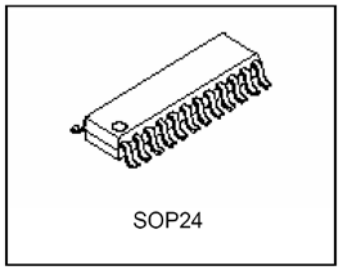
LED Driver IC

IK2107

DESCRIPTION

The IK2107 is specifically designed for cathode-grid LED and LED DISPLAY derivers.
The IK2107 have 12/9 segment output lines, 7 to 4 grid output lines, one display memory, control circuit and 3 line serial data interface. This function are all incorporated into a single chip to build a highly reliable peripheral device for a single chip microcomputer. It is very convenience to control for numeric display.
IK2107's pin assignments and application circuit are optimized for easy PCB Layout and cost saving advantages.



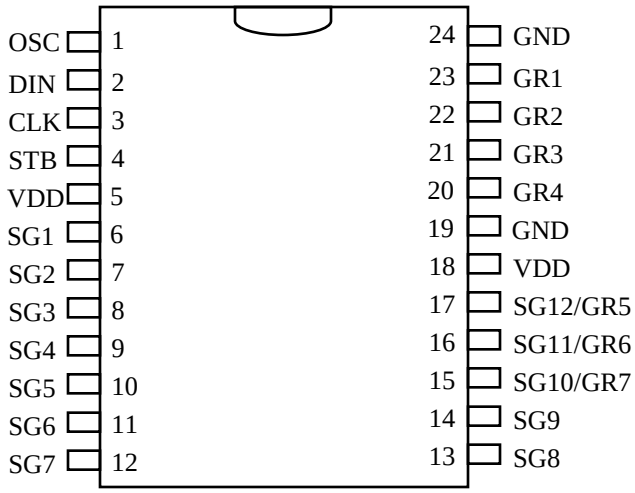
ORDERING INFORMATION

Device	Operating	Package	Packing
IK2107D	T_A = -20° to 70° C	SOP 24	Tube
IK2107DT		SOP 24	Tape &Reel

FEATURES

· CMOS Technology
· Segment output line selection by command : 12 ~ 9
· Grid output line selection by command : 7 ~ 4
· Operation voltage : 5V
· Low Power Consumption
· 8-Step Dimming control by command
· Serial Interface for Clock, Data Input, Strobe Pins
· 24-pin, SOP Package

