

### Description

The ACE2596 series of regulators are fixed frequency PWM buck (step-down) DC/DC converter, capable of driving a 3A load with excellent line and load regulation. These regulators include internal frequency compensation and a fixed frequency oscillator so that they are easy to use. A system adopting ACE2596 requires a minimum number of external components to work.

A standard series of inductors, optimized for use with the ACE2596 series, are available from several manufacturers. This feature greatly simplifies the design of switch-mode power supplies.

These ICs are available in TO-263-5 packages.

### Features

- 3.3V, 5V, 12V Fixed( $\pm 4\%$  Tolerance) and Adjustable ( $\pm 3\%$  Tolerance) Output Versions
- Guaranteed 3A Output Load Current
- 150kHz Fixed Frequency Internal Oscillator
- Input Voltage Range up to 32V
- Requires only 4 external components
- High Efficiency up to 90%
- Excellent Line and Load Regulation
- TTL Shutdown Capability
- Low Power Standby Mode,  $I_Q$  Typically 80 $\mu$ A
- Built-in Current Limit Protection and Thermal Shutdown Circuit

### Application

- LCD Monitor and LCD TV
- On-Card DC-DC Converter
- DVD Recorder
- PDP

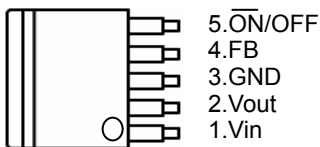
### Absolute Maximum Ratings

| Parameter   | Symbol                      | Max        | Unit          |
|---|-----------------------------|------------|---------------|
| Input voltage   | $V_{IN}$                    | 40         | V             |
| $\overline{ON/OFF}$ Pin Voltage                       | $V_{\overline{ON/OFF}}$     | 40         | V             |
| Feedback Pin Voltage                                  | $V_{FB}$                    | 40         | V             |
| Operating Junction Temperature                        | $T_J$                       | 150        | $^{\circ}C$   |
| Thermal Resistance (Junction to Ambient, No Heatsink) | TO-263-5<br>$R_{\theta JA}$ | 60         | $^{\circ}C/W$ |
| Lead Temperature (Soldering, 10sec)                   | $T_{LEAD}$                  | 260        | $^{\circ}C$   |
| Storage Temperature Range                             | $T_{STG}$                   | -65 to 150 | $^{\circ}C$   |

Note : Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

### Packaging Type

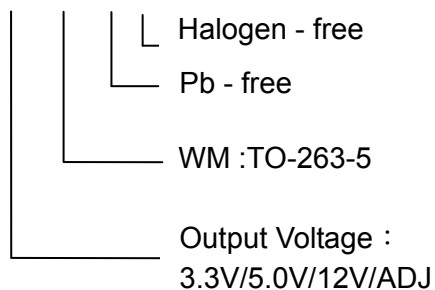
TO-263-5 (WM)



