



## UL319C

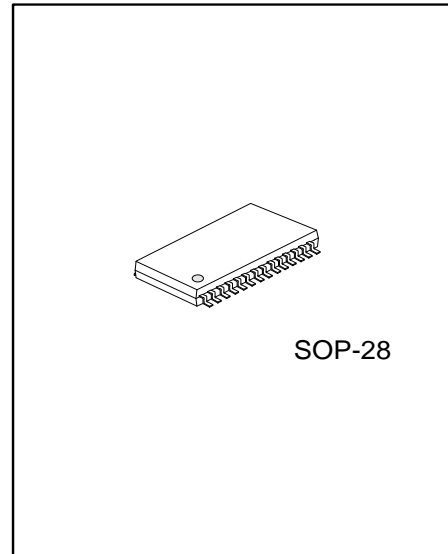
Preliminary

LINEAR INTEGRATED CIRCUIT

### SERIAL-INTERFACED 10-DIGIT LED CONTROLLER IC

#### DESCRIPTION

The **UL319C** is a compact LED controller and driver that interface microprocessors to LED displays through a serial 3-wire interface. It drives LED connected in common anode configuration. The **UL319C** drives up to 80 discrete LEDs in 10 segment/8 digit configuration while functioning from a supply voltage of 5.0V.



SOP-28

#### FEATURES

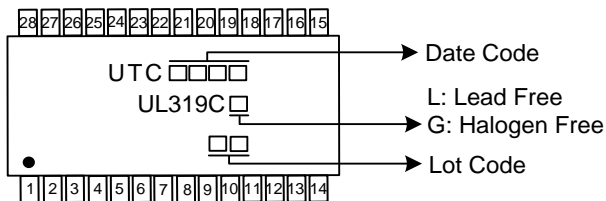
- \* LED driver with 18 outputs (10 segments/8 digits)
- \* Output pins connected directly to the LEDs
- \* 3-wire serial bus interface (CLK, STB, DI/O)
- \* 8-step dimming circuit to control the overall display brightness
- \* Inputs with Schmitt trigger give superior noise immunity
- \* 5.0 V ( $\pm 10\%$ ) for  $V_{DD}$
- \* Drives common-anode LED digits
- \* Built-in power on reset circuits
- \* Built-in pull-up resistor (CLK,STB,DI/O)

#### ORDERING INFORMATION

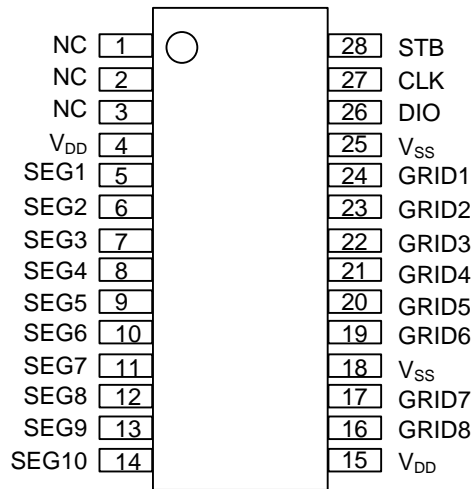
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UL319CG-S28-R	UL319CG-S28-R	SOP-28	Tape Reel

<p>UL319CG-S28-R</p> <ul style="list-style-type: none"> <li>(1) Packing Type</li> <li>(2) Package Type</li> <li>(3) Green Package</li> </ul>	<ul style="list-style-type: none"> <li>(1) R: Tape Reel</li> <li>(2) S28: SOP-28</li> <li>(3) G: Halogen Free and Lead Free, L: Lead Free</li> </ul>
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#### MARKING



