

MAXIM

+5V, +10V Precision Voltage References

MAX672/MAX673

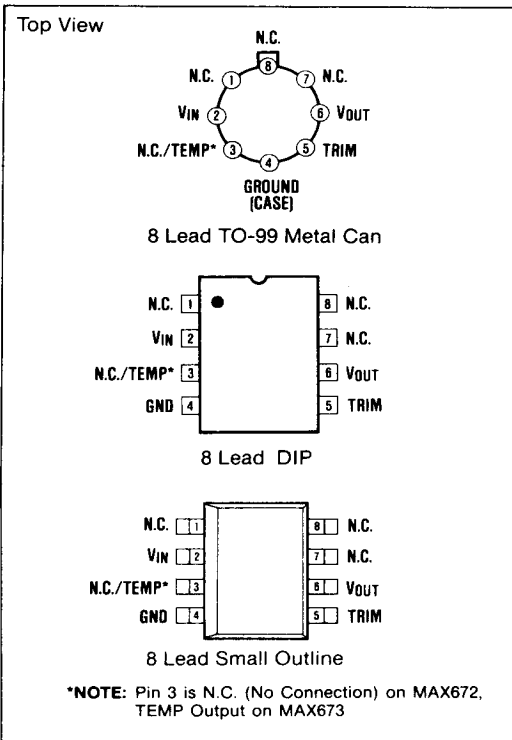
General Description

The MAX672 and MAX673 are precision voltages references that are pretrimmed to within $\pm 0.05\%$ of 10V and 5V respectively. Both references feature excellent temperature stability (as low as 5.0 ppm/ $^{\circ}\text{C}$ worst case), low current drain and low noise. The MAX673 also provides a TEMP pin whose output voltage varies linearly with temperature, making this device suitable for a wide variety of temperature sensing and control applications. Both devices are available from Maxim in the space-saving Small Outline package, as well as the standard 8 pin TO-99 and MINI-DIP packages.

Applications

- A to D Converters
- D to A Converters
- Digital Voltmeters
- Voltage Regulators
- Threshold Detectors

Pin Configuration



Features

- ◆ Pretrimmed to +5V, +10V $\pm 0.05\%$
- ◆ Excellent Temperature Stability 2 ppm/ $^{\circ}\text{C}$
- ◆ Low Noise: 10 $\mu\text{V}_{\text{p-p}}$ (MAX673)
- ◆ Low Supply Current: 1.4mA Max
- ◆ Short Circuit Proof
- ◆ Load Regulation 0.001%/mA
- ◆ Improved REF01 and REF02

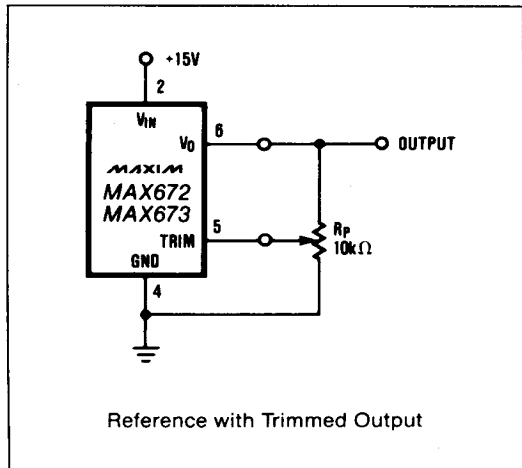
Ordering Information

PART	V _{OUT} @ 25 $^{\circ}\text{C}$	PACKAGE*
TEMP RANGE: 0$^{\circ}\text{C}$ TO +70$^{\circ}\text{C}$		
MAX672CTV	10V \pm 5mV	TO-99
MAX672CPA	10V \pm 5mV	Plastic Dip
MAX672CSA	10V \pm 5mV	Small Outline
TEMP RANGE: -40$^{\circ}\text{C}$ TO +85$^{\circ}\text{C}$		
MAX672ETV	10V \pm 5mV	TO-99
MAX672EJA	10V \pm 5mV	CERDIP
MAX672EPA	10V \pm 5mV	Plastic Dip
MAX672ESA	10V \pm 5mV	Small Outline
TEMP RANGE: -55$^{\circ}\text{C}$ TO +125$^{\circ}\text{C}$		
MAX672MTV	10V \pm 5mV	TO-99
MAX672MJA	10V \pm 5mV	CERDIP

(Ordering information continued on page 4.)