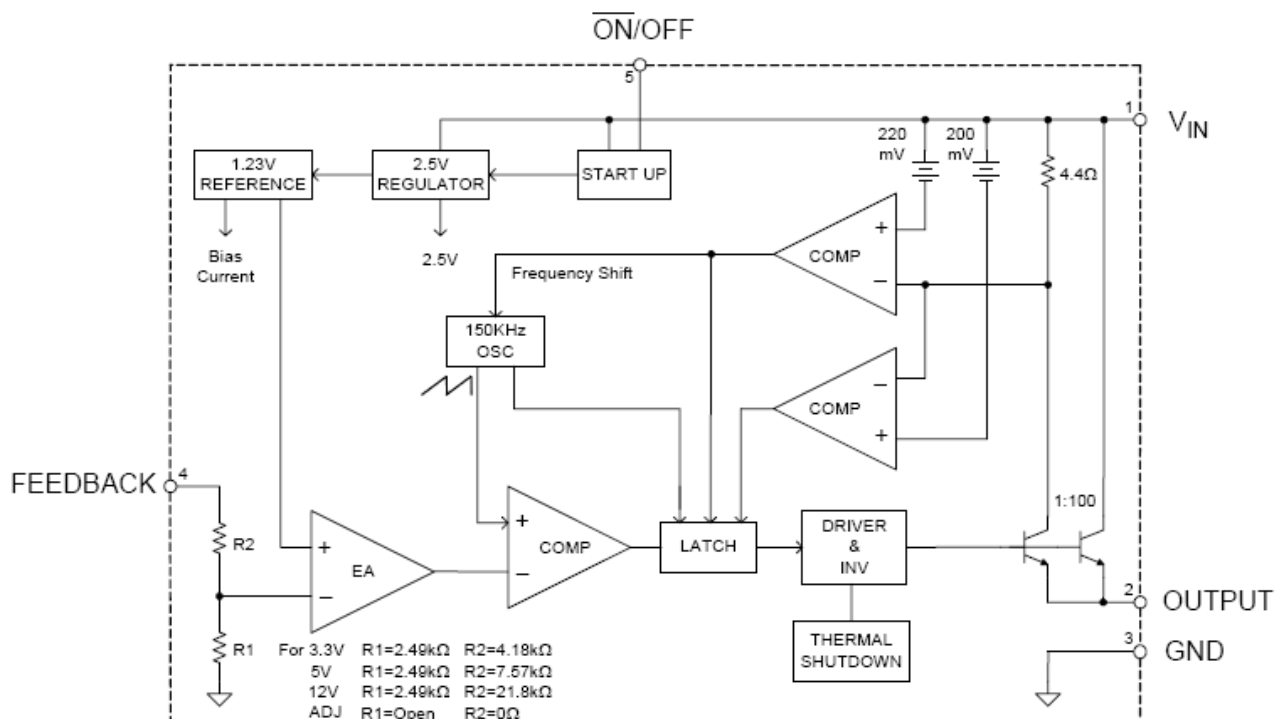
### Ordering information

Selection Guide

ACE2596 XX XXX + H



### Functional Block Diagram



## Recommended Operating Conditions

| Parameter                      |                        | Symbol   | Value      | Unit |
|--------------------------------|------------------------|----------|------------|------|
| Maximum Input Voltage (Note 2) | 3.3V                   | $V_{IN}$ | 32         | V    |
|                                | 5.0V                   |          | 32         |      |
|                                | 12V                    |          | 32         |      |
|                                | ADJ ( $V_{OUT}=3.2V$ ) |          | 32         |      |
|                                | ADJ ( $V_{OUT}=2.5V$ ) |          | 25         |      |
| Operating Junction Temperature |                        | $T_J$    | -40 to 125 | °C   |

Note : For ADJ version, the recommended supply voltage depends on the needed output voltage.

## Electrical Characteristics

For 3.3V Output Voltage Version

Unless otherwise specified,  $T_J=25^{\circ}C$ , The specifications with boldface type apply over Full Operating Junction Temperature Range.

| Parameter  | Symbol    | Conditions  | Min            | Typ | Max            | Unit |
|------------|-----------|---|----------------|-----|----------------|------|
| Output     | $V_{OUT}$ | $5.5V \leq V_{IN} \leq 32V$ ,<br>$0.2A \leq I_{LOAD} \leq 3A$ | 3.168<br>3.135 | 3.3 | 3.432<br>3.465 | V    |
| Efficiency | $\eta$    | $V_{IN}=12V, I_{LOAD}=3A$                                     |                | 75  |                | %    |

For 5V Output Voltage Version

Unless otherwise specified,  $T_J=25^{\circ}C$ , The specifications with boldface type apply over Full Operating Junction Temperature Range.

| Parameter  | Symbol    | Conditions  | Min            | Typ | Max            | Unit |
|------------|-----------|---|----------------|-----|----------------|------|
| Output     | $V_{OUT}$ | $7V \leq V_{IN} \leq 32V$ ,<br>$0.2A \leq I_{LOAD} \leq 3A$ | 4.800<br>4.750 | 5   | 5.200<br>5.250 | V    |
| Efficiency | $\eta$    | $V_{IN}=12V, I_{LOAD}=3A$                                   |                | 80  |                | %    |

For 12V Output Voltage Version

Unless otherwise specified,  $T_J=25^{\circ}C$ , The specifications with boldface type apply over Full Operating Junction Temperature Range.

| Parameter  | Symbol    | Conditions   | Min            | Typ  | Max            | Unit |
|------------|-----------|--|----------------|------|----------------|------|
| Output     | $V_{OUT}$ | $15V \leq V_{IN} \leq 32V$ ,<br>$0.2A \leq I_{LOAD} \leq 3A$ | 11.52<br>11.40 | 12.0 | 12.48<br>12.60 | V    |
| Efficiency | $\eta$    | $V_{IN}=24V, I_{LOAD}=3A$                                    |                | 88   |                | %    |

For ADJ Output Voltage Version

Unless otherwise specified,  $T_J=25^{\circ}\text{C}$ , The specifications with boldface type apply over Full Operating Junction Temperature Range.

| Parameter  | Symbol           | Conditions  | Min            | Typ  | Max            | Unit |
|------------|------------------|---|----------------|------|----------------|------|
| Output     | V <sub>OUT</sub> | $4.5\text{V} \leq V_{\text{IN}} \leq 32\text{V}$ ,<br>$0.2\text{A} \leq I_{\text{LOAD}} \leq 3\text{A}$<br>$V_{\text{OUT}}$ programmed for 2.5V | 1.193<br>1.180 | 1.23 | 1.267<br>1.280 | V    |
| Efficiency | $\eta$           | $V_{\text{IN}}=12\text{V}$ , $I_{\text{LOAD}}=3\text{A}$ , $V_{\text{OUT}}=2.5\text{V}$   |                | 73   |                | %    |

