

## Features

- Wide 4.5V to 40V Input Voltage Range
- 5V,12V and adjustable versions
- Output Adjustable from 1.23V to 37V
- Maximum Duty Cycle 100%
- Minimum Drop Out 1.5V
- Fixed 52KHz Switching Frequency
- 3A Constant Output Current Capability
- Internal Optimize Power Transistor
- High efficiency
- Excellent line and load regulation
- TTL shutdown capability
- ON/OFF pin with hysteresis function
- Built in thermal shutdown function
- Built in current limit function
- Available in TO-220,TO-263 packages

## General Description

The XL2576 is a 52 KHz fixed frequency PWM buck (step-down) DC/DC converter, capable of driving a 3A load with high efficiency, low ripple and excellent line and load regulation. Requiring a minimum number of external components, the regulator is simple to use and include internal frequency compensation and a fixed-frequency oscillator.

The PWM control circuit is able to adjust the duty ratio linearly from 0 to 100%. An enable function, an over current protection function is built inside. An internal compensation block is built in to minimize external component count.

## Applications

- LCD Monitor and LCD TV
- Digital Photo Frame
- Set-up Box
- ADSL Modem
- Telecom / Networking Equipment

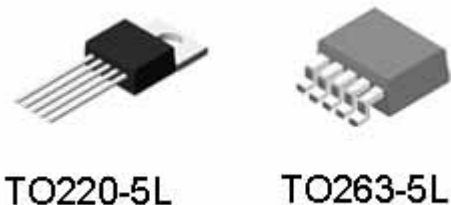


Figure1. Package Type of XL2576

## Pin Configurations

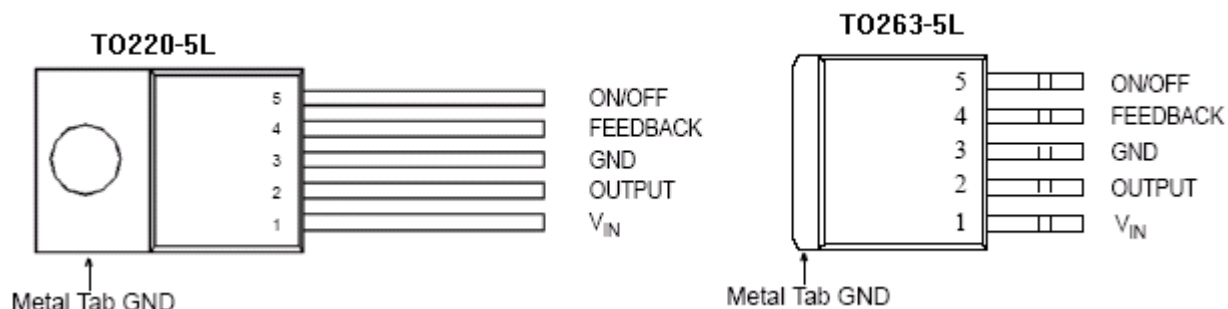


Figure2. Pin Configuration of XL2576 (Top View)

Table 1 Pin Description

| Pin Number | Pin Name | Description  |
|------------|----------|--|
| 1          | VIN      | Supply Voltage Input Pin. XL2576 operates from a 4.5V to 40V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.  |
| 2          | OUTPUT   | Power Switch Output Pin (SW). Output is the switch node that supplies power to the output.   |
| 3          | GND      | Ground Pin. Care must be taken in layout. This pin should be placed outside of the Schottky Diode to output capacitor ground path to prevent switching current spikes from inducing voltage noise into XL2576. |
| 4          | FEEDBACK | Feedback Pin (FB). Through an external resistor divider network, Feedback senses the output voltage and regulates it. The feedback threshold voltage is 1.23V.   |
| 5          | ON/OFF   | Enable Pin. Drive ON/OFF pin low to turn on the device, drive it high to turn it off. Floating is default low.   |

