

# M65845AFP

## Digital Echo with Microphone Mixing Circuit

REJ03F0170-0201

Rev.2.01

Jan 25, 2007

### Description

The M65845AFP is a CMOS IC built-in digital echo function with microphone peripheral circuits for Karaoke equipment packed in a single chip.

It is suitable for Karaoke equipments such as video CD player, mini stereo, CD-radio cassette, TV or VCR.

Being pin compatible with the M65845FP, the M65845AFP is suitable for upgrading the series.

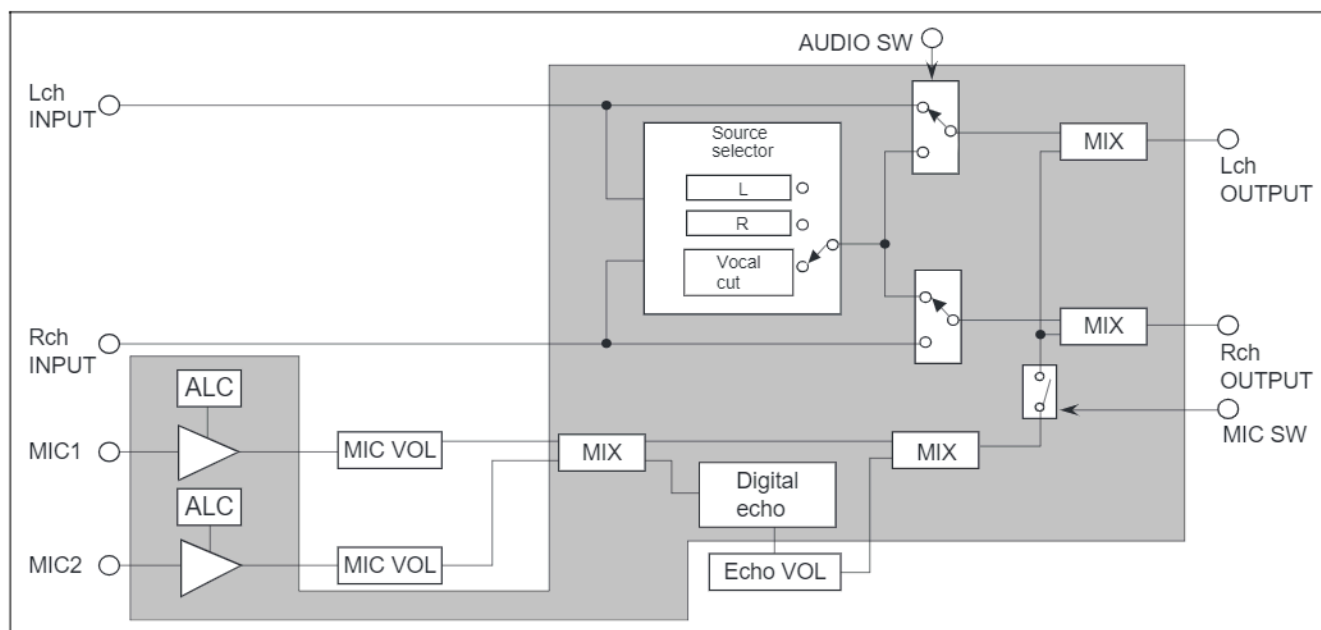
### Features

- High performance digital echo circuit thanks to 16 Kbit memory
- Two microphone-mixing lines, vocal cut circuit, digital echo, and line-mixing amplifier are contained, enabling single-chip package of microphone peripheral circuit of Karaoke equipment.
- ALC-equipped microphone amplifiers permit excessively high-input. ALC operating voltage can be set as desired.
- Vocal cut circuit of complete stereo construction
- Compatibility with the M65845FP
- Built-in current-control oscillation circuit
- Built-in automatic reset circuit activated with power on
- Single power supply (5 V)

