DESCRIPTION

The LX8817 is a dual channel positive-voltage linear regulator. This dual regulator has one fixed output coupled with an adjustable output. Each channel features low-dropout and high accuracy.

The LX8817 utilizes dual inputs that can be used as separate sources for the control and power sections. This configuration reduces power dissipation by operating the regulator near dropout (V_{PWR}-V_{OUT} = V_{DO} = 0.6V @ 2.5A) while providing sufficient operating headroom for the control logic.

The LX8817 provides designers with an efficient flexible power management solution, minimal printed circuit board area, and shorter design cycles.

Each channel can supply up to 2.5A independently with a regulator design optimized for system efficiency by consuming minimal ground current and directing quiescent current to the load.

The LX8817 features on-chip trimming of the internal voltage reference, enabling precise output voltages, typically ±1% of its specified value.

Power sequencing logic ensures proper startup regardless of the level of V_{CTRL} or V_{PWR}. The LX8817 outputs remain off while V_{PWR} < 2.4V.

Thermal and Short Circuit Current Protection are integrated on-chip and operate independently for each regulator output.

The LX8817 regulator is stable with a low-value output capacitor, typically 10µF tantalum or ceramic on the outputs, allowing designers flexibility in external component selection.

Linfinity’s S-PAK power package offers maximum power dissipation and ease of assembly using surface mount technology.

IMPORTANT: For the most current data, consult MICROSEMI’s website: http://www.microsemi.com

KEY FEATURES

- Two Independent Regulated Outputs
- Accurate Output Voltages
- Max. Dropout of 0.6V at Rated Current
- Independent Thermal and Current Limit Protection
- Low Profile 7 Lead SMT Power Package
- Low Tolerance Line (0.2%) and Load (0.4%) Regulation
- Wide DC Supply Voltage of 3.0V to 10.0V
- Loop Stability Independent of Output Capacitor Type

APPLICATIONS/BENEFITS

- 3.3V to 2.5V/ADJ Linear Regulator
- Low Voltage Logic Supplies
- Active SCSI Terminators
- Battery Charging Circuits
- Instrumentation
- PC Peripherals

PRODUCT HIGHLIGHT

![LX8817 Schematic](LX8817_Schematic.png)

PACKAGING ORDER INFO

<table>
<thead>
<tr>
<th>T_A (°C)</th>
<th>OUTPUT V_1</th>
<th>OUTPUT V_2</th>
<th>DF</th>
<th>Plastic S-PAK 7-PIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 125</td>
<td>2.5V</td>
<td>Adj</td>
<td>LX8817-25CDF</td>
<td></td>
</tr>
</tbody>
</table>

Note: Available in Tape & Reel. Append the letter “T” to the part number. (i.e. LX8817-25CDFT)
**Product Description**

**LX8817**

**Dual Channel 2.5A Low Dropout Regulator**

**Production Data Sheet**

### Absolute Maximum Ratings

- **Input Voltage (VCTRL, V_PWR)**: 13.5V
- **Load Current (Internally Limited)**: 3.0A
- **Power Dissipation**: Internally Limited
- **Short-Circuit Protection**: Indefinite
- **Operating Junction Temperature**: 150°C
- **Storage Temperature Range**: -65°C to 150°C
- **Lead Temperature (Soldering 180 seconds)**: 235°C

Note: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of specified terminal.

### Package Pin Out

- **DF Package** (Top View)
  - **TAB** is GND
  - **NC**
  - **ADJ_V2**
  - **V_OUT2**
  - **GND**
  - **V_PWR**
  - **V_OUT1**
  - **V_CTRL**

### Thermal Data

- **DF Plastic S-PAK 7-PIN**
  - **Thermal Resistance - Junction to Tab, θJT**: 4.5°C/W
  - **Thermal Resistance - Junction to Ambient, θJA**: 30°C/W

Junction Temperature Calculation: 

\[ T_J = T_A + (P_D \times θJA) \]

The θJA numbers are guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow. θJA can vary significantly depending on mounting technique. (See Application Notes Section: Thermal considerations)