3A 52KHz 40V Buck DC to DC Converter XL2576

### Function Block

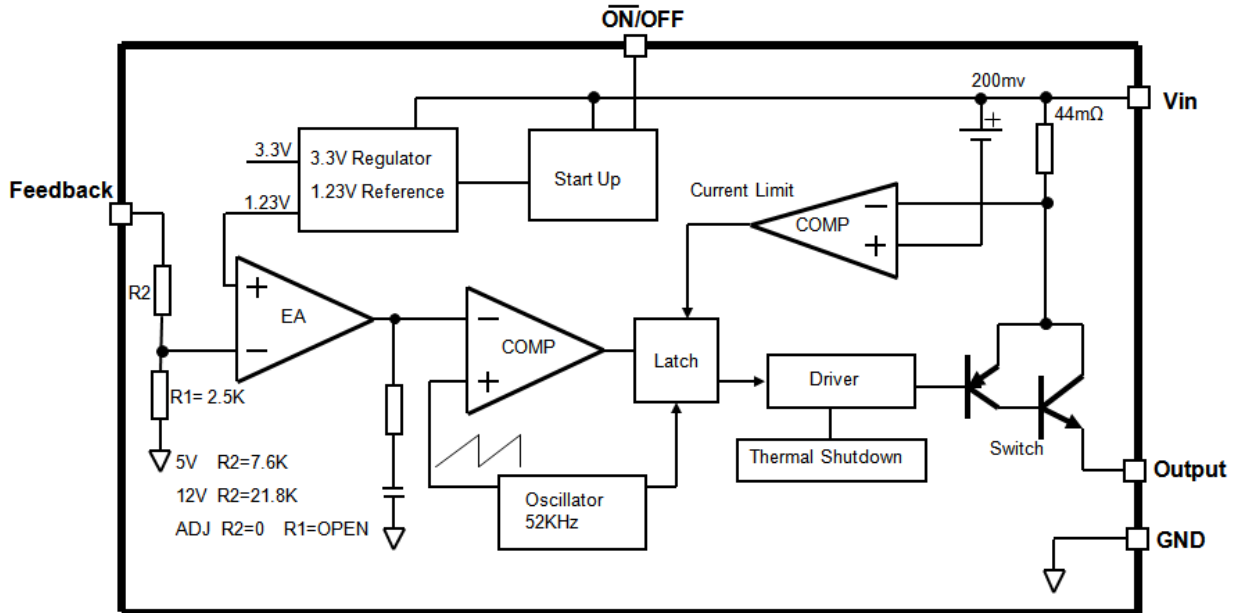


Figure3. Function Block Diagram of XL2576

### Typical Application Circuit

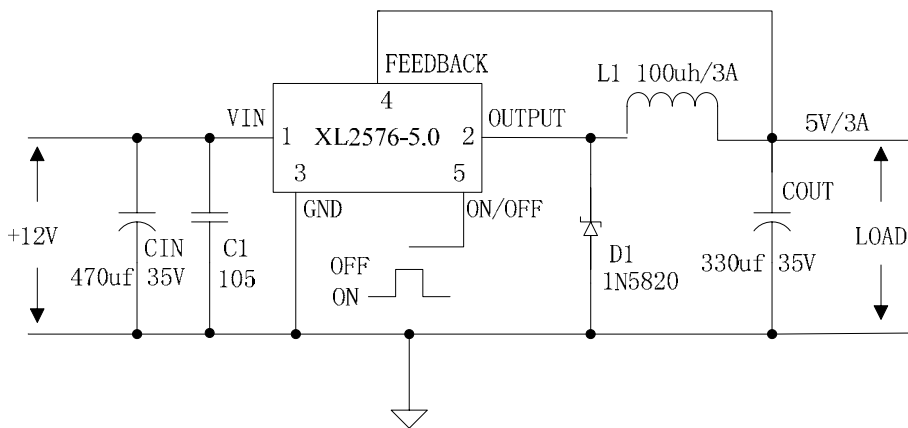
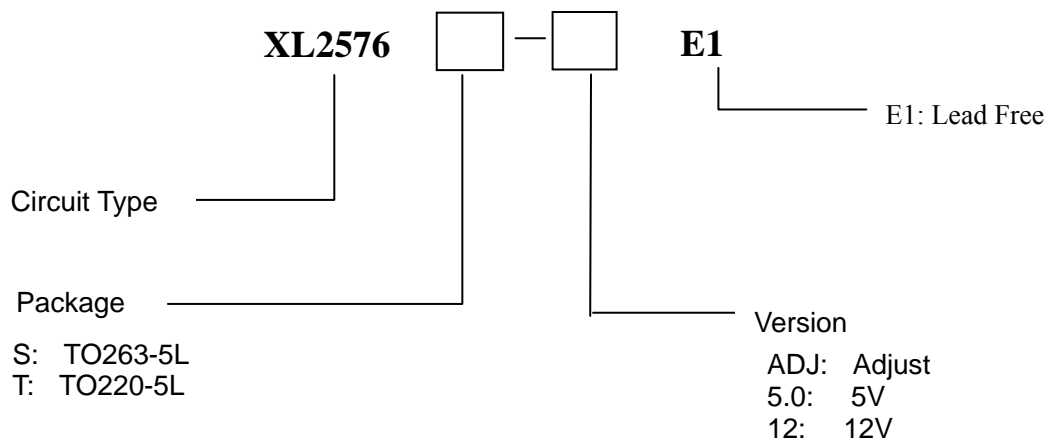


