



# SP6850

## Green-Mode PWM Controller

### DESCRIPTION

The SP6850 is the current mode PWM controller with green-mode power-saving operation, to meet the low standby-power needs of low-power SMPS. This green-mode function enables the power supply to easily meet even the strictest power conservation requirements. The functions such as the leading-edge blanking of the current sensing, internal slope compensation and the small package provide the high efficiency / low cost for SMPS power applications. SP6850 is processed by BiCMOS fabrication, that enables reducing the start-up current and the operating current. SP6850 is available by SOT-23-6L / DIP-8P packages.

### APPLICATIONS

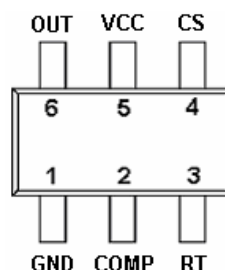
- AC/DC Switching Power Adaptor
- Battery Charger
- PC 5V Standby Power.
- Open-Frame Switching Power Supply

### FEATURES

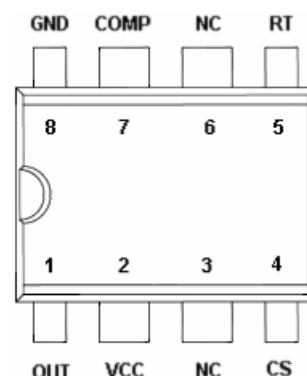
- High-Voltage BiCMOS Process
- Very Low Startup Current (Typ ~ 8μA)
- Under Voltage Lockout (UVLO )
- Current Mode Control with Cycle Peak
- Current Limiting
- Leading-Edge Blanking
- Programmable Switching Frequency
- Internal Slope Compensation
- Green-Mode Control for Power Saving
- Non-audible-noise Green Mode Control
- 300mA Driving Capability
- OVP (Over Voltage Protection) on Vcc Pin

