

Features

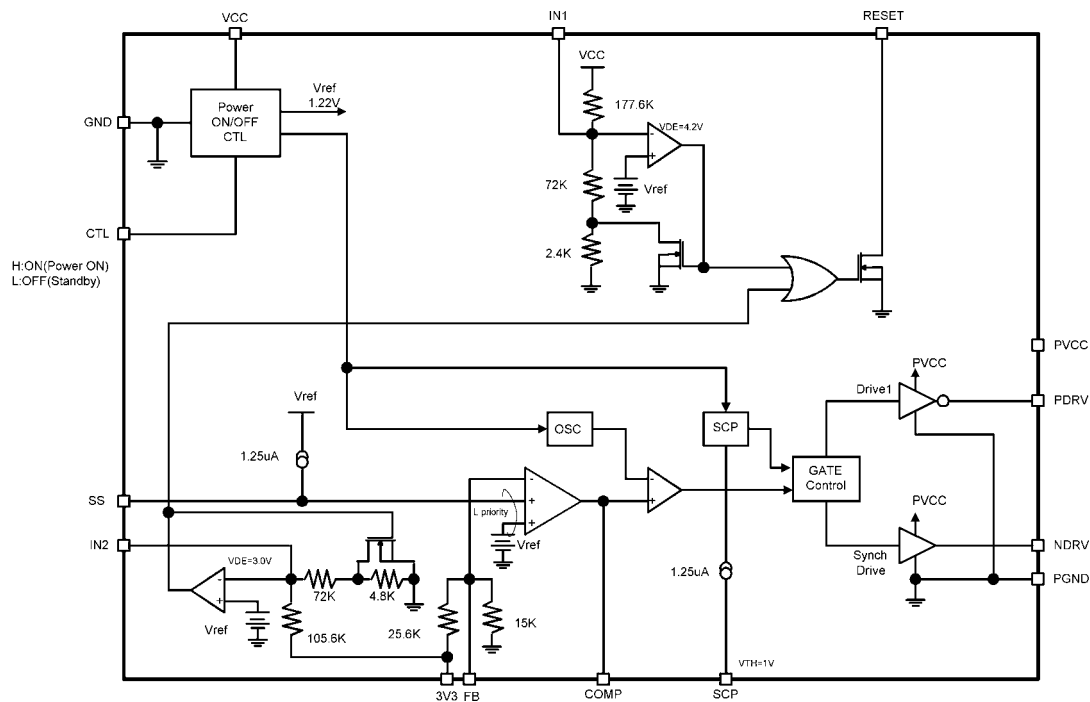
- High efficiency (min. 90% On $I_O=300\text{mA}$ ~600mA)
- Using external P and N channel MOSFET
- Supports for down and up/down Zeta conversion
- Maximum Duty 100%
- Oscillation frequency 300KHz or 600KHz
- Soft Start by an external capacity
- Output voltage accuracy $\pm 2\%$
- Built-in ON/OFF Function
- Built-in Short-circuit Protection
- Stand-by current max. $10\mu\text{A}$
- Quiescent Current 1mA
- Monitor the input voltage and 3V3 output
- Input voltage: $2.5\text{V} \sim 7.0\text{V}$

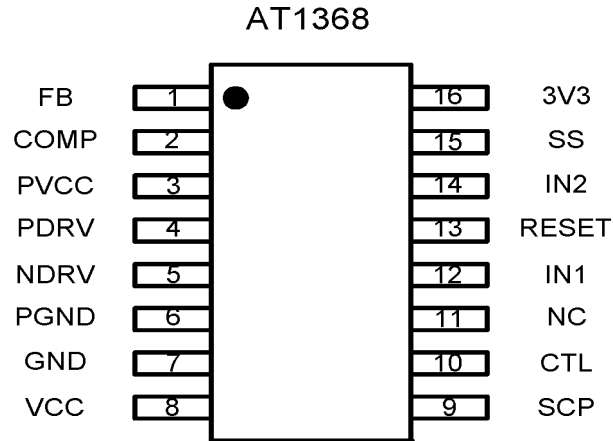
Applications

- Slim-Type CD-ROM/DVD-ROM/CD-RW
- Power Supply for portable devices
- Main or Sub Power source for notebook computers and peripherals.

General Description

The AT1368 provides complete control and protection for a DC/DC converter optimized for high-performance microprocessor applications. It is designed to drive one P-Channel and one N-Channel MOSFETs in a synchronous-rectified buck topology. The AT1368 integrates all of the control, output adjustment, monitoring and protection functions into a single package. The output voltage of the converter can be precisely regulated with a maximum tolerance of $\pm 2\%$ over temperature and line voltage variations. The AT1368 is a family of low-noise synchronous step-down DC/DC converters that is ideally suited for systems powered from a 1-cell Li-ion battery or from a 3-cell to 4-cell NiCd, NiMH, or alkaline battery. It can also be used to USB-Based power system.

