



Advanced Analog Technology, Inc.

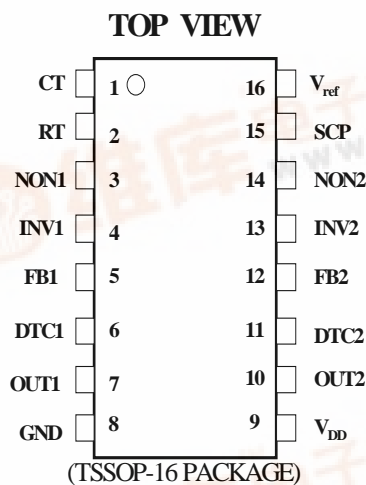
AAT1104/AAT1104A

2-CHANNEL SWITCHING REGULATOR CONTROLLER

Features

- Complete PWM Power Control Circuitry
- Precision Reference : $2.505V \pm 1\%$ ($25^\circ C$)
- Under-voltage Lockout Protection
- Open Drain Output
- Output Short Circuit Protection
- Low Dissipation Current : 1.6mA
- Dead Time Control : 0 to 100%
- Wide Operating Frequency : 10kHz to 800kHz
- VDD range : 4.0V to 6.5V

Pin Configuration



General Description

The AAT1104/AAT1104A provides an integrated two-channel pulse-width-modulation (PWM) solution for the power supply of DC-DC system, this device offers the systems engineer the flexibility to tailor the power supply circuitry to a specific application. Each channel contains its own error amplifier, PWM comparator, dead-time control and output driver. The under-voltage protection, oscillator, short circuit protection and voltage reference circuit are common for the two channels.

Both channel of AAT1104/AAT1104A can be used for DC/DC converter operations including step-up, step-down, and inverting. Dead-time control (DTC) can be set to provide 0% to 100% dead time by resistive divider network. Soft start can be implemented by paralleling the DTC resistor with a capacitor. Two dead time control inputs are assigned for Ch-1 and Ch-2 individually, and dead time control inputs can be used to control on / off operation.

With a minimum number of external components, the AAT1104/AAT1104A offers a simple and cost effective solution.

*Spec is subject to change without notice in this document.





Pin Description

Pin #	Name	I/O	Description
1	CT	I	External timing capacitance
2	RT	I	External timing resistance
3	NON1	I	Positive input for error amplifier 1
4	INV1	I	Negative input for error amplifier 1
5	FB1	I	Output for error amplifier 1
6	DTC1	I	Output 1 dead time / soft start setting
7	OUT1	O	Output 1
8	GND		Ground
9	V _{DD}	I	Power supply
10	OUT2	O	Output 2
11	DTC2	I	Output 2 dead time / soft start setting
12	FB2	I	Output for error amplifier 2
13	INV2	I	Negative input for error amplifier 2
14	NON2	I	Positive input for error amplifier 2
15	SCP	I	Timer latch setting
16	V _{ref}	O	Reference voltage (2.505V) output

**Absolute Maximum Ratings**

CHARACTERISTICS	SYMBOL	VALUE	UNIT
Supply voltage	V_{DD}	7	V
Input voltage (IN-, DTC)	V_I	V_{DD}	V
Output voltage	V_O	$V_{DD}+0.3$	V
Output current	I_O	120	mA
Operating free-air temperature range	T_{ope}	-20 to 85	°C
Storage temperature range	T_{stg}	-65 to 150	°C
Power dissipation	P_d	500	mW

Recommended Operating Conditions

	Symbol	Min	Max	Unit
Supply voltage, V_{DD}	V_{DD}	4.0	6.5	V
Input voltage, IN1, IN2	V_{cm}	0.5	1.6	V
Output voltage	V_O	0	V_{DD}	V
OSC capacitor	C_T	100	15000	pF
OSC resistor (Note 1)	R_T	5.1	50	k
Oscillator frequency	f_{OSC}	10	800	kHz
Output current, Iout1, Iout2	I_O		100	mA
Operating free-air temperature	T_{ope}	-20	85	°C



Electrical Characteristics, $V_{DD} = 5.0V$ (Unless Otherwise Specified) (See Note 1)

Oscillator

Parameter		Test Condition	Min	Typ	Max	Unit
Frequency	f_{OSC}	$C_T = 220pF, R_T = 10k$	320	400	480	KHz
Frequency change with V_{DD}	f_{dV}	$V_{DD} = 4.0V$ to $6.0V$, $T_A = 25^\circ C$ $C_T = 220pF, R_T = 10k$		1		%