### PIN CONFIGURATION

#### SOT-23-6L

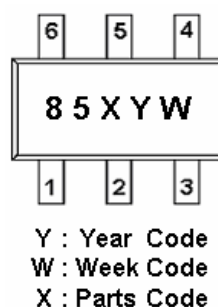


#### DIP-8P



### PART MARKING

#### SOT-23-6L



#### DIP-8P

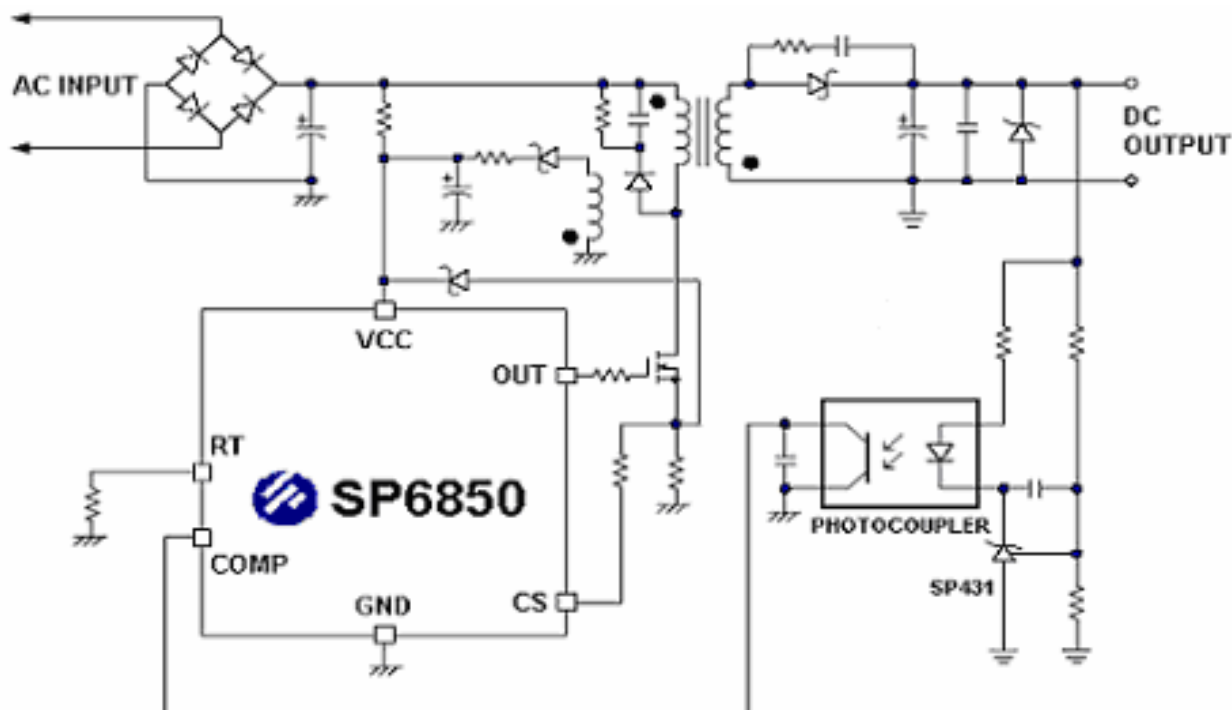




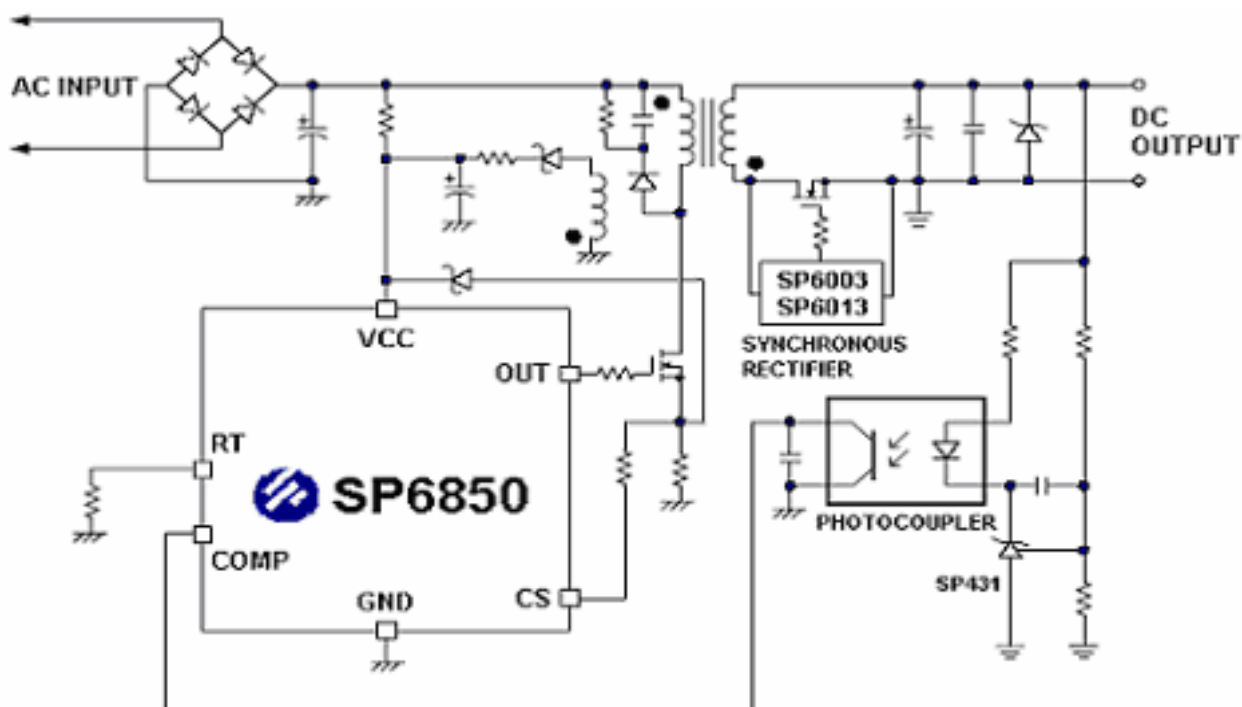
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### TYPICAL APPLICATION CIRCUIT



