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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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M65850P/FP

Digital Echo (Digital Delay)

REJ03F0171-0201

Rev.2.01

Jan 25, 2008

Description

The M65850P/FP is a CMOS IC for generating echo to be added to the voice through a Karaoke microphone.

It is optimal to provide the echo effect function for Karaoke player, such as radio cassette recorders, mini audio components and television sets.

Increased master clock frequency assures high-performance short delay, enabling the IC to be used for Dolby prologic surround system.

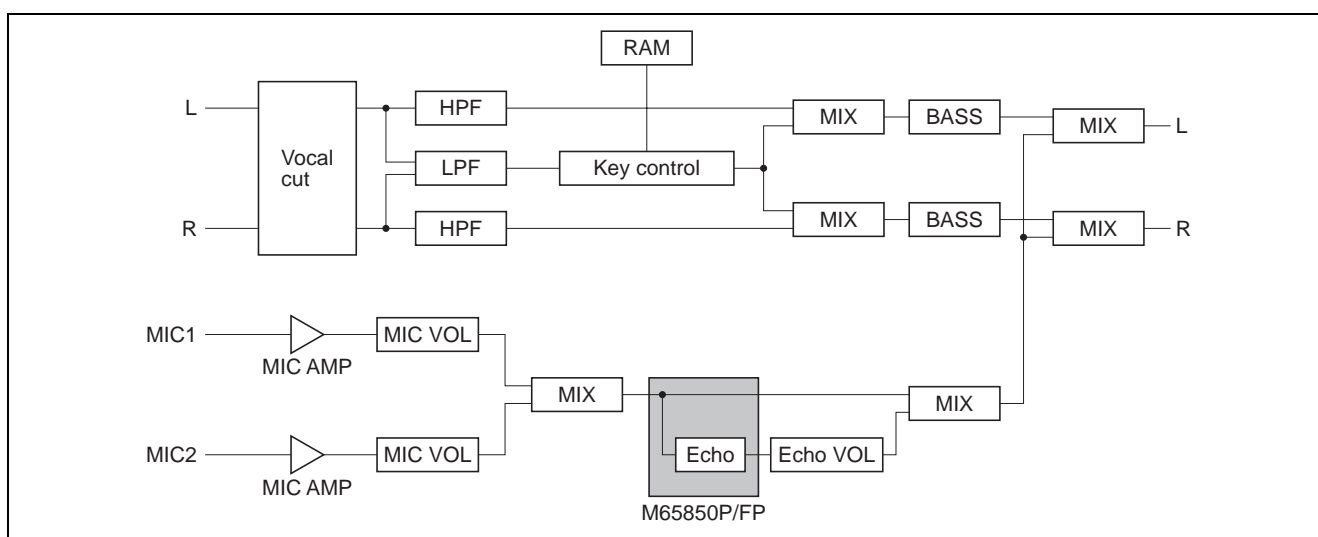
Features

- Built-in input/output filters, A/D and D/A converters, and memory realize a delay system with only a single chip.
- Built-in current control type clock oscillator circuit avoids clock affection outside, thus allowing prevention of undesired radiation.
- Delay time = 164 ms (with master clock set at 1 MHz)
(Selection of delay time in a range between 15 ms and 200 ms)
- Small package (14-pin DIP: PRDP0014AA-A (14P4), 16-pin SOP: PRSP0016DE-A (16P2N-A))
- Built-in 20 Kbit SRAM
- Built-in auto reset circuit (The IC reset as power is turned on)
- Single power supply (5 V)

