



# +10V Precision Voltage Reference

MAX674

## General Description

The MAX674 is a precision voltage reference that is pretrimmed to within  $\pm 0.15\%$  of 10V. The reference features excellent temperature stability (as low as 12.0ppm/ $^{\circ}\text{C}$  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 +10V,  $\pm 0.15\%$
- ◆ Excellent Temperature Stability: 12ppm/ $^{\circ}\text{C}$
- ◆ Low Noise: 20 $\mu\text{Vp-p}$
- ◆ Low Supply Current: 1.4mA (max)
- ◆ Short-Circuit Protected
- ◆ Load Regulation 0.001%/mA
- ◆ Pin-for-Pin Compatible with REF01

## Applications

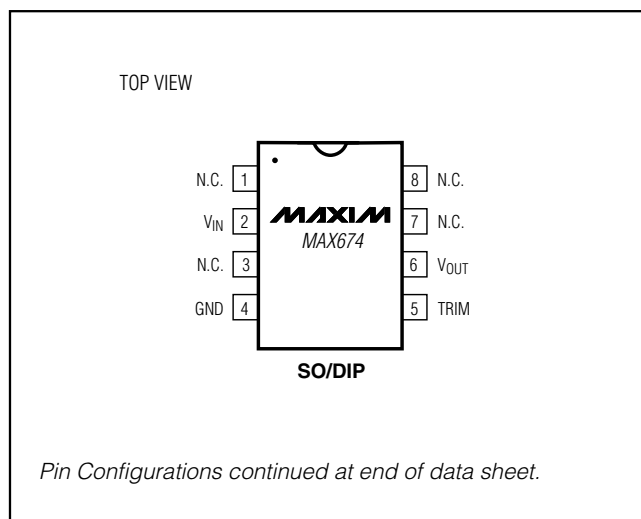
A/D Converters  
D/A Converters  
Digital Voltmeters  
Voltage Regulators  
Threshold Detectors

## Ordering Information

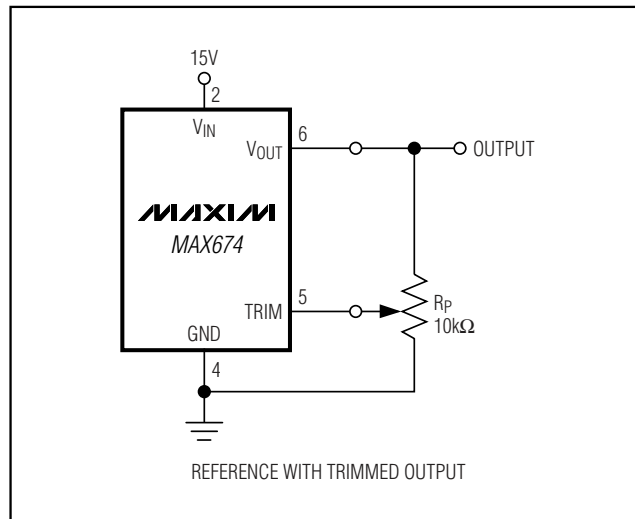
| PART      | TEMP RANGE                                       | PIN-PACKAGE | TEMPCO (ppm/ $^{\circ}\text{C}$ ) | INITIAL ERROR (mV) |
|-----------|--|-------------|-----------------------------------|--------------------|
| MAX674CPA | 0 $^{\circ}\text{C}$ to +70 $^{\circ}\text{C}$   | 8 PDIP      | 12                                | 15                 |
| MAX674CSA | 0 $^{\circ}\text{C}$ to +70 $^{\circ}\text{C}$   | 8 Narrow SO | 12                                | 15                 |
| MAX674EPA | -40 $^{\circ}\text{C}$ to +85 $^{\circ}\text{C}$ | 8 PDIP      | 15                                | 15                 |
| MAX674ESA | -40 $^{\circ}\text{C}$ to +85 $^{\circ}\text{C}$ | 8 Narrow SO | 15                                | 15                 |

Ordering Information continued at end of data sheet.

