

# M65847FP/SP

## DIGITAL KEY CONTROLLER

### DESCRIPTION

The M65847 is Complementary Metal Oxide Semiconductor Integrated Circuit used to control the key of music in karaoke players.

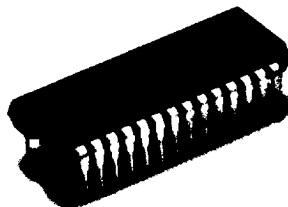
This device is suitable for providing a karaoke system such as a CD radio cassette recorder, a mini component stereo system or VCR, with a key control function.

### FEATURES

- I/O low-pass filter, A/D, D/A converters and control logic circuit which are required for digital key control are built-in to allow one-chip configuration of a digital key controller.
- Built-in 16K-bit RAM
- 3 modes are selectable for control: self mode, easy mode and MCU mode.
  - Self mode: Key conversion by push switch
  - Easy mode: Key conversion by parallel data
  - MCU mode: Key conversion by serial data
- Built-in clocks without an external circuit.
- Built-in auto reset circuit (The IC reset as power is turned on.)
- Single power supply (5V)



Outline 28P2W-A (FP)  
1.27mm pitch 450mil SOP  
(8.4mm×17.5mm×2.0mm)

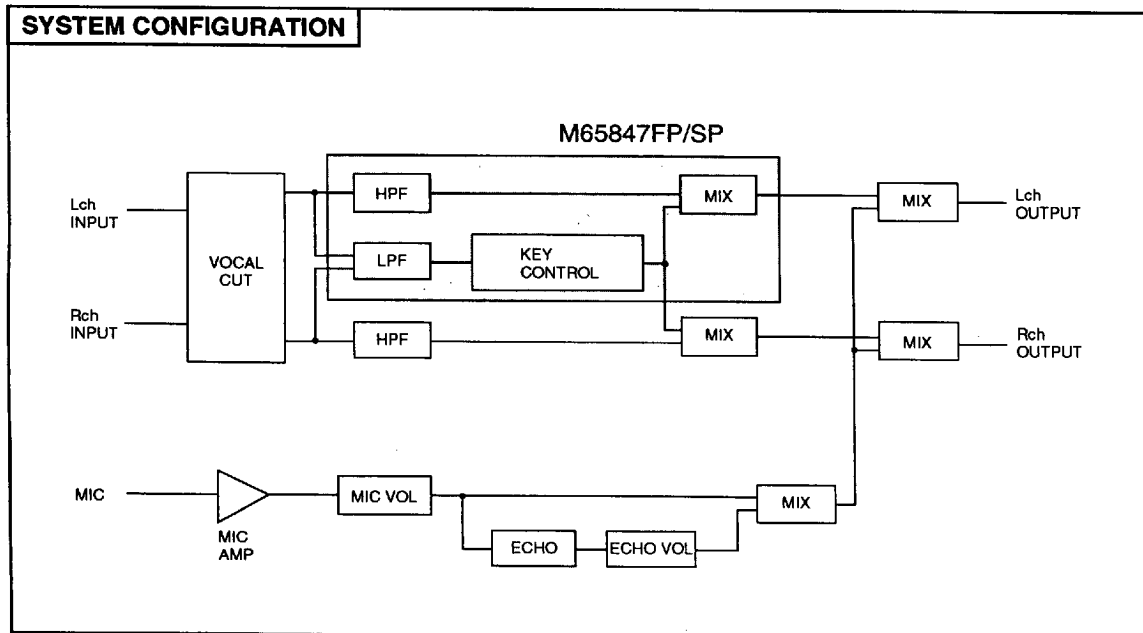


Outline 28P4B (SP)  
1.778mm pitch 400mil SDIP  
(8.9mm×28.0mm×3.8mm)

