AAT1110: Fast Transient 800 mA Step-Down Converter

Applications

- Cellular phones
- Digital cameras
- Handheld instruments
- Microprocessor/DSP core/IO power
- PDAs and handheld computers
- USB devices

Features

- V_{IN} range: 2.7 V to 5.5 V
- V_{OUT} fixed or adjustable from 0.6 V to V_{IN}
- 27 μA no-load quiescent current
- Output current up to 800 mA
- 1.4 MHz switching frequency
- 120 μs soft start
- Fast load transient
- Over-temperature protection
- Current limit protection
- 100% duty cycle low-dropout operation
- Shutdown current: <1 μA
- Temperature range: −40 °C to +85 °C
- SC70JW (8-pin, 2.2 mm × 2 mm) package (MSL1, 260 °C per JEDEC-J-STD-020)

Description

The AAT1110 SwitchReg™ is a member of Skyworks' Total Power Management IC (TPMIC™) product family. It is a 1.4 MHz step-down converter with an input voltage range of 2.7 V to 5.5 V and output as low as 0.6 V. Its low supply current, small size, and high switching frequency make the AAT1110 the ideal choice for portable applications.

The AAT1110 is available in either a fixed version with internal feedback or a adjustable version with external feedback resistors. It can deliver up to 800 mA of load current while maintaining a low 27 μA no-load quiescent current. The 1.4 MHz switching frequency minimizes the size of external components while keeping switching losses low. The AAT1110 has excellent load regulation and transient response with a small output inductor and capacitor.

The AAT1110 is designed to maintain high efficiency throughout the operating range and provides fast turn-on time.

The AAT1110 is available in a space-saving 2.0 mm × 2.2 mm SC70JW-8 package and is rated over the −40 °C to +85 °C temperature range.

A typical application circuit is shown in Figure 1. The pin configuration is shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.

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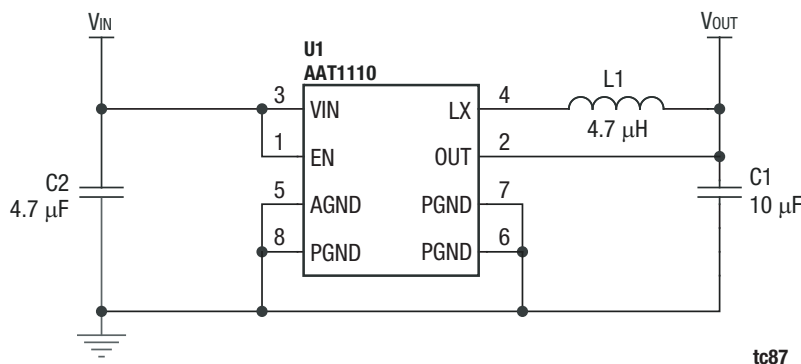
Figure 1. AAT1110 Typical Application Circuit

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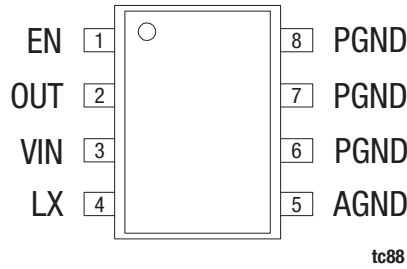
Figure 2. AAT1110 8-Pin SC70JW-8
(Top View)

Table 1. AAT1110 Pin Descriptions

Pin #	Name	Description
1	EN	Enable pin.
2	OUT	Feedback input pin. This pin is connected either directly to the converter output or to an external resistive divider for an adjustable output.
3	VIN	Input supply voltage for the converter.
4	LX	Switching node. Connect the inductor to this pin. It is internally connected to the drain of both high- and low-side MOSFETs.
5	AGND	Non-power signal ground pin.
6, 7, 8	PGND	Main power ground return pin. Connect to the output and input capacitor return.

Electrical and Mechanical Specifications

The absolute maximum ratings of the AAT1110 are provided in Table 2, and the electrical specifications are provided in Table 3.

Typical performance characteristics of the AAT1110 are illustrated in Figures 3 through 24.

Table 2. AAT1110 Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input voltage to GND	V_{IN}		6.0		V
LX to GND	V_{LX}	−0.3		Vin + 0.3	V
OUT to GND	V_{OUT}	−0.3		Vin + 0.3	V
EN to GND	V_{EN}	−0.3		+6.0	V
Operating junction temperature	T_J	−40		+140	°C
Maximum soldering temperature (at leads, 10 seconds)	T_{LEAD}		300		°C
Maximum power dissipation (SC70JW-8)	P_D		719		mW
Thermal resistance (SC70JW-8) (Note 2)	θ_{JA}		160		°C/W

Note 1: Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed may result in permanent damage to the device.

**Note 2:** Mounted on an FR4 board.

CAUTION: Although this device is designed to be as robust as possible, Electrostatic Discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times.

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Table 3. AAT1110 Electrical Specifications (Note 1)
(V_{IN} = 3.6 V, T_A = −40 °C to 85 °C, Unless Otherwise Noted. Typical Values are at T_A = 25 °C)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Step-Down Converter						
Input voltage	V_{IN}		2.7		5.5	V
UVLO threshold	V_{UVLO}	Vin rising			2.7	V
		Hysteresis		100		mV
		V_{IN} falling	1.8			V
Output voltage tolerance	ΔV_{OUT}	I_{OUT} = 0 to 800 mA, V_{IN} = 2.7 V to 5.5 V	−3.5		+3.5	%
Output voltage	V_{OUT}		0.6		V_{IN}	V
Quiescent current	I_Q	No load, 0.6 V adjustable version		27	70	μA
Shutdown current	I_{SHDN}	EN = AGND = PGND			1.0	μA
P-channel current limit	I_{LIM}		800	1200		mA
High-side switch on resistance	$R_{DS(ON)H}$			0.45		Ω
Low-side switch on resistance	$R_{DS(ON)L}$			0.40		Ω
Line regulation	$\Delta V_{LINEREG}$	V_{IN} = 2.7 V to 5.5 V		0.1		%/V
OUT pin leakage current	I_{OUT_LEAK}	0.6 V output			0.2	μA
Output impedance	R_{OUT}	>0.6 V output	250			kΩ
Soft-start time	t_{SS}	From enable to output regulation		120		μs
Oscillator frequency	f_{OSC}	T_A = 25 °C	1.0	1.4	2.0	MHz
Over-temperature shutdown threshold	T_{SD}			140		°C
Over-temperature shutdown hysteresis	T_{HYS}			15		°C
EN						
Enable threshold low	$V_{EN(L)}$				0.6	V
Enable threshold high	$V_{EN(H)}$		1.4			V
Input low current	I_{EN}	V_{IN} = V_{OUT} = 5.5 V	−1.0		1.0	μA

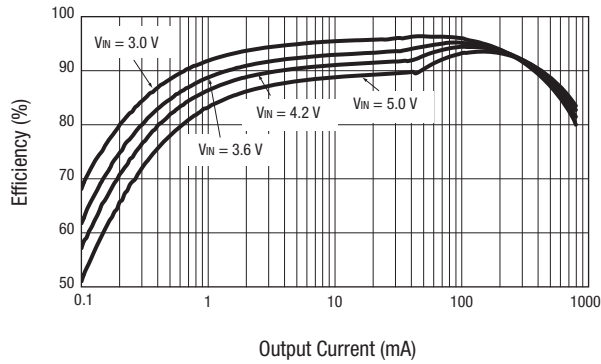**Note 1:** Performance is guaranteed only under the conditions listed in this Table.

