



## UL318

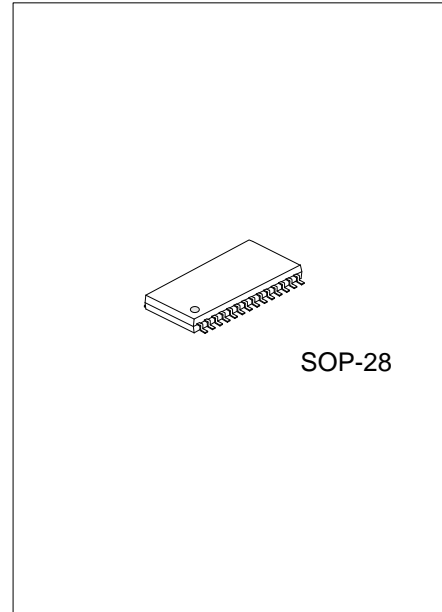
Preliminary

LINEAR INTEGRATED CIRCUIT

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

#### DESCRIPTION

The **UL318** 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 **UL318** drives up to LEDs in 10 segment/7 digit~13 segment/4 digit configuration while functioning from a supply voltage of 5.0V.



SOP-28

#### FEATURES

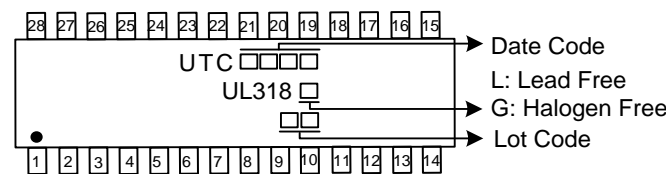
- \* LED driver with 17 outputs (10 segments/7 digits~13 segments/4 digits)
- \* Output pins connected directly to the LEDs
- \* Key-scanning (10 x 2 matrix)
- \* 3-wire serial bus interface (CLK, STB, DIO)
- \* 8-step dimming circuit to control the overall display brightness
- \* Inputs with Schmitt trigger give superior noise immunity
- \* 5.0 V (± 10%) for V<sub>DD</sub>
- \* Drives common-anode LED digits
- \* Built-in power on reset circuits
- \* Built-in pull-up resistor (CLK,STB,DIO)

#### ORDERING INFORMATION

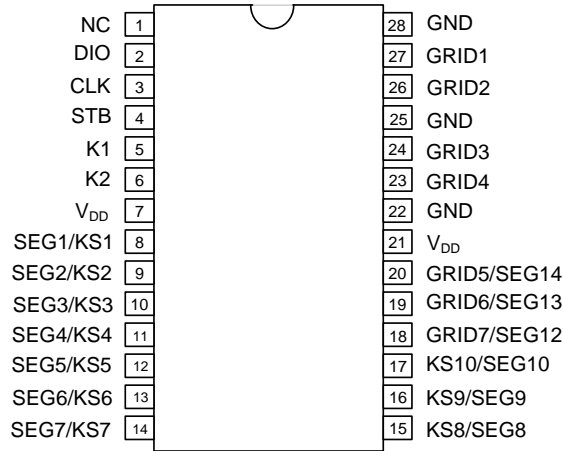
| Ordering Number |              | Package | Packing   |
|-----------------|--------------|---------|-----------|
| Lead Free       | Halogen Free |         |           |
| UL318L-S28-R    | UL318G-S28-R | SOP-28  | Tape Reel |

|  |  |
|--|--|
| <p>UL318G-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> |
|--|--|

