



# Application Note

## T-TYPE LED STRUCTURE

Version 1.03

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## 1 Introduction

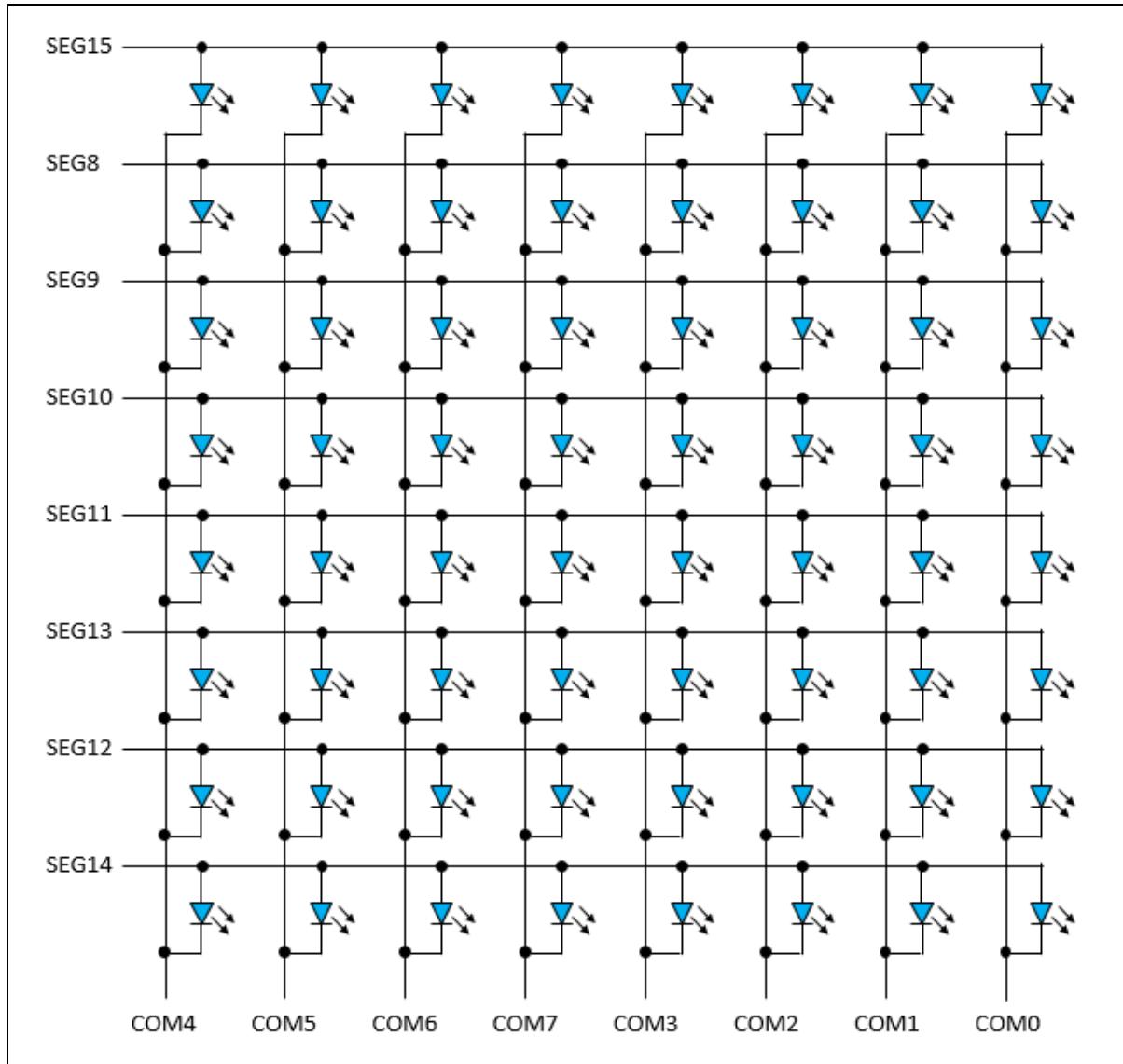
This document describes the T-Type LED structure and how to control it.