## Pin Configurations



## Typical Operating Circuit



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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 SO (S) (derate at 5.0mW/ C above +55°C) .....300mW  
 Storage Temperature Range .....-65°C to +150°C

Operating Temperature Range  
 MAX674C .....0°C to +70°C  
 MAX674E .....-40°C to +85°C  
 MAX674M .....-55°C to +125°C  
 Dice Junction Temperature (T<sub>J</sub>) .....-65°C to +150°C  
 Output Short-Circuit Duration  
 (to Ground or V<sub>IN</sub>).....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

(V<sub>IN</sub> = +15V, T<sub>A</sub> = +25°C, unless otherwise noted.)

| PARAMETER                                       | SYMBOL              | CONDITIONS                   | MIN  | TYP   | MAX   | UNITS             |
|---|---------------------|------------------------------|------|-------|-------|-------------------|
| Output Voltage Tolerance                        |                     | I <sub>L</sub> = 0mA         |      |       | ±15   | mV                |
| Output Voltage Temperature Coefficient (Note 1) | TCV <sub>O</sub>    | MAX674CTV/CPA/CSA            |      |       | 12    | ppm/°C            |
|   |                     | MAX674ETV/EJA/EPA/ESA        |      |       | 15    |                   |
|   |                     | MAX674MTV/MJA                |      |       | 20    |                   |
| Output Adjustment Range                         | V <sub>TRIM</sub>   | R <sub>p</sub> = 10          | ±300 | ±600  |       | mV                |
| Line Regulation (Note 2)                        |                     | V <sub>IN</sub> = 13V to 33V |      | 0.006 | 0.01  | %/V               |
| Load Regulation (Note 2)                        |                     | I <sub>L</sub> = 0 to 10mA   |      | 0.001 | 0.002 | %/mA              |
| Turn-On Settling Time                           | t <sub>ON</sub>     | To ±0.1% of final value      |      | 5     |       | μs                |
| Quiescent Supply Current                        | I <sub>Q</sub>      | No load                      |      | 750   | 1400  | μA                |
| Noise (Note 3)                                  | e <sub>N(P-P)</sub> | 0.1Hz to 10Hz                |      | 20    | 30    | μV <sub>P-P</sub> |
| Sink Current                                    | I <sub>S</sub>      |                              | 0.3  | 0.5   |       | mA                |
| Short-Circuit Current                           | I <sub>SC</sub>     | V <sub>OUT</sub> = 0V        |      | 30    |       | mA                |

**Note 1:** Temperature coefficient is measured by the "box" method, i.e., the maximum ΔV<sub>OUT</sub> is divided by ΔT.

**Note 2:** Line and load regulation specifications include the effect of self-heating.

**Note 3:** Guaranteed by design for MAX674CPA, MAX674CSA, MAX674EPA, MAX674ESA; sample tested for all other grades and packages.

