

#### **DESCRIPTION**

The SP6853 is a low cost , low startup current , current mode PWM controller with green-mode power-saving operation. The integrated functions include the leading-edge blanking of the current sensing, internal slope compensation. It would provide the users a superior AC/DC power application of higher efficiency, low external component counts, and lower cost solution for applications.

The SP6853 features more protections or functions for the following characteristics :

\*\*Add OLP (Over Load Protection) function to provide better protection performance for fault conditions like short circuit or over load.

\*\*Modify the OVP (Over Voltage Protection) mechanism from the cycle-by-cycle mode to the hiccup mode.

SP6853 is available by SOT-23-6L / DIP-8P packages.

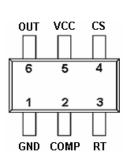
# APPLICATIONSAC/DC Switch

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

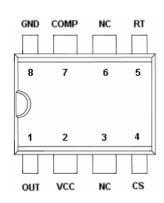
#### **FEATURES**

- High-Voltage BiCMOS Process
- Very Low Startup Current (<20μA)
- Under Voltage Lockout (UVLO)
- Current Mode Control
- Non-audible-noise Green Mode Control
- Current Limiting
- LEB (Leading-Edge Blanking) on CS Pin
- OLP (Over Load Protection)
- OVP (Over Voltage Protection) on Vcc Pin
- Leading-Edge Blanking
- Programmable Switching Frequency
- Internal Slope Compensation
- Green-Mode Control for Power Saving
- 300mA Driving Capability

# PIN CONFIGURATION SOT-23-6L

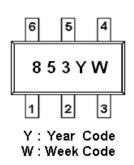


#### DIP-8P



# PART MARKING SOT-23-6L

DIP-8P



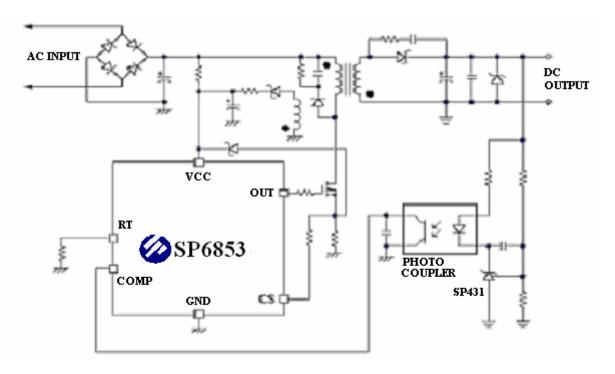
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SP6853I
AAAAAAA
BBBBBBBB

1 2 3 4
A: Lot Code

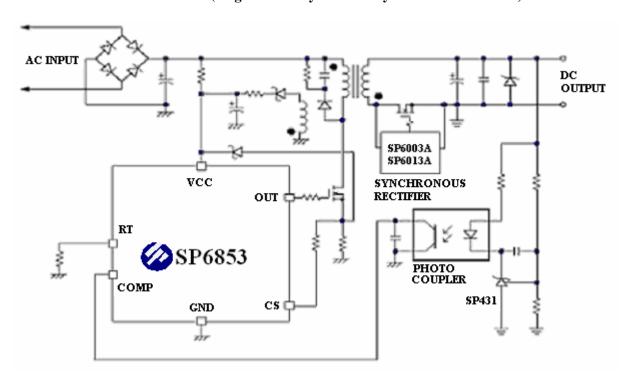
A:Lot Code B:Date Code



# TYPICAL APPLCATION CIRCUIT



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



# **PIN DESCRIPTION**

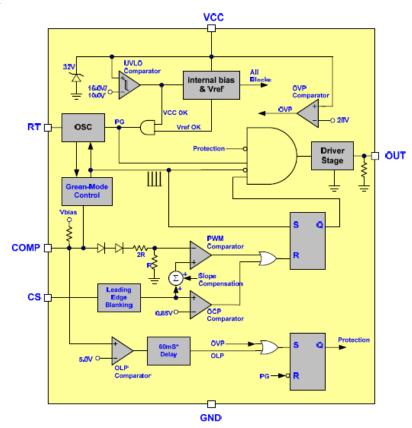
# **SP6853D8TG**

| 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  |  |  |  |
| 4   |        | 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   |  |  |  |