Under-voltage Protection

Parameter		Test Condition	Min	Typ	Max	Unit
Upper threshold voltage	V_{UPH}	$T_A = 25^\circ C$	2.6	2.9	3.2	V
Lower threshold voltage	V_{UPL}	$T_A = 25^\circ C$	2.23	2.53	2.83	V
Hysteresis ($V_{UPH} - V_{UPL}$)	V_{HYS}	$T_A = 25^\circ C$		0.37		V

Short Circuit Protection Control

Parameter		Test Condition	Min	Typ	Max	Unit
Input threshold voltage	V_{r1}	Ch-1, 2	0.95	1.05	1.15	V
		AAT1104A only	1.02	1.18	1.34	
Short-circuit detect threshold voltage	V_{r2}		1.48	1.64	1.8	V
		AAT1104A only	0.6	0.7	0.8	
SCP terminal source current	I_{SCP}		-1.5	-2.5	-3.5	μA
		AAT1104A only	-10	-15	-20	
Standby Voltage	V_{STB}			50	100	mV
Latch Voltage	V_{LT}			30	100	mV

Note1: Typical values of all parameters are specified at $T_A = 25^\circ C$.



Electrical Characteristics, $V_{DD} = 5.0V$ (Unless Otherwise Specified) (See Note 1) (continued)

Reference Voltage

Parameter		Test Conditions	Min	Typ	Max	Unit
Reference voltage	V_{REF}	$I_{REF} = -1mA, T_A = 25^\circ C$	2.48	2.505	2.53	V
Input voltage regulation	V_{RI}	$I_{REF} = -1mA,$ $V_{DD} = 4.0V$ to $6.0V$		1	5	mV
Output regulation	V_{RO}	$I_{REF} = -0.1mA$ to $-3mA$		1	10	mV

EA (Error Amplifier)

Parameter		Test Condition	Min	Typ	Max	Unit
Input offset voltage	V_{IO}	Ch-1,2, $A_v=1$			6	mV
Input bias current	I_{IB}	Ch-1,2		± 15	± 100	nA
Input voltage range	V_{IR}	Ch-1,2	0.5		1.6	V
Open-loop voltage amplification	A_{VD}		70	85		dB
Output voltage swing	V_{OM+}		2.3	2.5		V
	V_{OM-}			0.7	0.9	
Output sink current	I_{OM+}	FB=1.25V	3	20		mA
Output source current	I_{OM-}	FB=1.25V	-45	-75		μA
Common-mode rejection ratio	CMRR		60	80		dB



Electrical Characteristics, $V_{DD} = 5.0V$ (Unless Otherwise Specified) (See Note 1) (continued)

Dead Time Control & PWM

Parameter		Test Condition	Min	Typ	Max	Unit
Input bias current	I_{BDT}	$V_{DTC} = 2V$		0.1	1	μA
Input threshold voltage (DTC)	V_{d0}	Duty = 0%, $f_{OSC} = 10kHz$	1.87	1.97	2.07	V
		AAT1104A only	1.85	2.05	2.25	
	V_{d100}	Duty = 100%, $f_{OSC} = 10kHz$	1.38	1.48	1.58	
		AAT1104A only	1.2	1.45	1.7	
Latch input voltage	V_{DT}	$I_{DT} = 40\mu A$	2.28	2.48		V
Latch mode source current	I_{DT}	DTC1,2=0V	-200	-560		μA