### RECOMMENDED OPERATING CONDITION

Supply voltage range..... Vcc=4.5 to 5.5V

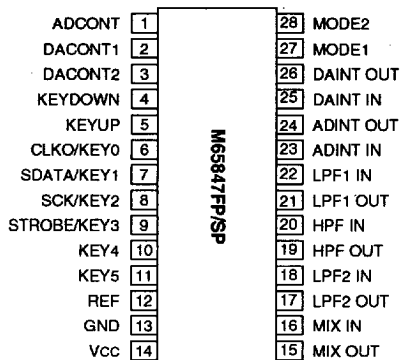
Rated supply voltage..... Vcc=5V



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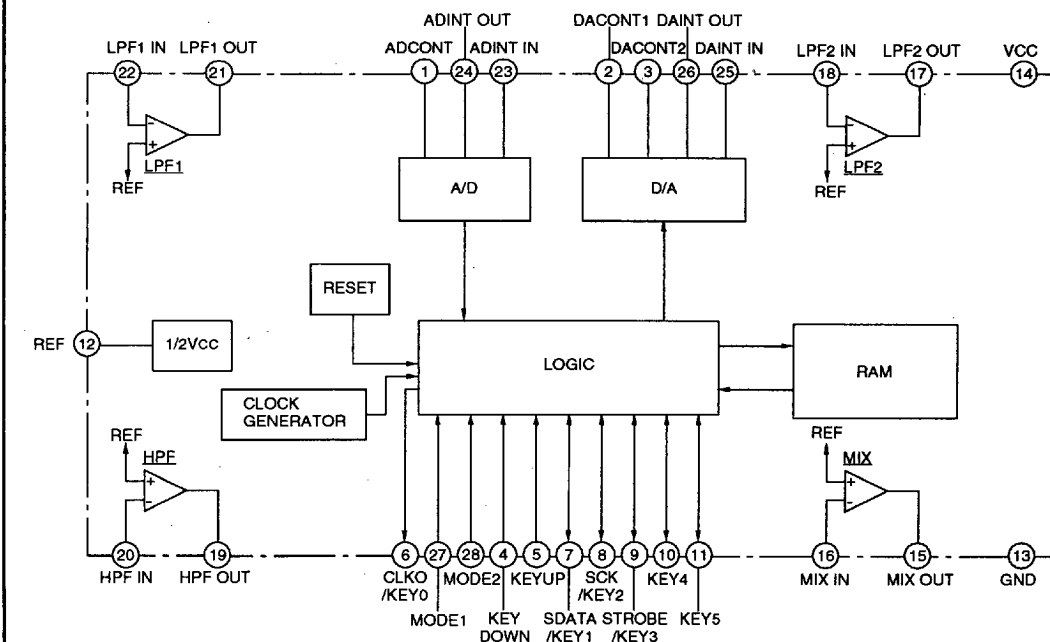
**PIN CONFIGURATION (TOP VIEW)**



Outline 28P2W-A (FP)

28P4B (SP)

