

## DESCRIPTION

PT6302 is a dot matrix VFD Driver/Controller IC utilizing CMOS Technology specially designed to display characters, numerals, and symbols. PT6302 provides 35 dot matrix, 2 additional segment drivers and 16 grid drivers. 248 types of character data (CGROM), 8 types of character data (CGRAM), 16 display digits x 2 bits symbol data, 16 display digits x 8 bits register for character data display and 2 general output bits for static operation are provided. Pin assignments and application circuit are optimized for easy PCB layout and cost saving advantages.

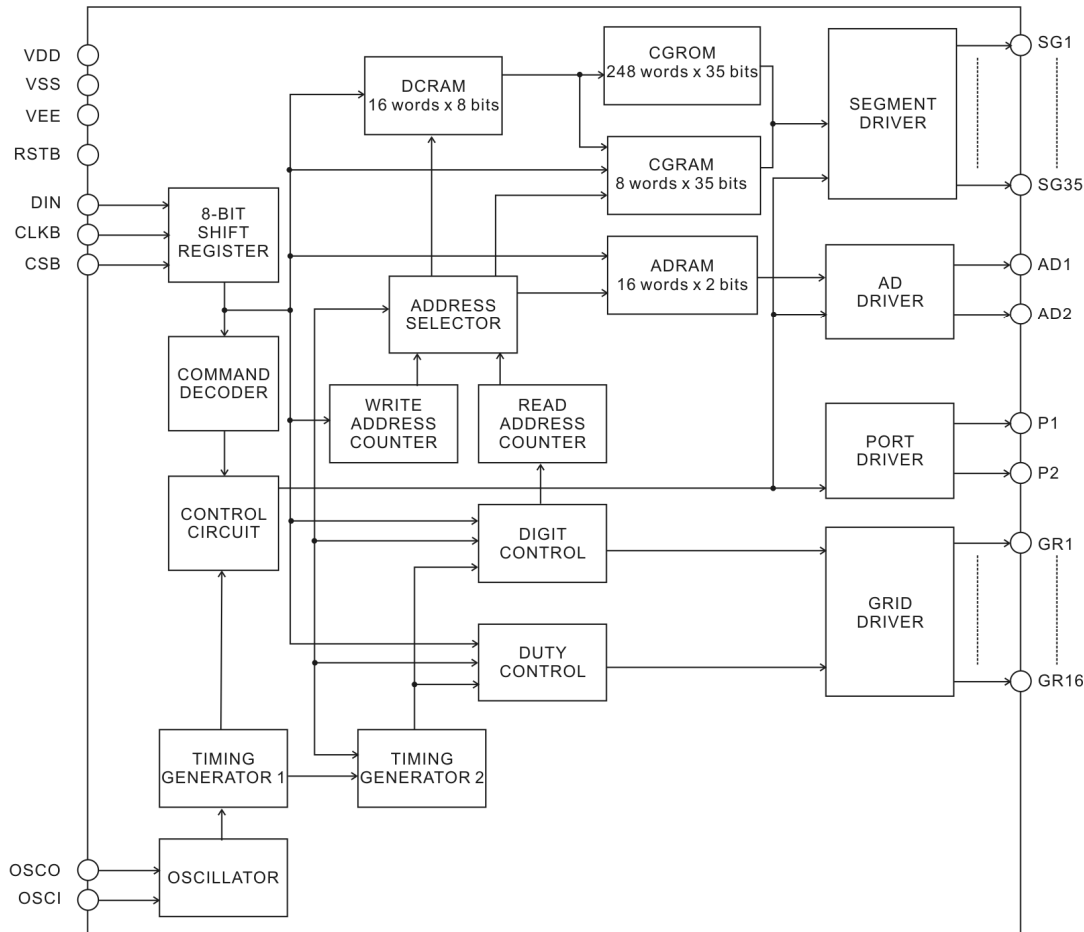
## APPLICATIONS

- Microcontroller peripheral device
- Audio/Video equipment

## FEATURES

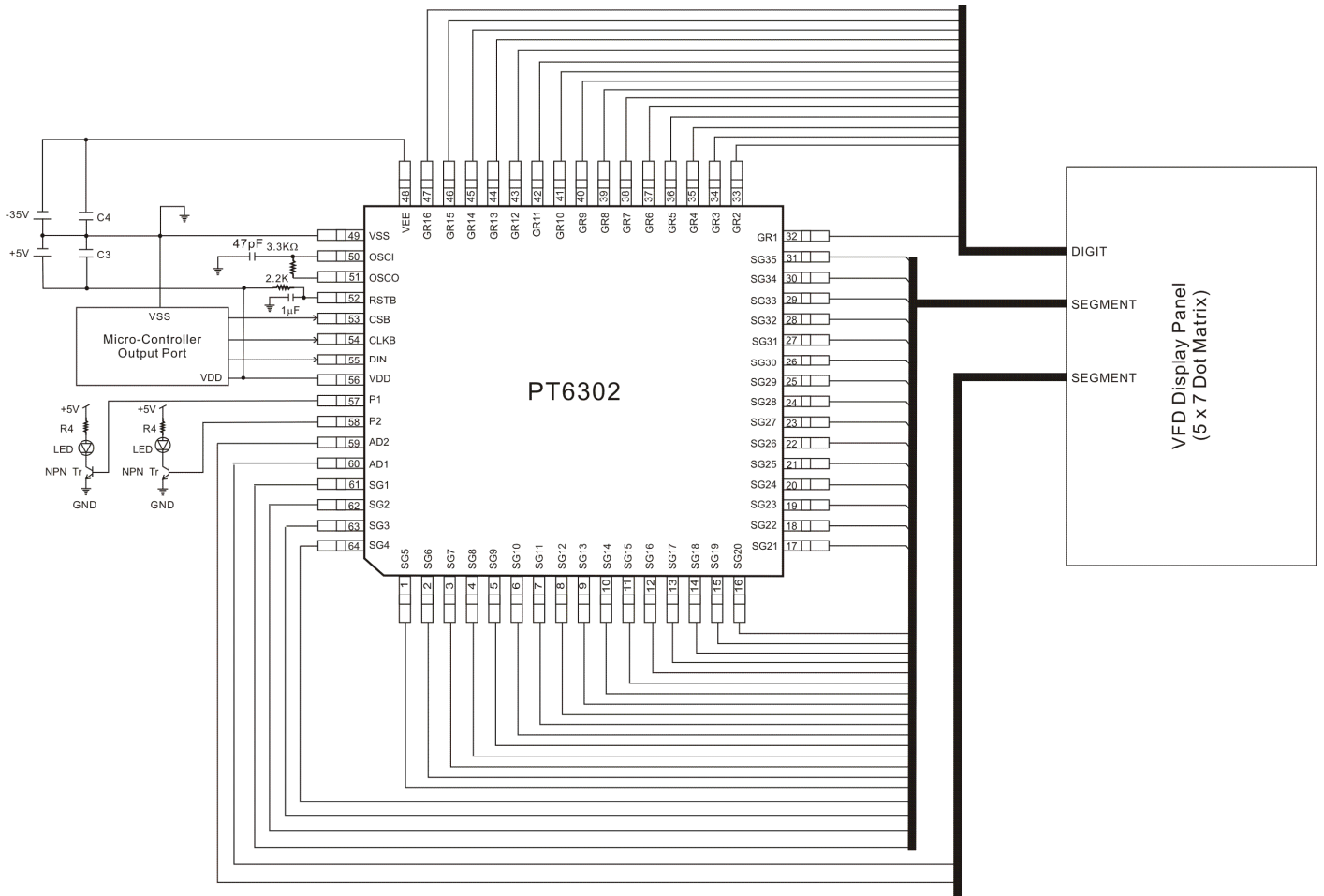
- CMOS technology
- Logic power supply: VDD=3.3V±10% or 5.0V±10%
- VFD drive power supply: VEE=-20V to -35V
- Built-in oscillation circuit (External RC)
- One-byte instruction execution (not including Data Write to RAM)
- Microcontroller interface
- Display contents:
  - Character generator ROM (CGROM): 5x7 Dots (248 Character data types)
  - Character generator RAM (CGRAM): 5x7 Dots (8 Character data types)
  - Additional data RAM (ADRAM): 16 Display digits x 2 Bits (Symbol data)
  - Data control RAM (DCRAM): 16 Display digits x 8 Bits (Character data display register)
  - General output port: 2 bits (Static operation)
- Display control function:
  - Display digits: 9 to 16 digits
  - Display duty (Contrast adjustment): 8 stages
  - All display lights: ON/OFF mode