6 Typical Performance Characteristics
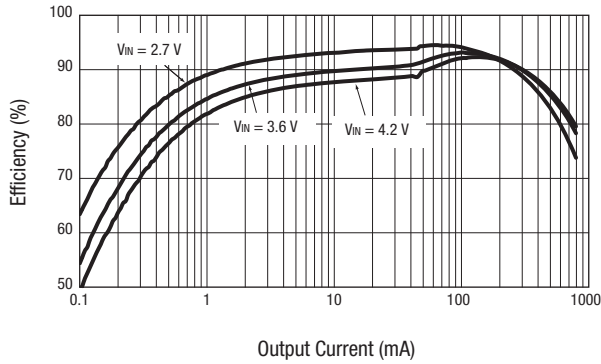
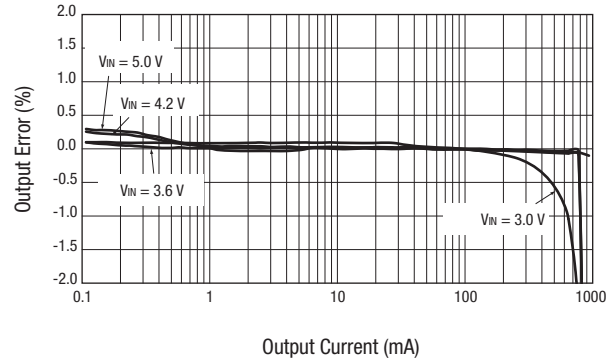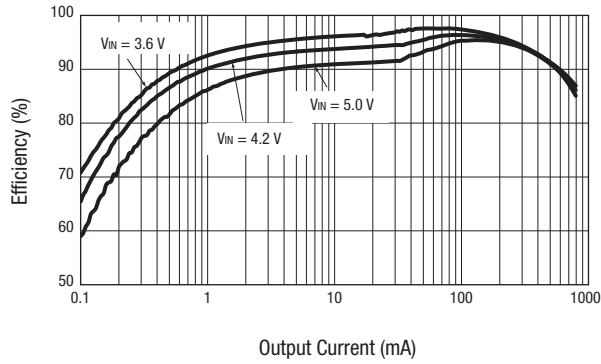**Figure 3. Efficiency vs Load**
(V$_{OUT}$ = 1.8 V, L = 4.7 μH)
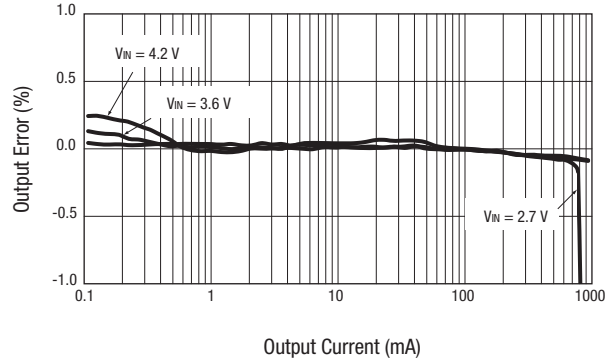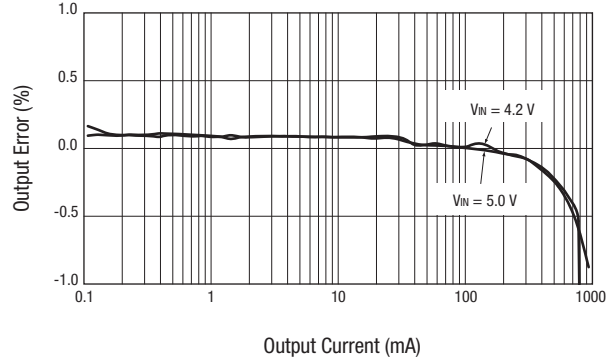
Figure 4. DC Regulation
(V$_{OUT}$ = 1.8 V)

Figure 5. Efficiency vs Load
(V$_{OUT}$ = 2.5 V, L = 6.8 μH)
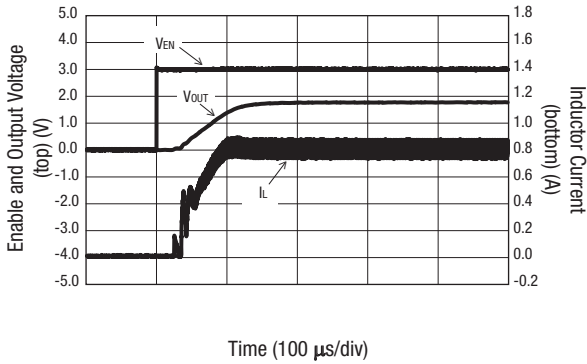
Figure 6. DC Regulation
(V$_{OUT}$ = 2.5 V)

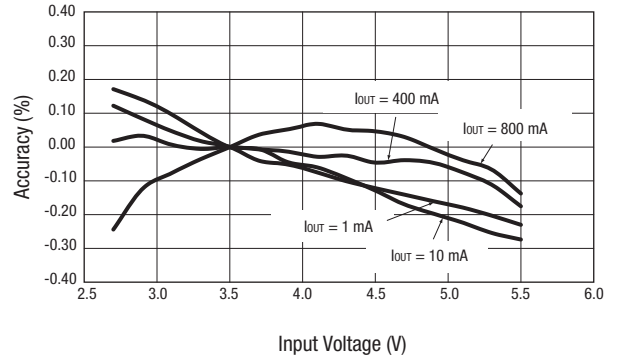**Figure 7. Efficiency vs Load**
(V$_{OUT}$ = 3.3 V, L = 6.8 μH)

Figure 8. DC Regulation
(V$_{OUT}$ = 3.3 V)

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Typical Performance Characteristics

