AP2004

PWM BUCK CONTROLLER

Features

- PWM Buck Control Circuitry
- Operating voltage can be up to 27V
- Under voltage Lockout (UVLO) Protection
- Short Circuit Protection (SCP)
- Soft-start circuit
- Variable Oscillator Frequency -- 300Khz Max
- 1.25V voltage reference Output
- 8-pin SOP package
- SOP-8L: Available in “Green” Molding Compound (No Br, Sb)
- Lead Free Finish/ RoHS Compliant (Note 1)

General Description

The AP2004 integrates Pulse-Width-Modulation (PWM) control circuit into a single chip, mainly designs for power-supply regulator. All the functions include an on-chip 1.25V reference output, an error amplifier, an adjustable oscillator, a soft-start, UVLO, SCP circuitry, and a push-pull output circuit. Switching frequency is adjustable by trimming CT. During low VCC situation, the UVLO makes sure that the outputs are off until the internal circuit operates normally.

Applications

- Backlight inverter
- LCD Monitor
- CDROM, XDSL Product
- DC/DC converters in computers, etc.

Ordering Information

AP 2004 S X - 13

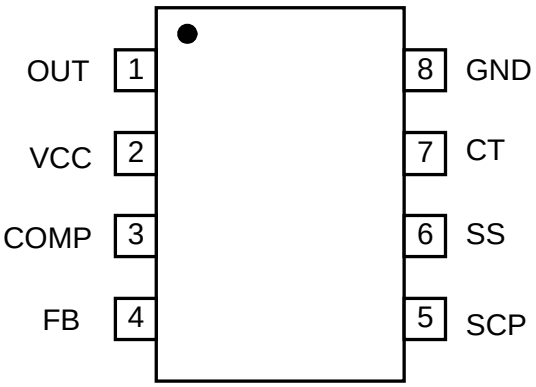
Package	Lead Free	Packing
S : SOP-8L	L : Lead Free G : Green	13 : Tape & Reel

Device	Package Code	Packaging (Note 2)	13” Tape and Reel	
			Quantity	Part Number Suffix
AP2004SL-13	S	SOP-8L	2500/Tape & Reel	-13
AP2004SG-13	S	SOP-8L	2500/Tape & Reel	-13

Notes: 1. EU Directive 2002/95/EC (RoHS). All applicable RoHS exemptions applied. Please visit our website at http://www.diodes.com/products/lead_free.html.
2. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf.

Pin Assignments

(Top View)

