# EVQ8112A-J-00A

## 60V, High-Side Current-Sense Amplifier Evaluation Board, AEC-Q100 Qualified

## DESCRIPTION

The EVQ8112A-J-00A is an evaluation board designed to demonstrate the capabilities of the MPQ8112A, a low-cost, unipolar, high-side current-sense amplifier. The device operates from a 2.7V to 60V supply voltage and typically consumes a 300µA current. The common mode input voltage ranges between 0V and 60V with a 700kHz high bandwidth.

The MPQ8112A converts the differential input voltage to a current output. This current is converted back to a voltage with an external load resistor. The MPQ8112A has an adjustable gain based on the external, common input resistors and load resistor.

The EV8112A-J-00A is a fully assembled and tested evaluation board.

The MPQ8112A is available in a TSOT23-6L package.

## ELECTRICAL SPECIFICATIONS

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| VCC supply voltage | $V_{CC}$ | 2.7 to 60 | V |
| Common input voltage | $V_{CM}$ | 0 to $V_{CC}$ | V |
| V5 supply voltage | V5 | 2.7 to 5.5 | V |
| Sense voltage | $V_{SENSE}$ | 0 to 200 | mV |
| Output gain | $A_V$ | 50 | V/V |

## FEATURES

- Low-Cost, Compact Current-Sense Solution
- 700kHz Bandwidth
- 300µA Typical Supply Current
- 2.7V to 60V Operating Supply Voltage Range
- 0V to 60V Common Mode Input Voltage Range
- 0.2µA Typical Shutdown Current
- 300µV Input Offset Voltage
- Available with Adjustable Gain
- ±1% Current-Sense Gain Accuracy
- High-Current Sensing Capabilities
- Available in a 6-Pin TSOT23-6L Package
- Available in AEC-Q100 Grade 1

## APPLICATIONS

- Advanced Driver Assistance Systems (ADAS)
- Sensor Fusion Systems
- Electric Power Steering (EPS) Systems
- Electronic Stability Control (ESC) Systems
- Brake Systems
- Battery-Operated Systems
- Energy Management Systems

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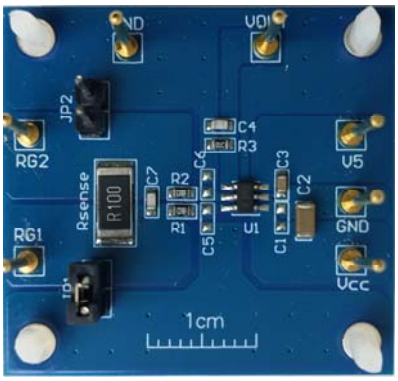
# EVQ8112A-J-00A EVALUATION BOARD