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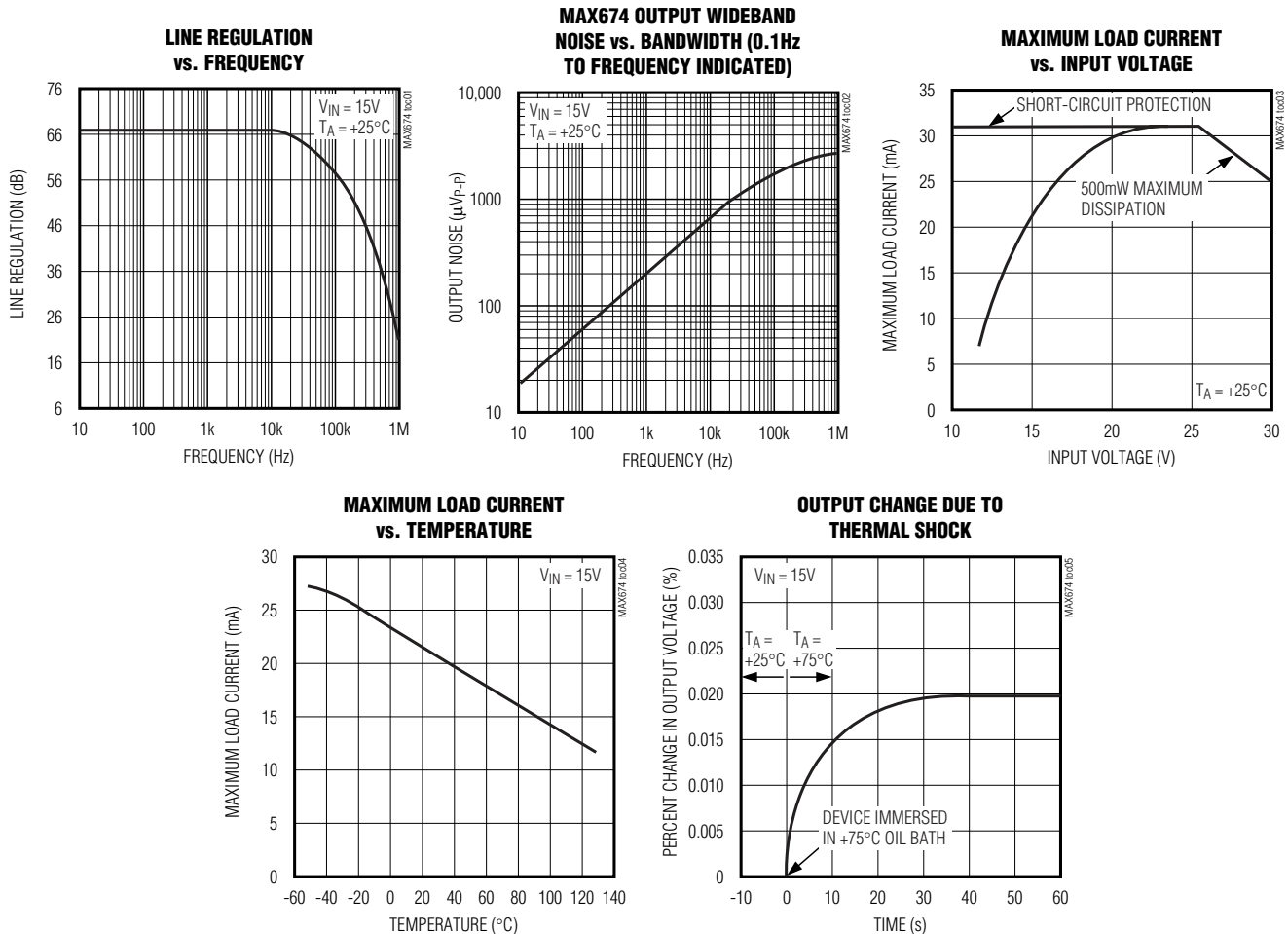
## Output Adjustment

The MAX674 trim terminal can be used to adjust the output voltage over a 10V  $\pm$ 300mV range. This feature allows system errors to be trimmed by setting the reference to a voltage other than 10V such as 10.240V for binary applications (see the *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/ $^{\circ}$ C for 100mV of output adjustment from its initial value.

## Typical Operating Characteristics

( $T_A = +25^{\circ}$ C, unless otherwise noted.)



