MAXIM

+5V Precision Voltage Reference

MAX675

General Description

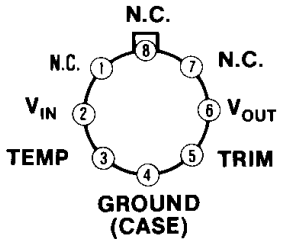
The MAX675 is a precision voltage reference that is pretrimmed to within ±0.15% of 5V. The reference features excellent temperature stability (as low as 12.0ppm/°C guaranteed), low current drain and low noise. It is supplied in the space-saving narrow Small Outline package, as well as, the standard 8-pin TO-99 Metal Can, Plastic DIP and CERDIP packages.

Applications

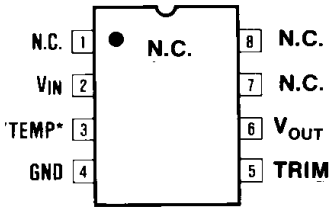
A/D Converters
D/A Converters
Digital Voltmeters
Voltage Regulators
Threshold Detectors

Pin Configuration

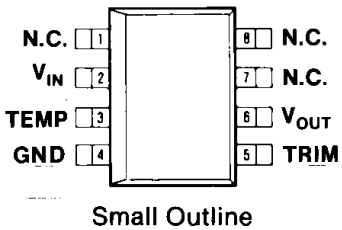
Top View



TO-99 Metal Can



DIP/CERDIP



Small Outline

Features

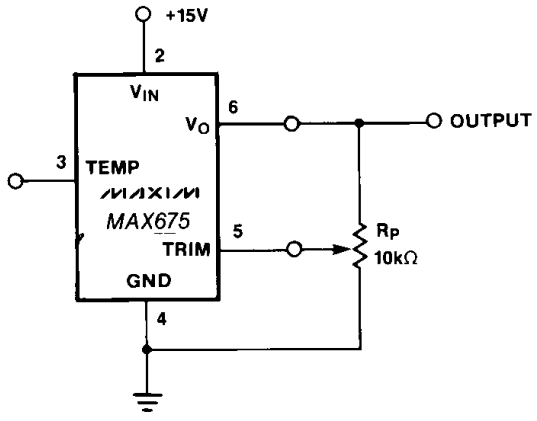
- **Pretrimmed to +5V, ±0.15%**
- **Excellent Temperature Stability: 12ppm/°C**
- **Low Noise: 10μV_{p-p}**
- **Low Supply Current: 1.4mA Max**
- **Short-Circuit Proof**
- **Load Regulation 0.001%/mA**
- **Pin-For-Pin Compatible with REF02**

Ordering Information

PART	PACKAGE*	TEMP. COEFFICIENT ppm/°C	INITIAL ERROR mV
TEMP. RANGE:	**0°C to +70°C**		
MAX675CTV	TO-99	12	7
MAX675CPA	Plastic DIP	12	7
MAX675CSA	Narrow SO	12	7
TEMP. RANGE:	**-40°C to +85°C**		
MAX675ETV	TO-99	15	7
MAX675EJA	CERDIP	15	7
MAX675EPA	Plastic DIP	15	7
MAX675ESA	Narrow SO	15	7
TEMP. RANGE:	**-55°C to +125°C**		
MAX675MTV	TO-99	20	7
MAX675MJA	CERDIP	20	7

**All devices — 8-pin packages*

Typical Operating Circuit



Reference with Trimmed Output

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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 Small Outline (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
Lead Temperature (Soldering, 60 sec) ..... +300°C
DICE Junction Temperature (T_J) ... -65°C to +150°C
Output Short-Circuit Duration
(to Ground or V_{IN}) ..... Indefinite

Stresses above 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 above those indicated in the operational sections of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect the device reliability.

