**Silan Microelectronics**

LED DRIVER IC (10 X 4 SEGMENTS)

DESCRIPTION

SC16458 is an LED controller driven on a 1/6 duty factor. It is suitable for most application in a lot of consumer products and is composed of one display memory, ten segment outputs, four grid outputs and control circuit. The microcomputer often needs this chip to build a highly reliable peripheral device. A three-line serial interface is used by SC16458 to get serial data.

FEATURES

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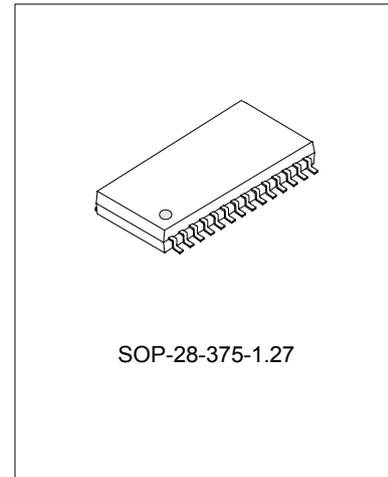
APPLICATIONS

* Microcomputer peripheral device

SOP-28-375-1.27

ORDERING INFORMATIONS

Device	Package
SC16458	SOP-28-375-1.27

BLOCK DIAGRAM
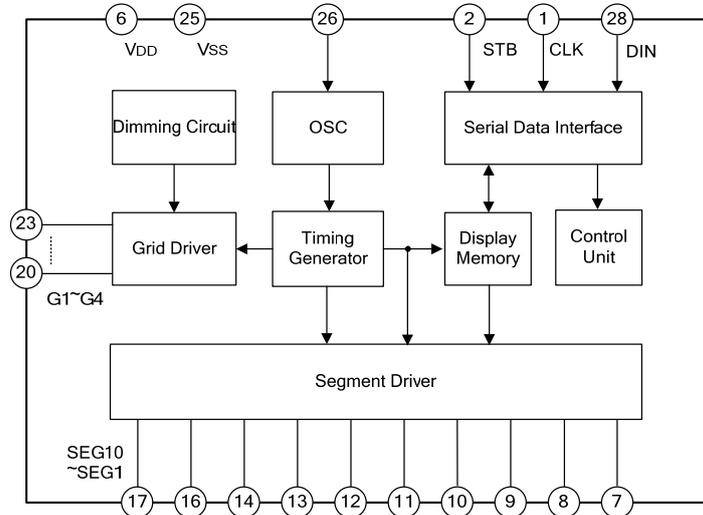
ABSOLUTE MAXIMUM RATINGS (unless otherwise stated, $T_{amb}=25°C$, $V_{SS}=0V$)

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, V_{DD}=5V, V_{SS}=0V, T_{amb}=25°C)

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage	V_{DD}		4.5	5	5.5	V
Dynamic Current (note)	I_{DDdyn}		--	--	5	mA
High-Level Output Current	I_{OHSG1}	V_O=V_{DD}-1V SEG1 to SEG10	-10	-14	--	mA
	I_{OHSG2}	V_O=V_{DD}-2V SEG1 to SEG10	-20	-25	--	mA
Low-Level Output Current	I_{OLGR}	V_O=0.3V, G1 to G5	100	140	--	mA
Segment High-Level Output Current Tolerance	I_{TOLSG}	V_O=V_{DD}-1V SEG1 to SEG10	--	--	±5	%
High-Level Input Voltage	V_{IH}	--	0.7V_{DD}	--	5	V
Low-Level Input Voltage	V_{IL}	--	0	--	0.3V_{DD}	V
Oscillation Frequency	Fosc	R=51kΩ	350	500	650	kHz

