

PWM Buck Controller

■ Features

- PWM Buck Control Circuitry
- Operating voltage can be up to 20V
- Under voltage Lockout (UVLO) Protection
- Short Circuit Protection (SCP)
- Soft-start circuit
- Variable Oscillator Frequency -- 300KHz Max
- 0.77V voltage reference Output
- 8-pin PDIP and SOP packages

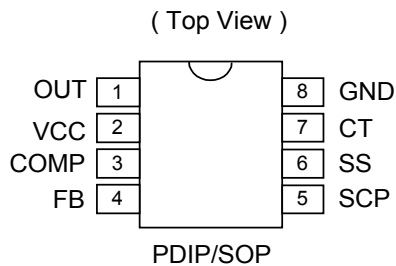
■ Applications

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

■ General Description

The AP2008 integrates Pulse-Width-Modulation (PWM) control circuit into a single chip, mainly designs for power-supply regulator. All the functions included an on-chip 0.77V reference output, an error amplifier, an adjusted oscillator, a soft-start, UVLO, SCP circuitry, and a push-pull output circuit. Switching frequency can be adjustable by trimming CT. During low VCC situation, the UVLO makes sure that the outputs are off until the internal circuit is operational normally.

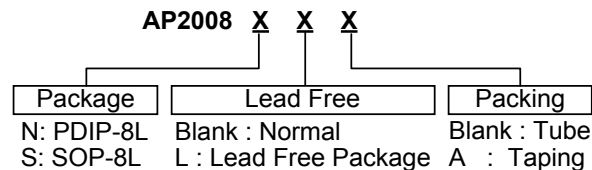
■ Pin Assignment



■ Pin Descriptions

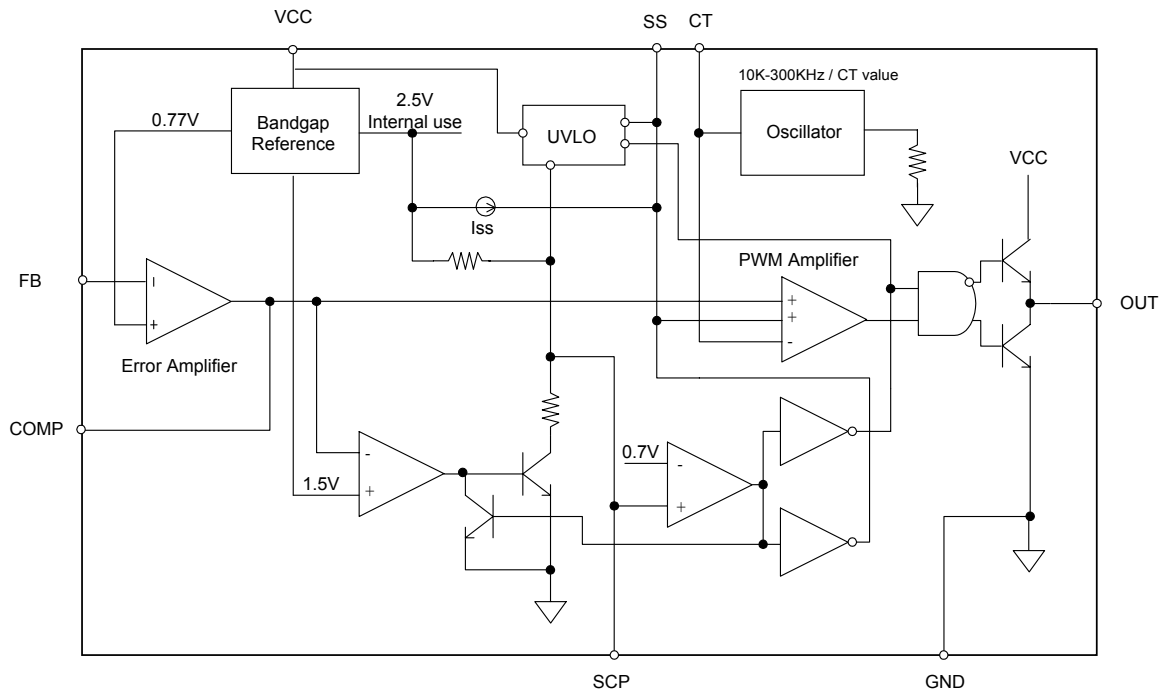
Name	Description
CT	Timing Capacitor
FB	Voltage Feedback
SS	Soft-Start.
COMP	Feedback Loop Compensation
OUT	PWM Output
GND	Ground
VCC	Supply Voltage
SCP	Short Circuit Protection