### TYPICAL APPLICATION CIRCUIT ( High Efficiency SMPS + Synchronous Rectifier )





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### PIN DESCRIPTION

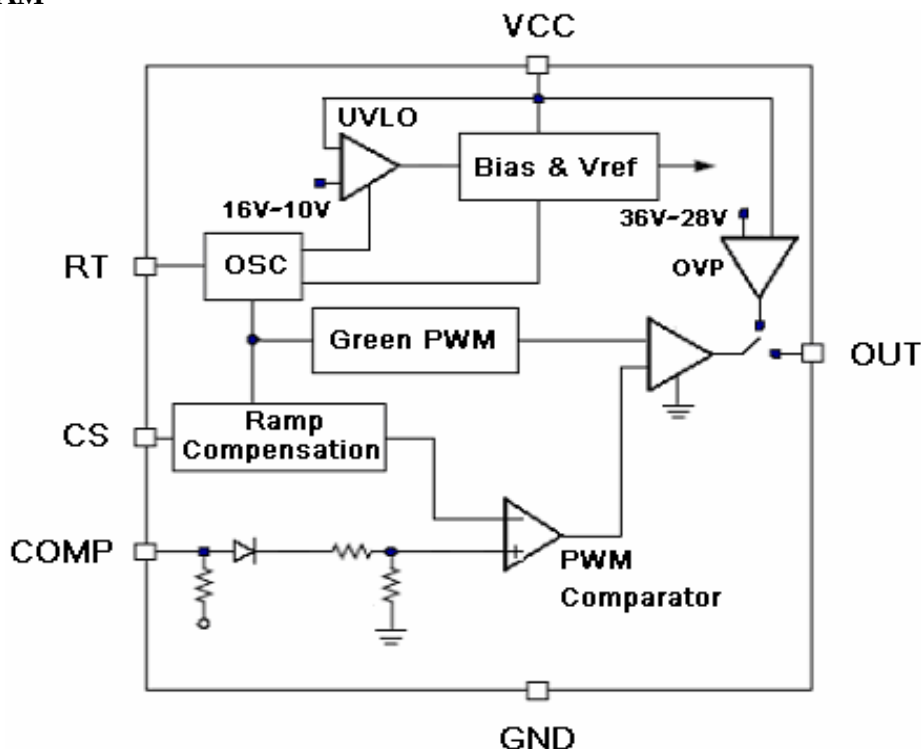
#### SP6850D8TG

| Pin | Symbol | Description                                                                                                                                                                           |
|-----|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | OUT    | Gate driver output to drive the external MOSFET                                                                                                                                       |
| 2   | VCC    | Supply Voltage in                                                                                                                                                                     |
| 3   | NC     | Unconnected pin                                                                                                                                                                       |
| 4   | CS     | Current sense. This pin senses the voltage across a resistor, to control PWM output. This pin also provides current amplitude information for current-mode control.                   |
| 5   | RT     | This current is used to charge an internal capacitor, to determine the switching frequency.                                                                                           |
| 6   | NC     | Unconnected pin                                                                                                                                                                       |
| 7   | COMP   | Voltage feedback. The pin provides the output voltage regulation signal., it provides feedback to the internal PWM comparator, so that the PWM comparator can control the duty cycle. |
| 8   | GND    | Ground                                                                                                                                                                                |

#### SP6850S26RG

| Pin | Symbol | Description                                                                                                                                                                          |
|-----|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | GND    | Ground                                                                                                                                                                               |
| 2   | COMP   | Voltage feedback. The pin provides the output voltage regulation signal., it provides feedback to the internal PWM comparator, so that the PWM comparator can control the duty cycle |
| 3   | RT     | This current is used to charge an internal capacitor, to determine the switching frequency.                                                                                          |
| 4   | CS     | Current sense. This pin senses the voltage across a resistor, to control PWM output. This pin also provides current amplitude information for current-mode control                   |
| 5   | VCC    | Supply Voltage in                                                                                                                                                                    |
| 6   | OUT    | Gate driver output to drive the external MOSFET                                                                                                                                      |

### BLOCK DIAGRAM





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## Green-Mode PWM Controller

### ORDERING INFORMATION

| Part Number  | Package   | Part Marking |
|--------------|-----------|--------------|
| SP6850AD8TG  | DIP-8P    | SP6850I      |
| SP6850BD8TG  | DIP-8P    | SP6850I      |
| SP6850AS26RG | SOT-23-6L | 85AYW        |
| SP6850BS26RG | SOT-23-6L | 850YW        |

※ SP6850AD8TG / SP6850BD8TG : Tube ; Pb – Free

※ SP6850AS26RG / SP6850BS26RG : Tape Reel ; Pb – Free

### ABSOLUTE MAXIMUM RATINGS ( $T_A=25^{\circ}\text{C}$ , unless otherwise specified.)

The following ratings designate persistent limits beyond which damage to the device may occur.