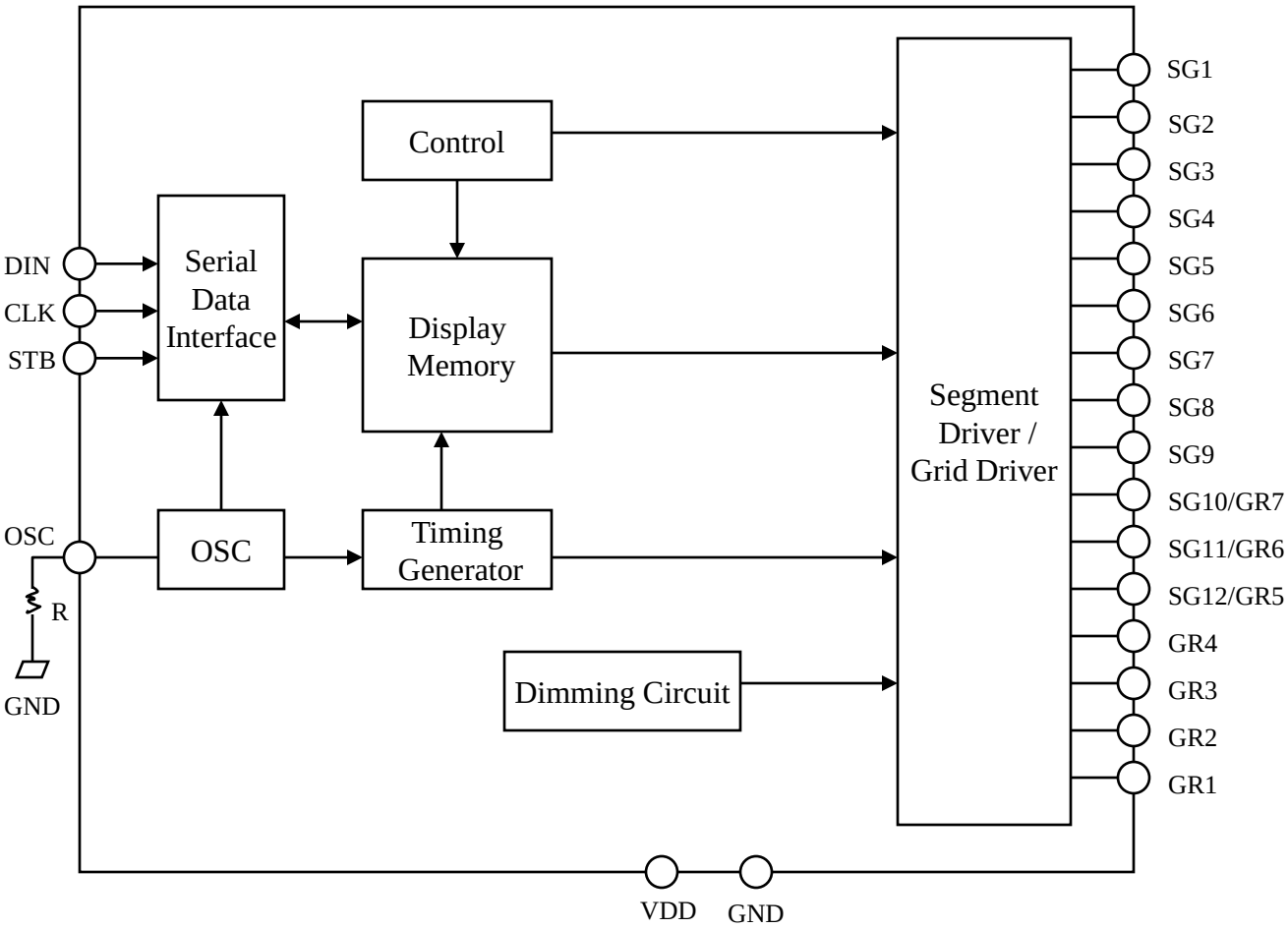
PIN CONNECTION



APPLICATION

· Segment LED display : VCR, DVD, MWO

BLOCK DIAGRAM



PIN DESCRIPTION

Pin Name	I/O	Description	Pin No.
OSC	I	Oscillator Input Pin. A resistor is connected to this pin and GND.	1
DIN	I	Data Input Pin. This pin inputs serial data at the rising edge of the shift clock (staring from the lower bit)	2
CLK	I	Clock Input Pin. Rising edge trigger.	3
STB	I	Strobe pin for Serial Interface. The data input after the STB has fallen is processed as a command. When this pin is “HIGH”, CLK is ignored.	4
VDD	-	Power Supply	5,18
SG1 to SG9	O	Segment Output Pins(p-channel, open drain)	6~14
SG10/GR7 to SG12/GR5	O	Segment Output Pin/ Grid Output Pin (CMOS Output)	15~17
GND	-	Ground Pin	19,24
GR4 to GR1	O	Grid Output Pins (n-channel, open drain)	20~23

FUNCTIONAL DESCRIPTION

Commands

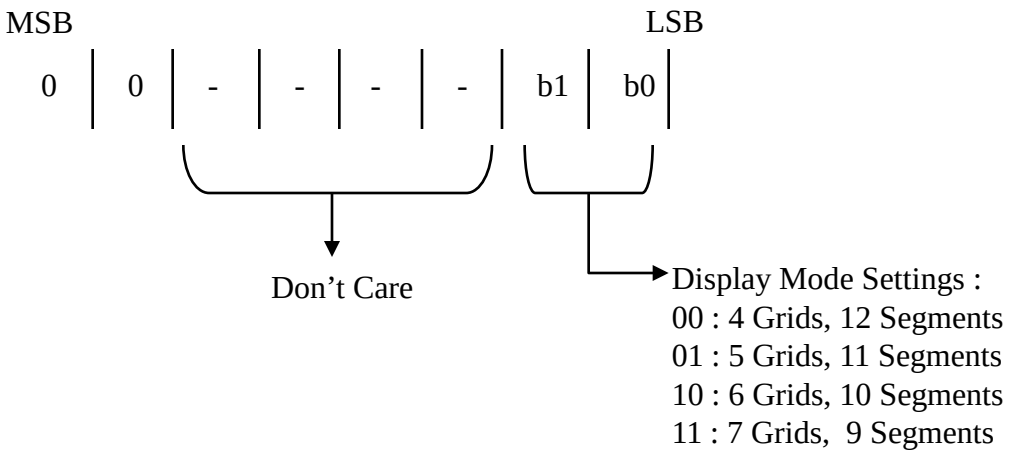
A command is the first byte (b0 to b7) inputted to IK2107 via DIN Pin after STB Pin has changed from ”HIGH” to “LOW” state. If for some reason the STB Pin is set “HIGH” while data or commands are being transmitted, the serial communication is initialized, and the data/commands being transmitted are considered invalid.

COMMAND 1 : DISPLAYMODE SETTING COMMANDS

IK2107 provides 4 display mode setting as shown in the diagram below: As stated earlier a command is the first one byte(b0 to b7) transmitted to IK2107 via the DIN Pin when STB is “LOW”. However, for these commands, Bit No.3 to Bit No.6(b2 to b5) are ignored,
Bit No.7 & Bit No.8(b6 to b7) are given a value of “0”.

The Display Mode Setting Commands determine the number of segments and grids be used (1/4 to 1/7 duty, 12 to 9 segments). When these commands are executed, the display forcibly turned off. A display command “ON” must be executed in order to resume display. If the same mode setting is selected, no command execution is take place, therefore, nothing happens.

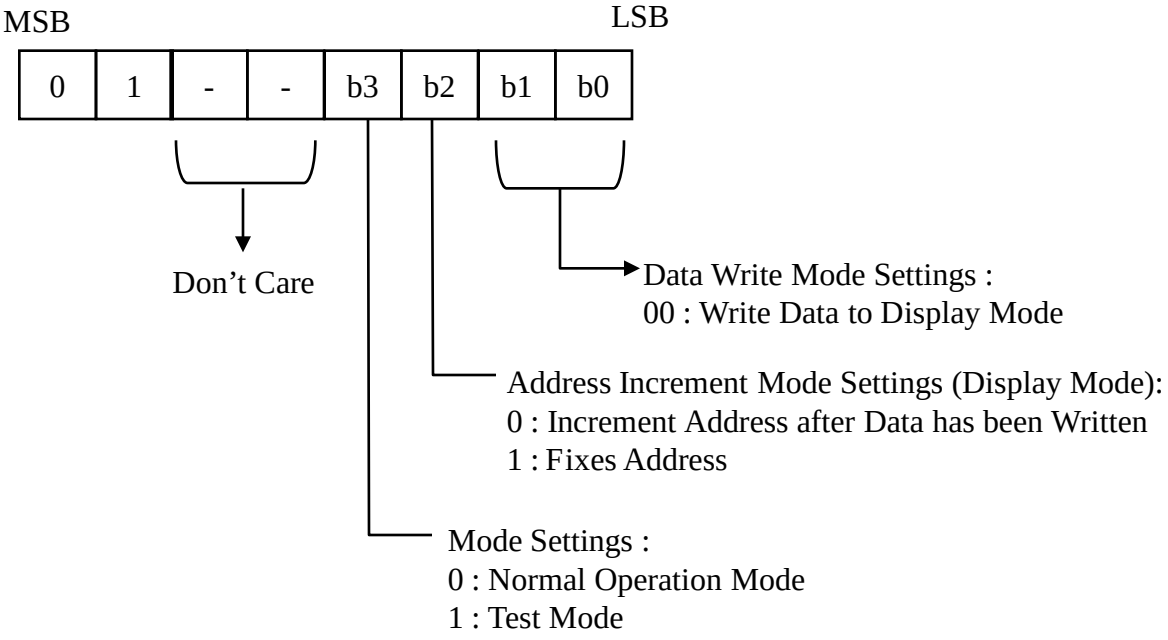
When Power is turned “ON”, the 7-Grid, 9-Segment Mode is selected.