Recommended Operating Condition

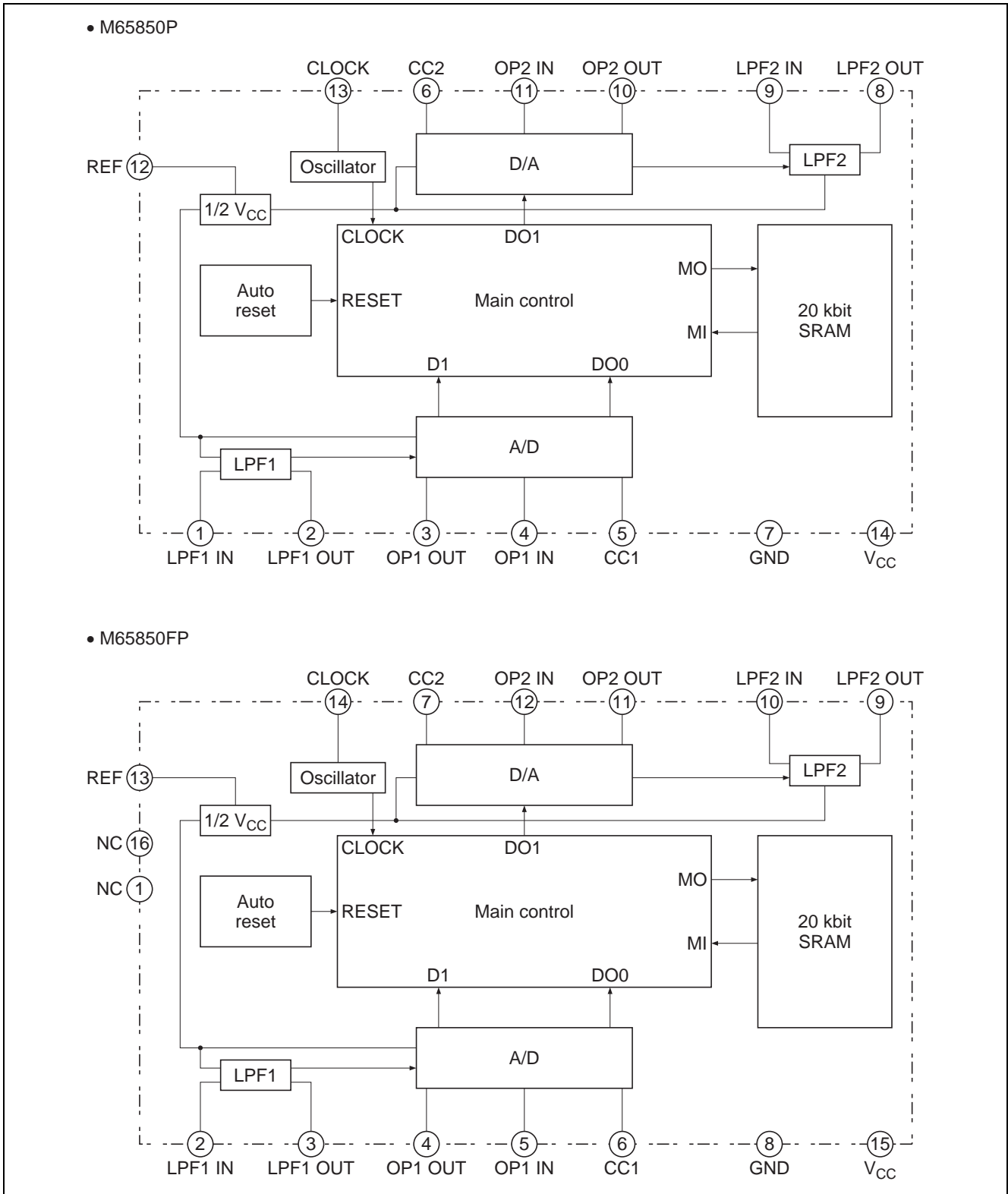
- Supply voltage range: $V_{CC} = 3.5$ to 5.5 V
- Rated supply voltage: $V_{CC} = 5$ V

