

## 3.0A, Buck Voltage Switching Regulator

### Features

- 3.3V, 5V, 12V and Adjustable Output Versions
- High Efficiency
- Wide Input Voltage Range, 6V up to 40V for LM2576 Series
- Guaranteed 3A Output Current
- Requires only 4 External Components
- 52 kHz Fixed Frequency Internal Oscillator
- TTL Shutdown Capability, Low Power Standby Mode
- Uses Readily Available Standard Inductors
- Thermal Shutdown and Current Limit Protection
- Adjustable Version Output Voltage Range, 1.23V to 37V  $\pm 4\%$  Max Over Line and Load Conditions

### Applications

- Simple High-Efficiency Step-Down (Buck) Regulator
- Efficient Pre-Regulator for Linear Regulators
- On-Card Switching Regulators
- Positive to Negative Converter (Buck-Boost)

### General Description

The LM2576 series of regulators are monolithic integrated circuit that provides all the active functions for a step-down (buck) switching regulator, capable of driving 3A load with excellent line and load regulation. The LM2576 available in fixed output voltages of 3.3V, 5V, 12V and an adjustable output version.

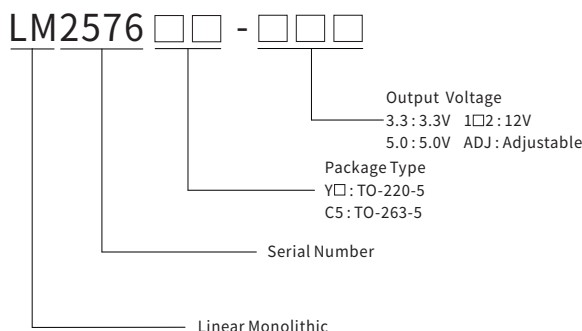
Requiring a minimum number of external components, these regulators are simple to use and include internal frequency compensation and a fixed-frequency oscillator.

The LM2576 series offers a high-efficiency replacement for popular three-terminal linear regulators. It substantially reduces the size of the heat sink, and in some cases no heat sink is required. A standard series of inductors optimized for use with the LM2576 are available from several different manufacturers. This feature greatly simplifies the design of switch-mode power supplies.

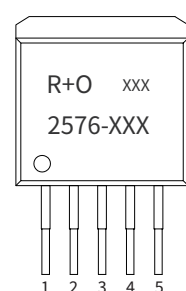
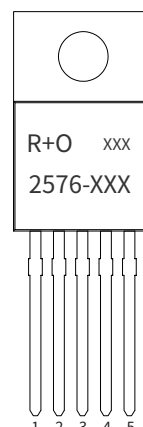
Other features include a guaranteed  $\pm 4\%$  tolerance on output voltage within specified input voltages and output load conditions, and  $\pm 10\%$  on the oscillator frequency. External shutdown is included, featuring 50 $\mu$ A (typical) standby current. The output switch includes cycle-by-cycle current limiting, as well as thermal shutdown for full protection under fault conditions.

The LM2576 series is available in TO220-5 and TO263-5 package.

### Part Numbering



### Pin Configuration & Marking

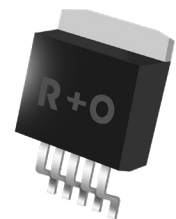


**Supply Voltage**  
+6.0V ~ +40V  
**Output Current**  
3.0A (Max.)

TO-220-5



TO-263-5



● Pin Description

| Pin Number | Pin Name              | Description                                                                                                                                                                                                                                           |
|------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1          | $V_{IN}$              | This pin is the positive input supply for the LM2576 series step - down switching regulator. In order to minimize voltage transients and to supply the switching currents needed by the regulator, a suitable input bypass capacitor must be present. |
| 2          | Output                | Internal switch, the voltage at this pin switches between $(+V_{IN} - V_{SAT})$ and approximately $-0.5V$ . To minimize coupling to sensitive circuitry, the PCB copper area connected to this pin should be kept to a minimum.                       |
| 3          | GND                   | Circuit Ground.                                                                                                                                                                                                                                       |
| 4          | Feedback              | Senses the regulated output voltage to complete the feedback loop.                                                                                                                                                                                    |
| 5          | $\overline{ON} / OFF$ | Allows the switching regulator circuit to be shut down using logic level signals.                                                                                                                                                                     |

● Ordering Information

| Order Number | Package  | Package Code | Unit Weight(g) | Tube(pcs) | Box(pcs) | Carton(pcs) | Delivery Mode | MSL |
|--------------|----------|--------------|----------------|-----------|----------|-------------|---------------|-----|
| LM2576Y-3.3  | TO-220-5 | -            | 1.986          | 50        | 1000     | 5000        | Tube          | 2   |
| LM2576Y-5.0  | TO-220-5 | -            | 1.986          | 50        | 1000     | 5000        | Tube          | 2   |
| LM2576Y-12   | TO-220-5 | -            | 1.986          | 50        | 1000     | 5000        | Tube          | 2   |
| LM2576Y-ADJ  | TO-220-5 | -            | 1.986          | 50        | 1000     | 5000        | Tube          | 2   |

| Order Number | Package  | Package Code | Unit Weight(g) | Tube/Reel(pcs) | Box(pcs) | Carton(pcs) | Delivery Mode | MSL |
|--------------|----------|--------------|----------------|----------------|----------|-------------|---------------|-----|
| LM2576C5-3.3 | TO-263-5 | R3           | 1.401          | 50/800         | 800      | 8000        | 13" reel      | 3   |
| LM2576C5-5.0 | TO-263-5 | R3           | 1.401          | 50/800         | 800      | 8000        | 13" reel      | 3   |
| LM2576C5-12  | TO-263-5 | R3           | 1.401          | 50/800         | 800      | 8000        | 13" reel      | 3   |
| LM2576C5-ADJ | TO-263-5 | R3           | 1.401          | 50/800         | 800      | 8000        | 13" reel      | 3   |