# **SP6853S26RG**

| Pin | Symbol | Description  |  |  |  |
|-----|--------|--|--|--|--|
| 1   | GND    | Ground   |  |  |  |
| 2   | COMP   | Voltage feedback. The pin provides the output voltage regulation signal., it provides feedback |  |  |  |
|     | COMP   | 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  |  |  |  |
| 4   |        | 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**





#### **ORDERING INFORMATION**

| Part Number  | Package   | Part Marking    |  |
|--------------|-----------|-----------------|--|
| SP6853D8TGB  | DIP-8P    | SP6853 <b>I</b> |  |
| SP6853S26RGB | SOT-23-6L | 853YW           |  |

※ SP6853D8TG : Tube; Pb − Free; Halogen-Free

※ SP6853S26RG : Tape Reel; Pb − Free; Halogen-Free

# **ABSOULTE MAXIMUM RATINGS** ( $T_A$ =25 $^{\circ}$ 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                        |           | <b>-</b> 0.3 ~ 7.0 | V              |
| $P_{\mathrm{D}}$ | Power Dissipation @ T <sub>A</sub> =85°C (*)  |           | 0.3                | W              |
| ESD              | Human Body Model                              |           | 4                  | KV             |
| ESD              | Machine Model                                 |           | 300                | V              |
| $T_{ope}$        | Operating Ambient Temperature                 |           | <b>-</b> 40 ∼ 85   | $^{\circ}$ C   |
| $T_{J}$          | Operating Junction Temperature Range          |           | <b>-4</b> 0 ~ 150  | $^{\circ}$ C   |
| $T_{STG}$        | Storage Temperature Range                     |           | <b>-</b> 40 ∼ 150  | $^{\circ}$ C   |
| $T_{LEAD}$       | Pb-Free Lead Soldering Temperature for 5 sec. |           | 260                | $^{\circ}\! C$ |
| $R_{\Theta JC}$  | Thermal Resistance Junction – Case (*)        | SOT-23-6L | 210                | °C/W           |
|                  | Thermal Resistance Junction – Case (*)        | DIP-8P    | 95                 | C/W            |

