Audio Digital Delay (KARAOKE echo)
BU9255FS

The BU9255FS has all the functions necessary for a single-chip KARAOKE system.
This product is ideal for radio cassette decks, compact components, sound cards and more.

●Applications

Audio equipment for compact components, radio cassette decks, VCRs, LDs, video CDs, DVDs and more.

●Features

1) Digital delay of up to 131ms (f_{CLK} = 375kHz).
2) Built-in mixing circuit that adds the original sound and echo sound.
3) Echo-mix ratio can be adjusted using DC voltage.
4) Built-in amplifier circuit for configuring 2nd-order LPF for I/O.
5) Echo-mute function. (mutes echo of output from pin 5)
6) Built-in CR oscillation circuit.
7) Built-in SRAM capacity : 8 kbits.

●Absolute maximum ratings (Ta=25℃)

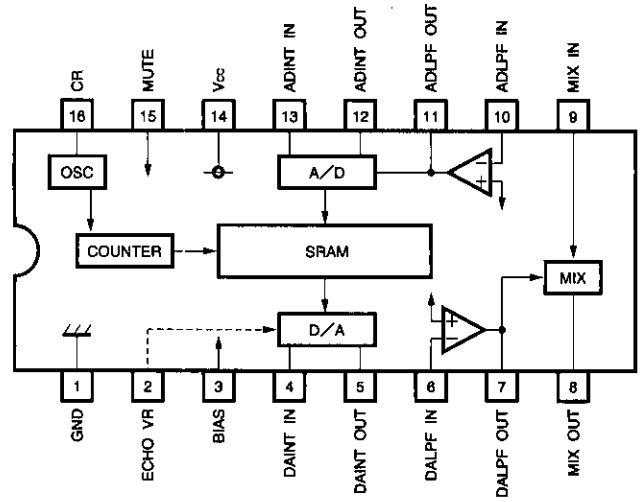
Parameter	Symbol	Limits	Unit
Applied voltage	$V_{CCMax.}$	7.0	V
Power dissipation	Pd	500*	mW
Operating temperature	Topr	−10~70	℃
Storage temperature	Tstg	−55~125	℃
Input voltage	V_{IN}	−0.3~V_{CC}+0.3	V

* Reduced by 5.0 mW for each increase in Ta of 1℃ over 25℃.

●Recommended operating conditions (Ta=25℃)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V_{CC}	4.0	5.0	5.5	V

●Block diagram



●Pin descriptions

Pin No.	Pin name	Function	Input/Output	Pin voltage
1	GND	Ground	—	—
2	ECHO VR	Echo level DC control	Hi I	—
3	BIAS	Analog DC bias	—	1/2 Vcc
4	DAINT IN	DA integrator input	Hi I	1/2 Vcc
5	DAINT OUT	DA integrator output	Lo O	1/2 Vcc
6	DALPF IN	DA LPF input	Hi I	1/2 Vcc
7	DALPF OUT	DA LPF output	Lo O	1/2 Vcc
8	MIX OUT	Source sound and echo sound mixing output	Lo O	1/2 Vcc
9	MIX IN	Mixing amplifier source sound input	Hi I	1/2 Vcc
10	ADLPF IN	AD LPF input	Hi I	1/2 Vcc
11	ADLPF OUT	AD LPF output	Lo O	1/2 Vcc
12	ADINT OUT	AD integrator output	Lo O	1/2 Vcc
13	ADINT IN	AD integrator input	Hi I	1/2 Vcc
14	Vcc	Vcc	—	—
15	MUTE	Mute control	Hi I	—
16	CR	Oscillator output	—	—

●Electrical characteristics (unless otherwise specified : Ta=25℃, V_{CC}=5.0V, f_{CLK}=375kHz, f=1kHz, V_I = −10dBV, 2-pin=V_{CC}, 15-pin=V_{CC}, distortion : 400 Hz ~ 30kHz filter, output noise voltage : DIN-AUDIO)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Current consumption	I_{CC}	—	6	12	mA	Quiescent
Voltage gain 1	G_{V1}	−5.6	−3.5	−1.4	dB	Delay total gain IN1→OUT
Voltage gain 2	G_{V2}	−1	0	1	dB	Through total gain IN2→OUT, pin2=ground
Output distortion 1	THD1	—	1.5	3	%	Delay
Output distortion 2	THD2	—	0.02	0.1	%	Through, pin2=ground
Output noise voltage 1	V_{NO1}	—	−80	−60	dBV	Delay, Rg=1kΩ
Output noise voltage 2	V_{NO2}	—	−90	−80	dBV	Through Rg=1kΩ, pin2=ground
Max. output voltage 1	V_{OM1}	1.4	1.7	—	Vrms	Delay, THD=1kΩ
Max. output voltage 2	V_{OM2}	1.4	1.7	—	Vrms	Through, THD = 1%, Pin 2 = ground
Mute control voltage	V_H	3.8	—	5.0	V	H mode hold voltage, pin 15 DC
	V_M	1.6	—	2.8	V	M mode hold voltage, pin 15 DC
	V_L	0	—	0.7	V	L mode hold voltage, pin 15 DC
Oscillation frequency	f_C	—	375	—	kHz	