Block Diagram


Pin Configuration

Ordering Information

Part number	Package	Marking
AT1368A	SSOP16	AT1368AR
AT1368B	SSOP16	AT1368BR
AT1368B	TSSOP16	AT1368BP

A: fosc =300KHz B: fosc =600KHz

Pin Description

Symbol	Pin No.	Descript	Symbol	Pin No.(A/B)	Descript
FB	1	Inverting input to error amplifier	SCP	9	Short-Circuit protection
COMP	2	Error amplifier output	CTL	10	Chip enable, high active
PVCC	3	Power blocks power supply	NC	11	-
PDRV	4	Output for Pch-MOSFET	IN1	12	VCC monitor voltage adjustable input pin
NDRV	5	Output for Nch-MOSFET	RESET	13	Power Good indicator
PGND	6	Power blocks ground	IN2	14	3V3 output monitor adjustable input pin
GND	7	Control blocks ground	SS	15	Soft-start
VCC	8	Control blocks power supply	3V3	16	Output voltage 3.3V

Absolute Maximum Ratings

Parameter	Condition	Rated Value		Unit
		Min.	Max.	
Power Supply Voltage	—	-	+8	V
Source Average Current of PDRV, NDRV	—	-	-50	mA
Sink Average Current of PDRV, NDRV	—	-	50	mA
Source Peak Current of PDRV, NDRV	—	-	-200	mA
Sink Peak Current of PDRV, NDRV	—	-	200	mA
Input Voltage to Error Amplifier	—	-	6.5	V
Continuous power dissipation	SSOP16 (T _a =+25°C)	-	560	mW
Operating temperature	—	-30	+85	°C
Storage temperature	—	-55	+125	°C

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Recommended Operating Conditions

 (T_a=+25°C)

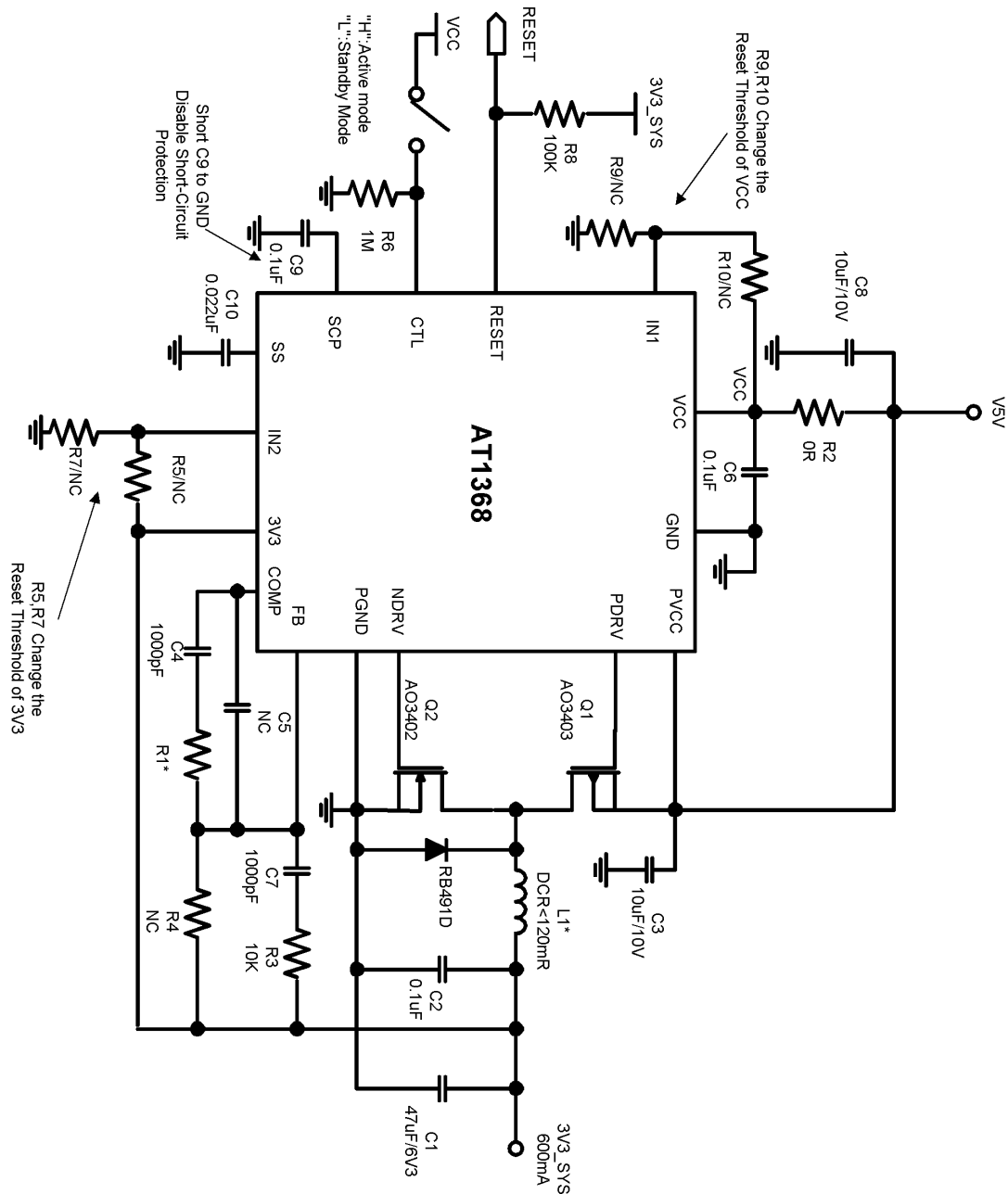
Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Power supply voltage	V _{CC}	2.5	--	7	V
Control input voltage	V _{CTL}	0	--	7	V
Operating temperature	T _{OP}	-20	+25	+85	°C