# +10V Precision Voltage Reference

## Typical Applications

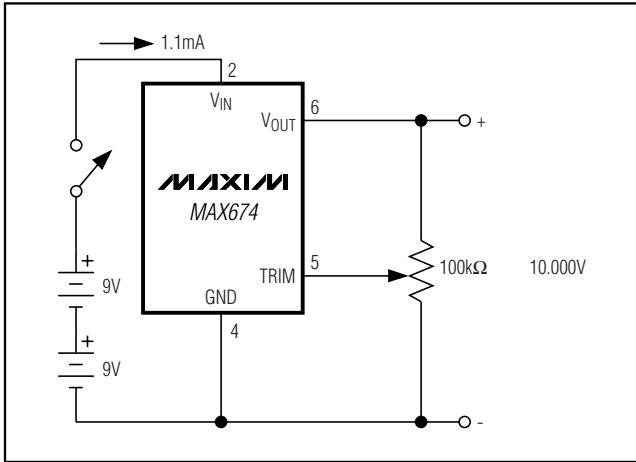


Figure 2. Precision Calibration Standard

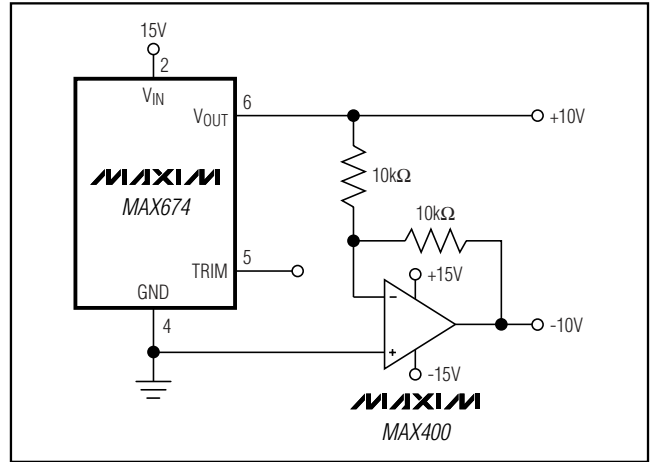


Figure 3. ±10V Reference

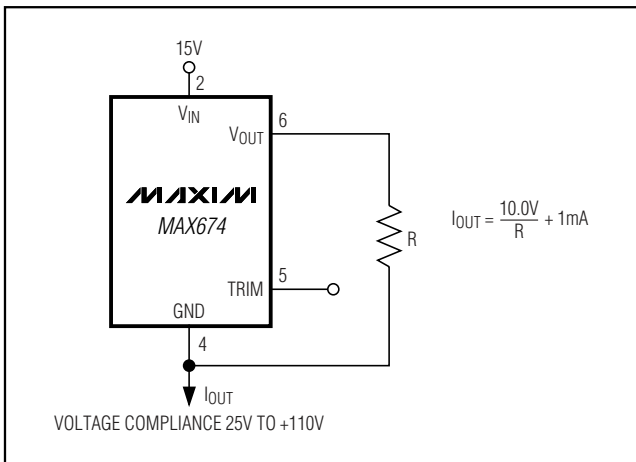


Figure 4. Current Source

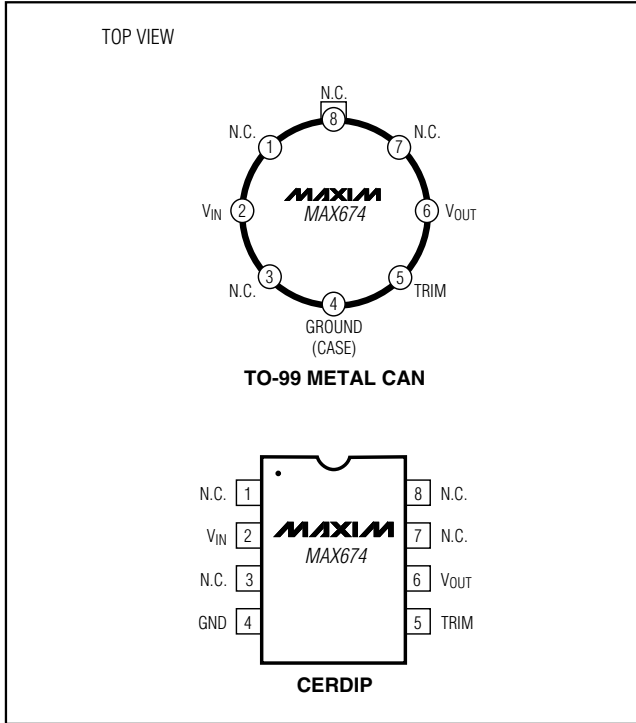
$$I_{OUT} = \frac{10.0V}{R} + 1mA$$

VOLTAGE COMPLIANCE 25V TO +110V

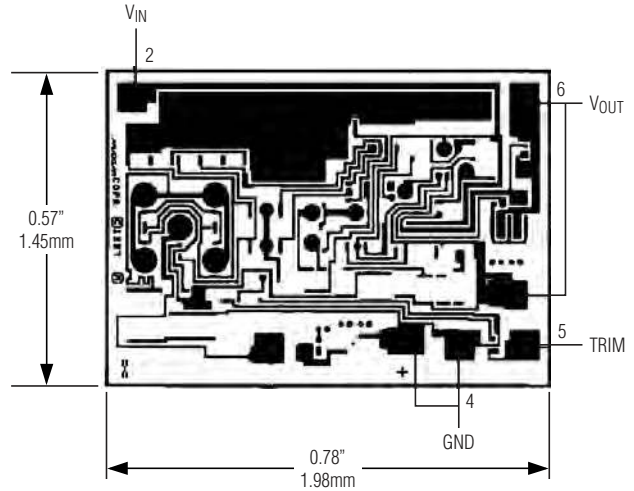
# +10V Precision Voltage Reference

**MAX674**

## Pin Configurations (continued)



## Chip Topography



## Ordering Information (continued)

| PART       | TEMP RANGE      | PIN-PACKAGE | TEMPCO (ppm/°C) | INITIAL ERROR (mV) |
|------------|-----------------|-------------|-----------------|--------------------|
| MAX674CTV* | 0°C to +70°C    | 8 TO-99     | 12              | 15                 |
| MAX674ETV* | -40°C to +85°C  | 8 TO-99     | 15              | 15                 |
| MAX674EJA* | -40°C to +85°C  | 8 CERDIP    | 15              | 15                 |
| MAX674MTV* | -55°C to +125°C | 8 TO-99     | 20              | 15                 |
| MAX674MJA* | -55°C to +125°C | 8 CERDIP    | 20              | 15                 |

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

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.

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## MAX674

### Part Number Table

**Notes:**

1. See the [MAX674 QuickView Data Sheet](#) for further information on this product family or download the [MAX674 full data sheet](#) (PDF, 108kB).
2. Other options and links for purchasing parts are listed at: <http://www.maxim-ic.com/sales>.
3. [Didn't Find What You Need?](#) Ask our applications engineers. Expert assistance in finding parts, usually within one business day.
4. Part number suffixes: T or T&R = tape and reel; + = RoHS/lead-free; # = RoHS/lead-exempt. More: See [full data sheet](#) or [Part Naming Conventions](#).
