

REMOTE FAN CONTROL IC

DESCRIPTION

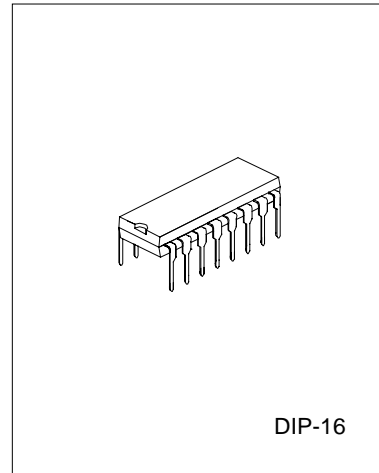
The SC2128A is a high performance electronic fan controller LSI. Speed control, off-timer, rhythm wind, sleep mode, head swing and/or light control are all built into a single chip. Indicator LED output, buzzer output, key control input, as well as remote control decoding circuitry are all provided to build a full function electronic fan with remote control capability having the highest performance with the least external components. Pin assignment and application circuit are optimized for easy PCB layout and cost saving for electronic fan application.

FEATURES

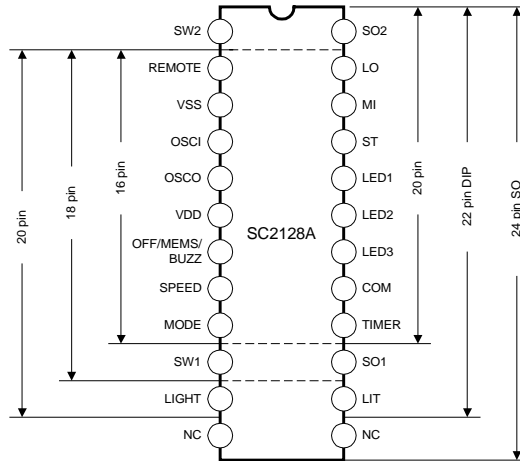
- * High performance CMOS Technology
- * Low power consumption
- * Optional independent light control
- * 90 seconds cycle/6 seconds per step(off step 3 seconds) rhythm wind pattern
- * Built-in remote control decoding circuitry with mask option custom code
- * DIP or SO package(22 pin SO not available)
- * Up to 3 dependent/independent swing-head/light output
- * Available in 16,18,20,22,24 pin package for none, one set or two sets of swing head and/or light control
- * Four operation modes: ordinary, rhythm, ordinary sleep and rhythm sleep.
- * Memory start-up mode
- * 2-3 seconds middle wind start-up(mask option)

APPLICATIONS

- * Optimized for fan application
- * Suitable for heater fan, cooling fan, and other home appliances with remote control, timer and/or output level control



