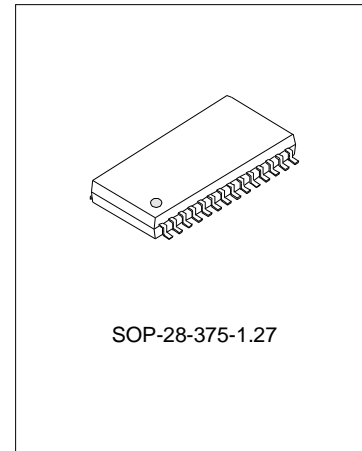


LED DRIVER IC OF (14~11) X (4~7) SEGMENTS DISPLAY

DESCRIPTION

SC16459 is an LED controller driven on a 1/4 to 1/7 duty factor. Fourteen to eleven segment output lines, 4 to 7 grid output lines, one display memory, control circuit are all incorporated into a single chip to build a highly reliable peripheral device for a single chip microcomputer. Serial data is fed to SC16459 via a three-line serial interface. SC16459's pin assignments and application circuit are optimized for easy PCB layout and cost saving advantages.



FEATURES

- * CMOS technology
- * Low power consumption
- * 8-step dimming circuitry
- * Serial interface for clock, data input, strobe pins

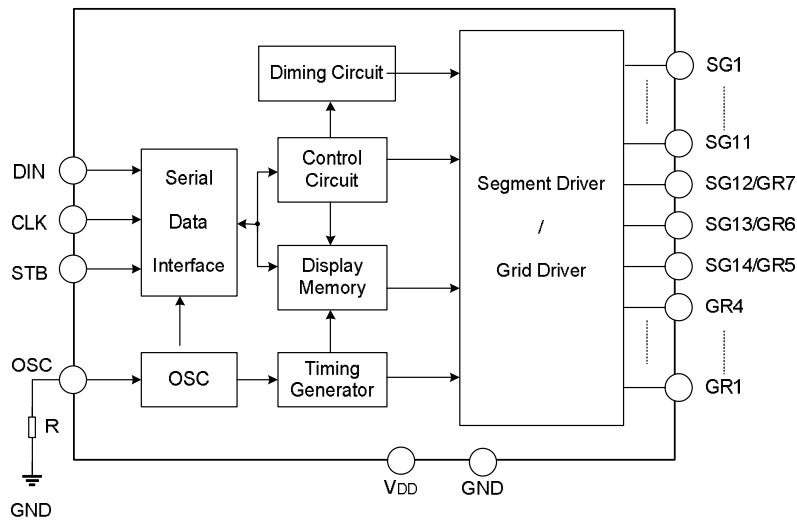
ORDERING INFORMATION

Device	Package
SC16459	SOP-28-375-1.27

APPLICATIONS

- * Microcomputer peripheral device

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (unless otherwise stated, $T_{amb}=25^{\circ}\text{C}$, $V_{SS}=0\text{V}$)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{DD}	-0.5 to +7	V
Logic Input Voltage	V_I	-0.5 to $V_{DD}+0.5$	V
Driver Output Current	I_{OLGR}	+250	mA
	I_{OHSG}	-50	mA

ELECTRICAL CHARACTERISTICS (unless otherwise stated, VDD=5V, VSS=0V, Tamb=25°C)

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage	VDD	--	4.5	5	5.5	V
Dynamic Current (note)	IDDdyn	--	--	--	5	mA
High-Level Output Current	IOHSG1	VO=VDD-1V, SG1 to SG11 SG12/GR7 to SG14/GR5	-10	-14	--	mA
	IOHSG2	VO=VDD-2V, SG1 to SG11 SG12/GR7 to SG14/GR5	-20	-25	--	mA
Low-Level Output Current	IOLGR	VO=0.3V, GR1~GR4, SG14/GR5~ SG12/GR7	100	140	--	mA
Segment High-Level Output Current Tolerance	ITOLSG	VO=VDD-1V, SG1 ~ SG11 SG12/GR7~SG14/GR5	--	--	±5	%
High-Level Input Voltage	VIH	--	0.7VDD	--	5	V
Low-Level Input Voltage	VIL	--	0	--	0.3VDD	V
Oscillation Frequency	fOSC	R=51kΩ	350	500	650	kHz

