# 4.0A 150KHz 50V Synchronous Buck LED Constant Current Driver XL9514

## Features

- Operation Voltage：5V~45V
- 0.23V Constant Current Sense Voltage
- Directly drive 1~9 Series LED
- Current Sense Voltage Accuracy ±4%
- Fixed 150KHz Switching Frequency
- 4A Constant Output Current Capability
- Internal Optimize Power MOSFET
- High efficiency up to 97%
- Max. Output power up to 30W
- Excellent line and load regulation
- Built in thermal shutdown function
- Built in current limit protection function
- Temperature Grade 1: −40℃ to 125℃ Ambient Operating Temperature Range
- Device HBM ESD Classification Level Class3A
- Available in TO252−5L package

## General Description

The XL9514 is a 150KHz fixed frequency PWM synchronous buck LED constant current driver, capable of driving a 4A load with high efficiency, low ripple and excellent line and load regulation. XL9514 supports wide input operating voltage range of 5V ~ 45V and a maximum duty cycle of 90% output.

A built−in loop compensation module reduces components in the system, lowering power system cost and reducing printed circuit board space.

The XL9514 has built−in thermal shutdown, current limit protection and output short protection function and so on.

## Applications

- Buck constant current driver
- Monitor LED Backlighting
- General purpose LED lighting

## Typical application schematic

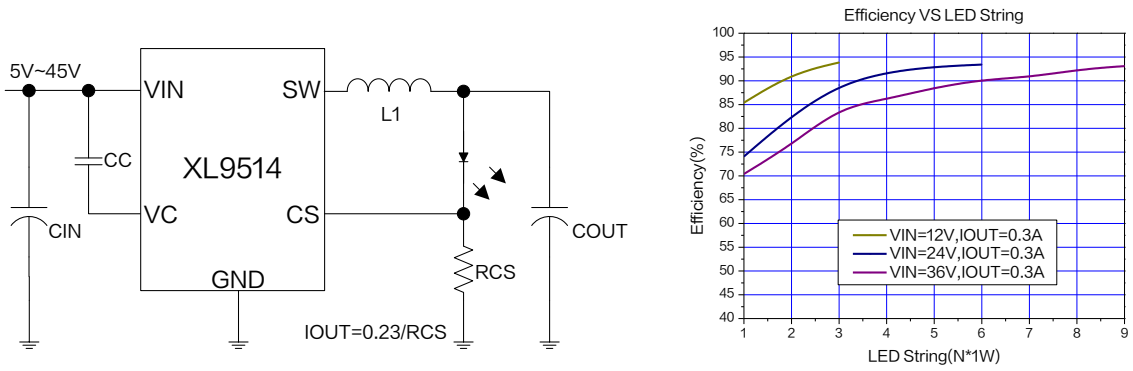



Figure1. XL9514 Typical application schematic and efficiency curve

4.0A 150KHz 50V Synchronous Buck LED Constant Current Driver XL9514

## Pin Configurations

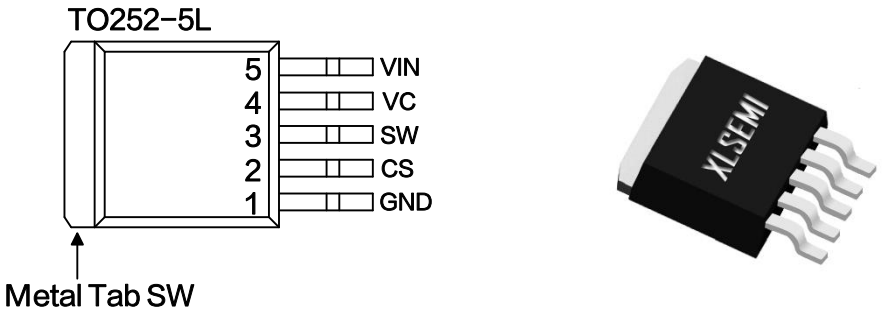



Figure2. Pin Configuration of XL9514

Table 1 Pin Description

| Pin Number | Pin Name | Description |
|---|---|---|
| 1 | GND | Ground Pin. |
| 2 | CS | Output constant current sense Pin (CS). The CS reference voltage is 0.23V. |
| 3 | SW | Power Switch Output Pin (SW). Output is the switch node that supplies power to the output. |
| 4 | VC | Internal Voltage Regulator Bypass Capacity. In typical system application, The VC pin connect a 1uF capacitor to VIN. |
| 5 | VIN | Supply Voltage Input Pin. XL9514 operates from 5V to 45V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input. |

## Ordering Information

| Order Information | Marking ID | Package Type | Eco Plan | Packing Type Supplied As |
|---|---|---|---|---|
| XL9514 | XL9514 | TO252-5L | RoHS & HF | 2500 Units on Reel |

