

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

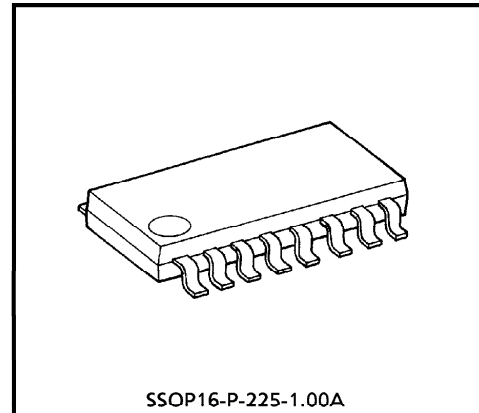
# TA2062F

## 5 BAND GRAPHIC EQUALIZER

TA2062F is 5-Band graphic equalizer IC, which have 5 resonance circuit and an output buffer amplifier. 5 band graphic equalizer for one channel can be formed easily by externally connecting capacitors and variable resistors which fix  $f_0$  (resonance frequency). This is suitable for sound field control of Car Audio System.

### FEATURES

- Few External Parts
- BOOST / CUT CONTROL RANGE :  $\pm 12\text{dB}$
- Low Distortion
  - : THD = 0.001% (Typ.)
  - ( $V_{CC} = 8\text{V}$ ,  $f = 1.1\text{kHz}$ ,  $V_{IN} = 1V_{rms}$ , FLAT)
- Low Noise
  - :  $V_{NO} = 3\mu V_{rms}$
  - ( $V_{CC} = 8\text{V}$ ,  $R_g = 0\Omega$ , FLAT,  $BW = 20\text{Hz} \sim 20\text{kHz}$ )
- Low Harmonic Distortion at Boost or Cut Mode
  - : 2nd and 3rd Harmonic Distortion are :
  - 2HD, 3HD  $\leq 0.01\%$  (Typ.)
  - ( $V_{CC} = 8\text{V}$ ,  $V_{IN} = 1V_{rms}$ ,  $\pm 6\text{dB}$  Boost or Cut,  $f = 20\text{Hz} \sim 20\text{kHz}$ )
- Maximum Output Voltage
  - :  $V_{OM} = 2.3V_{rms}$  (Typ.)
  - ( $V_{CC} = 8\text{V}$ ,  $f = 1.1\text{kHz}$ , THD = 1%, FLAT)
- Operating Supply Voltage Range
  - :  $V_{CC} (opr) = 4 \sim 16\text{V}$  ( $T_a = 25^\circ\text{C}$ )

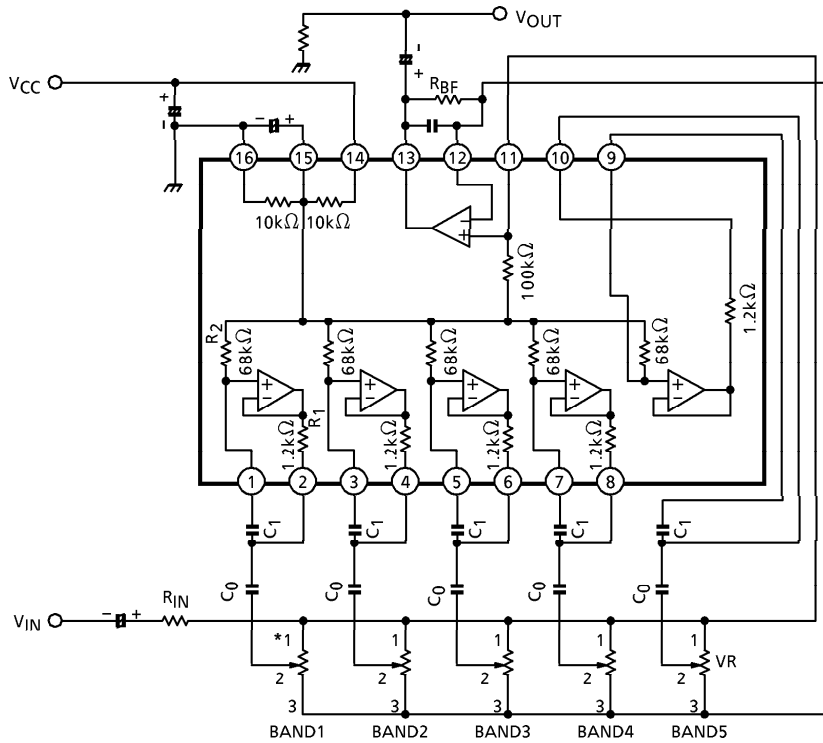


Weight : 0.14g (Typ.)

