

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 SOP package
- SOP-8L: Available in "Green" Molding Compound (No Br, Sb)
- Lead Free Finish/ RoHS Compliant (Note 1)

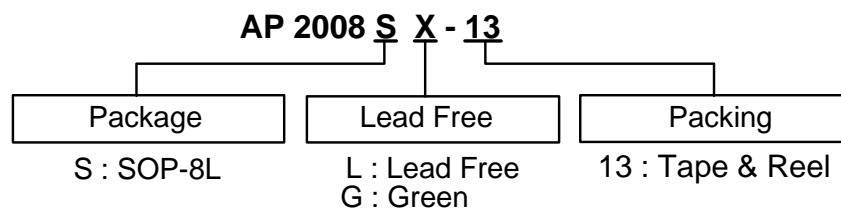
General Description

The AP2008 integrates Pulse-Width-Modulation (PWM) control circuit into a single chip, mainly designs for power-supply regulator. All the functions include an on-chip 0.77V 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 is operational normally.

Applications

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

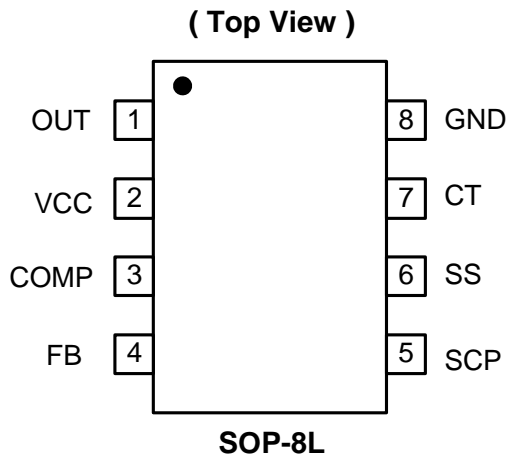
Ordering Information



| Device | Package Code | Packaging (Note 2) | 13" Tape and Reel | |
|-------------|--------------|--------------------|-------------------|--------------------|
| | | | Quantity | Part Number Suffix |
| AP2008SL-13 | S | SOP-8L | 2500/Tape & Reel | -13 |
| AP2008SG-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



Pin Descriptions

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

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 |

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 | | kΩ |
| C_T | Timing capacitor | 100 | 6800 | pF |
| F_{OSC} | Oscillator frequency | 10 | 300 | KHz |

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

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 | $T_A = -20^\circ\text{C} \sim 25^\circ\text{C}$ | | -0.1 | ± 1 | % |
| | | $T_A = 25^\circ\text{C} \sim 85^\circ\text{C}$ | | -0.2 | ± 1 | % |

Under voltage lockout (UVLO)

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|-----------|--------------------------------------|---|-----|------|-----|------|
| V_{UT} | Upper threshold voltage (V_{CC}) | $I_{O(REF)} = 0.1\text{mA}$ $T_A = 25^\circ\text{C}$ | | 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 | $T_A = 25^\circ\text{C}$ | 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 | $V_I = 0.7\text{V}$, $T_A = 25^\circ\text{C}$ | -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 | $C_T = 270\text{ pF}$ | | 200 | | KHz |
| ΔF_{OSC} | Standard deviation of frequency | $C_T = 270\text{ pF}$ | | 10 | | % |
| | Frequency change with voltage | $V_{CC} = 3.6\text{V} \sim 20\text{V}$ | | 1 | | |

Error-amplifier

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|----------|---------------------------------|--|-----------------|------|-----------|---------------|
| V_{IO} | Input offset voltage | $V_O(\text{FB}) = 0.77\text{V}$ | | | ± 6 | mV |
| I_{IO} | Input offset current | $V_O(\text{FB}) = 0.77\text{V}$ | | | ± 100 | nA |
| I_{IB} | Input bias current | $V_O(\text{FB}) = 0.77\text{V}$ | | 160 | 500 | nA |
| V_{CM} | Common-mode input voltage range | $V_{CC} = 3.6\text{V} \sim 20\text{V}$ | 1.05 | | 1.45 | V |
| AV | Open-loop voltage amplification | $R_F = 200\text{ k}\Omega$ | 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) | $V_{ID} = -0.1\text{V}$, $V_O = 0.77\text{V}$ | 0.5 | 1.6 | | mA |
| I_{OO} | Output (source) current (COMP) | $V_{ID} = 0.1\text{V}$, $V_O = 0.77\text{V}$ | -45 | -70 | | μA |

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

Output section

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|------------|------------------------------|-----------------------|-----|------|-----|---------------|
| I_{LEAK} | Leakage current | $V_O = 20\text{V}$ | | | 10 | μA |
| I_{DRV} | Sink current | $V_{IN} = 12\text{V}$ | | 200 | | mA |
| | Source current | $V_{IN} = 12\text{V}$ | | 200 | | mA |
| V_{SAT} | Output saturation voltage | $I_O = 10\text{mA}$ | | 1.0 | 1.5 | V |
| I_{SC} | Short-circuit output current | $V_O = 6\text{V}$ | | 120 | | mA |

