Communication ICs

PLL tone decoder IC BA1604 / BA1604F

The BA1604 and BA1604F are tone decoder ICs that enable the frequency to be selected in precise detail, using a PLL system. These ICs are configured of a PLL circuit, a detection circuit, a voltage comparator circuit and an output logic drive circuit.

When the input signal is within the transmission range of the circuit, PLL is synchronized (locked) to the input signal. At this point, the output voltage of the decoder drops, and the change turns on the transistors for the voltage comparator and output logic drive circuits. A load of up to 100mA can be driven. The center frequency (f₀) of the decoder is set by the mobile oscillation frequency of the current control oscillator. This frequency is determined by selecting a CR connected to Pins 5 and 6.

Applications
Telephones
Data communication systems
Remote control systems

Features

- 1) The detection bandwidth can be varied independently between 0 and 14%.
- The output circuit can withstand a load current of up to 100mA, and is directly coupled to the logic circuit.
- 3) The center frequency offers a high level of stability.
- High out-of-band signal and noise rejection capability.
- 5) Frequency can be changed over a range of 20 : 1 using an external resistor.
- Compatible with EXAR XR-567 and Signetics NE567.

Block diagram





●Absolute maximum ratings (Ta=25°C)

Parameter		Symbol	Limits	Unit
Power supply voltage		Vcc	9	V
Power dissipation	BA1604	L L	300 ^{*1}	10/
	BA1604F	Pd	350 ^{*2}	mW
Operating temperature		Topr	-10~+75	°C
Storage temperature		Tstg	-55~+125	Ĉ

*1 Reduced by 3 mW for each increase in Ta of 1°C over 25°C.

*2 Reduced by 3.5 mW for each increase in Ta of 1°C over 25°C.

Recommended operating conditions (Ta=25°C)

Parameter	Symbol	Min.	Тур.	Max.	Unit
Power supply voltage	Vcc	4.75	6.0	9.0	V

●Electrical characteristics (unless otherwise noted, Ta=25°C, Vcc=5V)

Parameter	Symbol	Min.	Тур.	Max.	Unit	Conditions
Quiescent current 1	lq - 1	_	6.0	10	mA	R∟=20kΩ, detector OFF
Quiescent current 2	lq - 2	_	10	15	mA	R∟=20kΩ, detector ON
Output voltage	Vout	_	_	15	V	_
Input voltage	Vin	-10	_	Vcc+0.5	V	_
Frequency stability	∆fот	_	±60	-	ppm / °C	_
Frequency stability	Δfov	—	0.5	2.0	%/V	_
Maximum detection bandwidth	W мах.	10	14	18	% of fo	fo=100kHz
Maximum detection bandwidth skew	∆ Wмах.	-	-	3	% of fo	-
Change in maximum detection bandwidth	ΔWt	-	±0.1	-	%/°C	VIN=300mVrms
Change in maximum detection bandwidth	ΔWv	_	±2	_	%/V	VIN=300mVrms
Input resistance	RiN	_	20	—	kΩ	-
Minimum input voltage at detector ON	DON	_	20	25	mVrms	I∟=100mA, fi=f₀
Maximum input voltage at detector OFF	DOFF	10	15	-	mVrms	I∟=100mA, fi=f₀
2-signal selection ratio	Vir	_	6	-	dB	In-band/out-of-band signals
Minimum input signal-to-wide-band noise ratio	R	—	6	—	dB	Bn=140kHz
Output saturation voltage 1	Vsat - 1	—	0.2	0.4	V	IL=30mA, VIN=25mVrms
Output saturation voltage 2	Vsat - 2	_	0.6	1.0	V	IL=100mA, VIN=25mVrms
Output leakage current	١L	_	0.01	25	μA	_
Maximum ON-OFF cycle	Тмах.	_	fo/ 20	_	_	_
Output rise time	tн	_	150	_	ns	RL=50Ω
Output fall time	t∟	_	30	—	ns	RL=50Ω



Measurement circuit



* Fine adjustment should be done until fo = 100 kHz

Fig. 1

Attached components

(1) C_1 and R_1 : Setting f_0

The center frequency (f_0) is determined by the resistor R_1 between Pins 5 and 6, and the capacitor C_1 between Pin 6 and the ground. The constants at this point are determined as follows :

$$f_{0} \doteqdot \frac{1}{C_{1}R_{1}} \quad (kHz) \ (C:\mu \ F, \ R: k\Omega)$$

A rectangular-wave voltage is output at Pin 5; the peakto-peak amplitude is between V_{CC} and 1.4 V, and the average DC value is V_{CC} / 2. This pin can drive a load resistance of up to 1k Ω . (The recommended value for R₁, however, is from 2k Ω to 20k Ω .)

A 1V peak-to-peak exponential function triangular wave with an average DC voltage level of V_{cc} / 2 is output at Pin 6. Since loading this pin adversely affects both the duty cycle and the temperature stability of the oscillator, it must only be connected to a high-impedance load.

(2) C2 : Loop filter

Connected between Pin 2 and the ground, C₂ functions as a low pass filter for the PLL circuit, and the time constant is determined by $T_2 = R_2C_2$ (R_2 is the internal impedance for Pin 2, at 10 k Ω). The value of C₂ also determines the detection bandwidth. The voltage at Pin 2 varies linearly at 20mV / % of f₀ over the range 0.95 f₀ to 1.05 f₀.

Application example



* C1 and R1 should be adjusted until fo = 100 kHz



(3) C₃: Output filter

Capacitor C₃, connected between Pin 1 and the ground, is used as a low pass filter to suppress out-of-band signals. The time constant T₃ is determined by T₃ = R₃C₃ (R₃ is the internal impedance for Pin 1, at 4.7k Ω).

To prevent false detection of spurious signals, it is recommended that $C_3 \ge 2 \times C_2$. If C_3 is made too large, however, this will increase the time required for voltage changes at Pin 1 to reach the threshold of the phase detector, thus slowing the response time.

- (4) C₄ : Input coupling capacitor
- (5) C5 : Power supply filter capacitor

Input and output pins

(1) Input : Pin 3

The input signal is applied through a coupling capacitor to Pin 3. Internal circuits set this pin to a DC potential of 2V with respect to the ground. The input impedance is approximately $20k\Omega$.

(2) Output : Pin 8

The output logic section has an internal power transistor with its collector connected to Pin 8. The load is connected between Pin 8 and V_{cc}. The transistor saturates when an in-band input signal is received, dropping the potential at Pin 8 to less than 1V (0.6V Typ.). The output can also drive a load connected to a separate supply voltage of up to 20V.

Operation notes

When setting the central frequency, which is determined by the capacitor and resistor connected to pins 5 and 6 of this IC, it is recommended to connect a variable resistor between pins 5 and 6 and align the central frequency of each component in order to prevent shifting of the central frequency caused by fluctuations in the IC, capacitor, or resistor.



•Electrical characteristic curves

Communication ICs



External dimensions (Units: mm)