### Electrical Characteristics

For All Output Voltage Versions

Unless otherwise specified,  $V_{\text{IN}}=12\text{V}$  for 3.3V, 5V and adjustable version,  $V_{\text{IN}}=24\text{V}$  for 12V version,  $I_{\text{LOAD}}=500\text{mA}$ ,  $T_J=25^{\circ}\text{C}$ . Specifications with boldface type apply over Full Operating Junction Temperature Range.

| Parameter   | Symbol            | Conditions   | Min        | Typ  | Max        | Unit          |
|---|-------------------|--|------------|------|------------|---------------|
| Feedback Bias Current   | $I_{\text{FB}}$   | Adjustable Version Only, $V_{\text{FB}}=1.3\text{V}$                                       |            | 10   | 50<br>100  | nA            |
| Oscillator Frequency  | f                 | (Note 3)   | 127<br>110 | 150  | 173<br>173 | kHz           |
| Saturation Voltage  | $V_{\text{SAT}}$  | $I_{\text{LOAD}}=3\text{A}$ (No output devices, $V_{\text{FB}}=0\text{V}$ )                |            | 1.2  | 1.5<br>1.6 | V             |
| Maximum Duty Cycle  | $D_{\text{MAX}}$  | $V_{\text{FB}}=0\text{V}$  |            | 100  |            | %             |
| Minimum Duty Cycle  | $D_{\text{MIN}}$  | $V_{\text{FB}}=1.3\text{V}$  |            | 0    |            | %             |
| Current Limit   | $I_{\text{CL}}$   | Peak Current, No output devices, $V_{\text{FB}}=0\text{V}$                                 | 3.6<br>3.4 | 4.5  | 6.9<br>7.5 | A             |
| Output Leakage Current  | $I_{\text{SWL}}$  | Output=0V, No output devices,<br>$V_{\text{FB}}=1.3\text{V}$ , $V_{\text{IN}}=32\text{V}$  |            | 50   |            | $\mu\text{A}$ |
|   |                   | Output=-1V, No output devices,<br>$V_{\text{FB}}=1.3\text{V}$ , $V_{\text{IN}}=32\text{V}$ |            | 2    | 30         | mA            |
| Quiescent Current   | $I_{\text{Q}}$    | $V_{\text{FB}}=1.3\text{V}$  |            | 5    | 10         | mA            |
| Standby Quiescent Current                                       | $I_{\text{STBY}}$ | $\overline{\text{ON/OFF}}$ Pin=5V, $V_{\text{IN}}=18\text{V}$                              |            | 80   | 200<br>250 | $\mu\text{A}$ |
| $\overline{\text{ON/OFF}}$ Pin Logic<br>Input Threshold Voltage | $V_{\text{IL}}$   | Regulator ON   |            |      | 0.6        | V             |
|   | $V_{\text{IH}}$   | Regulator OFF  | 2.0        |      |            | V             |
| $\overline{\text{ON/OFF}}$ Pin Input Current                    | $I_{\text{H}}$    | $V_{\text{PIN5}}=2.5\text{V}$ (Regulator OFF)  |            | 5    | 15         | $\mu\text{A}$ |
|   | $I_{\text{L}}$    | $V_{\text{PIN5}}=2.5\text{V}$ (Regulator ON)   |            | 0.02 | 5          | $\mu\text{A}$ |

Note :

1. The switching frequency is reduced when the second stage current limit is activated.
2. The specifications with boldface are GBD (Guaranteed By Design).

