

Features

- 3.3V, 5V and adjustable output versions
- Guaranteed 3A output load current
- Excellent line and load regulation
- 150kHz fixed frequency internal oscillator
- Built-in TTL On/Off Control
- Low power standby mode, I_Q typically 80uA
- Built-in current limit protection
- Built-in thermal shutdown circuit.
- Operating voltage: 4.5V~25V
- TO-263 package

Applications

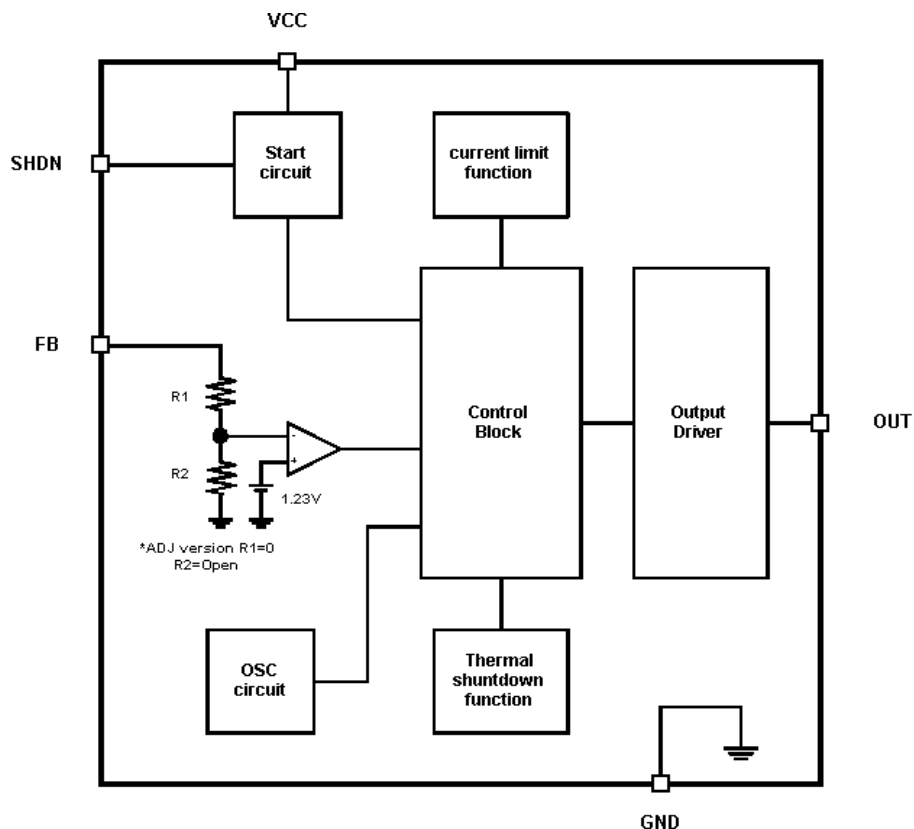
High-efficiency step-down regulator
TFT Scalar Board
On-card switching regulators

Description

The AT1796 series of regulators are step-down (buck) DC/DC converter, capable of driving a 3A load with excellent line and load regulation. Requiring a minimum number of external components, these regulators are simple to use.

The AT1796 series operates at a switching frequency of 150kHz. Available in a standard 5-lead TO-263 surface mount package. It include a guaranteed $\pm 4\%$ tolerance on output voltage under specified input voltage and output load conditions, and $\pm 15\%$ on the oscillator frequency.

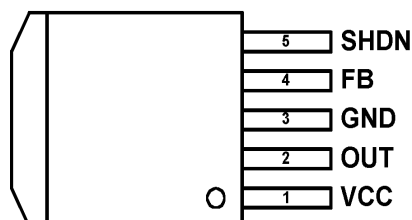
Block Diagram



Aimtron reserves the right without notice to change this circuitry and specifications.