ELECTRICAL CHARACTERISTICS (V_{IN} = +15V, T_A = +25°C. unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage Tolerance		I_L = 0mA			±7	mV
Output Voltage Change with Temperature	TCV_O	MAX675CTV/CPA/CSA MAX675ETV/EJA/EPA/ESA MAX675MTV/MJA			12 15 20	ppm/°C
Output Adjustment Range	V_{TRIM}	R_P = 10	±150	±300		mV
Line Regulation (Note 1)		V_{IN} = 8V to 33V		0.006	0.01	%/V
Load Regulation (Note 1)		I_L = 0 to 10mA		0.001	0.002	%/mA
Turn-on Settling Time	t_{ON}	To ±0.1% of final value		5		µs
Quiescent Supply Current	I_Q	No Load		750	1400	µA
Noise (Note 3)	e_{np-p}	0.1Hz to 10Hz		10	15	μV_{p-p}
Sink Current	I_S		-0.3	-0.5		mA
Short-Circuit	I_{SC}	V_O = 0		30		mA
Current Temperature Voltage Output	V_T	(Note 2)		630		mV

Note 1: Line and Load Regulation specifications include the effect of self heating.
Note 2: Limit current in or out of pin 3 to 50nA and capacitance on pin 3 to 30pF.
Note 3: Noise is sample tested.

Output Adjustment

The MAX675 trim terminal can be used to adjust the output voltage over a 5V ± 150mV range. This 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" on first page). 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 valu^

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

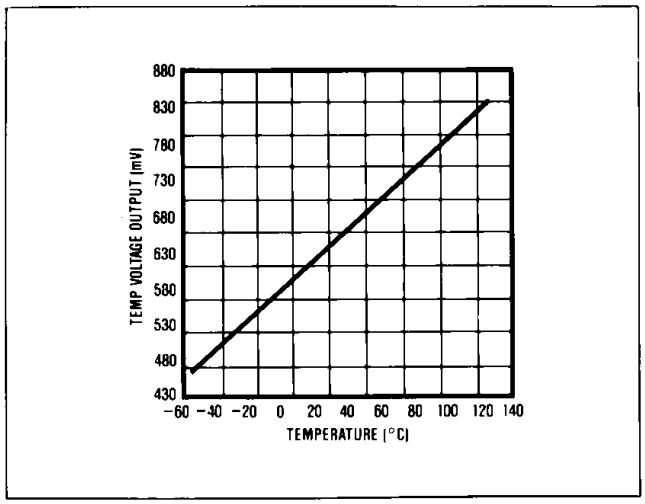
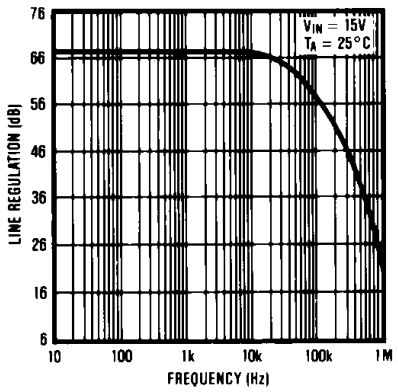


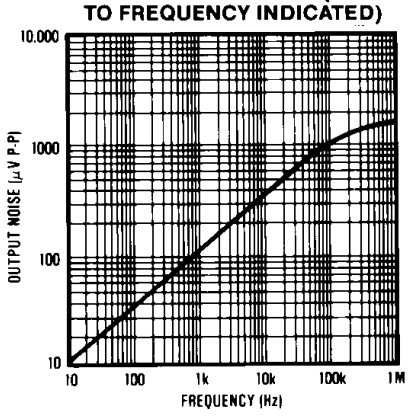
Figure 2. MAX675 Temperature Voltage Output vs. Temperature

Typical Operating Characteristics

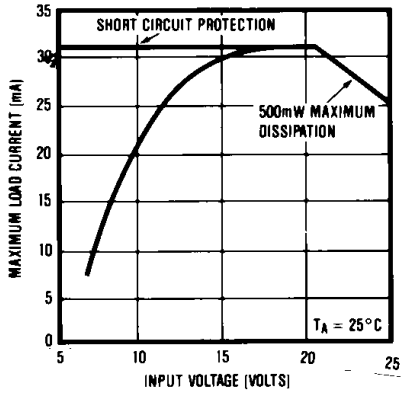
LINE REGULATION vs FREQUENCY



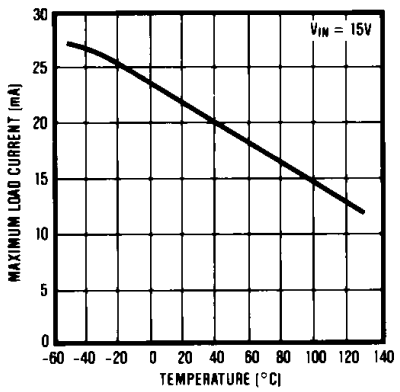
MAX675 OUTPUT WIDEBAND NOISE vs BANDWIDTH (0.1Hz TO FREQUENCY INDICATED)