## Typical Performance Characteristics

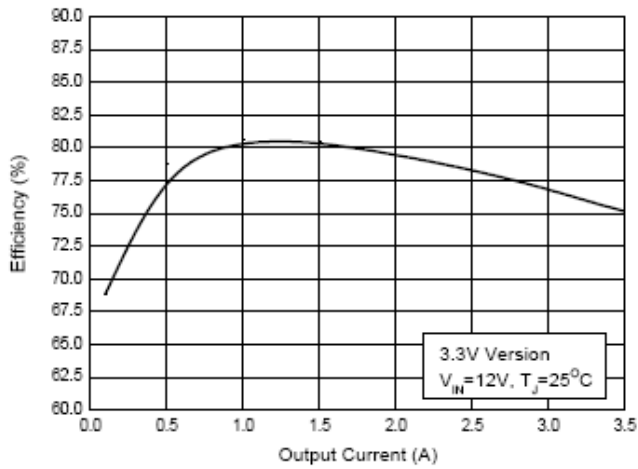


Figure 1. Efficiency vs. Output Current

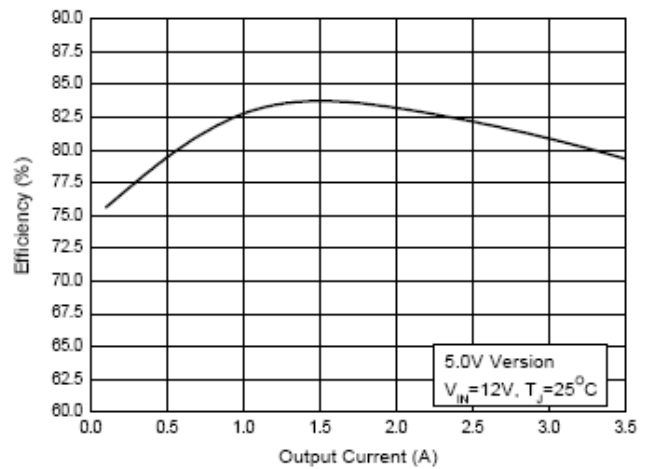


Figure 2. Efficiency vs. Output Current

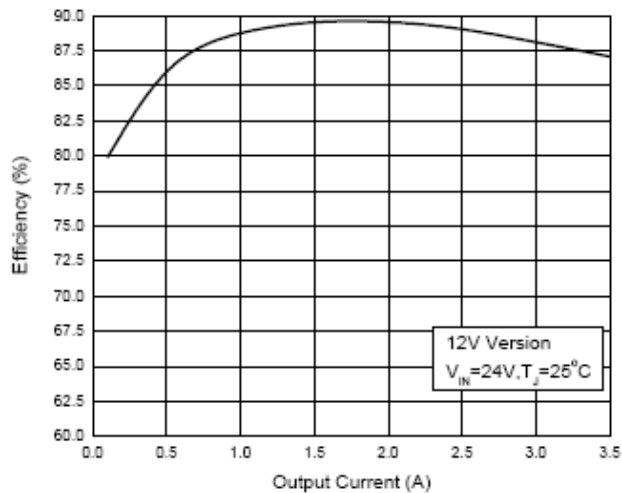


Figure 3. Efficiency vs. Output Current

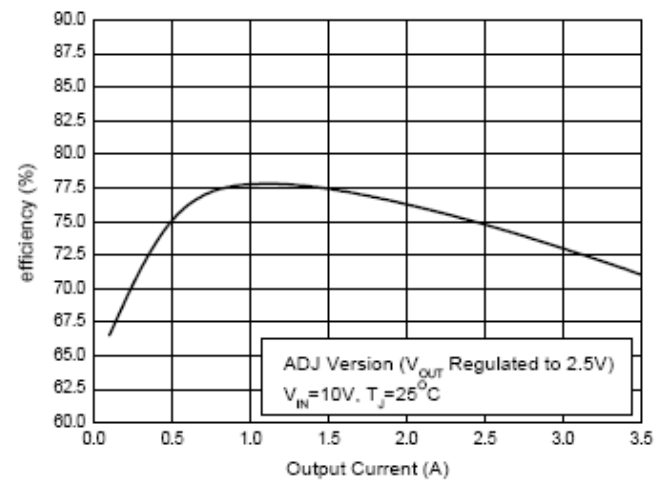


Figure 4. Efficiency vs. Output Current

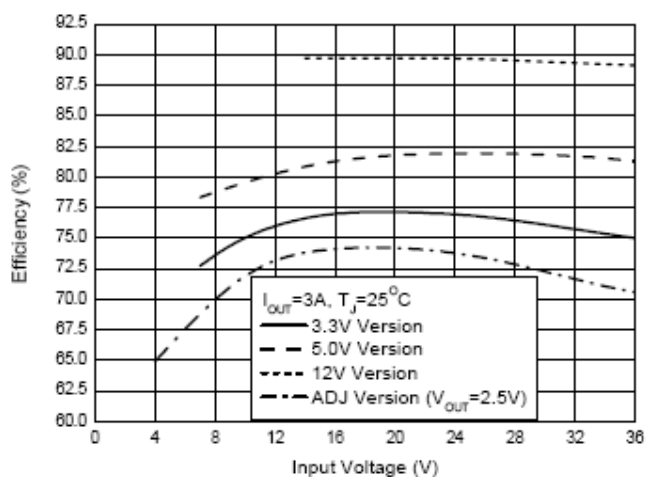


