



三合微科技股份有限公司
SAMHOP Microelectronics Corp.

SM5021
ENCODER

GENERAL DESCRIPTION

The SM5021A/B is a high performance infrared remote control encoder utilizing CMOS technology. Mode A is a signal-key control and mode B is a multi-key control during data transmission, supports eight data key inputs and a LED output to indicate the status during transmission.

Auto power off function when key is not pressed to save power, custom codes to distinguish different products. SM5021 encoder is paired with SM5032 decoder for more data control applications.

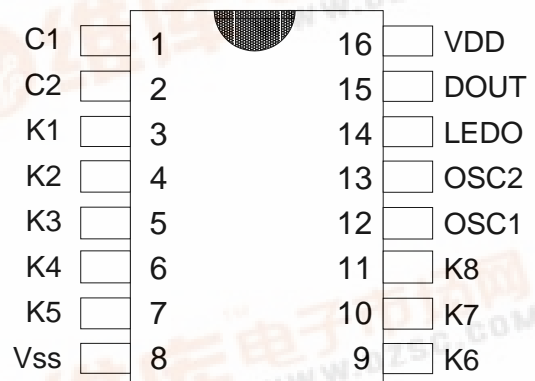
FEATURES

- * Wide operation voltage range, 2.4V to 6V
- * Eight data key control
- * Option of signal-key or multi-key control
- * Two custom codes to separate products
- * Auto power off for saving power
- * LED output to indicate transmission status
- * Direct infrared LED 38KHz modulation output
- * Low power consumption
- * Paired with SM5032 decoder
- * 16 pin DIP or SO package

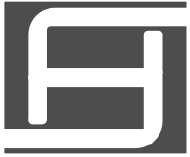
APPLICATIONS

- * SM3015 Fan Remote Control
- * Audio Remote Control
- * Toy Remote Control
- * Consumer Products Remote Control

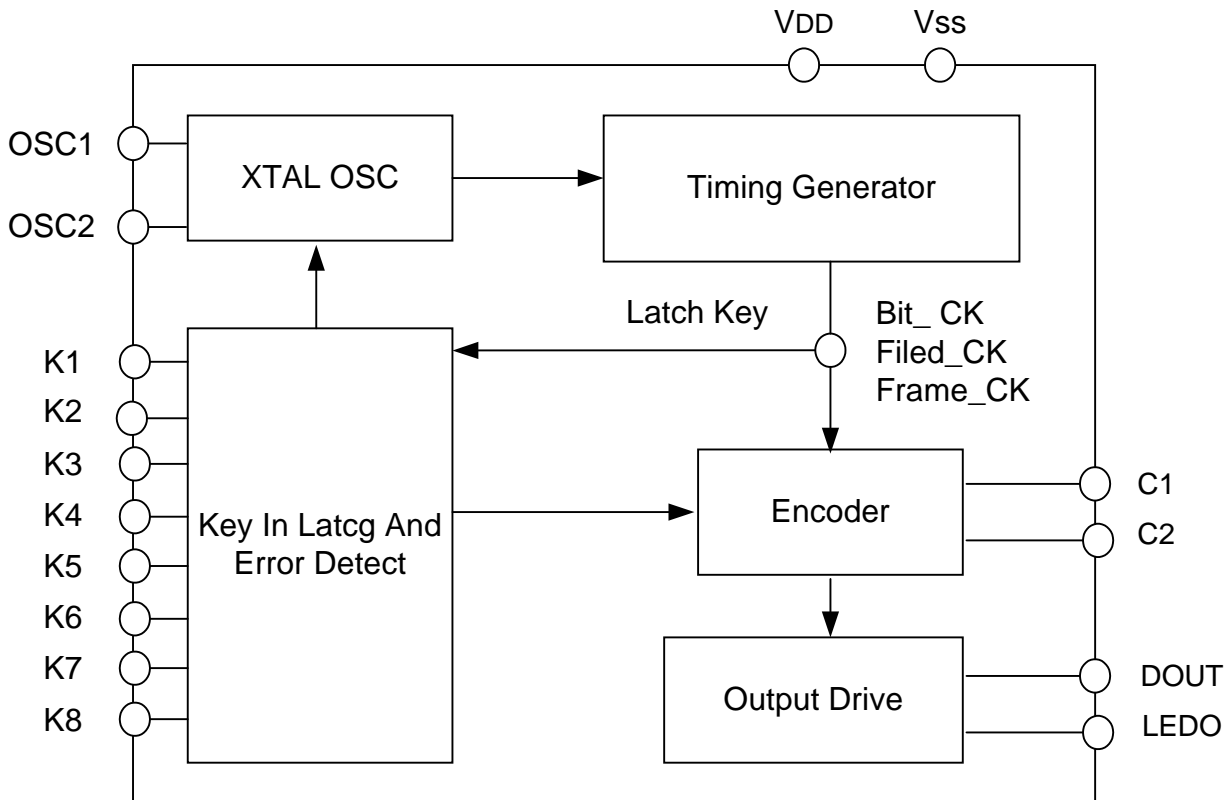
PIN ASSIGNMENT (TOP VIEW)