● Functional Block Diagram

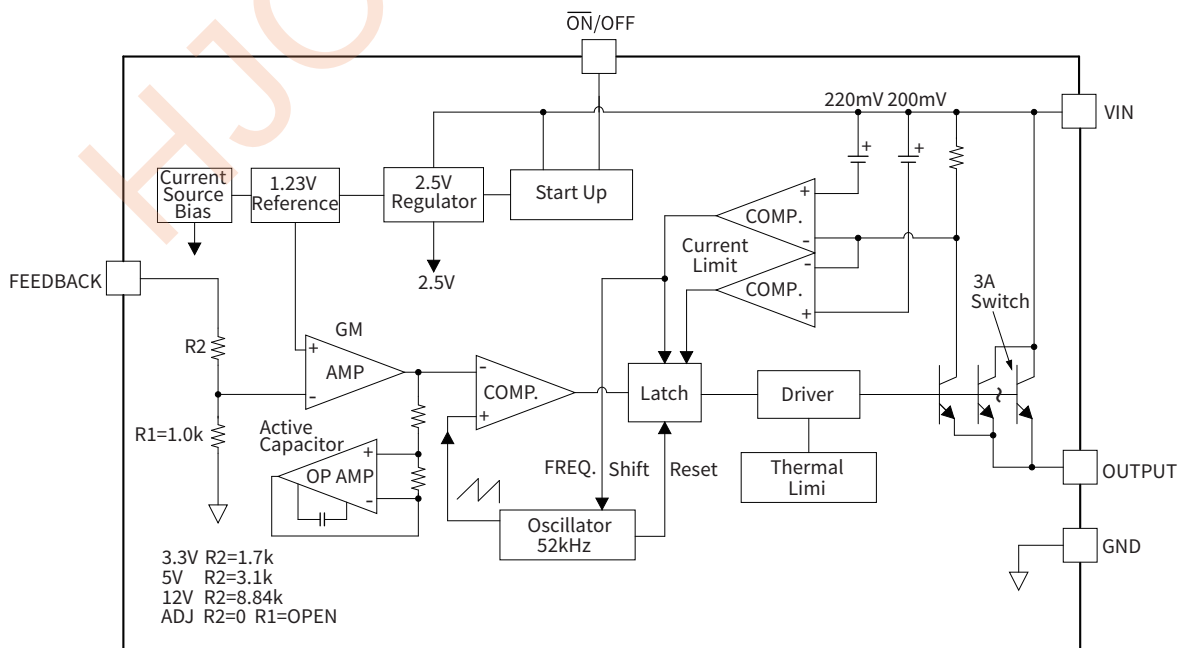


Figure 1.Internal Block Diagram

### ● Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ Unless otherwise specified.)

| Parameter                                      | Symbol                       | Value              | Unit             |
|------------------------------------------------|------------------------------|--------------------|------------------|
| Maximum Supply Voltage                         | $V_{IN}$                     | 45                 | V                |
| $\overline{\text{ON}}$ / OFF Pin Input Voltage | $\overline{\text{ON}}$ / OFF | -0.3V to $+V_{IN}$ | V                |
| Output Voltage to Ground (steady state)        | $V_{OUT}$                    | -1                 | V                |
| Power Dissipation                              | $P_{DMAX}$                   | Internally Limited | W                |
| Storage Temperature Range                      | $T_{stg}$                    | -65 to +150        | $^\circ\text{C}$ |
| Maximum Junction Temperature                   | $T_J$                        | 150                | $^\circ\text{C}$ |
| ESD Susceptibility (Human Body Model)          | ESD                          | 2                  | KV               |
| Lead Temperature (Soldering, 10 Seconds)       | $T_L$                        | 260                | $^\circ\text{C}$ |

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

### ● Recommended Operating Conditions

| Parameter Name                       | Symbol    | Value       | Unit             |
|--------------------------------------|-----------|-------------|------------------|
| Supply Voltage                       | $V_{IN}$  | 6 to 40     | V                |
| Operating Junction Temperature Range | $T_{opr}$ | -40 to +125 | $^\circ\text{C}$ |

### ● Electrical Characteristics ( $T_A = 25^\circ\text{C}$ , unless otherwise specified.)

| Parameter Name                                     | Symbol     | Test Conditions                           | Min. | Typ. | Max. | Units         |
|----------------------------------------------------|------------|-------------------------------------------|------|------|------|---------------|
| Device Parameters                                  |            |                                           |      |      |      |               |
| Feedback Bias Current                              | $I_b$      | Adjustable version only, $V_{OUT} = 5V$   | --   | 50   | 100  | nA            |
| Oscillator Frequency                               | $f_o$      | $T_A = 25^\circ\text{C}$                  | 47   | 52   | 58   | kHz           |
| $V_{SAT}$ Saturation Voltage <sup>(Note 1)</sup>   | $V_{SAT}$  | $I_{OUT} = 3A$                            | --   | 1.4  | 1.8  | V             |
| Max. Duty Cycle(ON)                                | DC         | $V_{FB} = 0V$                             | 93   | 98   | --   | %             |
| Current Limit                                      | $I_{CL}$   | See <sup>(Note 2)</sup>                   | 4.2  | 5.8  | 6.9  | A             |
| Output Leakage Current <sup>(Note 1)</sup>         | $I_L$      | Output=0V                                 | --   | --   | 2    | mA            |
|                                                    |            | Output=-1V                                | --   | 7.5  | 30   | mA            |
| Quiescent Current                                  | $I_Q$      | See <sup>(Note 3)</sup>                   | --   | 5    | 10   | mA            |
| Standby Quiescent Current                          | $I_{STBY}$ | $\overline{\text{ON}}$ / OFF pin=5V(OFF)  | --   | 50   | 200  | $\mu\text{A}$ |
| $\overline{\text{ON}}$ / OFF Control               |            |                                           |      |      |      |               |
| $\overline{\text{ON}}$ / OFF Pin Logic Input Level | $V_{IH}$   | $V_{OUT} = 0V$                            | 2.0  | --   | --   | V             |
|                                                    | $V_{IL}$   | $V_{OUT} = \text{Nominal Output Voltage}$ | --   | --   | 0.8  | V             |
| $\overline{\text{ON}}$ / OFF Pin Input Current     | $I_{IH}$   | $\overline{\text{ON}}$ / OFF pin=5V(OFF)  | --   | 12   | 30   | $\mu\text{A}$ |
|                                                    | $I_{IL}$   | $\overline{\text{ON}}$ / OFF pin=0V(ON)   | --   | 0    | 10   | $\mu\text{A}$ |