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

PIN CONFIGURATIONS
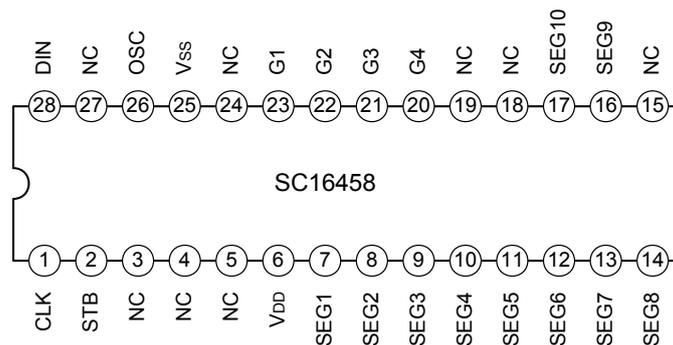
PIN DESCRIPTIONS

| Pin NO.	Pin name	Description
1	CLK	Clock input pin. This pin reads serial data at the rising edge.
2	STB	Serial interface strobe pin. The data input after the STB has fallen is processed as a command. When this pin is "HIGH", CLK is ignored.
3~5, 15, 18, 19, 24, 27	NC	No connection
6	V_{DD}	Logic power supply
7~14, 16~17	SEG1 ~ SEG8, SEG9~SEG10	Segment output pins (p-channel, open drain)
20~23	G4 to G1	Grid output pins (n-channel, open drain)
25	V_{SS}	Ground
26	OSC	Oscillator input pin. This pin requires a resistor to obtain the accurate oscillation frequency.
28	DIN	Data input pin. This pin inputs serial data at the rising edge of the shift clock (starting from the lower bits).

FUNCTION DESCRIPTIONS

COMMANDS

After the STB pin changes from "HIGH" to "LOW", SC16458G will obtain a command via the DIN pin. Otherwise, the STB pin is set to "HIGH", the data/commands being transmitted are considered invalid and the communication is initialized.

Command 1: data setting commands

The data setting commands executes the data write or data read modes for SC16458G. The data setting command, the bit 5 and bit 6 (b4, b5) are ignored, bit 7 (b6) is given the value of "1" while bit 8(b7) is set the value "0". Please refer to the diagram below.

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

```
MSB              LSB
 0  1  -  -  b3 b2 b1 b0
        |         |  |
        |         |  └── Data write & read mode settings:
        |         |      00: write data to display mode
        |         |
     Not          └───── Address increment mode settings (display mode):
   Relevant              0: increment address after data has been written (see note 1)
                         1: fixes address
        |
        └─────────────── Mode settings:
                         0: normal operation mode
                         1: test mode
```
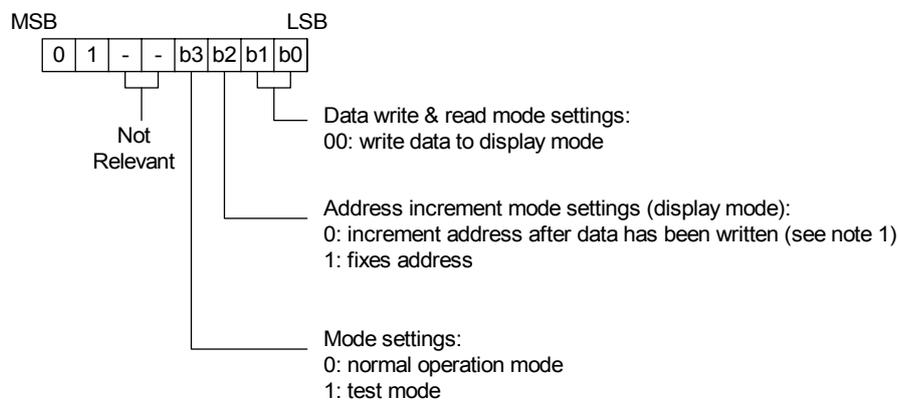
Note: 1. If you want to set bit 3 (b2) to "0", please remember that DIG5 address cannot be ignored since G5 exists, however, it is not externally bonded. Please refer to command 2, display mode and RAM address section.