3

Typical Operating Circuit



MAXIM

Maxim Integrated Products 3-7

MAXIM is a registered trademark of Maxim Integrated Products.

+5V, +10V Precision Voltage References

ABSOLUTE MAXIMUM RATINGS

Input Voltage	40V	Operating Temperature Range	
Power Dissipation		MAX672M/MAX673M	-55°C to +125°C
TO99 (TV) (Derate at 7.1mW/°C above +80°C)	500mW	MAX672E/MAX673E	-40°C to +85°C
CERDIP (J) (Derate at 6.7mW/°C above +75°C)	500mW	MAX672C/MAX673C	0°C to +70°C
Plastic DIP (P) (Derate at 5.6mW/°C above +36°C)	500mW	Lead Temperature (Soldering, 60 sec)	+300°C
Small Outline (S) (Derate at 5.0mW/°C above +55°C)	300mW	DICE Junction Temperature (T _J)	-65°C to +150°C
Storage Temperature Range	-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 ratings conditions for extended periods may affect the device reliability.

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

PARAMETER	SYMBOL	CONDITIONS	MAX672			MAX673			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Output Voltage	V _O	I _L = 0	9.995	10.000	10.005	4.9975	5.000	5.0025	V
Output Adjustment Range	ΔV _{trim}	R _D = 10kΩ	±3	±6		±3	±6		%
Output Voltage Noise	e _{np-p}	0.1Hz to 10Hz (Note 6)		10	15		10	15	μV _{p-p}
Line Regulation (Note 1)		V _{IN} = 13V to 33V (MAX672) V _{IN} = 8V to 33V (MAX673)		0.006	0.010		0.006	0.010	%/V
Load Regulation (Note 1)		I _L = 0 to 10mA		0.001	0.002		0.001	0.002	%/mA
Turn-on Settling Time	t _{ON}	To ±0.1% of final value		5			5		μs
Quiescent Supply Current	I _{SY}	No Load		1.0	1.4		1.0	1.4	mA
Sink Current	I _S		-0.3	-0.5		-0.3	-0.5		mA
Short-Circuit Current	I _{SC}	V _O = 0		30			30		mA
Temperature Voltage Output	V _T	(Note 2)					630		mV

ELECTRICAL CHARACTERISTICS (V_{IN} = +15V, T_{MIN} ≤ T_A ≤ T_{MAX}, I_L = 0mA, unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	MAX672			MAX673			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Output Voltage Change with Temperature (Notes 3, 4)	ΔV _{OT}	0°C ≤ T _A ≤ +70°C -40°C ≤ T _A ≤ +85°C -55°C ≤ T _A ≤ +125°C		.014 .022 .036	.035 .055 .090		.014 .022 .036	.035 .055 .090	%
Output Voltage Change with Temperature (Notes 3, 4)	ΔV _{OT}	0°C ≤ T _A ≤ +70°C -40°C ≤ T _A ≤ +85°C -55°C ≤ T _A ≤ +125°C		1.40 2.20 3.60	3.50 5.50 9.00		0.70 1.10 1.80	1.75 2.75 4.50	mV
Output Voltage Temperature Coefficient	TCV _O	(Note 5)		2	5		2	5	ppm/°C
Line Regulation (Note 1) (V _{IN} = 13V to 33V) (MAX672)		0°C ≤ T _A ≤ +70°C		0.007	0.012		0.007	0.012	%/V
Line Regulation (Note 1) (V _{IN} = 8V to 33V) (MAX673)		-40°C ≤ T _A ≤ +85°C		0.008	0.013		0.008	0.013	%/V
Line Regulation (Note 1)		-55°C ≤ T _A ≤ +125°C		0.009	0.015		0.009	0.015	%/V
Load Regulation (I _L = 0 to 8mA) (Note 1)		0°C ≤ T _A ≤ +70°C		0.001	0.002		0.001	0.002	%/mA
Load Regulation (Note 1)		-40°C ≤ T _A ≤ +85°C		0.001	0.002		0.001	0.002	%/mA
Load Regulation (Note 1)		-55°C ≤ T _A ≤ +125°C		0.001	0.002		0.001	0.002	%/mA