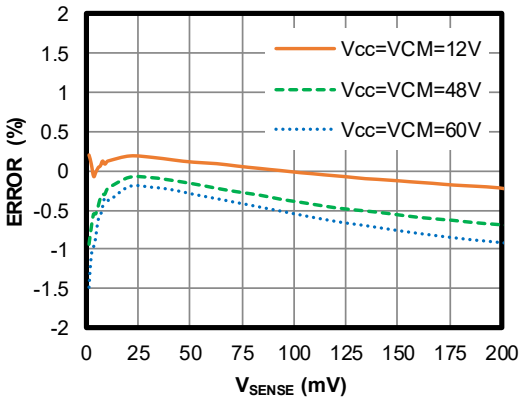



**LxWxH (3.6cmx3.4cmx1.3cm)**

| Board Number | MPS IC Number |
|---|---|
| EVQ8112A-J-00A | MPQ8112A |

**Total Output Error vs. $V_{SENSE}$**

$V_{CC}$ = $V_{CM}$





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## QUICK START GUIDE

1. Preset the power supply ($V_{CC}$) to be between 2.7V and 60V.
2. Turn the VCC power supply off.
3. Preset the V5 power supply to be between 2.7V and 5.5V.
4. Turn the V5 power supply off.
5. Preset the $I_{SENSE}$ load to be between 0A and 2A. This sets $V_{SENSE}$ between 0mV and 200mV ($V_{SENSE}$ = $I_{SENSE}$ x $R_{SENSE}$).
6. Turn the $I_{SENSE}$ load off.
7. Ensure that JP1 and JP2 are not shorted simultaneously. To set the JP1 and JP2 connections, follow the guidelines below:
   a. To test with $V_{CC}$ = $V_{CM}$, short JP1 and open JP2.
   b. To test with $V_{CC}$ > $V_{CM}$ and $V_{CM}$ = 0V, open JP1 and short JP2.
8. Connect the VCC power supply terminals to:
   a. Positive (+): VCC
   b. Negative (-): GND
9. Connect the V5 power supply terminals to:
   a. Positive (+): V5
   b. Negative (-): GND
10. To test with $V_{CC}$ = $V_{CM}$, short JP1 and open JP2, and then connect the load terminals to:
    a. Positive (+): RG2
    b. Negative (-): GND
11. To test with $V_{CC}$ > $V_{CM}$ and $V_{CM}$ = 0V, open JP1 and short JP2. Isolate the $I_{SENSE}$ load supply with an isolation transformer, and then connect the load terminals to:
    a. Positive (+): RG1
    b. Negative (-): GND
12. Turn the V5 power supply on. Then turn the VCC power supply on after making the connections.
13. Turn the $I_{SENSE}$ load on and adjust the $I_{SENSE}$ range. The MPQ8112A's output ($V_{OUT}$) can be estimated with Equation (1):

$$V_{OUT} = I_{SENSE} \times R_{SENSE} / R1 \times G_M \times R3 \quad (1)$$

Where $G_M$ is 5A/A. The MPQ8112A's gain ($A_V$) can be adjusted by selecting different combinations of R3 and R1. $A_V$ can be estimated with Equation (2):

$$A_V = V_{OUT} / V_{SENSE} = R3 / R1 \times G_M \quad (2)$$

Table 1 lists the possible $A_V$ values using different resistors.