System Configuration

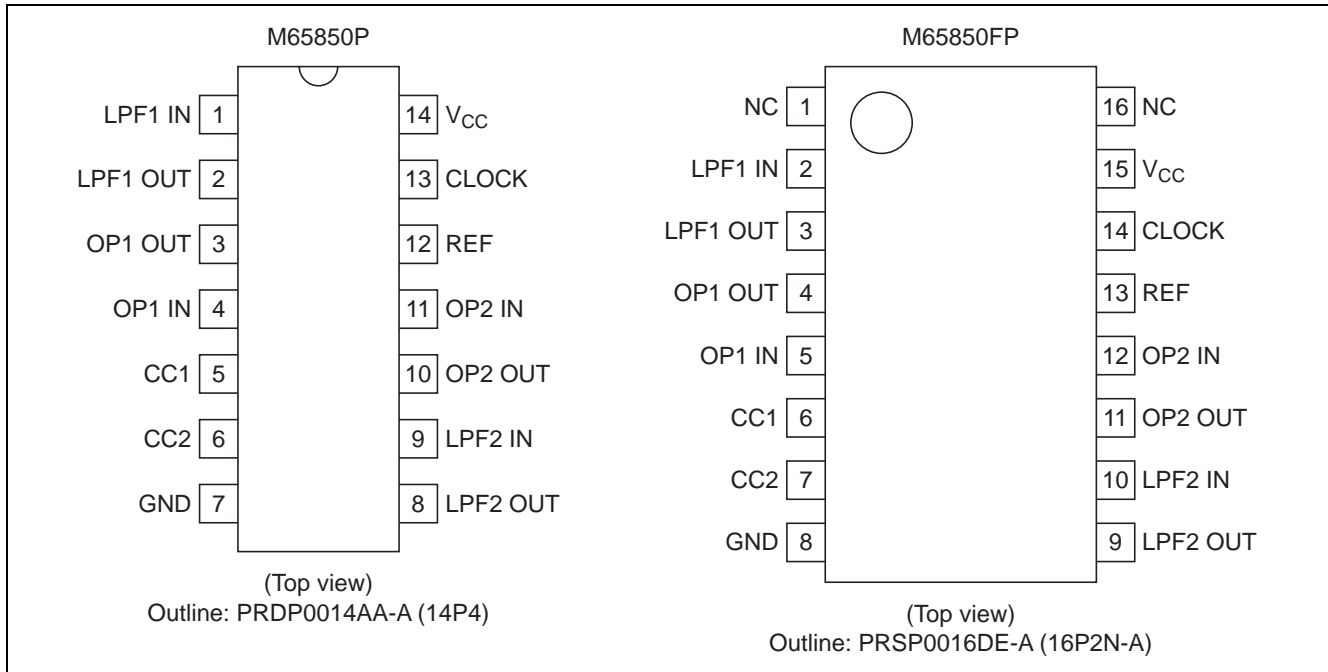


Note: Dolby is the registered trademarks of Dolby Laboratories Licensing Corporation.

Block Diagram



Pin Arrangement



Pin Description

Pin No.		Symbol	Name	I/O	Function
P	FP				
1	2	LPF1 IN	Low pass filter 1 input	I	To form input-side low pass filter by connecting external capacitor and resistor
2	3	LPF1 OUT	Low pass filter 1 output	O	
3	4	OP1 OUT	Operational amplifier 1 output	O	To form A/D conversion integrator by connecting external capacitor
4	5	OP1 IN	Operational amplifier 1 input	I	
5	6	CC1	Current control 1	—	ADM control of A/D converter
6	7	CC2	Current control 2	—	ADM control of D/A converter
7	8	GND	GND	—	
8	9	LPF2 OUT	Low pass filter 2 output	O	To form input-side low pass filter by connecting external capacitor and resistor
9	10	LPF2 IN	Low pass filter 2 input	I	
10	11	OP2 OUT	Operational amplifier 2 output	O	To form D/A conversion integrator by connecting external capacitor
11	12	OP2 IN	Operational amplifier 2 input	I	
12	13	REF	Reference	—	Analog reference voltage $\approx 1/2 V_{CC}$
13	14	CLOCK	Clock generator input	I	To form clock generator by connecting external resistor
14	15	V _{CC}	Supply voltage	—	To apply 3.5 to 5.5 V power (Rated voltage: 5 V)
—	1, 16	NC	No connection	—	

Absolute Maximum Ratings

(Ta = 25°C, unless otherwise noted)

Item	Symbol	Ratings	Units	Conditions
Supply voltage	V _{CC}	6.0	V	
Circuit current	I _{CC}	100	mA	
Power dissipation	P _d	800 (P), 550 (FP)	mW	
Operating temperature	T _{opr}	-20 to +75	°C	
Storage temperature	T _{stg}	-40 to +125	°C	

Recommended Operating Condition

Item	Symbol	Limits			Unit	Conditions
		Min	Typ	Max		
Supply voltage	V _{CC}	3.5	5	5.5	V	
Clock frequency	f _{ck}	0.8	—	11.0	MHz	

Electrical Characteristics

(V_{CC} = 5 V, f = 1 kHz, V_i = 100 mV_{rms}, f_{ck} = 1 MHz, Ta = 25°C, unless otherwise noted)

Item	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
Circuit current	I _{CC}	5	13	25	mA	No signal input
Voltage gain	G _v	-3.0	0	3.0	dB	R _L = 47 kΩ
Maximum output voltage	V _{omax}	0.7	1.0	—	V _{rms}	THD = 10%
Total harmonic distortion	THD	—	1.2	3.0	%	30 kHz LPF
Output noise voltage	No	—	-85	-70	dBV	DIN-AUDIO
Clock frequency	f _{ck}	0.85	1	1.15	MHz	R _C = 120 kΩ

Function Description

1. Delay time Td

The delay time can be calculated by the equation:

$$T_d = 8N / f_{ck} \quad (N = \text{the number of memory bits} = 20480)$$

When $f_{ck} = 1 \text{ MHz}$ ($f_s = 125 \text{ kHz}$), T_d can be set at 164 ms.

<Reference>

The M65850P/FP adopts ADM (Adaptive Delta Modulation) system in A/D, D/A converters.