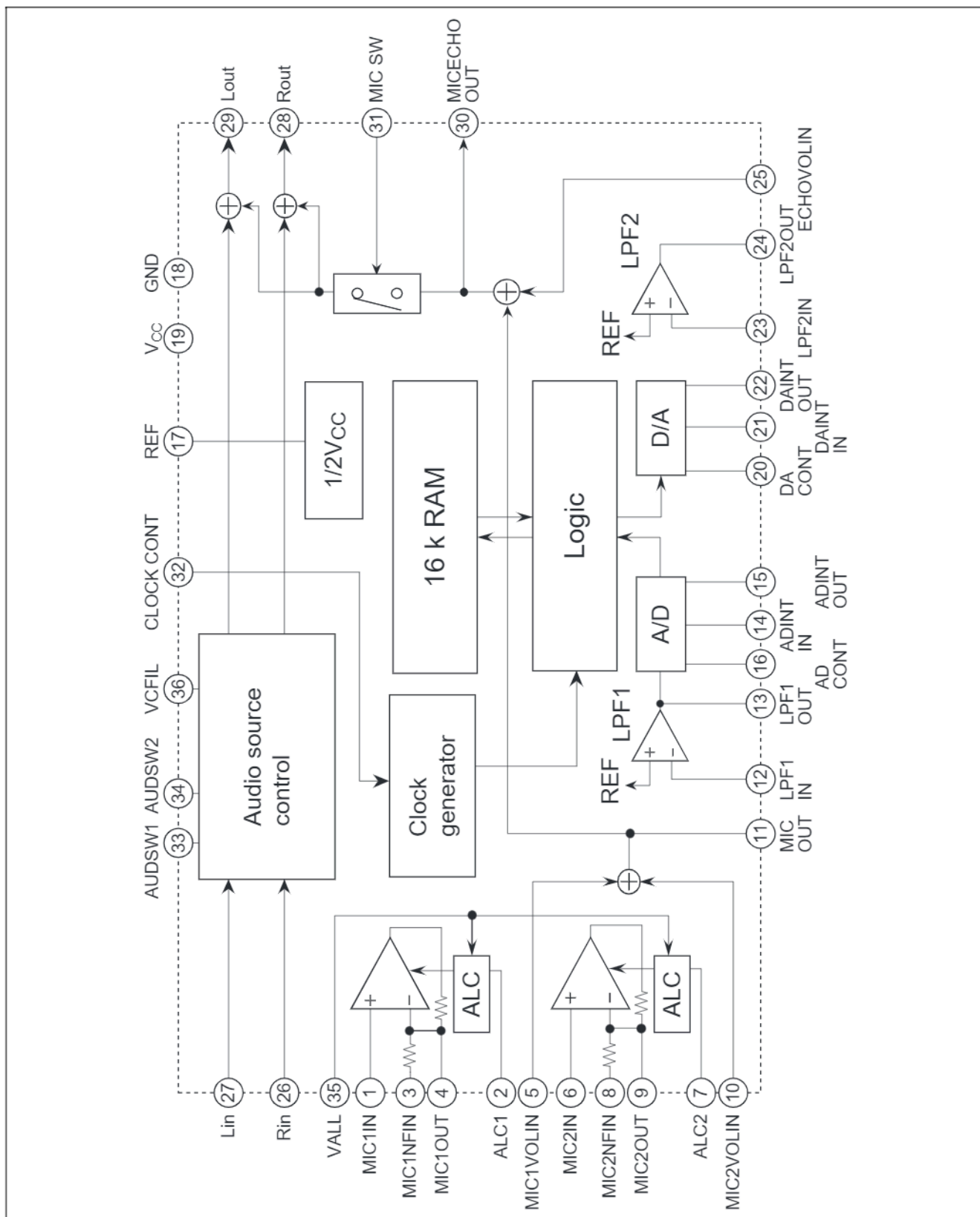
### Recommended Operating Condition

- Supply voltage range:  $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$
- Rated supply voltage:  $V_{CC} = 5 \text{ V}$