#### MARKING



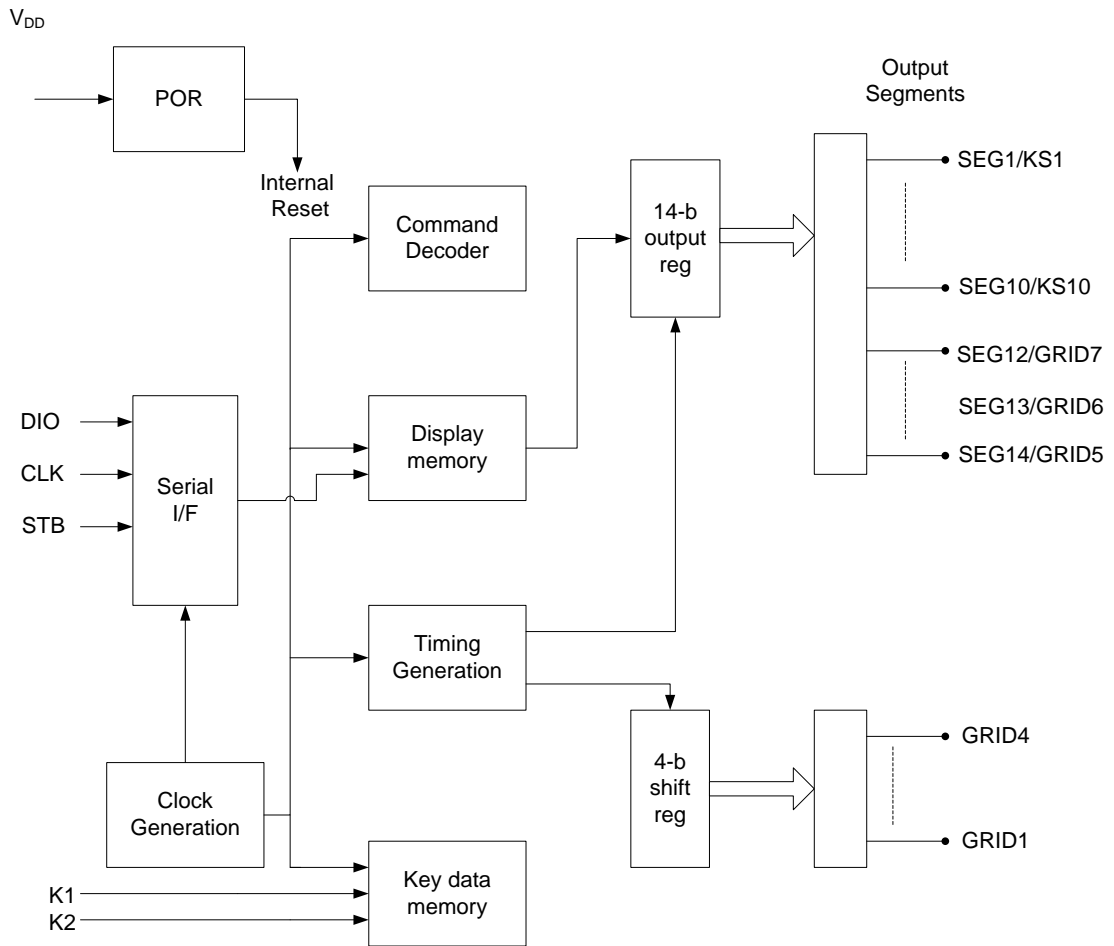
■ PIN CONFIGURATIONS



■ PIN CONFIGURATIONS

| PIN NUMBER  | SYMBOL                          | TYPE   | FUNCTION   |
|-------------|---------------------------------|--------|--|
| 1           | NC                              | /      | NC   |
| 2           | 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.  |
| 3           | CLK                             | IN     | Reads serial data at rising edge, and outputs data at falling edge.  |
| 4           | 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           | K1                              | IN     | Key input  |
| 6           | K2                              |        |  |
| 8 ~ 17      | SEG1/KS1<br>┆<br>SEG10/KS10     | OUT    | Segment output pin (dual function as key source)   |
| 18 ~ 20     | SEG12/GRID7<br>┆<br>SEG14/GRID5 | OUT    | Segment output pin (dual function as Digit output pin)   |
| 27,26,24,23 | GRID1<br>┆<br>GRID4             | OUT    | Digit output pin   |
| 7,21        | 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   |
| 22, 25, 28  | GND                             | PWR    | Connect this pin to system GND   |

■ 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 ( $T_A = -40$  to  $+85$  °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                   |      | $0.3 \times V_{DD}$ | 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        | $I_{OH}$       | $VO=V_{DD}-3V$                                 | -40                 | -75  | -110                | mA   |
| GRID Drive LED Sink Current             | $I_{OL}$       | $VO=0.3V$                                      | 80                  | 120  |                     | mA   |
| Segment Drive Current Matching          | $I_{TOLSEG}$   | $V_{CC}=5.0V, T_A = 25^\circ C, V_{LED}=2.5 V$ |                     | 3    |                     | %    |