■ Ordering Information



PWM Buck Controller

■ Block Diagram



■ Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V_{CC}	Supply voltage	22	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 temperature range	-20 to +85	°C
T_{ST}	Storage temperature range	-65 to +150	°C
T_{LEAD}	Lead temperature 1.6 mm(1/16 inch) from case for 10 seconds	260	°C



■ Recommended Operating Conditions

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Supply voltage	3.6	20	V
V_I	Amplifier input voltage	1.05	1.45	V
V_O	Collector output voltage		$V_{CC}-1.5$	V
I_{FB}	Current into feedback terminal		45	μA
R_F	Feedback resistor	100		$k\Omega$
C_T	Timing capacitor	100	6800	pF
F_{OSC}	Oscillator frequency	10	300	KHz
T_{OP}	Operating free-air temperature	-20	85	$^{\circ}C$

■ Electrical Characteristics ($T_A=25^{\circ}C$, $V_{CC}=6V$, $f=200$ KHz)

Reference (REF)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{REF}	Comp connect to FB		0.755	0.770	0.785	V
	Output voltage change with temperature	$T_A = -20^{\circ}C \sim 25^{\circ}C$		-0.1	± 1	%
		$T_A = 25^{\circ}C \sim 85^{\circ}C$		-0.2	± 1	%

Under voltage lockout (UVLO)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{UT}	Upper threshold voltage (V_{CC})	$I_{O(REF)} = 0.1mA$ $T_A = 25^{\circ}C$		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	$T_A = 25^{\circ}C$	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	$V_I = 0.7V$, $T_A = 25^{\circ}C$	-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	$V_{CC} = 3.6V \sim 20V$		1		



PWM Buck Controller

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

Error-amplifier

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _{IO}	Input offset voltage	V _O (FB)=0.77V			±6	mV
I _{IO}	Input offset current	V _O (FB)=0.77V			±100	nA
I _{IB}	Input bias current	V _O (FB)=0.77V		160	500	nA
V _{CM}	Common-mode input voltage range	V _{CC} =3.6V ~ 20V	1.05		1.45	V
A _V	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 = 0.77V	0.5	1.6		mA
I _{OO}	Output (source) current (COMP)	V _{ID} = 0.1V, V _O = 0.77V	-45	-70		μA

Output section

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I _{LEAK}	Leakage current	V _O = 20V			10	μA
I _{DRV}	Sink current	V _{IN} = 12V		200		mA
	Source current	V _{IN} = 12V		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)	C _T =6800pF		0.6	0.7	V
V _{T100}		Maximum duty cycle	1.2	1.3		V

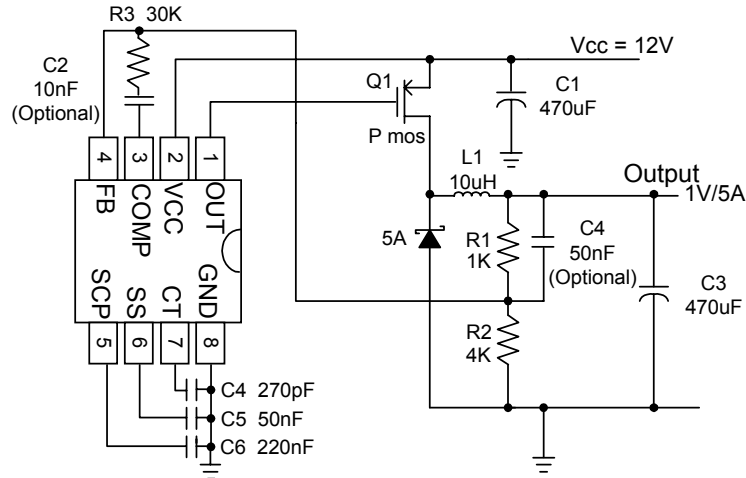
Total device

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I _{CCA}	Average supply current	C _T = 270pF		6	10	mA