Electrical Characteristics

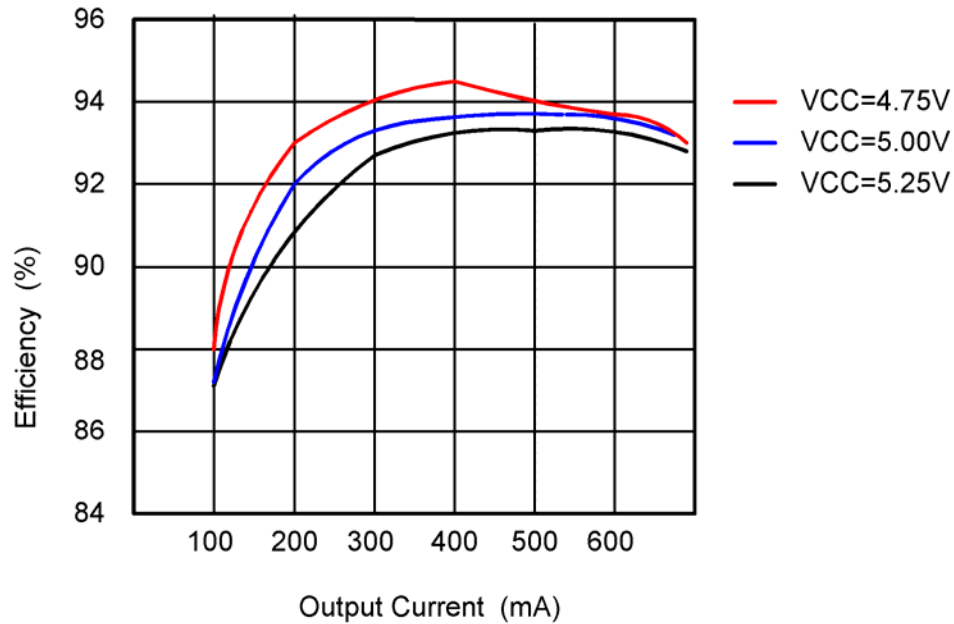
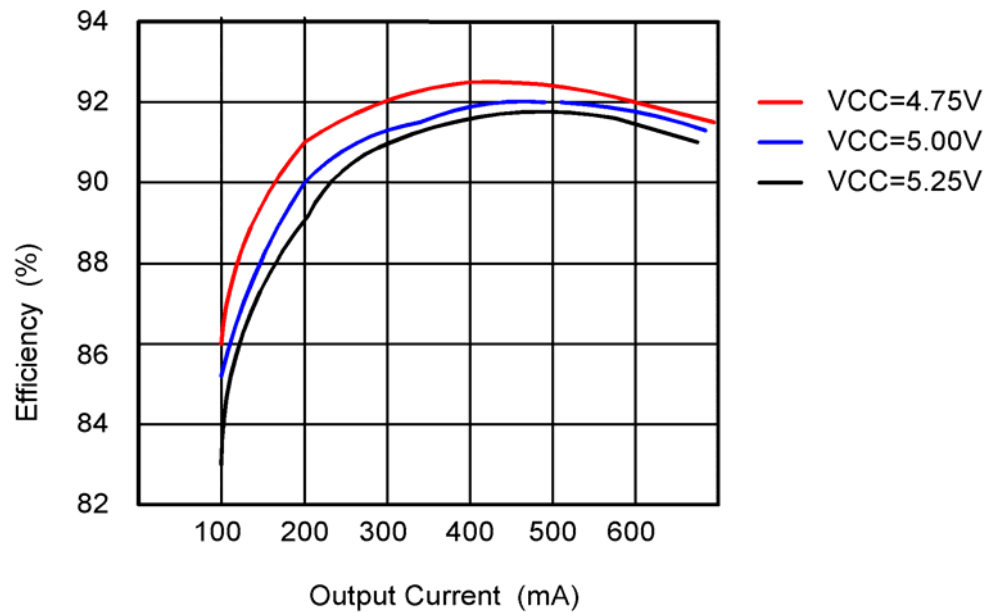
 (VCC = 5V, T_a = +25°C, unless otherwise noted.)