Command 2: address setting commands

The address of the display memory is set by address setting commands. If the address has a value of "00H" to "09H", it is considered valid. If the address is set to 0AH 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.

```
MSB                    LSB
 1  1  -  -  b3 b2 b1 b0
        |           |
      Not           └── Address: 00H to 09H
    Relevant
```
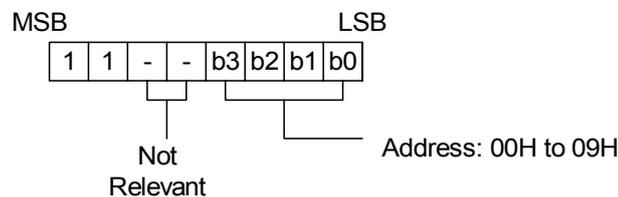
Display mode and RAM address

When an external device transmits the serial data into SC16458G, this data is stored in the display RAM and is assigned addresses. The RAM addresses of SC16458G are given below in 8-bit unit.

SEG1	SEG4	SEG5	SEG8	SEG9	SEG10	
00HL		00HU		01HL		DIG1
02HL		02HU		03HL		DIG2
04HL		04HU		05HL		DIG3
06HL		06HU		07HL		DIG4
08HL		08HU		09HL		DIG5

| b0	b3	b4	b7
xxHL		xxHu	
Lower 4 bits		Higher 4 bits	
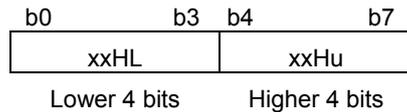
Command 3: display control commands.

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. A 1/16 pulse width is selected and the display is turned OFF only when the power is turned ON.

MSB   LSB

| 1 | 0 | - | - | b3 | b2 | b1 | b0 |

Not Relevant

Dimming Quantity Settings:
000: pulse width = 1/16
001: pulse width = 2/16
010: pulse width = 4/16
011: pulse width = 10/16
100: pulse width = 11/16
101: pulse width = 12/16
110: pulse width = 13/16
111: pulse width = 14/16

Display Setings:
0: display OFF
1: display ON
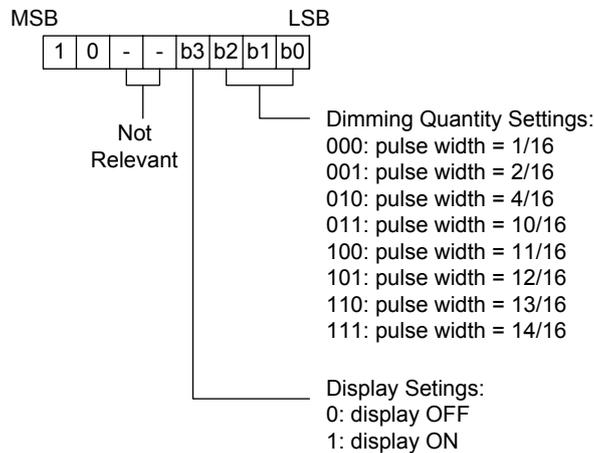
SERIAL COMMUNICATION FORMAT

The following diagram shows the SC16458G serial communication format.

RECEPTION (Data/Command Write)

probably data will continue

STB

DIN   b0 b1 b2 ------------------ b6 b7

CLK   1 2 3 ---------------- 7 8
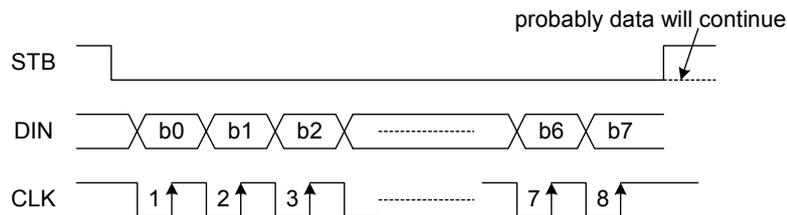
SWITCHING CHARACTERISTIC WAVEFORM

