



PRODUCT NAME

TR3001

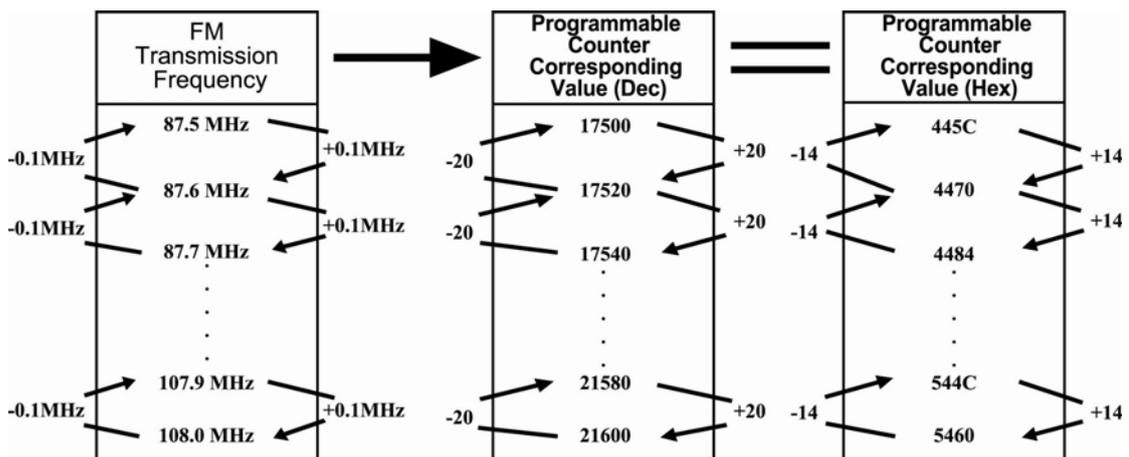
TITLE

1. The relationship between programmable counter settings and FM transmission frequency
2. Flow diagram to adjust FM transmission frequency
3. After turns off FM Transmitter power, method to lower MCU power consumption

APPLICATION NOTE

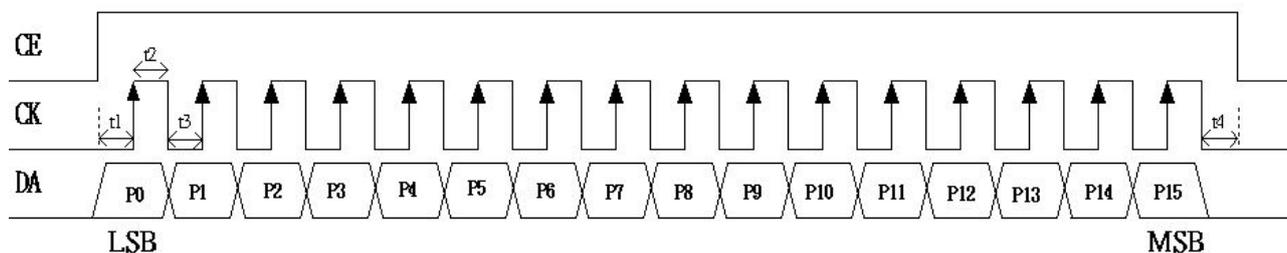
1. The relationship between programmable counter settings and FM transmission frequency:

- (1). TR3001 operation range is $VDD = 2.4V \sim 3.6V$. 1MHz~12MHz crystal may be used.
- (2). FM transmission frequency may be set from 87.5MHz to 108.0 MHz. The emission interval between transmission frequencies is 0.1MHz. There are a total of 206 FM transmission frequencies can be set.
- (3). For FM transmission frequencies between 87.5MHz to 108.0MHz, the required range settings for programmable counter are: 17500~21600. If the intervals of frequencies are $\pm 0.1MHz$, the variations of programmable counter are ± 20 .



(4). Serial data transfer format:

Use the serial I/O of TR3001 to transmit the values of the programmable counter.



- (A). CE signal: There shall be 16 CK clocks included in the time from signal start (upward edge) to signal end (downward edge).
- (B). CK signal: DA signal will be latched inside TR3001 at the downward edge of the CK.
- (C). DA signal: The values of the programmable counter shall be sent first from LSB.
- (D). t1, t2, t3, t4 time : > 4us ◦
- (E). After the 16 bits data were sent, CE & CK & DA signal shall be maintained at low status.

