TOSHIBA LED DOTMATRIX MODULE

TLMM514A1U

1. FEATURES

- Thin, lightweight.
- High operation speed. (Single phase clock : 30MHz, Dual phase : 2×20MHz)
- High heat radiation design.
- Multiple colors. (Red, Green, Amber)
- Controllable 256 gradient by 8bit color data. (65,536 colors)
- Brightness intensity control for each LED module by switches.

2. APPLICATIONS

- Departure / arrival schedules in stations and air ports
- Various display boards used in public facilities such as hospitals, hotels, schools, and wedding reception halls
- Event information board in department stores, etc.
- Various message boards in factories and office
- Various numeric information boards in stockbroking firms, etc.
- Information display board for inside and outside of trains

3. ORGANIZATION

ITEM	CONTENT	ITEM		CONTENT
Color	RED, GREEN, AMBER	Weight (Typ.)		400g
Dot Size	ϕ3mm	Current Consumption (V_{CC}=5V)	Logic	0.4A
Dot Pitch	4mm		LED	8.0A *
Number of Dots	1024	Using LED Lamp		—

* All LEDs light.

4. MAXIMUM RATINGS (Ta = 25°C)

ITEM	SYMBOL	CONDITION	UNIT
Power Supply Voltage	V_{CC1}	7	V
	V_{CC2}	5.25	
Clock Frequency	f	30 (single phase)	MHz
	f	20 (dual phase)	MHz
Input Voltage	V_{IN}	$-0.3 \sim V_{CC1}+0.3$	V
Operating Temperature	T_{opr}	$-10 \sim 60$	°C
Storage Temperature	T_{stg}	$-20 \sim 85$	°C

5. BRIGHTNESS (INITIAL)

COLOR	VALUE
RED	$130 \pm 20 cd/m^2$
GREEN	$130 \pm 20 cd/m^2$

* Refer to 11.

6. RECOMMENDABLE OPERATING CONDITION

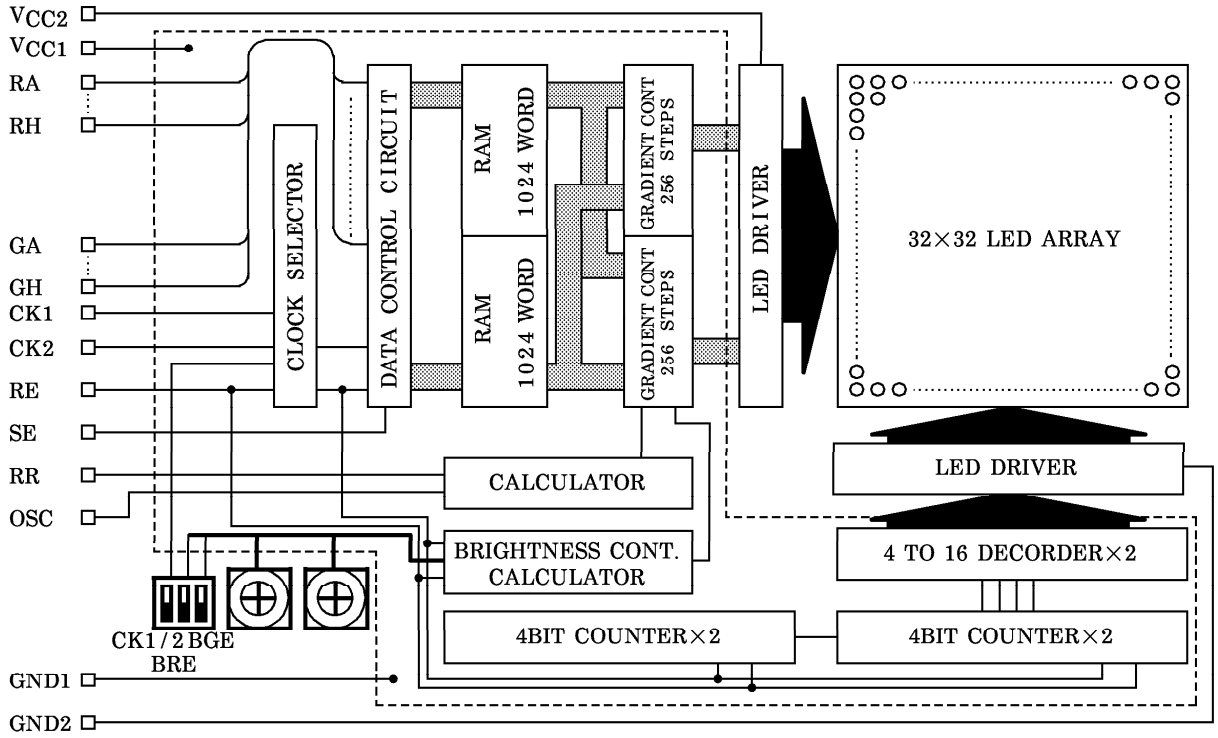
ITEM	SYMBOL	CONDITION	UNIT
Supply Voltage	V_{CC1}	$5 \pm 5\%$	V
	V_{CC2}	5	
Operating Temperature	T_{opr}	0~50	°C