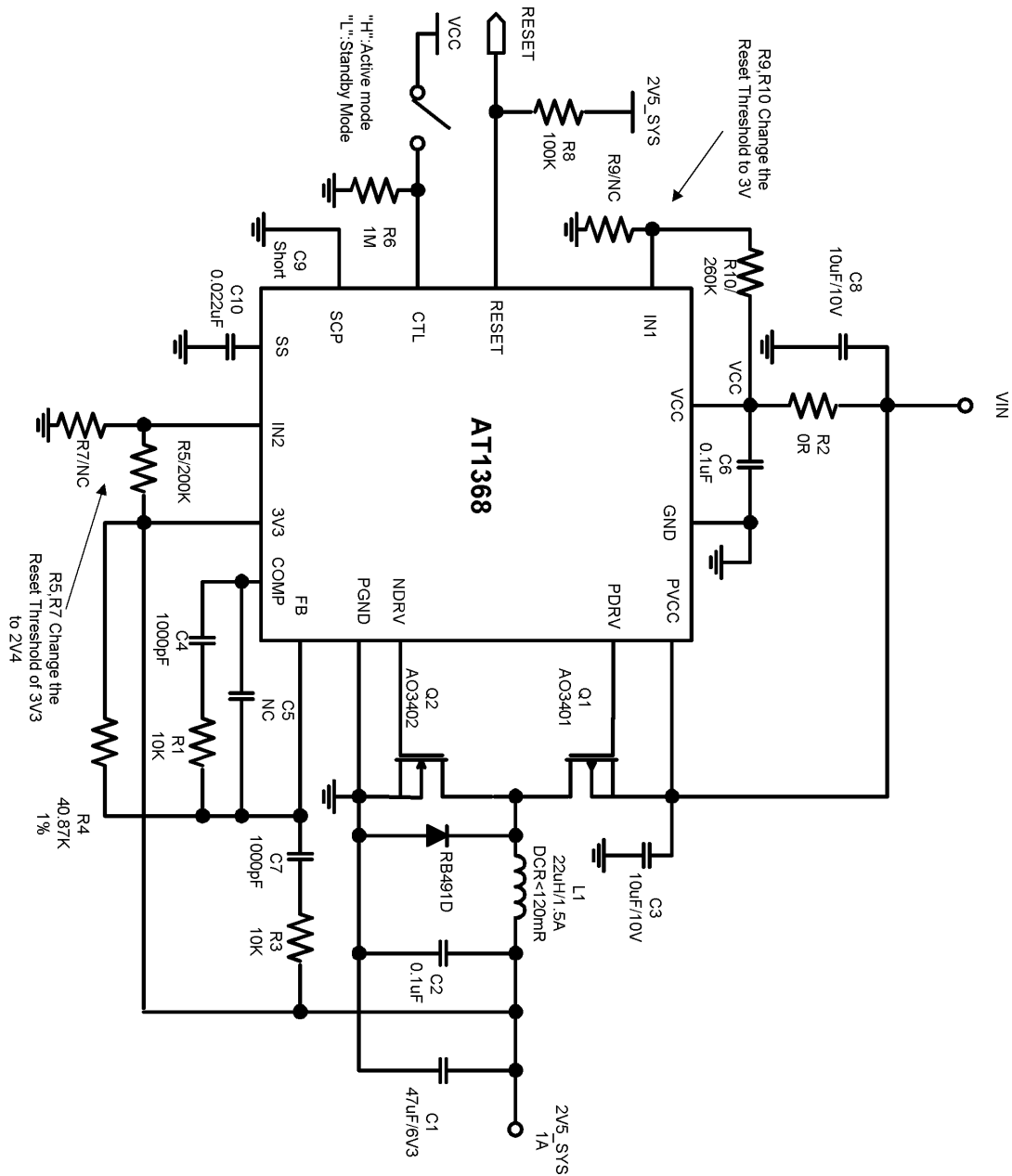
Parameter	Symbol	Condition	Values			Unit	
			Min.	Typ.	Max.		
Entire device	Input Supply Range	V _{CC}		2.5	--	7.0	V
	Quiescent Current	I _{CC}	Duty=50%, f _{OSC} =600KHz PDRV/NDRV No Load		1.0	1.5	mA
	Current in standby mode	I _{ST}	CTL=0V			10	μA
	Reference Voltage	V _{REF}	T _a = -20°C to +85°C	1.20	1.22	1.24	V
	Reference Voltage line-regulation	V _{REF-Line}	VCC=2.5V to 7.0V		1	5	mV
	Reference Variation with Temperature		T _a = -20°C to +85°C		0.5	1.5	%
Error amplifier	Input Offset Voltage	V _{IO}				10	mV
	Source Current	I _{OH}	V _{COMP} = V _{REF} - 0.5V	1.0	1.5	2.0	mA
	Sink Current	I _{OL}	V _{COMP} = 0.5V	-160	-120	-80	μA
	Source current Variation with temperature		T _a = -20°C to +85°C			20	%
	Sink current Variation with temperature		T _a = -20°C to +85°C			20	%
	Unity Gain Bandwidth	f _T			10.0		MHz
	Common Mode Input Voltage Range	V _{COM}		0.2		1.5	V
	DC Open Loop Gain	A _V			110		dB
Sawtooth wave oscillator (OSC)	Frequency	f _{osc}	AT1368A	250	300	350	KHz
		f _{osc}	AT1368B	500	600	700	KHz
	High Level Voltage				1.0		V
	Low Level Voltage				0.5		V
	Variation with Power Supply		Vcc=2.5V to 7V			2	%
	Variation with temperature		T _a = -20°C to +85°C			7	%
Soft-Start	Charge Current of SS	I _{CSS}			-1.0		μA
	Invalid threshold voltage of SS				1.0		V
Short-Circuit	Charge Current of SS	I _{CSS}			-1.25		μA
	Threshold Voltage of SCP				1.0		V