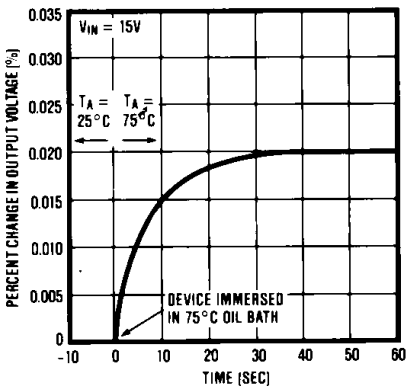
MAXIMUM LOAD CURRENT vs INPUT VOLTAGE



MAXIMUM LOAD CURRENT vs TEMPERATURE



OUTPUT CHANGE DUE TO THERMAL SHOCK



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Typical Applications

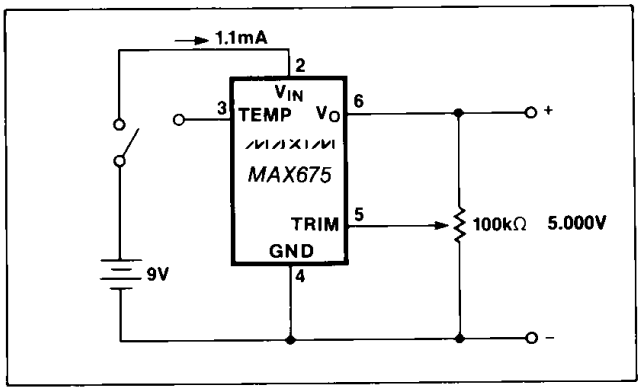

Figure 3. Precision Calibration Standard

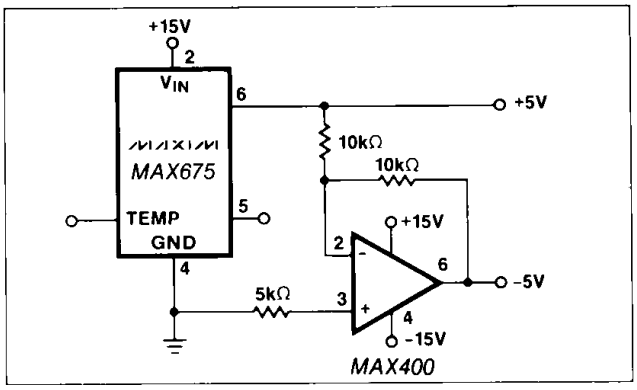

Figure 4. · 5V Reference

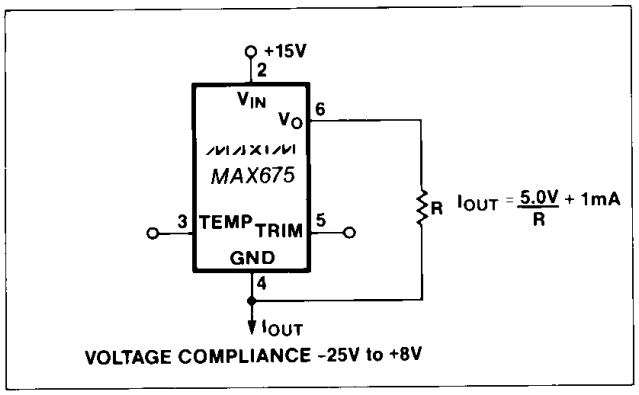

Figure 5. Current Source

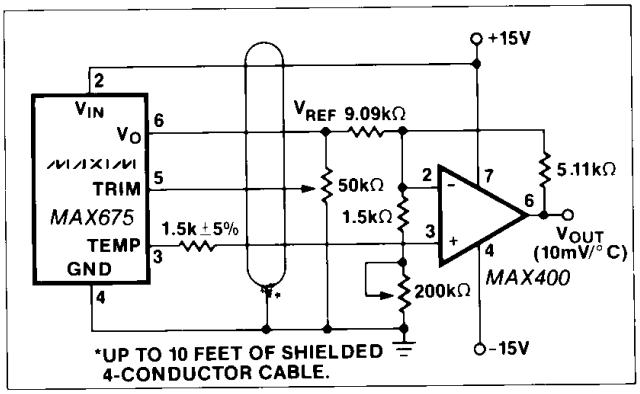

Figure 6. Precision Temperature Transducer with Remote Sensor

Chip Topography