Pin Configuration

Surface Mount Package
5-Lead TO-263



Ordering Information

Part number	Package	Marking
AT1796-50	TO-263(5.0V version)	AT1796-50A
AT1796-33	TO-263(3.3V version)	AT1796-33A
AT1796-ADJ	TO-263(ADJ version)	AT1796-ADJ

Absolute maximum ratings

Parameter	Symbol	Limits	unit
Power supply voltage	VCC	30	V
ON/OFF pin input voltage	V _{ON/OFF}	-0.3~+25	V
Power dissipation	P _d	Internally Limited	W
Operating Junction Temperature	T _J	-30~+125	°C
Storage temperature	T _{stg}	-65~+150	°C
Thermal Resistance from Junction to Ambient	θ _{JA}	30	°C/W
Thermal Resistance from Junction to Case	θ _{JC}	3	°C/W
Lead Temperature(Soldering, 5sec.)		260	°C
ESD Rating		2	KV

* θ_{JA} is measured with the component mounted on an evaluation PC board in free air that the required area of copper is 2.5in² (1 oz.) or larger.

Recommended operating conditions (T_A = 25°C)

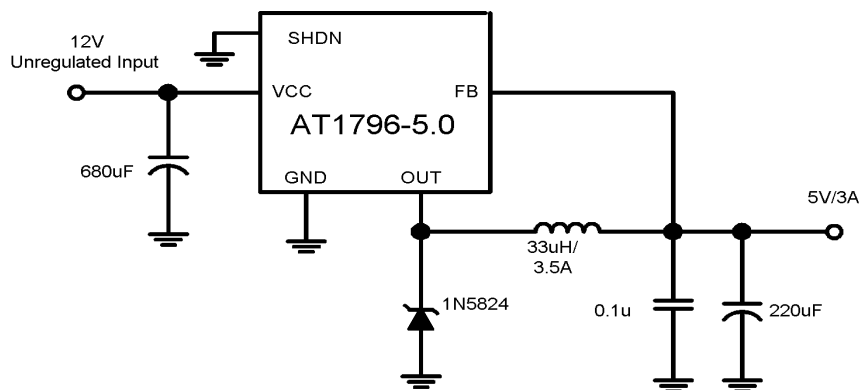
Parameter	Symbol	Limits	unit
Power supply voltage	VCC	4.5~28	V
ON/OFF pin input voltage	V _{ON/OFF}	0~+20	V

Electrical characteristics

(unless otherwise noted, $T_A = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current	I_{OC}	-	5	10	mA	
Stand-by quiescent current	I_{SQC}	-	80	200	μA	
ON/OFF pin logic input voltage threshold	V_{IL}	-	-	0.6	V	Active mode
	V_{IH}	2.0	-	-	V	Standby mode
ON/OFF pin logic input current	I_{IL}	-	0.02	5	μA	Active mode
	I_{IH}	-	5	15	μA	Standby mode
<AT1796-3.3V>						
Output voltage	V_{OUT}	3.168	3.3	3.432	V	$4.75\text{V} \leq V_{CC} \leq 30\text{V}$ $0.2\text{A} \leq I_{LOAD} \leq 3\text{A}$
Efficiency	η	73			%	$V_{IN} = 12\text{V}$, $I_{LOAD} = 3\text{A}$
<AT1796-5V>						
Output voltage	V_{OUT}	4.8	5	5.2	V	$4.75\text{V} \leq V_{CC} \leq 30\text{V}$ $0.2\text{A} \leq I_{LOAD} \leq 3\text{A}$
Efficiency	η	-	80	-	%	$V_{IN} = 12\text{V}$, $I_{LOAD} = 3\text{A}$
<AT1796-ADJ>						
Feedback Voltage	V_{FB}	1.193	1.230	1.267	V	$4.75\text{V} \leq V_{CC} \leq 30\text{V}$ $0.2\text{A} \leq I_{LOAD} \leq 3\text{A}$
Efficiency	η	-	73	-	%	$V_{IN} = 12\text{V}$, $I_{LOAD} = 3\text{A}$, $V_{OUT} = 3\text{V}$
<Device parameters>						
Saturation voltage	V_{SAT}	-	1.15	1.5	V	$I_{LOAD} = 3\text{A}$
Oscillator frequency	f_{OSC}	127	150	173	kHz	
Maximum duty cycle	D_{MAX}	-	100	-	%	$FB = 0\text{V}$
Minimum duty cycle	D_{MIN}	-	0	-	%	$FB = 3.3\text{V}$ or 5V
Current limit	I_{CL}	3.6	4.5	5.0	A	Peak current
Output leakage current	I_{L1}	-	50	-	μA	No diode, capacitor, inductor $FB = 12\text{V}$, Switching OFF, $OUT = 0\text{V}$
	I_{L2}	-	2	30	mA	$V_{CC} = 30\text{V}$, $OUT = -1\text{V}$

