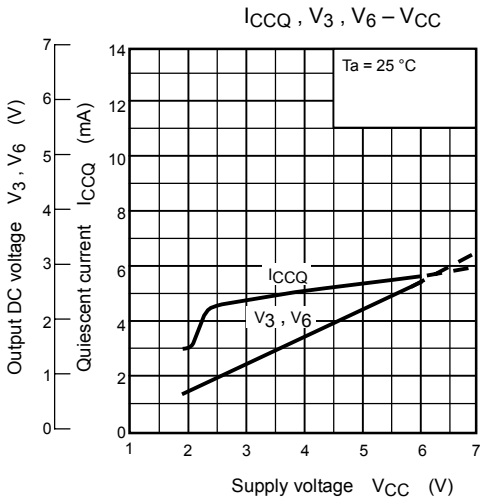
Quiescent Terminal DC Voltage (V_{CC} = 4.5V, Ta = 25°C, typ. value) [Unit: V]

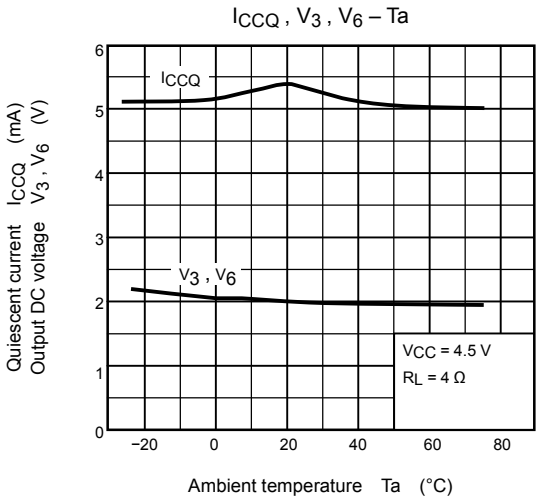
Terminal	1	2	3	4	5	6	7	8	9
Voltage (V)	0.003	0.59	1.98	4.5	0	1.98	1.28	0.59	0.003

Test circuit

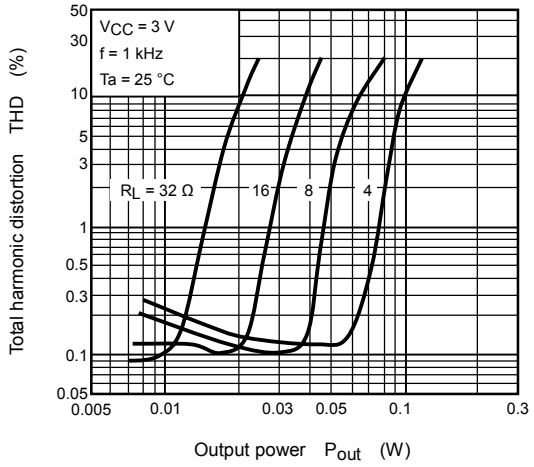


(Note) C_{RIP} is shown in item 3 and 4 of Application Note.