## BLOCK DIAGRAM





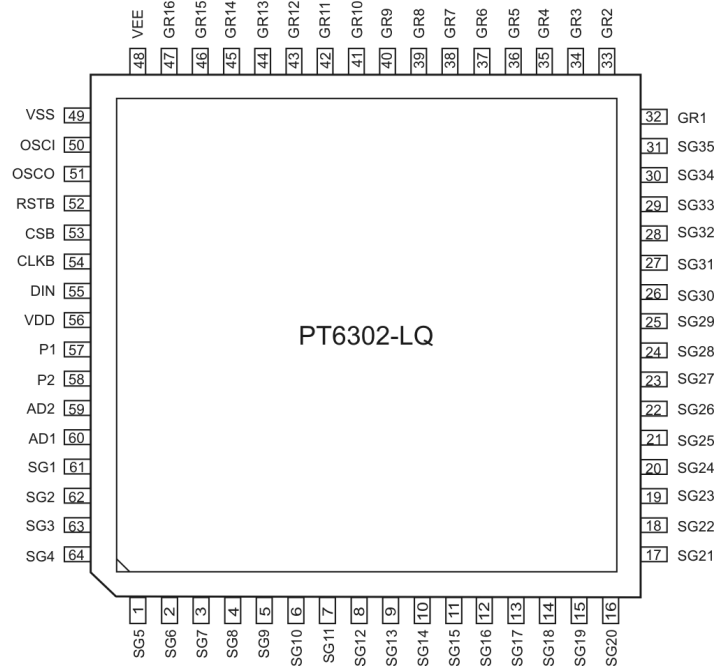
# APPLICATION CIRCUIT



## ORDER INFORMATION

Valid Part Number	Package Type	Top Code
PT6302LQ-001	64 pins, LQFP	PT6302LQ-001
PT6302LQ-002	64 pins, LQFP	PT6302LQ-002
PT6302LQ-003	64 pins, LQFP	PT6302LQ-003
PT6302LQ-005	64 pins, LQFP	PT6302LQ-005
PT6302LQ-006	64 pins, LQFP	PT6302LQ-006
PT6302LQ-007	64 pins, LQFP	PT6302LQ-007

## PIN CONFIGURATION

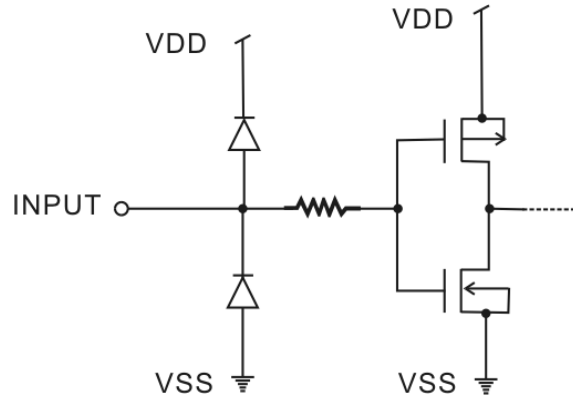


## PIN DESCRIPTION

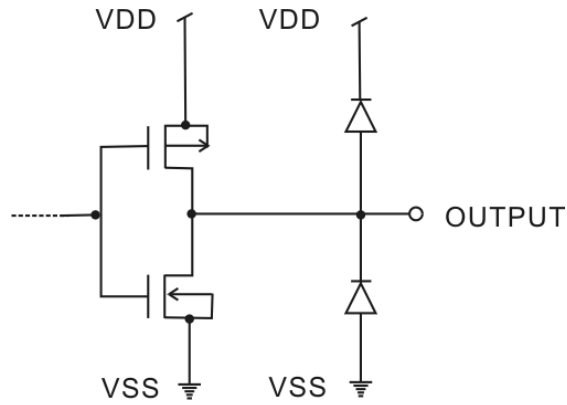
Pin Name	I/O	Description	Pin No.
SG5 to SG35 SG4 to SG1	O	Segment driver output pin	1 ~ 31 64 ~ 61
GR1 to GR16	O	Grid driver output pin	32 ~ 47
VEE	-	Power supply	48
VSS	-	Ground pin	49
OSCI	I	Oscillator input pin	50
OSCO	O	Oscillator output pin	51
RSTB	I	Reset input pin When this pin is set to "LOW", all functions are initialized.	52
CSB	I	Chip select input pin When this pin is set to "High" Level, the serial data transfer is disabled.	53
CLKB	I	Shift clock input pin The serial data is shifted at the rising edge of CLKB.	54
DIN	I	Serial data input pin	55
VDD	-	Positive power supply	56
P1 to P2	O	General purpose output pin	57 ~ 58
AD2 to AD1	O	Segment driver output pin	59 ~ 60

# INPUT & OUTPUT CONFIGURATION

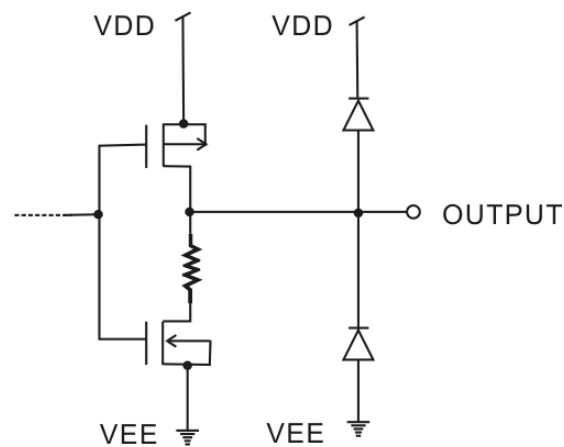
## LOGIC INPUT PINS



## LOGIC OUTPUT PINS



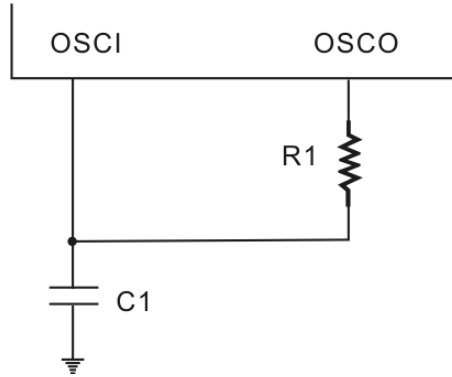
## DRIVER OUTPUT PINS



## FUNCTION DESCRIPTION

### OSCILLATION CIRCUIT

An oscillation circuit may be constructed by connecting external Resistor (R1) and Capacitor (C1) between the oscillator pins -- OSCO and OSCI. The RC time constant depends on the value of VDD voltage used. The target oscillation frequency is 2MHz. Please refer to the diagram below.

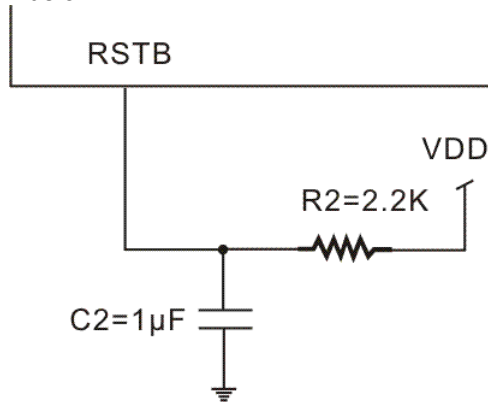


### RESET FUNCTION

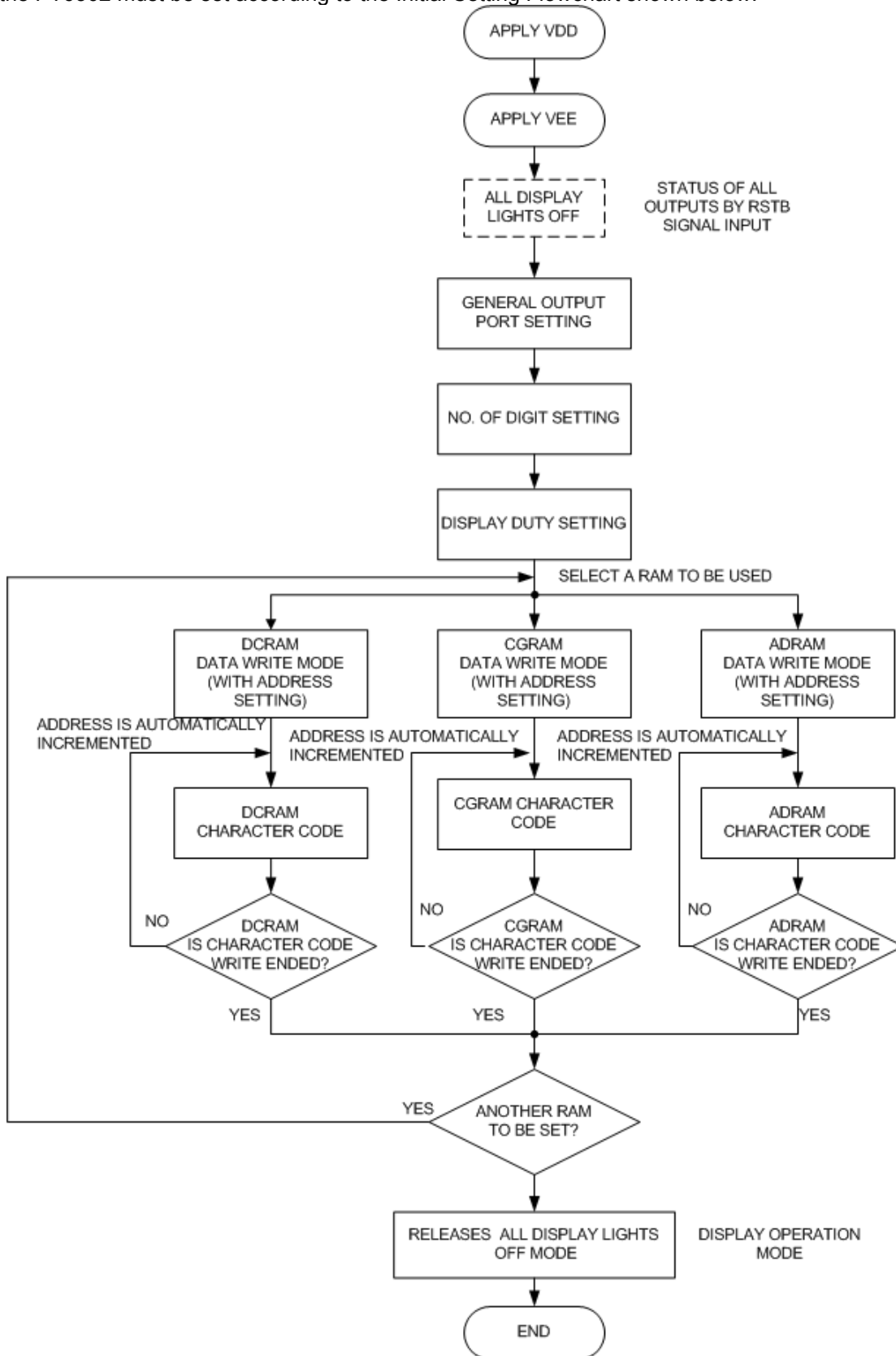
The Reset Function is enabled when the RSTB Pin is set to "Low" Level. All functions are initialized. The initial status of the various functions is given below:

1. Address of each RAM: Address "00"H
2. Data of each RAM: All contents are undefined.
3. General Output Ports: All General Output Ports are set to "LOW".
4. Display Digit: 16 Digits
5. Contrast Adjustment: 8/16
6. All Display Lights: OFF Mode
7. Segment Output: All Segment Outputs are set to "LOW".
8. AD Output: All AD Outputs are set to "LOW".

The RSTB Pin may be connected to either the microcontroller or an external Resistor and capacitor. For an external RC connection, please refer to the diagram below.

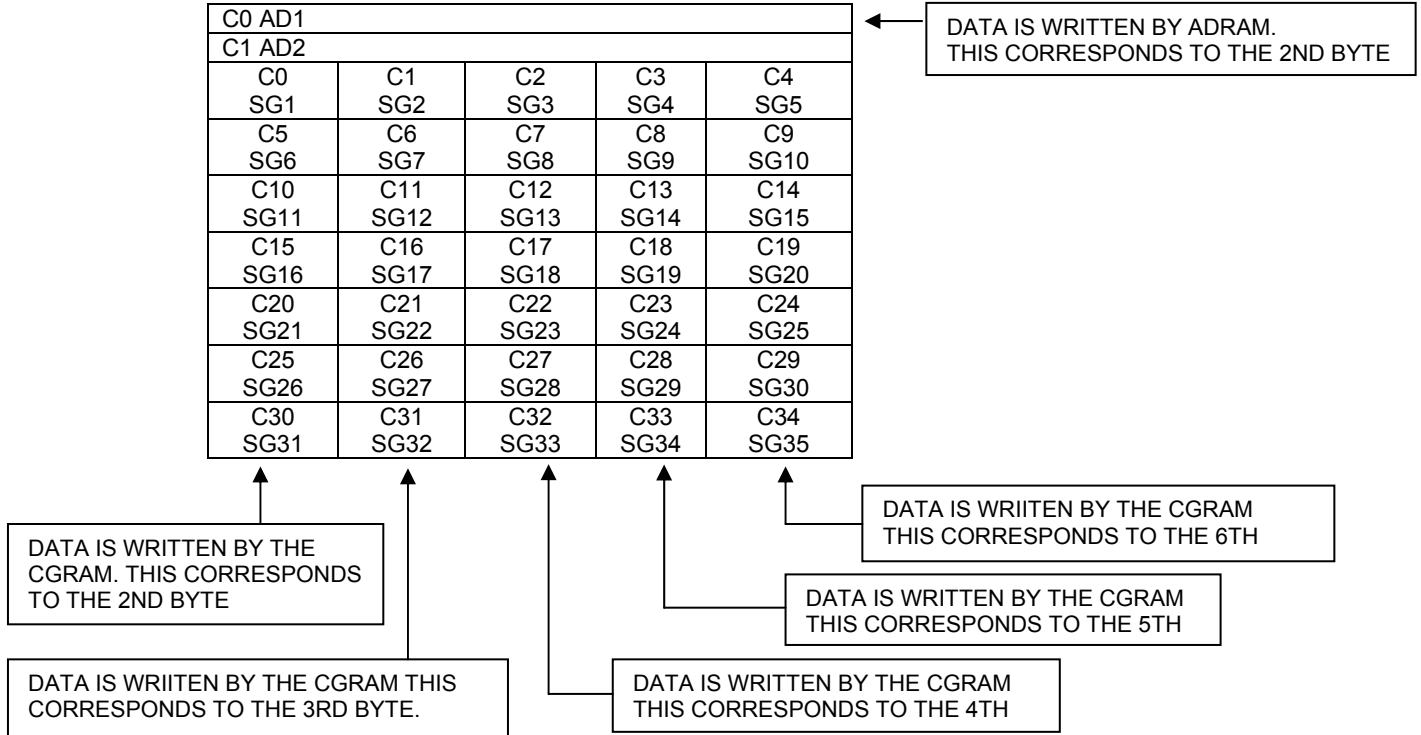


After reset, the PT6302 must be set according to the Initial Setting Flowchart shown below.



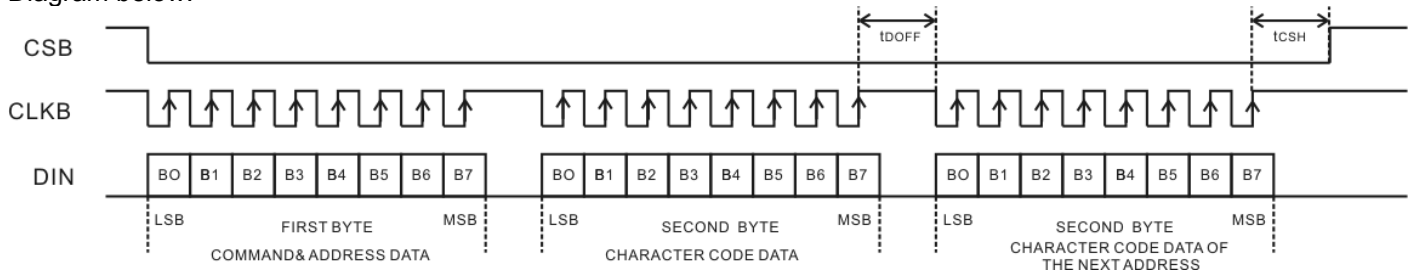
## RELATIONSHIP BETWEEN SEGMENT DRIVERS SGN AND ADN (ONE DIGIT)

The following diagram best describes the relationship between the Segment Drivers -- SGN and ADn.



## DATA TRANSFER

The Display Control Command and the data are written by an 8-bit serial data transfer. Please refer to the Write Timing Diagram below.



Note: When data is written into the RAM (DCRAM, ADRAM, CGRAM) in a continuous manner, the address are automatically incremented. Therefore it is not necessary to specify the first byte of the 2nd and later bytes when writing the RAM data.

When the CSB pin is set to "LOW" Level, data transfer operation is enabled. 8 bits of data are sequentially inputted into the DIN Pin (LSB first). The shift clock is inputted into CLKB pin and the shift register reads the data at rising edge of the shift clock. The internal load signals are automatically generated and the data is written to each register and RAM. Thus, it is not necessary to input load signals externally.

When the CSB Pin is set to "HIGH" Level, the data transfer operation is disabled. The data input when the CSB Pin changes from "HIGH" to "LOW" is recognized in 8-bit units.

# COMMANDS

The following are the list of commands issued by PT6302. When data is written into the RAM (DCRAM, CGRAM, or ADRAM) in a continuous manner, the addresses are automatically incremented internally. It is therefore not necessary to specify the first byte.

NO.	COMMAND	FIRST BYTE								SECOND BYTE							
		LSB					MSB				LSB					MSB	
		B0	B1	B2	B3	B4	B5	B6	B7	B0	B1	B2	B3	B4	B5	B6	B7
1	DCRAM DATA WRITE	X0	X1	X2	X3	1	0	0	0	C0	C1	C2	C3	C4	C5	C6	C7
2	CGRAM DATA WRITE	X0	X1	X2	*	0	1	0	0	C0	C1	C2	C3	C4	C5	C6	*
										C1	C6	C11	C16	C21	C26	C31	*
										C2	C7	C12	C17	C22	C27	C32	*
										C3	C8	C13	C18	C23	C28	C33	*
										C4	C9	C14	C19	C24	C29	C34	*
3	ADRAM DATA WRITE	X0	X1	X2	X3	1	1	0	0	C0	C1	*	*	*	*	*	*
4	GENERAL OUTPUT PORT SET	P1	P2	*	*	0	0	1	0								
5	DISPLAY DUTY SET	D0	D1	D2	*	1	0	1	0								
6	NO. OF DIGITS SET	K0	K1	K2	*	0	1	1	0								
7	ALL LIGHTS ON/OFF	L	H	*	*	1	1	1	0								
	TEST MODE	0	0	0	*	0	0	0	1								

2ND  
BYTE  
3RD  
BYTE  
4TH  
BYTE  
5TH  
BYTE  
6TH  
BYTE

Notes:

1. The Test Mode is not a user function, but an IC internal function
2. \*=Not relevant
3. Xn=RAM address bit, n = 0 to 3
4. Cn=RAM character code bit, n=0 to 34
5. Pn=General output port status bit, n=1 to 2
6. Dn=Display duty bit, n=0 to 2
7. Kn=Number of digits bit, n=0 to 2
8. H=All lights on
9. L=All lights off

## DATA CONTROL RAM (DCRAM) DATA WRITE COMMAND

The DCRAM Data Write Command is used to specify the address of the DCRAM and writes the character code of the CGROM and CGRAM. The DCRAM consists of 4 address bits which are used to store the CGRAM & CGROM character codes. The character codes specified by the DCRAM is converted to a 5 x 7 dot matrix character pattern via the CGROM and CGRAM. The DCRAM can store up to 16 characters. The DCRAM Data Write Command Format is shown below.

