

80V 1A High Efficiency Buck PFM LED Constant Current Driver**XL8002****Features**

- n Operation Voltage DC 12V~80V.
- n 0.1V current sense voltage reference.
- n Directly drive 1~18 Series 1W/3W LED.
- n Excellent line and load regulation.
- n Internal Optimize Power HV-MOSFET.
- n Built in Thermal Shutdown Function.
- n Built in Current Limiting Function.
- n Built in Soft-Start Circuit.
- n Available in TO263-5L package.
- n Up to 98% efficiency.

General Description

The XL8002 is a monolithic high voltage switching regulator with PFM that is specifically designed to operate from a 12V~80V DC power supply.

The XL8002 is a high efficiency LED driver switching regulator. The LED string is driven at DC constant current rather than constant voltage, thus providing constant light output and enhanced reliability.

Applications

- n LED Lighting & LED LAMP
- n General purpose LED lighting

**TO263-5L**

Figure1. Package Type of XL8002

Pin Configurations

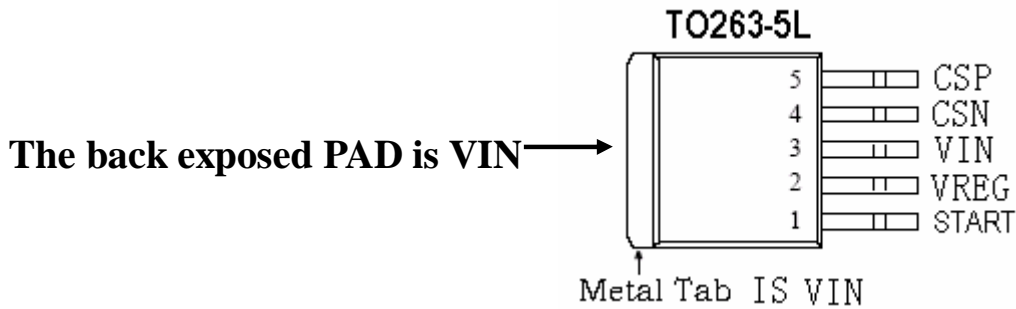


Figure2. Pin Configuration of XL8002 (Top View)

Table 1 Pin Description

| Pin Number | Pin Name | Description |
|------------|----------|---|
| 1 | START | Internal soft start Pin. |
| 2 | VREG | Internal Voltage Regulation Pin. (The VREG is about 8V) |
| 3 | VIN | Input high voltage Pin. (Operation voltage 12V~80V) |
| 4 | CSN | Current Sense Negative Pin. |
| 5 | CSP | Current Sense Positive Pin. (The current sense voltage is 0.1V) |