**IC INTERNAL BLOCK DIAGRAM**



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DIGITAL KEY CONTROLLER

PIN DESCRIPTION

Pin No.	Symbol	Name	I/O	Function					
				Self mode	Easy mode	MCU mode			
①	ADCONT	A/D control	—	Determines adaptive time constant for A/D conversion by ADM system					
②	DACONT1	D/A 1 control	—	Determines adaptive time constant for D/A conversion by ADM system					
③	DACONT2	D/A 2 control	—						
④	KEYDOWN	Key down	I:CMOS 50kΩ ↓	Key conversion (down)	Clock output at pin ⑤ is controlled by setting pins ④ and ⑤.	L	L	H	H
⑤	KEYUP	Key up	I:CMOS 50kΩ ↓			Key conversion (up)	L	H	L
⑥	CLKO/KEY0	Clock output/Key0	O:CMOS	Key setting status output:  LEDs can be driven directly. Key setting status can be indicated by connecting LEDs to outside	Voltage applied to each pin sets a key	OFF	320 kHz	450 kHz	2 MHz
⑦	SDATA/KEY1	Serial data/Key1	I:CMOS Schmitt 50kΩ ↓ O:CMOS			Key setting input:	Serial data input		
⑧	SCK/KEY2	Shift clock/Key2	I:CMOS Schmitt 50kΩ ↓ O:CMOS			Shift clock input			
⑨	STROBE/KEY3	Strobe/Key3	I:CMOS Schmitt 50kΩ ↓ O:CMOS			Strobe input			
⑩	KEY4	Key4	I:CMOS 20kΩ ↓ O:CMOS			—			
⑪	KEY5	Key5	I:CMOS 20kΩ ↓ O:CMOS	—					
⑫	REF	Reference	—	Analog reference = 1/2Vcc					
⑬	GND	GND	—						
⑭	Vcc	Power supply	—						
⑮	MIX OUT	Mix output	O:Operational amplifier output	Combine key-controlled low-pass signal and through high-pass signal					
⑯	MIX IN	Mix input	I:Operational amplifier input						
⑰	LPF2 OUT	Low-pass filter 2 output	O:Operational amplifier output	Forms Post-filters following D/A conversion for key control					
⑱	LPF2 IN	Low-pass filter 2 input	I:Operational amplifier input						
⑲	HPF OUT	High-pass filter output	O:Operational amplifier output	Forms High-pass filter					
⑳	HPF IN	High-pass filter input	I:Operational amplifier input						
㉑	LPF1 OUT	Low-pass filter 1 output	O:Operational amplifier output	Forms Pre-filter precedent to A/D conversion for key control					
㉒	LPF1 IN	Low-pass filter 1 input	I:Operational amplifier input						
㉓	ADINT IN	A/D integrator input	I:Operational amplifier input	Forms A/D conversion integrator with external C					
㉔	ADINT OUT	A/D integrator output	O:Operational amplifier output						
㉕	DAINT IN	D/A integrator input	I:Operational amplifier input	Forms D/A conversion integrator with external C					
㉖	DAINT OUT	D/A integrator output	O:Operational amplifier output						
㉗	MODE1	Mode1	I:CMOS 20kΩ ↓	Set to L.	Set to H.	Set to L.			
㉘	MODE2	Mode2	I:CMOS 20kΩ ↓	Set to H.	Set to L.	Set to L.			

↓ :With pull-down resistor

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**ABSOLUTE MAXIMUM RATINGS** (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Vcc	Maximum supply voltage	6.0	V
Icc	Circuit current	100	mA
Vi	Input voltage	-0.3 to Vcc+0.3	V
Pd	Power dissipation	1.35 (SP)/1.2 (FP)	W
Topr	Operating temperature	-20 to +75	°C
Tstg	Storage temperature	-40 to +125	°C

**RECOMMENDED OPERATING CONDITION**

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
Vcc	Supply voltage		4.5	5.0	5.5	V
ViH	Input voltage ("H" level)	pin ④ ⑤ ⑩ ⑪ ⑰ ⑱	0.7Vcc	—	Vcc	V
		pin ⑦ ⑧ ⑨ serial data input	Vcc-1	—	Vcc	
ViL	Input voltage ("L" level)	pin ④ ⑤ ⑩ ⑪ ⑰ ⑱	0	—	0.3Vcc	V
		pin ⑦ ⑧ ⑨ serial data input	0	—	0.8	

**ELECTRICAL CHARACTERISTICS** (Vcc=5V, f=1kHz, Vi=100mVrms, F0, Ta=25°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit		
			Min.	Typ.	Max.			
Icc	Circuit current	No signal	—	20	40	mA		
Gv	Voltage gain		-3	0	+3	dB		
THD	Output distortion	V <sub>o</sub> =100mVrms, 30kHz L. P. F	—	1.3	3	%		
No	Output noise voltage	JIS-A	—	-80	-65	dBV		
V <sub>omax</sub>	Maximum output voltage	THD=10%	0.7	1.5	—	Vrms		
fck	Clock frequency		6.8	8	9.2	MHz		
I <sub>oH</sub>	H output current	pin ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ Self mode	V <sub>oH</sub> =4.0V		—	-10	-4	mA
I <sub>oL</sub>	L output current		V <sub>oL</sub> =1.0V		12	18	—	mA
R <sub>id</sub>	Pull-down resistance	pin ④ ⑤ ⑦ ⑧ ⑨	25	50	100	kΩ		
		pin ⑩ ⑪ ⑰ ⑱	10	20	40	kΩ		

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**FUNCTION DESCRIPTION**

**1. Operation control**

Operation control is provided in the following 3 modes:

- (1) Self mode
- (2) Easy mode
- (3) Microcomputer mode

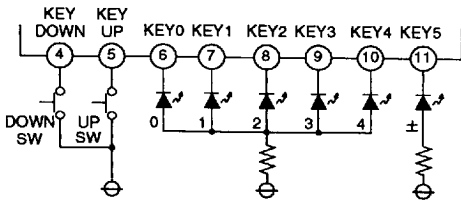
**MODE SETTING METHOD**

MODE1	MODE2	MODE	Key conversion method
L	L	MCU	Serial data from microcomputer
H	L	Easy	Parallel data
L	H	Self	UP/DOWN Key (no microcomputer required)
H	H	Test	Test mode (normally not available)

**2. Self mode**

**(1) Key setting**

A key can be set using the push switch connected to pin ④ KEYDOWN and pin ⑤ KEYUP.



The key goes down by one (chromatic) each time the DOWNSW is pushed, and goes up by one (chromatic) each time the UPSW is pushed. Once going down to -4, the key remains unchanged even if the DOWNSW is pushed. Also, once going up to +4 the key remains unchanged even if the UPSW is pushed. Keeping on pushing either switch changes the key in chromatic every 524msec (fck=8MHz).

Pushing both DOWNSW and UPSW simultaneously sets the key to ±.

**(2) LED indication**

Connecting LEDs to outside as shown previously allows LED indication of key setting status through the outputs of pin ⑥ KEY0 to pin ⑪ KEY5.

Key setting	KEY0	KEY1	KEY2	KEY3	KEY4	KEY5
F+4	H	H	H	H	L	H
F+3	H	H	H	L	H	H
F+2	H	H	L	H	H	H
F+1	H	L	H	H	H	H
F 0	L	H	H	H	H	H
F-1	H	L	H	H	H	L
F-2	H	H	L	H	H	L
F-3	H	H	H	L	H	L
F-4	H	H	H	H	L	L

↑ 0
↑ 1
↑ 2
↑ 3
↑ 4
↑ ± indication

**3. Easy mode**

**(1) Key setting**

Paralleled data entered into pin ⑦ KEY1 to pin ⑪ KEY5 can be used to set a key.

Key setting	KEY1	KEY2	KEY3	KEY4	KEY5
F+4	H	H	H	L	H
F+3	H	H	L	H	H
F+2	H	L	H	H	H
F+1	L	H	H	H	H
F 0	H	H	H	H	H
F-1	L	H	H	H	L
F-2	H	L	H	H	L
F-3	H	H	L	H	L
F-4	H	H	H	L	L

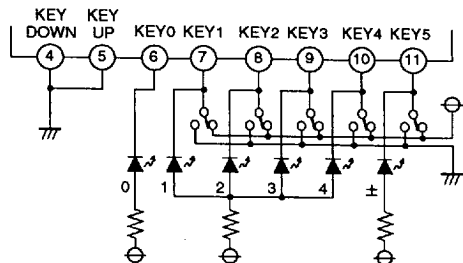
**(2) Clock output**

Data entered into pin ④ KEYDOWN and pin ⑤ KEYUP can be used to output square-wave clocks from pin ⑥ CLKO.

KEYDOWN	KEYUP	CLKO Clock frequency (fck=8MHz)	Remarks
L	L	OFF	Key setting status output for F0.F0.L, other than F0:H
L	H	320kHz	Clock for M65843P/AP (digital echo IC)
H	L	450kHz	Clock for M65830AP/CP (digital echo IC)
H	H	2MHz	Clock for M65831P/AP (digital echo IC)

**(3) LED indication**

Like the self mode, connecting LEDs to outside as shown below allow LED indication of key setting status.

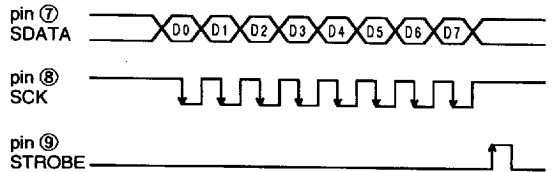


When the LEDs go on, current flows into the external L level setting, not into the IC. Thus, provide the L side with LED drive capability.