SC16458G switching characteristics waveform is given below.
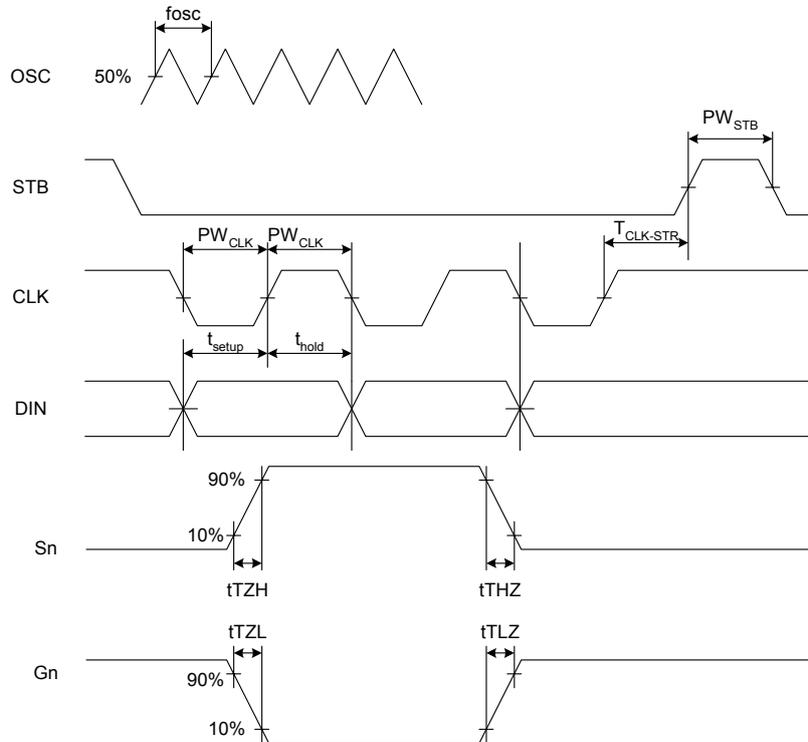
Where: PWCLK (clock pulse width)≥400ns   PWSTB (strobe pulse width) ≥ 1μs

t_{setup} (data setup time) ≥ 100ns t_{hold} (Data hold time) ≥ 100ns

$t_{clk-STB}$ (clock strobe time) ≥ 1μs t_{thz} (fall time)≤10μs

t_{tzh} (rise time) ≤1μs F_{OSC}= oscillation frequency

t_{TZL} <1μs t_{tlz} <10μs

APPLICATIONS

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

Where: Only when "STB" is low , the "CLK" signal is valid.
         Command 1: Data Setting Command
         Command 2: Address Setting Command
         Data 1 to n: Transfer Display Data (10 Bytes max.)
         Command 3: Display Control Command

The following diagram shows the waveforms when updating specific addresses.
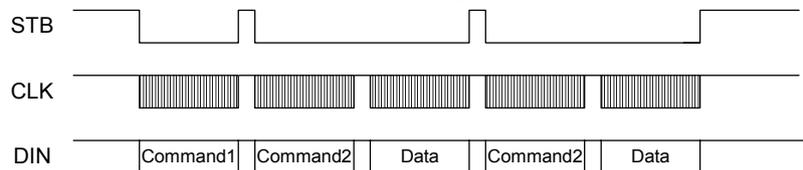
Where: Only when "STB" is low , the "CLK" signal is valid.
        Command 1--Data Setting Command
        Command 2-- Address Setting Command
        Data-- Display Data