Note: test condition: set display control commands=80H (display turn OFF state)

PIN CONFIGURATIONS



PIN DESCRIPTIONS

Pin NO.	Pin name	Description
1	OSC	Oscillator input pin, determine the oscillation frequency by a resistor which is connected to this pin.
2	DIN	Data input pin. This pin inputs serial data at the rising edge of the shift clock (starting from the lower bit).
3	CLK	Clock input pin. This pin reads serial data at the rising edge.
4	STB	Serial interface strobe pin. The data input after the STB has fallen is processed as a command. When this pin "HIGH", CLK is ignored.
5, 20	VDD	Logic Power supply.
6~16	SG1 to SG11	Segment output pins (p-channel. Open drain).
17~19	SG12/GR7 to SG14/GR5	Segment output Pin/Grid output pin (CMOS output).

(To be continued)

(Continued)

Pin NO.	Pin name	Description
21, 26	GND	Logic Ground pin.
22~25	GR4 to GR1	Grid output pins (n-channel, open drain).
27, 28	NC	No connection

FUNCTION DESCRIPTIONS

COMMANDS

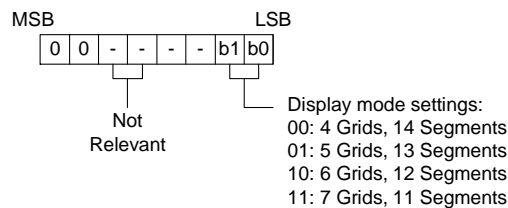
A command is the first byte (b0 to b7) inputted to SC16459 via the DIN pin after STB pin has changed from "HIGH" to "LOW" state. If for some reason the STB pin is set to "HIGH" while data or commands are being transmitted, the serial communication is initialized, and the data/commands being transmitted are considered invalid.

COMMAND 1: DISPLAY MODE SETTING COMMANDS

SC16459 provides 4 display mode settings as shown in the diagram below: As told above a command is the first one byte data (b0 to b7) which is transmitted to SC16459 via the DIN pin when STB is "LOW". However, for these commands, the bits 3 to bit 6 (b2 to b5) are ignored, the bits 7 & 8 (b6 to b7) are given a value of "0"

The display mode setting commands determine the number of segments and grids to be used (1/4 to 1/7 duty, 14 to 11 segments). The display is forcibly turned off when these commands are executed. In order to resume display, a display commands "ON" must be executed. If the same mode setting is selected, no command execution will be taken place, that is to say, nothing will happen.

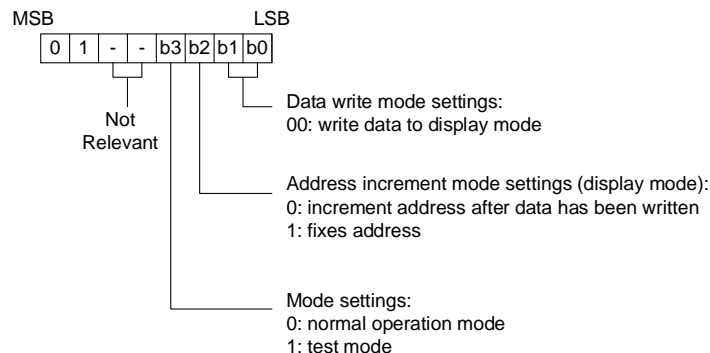
When power is turned "ON", the 7-Grid, 11-Segment mode is selected.



COMMAND 2: DATA SETTING COMMANDS

The Data Setting Commands execute the Data Write Mode for SC16459. The Data Setting Command, the bits 5 and 6 (b4, b5) are ignored, bit 7 (b6) is given the value of "1" while bit 8 (b7) is given the value of "0". Please refer to the diagram below.