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Function Block

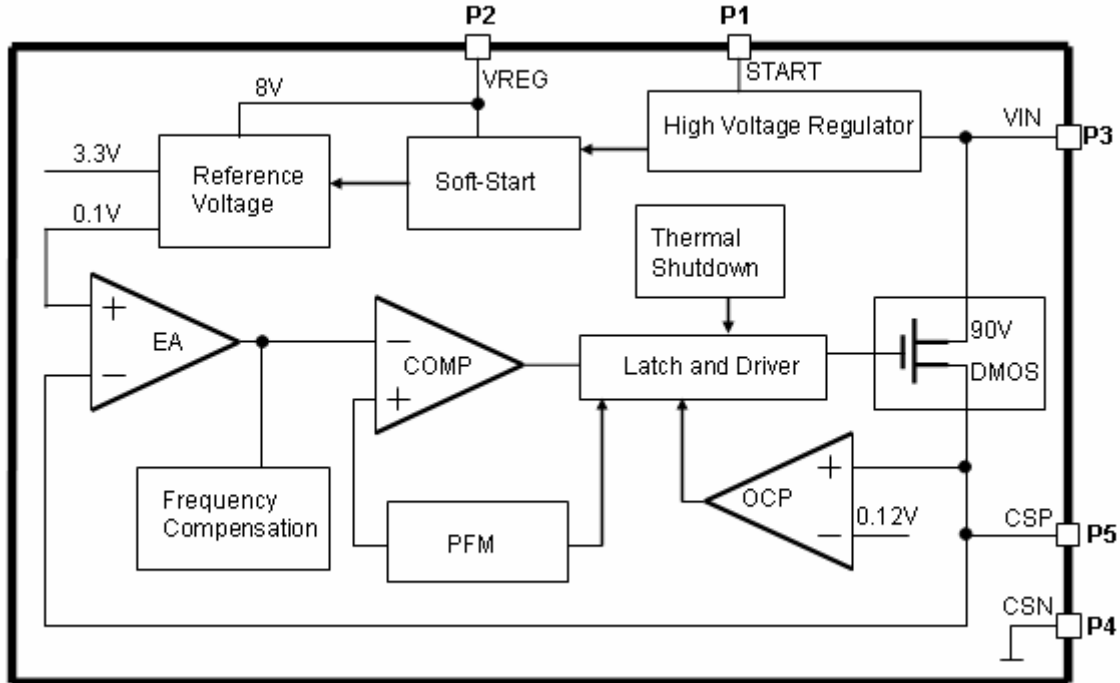


Figure3. Function Block Diagram of XL8002

Typical Application Circuit

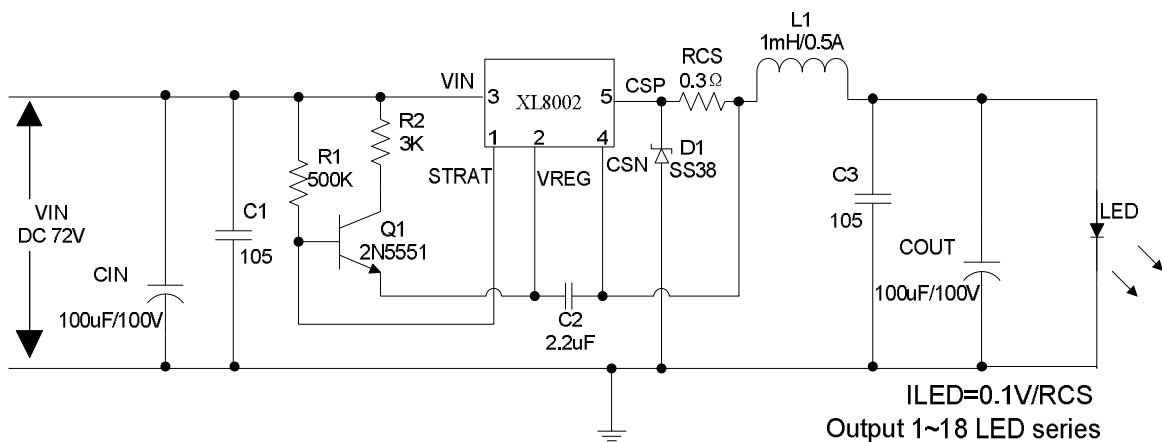


Figure4. XL8002 Typical Application

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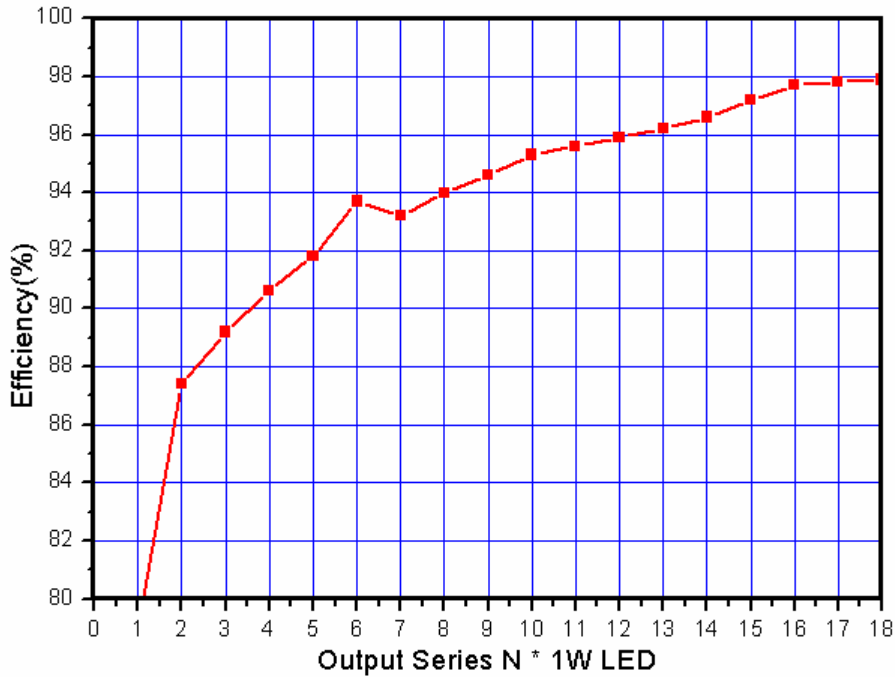


