SamHop Microelectronics Corp.

SM3015
REMOTE FAN MCU

GENERAL DESCRIPTION

SM3015 is a multi-function Fan Controller CMOS IC that can be applied to a variety of consumer products. It has an elastic function like MCU but does not need programming, user can just write a MASK form.

SM3015 has three or four wind modes; normal, rhythm and sleep-rhythm wind or normal, rhythm, sleep-normal and sleep-rhythm, the operation pattern of rhythm and sleep modes can be set by user.

Many kinds of timer setting and two swing head control that include micro-swing output can be chosen by user to tune the swing head angle.

Memory or non-memory function is available; the Speed, Mode, Swing functions will operate as last state in memory type.

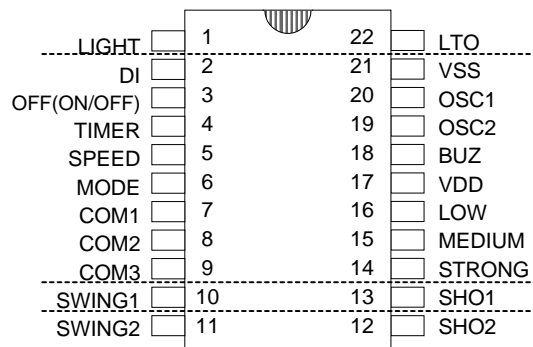Supports two-bit customer codes to distinguish different models.

FEATURES

* High performance CMOS technology.
* Rhythm wind or Normal wind for SLEEP mode can be chosen.
* Two to three-wind grade control in wind modes.
* Memory start-up function option.
* Many types of timer setting on three or four steps and ladder adder or non-ladder adder.
* Two swing head control, micro-swing output can be chosen by MASK option.
* SPEED or ON/OFF key can enable fan controller.
* 16 or 32 patterns per cycle of rhythm/sleep mode, each pattern has 2.5 sec.
* Panel control or pair with SM5021B for an infrared Remote Fan Controller.
* 16/18/20/22/24 pin plastic DIP package.
* Three types of sleep hold time by SLT key: 0.5hr/1hr/2hr.
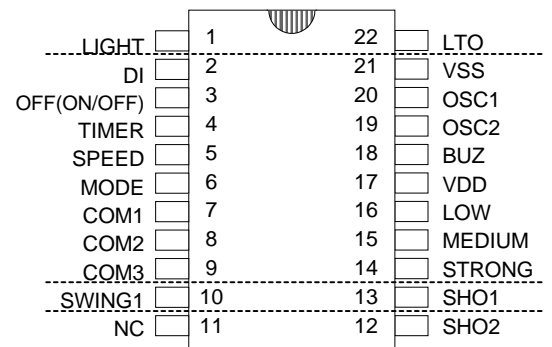* 32.768KHz/455KHz oscillator option.

APPLICATIONS

* Electronic Fan
* Heater Fan
* Air-Cleaner
* Dehumidifier
* Humidifier
* Kitchen Exhaust
* Dish Dryer
* Wall Fan

PIN ASSIGNMENTS (TOP VIEW)

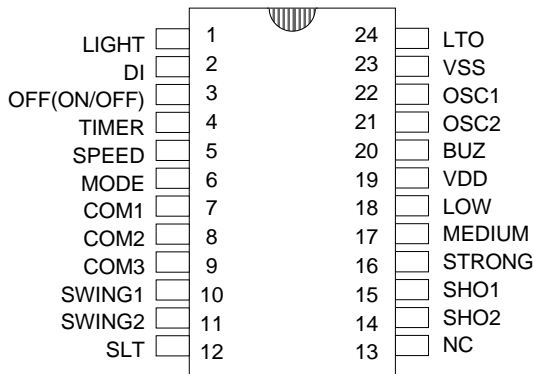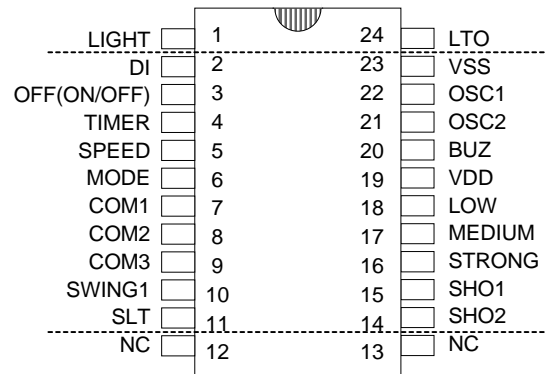| LIGHT | 1 | 22 | LTO |
DI	2	21	VSS
OFF(ON/OFF)	3	20	OSC1
TIMER	4	19	OSC2
SPEED	5	18	BUZ
MODE	6	17	VDD
COM1	7	16	LOW
COM2	8	15	MEDIUM
COM3	9	14	STRONG
SWING1	10	13	SHO1
SWING2	11	12	SHO2

SM3015A 16/18/20/22PIN

LIGHT	1	22	LTO
DI	2	21	VSS
OFF(ON/OFF)	3	20	OSC1
TIMER	4	19	OSC2
SPEED	5	18	BUZ
MODE	6	17	VDD
COM1	7	16	LOW
COM2	8	15	MEDIUM
COM3	9	14	STRONG
SWING1	10	13	SHO1
NC	11	12	SHO2

SM3015B 16/18/20/22PIN

SamHop Microelectronics Corp.

SM3015
REMOTE FAN MCU

PIN ASSIGNMENT (TOP VIEW)

LIGHT	1	24	LTO	
DI	2	23	VSS	
OFF(ON/OFF)	3	22	OSC1	
TIMER	4	21	OSC2	
SPEED	5	20	BUZ	
MODE	6	19	VDD	
COM1	7	18	LOW	
COM2	8	17	MEDIUM	
COM3	9	16	STRONG	
SWING1	10	15	SHO1	
SWING2	11	14	SHO2	
SLT	12	13	NC	

SM3015C 24PIN

LIGHT	1	24	LTO	
DI	2	23	VSS	
OFF(ON/OFF)	3	22	OSC1	
TIMER	4	21	OSC2	
SPEED	5	20	BUZ	
MODE	6	19	VDD	
COM1	7	18	LOW	
COM2	8	17	MEDIUM	
COM3	9	16	STRONG	
SWING1	10	15	SHO1	
SLT	11	14	SHO2	
NC	12	13	NC	

SM3015D 20/24PIN

PANEL DISPLAY

SM3015A TYPE

● S
○ M
● L

○ 4HR
● 2HR
● 1HR
● 1/2HR

● SLP-RHY
○ SLP-NOR
● RHY
● NOR

(SWING FUNCTION)

Right←→Left Up←→Down

● SHO1 ● SHO2

OFF / ON/OFF   SPEED   TIMER   MODE   SW1 / TUNER1   SW2 / TUNER2   LIGHT

SM3015B TYPE

(SWING FUNCTION)

● SHO1 ↑↓
● SHO2 ⇄

SWING

SM3015C TYPE

● S
○ M
● L

○ 4HR
● 2HR
● 1HR
● 1/2HR

● SLP-RHY
○ SLP-NOR
● RHY
● NOR

(SWING FUNCTION)

Right←→Left Up←→Down

● SHO1 ● SHO2

● 2HR
● 1HR
● 1/2HR

OFF / ON/OFF   SPEED   TIMER   MODE   SW1 / TUNER1   SW2 / TUNER2   SLEEP / HOLD TIME   LIGHT

SM3015D TYPE

(SWING FUNCTION)

● SHO1 ↑↓
● SHO2 ⇄

● 2 HR
● 1 HR
● 1/2 HR
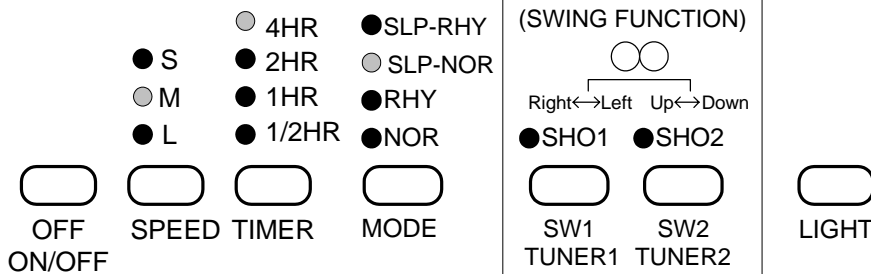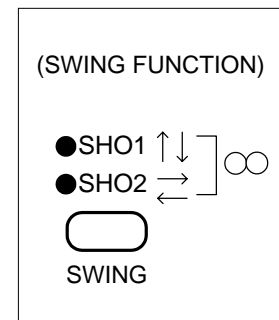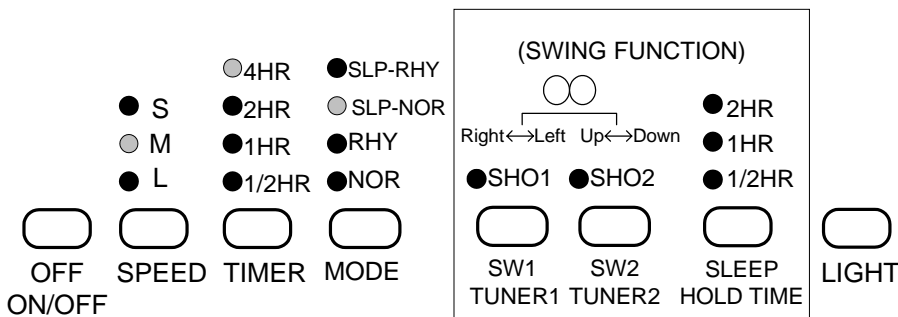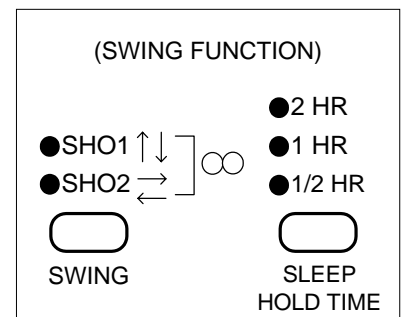
SWING   SLEEP / HOLD TIME

* Note: "○" Functions can be chosen by MASK or bonding option.