**Table 1: Selecting $A_V$**

| $A_V$ (V/V) | R1/R2 (kΩ) | R3 (kΩ) |
|---|---|---|
| 100 | 1 | 20 |
| 50 | 1 | 10 |
| 25 | 1.02 | 5.1 |
| 10 | 1 | 2 |


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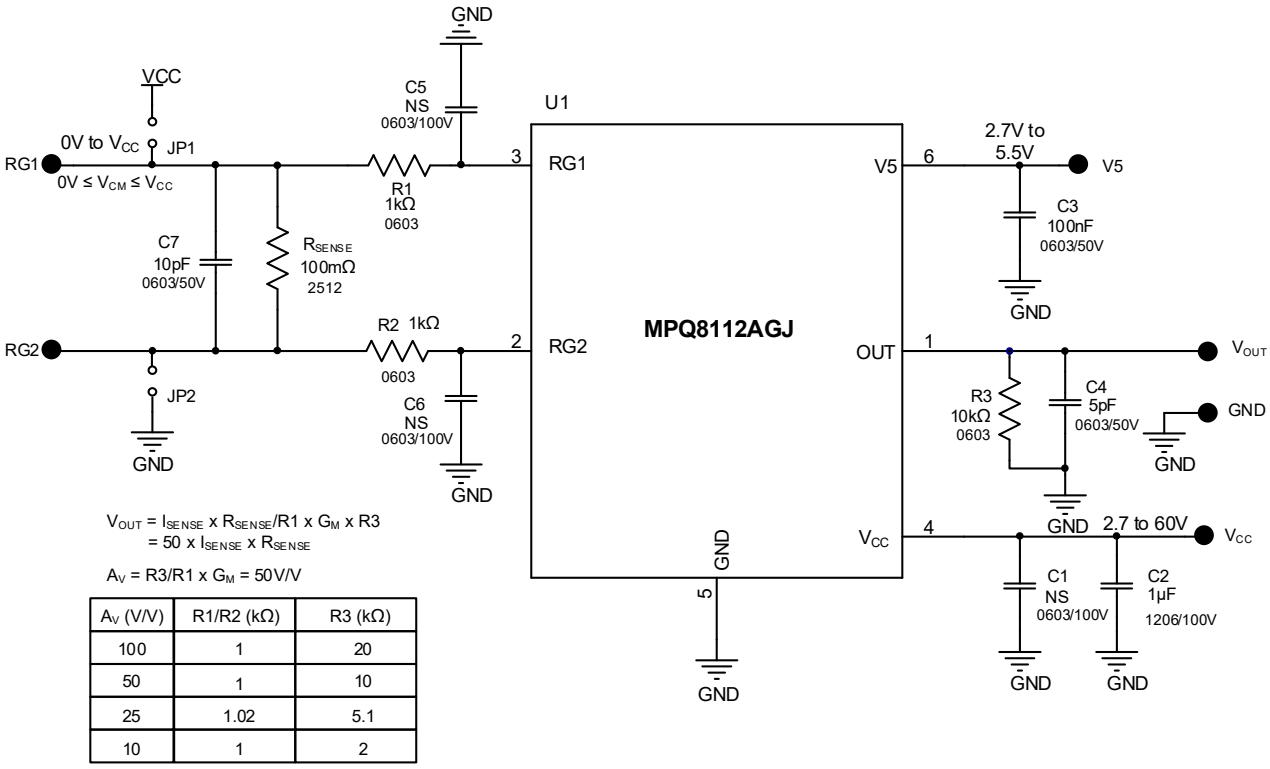
## EVALUATION BOARD SCHEMATIC



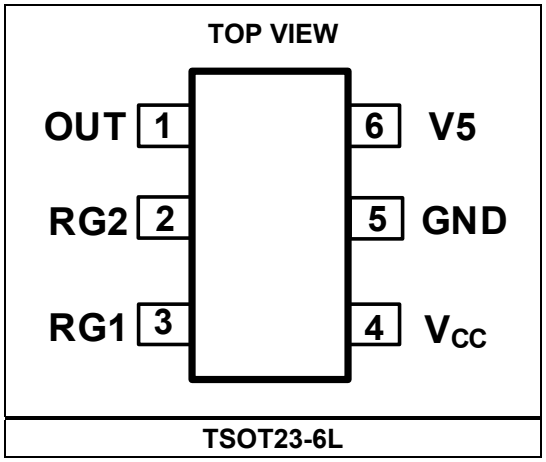

$V_{OUT} = I_{SENSE} \times R_{SENSE}/R1 \times G_M \times R3$
$= 50 \times I_{SENSE} \times R_{SENSE}$

$A_V = R3/R1 \times G_M = 50V/V$

| $A_V$ (V/V) | R1/R2 (kΩ) | R3 (kΩ) |
|---|---|---|
| 100 | 1 | 20 |
| 50 | 1 | 10 |
| 25 | 1.02 | 5.1 |
| 10 | 1 | 2 |

**Figure 1: Evaluation Board Schematic**

## PACKAGE REFERENCE





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## EVQ8112A-J-00A BILL OF MATERIALS