Figure5. Efficiency VS Output N*1W LED

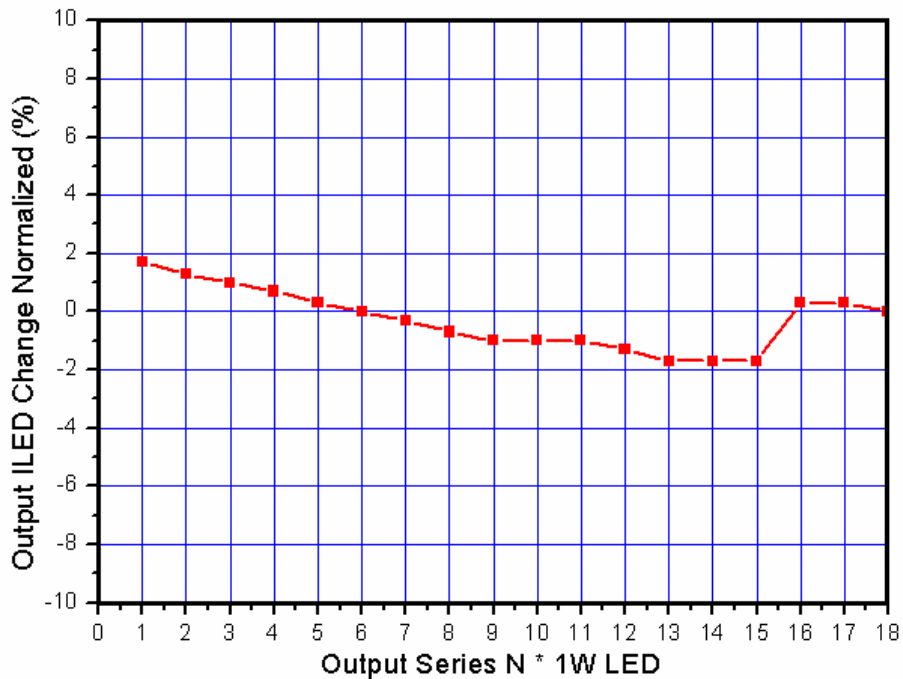


Figure6. Output ILED Load Regulation VS Output N*1W LED

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Ordering Information

| Package | Temperature Range | Part Number | Marking ID | Packing Type |
|---------|-------------------|-------------|------------|--------------|
| | | Lead Free | Lead Free | |
| | | XL8002E1 | XL8002E1 | Tube |
| | | XL8002TRE1 | XL8002E1 | Tape & Reel |

XLSEMI Pb-free products, as designated with “E1” suffix in the par number, are RoHS compliant.

Absolute Maximum Ratings (Note1)

| Parameter | Symbol | Value | Unit |
|---|------------|--------------------|------|
| Input Voltage | V_{in} | -0.3 to 90 | V |
| Power Dissipation | P_D | Internally limited | mW |
| Thermal Resistance (TO263-5L) (Junction to Ambient, No Heatsink, Free Air) | R_{JA} | 30 | °C/W |
| Operating Junction Temperature | T_J | -40 to 125 | °C |
| Storage Temperature | T_{STG} | -65 to 150 | °C |
| Lead Temperature (Soldering, 10 sec) | T_{LEAD} | 260 | °C |
| ESD (HBM) | | >3000 | 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.

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XL8002 Electrical Characteristics

T_a = 25 °C ;unless otherwise specified. Reference test circuit figure4

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|------------|-------------|--|------|------|------|------|
| VCSP | CSP Voltage | VIN=72V; Iled=300mA; Series 1~18 1W LED | 96 | 100 | 104 | mV |
| Efficiency | η | VIN=72V; Iled=300mA; Pout=16W | - | 98 | - | % |

Electrical Characteristics (DC Parameters)

| Parameters | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|--------------------------------------|---------------------|--|------|------|------|------|
| Input operation voltage | VIN | | 12 | | 80 | V |
| Switching Frequency | Fosc | Figure4 (12*1W) VIN=72V | 102 | 127 | 152 | KHz |
| Max. Duty Cycle | D _{MAX} | | | 85 | | % |
| VDMOS Drain-Source Breakdown Voltage | V _{BRDS} | V _{GS} =0V, I _{DS} =250uA | 90 | | | V |
| VDMOS Drain-Source on resistor | R _{DS(on)} | I _{DS} =1A, V _{GS} =8V | | 100 | 120 | mOhm |
| Thermal Shutdown | OTP | T _j | | 160 | | °C |
| Thermal Shutdown Window | | | | 20 | | °C |

| | |
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| 80V 1A High Efficiency Buck PFM LED Constant Current Driver | XL8002 |
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[1] Typical System Application (VIN=60V~80V)