	LSB		MSB						
1st Byte (1st)	B0	B1	B2	B3	B4	B5	B6	B7	DCRAM Data Write Mode is selected and the DCRAM Address is specified. (i.e. DCRAM Address = 0H)
	X0	X1	X2	X3	1	0	0	0	
	LSB		MSB						
2nd Byte (2nd)	B0	B1	B2	B3	B4	B5	B6	B7	CGROM & CGRAM Character Codes are specified. (They are written into the DCRAM Address 0H)
	C0	C1	C2	C3	C4	C5	C6	C7	

During a continuous data write operation from one DCRAM Address to the next, it is not necessary to specify the DCRAM address since they are automatically incremented; however, the character code must be specified. Please refer to the information below.

	LSB		MSB						
2nd Byte (3rd)	B0	B1	B2	B3	B4	B5	B6	B7	Character Code of CGRAM & CGROM are specified and written into the DCRAM Address 1H.
	C0	C1	C2	C3	C4	C5	C6	C7	



2nd Byte (4th)	LSB				MSB				Character Code of CGRAM & CGROM are specified and written into the DCRAM Address 2H.
	B0	B1	B2	B3	B4	B5	B6	B7	
	C0	C1	C2	C3	C4	C5	C6	C7	

2nd Byte (17th)	LSB				MSB				Character Code of CGRAM & CGROM are specified and written into the DCRAM Address FH.
	B0	B1	B2	B3	B4	B5	B6	B7	
	C0	C1	C2	C3	C4	C5	C6	C7	

2nd Byte (18th)	LSB				MSB				Character Code of CGRAM & CGROM are specified and rewritten into the DCRAM Address 0 H.
	B0	B1	B2	B3	B4	B5	B6	B7	
	C0	C1	C2	C3	C4	C5	C6	C7	

where:

1. X0 (LSB) to X3 (MSB): DCRAM Address Bits (16 Characters)
2. C0 (LSB) to C7 (MSB): CGROM & CGRAM Character Code Bits (256 Characters)

Please refer to the table below for the GRID position and DCRAM Address setting relationship.

Hex	X0	X1	X2	X3	GRID Position
0	0	0	0	0	GR1
1	1	0	0	0	GR2
2	0	1	0	0	GR3
3	1	1	0	0	GR4
4	0	0	1	0	GR5
5	1	0	1	0	GR6
6	0	1	1	0	GR7
7	1	1	1	0	GR8
8	0	0	0	1	GR9
9	1	0	0	1	GR10
A	0	1	0	1	GR11
B	1	1	0	1	GR12
C	0	0	1	1	GR13
D	1	0	1	1	GR14
E	0	1	1	1	GR15
F	1	1	1	1	GR16

## CGRAM DATA WRITE COMMAND

The Character Generator RAM (CGRAM) Data Write Command is used to specify the CGRAM address (00H to 07H) and write the character pattern data. It consists of 3 address bits which is used to store the 5 x 7 dot matrix character patterns. The CGRAM can store up to 8 types of character patterns which may be displayed by specifying the Character Code (DCRAM Address). The CGRAM Data Write Command Format is given below.

1st Byte (1st)	LSB				MSB				CGRAM Data Write Mode is selected and the CGRAM Address is specified (i.e. CGRAM Address = 00H).
	B0	B1	B2	B3	B4	B5	B6	B7	
	X0	X1	X2	*	0	1	0	0	
2nd Byte (2nd)	LSB				MSB				1st Column Data is specified and rewritten into the CGRAM Address 00H.
	B0	B1	B2	B3	B4	B5	B6	B7	
	C0	C5	C10	C15	C20	C25	C30	*	
3rd Byte (3rd)	LSB				MSB				2nd Column Data is specified and rewritten into the CGRAM Address 00H.
	B0	B1	B2	B3	B4	B5	B6	B7	
	C1	C6	C11	C16	C21	C26	C31	*	
4th Byte (4th)	LSB				MSB				3rd Column Data is specified and rewritten into the CGRAM Address 00H.
	B0	B1	B2	B3	B4	B5	B6	B7	
	C2	C7	C12	C17	C22	C27	C32	*	
5th Byte (5th)	LSB				MSB				4th Column Data is specified and rewritten into the CGRAM Address 00H.
	B0	B1	B2	B3	B4	B5	B6	B7	
	C3	C8	C13	C18	C23	C28	C33	*	
6th Byte (6th)	LSB				MSB				5th Column Data is specified and rewritten into the CGRAM Address 00H.
	B0	B1	B2	B3	B4	B5	B6	B7	
	C4	C9	C14	C19	C24	C29	C34	*	

During a continuous data write operation from one CGRAM Address to the next, it is not necessary to specify the CGRAM address since they are automatically incremented; however, the character pattern data must be specified. The 2nd to the 6th character pattern data byte are considered as one data item, therefore 300ns is sufficient value for parameter tDOFF between bytes. Please refer to the information below.

2nd Byte (7th)	LSB				MSB				1st Column Data is specified and rewritten into the CGRAM Address 01H.
	B0	B1	B2	B3	B4	B5	B6	B7	
	C0	C5	C10	C15	C20	C25	C30	*	
6th Byte (11th)	LSB				MSB				5th Column Data is specified and rewritten into the CGRAM Address 01H.
	B0	B1	B2	B3	B4	B5	B6	B7	
	C4	C9	C14	C19	C24	C29	C34	*	

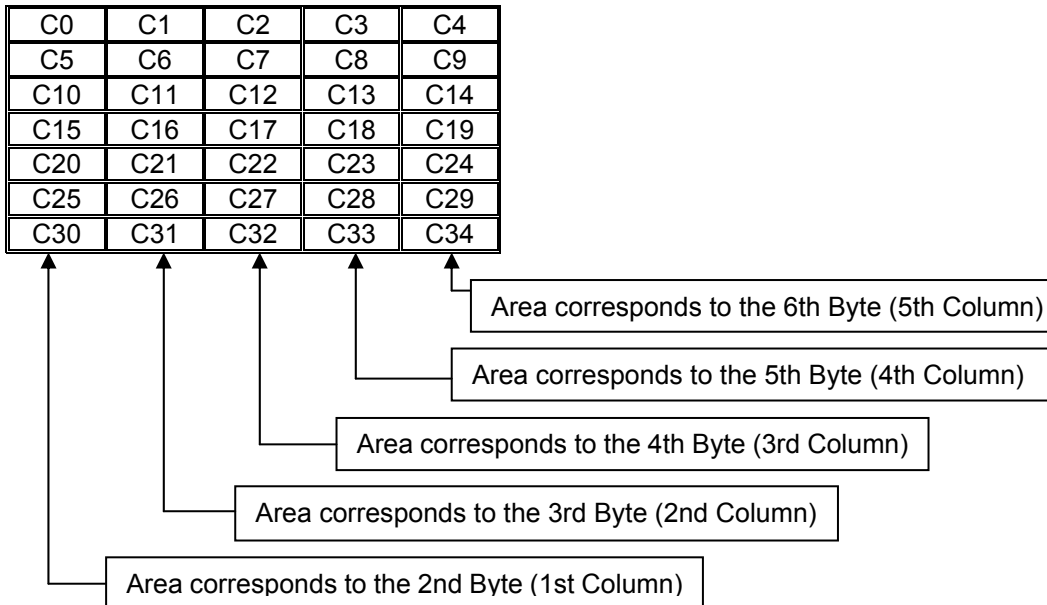
where:

1. X0 (LSB) to X2 (MSB): CGRAM Address Bits (8 Characters)
2. C0 (LSB) to C34 (MSB): Character Pattern Data Bits (35 outputs/digit)

Please refer below for the CGROM Address and CGRAM Address Setting relationship.

HEX	X0	X1	X2	CGROM Address
00	0	0	0	RAM00(00000000B)
01	1	0	0	RAM01(00000001B)
02	0	1	0	RAM02(00000010B)
03	1	1	0	RAM03(00000011B)
04	0	0	1	RAM04(00000100B)
05	1	0	1	RAM05(00000101B)
06	0	1	1	RAM06(00000110B)
07	1	1	1	RAM07(00000111B)

The CGROM and CGRAM output area placement is given in the table below.