PIN CONFIGURATION



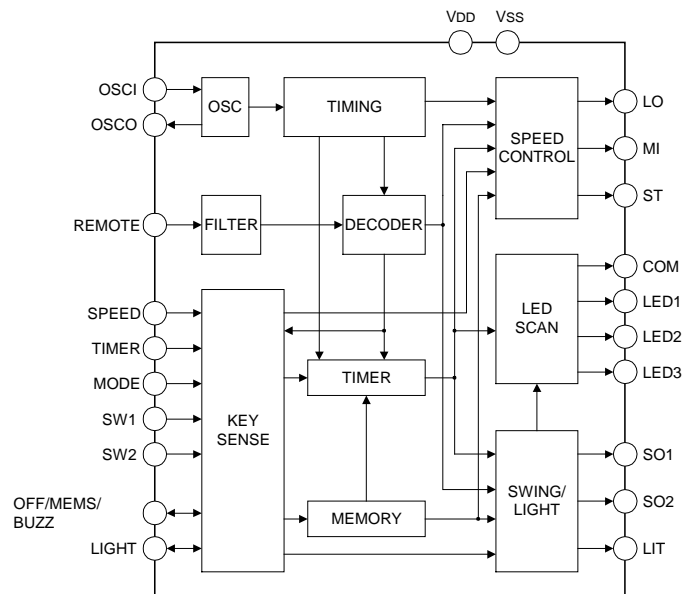
ORDERING INFORMATION

SC2128A- X X X X

- ↳ S = Swing Head Output(s) Controlled by a Single Key (Mask Option) (D can be omitted)
- ↳ D = Two Swing Head Outputs Controlled by Double Keys (D can be omitted)
- 0 = No Swing head Output
- 1 = 1 Swing head Output
- 2 = 2 Swing head Outputs
- 3 = 1 Swing head & Light Control Outputs
- 4 = 2 Swing head & Light Control Outputs
- 2 = 1/2/4 Hour, Non-Accumulated Timer
- 3 = 1/2/4 Hour, Accumulated Timer
- 4 = 0.5/1/2/4 Hour, Non-Accumulated Timer
- 5 = 0.5/1/2/4 Hour, Accumulated Timer
- 8 = 1/2/4/8 Hour, Non-Accumulated Timer
- 9 = 1/2/4/8 Hour, Accumulated Timer
- D = Non-Memory Start-up & Non-Middle Wind Start-up (Mask Option)
- C = Non-Memory Start-up & Middle Wind Start-up
- L = Memory Start-up & Non-Middle Wind Start-up (Mask Option)
- M = Memory Start-up & Middle Wind Start-up

Note: SC2128A Standard ICs: SC2128A-C31, SC2128A-C51, SC2128A-C80, SC2128A-C81, SC2128A-C82, SC2128A-C83, SC2128A-C92. Other options are available upon request and require a minimum order Quantity. Please contact Silan or your local agent for details.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Test Conditions	Value	Unit
Supply Voltage	V _{DD}	--	0 ~ 6.0	V
Input/Output Voltage	V _I , V _O	V _{DD} - V _{SS}	-0.3V ~ V _{DD} +0.3V	V
Power Dissipation	P _d	V _{DD} - V _{SS} = 5.0	500	mW
Operating Temperature	T _{opr}	--	-20 ~ +70	°C
Storage Temperature	T _{stg}	--	-40 ~ +125	°C

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Test conditions	Min	Typ	Max	Unit
Supply Voltage	V _{DD}	--	4.0	5.0	6.0	V
Stand-by Current	I _q	V _{DD} =5.0V, Oscillator stops. All output floating, All input fixed to V _{DD} .	--	134	200	μA
Input High Level Voltage	V _{IH}	--	V _{DD} -1.5	--	--	V
Input Low Level Voltage	V _{IL}	--	--	--	1.5	V
Drive Current (COM)	I _{OH}	V _{DD} =5.0V, V _O =3.5V	15	21.5	--	mA
Sink Current (COM)	I _{OL}	V _{DD} =5.0V, V _O =1.5V	-12	-16.5	--	mA
Drive Current (LED1, LED2, LED3)	I _{OH}	V _{DD} =5.0V, V _O =3.5V	5	6.5	--	mA
Sink Current (LED1, LED2, LED3)	I _{OL}	V _{DD} =5.0V, V _O =1.5V	-4	-5.7	--	mA
Drive Current (OFF/BUZZ)	I _{OH}	V _{DD} =5.0V, V _O =2.5V	1.5	3.0	--	mA
Sink Current (OFF/BUZZ)	I _{OL}	V _{DD} =5.0V, V _O =2.5V	-2	-3.7	--	mA
Sink Current (LO, MI, ST, SO1, SO2, LIT)	I _{OL}	V _{DD} =5.0V, V _O =2.5V	-6.5	-16	--	mA
Oscillation frequency	f _{osc}	--	--	32768	--	Hz
Key Press Duration	T _{key}	--	80	--	--	ms
Remote Input Bit Duration	T _{bit}	--	2.0	2.5	3.0	ms