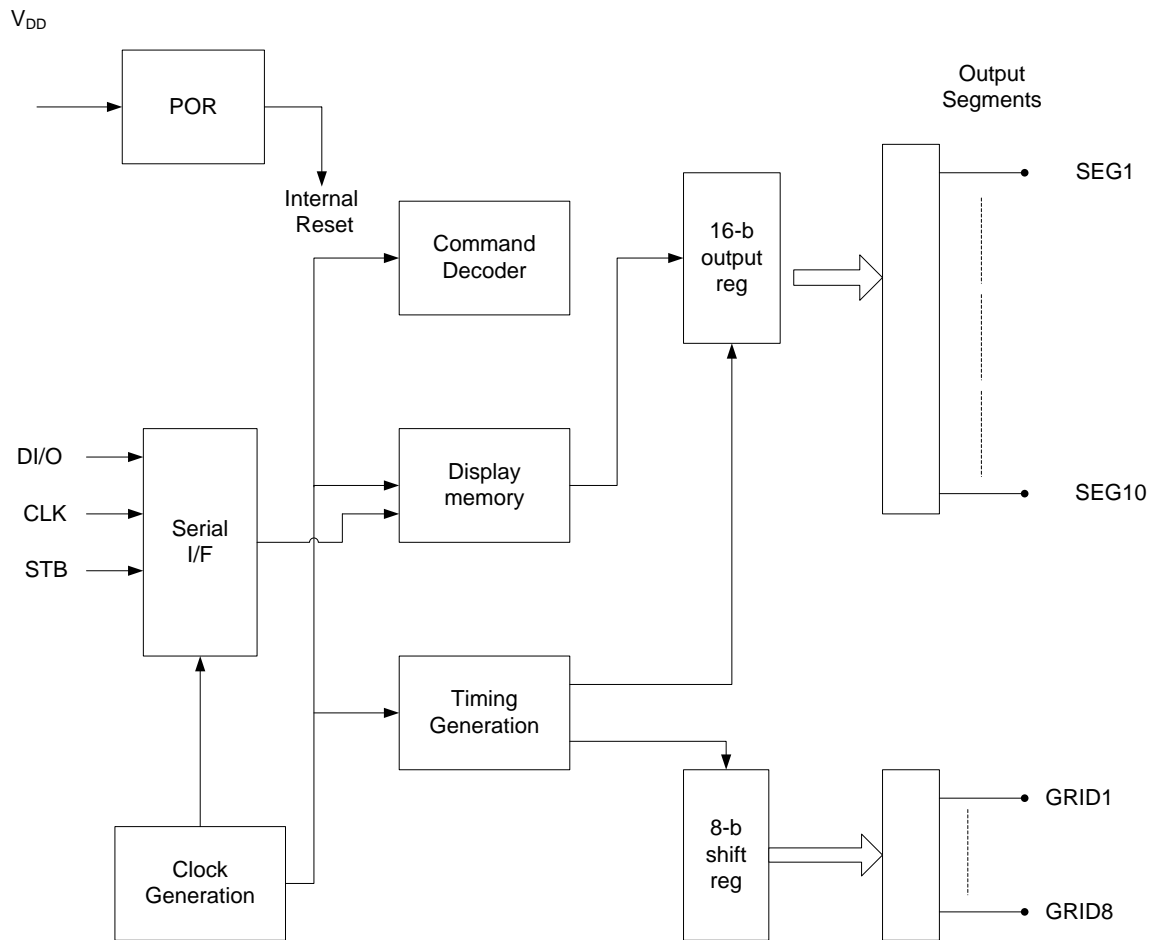
■ PIN CONFIGURATIONS



■ PIN CONFIGURATIONS

PIN NUMBER	SYMBOL	TYPE	FUNCTION
26	DIO	IN/OUT	Output serial data at falling edge of the shift clock, starting from lower bit. Input serial data is clocked in at rising edge of the shift clock, starting from lower bit.
27	CLK	IN	Reads serial data at rising edge, and outputs data at falling edge.
28	STB	IN	Initializes serial interface at rising or falling edge for reception of command. Data input after the falling edge of STB are processed as a command. While command data are processed, current processing is stopped, and the serial interface is initialized. While STB is high, instructions are ignored.
5 ~ 15	SEG1/ ┆ SEG10	OUT	Segment output pin
24,23,22,21,20 ,19,17,16	GRID1 ┆ GRID8	OUT	Digit output pin
4,15	V <sub>DD</sub>	PWR	5.0 V ± 10% Core main supply voltage. Bypass to GND through a 0.1 μF capacitor as close to the pin as possible
18,25	V <sub>SS</sub>	PWR	Connect this pin to system GND
1~3	NC		

■ BLOCK DIAGRAM



### ■ ABSOLUTE MAXIMUM RATINGS (all voltages are referenced to GND)

PARAMETER	SYMBOL	VALUES	UNIT
Supply Voltage to Ground	$V_{DD}$	7	V
Logic Input Voltage	$V_{IN}$	$V_{DD}$	V
Junction Temperature	$T_J$	+150	°C
Operating Ambient Temperature	$T_{OPR}$	-40 ~ +85	°C
Storage Temperature	$T_{STG}$	-65 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