Note: The Character Generator ROM (CGROM) consists of 8 CGROM Address bits generating 5 x 7 dot matrix character patterns. It can store up to a maximum of 248 types of character patterns.

## ADRAM DATA WRITE COMMAND

The Additional Data RAM (ADRAM) consists of 4 address bits used to store the symbol data. It can store up to 2 types of symbol patterns per digit. The symbol data specified by the ADRAM is directly outputted. The terminals to which the ADRAM data are outputted may be used as a cursor. The ADRAM command format is given below.

	LSB				MSB				
1st Byte (1st)	B0	B1	B2	B3	B4	B5	B6	B7	ADRAM Data Write Mode is selected and the ADRAM address is specified. (i.e. ADRAM Address = 0H)
	X0	X1	X2	X3	1	1	0	0	

	LSB				MSB				
2nd Byte (2nd)	B0	B1	B2	B3	B4	B5	B6	B7	Symbol Data is specified and written into the ADRAM Address 0H.
	C0	C1	*	*	*	*	*	*	

During a continuous data write operation from one ADRAM Address to the next, it is not necessary to specify the ADRAM address since they are automatically incremented; however, the symbol data must be specified. Please refer to the information below.

	LSB				MSB				
2nd Byte (3rd)	B0	B1	B2	B3	B4	B5	B6	B7	Symbol Data is specified and written into the ADRAM Address 1H.
	C0	C1	*	*	*	*	*	*	

	LSB				MSB				
2nd Byte (4th)	B0	B1	B2	B3	B4	B5	B6	B7	Symbol Data is specified and written into the ADRAM Address 2H.
	C0	C1	*	*	*	*	*	*	

⋮

	LSB				MSB				
2nd Byte (17th)	B0	B1	B2	B3	B4	B5	B6	B7	Symbol Data is specified and written into the ADRAM Address FH.
	C0	C1	*	*	*	*	*	*	

	LSB				MSB				
2nd Byte (18th)	B0	B1	B2	B3	B4	B5	B6	B7	Symbol Data is specified and rewritten into the ADRAM Address 0H.
	C0	C1	*	*	*	*	*	*	

where:

1. X0 (LSB) to X3 (MSB): ADRAM address bits (16 Characters)
2. C0 (LSB) to C1 (MSB): Symbol data bits (2 symbol data per digit)

Please refer to the table below for the GRID and ADRAM Address relationship.

HEX	X0	X1	X2	X3	GRID Position
0	0	0	0	0	GR1
1	1	0	0	0	GR2
2	0	1	0	0	GR3
3	1	1	0	0	GR4
4	0	0	1	0	GR5
5	1	0	1	0	GR6
6	0	1	1	0	GR7
7	1	1	1	0	GR8
8	0	0	0	1	GR9
9	1	0	0	1	GR10
A	0	1	0	1	GR11
B	1	1	0	1	GR12
C	0	0	1	1	GR13
D	1	0	1	1	GR14
E	0	1	1	1	GR15
F	1	1	1	1	GR16

## GENERAL OUTPUT PORT SET COMMAND

The General Output Port Set Command is used to specify the general output port status. The general output port is used to control other input/output devices as well as turn on the LED Display. When the general output port is set to "HIGH", the output is equivalent to the VDD voltage. When the general output port is set to "LOW" Level, the output becomes ground potential. The command format is given below.

	LSB				MSB				
1st Byte	B0	B1	B2	B3	B4	B5	B6	B7	
	P1	P2	*	*	0	0	1	0	A General Output Port is selected and the output status is specified.

where:

1. P1, P2: General output port
2. \*=Not relevant

The following table shows the data setting in relation to the Status of the General Output Port

P1	P2	General Output Port Display Status
0	0	P1 ="LOW", P2="LOW" (see note 1)
1	0	P1="HIGH", P2="LOW"
0	1	P1="LOW", P2="HIGH"
1	1	P1="HIGH", P2="HIGH"

Note: The state when the power is applied or when the RSTB is inputted.

## DISPLAY DUTY SET COMMAND

The Display Duty Set Command is used to write the display duty value to the duty cycle register. Using a 3-bit data, the display duty adjusts the contrast in 8 stages. When the power is turned ON or when the RSTB signal is inputted, the duty cycle register value is set to "0". It is advisable to always execute this command before turning on the display, after which the desired duty value may be set. The command format is given below.

	LSB				MSB				
1st Byte	B0	B1	B2	B3	B4	B5	B6	B7	Display Duty Set Mode is selected and the duty value is specified.
	D0	D1	D2	*	1	0	1	0	

where:

1. D0 (LSB) to D2 (MSB): Display duty data bits (8 stages)
2. \*=Not relevant

The Relationship between the Setup Data and the Controlled GRID Duty is given in the table below.

HEX	D2	D1	D0	GRID Duty
0	0	0	0	8/16
1	0	0	1	9/16
2	0	1	0	10/16
3	0	1	1	11/16
4	1	0	0	12/16
5	1	0	1	13/16
6	1	1	0	14/16
7	1	1	1	15/16

The state when the Power is turned ON or when the RSTB signal is inputted

## NUMBER OF DIGITS SET COMMAND

The Number of Digits Set Command is used to write the number of display digits into the display digit register. Using a 3-bit data, the Number of Digits Set Command can display 9 to 16 digits. When the power is turned ON or when the RSTB signal is inputted, the value is set to "0". It is advisable to always execute this command before the turning on the display. The command format is given below.

	LSB				MSB				
1st Byte	B0	B1	B2	B3	B4	B5	B6	B7	The Number of Digits Set Mode is selected and the number of digit value is specified.
	K0	K1	K2	*	0	1	1	0	

The table below shows the relationship between the setup data and the controlled GR.

HEX	K2	K1	K0	Number of Digits of GR
0	0	0	0	GR1 ~ GR16
1	0	0	1	GR1 ~ GR9
2	0	1	0	GR1 ~ GR10
3	0	1	1	GR1 ~ GR11
4	1	0	0	GR1 ~ GR 12
5	1	0	1	GR1~ GR13
6	1	1	0	GR1~ GR14
7	1	1	1	GR1~ GR15

The state when the Power is turned ON or when the RSTB signal is inputted.

## DISPLAY LIGHT SET COMMAND

The Display Light Set Command is used to turn all display lights ON or OFF. All Display Lights ON Mode is primarily used for testing the display. The All Display Light OFF Mode is used for the blinking display and to prevent any malfunction when the power is turned ON. The general output port cannot be controlled by this command. The command format is given below.

	LSB				MSB			
1st Byte	B0	B1	B2	B3	B4	B5	B6	B7
	L	H	*	*	1	1	1	0

The Display Light Set Command is selected.

where:

1. L=All display lights are turned off
2. H=All display lights are turned on
3. \*=Not relevant

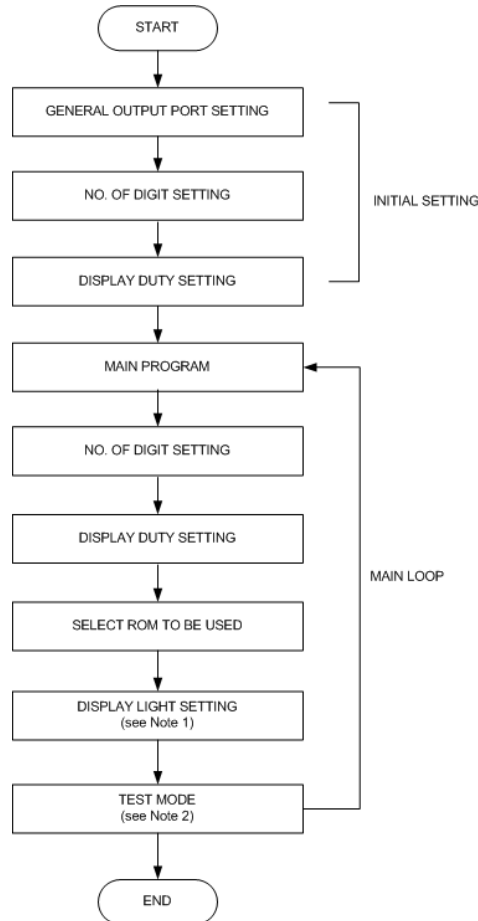
The table below shows the SG and AD Display Status in relation to the Display Light Set Command data.

L	H	SG and AD Display State
0	0	Normal Display Mode
1	0	All Outputs ="LOW"
0	1	All Outputs ="HIGH"
1	1	All Outputs ="HIGH"

The state when the power is applied or when the RSTB signal is inputted

All Display Light ON Mode has the first priority.