BLOCK DIAGRAM
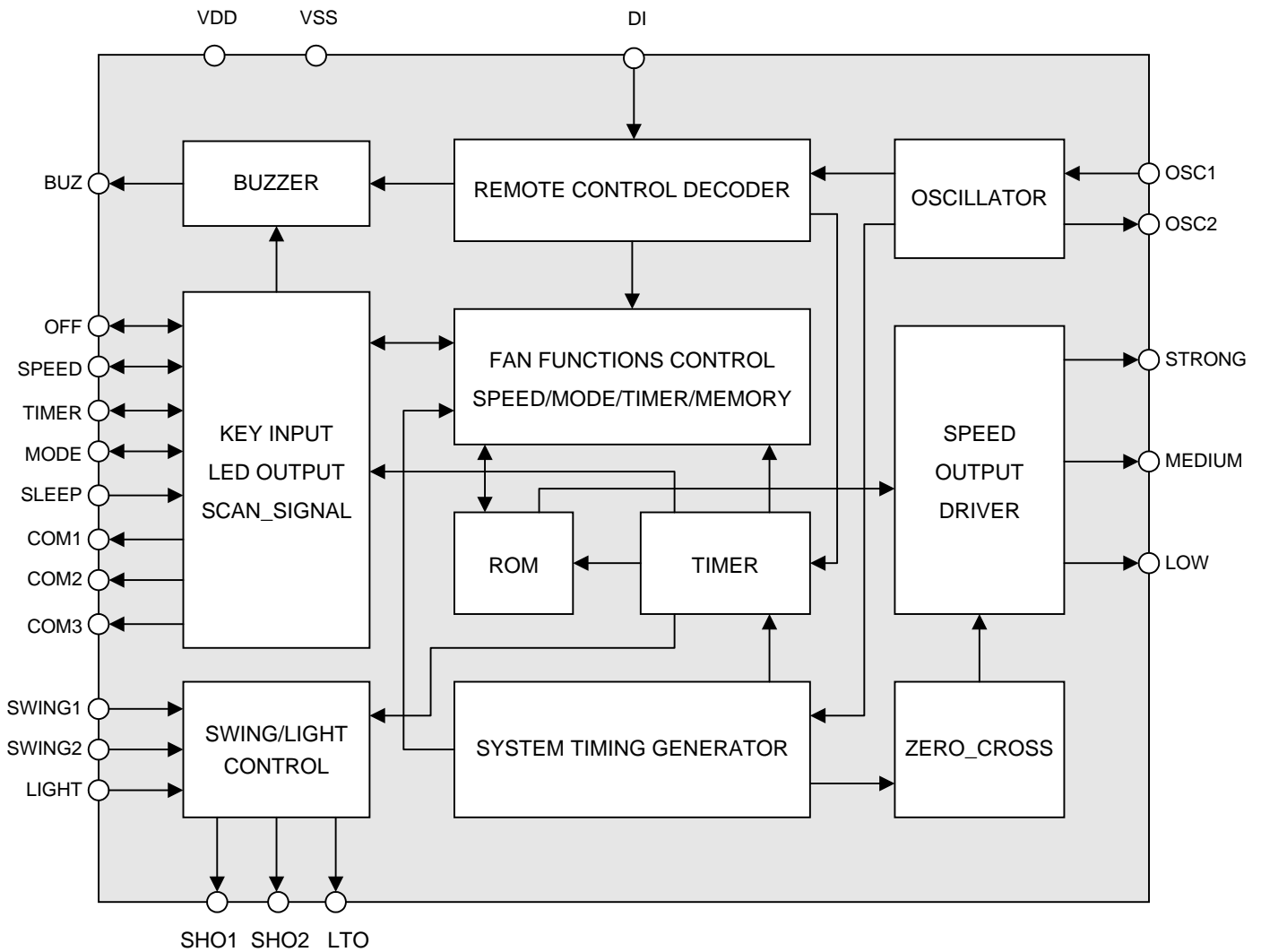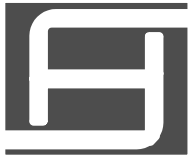
PIN DESCRIPTIONS

No.	Pin Name	I / O	Function
1	LIGHT	I	Light control input
2	DI	I	Remote control input
3	ON_OFF/OFF	I/O	On-Off or Off function control input
4	TIMER	I/O	Timer setting input
5	SPEED	I/O	Wind grade selection input
6	MODE	I/O	Wind mode selection input
7	COM1	O	LED scanning common pin / Customer code
8	COM2	O	LED scanning common pin / Customer code
9	COM3	O	LED scanning common pin
10	SWING1	I	Swing head control input / Customer code
11	SWING2	I	Swing head control input
12	SLT	I/O	Sleep time control input
13	NC		No connection
14	SHO2	O	Swing head / tuner pulse output
15	SHO1	O	Swing head / tuner pulse output
16	STRONG	O	Wind speed control output
17	MEDIUM	O	Wind speed control output
18	LOW	O	Wind speed control output
19	VDD	POWER	Positive power supply
20	BUZ	O	Trigger output to drive piezo
21	OSC2	O	Crystal output
22	OSC1	I	Crystal input
23	VSS	POWER	Negative power supply (Substrate)
24	LTO	O	Light control output

FUNCTION DESCRIPTION

SM3015 has two control types : panel keypad and infrared remote control.
There are four to eight control signal operations :

* Start-up by SPEED key
    a. function turn off (OFF key)
    b. wind mode select (MODE key)
    c. start-up function and wind speed select (SPEED key)
    d. timer setting (TIMER key)
    e. swing head or tuner for swing angle (SW1 and SW2 key)
    f. lighting control (LIGHT key)

* Start-up by ON/OFF key
    a. function control (ON/OFF key)
    b. wind mode select (MODE key)
    c. wind speed select (SPEED key)
    d. timer setting (TIMER key)
    e. swing head or tuner for swing angle (SW1 and SW2 key)
   f. lighting control (LIGHT key)

All functions can be planned by user like an MCU for more product application.
Only SPEED or ON/OFF key can enable the fan controller, except for the light control. Wind mode, timer and swing head inputs can not be accepted when fan is not activated. The fan controller will be turned off by timer and OFF (ON/OFF) key inputs.
When more than one key are pressed, controller will not accept the multi-key's control signal, if the panel keys are pressed more than six seconds, controller will generate a " BI-BI-BI-BI" warning sound.
When fan is enabled by SPEED or ON/OFF key, the initial state of fan controller is as follows:

* Memory function available
   If Fan controller is OFF on sleep mode, all memory functions will be returned to the LAST TURN
   ON STATE.
    a.Grade as last state but with starting medium wind for three seconds (MASK option)
    b. The wind mode as last state except sleep mode
    c. Swing function as last state
    d. Timer setting off
    e. Light is independent

* Non-memory function (Bonding option)
    a. Grade is low wind function but with starting medium wind for three seconds (MASK option)
    b. Normal wind mode operation
    c. Timer setting and swing head off
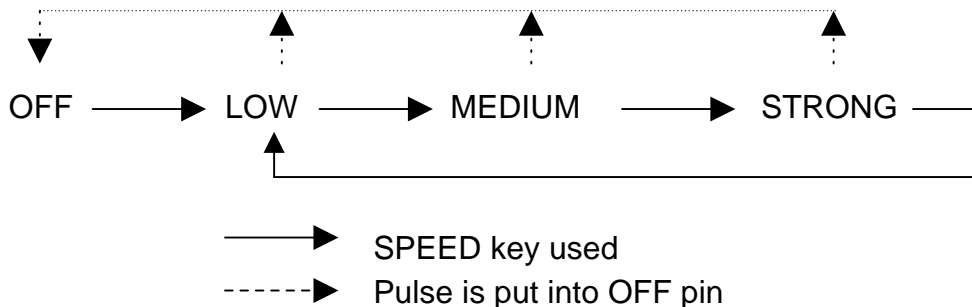   d. Light is independent
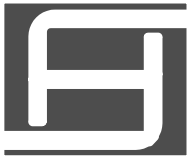
A. OFF KEY

When fan controller is on, press the OFF key on panel or remote control handset, fan functions will be turned off except light output.