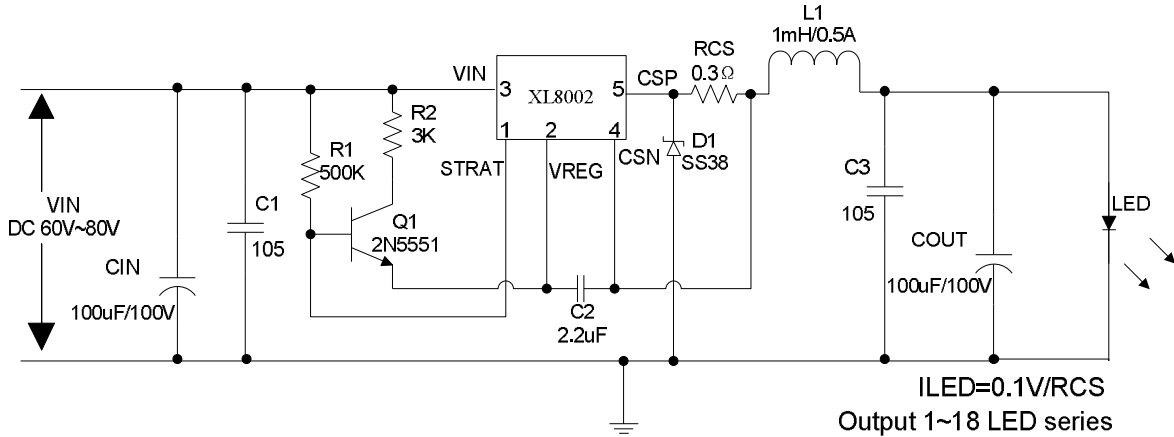


Figure7. XL8002 System Application at VIN=60V~80V Schematic

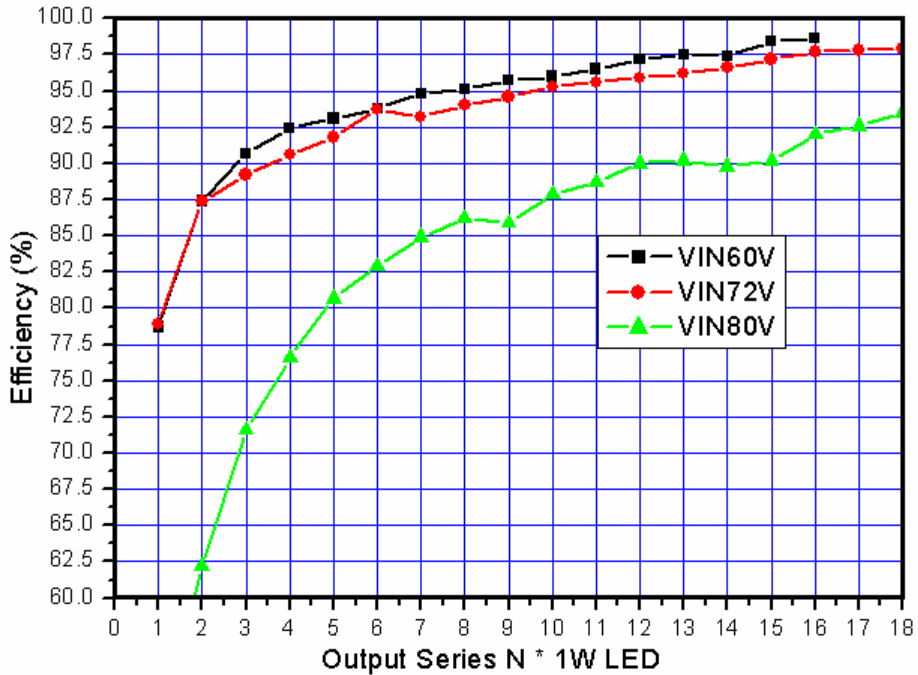


Figure8. XL8002 System Application at VIN=60V~80V Efficiency Curve

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Table1: Figure7 Input VIN=60V/72V/80V system parameters table:

| LED String 1W*N | VIN=60V | | | VIN=72V | | | VIN=80V | | |
|--------------------|---------|--------|------------|---------|--------|------------|---------|--------|------------|
| | FOSC | Pout | Efficiency | FOSC | Pout | Efficiency | FOSC | Pout | Efficiency |
| 1 | 27.54K | 1.04W | 78.7% | 25.41K | 0.97W | 78.9% | 28.84K | 1.14W | 50.8% |
| 2 | 45.90K | 1.99W | 87.4% | 45.76K | 2.02W | 87.4% | 46.98K | 2.09W | 62.2% |
| 3 | 61.79K | 2.94W | 90.7% | 61.10K | 2.89W | 89.2% | 63.69K | 3.04W | 71.6% |
| 4 | 74.70K | 3.83W | 92.4% | 75.13K | 3.79W | 90.6% | 78.04K | 3.92W | 76.6% |
| 5 | 85.92K | 4.75W | 93.1% | 87.70K | 4.70W | 91.8% | 91.51K | 4.85W | 80.7% |
| 6 | 94.64K | 5.63W | 93.8% | 98.50K | 5.61W | 93.7% | 103.35K | 5.78W | 82.9% |
| 7 | 101.06K | 6.48W | 94.8% | 107.44K | 6.45W | 93.2% | 113.48K | 6.66W | 84.9% |
| 8 | 105.65K | 7.36W | 95.1% | 114.66K | 7.37W | 94.0% | 121.91K | 7.52W | 86.2% |
| 9 | 108.26K | 8.21W | 95.7% | 120.15K | 8.24W | 94.6% | 129.09K | 8.39W | 85.9% |
| 10 | 109.06K | 9.10W | 96.0% | 124.10K | 9.13W | 95.3% | 134.73K | 9.29W | 87.9% |
| 11 | 107.72K | 10.01W | 96.5% | 126.54K | 10.12W | 95.6% | 138.71K | 10.16W | 88.7% |
| 12 | 104.57K | 10.91W | 97.2% | 126.90K | 10.97W | 95.9% | 141.32K | 11.03W | 90.0% |
| 13 | 98.61K | 11.92W | 97.5% | 125.62K | 11.92W | 96.2% | 142.28K | 12.00W | 90.2% |
| 14 | 88.21K | 12.92W | 97.4% | 122.06K | 12.94W | 96.6% | 141.32K | 13.02W | 89.8% |
| 15 | 74.63K | 13.87W | 98.4% | 116.52K | 13.94W | 97.2% | 137.62K | 13.95W | 90.2% |
| 16 | 46.44K | 15.62W | 98.6% | 99.20K | 15.77W | 97.7% | 121.04K | 15.84W | 92.0% |
| 17 | | | | 89.37K | 16.69W | 97.8% | 113.56K | 16.37W | 92.6% |
| 18 | | | | 75.17K | 17.64W | 97.9% | 103.65K | 17.36W | 93.5% |