PDRV Output Block	Output source current	I_{source}	Duty \geq 95% PDRV=0V	-	-130	-80	mA
	Output sink current	I_{sink}	Duty \leq 5% PDRV=5V	65	100		mA
	Output ON resistor	R_{OH}	PDRV=-15mA		18	30	Ω
		R_{OL}	PDRV=15mA		16	25	Ω
NDRV Output Block	Output source current	I_{source}	Duty \geq 95% NDRV=0V	-	-130	-80	mA
	Output sink current	I_{sink}	Duty \leq 5% NDRV=5V	65	100		mA
	Output ON resistor	R_{OH}	NDRV=-15mA		18	30	Ω
		R_{OL}	NDRV=15mA		16	25	Ω
Control Block	CTL input voltage	V_{IH}	Active mode	1.5		VCC	V
		V_{IL}	Standby mode	0		0.8	V
	CTL input Current	I_{CTL}	CTL=5.0V			20	μ A
RESET Monitor Block	VCC reset ON voltage	V_{RSTON1}	VCC rising	4.10	4.20	4.30	V
	VCC reset hysteresis	$V_{RSTON1\ hvs}$	VCC falling			100	mV
	3V3 reset ON voltage	V_{RSTON2}	3V3 rising	2.94	3.0	3.06	V
	3V3 reset hysteresis	$V_{RSTON2\ hvs}$	3V3 falling			100	mV
	Reset output voltage	V_{OL}	$I_L = 1mA$			0.4	V
	Reset leakage current	I_{Leak}				2.0	μ A

Typical Application Circuit: 3V3 Output


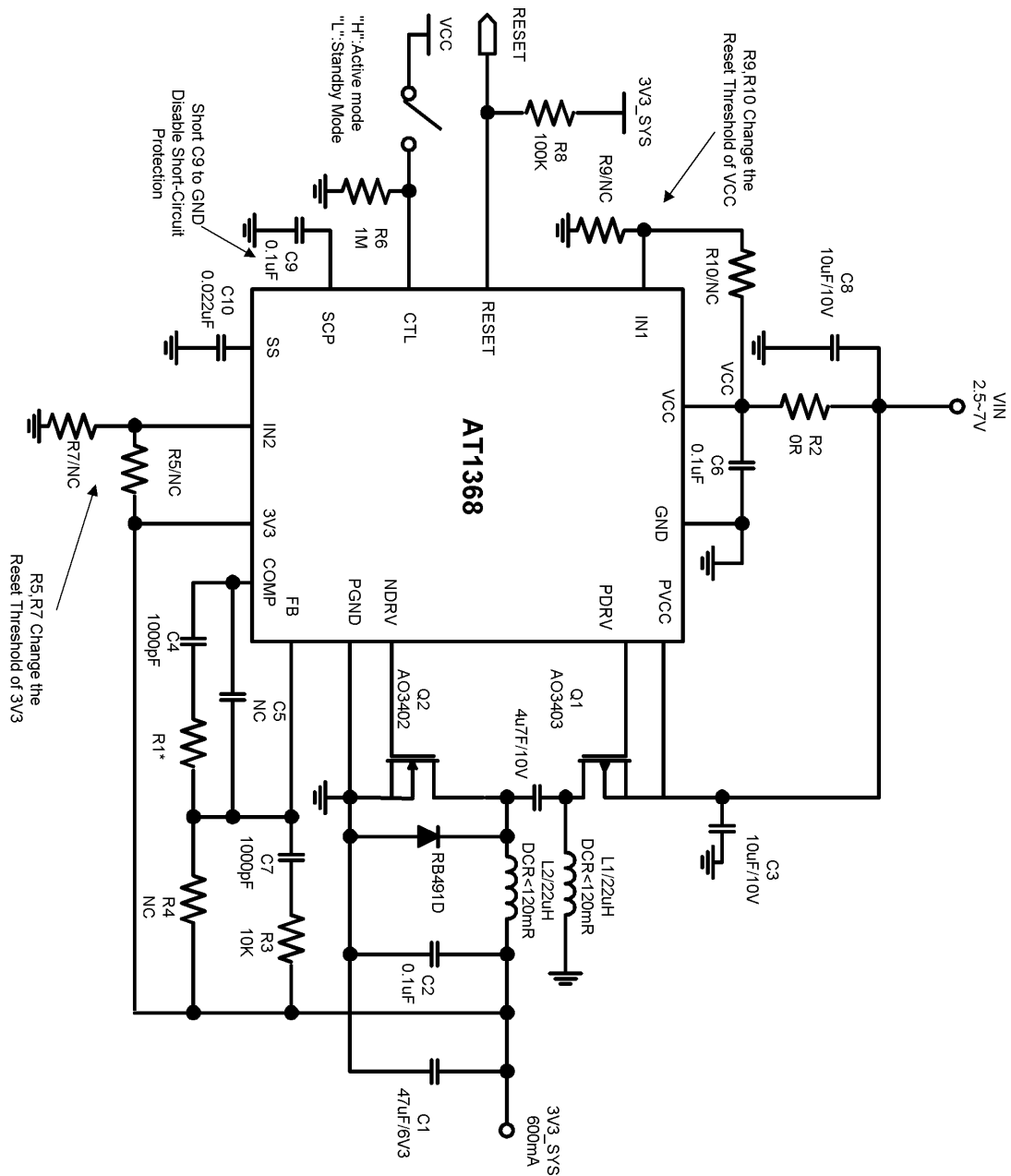
- L1:** AT1368A: 22 μ H/0.77A/104m Ω TDK-SLF6028T-220MR77
 AT1368B: 10 μ H/1A/74.5m Ω TDK-SLF6028T-100M1R0
R1: AT1368A: 100K
 AT1368B: 10K