| Symbol           | Parameter                                        | Value      | Unit               |
|------------------|--------------------------------------------------|------------|--------------------|
| $V_{CC}$         | DC Supply Voltage                                | 36         | V                  |
| $V_{COMP/RT/CS}$ | COMP / RT / CS Voltage                           | -0.3 ~ 7.0 | V                  |
| $P_D$            | Power Dissipation @ $T_A=85^{\circ}\text{C}$ (*) | 0.3        | W                  |
| ESD              | Human Body Model                                 | 4          | KV                 |
|                  | Machine Model                                    | 300        | V                  |
| $T_{ope}$        | Operating Ambient Temperature                    | -40 ~ 85   | $^{\circ}\text{C}$ |
| $T_J$            | Operating Junction Temperature Range             | -40 ~ 150  | $^{\circ}\text{C}$ |
| $T_{STG}$        | Storage Temperature Range                        | -40 ~ 150  | $^{\circ}\text{C}$ |
| $T_{LEAD}$       | Pb-Free Lead Soldering Temperature for 5 sec.    | 260        | $^{\circ}\text{C}$ |
| $R_{\theta JC}$  | Thermal Resistance Junction – Case (*)           | SOT-23-6L  | 210                |
|                  |                                                  | DIP-8P     | 95                 |

(\*) The power dissipation and thermal resistance are evaluated under copper board mounted with free air conditions.



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## Green-Mode PWM Controller

### ELECTRICAL CHARACTERISTICS

(T<sub>A</sub>=25°C, V<sub>CC</sub>=15V, unless otherwise specified.)

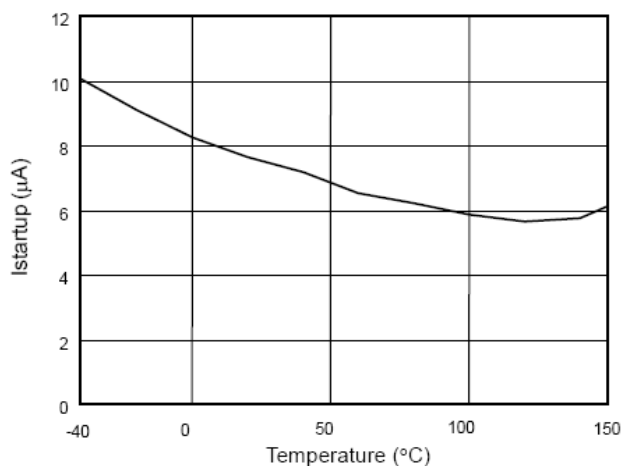
| Symbol                                | Parameter                                            | Conditions                                    | Min. | Typ. | Max. | Unit |
|---------------------------------------|------------------------------------------------------|-----------------------------------------------|------|------|------|------|
| <b>Supply Voltage ( Vcc Pin )</b>     |                                                      |                                               |      |      |      |      |
| I <sub>stt</sub>                      | Startup Current                                      |                                               |      | 8    | 20   | uA   |
| I <sub>op</sub>                       | Operating Current                                    | V <sub>COMP</sub> = 3V                        |      | 2    | 4    | mA   |
| UVLO (off)                            | Min. Operating Voltage                               |                                               | 9.0  | 10.0 | 11.0 | V    |
| UVLO (on )                            | Start Threshold Voltage                              |                                               | 15.0 | 16.0 | 17.0 | V    |
| OVP Level                             | Over Voltage Protection                              |                                               | 28   |      | 36   | V    |
| <b>Voltage Feedback ( Comp Pin )</b>  |                                                      |                                               |      |      |      |      |
| I <sub>sc</sub>                       | Short Circuit Current                                |                                               |      | 2.2  | 3.0  | mA   |
| V <sub>op</sub>                       | Open Loop Voltage                                    |                                               |      | 5.0  |      | V    |
| V <sub>TH(GM)</sub>                   | Green Mode Threshold V <sub>COMP</sub>               |                                               |      | 2.35 |      | V    |
| <b>Oscillator ( RT Pin )</b>          |                                                      |                                               |      |      |      |      |
| F <sub>osc</sub>                      | Frequency                                            | R <sub>T</sub> =100KΩ                         | 60.0 | 65.0 | 75.0 | KHz  |
| F <sub>osc(GM)</sub>                  | Green Mode Frequency                                 | F <sub>s</sub> =65.0KHz                       |      | 20   |      | KHz  |
| F <sub>dt</sub>                       | Frequency Variation versus Temp. Deviation           | (-40°C ~105°C)                                |      |      | 3    | %    |
| F <sub>dv</sub>                       | Frequency Variation versus V <sub>CC</sub> Deviation | (V <sub>CC</sub> =11V-25V)                    |      |      | 1    | %    |
| <b>Current Sensing ( CS Pin )</b>     |                                                      |                                               |      |      |      |      |
| V <sub>cs(off)</sub>                  | Maximum Input Voltage                                | SP6850BD8TG<br>SP6850BS26RG                   | 0.8  | 0.85 | 0.9  | V    |
|                                       |                                                      | SP6850AD8TG<br>SP6850AS26RG                   | 0.7  | 0.75 | 0.8  |      |
| Z <sub>cs</sub>                       | Input impedance                                      |                                               |      | 50   |      | KΩ   |
| T <sub>PD</sub>                       | Delay to Output                                      |                                               |      | 150  |      | nS   |
| <b>Gate Driver Output ( OUT Pin )</b> |                                                      |                                               |      |      |      |      |
| DC (Max)                              | Maximum Duty Cycle                                   |                                               | 70   | 75   | 80   | %    |
| DC (Min)                              | Minimum Duty Cycle                                   |                                               |      | 0    |      | %    |
| V <sub>OL</sub>                       | Output Low Level                                     | V <sub>CC</sub> =15V,<br>I <sub>O</sub> =20mA |      |      | 1    | V    |
| V <sub>OH</sub>                       | Output High Level                                    | V <sub>CC</sub> =15V,<br>I <sub>O</sub> =20mA | 8    |      |      | V    |
| T <sub>r</sub>                        | Rising Time                                          | Load Cap=1000pF                               |      | 50   | 200  | nS   |
| T <sub>f</sub>                        | Falling Time                                         | Load Cap=1000pF                               |      | 30   | 120  | nS   |