7. INPUT LEVEL

ITEM	SYMBOL	MIX.	TYP.	MAX.	UNIT
"L" Level Input	V_{IL}	—	—	0.8	V
"H" Level Input	V_{IH}	2.2	—	—	

* All the inputs are pulled up by the resistance of 100kΩ.

8. BLOCK DIAGRAM



9. FUNCTION EXPLANATION

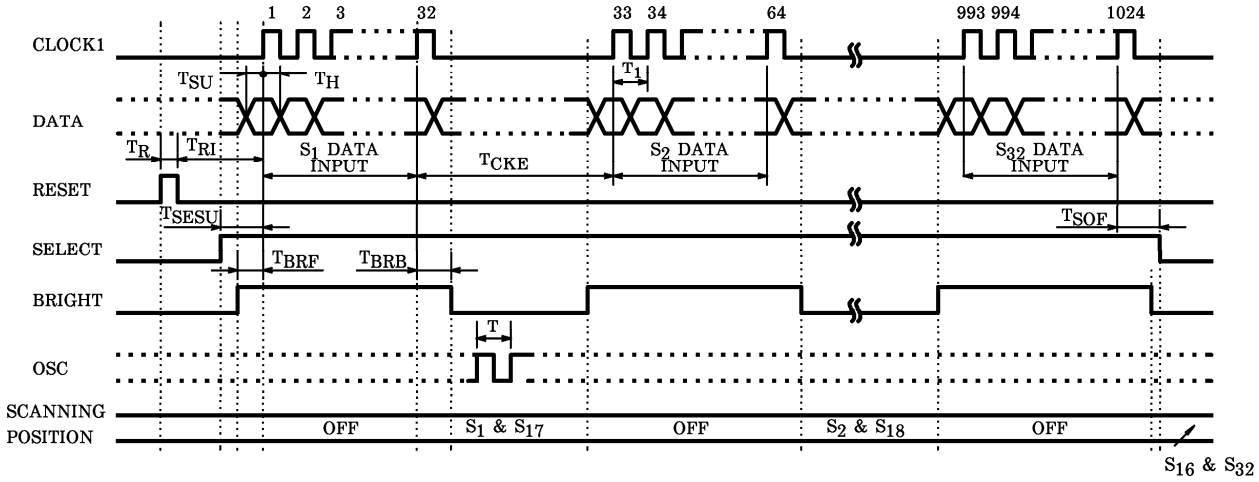
- V_{CC1} : Power supply for Logic
- V_{CC2} : Power supply for LEDs
- GND1 : Ground for the Logic
- GND2 : Ground for the LED
- RED DATA (RA-RH) : Red data with the clock signal
- GREEN DATA (GA-GH) : Green data with the clock signal
- SELECT (SE) : Signal to select the data for display
  "H" : Display off
  "L" : Display on
- BRIGHT (BR) : Signal to select display on / off time
  "H" : Display off
  "L" : Display on
- CLOCK1 * (CK1) : Clock signal for data input and column scanning
- CLOCK2 * (CK2) : Clock signal for data input and column scanning

- OSC : Signal to use brightness control and gradient control (without synchronized)
- RESET (RE) : Signal to Initialize for lighting position (column)