## Function Block

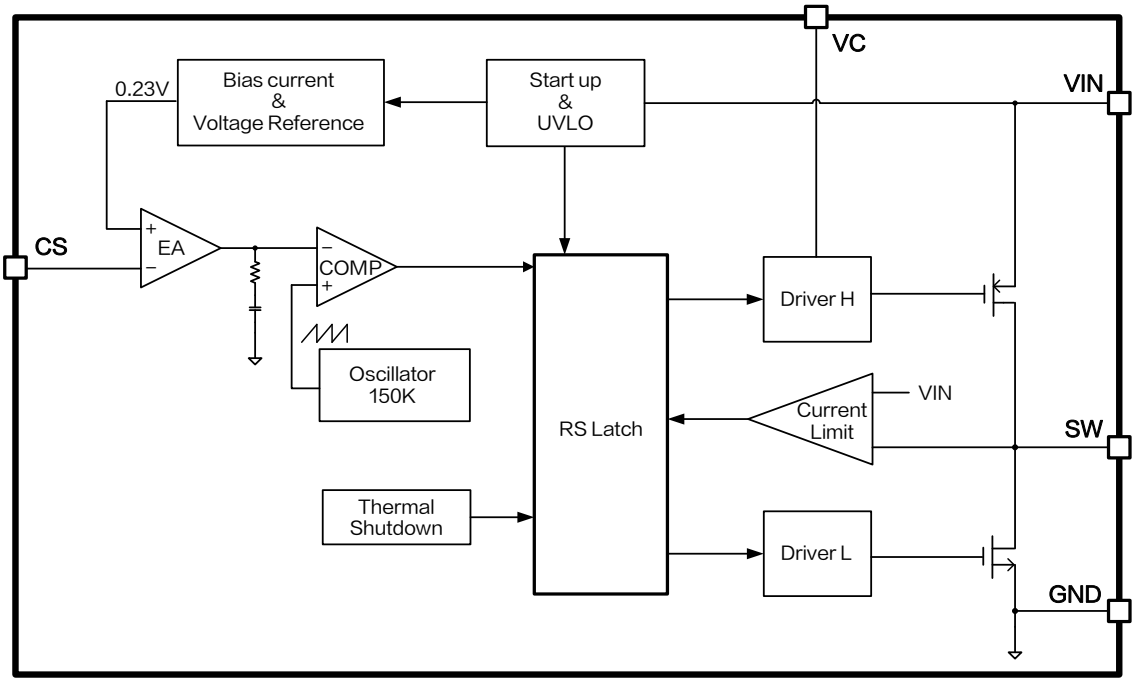



Figure3. Function Block Diagram of XL9514

## Absolute Maximum Ratings（Note1）

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Input Voltage | $V_{IN}$ | −0.3~50 | V |
| Current Sense Pin Voltage | $V_{CS}$ | −0.3~7 | V |
| Output Switch Pin Voltage | $V_{SW}$ | −0.3~$V_{IN}$ | V |
| VC Pin Voltage | $V_C$ | −0.3~$V_{IN}$ | V |
| Power Dissipation | $P_D$ | Internally limited | mW |
| Thermal Resistance (TO252−5L)<br>(Junction to Ambient, No Heatsink, Free Air) | $R_{JA}$ | 50 | ℃/W |
| Operating Junction Temperature | $T_J$ | −40~150 | ℃ |
| Storage Temperature | $T_{STG}$ | −65~150 | ℃ |
| Lead Temperature (Soldering, 10 sec) | $T_{LEAD}$ | 260 | ℃ |
| ESD (HBM) | | >7000 | V |

**Note1:** Stresses greater than those listed under Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## XL9514 Electrical Characteristics

$T_A$ = 25℃; system parameters test circuit figure4, unless otherwise specified.

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{CS}$ | Current Sense Voltage | $V_{IN}$ =12V, $V_{OUT}$=3.3V $I_{OUT}$=0.3A | 220.8 | 230.0 | 239.2 | mV |
| η | Efficiency | $V_{IN}$ =12V, $V_{OUT}$ =9.9V $I_{OUT}$ =0.3A | – | 93.9 | – | % |
| η | Efficiency | $V_{IN}$ =24V, $V_{OUT}$ =19.8V $I_{OUT}$ =0.9A | – | 97.1 | – | % |

## Electrical Characteristics (DC Parameters)

$T_A$=25℃,$V_{IN}$=12V;system parameters test circuit figure4, unless otherwise specified.

| Parameters | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Input operation voltage | $V_{IN}$ | | 5 | | 45 | V |
| Quiescent Supply Current | $I_Q$ | $V_{CS}$ =2V | | 2.8 | 5 | mA |
| Oscillator Frequency | $F_{OSC}$ | | 127 | 150 | 172 | KHz |
| Switch Current Limit | $I_L$ | $V_{CS}$=0V | | 4.2 | | A |
| High side MOS On-resistance | $R_{DS(ON)H}$ | | | 68 | | mΩ |
| Low side MOS On-resistance | $R_{DS(ON)L}$ | | | 50 | | mΩ |
| Thermal Shutdown Temperature | $T_{SD}$ | | | 160 | | ℃ |
| Thermal Shutdown Hysteresis | $T_D$ | | | 20 | | ℃ |
| Max. Duty Cycle | $D_{MAX}$ | | | 90 | | % |