Figure4. XL2576 Typical Application Circuit 12V-5V/3A

## Ordering Information



| Package  | Temperature Range | Marking ID    | Packing Type Supplied As |
|----------|-------------------|---------------|--------------------------|
|          |                   | Lead Free     |                          |
| TO220-5L | -40°C ~ 85°C      | XL2576T-ADJE1 | Tube                     |
|          |                   | XL2576T-5.0E1 | Tube                     |
| TO263-5L | -40°C ~ 85°C      | XL2576S-ADJE1 | 800 Units on Tape & Reel |
|          |                   | XL2576S-5.0E1 | 800 Units on Tape & Reel |
|          |                   | XL2576S-12E1  | 800 Units on 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 <sub>in</sub>     | -0.3 to 45              | V    |
| Feedback Pin Voltage   | V <sub>FB</sub>     | -0.3 to V <sub>in</sub> | V    |
| ON/OFF Pin Voltage   | V <sub>ON/OFF</sub> | -0.3 to V <sub>in</sub> | V    |
| Output Switch Pin Voltage  | V <sub>Output</sub> | -0.3 to V <sub>in</sub> | V    |
| Power Dissipation  | P <sub>D</sub>      | Internally limited      | mW   |
| Thermal Resistance (TO220 & TO263)<br>(Junction to Ambient, No Heatsink, Free Air) | R <sub>JA</sub>     | 30                      | °C/W |
| Operating Junction Temperature   | T <sub>J</sub>      | -40 to 125              | °C   |
| Storage Temperature  | T <sub>STG</sub>    | -65 to 150              | °C   |
| Lead Temperature (Soldering, 10 sec)   | T <sub>LEAD</sub>   | 260                     | °C   |
| ESD (HBM)  |                     | >2000                   | 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.

3A 52KHz 40V Buck DC to DC Converter

XL2576

## XL2576-5.0 Electrical Characteristics

$T_a = 25$  ;unless otherwise specified.

| Symbol  | Parameter      | Test Condition                      | Min. | Typ. | Max. | Unit |
|---|----------------|-------------------------------------|------|------|------|------|
| <i>System parameters test circuit figure7</i> |                |                                     |      |      |      |      |
| VOUT  | Output Voltage | Vin = 7V to 40V<br>Iload=0.2A to 3A | 4.8  | 5    | 5.2  | V    |
| Efficiency                                    | $\eta$         | Vin=12V ,Vout=5V<br>Iout=3A         | -    | 78   | -    | %    |

## XL2576-12 Electrical Characteristics

$T_a = 25$  ;unless otherwise specified.

| Symbol  | Parameter      | Test Condition                       | Min.  | Typ. | Max.  | Unit |
|---|----------------|--------------------------------------|-------|------|-------|------|
| <i>System parameters test circuit figure5</i> |                |                                      |       |      |       |      |
| VOUT  | Output Voltage | Vin = 15V to 40V<br>Iload=0.2A to 2A | 11.52 | 12   | 12.48 | V    |
| Efficiency                                    | $\eta$         | Vin=24V ,Vout=12V<br>Iout=2A         | -     | 92   | -     | %    |

## XL2576-ADJ Electrical Characteristics

$T_a = 25$  ;unless otherwise specified.

| Symbol  | Parameter      | Test Condition                        | Min.  | Typ. | Max.  | Unit |
|---|----------------|---------------------------------------|-------|------|-------|------|
| <i>System parameters test circuit figure8</i> |                |                                       |       |      |       |      |
| VOUT  | Output Voltage | Vin = 4.5V to 40V<br>Iload=0.2A to 3A | 1.193 | 1.23 | 1.267 | V    |
| Efficiency                                    | $\eta$         | Vin=12V ,Vout=3V<br>Iout=3A           | -     | 73   | -     | %    |

## Electrical Characteristics (DC Parameters)

$V_{in} = 12V$  for the 5V, and Adjustable versions and  $V_{in} = 24V$  for the 12V version,  $GND = 0V$ ,  $V_{in}$  &  $GND$  parallel connect a 220uf/50V capacitor;  $I_{out} = 500mA$ ,  $T_a = 25$  ; the others floating unless otherwise specified.