### ■ 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   |

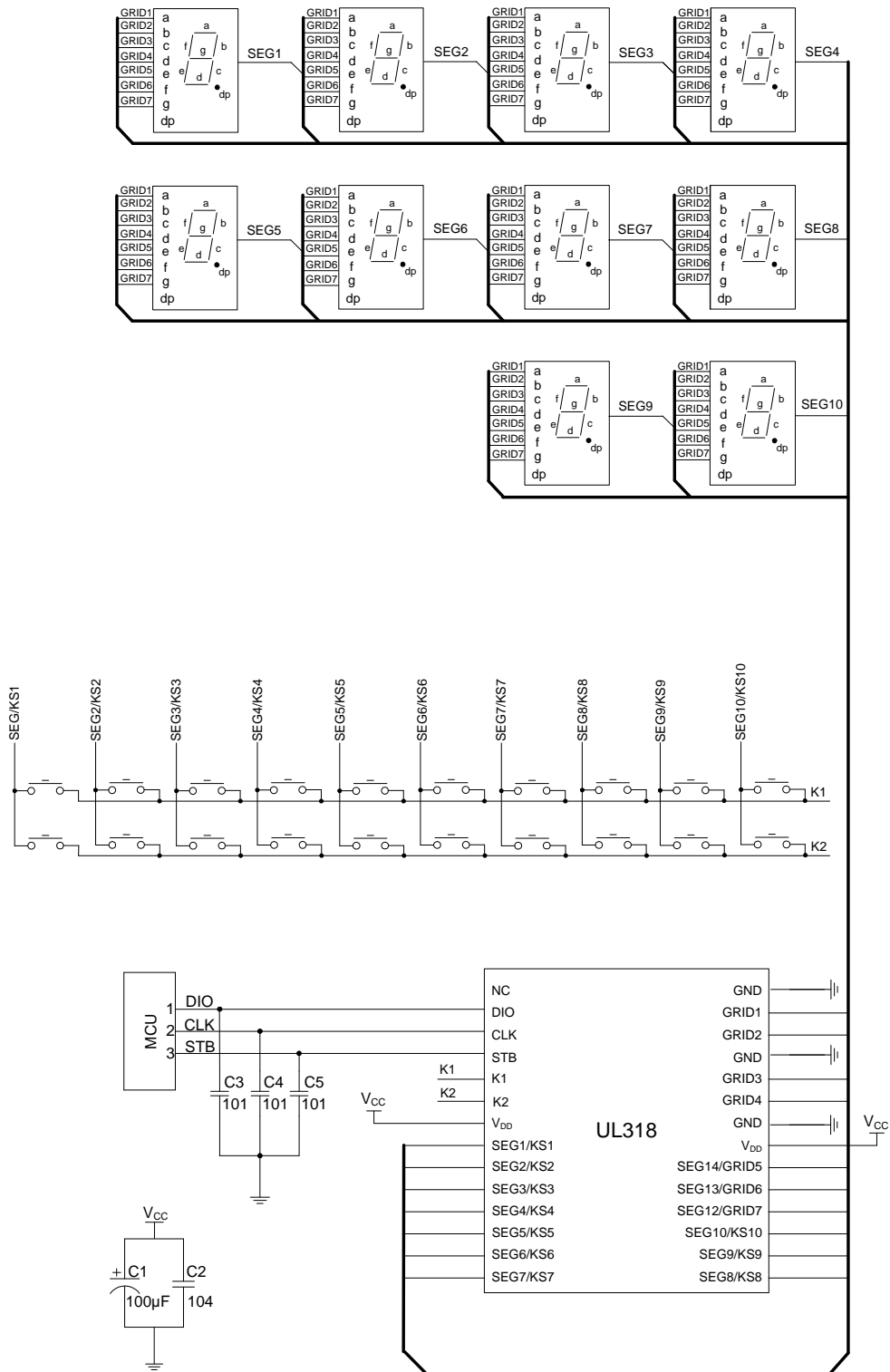
### ■ TIMING CHARACTERISTICS

( $T_A = -40$  ~  $+85$  °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   |     | $\mu s$ |