| Qty | Ref | Value | Description | Package | Manufacturer | Manufacturer P/N |
|---|---|---|---|---|---|---|
| 3 | C1, C5, C6 | NS | Ceramic capacitor, 100V, X7R | 0603 | | |
| 1 | C2 | 1μF | Ceramic capacitor, X7R, 100V | 1206 | Murata | GRM31CR72A105KA01L |
| 1 | C3 | 0.1μF | Ceramic capacitor, 50V, X7R | 0603 | Murata | GRM188R71H104KA93D |
| 1 | C4 | 5pF | Ceramic capacitor, COG, 50V | 0603 | TDK | C1608C0G1H050C |
| 1 | C7 | 10pF | Ceramic capacitor, COG, 50V | 0603 | muRata | GRM1885C1H100JA01 |
| 2 | R1, R2 | 1kΩ | Film resistor, 1% | 0603 | Yageo | RC0603FR-071KL |
| 1 | R3 | 10kΩ | Film resistor, 1% | 0603 | Yageo | RC0603FR-0710KL |
| 1 | $R_{SENSE}$ | 100mΩ | Film resistor, 1%, 1W | 2512 | Yageo | RL2512FK-070R1L |
| 1 | U1 | MPQ8112A | Current-sense amplifier | TSOT23-6L | MPS | MPQ8112AGJ |
| 2 | JP1, JP2 | 2.54mm | 2 x 1, 2.54mm, 180° connector | | Custom | |
| 1 | JP1 | 2.54mm | 2.54mm jumper | | Custom | |
| 7 | V5, Vcc, RG1, RG2, GND, GND, VOUT | Test point | 1.0 golden pin | | Custom | |


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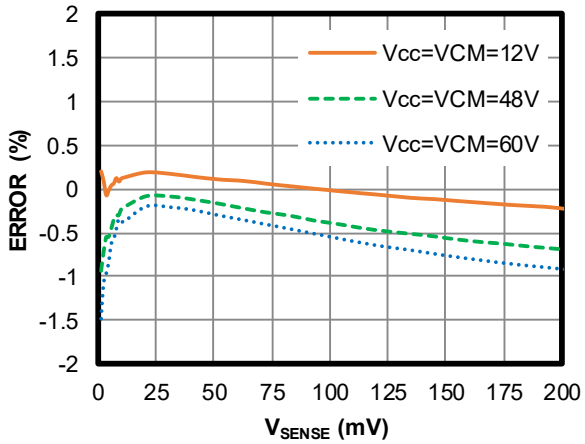
## EVB TEST RESULTS