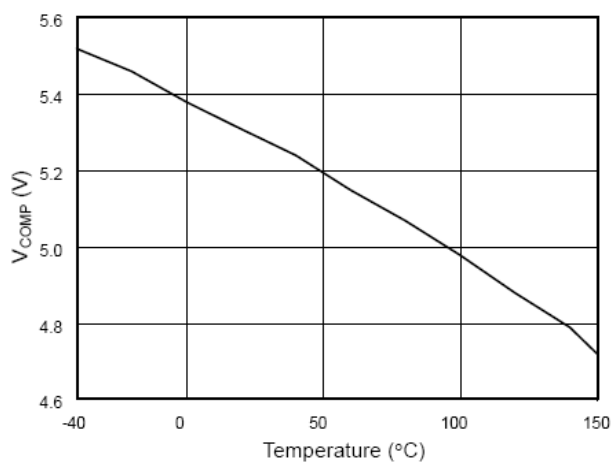
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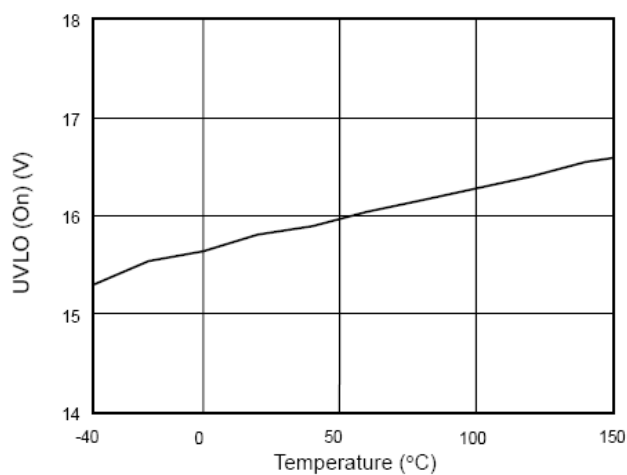
PERFORMANCE CHARACTERISTICS ( $T_A=25^\circ\text{C}$ , unless otherwise specified.)



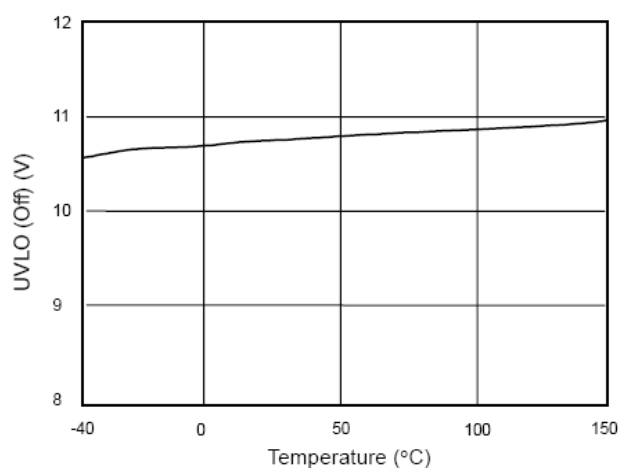
Startup Current (I<sub>startup</sub>) vs. Temperature