SM5021A/B



BLOCK DIAGRAM



PIN DESCRIPTION

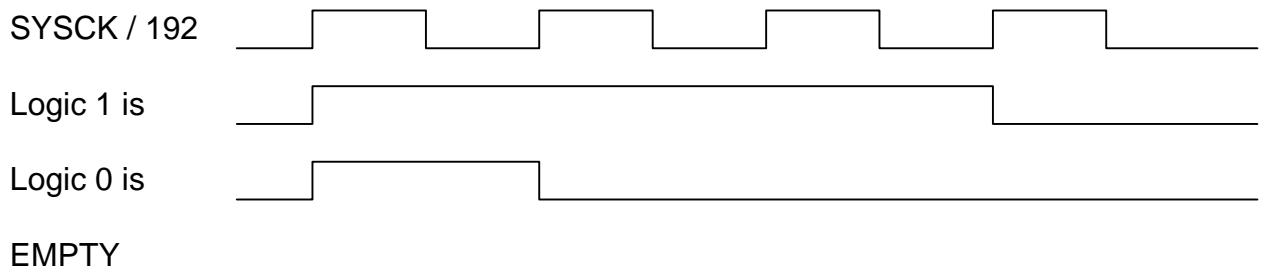
| Pin Name | I / O | Function |
|----------|-------|---|
| C1,C2 | I | Custom Code |
| K1 ~ K8 | I | Remote Control Key Inputs (Built-In Pull-Low Resistor) |
| Vss | POWER | Negative Power Supply (Substrate) |
| OSC1 | I | 455KHz XTAL OSC Pin |
| OSC2 | O | 455KHz XTAL OSC Pin |
| DOUT | O | Signal Output |
| LEDO | O | Transmission Indicator |
| VDD | POWER | Positive Power Supply |



FUNCTION DESCRIPTION

A. Encoder Singal Output Format

Bit Format



Frame Format

There are four frames, encoder generates during sending. Each frame contains four field:

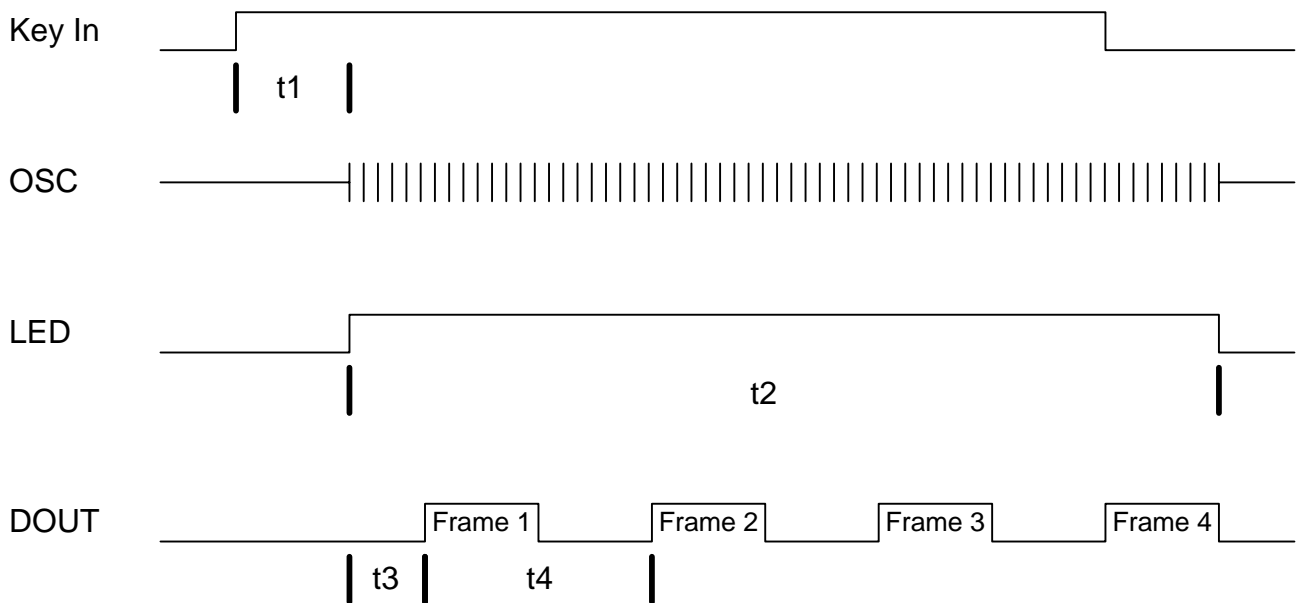
- | | |
|-------------------------------------|-----------------------------|
| a) Frame head / Three-bits | 1 1 0 (Metal option) |
| b) Custom code / Two-bits | C1 C2 |
| c) Control word / Seven-bits | 0 0 0 0 0 1 ~ 1 0 0 0 1 1 0 |
| d) Synch field / Four-bits of empty | |