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



# **ELECTRICAL CHARACTERISTICS**

 $(T_A=25^{\circ}C, V_{CC}=15V, unless otherwise specified.)$ 

| Supply Voltage ( Vcc Pin )   Istt   Startup   Current   | Symbol             | Parameter                                  | Conditions       | Min. | Typ. | Max. | Unit      |  |
|---|--------------------|--|------------------|------|------|------|-----------|--|
| Iop   Operating Current   VCOMP = 0V   2.7   4   mA   VCOMP = 3V   2.4   mA   MA   VCOMP   |                    |  |                  |      |      |      |           |  |
| Top   | Istt               | Startup Current                            |                  |      | 10   | 20   | uA        |  |
| Vol. O (off)   Min. Operating Voltage   9.0   10.0   11.0   V   |                    |  | $V_{COMP} = 0V$  |      | 2.7  | 4    | mA        |  |
| VIVLO (off)   Min. Operating Voltage   9.0   10.0   11.0   V   VIVLO (on)   Start Threshold Voltage   15.0   16.0   17.0   V   VIVLO (on)   Start Threshold Voltage   15.0   16.0   17.0   V   VIVLO (on)   Start Threshold Voltage   15.0   16.0   17.0   V   VIVLO (on)   Start Threshold Voltage Protection   24   26   29.5   V   VIVLO (on)   Start Threshold Voltage Protection   24   26   29.5   V   VIVLO (on)   Start Threshold Voltage   VIVLO (on)   Start Threshold Voltage   VIVLO (on)   Start Threshold Voltage   Short Circuit Current   1.25   2.2   mA   Vop   Open Loop Voltage   6   V   VIVLO (on)   V   V   VIVLO (on)   V   V   V   V   V   V   V   V   V   | Ion                | Operating Current                          | $V_{COMP} = 3V$  |      | 2.4  |      | mA        |  |
| UVLO (on )   Start Threshold Voltage   15.0   16.0   17.0   V   | ТОР                | operating current                          |                  |      | 1.0  |      | mA        |  |
| OVP Level         Over Voltage Protection         24         26         29.5         V           Voltage Feedback ( Comp Pin )         Isc         Short Circuit Current         1.25         2.2         mA           Vop         Open Loop Voltage         6         V           VTH(GM)         Green Mode Threshold VCOMP         2.35         V           Oscillator ( RT Pin )         Frequency RT Fin )           Fosc         Frequency         RT=100KΩ         60.0         68.0         75.0         KHz           Fosc(GM)         Green Mode Frequency         Fs=65.0KHz         22         KHz           Fdt         Frequency Variation versus Temp. Deviation (-40°C ~105°C)         3         %           Fdv         Frequency Variation versus Vcc Deviation (Vcc=11V-25V)         1         %           Current Sensing ( CS Pin )         Vcs(off)         Maximum Input Voltage         0.8         0.85         0.9         V           TLEDD         Leading Edge Blanking Time         280         nS           Zcs         Input impedance         1         MΩ         Ω           TPD         Delay to Output         0         nS           Gate Driver Output ( OUT Pin )         0         70         7  | UVLO (off)         | Min. Operating Voltage                     |                  | 9.0  | 10.0 | 11.0 | V         |  |
| Voltage Feedback ( Comp Pin )   Isc   Short Circuit Current   Short Circuit Current Sensor   Stephen   Short Circuit Current Sensor   Stephen   Short Circuit Current Sensor   Short Circuit Current Sensor   Short Curr | UVLO (on )         | Start Threshold Voltage                    |                  | 15.0 | 16.0 | 17.0 | V         |  |
| Sc   Short Circuit Current   1.25   2.2   mA  | OVP Level          | Over Voltage Protection                    |                  | 24   | 26   | 29.5 | V         |  |
| Vop   | Voltage Feed       | lback ( Comp Pin )                         |                  |      |      |      |           |  |
| VTH(GM)   Green Mode Threshold VCOMP   2.35   V   | Isc                | Short Circuit Current                      |                  |      | 1.25 | 2.2  | mA        |  |
| Socillator (RT Pin   Fosc   Frequency   | Vop                | Open Loop Voltage                          |                  |      | 6    |      | V         |  |
| Fosc Frequency         RT=100KΩ         60.0         68.0         75.0         KHz           Fosc(GM)         Green Mode Frequency         Fs=65.0KHz         22         KHz           Fdt         Frequency Variation versus Temp. Deviation $(-40^{\circ}\text{C} \sim 105^{\circ}\text{C})$ 3         %           Fdv         Frequency Variation versus Vcc Deviation $(\text{Vcc}=11\text{V}-25\text{V})$ 1         %           Current Sensing ( CS Pin )         Vcs(off)         Maximum Input Voltage         0.8         0.85         0.9         V           TLEDD         Leading Edge Blanking Time         280         nS         Zes         nS         Zes         Input impedance         1         MΩ         MΩ         TPD         Delay to Output         100         nS         Sete Diver Output ( OUT Pin )         NS         Gate Driver Output ( OUT Pin )         VCCCID (Max)         Maximum Duty Cycle         70         75         80         %         DC (Min)         Minimum Duty Cycle         0         %         VCCCID (Min)  | VTH(GM)            | Green Mode Threshold VCOMP                 |                  |      | 2.35 |      | V         |  |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | Oscillator (       | RT Pin )                                   |                  |      |      |      |           |  |