PWM comparator

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|------------|---|-----------------------|-----|------|-----|------------|
| V_{T0} | Input threshold voltage at $f = 10\text{KHz}$ (COMP) | $C_T = 6800\text{pF}$ | | 0.6 | 0.7 | V |
| V_{T100} | | Maximum duty cycle | 1.2 | 1.3 | | V |

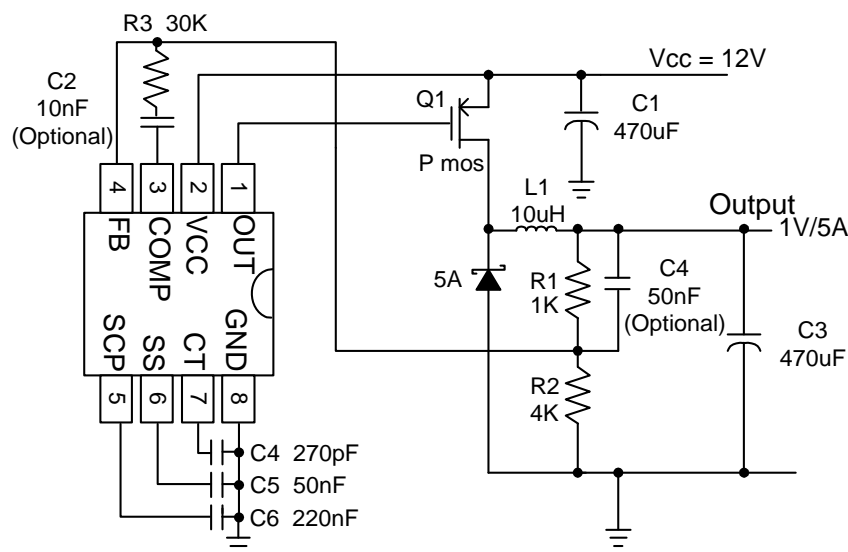
Total device

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

Soft Start

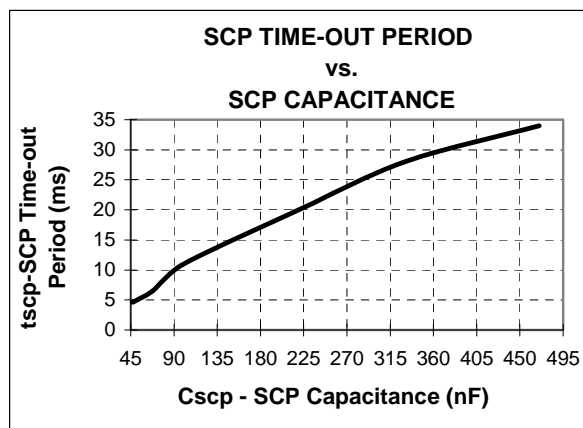
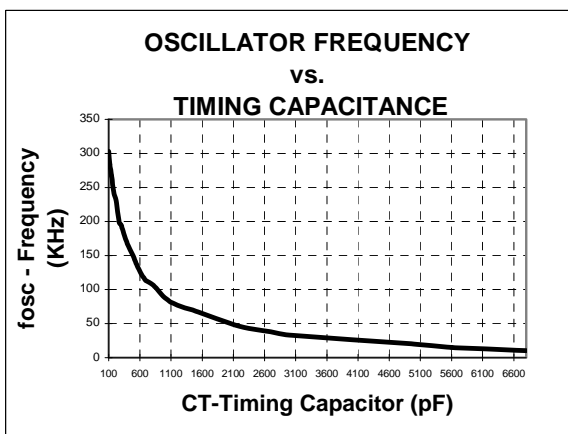
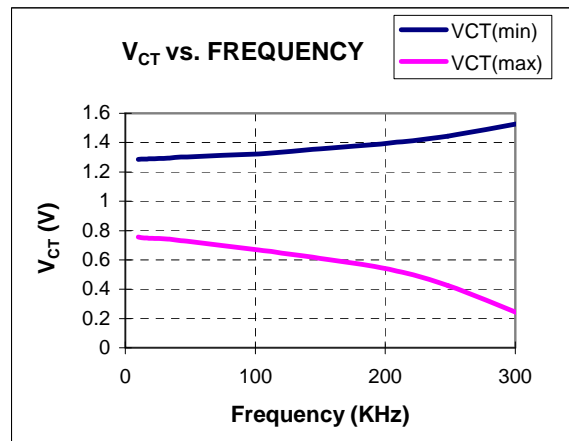
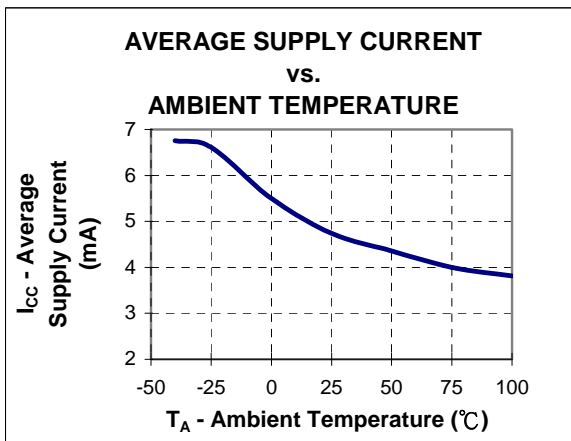
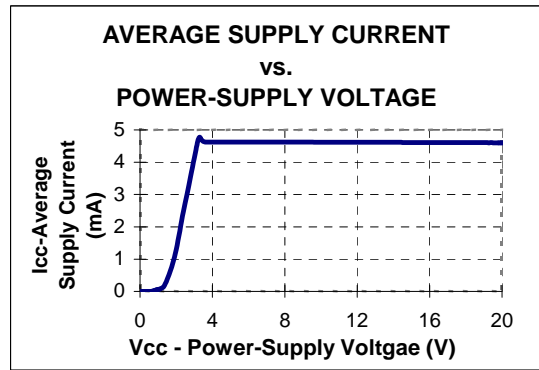
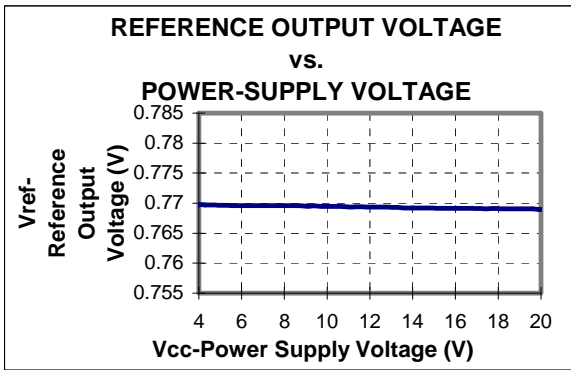
| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|----------|-------------------------|------------|-----|------|-----|---------------|
| V_{SS} | Soft-start Voltage | | | 2.3 | | V |
| I_{SS} | Constant Charge Current | | | 20 | | μA |

