

# ADVANCE INFORMATION

All information in this data sheet is preliminary and subject to change.

8/93

EVALUATION KIT AVAILABLE

# MAXIM

## Low-Voltage-Input, 3V/3.3V/5V/Adjustable-Output, Step-Up DC-DC Converters

### General Description

The MAX777/MAX778/MAX779 are pulse-skipping, DC-DC converters that step-up from low-voltage inputs (1V, guaranteed). They require only three external components—an inductor (typically 22 $\mu$ H), and two capacitors. The MAX777 delivers a 5V output, the MAX778 generates pin-selectable voltages of 3.0V or 3.3V, and the MAX779 output can be adjusted from 1V to 6V via an external resistor divider.

The devices include an active rectifier that eliminates the need for an external catch diode. It also permits regulation even when the input is greater than the output. And, unlike other step-up converters, the MAX777/MAX778/MAX779's active rectifier is disabled in shutdown mode. When disabled, the active rectifier appears as a very high impedance in series with the input, inductor, and load. This high impedance effectively stops current drain associated with conventional step-up converters in the shutdown state.

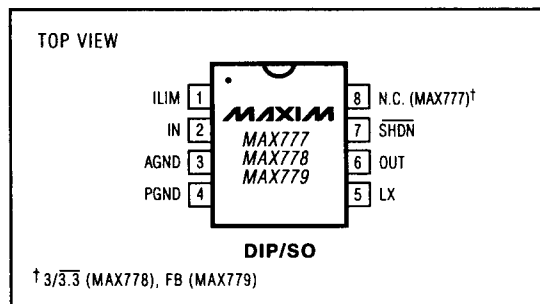
The high-frequency operation of these devices (up to 300kHz) allows the use of small surface-mount inductors with values of 10 $\mu$ H or less. Supply current is 220 $\mu$ A under no load and only 20 $\mu$ A in the standby mode. Supply voltage can range from 1V to 6.2V (1 to 4 cells). With a 2V input, these devices can deliver 200mA at 5V or 300mA at 3V.

For step-up/step-down applications (where the input can be both above and below the output), refer to the MAX877/MAX878/MAX879 data sheet.

### Applications

Single Battery-Cell (1V), Step-Up Voltage Conversion  
Efficient, High-Power Step-Up Regulation from Low Input Voltages  
Pagers  
Portable Instruments & Handy-Terminals  
Laptop and Palmtop Computers

### Pin Configuration



### Features

- ◆ 1V to 6.2V Input Guaranteed Start-Up Under Load
- ◆ Up to 240mA Outputs
- ◆ 85% Typical Efficiency
- ◆ Also Regulates When Input Voltage is Above the Output Voltage
- ◆ Internal 1A Power Switch
- ◆ Adjustable Current-Limit
- ◆ Internal 1A Active Rectifier with Input-to-Load Disconnect in Shutdown
- ◆ 220 $\mu$ A Quiescent Supply Current
- ◆ 20 $\mu$ A Shutdown Supply Current
- ◆ 3V/3.3V, 5V, and Adjustable Output-Voltage Versions

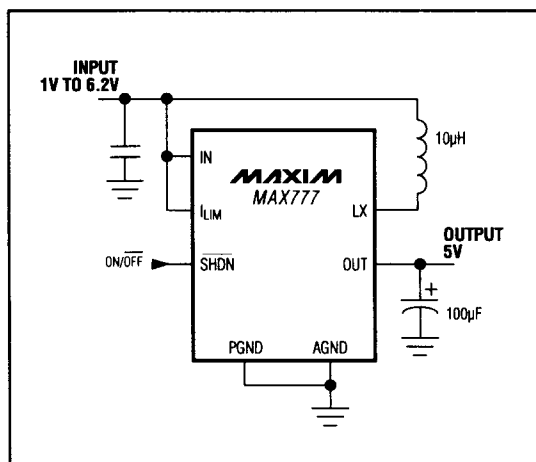
### Ordering Information

| PART      | TEMP. RANGE     | PIN-PACKAGE   |
|-----------|-----------------|---------------|
| MAX777CPA | 0°C to +70°C    | 8 Plastic DIP |
| MAX777CSA | 0°C to +70°C    | 8 SO          |
| MAX777C/D | 0°C to +70°C    | Dice*         |
| MAX777EPA | -40°C to +86°C  | 8 Plastic DIP |
| MAX777ESA | -40°C to +85°C  | 8 SO          |
| MAX777MJA | -55°C to +125°C | 8 CERDIP      |

Ordering Information continued on last page.

\* Contact factory for dice specifications.

### Typical Operating Circuit



# MAXIM

Maxim Integrated Products 4-189

Call toll free 1-800-998-8800 for free samples or literature.