Figure 5. Efficiency vs. Input Current

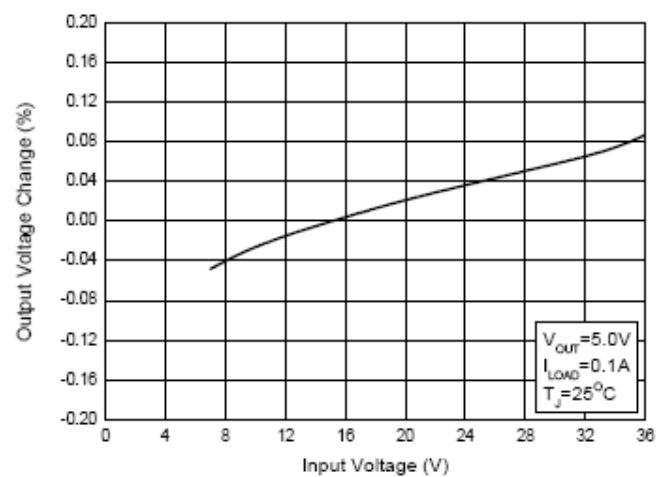


Figure 6. Line Regulation

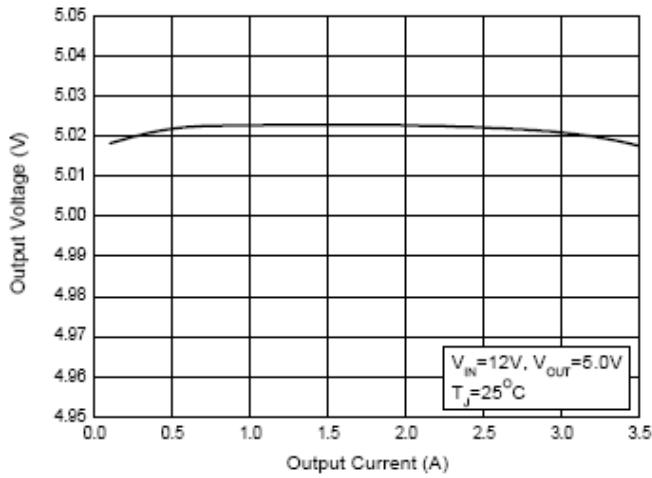


Figure 7. Load Regulation

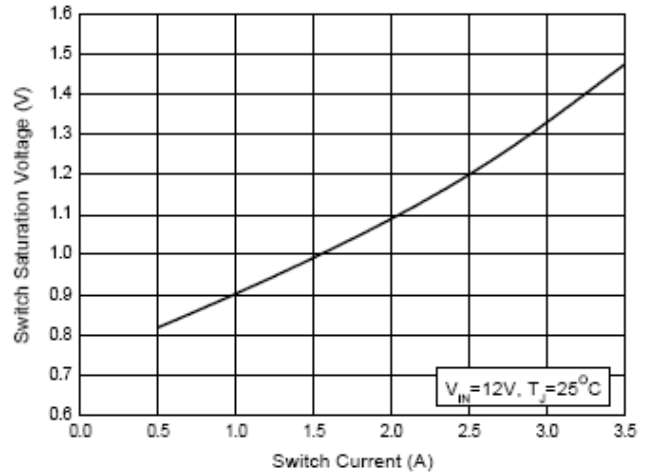


Figure 8. Switch Saturation Voltage vs. Switch Current

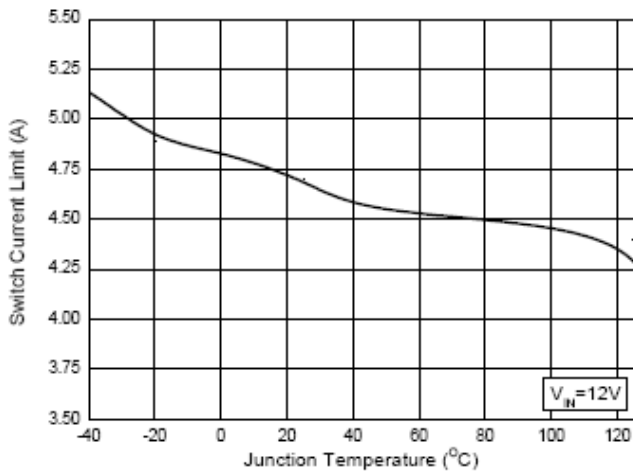


Figure 9. Switch Current Limit vs. Junction Temperature

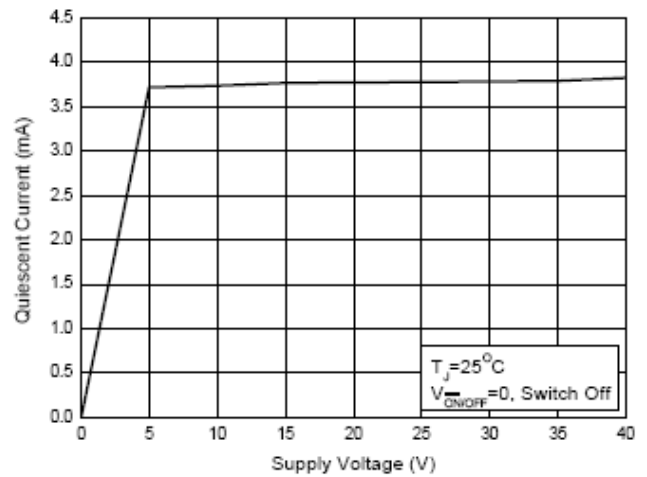


