**General Description**

The MAX675 is a precision voltage reference that is pretrimmed to within ±0.15% of 5V. The reference features excellent temperature stability (as low as 12.0ppm/°C guaranteed), low current drain and low noise. It is supplied in the space-saving narrow SO package, as well as, the standard 8-pin Plastic DIP package.

**Features**

- Pretrimmed to +5V, ±0.15%
- Excellent Temperature Stability: 12ppm/°C
- Low Noise: 10µVp-p
- Low Supply Current: 1.4mA (max)
- Short-Circuit Protected
- Load Regulation 0.001%/mA
- Pin-for-Pin Compatible with REF02

**Applications**

A/D Converters
D/A Converters
Digital Voltmeters
Voltage Regulators
Threshold Detectors

**Ordering Information**

<table>
<thead>
<tr>
<th>PART</th>
<th>TEMP RANGE</th>
<th>PIN-PACKAGE</th>
<th>TEMPCO (ppm/°C)</th>
<th>INITIAL ERROR (mV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX675CPA</td>
<td>0°C to +70°C</td>
<td>8 PDIP</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>MAX675CSA</td>
<td>0°C to +70°C</td>
<td>8 Narrow SO</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>MAX675EPA</td>
<td>-40°C to +85°C</td>
<td>8 PDIP</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>MAX675ESA</td>
<td>-40°C to +85°C</td>
<td>8 Narrow SO</td>
<td>15</td>
<td>7</td>
</tr>
</tbody>
</table>

Ordering Information continued at end of data sheet.

**Pin Configurations**

![Pin Configurations](image)

Pin Configurations continued at end of data sheet.

**Typical Operating Circuit**

![Typical Operating Circuit](image)
**+5V Precision Voltage Reference**

**ABSOLUTE MAXIMUM RATINGS**

- **Input Voltage**: ................. +40V
- **Power Dissipation**
  - TO-99 (TV) (derate at 7.1mW/°C above +80°C) ....... 500mW
  - CERDIP (J) (derate at 6.7mW/°C above +75°C) ...... 500mW
  - Plastic DIP (P) (derate at 5.6mW/°C above +36°C) .... 500mW
  - Narrow SO (S) (derate at 5.0mW/°C above +55°C) .... 300mW
- **Storage Temperature Range**: .............. -65°C to +150°C
- **Operating Temperature Range**
  - MAX675C ........................................... 0°C to +70°C
  - MAX675E ........................................... -40°C to +85°C
  - MAX675M ........................................... -55°C to +125°C
- **Dice Junction Temperature (TJ)** ................. -65°C to +150°C
- **Output Short-Circuit Duration**
  - (to Ground or VIN) .............................. Indefinite
- **Lead Temperature (soldering, 60s)** ............... +300°C

*Stresses beyond 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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