COMMAND 2 : DATA SETTING COMMANDS

The Data Setting Commands executes the Data Write Mode for IK2107. The Data Setting Command, the bits5 and 6 (b4, b5) are ignored, bit7(b6) is given the value of “1” while bit8(b7) is given the value of “0”. Please refer to the diagram below.

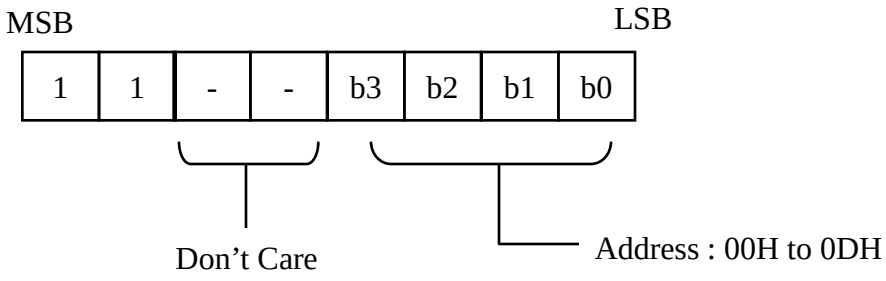
When power is turned ON, bit 4 to bit 1 (b3 to b0) are given the value of “0”.



COMMAND 3 : ADDRESS SETTING COMMANDS

Address Setting Commands are used to set the address of the display memory. The address is considered valid if it has a value of “00H” to 0DH”. If the address is set to 0EH or higher, the data is ignored until a valid address is set. When power is turned ON, the address is set at “00H”.

Please refer to the diagram below.



Display Mode and RAM Address

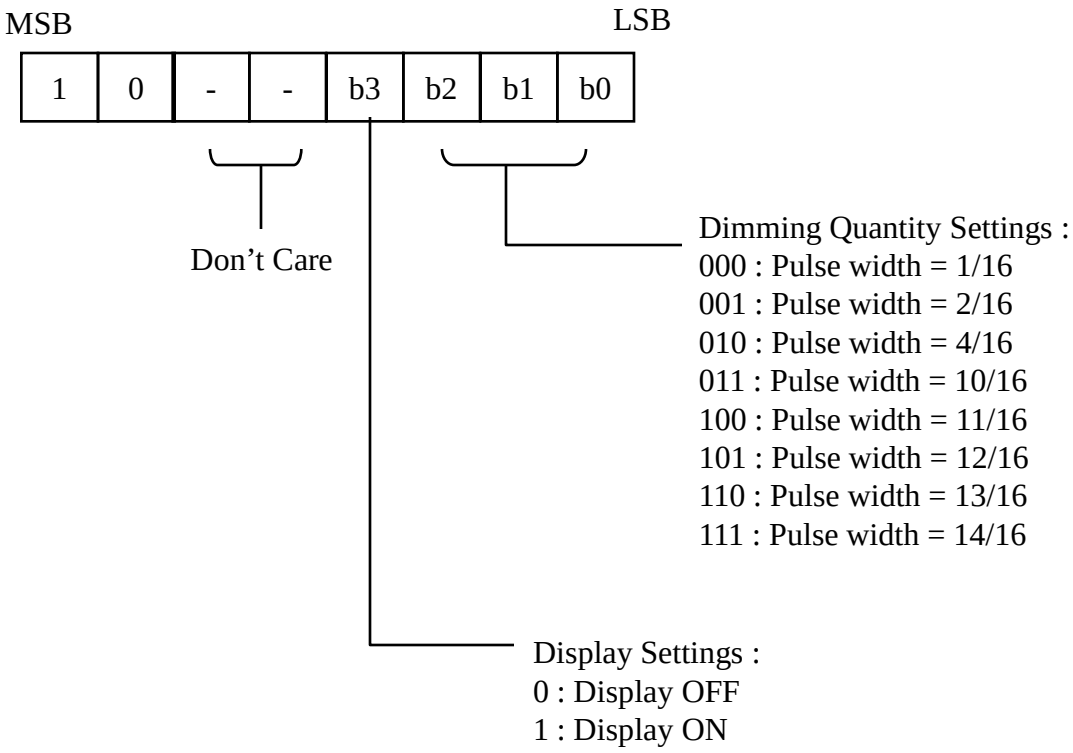
Data transmitted from an external device to IK2107 via the serial interface are stored in the Display RAM and are assigned addresses. The RAM Addresses of IK2107 are given below in 8 bit unit.