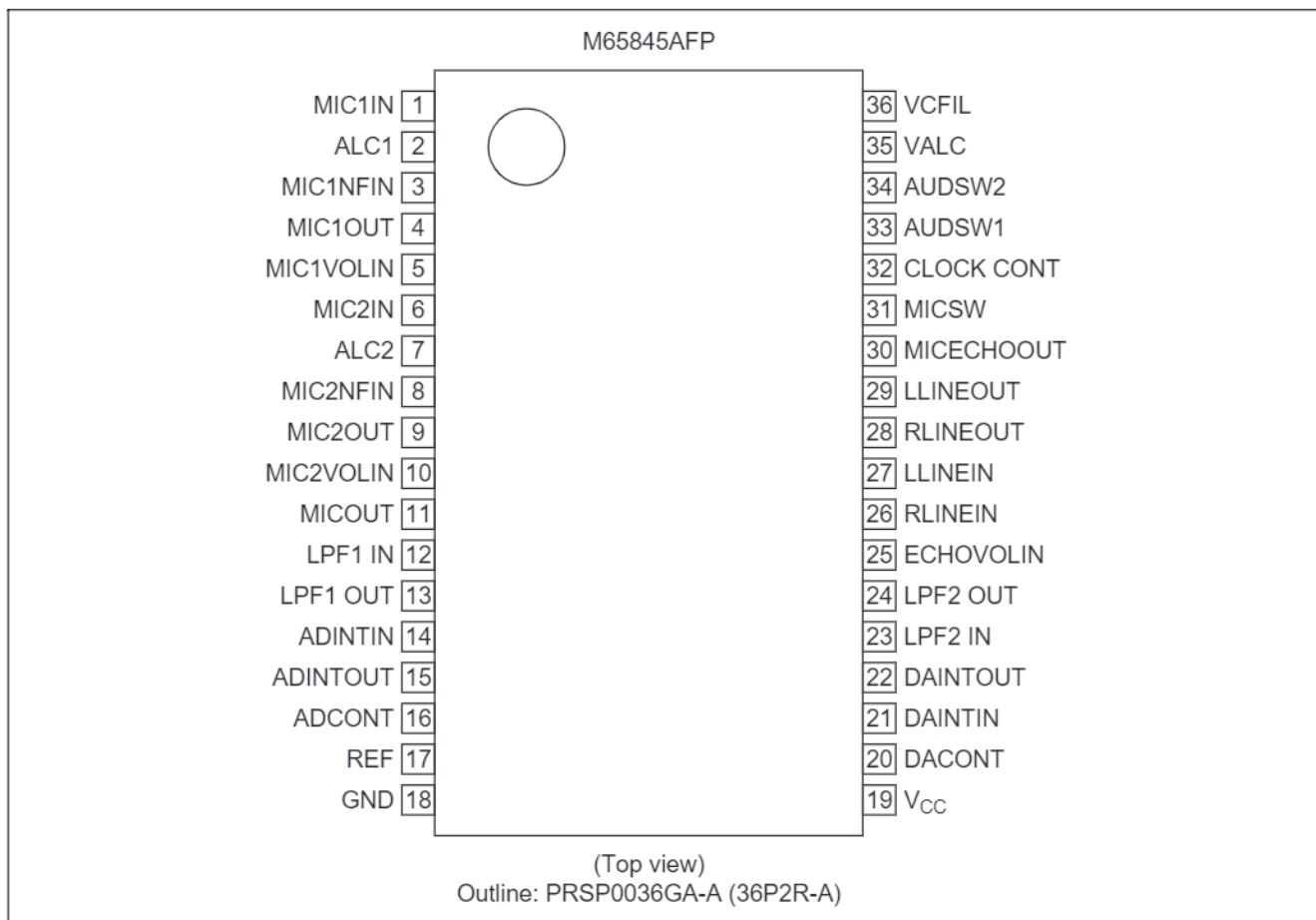
### System Configuration



## Block Diagram



## Pin Arrangement



## Pin Description

Pin No.	Symbol	Pin Name	Function
1	MIC1IN	MIC1 input	Connect MIC1
2	ALC1	ALC1 control	Connect C which determine recovery time
3	MIC1NFIN	MIC1 NF input	Set up MIC1 amp gain for feedback circuit
4	MIC1OUT	MIC1 output	
5	MIC1VOLIN	MIC1 volume input	Connect microphone volume which turn down input signal
6	MIC2IN	MIC2 input	Connect MIC2
7	ALC2	ALC2 control	Connect C which determine ALC attack, recovery time
8	MIC2NFIN	MIC2 NF input	Forms MIC2 amp gain with feedback
9	MIC2OUT	MIC2 output	
10	MIC2VOLIN	MIC2 volume input	Connect microphone volume which turn down input signal
11	MICOUT	MIC output	Mixing output with MIC1 and MIC2
12	LPF1 IN	Low pass filter 1 input	Forms the front low pass filter with external CR for digital echo
13	LPF1 OUT	Low pass filter 1 output	
14	ADINTIN	A/D integral input	Forms integrator with external C and R
15	ADINTOUT	A/D integral output	
16	ADCONT	A/D control	ADM A/D adaptive control
17	REF	Reference	1/2 V <sub>CC</sub> , connect filter C
18	GND	GND	
19	V <sub>CC</sub>	Power supply	
20	DACONT	D/A control	ADM A/D adaptive control
21	DAINTIN	D/A integral input	Forms integrator with external C
22	DAINTOUT	D/A integral output	
23	LPF2 IN	Low pass filter 2 input	Forms post low pass filter with external CR for digital echo
24	LPF2 OUT	Low pass filter 2 output	
25	ECHOVOLIN	Echo volume input	Connect microphone volume which turn down input signal
26	RLINEIN	Rch line input	Mixing output with line and microphone
27	LLINEIN	Lch line input	
28	RLINEOUT	Rch line output	
29	LLINEOUT	Lch line output	
30	MICECHOOOUT	MIC echo output	Mixing output with microphone and echo
31	MICSW	MIC SW	L: Microphone OFF, H: Microphone ON
32	CLOCK CONT	Clock control	Controls built-in clock generation circuit with external R
33	AUDSW1	Audio SW1	Changing source sound signal
34	AUDSW2	Audio SW2	
35	VALC	ALC supply voltage control	Form ALC operation voltage with control voltage
36	VCFIL	Vocal cut filter	Through frequency under vocal level

## Absolute Maximum Ratings

(Ta = 25°C, unless otherwise noted)

Item	Symbol	Rations	Unit	Conditions
Supply voltage	V <sub>CC</sub>	6.0	V	
Circuit current	I <sub>CC</sub>	85	mA	
Input voltage	V <sub>i</sub>	-0.3 to V <sub>CC</sub> + 0.3	V	
Power dissipation	P <sub>d</sub>	860	mW	
Operating temperature	T <sub>opr</sub>	-20 to +75	°C	
Storage temperature	T <sub>stg</sub>	-40 to +125	°C	

## Recommended Operating Condition

Item	Symbol	Limits			Unit	Conditions
		Min	Typ	Max		
Supply voltage	V <sub>CC</sub>	4.5	5	5.5	V	
L input voltage	V <sub>IL</sub>	0	—	1	V	Pin 33, 34
H input voltage	V <sub>IH</sub>	4	—	V <sub>CC</sub>	V	

## Electrical Characteristics

(V<sub>CC</sub> = 5 V, f = 1 kHz, V<sub>i</sub> = 100mVrms, f<sub>ck</sub> = 2 MHz, Ta = 25°C, unless otherwise noted)

Item		Symbol	Limits			Unit	Conditions
			Min	Typ	Max		
Total	Circuit current	I <sub>CC</sub>	25	34	70	mA	No signal
Microphone amplifier	Voltage gain	G <sub>VO</sub>	44	47	50	dB	V <sub>o</sub> = -17 dBV
	Distortion 1	THD1	—	0.5	1.5	%	V <sub>o</sub> = -17 dBV, without ALC
	Distortion 2	THD2	—	3.0	6.0	%	V <sub>i</sub> = -27 dBV, ALC operate
	ALC voltage	V <sub>OALC</sub>	-3	0	+3	dB	at -10 to +3 dBV
	ALC attack time	T <sub>ALCAT</sub>	25	40	55	ms	at C = 4.7 μF
	ALC recovery time	T <sub>ALCRE</sub>	1.0	1.5	2.0	s	at C = 4.7 μF
	Maximum output voltage	V <sub>O_MAX</sub>	-1	2	—	dBV	THD = 10%
	Noise voltage	No	—	-68	-57	dBV	G <sub>v</sub> = 47 dB, JIS-A, V <sub>i</sub> = 0 Vrms
	Input impedance	Z <sub>i</sub>	5	10	20	kΩ	
Echo	Delay time	T <sub>d</sub>	167	197	226	ms	R <sub>C</sub> = 51 kΩ
	Voltage gain	G <sub>v</sub>	-3	0	+3	dB	
	Distortion	THD	—	2.0	4.0	%	
	Maximum output voltage	V <sub>O_MAX</sub>	-3	+1	—	dBV	THD = 10%
	Noise voltage	No	—	-82	-67	dBV	JIS-A
Line	Voltage gain	G <sub>v</sub>	-3	0	+3	dB	
	Distortion	THD	—	0.02	0.1	%	
	Maximum output voltage	V <sub>O_MAX</sub>	1	4	—	dBV	THD = 10%
	Noise voltage	No	—	-97	-88	dBV	JIS-A, MICSW = OFF
	Input impedance	Z <sub>i</sub>	10	20	40	kΩ	
Vocal cut	Noise voltage	No	—	-95	-72	dBV	JIS-A, Vocal cut ON
	Voltage gain	G <sub>v</sub>	-3	0	+3	dB	Input one side channel
	Maximum output voltage	V <sub>O_MAX</sub>	1	4	—	dBV	THD = 10%
	Vocal rejection ratio	G <sub>REJ</sub>	14	18	—	dB	

## Function Description

### Microphone Amplifier

The gain ( $G_V$ ) and low cut-off frequency (fcl) of microphone amplifier are expressed as follows.