- Note 1:** Line and Load Regulation specifications include the effect of self heating.
- Note 2:** Limit current in or out of pin 3 to 50mA and capacitance on pin 3 to 30pF.
- Note 3:** ΔV_{OT} is defined as the absolute difference between the maximum output voltage and the minimum output voltage over the specified temperature range expressed as a percentage of 10V (MAX672) or 5V (MAX673).
- Note 4:** ΔV_{OT} specification applies trimmed to +10.000V/5.000V or untrimmed.
- Note 5:** TCV_O is defined as ΔV_{OT} divided by the temperature range.
- Note 6:** Sample tested.

+5V, +10V Precision Voltage References

Output Adjustment

The MAX672(MAX673) trim terminal can be used to adjust the voltage over a 10V(5V) ± 300mV range. This feature allows the system designer to trim system errors by setting the reference to a voltage other than 10V(5V), including 10.240V for binary applications (see "Typical Operating Circuit" on first page).

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

Temperature Voltage Output

The MAX673 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).

$$\text{Output Voltage} = 2.1(T + 273)\text{mV}$$

where T = Temperature in °C

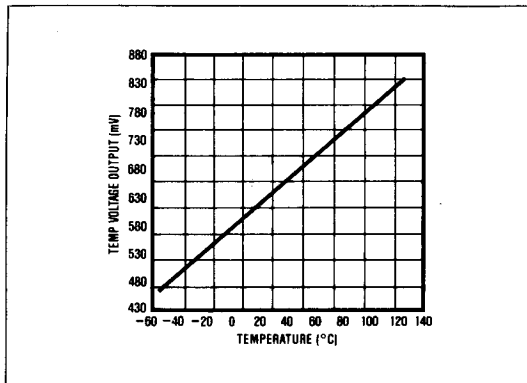
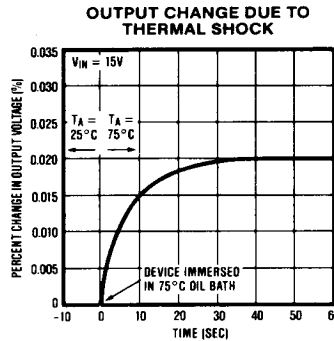
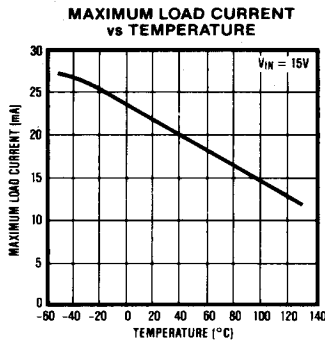
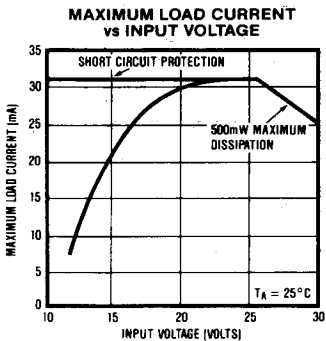
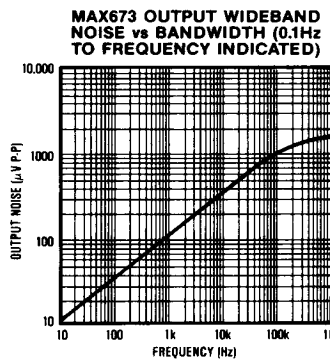
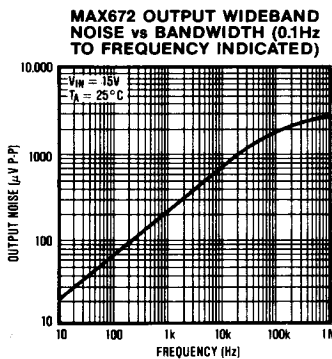
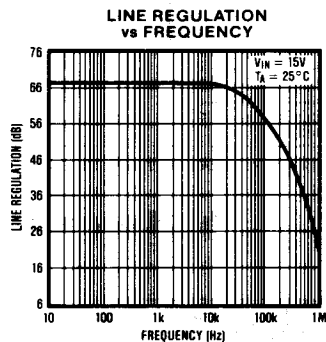


Figure 2. MAX673 Temperature Voltage Output vs. Temperature.