## Typical System Application Schematic ($I_{OUT}$=0.3A)

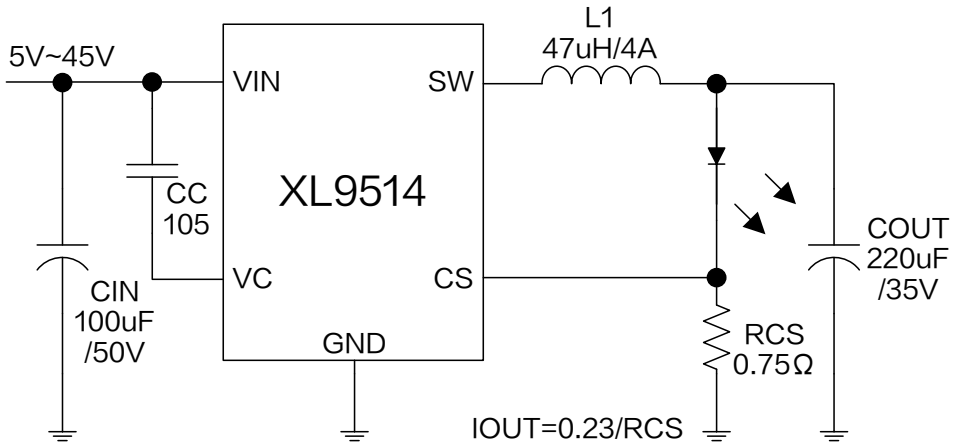



Figure4. XL9514 System Parameters Test Circuit ($I_{OUT}$=0.3A)

## Typical System Application Transfer Efficiency

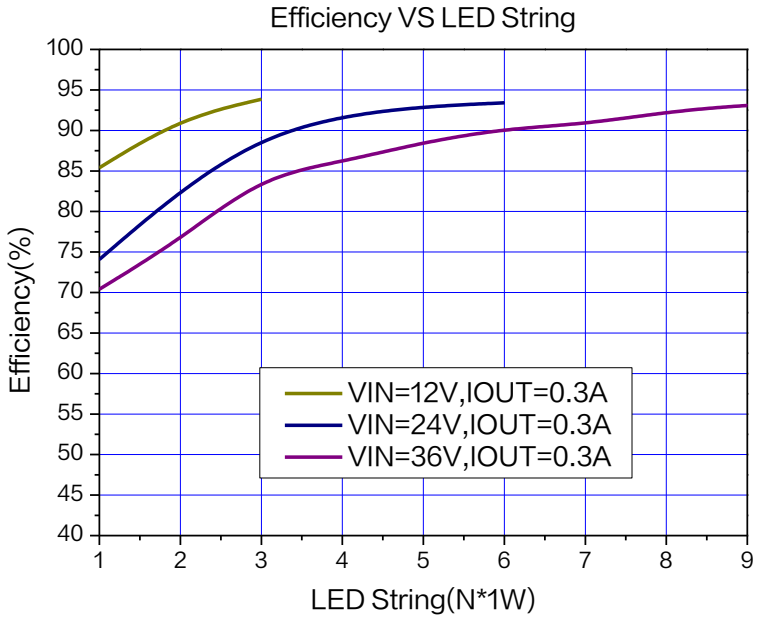



Figure5. XL9514 System Efficiency Curve($I_{OUT}$=0.3A)

## Typical System Application Schematic ($I_{OUT}$=0.9A)

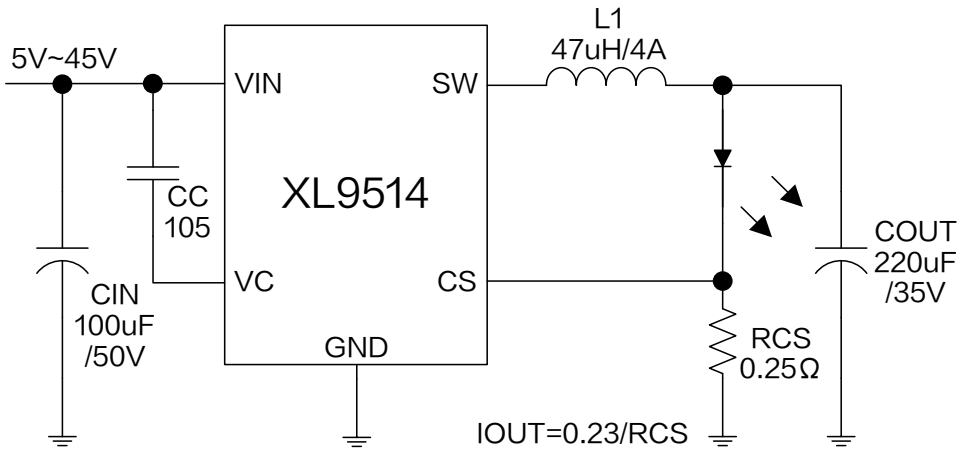



Figure6. XL9514 System Parameters Test Circuit ($I_{OUT}$=0.9A)