Soft Start

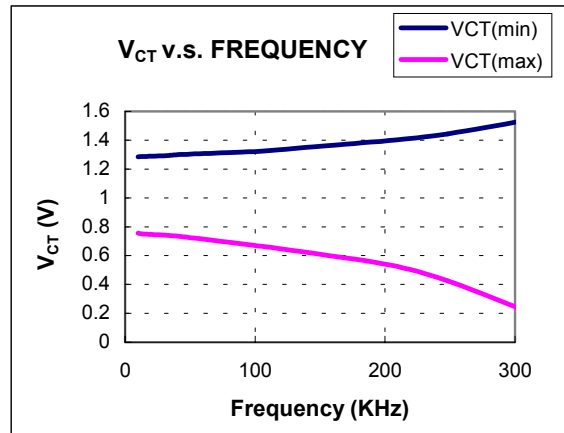
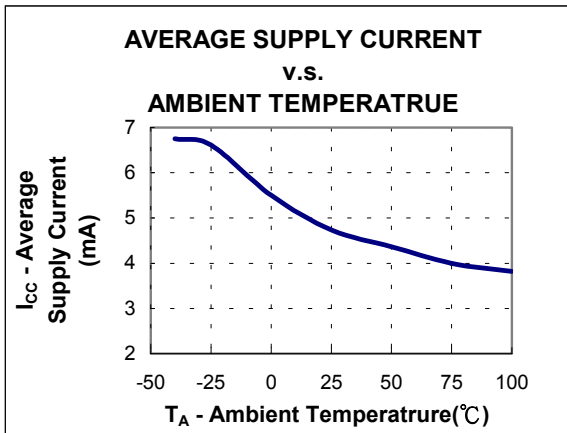
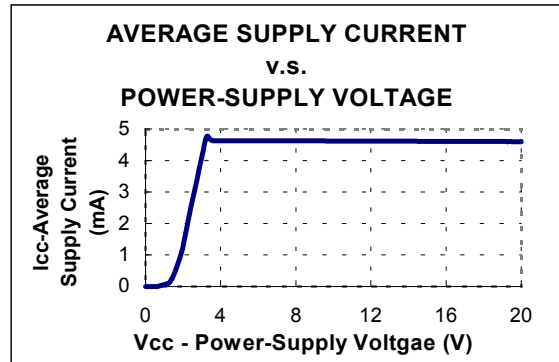
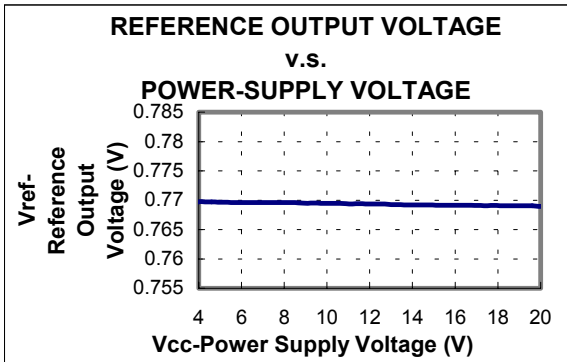
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _{SS}	Soft-start Voltage			2.3		V
I _{SS}	Constant Charge Current			20		μA