## Electrical Characteristics(Cont.)

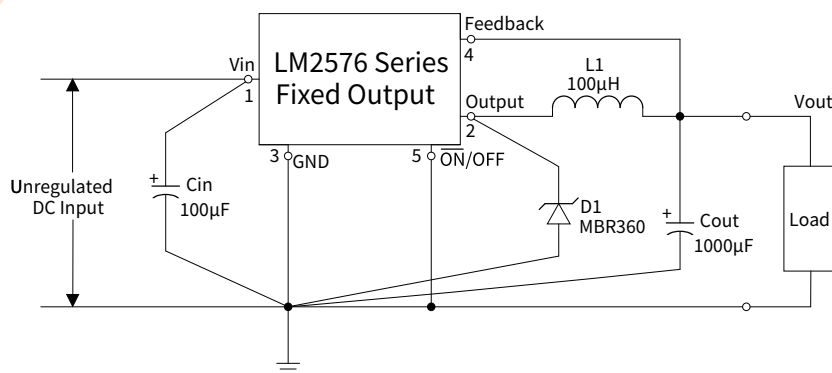
| Parameter Name | Symbol           | Test Conditions                                                                    | Min.  | Typ.   | Max.  | Units |
|----------------|------------------|------------------------------------------------------------------------------------|-------|--------|-------|-------|
| LM2576-3.3     |                  |                                                                                    |       |        |       |       |
| Output Voltage | V <sub>OUT</sub> | V <sub>IN</sub> = 12V, I <sub>O</sub> = 500mA                                      | 3.234 | 3.3    | 3.366 | V     |
|                |                  | 6V ≤ V <sub>IN</sub> ≤ 40V<br>0.5A ≤ I <sub>LOAD</sub> ≤ 3A                        | 3.168 | 3.3    | 3.450 | V     |
| Efficiency     | η                | V <sub>IN</sub> = 12V, I <sub>LOAD</sub> = 3A                                      | 75    |        |       | %     |
| LM2576-5.0     |                  |                                                                                    |       |        |       |       |
| Output Voltage | V <sub>OUT</sub> | V <sub>IN</sub> = 12V, I <sub>O</sub> = 500mA                                      | 4.90  | 5.00   | 5.10  | V     |
|                |                  | 8V ≤ V <sub>IN</sub> ≤ 40V<br>0.5A ≤ I <sub>LOAD</sub> ≤ 3A                        | 4.80  | 5.00   | 5.20  | V     |
| Efficiency     | η                | V <sub>IN</sub> = 12V, I <sub>LOAD</sub> = 3A                                      | 77    |        |       | %     |
| LM2576-12      |                  |                                                                                    |       |        |       |       |
| Output Voltage | V <sub>OUT</sub> | V <sub>IN</sub> = 25V, I <sub>O</sub> = 500mA                                      | 11.76 | 12.000 | 12.24 | V     |
|                |                  | 15V ≤ V <sub>IN</sub> ≤ 40V<br>0.5A ≤ I <sub>LOAD</sub> ≤ 3A                       | 11.52 | 12.00  | 12.48 | V     |
| Efficiency     | η                | V <sub>IN</sub> = 25V, I <sub>LOAD</sub> = 3A                                      | 88    |        |       | %     |
| LM2576-ADJ     |                  |                                                                                    |       |        |       |       |
| Output Voltage | V <sub>OUT</sub> | V <sub>IN</sub> = 12V, I <sub>O</sub> = 500mA, V <sub>OUT</sub> = 5V               | 1.217 | 1.230  | 1.243 | V     |
|                |                  | 8V ≤ V <sub>IN</sub> ≤ 40V, V <sub>OUT</sub> = 5V<br>0.5A ≤ I <sub>LOAD</sub> ≤ 3A | 1.193 | 1.230  | 1.267 | V     |
| Efficiency     | η                | V <sub>IN</sub> = 12V, I <sub>LOAD</sub> = 3A, V <sub>OUT</sub> = 5V               | 77    |        |       | %     |

**Note 1 :** Output pin sourcing current. No diode, inductor or capacitor connected to output.

**Note 2 :** The oscillator frequency reduces to approximately 11 kHz in the event of an output short or an overload which causes the regulated output voltage to drop approximately 40% from the nominal output voltage. This self protection feature lowers the average power dissipation of the IC by lowering the minimum duty cycle from 5% down to approximately 2%.

**Note 3 :** Feedback pin removed from output and connected to 12 V for the 3.3-V, 5-V, and the adjustable versions, and 15 V for the 12-V version, to force the output transistor switch OFF.

## Test Circuit



Cin - 100µF, 75V, Aluminium Electrolytic    D1 - Schottky, MBR360    R1 - 2.0k, 0.1%  
Cout - 1000µF, 25V, Aluminium Electrolytic    L1 - 100µH, Pulse Eng. PE-92108    R2 - 6.12k, 0.1%

