UNISONIC TECHNOLOGIES CO., LTD

# UL0512    Preliminary    *CMOS IC*

# LANDSCAPE LIGHTING DRIVE IC

■ **DESCRIPTION**

The UTC **UL0512** is a three-channel LED drive control IC using single channel transmit the unipolar return-to-zero(RZ) code data protocol.

The UTC **UL0512** contains power clamp module, signal decoding module, oscillation module, data regeneration module, output current drive module etc. After receiving its own data, the data regeneration module will automatically shape and forward the cascaded data to ensure that the data is not attenuated in the process of serial transmission.

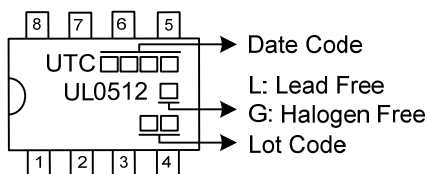The UTC **UL0512** builds in output current setting module, the default output current of OUT R/G/B is 12mA.

DIP-8
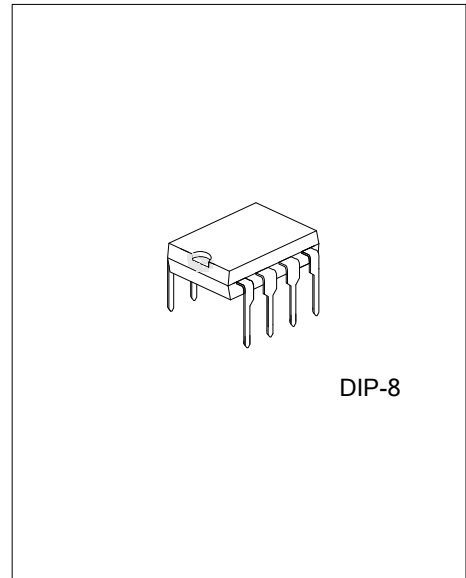
■ **FEATURES**

* Input Voltage: 3.5V~5.5V
* OUT R/G/B Constant Current: 12mA
* OUT R/G/B Output Gray Level: 256
* OUT R/G/B Power-on state: OFF
* Build in high precision and high stability oscillator
* Serial data transmission
* Shaping the cascade data before output to prevent attenuation
* Data transmission rate : 800Kbps
* Synchronous refresh of display data in the same frame
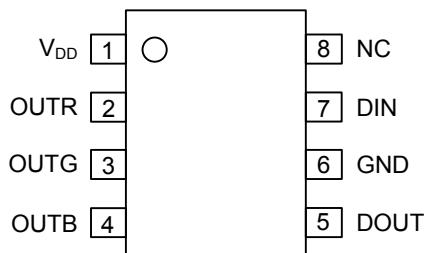
■ **ORDERING INFORMATION**

| Ordering Number | | Package | Packing |
|---|---|---|---|
| Lead Free | Halogen Free | | |
| UL0512L-D08-T | UL0512G-D08-T | DIP-8 | Tube |

UL0512G-D08-T
└─ (1)Packing Type
└─ (2)Package Type
└─ (3)Green Package

(1) T: Tube

(2) D08: DIP-8

(3) G: Halogen Free and Lead Free, L: Lead Free

■ **MARKING**

```
 8  7  6  5
UTC□□□□  ──→ Date Code
UL0512 □   ── L: Lead Free
        □□ ── G: Halogen Free
 1  2  3  4 ──→ Lot Code
```

QW-R125-103.a

■ **PIN CONFIGURATION**

```
        ┌─────────┐
VDD  1 │ ○       │ 8  NC
OUTR 2 │         │ 7  DIN
OUTG 3 │         │ 6  GND
OUTB 4 │         │ 5  DOUT
        └─────────┘
```