## RECOMMENDED SOFTWARE FLOWCHART



Notes:

1. Display light active mode (ex. 0111XX00B)
2. Test mode off (ex. 1000X000B)

## ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Rating	Unit
Supply voltage 1	$V_{DD}$	-	-0.3 to 6.5	V
Supply voltage 2	$V_{EE}$	-	-35 to $V_{DD}+0.3$	V
Input voltage	$V_{IN}$	-	-0.3 to $V_{DD}+0.3$	V
Power dissipation	$P_D$	$T_a \leq 25^\circ\text{C}$	541	mW
Output current 1	$I_{O1}$	GR1 to GR16	-40 to 0	mA
Output current 2	$I_{O2}$	AD1 to AD2	-20 to 0	mA
Output current 3	$I_{O3}$	SG1 to SG35	-10 to 0	mA
Output current 4	$I_{O4}$	P1 to P2	-4.0 to 4.0	mA
Operating temperature	$T_{opr}$	-	-40 to +85	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-	-65 to +150	$^\circ\text{C}$

## RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage 1	$V_{DD}$		4.5	5.0	5.5	V
			3.0	3.3	3.6	V
Supply voltage 2	$V_{EE}$	Power supply voltage=5V	-35	-	-20	V
		Power supply voltage=3.3V	-35	-	-20	V
High level input voltage	$V_{IH}$	Power supply voltage=5V All input pins except OSC1.	$0.7V_{DD}$	-	-	V
		Power supply voltage=3.3V All input pins except OSC1.	$0.8V_{DD}$	-	-	V
Low level input voltage	$V_{IL}$	Power supply voltage=5V All input pins except OSC1.	-	-	$0.3V_{DD}$	V
		Power supply voltage=3.3V All input pins except OSC1.	-	-	$0.2V_{DD}$	V
CLKB frequency	$f_c$	Power supply voltage=5V	-	-	1.0	MHz
		Power supply voltage=3.3V	-	-	1.0	MHz
Oscillation frequency	$f_{osc}$	Power supply voltage=5V R1=3.3K $\Omega$ , C1=47pF	1.5	2.0	2.5	MHz
		Power supply voltage=3.3V R1=3.3K $\Omega$ , C1=39pF	1.5	2.0	2.5	MHz
Frame frequency	$f_{FR}$	Power supply voltage=5V DIGIT=1 to 16, R1=3.3K $\Omega$ , C1=47pF	183	244	305	Hz
		Power supply voltage=3.3V DIGIT=1 to 16, R1=3.3K $\Omega$ , C1=39pF	183	244	305	Hz
RSTB input time	$t_{RSON}$	Power supply voltage=5V	200	-	-	$\mu\text{s}$
		Power supply voltage=3.3V	200	-	-	$\mu\text{s}$
Operating temperature	$T_{opr}$	Power supply voltage=5V	-40	-	85	$^\circ\text{C}$
		Power supply voltage=3.3V	-40	-	85	$^\circ\text{C}$



# DC ELECTRICAL CHARACTERISTICS

 (Unless otherwise specified,  $V_{EE}=-35V$ ,  $T_a=-40$  to  $+85^{\circ}C$ )

Parameter	Symbol	Condition	Min.	Max.	Unit
High level input voltage	$V_{IH}$	$V_{DD}=5.0\pm 10\%$ CSB, CLKB, DIN, RSTB	$0.7V_{DD}$	-	V
		$V_{DD}=3.3\pm 10\%$ CSB, CLKB, DIN, RSTB	$0.8V_{DD}$	-	V
Low level input Voltage	$V_{IL}$	$V_{DD}=5.0\pm 10\%$ CSB, CLKB, DIN, RSTB	-	$0.3V_{DD}$	V
		$V_{DD}=3.3\pm 10\%$ CSB, CLKB, DIN, RSTB	-	$0.2V_{DD}$	V
High level input current	$I_{IH}$	$V_{DD}=5.0\pm 10\%$ CSB, CLKB, DIN, RSTB; $V_{IH}=V_{DD}$	-1.0	1.0	$\mu A$
		$V_{DD}=3.3\pm 10\%$ CSB, CLKB, DIN, RSTB; $V_{IH}=V_{DD}$	-1.0	1.0	$\mu A$
Low level input current	$I_{IL}$	$V_{DD}=5.0\pm 10\%$ CSB, CLKB, DIN, RSTB; $V_{IL}=0V$	-1.0	1.0	$\mu A$
		$V_{DD}=3.3\pm 10\%$ CSB, CLKB, DIN, RSTB; $V_{IL}=0V$	-1.0	1.0	$\mu A$
High level output voltage 1	$V_{OH1}$	$V_{DD}=5.0\pm 10\%$ GR1 to GR16; $I_{OH}=-30mA$	$V_{DD}-1.5$	-	V
		$V_{DD}=3.3\pm 10\%$ GR1 to GR16; $I_{OH}=-30mA$	$V_{DD}-1.5$	-	V
High level output voltage 2	$V_{OH2}$	$V_{DD}=5.0\pm 10\%$ AD1 to AD2, $I_{OH}=-15mA$	$V_{DD}-1.5$	-	V
		$V_{DD}=3.3\pm 10\%$ AD1 to AD2, $I_{OH}=-15mA$	$V_{DD}-1.5$	-	V
High level output voltage 3	$V_{OH3}$	$V_{DD}=5.0\pm 10\%$ SG1 to SG35, $I_{OH}=-6mA$	$V_{DD}-1.5$	-	V
		$V_{DD}=3.3\pm 10\%$ SG1 to SG35, $I_{OH}=-6mA$	$V_{DD}-1.5$	-	V
High level output voltage 4	$V_{OH4}$	$V_{DD}=5.0\pm 10\%$ P1 to P2, $I_{OH}=-5mA$	$V_{DD}-1.0$	-	V
		$V_{DD}=3.3\pm 10\%$ P1 to P2, $I_{OH}=-2.5mA$	$V_{DD}-1.0$	-	V
Low level output voltage 1	$V_{OL1}$	$V_{DD}=5.0\pm 10\%$ GR1 to GR16, AD1 to AD2, SG1 to SG35	-	$V_{EE}+1.0$	V
		$V_{DD}=3.3\pm 10\%$ GR1 to GR16, AD1 to AD2; SG1 to SG35	-	$V_{EE}+1.0$	V
Low level output voltage	$V_{OL2}$	$V_{DD}=5.0\pm 10\%$ P1, P2, $I_{OL}=15mA$	-	1.0	V
		$V_{DD}=3.3\pm 10\%$ P1, P2, $I_{OL}=7.5mA$	-	1.0	V
Current consumption 1	$I_{DD1}$	$V_{DD}=5.0\pm 10\%$ $V_{DD}$ , fosc=2MHz, No Load Duty 15/16, DIGIT 1 to 16; All outputs lights ON	-	4	mA
		$V_{DD}=3.3\pm 10\%$ $V_{DD}$ , fosc=2MHz, No Load Duty 15/16, DIGIT 1 to 16; All outputs lights ON	-	3	mA
Current consumption 2	$I_{DD2}$	$V_{DD}=5.0\pm 10\%$ $V_{DD}$ , fosc=2MHz, No Load Duty 8/16, DIGIT 1 to 9; All outputs lights OFF	-	3	mA
		$V_{DD}=3.3\pm 10\%$ $V_{DD}$ , fosc=2MHz, No Load Duty 8/16, DIGIT 1 to 9; All outputs lights OFF	-	2	mA

## AC CHARACTERISTICS

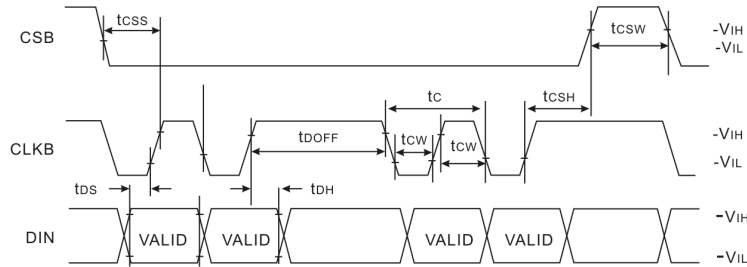
 (Unless otherwise specified,  $V_{EE}=-35V$ ,  $T_a=-40$  to  $+85^{\circ}C$ )

Parameter	Symbol	Condition	Min.	Max.	Unit
CLKB cycle time	fc	$V_{DD}=5.0V+10\%$	1.0	-	$\mu s$
		$V_{DD}=3.3V+10\%$	1.0	-	$\mu s$
CLKB pulse width	$t_{CW}$	$V_{DD}=5.0V+10\%$	300	-	ns
		$V_{DD}=3.3V+10\%$	300	-	ns
DIN setup time	$t_{DS}$	$V_{DD}=5.0V+10\%$	300	-	ns
		$V_{DD}=3.3V+10\%$	300	-	ns
DIN hold time	$t_{DH}$	$V_{DD}=5.0V+10\%$	300	-	ns
		$V_{DD}=3.3V+10\%$	300	-	ns
CSB setup time	$t_{CSS}$	$V_{DD}=5.0V+10\%$	300	-	ns
		$V_{DD}=3.3V+10\%$	300	-	ns
CSB hold time	$t_{CSH}$	$V_{DD}=5.0V+10\%$ $R1=3.3K\Omega$ , $C1=47pF$	16	-	$\mu s$
		$V_{DD}=3.3V+10\%$ $R1=3.3K\Omega$ , $C1=39pF$	16	-	$\mu s$
CSB wait time	$t_{CSW}$	$V_{DD}=5.0V+10\%$	300	-	ns
		$V_{DD}=3.3V+10\%$	300	-	ns
Data processing time	$t_{DOFF}$	$V_{DD}=5.0V+10\%$ $R1=3.3K\Omega$ , $C1=47pF$	8	-	$\mu s$
		$V_{DD}=3.3V+10\%$ $R1=3.3K\Omega$ , $C1=39pF$	8	-	$\mu s$
RSTB pulse width	$t_{WRSTB}$	$V_{DD}=5.0V+10\%$ When the RSTB signal is externally inputted from the microcontroller.	300	-	ns
		$V_{DD}=3.3V+10\%$ When the RSTB signal is externally inputted from the microcontroller.	300	-	ns
DIN wait time	$t_{RSOFF}$	$V_{DD}=5.0V+10\%$	300	-	ns
		$V_{DD}=3.3V+10\%$	300	-	ns
All outputs slew rate	$t_R$	$V_{DD}=5.0V+10\%$ $C_i=100pF$ , $tR=20\%$ to $80\%$	-	4.0	$\mu s$
		$V_{DD}=3.3V+10\%$ $C_i=100pF$ , $tR=20\%$ to $80\%$	-	4.0	$\mu s$
	$t_F$	$V_{DD}=5.0V+10\%$ $C_i=100pF$ , $tF=80\%$ to $20\%$	-	4.0	$\mu s$
		$V_{DD}=3.3V+10\%$ $C_i=100pF$ , $tF=80\%$ to $20\%$	-	4.0	$\mu s$
VDD rise time	$t_{PRZ}$	$V_{DD}=5.0V+10\%$ Mounted in the Unit	100	-	$\mu s$
		$V_{DD}=3.3V+10\%$ Mounted in the Unit	100	-	
VDD off time	$t_{POF}$	$V_{DD}=0V$ Mounted in the Unit	5.0	-	ms