Figure 2. Typical Test Circuit - Fixed Output Voltage Version

## ● Test Circuit(Cont.)

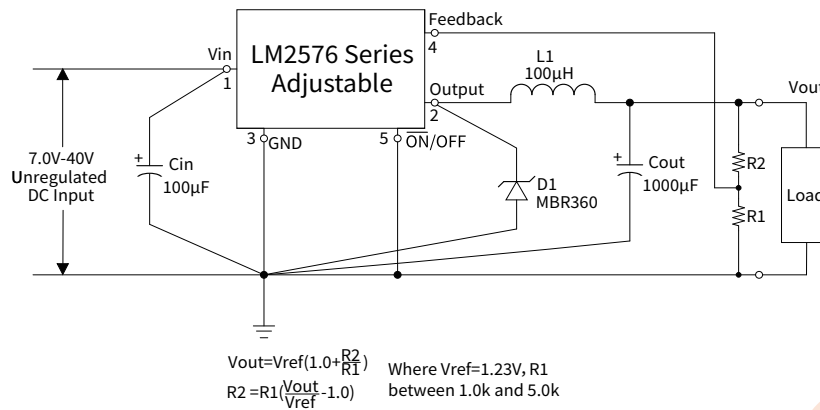
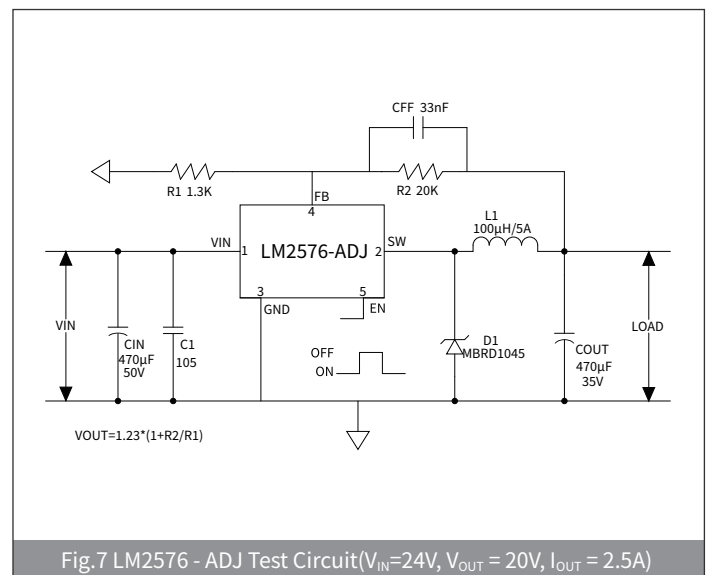
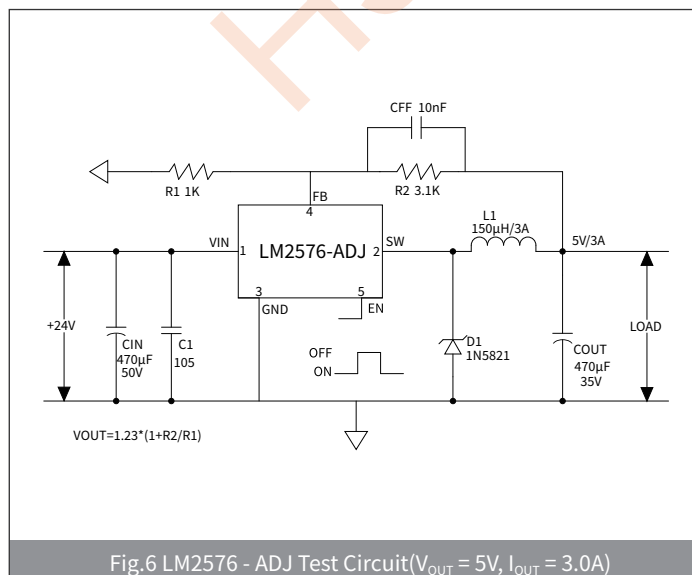
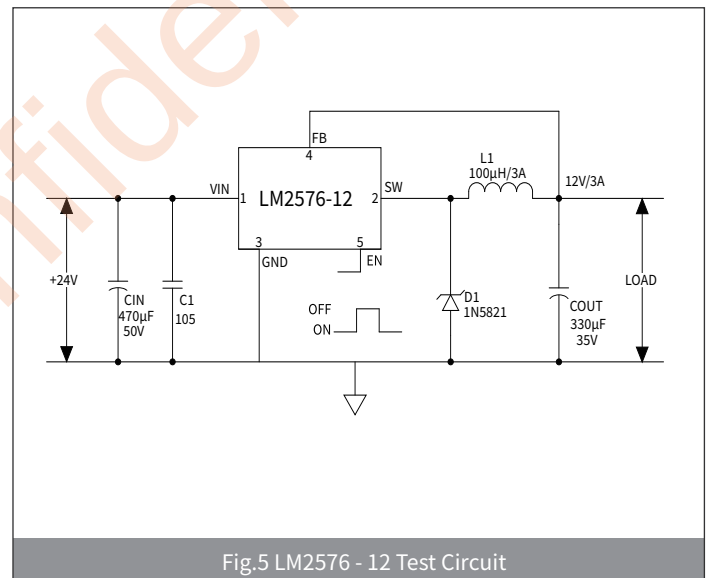
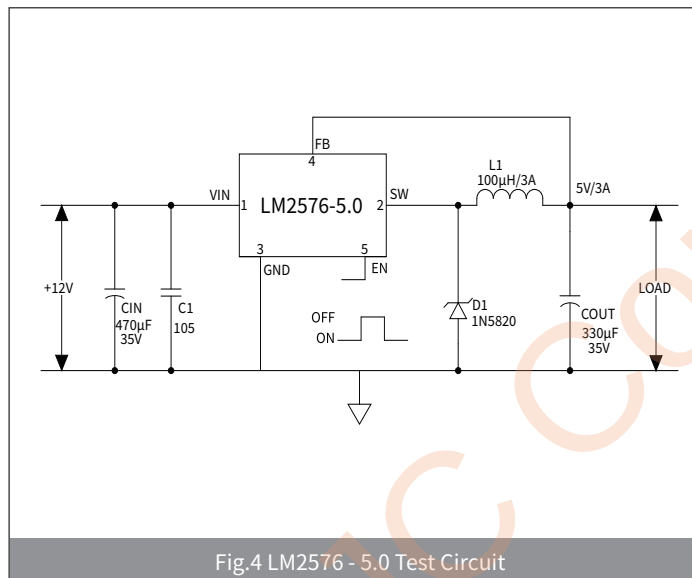


Figure 3. Typical Test Circuit - Adjustable Output Voltage Version

## ● Typical Applications



## ● Application Information

### Input Capacitor ( $C_{IN}$ )

A low ESR aluminum or tantalum bypass capacitor is needed between the input pin and ground pin. It must be located near the regulator using short leads. This capacitor prevents large voltage transients from appearing at the input, and provides the instantaneous current required each time the switch turns on.

The important parameters for the Input capacitor are the voltage rating and the RMS current rating. Because of the relatively high RMS currents flowing in a buck regulator's input capacitor, this capacitor should be chosen for its RMS current rating rather than its capacitance or voltage ratings, although the capacitance value and voltage rating are directly related to the RMS current rating.

The RMS current rating of a capacitor could be viewed as a capacitor's power rating. The RMS current flowing through the capacitor's internal ESR produces power which causes the internal temperature of the capacitor to rise. The RMS current rating of a capacitor is determined by the amount of current required to raise the internal temperature approximately 10 °C above an ambient temperature of 105°C. The ability of the capacitor to dissipate this heat to the surrounding air will determine the amount of current the capacitor can safely sustain. Capacitors that are physically large and have a large surface area will typically have higher RMS current ratings.

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Selecting an input capacitor requires consulting the manufacturer's data sheet for maximum allowable RMS ripple current. For a maximum ambient temperature of 40°C, a general guideline would be to select a capacitor with a ripple current rating of approximately 50% of the DC load current. For ambient temperatures up to 70°C, a current rating of 75% of the DC load current would be a good choice for a conservative design. The capacitor voltage rating must be at least 1.25 times greater than the maximum input voltage, and often a much higher voltage capacitor is needed to satisfy the RMS current requirements.

Because of their small size and excellent performance, surface mount solid tantalum capacitors are often used for input bypassing, but several precautions must be observed. A small percentage of solid tantalum capacitors can short if the inrush current rating is exceeded. This can happen at turn on when the input voltage is suddenly applied, and of course, higher input voltages produce higher inrush currents. Several capacitor manufacturers do a 100% surge current testing on their products to minimize this potential problem. If high turn on currents are expected, it may be necessary to limit this current by adding either some resistance or inductance before the tantalum capacitor, or select a higher voltage capacitor. As with aluminum electrolytic capacitors, the RMS ripple current rating must be sized to the load current.

With most electrolytic capacitors, the capacitance value decreases and the ESR increases with lower temperatures and age. Paralleling a ceramic or solid tantalum capacitor will increase the regulator stability at cold temperatures. For maximum capacitor operating lifetime, the capacitor's RMS ripple current rating should be greater than  $1.2 \times (t_{on} / T) \times I_{LOAD}$ , Where  $(t_{on} / T) = (V_{on} / V_{IN})$  for a buck regulator and  $(t_{on} / T) = (|V_{OUT}| / |V_{OUT}| + V_{IN})$  for a buck-boost regulator.