●Application circuit

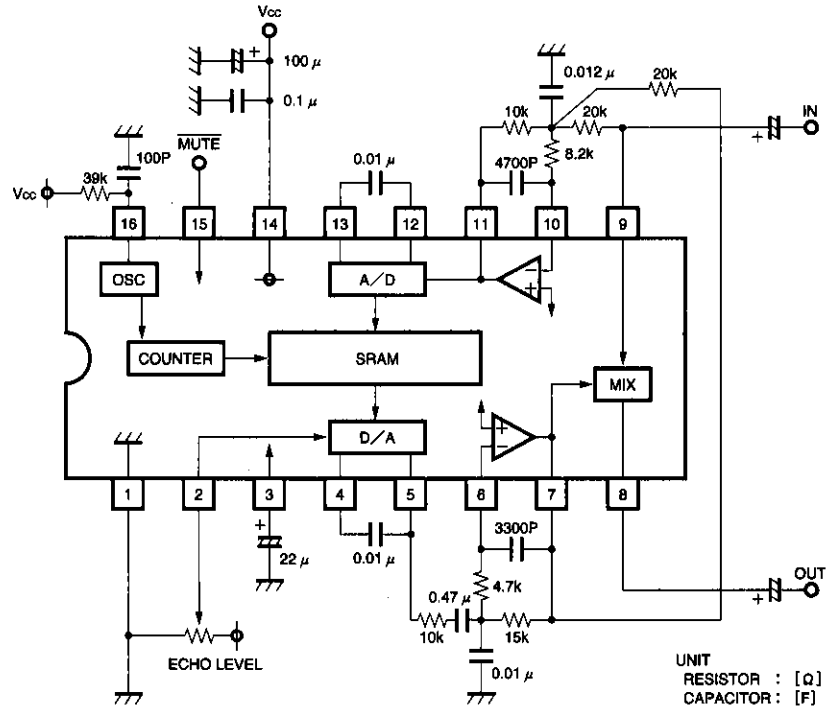
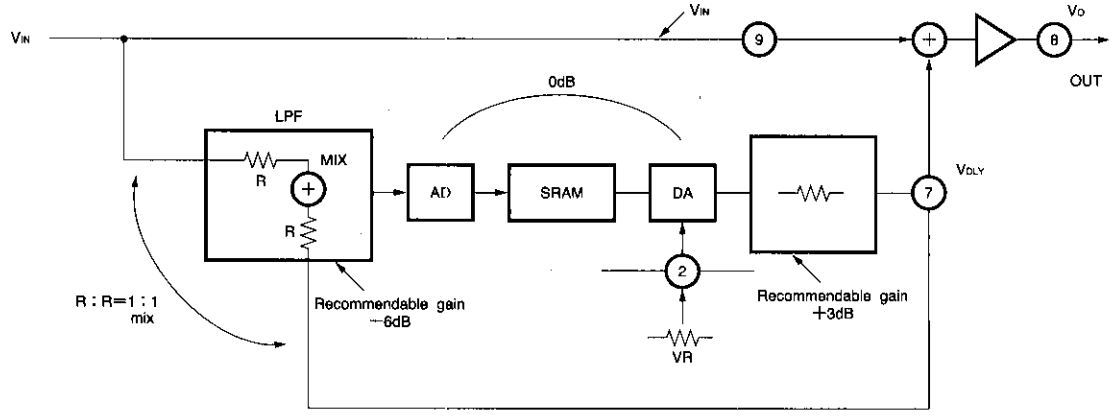


Fig. 1

●Operation notes

Although the circuit examples included in this handbook are highly recommendable for general use, you should be thoroughly familiar with circuit characteristics as they relate to your own use conditions. If you intend to change the number of external circuits, leave an ample margin, taking into account discrepancies in both static and dynamic characteristics of external parts and Rohm ICs. In addition, please be advised that Rohm cannot provide complete assurance regarding patent rights.

Setting echo-loop gain



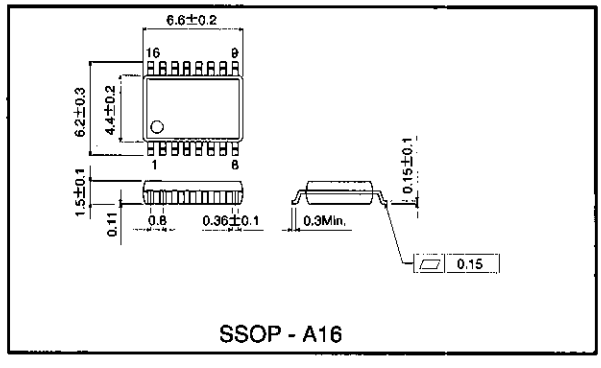
Echo loop ATT $V_{IN} \sim V_{DLY} \cdots A = \frac{V_{DLY}}{V_{IN}}$ $(A<1)$

In the above equation, making $V_{OMax.}$ the maximum amplitude for V_O provides the following equation (when the phases are aligned, including the delay circuit filter) :

$$V_{OMax.} = (1+A+A2+\cdots)\, V_{IN} = \sum_{K=0}^{\infty} A^K \cdot V_{IN} = \frac{1}{1-A}\, V_{IN}$$

Therefore, the maximum allowable input becomes the $V_{OMax.}$ (1 − A) listed on the specifications.
If the feedback ratio A is made 0.7 and the maximum value for V_{OUT} is made 4.0V_{P-P}, V_{IN} must be made 1.2V_{P-P} or below.

●External dimensions (Units: mm)



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