Figure 10. Quiescent Current vs. Supply Voltage

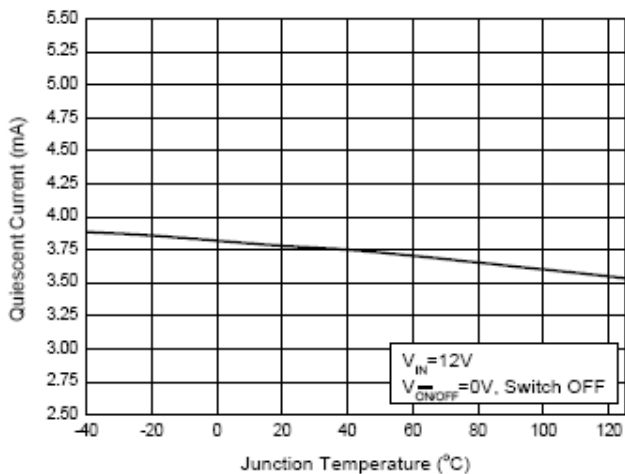


Figure 11. Quiescent Current Limit vs. Junction Temperature

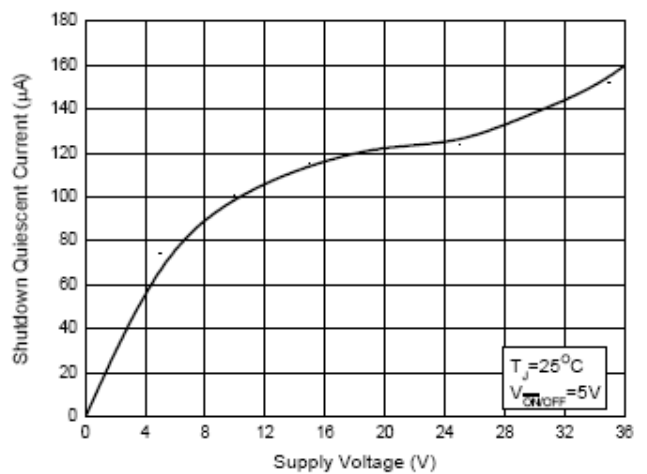


Figure 12. Shutdown Quiescent Current vs. Input Voltage

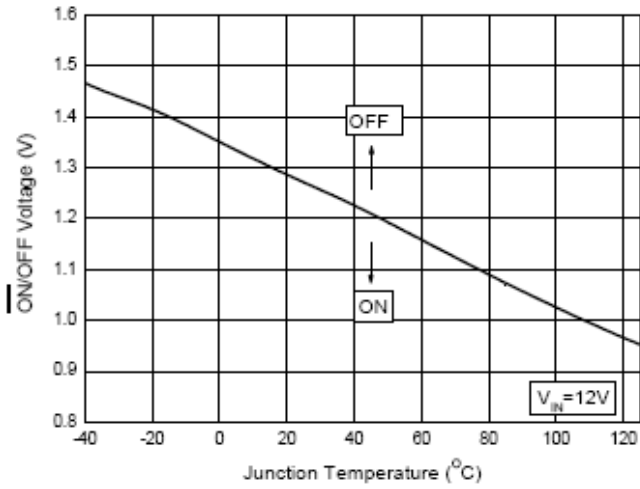


Figure 13. On/Off Threshold Voltage vs. Junction Temperature

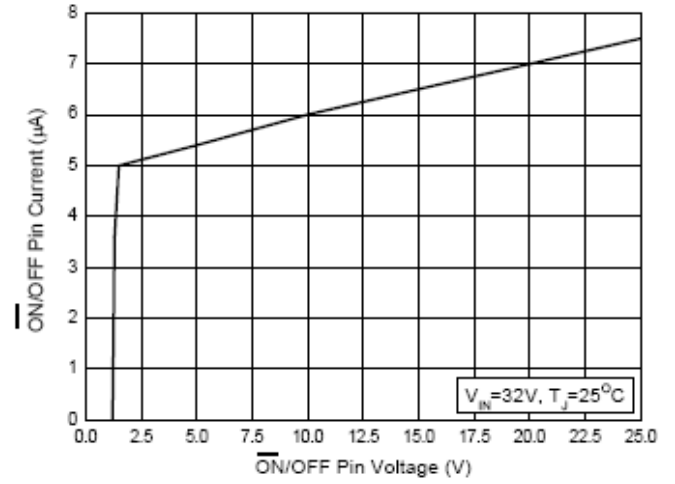