**$V_{CC}$ = 12V, $V_{RG1}$ = 12V, V5 = 5V, $T_A$ = 25°C, R1 = R2 = 1kΩ, and R3 = 10kΩ, unless otherwise noted.**

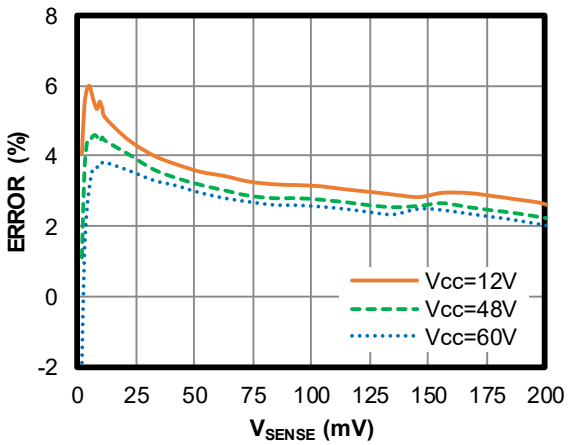
### Total Output Error vs. $V_{SENSE}$

$V_{CC}$ = $V_{CM}$



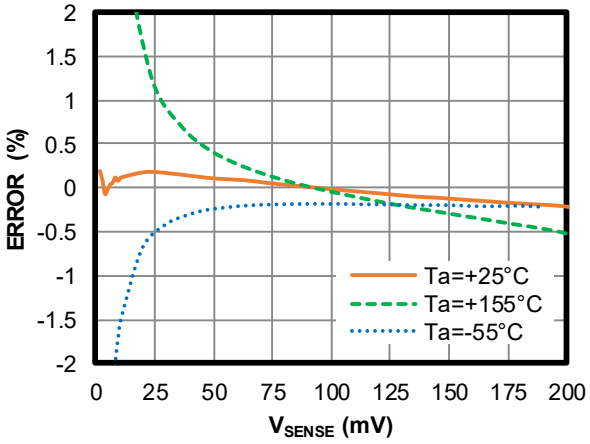

### Total Output Error vs. $V_{SENSE}$

$V_{CM}$ = 0V



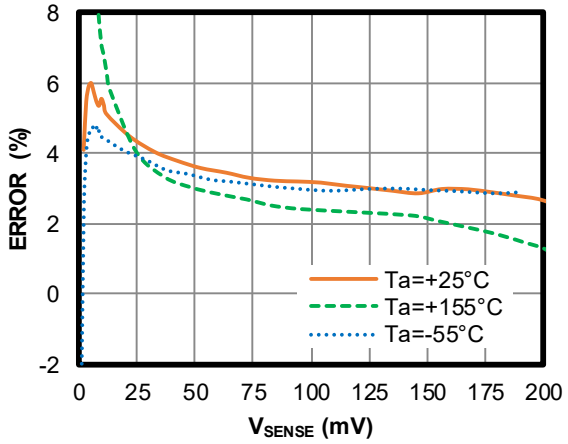

### Total Output Error vs. $V_{SENSE}$

$V_{CC}$ = $V_{CM}$



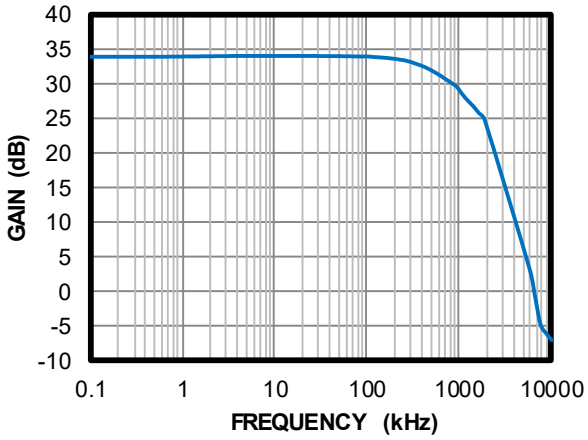

### Total Output Error vs. $V_{SENSE}$

$V_{CM}$ = 0V




### Gain vs. Frequency

$C_{OUT}$ = 5pF





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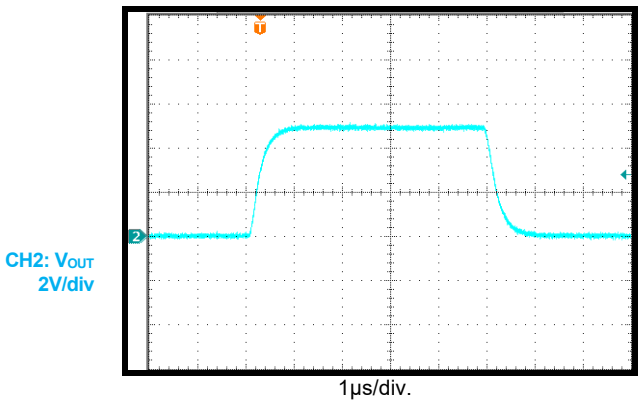
## EVB TEST RESULTS *(continued)*