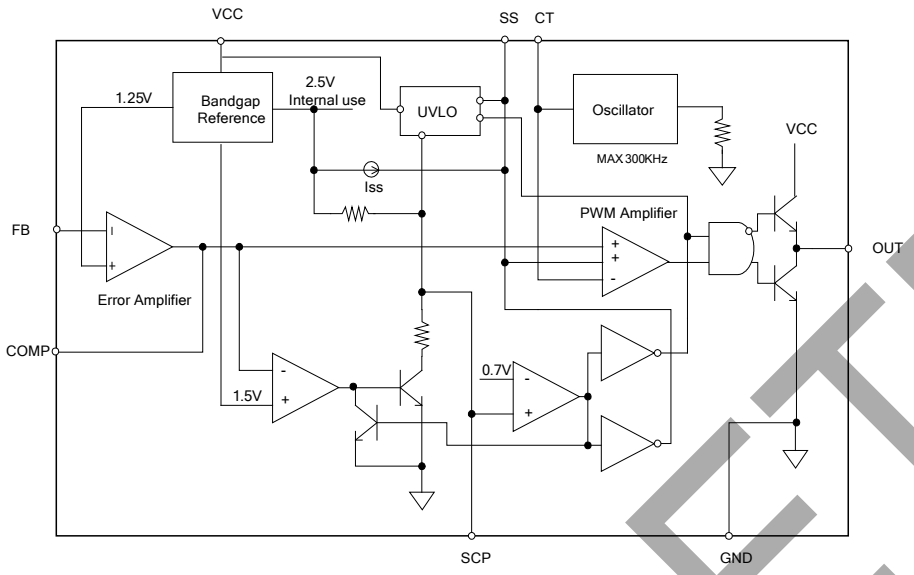


SOP-8L

Pin Descriptions

Pin Name	Description
CT	Timing Capacitor
FB	Voltage Feedback
SS	Soft-Start.
COMP	Feedback Loop Compensation
OUT	PWM Output
GND	Ground
VCC	Supply Voltage
SCP	Short Circuit Protection

Block Diagram



Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
P_D	Power dissipation at 25°C	600	mW
V_{CC}	Supply voltage	28	V
V_I	Amplifier input voltage	20	V
V_O	Collector output voltage	V_{CC}-1.0V	V
I_{SOURCE}	Source current	200	mA
I_{SINK}	Sink current	200	mA
T_{OP}	Operating junction temperature range	-20 to +125	°C
T_{ST}	Storage temperature range	-65 to +150	°C

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply voltage	3.6	27	V
V_I	Amplifier input voltage	1.05	1.45	V
V_O	Collector output voltage		Vcc-1.5	V
I_{FB}	Current into feedback terminal		45	μA
R_F	Feedback resistor	100		kΩ
C_T	Timing capacitor	100	6800	pF
F_{OSC}	Oscillator frequency	10	300	KHz

Electrical Characteristics (T_A = 25ºC, V_{CC} = 6V, f = 200 Khz)

Reference (REF)

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
V_{REF}	Comp connect to FB		1.225	1.25	1.275	V
	Output voltage change with temperature	T_A = -20ºC ~ 25ºC		-0.1	±1	%
		T_A = 25ºC ~ 85ºC		-0.2	±1	%

Under voltage lockout (UVLO)

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
V_{UT}	Upper threshold voltage (V_{CC})	$I_{O(REF)}$ = 0.1mA T_A = 25ºC		2.9		V
V_{LWT}	Lower threshold voltage (V_{CC})			2.4		V
V_{HT}	Hysteresis (V_{CC})			500		mV

Short-circuit protection (SCP) control

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
V_{IT}	Input threshold voltage	T_A = 25ºC	0.60	0.67	0.75	V
V_{STB}	Standby voltage	No pull up	100	130	160	mV
V_{LT}	Latched input voltage	No pull up		50	100	mV
I_{SCP}	Input (source) current	V_I = 0.7V, T_A = 25ºC	-10	-15	-20	µA
V_{CT}	Comparator threshold voltage (COMP)			1.5		V

Oscillator (OSC)

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
F_{OSC}	Frequency	C_T = 270 pF		200		KHz
ΔF_{OSC}	Standard deviation of frequency	C_T = 270 pF		10		%
	Frequency change with voltage	V_{CC} = 3.6V ~ 20V		1		

Error-amplifier

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
V_{IO}	Input offset voltage	V_O (FB) = 1.25V			±6	mV
I_{IO}	Input offset current	V_O (FB) = 1.25V			±100	nA
I_{IB}	Input bias current	V_O (FB) = 1.25V		160	500	nA
V_{CM}	Common-mode input voltage range	V_{CC} = 3.6V ~ 20V	1.05		1.45	V
AV	Open-loop voltage amplification	R_F = 200 kΩ	70	80		dB
GBW	Unity-gain bandwidth			1.5		MHz
CMRR	Common-mode rejection ratio		60	80		dB
V_{OH}	Max. output voltage		V_{ref}-0.1			V
V_{OL}	Min. output voltage				1	V
I_{OI}	Output (sink) current (COMP)	V_{ID} = -0.1V, V_O = 1.25V	0.5	1.6		mA
I_{OO}	Output (source) current (COMP)	V_{ID} = 0.1V, V_O = 1.25V	-45	-70		µA