MAX777/MAX778/MAX779

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# Low-Voltage-Input, 3V/3.3V/5V/Adjustable-Output, Step-Up DC-DC Converters

## ELECTRICAL CHARACTERISTICS

( $V_{IN} = 2.5V$ ,  $I_{LOAD} = 0mA$ ,  $LX = 22\mu H$ ,  $CF = 100\mu F$ ,  $\overline{SHDN}$  and  $I_{LIM}$  connected to  $IN$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)

| PARAMETER                          | CONDITIONS                                                                           |                                                                                                                                                                          | MIN   | TYP  | MAX  | UNITS |    |
|------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|------|-------|----|
| Output Voltage<br>MAX778           | 0mA < I <sub>LOAD</sub> < 100mA                                                      | 3V/3.3V = open:<br>1.0V < V <sub>IN</sub> < 3V (T <sub>A</sub> =+25°C),<br>1.1V < V <sub>IN</sub> < 3V (C temp range),<br>1.2V < V <sub>IN</sub> <3V (E temp range)      | 2.88  | 3.00 | 3.12 | V     |    |
|                                    |                                                                                      | 3V/3.3V = 0V:<br>1.0V < V <sub>IN</sub> < 3.3V (T <sub>A</sub> =+25°C),<br>1.1V < V <sub>IN</sub> < 3.3V (C temp range),<br>1.2V < V <sub>IN</sub> < 3.3V (E temp range) | 3.17  | 3.30 | 3.43 |       |    |
|                                    | 0mA < I <sub>LOAD</sub> < 240mA                                                      | 3V/3.3V = open:<br>1.8V < V <sub>IN</sub> < 3V (T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> )                                                                  | 2.88  | 3.00 | 3.12 |       |    |
|                                    |                                                                                      | 3V/3.3V=0V:<br>1.8V < V <sub>IN</sub> < 3V (T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> )                                                                      | 3.17  | 3.30 | 3.43 |       |    |
| Output Voltage<br>MAX777           | 0mA < I <sub>LOAD</sub> < 60mA                                                       | 1.0V < V <sub>IN</sub> < 5V (T <sub>A</sub> =+25°C),<br>1.1V < V <sub>IN</sub> < 5V (C temp range),<br>1.2V < V <sub>IN</sub> < 5V (E temp range)                        | 4.8   | 5.0  | 5.2  | V     |    |
|                                    | 0mA < I <sub>LOAD</sub> < 150mA                                                      | 1.8V <V <sub>IN</sub> < 5V (T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> )                                                                                      | 4.8   | 5.0  | 5.2  |       |    |
| Efficiency                         | I <sub>LOAD</sub> = 100mA, V <sub>IN</sub> = 2.5V                                    |                                                                                                                                                                          | 86    |      |      | %     |    |
| No-Load Supply Current             | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> , I <sub>LOAD</sub> = 0mA      |                                                                                                                                                                          | 220   |      |      | 310   | μA |
| Shutdown Supply Current            | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> , 0V < SHDN < V <sub>STH</sub> |                                                                                                                                                                          | 0     | 20   | 30   | μA    |    |
| SHDN Bias Current                  | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>                                | 0V < SHDN < V <sub>STH</sub>                                                                                                                                             | 100   |      |      | nA    |    |
|                                    |                                                                                      | V <sub>STH</sub> < SHDN < 5V                                                                                                                                             | 40    |      |      | μA    |    |
| SHDN Threshold (V <sub>STH</sub> ) | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>                                | V <sub>IN</sub> = 1V                                                                                                                                                     | 0.55  | 0.90 |      | V     |    |
|                                    |                                                                                      | V <sub>IN</sub> = 2.5V                                                                                                                                                   | 1.20  | 1.60 |      |       |    |
|                                    |                                                                                      | V <sub>IN</sub> = 5V                                                                                                                                                     | 2.00  | 2.80 |      |       |    |
| SHDN Enable Delay                  |                                                                                      |                                                                                                                                                                          | 150   |      |      | μs    |    |
| Current Limit                      |                                                                                      |                                                                                                                                                                          | 1.0   |      |      | A     |    |
| Current Limit Tempco               |                                                                                      |                                                                                                                                                                          | -0.3  |      |      | %/°C  |    |
| Switch Saturation Voltage          | I <sub>SW</sub> = 400mA                                                              |                                                                                                                                                                          | 0.275 |      |      | V     |    |
|                                    | I <sub>SW</sub> = 600mA                                                              |                                                                                                                                                                          | 0.350 |      |      |       |    |
|                                    | I <sub>SW</sub> = 1000mA                                                             |                                                                                                                                                                          | 0.550 |      |      |       |    |
| Switch-Off Leakage Current         | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> , 0V < SHDN < V <sub>STH</sub> |                                                                                                                                                                          | 0.4   | 2.0  | μA   |       |    |
| Maximum Switch-On Time             | V <sub>IN</sub> = 2.5V                                                               |                                                                                                                                                                          | 4.0   |      |      | μs    |    |
|                                    | V <sub>IN</sub> = 1.8V                                                               |                                                                                                                                                                          | 5.9   |      |      |       |    |
|                                    | V <sub>IN</sub> = 1V                                                                 |                                                                                                                                                                          | 12.6  |      |      |       |    |
| Minimum Switch-Off Time            | MAX778                                                                               |                                                                                                                                                                          | 2.5   |      |      | μs    |    |
|                                    | MAX777                                                                               |                                                                                                                                                                          | 1.5   |      |      |       |    |
| Rectifier Forward Voltage Drop     | I <sub>OUT</sub> = 400mA                                                             |                                                                                                                                                                          | 0.21  |      |      | V     |    |
|                                    | I <sub>OUT</sub> = 600mA                                                             |                                                                                                                                                                          | 0.31  |      |      |       |    |
|                                    | I <sub>OUT</sub> = 1000mA                                                            |                                                                                                                                                                          | 0.50  |      |      |       |    |

**MAX777/MAX778/MAX779**

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