Application Example



CH1:SHDN CH2:5V Output CH3:OUT CH4:I_{IN}

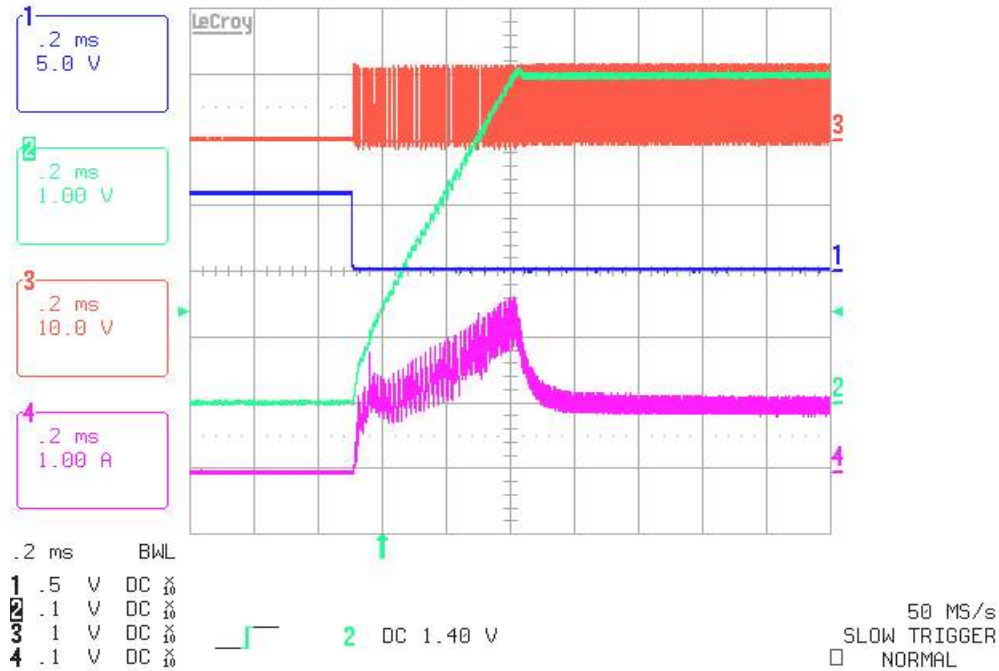


Fig1. 5V/2A Output

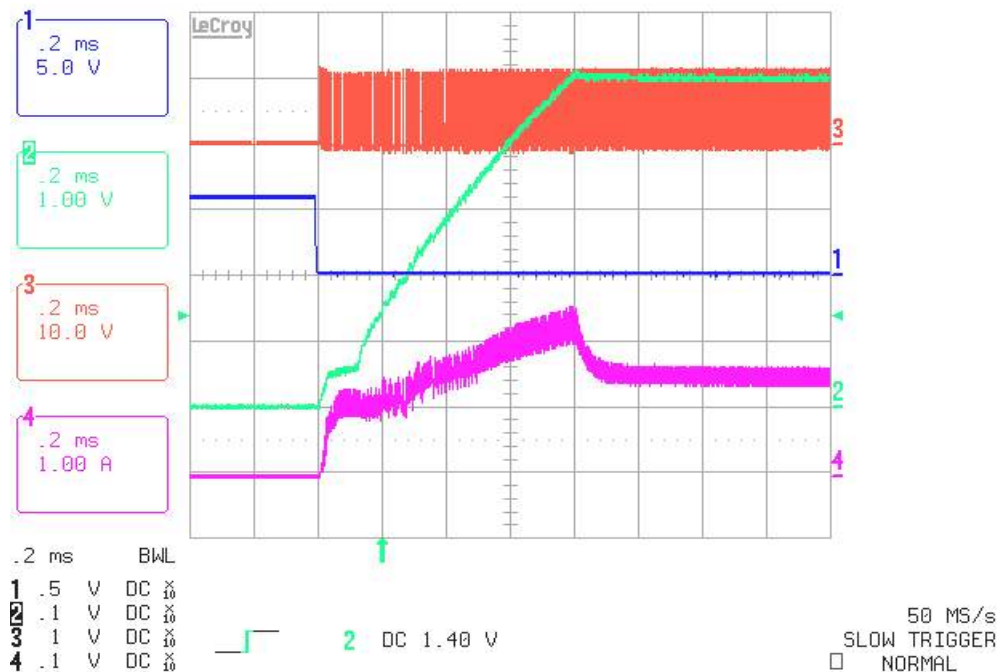
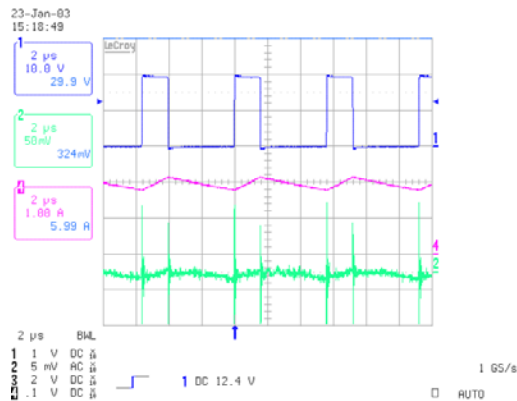