5. \* Some packages have variations, listed on the drawing. "PkgCode/Variation" tells which variation the product uses.

| Part Number     | Free Sample              | Buy Direct               | Package: TYPE PINS SIZE<br>DRAWING CODE/VAR *   | Temp          | RoHS/Lead-Free?<br>Materials Analysis                                     |
|-----------------|--------------------------|--------------------------|---|---------------|---|
| MAX674MJA/883B  | <input type="checkbox"/> | <input type="checkbox"/> |   | -55C to +125C | RoHS/Lead-Free: <a href="#">No</a>  |
| MAX674CPA       | <input type="checkbox"/> | <input type="checkbox"/> | PDIP;8 pin;.300"<br>Dwg: <a href="#">21-0043D</a> (PDF)<br>Use pkgcode/variation: P8-2* | 0C to +70C    | RoHS/Lead-Free: <a href="#">No</a><br><a href="#">Materials Analysis</a>  |
| MAX674CPA+      | <input type="checkbox"/> | <input type="checkbox"/> | PDIP;8 pin;.300"<br>Dwg: <a href="#">21-0043D</a> (PDF)<br>Use pkgcode/variation: P8+2* | 0C to +70C    | RoHS/Lead-Free: <a href="#">Yes</a><br><a href="#">Materials Analysis</a> |
| MAX674EPA-G106  | <input type="checkbox"/> | <input type="checkbox"/> | PDIP;8 pin;.300"<br>Dwg: <a href="#">21-0043D</a> (PDF)<br>Use pkgcode/variation: P8-2* | -40C to +85C  | RoHS/Lead-Free: <a href="#">No</a><br><a href="#">Materials Analysis</a>  |
| MAX674EPA+      | <input type="checkbox"/> | <input type="checkbox"/> |   | -40C to +85C  | RoHS/Lead-Free: <a href="#">Yes</a>                                       |
| MAX674EPA       | <input type="checkbox"/> | <input type="checkbox"/> | PDIP;8 pin;.300"<br>Dwg: <a href="#">21-0043D</a> (PDF)<br>Use pkgcode/variation: P8-2* | -40C to +85C  | RoHS/Lead-Free: <a href="#">No</a><br><a href="#">Materials Analysis</a>  |
| MAX674ESA-TG106 | <input type="checkbox"/> | <input type="checkbox"/> | SOIC;8 pin;.150"<br>Dwg: <a href="#">21-0041B</a> (PDF)<br>Use pkgcode/variation: S8-4* |               | RoHS/Lead-Free: <a href="#">No</a><br><a href="#">Materials Analysis</a>  |

