## Introduction

The AAT1145 Evaluation Board contains a fully tested 1.2A, 1.5 MHz step-down DC/DC regulator. The circuit has an input voltage range of 2.5 V to 5.5 V and a 1.8 V output capable of delivering up to 1.2 A output current with a $3.6 \mathrm{~V} \mathrm{~V}_{\mathbb{I N}}$. The output is adjustable from 0.6 V to $\mathrm{V}_{\mathbb{I N}}$. The circuit can provide up to $96 \%$ efficiency and it consumes less than $1 \mu \mathrm{~A}$ in shutdown mode. In light load mode operation there is very low output ripple voltage for noise-sensitive applications.

The AAT1145 comes in a small 10-pin DFN package, which has an exposed pad on the bottom-side of the IC for better thermal performance. The board has a ground pad just below the exposed pad for reliable soldering and better thermal dissipation. These features, plus the nominal operating frequency of 1.5 MHz allowing the use of low profile surface mount components, make the AAT1145 an ideal circuit for use in battery-powered, hand-held applications.


Figure 1: AAT1145 Evaluation Board.

## Layout Guidelines

The following guidelines should be followed to ensure proper operation of the AAT1145:

1. The Exposed Pad (EP) must be reliably soldered to GND. A large pad under the device is strongly recommended for heat sinking purposes.
2. The power traces, including the GND trace, the LX-to-L1-to-VOUT trace and the VIN-to-IN trace should be kept short, direct and wide to allow large current flow. Put many multiple-layer VIA pads when connecting traces change between layers.
3. Connect the input capacitor C 1 to the IN and AIN pins as close as possible to get good power filtering.
4. Keep the switching node, LX pin 7 and 8 , away from the sensitive $\mathrm{FB} / \mathrm{OUT}$ node.
5. To avoid large GND noise affecting the accurate reference circuit, it is recommended that pin 4 and pin 6 AGND connect to the GND plane to a single point under the device.


Figure 2: AAT1145 Evaluation Board Schematic.

| Specification | Test Conditions | Min | Typ | Max | Units |
| :--- | :--- | :---: | :---: | :---: | :---: |
| Input Voltage |  | 2.5 | 3.6 | 5.5 | V |
| Output Error Voltage |  |  | $\pm 3$ |  | $\%$ |
| Output Current |  | 0 |  | 1200 | mA |

Table 1: AAT1145 Evaluation Board Specifications.


Figure 3: AAT1145 Evaluation Board PCB Top Side.


Figure 4: AAT1145 Evaluation Board PCB Bottom Side.

## Test Equipment

1 8.0V 5.0A laboratory power supply: Agilent E3648A or equivalent.
2. Electronic load: Agilent N3301A
3. DC voltmeter: Agilent 34401A or equivalent.
4. Oscilloscope: Tektronix TDS3034B or equivalent.

## Setup and Test (see connection diagram in Figure 5)

## A: Load and Line Regulation

1. Apply a DC power supply and DC voltmeter across the input voltage terminals: VIN (positive terminal) and GND (negative terminal or return).
2. Apply a DC load and DC voltmeter to the output terminals: VOUT and GND.
3. Before turning on the supply, set the jumper to the side labeled "Enable".
4. Vary the load from 0 to 1.2 A and the input voltage from 2.5 V to 5.5 V while monitoring the output voltage.
5. The output voltage as measured at the output terminals of the evaluation boards should not vary by more than $\pm 3 \%$ of the nominal voltage.

## B: Ripple and Shutdown Current

1. Set the output load current between 0 A and 1.2 A , and measure the output ripple voltage; the measurement should be less than 20 mVAC .
2. Apply 4.2 V at VIN . Set the jumper from "Enable" state to GND. Measure the shutdown supply current. The supply current will be less than $1 \mu \mathrm{~A}$.

## C: Short-Circuit and Over-Temperature Protection

1. Raise the input voltage to 5.5 V .
2. Apply a short from VOUT to GND at the evaluation board terminals.
3. Remove the short and verify that the output returns to its initial value.

## D: Enable Output

1. Short the Enable pin to GND. The output should decay to zero.
2. Remove the short applied to the Enable pin. The output should recover to its initial value.