| Parameters                       | Symbol       | Test Condition                             | Min. | Typ.       | Max. | Unit |
|----------------------------------|--------------|--|------|------------|------|------|
| Input operation voltage          | $V_{in}$     |  | 4.5  |            | 40   | V    |
| Shutdown Supply Current          | $I_{STBY}$   | $V_{ON/OFF} = 5V$                          |      | 80         | 200  | uA   |
| Quiescent Supply Current         | $I_q$        | $V_{ON/OFF} = 0V$ ,<br>$V_{FB} = V_{in}$   |      | 2          | 10   | mA   |
| Oscillator Frequency             | $F_{osc}$    |  | 40   | 52         | 64   | Khz  |
| Switch Current Limit             | $I_L$        | $V_{FB} = 0$                               | 3.6  | 4.8        | 6.9  | A    |
| ON/OFF Pin Threshold             | $V_{ON/OFF}$ | High (Regulator OFF)<br>Low (Regulator ON) |      | 1.4<br>0.8 |      | V    |
| ON/OFF Pin Input Leakage Current | $I_H$        | $V_{ON/OFF} = 2.5V$ (OFF)                  |      | 5          | 15   | uA   |
|                                  | $I_L$        | $V_{ON/OFF} = 0.5V$ (ON)                   |      | 0.2        | 5    | uA   |
| Output Saturation Voltage        | $V_{CE}$     | $V_{FB} = 0V$<br>$I_{out} = 3A$            |      | 1.3        | 1.5  | V    |
| Max. Duty Cycle                  | $D_{MAX}$    | $V_{FB} = 0V$                              |      | 100        |      | %    |

## Test Circuit and Layout guidelines

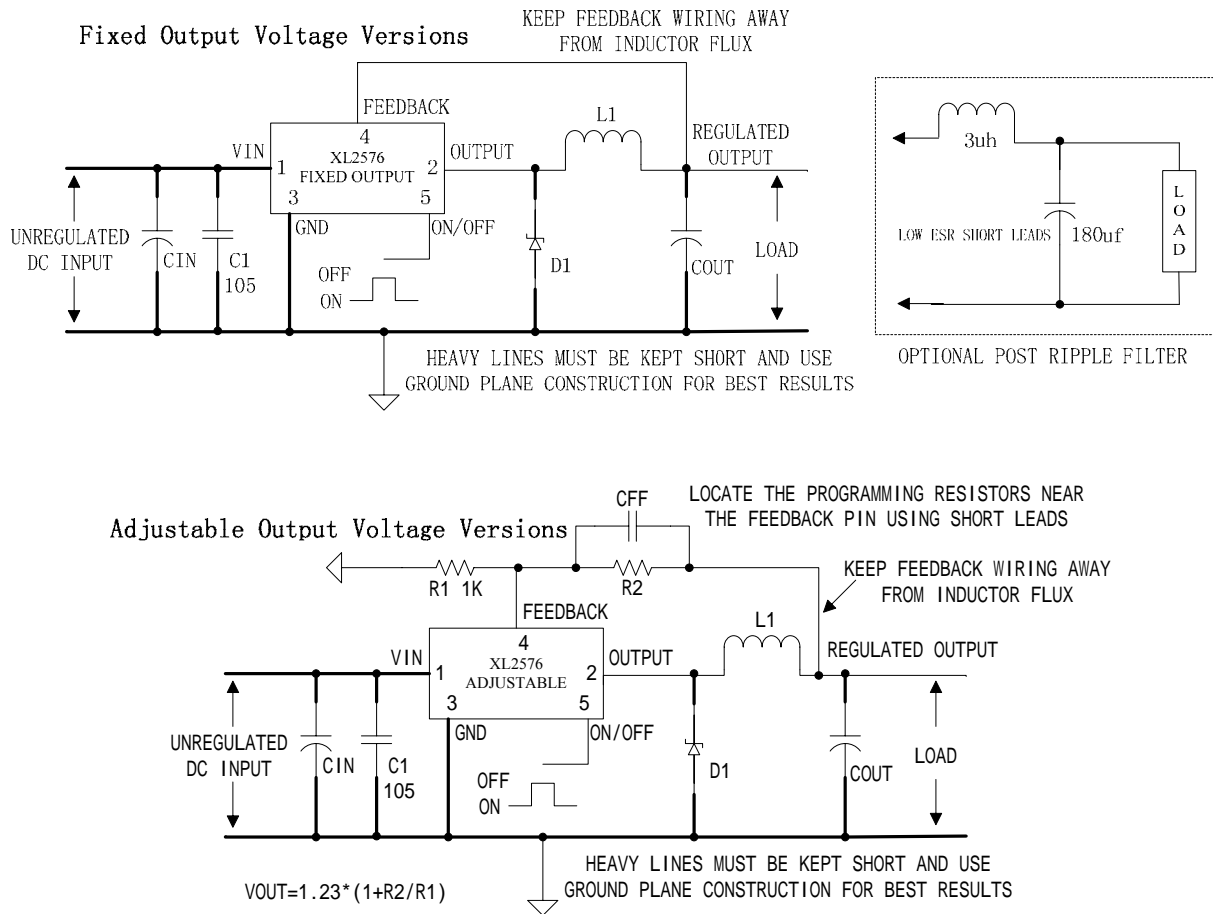


Figure5. Standard Test Circuits and Layout Guides

Select R1 to be approximately 1K, use a 1% resistor for best stability.