PIN DESCRIPTION

Symbol	Pin No.						I/O	Function
	16 PIN	18 PIN	20 PIN <small>Note1</small>	20 PIN <small>Note2</small>	22 PIN <small>Note3</small>	24 PIN <small>Note4</small>		
VDD	5	5	5	6	6	6	--	Positive power supply
VSS	2	2	2	3	3	3	--	Negative power supply
COM	10	12	14	13	15	17	O	Indicator LED common output
LED1	13	15	17	16	18	20	O	Indicator LED output pins
LED2	12	14	16	15	17	19	O	
LED3	11	13	15	14	16	18	O	
SPEED	7	7	7	8	8	8	I	SPEED key control input
MODE	8	8	8	9	9	9	I	MODE key control input
TIMER	9	11	13	12	14	16	I	TIMER key control input
SW1	--	9	9	10	10	10	I	Swing head 1 control key input
SW2	--	--	--	1	1	1	I	Swing head 2 control key input
OFF/MEMS/ BUZZ	6	6	6	7	7	7	I/O	OFF control key input, shared with buzzer output
LIGHT	--	--	10	--	11	11	I	Light control key input
SO1	--	10	12	11	13	15	O	Swing head 1 output
SO2	--	--	--	20	22	24	O	Swing head 2 output
LIT	--	--	11	--	12	14	O	Light output
LO	16	18	20	19	21	23	O	Speed outputs
MI	15	17	19	18	20	22	O	
ST	14	16	18	17	19	21	O	
REMOTE	1	1	1	2	2	2	I	Remote control sensor input
OSCI	3	3	3	4	4	4	I	Oscillator input pin
OSCO	4	4	4	5	5	5	O	Oscillator output pin
NC	--	--	--	--	--	12	I	No connection
NC	--	--	--	--	--	13	I	No connection

Note1 : One swing head control plus light control type

Note2 : Two Sets of Swing Head Control Type

Note3 : DIP Package Only

Note4 : SO Package Only

FUNCTIONAL DESCRIPTION

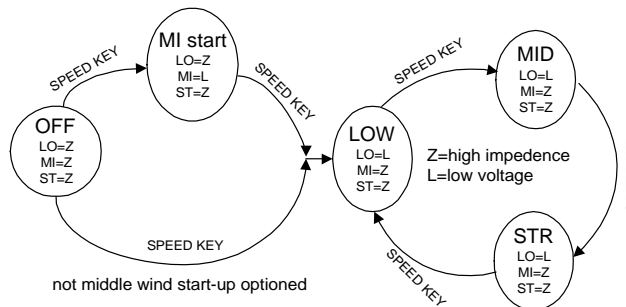
1. CONTROL KEYS

Up to seven function keys – SPEED, MODE, TIMER, SW1, SW2, LIGHT and OFF/MEMS – may be used on the control panel of fan to access SC2128A to its full versatility. OFF/MEMS key input pin serves further as buzzer output BUZZ pin. All key inputs are internally pulled-high in SC2128A.

SPEED key controls the fan speed. TIMER key adjusts off-timer. MODE key sets fan into various modes of operation. SW1 and SW2 keys control the head swing of fan. LIGHT key toggles the LIT output ON and OFF. OFF/MEMS key resets the fan to idle state when fan is ON. It starts fan into memory mode if pressed when fan is OFF, provided memory option is enabled. LIT output is not affected by OFF key.

2. SPEED KEY

SPEED key is used to (1) turn on the fan (2) change speed of the fan. OFF/MEMS may also be used to turn on the fan into memory mode, provided memory mode is enabled. SLEEP key may turn on the fan from remote control handset. All the other keys can NOT turn on the fan. All the other keys, except LIGHT key, can NOT operate until fan is turned on. The diagram shows the state transition of SC2128A for successive pressing of SPEED key.

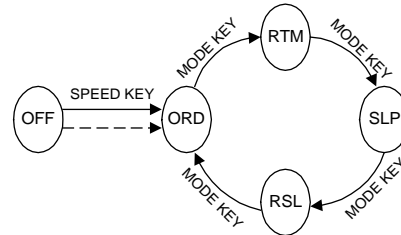


3. TIMER KEY

TIMER key is used to set time schedule after which SC2128A will automatically restore off state(off-timer). When the fan is on, pressing TIMER key sets up the off-timer. Each pressing of TIMER key increases the timer by one step. Each time increment step is determined by various timer options. Either 0.5 or 1 hour per step may be selected, and either 3 levels or 4 levels timer may be selected. Please see TIMER section for details.