Figure 14. On/Off Pin Current vs. On/Off Pin Voltage

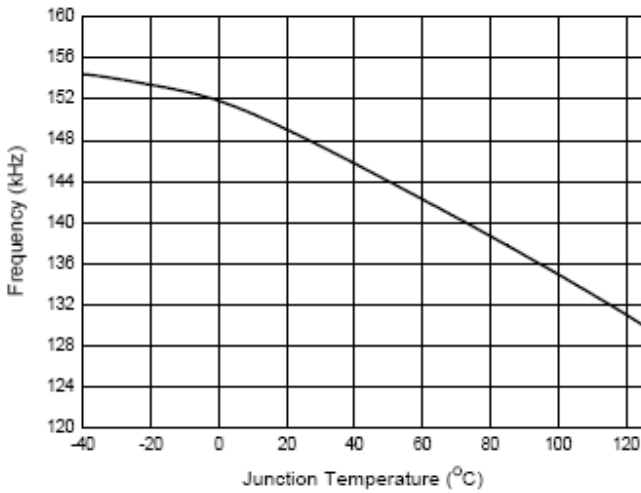
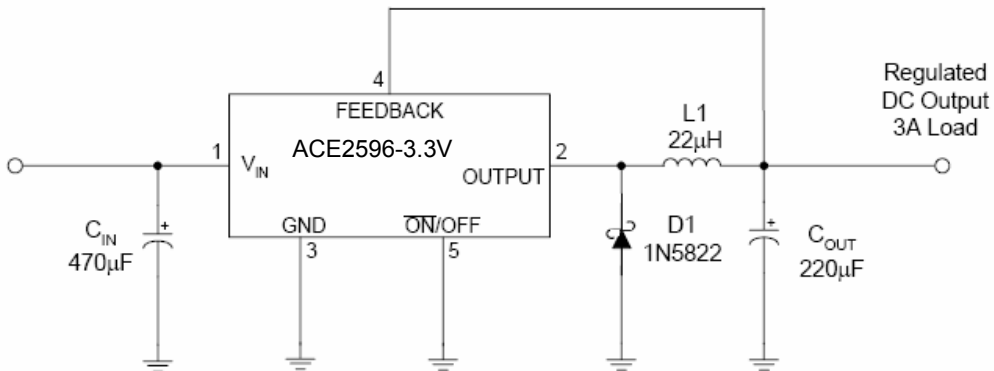


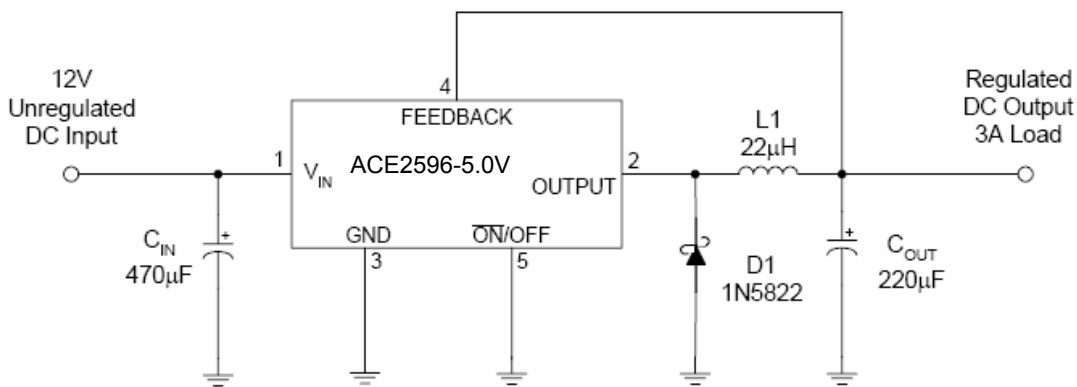
Figure 15. Switching Frequency vs. Junction Temperature

### Typical Application



L1: Sumida CDRH127/LDNP-220MC or Equivalent

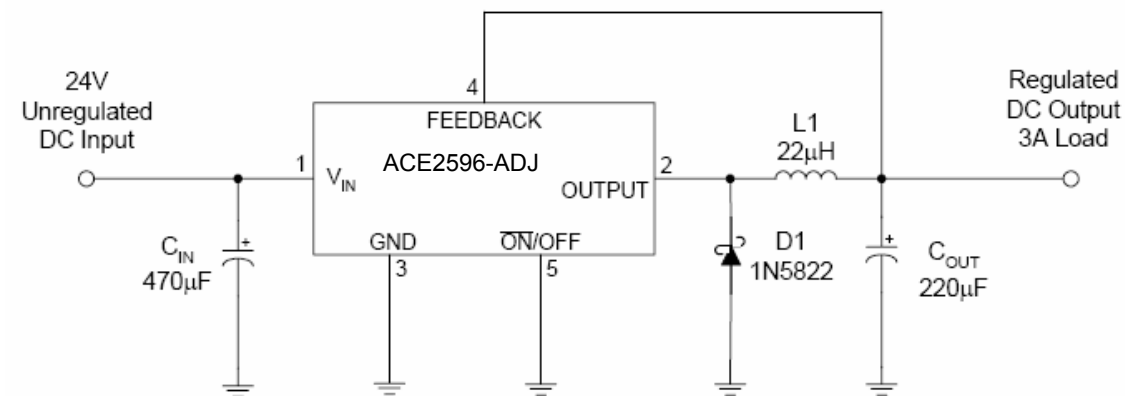
Figure 16. Typical Application of ACE2596-3.3V



