***MAXIM***

# Low-Cost, UCSP/SOT23, Micropower, High-Side Current-Sense Amplifier with Voltage Output

**MAX4372T/F/H**

## General Description

The MAX4372 low-cost, precision, high-side current-sense amplifier is available in a tiny, space-saving SOT23-5-pin package. Offered in three gain versions (T = 20V/V, F = 50V/V, and H = 100V/V), this device operates from a single 2.7V to 28V supply and consumes only 30µA. It features a voltage output that eliminates the need for gain-setting resistors and is ideal for today's notebook computers, cell phones, and other systems where battery/DC current monitoring is critical.

High-side current monitoring is especially useful in battery-powered systems since it does not interfere with the ground path of the battery charger. The input common-mode range of 0 to 28V is independent of the supply voltage and ensures that the current-sense feedback remains viable even when connected to a 2-cell battery pack in deep discharge.

The user can set the full-scale current reading by choosing the device (T, F, or H) with the desired voltage gain and selecting the appropriate external sense resistor. This capability offers a high level of integration and flexibility, resulting in a simple and compact current-sense solution. For higher bandwidth applications, refer to the MAX4173T/F/H data sheet.

## Applications

Power-Management Systems

General-System/Board-Level Current Monitoring

Notebook Computers

Portable/Battery-Powered Systems

Smart-Battery Packs/Chargers

Cell Phones

Precision-Current Sources

## Pin Configurations



Pin Configurations continued at end of datasheet.
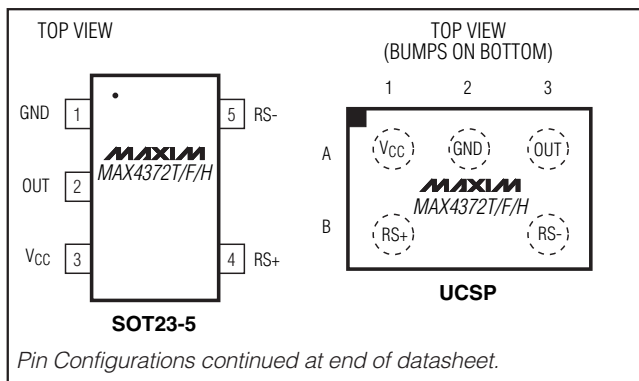
## Features

♦ **Low-Cost, Compact Current-Sense Solution**

♦ **30µA Supply Current**

♦ **2.7V to 28V Operating Supply**

♦ **0.18% Full-Scale Accuracy**

♦ **0.3mV Input Offset Voltage**

♦ **Low 1.5Ω Output Impedance**

♦ **Three Gain Versions Available**
   **20V/V (MAX4372T)**
   **50V/V (MAX4372F)**
   **100V/V (MAX4372H)**

♦ **Wide 0 to 28V Common-Mode Range, Independent of Supply Voltage**

♦ **Available in a Space-Saving 5-Pin SOT23 Package and 3 x 2 UCSP™ (1mm x 1.5mm) Package**

## Ordering Information

| PART | TEMP RANGE | PIN-PACKAGE | TOP MARK |
|------|-----------|-------------|----------|
| **MAX4372T**EUK-T | -40°C to +85°C | 5 SOT23-5 | ADIU |
| MAX4372TESA | -40°C to +85°C | 8 SO | — |
| MAX4372TEBT-T | -40°C to +85°C | 3 x 2 UCSP | ACX |

**Note:** *Gain values are as follows: 20V/V for the T version, 50V/V for the F version, and 100V/V for the H version.*
**Ordering Information continued at end of datasheet.**

## Typical Operating Circuit
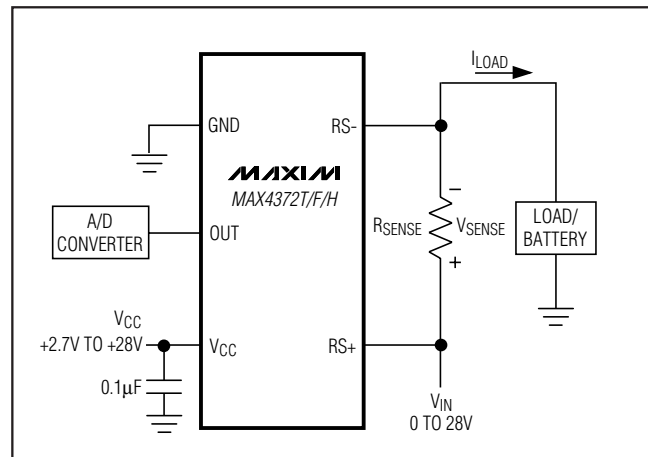


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*For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.*

# Low-Cost, UCSP/SOT23, Micropower, High-Side Current-Sense Amplifier with Voltage Output

## ABSOLUTE MAXIMUM RATINGS

$V_{CC}$, RS+, RS- to GND ...........................................-0.3V to +30V
OUT to GND ...........................................................-0.3V to +15V
Differential Input Voltage ($V_{RS+}$ - $V_{RS-}$) ..............................±0.3V
Current into Any Pin...........................................................±10mA
Continuous Power Dissipation ($T_A$ = +70°C)
  5-Pin SOT23 (derate 7.1mW/°C above +70°C)............571mW
  8-Pin SO (derate 5.88mW/°C above +70°C)................471mW
  3 x 2 UCSP (derate 3.4mW/°C above +70°C) ...........273.2mW