(5). How to calculate the settings of the programmable counter:

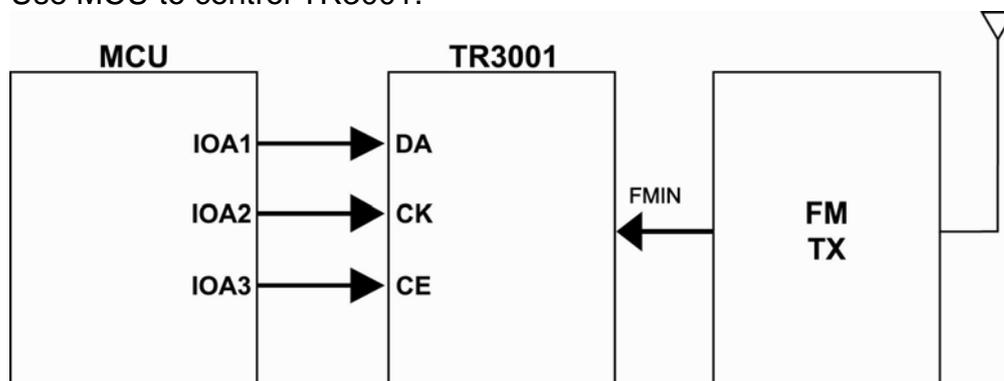
$$[P15.....P0] = N \text{ (Programmable counter settings: } 1600(\text{dec}) < N < 65280 \text{ (dec))}$$

For example:

If $N = 17500$;
 Crystal Frequency = 4MHz;
 Reference Frequency = 4MHz/800 (fixed) = 5kHz
 Synthesis Frequency $f = 5\text{kHz} * N = 5\text{kHz} * 17500$
 $= 87.5\text{MHz}$

(6). Hardware: (as shown in the following block diagram)

Use MCU to control TR3001.



- (7). The following program example uses the 4 bit MCU of tenx technology inc. to control TR3001 and transmit 87.5MHz [445C(hex)] FM frequency signal. (Use IOA port to transmit CE & CK & DA signals. And define IOA3=CE & IOA2=CK & IOA1=DA)

```
.data
    data0 equ 00h           ;define data0 ~ data3 as the values for
                            ;programmable counter
    data1 equ 01h           ;data3 is MSB ; data0 is LSB
    data2 equ 02h
    data3 equ 03h

    serial_signal equ 04h   ;define send out CE, CK, DA signal
    data_times equ 05h
    data_buff0 equ 06h
    data_buff1 equ 07h
    .endd

.code
Start:
    lds data0 , 0CH         ;initialize data0 ~ data3(445C)
    lds data1 , 05H
    lds data2 , 04H
    lds data3 , 04H

    lds serial_signal, 00h ;initialize CE=0,CK=0 and DA=0
    opa serial_signal,    ;send out from IOA port
    spa 1fh

    lds 70H, 00h           ;move data0 register content to data_buff0
                            ;register
    mvl 70H
    mvh 71H
    mvu 70H
    lda# @hl
    sta data_buff0
    lds data_times, 04H    ;code data total 16 bit
    lds data_buff1,04H    ;set data_times *data_buff1=16
    call send_clk

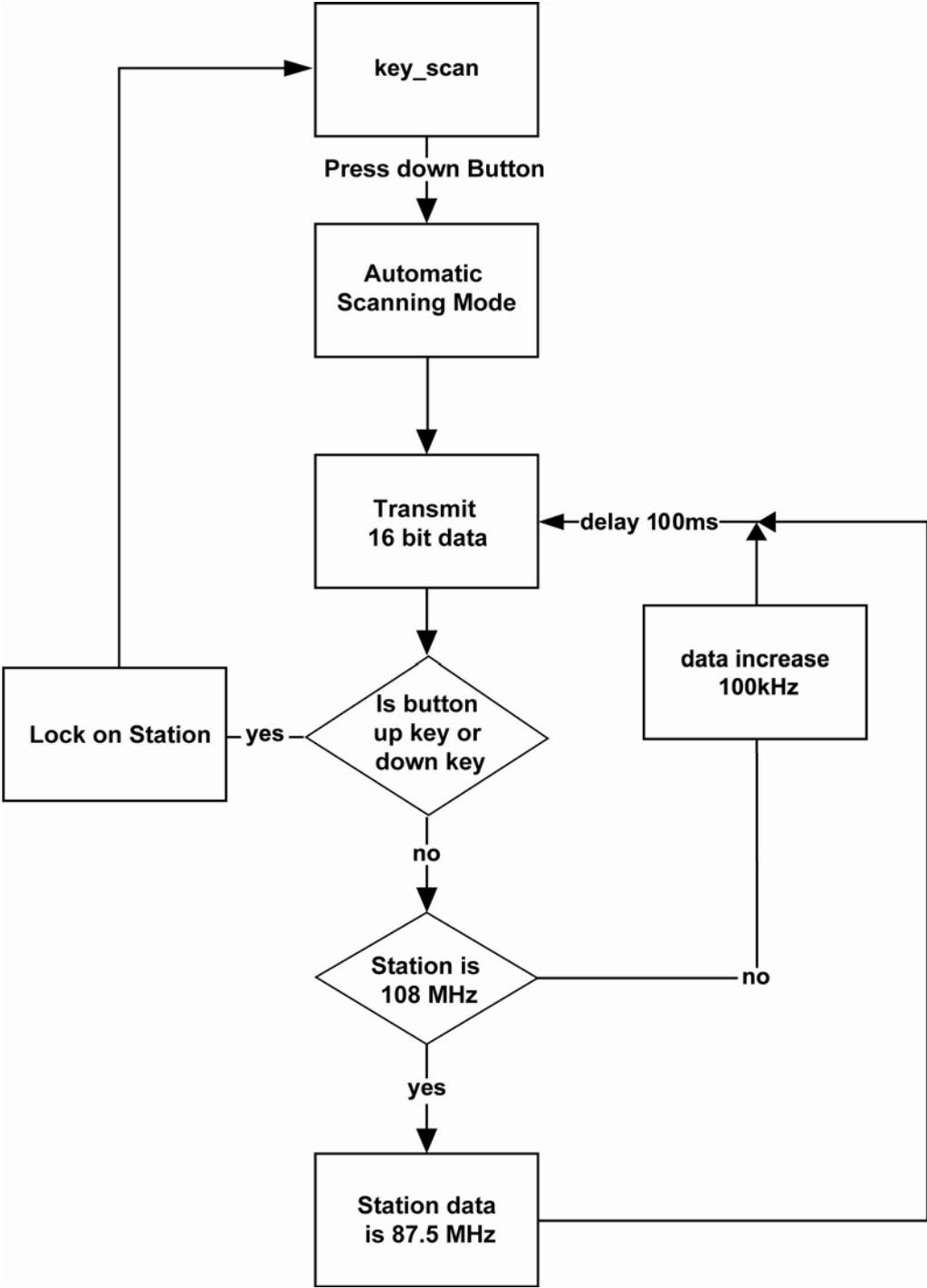
.endc
;*****
,
send_clk:                  ;send_clk subroutine function: use serial mode
                            ;method to send out data0 ~ data3 register
                            ;contents from IOA port

send_clk0:
    lda data_buff0
    jb0 send_clk1
    lds serial_signal,04h
    opa serial_signal
    lds serial_signal,06h
```