| Fdt         Frequency Variation versus Temp. Deviation         (-40°C ~105°C)         3         %           Fdv         Frequency Variation versus Vcc Deviation         (Vcc=11V-25V)         1         %           Current Sensing ( CS Pin )           Ves(off)         Maximum Input Voltage         0.8         0.85         0.9         V           TLEDD         Leading Edge Blanking Time         280         nS           Zcs         Input impedance         1         MΩ         MΩ           TPD         Delay to Output         100         nS           Gate Driver Output (OUT Pin)           DC (Max)         Maximum Duty Cycle         70         75         80         %           DC (Min)         Minimum Duty Cycle         0         %           Vol         Output Low Level         Vcc=15V, lo=20mA         1         V           VOH         Output High Level         Vcc=15V, lo=20mA         8         V           Tr         Rising Time         Load Cap=1000pF         50         200         nS           Tf         Falling Time         Load Cap=1000pF         30         120         nS           OLP (Over Load Protection)         5.0         V </td <td>Fosc</td> <td>Frequency</td> <td><math>R_T=100K\Omega</math></td> <td>60.0</td> <td>68.0</td> <td>75.0</td> <td>KHz</td>   | Fosc               | Frequency                                  | $R_T=100K\Omega$ | 60.0 | 68.0 | 75.0 | KHz       |  |
| Fdv   Frequency Variation versus Vcc Deviation   (Vcc=11V-25V)   1  | Fosc(gm)           | Green Mode Frequency                       | Fs=65.0KHz       |      | 22   |      | KHz       |  |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | Fdt                | Frequency Variation versus Temp. Deviation | (-40°C ~105°C)   |      |      | 3    | %         |  |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | Fdv                | Frequency Variation versus VCC Deviation   | (Vcc=11V-25V)    |      |      | 1    | %         |  |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | <b>Current Sen</b> | sing ( CS Pin )                            |                  |      |      |      |           |  |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | Vcs(off)           | Maximum Input Voltage                      |                  | 0.8  | 0.85 | 0.9  | V         |  |
| TPD   | TLEDD              | Leading Edge Blanking Time                 |                  |      | 280  |      | nS        |  |
| Gate Driver Output ( OUT Pin )           DC (Max)         Maximum Duty Cycle         70         75         80         %           DC (Min)         Minimum Duty Cycle         0         %           VOL         Output Low Level         Vcc=15V, Io=20mA         1         V           VOH         Output High Level         Vcc=15V, Io=20mA         8         V           Tr         Rising Time         Load Cap=1000pF         50         200         nS           Tf         Falling Time         Load Cap=1000pF         30         120         nS           OLP ( Over Load Protection )         TLOLP         DLP Trip Level         5.0         V   | Zcs                | Input impedance                            |                  | 1    |      |      | $M\Omega$ |  |
| DC (Max)         Maximum Duty Cycle         70         75         80         %           DC (Min)         Minimum Duty Cycle         0         %           Vol         Output Low Level         Vcc=15V, Io=20mA         1         V           Voh         Output High Level         Vcc=15V, Io=20mA         8         V           Tr         Rising Time         Load Cap=1000pF         50         200         nS           Tf         Falling Time         Load Cap=1000pF         30         120         nS           OLP (Over Load Protection )         TLOLP         5.0         V  | TPD                | Delay to Output                            |                  |      | 100  |      | nS        |  |
| DC (Min)   Minimum Duty Cycle   0   | <b>Gate Driver</b> | Output ( OUT Pin )                         | 1                |      | •    | •    |           |  |
| VOL         Output Low Level         Vcc=15V, Io=20mA         1         V           VOH         Output High Level         Vcc=15V, Io=20mA         8         V           Tr         Rising Time         Load Cap=1000pF         50         200         nS           Tf         Falling Time         Load Cap=1000pF         30         120         nS           OLP (Over Load Protection )         TLOLP         DLP Trip Level         5.0         V  | DC (Max)           | Maximum Duty Cycle                         |                  | 70   | 75   | 80   | %         |  |
| VOL         Output Low Level         Io=20mA         I         V           VOH         Output High Level         Vcc=15V, Io=20mA         8         V           Tr         Rising Time         Load Cap=1000pF         50         200         nS           Tf         Falling Time         Load Cap=1000pF         30         120         nS           OLP ( Over Load Protection )         TLOLP         OLP Trip Level         5.0         V  | DC (Min)           | Minimum Duty Cycle                         |                  |      | 0    |      | %         |  |
| Voh         Output High Level         Io=20mA         8         V           Tr         Rising Time         Load Cap=1000pF         50         200         nS           Tf         Falling Time         Load Cap=1000pF         30         120         nS           OLP ( Over Load Protection )         TLOLP         OLP Trip Level         5.0         V  | Vol                | Output Low Level                           |                  |      |      | 1    | V         |  |
| Tf         Falling Time         Load Cap=1000pF         30         120         nS           OLP ( Over Load Protection )         TLOLP         OLP Trip Level         5.0         V   | Voh                | Output High Level                          |                  | 8    |      |      | V         |  |
| OLP ( Over Load Protection )         5.0         V  | Tr                 | Rising Time                                | Load Cap=1000pF  |      | 50   | 200  | nS        |  |
| OLP ( Over Load Protection )         5.0         V  | Tf                 | Falling Time                               | Load Cap=1000pF  |      | 30   | 120  | nS        |  |
| TLOLP OLP Trip Level 5.0 V  |                    |  |                  |      |      |      |           |  |
| TDOLP OLP Delay Time (note) 60 mS   |                    |  |                  |      | 5.0  |      | V         |  |
|   | TDOLP              |  |                  |      | 60   |      | mS        |  |