Typical Application Circuit

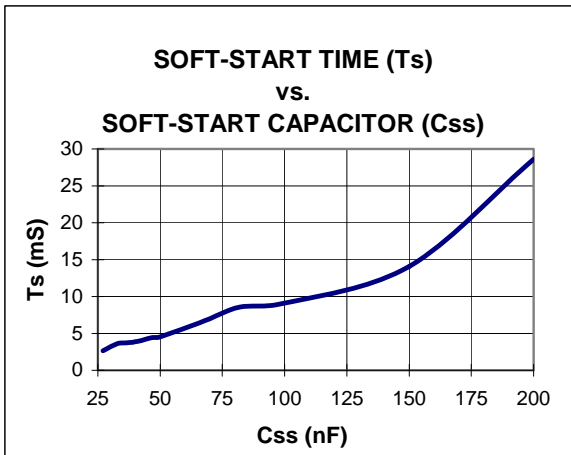


Step-Down DC/DC converter

Typical Characteristics

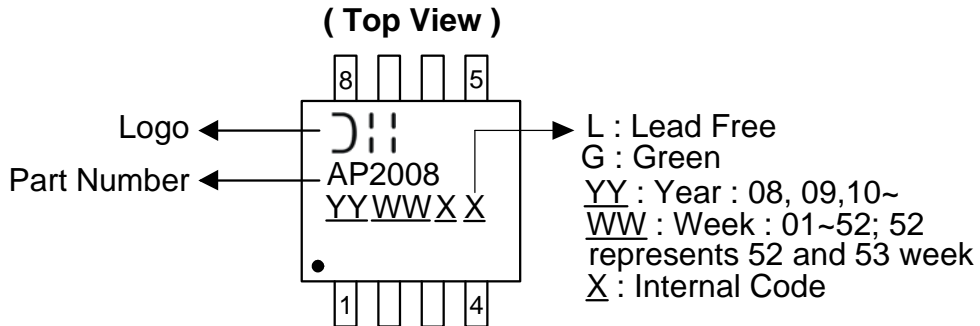


Typical Characteristics (Continued)



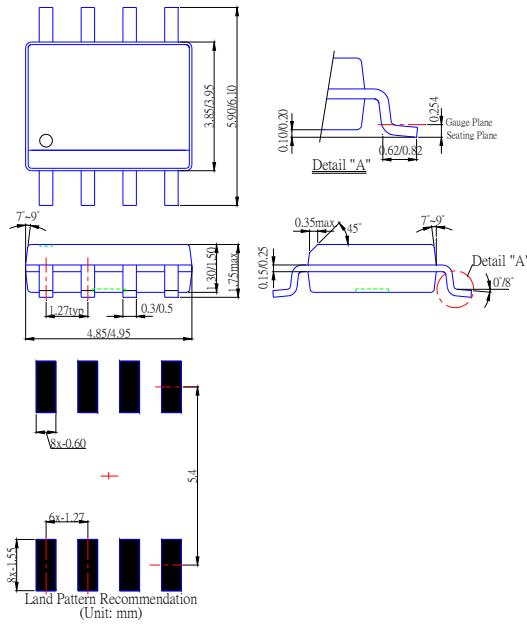
Marking Information

(1) SOP-8L



Package Information (All Dimensions in mm)

(1) Package Type: SOP- 8L



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