B. Transmission Code Table

| Start Word | | | Custom Code | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | Transmit |
|------------|---|---|-------------|----|----|----|----|----|----|----|----|----------|
| 1 | 1 | 0 | C1 | C2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | K1 |
| 1 | 1 | 0 | C1 | C2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | K2 |
| 1 | 1 | 0 | C1 | C2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | K3 |
| 1 | 1 | 0 | C1 | C2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | K4 |
| 1 | 1 | 0 | C1 | C2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | K5 |
| 1 | 1 | 0 | C1 | C2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | K6 |
| 1 | 1 | 0 | C1 | C2 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | K7 |
| 1 | 1 | 0 | C1 | C2 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | K8 |



C. Transmission Timing



* t1: Key pressing > 32ms

* t2: Transmission time $t3 + 108\text{ms}$ (Four frame)
If t1 is over $t3 + 108\text{ms}$, DOUT will be transmitted again.
 $[(\text{Pressing time}) \text{MOD} (t3 + 108\text{ms}) + 1] * 108\text{ms} + t3$

* t3: Oscillator stable time. $\text{OSC} * 384 = 0.8\text{ms}$

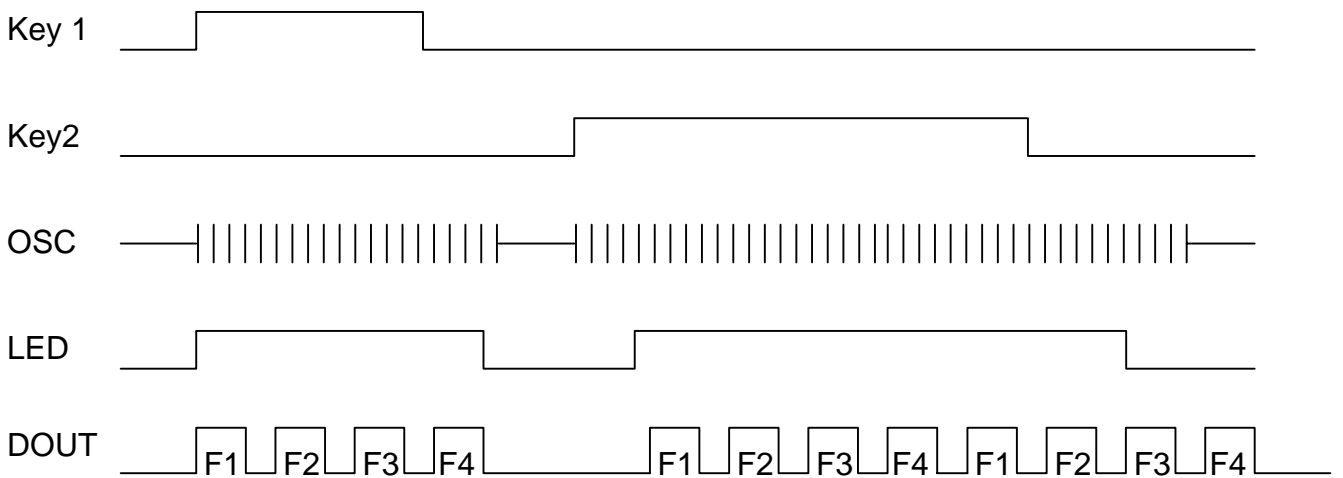
* t4: 3-Bits(Head) + 2-Bits(Custom Code) + 7-Bits(Data) + 6-Bits(Empty) = 18-Bits (27ms)