### Functional Pin Description

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V_CTRL</td>
<td>Unregulated input voltage supply, provides bias for control circuitry, (V_CTRL – V_OUT) &gt; 1V.</td>
</tr>
<tr>
<td>2</td>
<td>V_OUT1</td>
<td>Regulator #1 fixed output voltage.</td>
</tr>
<tr>
<td>3</td>
<td>V_PWR</td>
<td>Unregulated input voltage supply for power section. For proper operation: (V_PWR – V_OUT) &gt; V_DROPOUT.</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Common terminal for ground reference, Tab of package is internally connected to this pin.</td>
</tr>
<tr>
<td>5</td>
<td>V_OUT2</td>
<td>Regulator #2 adjustable output.</td>
</tr>
<tr>
<td>6</td>
<td>ADJ_V2</td>
<td>Regulator #2 voltage feedback. Sets the output voltage for regulator #2 via an external resistor divider.</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>Not used.</td>
</tr>
</tbody>
</table>
# Dual Channel 2.5A Low Dropout Regulator

## Production Data Sheet

### Recommended Max Operating Condition

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>LX8817-25</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage</td>
<td>VCTRL</td>
<td>10</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>VPWR</td>
<td>7.5</td>
<td>V</td>
</tr>
<tr>
<td>Load Current (Internally Limited)</td>
<td>I1, I2</td>
<td>3.0</td>
<td>A</td>
</tr>
<tr>
<td>Operating Junction Temperature</td>
<td>TJ</td>
<td>125</td>
<td>°C</td>
</tr>
</tbody>
</table>

### Electrical Characteristics

Unless otherwise specified, the following specifications apply over the operating ambient temperature 0°C ≤ TA ≤ 125°C except where otherwise noted and the following test conditions: VCTRL = 5V, VPWR = 3.3V IOUT = 5mA, C1, 2, 3, 4 = 10µF (Tantalum), and TJ = TA using low duty cycling methods.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>LX8817-25</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIXED OUTPUT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Voltage</td>
<td>V1</td>
<td>5mA &lt; I1 &lt; 2.5A, 3.75V &lt; VCTRL &lt; 10V</td>
<td>2.438</td>
<td>2.500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.3V &lt; VPWR &lt; 5.5V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line Regulation</td>
<td>ΔV1(VIN)</td>
<td>3.3V &lt; VCTRL &lt; 10V, 3.3V &lt; VPWR &lt; 5.5V, I1 = 5mA</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>ΔV1(I1)</td>
<td>5mA &lt; I1 &lt; 2.5A, VCTRL=5V, VPWR=3.3V</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Dropout Voltage (PWR)</td>
<td>VPWR-V1</td>
<td>I1 = 2.5A, ΔV1 = -2%</td>
<td>0.500</td>
<td>0.730</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I1 = 2.0A, ΔV1 = -2%</td>
<td>0.375</td>
<td>0.580</td>
</tr>
<tr>
<td>Current Limit</td>
<td>I1(MAX)</td>
<td>Note 1</td>
<td>2.55</td>
<td>3.0</td>
</tr>
<tr>
<td>Minimum Load Current</td>
<td>I1</td>
<td>Note 1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>ADJUSTABLE OUTPUT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference Voltage</td>
<td>V2</td>
<td>5mA &lt; I2 &lt; 2.5A, 3.75V &lt; VCTRL &lt; 10V</td>
<td>1.231</td>
<td>1.250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.3V &lt; VPWR &lt; 5.5V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line Regulation</td>
<td>ΔV2(VIN)</td>
<td>3.3V &lt; VCTRL &lt; 10V, 3.3V &lt; VPWR &lt; 5.5V, I2 = 5mA</td>
<td>0.05</td>
<td>3</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>ΔV2(I2)</td>
<td>5mA &lt; I2 &lt; 2.5A, VCTRL=5V, VPWR=3.3V</td>
<td>10</td>
<td>19</td>
</tr>
<tr>
<td>Dropout Voltage</td>
<td>VPWR-V2</td>
<td>I2 = 2.5A, ΔV2 = -2%</td>
<td>0.500</td>
<td>0.730</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I2 = 2.0A, ΔV2 = -2%</td>
<td>0.375</td>
<td>0.580</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I2 = 1.0A, ΔV2 = -2%</td>
<td>0.225</td>
<td>0.390</td>
</tr>
<tr>
<td>Current Limit</td>
<td>I2(MAX)</td>
<td>Note 1</td>
<td>2.55</td>
<td>3.0</td>
</tr>
<tr>
<td>Minimum Load Current</td>
<td>I2</td>
<td>Note 1</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Adjust Pin Bias Current</td>
<td>IADJ</td>
<td>Note 1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>ENTIRE REGULATOR</td>
<td>VPPR</td>
<td>2.6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Minimum Operating Voltage</td>
<td>VCTRL</td>
<td>3.3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Under Voltage Lockout</td>
<td>VPPR Rising, 3.0V &lt; VCTRL &lt; 10V, Both Outputs Off</td>
<td>2.2</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Quiescent Current</td>
<td>Iq</td>
<td>I1=I2=5mA</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I1=I2=2.5A</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Ripple Rejection</td>
<td>PSRR</td>
<td>f=120Hz, TJ = 25°C</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>RMS Output Noise</td>
<td></td>
<td>10Hz &lt; f &lt; 10kHz</td>
<td>0.003</td>
<td>%VOUT</td>
</tr>
<tr>
<td>Thermal Shutdown</td>
<td>TSHDN</td>
<td>160</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Minimum load current is defined as the amount of output current required to maintain regulation. Typically this current provides the bias to the external resistor divider network used to set the output voltage.
**CHARACTERISTIC CURVES**

