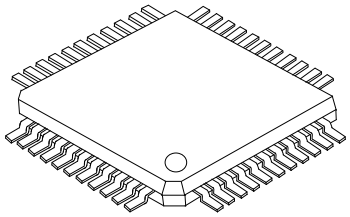
UL319 **Preliminary** ***LINEAR INTEGRATED CIRCUIT***

SERIAL-INTERFACED 16-DIGIT LED CONTROLLER IC WITH KEYSCAN



QFP-44(10×10)

■ DESCRIPTION

The **UL319** is a compact LED controller and driver that interface microprocessors to LED displays through a serial 4-wire interface. It drives LED connected in common anode configuration. The **UL319** drives up to 128 discrete LEDs in 16 segment/8 digit configuration while functioning from a supply voltage of 5.0V.

■ FEATURES

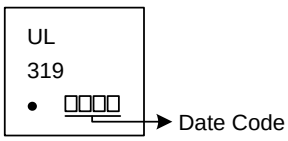
* LED driver with 24 outputs (16 segments/8 digits)
* Output pins connected directly to the LEDs
* Key-scanning (8 x 4 matrix)
* 3-wire serial bus interface (CLK, STB, DI/O)
* 8-step dimming circuit to control the overall display brightness
* Inputs with Schmitt trigger give superior noise immunity
* 5.0 V (± 10%) for V_{DD}
* Drives common-anode LED digits
* Built-in power on reset circuits
* Built-in pull-up resistor (CLK,STB,DOUT)

■ ORDERING INFORMATION

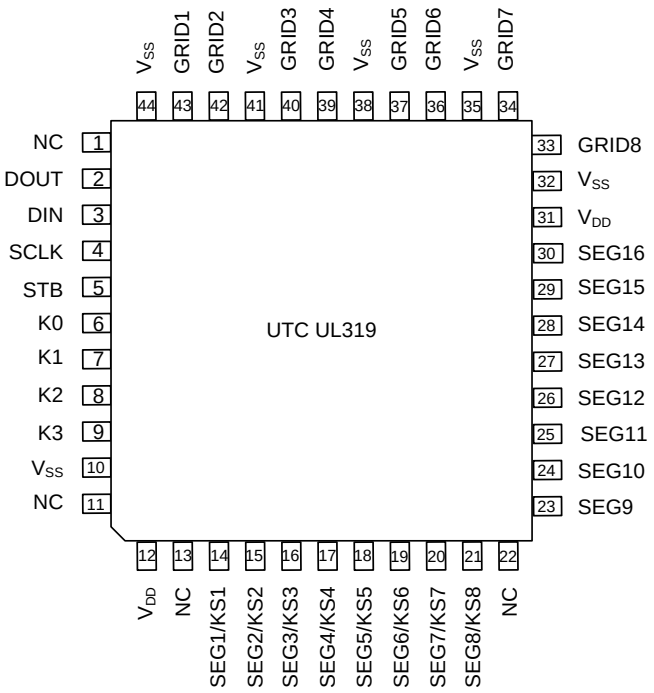
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UL319L-QM1-Y	UL319G-QM1-Y	QFP-44	Tray

UL319G-QM1-Y (1)Packing Type (2)Package Type (3)Green Package	(1) R: Tape Reel (2) QM1: QFP-44(10×10) (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