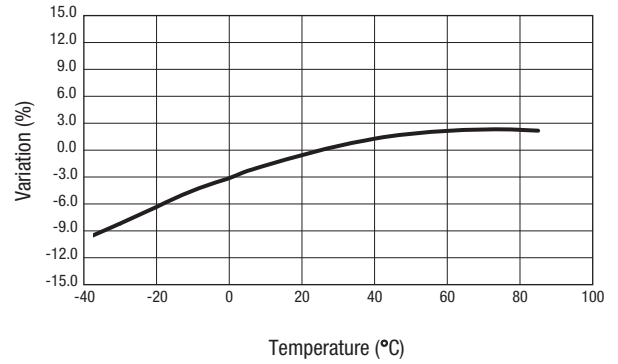Figure 9. Soft Start
(V$_{IN}$ = 3.6 V, V$_{OUT}$ = 1.8 V, I$_{OUT}$ = 800 mA)
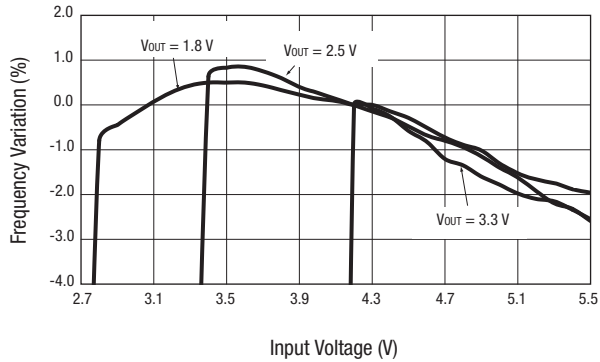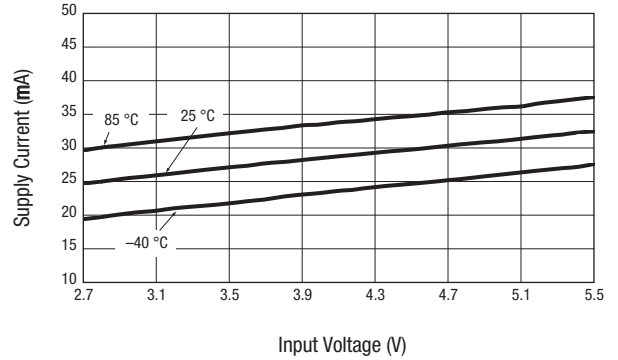

Figure 10. Line Regulation
(V$_{OUT}$ = 1.8 V)
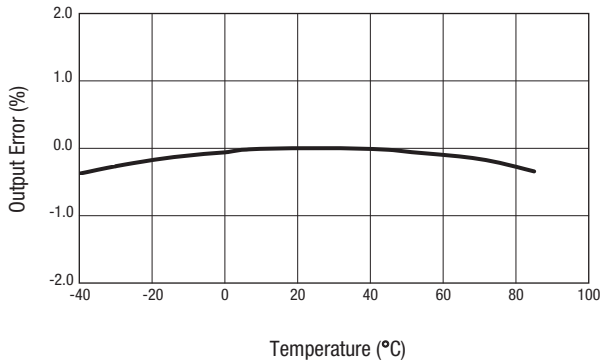
Figure 11. Output Voltage Error vs Temperature
(V$_{IN}$ = 3.6 V, V$_{OUT}$ = 1.8 V, I$_{OUT}$ = 400 mA)

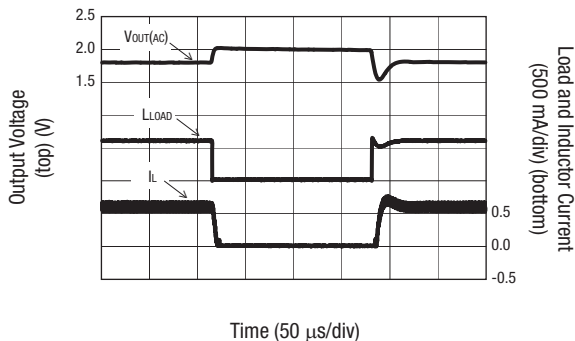Figure 12. Switching Frequency vs Temperature
(V$_{IN}$ = 3.6 V, V$_{OUT}$ = 1.8 V)

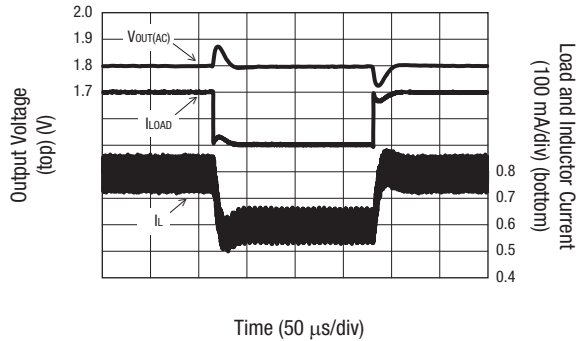Figure 13. Frequency vs Input Voltage
(I$_{OUT}$ = 800 mA)
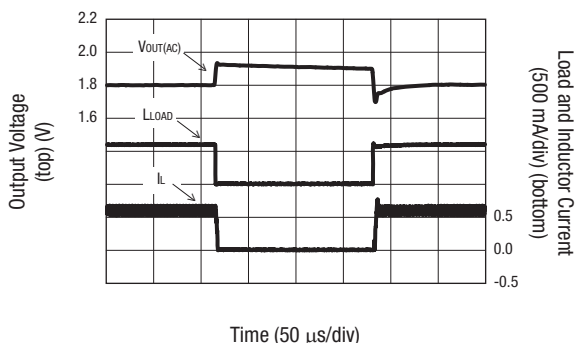

Figure 14. No Load Quiescent Current vs Input Voltage
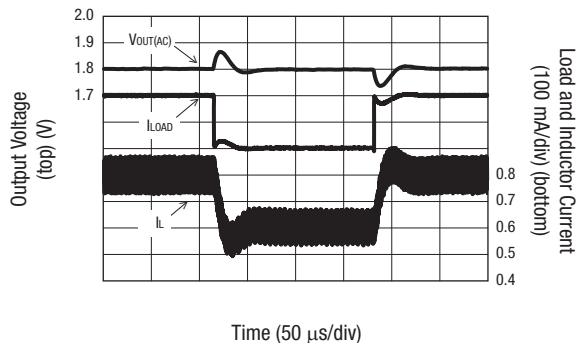
Typical Performance Characteristics

Figure 15. Load Transient Response
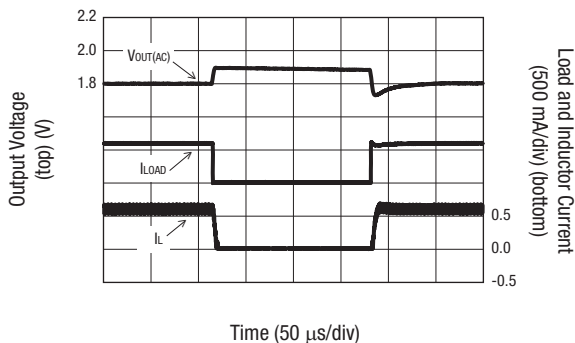**(1 mA to 600 mA, V$_{IN}$ = 3.6 V, V$_{OUT}$ = 1.8 V, C1 = 10 μF)**