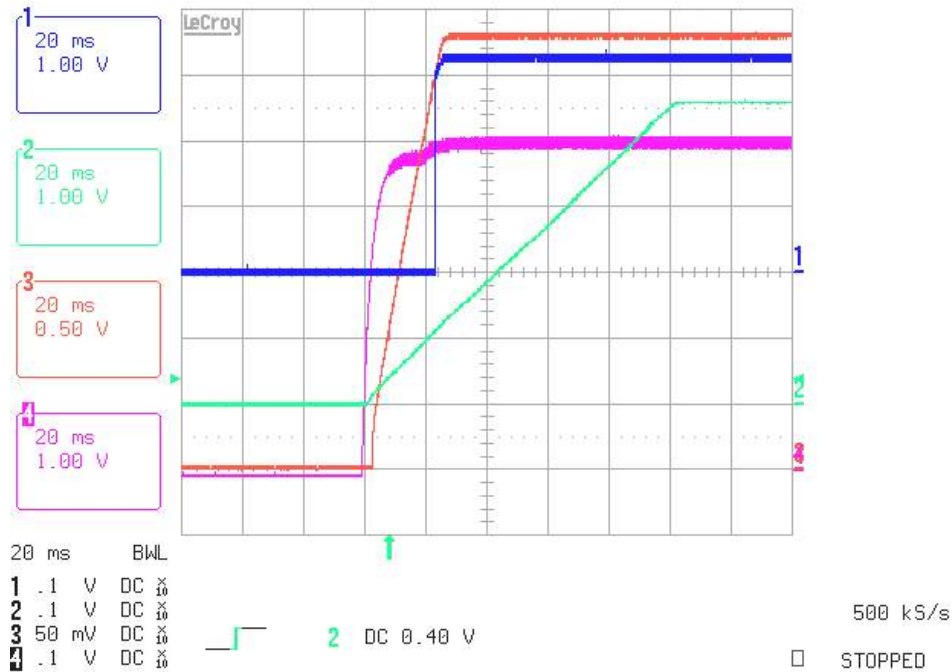
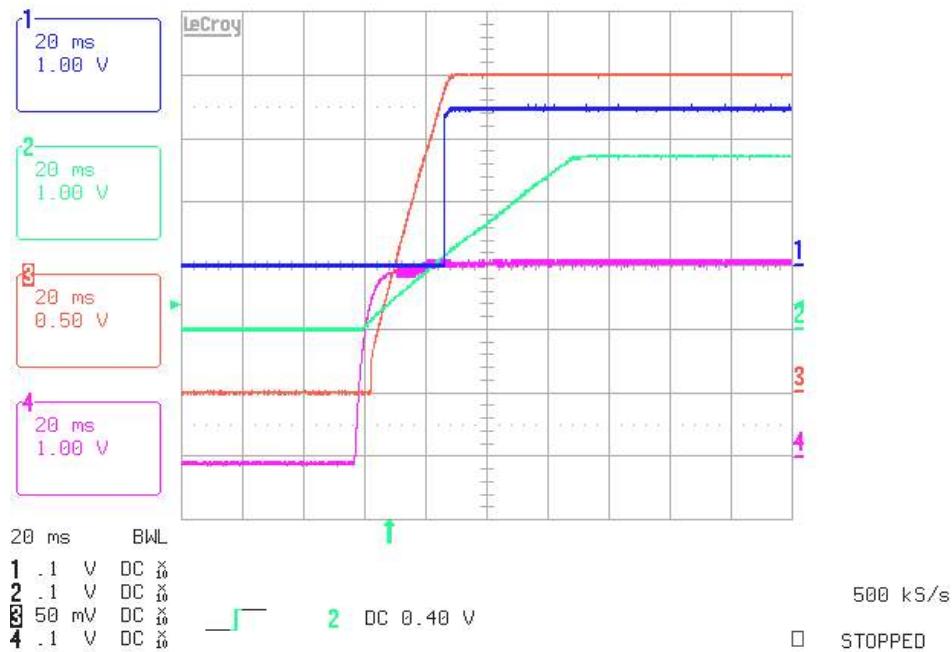
AT1368A Efficiency