■ **PIN DESCRIPTION**

| PIN NO. | PIN NAME | DESCRIPTION |
|---------|----------|-------------|
| 1 | $V_{DD}$ | Power |
| 2 | OUTR | Constant current output R |
| 3 | OUTG | Constant current output G |
| 4 | OUTB | Constant current output B |
| 5 | DOUT | Data output |
| 6 | GND | Ground |
| 7 | DIN | Data input |
| 8 | NC | No Connection |

■ **BLOCK DIAGRAM**
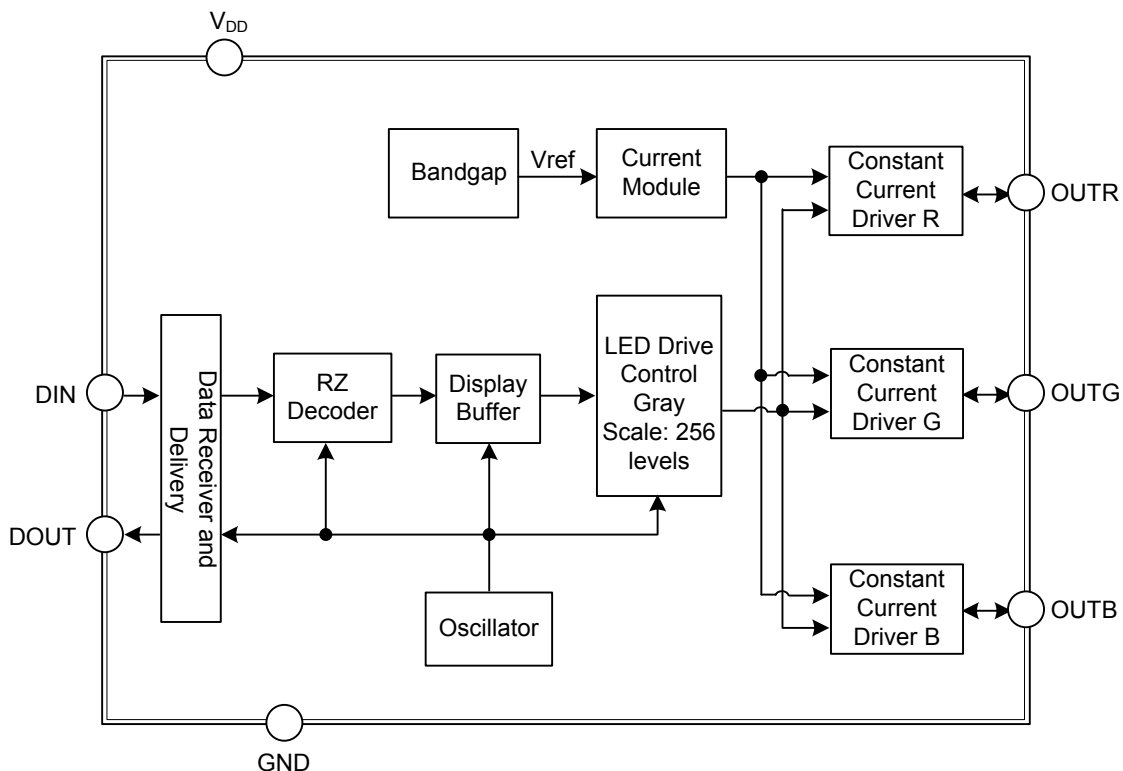
■ **ABSOLUTE MAXIMUM RATING** ($T_A$=25°C, unless otherwise specified)

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Supply Voltage | $V_{DD}$ | 5.5 | V |
| Logic input Voltage | $V_{IN}$ | $V_{DD}$ | V |
| OUT R/G/B Breakdown Voltage | $BV_{OUT}$ | 16 | V |
| OUT R/G/B Output Current | $I_{OUT}$ | 13 | mA |
| Junction Temperature | $T_J$ | -40 ~ +150 | °C |
| Storage Temperature | $T_{STB}$ | -55 ~ +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.