Operating Temperature Range ..........................-40°C to +85°C
Storage Temperature Range ............................-65°C to +150°C
Lead Temperature (soldering, 10s). ...............................+300°C
Bump Temperature (soldering)
  Infrared (15s) ...............................................................+200°C
  Vapor Phase (20s) .......................................................+215°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

($V_{RS+}$ = 0 to 28V, $V_{CC}$ = 2.7V to 28V, $V_{SENSE}$ = 0, $R_{LOAD}$ = 1MΩ, $T_A$ = $T_{MIN}$ to $T_{MAX}$, unless otherwise noted. Typical values are at $T_A$ = +25°C.) (Note 1)

| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Operating Voltage Range (Note 2) | $V_{CC}$ | | | 2.7 | | 28 | V |
| Common-Mode Input Range (Note 3) | $V_{CMR}$ | | | 0 | | 28 | V |
| Common-Mode Rejection | CMR | $V_{RS+}$ > 2V | | | 85 | | dB |
| Supply Current | $I_{CC}$ | $V_{RS+}$ > 2V, $V_{SENSE}$ = 5mV | | | 30 | 60 | µA |
| Leakage Current | $I_{RS+}$, $I_{RS-}$ | $V_{CC}$ = 0 | | | 0.05 | 1.2 | µA |
| Input Bias Current | $I_{RS+}$ | $V_{RS+}$ > 2V | | 0 | | 1 | µA |
| | | $V_{RS+}$ ≤ 2V | | -25 | | 2 | |
| | $I_{RS-}$ | $V_{RS+}$ > 2V | | 0 | | 2 | |
| | | $V_{RS+}$ ≤ 2V | | -50 | | 2 | |
| Full-Scale Sense Voltage (Note 4) | $V_{SENSE}$ | Gain = 20V/V or 50V/V | | | 150 | | mV |
| | | Gain = 100V/V | | | 100 | | |
| Input Offset Voltage (Note 5) | $V_{OS}$ | $T_A$ = +25°C $V_{CC}$ = $V_{RS+}$ = 12V | MAX4372_ESA | | 0.3 | ±0.8 | mV |
| | | | MAX4372_EUK, _EBT | | 0.3 | ±1.3 | |
| | | $T_A$ = $T_{MIN}$ to $T_{MAX}$ $V_{CC}$ = $V_{RS+}$ = 12V | MAX4372_ESA | | | ±1.1 | |
| | | | MAX4372_EUK, _EBT | | | ±1.9 | |
| Full-Scale Accuracy (Note 5) | | $V_{SENSE}$ = 100mV, $V_{CC}$ = 12V, $V_{RS+}$ = 12V, $T_A$ = +25°C (Note 7) | | | ±0.18 | ±3 | % |
| Total OUT Voltage Error (Note 6) | | $V_{SENSE}$ = 100mV, $V_{CC}$ = 12V, $V_{RS+}$ = 12V (Note 7) | | | | ±6 | % |
| | | $V_{SENSE}$ = 100mV, $V_{CC}$ = 28V, $V_{RS+}$ = 28V (Note 7) | | | ±0.15 | ±7 | |
| | | $V_{SENSE}$ = 100mV, $V_{CC}$ = 12V, $V_{RS+}$ = 0.1V (Note 7) | | | ±1 | ±28 | |
| | | $V_{SENSE}$ = 6.25mV, $V_{CC}$ = 12V, $V_{RS+}$ = 12V (Note 8) | | | ±0.15 | | |
| OUT Low Voltage | | $V_{CC}$ = 2.7V | $I_{OUT}$ = 10µA | | 2.6 | | mV |
| | | | $I_{OUT}$ = 100µA | | 9 | 65 | |
| OUT High Voltage | $V_{CC}$ - $V_{OH}$ | $V_{CC}$ = 2.7V, $I_{OUT}$ = -500µA | | | 0.1 | 0.25 | V |

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## ELECTRICAL CHARACTERISTICS (continued)

($V_{RS+}$ = 0 to 28V, $V_{CC}$ = 2.7V to 28V, $V_{SENSE}$ = 0, $R_{LOAD}$ = 1MΩ, $T_A$ = $T_{MIN}$ to $T_{MAX}$, unless otherwise noted. Typical values are at $T_A$ = +25°C.) (Note 1)

| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| -3dB Bandwidth | BW | $V_{RS+}$ = 12V, $V_{CC}$ = 12V, $C_{LOAD}$ = 10pF | $V_{SENSE}$ = 20mV, gain = 20V/V | | 275 | | kHz |
| | | | $V_{SENSE}$ = 20mV, gain = 50V/V | | 200 | | |
| | | | $V_{SENSE}$ = 20mV, gain = 100V/V | | 110 | | |
| | | | $V_{SENSE}$ = 6.25mV | | 50 | | |
| Gain | | MAX4372T | | | 20 | | V/V |
| | | MAX4372F | | | 50 | | |
| | | MAX4372H | | | 100 | | |
| Gain Accuracy | | $V_{SENSE}$ = 20mV to 100mV | $T_A$ = +25°C | | ±0.25 | ±2.5 | % |
| | | | $T_A$ = -40°C to +85°C | | | ±5.5 | |
| OUT Settling Time to 1% of Final Value | | Gain = 20V/V, $V_{CC}$ = 12V, $V_{RS+}$ = 12V, $C_{LOAD}$ = 10pF | $V_{SENSE}$ = 6.25mV to 100mV | | 20 | | µs |
| | | | $V_{SENSE}$ = 100mV to 6.25mV | | 20 | | |
| Capacitive-Load Stability | | No sustained oscillations | | | 1000 | | pF |
| OUT Output Resistance | $R_{OUT}$ | $V_{SENSE}$ = 100mV | | | 1.5 | | Ω |
| Power-Supply Rejection | PSR | $V_{OUT}$ = 2V, $V_{RS+}$ > 2V | | 75 | 85 | | dB |
| Power-Up Time to 1% of Final Value | | $V_{CC}$ = 12V, $V_{RS+}$ = 12V, $V_{SENSE}$ = 100mV, $C_{LOAD}$ = 10pF | | | 0.5 | | ms |
| Saturation Recovery Time (Note 9) | | $V_{CC}$ = 12V, $V_{RS+}$ = 12V, $C_{LOAD}$ = 10pF | | | 0.1 | | ms |