SG1	SG4 SG5	SG8 SG9	SG12	
$00H_L$	$00H_U$	$01H_L$		DIG1
$02H_L$	$02H_U$	$03H_L$		DIG2
$04H_L$	$04H_U$	$05H_L$		DIG3
$06H_L$	$06H_U$	$07H_L$		DIG4
$08H_L$	$08H_U$	$09H_L$		DIG5
$0AH_L$	$0AH_U$	$0BH_L$		DIG6
$0CH_L$	$0CH_U$	$0DH_L$		DIG7

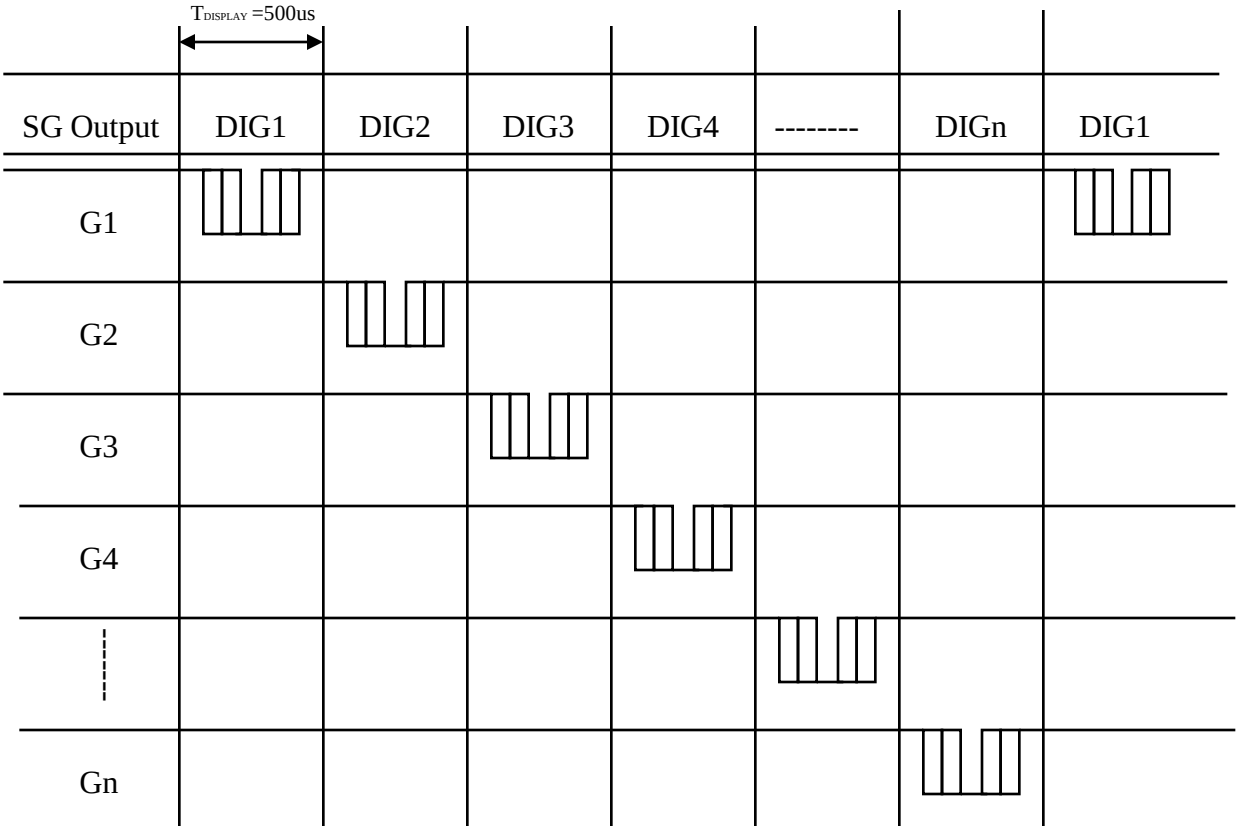
b0 b3	b4 b7
xxH_L	xxH_U
Lower 4 bits	Higher 4 bits

COMMAND 4 : DISPLAY CONTROL COMMANDS

The Display Control Commands are used to turn ON or OFF a display. It also used to set the pulse width. Please refer to the diagram below. When the power is turned ON, a 1/16 pulse width is selected and the displayed is turned OFF.