**4. MCU mode**

**(1) key setting**

Serial data from the microcomputer allows key setting.



Data is taken inside at the falling edge of SCK and the last-packed 8 bits are latched at the raising edge of STROBE.

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DIGITAL KEY CONTROLLER

(2) Data format

Key setting		D4	D3	D2	D1	D0
VSC	VMC					
F+20		H	H	H	H	H
F+18		H	H	H	H	L
F+16		H	H	H	L	H
F+14		H	H	H	L	L
F+13		H	H	L	H	H
F+11		H	H	L	H	L
F+ 9		H	H	L	L	H
F+ 8	F+ 8	H	H	L	L	L
F+ 7	F+ 7	H	L	H	H	H
F+ 6	F+ 6	H	L	H	H	L
F+ 5	F+ 5	H	L	H	L	H
F+ 4	F+ 4	H	L	H	L	L
F+ 3	F+ 3	H	L	L	H	H
F+ 2	F+ 2	H	L	L	H	L
F+ 1	F+ 1	H	L	L	L	H
F 0	F 0	H	L	L	L	L
F- 1	F- 1	L	H	H	H	H
F- 2	F- 2	L	H	H	H	L
F- 3	F- 3	L	H	H	L	H
F- 4	F- 4	L	H	H	L	L
F- 5	F- 5	L	H	L	H	H
F- 6	F- 6	L	H	L	H	L
F- 7	F- 7	L	H	L	L	H
F- 8	F- 8	L	H	L	L	L
F- 9		L	L	H	H	H
F-11		L	L	H	H	L
F-12		L	L	H	L	H
F-13		L	L	H	L	L
F-14		L	L	L	H	H
F-16		L	L	L	H	L
F-18		L	L	L	L	H
F-20		L	L	L	L	L

Mode setting		D5	D6	D7
VSC/VMC	VSC	H	-	-
	VMC	L	-	-
Mute (key control output mute)	Mute ON	-	H	-
	Mute OFF	-	L	-
Test	Test (normal setting disabled)	-	-	H
	Normal	-	-	L

There are two major modes to change the key; VMC (variable music control) and VSC (variable speech control). VMC provides relatively small variable range but maintains high sound quality, which is mainly used key control orchestra music for singing (called KARAOKE). On the other hand VSC provides lower sound quality but variable key range as wide as  $\pm 1$  octave or more, which is used key compensation in reproduction of source music in double speed.

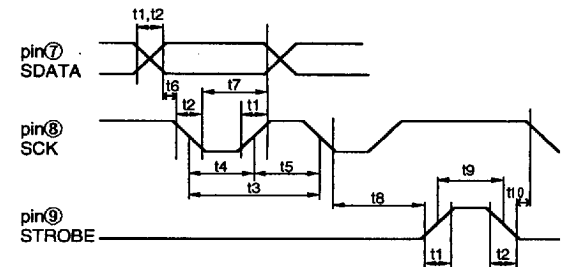
D/A converter output (pin ⑨ DAIN T OUT) after key control is muted.

(3) Clock output

Like the easy mode, data entered into pin ④ KEYDOWN and pin ⑤ KEYUP can be used to output square-wave clocks from pin ⑥ CLKO.

④ KEYDOWN	⑤ KEYUP	⑥ CLKO Clock frequency (f <sub>clk</sub> =8MHz)	Remarks
L	L	OFF	Hi-impedance
L	H	320kHz	Clock for M65843P/AP (digital echo IC)
H	L	450kHz	Clock for M65830AP/CP (digital echo IC)
H	H	2MHz	Clock for M65831P/AP (digital echo IC)

(4) Data input timing



Symbol	Name	Min.	Typ.	Max.	Unit
t1	Data rise time	-	-	500	ns
t2	Data fall time	-	-	500	ns
t3	SCK clock width	250	-	-	ns
t4	SCK "L" pulse width	100	-	-	ns
t5	SCK "H" pulse width	100	-	-	ns
t6	SDATA setup time	100	t3/2	-	ns
t7	SDATA hold time	100	t3/2	-	ns
t8	STROBE rise hold time	200	-	-	ns
t9	STROBE "H" pulse width	100	-	-	ns
t10	SCK setup time	100	-	-	ns

(5) Clock oscillator circuit

The M65847 incorporates a clock oscillator circuit in it, thus allowing supply of master clocks without an external circuit.