Figure 16. Load Transient Response
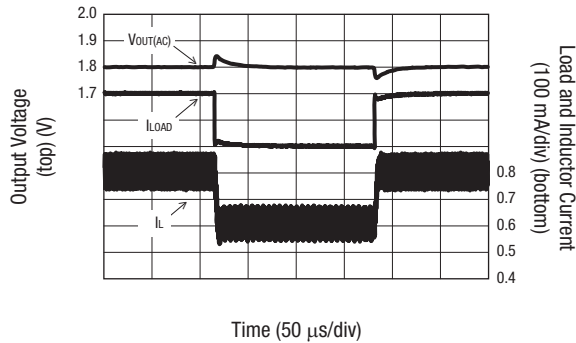**(600 mA to 800 mA, V$_{IN}$ = 3.6 V, V$_{OUT}$ = 1.8 V, C1 = 10 μF)**

Figure 17. Load Transient Response
(1 mA to 600 mA, V$_{IN}$ = 3.6 V, V$_{OUT}$ = 1.8 V,
C1 = 10 μF, C$_{FF}$ = 100 pF)
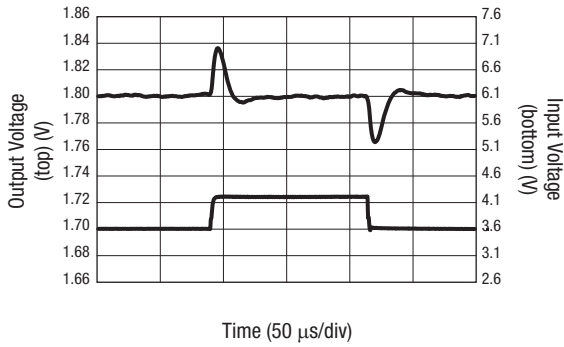

Figure 18. Load Transient Response
(600 mA to 800 mA, V$_{IN}$ = 3.6 V, V$_{OUT}$ = 1.8 V, C1 = 22 μF)

Figure 19. Load Transient Response
(1 mA to 600 mA, V$_{IN}$ = 3.6 V, V$_{OUT}$ = 1.8 V,
C1 = 22 μF, C$_{FF}$ = 100 pF)

Figure 20. Load Transient Response
(600 mA to 800 mA, V$_{IN}$ = 3.6 V, V$_{OUT}$ = 1.8 V,
C1 = 10 μF, C$_{FF}$ = 100 pF)

Typical Performance Characteristics

Figure 21. Line Response
(V$_{OUT}$ = 1.8 V @ 800 mA)
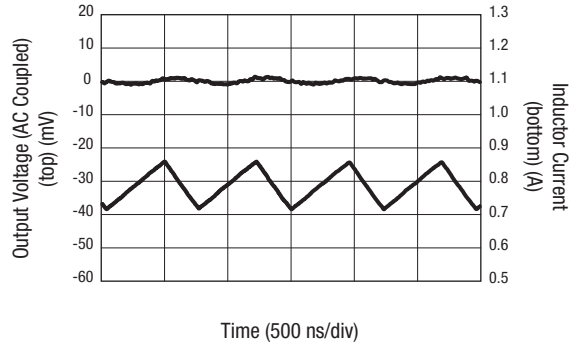
Figure 22. Output Ripple
(V$_{IN}$ = 3.6 V, V$_{OUT}$ = 1.8 V, I$_{OUT}$ = 800 mA)

Figure 23. Output Ripple
(V$_{IN}$ = 3.6 V, V$_{OUT}$ = 1.8 V, I$_{OUT}$ = 1 mA)
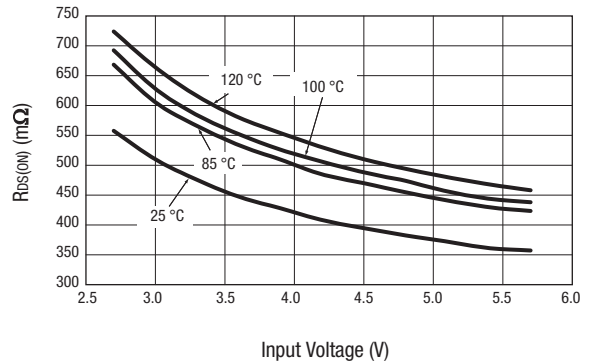
Figure 24. P-Channel R$_{DS(ON)}$ vs Input Voltage
(V$_{OUT}$ = 1.8 V; C$_{FF}$ = 100 pF)
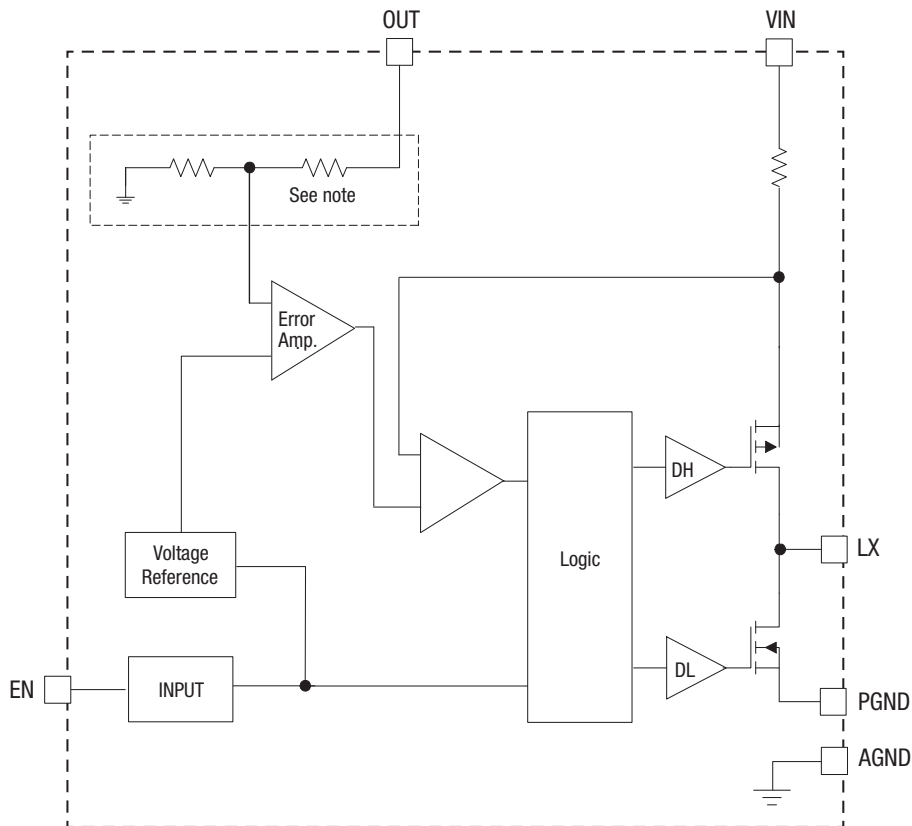
Note: For adjustable version, the internal feedback divider is omitted and the OUT pin is tied directly
to the internal error amplifier.

