MAXIM

+5V, +10V Precision Voltage References

General Description

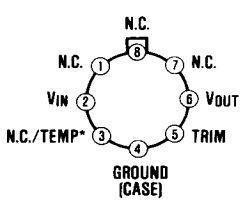
The MAX672 and MAX673 are precision voltages references that are pretrimmed to within ±.05% of 10V and 5V respectively. Both references feature excellent temperature stability (as low as 5.0 ppm/°C worst case), low current drain and low noise. The MAX673 also provides a TEMP pin whose output voltage 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

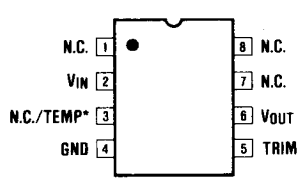
A to D Converters
D to A Converters
Digital Voltmeters
Voltage Regulators
Threshold Detectors

Pin Configuration

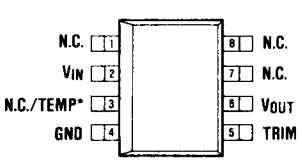
Top View



8 Lead TO-99 Metal Can



8 Lead DIP



8 Lead Small Outline

***NOTE:** Pin 3 is N.C. (No Connection) on MAX672, TEMP Output on MAX673

Features

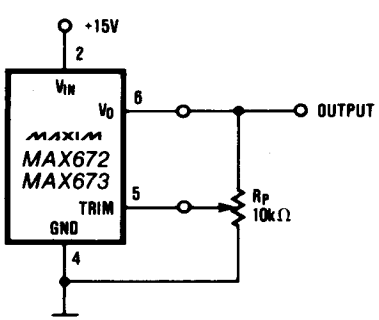
- **Pretrimmed to +5V, +10V ±0.05%**
- **Excellent Temperature Stability 2 ppm/°C**
- **Low Noise: 10μV_{p-p} (MAX673)**
- **Low Supply Current: 1.4mA Max**
- **Short Circuit Proof**
- **Load Regulation 0.001%/mA**
- **Improved REF01 and REF02**

Ordering Information

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

(Ordering information continued on page 4.)

Typical Operating Circuit



Reference with Trimmed Output

+5V, +10V Precision Voltage References

ABSOLUTE MAXIMUM RATINGS

Input Voltage 40V
Power Dissipation
TO99 (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
Small Outline (S) (Derate at 5.0mW/°C above +55°C) ... 300mW
Storage Temperature Range ..... -65°C to +150°C
Operating Temperature Range
MAX672M/MAX673M ..... -55°C to +125°C
MAX672E/MAX673E ..... -40°C to +85°C
MAX672C/MAX673C ..... 0°C to +70°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 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_p = 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, $T_{MIN} \leq T_A \leq T_{MAX}$, 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) (V_{IN} = 8V to 33V) (MAX673)		0°C ≤ T_A ≤ +70°C -40°C ≤ T_A ≤ +85°C -55°C ≤ T_A ≤ +125°C		0.007 0.008 0.009	0.012 0.013 0.015		0.007 0.008 0.009	0.012 0.013 0.015	%/V %/V
Load Regulation (I_L = 0 to 8mA) (Note 1)		0°C ≤ T_A ≤ +70°C -40°C ≤ T_A ≤ +85°C -55°C ≤ T_A ≤ +125°C		0.001 0.001 0.001	0.002 0.002 0.002		0.001 0.001 0.001	0.002 0.002 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 50nA 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.

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).

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

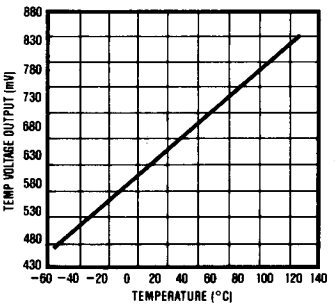
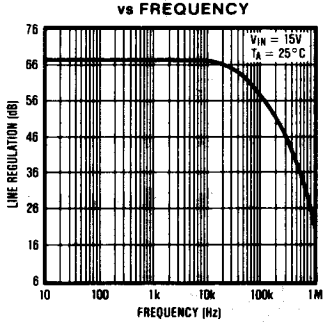


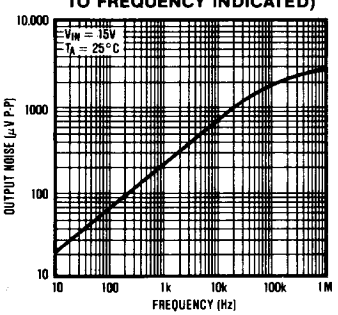
Figure 2. MAX673 Temperature Voltage Output vs. Temperature.