Fig1. 5V/3A Output

Typical Performance Characteristics

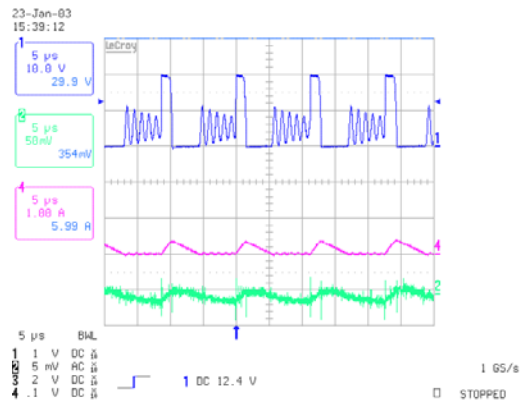
Continuous mode switching waveforms

$V_{IN}=20V$, $V_{OUT}=5V$, $I_{LOAD}=2A$, $L=33\mu H$
 $C_{OUT}=220\mu F$, $C_{OUT} ESR=50m\Omega$



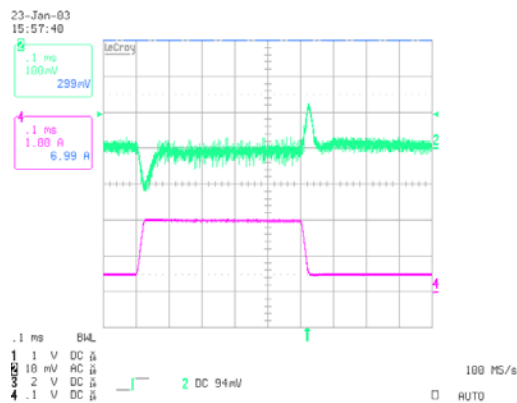
Discontinuous mode switching waveforms

$V_{IN}=20V$, $V_{OUT}=5V$, $I_{LOAD}=90mA$, $L=33\mu H$
 $C_{OUT}=220\mu F$, $C_{OUT} ESR=50m\Omega$



Load transient response for continuous mode

$V_{IN}=20V$, $V_{OUT}=5V$, $I_{LOAD}=500mA$ to $2A$
 $L=33\mu H$, $C_{OUT}=220\mu F$, $C_{OUT} ESR=50m\Omega$



Application Data

Quick Design Component Selection Table for Fixed Output

Input/Output Condition			Inductor		Output Capacitor(μF/V)			
Output Voltage (V)	Load Current (A)	Max. Input Voltage (V)	Inductance (μH)	Current (A)	Through Hole electrolytic		Surface Mount Tantalum	
					Nichicon PL Series	Panasonic HFQ Series	Sprague 595D Series	AVX TPS Series
5	3	8	22	3.5	560/25	560/25	330/10	220/10
		15	33	3.5	330/35	330/35	330/10	220/10
		25	47	3.5	270/35	330/35	330/10	220/10
	2	9	22	3.1	560/16	470/25	330/10	220/10
		15	68	3.1	180/35	180/35	270/10	100/10
		25	68	3.1	180/35	180/35	270/10	100/10
3.3	3	5	22	3.5	560/16	470/25	390/6.3	330/6.3
		12	22	3.5	560/25	560/35	390/6.3	330/6.3
		25	33	3.5	470/35	680/35	390/6.3	330/6.3
	2	6	22	3.1	470/35	470/25	390/6.3	330/6.3
		12	33	3.1	330/35	330/35	390/6.3	330/6.3
		25	47	3.1	270/50	330/35	330/10	220/10