1. LED Matrix Structure
  - M-Type Structure
  - T-Type Structure
2. T-Type Structure Control

## 2 LED Matrix Structure

### 2.1 M-Type Structure

: The M-Type structure is composed of physically separated COM/SEG ports. Therefore, In case of 8COM/8SEG configuration, the number of ports is 8+8, and the number of LEDs is 8x8.



**Figure 1. M-Type Structure**

### 2.2 T-Type Structure

: The T-Type structure is physically shares the COM/SEG ports. For this reason, a port running as COM can't act as a SEG. Therefore, In case of 8COM/SEG configuration, the number of ports is 8, and the number of LEDs is 8 x (8-1).

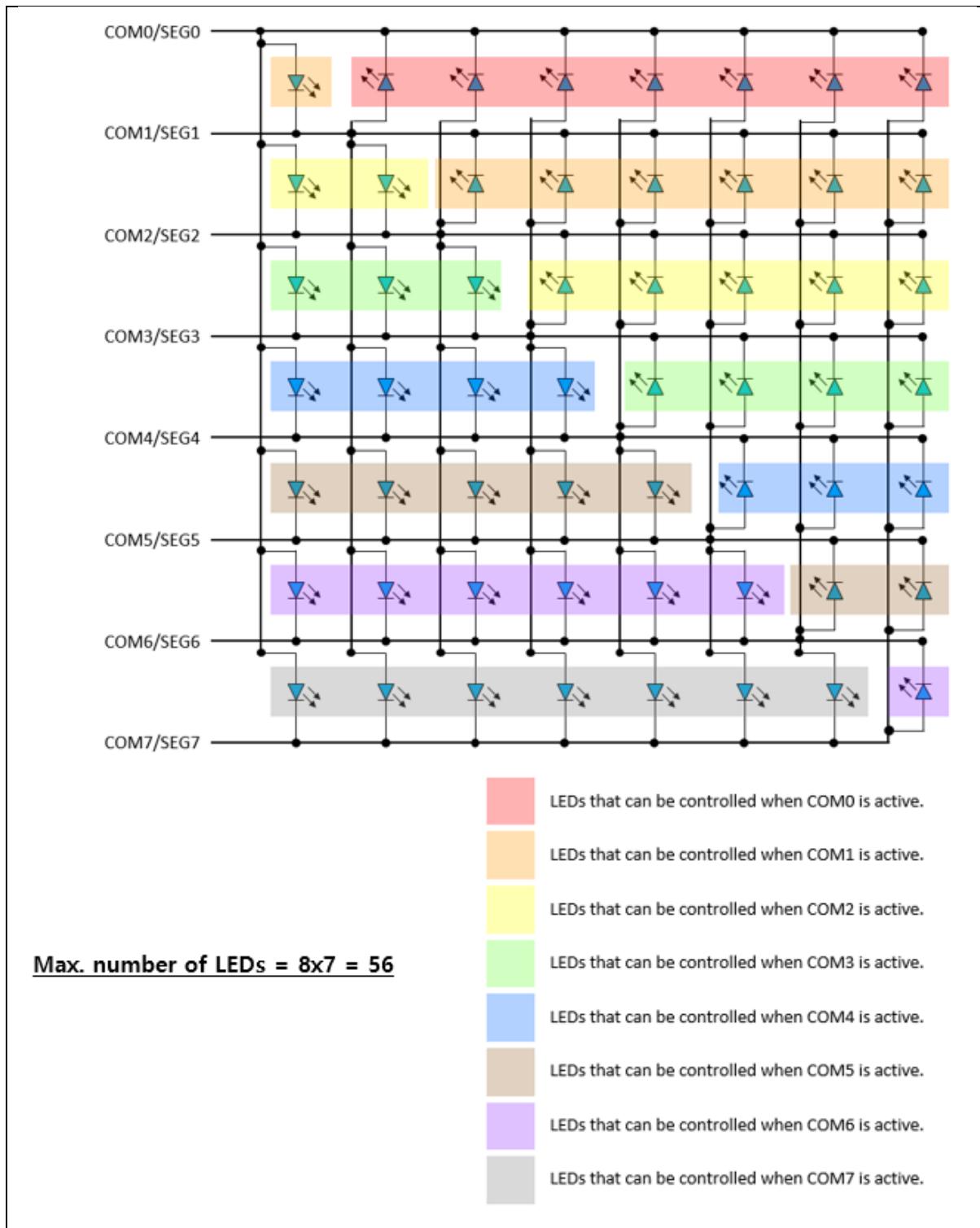
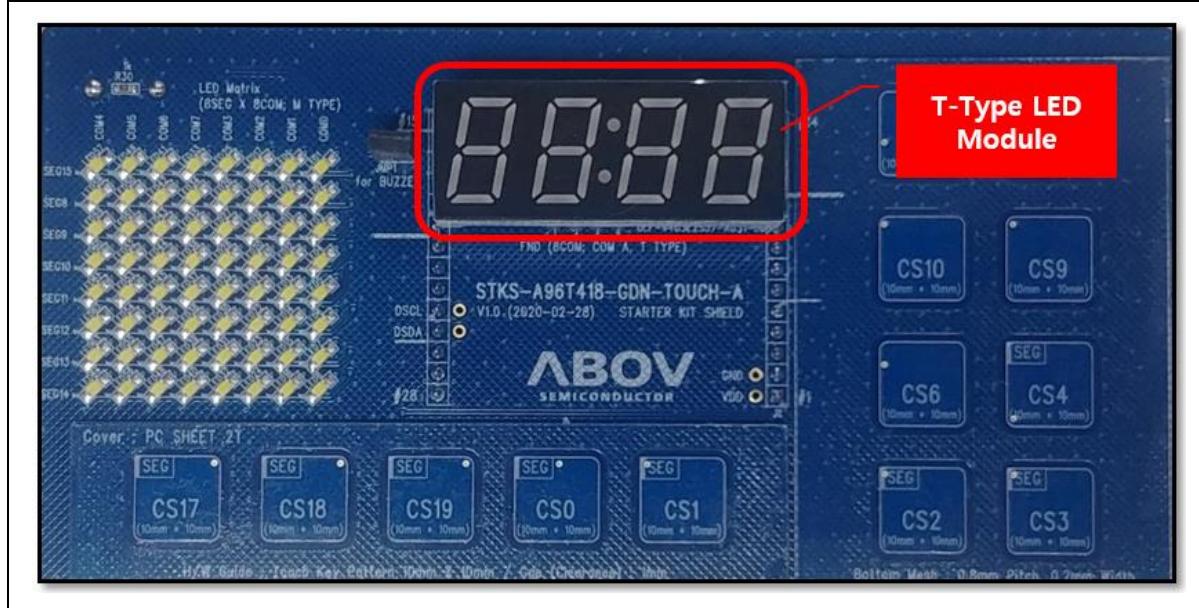