AT1368B Efficiency


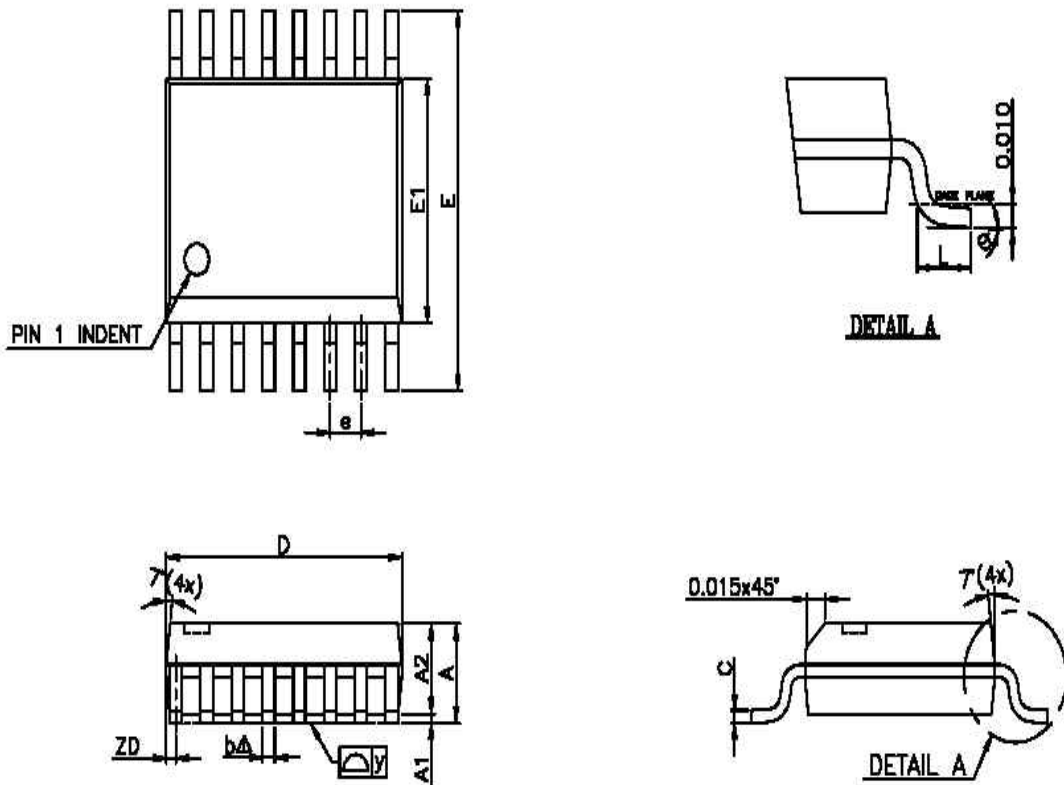
Typical Application Circuit: 2V5 Output


*1V8 Output: R4:9.8KΩ R5:38.7KΩ

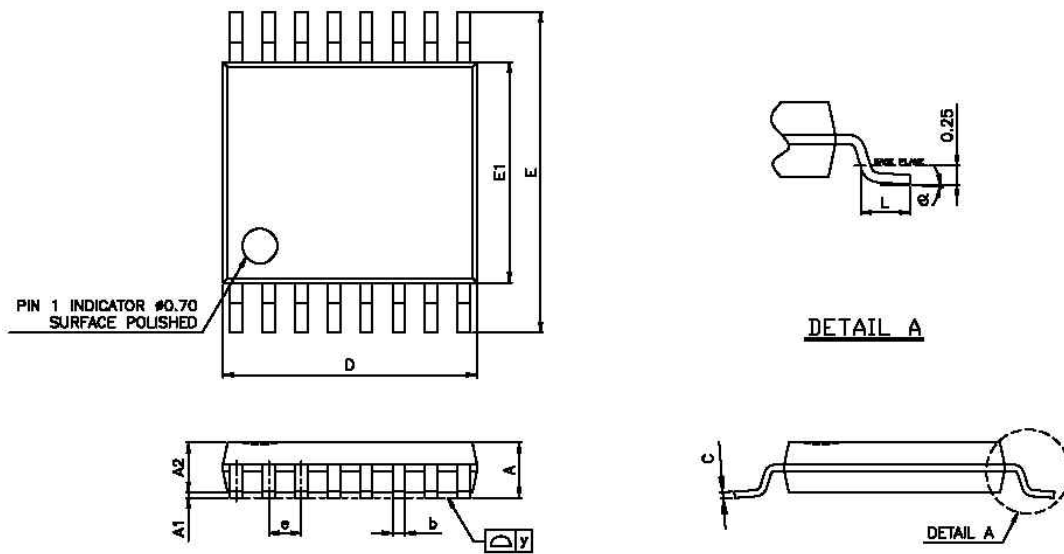
*Vin from 2.5V to 7V, disable SCP function