* BONDING OPTION : **ON/OFF KEY**

 When fan controller functions are on, press ON/OFF key on panel or remote control handset, fan functions will be turned off; if functions are off, press the key to turn on fan functions. Light output is independent.
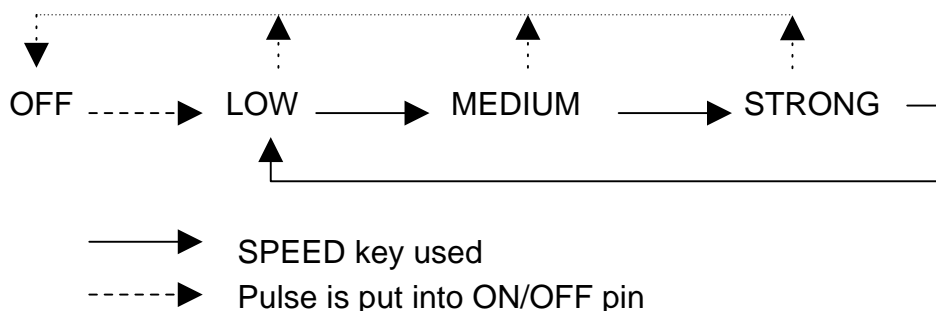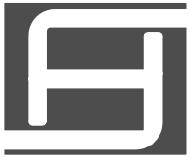
B. SPEED KEY

When fan control is off, press SPEED key on panel or remote control handset, fan is turned on; when memory function is available, the wind grade will operate as last state. Both conditions have three seconds starting wind. Press the SPEED key again, the wind will be changed as follows :

```
        ┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
        ▼         ▲         ▲              ▲
      OFF ───▶ LOW ───▶ MEDIUM ───▶ STRONG ─┐
                    ▲                        │
                    └────────────────────────┘
```

```
    ──────▶   SPEED key used
    ------▶   Pulse is put into OFF pin
```

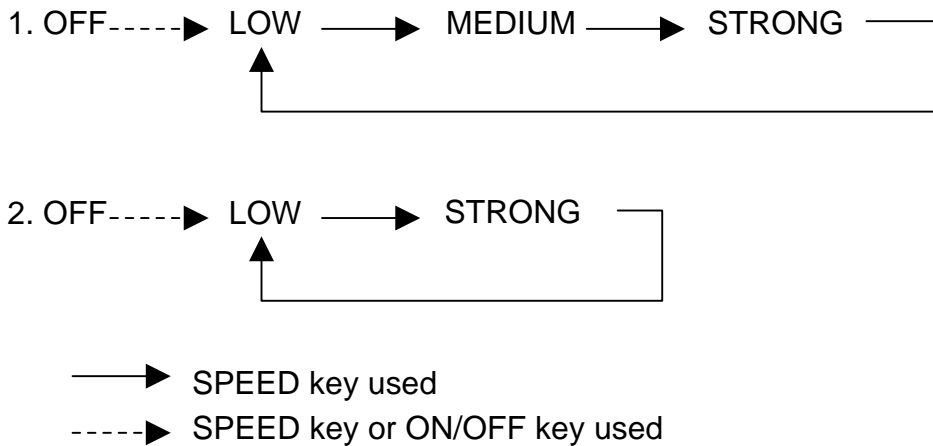* BONDING OPTION: **SPEED KEY ONLY**

 If fan controller is off, SPEED key cannot be used, must press ON/OFF key to turn on the fan controller. When fan controller is on, press SPEED key on panel or remote control handset and wind grade changes as follows:

```
        ┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
        ▼         ▲         ▲              ▲
      OFF - -▶ LOW ───▶ MEDIUM ───▶ STRONG ─┐
                    ▲                        │
                    └────────────────────────┘
```

```
    ──────▶   SPEED key used
    ------▶   Pulse is put into ON/OFF pin
```
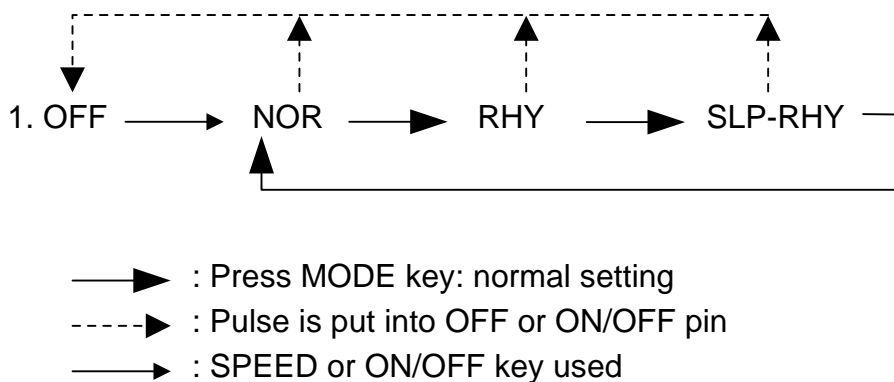
* MASK OPTION: WIND GRADE

    a. There are two types of wind grade control function to choose. If fan controller is on, press SPEED key on panel or remote control handset, wind grade changes as follows:

1. OFF - - - - ▶ LOW ⟶ MEDIUM ⟶ STRONG ⟶

2. OFF - - - - ▶ LOW ⟶ STRONG ⟶

⟶ SPEED key used

- - - - ▶ SPEED key or ON/OFF key used

    b. Memory or non-memory function can be chosen.
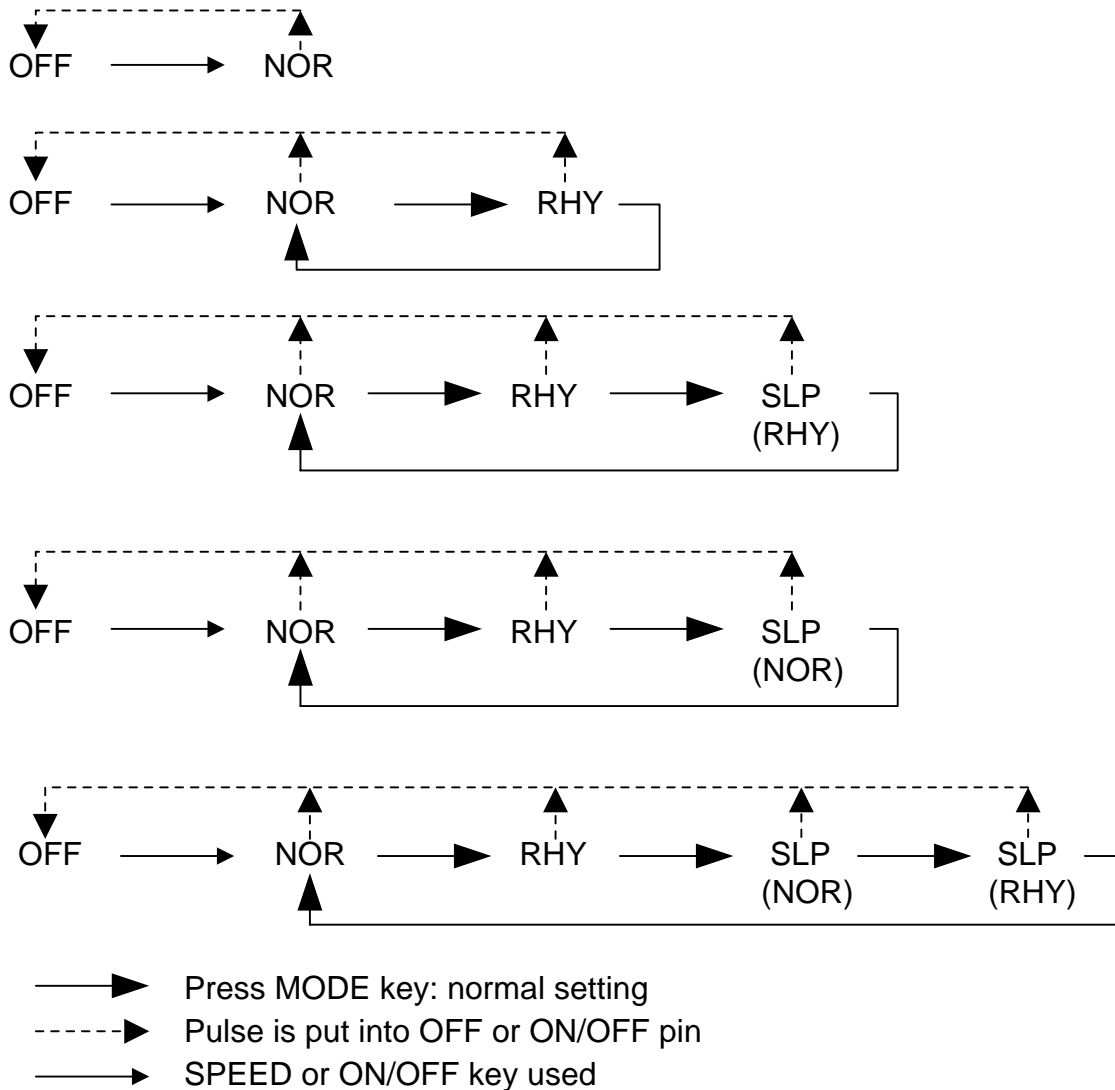
C. MODE KEY

SM3015 has four types of wind mode: normal, rhythm, sleep + rhythm, and sleep + normal these can be chosen by mode key setting. Memory function is available except on sleep mode.

1. OFF ⟶ NOR ⟶ RHY ⟶ SLP-RHY ⟶

⟶ : Press MODE key: normal setting

- - - - ▶ : Pulse is put into OFF or ON/OFF pin

⟶ : SPEED or ON/OFF key used

* MASK OPTION:
a. Memory or non-memory function can be chosen.
b. There are five kinds of wind mode operation.