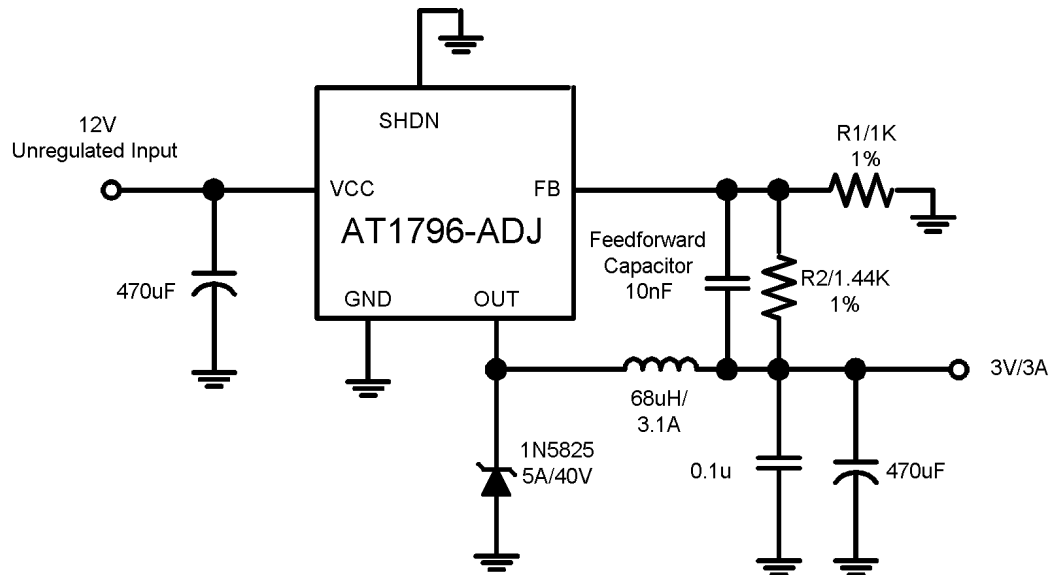
Quick Design Component Selection Table for Adjustable Output

Output Voltage (V)	Through Hole Output Capacitor			Surface Mount Output Capacitor		
	Panasonic HFQ Series (μF/V)	Nichicon PL Series (μF/V)	Feedforward Capacitor	Panasonic HFQ Series (μF/V)	Nichicon PL Series (μF/V)	Feedforward Capacitor
2	820/35	820/35	33nF	330/6.3	470/4	33nF
4	560/35	470/35	10nF	330/6.3	390/6.3	10nF
6	470/25	470/25	3.3nF	220/10	330/10	3.3nF
9	330/25	330/25	1.5nF	100/16	180/16	1.5nF
12	330/25	330/25	1nF	100/16	180/16	1nF
15	220/35	220/35	680pF	68/20	120/20	680pF
24	220/35	150/35	560pF	33/25	33/25	220pF

Diode Selection Table

VR(V)	3A Diode		4~6A Diode	
	Surface Mount	Through Hole	Surface Mount	Through Hole
	Schottky	Schottky	Schottky	Schottky
20	SK32	1N5820 SR302 MBR320		1N5823 SR502 SB520
30	30WQ03 SK33	1N5821 MBR330 31DQ03	50WQ03	1N5824 SR503 SB530
40	SK34 MBRS340 30WQ04	1N5822 SR304 MBR340 31DQ04	50WQ04	1N5825 SR504 SB540
50	SK35 MBRS360 30WQ05 MURS320 30WF10	SR305 MBR350 31DQ05 MUR320	50WQ05 50WF10	SB550 50SQ080 MUR620 HER601