C1 and CFF are optional; in order to increase stability and reduce the input power line noise, CIN and C1 must be placed near to PIN1 and PIN3;

For output voltages greater than approximately 10V, an additional capacitor CFF is required. The compensation capacitor is typically between 100 pf and 33 nf, and is wired in parallel with the output voltage setting resistor, R2. It provides additional stability for high output voltage, low input-output voltages, and/or very low ESR output capacitors, such as solid tantalum capacitors.

$CFF = 1 / (31 * 1000 * R2)$ ; This capacitor type can be ceramic, plastic, silver mica, etc. (Because of the unstable characteristics of ceramic capacitors made with Z5U material, they are not recommended.)



## XL2576 Series Buck Regulator Design Procedure (Fixed Output)

| Conditions         |                  |                       | Inductor (L1)               | Output Capacitor (COUT) |                           |                       |                            |
|--------------------|------------------|-----------------------|-----------------------------|-------------------------|---------------------------|-----------------------|----------------------------|
| Output Voltage (V) | Load Current (A) | Max Input Voltage (V) |                             | Inductance (uh)         | Through Hole Electrolytic |                       | Surface Mount Tantalum     |
|                    |                  |                       | Panasonic HFQ Series (uf/V) |                         | Nichicon PL Series (uf/V) | AVX TPS Series (uf/V) | Sprague 595D Series (uf/V) |
| 5                  | 3                | 7                     | 47                          | 470/25                  | 560/16                    | 220/10                | 330/10                     |
|                    |                  | 9                     | 68                          | 560/25                  | 560/25                    | 220/10                | 330/10                     |
|                    |                  | 15                    | 100                         | 330/35                  | 330/35                    | 220/10                | 330/10                     |
|                    |                  | 40                    | 150                         | 330/35                  | 270/35                    | 220/10                | 330/10                     |
| 12                 | 3                | 15                    | 47                          | 470/25                  | 470/25                    | 100/16                | 180/16                     |
|                    |                  | 18                    | 68                          | 330/25                  | 330/25                    | 100/16                | 180/16                     |
|                    |                  | 30                    | 100                         | 180/25                  | 180/25                    | 100/16                | 120/20                     |
|                    |                  | 40                    | 150                         | 180/35                  | 180/25                    | 100/16                | 120/20                     |
|                    | 2                | 15                    | 47                          | 330/25                  | 330/25                    | 100/16                | 180/16                     |
|                    |                  | 20                    | 100                         | 180/25                  | 180/25                    | 100/16                | 120/20                     |
|                    |                  | 40                    | 150                         | 82/25                   | 82/25                     | 68/20                 | 68/25                      |

## XL2576 Series Buck Regulator Design Procedure (Adjustable Output)

| Output Voltage (V) | Through Hole Output Electrolytic |                           |                       | Surface Mount Output Capacitor |                            |                       |
|--------------------|----------------------------------|---------------------------|-----------------------|--------------------------------|----------------------------|-----------------------|
|                    | Panasonic HFQ Series (uf/V)      | Nichicon PL Series (uf/V) | Feedforward Capacitor | AVX TPS Series (uf/V)          | Sprague 595D Series (uf/V) | Feedforward Capacitor |
| 2                  | 820/35                           | 820/35                    | 33nf                  | 330/6.3                        | 470/4                      | 33nf                  |
| 4                  | 560/35                           | 470/35                    | 10nf                  | 330/6.3                        | 390/6.3                    | 10nf                  |
| 6                  | 470/25                           | 470/35                    | 3.3nf                 | 220/10                         | 330/10                     | 3.3nf                 |
| 9                  | 330/25                           | 330/25                    | 1.5nf                 | 100/16                         | 180/16                     | 1.5nf                 |
| 12                 | 330/25                           | 330/25                    | 1nf                   | 100/16                         | 180/16                     | 1nf                   |
| 15                 | 220/25                           | 220/35                    | 680pf                 | 68/20                          | 120/20                     | 680pf                 |
| 24                 | 220/35                           | 150/35                    | 560pf                 | 33/25                          | 33/25                      | 220pf                 |
| 28                 | 100/50                           | 100/50                    | 390pf                 | 10/35                          | 15/50                      | 220pf                 |