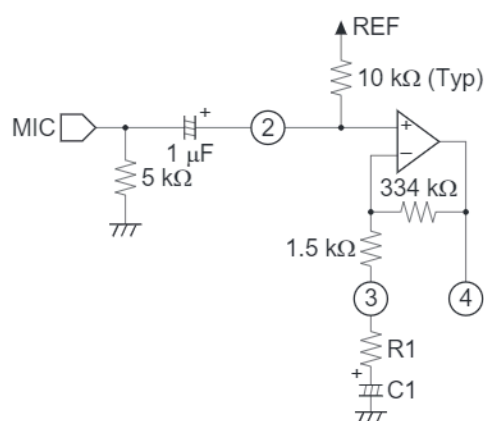
$$G_V = 20 \log \bullet \frac{R1 + 1.5 \text{ k} + 334 \text{ k}}{R1 + 1.5 \text{ k}} \quad fcl = \frac{1}{2\pi \bullet (R1 + 1.5 \text{ k}) \bullet C1}$$

$$G_V (\text{max}) = 47 \text{ dB}, fcl = 50 \text{ Hz}$$

$$R1 = 0 \Omega, C1 = 2.2 \mu\text{F}$$

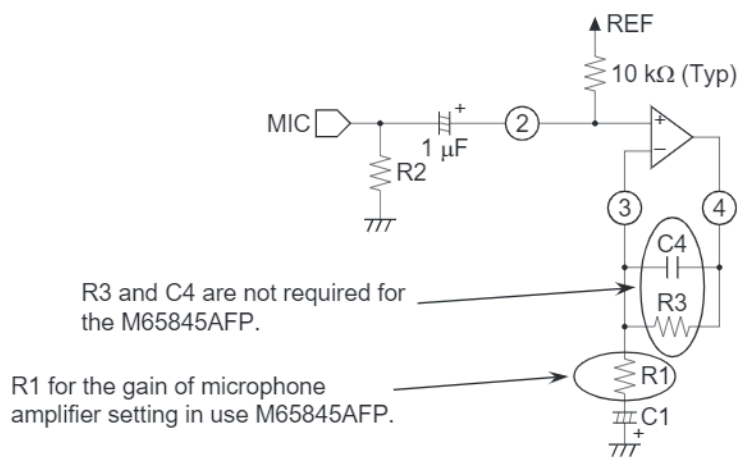
Assuming  $G_V = 37 \text{ dB}$ ,  $fcl = 15 \text{ Hz}$ , for instance, the constants take the following values.

$$R1 = 3.3 \text{ k}\Omega, C1 = 2.2 \mu\text{F}$$



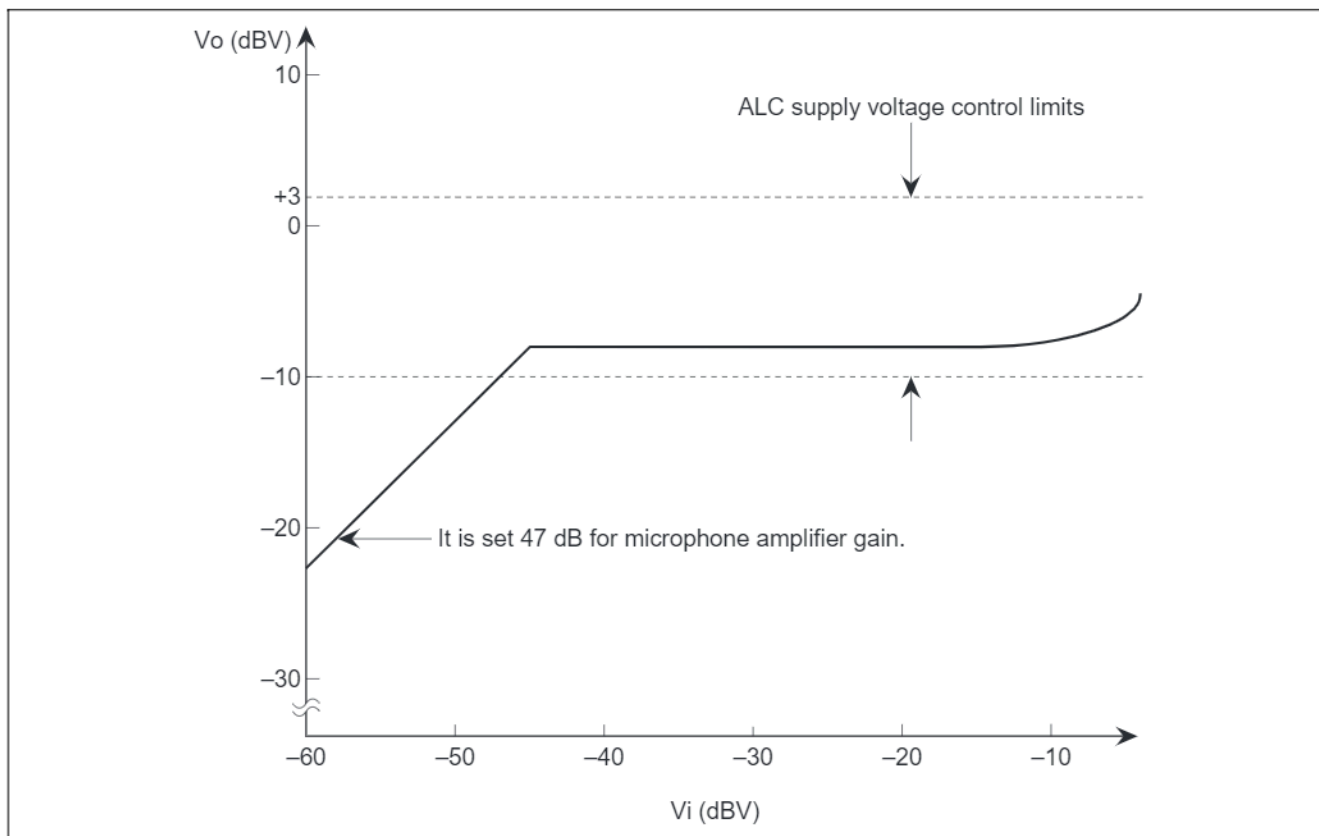
<Attention point when M65845FP is replaced with M65845AFP>