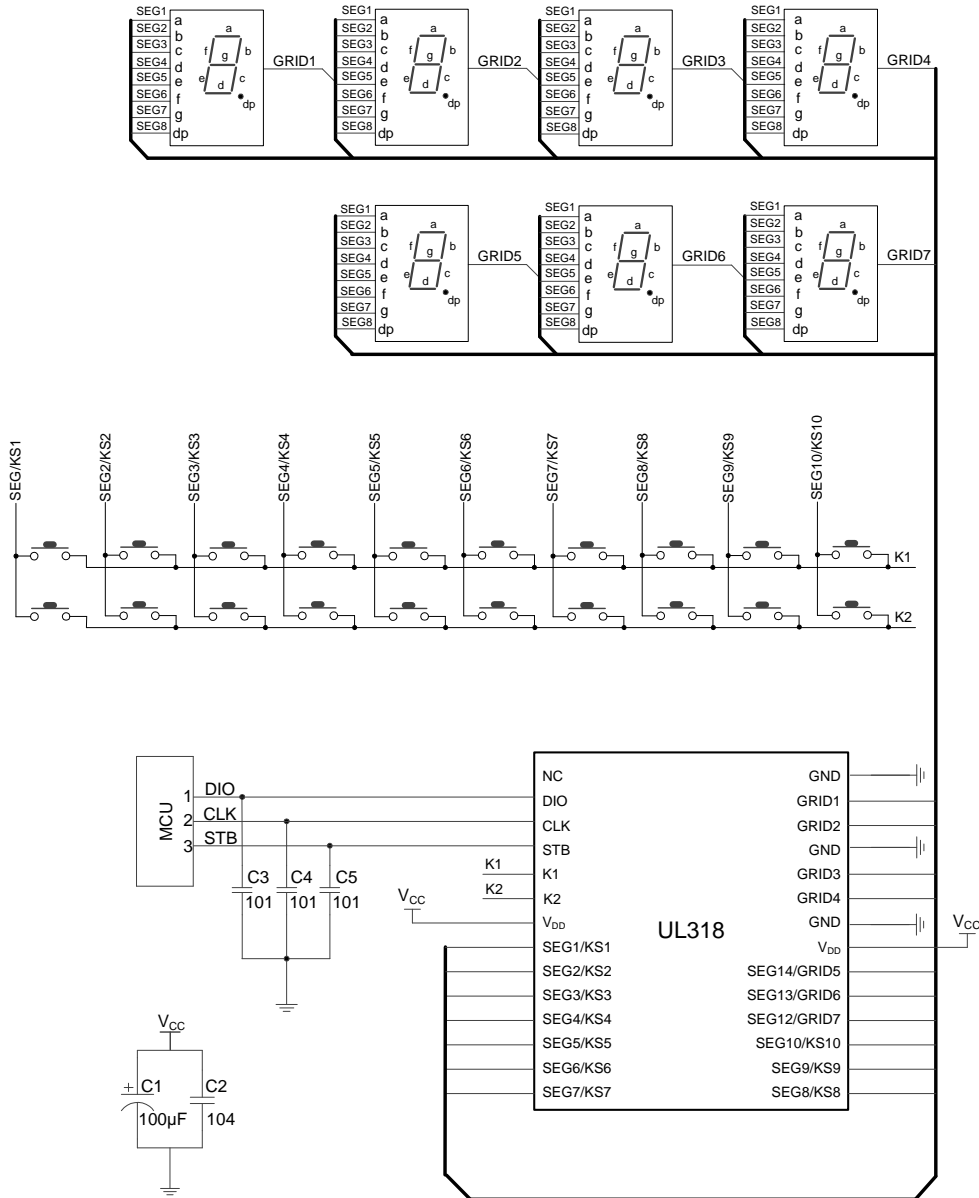
## ■ TYPICAL APPLICATION CIRCUIT

UL318 driver total of anode digital screen hardware circuit



## ■ TYPICAL APPLICATION CIRCUIT (Cont.)

UL318 driver Common cathode digital screen hardware circuit



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