Electrical Characteristics (Continued) (T_A = 25°C, V_{CC} = 6V, f = 200 Khz)

Output section

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
I_{LEAK}	Leakage current	V_O = 25V			10	μA
I_{DRV}	Sink current	V_{IN} = 20V		200		mA
	Source current	V_{IN} = 20V		200		mA
V_{SAT}	Output saturation voltage	I_O = 10 mA		1.0	1.5	V
I_{SC}	Short-circuit output current	V_O = 6V		120		mA

PWM comparator

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
V_{T0}	Input threshold voltage at f = 10 KHz (COMP)	CT		0.6	0.7	V
V_{T100}		Maximum duty cycle	1.2	1.3		V

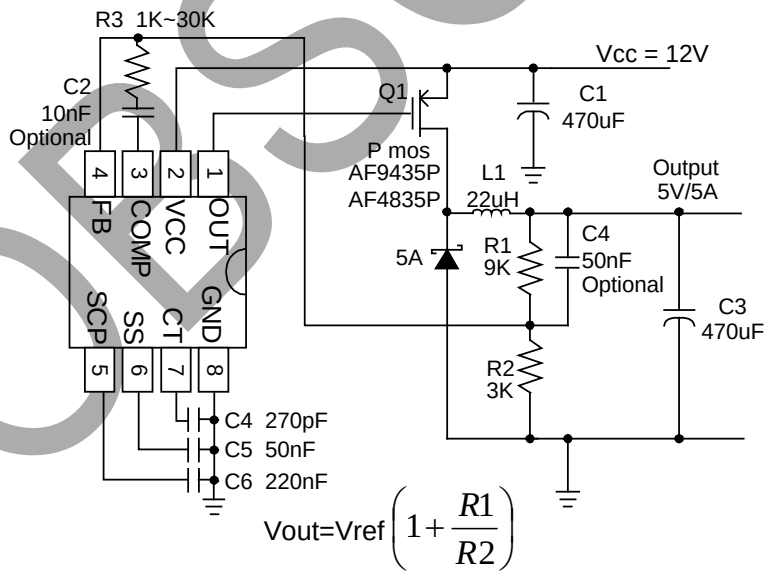
Total device

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
I_{CCA}	Average supply current	C_T = 270pF		6	10	mA

Soft Start

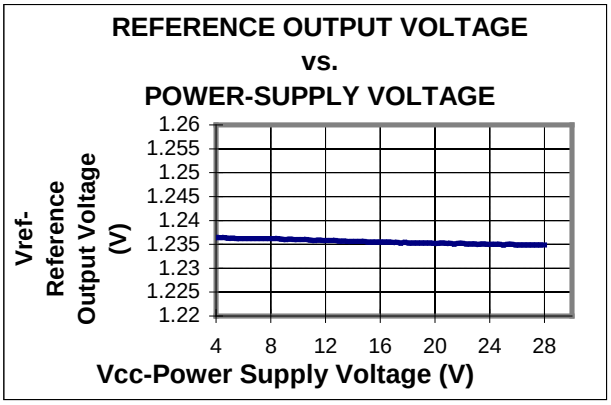
Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
V_{SS}	Soft-start Voltage			2.3		V
I_{SS}	Constant Charge Current			20		μA