L1: Sumida CDRH127/LDNP-220MC or Equivalent

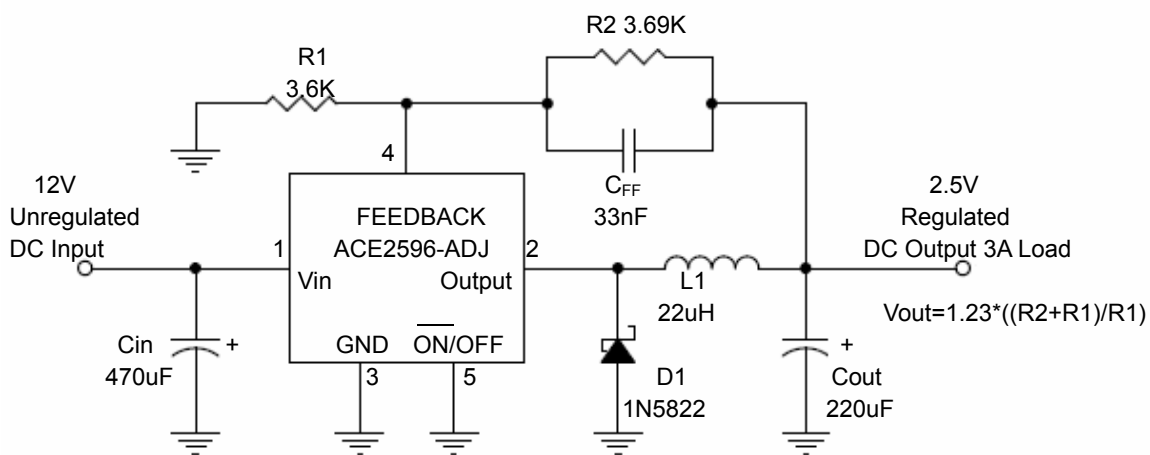
Figure 17. Typical Application of ACE2596-5.0V





L1: Sumida CDRH127/LDNP-220MC or Equivalent

Figure 18. Typical Application of ACE2596-12V

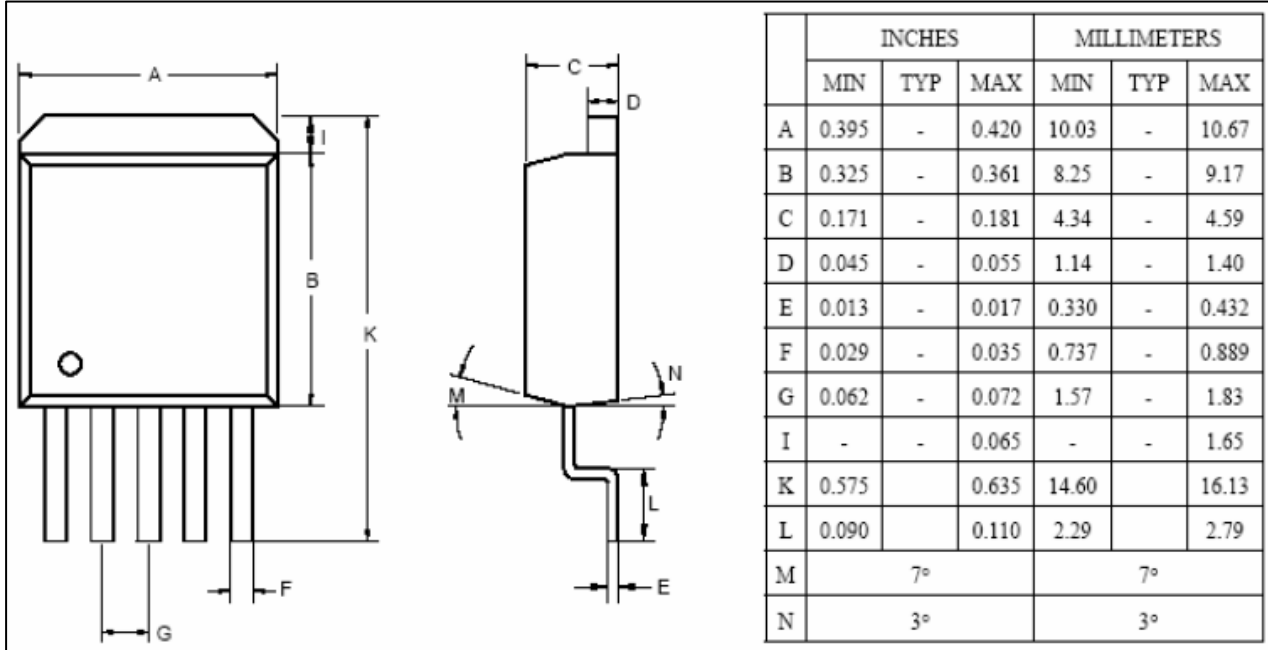


L1: Sumida CDRH127/LDNP-220MC or Equivalent

Figure 19. Typical Application of ACE2596-ADJ

### Packing Information

#### TO-263-5



Notes

ACE does not assume any responsibility for use as critical components in life support devices or systems without the express written approval of the president and general counsel of ACE Electronics Co., LTD. As sued herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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