The oscillator frequency is:  
f<sub>clk</sub>=8MHz

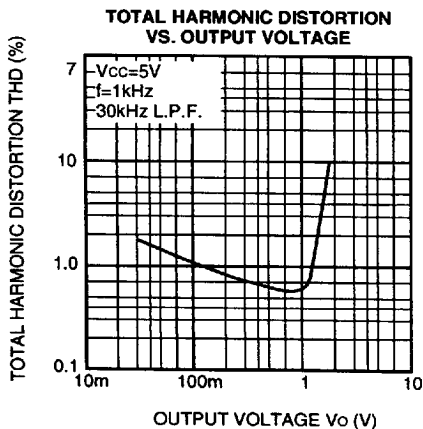
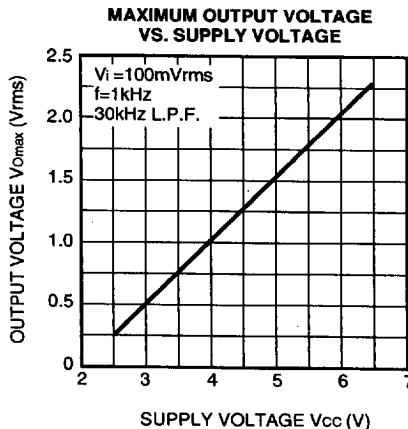
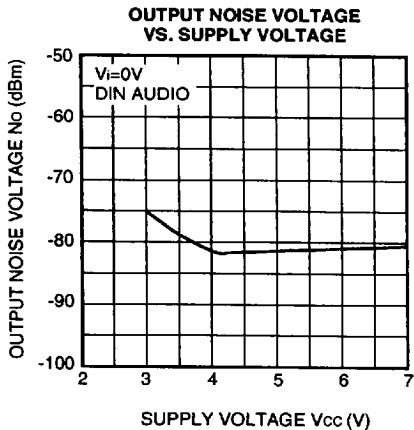
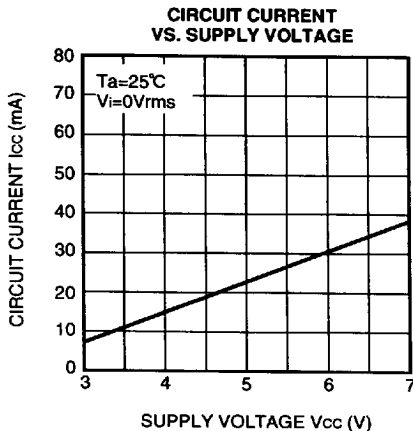
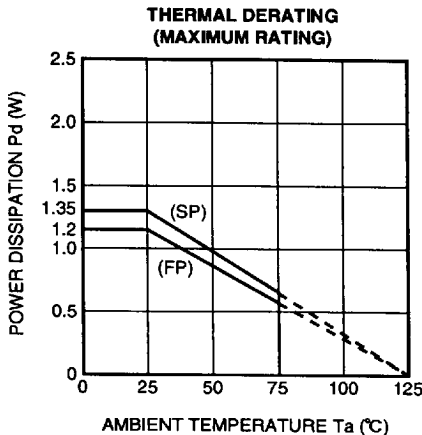
6. Reset

The M65847 is automatically reset when the power is turned on, and is automatically canceled nearly 120msec later.