R3 and C4 are required for the M65845FP, not for the M65845AFP. As mentioned above, the gain of microphone amplifier can set it up with R1.



Recommended circuit in use M65845FP

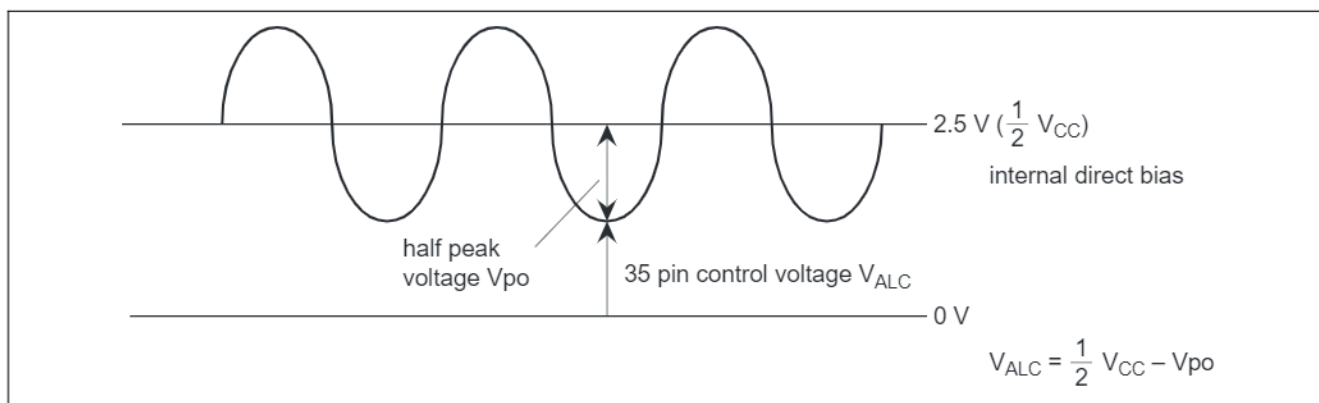
## ALC Level Block Diagram



## ALC Operation Voltage Control

ALC operation voltage can be formed within the limits of -10 to +3 dBV controlled by DC control voltage which connect pin 35.

(Setting up forms)



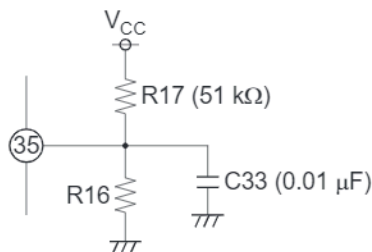
When ALC operation voltage is -5 dBV (at  $V_{CC} = 5\text{ V}$ )

$$-5\text{ dBV} = 0.56\text{ V}_{rms} = 1.59\text{ V}_{p-p} = 0.80\text{ V}_{p-o}$$

$$V_{ALC} = 2.5 - 0.8 = 1.7\text{ V}$$

are concerned.

Input impedance to pin 35 is so high (1 M $\Omega$ ) that ALC base voltage can be determined by division resistance.



at  $V_{CC} = 5\text{ V}$

ALC Operation Voltage (dBV)	Pin 35 Control Voltage VALC (V)	Resistance R16 ( $\Omega$ )
+3	0.50	5.6 k
0	1.09	15 k
-2	1.38	20 k
-4	1.61	24 k
-6	1.79	27 k
-8	1.94	33 k
-10	2.05	36 k

### MIC SW

Input low level to pin 31 (MIC SW), then microphone and echo signal can be cut.

Pin 31 (MIC SW)	MIC SW	Echo Signal Output
H or Open	On	On
L	Off	Mute

### Audio Source Select

Changing the switch, sound source changes four patterns matching with Karaoke soft.

Pin 33 AUDSW1: D1	Pin 34 AUDSW2: D2	Movements
L	L	Stereo
L	H	Lch monaural
H	L	Rch monaural
H	H	Vocal cut

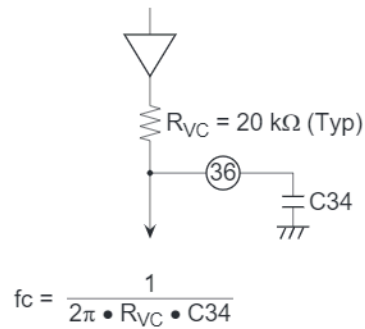
1. Stereo  
Under the conditions usual 2ch are played back to each outputs.
2. Lch monaural  
Under the conditions Lch source is played back to 2ch outputs and suitable for Karaoke reproduction of multiple Karaoke soft and main sound reproduction of laser disks.
3. Rch monaural  
Under the conditions Rch source is played back to 2ch outputs and suitable for reference vocal reproduction of multiple Karaoke soft and sub sound reproduction of laser disks.

## 4. Vocal cut

It is a method turned down Lch and Rch input having the same phase and sound.

Low pass cut off frequency  $f_c$  is determined by a capacitance which connect to pin 36 (vocal cut filter).