## Typical System Application Transfer Efficiency

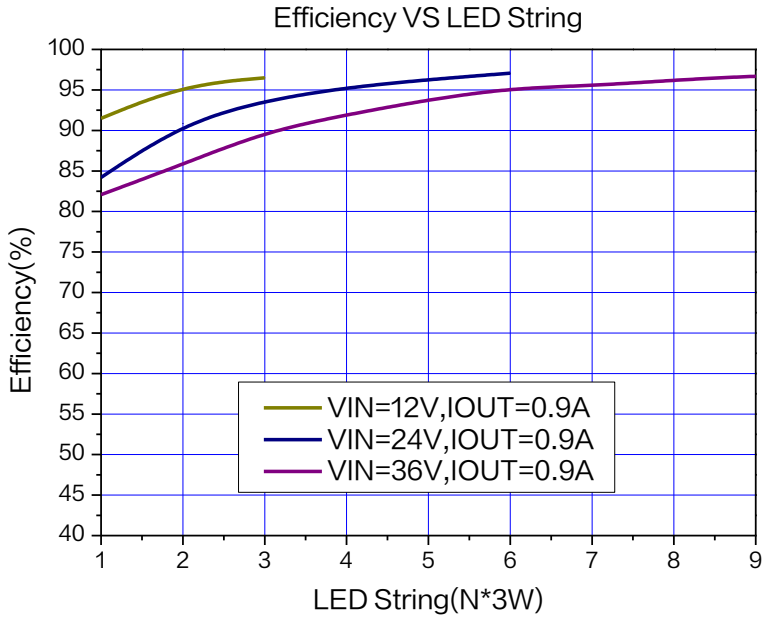



Figure7. XL9514 System Efficiency Curve($I_{OUT}$=0.9A)

## Typical System Application Schematic ($I_{OUT}$=1.5A)

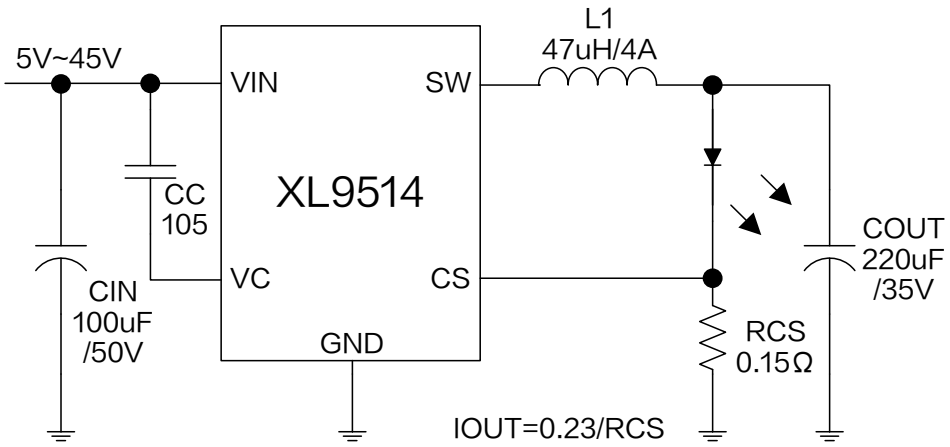



Figure8. XL9514 System Parameters Test Circuit ($I_{OUT}$=1.5A)

## Typical System Application Transfer Efficiency

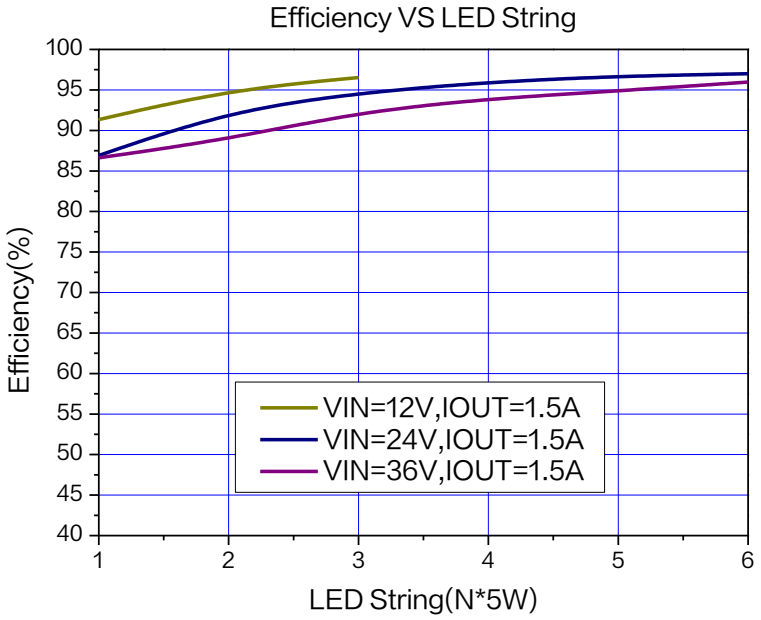



Figure9. XL9514 System Efficiency Curve($I_{OUT}$=1.5A)

## Typical System Application Schematic ($I_{OUT}$=2.1A)

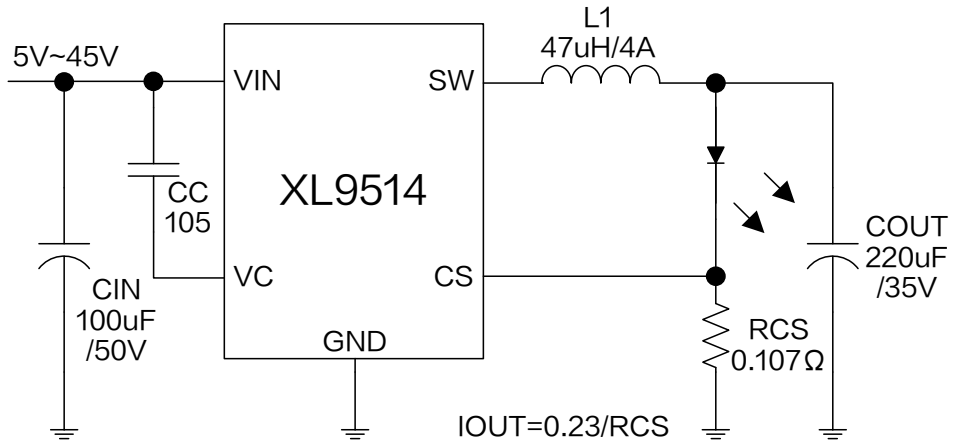



Figure10. XL9514 System Parameters Test Circuit ($I_{OUT}$=2.1A)