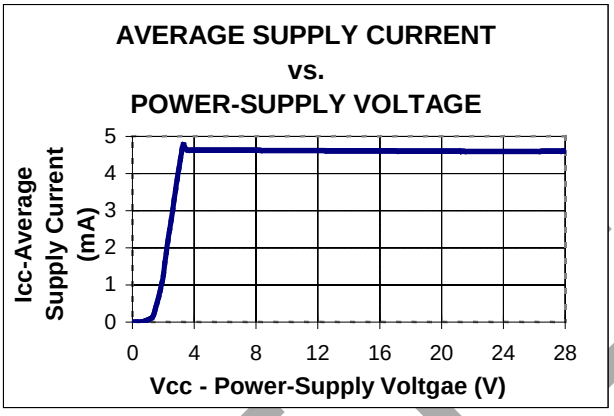
Typical Application Circuit

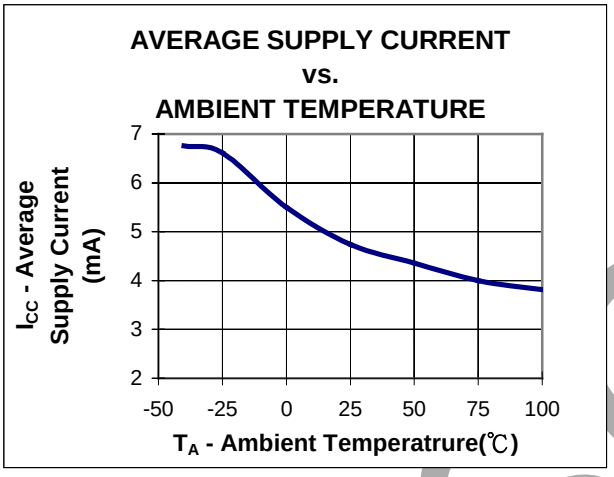


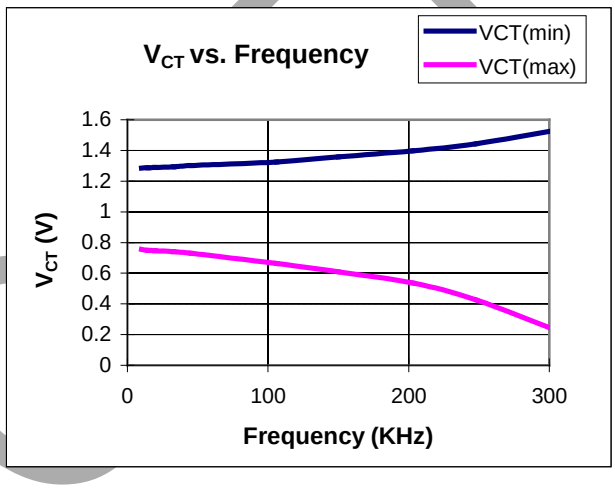
Step-Down DC/DC converter

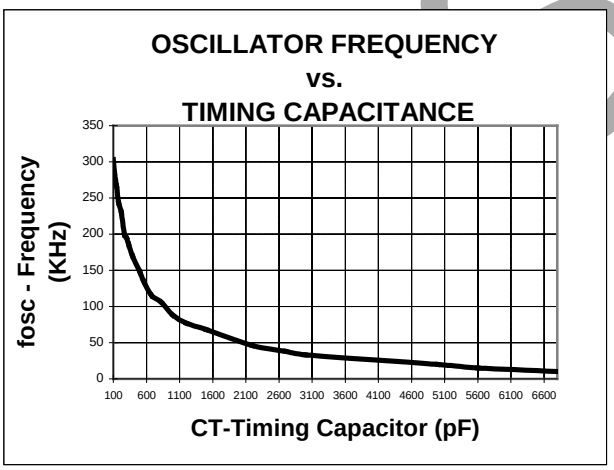
Typical Characteristics

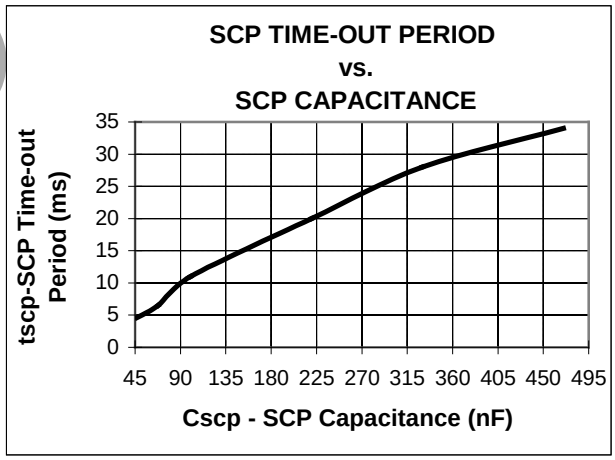