The sampling frequency can be calculated by the following equation:

$$f_s = \text{clock frequency} / 8 \text{ (Hz)}$$

For clock frequency (f_{ck}) = 1MHz, the calculated sampling frequency is :

$$f_s = 1 \text{ MHz} / 8 = 125 \text{ kHz}$$

2. Clock oscillator circuit

The M65850P incorporates a current control type clock oscillator circuit in it, thus providing circuit configuration just by connecting a resistor for current control to pin 13 (FP: pin 14) CLOCK.

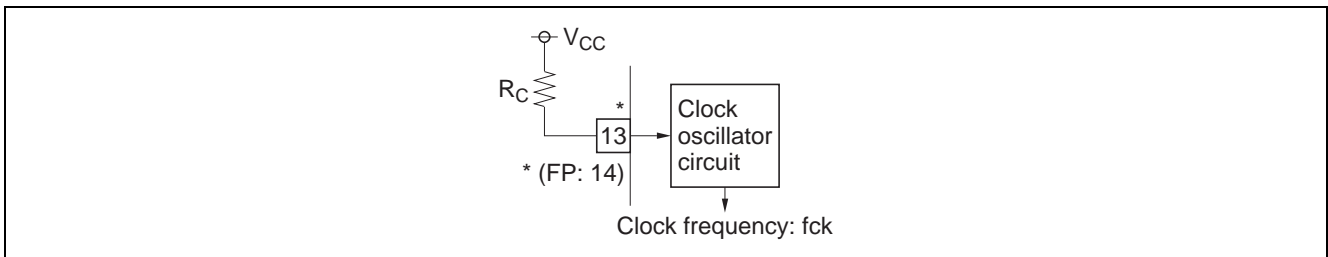
Fully internal clock supply prevents occurrence of undesired radiation without affecting any external circuit.

The oscillator frequency is:

$$f_{ck} = 1 \text{ MHz} \quad (R_C = 120 \text{ k}\Omega)$$

The resistor for current control can be calculated using the following equation.

$$R_C \approx K / \text{Clock frequency (fck)} [\Omega]$$



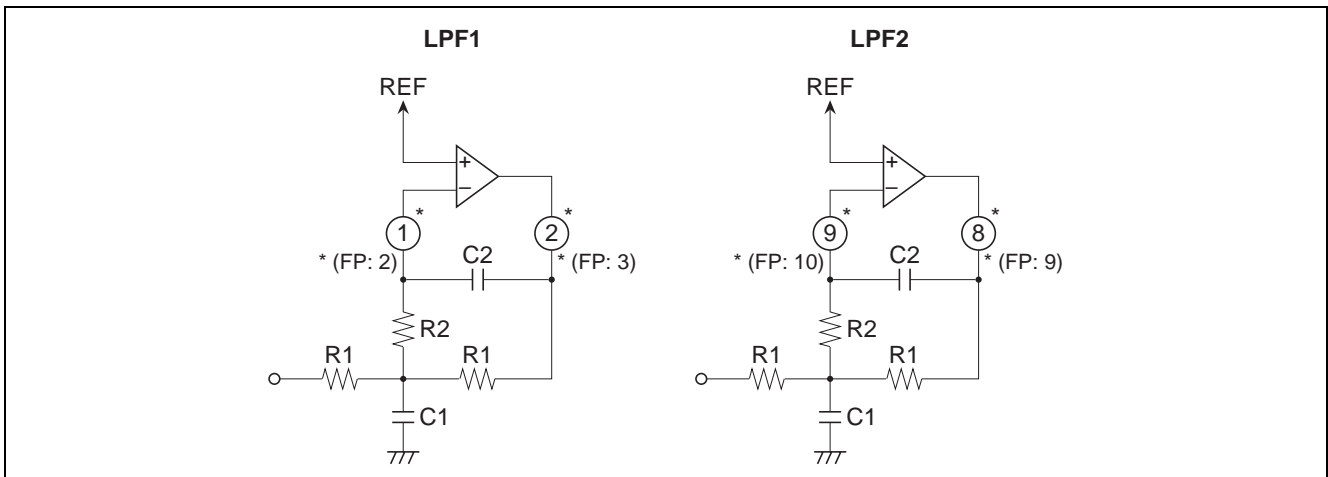
K is the coefficient, and changes according to clock frequency, as shown below.