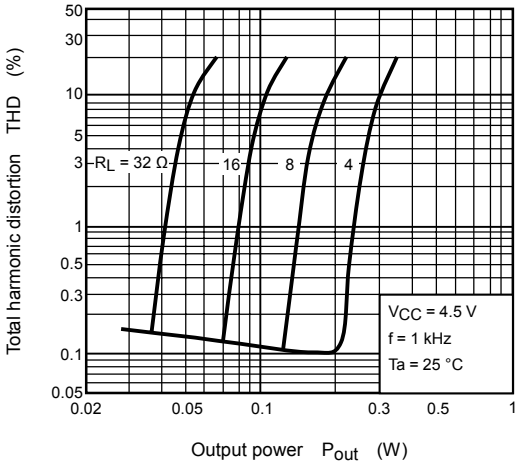




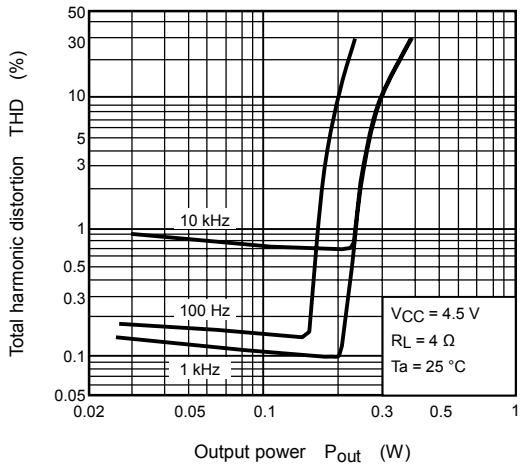
THD – P_{out}



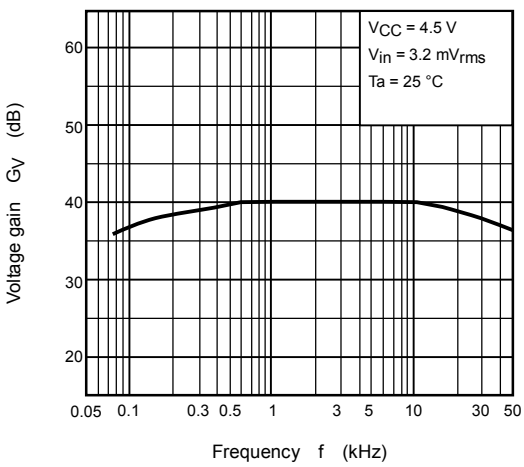
THD – P_{out}



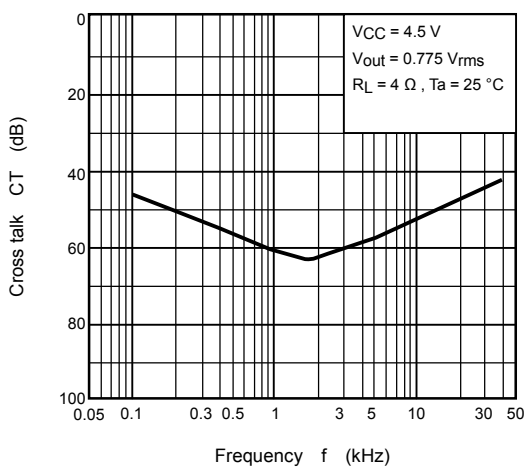
THD – P_{out}



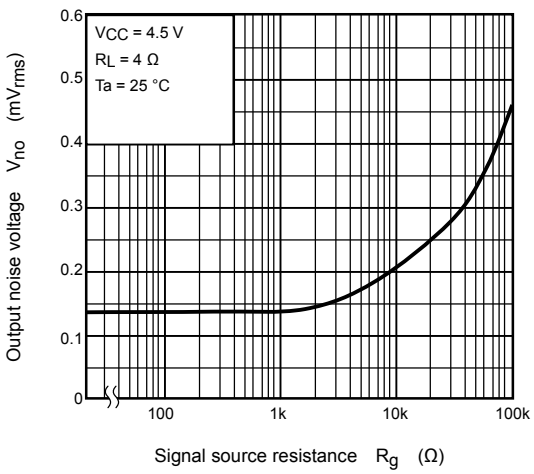
G_V – f



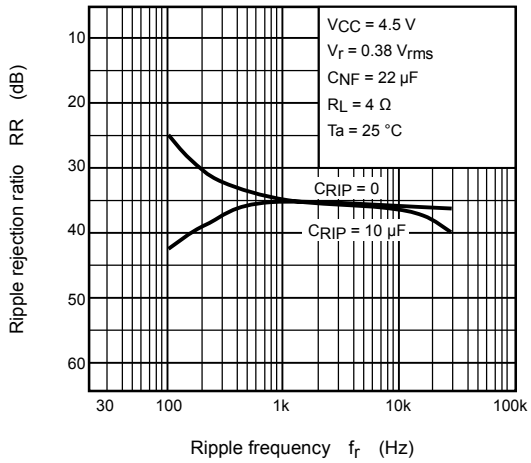
CT – f



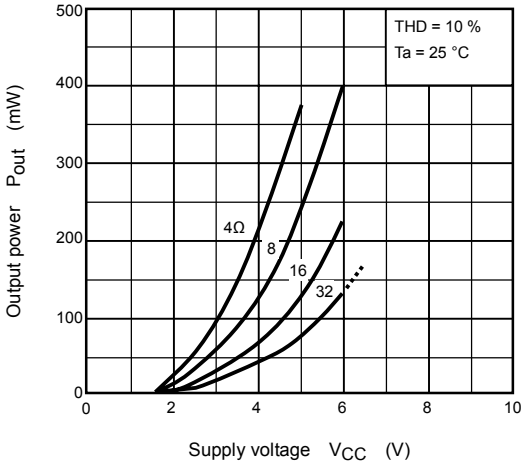
V_{no} – R_g