Output Stage

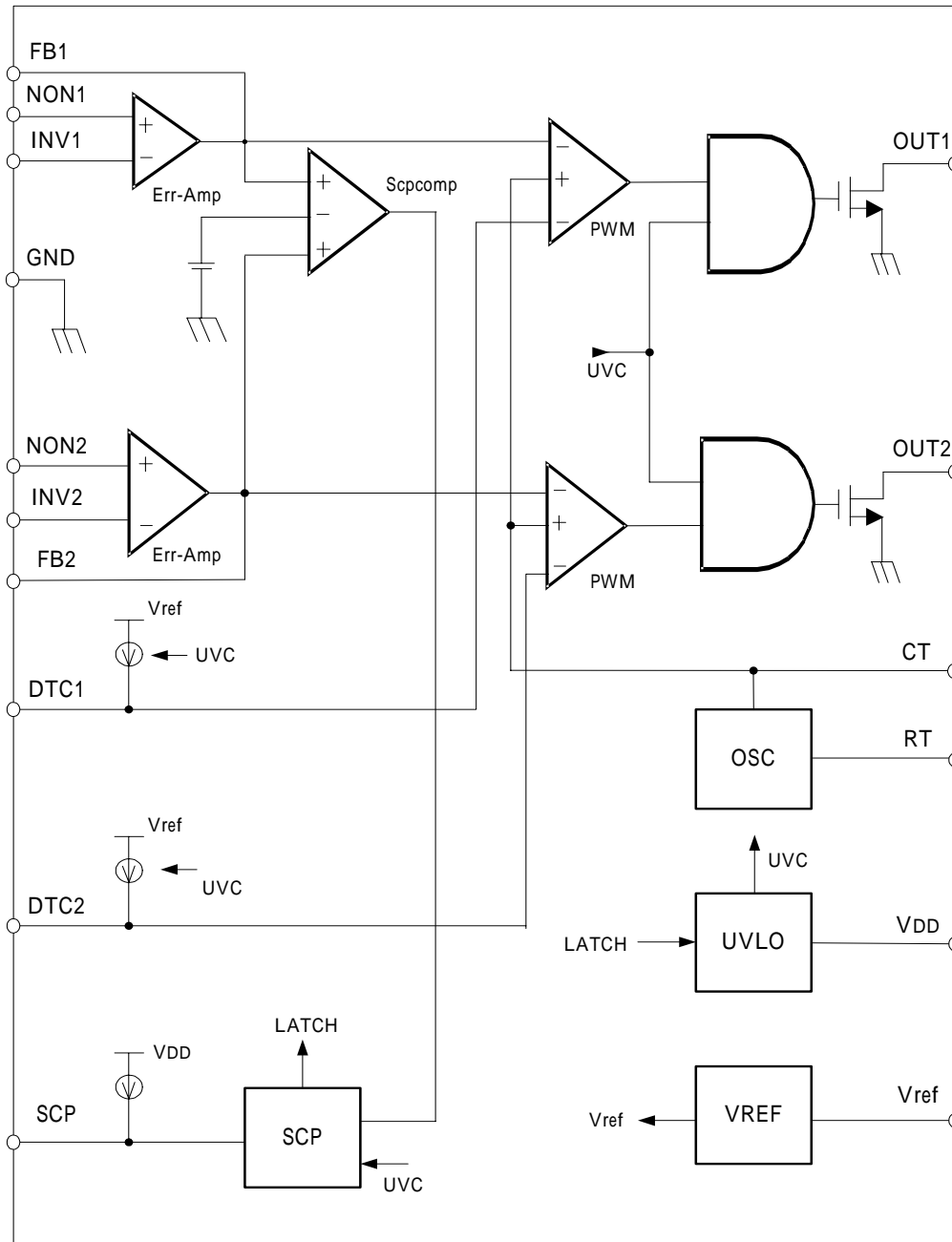
Parameter		Test Condition	Min	Typ	Max	Unit
Saturation voltage	V_{SAT}	$I_O = 75mA$ (CH-1,2)		0.8	1.2	V
Leakage current	I_{peak}	$V_o = 6.0V$			5	μA

Operating Current

Parameter		Test Condition	Min	Typ	Max	Unit
Supply current	I_{DD-OFF}	Output "OFF" state		1.3		mA
	I_{DD-ON}	$R_{RT} = 10k$		1.6		mA