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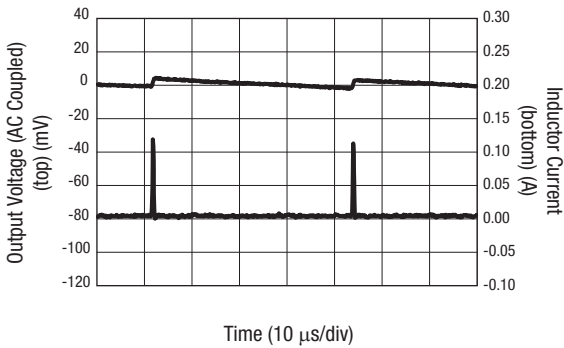
Figure 25. AAT1110 Functional Block Diagram

Functional Description

The AAT1110 is a high performance 800 mA, 1.4 MHz
monolithic step-down converter. It has been designed with the
goal of minimizing external component size and optimizing
efficiency over the complete load range. Apart from the small
bypass input capacitor, only a small L-C filter is required at the
output. Typically, a 4.7 μH inductor and a 10 μF ceramic
capacitor are recommended..

A functional block diagram is shown in Figure 25.

The fixed output version requires only three external power
components (C_{IN}, C_{OUT}, and L). The adjustable version can be
programmed with external feedback to any voltage, ranging
from 0.6 V to the input voltage. An additional feed-forward
capacitor (C4) can also be added to the external feedback to
provide improved transient response (see Figure 26).

At dropout, the converter duty cycle increases to 100% and the
output voltage tracks the input voltage minus the R_{DSON} drop of
the P-channel high-side MOSFET.

The input voltage range is 2.7 V to 5.5 V. The converter
efficiency has been optimized for all load conditions, ranging
from no load to 800 mA.

The internal error amplifier and compensation provides
excellent transient response, load, and line regulation. Soft start
eliminates any output voltage overshoot when the enable is
applied.

Control Loop

The AAT1110 is a peak current mode step-down converter. The
current through the P-channel MOSFET (high side) is sensed for
current loop control, as well as short circuit and overload
protection. A fixed slope compensation signal is added to the
sensed current to maintain stability for duty cycles greater than
50%. The peak current mode loop appears as a voltage-
programmed current source in parallel with the output capacitor.

The output of the voltage error amplifier programs the current
mode loop for the necessary peak switch current to force a
constant output voltage for all load and line conditions. Internal
loop compensation terminates the transconductance voltage
error amplifier output. For fixed voltage versions, the error
amplifier reference voltage is internally set to program the
converter output voltage. For the adjustable output, the error
amplifier reference is fixed at 0.6 V.

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U1: AAT1110 SC70JW-8
L1: CDRH3D16-4R7
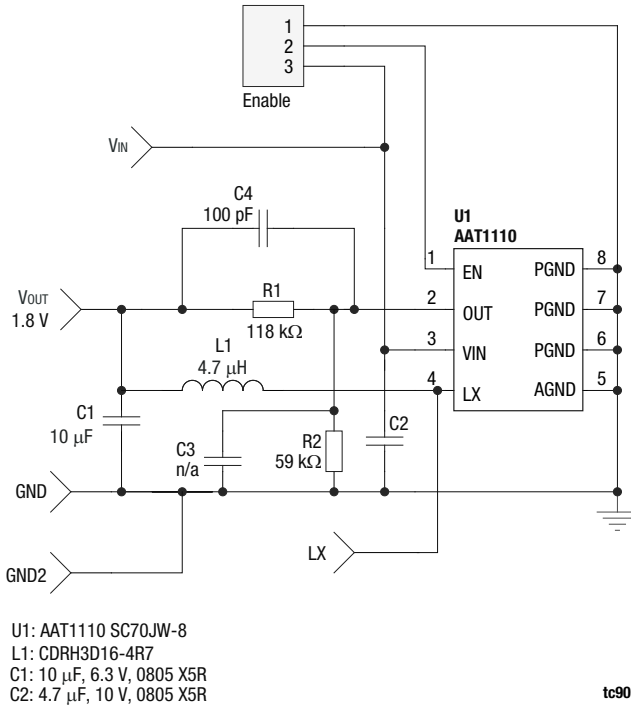C1: 10 µF, 6.3 V, 0805 X5R
C2: 4.7 µF, 10 V, 0805 X5R

tc90

Figure 26. Enhanced Transient Response Schematic

Soft Start/Enable

Soft start limits the current surge seen at the input and eliminates output voltage overshoot. When pulled low, the enable input forces the AAT1110 into a low power, non-switching state. The total input current during shutdown is less than 1 µA.

Current Limit and Over-Temperature Protection

For overload conditions, the peak input current is limited. To minimize power dissipation under current limit and short-circuit conditions, switching is terminated after entering current limit for a series of pulses. Switching is terminated for seven consecutive clock cycles after a current limit has been sensed for a series of four consecutive clock cycles.

Thermal protection completely disables switching when internal dissipation becomes excessive. The junction over-temperature threshold is 140 °C with 15 °C of hysteresis. Once an over-temperature or over-current fault conditions is removed, the output voltage automatically recovers.

Under-Voltage Lockout

Internal bias of all circuits is controlled via the V_{IN} input. Under-voltage lockout (UVLO) guarantees sufficient V_{IN} bias and proper operation of all internal circuitry prior to activation.

Applications Information

Inductor Selection

The step-down converter uses peak current mode control with slope compensation to maintain stability for duty cycles greater than 50%. The output inductor value must be selected so the inductor current down slope meets the internal slope compensation requirements. The internal slope compensation for the adjustable and low-voltage fixed versions of the AAT1110 is 0.24 A/µs. This equates to a slope compensation that is 75% of the inductor current down slope for a 1.5 V output and 4.7 µH inductor.

$$m = \frac{0.75 \times V_{OUT}}{L} = \frac{0.75 \times 1.5V}{4.7\,\mu H} = 0.24\,\frac{A}{\mu s}$$

This is the internal slope compensation for the adjustable (0.6 V) version or low-voltage fixed versions. When externally programming the 0.6 V version to 2.5 V, the calculated inductance is 7.5 µH.

$$L = \frac{0.75 \times V_{OUT}}{m} = \frac{0.75 \times V_{OUT}}{0.24\,\dfrac{A}{\mu s}} \approx 3\,\frac{\mu s}{A} \times V_{OUT}$$

$$= 3\,\frac{\mu s}{A} \times 2.5V = 7.5\,\mu H$$

In this case, a standard 6.8 µH value is selected.

For high-voltage fixed versions ($\geq$ 2.5 V), m = 0.48 A/µs.