**ELECTRICAL CHARACTERISTICS**

(VIN = +15V, TA = +25°C, unless otherwise noted.)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage Tolerance</td>
<td>IL = 0mA</td>
<td></td>
<td>±7</td>
<td></td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>Output Voltage Temperature Coefficient (Note 1)</td>
<td>TCVO</td>
<td>MAX675CTV/CPA/CSA</td>
<td>12 ppm/°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Voltage Temperature Coefficient (Note 1)</td>
<td>TCVO</td>
<td>MAX675ETV/EJA/EPA/ESA</td>
<td>15 ppm/°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Voltage Temperature Coefficient (Note 1)</td>
<td>TCVO</td>
<td>MAX675MTV/MJA</td>
<td>20 ppm/°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Adjustment Range</td>
<td>VTRIM</td>
<td>Rp = 10</td>
<td>±150</td>
<td>±300</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>Line Regulation (Note 2)</td>
<td>VIN = 18V to 33V</td>
<td></td>
<td>0.006</td>
<td>0.01</td>
<td>%/V</td>
<td></td>
</tr>
<tr>
<td>Load Regulation (Note 2)</td>
<td>IL = 0 to 10mA</td>
<td></td>
<td>0.001</td>
<td>0.002</td>
<td>%/mA</td>
<td></td>
</tr>
<tr>
<td>Turn-On Settling Time</td>
<td>tON</td>
<td>To ±0.1% of final value</td>
<td>5</td>
<td>µs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quiescent Supply Current</td>
<td>IQ</td>
<td>No load</td>
<td>750</td>
<td>1400</td>
<td>µA</td>
<td></td>
</tr>
<tr>
<td>Noise (Note 3)</td>
<td>eN(P-P)</td>
<td>0.1Hz to 10Hz</td>
<td>10</td>
<td>15</td>
<td>µVPP</td>
<td></td>
</tr>
<tr>
<td>Sink Current</td>
<td>IS</td>
<td></td>
<td>0.3</td>
<td>0.5</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Short-Circuit Current</td>
<td>ISC</td>
<td>VOUT = 0V</td>
<td>30</td>
<td></td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Current Temperature Voltage Output</td>
<td>VT</td>
<td>(Note 4)</td>
<td>630</td>
<td></td>
<td>mV</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. Temperature Coefficient is measured by the “box” method, i.e., the maximum ΔVOUT is divided by ΔT.
2. Line and Load Regulation specifications include the effect of self-heating.
3. Guaranteed by design for MAX675CPA, MAX675CSA, MAX675EP A, MAX675ESA; sample tested for all other grades and packages.
4. Limit current in or out of pin 3 to 50nA and capacitance on pin 3 to 30pF.
Output Adjustment

The MAX675 trim terminal can be used to adjust the output voltage over a 5V ±150mV range. This feature allows system errors to be trimmed by setting the reference to a voltage other than 5V such as 5.120V for binary applications (see Typical Operating Circuit). The trim terminal may, of course, be left open if no adjustment is needed.

Adjustment of the output does not significantly affect the temperature performance of the device. The temperature coefficient change is approximately 0.7ppm/°C for each 100mV of output adjustment from its initial value.

Temperature Voltage Output

The MAX675 provides a temperature-dependent output voltage on the TEMP pin. This voltage is proportional to the absolute temperature, and has a scale factor of approximately 2.1mV/°C (Figure 2).

Output Voltage = 2.1(T + 273)mV
where T = Temperature in °C

Typical Operating Characteristics

(TA = +25°C, unless otherwise noted.)

Figure 2. MAX675 Temperature Voltage Output vs. Temperature
**+5V Precision Voltage Reference**

**Typical Operating Characteristics (continued)**

(T$_A$ = +25°C, unless otherwise noted.)

**MAXIMUM LOAD CURRENT vs. TEMPERATURE**

![Graph of MAXIMUM LOAD CURRENT vs. TEMPERATURE](image)

**OUTPUT CHANGE DUE TO THERMAL SHOCK**

![Graph of OUTPUT CHANGE DUE TO THERMAL SHOCK](image)

**Typical Applications**

![Figure 3. Precision Calibration Standard](image)

![Figure 4. ±5V Reference](image)
**+5V Precision Voltage Reference**

![Chip Topography](image)

**Figure 5. Current Source**

![Pin Configurations (continued)](image)

**Figure 6. Precision Temperature Transducer with Remote Sensor**

**Chip Topography**

**Pin Configurations (continued)**

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<td>0°C to +70°C</td>
<td>8 TO-99</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>MAX675ETV*</td>
<td>-40°C to +85°C</td>
<td>8 TO-99</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>MAX675EJA*</td>
<td>-40°C to +85°C</td>
<td>8 CERDIP</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>MAX675MTV*</td>
<td>-55°C to +125°C</td>
<td>8 TO-99</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>MAX675MJA*</td>
<td>-55°C to +125°C</td>
<td>8 CERDIP</td>
<td>20</td>
<td>7</td>
</tr>
</tbody>
</table>

*Contact factory for availability. Not recommended for new designs.

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