* OSC: 455KHz resonator



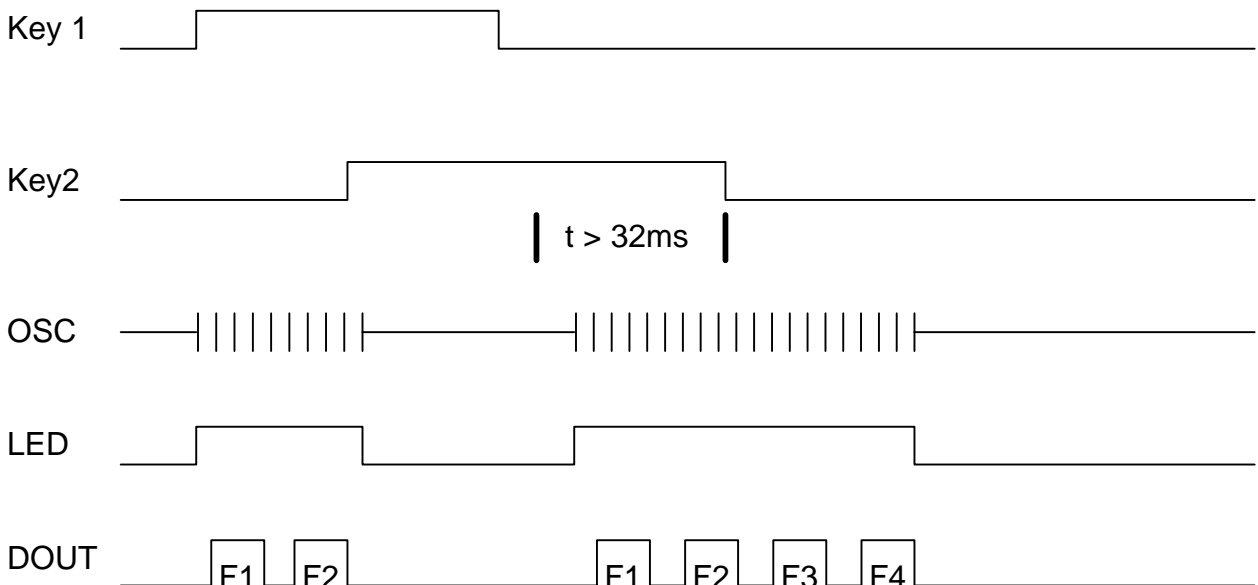
D. SM5021A Transmission Waveform

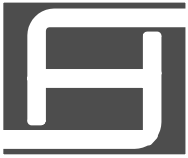
Normal Condition



Overlap Condition

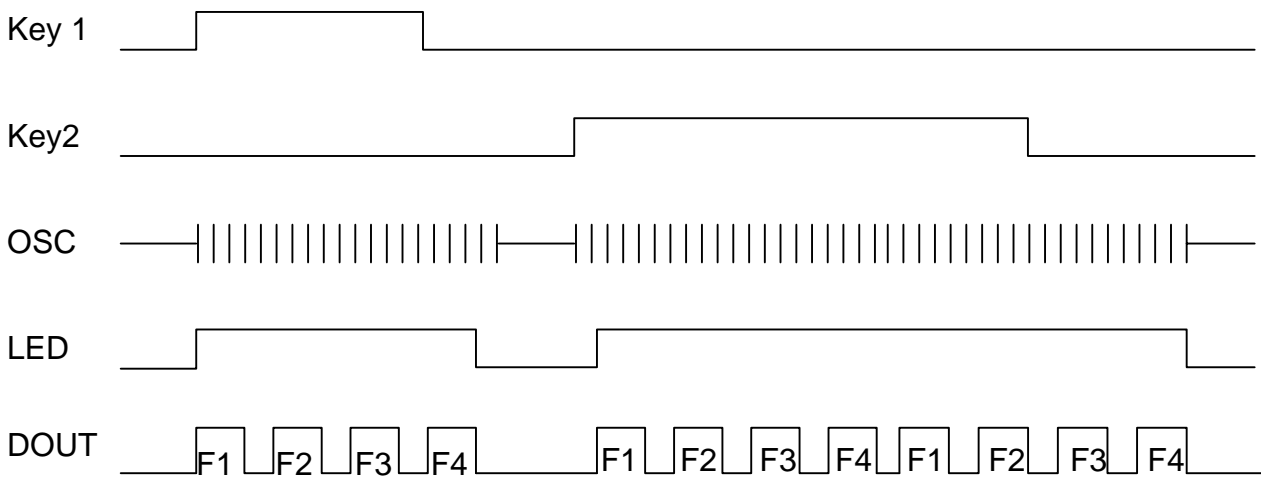
If more than one key is pressed, transmission stops.