OFF ⟶ NOR

OFF ⟶ NOR ⟶ RHY

OFF ⟶ NOR ⟶ RHY ⟶ SLP
(RHY)

OFF ⟶ NOR ⟶ RHY ⟶ SLP
(NOR)

OFF ⟶ NOR ⟶ RHY ⟶ SLP ⟶ SLP
(NOR)   (RHY)

⟶ Press MODE key: normal setting
----► Pulse is put into OFF or ON/OFF pin
⟶ SPEED or ON/OFF key used

D. LIGHTING CONTROL KEY

The LIGHT key is independent and the output is toggle function. When the LIGHT key is pressed on panel or remote control handset, operation is as follows :

OFF ⟶ Light output key
       Press LIGHT key

⟶
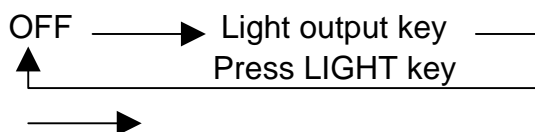
* MASK OPTION:
Fan controller is off, LIGHT key cannot be used.

E. TIMER KEY SETTING

SM3015 has many types of timer
adder for three or four steps. Timer key will not activate when fan controller is off. These types of timer may be chosen by bonding option.

MODE A: Timer with accumulation

Timer Pulse No.	Four-steps Type				Three-steps Type		
	A*1	A*2	A*3	A*4	A*1	A*2	A*3
1	●				●		
2		●				●	
3	●	●			●	●	
4			●				●
5	●		●		●		●
6		●	●			●	●
7	●	●	●		●	●	●
8				●			
9	●			●			
10		●		●			
11	●	●		●			
12			●	●			
13	●		●	●			
14		●	●	●			
15	●	●	●	●			
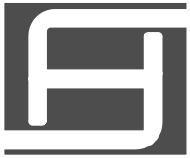
MODE B: Timer with non-accumulation

Timer Pulse No.	Four-steps Type				Three-steps Type		
	A	B	C	D	A	B	C
1	●				●		
2		●				●	
3			●				●
4				●			

● LED display

* MASK OPTION:

A,B,C,D time base are common multiple by 15 minute ascending, and each number can be set by user.
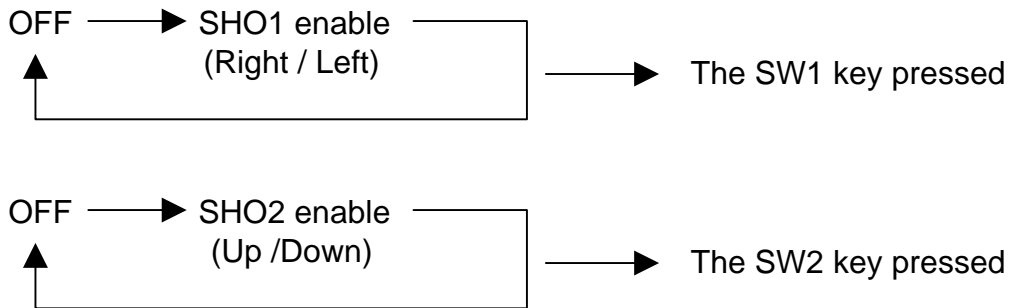
SAMHOP Microelectronics Corp.

F. SWING KEY:SWING1 AND SWING2

The swing key will not activate when fan controller is off. Memory function is available, the swing output will operate as last state when press SPEED or ON/OFF key, except tuner function using.
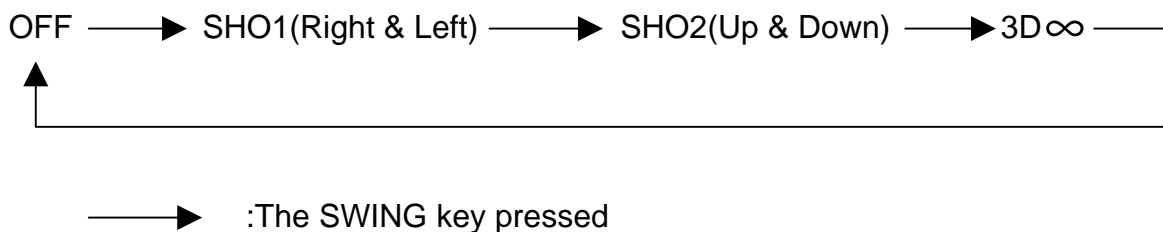
A/C Type :

SM3015A has two keys of SW1 and SW2 to control the outputs of SHO1 and SHO2 (toggle function).

```
OFF ──────► SHO1 enable ───────┐
  ▲          (Right / Left)      │──────► The SW1 key pressed
  └──────────────────────────────┘


OFF ──────► SHO2 enable ───────┐
  ▲          (Up /Down)         │──────► The SW2 key pressed
  └──────────────────────────────┘
```

When SHO1 and SHO2 outputs enable together, the swing head has 3D function.

B/D Type :

SM3015B/D has only one SWING key to control the outputs of SHO1 and SHO2.

```
OFF ──────► SHO1(Right & Left) ──────► SHO2(Up & Down) ──────► 3D∞ ──┐
  ▲                                                                    │
  └────────────────────────────────────────────────────────────────────┘


──────►  :The SWING key pressed
```

* MASK OPTION :

a. SHO1 and SHO2 output can be enabled when fan controller is off.
b. SHO1 and SHO2 output functions can be chosen as a continuous outputs respectively like a micro-swing switch to tune the swing angle.

G. SLT KEY

When fan controller functions are on, pres
the sleep mode, then press the SLT key to set the timer of the wind grade down. The time base of
SLT key is 0.5HR/1HR/2HR.

H. MEMORY FUNCTION

Memory of speed, mode(except sleep mode) and swing functions can be set independently.
Memory function can be cancelled by Bonding option. When memory function is available, wind
speed mode and swing functions will operate as last state; if last state is sleep mode, press
SPEED or ON/OFF key enable fan controller while memory functions(Speed/Mode/Swing) will be
returned to the last state before sleep mode operation.

I. STARTING WIND

Memory or non-memory type, fan controller starts with three seconds starting wind.

J. CUSTOMER CODE

SM3015 provide two-bit customer code to distinguish different product models. There are four
types, that can be set by diode.

a. Set code bit to "0", connect diode to COM1/COM2 and SWING/SW1 terminal
b. Set code bit to "1", open the circuit.

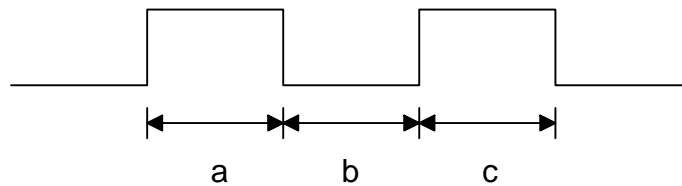| D1	D2
0	0
0	1
1	0
1	1
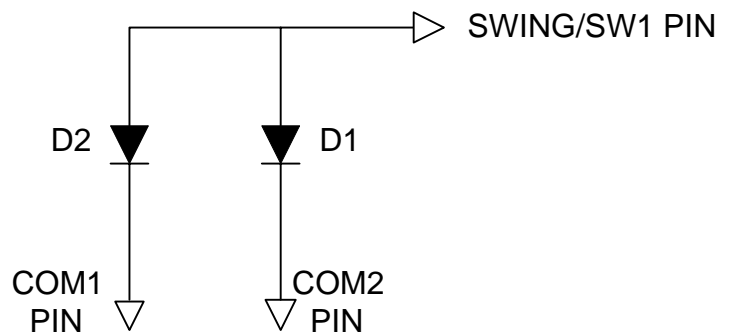
K. BUZZER

Any key pressed on panel or fan controller receives a control signal from remote control handset, will generate a 4KHz 50% duty cycle pulse train on buzzer output pin.
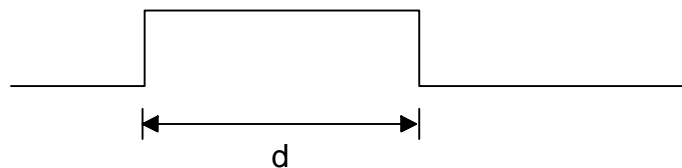
a. When FAN is from stop mode to start mode (press SPEED or ON_OFF key)
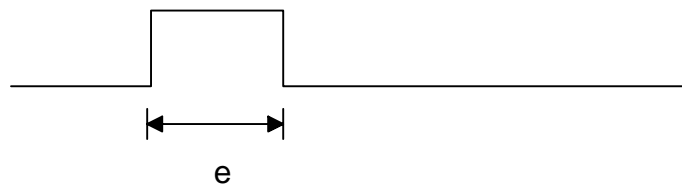Buzzer output will generate a "BI-BI" sound.

b. When FAN is from start mode to stop mode (press OFF/ON_OFF key)
Buzzer output will generate a long "BI" sound.