## Schottky Diode Selection Table

| Current | Surface Mount | Through Hole | VR (The same as system maximum input voltage) |        |        |        |        |
|---------|---------------|--------------|---|--------|--------|--------|--------|
|         |               |              | 20V   | 30V    | 40V    | 50V    | 60V    |
| 1A      |               |              | 1N5817  | 1N5818 | 1N5819 |        |        |
|         |               |              | 1N5820  | 1N5821 | 1N5822 |        |        |
| 3A      |               |              | MBR320  | MBR330 | MBR340 | MBR350 | MBR360 |
|         |               |              | SK32  | SK33   | SK34   | SK35   | SK36   |
|         |               |              |   | 30WQ03 | 30WQ04 | 30WQ05 |        |
|         |               |              |   | 31DQ03 | 31DQ04 | 31DQ05 |        |
|         |               |              | SR302   | SR303  | SR304  | SR305  | SR306  |
|         |               |              |   |        |        |        |        |
| 5A      |               |              | 1N5823  | 1N5824 | 1N5825 |        |        |
|         |               |              | SR502   | SR503  | SR504  | SR505  | SR506  |
|         |               |              | SB520   | SB530  | SB540  | SB550  | SB560  |
|         |               |              |   | 50WQ03 | 50WQ04 | 50WQ05 |        |