### ■ DC ELECTRICAL CHARACTERISTICS

DC electrical characteristics ( $T_A = -40 \sim +85$  °C,  $V_{CC} = 5.0$  V  $\pm$  10%, GND = 0 V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Logic Supply Voltage	$V_{DD}$		4.5	5.0	5.5	V
High Level Input Voltage	$V_{IH}$	High Level Guaranteed Digital Pins	$0.7 \times V_{DD}$		$V_{DD}$	V
Low Level Input Voltage	$V_{IL}$	Low Level Guaranteed Digital Pins	0		$0.3V_{DD}$	V
Hysteresis Voltage (DIN, CLK, STB pins)	$V_{HYS}$			0.35		V
Low Level Output Voltage	$V_{OL(DOUT)}$	$D_{OUT}, I_{OL2}=4mA$			0.4	V
Segment Drive LED Source Current	$I_{OH}$	$V_O=V_{DD}-3V$	-40	-75	-110	mA
GRID Drive LED Sink Current	$I_{OL}$	$V_O=0.3V$	80	120		mA
Segment Drive Current Matching	$I_{TOLSEG}$	$V_{CC}=5.0V, T_A=25^\circ C, V_{LED}=2.5V$		5		%

### ■ POWER SUPPLY CHARACTERISTICS ( $T_A = -40$ to +85 °C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Quiescent Power Supply Current	$I_{STBY}$	$V_{DD}=5.0V, \text{All Inputs}=V_{DD}$ or GND			1	mA
Operating Power Supply Current (display ON)	$I_{CC}$	All Segments ON, All Digits Scanned, Intensity Set to Full, Internal Oscillator, No Display Load Connected			5	mA

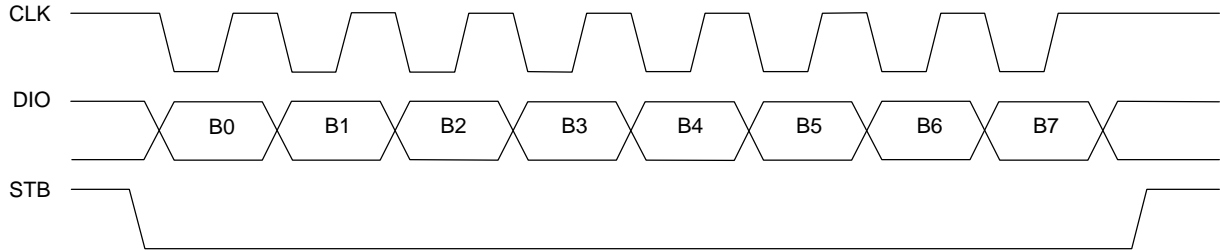
### ■ TIMING CHARACTERISTICS

( $T_A = -40 \sim +85$  °C,  $V_{CC}=5.0V \pm 10\%$ , Typical values are at 25 °C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Clock Pulse Width	$PW_{CLK}$			400		ns
Strobe Pulse Width	$PW_{STB}$			1		$\mu s$
Data Setup Time	$t_{SETUP}$			100		ns
Data Hold Time	$t_{HOLD}$	CLK Rising Edge to STB Rising Edge		100		ns
Clock-Strobe Time	$t_{CLK-STB}$			1		$\mu s$

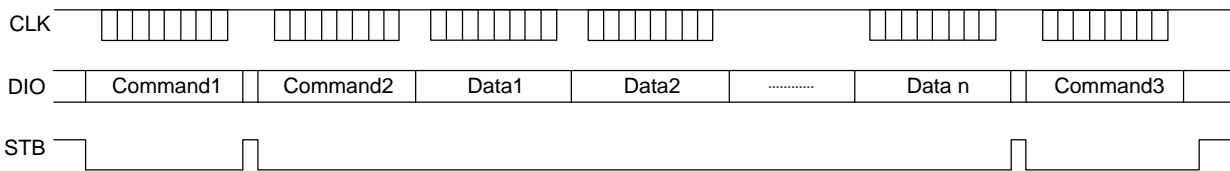
■ SERIAL COMMUNICATION FORMAT (RECEPTION)