Manufacturer's specifications list both the inductor DC current rating, which is a thermal limitation, and the peak current rating, which is determined by the saturation characteristics. The inductor should not show any appreciable saturation under normal load conditions. Some inductors may meet the peak and average current ratings yet result in excessive losses due to a high DCR. Always consider the losses associated with the DCR and its effect on the total converter efficiency when selecting an inductor.

Input Capacitor

Select a 4.7 µF to 22 µF X7R or X5R ceramic capacitor for the input. To estimate the required input capacitor size, determine the acceptable input ripple level (V_{PP}) and solve for C. The calculated value varies with input voltage and is a maximum when V_{IN} is double the output voltage.

$$C_{IN} = \frac{\dfrac{V_{OUT}}{V_{IN}} \times \left(1 - \dfrac{V_{OUT}}{V_{IN}} \right)}{\left(\dfrac{V_{PP}}{I_{OUT}} - ESR \right) \times f_S}$$

$$\frac{V_{OUT}}{V_{IN}} \times \left(1 - \frac{V_{OUT}}{V_{IN}} \right) = \frac{1}{4} \quad \textit{for} \quad V_{IN} = 2 \times V_{OUT}$$

$$C_{IN(MIN)} = \frac{1}{\left(\dfrac{V_{PP}}{I_{OUT}} - ESR\right) \times 4 \times f_S}$$

Where, fs is the switching frequency.

Always examine the ceramic capacitor DC voltage coefficient characteristics when selecting the proper value. For example, the capacitance of a 10 μF, 6.3 V, X5R ceramic capacitor with 5.0 V DC applied is actually about 6 μF.

The maximum input capacitor RMS current is:

$$I_{RMS} = I_{OUT} \times \sqrt{\frac{V_{OUT}}{V_{IN}} \times \left(1 - \frac{V_{OUT}}{V_{IN}}\right)}$$

The input capacitor RMS ripple current varies with the input and output voltage and always is less than or equal to half of the total DC load current.

$$\sqrt{\frac{V_{OUT}}{V_{IN}} \times \left(1 - \frac{V_{OUT}}{V_{IN}}\right)} = \sqrt{D \times (1-D)} = \sqrt{0.5^2} = \frac{1}{2}$$

for $V_{IN} = 2 \times V_{OUT}$

$$I_{RMS\ (MAX)} = \frac{I_{OUT}}{2}$$

The term $\frac{V_{OUT}}{V_{IN}} \times \left(1 - \frac{V_{OUT}}{V_{IN}}\right)$ appears in both the input voltage ripple and input capacitor RMS current equations and is a maximum when V_{OUT} is twice V_{IN}. This is why the input voltage ripple and the input capacitor RMS current ripple are a maximum at 50% duty cycle.

The input capacitor provides a low impedance loop for the edges of pulsed current drawn by the AAT1110. Low ESR/ESL X7R and X5R ceramic capacitors are ideal for this function. To minimize stray inductance, the capacitor should be placed as closely as possible to the IC. This keeps the high frequency content of the input current localized, minimizing EMI and input voltage ripple.

The proper placement of the input capacitor (C2) can be seen in the evaluation board layout in Figure 28.

A laboratory test setup typically consists of two long wires running from the bench power supply to the evaluation board input voltage pins. The inductance of these wires, along with the low-ESR ceramic input capacitor, can create a high-Q network that may affect converter performance. This problem often becomes apparent in the form of excessive ringing in the output voltage during load transients. Errors in the loop phase and gain measurements can also result.

Because the inductance of a short PCB trace feeding the input voltage is significantly lower than the power leads from the bench power supply, most applications do not exhibit this problem.

In applications where the input power source lead inductance cannot be reduced to a level that does not affect the converter performance, a high ESR tantalum or aluminum electrolytic should be placed in parallel with the low ESR, ESL bypass ceramic. This dampens the high-Q network and stabilizes the system.

Output Capacitor

The output capacitor limits the output ripple and provides holdup during large load transitions. A 4.7 μF to 10 μF X5R or X7R ceramic capacitor typically provides sufficient bulk capacitance to stabilize the output during large load transitions and has the ESR and ESL characteristics necessary for low output ripple.

The output voltage droop due to a load transient (ΔI$_{LOAD}$) is dominated by the capacitance of the ceramic output capacitor. During a step increase in load current, the ceramic output capacitor alone supplies the load current until the loop responds. Within two or three switching cycles, the loop responds and the inductor current increases to match the load current demand. The relationship of the output voltage droop during the three switching cycles to the output capacitance can be estimated by:

$$C_{OUT} = \frac{3 \times \Delta I_{LOAD}}{V_{DROOP} \times f_S}$$

Once the average inductor current increases to the DC load level, the output voltage recovers. The above equation establishes a limit on the minimum value for the output capacitor with respect to load transients.

The internal voltage loop compensation also limits the minimum output capacitor value to 4.7 μF. This is due to its effect on the loop crossover frequency (bandwidth), phase margin, and gain margin. Increased output capacitance reduces the crossover frequency with greater phase margin.

The maximum output capacitor RMS ripple current is given by:

$$I_{RMS\ (MAX)} = \frac{1}{2\sqrt{3}} \times \frac{V_{OUT} \times (V_{IN(MAX)} - V_{OUT})}{L \times f_S \times V_{IN(MAX)}}$$

Dissipation due to the RMS current in the ceramic output capacitor ESR is typically minimal, resulting in less than a few degrees rise in hot-spot temperature.

Adjustable Output Resistor Selection

For applications requiring an adjustable output voltage, the 0.6 V version can be externally programmed. Resistors R1 and R2 of Figure 28 program the output to regulate at a voltage higher than 0.6 V. To limit the bias current required for the external feedback resistor string while maintaining good noise immunity, the minimum suggested value for R2 is 59 kΩ. Although a larger value can further reduce quiescent current, it also increases the impedance of the feedback node, making it more sensitive to external noise and interference. Table 4 summarizes the resistor values for various output voltages with R2 set to either 59 kΩ for good noise immunity or 221 kΩ for reduced no-load input current.

$$R1 = \left(\frac{V_{OUT}}{V_{REF}} - 1 \right) \times R2 = \left(\frac{1.5V}{0.6V} - 1 \right) \times 59k\Omega = 88.5k\Omega$$

The adjustable version of the AAT1110, combined with an external feed-forward capacitor (C4 in Figure 26), delivers enhanced transient response for extreme pulsed load applications. Addition of the feed-forward capacitor typically requires a larger output capacitor C1 for stability.