RECOMMENDED PROGRAMMING FLOWCHART

```
        ┌─────────────┐
        │    START    │
        └──────┬──────┘
        ┌──────┴──────┐
        │  SET DATA   │────────┐
        └──────┬──────┘        │
        ┌──────┴──────┐        │  INITIAL
        │     SET     │        │  SETTING
        │   ADDRESS   │        │
        │ Clear Display RAM    │
        │  (see Note) │        │
        └──────┬──────┘        │
        ┌──────┴──────┐        │
        │     SET     │        │
        │   DISPLAY   │────────┘
        │ Display ON  │
        │ ("10xx1xxx")│
        └──────┬──────┘
        ┌──────┴──────┐◄───────┐
        │    MAIN     │        │
        │   PROGRAM   │        │
        └──────┬──────┘        │
        ┌──────┴──────┐        │
        │  SET DATA   │        │  MAIN
        └──────┬──────┘        │  LOOP
        ┌──────┴──────┐        │
        │     SET     │        │
        │   ADDRESS   │        │
        └──────┬──────┘        │
        ┌──────┴──────┐        │
        │     SET     │        │
        │   DISPLAY   │────────┘
        │ Display ON  │
        │ ("10xx1xxx")│
        └──────┬──────┘
        ┌──────┴──────┐
        │     END     │
        └─────────────┘
```
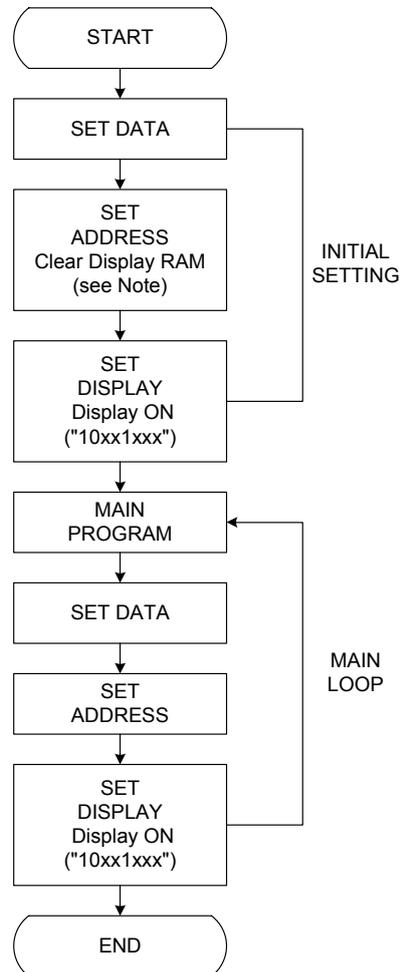
Note: When IC power is applied for the first time, the contents of the display RAM are not defined; thus, it is strongly suggested that the contents of the display RAM must be cleared during the initial setting.

TYPICAL APPLICATION CIRCUIT
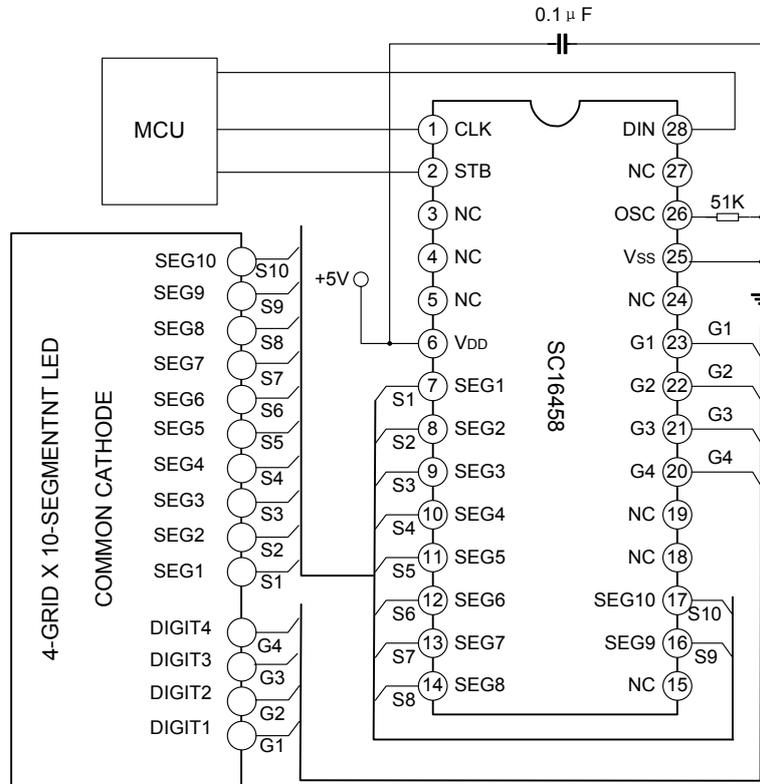
Note: the capacitor (0.1μF) connected between the GND and V_{DD} pins must be located as near as possible to the SC16458 chip.
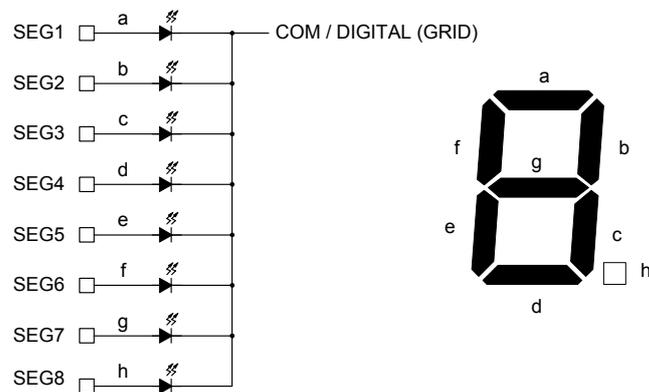
PACKAGE OUTLINE

