

## 1. DESCRIPTION

The XL432MA integrates two operational amplifiers and one 2.5V reference. Adjustable shunt regulator with the output voltage adjusted to a fixed 2.5V. The Op Amps are similar to the traditional LM358 or XINLUDA's XL358D with a common-mode input range that includes ground. Integrating the reference and Op Amps creates a solution for low cost charging applications.

## 2. FEATURES

**Dual Op Amp Circuitry** (Typical for  $V_S = 5V$ )

- Input offset voltage 1mV (typ.), 5mV (max.)
- Input offset current 10nA (typ.)
- Input bias current 30nA (typ.)
- Common-mode input voltage range 0V to  $V_S - 1.5V$
- Power supply current 0.5mA (Max.)

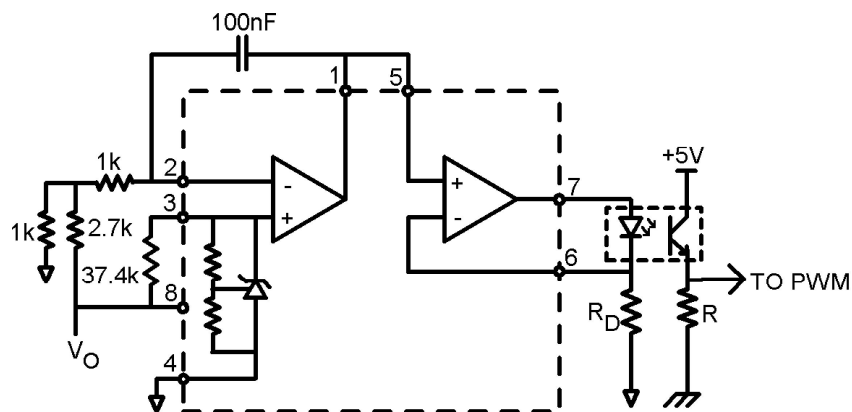
**Reference Circuitry**

- Reference voltage 2.5V  $\pm 1\%$
- Reference voltage deviation ( $-40^{\circ}C$  to  $85^{\circ}C$ ) 5mV
- Sink Current Capability up to 15mA

## 3. APPLICATIONS

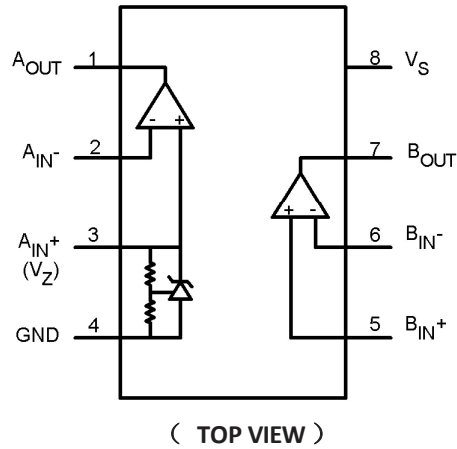
- Low cost charging circuitry
- Power supplies and adapters

## 4. APPLICATION CIRCUIT



Optocoupler Driver Circuit for Power Supply Isolation

## 5. CONNECTION DIAGRAM



## 6. ABSOLUTE MAXIMUM RATINGS (Note 1, 3)

- Supply Voltage ( $V_S$ ) .....30V
- Storage Temperature .....  $-65^{\circ}\text{C}$  to  $150^{\circ}\text{C}$
- Junction Temperature ( $T_J$ ).....  $150^{\circ}\text{C}$
- ESD Human Body Model..... 2kV
- Input Voltage Range.....  $-0.3\text{V}$  to  $20\text{V}$

## 7. RECOMMENDED OPERATING CONDITIONS (Note 2, 3)

- Ambient Temperature Range:  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$
- Supply Voltage (Note 7) :        3 V to 24 V
- Thermal Resistance ( $\theta_{JA}$ ) :     $170^{\circ}\text{C/W}$  (typical)

## 8. ELECTRICAL CHARACTERISTICS

The following specifications apply for both amplifiers at  $V_S = 5V$ ,  $V_{CM} = 2.5V$ ,  $V_O = 2.5V$ ,  $R_L = \infty$ , and  $T_J = 25^\circ C$ , unless otherwise noted.