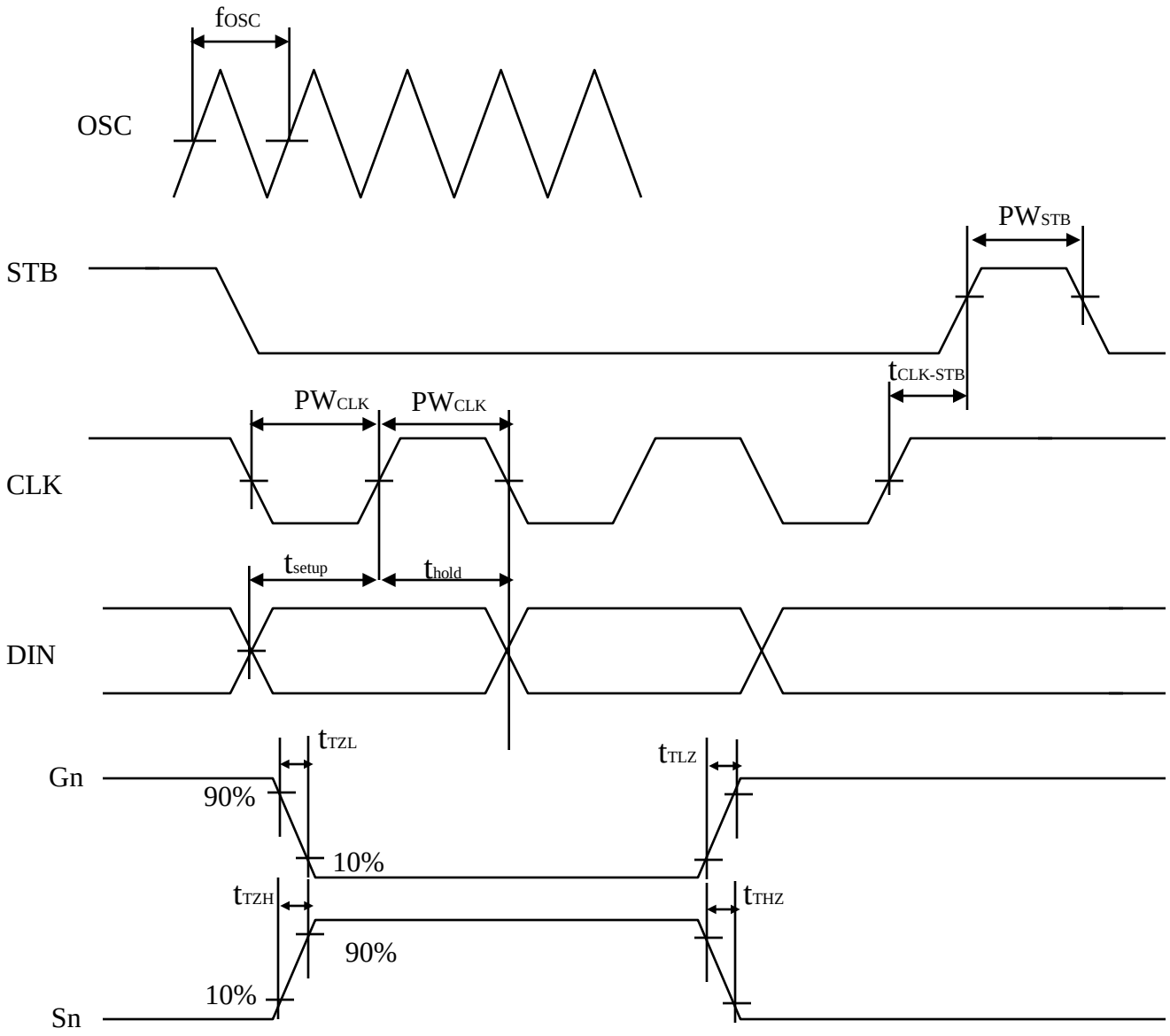


DISPLAY TIMING WAVEFORM



SWITCHING CHARACTERISTIC WAVEFORM

IK2107 Switching Characteristies Waveform is given below.



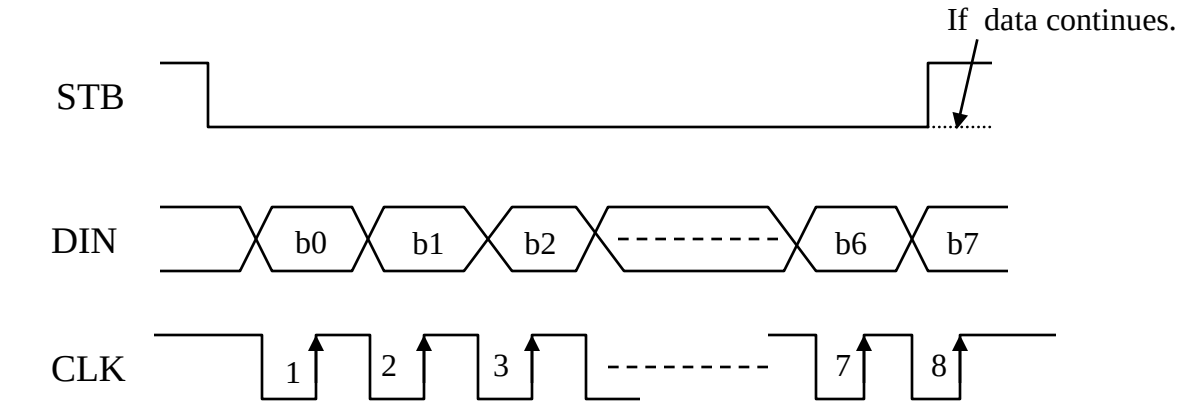
PW $_{CLK}$ (Clock Pulse Width) ≥400ns
t setup (Data Setup Time) ≥ 100ns
t $_{CLK-STB}$ (Clock - Strobe Time) ≥ 1μs
t $_{TZH}$ (Rise Time) ≤ 1μs
t $_{TZL}$ <1μs

PW$_{STB}$ (Strobe Pulse Width) ≥ 1μs
thold (Data Hold Time) ≥ 100ns
t $_{THZ}$ (Fall Time) ≤ 10μs
fosc = Oscillation Frequency
t $_{TlZ}$ <10μs

SERIAL COMMUMICATION FORMAT

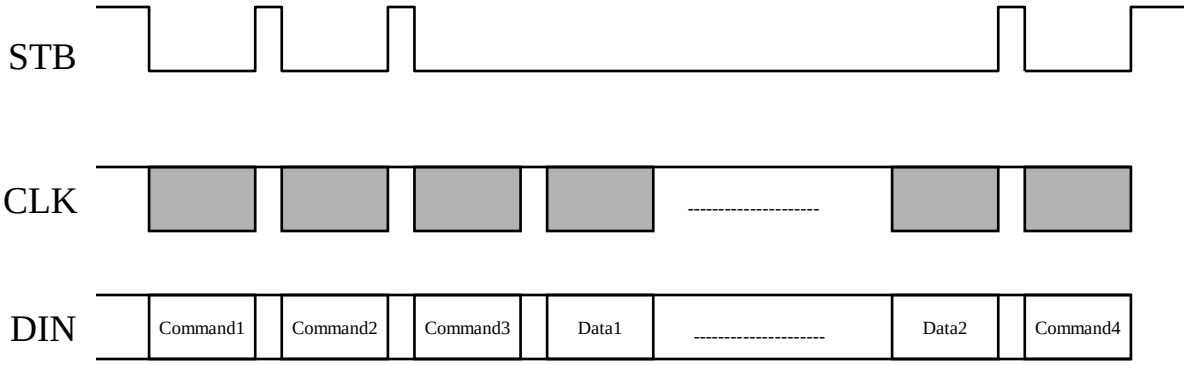
The following diagram shows the IK2107 serial communication format.