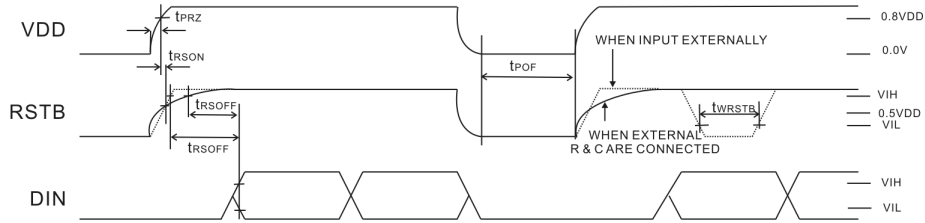
# TIMING CHARACTERISTICS

Parameter	Symbol	VDD=3.3V±10%	VDD=5.0±10%
High level input voltage	$V_{IH}$	$0.8V_{DD}$	$0.7V_{DD}$
Low level input voltage	$V_{IL}$	$0.2V_{DD}$	$0.3V_{DD}$

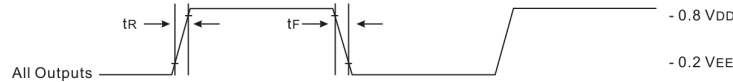
## DATA TIMING



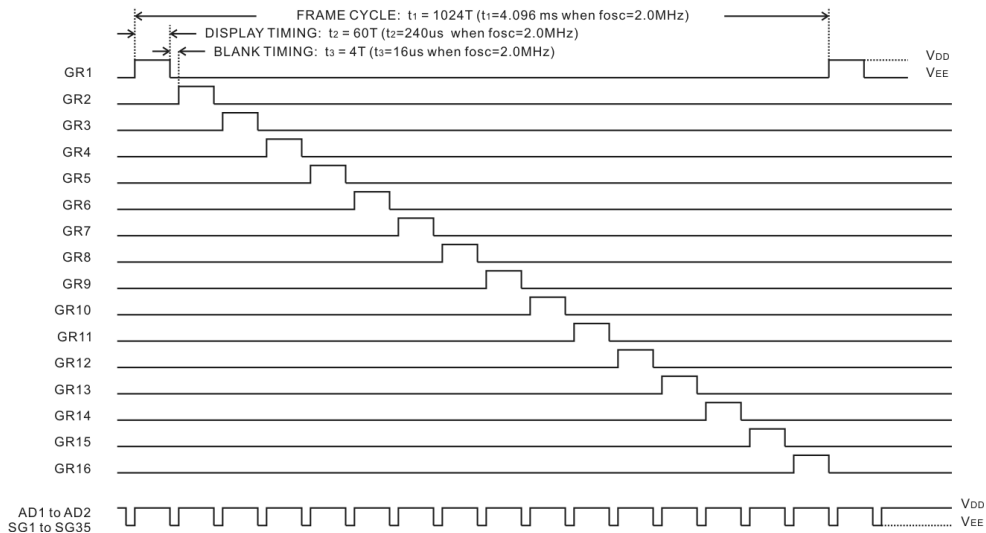
## RESET (RSTB) TIMING



## OUTPUT TIMING



## DIGIT OUTPUT TIMING (16-DIGIT DISPLAY, DUTY= 15/16)



where:  $T=8/f_{osc}$



# PT6302-001 CHARACTER FONT TABLE

MSB \ LSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	RAM0	一		0	0	P	'	o	3	■	°	△	田	台	台	台
1	RAM1	7	!	1	A	Q	a	o	天	△	士	△	田	台	台	台
2	RAM2	Y	"	2	B	R	b	r	ウ	△	卒	△	田	台	台	台
3	RAM3	o	#	3	C	S	c	s	天	E	E	△	田	台	台	台
4	RAM4	工	\$	4	D	T	d	t	木	木	'	△	田	台	台	台
5	RAM5	才	%	5	E	U	e	u	十	工	羊	△	田	台	台	台
6	RAM6	力	&	6	F	V	f	v	二	日	!	田	田	台	台	台
7	RAM7	井	'	7	G	W	g	w	又	日	△	△	田	台	台	台
8		子	()	8	H	X	h	x	卒	U	十	田	田	台	台	台
9		古	)	9	I	Y	i	y	人	U	!	田	田	台	台	台
A		五	*	:	J	Z	j	z	山	U	△	田	田	台	台	台
B		才	+	:	K	C	k	c	E	口	*	*	田	田	台	台
C		木	,	<	L	X	l	x	口	口	一	△	田	田	台	台
D		工	-	=	M	J	m	j	△	△	田	田	田	台	台	台
E		目	也	>	N	^	n	~	市	"	田	田	田	田	台	台
F		ウ	/	?	O	□	o	■	又	△	△	田	田	田	台	台



# PT6302-002 CHARACTER FONT TABLE

MSB \ LSB		0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	RAM0	☐	☐	0	1	2	3	4	5	6	7	8	9	☐	☐	☐	☐
0001	RAM1	☐	!	T	A	Q	a	q	☐	☐	☐	☐	☐	☐	☐	☐	☐
0010	RAM2	☐	"	Z	B	R	b	r	☐	☐	☐	☐	☐	☐	☐	☐	☐
0011	RAM3	☐	#	3	C	S	c	s	!	☐	☐	☐	☐	☐	☐	☐	☐
0100	RAM4	☐	\$	4	O	T	d	t	\	☐	☐	☐	☐	☐	☐	☐	☐
0101	RAM5	☐	%	5	E	U	e	u	×	☐	☐	☐	☐	☐	☐	☐	☐
0110	RAM6	☐	&	6	F	V	f	v	÷	☐	☐	☐	☐	☐	☐	☐	☐
0111	RAM7	☐	'	7	G	W	g	w	†	☐	☐	☐	☐	☐	☐	☐	☐
1000		☐	:	8	H	X	h	x	*	☐	☐	☐	☐	☐	☐	☐	☐
1001		☐	;	9	I	Y	i	y	!	☐	☐	☐	☐	☐	☐	☐	☐
1010		☐	.	*	J	Z	j	z	!	☐	☐	☐	☐	☐	☐	☐	☐
1011		☐	+	:	K	C	k	c	!	☐	☐	☐	☐	☐	☐	☐	☐
1100		☐	,	<	L	羊	l	!	☐	☐	☐	☐	☐	☐	☐	☐	☐
1101		☐	-	=	M	J	m	!	☐	☐	☐	☐	☐	☐	☐	☐	☐
1110		☐	.	>	N	^	n	!	☐	☐	☐	☐	☐	☐	☐	☐	☐
1111		☐	/	?	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐



# PT6302-003 CHARACTER FONT TABLE

MSB LSB		0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	RAM0																
0001	RAM1																
0010	RAM2																
0011	RAM3																
0100	RAM4																
0101	RAM5																
0110	RAM6																
0111	RAM7																
1000																	
1001																	
1010																	
1011																	
1100																	
1101																	
1110																	
1111																	