Table 4. Adjustable Resistor Values for Use with 0.6 V Step-Down Converter

V_OUT (V)	R1 (kΩ) (R2 = 59 kΩ)	R1 (kΩ) (R2 = 221 kΩ)
0.8	19.6	75
0.9	29.4	113
1.0	39.2	150
1.1	49.9	187
1.2	59.0	221
1.3	68.1	261
1.4	78.7	301
1.5	88.7	332
1.8	118	442
1.85	124	464
2.0	137	523
2.5	187	715
3.3	267	1000

Thermal Calculations

There are three types of losses associated with the AAT1110 step-down converter: switching losses, conduction losses, and quiescent current losses. Conduction losses are associated with the R_DS(ON) characteristics of the power output switching devices. Switching losses are dominated by the gate charge of the power output switching devices. At full load, assuming continuous conduction mode (CCM), a simplified form of the losses is given by:

$$P_{TOTAL} = \frac{I_{OUT}^2 \times \left(R_{DS(ON)H} \times V_{OUT} + R_{DS(ON)L} \times [V_{IN} - V_{OUT}] \right)}{V_{IN}}$$
$$+ \left(t_{SW} \times f_S \times I_{OUT} + I_Q \right) \times V_{IN}$$

I_Q is the step-down converter quiescent current. The term t_SW is used to estimate the full load step-down converter switching losses.

For the condition where the step-down converter is in dropout at 100% duty cycle, the total device dissipation reduces to:

$$P_{TOTAL} = I_{OUT}^2 \times R_{DS(ON)H} + I_Q \times V_{IN}$$

Since R_DS(ON), quiescent current, and switching losses all vary with input voltage, the total losses should be investigated over the complete input voltage range.

Given the total losses, the maximum junction temperature can be derived from the θ_JA for the SC70JW-8 package which is 160 °C/W.

$$T_{J(MAX)} = P_{TOTAL} \times \theta_{JA} + T_A$$

Layout

The following guidelines should be used to help ensure a proper layout.

- The input capacitor (C2) should connect as closely as possible to VIN (Pin 3) and PGND (Pins 6-8).

- C1 and L1 should be connected as closely as possible. The connection of L1 to the LX pin should be as short as possible.

- The feedback trace or OUT pin (Pin 2) should be separate from any power trace and connect as closely as possible to the load point. Sensing along a high-current load trace degrades DC load regulation. If external feedback resistors are used, they should be placed as closely as possible to the OUT pin (Pin 2) to minimize the length of the high impedance feedback trace.

- The resistance of the trace from the load return to the PGND (Pins 6-8) should be kept to a minimum. This helps minimize any error in DC regulation due to differences in the potential of the internal signal ground and the power ground.

Evaluation Board Description

The AAT1110 Evaluation Board schematic diagram is provided in Figure 27. The PCB layer details are shown in Figure 28. Table 5 lists the evaluation board component values. Tables 6 and 7 give the typical surface mount inductors and surface mount capacitors.
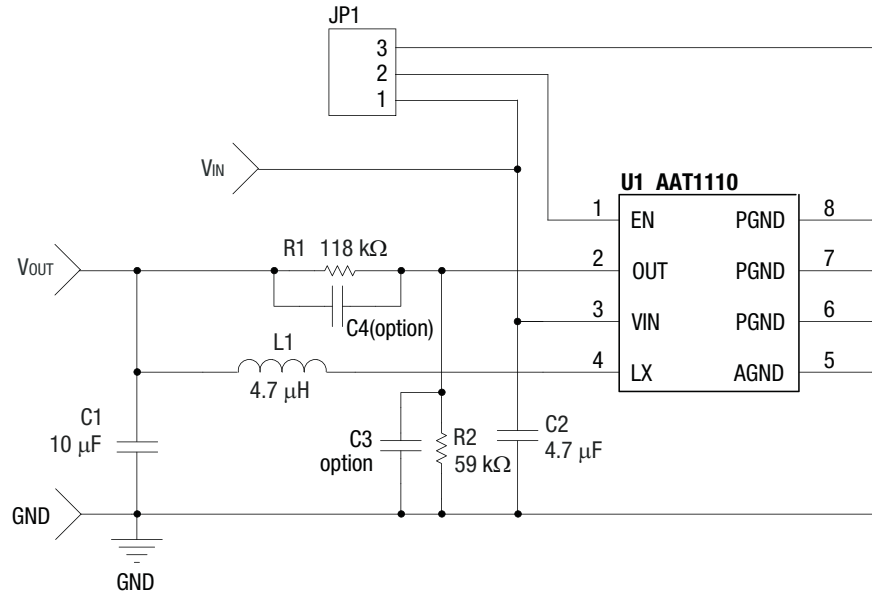
U1: AAT1110 SC70JW-8
L1: CDRH3D16-4R7
C1: 10 μF, 6.3 V, 0805 X5R
C2: 4.7 μF, 10 V, 0805 X5R

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Figure 27. AAT1110 Adjustable Evaluation Board Schematic
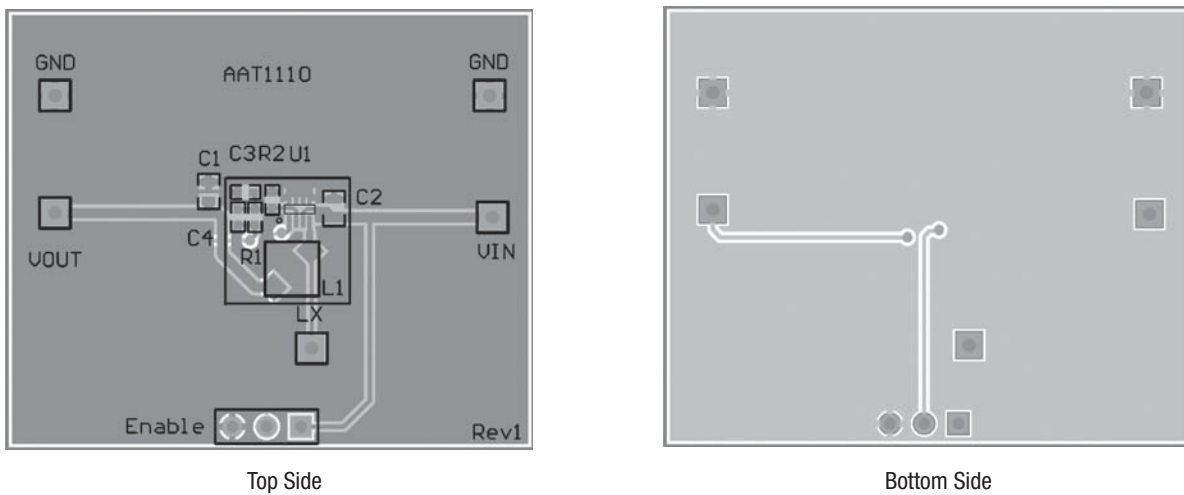
Top Side

Bottom Side

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Figure 28. AAT1110 Evaluation Board Layer Details

Table 5. Evaluation Board Component Values

Adjustable Version (0.6 V device)			
V_{OUT} (V)	R1 (kΩ) (R2 = 59 kΩ)	R1 (kΩ) (R2 = 221 kΩ) (Note 1)	L1 (μH)
0.8	19.6	75.0	2.2
0.9	29.4	113	2.2
1.0	39.2	150	2.2
1.1	49.9	187	2.2
1.2	59.0	221	2.2
1.3	68.1	261	2.2
1.4	78.7	301	4.7
1.5	88.7	332	4.7
1.8	118	442	4.7
1.85	124	464	4.7
2.0	137	523	6.8
2.5	187	715	6.8
3.3	267	1000	6.8
Fixed Version			
V_{OUT} (V)	（R1, R2 Not Used）		L1 (μH)
0.6-3.3V			4.7

Note 1: For reduced quiescent current, R2 = 221 kΩ.