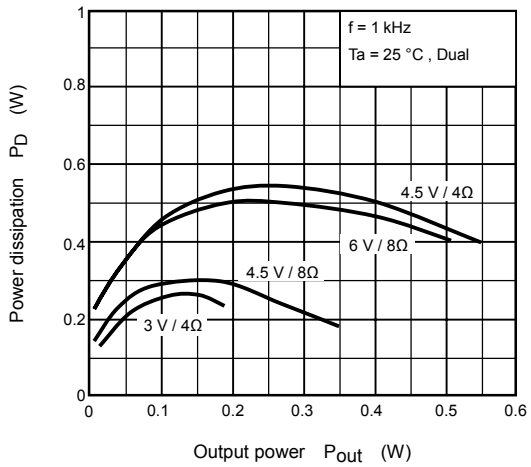
$RR - f_r$



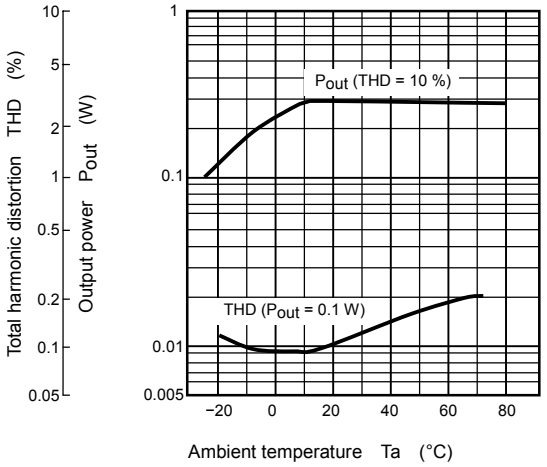
$P_{out} - V_{CC}$



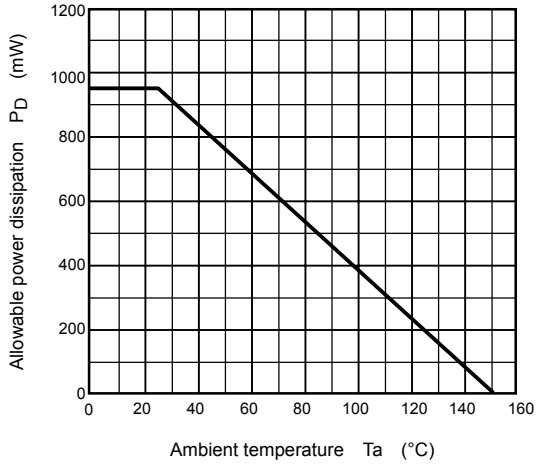
$P_D - P_{out}$



THD , P_{out} – Ta

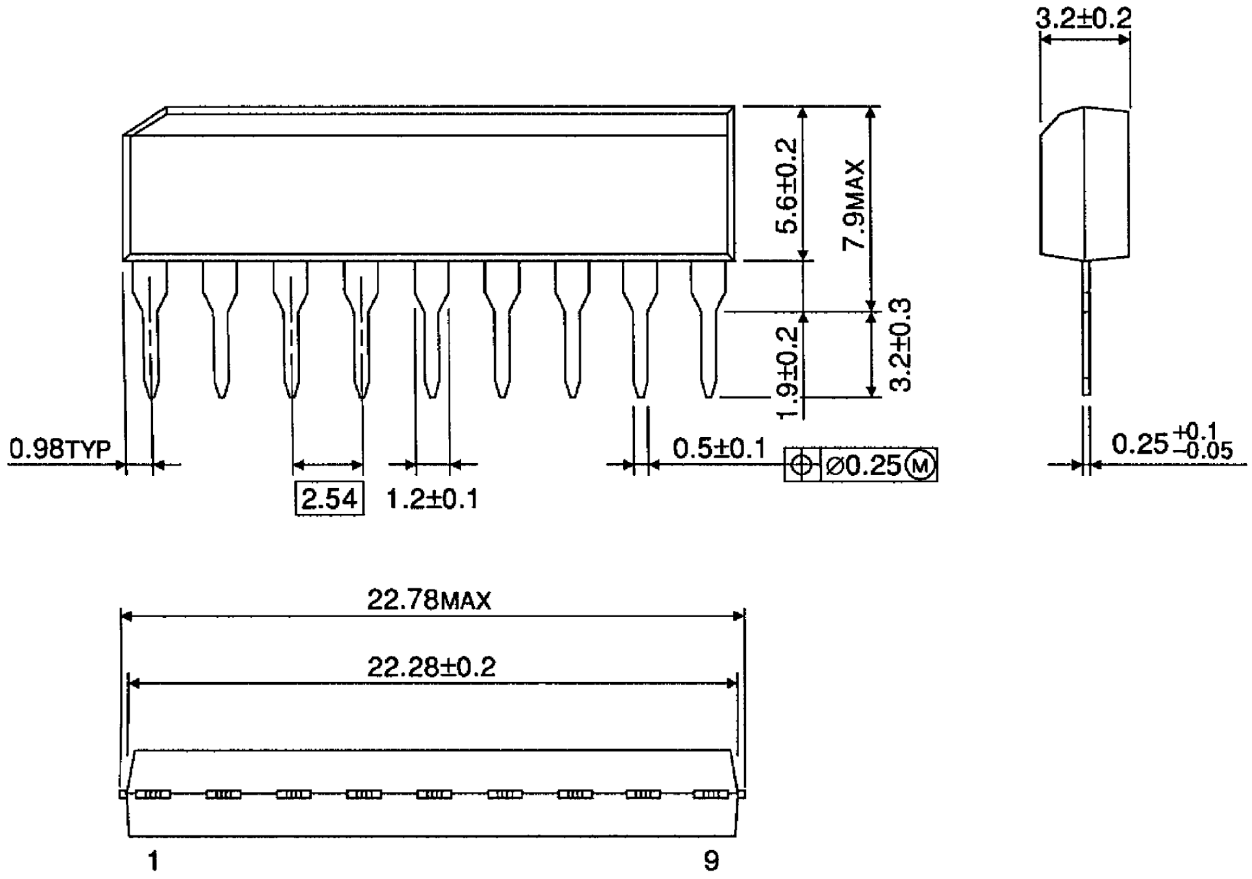


P_D – Ta



Package Dimensions

SIP9-P-2.54A Unit : mm



Weight: 0.92g (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.