■ Typical Application Circuit

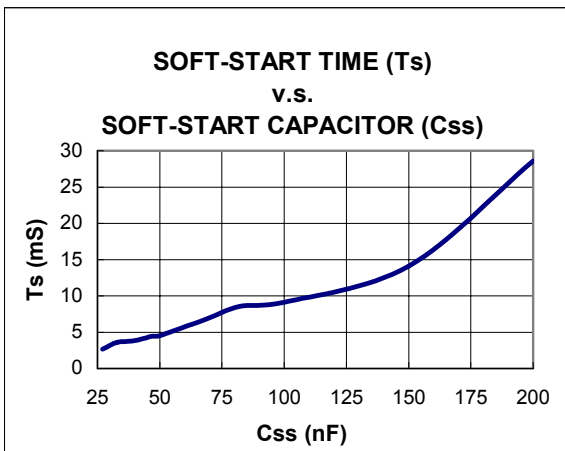
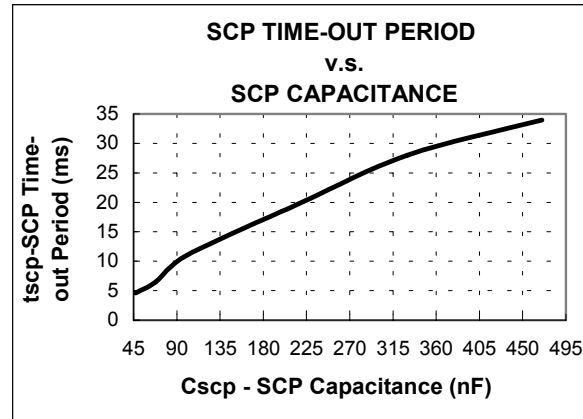
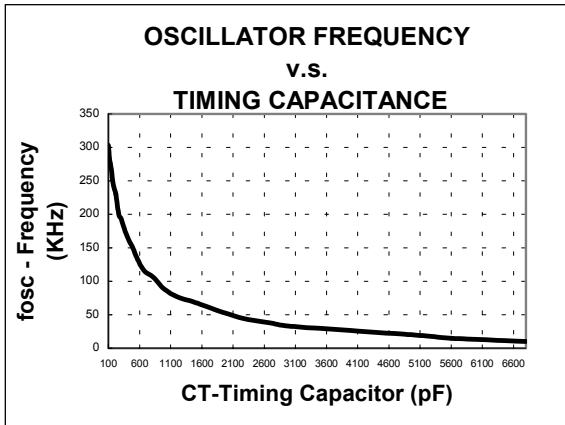


Step-Down DC/DC converter

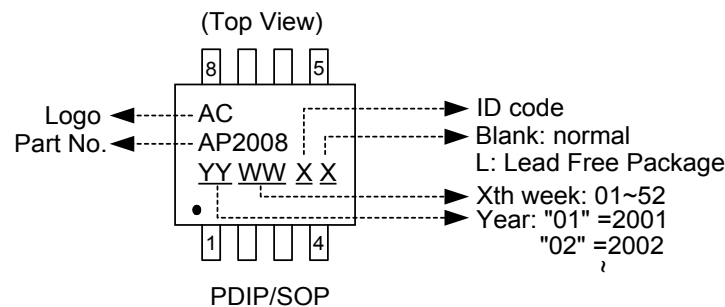
■ Typical Characteristics



■ Typical Characteristics (Continued)