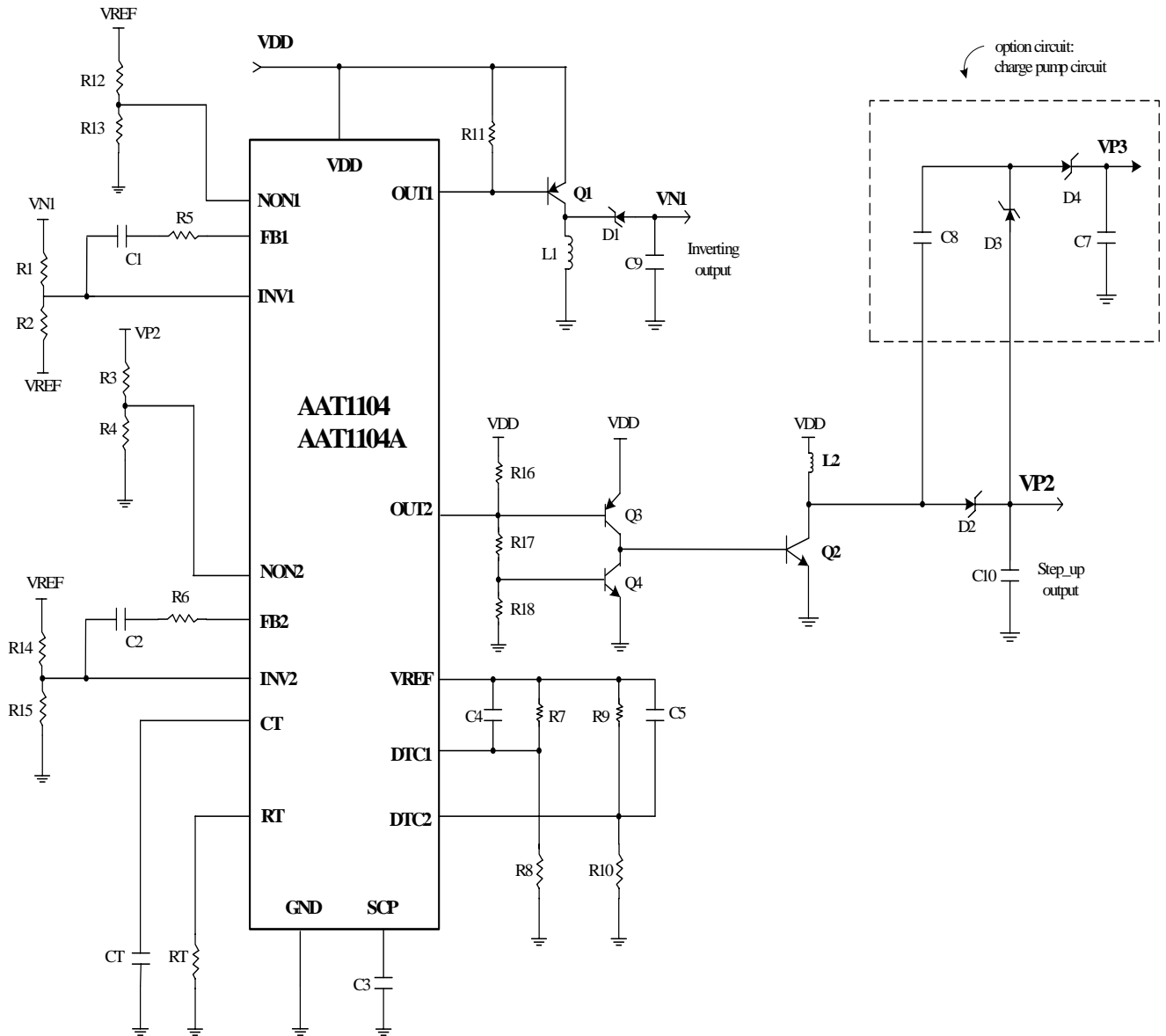


Function Block Diagram





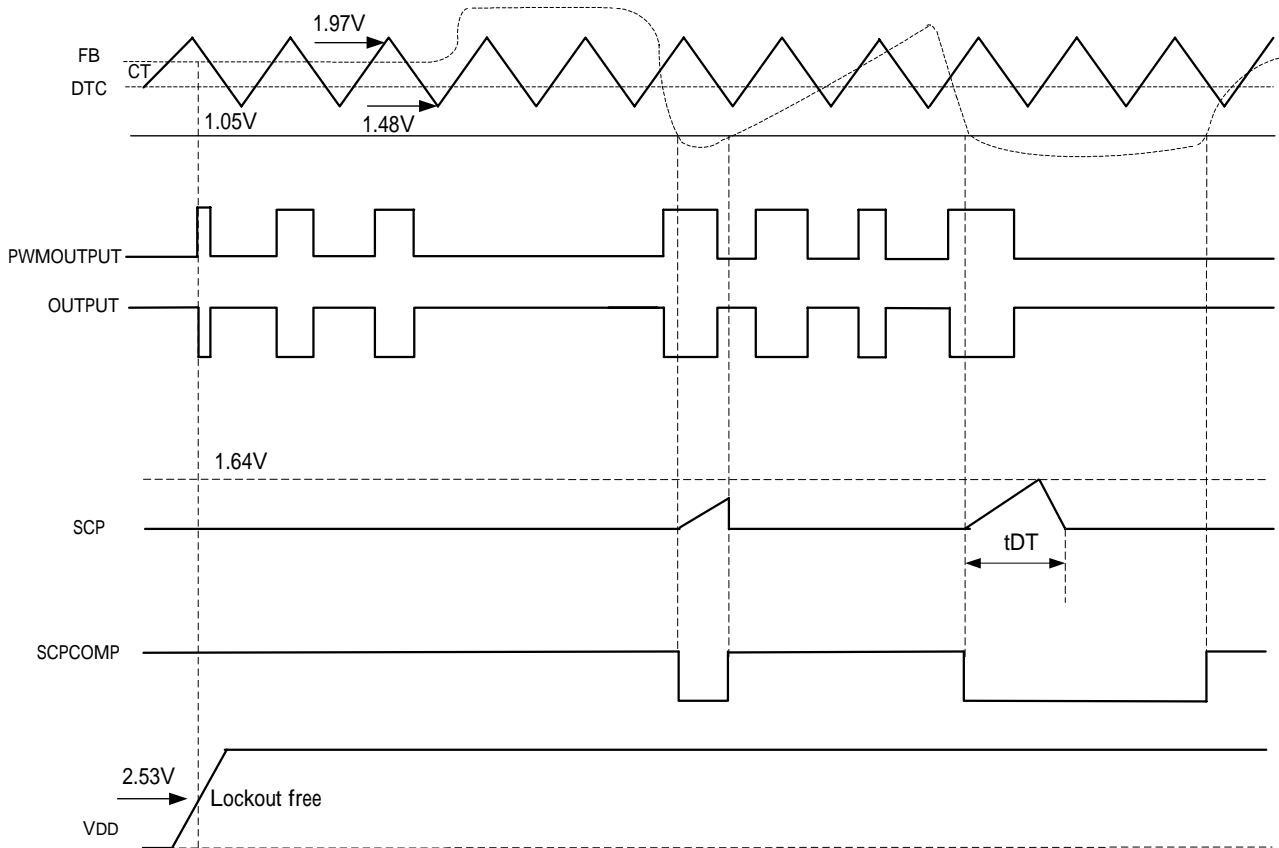
Application Circuit





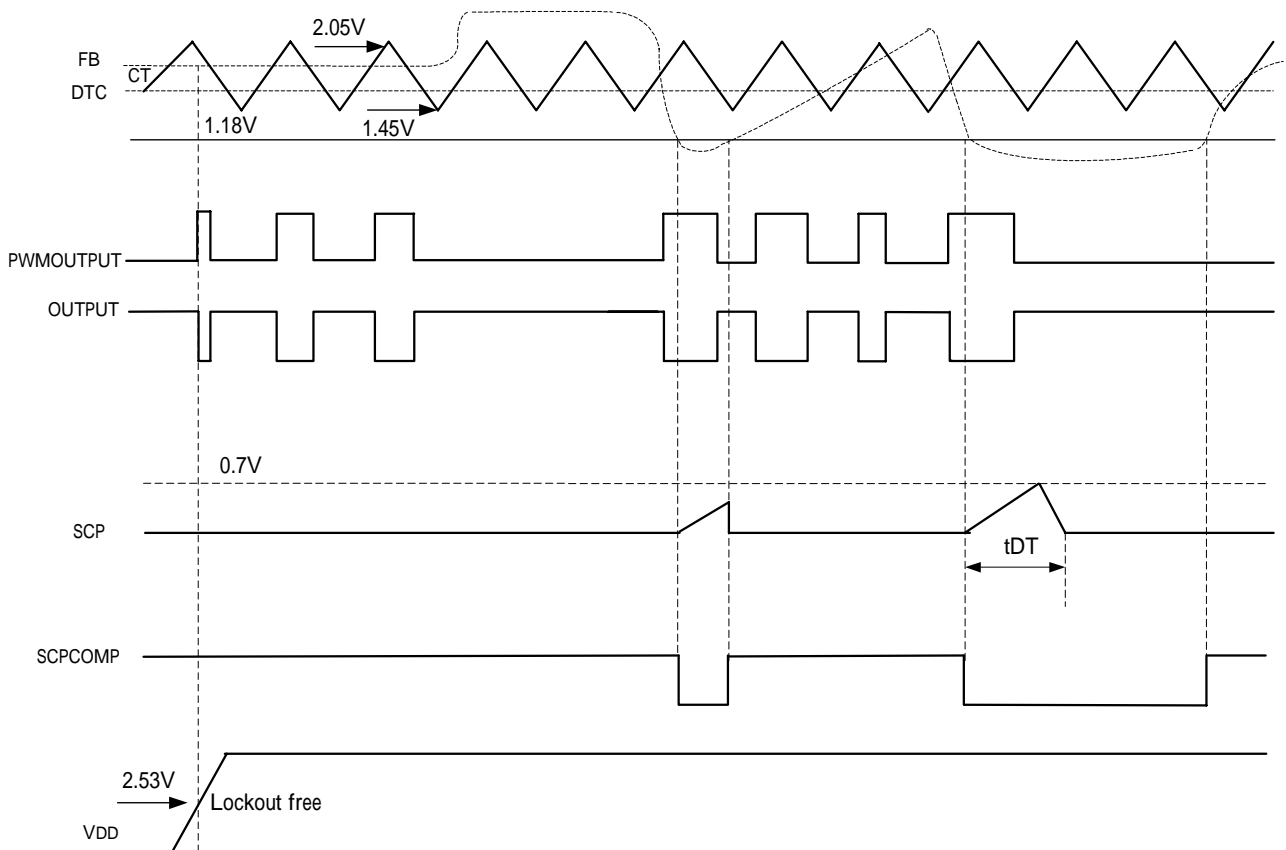
Timing Chart

AAT1104