RECEPTION (Data/Command Write)



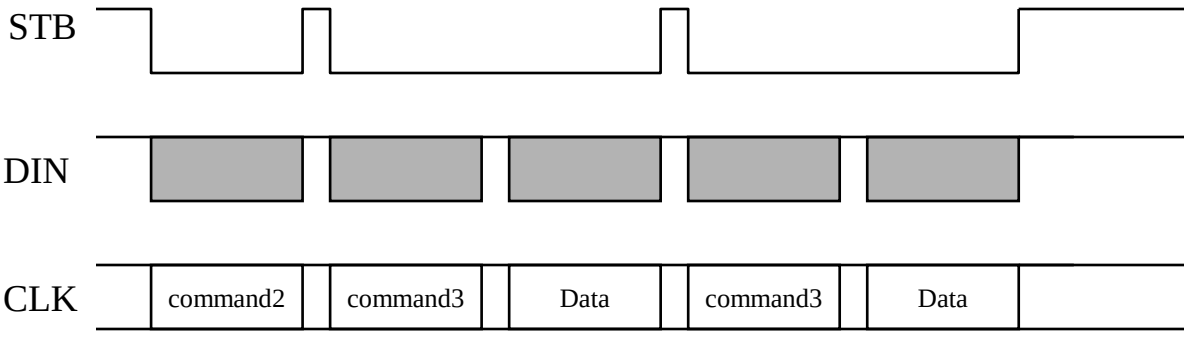
APLICATIONS

Display memory is updated by incrementing addresses. Please refer to the following diagram.



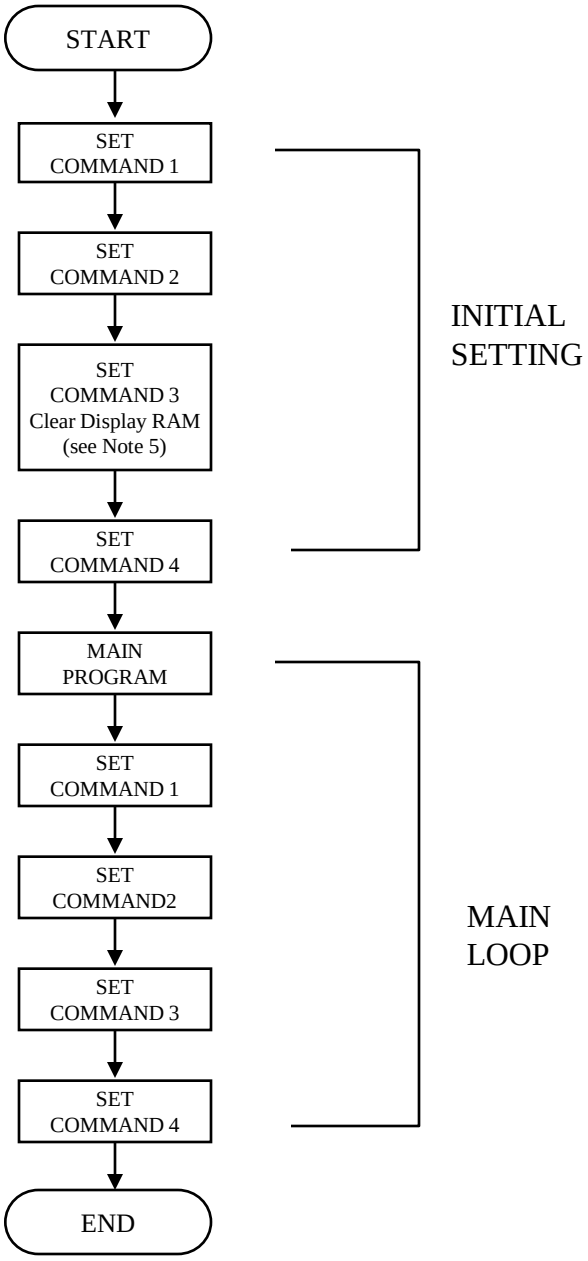
Where : Command 1 : Display Mode Setting
Command 2 : Data Setting Command
Command 3 : Address Setting Command
Data 1 to n : Transfer Display Data (14 Bytes max.)
Command 4 : Display Control Command

The following diagram shows the waveforms when updating specific addresses.



Where : Command 2 -- Data Setting Command
Command 3 -- Address Setting Command
Data -- Display Data