■ **ELECTRICAL CHARACTERISTICS** ($V_{DD}$=5V, $T_A$=25°C, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Operating Voltage | $V_{DD}$ | | 3.5 | | 5.5 | V |
| Operating Current | $I_{DD}$ | $V_{DD}$=4.5V, $I_{OUT}$ "OFF" | | 0.7 | | mA |
| Input Threshold Voltage | $V_{IH}$ | DIN High level input | 0.7×$V_{DD}$ | | | V |
| | $V_{IL}$ | DIN Low level input | | | 0.3×$V_{DD}$ | V |
| DOUT Current | $I_{OH}$ | DOUT output high, connecting a 10 ohm resistor to GND | | -40 | | mA |
| | $I_{OL}$ | DOUT output low, $V_{DD}$ supply current to DOUT | | 40 | | mA |
| OUT R/G/G Inflection Point Voltage | $V_{DS\_S}$ | $I_{OUT}$=12mA | | 0.5 | | V |
| OUT R/G/B Output Current Variation | %vs.$V_{DS}$ | $I_{OUT}$=12mA, $V_{DS}$=1.0~3.0V | | 0.5 | | % |
| | %vs.$V_{DD}$ | $I_{OUT}$=12mA, $V_{DD}$=4.5~5.5V | | 0.5 | | % |
| | %vs.$T_A$ | $I_{OUT}$=12mA, $T_A$=-40~+85°C | | 7.0 | | % |
| OUT R/G/B Leakage Current | $I_{leak}$ | $V_{DS}$=15V, $I_{OUT}$ "OFF" | | | 1 | uA |

■ **SWITCHING CHARACTERISTICS** ($V_{DD}$=5V, $T_A$=25°C, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| OUT R/G/B Output PWM frequency | $f_{PWM}$ | $I_{OUT}$=12mA, OUT connects a 200 ohm resistor to $V_{DD}$ | | 1.0 | | KHz |
| Signal Transmission Delay | $t_{PLH}$ | DOUT connects a 30pF load capacitance to ground. Signal transmission delay from DIN to DOUT | | 80 | | ns |
| | $t_{PHL}$ | | | 80 | | ns |
| DOUT Conversion Time | $t_{TLH}$ | DOUT connects a 30pF load capacitance to ground | | 9.6 | | ns |
| | $t_{THL}$ | | | 11.6 | | ns |
| OUT R/B Conversion Time | $t_r$ | $I_{OUT\ R/B}$=12mA, OUT R/B connect a 200 ohm resistor to $V_{DD}$ and a 30pF load capacitance to ground | | 50 | | ns |
| | $t_f$ | | | 75 | | ns |
| OUTG Conversion Time | $t_r$ | $I_{OUTG}$=12mA, OUT R/B connect a 200 ohm resistor to $V_{DD}$ and a 30pF load capacitance to ground | | 50 | | ns |
| | $t_f$ | | | 110 | | ns |