Typical Operating Characteristics



3

+5V, +10V Precision Voltage References

Typical Applications

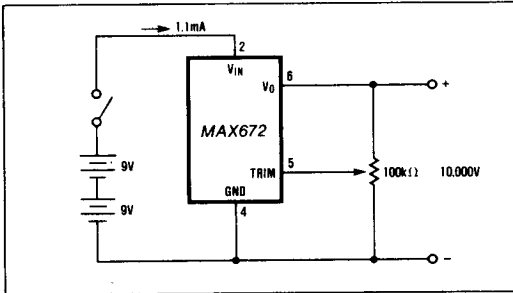


Figure 3. Precision Calibration Standard

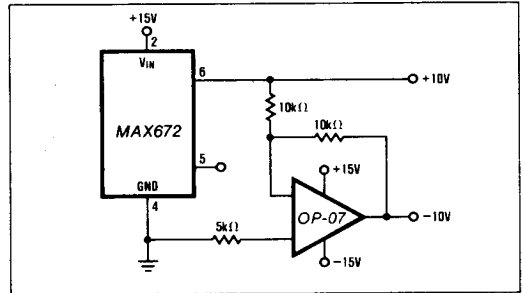


Figure 4. ±10V Reference

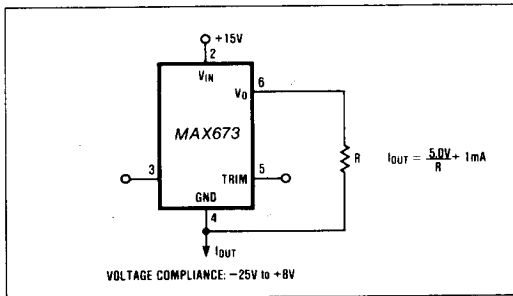


Figure 5. Current Source

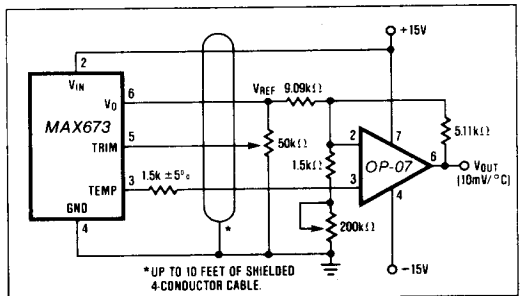
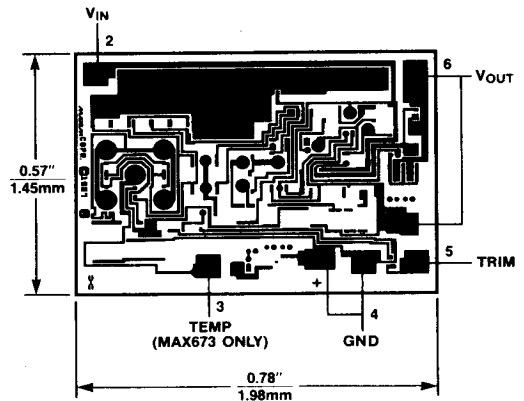


Figure 6. Precision Temperature Transducer with Remote Sensor

Ordering Information (continued)

PART	V _{OUT} @ 25°C	PACKAGE
TEMP RANGE: 0°C TO +70°C		
MAX673CTV	5V ± 2.5mV	TO-99
MAX673CPA	5V ± 2.5mV	Plastic Dip
MAX673CSA	5V ± 2.5mV	Small Outline
TEMP RANGE: -40°C TO +85°C		
MAX673ETV	5V ± 2.5mV	TO-99
MAX673EJA	5V ± 2.5mV	Hermetic Dip
MAX673EPA	5V ± 2.5mV	Plastic Dip
MAX673ESA	5V ± 2.5mV	Small Outline
TEMP RANGE: -55°C TO +125°C		
MAX673MTV	5V ± 2.5mV	TO-99
MAX673MJA	5V ± 2.5mV	Hermetic Dip

Chip Topography



Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.