- Self mode.....Key F0
- Microcomputer mode.....Key F0, VMC, Mute OFF
- Easy mode..... Depending on setting of pin ⑦ to ⑩



TYPICAL CHARACTERISTICS

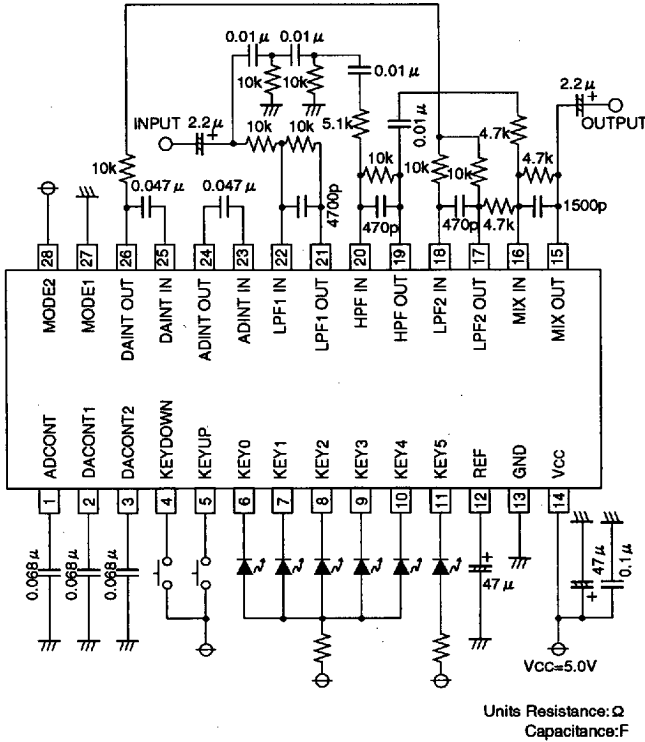


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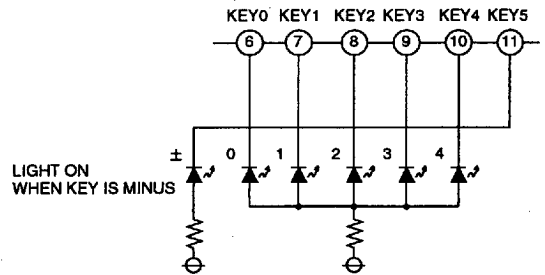
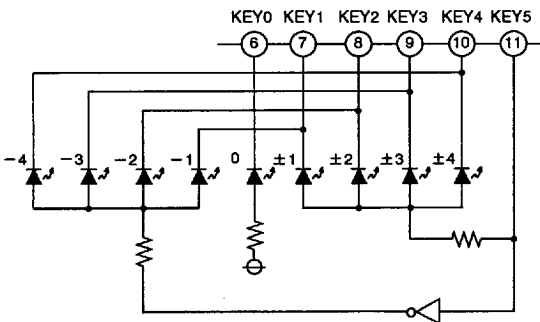
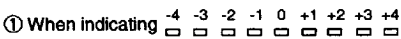


APPLICATION EXAMPLE

1. Self mode



LED indication and application example



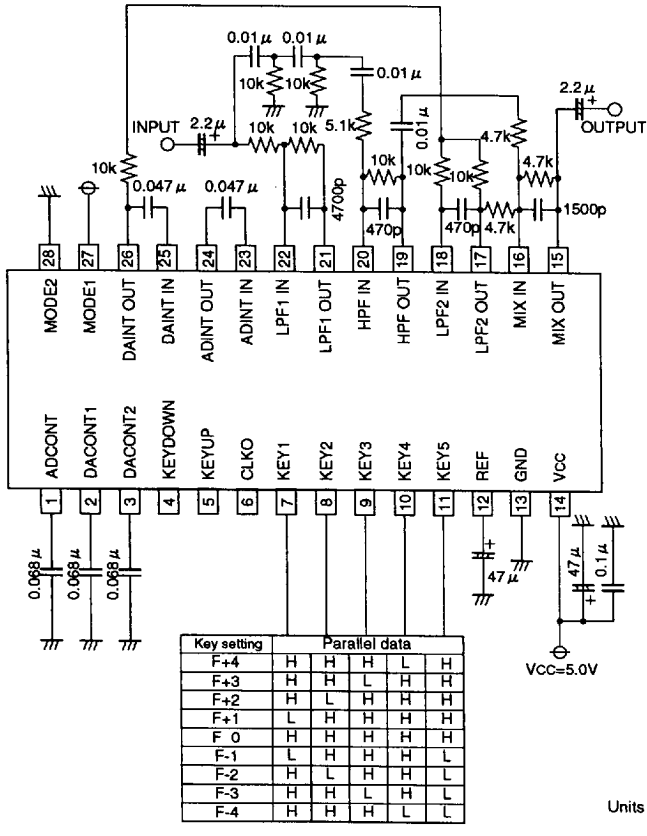
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**DIGITAL KEY CONTROLLER**