**$V_{CC}$ = 12V, $V_{RG1}$ = 12V, V5 = 5V, $T_A$ = 25°C, R1 = R2 = 1kΩ, and R3 = 10kΩ, unless otherwise noted.**

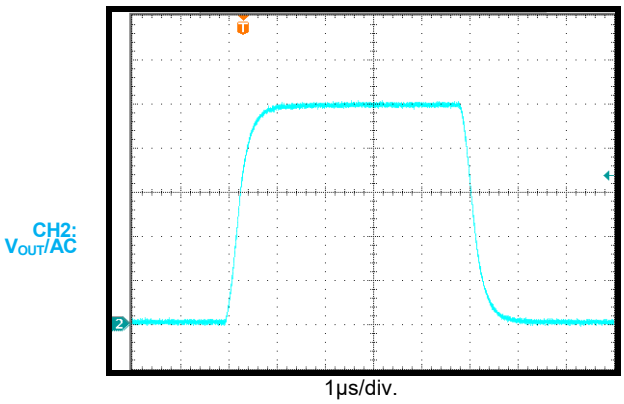
### Transient Response

$V_{SENSE}$ = 0mV to 100mV



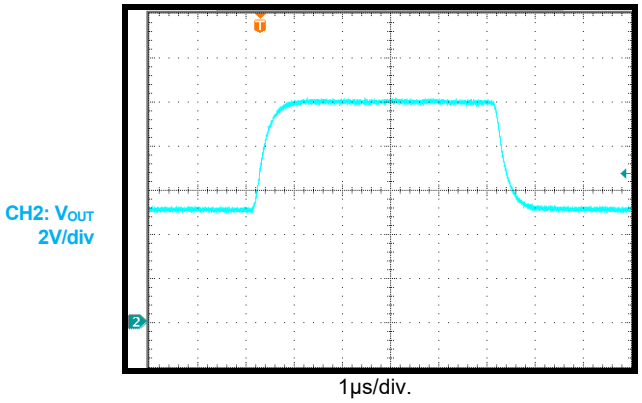

### Transient Response

$V_{SENSE}$ = 0mV to 200mV




### Transient Response

$V_{SENSE}$ = 100mV to 200mV





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## PCB LAYOUT

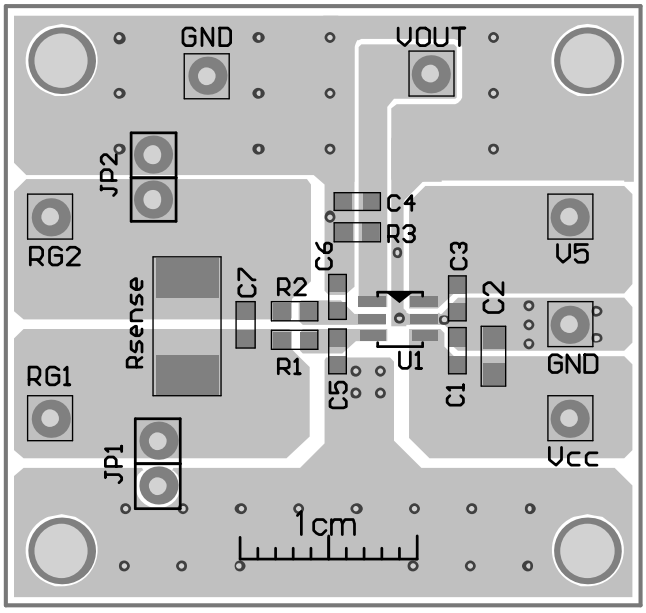


Figure 2: Top Silk Layer

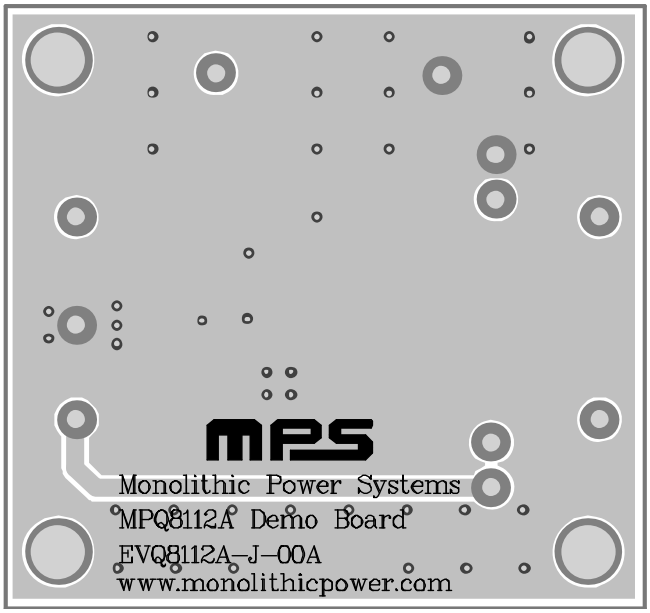


Figure 3: Bottom Layer


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## REVISION HISTORY

| Revision # | Revision Date | Description | Pages Updated |
|---|---|---|---|
| 1.0 | 06/08/2021 | Initial Release | - |

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