**Note 1:** All devices are 100% production tested at $T_A$ = +25°C. All temperature limits are guaranteed by design.
**Note 2:** Guaranteed by PSR test.
**Note 3:** Guaranteed by OUT Voltage Error test.
**Note 4:** Output voltage is internally clamped not to exceed 12V.
**Note 5:** $V_{OS}$ is extrapolated from the gain accuracy tests.
**Note 6:** Total OUT voltage error is the sum of gain and offset voltage errors.
**Note 7:** Measured at $I_{OUT}$ = -500µA ($R_{LOAD}$ = 4kΩ for gain = 20V/V, $R_{LOAD}$ = 10kΩ for gain = 50V/V, $R_{LOAD}$ = 20kΩ for gain = 100V/V).
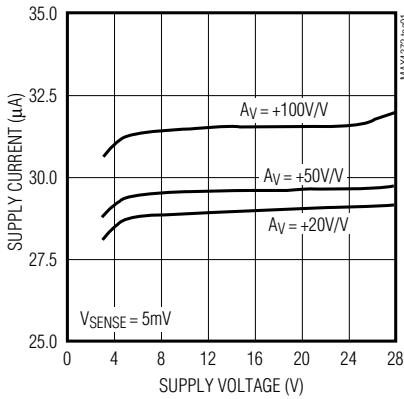**Note 8:** 6.25mV = 1/16 of 100mV full-scale voltage (C/16).
**Note 9:** The device will not reverse phase when overdriven.

MAX4372T/F/H

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# Low-Cost, UCSP/SOT23, Micropower, High-Side Current-Sense Amplifier with Voltage Output
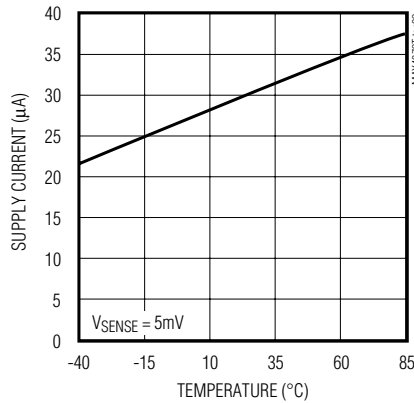
MAX4372T/F/H

## _Typical Operating Characteristics_

($V_{CC}$ = 12V, $V_{RS+}$ = 12V, $V_{SENSE}$ = 100mV, $T_A$ = +25°C, unless otherwise noted.)
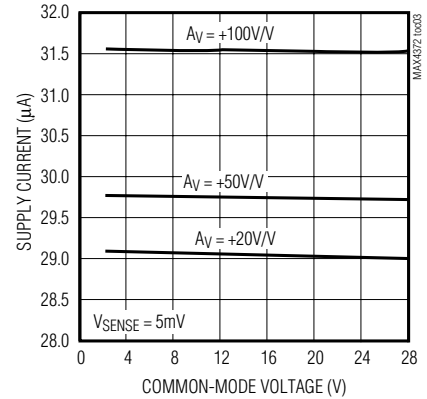


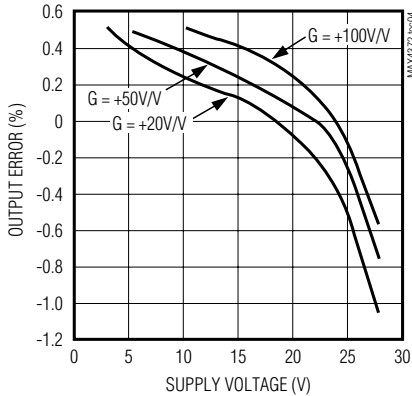SUPPLY CURRENT vs. SUPPLY VOLTAGE
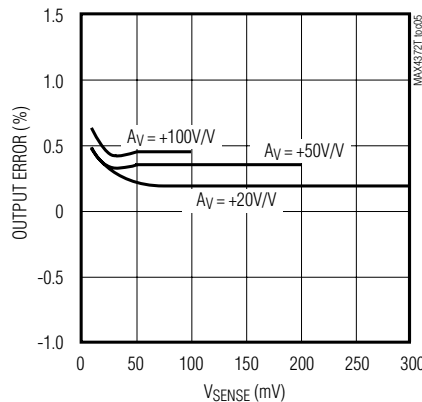