Data reception (write)



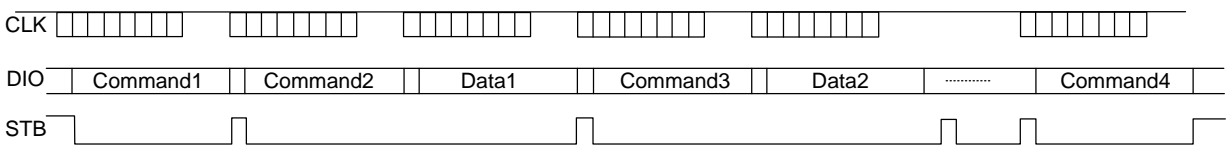
Application of serial data transfer:

1. address increasing mode using automatic mode, set the address is actually set the starting address of the flow of data storage. The starting address sent command word, "STB" does not need to buy high, followed by the data up to 16 byte, data is transferred to "STB" high.



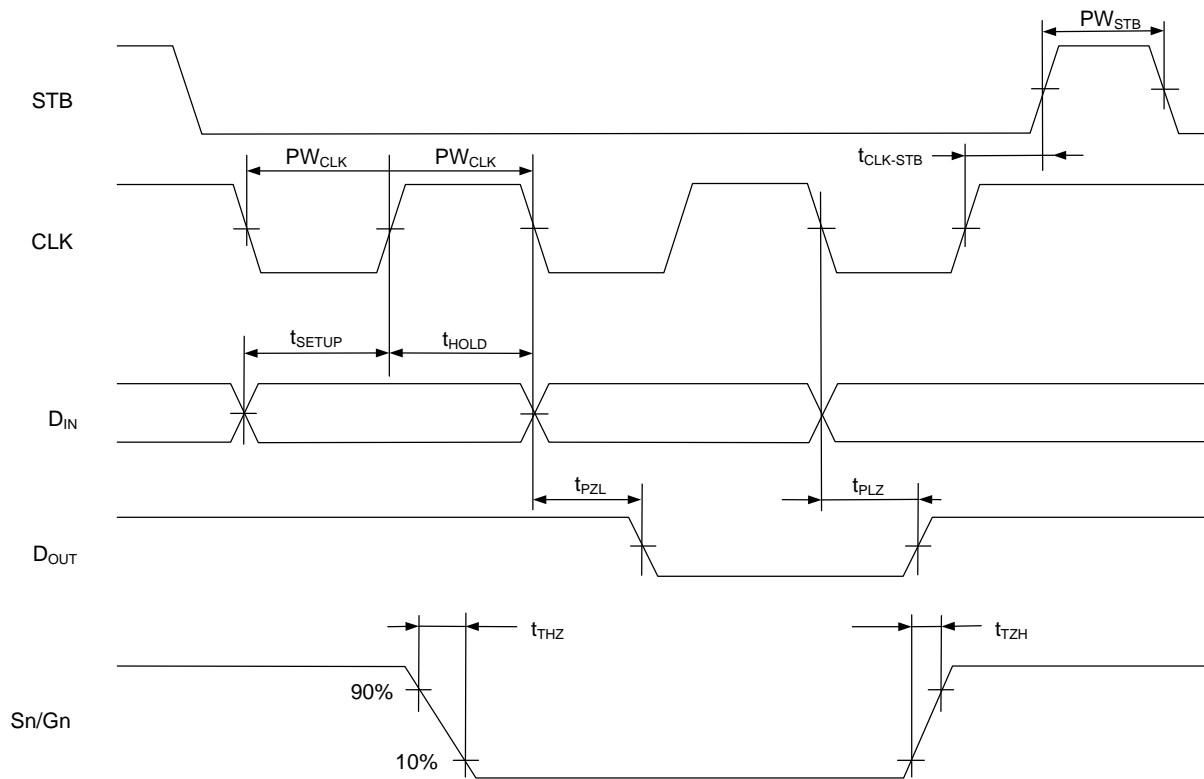
- Command1: Set the data command
- Command2: Set the address command
- Data1~n: Transmit data to the Command3 inside address and the following address (up to 16 bytes)
- Command3: Display control command

2. Fixed address mode using a fixed pattern, set the address of the set is, in fact, you need to pass 1 byte data store address. The address is sent, the "STB" is not need to buy high, followed by 1 byte data transfer, data is transferred to "STB" high. And then reset the second address, data needs to be stored up 16 byte data is transferred, "STB" high.