It is also having a function which through frequency under vocal level for supplying a lack of low level sound.



at  $f_c = 50$  Hz,  $C34 = 0.15$   $\mu$ F is determined.

Caution: Inside resistance is changeable one by one which rate is  $\pm 30\%$ .

**Digital Echo**

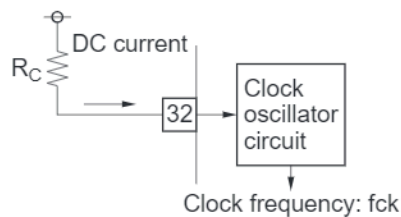
## 1. Clock oscillator circuit

This IC incorporates a current control type clock oscillator circuit in it, thus providing circuit configuration just by connecting an  $R_C$  for current control pin 32 (CLOCK CONT).

Fully internal clock supply prevents occurrence of undesired radiation without affecting any external circuit.

The oscillator frequency  $f_{ck}$  is following.

$$f_{ck} = 2 \text{ MHz } (R_C = 51 \text{ k}\Omega)$$



Note: The delay time ( $T_d$ ) for echo is determined by the clock frequency ( $f_{ck}$ ).

$$\text{Delay time} = 1/f_{ck} \times 24 \times N$$

( $N$  = the number of memory bits = 16384)

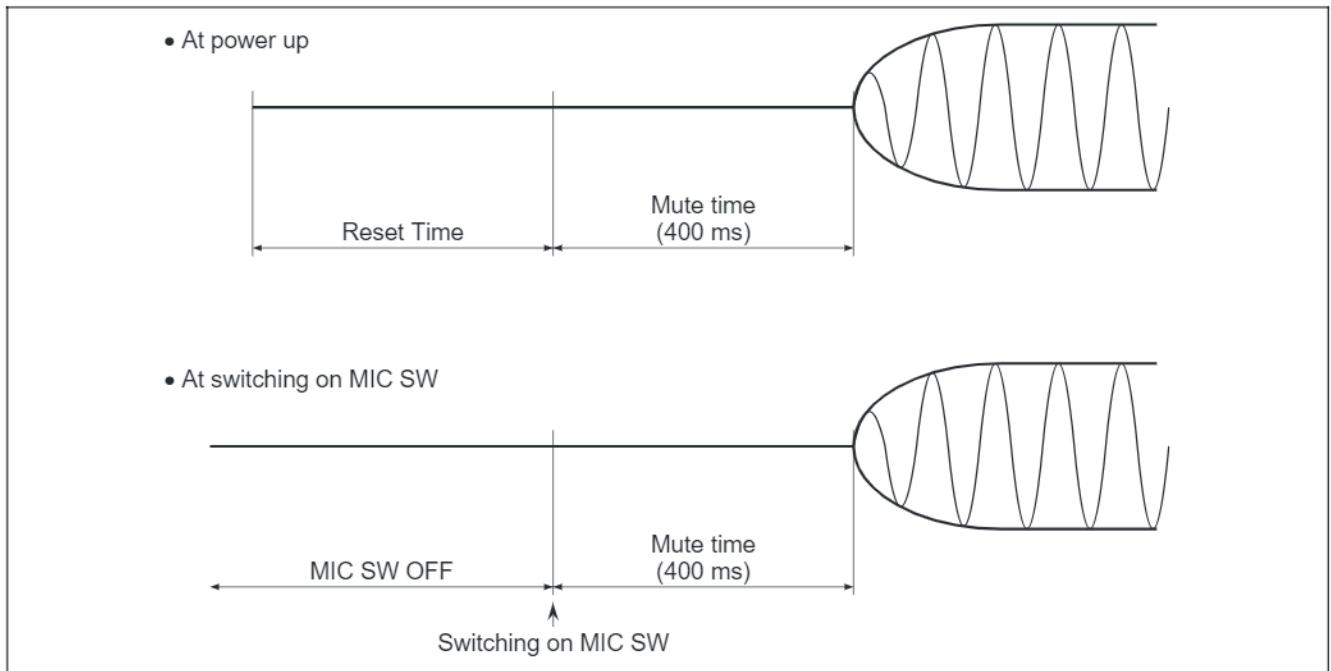
$f_{ck} = 2$  MHz ( $R_C = 51$  k $\Omega$ ): Delay time = 197 ms

$f_{ck} = 2.6$  MHz ( $R_C = 39$  k $\Omega$ ): Delay time = 150 ms

$f_{ck} = 3.9$  MHz ( $R_C = 24$  k $\Omega$ ): Delay time = 100 ms

## 2. Auto mute function

The IC carries out auto mute function at the time of powering up and switching on MIC SW in order to suppress shock noise that the digital delay may produce.