SUPPLY CURRENT vs. TEMPERATURE



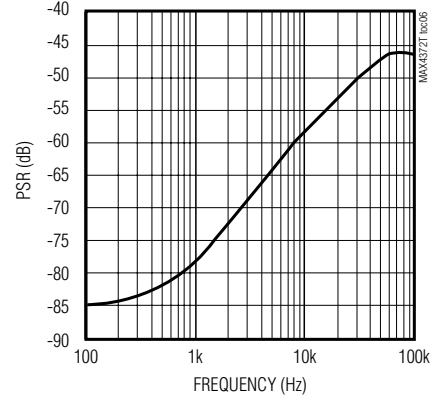SUPPLY CURRENT vs. COMMON-MODE VOLTAGE
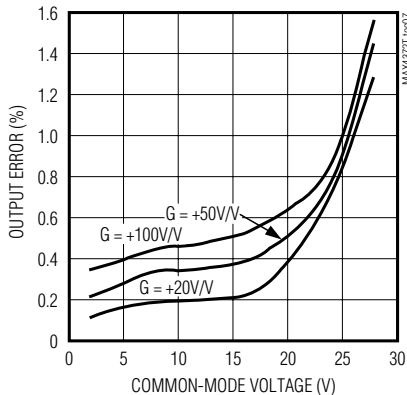


TOTAL OUTPUT ERROR vs. SUPPLY VOLTAGE



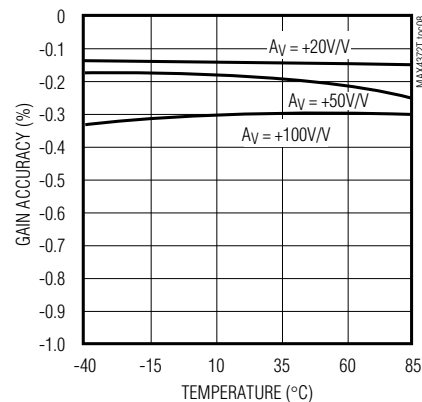TOTAL OUTPUT ERROR vs. $V_{SENSE}$



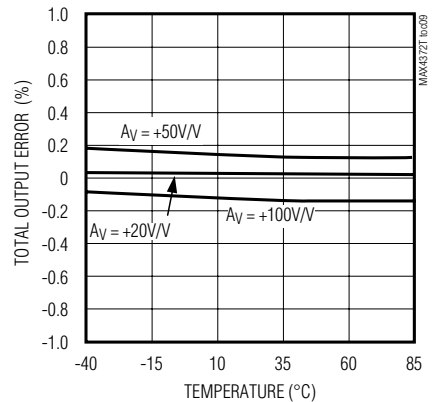POWER-SUPPLY REJECTION vs. FREQUENCY



TOTAL OUTPUT ERROR vs. COMMON-MODE VOLTAGE



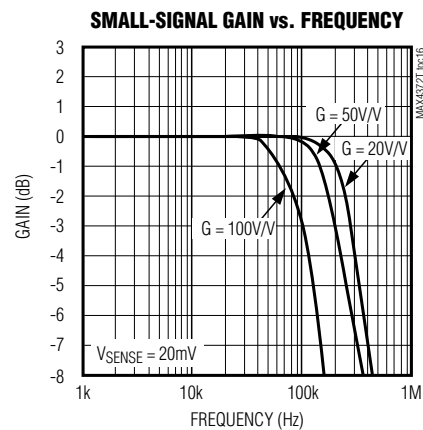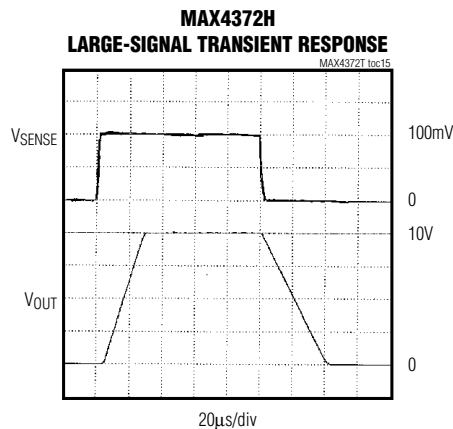GAIN ACCURACY vs. TEMPERATURE



TOTAL OUTPUT ERROR vs. TEMPERATURE

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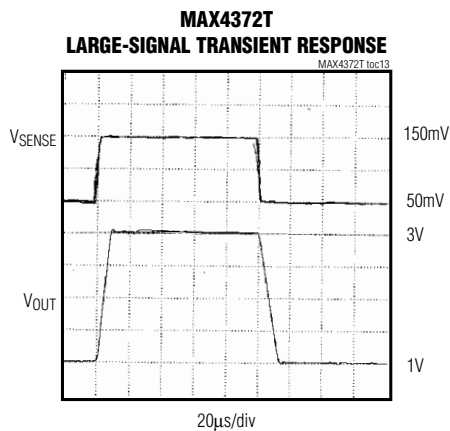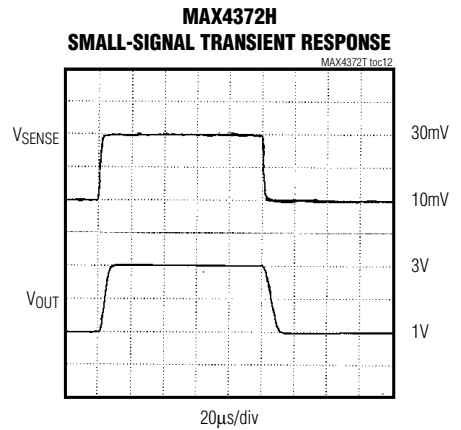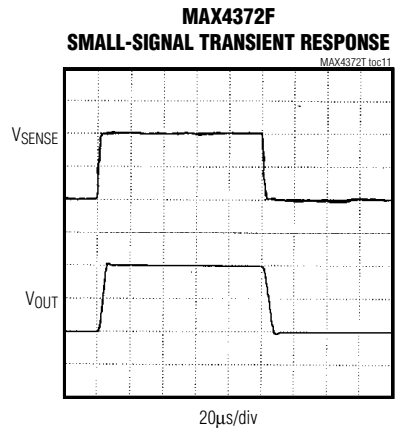# Low-Cost, UCSP/SOT23, Micropower, High-Side Current-Sense Amplifier with Voltage Output

## _____*Typical Operating Characteristics (continued)*

(V$_{CC}$ = 12V, V$_{RS+}$ = 12V, V$_{SENSE}$ = 100mV, T$_A$ = +25°C, unless otherwise noted.)