($V_{CC} = 5 \text{ V}$, $T_a = 25^\circ\text{C}$)

Delay Time (ms)	Clock Frequency (Hz)	K Value	R_C (Ω)
15 to 30	11.0 M to 5.5 M	0.8×10^{11}	7.5 k to 15 k
31 to 100	5.3 M to 1.64 M	1.0×10^{11}	18 k to 62 k
101 to 200	1.62 M to 800 k	1.2×10^{11}	75 k to 150 k

3. Input/output LPF

It is necessary to change the LPF setting (signal pass band, fsig) of digital echo according to the clock frequency. (Refer to the table below)



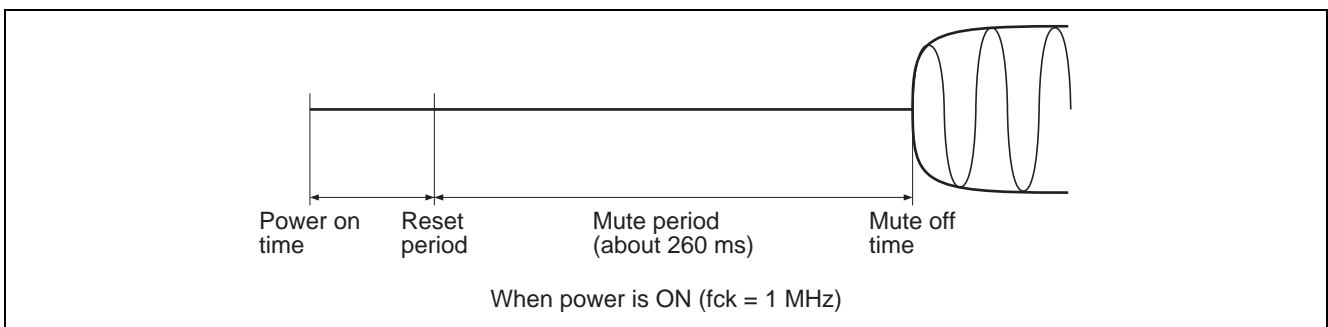
$$\therefore f_{sig} = \frac{1}{2\pi \sqrt{C1 \cdot C2 \cdot R1 \cdot R2}}$$

(V_{CC} = 5 V, V_i = 100mVrms, f = 1 kHz, T_a = 25°C)

Delay Time (ms)	Clock Frequency (Hz)	Signal Pass Band (Hz)	LPF				Distortion (Reference Value) (%)
			R1 (Ω)	R2 (Ω)	C1 (F)	C2 (F)	
15 to 30	11.0 M to 5.5 M	7 k	15 k	15 k	3300 p	680 p	0.2% (T _d = 20 ms)
31 to 100	5.3 M to 1.64 M	5 k	13 k	13 k	4700 p	1000 p	0.3% (T _d = 50 ms)
101 to 200	1.62 M to 800 k	3 k	16 k	16 k	6800 p	1500 p	1.2% (T _d = 160 ms)

4. Mute

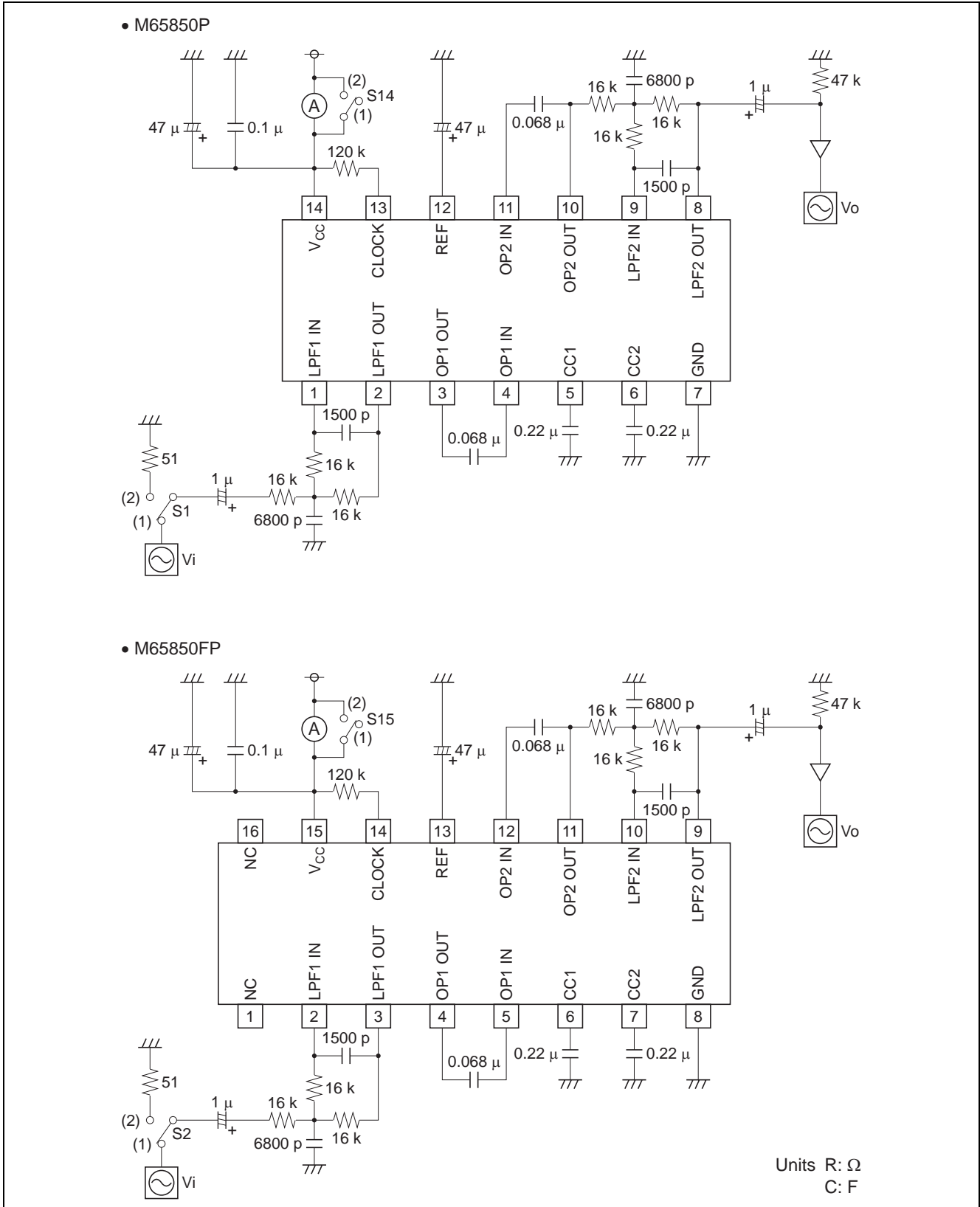
When power is turned on, the mute function works automatically to prevent noise generation. (Here, however, “mute” means the function which prevents noise generation after the reset time.)