## Inductor Selection (L1)

All switching regulators have two basic modes of operation: continuous and discontinuous. The difference between the two types relates to the inductor current, whether it is flowing continuously, or if it drops to zero for a period of time in the normal switching cycle. Each mode has distinctively different operating characteristics, which can affect the regulator performance and requirements. Most switcher designs will operate in the discontinuous mode when the load current is low.

The LM2576 series can be used for both continuous and discontinuous modes of operation.

When using inductor values shown in the inductor selection guide, the peak-to-peak inductor ripple current will be approximately 20% to 30% of the maximum DC current. With relatively heavy load currents, the circuit operates in the continuous mode (inductor current always flowing), but under light load conditions, the circuit will be forced to the discontinuous mode (inductor current falls to zero for a period of time). This discontinuous mode of operation is perfectly acceptable. For light loads (less than approximately 300mA) it may be desirable to operate the regulator in the discontinuous mode, primarily because of the lower inductor values required for the discontinuous mode. The selection guide chooses inductor values suitable for continuous mode operation, but if the inductor value chosen is prohibitively high, the designer should investigate the possibility of discontinuous operation.

Inductors are available in different styles such as pot core, toroid, E-frame, bobbin core, etc., as well as different core materials, such as ferrites and powdered iron. The least expensive, the bobbin core type, consists of wire wrapped on a ferrite rod core. This type of construction makes for an inexpensive inductor, but since the magnetic flux is not completely contained within the core, it generates more electromagnetic interference (EMI). This EMI can cause problems in sensitive circuits, or can give incorrect scope readings because of induced voltages in the scope probe. The inductors listed in the selection chart include ferrite pot core construction for AIE, powdered iron toroid for Pulse Engineering, and ferrite bobbin core for Renco.

An inductor should not be operated beyond its maximum rated current because it may saturate. When an inductor begins to saturate, the inductance decreases rapidly and the inductor begins to look mainly resistive (the DC resistance of the winding). This will cause the switch current to rise very rapidly. Different inductor types have different saturation characteristics, and this should be kept in mind when selecting an inductor.

The inductor manufacturer's data sheets include current and energy limits to avoid inductor saturation.

## Inductor Ripple Current

When the switcher is operating in the continuous mode, the inductor current waveform ranges from a triangular to a sawtooth type of waveform (depending on the input voltage). For a given input voltage and output voltage, the peak-to-peak amplitude of this inductor current waveform remains constant. As the load current rises or falls, the entire sawtooth current waveform also rises or falls. The average DC value of this waveform is equal to the DC load current (in the buck regulator configuration). If the load current drops to a low enough level, the bottom of the sawtooth current waveform will reach zero, and the switcher will change to a discontinuous mode of operation. This is a perfectly acceptable mode of operation. Any buck switching regulator (no matter how large the inductor value is) will be forced to run discontinuous if the load current is light enough.

## Catch Diode (D1)

Buck regulators require a diode to provide a return path for the inductor current when the switch is off. This diode should be located close to the LM2576 using short leads and short printed circuit traces. Because of their fast switching speed and low forward voltage drop, Schottky diodes provide the best efficiency, especially in low output voltage switching regulators (less than 5V). Fast-Recovery, High-Efficiency, or Ultra-Fast Recovery diodes are also suitable, but some types with an abrupt turn-off characteristic may cause instability and EMI problems. A fast-recovery diode with soft recovery characteristics is a better choice. Standard 60 Hz diodes (e.g., 1N4001 or 1N5400, etc.) are also not suitable.

## Output Capacitor ( $C_{OUT}$ )

An output capacitor is required to filter the output voltage and is needed for loop stability. The capacitor should be located near the LM2576 using short PCB traces. Standard aluminum electrolytics are usually adequate, but low ESR types are recommended for low output ripple voltage and good stability. The ESR of a capacitor depends on many factors, some which are: the value, the voltage rating, physical size and the type of construction. In general, low value or low voltage (less than 12V) electrolytic capacitors usually have higher ESR numbers.

The amount of output ripple voltage is primarily a function of the ESR (Equivalent Series Resistance) of the output capacitor and the amplitude of the inductor ripple current ( $\Delta I_{IND}$ ). See the section on inductor ripple current in Application Hints. The lower capacitor values (220  $\mu$ F – 1000  $\mu$ F) will allow typically 50 mV to 150 mV of output ripple voltage, while larger-value capacitors will reduce the ripple to approximately 20 mV to 50mV. Output Ripple Voltage = ( $\Delta I_{IND}$ ) (ESR of  $C_{OUT}$ ).

To further reduce the output ripple voltage, several standard electrolytic capacitors may be paralleled, or a higher-grade capacitor may be used. Such capacitors are often called "high-frequency" "low-inductance" or "low-ESR". These will reduce the output ripple to 10 mV or 20 mV. However, when operating in the continuous mode, reducing the ESR below 0.03 $\Omega$  can cause instability in the regulator. Tantalum capacitors can have a very low ESR, and should be carefully evaluated if it is the only output capacitor. Because of their good low temperature characteristics, a tantalum can be used in parallel with aluminum electrolytics, with the tantalum making up 10% or 20% of the total capacitance. The capacitor's ripple current rating at 52 kHz should be at least 50% higher than the peak-to-peak inductor ripple current.

## Output Voltage Ripple and Transients

The output voltage of a switching power supply will contain a sawtooth ripple voltage at the switcher frequency, typically about 1% of the output voltage, and may also contain short voltage spikes at the peaks of the sawtooth waveform. The output ripple voltage is due mainly to the inductor sawtooth ripple current multiplied by the ESR of the output capacitor. The voltage spikes are present because of the fast switching action of the output switch, and the parasitic inductance of the output filter capacitor. To minimize these voltage spikes, special low inductance capacitors can be used, and their lead lengths must be kept short. Wiring inductance, stray capacitance, as well as the scope probe used to evaluate these transients, all contribute to the amplitude of these spikes. An additional small LC filter (20  $\mu$ H & 100  $\mu$ F) can be added to the output to further reduce the amount of output ripple and transients. A 10  $\times$  reduction in output ripple voltage and transients is possible with this filter.