V<sub>COMP</sub> open loop voltage v.s. Temperature



UVLO (On) vs. Temperature



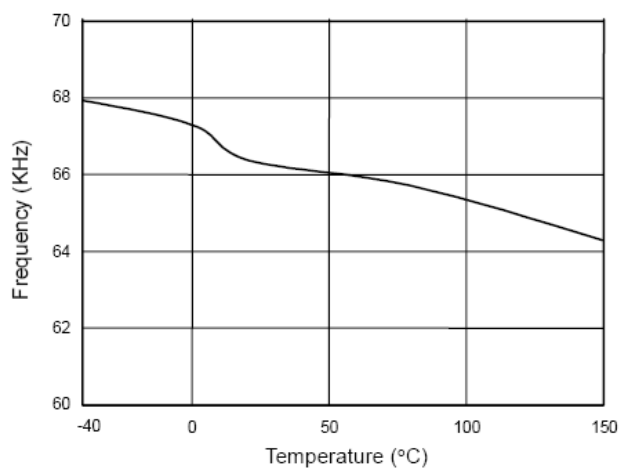
UVLO Off v.s. Temperature



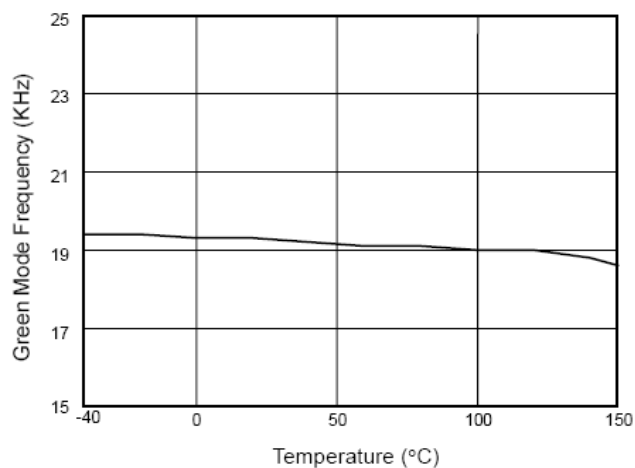
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## Green-Mode PWM Controller

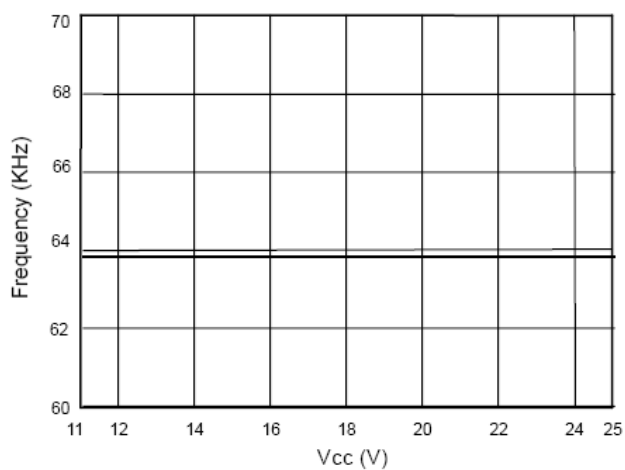
PERFORMANCE CHARACTERISTICS ( $T_A=25^{\circ}\text{C}$ , unless otherwise specified.)