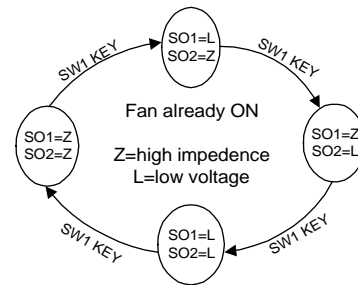
4. MODE KEY

MODE key is used to bring SC2128A around ORD (ordinary wind) mode, RTM(rhythm wind) mode, SLP (sleep wind) mode and RSL(rhythm sleep wind) mode. In ORD mode, the wind speed is set by SPEED key and does not change as time passes. In RTM mode the wind speed cycles through three rhythm wind, patterns as set by the SPEED key. In SLP and RSL mode, however, the fan automatically steps down one level (strong to middle, middle to low) every 30 minutes and keeps in low wind until off-timer times out. Four modes of operation are described in details later.



5. SW1 and SW2 KEYS

SW1 and SW2 keys control the output status of SO1 and SO2 outputs which in turn control the head swing of fan. Depending on the 2SW mask option, SO2 is controlled by either SW1 or SW2 key. If 2SW option is selected each pressing of SW1 key toggles SO1 ON(L) and OFF(Z) and each pressing of SW2 key toggles SO1 ON(L) and OFF(Z). If 2SW option is not selected, pressing SW1 key cycles SO1 and SO2 output as shown in the diagram and SW2 key has no effect. 2SW option is described later.



6. LIGHT KEY

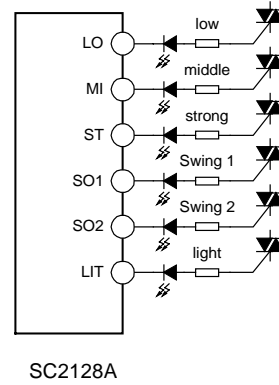
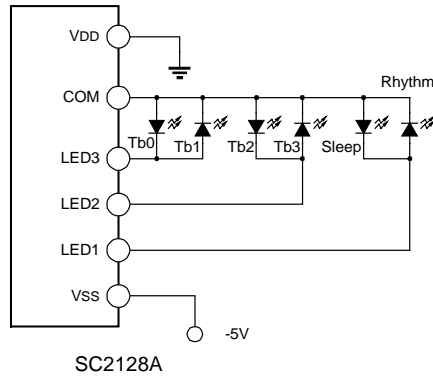
LIGHT key toggles LIT output on(L) and off(Z). LIT output can only be controlled with LIGHT key (from both panel and remote control) and SLEEP key (if available) on remote control handset. OFF key does NOT affect LIT output. LIT output is NOT affected by OFF key as well as off-timer times out.

7. OFF/MEMS KEY

OFF/MEMS key functions differently depending on whether the fan is ON or OFF. It functions as OFF key when the fan is ON, and is used to bring SC2128A from any on state into off state. LIT output is NOT affected by OFF key. When fan is OFF, it functions as MEMS (memory start) and is used to turn on the fan and set to the memory mode, provided memory mode is enabled. Memory mode is explained later in the MEMORY MODE section.

8. INDICATOR LEDS

Up to twelve(12) indicator LEDs may be constructed on the control panel of fan built with SC2128A. Six(6) LEDs are constructed as 3x2 LED matrix formed by COM and LED1, LED2, LED3. The other six(6)LEDs are built in series with TRIAC outputs. The diagrams show how the LED matrix is constructed.



* Four LEDs (Tb0, Tb1, Tb2, Tb3) are used to indicate the off-timer period. Depending on the base timer step option, timer step may be 0.5 hour or 1 hour as indicated in the diagram.

If SC2128A is selected with 4 hour timer option

Tb0=0.5 hour
b1=1 hour
b2=2 hour
b3=4 hour

If SC2128A is selected with 8 hour timer option

Tb0=1 hour
b1=2 hour
b2=4 hour
b3=8 hour

The time schedule is the sum of all ON LEDs. For example, if SC2128A is programmed with 0.5/1/2/4 hour accumulated timer option, and is Tb0 is ON, Tb1 is OFF, Tb2 is OFF, Tb3 is ON, then the schedule period is 4.5 hours (0.5 hr + 4 hr).

* Rhythm LED and Sleep LED indicate SC2128A operation modes.