[2] Typical System Application (VIN=36V~60V)

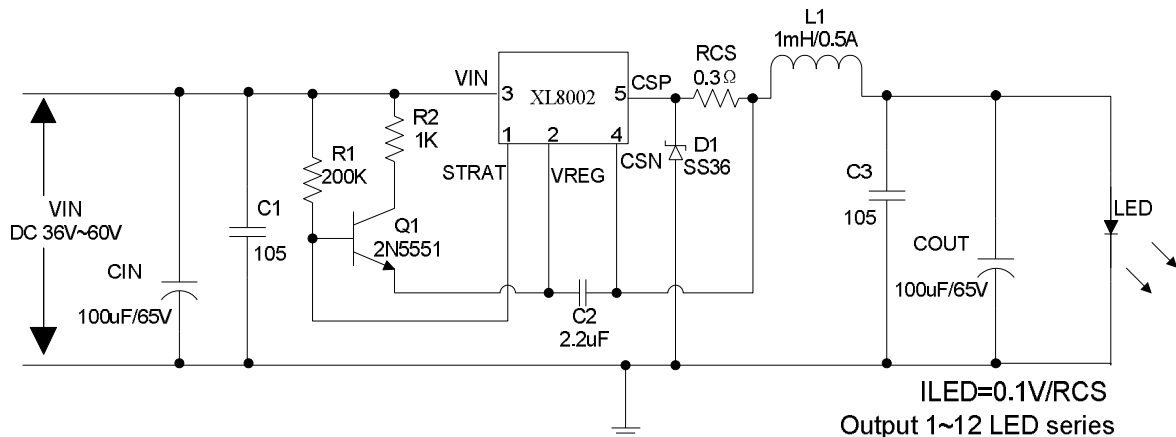


Figure9. XL8002 System Application at VIN=36V~60V Schematic

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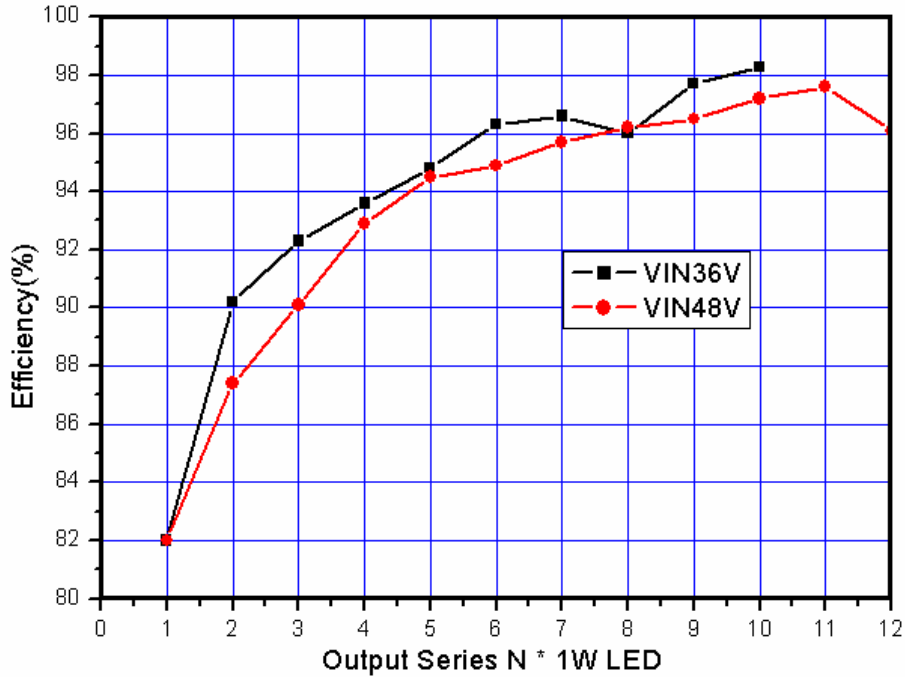