| SYMBOL                                                                                                                                           | PARAMETER                                                                 | CONDITIONS                                                                    | MIN         | TYP<br>(Note 4) | MAX         | UNITS    |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------|-----------------|-------------|----------|
| <b>OP Amp Circuitry</b>                                                                                                                          |                                                                           |                                                                               |             |                 |             |          |
| $V_{OS}$                                                                                                                                         | Input Offset Voltage                                                      | Amplifier B only                                                              | -5          | 1               | 5           | mV       |
| $I_{OS}$                                                                                                                                         | Input Offset Current                                                      | Amplifier B only                                                              |             | 10              | 50          | nA       |
| $I_B$                                                                                                                                            | Input Bias Current                                                        | Amplifier B only                                                              |             | 30              | 200         | nA       |
| $V_{CM}$                                                                                                                                         | Common-Mode Input Voltage Range                                           | Amplifier B only,<br>CMRR > 50dB                                              | 0           |                 | $V_S - 1.5$ | V        |
| $I_S$                                                                                                                                            | Power Supply Current (No load)                                            | Total for both amplifiers                                                     |             | 200             | 500         | $\mu A$  |
| $A_V$                                                                                                                                            | Voltage Gain                                                              | $V_S = 16V$ , $1V < V_O < 11V$ ,<br>$R_L = 10k\Omega$ connected to<br>$V_S/2$ | 60          | 90              |             | dB       |
| $V_{OL}$                                                                                                                                         | Output Voltage Low                                                        |                                                                               |             | 3               | 50          | mV       |
| $V_{OH}$                                                                                                                                         | Output Voltage High                                                       |                                                                               | $V_S - 1.5$ | $V_S - 1.2$     |             | V        |
| $I_{SOURCE}$                                                                                                                                     | Output Current Source                                                     |                                                                               |             | 25              |             | mA       |
| $I_{SINK}$                                                                                                                                       | Output Current Sink                                                       |                                                                               |             | 15              |             | mA       |
| <b>Reference Circuitry For Op Amp A</b> The following specifications apply for $I_Z = 200\mu A$ and $T_J = 25^\circ C$ , unless otherwise noted. |                                                                           |                                                                               |             |                 |             |          |
| $V_Z$                                                                                                                                            | Reference Voltage at IN+ Terminal                                         |                                                                               | 2.475       | 2.5             | 2.525       | V        |
| $V_{ZDEV}$                                                                                                                                       | Reference Voltage Deviation at IN+Terminal Over Temperature<br>(Note 5,8) | $-40^\circ C \leq T_J \leq 85^\circ C$                                        |             | 5               | 80          | mV       |
| $I_{Z(MIN)}$                                                                                                                                     | Minimum Cathode Current for Regulation at IN+ ( $V_Z$ ) Terminal          |                                                                               |             | 150             | 200         | $\mu A$  |
| $r_z$                                                                                                                                            | Dynamic Output Impedance<br>(Note 6)                                      | $200\mu A < I_Z < 1mA$<br>Freq = 0Hz                                          |             | 0.3             |             | $\Omega$ |

**Note 1:** Absolute Maximum Ratings indicate limits beyond which damage to the device may occur.

**Note 2:** Operating Rating indicate conditions for which the device is functional. These rating do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

**Note 3:** All voltages are measured with respect to GND = 0V<sub>DC</sub>, unless otherwise specified.

**Note 4:** Typicals represent the most likely parametric norm.

**Note 5:** Reference voltage deviation,  $V_{ZDEV}$ , is defined as the maximum variation of the reference input voltage over the full temperature range.