Typical Operating Characteristics

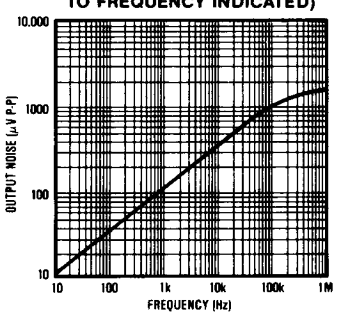
LINE REGULATION vs FREQUENCY



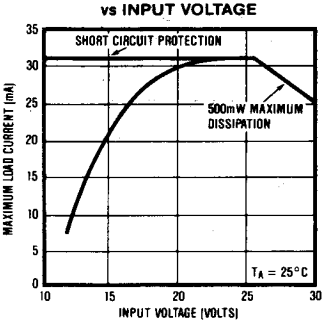
MAX672 OUTPUT WIDEBAND NOISE vs BANDWIDTH (0.1Hz TO FREQUENCY INDICATED)



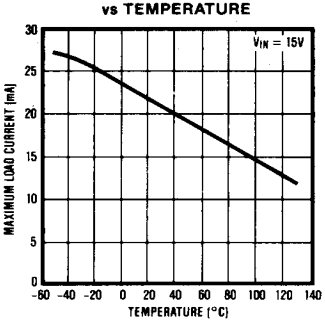
MAX673 OUTPUT WIDEBAND NOISE vs BANDWIDTH (0.1Hz TO FREQUENCY INDICATED)



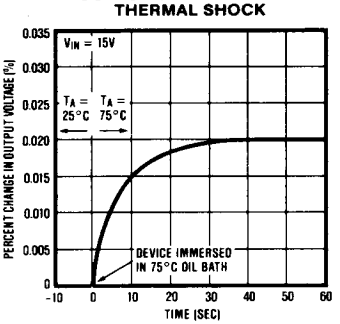
MAXIMUM LOAD CURRENT vs INPUT VOLTAGE



MAXIMUM LOAD CURRENT vs TEMPERATURE



OUTPUT CHANGE DUE TO THERMAL SHOCK



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Typical Applications

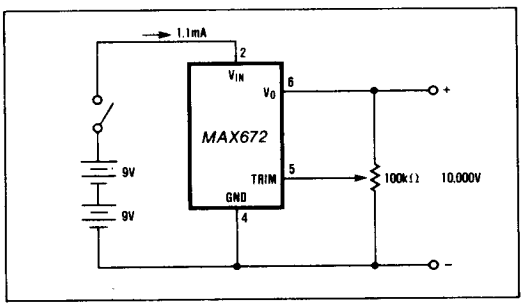

Figure 3. Precision Calibration Standard

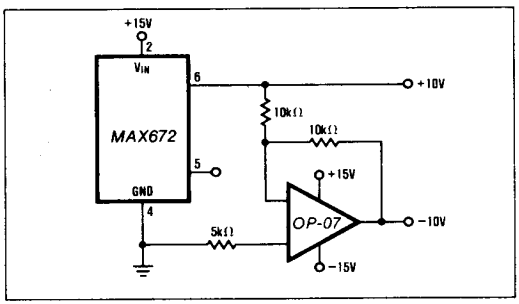

Figure 4. ±10V Reference

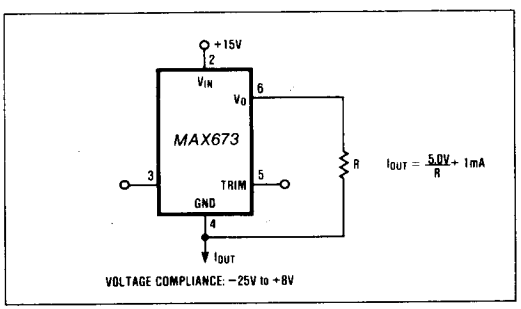

Figure 5. Current Source

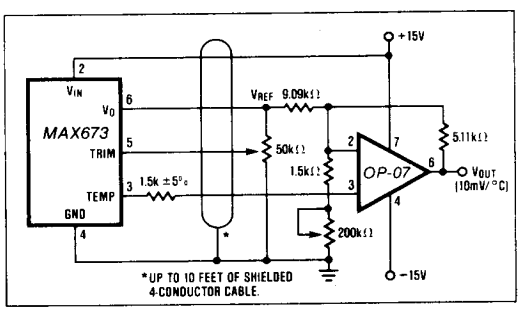

Figure 6. Precision Temperature Transducer with Remote Sensor

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