Test Conditions

Item	Symbol	S1	S14	Remarks
Circuit current	I_{CC}	2	2	No-signal time
Voltage gain between input and output	G_V	1	1	$R_L = 47\text{ k}\Omega$
Maximum output voltage	V_{omax}	1	1	THD = 10%
Output distortion	THD	1	1	30 kHz LPF
Output noise voltage	No	2	1	DIN-AUDIO

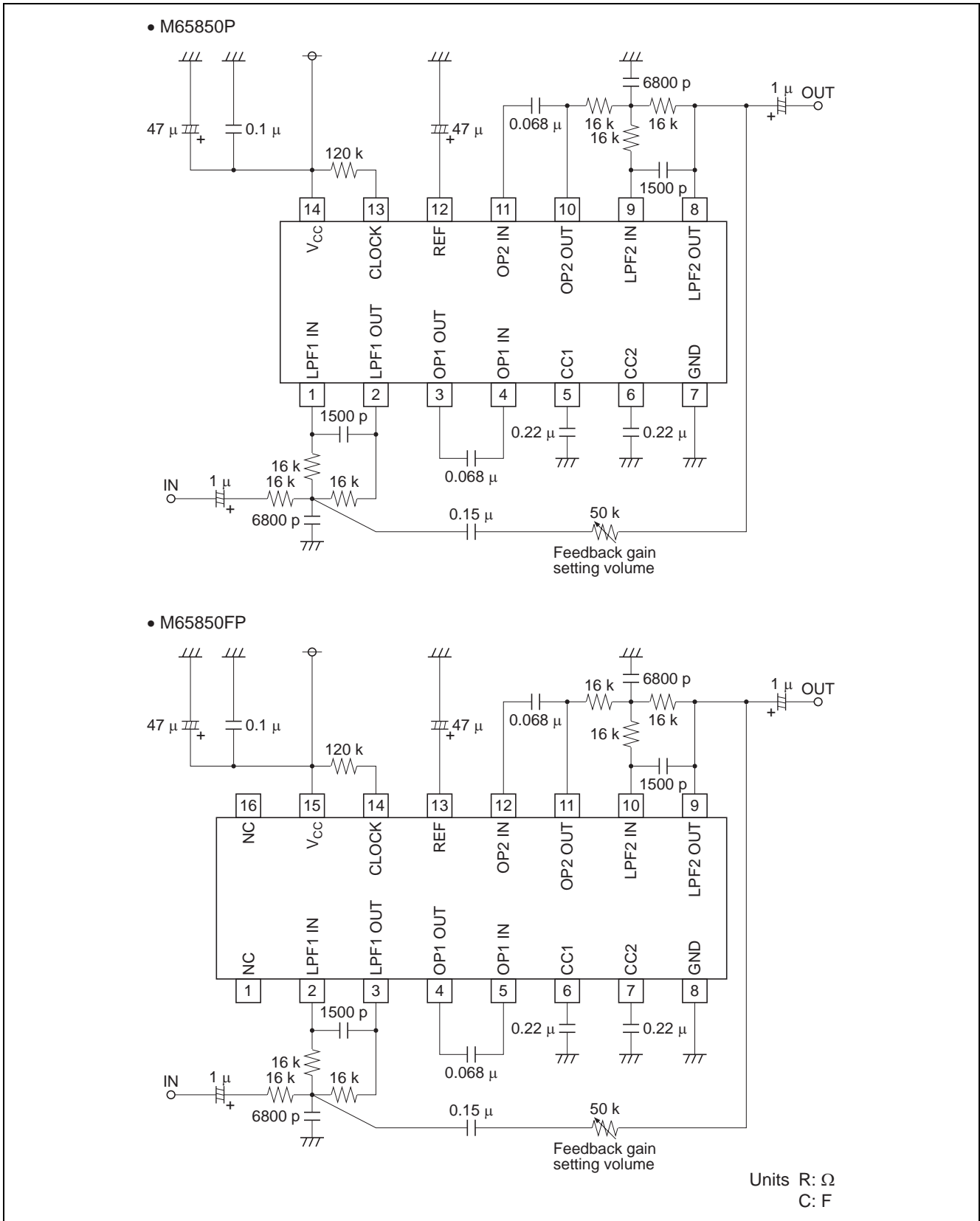
Test Circuit



Application Example

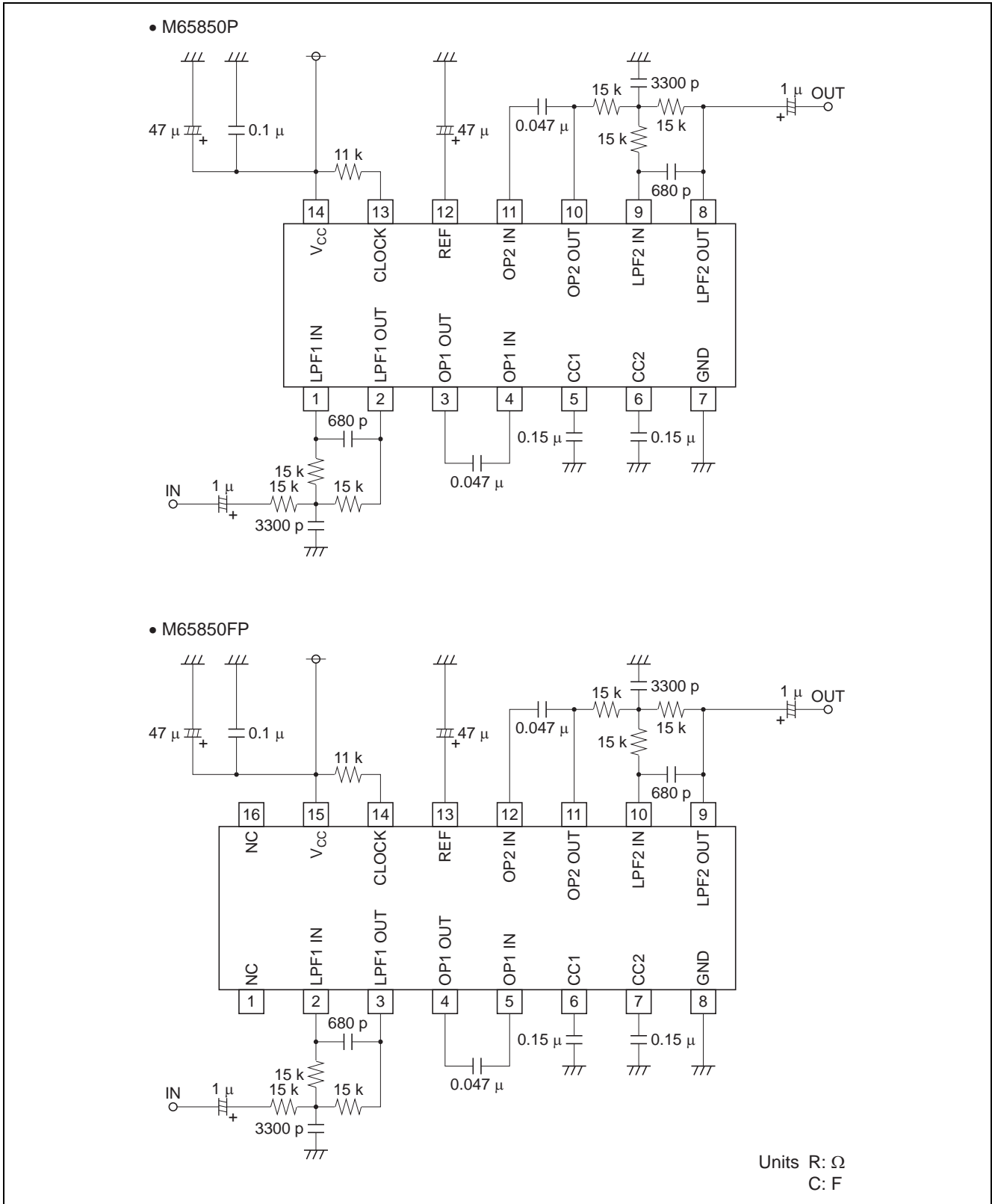
1. Echo

Delay time 164 ms (Signal pass band 3 kHz)



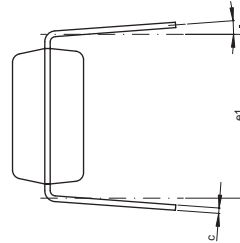