Table 6. Typical Surface Mount Inductors

Manufacturer	Part Number/Type	Inductance (μH)	Max. DC Current (A)	DCR (mΩ)	Size (mm) L×W×H
TOKO	1276AS-H-2R2N	2.2	1.60	98	3.2×2.5×1.0
TOKO	1239AS-H-4R7M	4.7	1.30	200	2.5×2.0×1.2
TOKO	1277AS-H-6R8N	6.8	1.20	230	3.2×2.5×1.2
Murata	LQM2HPN2R2MMR	2.2	1.38	68	2.5×2.0×1.1
Murata	LQH32PN4R7NNC	4.7	1.20	155	3.1×3.1×1.5
Coilcraft	LPS3015-222MLB	2.2	2.0	110	3.1×3.1×1.5

Table 7. Surface Mount Capacitors

Manufacturer	Part Number	Value (μF)	Voltage (V)	Temperature Coefficient	Case
Murata	GRM219R61A475KE19	4.7	10	X5R	0805
Murata	GRM21BR60J106KE19	10	6.3	X5R	0805
Murata	GRM21BR60J226ME39	22	6.3	X5R	0603

Package Information

Package dimensions and tape & reel dimensions are shown in
Figures 29 and 30, respectively.
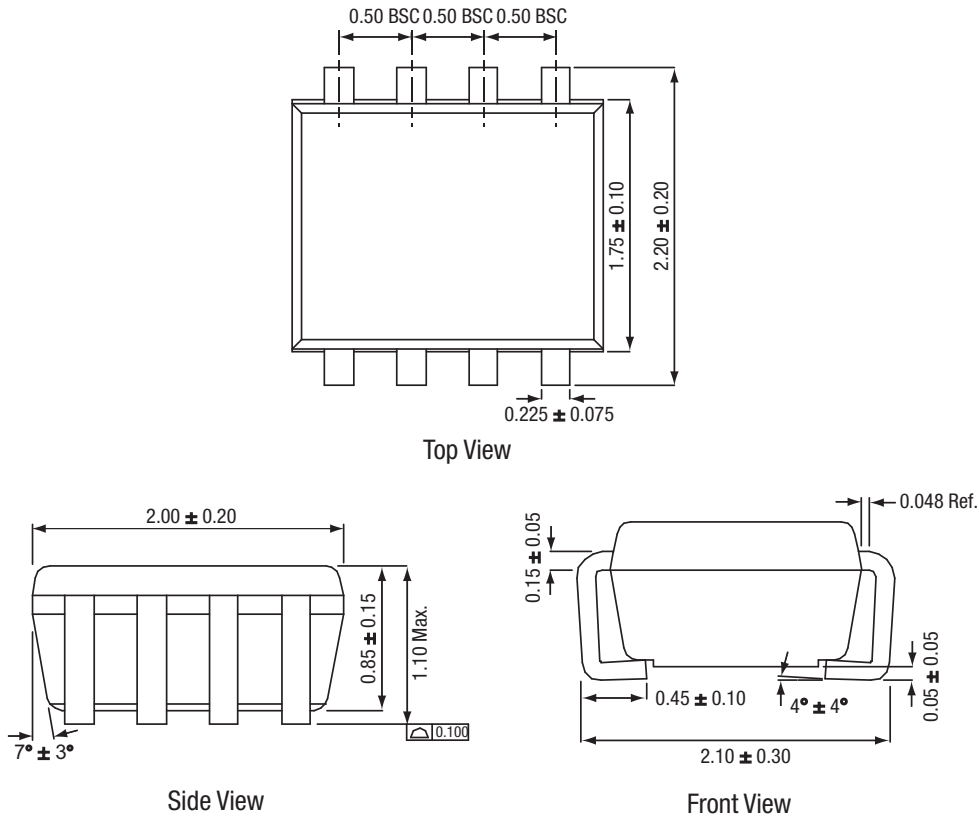
Figure 29. AAT1110 8-pin SC70JW Package Dimensions
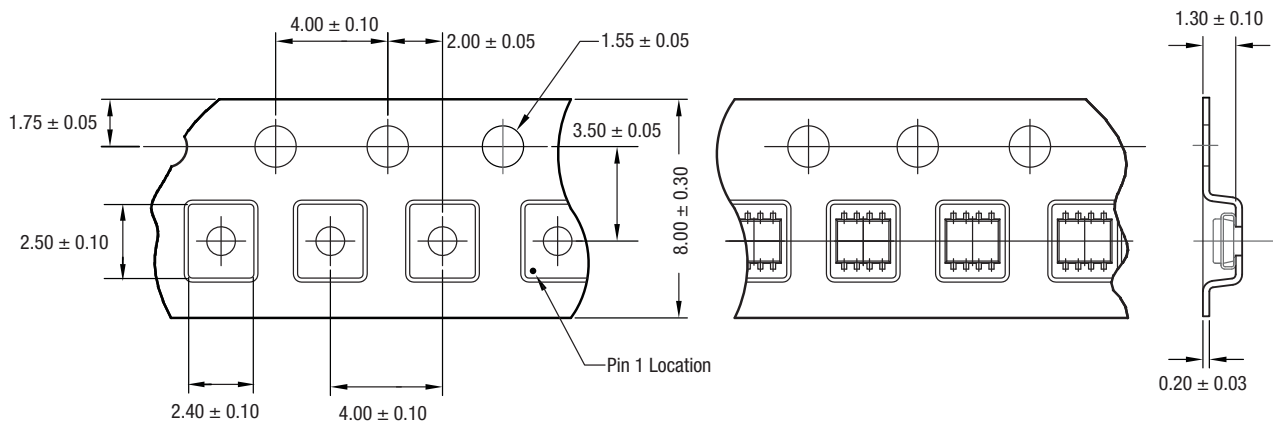
Figure 30. AAT1110 Carrier Tape Dimensions

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Ordering Information

Model Name	Output Voltage (Note 1)	Package	Marking (Note 2)	Manufacturing Part Number (Note 3)
AAT1110 Fast Transient 800 mA Step-Down Converter	3.3 V	SC70JW-8	TSXYY	**AAT1110IJS-3.3-T1**
	Adj. ≥ 0.6 V	SC70JW-8	SRXYY	**AAT1110IJS-0.6-T1**

Note 1: Contact Sales for other voltage options.

Note 2: XYY = assembly and date code.

Note 3: Sample stock is generally held on part numbers listed in **BOLD**.