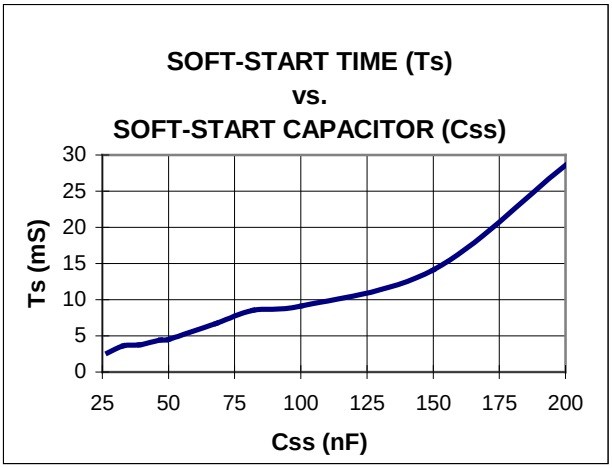






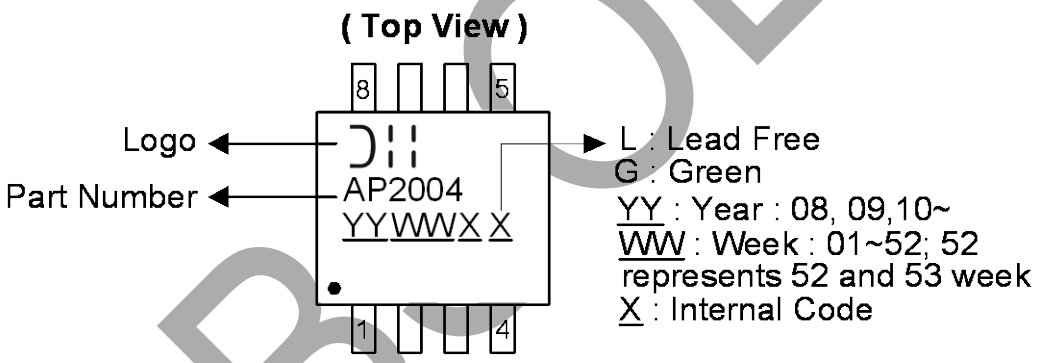


Typical Characteristics (Continued)



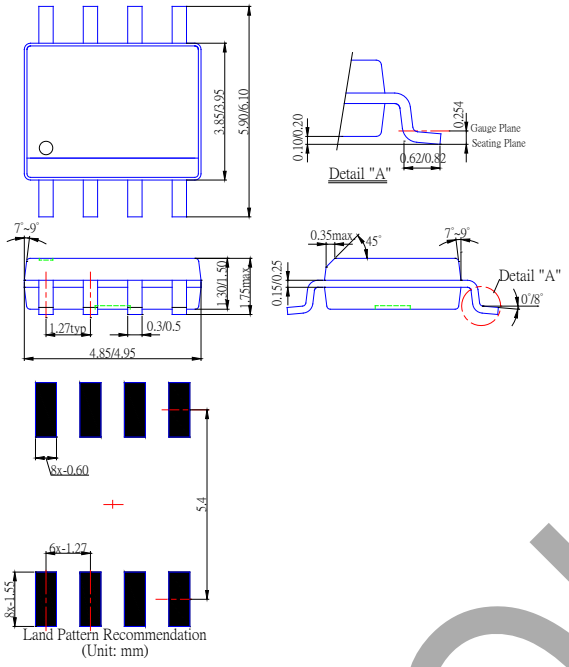
Marking Information

(1) SOP-8L



Package Information (All Dimensions in mm)

(1) Package Type: SOP- 8L



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