Operation mode	Rhythm LED	Sleep LED
ORD (ordinary wind)	OFF	OFF
RTM (rhythm wind)	ON	OFF
SLP (sleep wind)	OFF	ON
RSL (rhythm sleep wind)	ON	ON

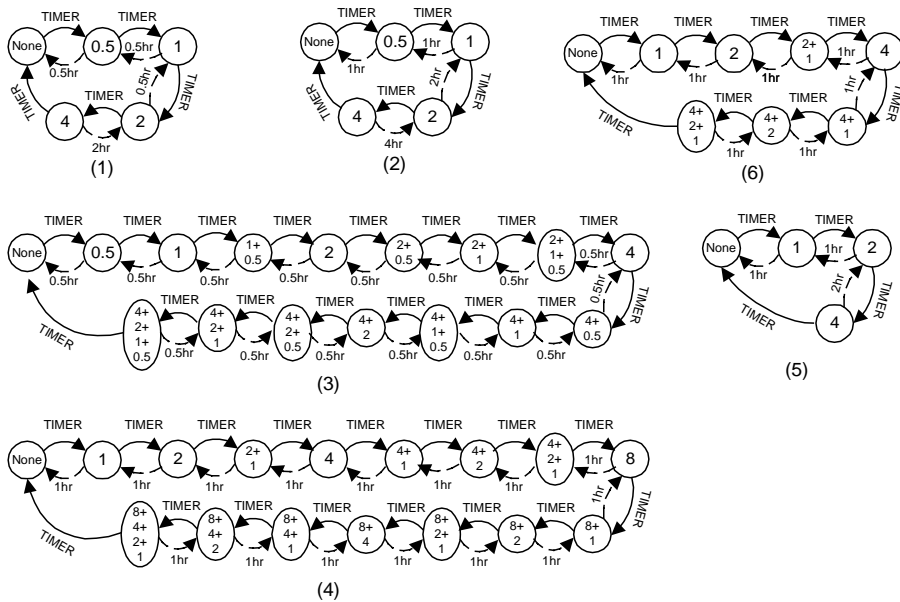
* Three LEDs – Low, Middle and Strong – are used to indicate the respective output status of LO, MI, ST output. LED being ON indicates output active (L). LED being OFF indicates output inactive (Z). Only one output among LO, MI and HI may be active at a specific time.

* Swing1 LED, Swing2 LED and Light LED indicated respective output status of SO1, SO2, and LIT.

9. TIMER

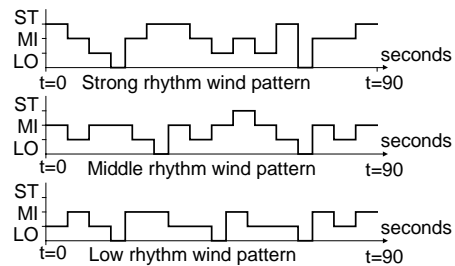
The external timer of SC2128A may be bonding optioned into six (6) configurations as shown. Each pressing of TIMER key will step the internal timer one step up. The actual sequence depends on the TIMER option selected. The following diagrams show the timer sequence for each TIMER option. TIMER automatically counts down as time passes by. The count down sequence reverses the key sequence and is also shown in the following diagrams.

- ☆: 0.5, 1, 2, 4 hours non-accumulated
- ⌚: 1, 2, 4, 8 hours non-accumulated
- ⌚: 0.5, 1, 2, 4 hours accumulated
- ⌚: 1, 2, 4, 8 hours accumulated
- ⌚: 1, 2, 4 hours non-accumulated
- ⌚: 1, 2, 4 hours accumulated



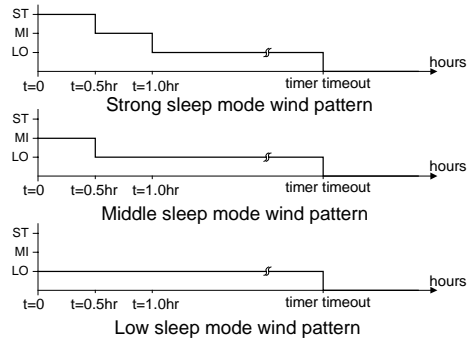
10. RHYTHM WIND

SC2128A features rhythm wind mode. It can be set into rhythm wind mode by pressing MODE key. Furthermore, there are three levels – strong, middle and low rhythm wind. Pressing SPEED key cycles SC2128A around the three levels, from low to middle, middle to strong, then strong to low. Initial rhythm wind level on entering RHYTHM wind mode is the same as the ordinary wind level while leaving ORDINARY wind mode and entering RHYTHM wind mode. The right diagram depicts the strong, middle and low rhythm wind patterns.