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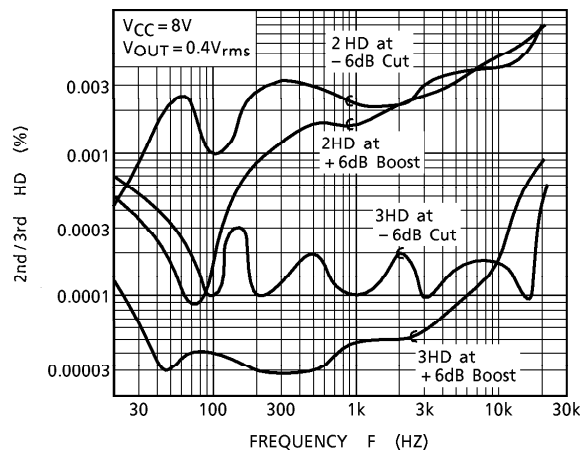
**BLOCK DIAGRAM**



\*1 : CUT    2 : FLAT    3 : BOOST

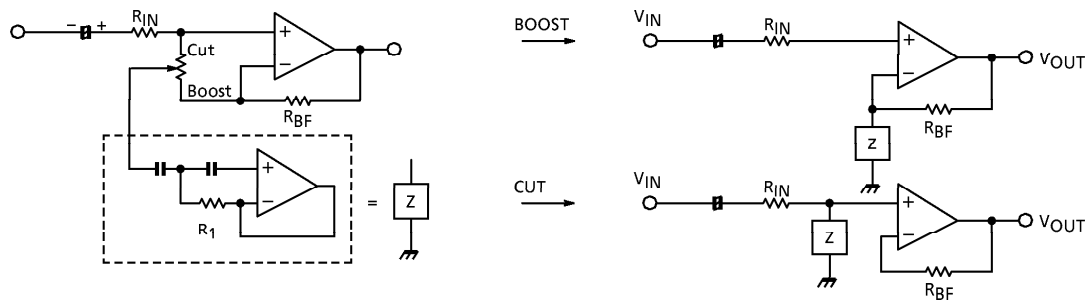
**1. (2ND AND 3RD) HARMONIC DISTORTION AT 6dB BOOST OR CUT MODE**

This IC is designed the 2nd and 3rd Harmonic Distortion are less than 0.01% at 6dB boost or cut between 20Hz and 20kHz.



(Fig-1)

## 2. ADJUSTMENT OF BOOST AND CUT AMOUNT



(Fig-2)

Boost and cut amount are decided as below.

$$\text{Boost : } G_V(\text{BOOST}) = \frac{R_{BF} + Z}{Z} \left( \approx \frac{R_{BF} + R_1}{R_1} \right)$$

$$\text{Cut : } G_V(\text{CUT}) = \frac{Z}{R_{IN} + Z} \left( \approx \frac{R_1}{R_{IN} + R_1} \right)$$

It must be adjusted  $R_{BF} = R_{IN}$  if Boost amount is same as cut amount.

In case signal source resistance  $R_g$  is large enough, it is necessary to be set  $R_{BF} = R_{IN} + R_g$ .