## Typical System Application Transfer Efficiency

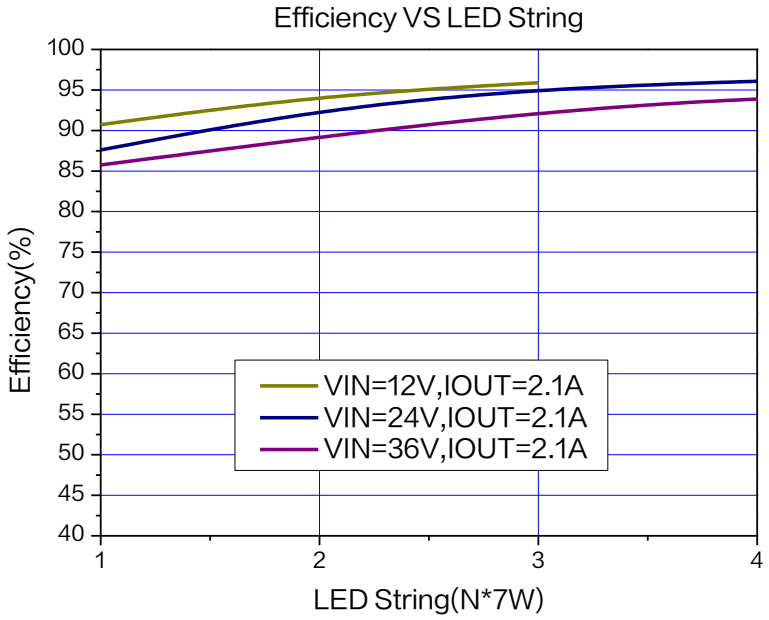



Figure11. XL9514 System Efficiency Curve($I_{OUT}$=2.1A)