Figure 2. T-Type Structure

### 3 T-Type Structure Control

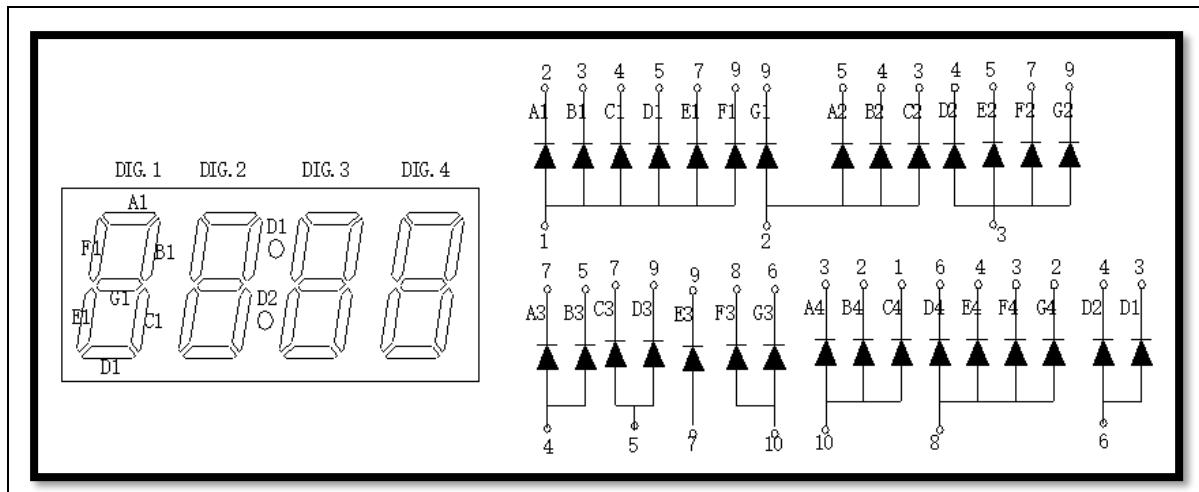
#### 3.1 Hardware Configuration

##### 1. A96T418GDN Shield Board



**Figure 3. T-Type LED Module of the A96T418GDN Shield Board**

##### 2. T-Type LED module pin map



**Figure 4. T-Type LED module pin map**

##### 3. Schematic

- The LED driver of A96T418 is common cathode type IP.
- The T-Type LED module applied to the circuit is the common anode type.
- For all LED segments control, COM3/SEG3 and COM7/SEG7 are double connected to the LED segment module.

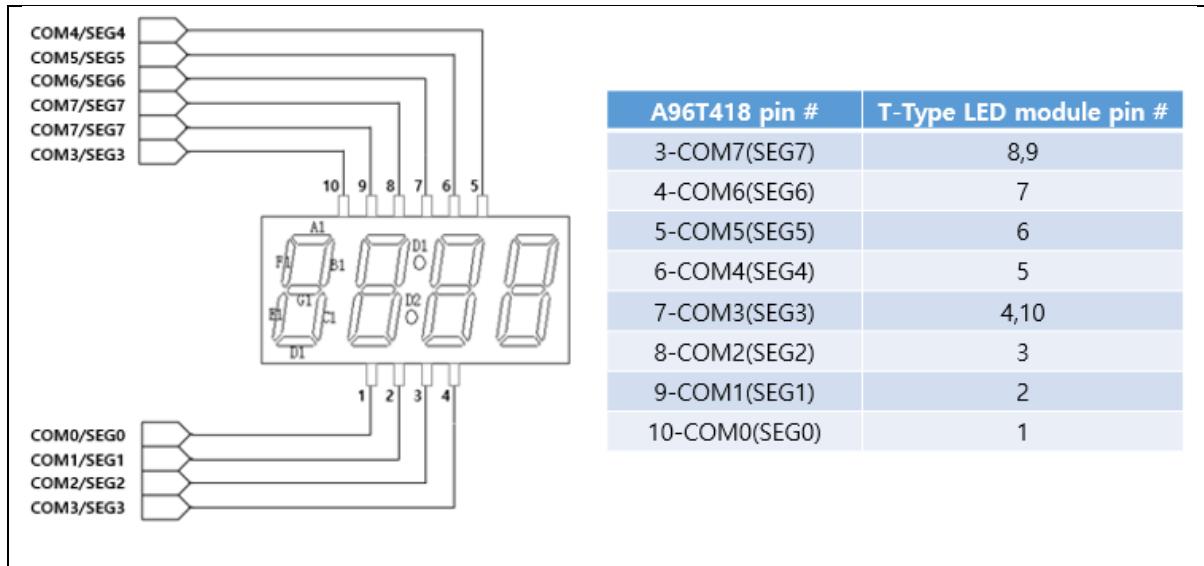


Figure 5. Schematic

### 3.2 Software Control

#### 1. Segment Turn-on Condition

- Example of A1 segment

: A1 segment lights up when SEG0 is high in the COM1 active section

**DIG. 1    DIG. 2    DIG. 3    DIG. 4**

	C0	C1	C2	C3	C4	C5	C6	C7
S0	1	2	3	4,10	5	6	7	8
S1	2		C2	B2	A2		DP1	G1
S2	3			D2	E2		F2	G2
S3	4,10	C4	B4	A4		B3	G3	A3
S4	5						C3	D3
S5	6		H6	H5				
S6	7						E3	
S7	8		G4	F4	E4		D4	