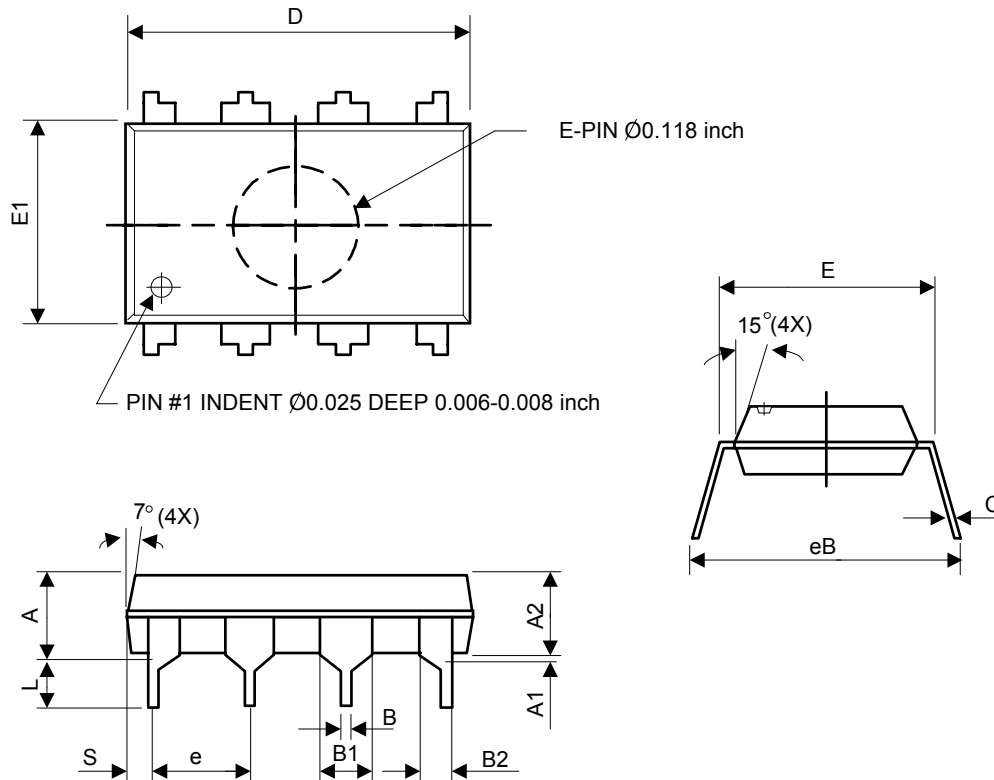


■ Marking Information



■ Package Information

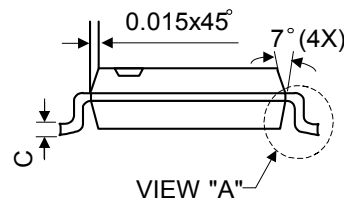
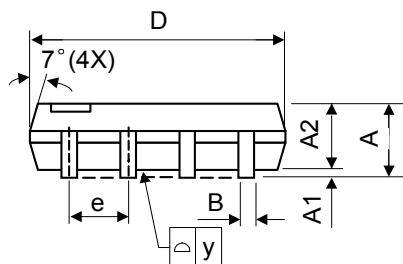
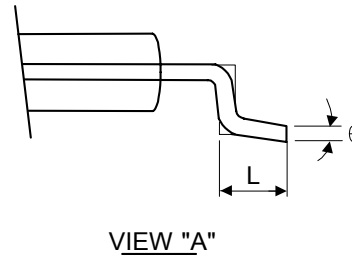
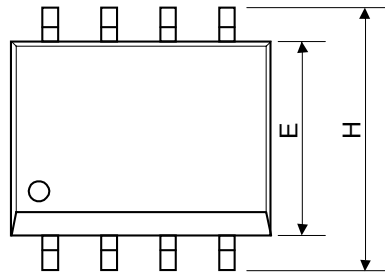
(1) PDIP-8L (Plastic Dual-in-line Package)



Symbol	Dimensions in millimeters			Dimensions in inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	5.33	-	-	0.210
A1	0.38	-	-	0.015	-	-
A2	3.1	3.30	3.5	0.122	0.130	0.138
B	0.36	0.46	0.56	0.014	0.018	0.022
B1	1.4	1.52	1.65	0.055	0.060	0.065
B2	0.81	0.99	1.14	0.032	0.039	0.045
C	0.20	0.25	0.36	0.008	0.010	0.014
D	9.02	9.27	9.53	0.355	0.365	0.375
E	7.62	7.94	8.26	0.300	0.313	0.325
E1	6.15	6.35	6.55	0.242	0.250	0.258
e	-	2.54	-	-	0.100	-
L	2.92	3.3	3.81	0.115	0.130	0.150
eB	8.38	8.89	9.40	0.330	0.350	0.370
S	0.71	0.84	0.97	0.028	0.033	0.038

■ Package Information (Continued)

(2) SOP- 8L(JEDEC Small Outline Package)



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.40	1.60	1.75	0.055	0.063	0.069
A1	0.10	-	0.25	0.040	-	0.100
A2	1.30	1.45	1.50	0.051	0.057	0.059
B	0.33	0.41	0.51	0.013	0.016	0.020
C	0.19	0.20	0.25	0.0075	0.008	0.010
D	4.80	5.05	5.30	0.189	0.199	0.209
E	3.70	3.90	4.10	0.146	0.154	0.161
e	-	1.27	-	-	0.050	-
H	5.79	5.99	6.20	0.228	0.236	0.244
L	0.38	0.71	1.27	0.015	0.028	0.050
y	-	-	0.10	-	-	0.004
θ	0°	-	8°	0°	-	8°