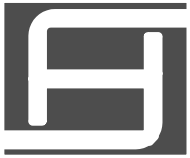**c. When FAN is operating (press any key other than OFF/ON_OFF key)**
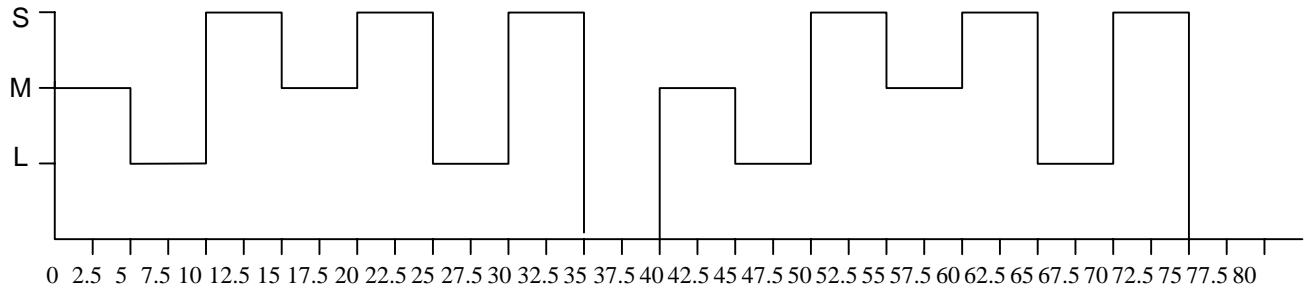Buzzer output will generate a "BI" sound.

When   a = c = e = 62ms
            b = 124ms
            d = 250ms

* MASK OPTION
Fan controller will generate a 150ms duration 2KHz 50% duty cycle pulse train on BUZ output pin.

L-1. RHYTHM WIND FUNCTION (DEFAULT)

STRONG RHYTHM WIND PATTERN

(SEC)

MEDIUM RHYTHM WIND PATTERN

(SEC)

LOW RHYTHM WIND PATTERN

(SEC)

*MASK OPTION:

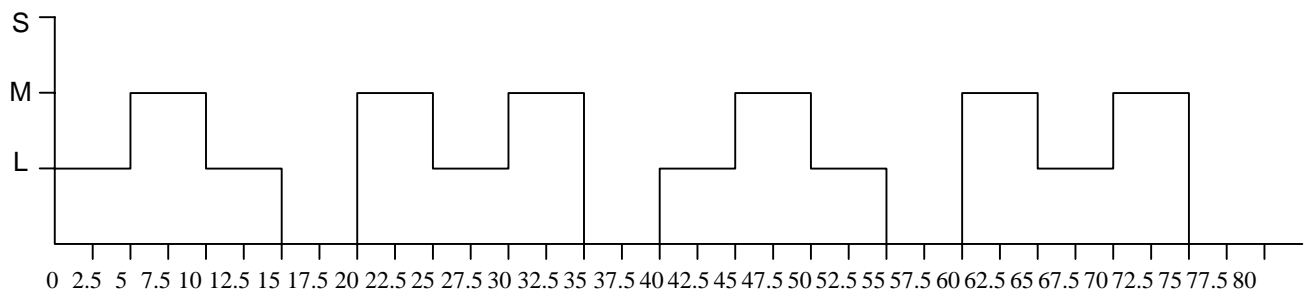32 patterns per cycle, each pattern (2.5 seconds) can be set by user.

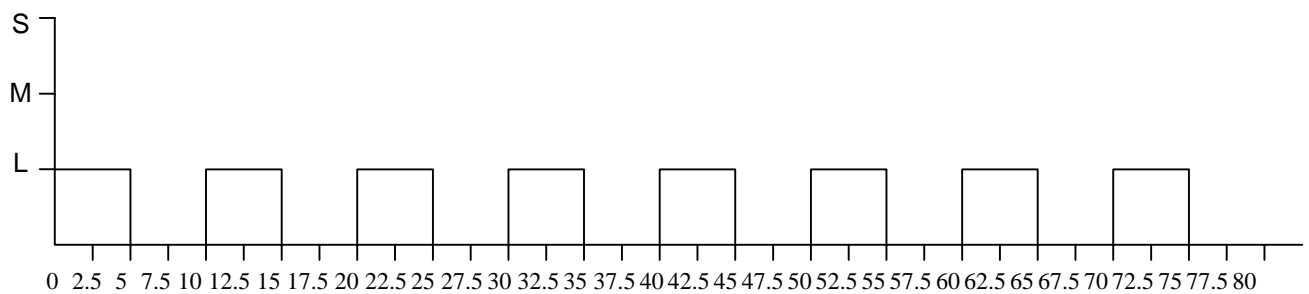## L-2. RHYTHM WIND FUNCTION (DEFAULT)
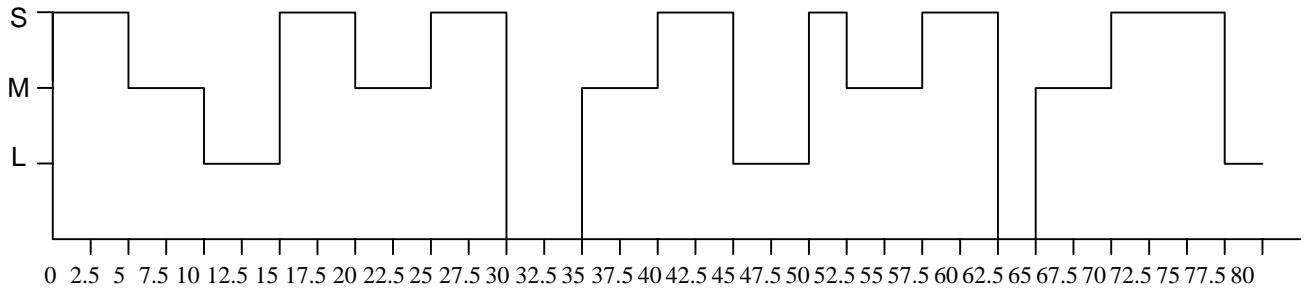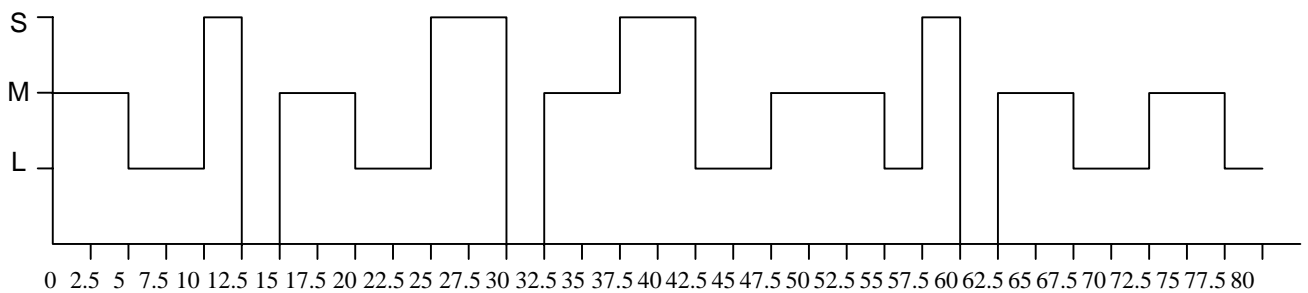
STRONG RHYTHM WIND PATTERN

(SEC)

MEDIUM RHYTHM WIND PATTERN

(SEC)

LOW RHYTHM WIND PATTERN

(SEC)
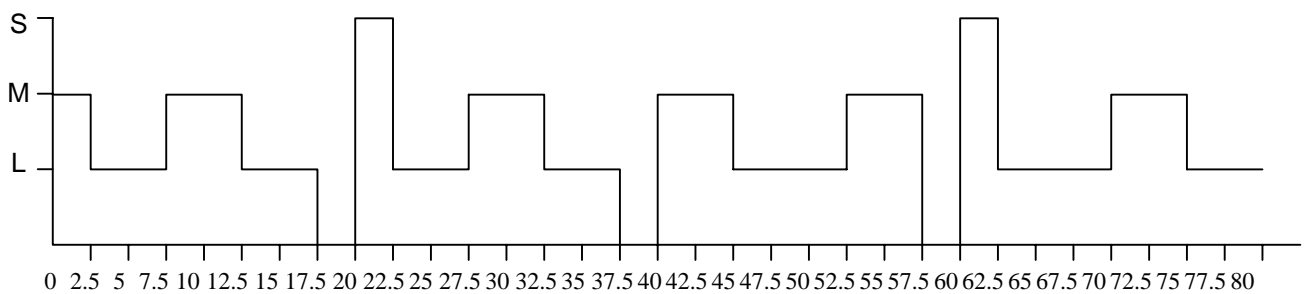
*MASK OPTION:

32 patterns per cycle, each pattern (2.5 seconds) can be set by user.