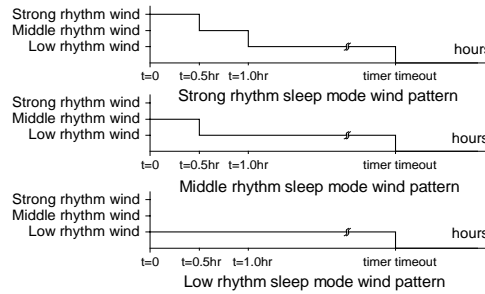
11. SLEEP WIND MODE

In sleep wind mode, the wind speed steps down automatically one level every 30 minutes, until it reaches low wind level. If no off-timer is set, SC2128A keeps in low wind level. Otherwise, it restores off state when off-timer times out. To enter sleep wind mode, turn on the fan by SPEED key first. Adjust to desired LO, MI, ST wind speed. Press MODE key twice to bring SC2128A to LOW, MIDDLE or STRONG sleep wind mode as the LO, MI, ST wind speed set before entering sleep wind mode. Press MODE key in sleep wind mode forces SC2128A to leave sleep wind mode and enter rhythm sleep wind mode.



12. RHYTHM SLEEP WIND MODE

Pressing MODE key in sleep wind mode brings SC2128A into rhythm sleep wind. In rhythm sleep wind mode, SC2128A outputs LOW, MIDDLE or STRONG rhythm wind pattern and automatically steps down one level every 30 minutes until it reaches low rhythm wind level. If no off-timer is set, SC2128A keeps in low rhythm wind output. Otherwise it restores off state when the off-timer times out.



13. MEMORY MODE

SC2128A features on-chip operation memory, in which operation state may be stored. OFF/MEMS key also functions as a special MEMS(memory start) key. If this key is pressed when SC2128A is in off state, SC2128A is activated into the operation mode stored in the operation memory. After power on, the operation memory is initialized as follows: *middle speed, ordinary wind, none off-timer setting, SO1 and SO2 swing head outputs both off, LIT output off.*

Operation memory memorizes the following:

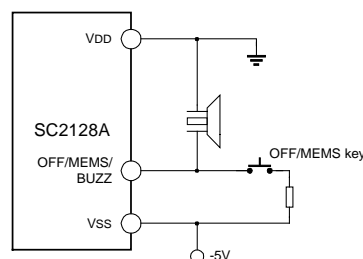
- (1) **SPEED** low, middle or strong,
- (2) **MODE** ordinary, rhythm, sleep or rhythm sleep.
- (3) **OFF-TIMER:** off-timer setting,
- (4) **SWING HEAD** SO1 and SO2 output state,
- (5) **LIGHT** LIT output status.

If the fan is turned on by SPEED key, subsequent adjustments to the fan operation either from pannel key or from remote control handset do not affect the operation memory. If, however, the fan is turned on by MEMS, the subsequent adjustments to speed, mode, off-timer, SO1, SO2 and LIT output will update the operation memory to

the final adjustments, regardless the adjustments are made from panel key or from remote control handset. One exception is the SLEEP key available on the remote control handset. SLEEP key start or adjusts the fan to the default sleep settings. Regardless the fan is started by SPEED or by MEMS, SLEEP key does not affect the operation memory.