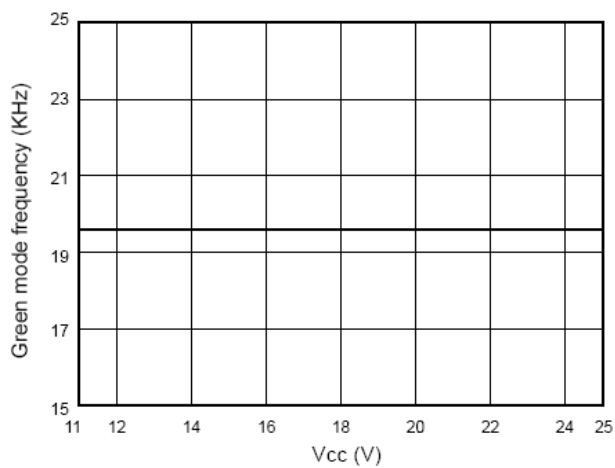
Frequency v.s. Temperature



Green Mode Frequency v.s. Temperature



Frequency v.s. Vcc



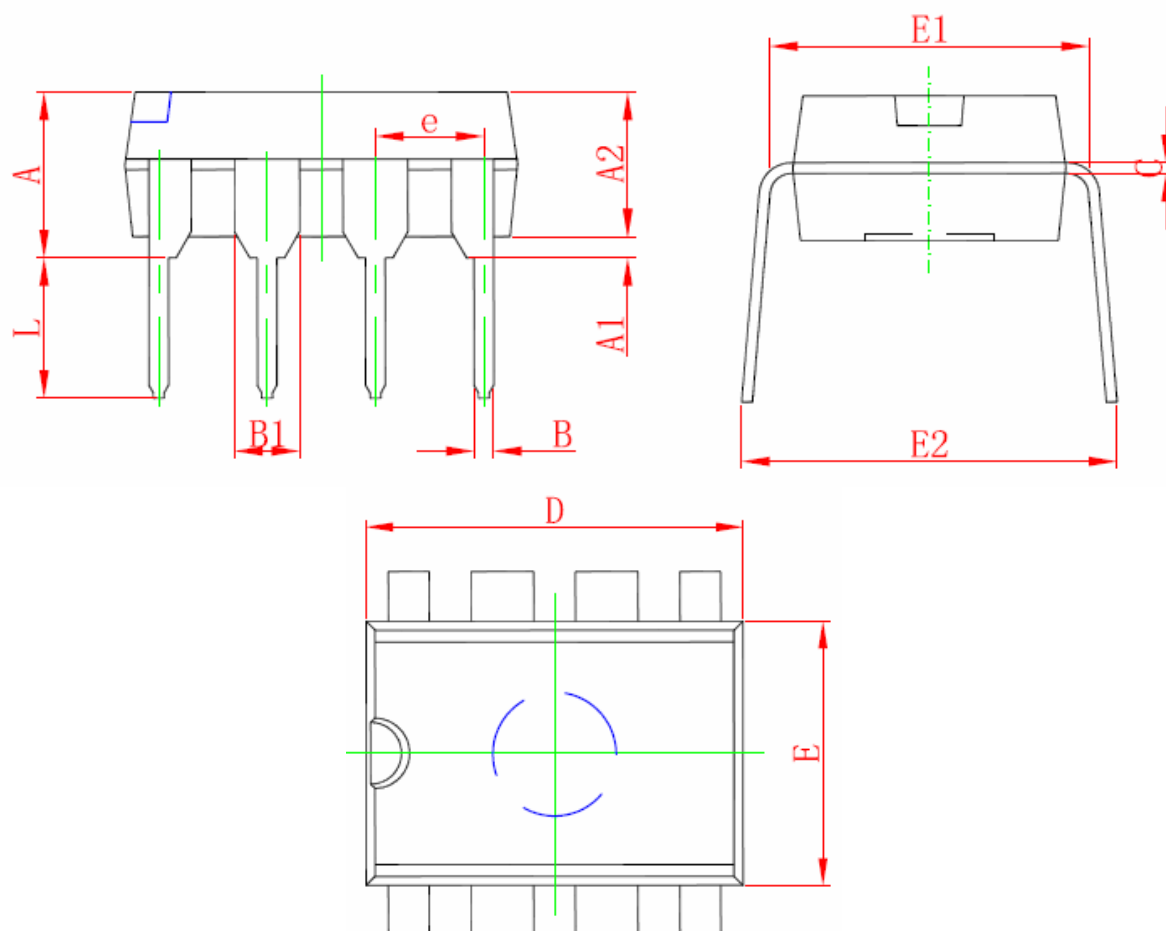
Green mode frequency v.s. Vcc



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## Green-Mode PWM Controller