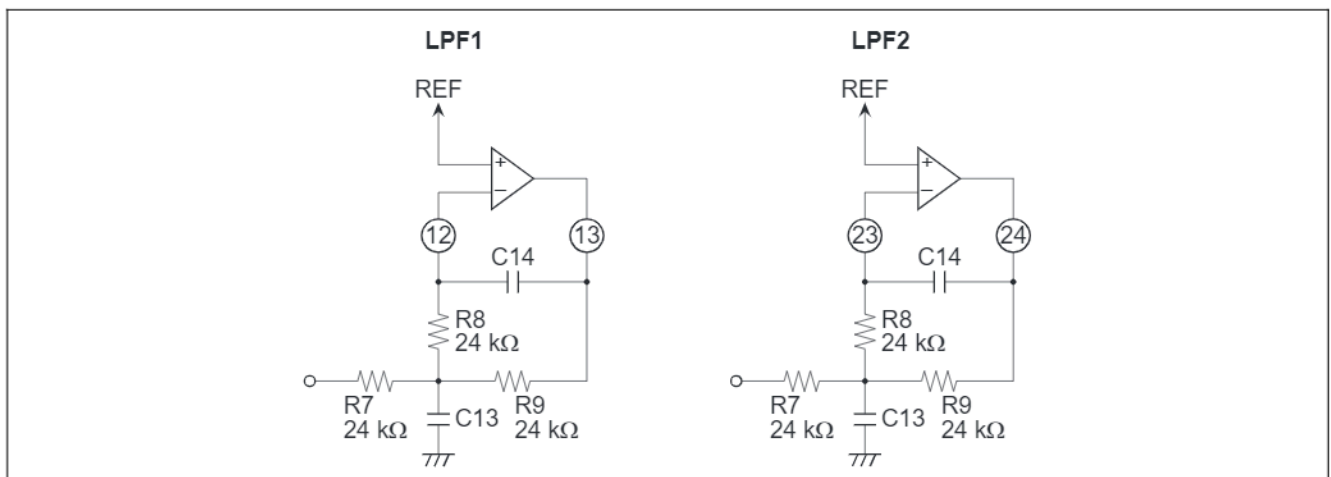
## 3. Input and output LPF

Signal through frequency  $f_{sig}$  is also determined by LPF of digital echo cut off frequency.

2 degree LPF of digital echo is formed by external resistance and capacitor. (refer to next figure)

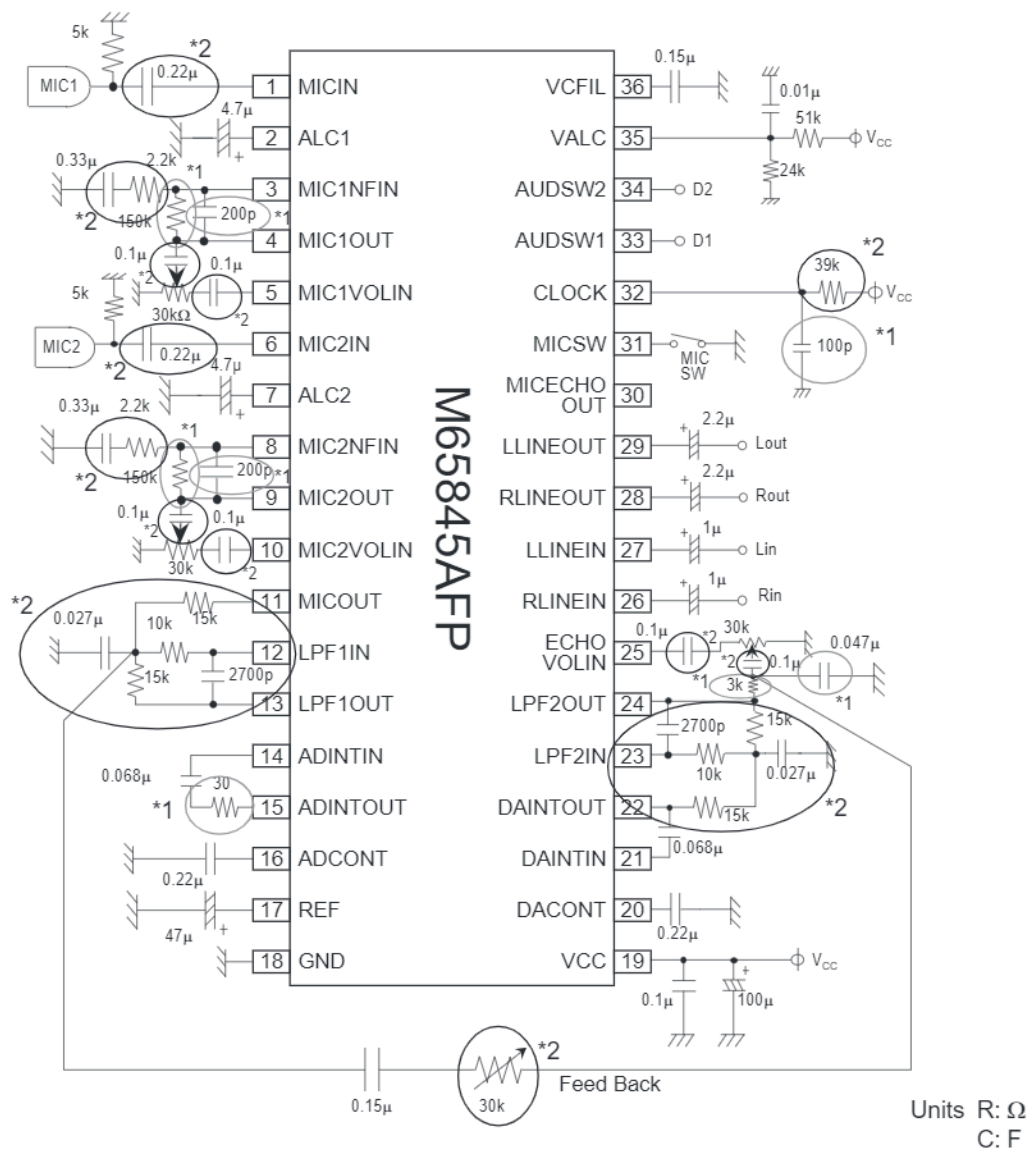
So, cut off frequency is determined by next formula.

$$f_{sig} = \frac{1}{2\pi \sqrt{R8 \cdot R9 \cdot C13 \cdot C14}}$$



## Compatibility with M65845FP

## &lt;Application Example in Use M65845FP&gt;



As mentioned above, the M65845AFP can be replaced with the M65845FP without changing the board.

Notes: \*1. The components marked with a circle are required for the M65845FP, not for the M65845AFP.

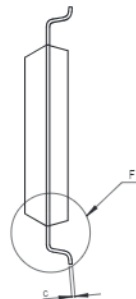
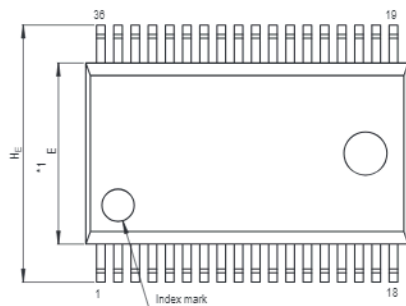
\*2. The M65845AFP is different from the M65845FP a part of the components marked with a circle.