# PT6302-005 CHARACTER FONT TABLE

Upper Nibble	D7	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	D6	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
Lower Nibble	D5	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
	D4	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
D3 D2 D1 D0		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 0 0 0	0	CG-RAM (#0)	α	β	γ	δ	ε	ζ	η	θ	ι	κ	λ	μ	ν	ξ	ο
0 0 0 1	1	CG-RAM (#1)	π	ρ	σ	τ	υ	φ	χ	ψ	ω	α	β	γ	δ	ε	ζ
0 0 1 0	2	CG-RAM (#2)	⊠	"	2	B	R	b	r	é	ê	ë	ä	å	æ	ø	œ
0 0 1 1	3	CG-RAM (#3)	π	#	3	C	S	c	s	ä	ö	ü	×	W	E	Ö	¼
0 1 0 0	4	CG-RAM (#4)	Σ	\$	4	D	T	d	t	ä	ö	ñ	3	b	é	ö	7
0 1 0 1	5	CG-RAM (#5)	α	%	5	E	U	e	u	ä	ö	ñ	A	B	N	Ö	8
0 1 1 0	6	CG-RAM (#6)	Π	&	6	F	U	f	u	ä	ö	ä	A	ä	ä	ä	ä
0 1 1 1	7	CG-RAM (#7)	τ	'	7	G	W	w	g	ü	ö	ö	ä	ä	ä	ä	ä
1 0 0 0	8		≤	⊗	(	8	H	X	h	x	é	é	é	é	é	é	é
1 0 0 1	9		≥	⊙	)	9	I	Y	i	y	é	ö	ü	ü	ü	ü	ü
1 0 1 0	A		≠	Ω	*	:	J	Z	j	z	é	ü	ü	ü	ü	ü	ü
1 0 1 1	B		≡	δ	+	;	K	C	k	c	i	æ	æ	æ	æ	æ	æ
1 1 0 0	C		∥	ω	,	<	L	\	l	\	i	é	é	é	é	é	é
1 1 0 1	D		≡	φ	-	=	M	I	m	3	i	φ	φ	φ	φ	φ	φ
1 1 1 0	E		⊥	E	.	>	N	^	n	~	A	X	X	X	X	X	X
1 1 1 1	F		⊗	∩	/	?	O	_	o	⊗	A	f	⊗	φ	φ	φ	φ



# PT6302-006 CHARACTER FONT TABLE

D3 D2 D1 D0	D7	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	D6	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
D5	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	1
D4	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	1
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 0 0 0	0	RAM0	—	SP	0	P	p	9	ε	∞	.	Δ	∇	∆	∇	∆	∇
0 0 0 1	1	RAM1	7	!	1	A	Q	a	q	†	Δ	i	.	Δ	∇	∆	∇
0 0 1 0	2	RAM2	4	"	2	B	R	b	r	∩	∞	∞	∞	∞	∞	∞	∞
0 0 1 1	3	RAM3	9	#	3	C	S	c	s	τ	ε	ε	ε	ε	∞	∞	∞
0 1 0 0	4	RAM4	1	*	4	D	T	d	t	∩	∞	∞	∞	∞	∞	∞	∞
0 1 0 1	5	RAM5	4	%	5	E	U	e	u	†	1	∞	∞	∞	∞	∞	∞
0 1 1 0	6	RAM6	∞	&	6	F	V	f	v	∞	∞	∞	∞	∞	∞	∞	∞
0 1 1 1	7	RAM7	†	'	7	G	W	g	w	∞	∞	∞	∞	∞	∞	∞	∞
1 0 0 0	8		4	∞	∞	H	X	h	x	∞	∞	∞	∞	∞	∞	∞	∞
1 0 0 1	9		∞	∞	∞	I	Y	i	y	∞	∞	∞	∞	∞	∞	∞	∞
1 0 1 0	A		∞	∞	*	:	J	Z	j	z	∞	∞	∞	∞	∞	∞	∞
1 0 1 1	B		∞	∞	∞	:	K	C	k	c	∞	∞	∞	∞	∞	∞	∞
1 1 0 0	C		∞	∞	∞	<	L	N	l	n	∞	∞	∞	∞	∞	∞	∞
1 1 0 1	D		∞	∞	∞	=	M	I	m	∞	∞	∞	∞	∞	∞	∞	∞
1 1 1 0	E		∞	∞	∞	>	N	∞	n	∞	∞	∞	∞	∞	∞	∞	∞
1 1 1 1	F		∞	∞	∞	?	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞



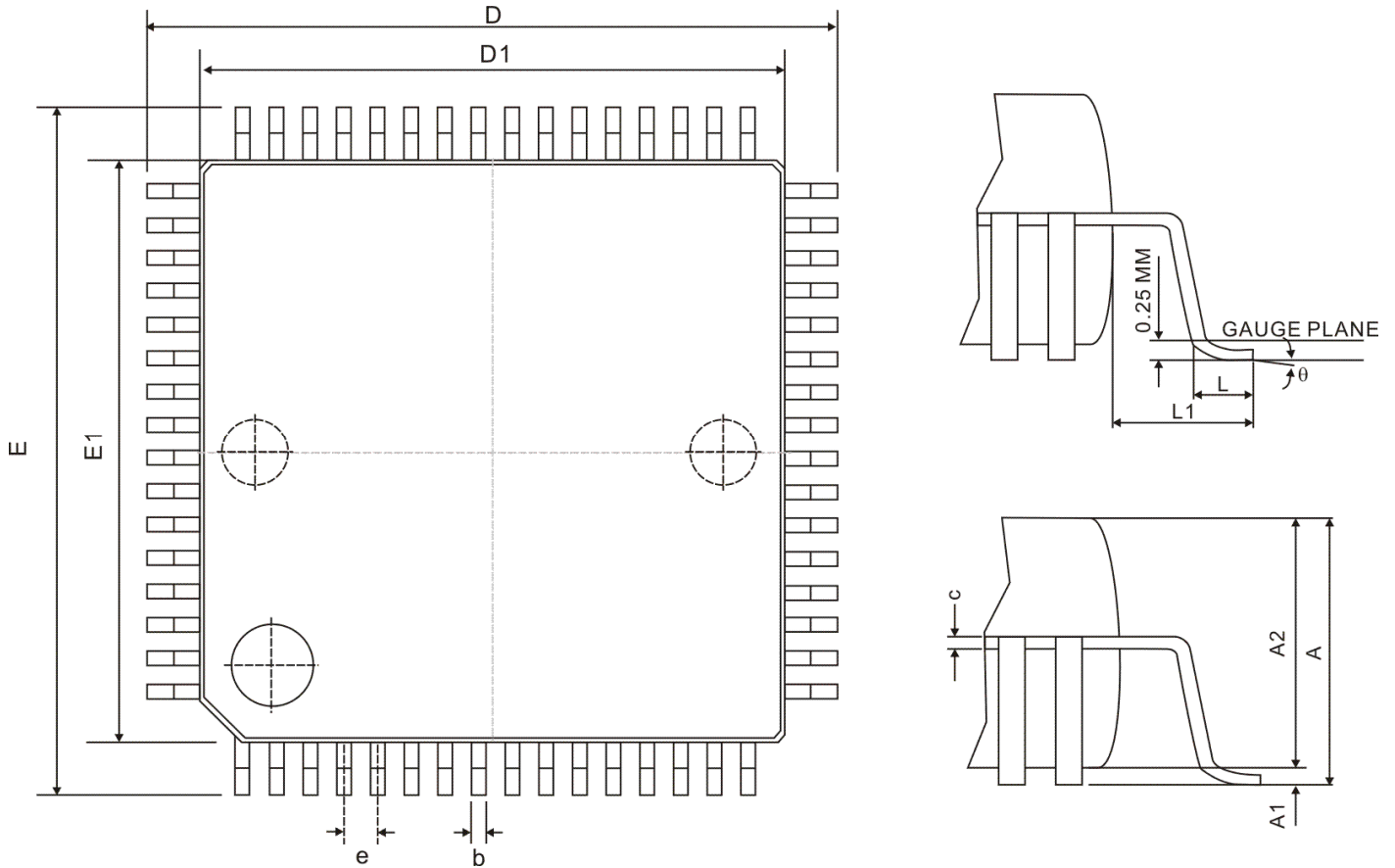


# PT6302-007 CHARACTER FONT TABLE

MSB LSB		0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011
0000	RAM0			0	1	P	l	e	3	3	3	3	3
0001	RAM1		!	T	A	Q	a	a	3	3	3	3	3
0010	RAM2		"	2	B	R	b	r	e	e	3	3	3
0011	RAM3		#	3	C	S	c	s	3	3	3	3	3
0100	RAM4		4	O	T	d	t	i	i	3	3	3	3
0101	RAM5		5	E	U	e	u	i	i	3	3	3	3
0110	RAM6		6	F	V	f	v	3	3	3	3	3	3
0111	RAM7		7	G	W	w	3	3	3	3	3	3	3
1000			8	H	X	h	x	3	3	3	3	3	3
1001			9	I	Y	i	y	3	3	3	3	3	3
1010			*	:	J	Z	j	z	3	3	3	3	3
1011			+	:	K	L	k	l	3	3	3	3	3
1100			,	<	L	\	l	l	3	3	3	3	3
1101			-	=	M	J	m	j	3	3	3	3	3
1110			.	>	N	^	n	^	i	i	3	3	3
1111			/	?	0	_	o	■	U	A	+	3	3

# PACKAGE INFORMATION

## 64 PINS, LQFP



Symbol	Min.	Nom.	Max.
A	-	-	1.60
A1	0.05	-	0.15
A2	1.35	1.40	1.45
b	0.30	0.35	0.40
c	0.09	-	0.16
D	16.00 BSC		
D1	14.00 BSC		
E	16.00 BSC		
E1	14.00 BSC		
e	0.80 BSC		
L	0.45	0.60	0.75
L1	1.00 REF.		
θ	0°	3.5°	7°

Notes:

1. All dimensions are in millimeter
2. Refer to JEDEC MS-022 BE

## **IMPORTANT NOTICE**

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