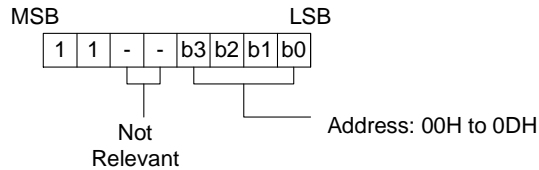
When power is turned ON, bit 4 to bit 1 (b3 to b0) are given the value of "0".



COMMAND 3: ADDRESS SETTING COMMANDS

Address Setting Commands are used to set the address of the display memory. If it has a value of "00H" to "0DH", the address is considered valid. 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

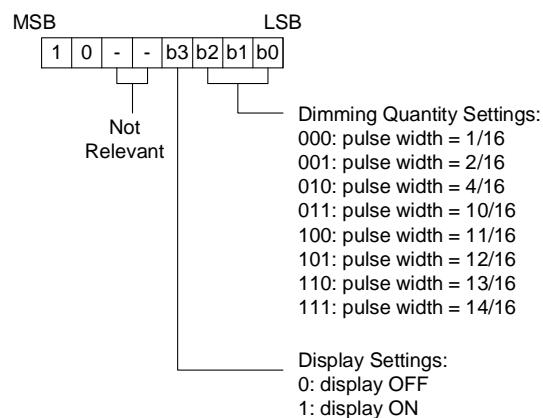
Data transmitted from an external device to SC16459 via the serial interface are stored in the display RAM and are assigned addresses. The RAM addresses of SC16459 are given below in 8 bits unit.

SG1	SG4	SG5	SG8	SG9	SG12	SG13	SG14	
00HL		00HU			01HL		01HU	DIG1
02HL		02HU			03HL		03HU	DIG2
04HL		04HU			05HL		05HU	DIG3
06HL		06HU			07HL		07HU	DIG4
08HL		08HU			09HL		09HU	DIG5
0AHL		0AHU			0BHL		0BHU	DIG6
0CHL		0CHU			0DHL		0DHU	DIG7

b0	b3	b4	b7
xxHL		xxHu	
Lower 4 bits		Higher 4 bits	

COMMAND 4: DISPLAY CONTROL COMMANDS

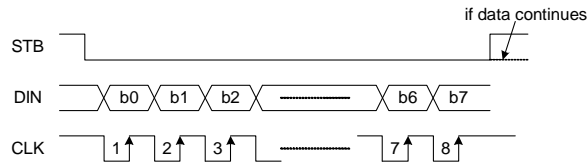
The Display Control Commands are used to turn ON or OFF a display. It also used to set the pulse width. Please refer to the diagram below. When the power is turned ON, a 1/16 pulse width is selected and the displayed is turned OFF.



SERIAL COMMUNICATION FORMAT

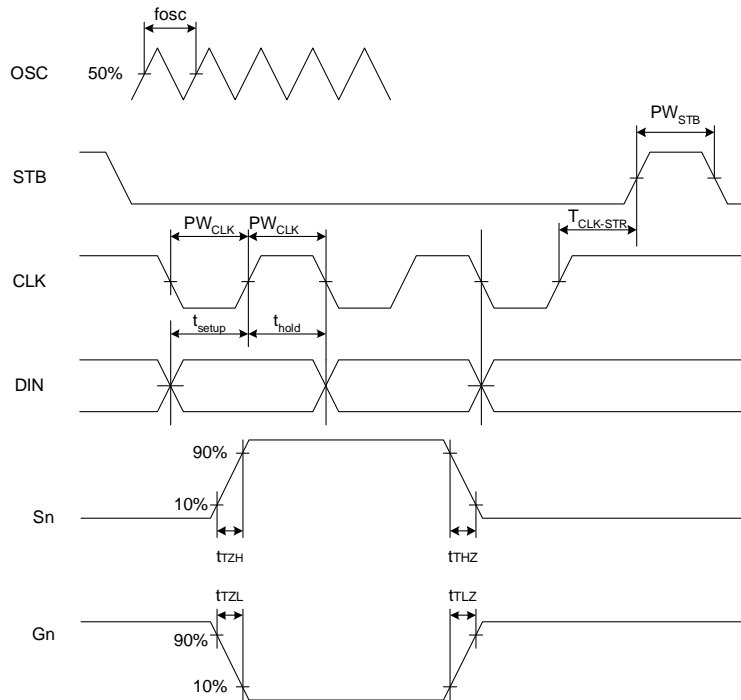
The following diagram shows the SC16459 serial communication format.