Figure 5: AAT1145 Connection Diagram.

## Waveforms



Figure 6: Light Load Switching Waveforms $\left(\mathrm{V}_{\text {IN }}=3.6 \mathrm{~V}, \mathrm{~V}_{\text {OUT }}=1.8 \mathrm{~V}\right.$, No Load; Ch1: (SW) LX pin, Ch2: $\mathrm{V}_{\text {out }}(\mathrm{AC})$, Ch3: LX $\mathrm{I}_{\text {INDUCTOR }}$ ).


Figure 7: Full Load Switching Waveforms $\left(\mathrm{V}_{\mathrm{IN}}=3.6 \mathrm{~V}, \mathrm{~V}_{\text {OUT }}=1.8 \mathrm{~V}, 1.2 \mathrm{~A}\right.$ Load; Ch1: (SW) LX pin, Ch2: V ${ }_{\text {OUT }}(\mathrm{AC})$, Ch3: LX I inductor).


Figure 8: Startup Waveforms
$\mathrm{V}_{\text {IN }}=3.6 \mathrm{~V}, \mathrm{~V}_{\text {OUT }}=1.8 \mathrm{~V}, 3 \Omega$ Load; Ch1: EN, Ch2: V

| Component | Part Number | Description | Manufacturer |
| :---: | :--- | :--- | :--- |
| U1 | AAT1145 | 1.5 MHz,1.2A Synchronous Step-Down Converter | Analogic Tech |
| L1 | CDRH2D14NP-2R2NC | Inductor 2.2uH 1.5A SMD | Sumida |
| C1 | GRM21BR61C106K | Cap Ceramic 10uF 0805 X5R 16V10\% | Murata |
| C2 | GRM21BR60J26M | Cap Ceramic 10uF 0805 X5R 6.3V 20\% | Murata |
| C3 | C1005COG1H220JT000P | Cap Ceramic 22pF 0402 C0G 50V 5\% | TDK |
| R1 | Chip Resistor | Res 316Kת 1/16W 1\% 0402 SMD | Any |
| R2 | Chip Resistor | Res 634k 1/16W 1\% 0402 SMD | Any |

Table 2: AAT1145 EVAL Bill of Materials.

## Output Voltage

There are two versions of the AAT1145, a fixed 1.8 V output (AAT1145IDE-1.8) without feedback resistors R1 and R 2 , and an adjustable version that is set to 0.6 V . To adjust the output from the 0.6 V default, set R1 to $316 \mathrm{k} \Omega$ and select R2 according to Table 3. A smaller value resistor divider can be used for better noise immunity, values are shown in columns 2 and 5 . A larger value resistor divider is used as default for lower current consumption in columns 3 and 6 . Standard $1 \%$ resistor values are substituted for calculated values.

| $\mathrm{V}_{\text {OUT }}(\mathrm{V})$ | $\begin{gathered} \text { R1 }=59 k \Omega \\ \text { R2 (k } \Omega) \end{gathered}$ | $\begin{gathered} R 1=316 k \Omega \\ R 2(k \Omega) \end{gathered}$ | $\mathrm{V}_{\text {OUT }}(\mathrm{V})$ | $\begin{gathered} R 1=59 k \Omega \\ R 2(k \Omega) \end{gathered}$ | $\begin{gathered} R 1=316 \mathrm{k} \Omega \\ \text { R2 }(\mathrm{k} \Omega) \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.6 | 19.6 | 0(short) | 1.4 | 88.7 | 422 |
| 0.8 | 29.4 | 105 | 1.5 | 118 | 475 |
| 0.9 | 39.2 | 158 | 1.8 | 124 | 634 |
| 1.0 | 49.9 | 210 | 1.85 | 137 | 655 |
| 1.1 | 59.0 | 261 | 2.5 | 187 | 1000 |
| 1.2 | 68.1 | 316 | 3.0 | 294 | 1270 |
| 1.3 | 78.7 | 365 | 3.3 | 267 | 1430 |

Table 3: Resistor Selection for Adjustable Output Voltage.
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