**MAX4372T
SMALL-SIGNAL TRANSIENT RESPONSE**

MAX4372T toc10

V$_{SENSE}$ ... 30mV ... 10mV

V$_{OUT}$ ... 600mV ... 200mV

20µs/div

**MAX4372F
SMALL-SIGNAL TRANSIENT RESPONSE**

MAX4372T toc11

V$_{SENSE}$ ... 30mV ... 10mV

V$_{OUT}$ ... 1.5V ... 0.5V

20µs/div

**MAX4372H
SMALL-SIGNAL TRANSIENT RESPONSE**

MAX4372T toc12

V$_{SENSE}$ ... 30mV ... 10mV

V$_{OUT}$ ... 3V ... 1V

20µs/div

**MAX4372T
LARGE-SIGNAL TRANSIENT RESPONSE**

MAX4372T toc13

V$_{SENSE}$ ... 150mV ... 50mV

V$_{OUT}$ ... 3V ... 1V

20µs/div

**MAX4372F
LARGE-SIGNAL TRANSIENT RESPONSE**

MAX4372T toc14

V$_{SENSE}$ ... 150mV ... 50mV

V$_{OUT}$ ... 7.5V ... 2.5V

20µs/div

**MAX4372H
LARGE-SIGNAL TRANSIENT RESPONSE**

MAX4372T toc15

V$_{SENSE}$ ... 100mV ... 0

V$_{OUT}$ ... 10V ... 0

20µs/div

**SMALL-SIGNAL GAIN vs. FREQUENCY**

MAX4372T toc16

GAIN (dB): 3, 2, 1, 0, -1, -2, -3, -4, -5, -6, -7, -8

G = 50V/V
G = 20V/V
G = 100V/V
V$_{SENSE}$ = 20mV

FREQUENCY (Hz): 1k, 10k, 100k, 1M

**MAX4372T/F/H**

| PIN | | | NAME | FUNCTION |
|---|---|---|---|---|
| SOT23 | SO | UCSP | | |
| 1 | 3 | A2 | GND | Ground |
| 2 | 4 | A3 | OUT | Output Voltage. $V_{OUT}$ is proportional to the magnitude of $V_{SENSE}$ ($V_{RS+}$ - $V_{RS-}$). |
| 3 | 1 | A1 | $V_{CC}$ | Supply Voltage. Use at least a 0.1µF capacitor to decouple $V_{CC}$ from fast transients. |
| 4 | 8 | B1 | RS+ | Power Connection to the External Sense Resistor |
| 5 | 6 | B3 | RS- | Load-Side Connection to the External Sense Resistor |
| — | 2, 5, 7 | — | N.C. | No Connection. Not internally connected. |

## _____*Detailed Description*

The MAX4372 high-side current-sense amplifier features a 0 to 28V input common-mode range that is independent of supply voltage. This feature allows the monitoring of current flow out of a battery in deep discharge, and also enables high-side current sensing at voltages far in excess of the supply voltage ($V_{CC}$).

Current flows through the sense resistor, generating a sense voltage (Figure 1). Since A1's inverting input is high impedance, the voltage on the negative terminal equals $V_{IN}$ - $V_{SENSE}$. A1 forces its positive terminal to match its negative terminal; therefore, the voltage across $R_{G1}$ ($V_{IN}$ - V1-) equals $V_{SENSE}$. This creates a current to flow through $R_{G1}$ equal to $V_{SENSE}$ / $R_{G1}$. The transistor and current mirror amplify the current by a factor of β. This makes the current flowing out of the current mirror equal to:

$$I_M = \beta \, V_{SENSE} / R_{G1}$$

A2's positive terminal presents high impedance, so this current flows through $R_{GD}$, with the following result:

$$V2+ = R_{GD} \, \beta \cdot V_{SENSE} / R_{G1}$$

R1 and R2 set the closed-loop gain for A2, which amplifies V2+, yielding:

$$V_{OUT} = R_{GD} \cdot \beta \cdot V_{SENSE} / R_{G1} \, (1 + R2 / R1)$$

The gain of the device equals:

$$\frac{V_{OUT}}{V_{SENSE}} = R_{GD} \cdot \beta \, (1 + R2 / R1) / R_{G1}$$

## _____*Applications Information*

### *Recommended Component Values*

The MAX4372 operates over a wide variety of current ranges with different sense resistors. Table 1 lists common resistor values for typical operation of the MAX4372.
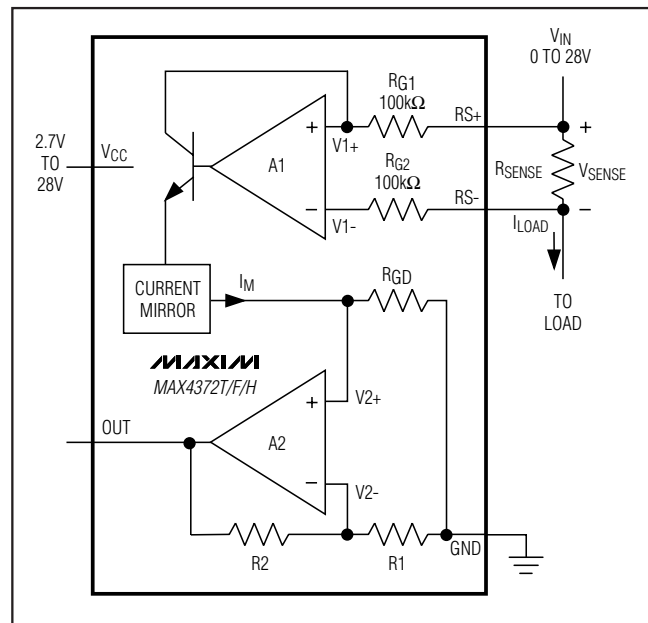


*Figure 1. Functional Diagram*

### *Choosing R$_{SENSE}$*

Given the gain and maximum load current, select $R_{SENSE}$ such that $V_{OUT}$ does not exceed $V_{CC}$ - 0.25V or 10V. To measure lower currents more accurately, use a high value for $R_{SENSE}$. A higher value develops a higher sense voltage, which overcomes offset voltage errors of the internal current amplifier.

In applications monitoring very high current, ensure $R_{SENSE}$ is able to dissipate its own $I^2R$ losses. If the resistor's rated power dissipation is exceeded, its value may drift or it may fail altogether, causing a differential voltage across the terminals in excess of the absolute maximum ratings.

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## Table 1. Recommended Component Values

| FULL-SCALE LOAD CURRENT, $I_{LOAD}$ (A) | CURRENT-SENSE RESISTOR, $R_{SENSE}$ (m$\Omega$) | GAIN (V/V) | FULL-SCALE OUTPUT VOLTAGE (FULL-SCALE $V_{SENSE}$ = 100mV), $V_{OUT}$ (V) |
|---|---|---|---|
| 0.1 | 1000 | 20 | 2.0 |
|  |  | 50 | 5.0 |
|  |  | 100 | 10.0 |
| 1 | 100 | 20 | 2.0 |
|  |  | 50 | 5.0 |
|  |  | 100 | 10.0 |
| 5 | 20 | 20 | 2.0 |
|  |  | 50 | 5.0 |
|  |  | 100 | 10.0 |
| 10 | 10 | 20 | 2.0 |
|  |  | 50 | 5.0 |
|  |  | 100 | 10.0 |

### Using a PC Board Trace as $R_{SENSE}$

If the cost of $R_{SENSE}$ is an issue and accuracy is not critical, use the alternative solution shown in Figure 2. This solution uses copper PC board traces to create a sense resistor. The resistivity of a 0.1-inch-wide trace of 2-ounce copper is about 30m$\Omega$/ft. The resistance temperature coefficient of copper is fairly high (approximately 0.4%/°C), so systems that experience a wide temperature variance must compensate for this effect. In addition, self-heating will introduce a nonlinearity error. Do not exceed the maximum power dissipation of the copper trace.

For example, the MAX4372T (with a maximum load current of 10A and an $R_{SENSE}$ of 5m$\Omega$) creates a full-scale $V_{SENSE}$ of 50mV that yields a maximum $V_{OUT}$ of 1V. $R_{SENSE}$, in this case, requires about 2 inches of 0.1-inch-wide copper trace.

### ____UCSP Applications Information

For the latest application details on UCSP construction, dimensions, tape carrier information, printed circuit board techniques, bump-pad layout, and recommended reflow temperature profile, as well as the latest information on reliability testing results, go to the Maxim's website at www.maxim-ic.com/ucsp to find the Application Note: *UCSP—A Wafer-Level Chip-Scale Package.*
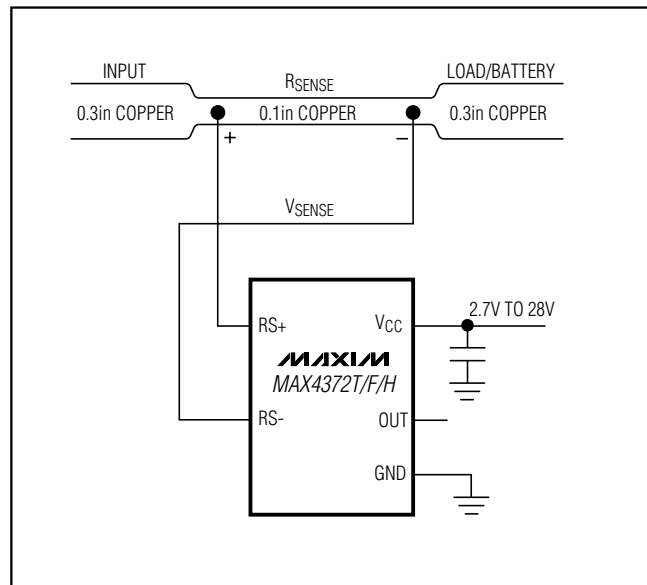