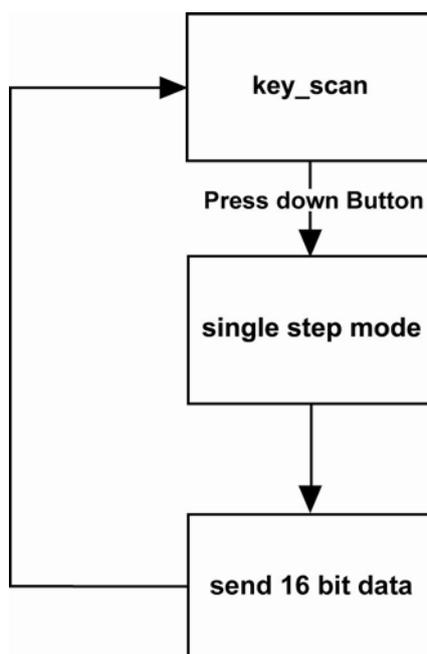
```
    jmp  send_clk2
send_clk1:
    lds  serial_signal,05h
    opa  serial_signal
    lds  serial_signal,07h
    nop
send_clk2:
    dec* data_buff1
    jz   send_clk3
    nop
    nop
    nop
    opa  serial_signal
    sr0  data_buff0
    nop
    nop
    jmp  send_clk0
send_clk3:
    lds  data_buff1,04h
    dec* data_times
    jz   send_clk4
    opa  serial_signal
    lda# @hl
    sta  data_buff0
    nop
    jmp  send_clk0
send_clk4:
    opa  serial_signal
    nop
    nop
    nop
    nop
    nop
    nop
    nop
    lds  70h,04h
    opa  70h
    nop
    nop
    nop
    nop
    nop
    nop
    lds  70h,00h
    opa  70h
    rts
```

2. Flow diagram to adjust FM transmission frequency:

(1). Flow diagram to replace transmission frequency station automatically (Suggested method to change transmission frequency is from 87.5MHz upward to 108.0MHz):



(2). Flow diagram mode to replace 0.1 MHz transmission frequency each time:



3. Set the status of the three signals CE, CK and DA between MCU and TR3001 to "LOW" after turning off FM Transmitter power, this will reduce the unnecessary power consumption on the MCU I/O pins.