M. SLEEP FUNCTION

In sleep mode, wind grade is changed by timing automatically.
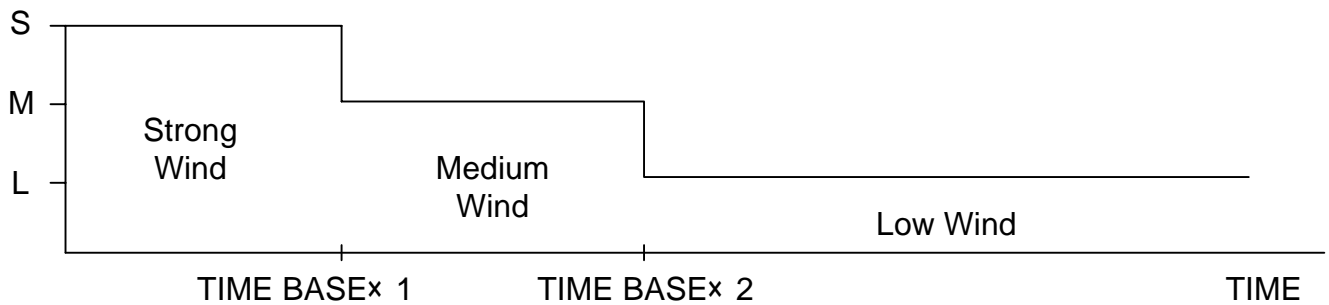
TIMER OPTION:

Sleep Hold Time Key can be chosen the time base of 0.5/1/2HR by SLT key in SM3015C/D type only.

TIMING CONTROL

Speed Key
On/Off Key

t key

Buz

t buz

Low

Medium

3 sec.

Strong

Mode Key

t key

Normal

Rhythm

Sleep

Off Key
On/Off Key

t key

Fan Enable
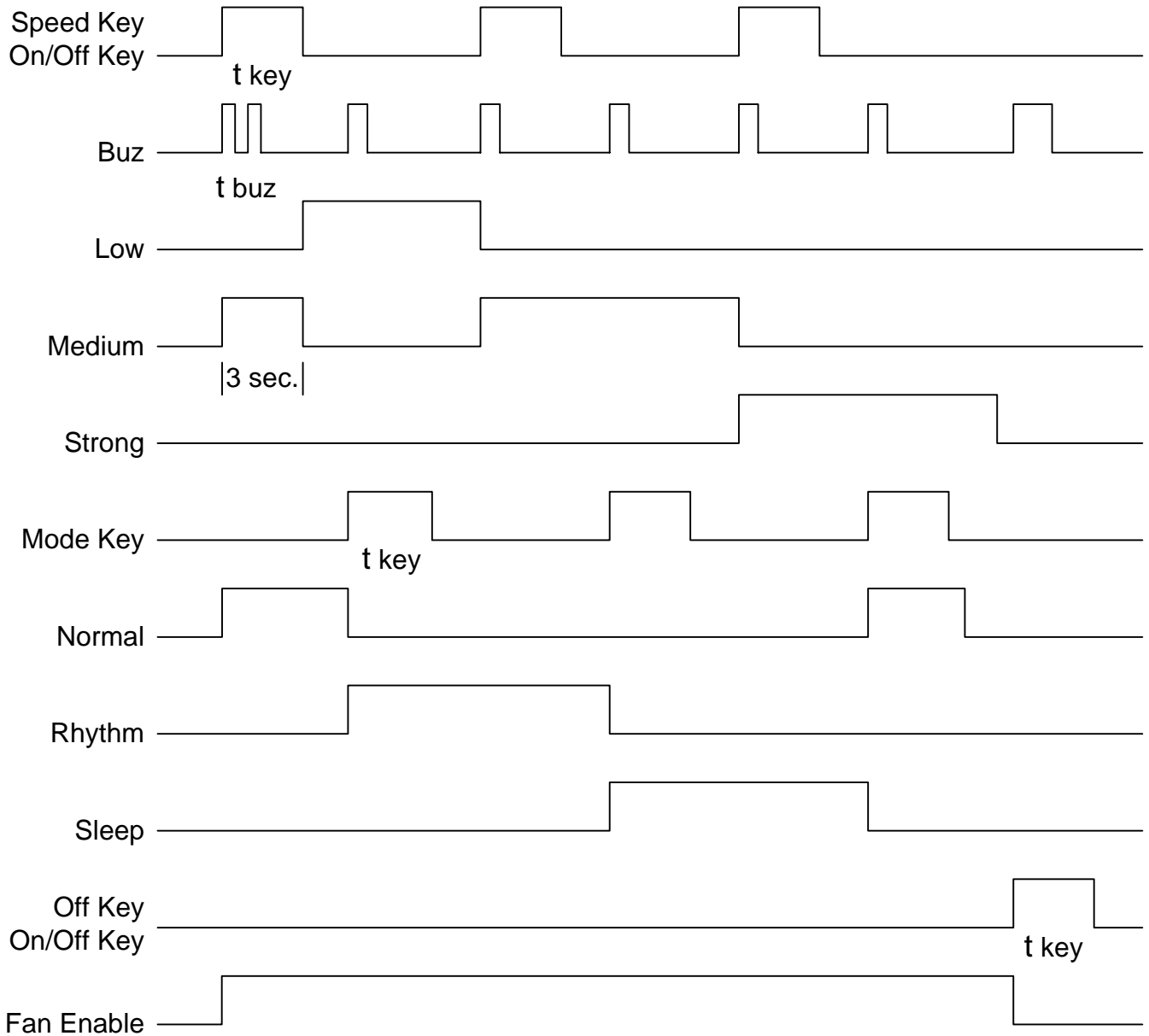
* NOTE: tbuz see page 12 and tkey see page 6
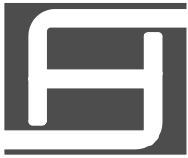
DC ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD		3	5	6	V
Stand-by Current	ISB	OSC stop all output pins open all input fixed to VDD			500	uA
Input High Level	VIH		3.5			V
Input Low Level	VIL				1.5	V
Sink Current (OFF,MODE,SPEED TIMER,SLEEP)	IOL	VOL=+0.7V		10		mA
Source Current (OFF,MODE,SPEED TIMER,SLEEP)	IOH	VOH=+4.3V		10		mA
Triac Sink Current (S,M,L,SW1, SW2,LIGHT)	IOL	VOL=+0.7V		10		mA
Triac Source Current (S,M,L,SW1, SW2,LIGHT)	IOH	VOH=+4.3V		5		mA
Sink Current (COM1~COM3)	IOL	VOL=+0.7V		40		mA
Source Current (COM1~COM3)	IOH	VOH=+4.3V		10		mA
Sink Current (BUZ)	IOL	VOL=+0.7V		4		mA
Source Current (BUZ)	IOH	VOH=+4.3V		5		mA
Pull-high Resister (Input pin)	RPH			200		K OHM

*NOTE: All test conditions are on VDD = 5V / VSS = GND

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Test conditions	Ratings	Unit
Supply Voltage	VDD-VSS		-0.3~6	V
Input Voltage	Vi-VSS		VSS-0.3~VDD+0.3	V
Output Voltage	Vo-VSS		VSS-0.3~VDD+0.3	V
Maximum Power Consumption	Pa	VDD-VSS=5V	500	mW
Operating Temperature	Topr		-10~70	$^{\circ}$C
Storage Temperature	Tstg		-40~125	$^{\circ}$C

AC CHARACTERISTICS

Oscillator Frequency:455KHz/32.768KHz

Parameter	Symbol	Ratings			Unit
		Min.	Typ.	Max.	
Key Press Duration	t key		30		ms
Remote Input Bit Duration	t bit	1.17	1.68	2.18	ms