|                 |  |  |   |              |  |
|-----------------|--|--|---|--------------|--|
| MAX674CSA-TG106 |  |  | SOIC;8 pin;.150"<br>Dwg: <a href="#">21-0041B</a> (PDF)<br>Use pkgcode/variation: S8-4* | 0C to +70C   | RoHS/Lead-Free: <a href="#">No Materials Analysis</a>  |
| MAX674CSA+T     |  |  | SOIC;8 pin;.150"<br>Dwg: <a href="#">21-0041B</a> (PDF)<br>Use pkgcode/variation: S8+4* | 0C to +70C   | RoHS/Lead-Free: <a href="#">Yes Materials Analysis</a> |
| MAX674CSA+      |  |  | SOIC;8 pin;.150"<br>Dwg: <a href="#">21-0041B</a> (PDF)<br>Use pkgcode/variation: S8+4* | 0C to +70C   | RoHS/Lead-Free: <a href="#">Yes Materials Analysis</a> |
| MAX674CSA       |  |  | SOIC;8 pin;.150"<br>Dwg: <a href="#">21-0041B</a> (PDF)<br>Use pkgcode/variation: S8-4* | 0C to +70C   | RoHS/Lead-Free: <a href="#">No Materials Analysis</a>  |
| MAX674CSA-T     |  |  | SOIC;8 pin;.150"<br>Dwg: <a href="#">21-0041B</a> (PDF)<br>Use pkgcode/variation: S8-4* | 0C to +70C   | RoHS/Lead-Free: <a href="#">No Materials Analysis</a>  |
| MAX674CSA-G106  |  |  | SOIC;8 pin;.150"<br>Dwg: <a href="#">21-0041B</a> (PDF)<br>Use pkgcode/variation: S8-4* | 0C to +70C   | RoHS/Lead-Free: <a href="#">No Materials Analysis</a>  |
| MAX674ESA+      |  |  | SOIC;8 pin;.150"<br>Dwg: <a href="#">21-0041B</a> (PDF)<br>Use pkgcode/variation: S8+4* | -40C to +85C | RoHS/Lead-Free: <a href="#">Yes Materials Analysis</a> |
| MAX674ESA+T     |  |  | SOIC;8 pin;.150"<br>Dwg: <a href="#">21-0041B</a> (PDF)<br>Use pkgcode/variation: S8+4* | -40C to +85C | RoHS/Lead-Free: <a href="#">Yes Materials Analysis</a> |
| MAX674ESA       |  |  | SOIC;8 pin;.150"<br>Dwg: <a href="#">21-0041B</a> (PDF)<br>Use pkgcode/variation: S8-4* | -40C to +85C | RoHS/Lead-Free: <a href="#">No Materials Analysis</a>  |
| MAX674ESA-T     |  |  | SOIC;8 pin;.150"<br>Dwg: <a href="#">21-0041B</a> (PDF)<br>Use pkgcode/variation: S8-4* | -40C to +85C | RoHS/Lead-Free: <a href="#">No Materials Analysis</a>  |

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