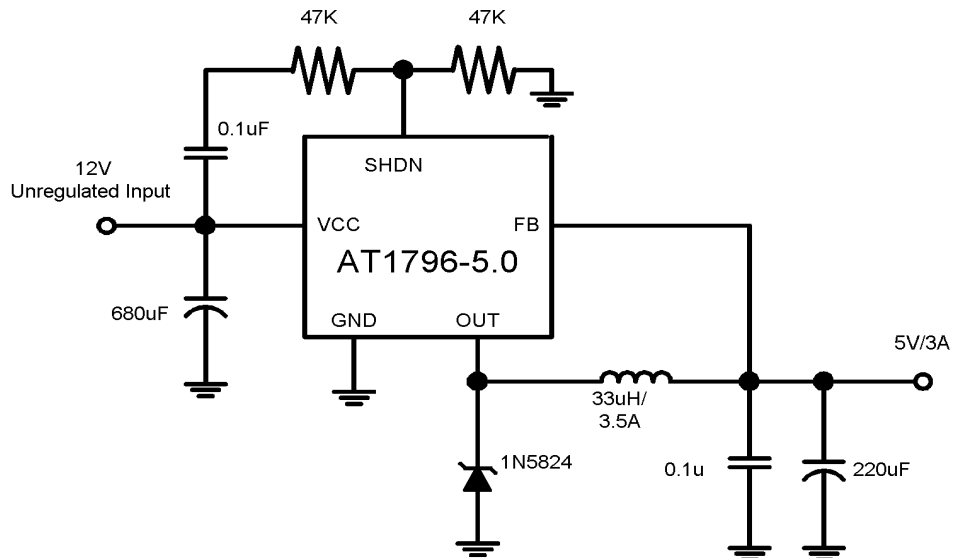
Adjustable Output Application Example :



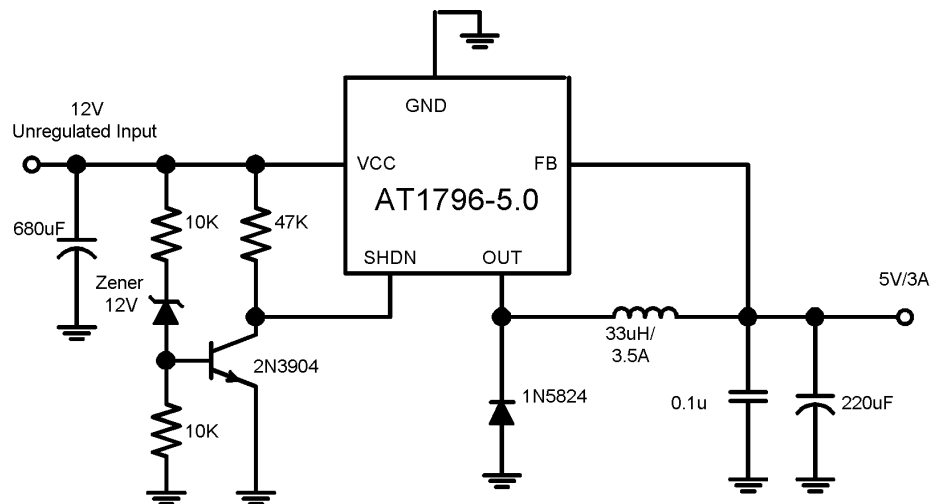
$$V_{OUT} = V_{FB} \left(1 + \frac{R2}{R1} \right)$$