**VOUT vs Temperature**

- **Vout vs Temperature Chart**
  - Output Voltage (V) vs Temperature (°C)
  - **Vo1: 2.5V Fixed**
  - **Vo2: Adjustable**

**Dropout Voltage**

- **Dropout Voltage Chart**
  - Dropout Voltage vs Temperature (°C)
  - **Iout=2.5A**
  - **Iout=1A**
  - **Iout=0.5A**

**Quiescent Current**

- **Quiescent Current Chart**
  - Quiescent Current (mA) vs Temperature (°C)
  - **IL1&IL2=2.5A**
  - **IL1&IL2=5mA**

**Supply Ramp (Vcntrl+Vpwr)**

- **Supply Ramp Chart**
  - Supply Ramp (Vcntrl+Vpwr)
  - CH1 = Vp = VC
  - CH2 = V1
  - CH3 = V2
  - CH4 = Ip 2A/DIV

**Step Load Response With Ceramic Cap (10µF)**

- **Step Load Response Chart**
  - CH2 = Vp
  - CH4 = Io1 (10mA to 2.5A Step)

**Step Load Response With Tantalum Cap (10µF)**

- **Step Load Response Chart**
  - CH2 = Vp
  - CH4 = Io1 (10mA to 2.5A Step)
APPLICATION CIRCUIT/BLOCK DIAGRAM

V_PWR
C_1
10µF

V_CTRI
C_2
10µF

GND

BIAS
1.25V
V_REF

Input Power Sequencing (UVLO)

1.25x + I_ADJ x R1

V2

V1

C_3
10µF

V_CTRL

C_4
10µF

R1

R2

V2 = 1.25x \left( \frac{R_1}{R_2} \right) + I_{ADJ} x R1

(Adjustable)

FIGURE – Block Diagram / Application Circuit
APPLICATION INFORMATION

The LX8817 is part of a family of Dual LDO (Low Drop-Out) linear regulators in Linfinity’s S-PAK power package which offer maximum power dissipation in a low profile surface mount technology. The family includes combination fixed and adjustable versions. Each channel can supply up to 2.5A independently with a regulator design optimized for system efficiency by consuming minimal ground current and directing quiescent current to the load.

INPUT CAPACITOR
To improve load transient response and noise rejection a input bypass capacitor is of at least 10uF is required. Generally we recommend a 10uF ceramic or tantalum or 22uF electrolytic capacitor.

OUTPUT CAPACITOR
The regulator requires output capacitors connected between each output (V1, V2) to GND to stabilize the internal control loop. Many types of capacitors are available, with different capacitance values tolerances, temperature coefficients and equivalent series resistance. We recommend a minimum of 4.7uF. To ensure good transient response from the power supply system under rapidly changing load conditions, designers generally use additional output capacitors connected in parallel. Such an arrangement serves to minimize the effects of the parasitic resistance (ESR) and inductance (ESL) that are present in all capacitors. The regulator has been tested stable with capacitor ESR’s in the range of 0.05 to 2 ohms. We have found it best to use the same type of capacitor for both input and output bypass.

ADJUSTABLE OUTPUT VOLTAGE
The LX8817x develops a 1.25V reference voltage between the output and the adjust terminal (See Figure 2). By placing a resistor, R1, between these two terminals, a constant current is caused to flow through R1 and down through R2 to set the overall output voltage. Because I\text{ADJ} is very small and constant when compared with the current through R1, it represents a small error and can usually be ignored.

\[ V_2 = V_{\text{REF}} \left( 1 + \frac{R_1}{R_2} \right) + I_{\text{ADJ}} R_1 \]

**FIGURE 2 - BASIC ADJUSTABLE REGULATOR**

MINIMUM LOAD REQUIREMENT
The LX8817 has a minimum load is requirement for proper output regulation. This typical current is specified at 0mA for the fixed output and 1mA for the adjustable output regulators.