RECEPTION (Data/Command Write)



SWITCHING CHARACTERISTIC WAVEFORM

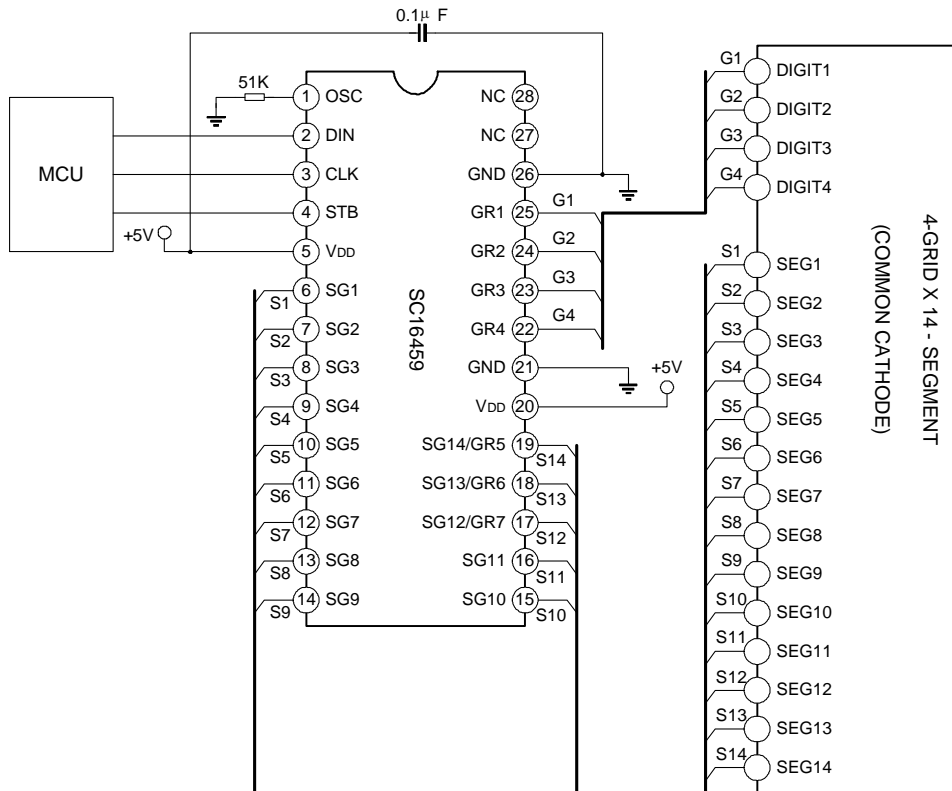
SC16459 switching characteristics waveform is given below.



Where:

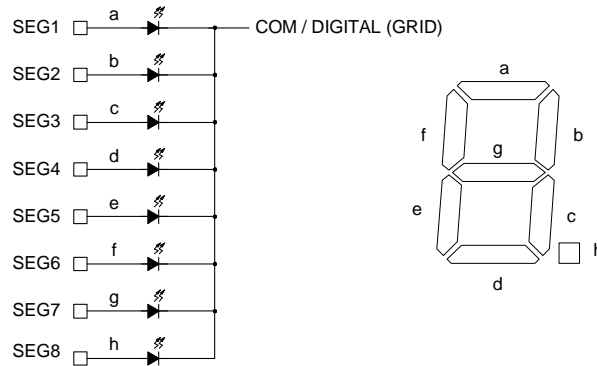
PW_{CLK} (clock pulse width) $\geq 400\text{ns}$	PW_{STB} (strobe pulse width) $\geq 1\mu\text{s}$
t_{setup} (data setup time) $\geq 100\text{ns}$	t_{hold} (Data hold time) $\geq 100\text{ns}$
$t_{CLK-STB}$ (clock strobe time) $\geq 1\mu\text{s}$	t_{TfZ} (fall time) $\leq 10\mu\text{s}$
t_{TfZ} (rise time) $\leq 1\mu\text{s}$	f_{OSC} = Oscillation Frequency
$t_{TZL} < 1\mu\text{s}$	$t_{TZL} < 10\mu\text{s}$