Figure 2. Connections Showing Use of PC Board

**MAX4372T/F/H** *(vertical side text)*

## __Ordering Information (continued)

| PART | TEMP RANGE | PIN-PACKAGE | TOP MARK |
|---|---|---|---|
| **MAX4372F**EUK-T | -40°C to +85°C | 5 SOT23-5 | ADIV |
| MAX4372FESA | -40°C to +85°C | 8 SO | — |
| MAX4372FEBT-T | -40°C to +85°C | 3 x 2 UCSP | ACY |
| **MAX4372H**EUK-T | -40°C to +85°C | 5 SOT23-5 | ADIW |
| MAX4372HESA | -40°C to +85°C | 8 SO | — |
| MAX4372HEBT-T | -40°C to +85°C | 3 x 2 UCSP | ACZ |

## _____Chip Information

TRANSISTOR COUNT: 225

PROCESS: BiCMOS

## _____Pin Configurations (continued)



```
V_CC  1        8  RS+
N.C.  2        7  N.C.
         MAXIM
       MAX4372T/F/H
GND   3        6  RS-
OUT   4        5  N.C.
```

**SO**
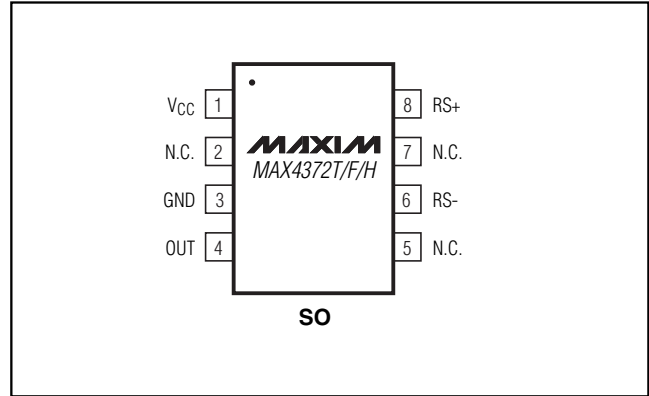
## _____Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)



| | COMMON DIMENSIONS |
|---|---|
| A | 0.62+0.05−0.08 |
| A1 | 0.29±0.02 |
| A2 | 0.33 REF. |
| b | Ø0.35±0.03 |
| D1 | 0.50 BASIC |
| E1 | 1.00 BASIC |
| e | 0.50 BASIC |
| SD | 0.25 BASIC |
| SE | 0.00 BASIC |

| PKG. CODE | VARIABLE DIMENSIONS D | VARIABLE DIMENSIONS E | DEPOPULATED SOLDER BALLS |
|---|---|---|---|
| B6-1 | 1.00±0.05 | 1.52±0.05 | NONE |
| B6-2 | 1.00±0.05 | 1.52±0.05 | B2 |
| B6-3 | 1.05±0.05 | 1.57±0.05 | NONE |
| B6-4 | 1.05±0.05 | 1.57±0.05 | B2 |
| B6-5 | 0.97±0.05 | 1.46±0.05 | NONE |
| B6-6 | 1.16±0.05 | 1.57±0.05 | NONE |

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. PRODUCT MARKING: NUMBER OF CHARACTERS AND LINES VARY PER PRODUCT.

TOP VIEW

BOTTOM VIEW

SIDE VIEW

6L, UCSP.EPS

**DALLAS SEMICONDUCTOR** **/VI/IXI/VI**
PROPRIETARY INFORMATION
TITLE: PACKAGE OUTLINE, 3x2 UCSP
APPROVAL | DOCUMENT CONTROL NO. 21-0097 | REV. G | 1/1
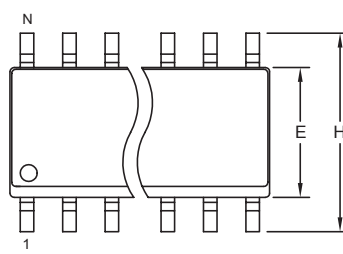
**Note**: MAX4372_EBT uses package code B6-2.
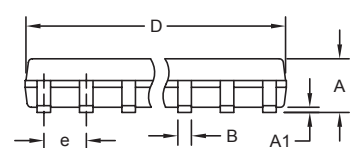
**/VI/IXI/VI**

## Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

SOICN.EPS

**MAX4372T/F/H**

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.053 | 0.069 | 1.35 | 1.75 |
| A1 | 0.004 | 0.010 | 0.10 | 0.25 |
| B | 0.014 | 0.019 | 0.35 | 0.49 |
| C | 0.007 | 0.010 | 0.19 | 0.25 |
| e | 0.050 BSC | | 1.27 BSC | |
| E | 0.150 | 0.157 | 3.80 | 4.00 |
| H | 0.228 | 0.244 | 5.80 | 6.20 |
| L | 0.016 | 0.050 | 0.40 | 1.27 |

VARIATIONS:

| | INCHES | | MILLIMETERS | | | |
|---|---|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX | N | MS012 |
| D | 0.189 | 0.197 | 4.80 | 5.00 | 8 | AA |
| D | 0.337 | 0.344 | 8.55 | 8.75 | 14 | AB |
| D | 0.386 | 0.394 | 9.80 | 10.00 | 16 | AC |

N

TOP VIEW

1

D

A

e    B    A1

FRONT VIEW

C

L

0∞-8∞

SIDE VIEW

E    H

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm (.006").
3. LEADS TO BE COPLANAR WITHIN 0.10mm (.004").
4. CONTROLLING DIMENSION: MILLIMETERS.
5. MEETS JEDEC MS012.
6. N = NUMBER OF PINS.