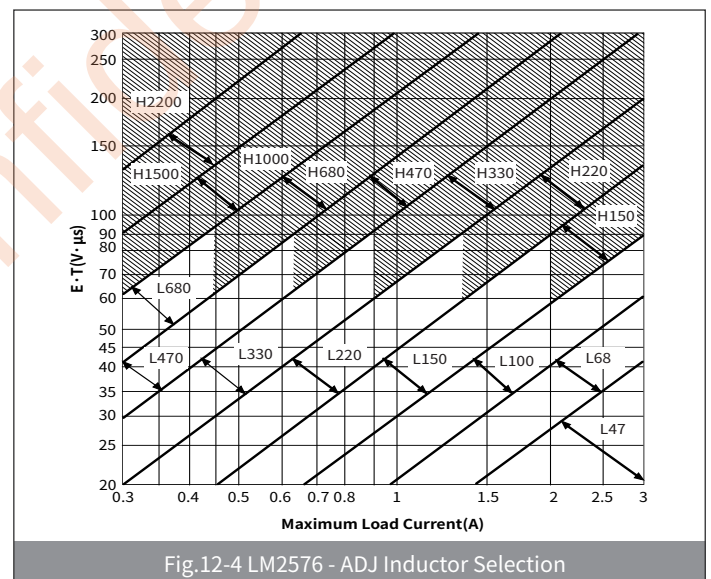
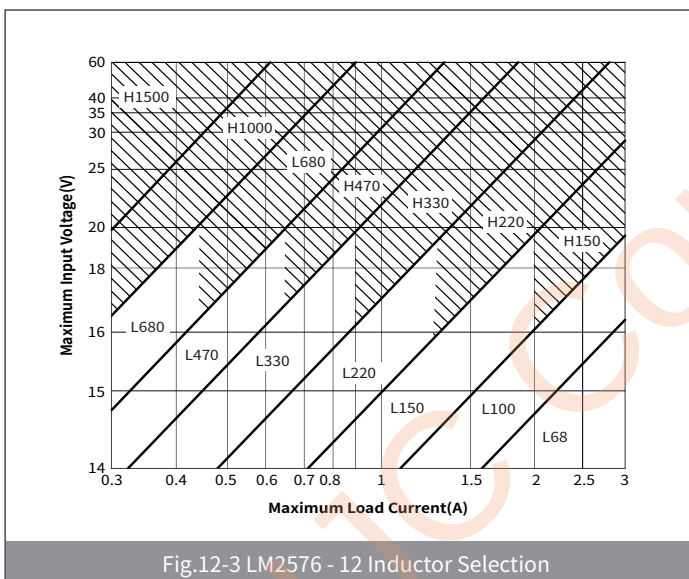
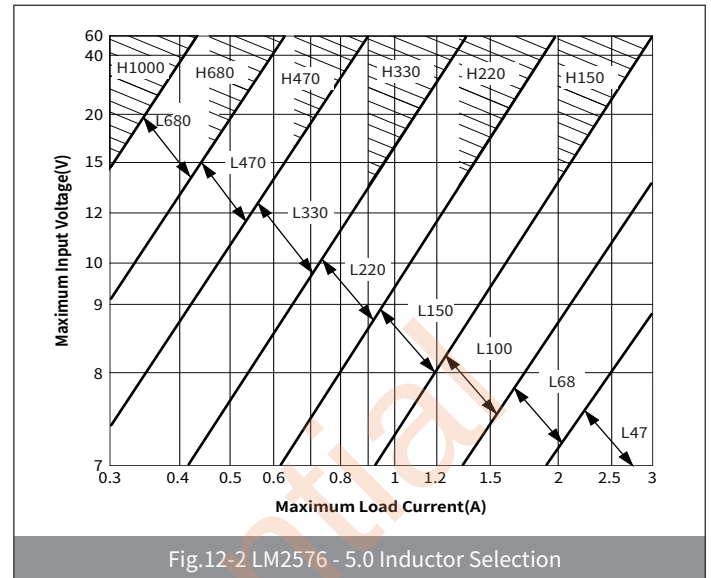
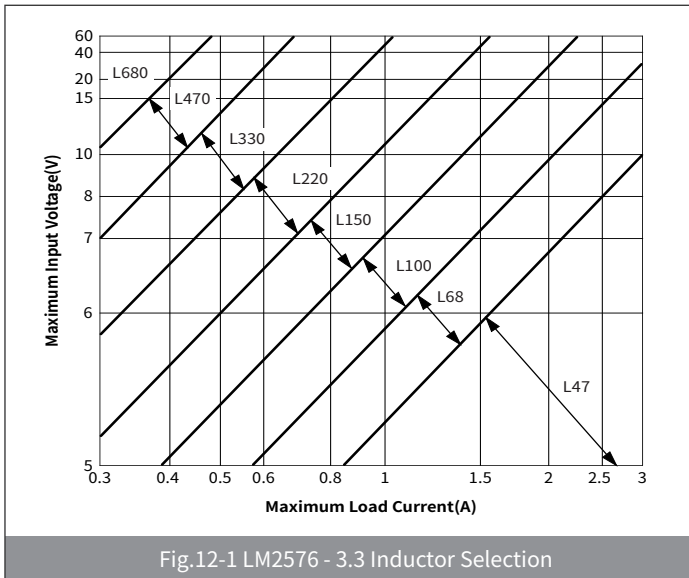
## Feedback Connection

The LM2576 (fixed voltage versions) feedback pin must be wired to the output voltage point of the switching power supply. When using the adjustable version, physically locate both output voltage programming resistors near the LM2576 to avoid picking up unwanted noise. Avoid using resistors greater than 100k $\Omega$  because of the increased chance of noise pickup.

## $\overline{ON}$ / OFF Input

For normal operation, the  $\overline{ON}$  / OFF pin should be grounded or driven with a low-level TTL voltage (typically below 1.6V). To put the regulator into standby mode, drive this pin with a high-level TTL or CMOS signal. The  $\overline{ON}$  / OFF pin can be safely pulled up to +VIN without a resistor in series with it. The  $\overline{ON}$  / OFF pin should not be left open.