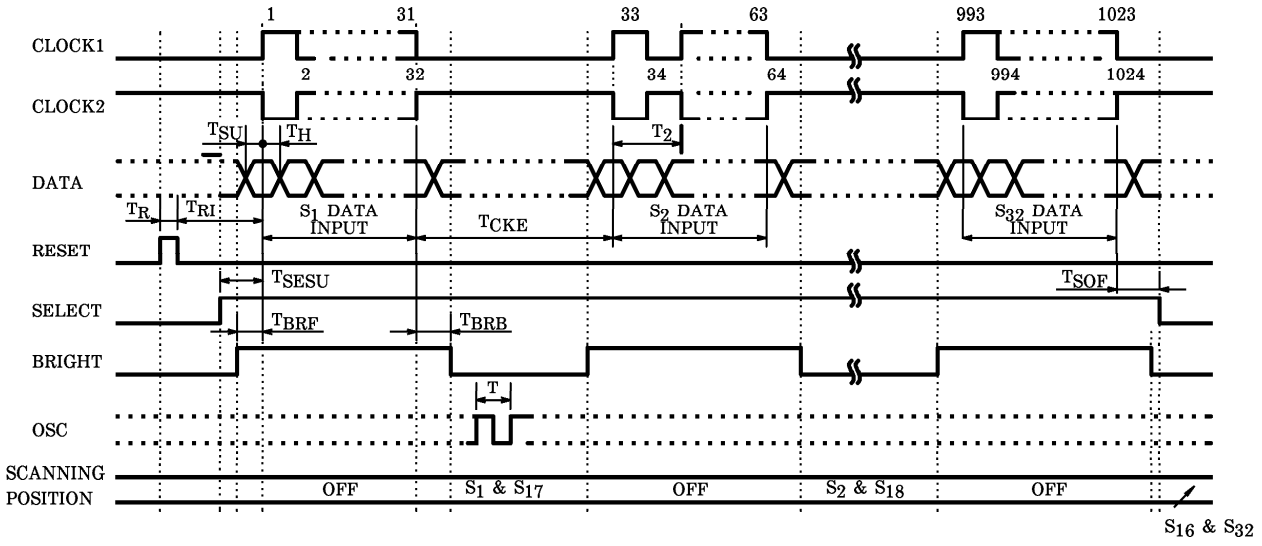
* CLOCK : CLOCK2 is only used for the dual phase mode. When the dual phase mode, setting SW_3 (CK1 / 2) is ON position. When the single phase mode, input "H" or "L" level to CLOCK 2 and setting SW_3 (CK1 / 2) is OFF position (initial setting position).

10. TIMING CHART

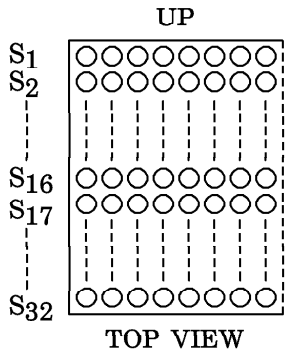
(A) Single phase input (CK2="H" or "L")



(B) Duale phase input



* The phase can be switched to a single-phase or dual-phase using SW3-1 (CK1 / 2)
Single-phase : OFF (set at delivery) Dual-phase : ON



ITEM	SYMBOL	MIN. (ns)	MAX. (ns)
Clock Frequency (Dr=1/2)	T	33.3	—
Clock Frequency (Dr=1/2)	T_1	33.3 Note 1	—
Clock Frequency (Dr=1/2)	T_2	50 Note 2	—
Data Set Up Time	T_{SU}	10	—
Data Hold Time	T_H	20	—
Clock Enable Time	T_{CKE}	Note 3	—
Reset Set Up Time	T_{RI}	20	—
Reset Hold Time	T_R	20	—
Select Set Up Time	T_{SESU}	20	—
Select Off Time	T_{SOF}	20	—
Bright Input Time (Front)	T_{BRF}	Note 4	—
Bright Input Time (Back)	T_{BRB}	100	—

Note : 1) Applied to CK1 at single-phase input (CK2 is fixed to "H" or "L")
2) Applied to CK1 and CK2 at dual-phase input
3) The LED ON time (brightness) is determined by the time of $T_{CKE} - (T_{BRF} + T_{BRB})$ and it is recommended to normally ensure 20μs or more.
4) Determine T_{BRF} based on the following expression.
$T_{BRF}(\mu s) = 0$
$T_{BRF}(\mu s) = 7 - 31 \times T_1$ (single-phase)
$T_{BRF}(\mu s) = 7 - 15.5 \times T_2$ (dual-phase)

11. SURFACE BRIGHTNESS ADJUSTMENT

Since the surface brightness of red and green has been applied to this product at delivery, brightness differences among products are minimized when multiple products are used on one surface.
However, since the following operation conditions must be satisfied in order to fully utilize the surface brightness adjustment function, the conditions must be taken into account at circuit design.