14. BUZZER OUTPUT

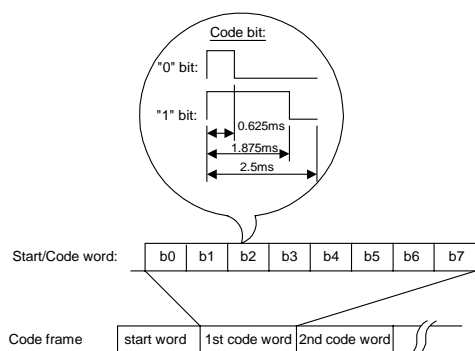
All valid key pressed except OFF/MEMS initiates a 150ms duration 4kHz 50% duty cycle pulse train at OFF/MEMS/BUZZ pin. OFF/MEMS key function as OFF key if pressed when fan is in any on state. In this case, it does NOT initiate an output on BUZZ. OFF/MEMS key functions as MEMORY-START key if pressed when fan is in off state. In this case, it DOES initiate a 150ms duration 4kHz 50% duty cycle pulse train on BUZZ. Note that when OFF/ MEMS/BUZZ outputs the pulse train, key input is suppressed. That is, pressing OFF/MEMS key when the buzzer is buzzing is NOT recognized by SC2128A. The diagram right shows the buzzer connection.



15. REMOTE CONTROL DECODER

SC2128A is designed to be used together with SC2268 infrared ray remote control encoder. Such combination allows up to 8 remote control keys – SPEED, MODE, TIMER, LIGHT, SLEEP, SW1, SW2, OFF/MEMS – to be built on the remote control handset. 4 bits customer code, b3 ~ b6, is encoded by SC2268 and decoded by SC2128A in order to avoid remote control contention between devices. With SC2268, b3 is determined by bonding option; b4, b5 and b6 are determined by connecting respective c4, c5, c6 pin to VDD or VSS. With SC2128A, b3 and b6 can be mask programmed upon customer request and with NRE.

The remote control signal coding scheme is fully compatible with SC2268. Some description follows. Please refer to specification of SC2268 for details. When SC2128A receives a remote control signal at its REMOTE pin, it decodes the received waveform into consecutive "0" bits and "1" bits. It first compares the received start word against its customer code. If and only if the start word matches the customer code, it then compares for two consecutive and matched code words. It then actuates the command according to the code words table shown later.



16. CUSTOMER CODE

The default customer code of SC2128A is internally mask programmed to b0 ~ b7 = 00110011. Code bit b3 ~ b6 may be mask programmed to any value according to customer specification under terms and conditions agreed by SILAN. Suitable NRE is involved with customizing default customer code. Please refer to the following table.

Mask Option	Start word							
Default Customer Code	b0	b1	b2	b3	b4	b5	b6	b7
Mask Programmable Customer Code	0	0	1	1	0	0	1	1
	0	0	1	1	0	0	0	1
	0	0	1	1	0	1	1	1
	0	0	1	1	0	1	0	1
	0	0	1	1	1	0	1	1
	0	0	1	1	1	0	0	1
	0	0	1	1	1	1	1	1
	0	0	1	1	1	1	0	1
	0	0	1	0	0	0	1	1
	0	0	1	0	0	0	0	1
	0	0	1	0	0	1	1	1
	0	0	1	0	0	1	0	1
	0	0	1	0	1	0	1	1
	0	0	1	0	1	0	0	1
	0	0	1	0	1	1	1	1

17. REMOTE CONTROL KEYS

Up to eight keys may be built on the remote control handset. Except SLEEP key, all keys functions the same as their panel counterparts. SLEEP key is not available on fan panel, and is only available on remote control handset. Pressing SLEEP key brings SC2128A to the output states as follows:

SPEED	Middle wind
MODE	RSL wind (may be mask programmed to SLP Wind with NRE)
TIMER	4 hours or 8 hours
SWING	SO1 ON, SO2 OFF
LIGHT	LIT ON

The remote transmission code words are defined in the following table.

Equivalent Key	Code word								SC2268 Corresponding Keys
	b0	b1	b2	b3	b4	b5	b6	b7	
SPEED	0	0	1	1	1	0	1	0	11
MODE	0	1	0	1	1	0	0	0	12
TIMER	0	1	1	0	0	0	1	0	13
LIGHT	1	0	0	1	1	1	0	0	14
SLEEP	1	0	1	0	0	1	1	0	15
SW2	1	0	1	1	0	0	0	1	16
SW1	1	1	0	0	0	1	0	1	17
OFF/MEMS	1	1	0	1	0	0	1	0	18

18. VARIOUS OPTIONS

SC2128A accommodates many option possibilities. The options are summarized below:

* Package Option:

Either 16, 18, 20, 22, or 24 pin package.