## MAXIMUM RATINGS

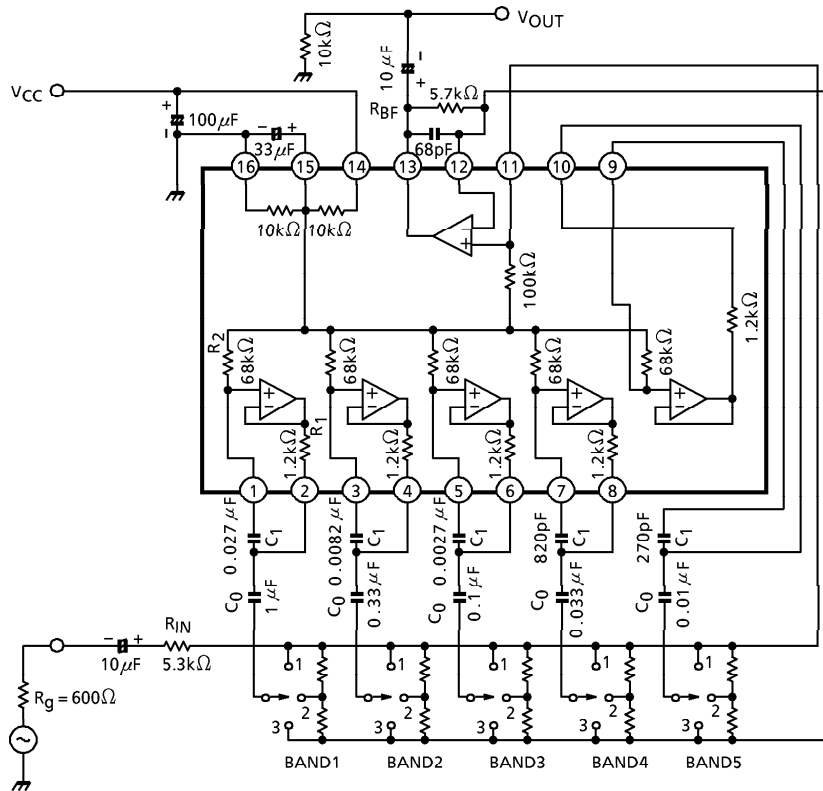
CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	$V_{CC}$	16	V
Power Dissipation	$P_D$	350	mW
Operating Temperature	$T_{opr}$	-40~85	°C
Storage Temperature (Note)	$T_{stg}$	-55~150	°C

(Note) Derated above  $T_a = 25^\circ\text{C}$  in the proportion of  $2.8\text{mW}/^\circ\text{C}$ .

ELECTRICAL CHARACTERISTICS (Unless otherwise specified,  $V_{CC} = 8\text{V}$ ,  $f = 1.1\text{kHz}$ ,  $R_L = 10\text{k}\Omega$ ,  $T_a = 25^\circ\text{C}$ )

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Current	$I_{ccq}$	—	$V_{IN} = 0$	—	9	15	mA
Voltage Gain	$G_V$ (FLAT)	—	$V_{OUT} = 1V_{rms}$	-1.5	0	+1.5	dB
	$G_V$ (BST)	—	$V_{OUT} = 1V_{rms}$ , $f = 110\text{Hz}$	10	12	14	
			$V_{OUT} = 1V_{rms}$ , $f = 340\text{Hz}$	10	12	14	
			$V_{OUT} = 1V_{rms}$ , $f = 1.1\text{kHz}$	10	12	14	
			$V_{OUT} = 1V_{rms}$ , $f = 3.4\text{kHz}$	10	12	14	
			$V_{OUT} = 1V_{rms}$ , $f = 11\text{kHz}$	10	12	14	
	$G_V$ (CUT)	—	$V_{OUT} = 1V_{rms}$ , $f = 110\text{Hz}$	-14	-12	-10	
			$V_{OUT} = 1V_{rms}$ , $f = 340\text{Hz}$	-14	-12	-10	
			$V_{OUT} = 1V_{rms}$ , $f = 1.1\text{kHz}$	-14	-12	-10	
			$V_{OUT} = 1V_{rms}$ , $f = 3.4\text{kHz}$	-14	-12	-10	
$V_{OUT} = 1V_{rms}$ , $f = 11\text{kHz}$			-14	-12	-10		
Total Harmonic Distortion	THD (FLT)	—	$V_{OUT} = 1V_{rms}$	—	0.001	0.01	%
Output Noise Voltage	$V_{NO}$ (FLT)	—	$R_g = 620\Omega$ , $V_{IN} = 0$ $BW = 20\text{Hz} \sim 20\text{kHz}$	—	3	8	$\mu V_{rms}$
Maximum Output Voltage	$V_{OM}$	—	THD = 1%	1.8	2.3	—	$V_{rms}$