A) Number of horizontal scanning lines : 256 lines or more

Number of horizontal scanning lines from a reset signal to the nest reset signal.
When the number of scanning lines does not reach 256, the surface brightness adjustment control does not function and the light may come on at the maximum brightness (or may not come on at all) according to the value set for the surface brightness adjustment switch.
If 512 or more horizontal scanning lines can be prepared, the permissible value of the surface brightness compensation value can be reduced by half.

B) Prohibition of changing the number of scanning lines during display operation or data write operation

If the number of scanning lines has to be changed, caution is necessary since an abnormality occurs in the surface brightness during two reset periods including the reset period at change.
Display returns to normal after these periods.

Note : Display during two reset periods becomes abnormal immediately after power supply connection regardless of the conditions described above.

The adjustment of brightness intensity

The adjustment step is different between the following conditions.

a) The scanning times of LED module are from 16 to 31.

The IFC works 16 steps for each color with higher 4bits of control switch, when the lowest bit don't work.

b) The scanning times of LED module are more than 32.

The IFC works 32 steps for each color with 5bits of control switch.

<Measurement conditions of brightness intensity (Ta=25°C)>

Input

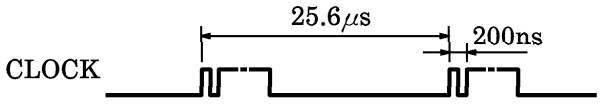
V_{CC1} : 5V
V_{CC2} : 5V
BRIGHT : "L" level
RESET : Frequency=76Hz, T_R=3.2

Measure equipment and conditions

Equipment : BM-820D (TOPCON Ltd.) Respons switch is slow position.
Distance : 2500 mm (between LED surface and detector top)
Timing : Measurement timing is after 2s from lighting of LED module.

<Measurement condition of total brightness (Ta=25°C)>

- Input



V_{CC1} : 5V
V_{CC2} : 5V
OSC : 5MHz
BRIGHT : L level
RESET : Frequency=76Hz, T_R=3.2μs

- Measurement equipment

  BM-820D (TOPCON Ltd.)-Respons switch set to slow.

- Distance

  2500mm (From LED top to ditector's top)

- Measurement

  Measurement 2s after LED power is switched on.

  <Surface Brightness Adjustment Switches>

  SW1 (BR) : Low-order 4 bits for red surface brightness compensation (decoding switch)

  SW2 (BG) : Low-order 4 bits for green surface brightness compensation (decoding switch)

  SW3-No.2 (BRE) : Highest bit for red surface brightness compensation

  SW3-No.1 (BGE) : Highest bit for green surface brightness compensation

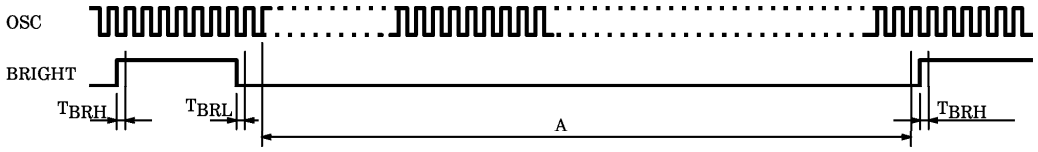
  *Adjustment

  Number of horizontal scanning lines

  256 : Brightest when SW1 and SW2 are set to "0" and SW3 is set to "OFF".
  SW3 "OFF" : 8-step adjustments are enabled by the decoding switches.
  SW3 "ON" : Further 8-step adjustments are enabled by the decoding switches.

  512 : Brightest when SW1 and SW2 are set to "0" and SW3 is set to "OFF".
  SW3 "OFF" : 16-step adjustments are enabled by the decoding switches.
  SW3 "ON" : Further 16-step adjustments are enabled by the decoding switches.