* Bonding option:

ACC: Accumulated or non-accumulated timer option.

T0.5: Timer scale, 0.5/1/2/4 hour timer or 1/2/4/8 timer option.

3LT: Timer level option, either 4 levels or 3 levels.

NM: Disable memory mode.

* Metal Option:

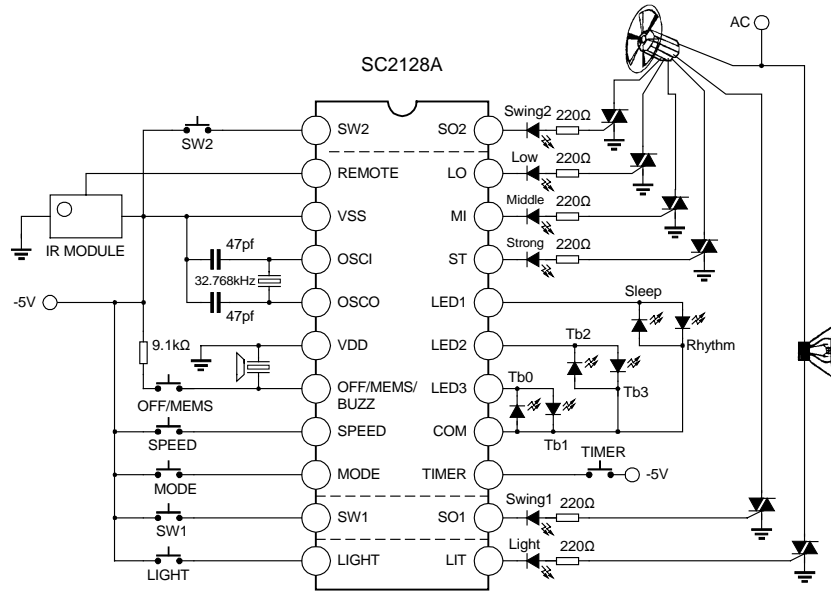
b3 ~ b6: Replaces default customer codes

NMS: Disable middle wind start-up function

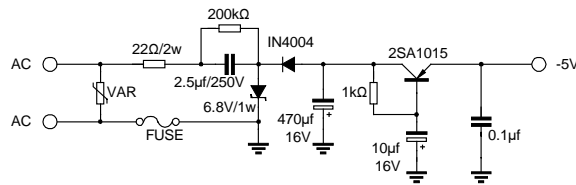
2SW: Dependent/Independent swing head control option.

RSL: SLEEP key start-up mode option – select RSL or SLP mode for SLEEP key start-up.

APPLICATION CIRCUIT

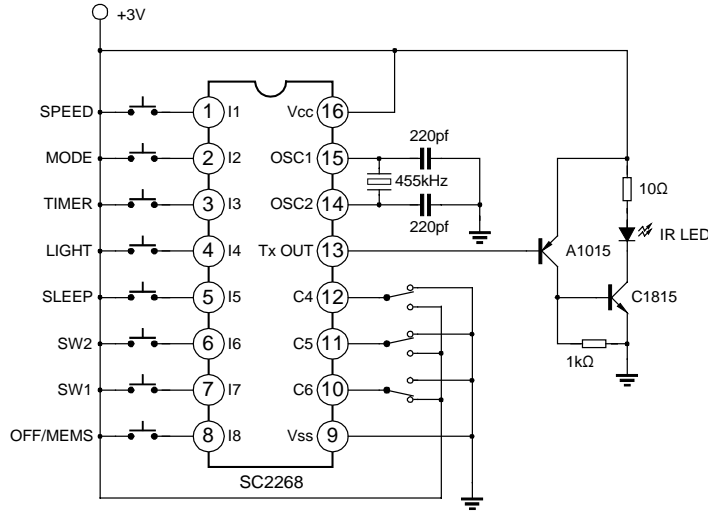


Swing Head 1: Controlled by SW1
Swing Head 2: Controlled by SW2



Supply Circuit

SC2268 IR TRANSMITTER APPLICATION CIRCUIT



Note: SC2268 is recommended to be used with SC2128A. For this circuit, the "Start Word" is "00110011"

PACKAGE OUTLINE