### DIP- 8P PACKAGE OUTLINE



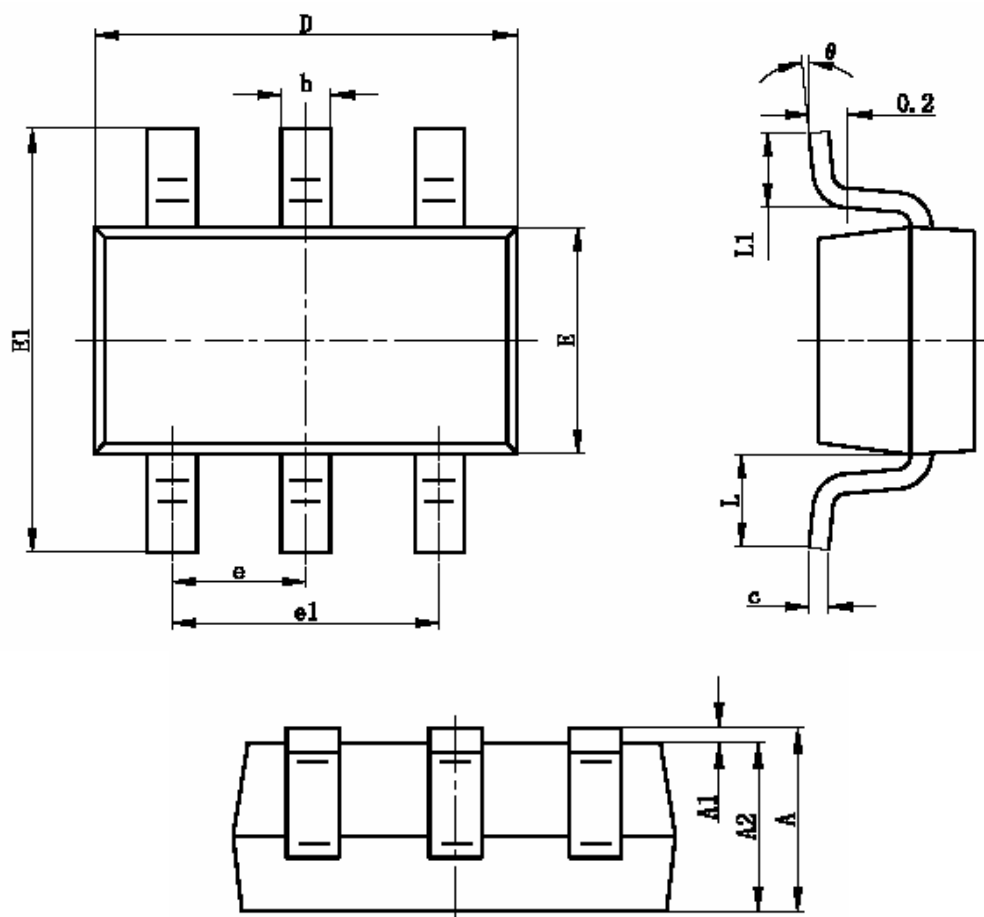
| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 3.710                     | 4.310 | 0.146                | 0.170 |
| A1     | 0.510                     |       | 0.020                |       |
| A2     | 3.200                     | 3.600 | 0.126                | 0.142 |
| B      | 0.380                     | 0.570 | 0.015                | 0.022 |
| B1     | 1.524 (BSC)               |       | 0.060 (BSC)          |       |
| C      | 0.204                     | 0.360 | 0.008                | 0.014 |
| D      | 9.000                     | 9.400 | 0.354                | 0.370 |
| E      | 6.200                     | 6.600 | 0.244                | 0.260 |
| E1     | 7.320                     | 7.920 | 0.288                | 0.312 |
| e      | 2.540 (BSC)               |       | 0.100 (BSC)          |       |
| L      | 3.000                     | 3.600 | 0.118                | 0.142 |
| E2     | 8.400                     | 9.000 | 0.331                | 0.354 |



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### SOT-23-6L PACKAGE OUTLINE



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 1.050                     | 1.250 | 0.041                | 0.049 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2     | 1.050                     | 1.150 | 0.041                | 0.045 |
| b      | 0.300                     | 0.400 | 0.012                | 0.016 |
| c      | 0.100                     | 0.200 | 0.004                | 0.008 |
| D      | 2.820                     | 3.020 | 0.111                | 0.119 |
| E      | 1.500                     | 1.700 | 0.059                | 0.067 |
| E1     | 2.650                     | 2.950 | 0.104                | 0.116 |
| e      | 0.950TYP                  |       | 0.037TYP             |       |
| e1     | 1.800                     | 2.000 | 0.071                | 0.079 |
| L      | 0.700REF                  |       | 0.028REF             |       |
| L1     | 0.300                     | 0.600 | 0.012                | 0.024 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |



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SYNC Power Corporation  
7F-2, No.3-1, Park Street  
NanKang District (NKSP), Taipei, Taiwan, 115, R.O.C  
Phone: 886-2-2655-8178  
Fax: 886-2-2655-8468  
<http://www.syncpower.com>