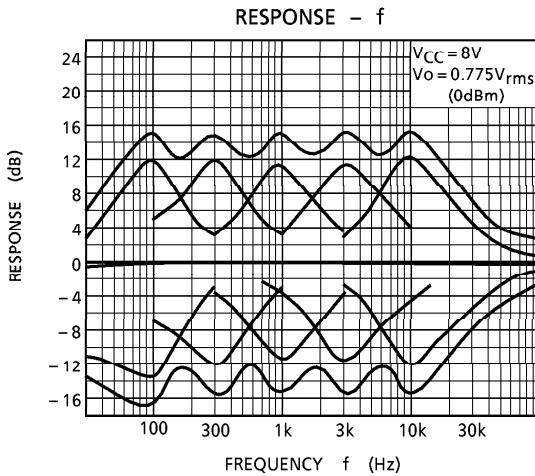
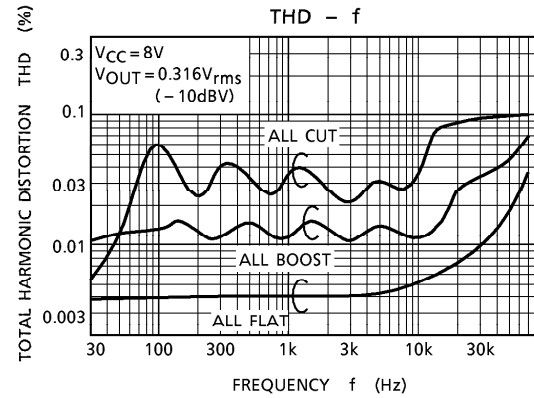
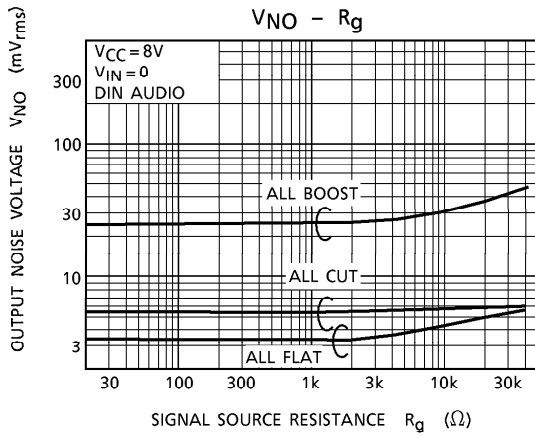
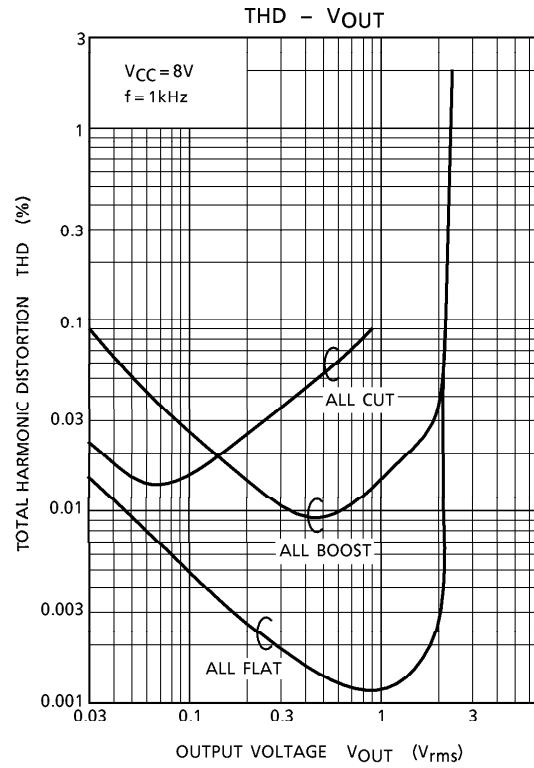
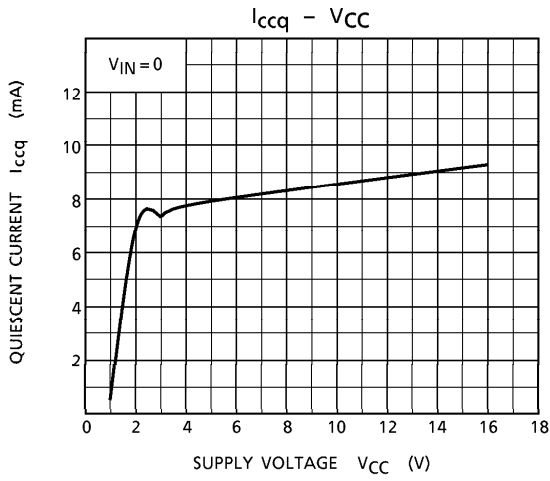
## TEST CIRCUIT