■ **TEST CIRCUIT**
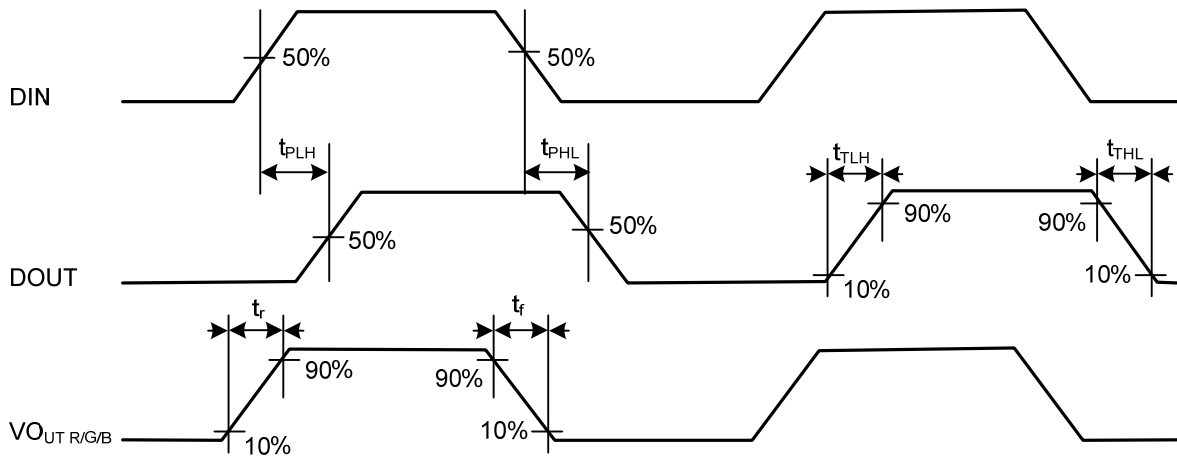


Figure 1. Schematic Diagram of Dynamic Parameter Test

■ **DATA COMMUNICATION PROTOCOL**

**Coding Description**

The UTC **UL0512** protocol uses unipolar return-to-zero (RZ) code, and each code element must have low level. Each code element of this protocol starts at high level, and time of this high level determines the 0 code or 1 code.
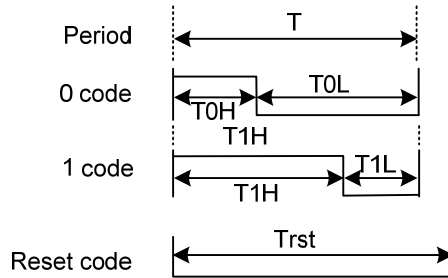
Input code type:



Figure 2. UTC **UL0512** RZ-code data communication protocol diagram

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Period | T | 1200 | | | ns |
| 0 code, High Level Time | T0H | 200 | 300 | 400 | ns |
| 0 code, Low Level Time | T0L | 800 | 900 | | ns |
| 1 code, High Level Time | T1H | 650 | 900 | 1000 | ns |
| 1 code, Low Level Time | T1L | 200 | 300 | | ns |
| Reset code, Low Level Time | Trst | 200 | | | µs |

Notes: 1. When writing programs, the minimum code element period requirement is 1.2µs.
2. The high level time of 0 code、1 code shall be in accordance with the above table, and the low level time requirement of 0 code、1 code is less than 20µs.
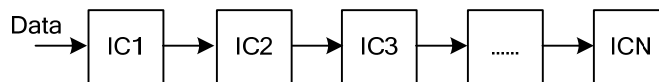
**Data protocol format**

Trst + 24bits data of the 1st chip + 24bits data of the 2nd chip + …… + 24bits data of the Nth chip + Trst

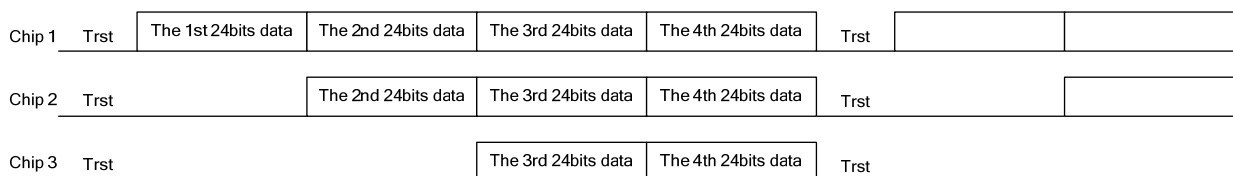1. 24bit data structure of gray level: MSB, sending in the order of RGB

| R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
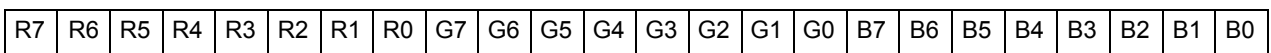
bit23·············································································································bit0

2. System topology



3. Input data stream of each chip (Take three chips as an example)