Typical Application Circuit: Zeta converter 3V3 Output


CH1:Reset CH2:SS CH3:Vout CH4:Vin

Fig.1 Vout:3.3V/1A Vin:5V Start-Up Waveform

Fig.2 Vout:2.5V/1A Vin:3.1V Start-Up Waveform

Package Outline 16-pin SSOP


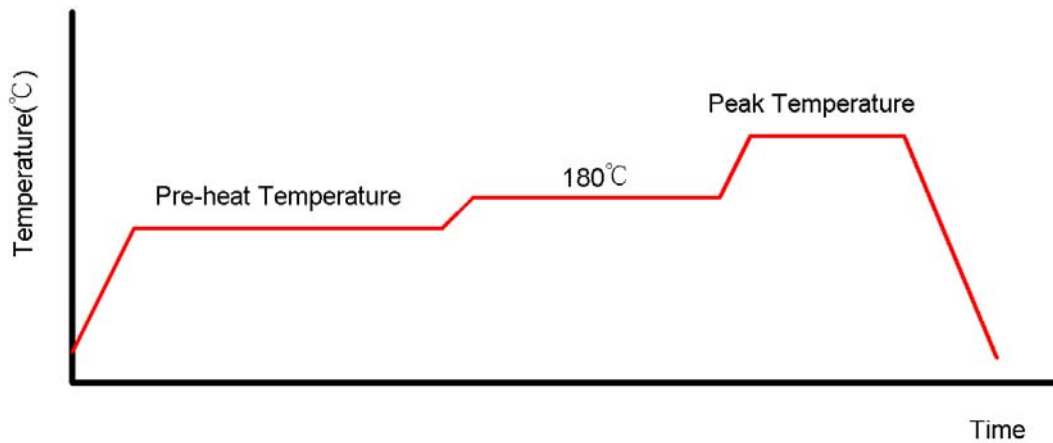
SYMBOL	MILLIMETERS			INCHES		
	MIN	TYP	MAX	MIN	TYP	MAX
A	1.35	1.60	1.75	0.053	0.063	0.069
A1	0.10	0.15	0.25	0.004	0.006	0.010
A2	-	-	1.50	-	-	0.059
b	0.20	-	0.30	0.008	-	0.012
C	0.18	-	0.25	0.007	-	0.010
D	4.80	4.85	5.00	0.189	0.191	0.197
ZD	-	0.20	-	-	0.008	-
E	5.79	5.99	6.20	0.228	0.236	0.244
E1	3.81	3.91	3.99	0.150	0.154	0.157
L	0.41	0.71	1.27	0.016	0.028	0.050
e	-	0.64	-	-	0.025	-
y	-	-	0.076	-	-	0.003
θ	0°	-	8°	0°	-	8°

Package Outline 16-pin TSSOP


SYMBOL	MILLIMETERS			INCHES		
	MIN	TYP	MAX	MIN	TYP	MAX
A	1.05	1.10	1.20	0.041	0.043	0.047
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2	-	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
E1	4.30	4.40	4.50	0.170	0.173	0.177
L	0.50	0.60	0.70	0.020	0.024	0.028
e	-	0.65	-	-	0.026	-
y	-	-	0.076	-	-	0.003
θ	0°		8°	0°		8°

Reflow Condition (IR/Convection or VPR Reflow)

Reference JEDEC Standard J-STD-020A


Classification Reflow Profiles

	Convection or IR/Convection	VPR
Average Heating Rate(180°C to peak)	5°C/second max.	10°C/second max.
Preheat Temperature(125±20°C)	120 seconds max.	
Temperature maintained above 180°C	10~150 seconds	
Time within 5°C of actual Peak Temperature	10~20 seconds	60 seconds
Peak Temperature Range(Note 1)	219~225°C or 235~240°C	219~225°C or 235~240°C
Cooling Rate	6°C /second max.	10°C/second max.
Time 25°C to Peak Temperature	6 minutes max.	

*1 The maximum peak temperatures for IR and VP reflow are depending on package dimensions.

Package Reflow Conditions

Pkg. Thickness ≥2.5mm and all bags	Pkg. Thickness <2.5mm and Pkg. Volume ≥350 mm ³	Pkg. Thickness <2.5mm and Pkg. Volume <350 mm ³
Convection 219~225°C		Convection 235~240°C
VPR 219~225°C		VPR 235~240°C
IR/Convection 219~225°C		IR/Convection 235~240°C