12. GRADATION OPERATION



T_{BRH} : 10ns (MIN.) T_{BRL} : 10ns (MIN.)

This product performs gradation control based on the experession shown below and can control up to 256 gradations for each dot and each color. Gradation operation is calculated based on the OSC clock and since the result is feed back, desplay output canot be obtained unless there is pulse input to OSC. Therefore, even if gradation operation is not required (the entire data is set to "H" or "L" display), pulse to OSC must be input.

$(n \times DATA) \div 256 = m$

n : Number of OSCs of first transition within time A
Since OSC and BR are synchronized within the module and counting starts, the first OSC after termination of BR will not be counted.

DATA : Gradation data of red, green, (input data RA to RH, GA to GH)

m : Number of OSC counts at gradation

Note : 1) When the cycle of the BRIGHT (BR) signal is changed, normal gradation operation is not performed for one cycle of the BR that has been changed.

2) In the existing Toshiba module, a signal is generated by composing the BR signasl and RESET (RE).
In this module, since the period while BR is set to "L" is impotant in gradation operation, RE composite processing must not be perfomed.
In the existing module drive circuit example, the BR signal is stopped at generation of a reset pulse.
In this way, the LED (first line) that displays data immediately after reset does not indicate normal gradation operation.
Therefore, design the circuit so that BR is continuously sent at a regular cycle.

13. PIN CONNECTIONS

<Connector>

CN1 : FCN214Q040-G/0 (FUJITSU Ltd.)

CN2 : B8P-VH (J.S.T MANUFACTURING Co., Ltd.)

CN3 : 53253-0410 (MOLEX (JAPAN) Ltd.)

CN4 : 53253-0410 (MOLEX (JAPAN) Ltd.)

<Connection>

CN1

No.	PIN NAME	No.	PIN NAME	No.	PIN NAME	No.	PIN NAME
1	GND1	11	GND1	21	GND1	31	GND1
2	RED DATA A	12	RED DATA F	22	GREEN DATA C	32	GREEN DATA H
3	GND1	13	GND1	23	GND1	33	GND1
4	RED DATA B	14	RED DATA G	24	GREEN DATA D	34	CLOCK1
5	GND1	15	GND1	25	GND1	35	GND1
6	RED DATA C	16	RED DATA H	26	GREEN DATA E	36	CLOCK2
7	GND1	17	GND1	27	GND1	37	GND1
8	RED DATA D	18	GREEN DATA A	28	GREEN DATA F	38	OSC
9	GND1	19	GND1	29	GND1	39	GND1
10	RED DATA E	20	GREEN DATA B	30	GREEN DATA G	40	BRIGHT

CN2

No.	PIN NAME	No.	PIN NAME
1	GND1	5	V_{CC2}
2	GND2	6	V_{CC2}
3	GND2	7	V_{CC2}
4	GND2	8	V_{CC1}

CN3, CN4

No.	PIN NAME	No.	PIN NAME
1	GND1	3	GND1
2	SELECT	4	RESET

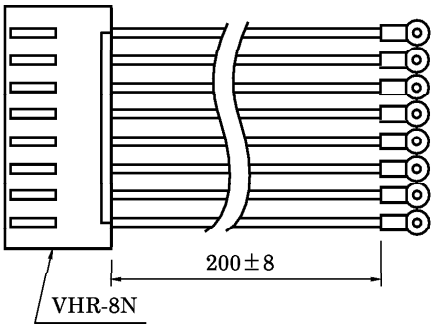
14. ACCESSORIES

<Power supply cable> : AC556 ..... for CN2

<Signal (SELECT, RESET) cable> : AC574 ..... for CN3 and CN4

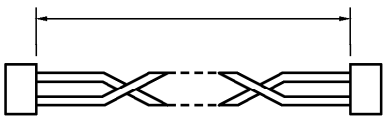
<Connecter for CN1> : AC575 * ..... for CN1

TYPE No. AC556



VHR-8N (J.S.T MANUFACTURING Co., Ltd.)