## ● Inductor Value Selection Guides ( For Continuous Mode Operation)



# LM2576 Series

Step-Down Voltage Regulator

## ● Inductor Manufacturers Part Numbers

| Inductor Code | Inductor Value | Schott    | Pulse Engineering | Renco  |
|---------------|----------------|-----------|-------------------|--------|
| L47           | 47 $\mu$ H     | 671 26980 | PE-53112          | RL2442 |
| L68           | 68 $\mu$ H     | 671 26990 | PE-92114          | RL2443 |
| L100          | 100 $\mu$ H    | 671 27000 | PE-92108          | RL2444 |
| L150          | 150 $\mu$ H    | 671 27010 | PE-53113          | RL1954 |
| L220          | 220 $\mu$ H    | 671 27020 | PE-52626          | RL1953 |
| L330          | 330 $\mu$ H    | 671 27030 | PE-52627          | RL1952 |
| L470          | 470 $\mu$ H    | 671 27040 | PE-53114          | RL1951 |
| L680          | 680 $\mu$ H    | 671 27050 | PE-52629          | RL1950 |
| H150          | 150 $\mu$ H    | 671 27060 | PE-53115          | RL2445 |
| H220          | 220 $\mu$ H    | 671 27070 | PE-53116          | RL2446 |
| H330          | 330 $\mu$ H    | 671 27080 | PE-53117          | RL2447 |
| H470          | 470 $\mu$ H    | 671 27090 | PE-53118          | RL1961 |
| H680          | 680 $\mu$ H    | 671 27100 | PE-53119          | RL1960 |
| H1000         | 1000 $\mu$ H   | 671 27110 | PE-53120          | RL1959 |
| H1500         | 1500 $\mu$ H   | 671 27120 | PE-53121          | RL1958 |
| H2200         | 2200 $\mu$ H   | 671 27130 | PE-53122          | RL2448 |

## ● Diode Selection Table

| VR  | Schottky                            |                            | Fast Recovery                                                        |                                                                                 |
|-----|-------------------------------------|----------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------|
|     | 3A                                  | 4A-6A                      | 3A                                                                   | 4A-6A                                                                           |
| 20V | 1N5820<br>MBR320P<br>SR302          | 1N5823                     | The following diodes are all<br>rated to 100V<br><br>31DF1<br>HER302 | The following diodes are all<br>rated to 100V<br><br>50WF10<br>MUR410<br>HER602 |
| 30V | 1N5821<br>MBR330<br>31DQ03<br>SR303 | 50WQ03<br>1N5824           |                                                                      |                                                                                 |
| 40V | 1N5822<br>MBR340<br>31DQ04<br>SR304 | MBR340<br>50WQ04<br>1N5825 |                                                                      |                                                                                 |
| 50V | MBR350<br>31DQ05<br>SR305           | 50WQ05                     |                                                                      |                                                                                 |
| 60V | MBR360<br>DQ06<br>SR306             | 50WR06<br>50SQ060          |                                                                      |                                                                                 |

## Grounding

To maintain output voltage stability, the power ground connections must be low-impedance. For the 5-lead TO220 and TO263 style package, both the tab and pin 3 are ground and either connection may be used, as they are both part of the same copper lead frame.