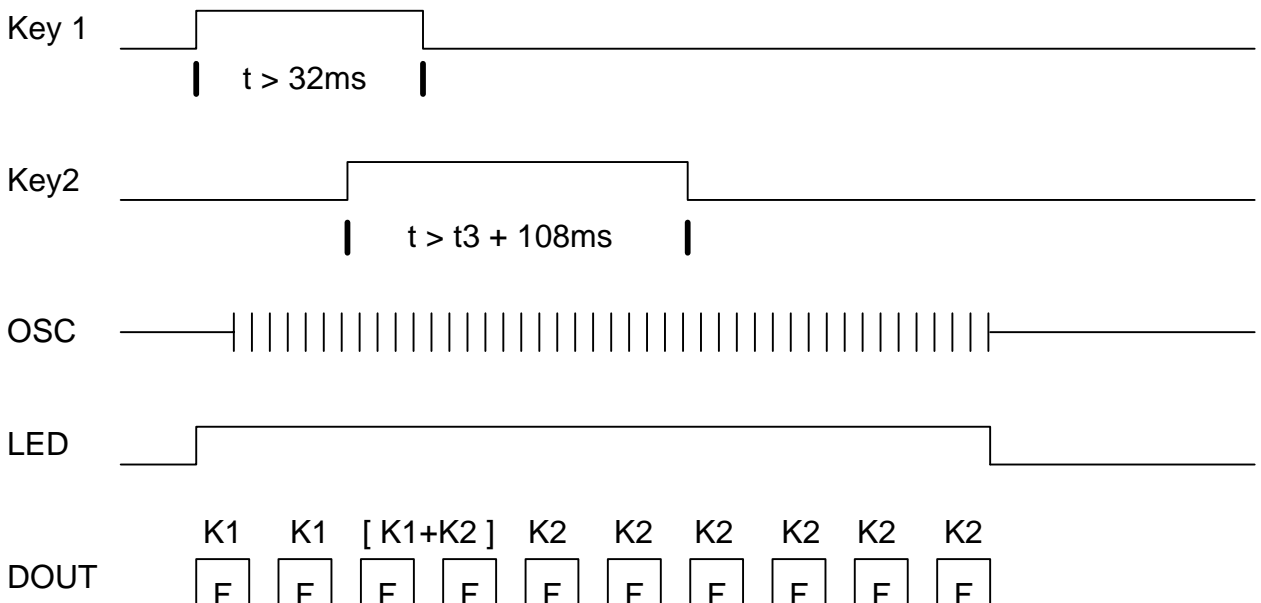
E. SM5021B Transmission Waveform

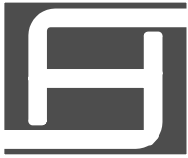
Normal Condition



Overlap Condition

If more than one key is pressed, multi-key data transmission.



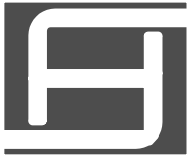


ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Test Conditions | Ratings | Unit |
|---------------------------|---------|-----------------|---------------------|------|
| Supply Voltage | VDD-Vss | | -0.3 ~ 6 | V |
| Input Voltage | VI | | Vss -0.3 ~ VDD +0.3 | V |
| Output Voltage | VO | | Vss -0.3 ~ VDD +0.3 | V |
| Maximum Power Consumption | Pa | VDD - Vss = 5V | 500 | mW |
| Operating Temperature | Topr | | -10 ~ 70 | |
| Storage Temperature | Tstg | | -40 ~ 125 | |

DC ELECTRICAL CHARACTERISTICS

| Parameter | Symbol | Conditions | Limit | | | Unit |
|---------------------|--------|--|-------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Supply Voltage | VDD | | 2.4 | 3 | 6 | V |
| Stand-by Current | ISB | VDD - Vss = 3V OSC stop all output pins open | | 1 | | μA |
| Input High Level | VIH | | 1.5 | | 3.5 | V |
| Input Low Level | VIL | | 0 | | 1.5 | V |
| DOUT Source Current | IOH | VOH = +2.4V | | | 5 | mA |
| LEDO Source Current | IOH | VOH = +2.4V | | | 7.5 | mA |
| DOUT Sink Current | IOL | VOL = +0.4V | | | 5 | mA |



APPLICATION CIRCUIT