TYPE No. AC574

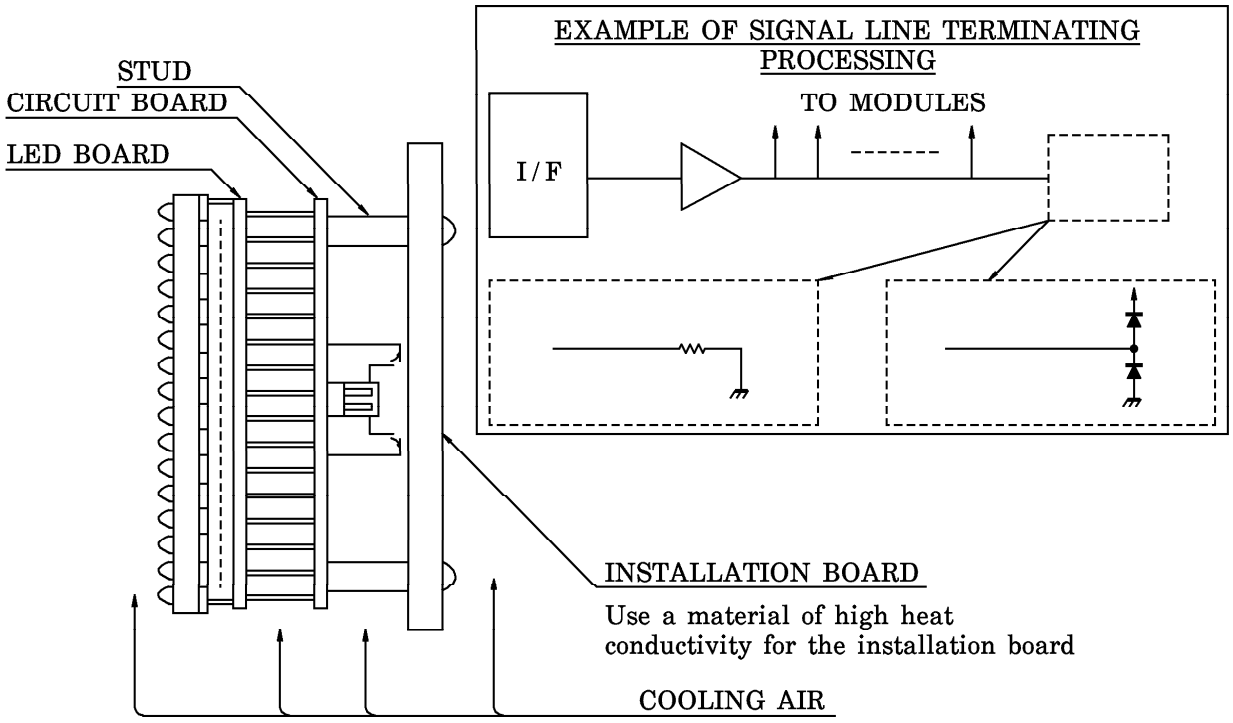


* TYPE No.575 is FCN-217J040-G/0 (FUJITSU Ltd.). for CN1, and 50psc is the standerd unit at receive an order, so, an integer number of 50pcs is requestedat the press order.

15. PRECAUTION

- When many modules are used by combining them, utmost care is necessary with regard to gradation.

  Note : Apply forced air conditioning in order to maintain the surface temperature of LED to 70°C or less. Ensure the design is such that there will be no voltage differences among modules in order to maintain operational stability.
- Do not drop the module because it may be deformed by any such large impact force.
- The reflection board can be easily scratched so do not touch it with any sharp material or hard objects.
- Since an operation error may occur due to electrical noise if the module is operated at a high frequency, use a twisted wire or a shield wire, or carry out terminating processing.
- When power is supplied to V_{CC1} without supply of power to V_{CC2} or a signal is input without supplying power to V_{CC1} or V_{CC2}, LED comes on. In this case, it is recommended to set the BRIGHT input to the "H" level forcibly. (The brightness varies according to the number of data items displayed in one module.)
  Even if this processing is not performed, there is no adverse influence on the performance of the product.
- Caution is necessary at power connection / disconnection of each device, including adjustment time, so that the CLOCK signal does not become no-input while a voltage is applied to the module. (When the CLOCK signal is in a non-input state, display scan is not performed so that DC ON may occur in LED due to the high current.)



COOLING EXAMPLE

16. DIMENSIONS

Unit in mm
Tolerance is ±0.3