APPLICATION CIRCUIT

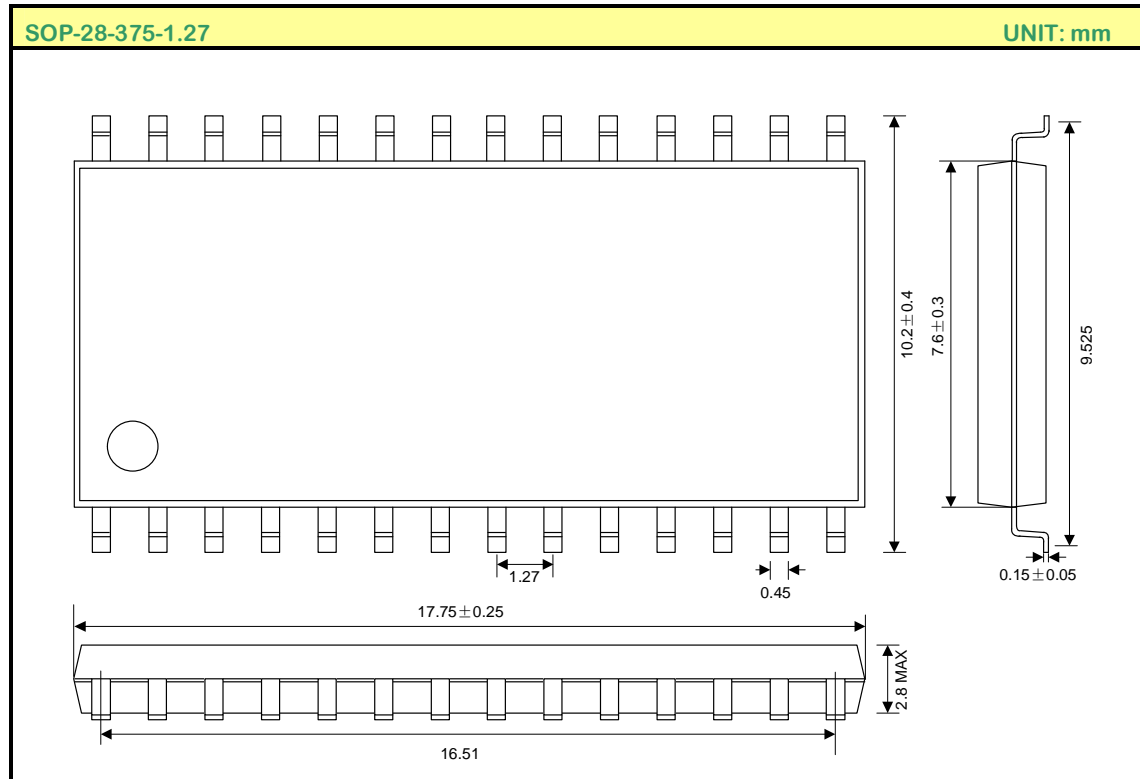


Note: the capacitor (0.1µF) connected between the GND and VDD pins must be located as near as possible to the SC16459 chip.

COMMON CATHODE TYPE LED PANEL:



PACKAGE OUTLINE



HANDLING MOS DEVICES:

Electrostatic charges can exist in many things. All of our MOS devices are internally protected against electrostatic discharge but they can be damaged if the following precautions are not taken:

- Persons at a work bench should be earthed via a wrist strap.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed for dispatch in antistatic/conductive containers.

ATTACHMENT

Revision History

Data	REV	Description	Page
2004.02.04	1.0	Original	
2004.07.19	1.1	Modify the" ELECTRICAL CHARACTERISTICS"	