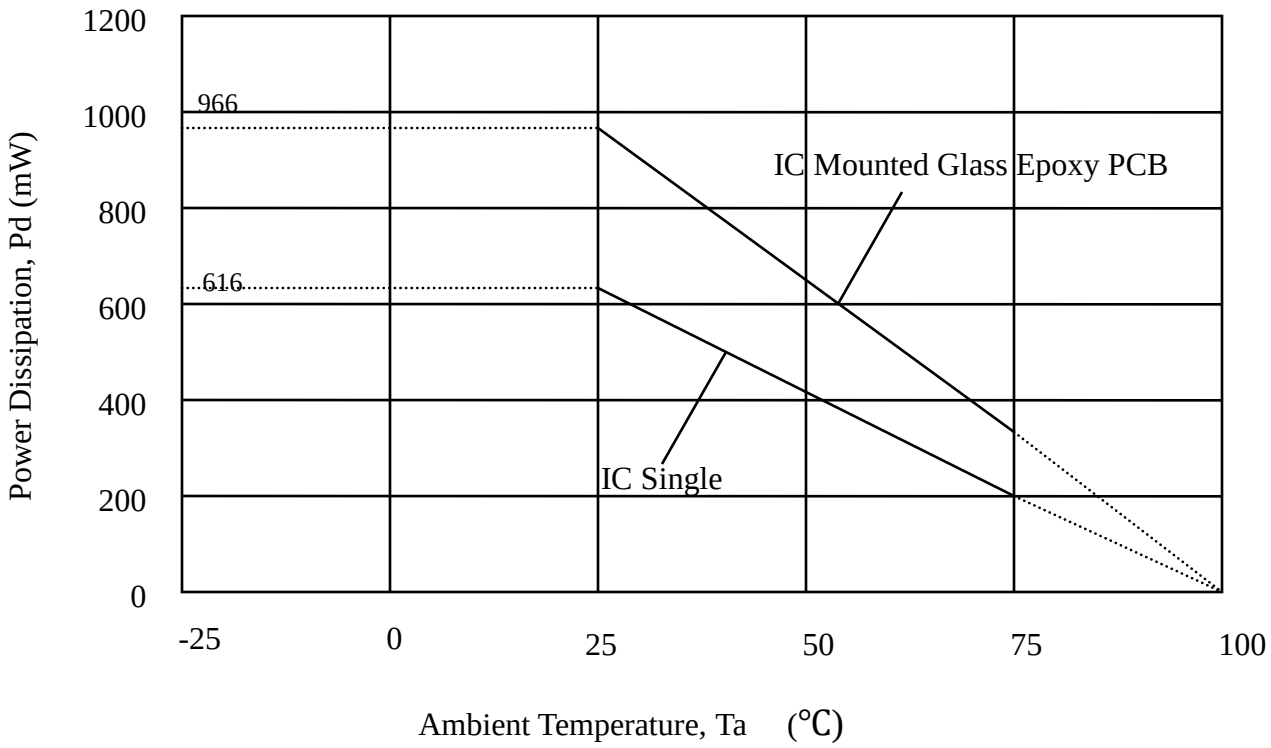
RECOMMENDED SOFTWARE PROGRAMMING FLOWCHART



Note : 1. Command 1 : Display Mode Setting
2. Command 2 : Data Setting Commands
3. Command 3 : Address Setting Commands
4. Command 4 : Display Control Commands
5. When IC power is applied for the first time, the contents of the Display RAM are not defined : thus, it is strongly suggested that the contents of the Display RAM must be cleared during the initial setting.

SOP 24L (300 MIL) THERMAL PERFORMANCE IN STILL AIR

Junction Temperature : 100℃



ABSOLUTE MAXIMUM RATINGS*

(Unless otherwise stated, Ta=25℃, GND=0V)

Parameter	Symbol	Rating	Units
Supply Voltage	V_{DD}	-0.5 to +7.0	V
Logic Input Voltage	VI	-0.5 to V_{DD}+0.5	V
Driver Output Current/Pin	IOLGR	+250	mA
	IOHSG	-50	mA
Maximum Driver Output Current/Total	ITOTAL	400	mA

* Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied.
Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING RANGE

(Unless otherwise stated, Ta= -20 to +70℃, GND=0V)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Logic Supply Voltage	V_{DD}	4.5	5	5.5	V
Dynamic Current (see Note)	I_{DDdyn}	.	.	5	mA
High-Level Input Voltage	V_{IH}	0.8V_{DD}	.	V_{DD}	V
Low-Level Input Voltage	VIL	0	.	0.3 V_{DD}	V

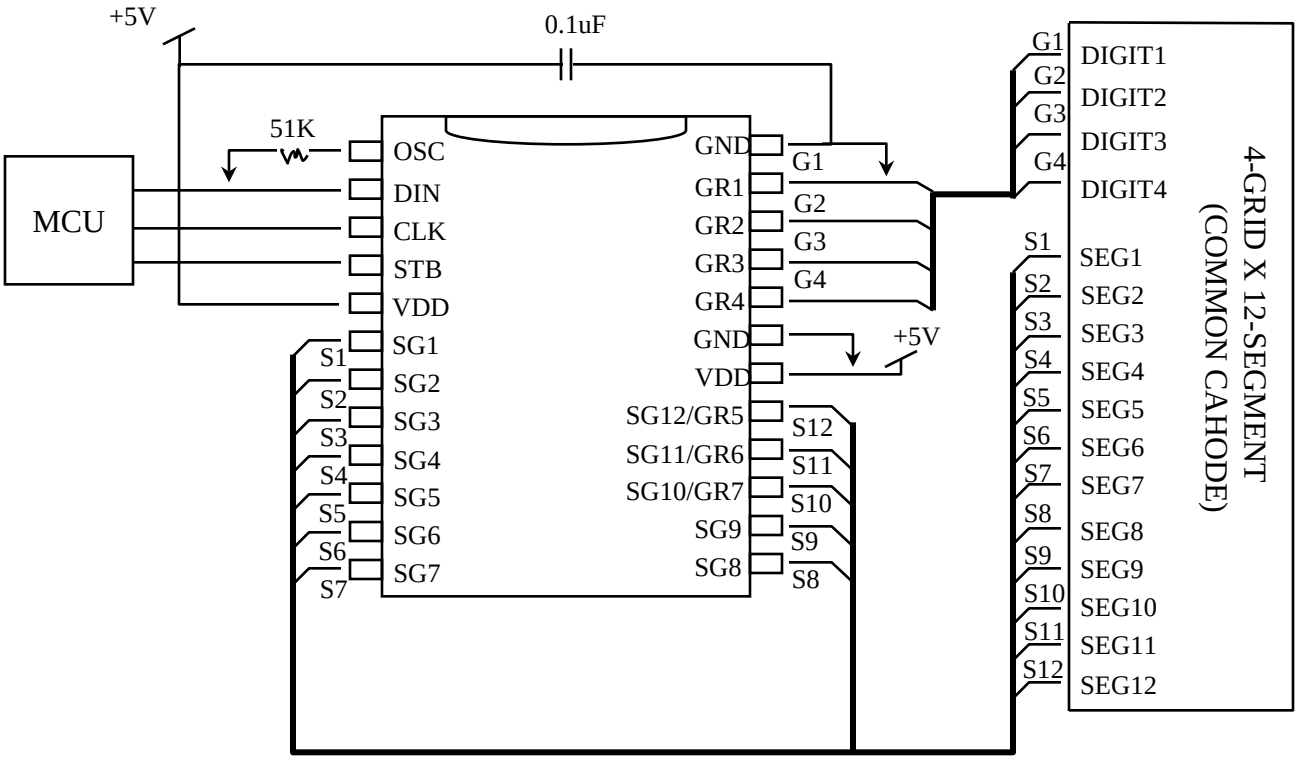
Note : Test Condition : Set Display Control Commands = 80H (Display Turn OFF State)