SOP-28-375-1.27   **UNIT: mm**
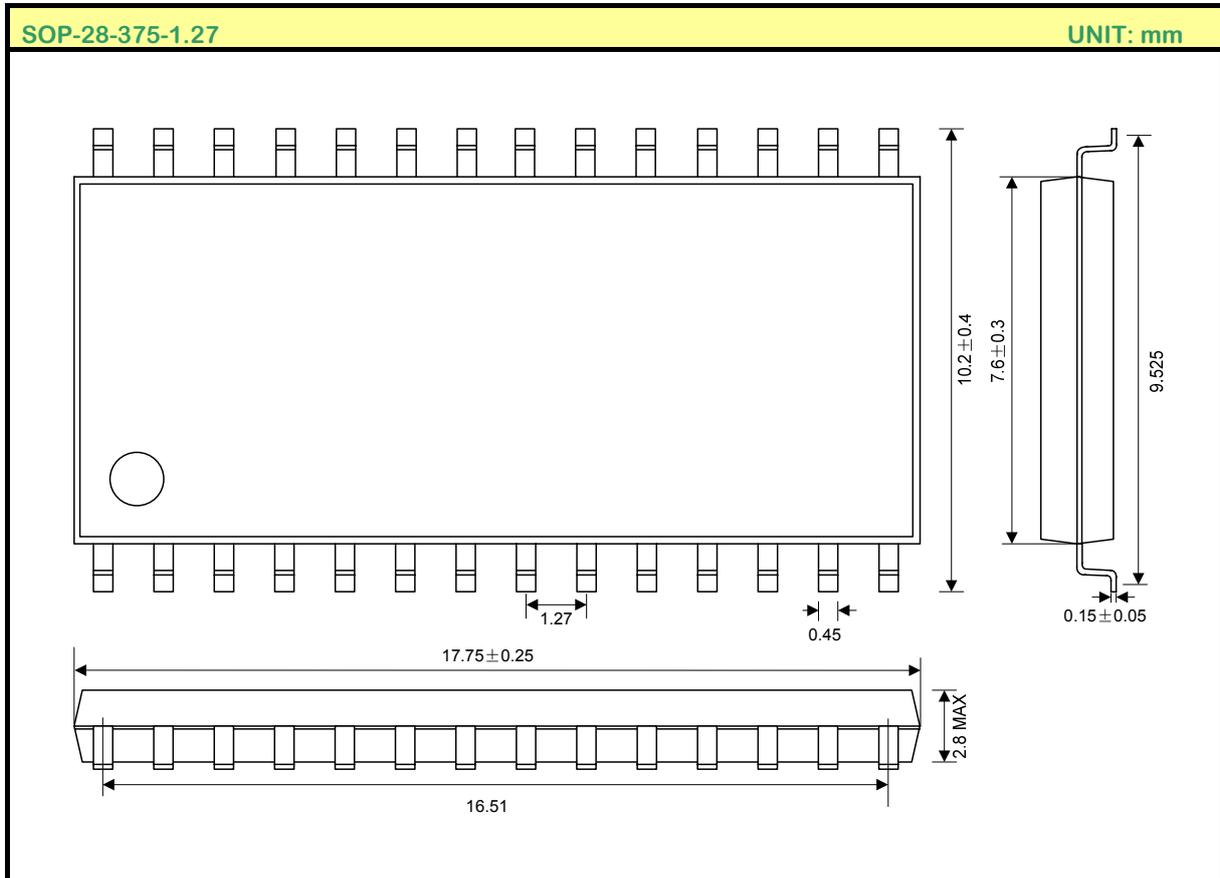
HANDLING MOS DEVICES:

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.