Cut-off frequency 3.1 kHz

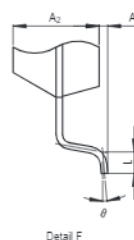
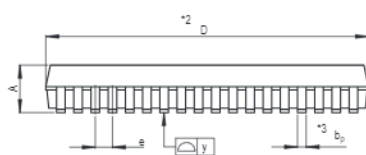


## Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SSOP36-8.4x15-0.80	PRSP0036GA-A	36P2R-A	0.5g



NOTE)  
1. DIMENSIONS "1" AND "2"  
DO NOT INCLUDE MOLD FLASH.  
2. DIMENSION "3" DOES NOT  
INCLUDE TRIM OFFSET.



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	14.8	15.0	15.2
E	8.2	8.4	8.6
A <sub>2</sub>	—	2.0	—
A	—	—	2.4
A <sub>1</sub>	0.05	—	—
b <sub>p</sub>	0.35	0.4	0.5
c	0.13	0.15	0.2
θ	0°	—	10°
H <sub>E</sub>	11.63	11.93	12.23
e	0.65	0.8	0.95
y	—	—	0.15
L	0.3	0.5	0.7

**Notes:**

1. This document is provided for reference purposes only so that Renesas customers may select the appropriate Renesas products for their use. Renesas neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of Renesas or any third party with respect to the information in this document.
2. Renesas shall have no liability for damages or infringement of any intellectual property or other rights arising out of the use of any information in this document, including, but not limited to, product data, diagrams, charts, programs, algorithms, and application circuit examples.
3. You should not use the products or the technology described in this document for the purpose of military applications such as the development of weapons of mass destruction or for the purpose of any other military use. When exporting the products or technology described herein, you should follow the applicable export control laws and regulations, and procedures required by such laws and regulations.
4. All information included in this document such as product data, diagrams, charts, programs, algorithms, and application circuit examples, is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas products listed in this document, please confirm the latest product information with a Renesas sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas such as that disclosed through our website. (<http://www.renesas.com>)
5. Renesas has used reasonable care in compiling the information included in this document, but Renesas assumes no liability whatsoever for any damages incurred as a result of errors or omissions in the information included in this document.
6. When using or otherwise relying on the information in this document, you should evaluate the information in light of the total system before deciding about the applicability of such information to the intended application. Renesas makes no representations, warranties or guarantees regarding the suitability of its products for any particular application and specifically disclaims any liability arising out of the application and use of the information in this document or Renesas products.
7. With the exception of products specified by Renesas as suitable for automobile applications, Renesas products are not designed, manufactured or tested for applications or otherwise in systems the failure or malfunction of which may cause a direct threat to human life or create a risk of human injury or which require especially high quality and reliability such as safety systems, or equipment or systems for transportation and traffic, healthcare, combustion control, aerospace and aeronautics, nuclear power, or undersea communication transmission. If you are considering the use of our products for such purposes, please contact a Renesas sales office beforehand. Renesas shall have no liability for damages arising out of the uses set forth above.
8. Notwithstanding the preceding paragraph, you should not use Renesas products for the purposes listed below:
  - (1) artificial life support devices or systems
  - (2) surgical implantations
  - (3) healthcare intervention (e.g., excision, administration of medication, etc.)
  - (4) any other purposes that pose a direct threat to human lifeRenesas shall have no liability for damages arising out of the uses set forth in the above and purchasers who elect to use Renesas products in any of the foregoing applications shall indemnify and hold harmless Renesas Technology Corp., its affiliated companies and their officers, directors, and employees against any and all damages arising out of such applications.
9. You should use the products described herein within the range specified by Renesas, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas shall have no liability for malfunctions or damages arising out of the use of Renesas products beyond such specified ranges.
10. Although Renesas endeavors to improve the quality and reliability of its products, IC products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Please be sure to implement safety measures to guard against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other applicable measures. Among others, since the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
11. In case Renesas products listed in this document are detached from the products to which the Renesas products are attached or affixed, the risk of accident such as swallowing by infants and small children is very high. You should implement safety measures so that Renesas products may not be easily detached from your products. Renesas shall have no liability for damages arising out of such detachment.
12. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written approval from Renesas.
13. Please contact a Renesas sales office if you have any questions regarding the information contained in this document, Renesas semiconductor products, or if you have any other inquiries.



**RENESAS SALES OFFICES**

<http://www.renesas.com>

Refer to "<http://www.renesas.com/en/network>" for the latest and detailed information.

**Renesas Technology America, Inc.**  
450 Holger Way, San Jose, CA 95134-1368, U.S.A  
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

**Renesas Technology Europe Limited**  
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.  
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

**Renesas Technology (Shanghai) Co., Ltd.**  
Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120  
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7858/7898

**Renesas Technology Hong Kong Ltd.**  
7th Floor, North Tower, World Finance Centre, Harbour City, Canton Road, Tsimshatsui, Kowloon, Hong Kong  
Tel: <852> 2265-6688, Fax: <852> 2377-3473

**Renesas Technology Taiwan Co., Ltd.**  
10th Floor, No.99, Fushing North Road, Taipei, Taiwan  
Tel: <886> (2) 2715-2888, Fax: <886> (2) 3518-3399

**Renesas Technology Singapore Pte. Ltd.**  
1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632  
Tel: <65> 6213-0200, Fax: <65> 6278-8001

**Renesas Technology Korea Co., Ltd.**  
Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea  
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

**Renesas Technology Malaysia Sdn. Bhd**  
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia  
Tel: <603> 7955-9390, Fax: <603> 7955-9510