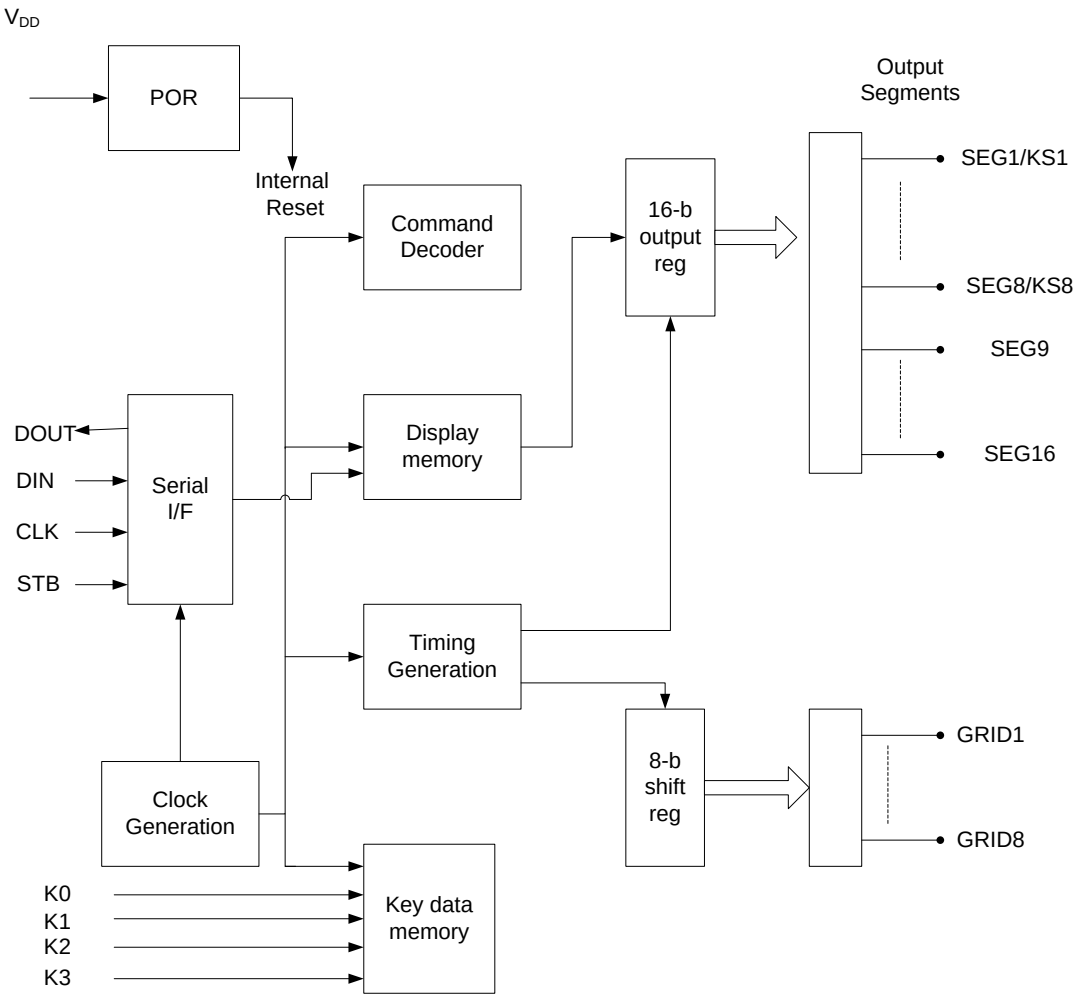
■ PIN CONFIGURATIONS



■ PIN CONFIGURATIONS

PIN NUMBER	SYMBOL	TYPE	FUNCTION
2	DOUT	OUT	Output serial data at falling edge of the shift clock, starting from lower bit.
3	DIN	IN	Input serial data is clocked in at rising edge of the shift clock, starting from lower bit.
4	CLK	IN	Reads serial data at rising edge, and outputs data at falling edge.
5	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.
6 ~ 9	K0 ~ K3	IN	Key input
14 ~ 21	SEG1/KS1 ∫ SEG8/KS8	OUT	Segment output pin (dual function as key source)
23~ 30	SEG9 ∫ SEG16	OUT	Segment output pin
43,42,40,39,37 ,36,34,33	GRID1 ∫ GRID8	OUT	Digit output pin
12, 31	V_{DD}	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
10,32,35,38,41 ,44	V_{SS}	PWR	Connect this pin to system GND
1,11,13,22	NC	/	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 to +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 ± 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×V_{DD}		V_{DD}	V
Low Level Input Voltage	V_{IL}	Low Level Guaranteed Digital Pins	0		0.3×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}	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°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, 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