Figure10. XL8002 System Application at VIN=36V~60V Efficiency Curve

Table2: Figure9 Input VIN=36V/48V system parameters table:

| LED String 1W*N | VIN=36V | | | VIN=48V | | |
|-----------------|---------|-------|------------|---------|--------|------------|
| | FOSC | Pout | Efficiency | FOSC | Pout | Efficiency |
| 1 | 28.83K | 1.09W | 82.0% | 29.18K | 1.10W | 82.0% |
| 2 | 45.06K | 2.05W | 90.2% | 46.81K | 2.06W | 87.4% |
| 3 | 56.98K | 2.99W | 92.3% | 61.45K | 2.98W | 90.1% |
| 4 | 64.58K | 3.88W | 93.6% | 72.05K | 3.88W | 92.9% |
| 5 | 68.53K | 4.77W | 94.8% | 80.32K | 4.76W | 94.5% |
| 6 | 68.66K | 5.68W | 96.3% | 85.95K | 5.65W | 94.9% |
| 7 | 65.21K | 6.57W | 96.6% | 88.95K | 6.52W | 95.7% |
| 8 | 58.26K | 7.36W | 96.0% | 89.37K | 7.38W | 96.2% |
| 9 | 48.75K | 8.33W | 97.7% | 87.31K | 8.24W | 96.5% |
| 10 | 34.20K | 9.29W | 98.3% | 82.56K | 9.14W | 97.2% |
| 11 | | | | 74.92K | 10.06W | 97.6% |
| 12 | | | | 62.77K | 10.92W | 96.1% |

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[3] Typical System Application (VIN=12V~36V)

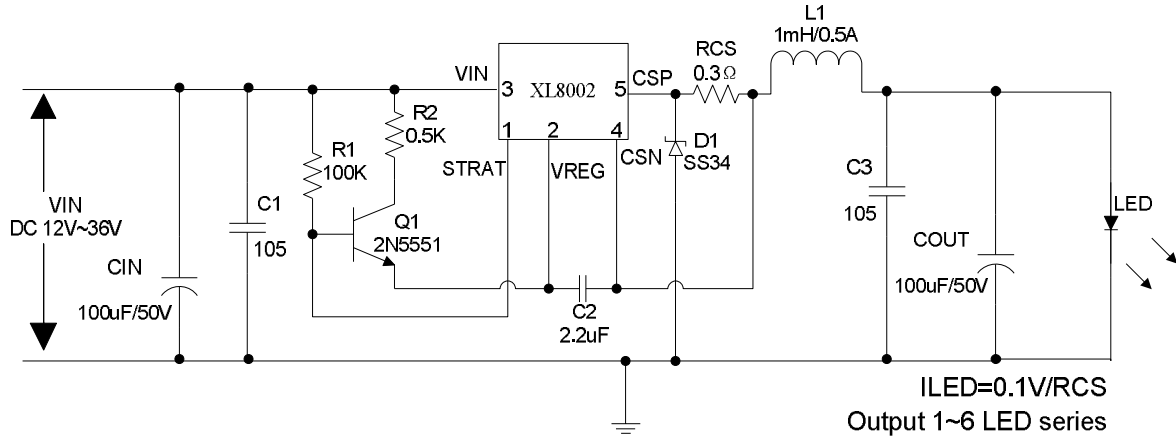


Figure11. XL8002 System Application at VIN=12V~36V Schematic

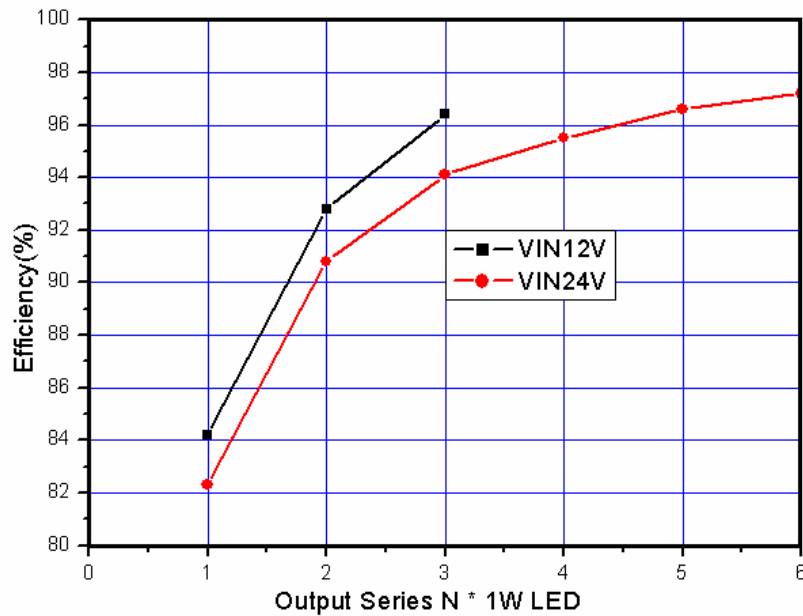


Figure12. XL8002 System Application at VIN=12V~36V Efficiency Curve

Table3: Figure11 Input VIN=12V/24V system parameters table:

| LED String 1W*N | VIN=12V | | | VIN=24V | | |
|--------------------|---------|-------|------------|---------|-------|------------|
| | FOSC | Pout | Efficiency | FOSC | Pout | Efficiency |
| 1 | 22.75K | 1.06W | 84.2% | 26.42K | 1.01W | 82.3% |
| 2 | 24.18K | 2.02W | 92.8% | 39.74K | 1.96W | 90.8% |
| 3 | 10.37K | 3.10W | 96.4% | 46.63K | 2.91W | 94.1% |
| 4 | | | | 47.25K | 3.80W | 95.5% |
| 5 | | | | 42.17K | 4.70W | 96.6% |
| 6 | | | | 31.13K | 5.61W | 97.2% |

| | |
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| 80V 1A High Efficiency Buck PFM LED Constant Current Driver | XL8002 |
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[4] Typical System Application (VIN=60V~80V, Output Series 3W LED)