## Typical System Application（PWM DIMMING）

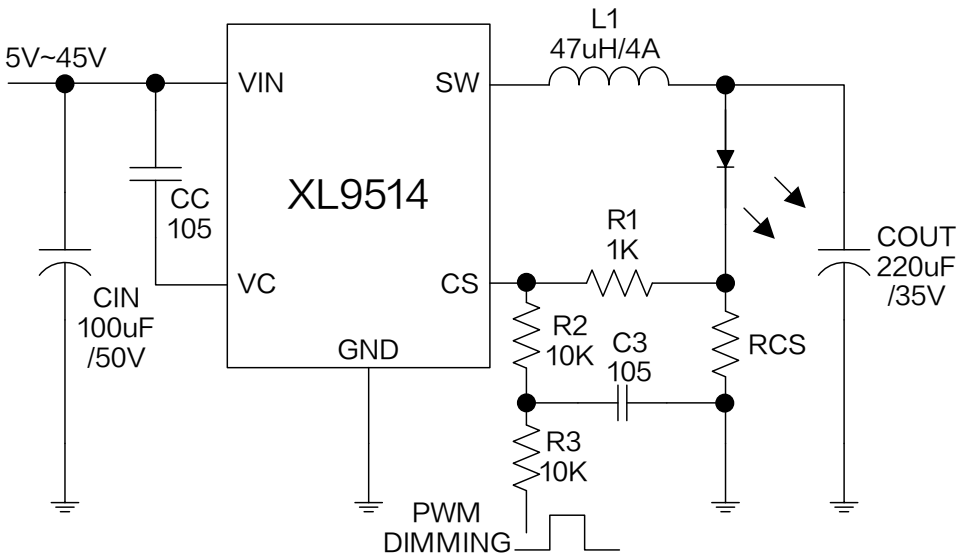



Figure12. XL9514 System Parameters Test Circuit（PWM DIMMING）

**Typical Characteristics** (LED forward voltage $V_F$ is 3.3V at $I_F$=0.3A, unless otherwise noted.)

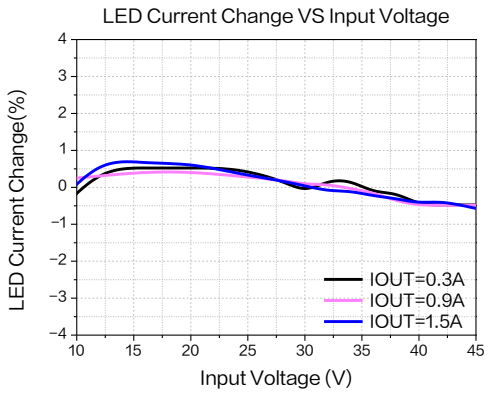



Figure13.Line Regulation

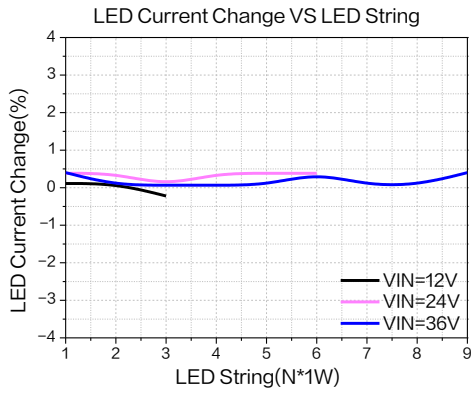



Figure14.Load Regulation

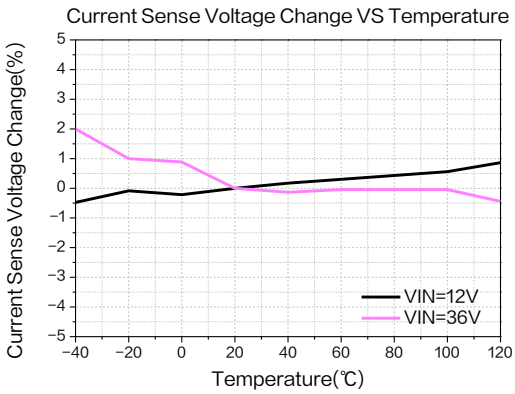



Figure15.Current Sense Voltage Regulation

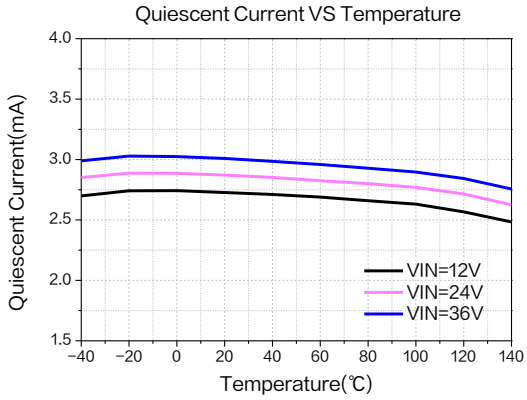



Figure16.Quiescent Current

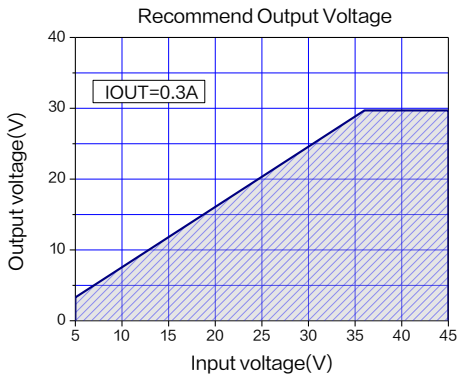



Figure17.Max Output Voltage
($I_{OUT}$=0.3A，$T_A$=25℃)

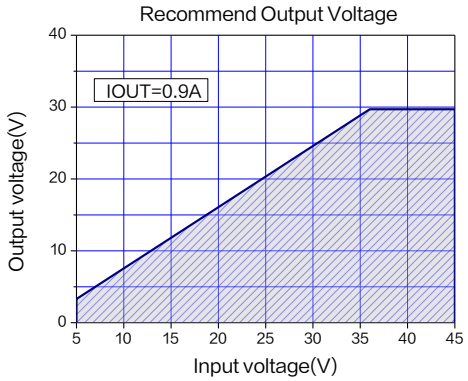



Figure18.Max Output Voltage
($I_{OUT}$=0.9A，$T_A$=25℃)

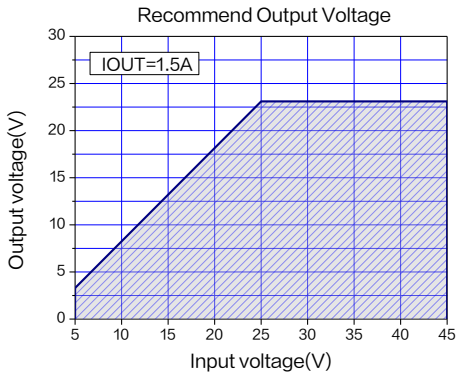



Figure19.Max Output Voltage
($I_{OUT}$=1.5A，$T_A$=25℃)

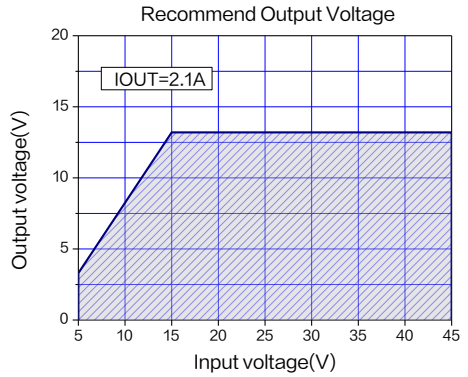



Figure20.Max Output Voltage
($I_{OUT}$=2.1A，$T_A$=25℃)