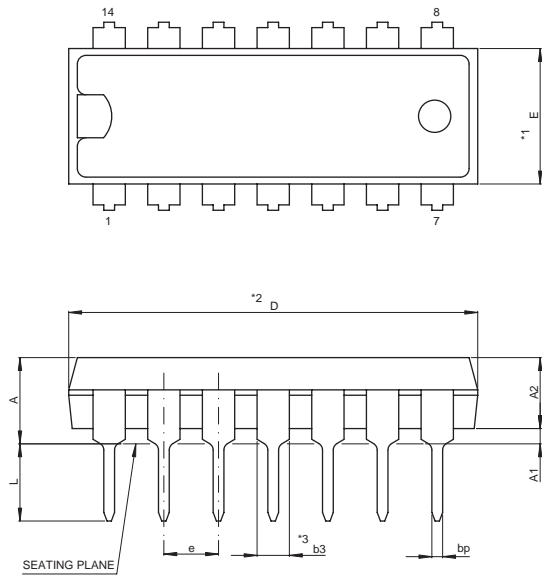
2. Surround

Delay time 20 ms (Signal pass band 7 kHz)



Package Dimensions

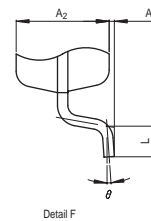
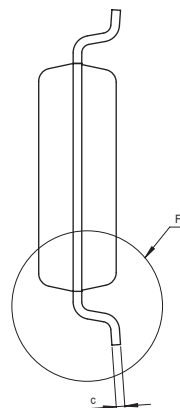
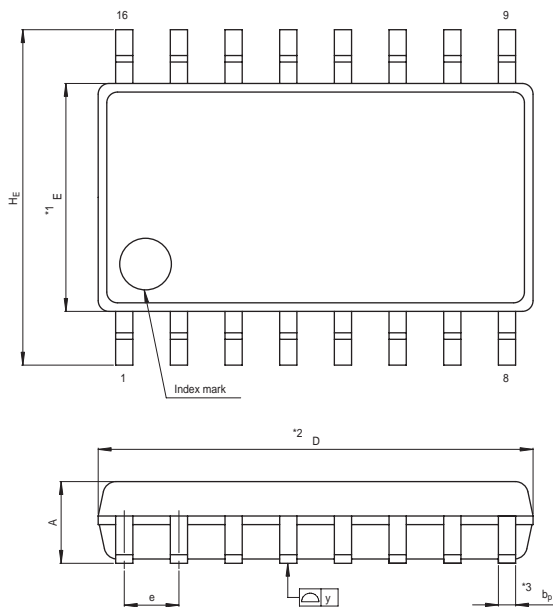
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP14-6.3x19-2.54	PRDP0014AA-A	14P4	1.0g



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
e1	7.32	7.62	7.92
D	18.8	19.0	19.2
E	6.15	6.3	6.45
A	—	—	4.5
A1	0.51	—	—
A2	—	3.3	—
bp	0.4	0.5	0.6
b3	1.4	1.5	1.8
c	0.22	0.27	0.34
θ	0°	—	15°
e	2.29	2.54	2.79
L	3.0	—	—

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP16-5.3x10.1-1.27	PRSP0016DE-A	16P2N-A	0.2g



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Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	10.0	10.1	10.2
E	5.2	5.3	5.4
A2	—	1.8	—
A1	0	0.1	0.2
A	—	—	2.1
bp	0.35	0.4	0.5
c	0.18	0.2	0.25
θ	0°	—	8°
HE	7.5	7.8	8.1
e	1.12	1.27	1.42
y	—	—	0.1
L	0.4	0.6	0.8

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