$$V_{FB} = 1.23V$$

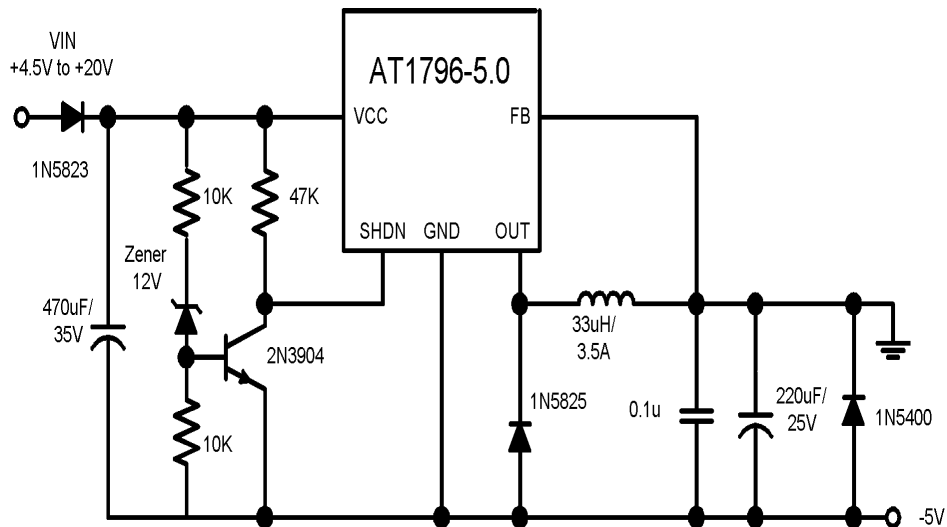
Application Circuit



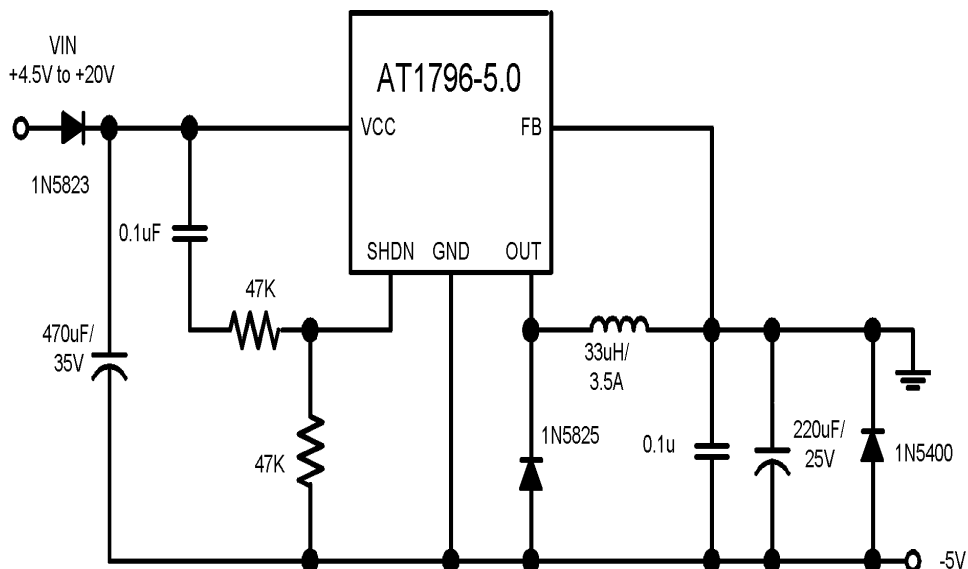
Delay Startup for Buck Regulator



Undervoltage Lockout for Buck Regulator



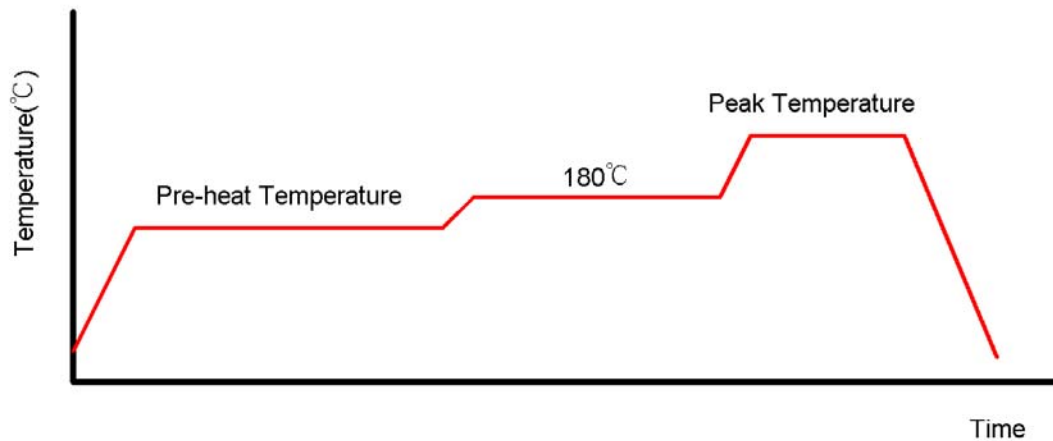
Inverting -5V Regulator with Undervoltage Lockout



Inverting -5V Regulator with Delay Startup

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