## ● Typical Performance Characteristics

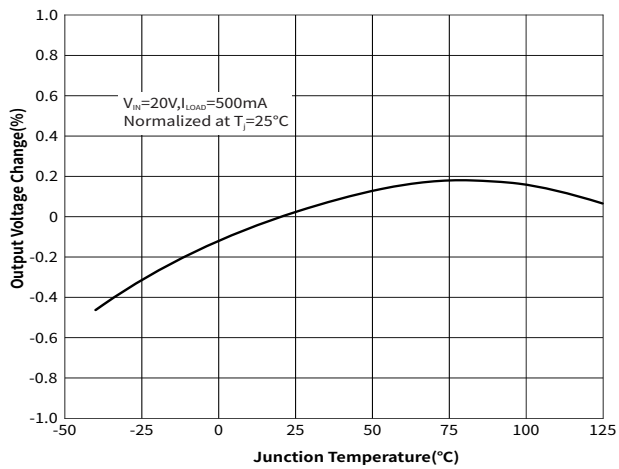


Fig.13 Normalized Output Voltage

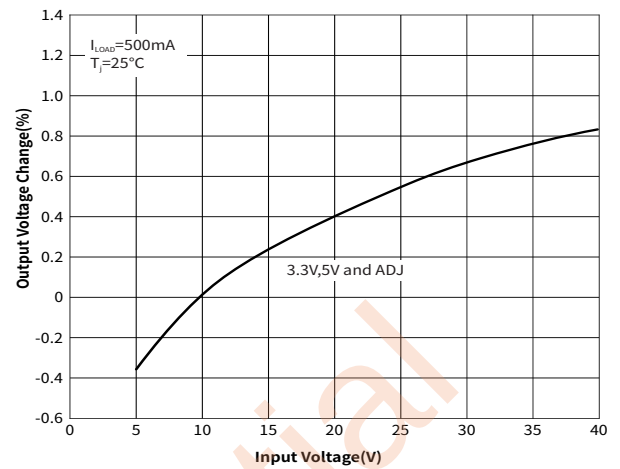


Fig.14 Line Regulation

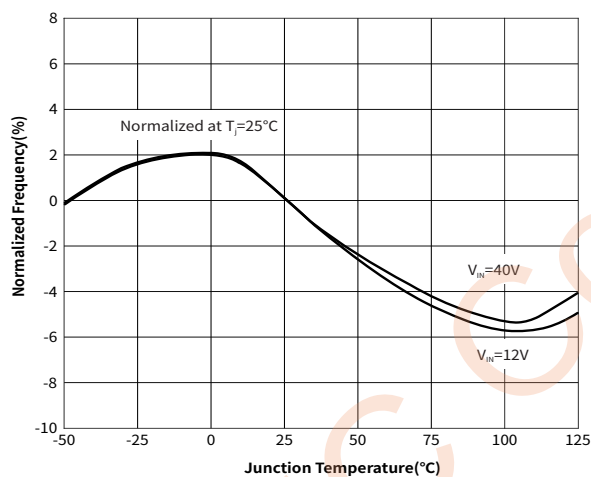


Fig.15 Oscillator Frequency

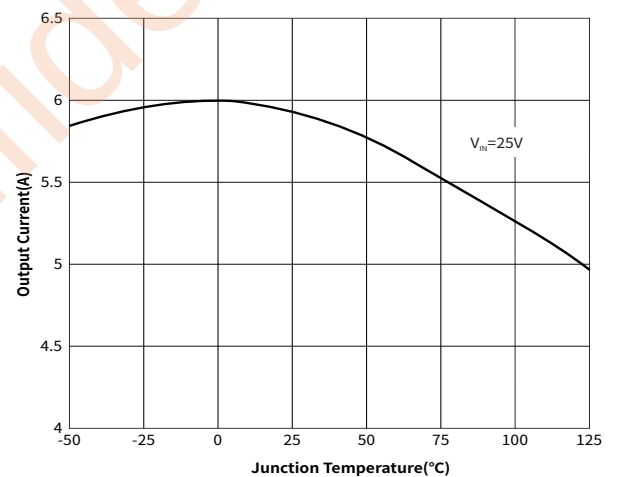


Fig.16 Current Limit

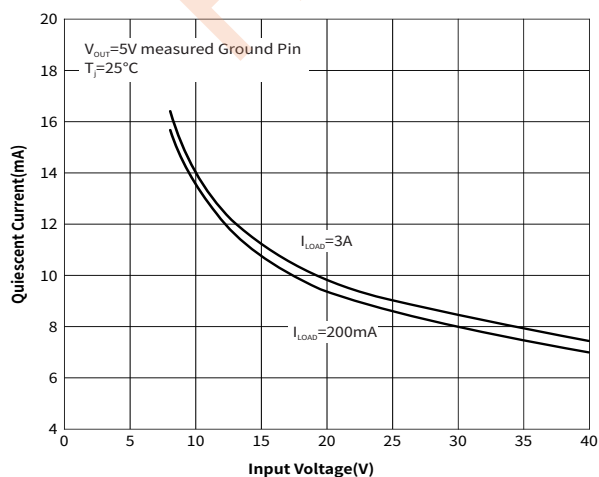


Fig.17 Quiescent Current

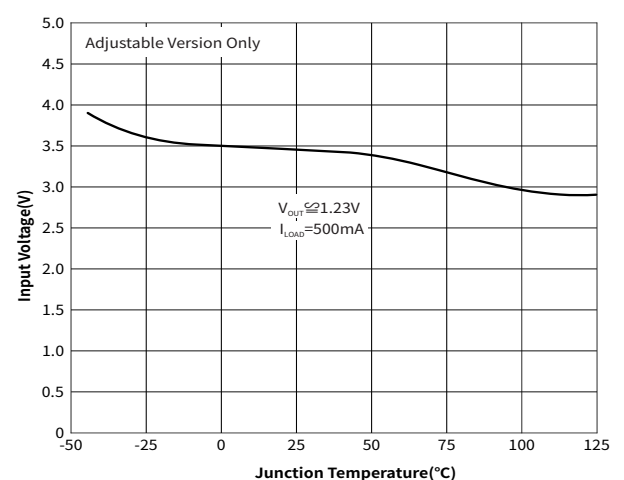
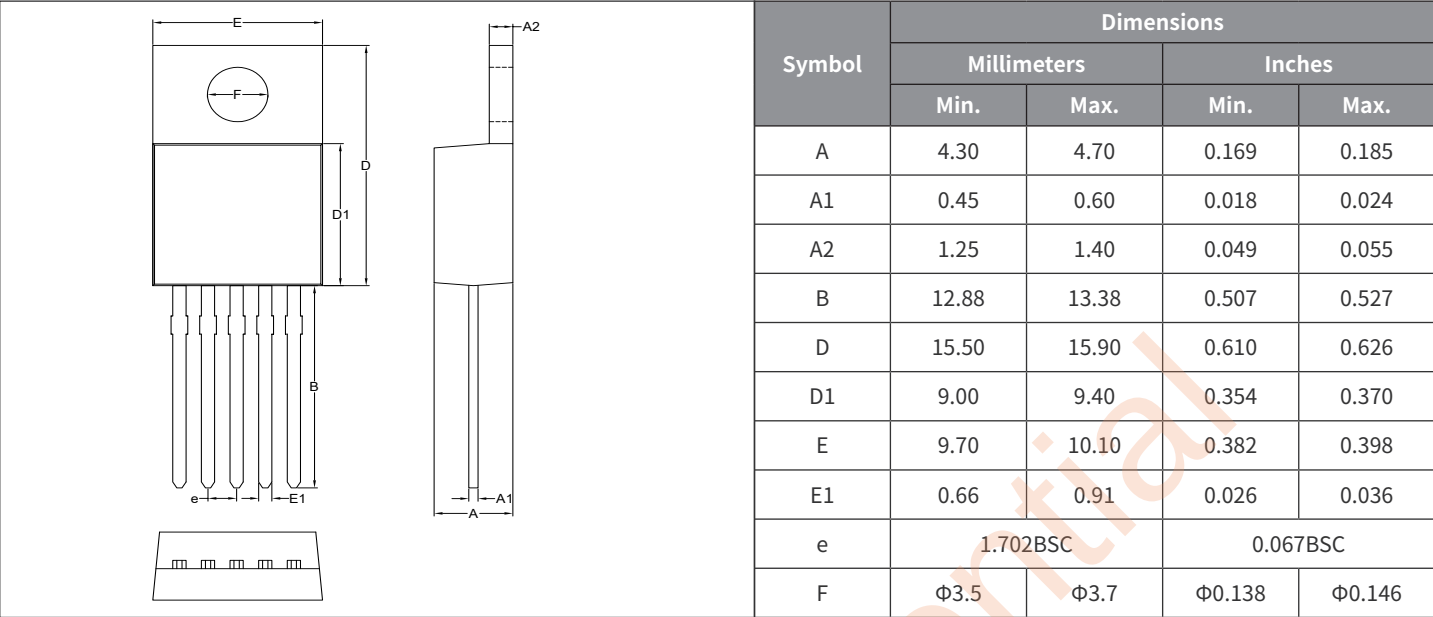


Fig.18 Minimum Operating Voltage

# LM2576 Series

Step-Down Voltage Regulator

● Package Outline Dimensions (TO-220-5)



# LM2576 Series

Step-Down Voltage Regulator

## Package Outline Dimensions (TO-263-5)

| Symbol | Dimensions  |       |          |       |
|--------|-------------|-------|----------|-------|
|        | Millimeters |       | Inches   |       |
|        | Min.        | Max.  | Min.     | Max.  |
| A      | 1.15        | 1.40  | 0.045    | 0.055 |
| A1     | 4.35        | 4.75  | 0.171    | 0.187 |
| A2     | 0.31        | 0.53  | 0.012    | 0.021 |
| B1     | 1.30        | 2.74  | 0.051    | 0.108 |
| C      | 5.08REF     |       | 0.2REF   |       |
| D      | 0.90        | 1.70  | 0.035    | 0.067 |
| D1     | 8.10        | 8.90  | 0.319    | 0.350 |
| D2     | 13.90       | 15.50 | 0.547    | 0.610 |
| E      | 0.66        | 0.97  | 0.026    | 0.038 |
| E1     | 9.80        | 10.40 | 0.386    | 0.409 |
| e      | 1.70BSC     |       | 0.067BSC |       |

## Suggested Pad Layout

| Symbol | Dimensions  |       |        |       |
|--------|-------------|-------|--------|-------|
|        | Millimeters |       | Inches |       |
|        | Min.        | Max.  | Min.   | Max.  |
| X      | -           | 10.90 | -      | 0.429 |
| X1     | -           | 1.05  | -      | 0.041 |
| Y      | -           | 15.70 | -      | 0.618 |
| Y1     | -           | 9.10  | -      | 0.358 |
| Y2     | -           | 2.50  | -      | 0.098 |
| C      | -           | 1.70  | -      | 0.067 |