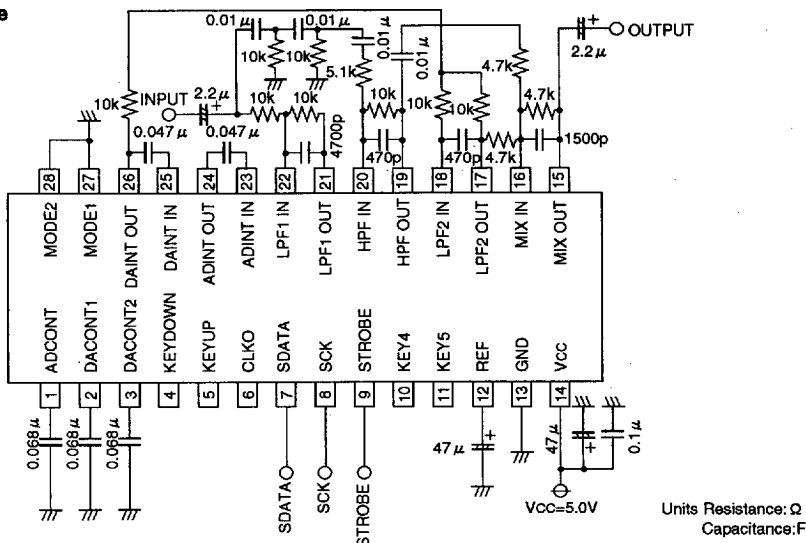
**2. Easy mode**



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3. MCU mode



COMPATIBILITY WITH M65840

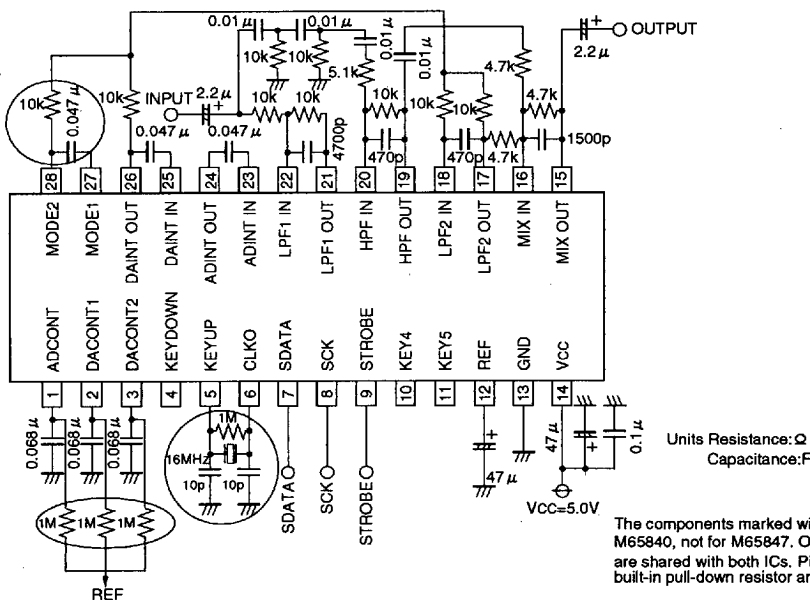
In the MCU mode, the M65847 is compatible with our key controller IC M65840 as follows:

(1) Control data format

The setting function, data format and data input timing are the same as those of M65840

(2) Pin configuration and external components

The pin configuration and external components are almost the same as those of M65840 part of external components can be reduced (See below)



As mentioned above, the M65847 can be replaced with M65840 without changing the program and board of the microcomputer

(3) Electrical characteristics

Because of a sampling frequency of 250kHz (M65840:500kHz), the M65847 has different electrical characteristics

Noise:-80dBVtyp (M65840:-85dBVtyp) THD:1.3%typ (M65840:0.8%)

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