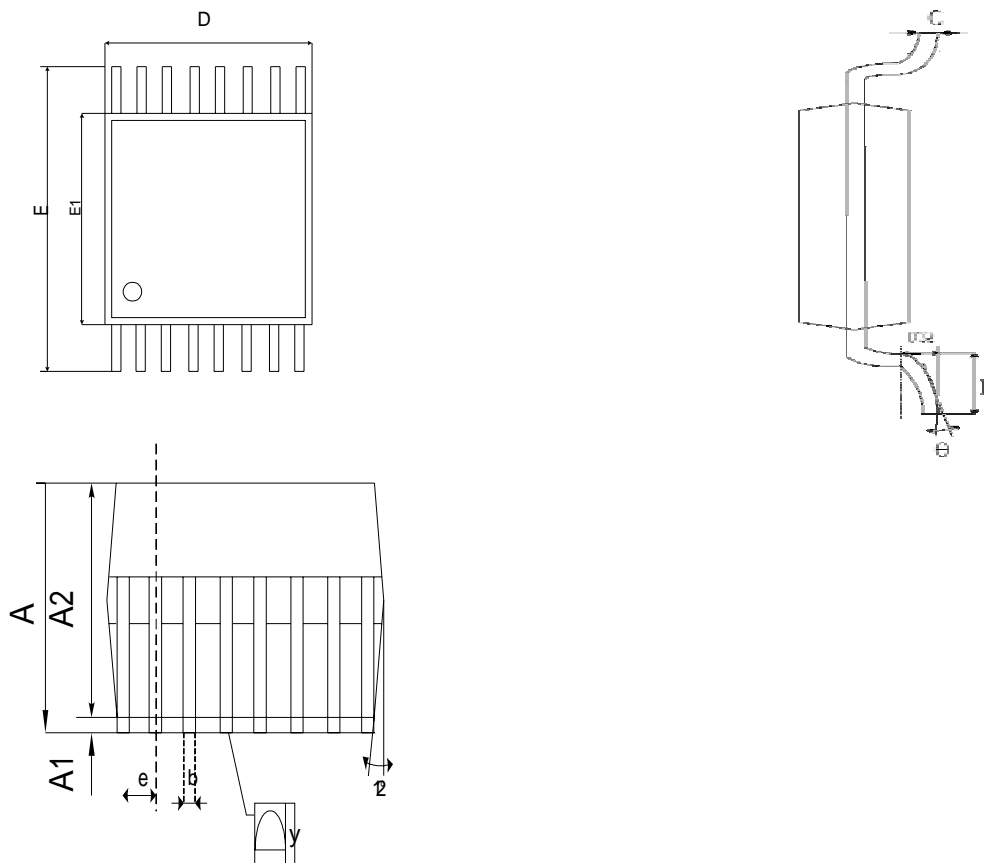


Timing Chart
AAT1104A





Package Dimension (Unit: Mil)



A 1	0.05	0.10	0.15	0.002	0.004	0.006
A 2	—	1.00	1.05	—	0.039	0.041
b	0.20	0.25	0.28	0.008	0.010	0.011
C	—	0.127	—	—	0.005	—
D	4.90	5.075	5.10	0.193	0.1998	0.200
E	6.20	6.40	6.60	0.244	0.252	0.260
E 1	4.30	4.40	4.50	0.170	0.173	0.177
e	—	0.65	—	—	0.026	—
L	0.5	0.60	0.70	0.02	0.024	0.028
y	—	—	0.076	—	—	0.003
	0°	4°	8°	0°	4°	8°