**COM-SEG Control Table**

↑  
SEG #  
LED Mdule Pin #

COM #      LED Mdule Pin #

DIG.1  
DIG.2  
DIG.3  
DIG.4

Figure 6. COM-SEG Control Table

## 2. Program Structure

## A. user.h

: define the SEG bit for each segment.

SEG #		C0	C1	C2
	SEG #	COM-S		
#define A1 BIT(0)	S0	1	2	
#define B1 BIT(0)	S1	2		C
#define C1 BIT(0)	S2	3		
#define D1 BIT(0)	S3	4,10	C4	B4
#define E1 BIT(0)	S4	5		A
#define F1 BIT(0)	S5	6		
#define G1 BIT(1)	S6	7		
#define A2 BIT(1)	S7	8	G4	I
#define B2 BIT(1)				
#define C2 BIT(1)				
#define D2 BIT(2)				
#define E2 BIT(2)				
#define F2 BIT(2)				
#define G2 BIT(2)				
#define A3 BIT(3)				
#define B3 BIT(3)				
#define C3 BIT(4)				
#define D3 BIT(4)				
#define E3 BIT(6)				
#define F3 BIT(3)				
#define G3 BIT(3)				
#define A4 BIT(3)				
#define B4 BIT(3)				
#define C4 BIT(3)				
#define D4 BIT(7)				
#define E4 BIT(7)				
#define F4 BIT(7)				
#define G4 BIT(7)				

Figure 7. SEG bit definition

## B. user.c

## 1. Control Table For 4-digit

: For each of the 4-digit, a table that can display 10 numbers (0 to 9) may be required.