TEMPERATURE PROTECTION
The thermal protection shuts the LX8817 down when the junction temperature exceeds 160°C. Each output has independent thermal shutdown capability. Exposure to absolute maximum rated conditions for extended periods may affect device reliability, see Thermal Considerations below.

CURRENT LIMIT PROTECTION
The LX8817 includes over current protection, when the output load current exceeds typically 3A the circuit forces the regulator decrease in output.

THERMAL CONSIDERATIONS
Thermal shutdown protects the integrated circuit from thermal overload caused from a rise in junction temperature during power dissipation. This means of protection is intended for fault protection only and not as a means of current or power limiting during normal application usage. Proper thermal evaluation should be done to ensure that the junction temperature dose not exceed it's maximum rating. Operating at the maximum T\text{J} of 150°C can impact reliability. Due to variation in individual device electrical characteristics and thermal resistance, the built in thermal overload protection may be activated at power levels slightly above or below the rated dissipation. Also peak output power should be considered for each individual output.

Power dissipation for regulator can be calculated using the following equation:

\[ P_D = (V_{\text{IN(MAX)}} - V_1) \times I_1 + (V_{\text{IN(MAX)}} - V_2) \times I_2 \]

(Note: power dissipation resulting from quiescent (ground) current is negligible)

For the S-PAK package, thermal resistance, θ\text{TA-BAM} is 25-45°C/W depending on mounting technique when mounted on a FR4 copper clad PCB. Junction temperature of the integrated circuit can be calculated using:

\[ T_{\text{JUNCTION}} \leq T_{\text{JUNCTION-TABRISE+TAB-AMBI+AMB}} \]

\[ T_{\text{TAB}} = P_{\text{DMAX}} \times \theta_{\text{JT}} : T_{\text{TAB-AMB}} = (P_{\text{DREG1}} + P_{\text{DREG2}}) \times \theta_{\text{PCB}} \]

An example: Given conditions: T\text{A} = 50°C, V\text{IN}= 5.0V, V1= 2.5V, I1= 210mA, V2= 3.3V I2= 1A.

Calculated values:

\[ T_{J-\text{TABREG1}} = (5V - 2.5V) \times 4.5°C/W = (0.525) \times 4.5°C/W = 2.3°C \]
\[ T_{J-\text{TABREG2}} = (5V - 3.3V) \times (1A) \times 4.5°C/W = (1.7) \times 4.5°C/W = 7.7°C \]
\[ T_{\text{TAB-AMBI+AMBRISE}} = (0.525W + 1.7W) \times 30°C/W = 66.8°C \]
\[ T_{\text{JUNCTION}} = 7.7°C + 66.8°C + 50°C = 124.5°C \]

It is important to note that although each output of the regulator will produce up to 2.5A in current, the individual or total power dissipation may limit the useful total current draw. The junction temperature should be calculated for each individual output as well as the combined outputs to insure the maximum junction temperature in not exceeded.

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11861 Western Avenue, Garden Grove, CA. 92841, 714-898-8121, Fax: 714-893-2570
### MECHANICAL DIMENSIONS

![Diagram of the dimensions](image)

<table>
<thead>
<tr>
<th>Dim</th>
<th>MILLIMETERS</th>
<th>INCHES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIN</td>
<td>MAX</td>
</tr>
<tr>
<td>A</td>
<td>9.27</td>
<td>9.52</td>
</tr>
<tr>
<td>B</td>
<td>8.89</td>
<td>9.14</td>
</tr>
<tr>
<td>C</td>
<td>1.77</td>
<td>2.03</td>
</tr>
<tr>
<td>D</td>
<td>7.49</td>
<td>7.74</td>
</tr>
<tr>
<td>E</td>
<td>0.12</td>
<td>0.38</td>
</tr>
<tr>
<td>F</td>
<td>0.58</td>
<td>0.84</td>
</tr>
<tr>
<td>G</td>
<td>1.27</td>
<td>BSC</td>
</tr>
<tr>
<td>H</td>
<td>0.79</td>
<td>1.04</td>
</tr>
<tr>
<td>I</td>
<td>4.31</td>
<td>6.86</td>
</tr>
<tr>
<td>J</td>
<td>0.03</td>
<td>0.13</td>
</tr>
<tr>
<td>K</td>
<td>10.41</td>
<td>10.67</td>
</tr>
</tbody>
</table>

**Note:**
1. Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm (.006") on any side. Lead dimension shall not include solder coverage.