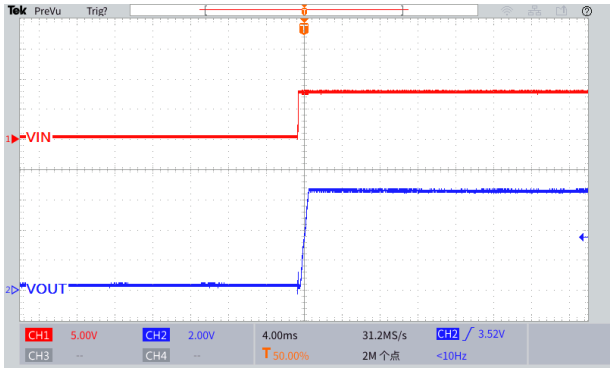



Figure21. Start-Up Characteristic
($V_{IN}$=8V，$V_{OUT}$=6.6V，$I_{OUT}$=0.3A)

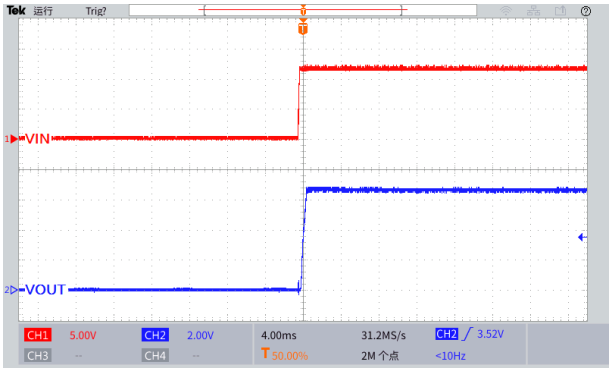



Figure22. Start-Up Characteristic
($V_{IN}$=12V，$V_{OUT}$=6.6V，$I_{OUT}$=0.3A)

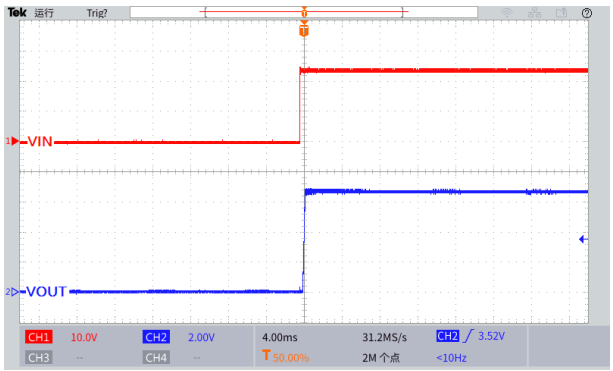



Figure23. Start-Up Characteristic
($V_{IN}$=24V，$V_{OUT}$=6.6V，$I_{OUT}$=0.3A)

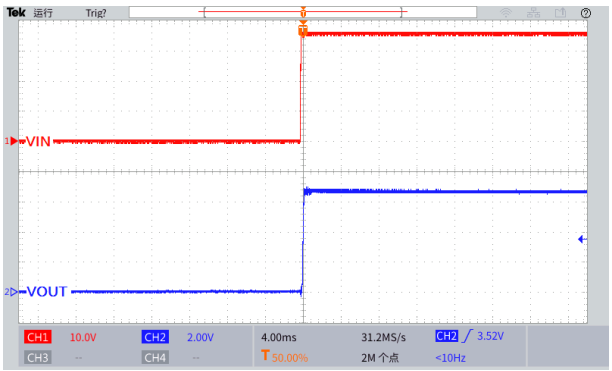



Figure24. Start-Up Characteristic
($V_{IN}$=36V，$V_{OUT}$=6.6V，$I_{OUT}$=0.3A)

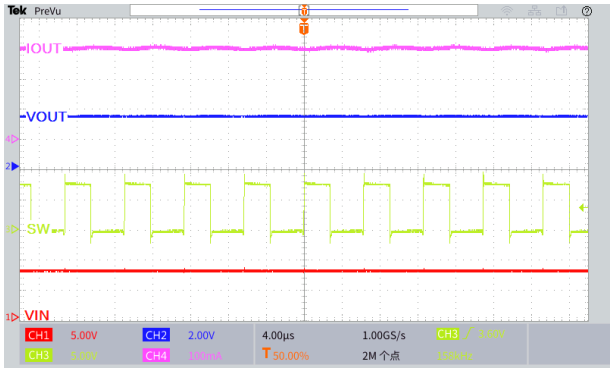



Figure25. LED Current Ripple
($V_{IN}$=8V，$V_{OUT}$=3.3V，$I_{OUT}$=0.3A)

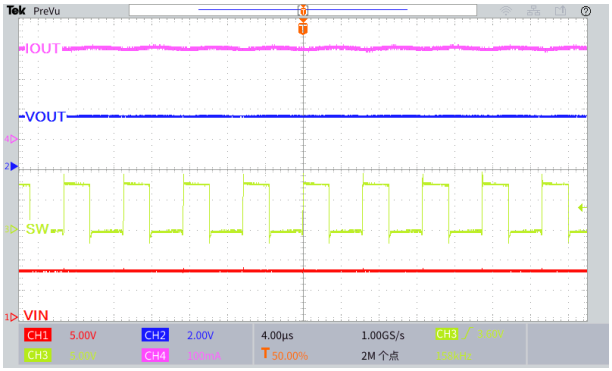



Figure26. LED Current Ripple
($V_{IN}$=12V，$V_{OUT}$=6.6V，$I_{OUT}$=0.3A)