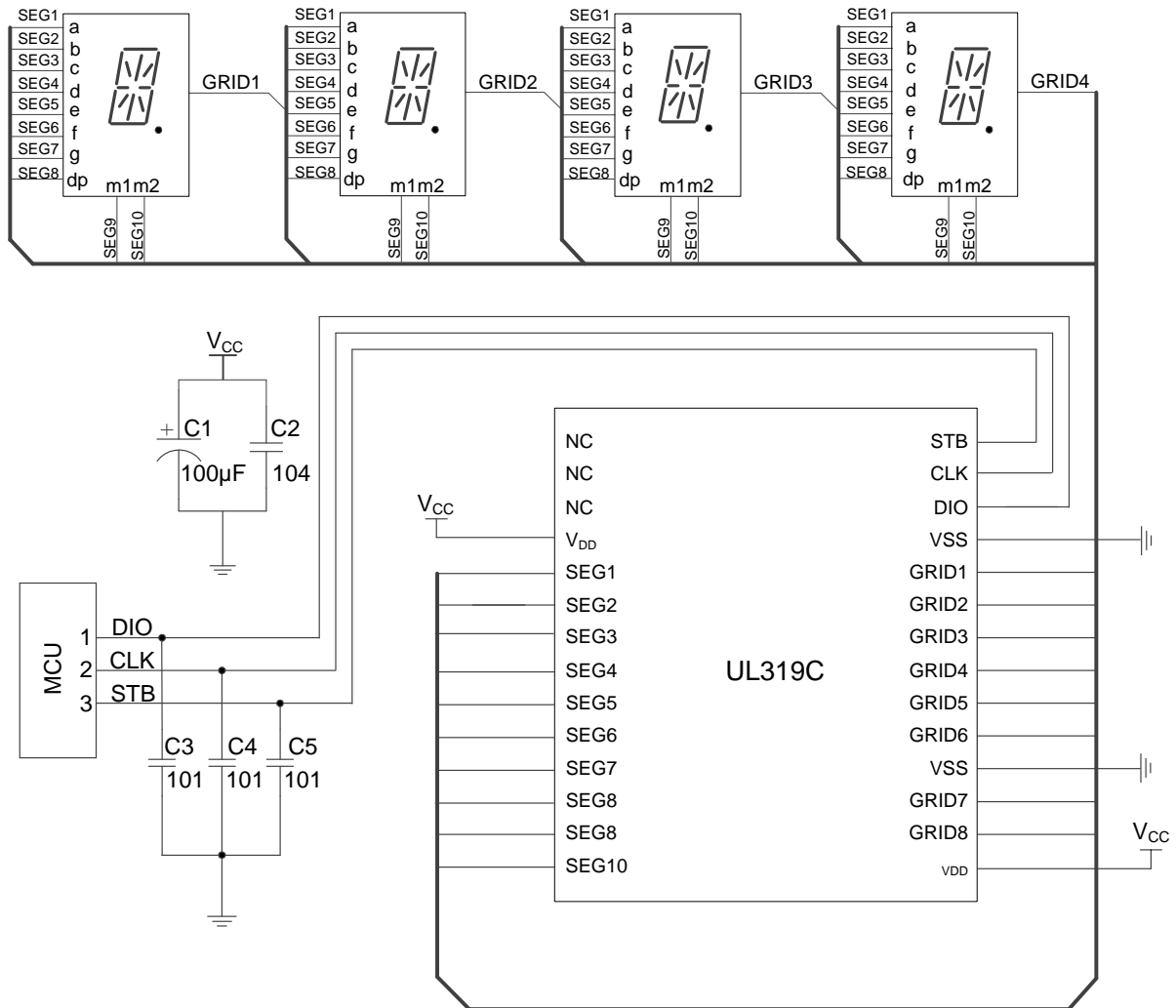
- Command1: Set the data command
- Command2: Set the address1 command
- Data1: Display data within 1 to Command3 address
- Command3: Set the address2 command
- Data2: Display data within 2 to Command4 address
- Command4: Display control command

■ SWITCHING CHARACTERISTICS WAVEFORM



■ TYPICAL APPLICATION CIRCUIT

UL319C driver Common cathode digital screen hardware circuit



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