## Typical System Application for 5V Version

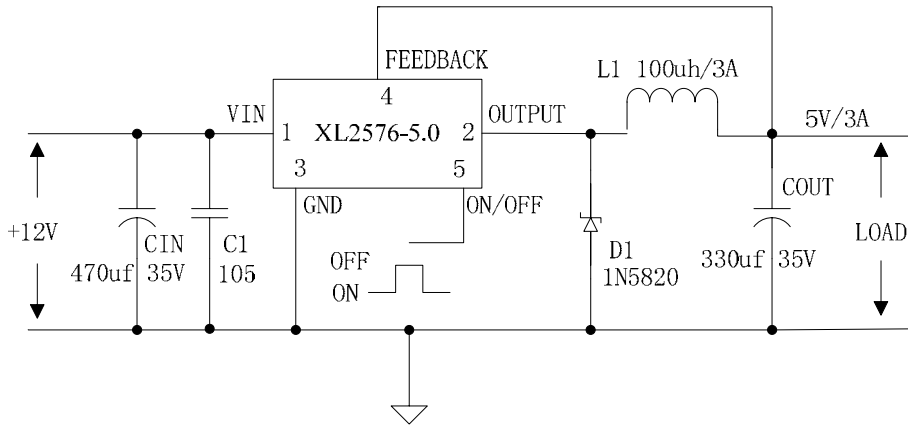


Figure6. XL2576-5.0 System Parameters Test Circuit

## Typical System Application for 12V Version

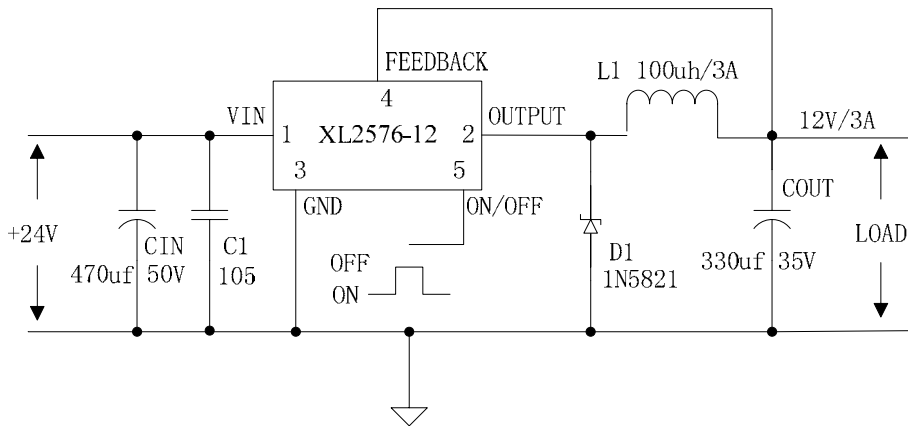


Figure7. XL2576-12 System Parameters Test Circuit

**Typical System Application for ADJ Version**

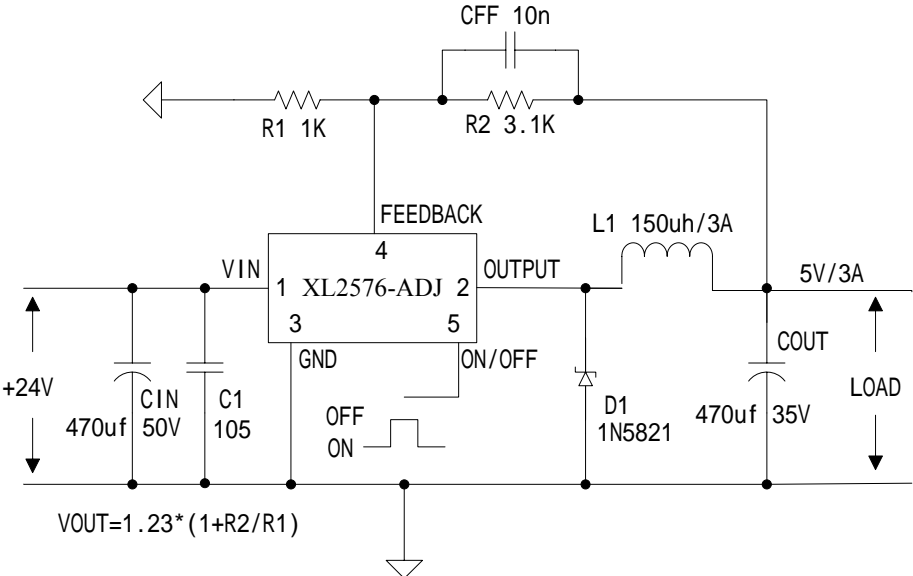
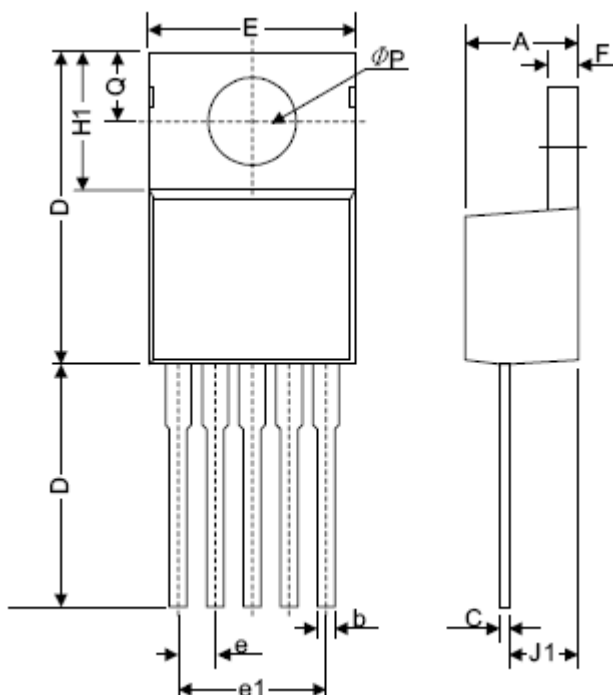