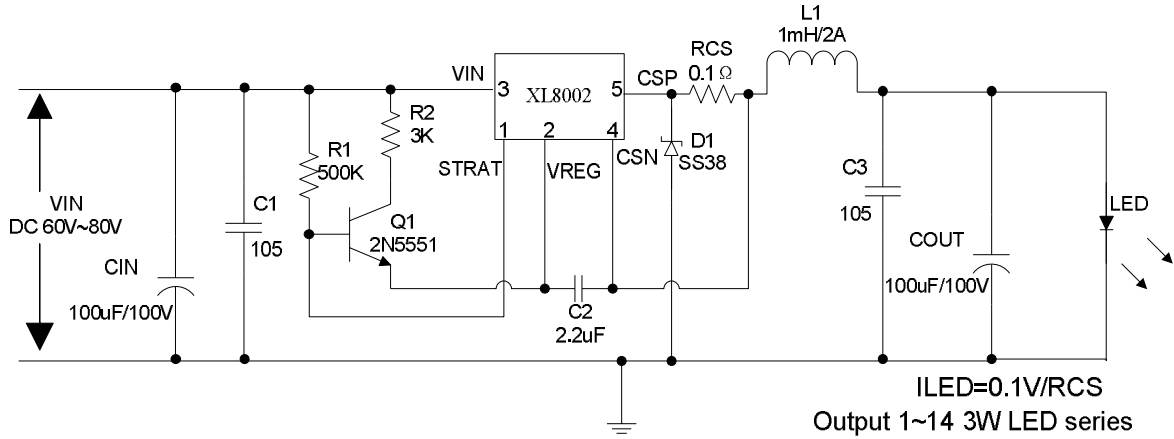


Figure13. XL8002 System Application at VIN=60V~80V Schematic

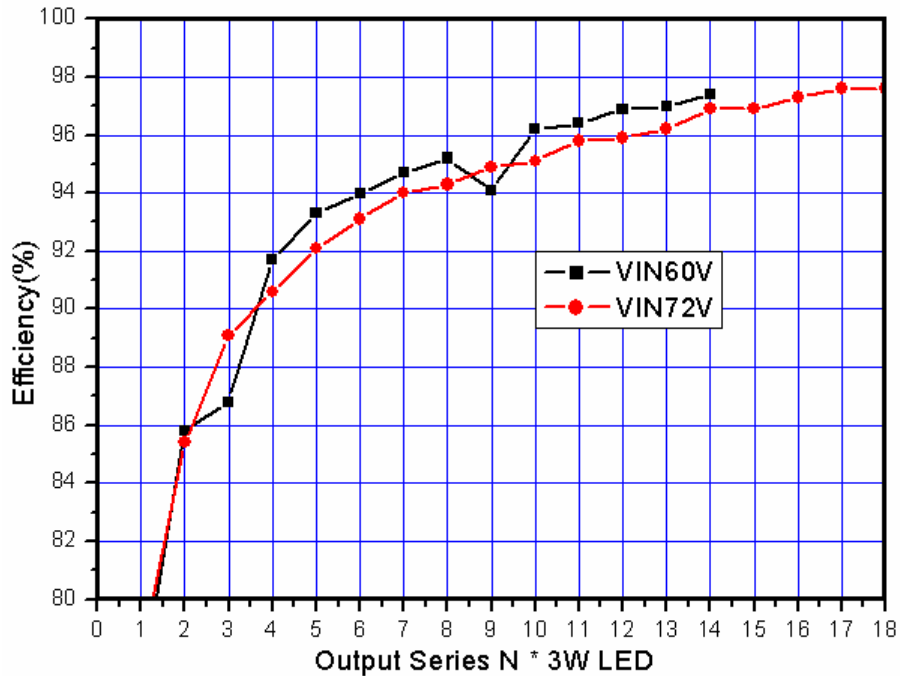


Figure14. XL8002 System Application at VIN=60V~80V Efficiency Curve

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Table4: Figure13 Input VIN=60V/72V system parameters table:

| LED String 3W*N | VIN=60V | | | VIN=72V | | |
|--------------------|---------|--------|------------|---------|--------|------------|
| | FOSC | Pout | Efficiency | FOSC | Pout | Efficiency |
| 1 | 29.69K | 3.09W | 76.8% | 30.19K | 3.31W | 77.9% |
| 2 | 49.15K | 6.04W | 85.8% | 49.44K | 6.28W | 85.4% |
| 3 | 67.05K | 8.92W | 86.8% | 66.47K | 9.19W | 89.1% |
| 4 | 79.4K | 11.68W | 91.7% | 80.02K | 11.76W | 90.6% |
| 5 | 90.69K | 14.40W | 93.3% | 92.67K | 14.47W | 92.1% |
| 6 | 99.29K | 16.99W | 94.0% | 103.38K | 17.11W | 93.1% |
| 7 | 105.99K | 19.68W | 94.7% | 112.28K | 19.72W | 94.0% |
| 8 | 110.14K | 22.24W | 95.2% | 119.03K | 22.30W | 94.3% |
| 9 | 112.33K | 24.62W | 94.1% | 124.22K | 24.90W | 94.9% |
| 10 | 112.21K | 27.43W | 96.2% | 127.71K | 27.42W | 95.1% |
| 11 | 110.21K | 29.95W | 96.4% | 129.3K | 30.02W | 95.8% |
| 12 | 106.33K | 32.32W | 96.9% | 129.88K | 32.44W | 95.9% |
| 13 | 100.82K | 34.72W | 97.0% | 125.21K | 35.28W | 96.2% |
| 14 | 92.68K | 37.37W | 97.4% | 122.24K | 37.92W | 96.9% |
| 15 | | | | 119.06K | 40.50W | 96.9% |
| 16 | | | | 112.73K | 42.86W | 97.3% |
| 17 | | | | 103.35K | 45.47W | 97.6% |
| 18 | | | | 93.18K | 47.89W | 97.6% |

Schottky Diode Selection Table

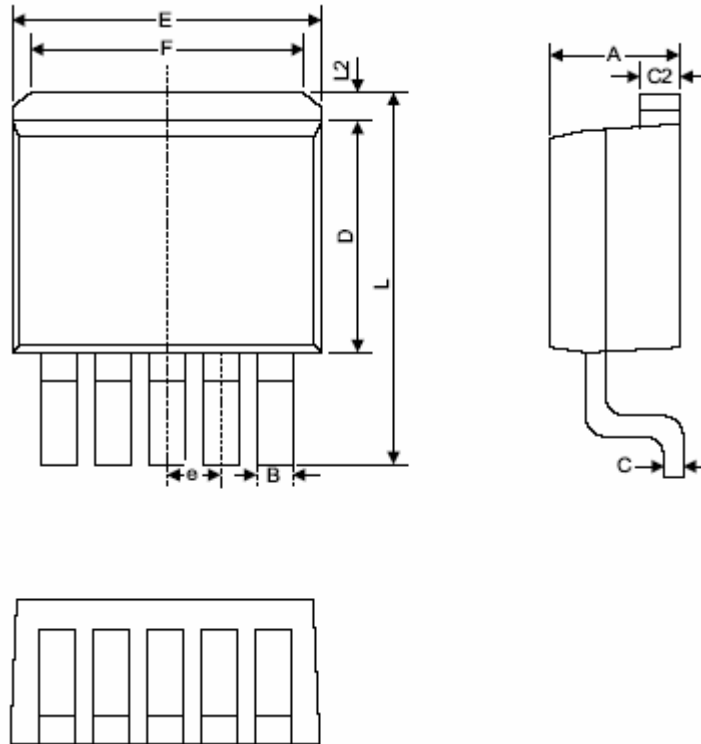
| VR | 1A | 3A | | | | |
|------|--------|-------|------|--------|--------|-------|
| 20V | 1N5817 | SS32 | SK32 | 1N5820 | MBR320 | SR302 |
| 30V | 1N5818 | SS33 | SK33 | 1N5821 | MBR330 | SR303 |
| 40V | 1N5819 | SS34 | SK34 | 1N5822 | MBR340 | SR304 |
| 50V | | SS35 | SK35 | | MBR350 | SR305 |
| 60V | | SS36 | SK36 | | MBR360 | SR306 |
| 70V | | SS37 | SK37 | | | SR307 |
| 80V | | SS38 | SK38 | | | SR308 |
| 90V | | SS39 | SK39 | | | SR309 |
| 100V | | SS310 | S310 | | | SR310 |

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Package Information

TO263-5L



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 4.06 | 4.83 | 0.160 | 0.190 |
| B | 0.76 | 1.02 | 0.030 | 0.040 |
| C | 0.36 | 0.64 | 0.014 | 0.025 |
| C2 | 1.14 | 1.40 | 0.045 | 0.055 |
| D | 8.64 | 9.65 | 0.340 | 0.380 |
| E | 9.78 | 10.54 | 0.385 | 0.415 |
| e | 1.57 | 1.85 | 0.062 | 0.073 |
| F | 6.60 | 7.11 | 0.260 | 0.280 |
| L | 15.11 | 15.37 | 0.595 | 0.605 |
| L2 | - | 1.40 | - | 0.055 |