ELECTRICAL CHARACTERISTICS

(Unless otherwise stated, V_{DD}=5V, GND=OV, Ta=25℃,

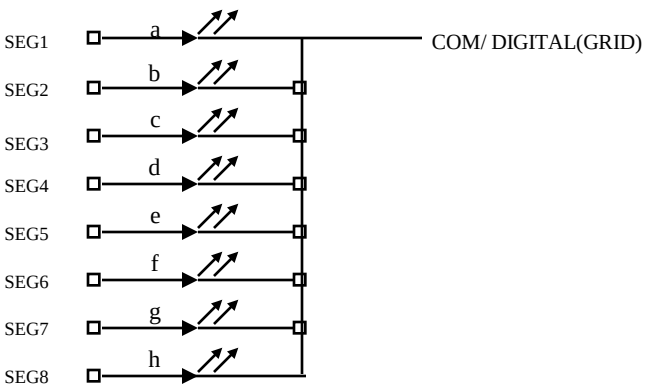
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
High-Level Output Current	I_{OHSG1}	$V_O = V_{DD}$ - 1V SG1 to SG9. SG10/GR7 to SG12/GR5	-10	-14	-30	mA
	I_{OHSG2}	$V_O = V_{DD}$ - 2V SG1 to SG9. SG10/GR 7 to SG12/GR5	-20	-25	-50	mA
Low-Level Output Current	I_{OLGR}	V_O = 0.3V GR1 TO GR4. SG10/GR7 to SG12/GR5	100	140	-	mA
Segment High-Level Output Current Tolerance	I_{TOLSG}	$V_O = V_{DD}$ - 1V SG1 TO SG9. SG10/GR7 to SG12/GR5	-	-	±5	%
High-Level Input Voltage	V_{IH}	-	0.8VDD	-	-	V
Low-Level Input Voltage	V_{IL}	-	.	-	0.3VDD	V
Oscillation Frequency	f_{OSC}	R = 51KOms	350	500	650	kHz

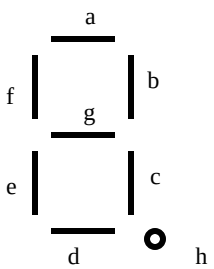
APPLICATION CIRCUIT



Note : The capacitor (0.1uF) connected between the GND and VDD Pins must be located as near as possible to the IK2107 chip.

COMMON CATHODE TYPE LED PANEL

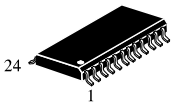


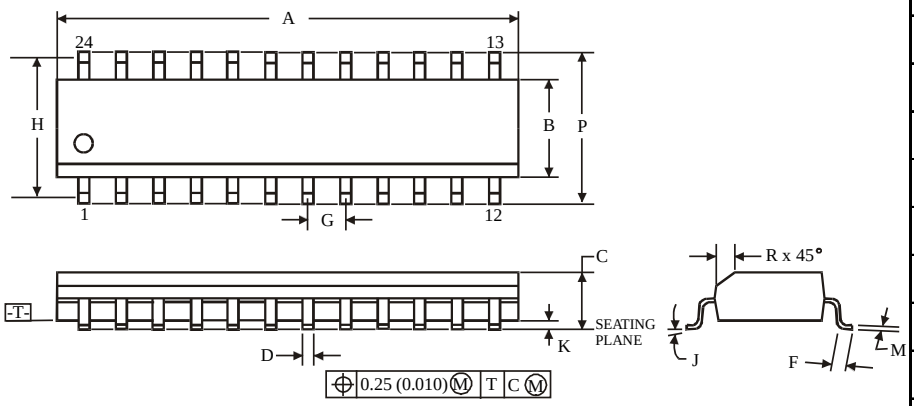


Package Dimensions

24 SOP

D SUFFIX SOIC
(MS - 013AD)





	Dimension, mm	
Symbol	MIN	MAX
A	15.20	15.60
B	7.40	7.60
C	2.35	2.65
D	0.33	0.51
F	0.40	1.27
G	1.27	
H	9.53	
J	0°	8°
K	0.10	0.30
M	0.23	0.32
P	10.00	10.65
R	0.25	0.75

NOTES:

1. Dimensions A and B do not include mold flash or protrusion.
2. Maximum mold flash or protrusion 0.15 mm (0.006) per side for A; for B – 0.25 mm (0.010) per side.