SM5021 (ENCODER) APPLICATION CIRCUIT
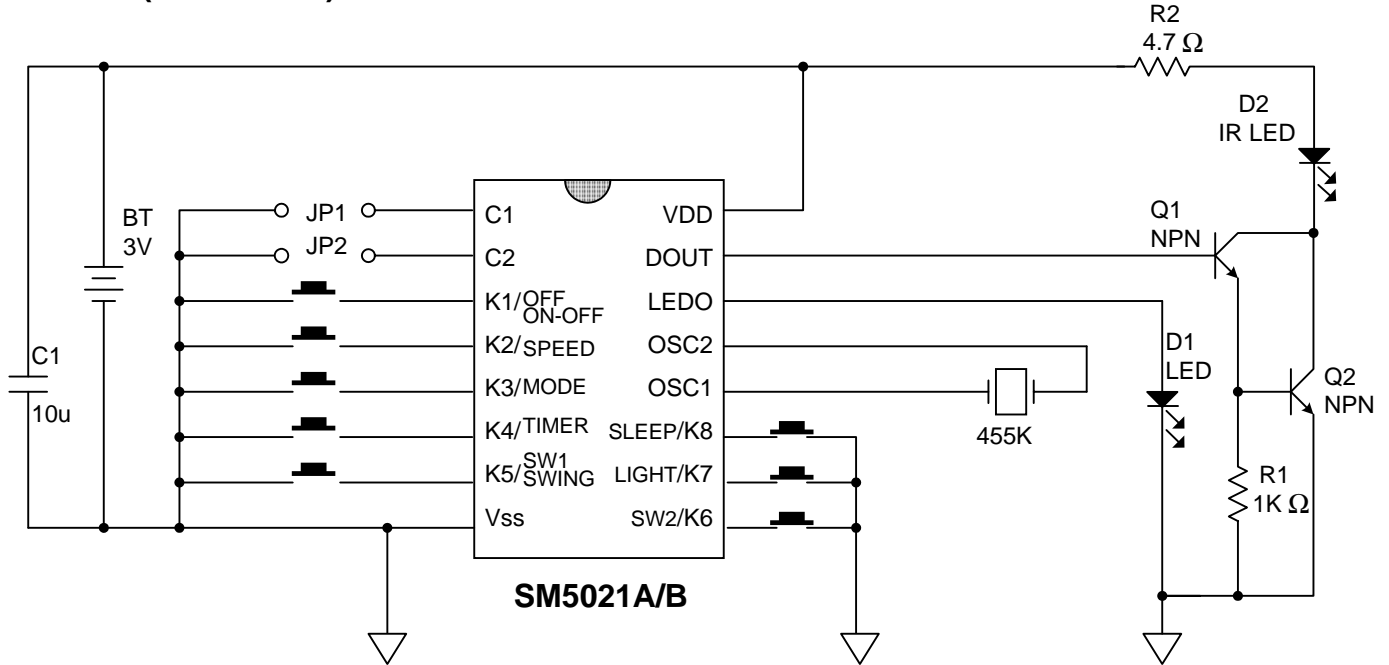
SM3015 POWER SUPPLY APPLICATION CIRCUIT
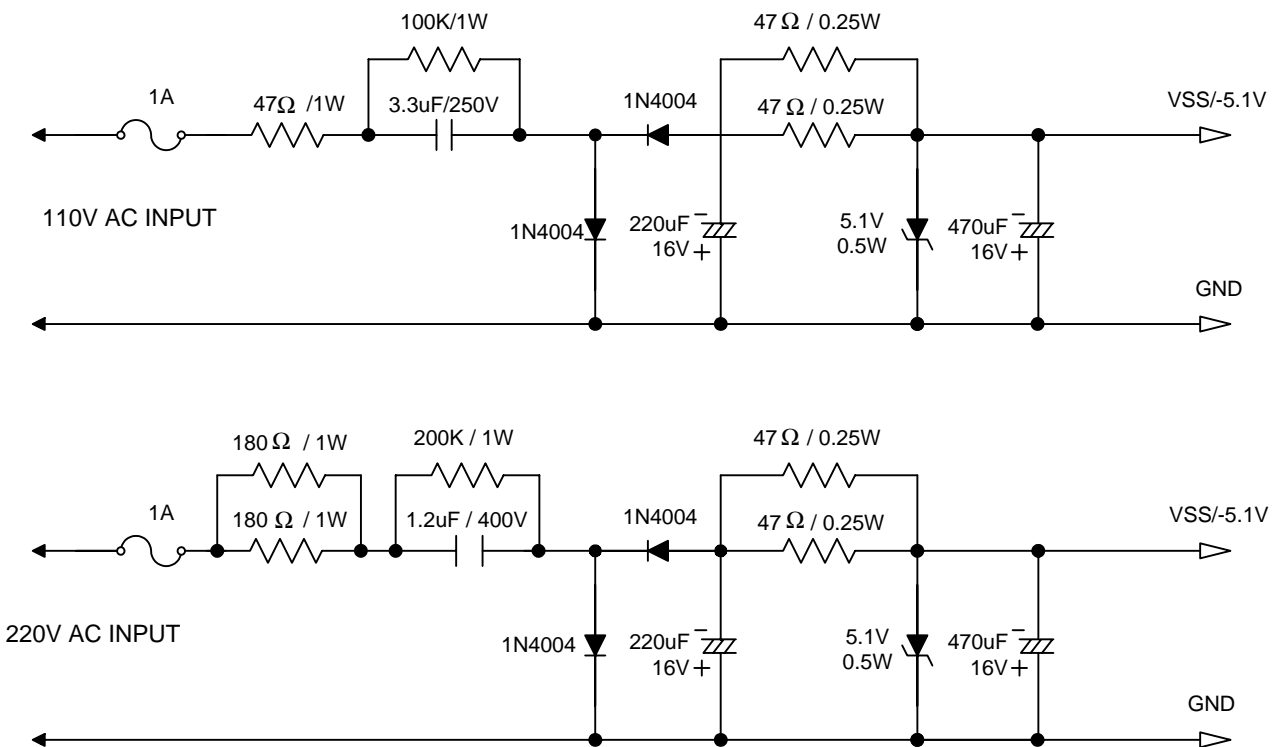
SM3015 APPLICATION CIRCUIT

AC INPUT

VDD/GND

VSS/-5.1V

R7 10K R6 10K R5 10K R4 10K R3 10K R2 10K R1 10K R8 10K

C1 100p (10p)   C2 100p (10p)

455KHz(32.768KHz)

SWING1   SPEED   ON-OFF / OFF   SLT

S7 S6 S5 S4 S3 S2 S1 S8

GND VDD

SWING2   MDOE   TIMER   LIGHT

SM3015A/C

LIGHT	LTO
DI	VSS
OFF(ON/OFF)	OSC1
TIMER	OSC2
SPEED	BUZ
MODE	VDD
COM1	LOW
COM2	MED
COM3	STR
SW1	SHO1
SW2	SHO2
SLT	NC

DOUT

IR MODULE

0~100Ω R1
0~100Ω R1
0~100Ω R1 7

D2 D1

1/2   1   2   4   SPT 1/2

RHY   LOW   MED   STE   SPT1

NOR   SLP+R   SLP+N   SPT2

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LP   M1   M2   M3

LIGHT L   M   S   SW1 SW2

560 Ω
R14

-   C3
+   47u

R9/560
R10/560
R11/560
SW1   R12/560
SW2   R13/560
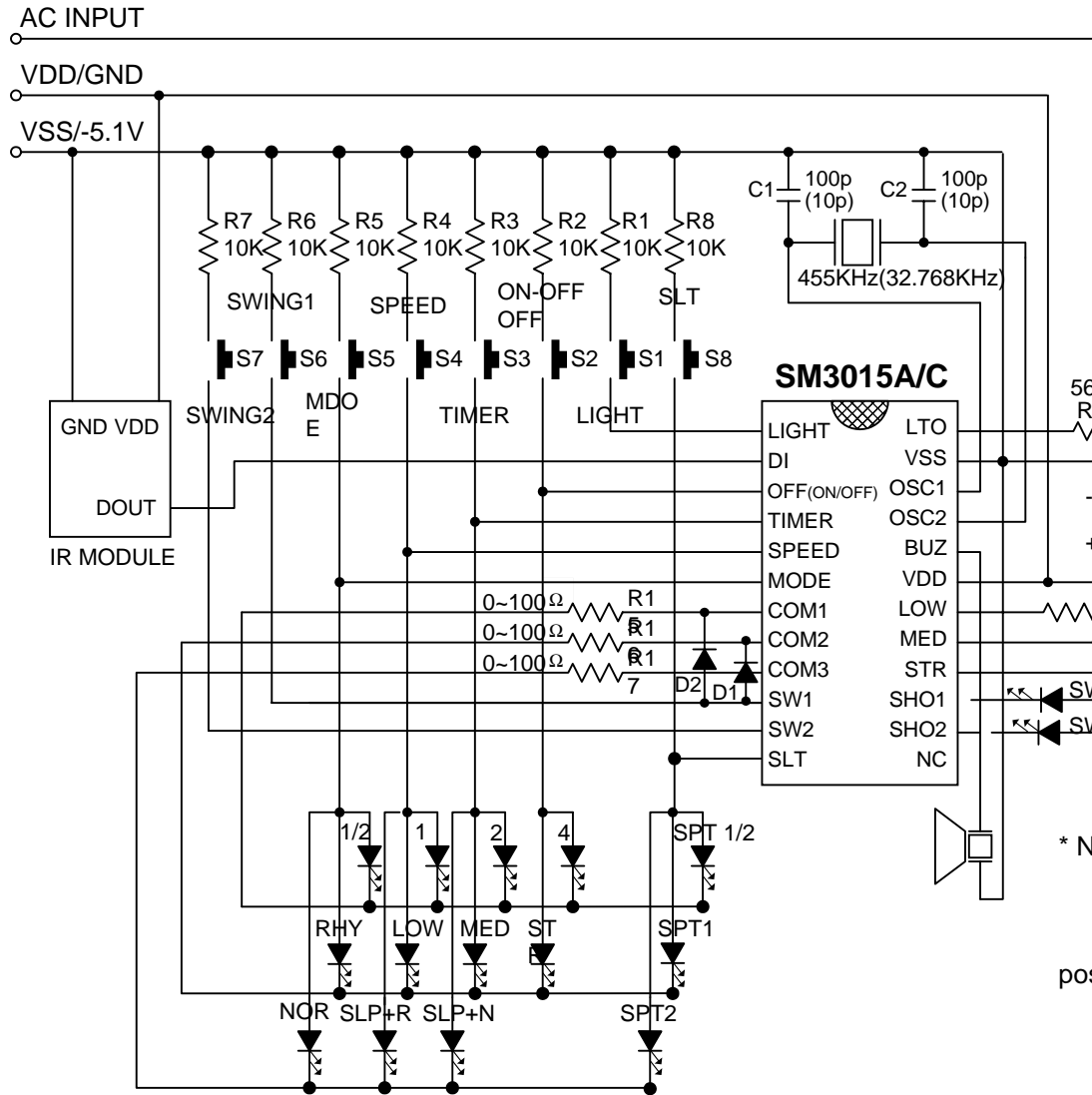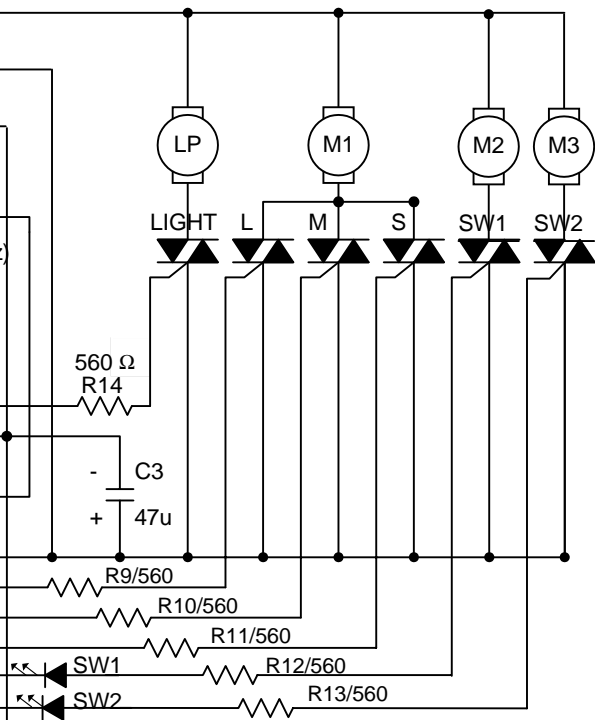
* NOTE: 1. D1 and D2 for custom code.
            Code 1: open the diode
            Code 0: use the diode
        2. C3 must be closed to IC as
possible of PCB layout.
        3. A Type: SLT PIN = NC
        4. Oscillator Option:

Option	Oscillator	C1,C2
1	455KHz	100p
2	32.768KHz	10p

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SM3015 APPLICATION CIRCUIT

AC INPUT

VDD/GND

VSS/-5.1V

C1 100p (10p) C2 100p (10p)

R6 10K R5 10K R4 10K R3 10K R2 10K R1 10K R7 10K

455KHz(32.768KHz)

SWING1   SPEED   ON-OFF OFF   SLT

S6 S5 S4 S3 S2 S1 S7

SM3015B/D

MDOE   TIMER   LIGHT

GND VDD

560 Ω R14

LIGHT	LTO
DI	VSS
OFF(ON/OFF)	OSC1
TIMER	OSC2
SPEED	BUZ
MODE	VDD
COM1	LOW
COM2	MED
COM3	STR
SW1	SHO1
SLT	SHO2
NC	NC

DOUT

IR MODULE

0~100Ω R1
0~100Ω R1
0~100Ω R1 7

D2 D1

R9

SW1
SW2

1/2 1 2 4 SPT 1/2

RHY LOW MED STE SPT1

NOR SLP+R SLP+N SPT2

* NOT

poss

LP M1 M2 M3

LIGHT   L   M   S   SW1   SW2

560 Ω
R14

-   C3
+   47u

R9/560
R10/
560   R11/
560   R12/
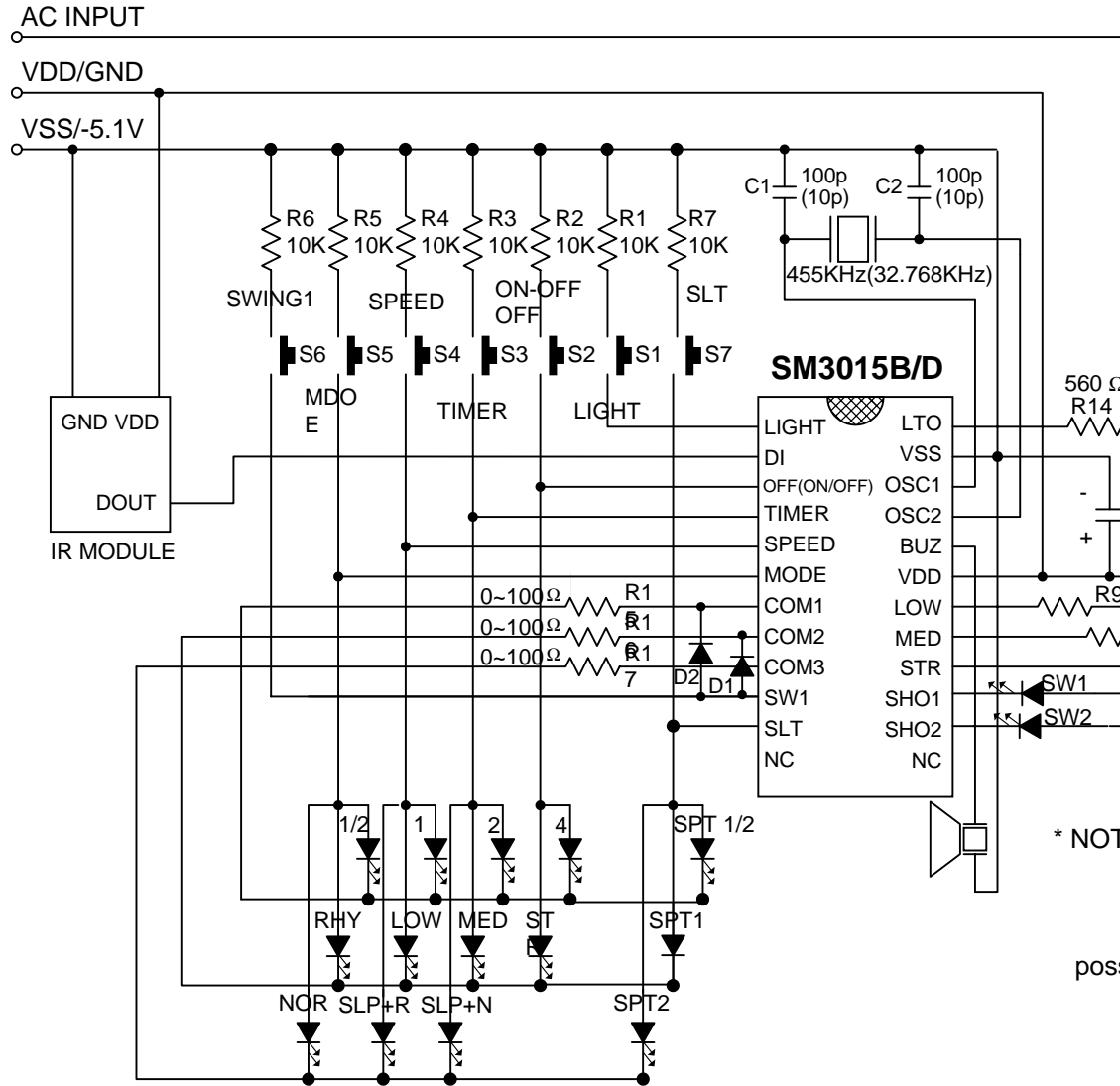SW1   560   R13/
SW2   560

* NOTE: 1. D1 and D2 for custom code.
           Code 1: open the diode
           Code 0: use the diode
        2. C3 must be closed to IC as
   possible of PCB layout.
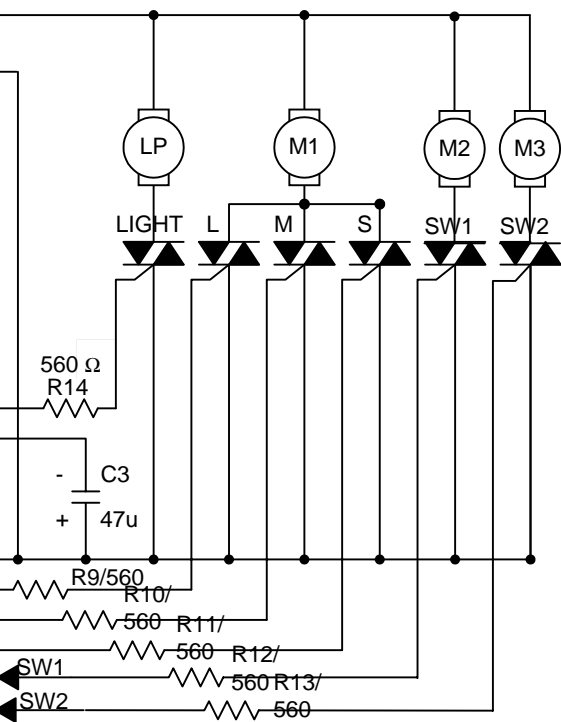   3. B Type: SLT PIN = NC
        4. Oscillator Option:

Option	Oscillator	C1,C2
1	455KHz	100p
2	32.768KHz	10p

V.2.0 Mar 8, 2002

ORDERING INFORMATION

SM3015 AX-

AM4A - FL2ST

△ XXX XX

- Logo
- Product No.
- A: A Type
  B: B Type
  C: C Type
  D: D Type
- Empty: 455KHz
  X: 32.768kHz
- A: ON/OFF Key Start-up
  B: SPEED Key Start-up
- M: Memory Function
  N: Non-memory Function
- 4: 0.5HR, 1HR, 2HR, 4HR
  8: 1HR, 2HR, 4HR, 8HR
- A: Timer Setting-Ladder Adder
  B: Timer Setting-Shift

- O: One Operation Wind Mode
  T: Two Operation Wind Mode
  Empty: Three Operation Wind Mode
  F: Four Operation Wind Mode
- S: Tuner Control In Swing2
  F: Tuner Control In Swing1
  N: Non-Tuner Control
- 2: Two Swing Head Control
  1: One Swing Head Control
  N: Non-Swing Head Control
- L: Light Function
  N: Non-Light Function
- F: Four Steps For Timer
  T: Three Steps For Timer
- Serial Number
- Date Code
- ESD Protection Mark