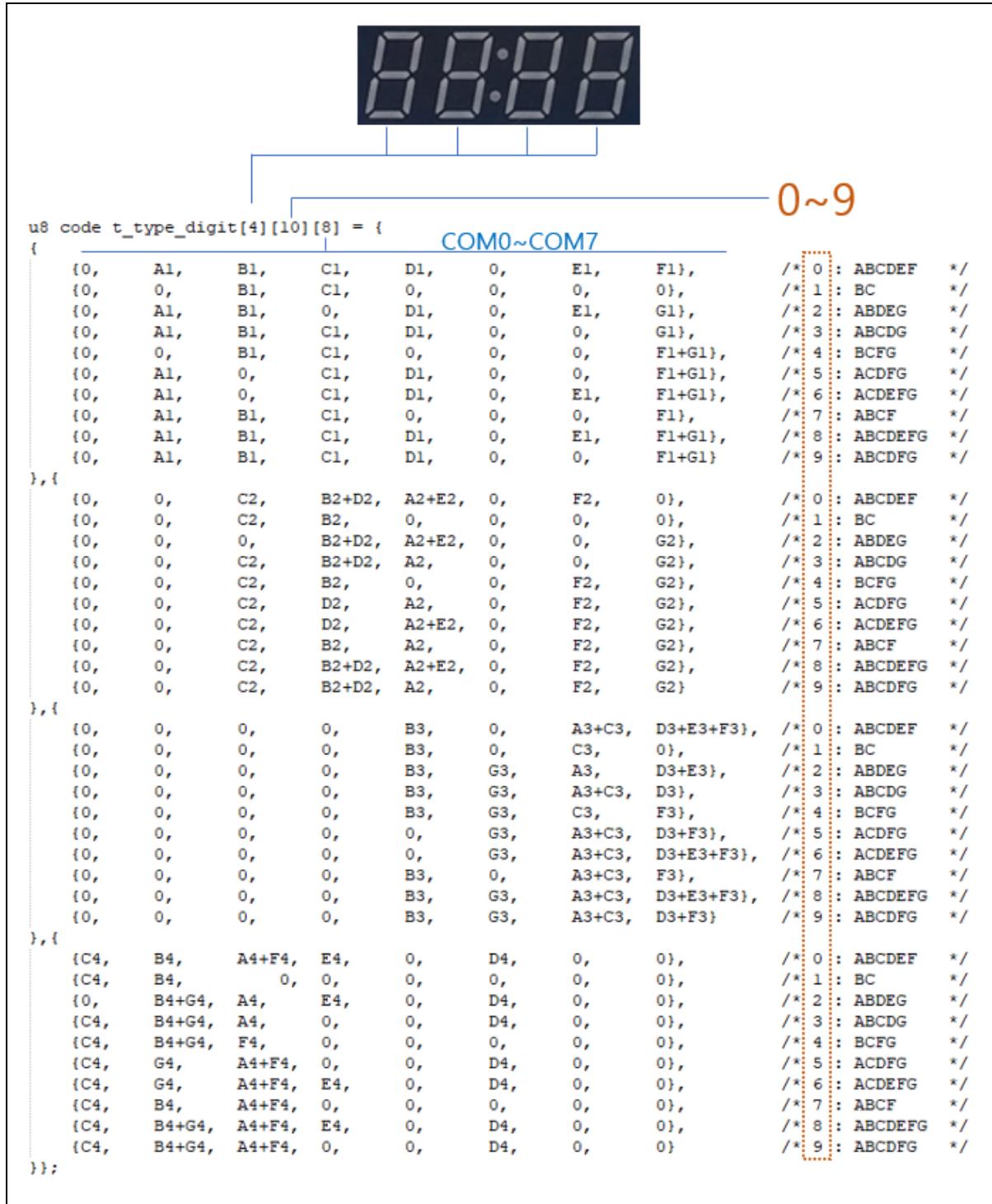


Figure 8. Control table for 4-digit

## 2. Control Code

: For 8 COM sections, each SEG output value is ORed.

```

void LED_Renew_Data(void)
{
    u8 seg_low[8];
    u8 seg_high[8];
    u8 *disp_addr;
    u8 digit[4];

    u8 com_idx;
    u8 num_idx;

    disp_addr = (u8*) (&DISPLAYRAM0L);

    /****** clear led data *****/
    for (com_idx = 0; com_idx < 8; com_idx++)
    {
        seg_high[com_idx] = 0;
        seg_low[com_idx] = 0;
    }

    #if (1)
    /****** T-TYPE 4DIGIT 7-SEGMENT *****/
    for (num_idx = 0; num_idx < 4; num_idx++)
    {
        digit[num_idx] = ((ts.detect_key>>(num_idx*4)) & 0x0f);
    }
    for (num_idx = 0; num_idx < 4; num_idx++) /* 4DIGIT */
    {
        for (com_idx = 0; com_idx < 8; com_idx++) /* COM0~7 */
        {
            seg_low[com_idx] |= t_type_digit[num_idx][digit[num_idx]][com_idx];
        }
    }
    #endif

    /****** M-TYPE 8x8 : '0'~'C' display *****/
    for (num_idx = 0; num_idx < 13; num_idx++)
    {
        if (ts.detect_flag & BIT(num_idx))
        {
            break;
        }
    }
    for (com_idx = 0; com_idx < 8; com_idx++) /* COM0~7 */
    {
        seg_high[com_idx] |= m_type_digit[num_idx][com_idx];
    }

    /****** renew led data *****/
    for (com_idx = 0; com_idx < 8; com_idx++)
    {
        *(disp_addr+com_idx*2+1) = seg_high[com_idx]; Display RAM update
        *(disp_addr+com_idx*2+0) = seg_low[com_idx];
    }
}

```

For 8 COM sections,  
each SEG output value is ORed

Figure 9. Control Code

## Revision history

Date	Revision	Description
20.04.10	1.00	Document created
21.01.04	1.01	Variable name & Function name modified
22.11.01	1.02	Revised the font of this document
24.12.02	1.03	Updated the disclaimer.

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