**DALLAS** SEMICONDUCTOR  **MAXIM**

PROPRIETARY INFORMATION

TITLE:
PACKAGE OUTLINE, .150" SOIC

| APPROVAL | DOCUMENT CONTROL NO. | REV. | |
|---|---|---|---|
| | 21-0041 | B | 1/1 |

**MAXIM**

9

**MAX4372T/F/H**

## Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)
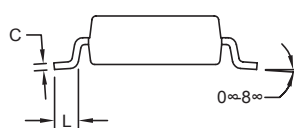


| SYMBOL | MIN | MAX |
|--------|-----|-----|
| A | 0.90 | 1.45 |
| A1 | 0.00 | 0.15 |
| A2 | 0.90 | 1.30 |
| b | 0.35 | 0.50 |
| C | 0.08 | 0.20 |
| D | 2.80 | 3.00 |
| E | 2.60 | 3.00 |
| E1 | 1.50 | 1.75 |
| L | 0.35 | 0.60 |
| L1 | 0.60 REF | |
| e | 0.95 BSC. | |
| e1 | 1.90 BSC. | |
| α | 0° | 8° |

TOP VIEW

SIDE VIEW

FRONT VIEW

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. FOOT LENGTH MEASURED AT INTERCEPT POINT BETWEEN DATUM A & LEAD SURFACE.
3. PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH & METAL BURR. MOLD FLASH, PROTRUSION OR METAL BURR SHOULD NOT EXCEED 0.25 MM.
4. PACKAGE OUTLINE INCLUSIVE OF SOLDER PLATING.
5. MEETS JEDEC MO178, VARIATION AA.
6. LEADS TO BE COPLANAR WITHIN 0.10 mm.
7. SOLDER THICKNESS MEASURED AT FLAT SECTION OF LEAD BETWEEN 0.08mm AND 0.15mm FROM LEAD TIP.

**DALLAS SEMICONDUCTOR** /\/\/\XI/\/\
PROPRIETARY INFORMATION

TITLE:
PACKAGE OUTLINE, SOT-23, 5L

| APPROVAL | DOCUMENT CONTROL NO. | REV. | |
|----------|---------------------|------|---|
| | 21-0057 | E | 1/1 |
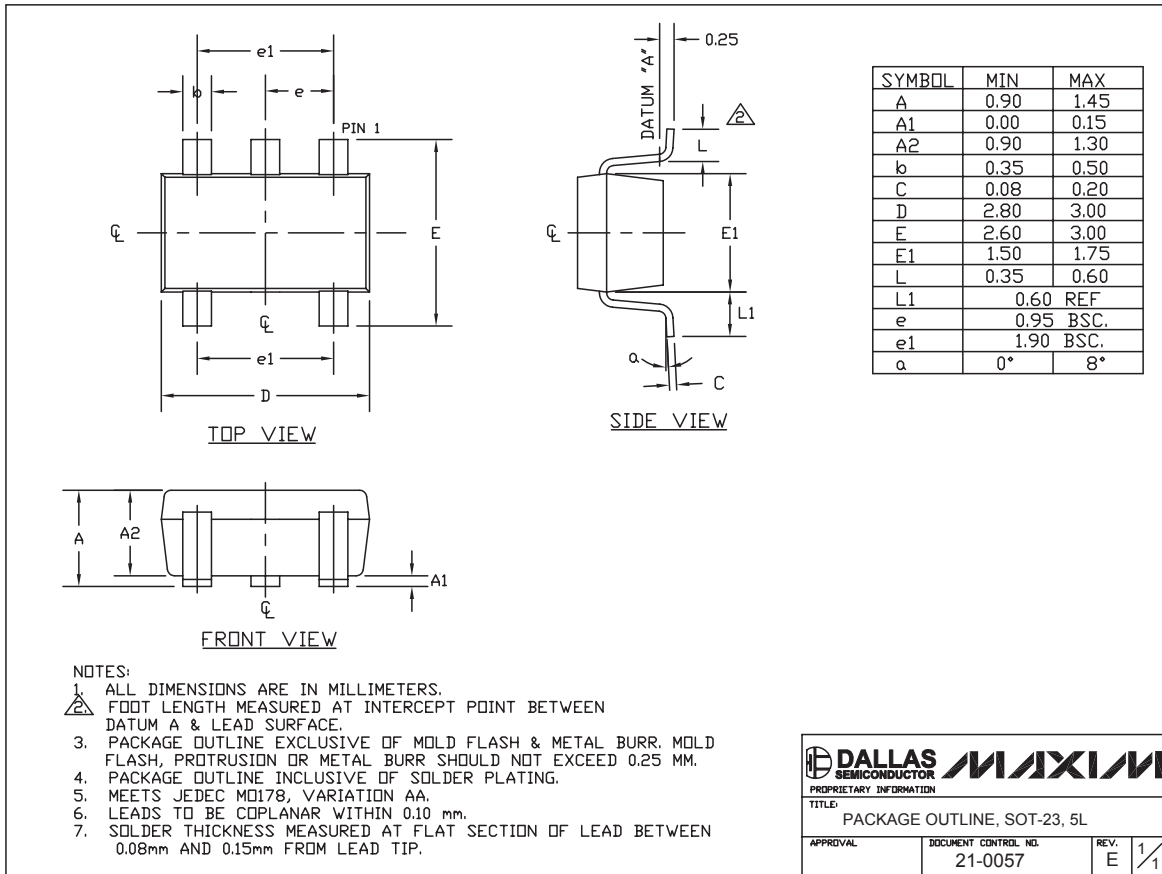
SOT-23 5L .EPS

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