- Fixed  $R_{BF} \approx (R_{IN} + R_g)$  to be same as Boost and Cut amount.
- At each band :
  - 1 : CUT    2 : FLAT    3 : BOOST
- $f_o$  (Resonance Frequency)

$$f_o = \frac{1}{2\pi\sqrt{C_0 \cdot C_1 \cdot R_1 \cdot R_2}} \quad (R_1 = 1.2k\Omega, R_2 = 68k\Omega \text{ on chip resistor})$$

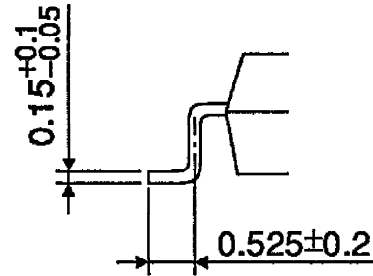
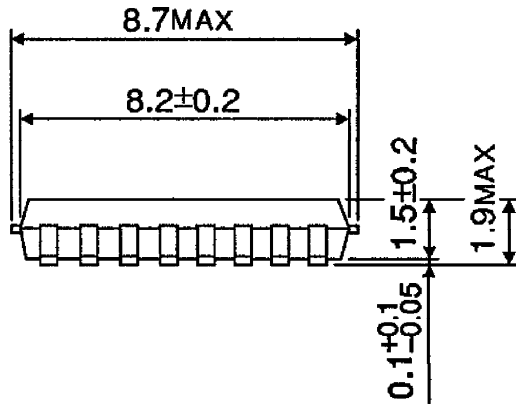
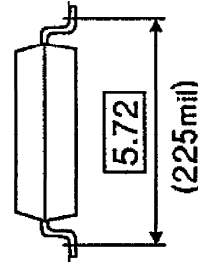
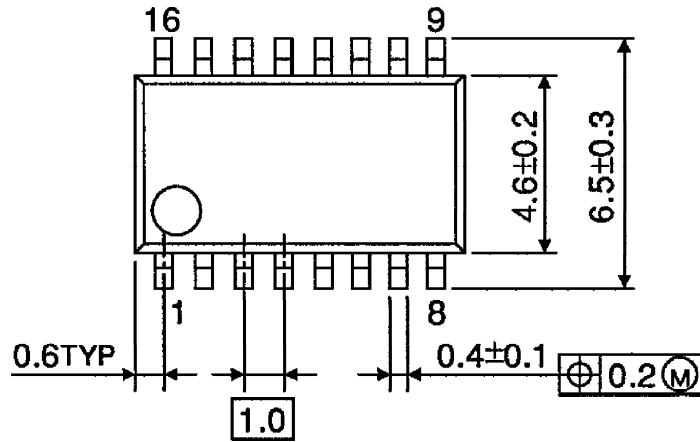
BAND	1	2	3	4	5
$C_0$ (F)	$1\mu$	$0.33\mu$	$0.1\mu$	$0.033\mu$	$0.01\mu$
$C_1$ (F)	$0.027\mu$	$0.0082\mu$	$0.0027\mu$	820p	270p
$f_o$ (Hz)	107	340	1.07k	3.40k	10.7k



### OUTLINE DRAWING

SSOP16-P-225-1.00A

Unit : mm



Weight : 0.14g (Typ.)