Figure8. XL2576-ADJ System Parameters Test Circuit

## Package Information

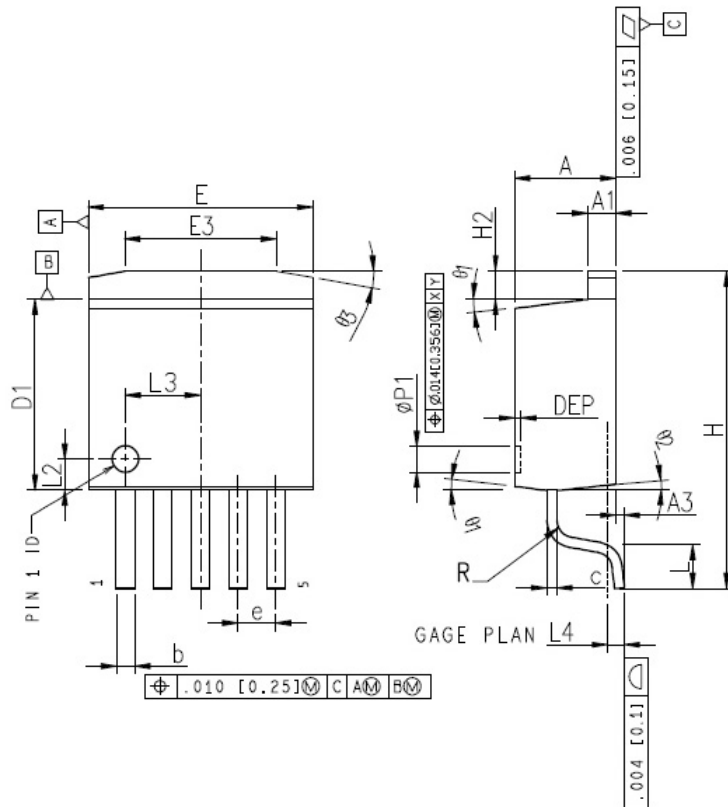
### (1) TO220-5L



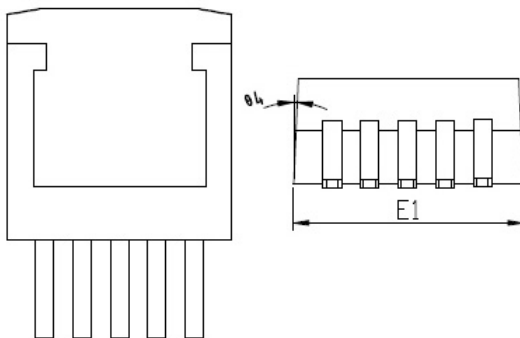
| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min.                      | Max.  | Min.                 | Max.  |
| A        | 4.06                      | 4.83  | 0.160                | 0.190 |
| b        | 0.76                      | 1.02  | 0.030                | 0.040 |
| C        | 0.36                      | 0.64  | 0.014                | 0.025 |
| D        | 14.22                     | 15.49 | 0.560                | 0.610 |
| E        | 9.78                      | 10.54 | 0.385                | 0.415 |
| e        | 1.57                      | 1.85  | 0.062                | 0.073 |
| e(1)     | 6.68                      | 6.93  | 0.263                | 0.273 |
| F        | 1.14                      | 1.40  | 0.045                | 0.055 |
| H(1)     | 5.46                      | 6.86  | 0.215                | 0.270 |
| J(1)     | 2.29                      | 3.18  | 0.090                | 0.125 |
| L        | 13.21                     | 14.73 | 0.520                | 0.580 |
| $\phi P$ | 3.68                      | 3.94  | 0.145                | 0.155 |
| Q        | 2.54                      | 2.92  | 0.100                | 0.115 |

## Package Information

### (2) TO263-5L



| COMMON DIMENSIONS |         |       |       |          |       |       |
|-------------------|---------|-------|-------|----------|-------|-------|
| SYMBOL            | MM      |       |       | INCH     |       |       |
|                   | MIN     | NDM   | MAX   | MIN      | NDM   | MAX   |
| A                 | 4.45    | 4.57  | 4.70  | 0.175    | 0.180 | 0.185 |
| A1                | 1.22    | 1.27  | 1.32  | 0.048    | 0.050 | 0.052 |
| A3                | 0       | -     | 0.15  | 0.000    | -     | 0.006 |
| b                 | 0.71    | -     | 0.97  | 0.028    | -     | 0.038 |
| c                 | 0.38    | -     | 0.76  | 0.015    | -     | 0.030 |
| D1                | 8.38    | 8.70  | 8.89  | 0.330    | 0.343 | 0.350 |
| E                 | 9.91    | 10.16 | 10.39 | 0.390    | 0.400 | 0.410 |
| E1                | 10.03   | 10.16 | 10.54 | 0.395    | 0.400 | 0.415 |
| E3                | 6.61    | 6.86  | 7.11  | 0.260    | 0.270 | 0.280 |
| e                 | 1.70BSC |       |       | 0.067BSC |       |       |
| H                 | -       | -     | 14.35 | -        | -     | 0.565 |
| H2                | -       | -     | 1.27  | -        | -     | 0.050 |
| L                 | -       | 1.98  | -     | -        | 0.078 | -     |
| L2                | 1.47REF |       |       | 0.058REF |       |       |
| L3                | 3.40REF |       |       | 0.134REF |       |       |
| L4                | -       | 0.76  | -     | -        | 0.030 | -     |
| φp1               | 1.07    | 1.20  | 1.32  | 0.042    | 0.047 | 0.052 |
| R                 | -       | -     | 0.76  | -        | -     | 0.030 |
| θ1                | -       | 7°    | -     | -        | 7°    | -     |
| θ2                | -       | 3°    | -     | -        | 3°    | -     |
| θ3                | 7°      | 10°   | 13°   | 7°       | 10°   | 13°   |
| θ4                | -       | 3°    | -     | -        | 3°    | -     |
| DEP               | 0.10    | 0.18  | 0.25  | 0.004    | 0.007 | 0.010 |



NOTES:  
 1. ALL DIMENSIONS REFER TO JEDEC STANDARD TO-263, DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.