**Note 6:** The Dynamic Output Impedance,  $r_z$ , is defined as  $r_z = \Delta V_Z / \Delta I_Z$

**Note 7:** Minimum value of operating voltage is for Amplifier B only.

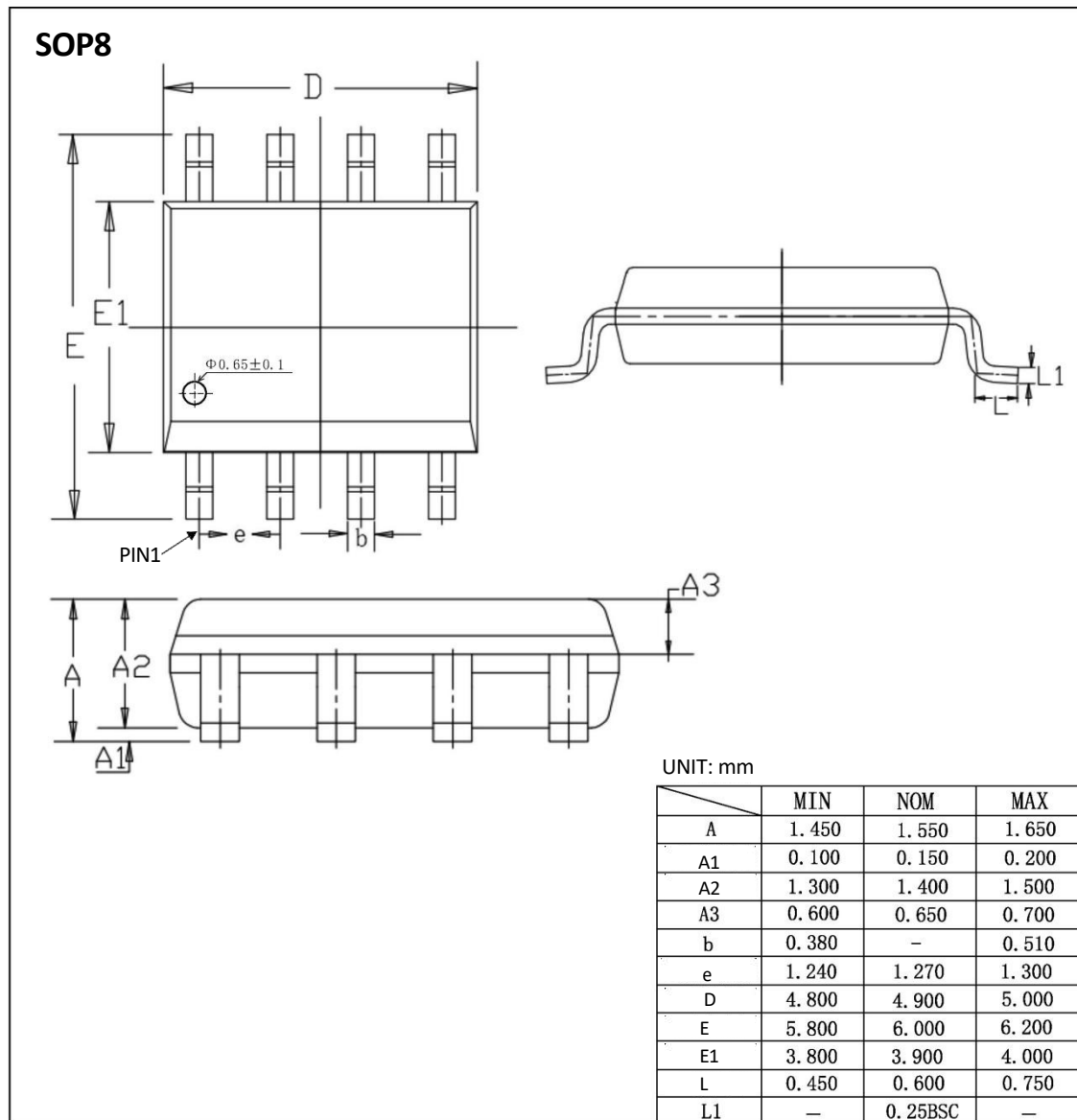
**Note 8:** Typical Temperature drift  $\Delta V / \Delta T = 12.8ppm/^\circ C$

## 9. ORDERING INFORMATION

Ordering Information

| Part Number | Device Marking | Package Type | Body size (mm) | Temperature (°C) | MSL  | Transport Media | Package Quantity |
|-------------|----------------|--------------|----------------|------------------|------|-----------------|------------------|
| XL432MA     | XL432MA        | SOP8         | 4.90 * 3.90    | - 40 to 85       | MSL3 | T&R             | 2500             |

## 10. DIMENSIONAL DRAWINGS



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