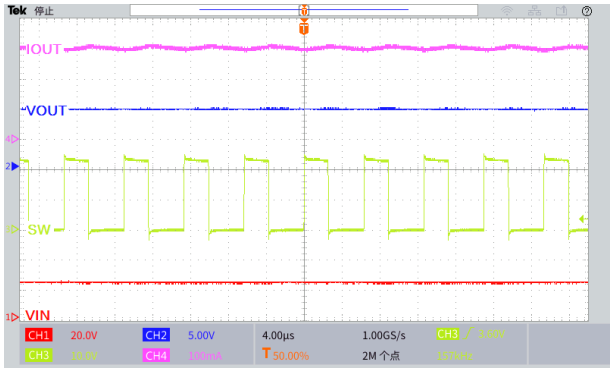



Figure27. LED Current Ripple
($V_{IN}$=24V，$V_{OUT}$=9.9V，$I_{OUT}$=0.3A)

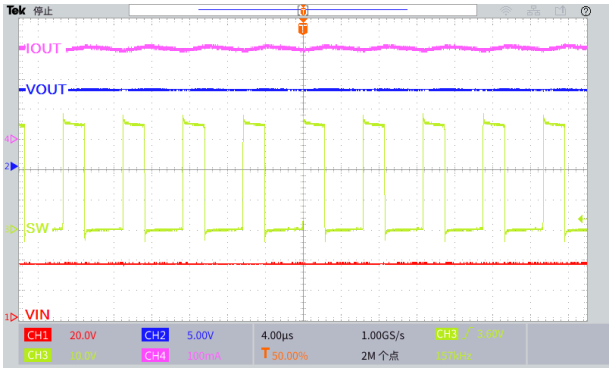
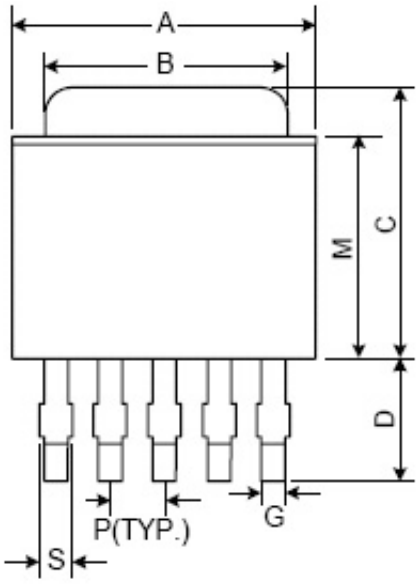
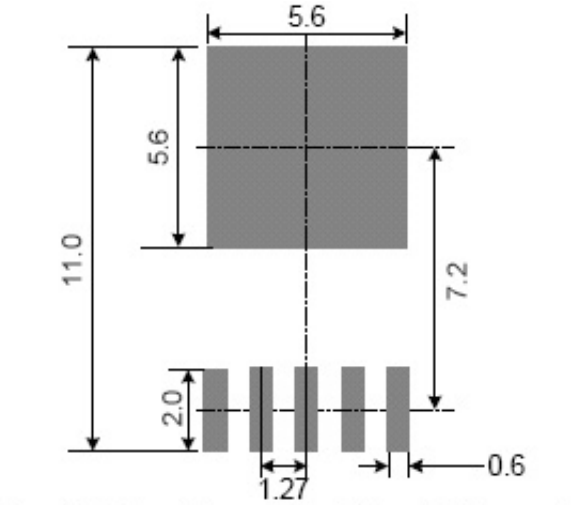



Figure28. LED Current Ripple
($V_{IN}$=36V，$V_{OUT}$=13.2V，$I_{OUT}$=0.3A)

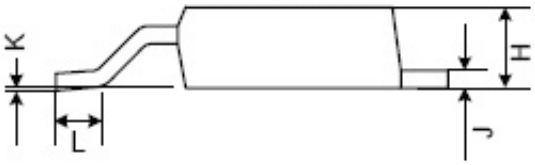
## Package Information

### TO252-5L




Land Pattern Recommendation (Unit: mm)




| Symbol | Dimensions In Millimeters | | | Dimensions In Inches | | |
|---|---|---|---|---|---|---|
| | Min. | Nom. | Max. | Min. | Nom. | Max. |
| A | 6.35 | 6.60 | 6.85 | 0.250 | 0.260 | 0.270 |
| B | 5.20 | 5.35 | 5.50 | 0.205 | 0.211 | 0.217 |
| C | 6.80 | 7.00 | 7.30 | 0.268 | 0.276 | 0.287 |
| D | 2.40 | 2.80 | 3.20 | 0.094 | 0.110 | 0.126 |
| P | 1.27 REF. | | | 0.05 REF. | | |
| S | 0.50 | 0.65 | 0.80 | 0.020 | 0.026 | 0.031 |
| G | 0.40 | 0.50 | 0.63 | 0.016 | 0.020 | 0.025 |
| H | 2.20 | 2.30 | 2.40 | 0.087 | 0.091 | 0.094 |
| J | 0.45 | 0.52 | 0.58 | 0.018 | 0.020 | 0.023 |
| K | 0.00 | 0.08 | 0.15 | 0.000 | 0.003 | 0.006 |
| L | 0.90 | 1.20 | 1.77 | 0.035 | 0.047 | 0.064 |
| M | 5.40 | 5.80 | 6.20 | 0.213 | 0.228 | 0.244 |

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