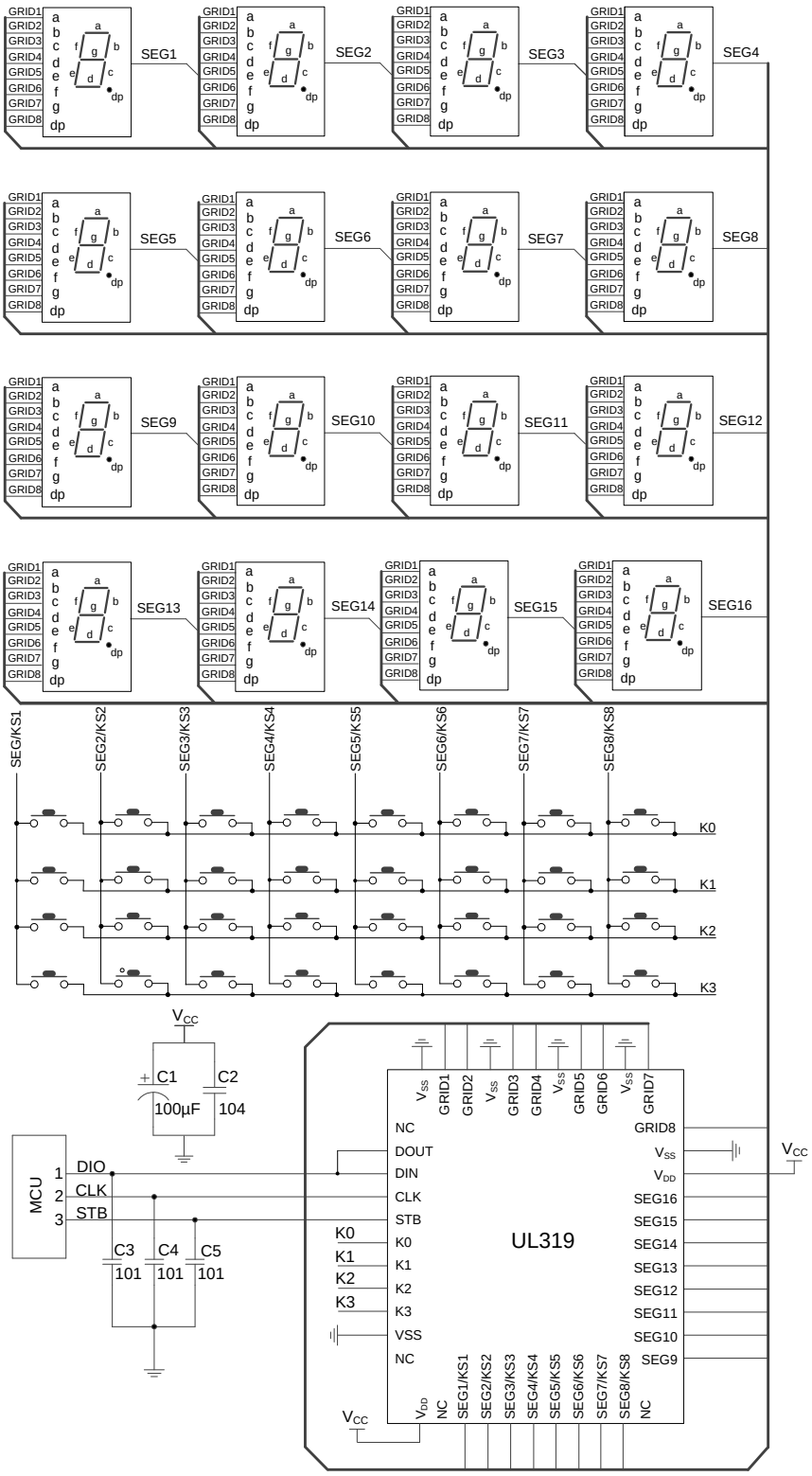
■ TIMING CHARACTERISTICS

(T_A= -40 ~ +85°C, V_{CC}=5.0V±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		µs
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		µs

■ TYPICAL APPLICATION CIRCUIT

UL319 driver total of anode digital screen hardware circuit



■ TYPICAL APPLICATION CIRCUIT (Cont.)

UL319 driver Common cathode digital screen hardware circuit