Note: The OLP delay time is proportional to the period of switching cycle. So that, the lower RT value will set the higher switching frequency and the shorter OLP delay time.

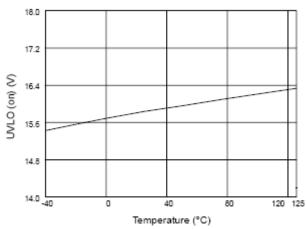


Fig. 1 UVLO (on) vs. Temperature

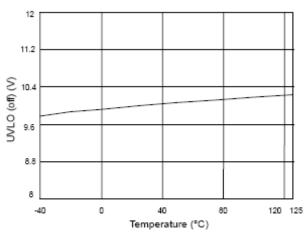


Fig. 2 UVLO (off ) vs. Temperature

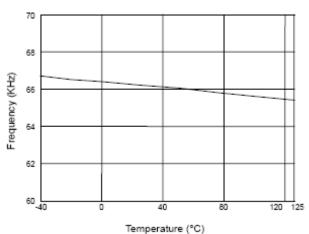


Fig. 3 Frequency vs. Temperature

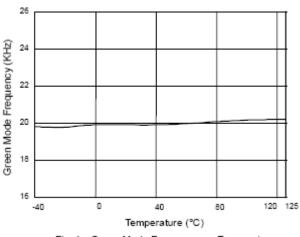


Fig. 4 Green Mode Frequency vs. Temperature

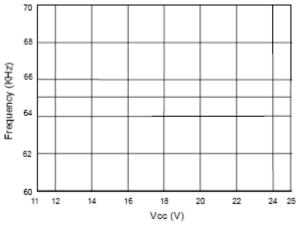


Fig. 5 Frequency vs. Vcc

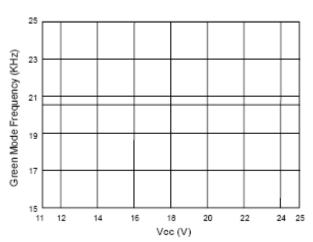


Fig. 6 Green Mode Frequency vs. Vcc

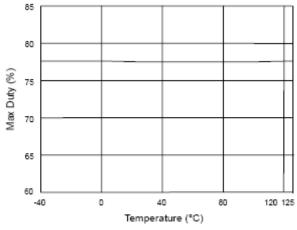


Fig. 7 Max Duty vs. Temperature

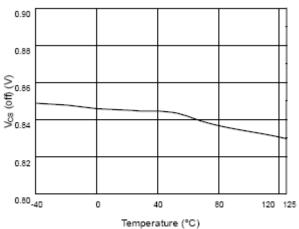


Fig. 8 V<sub>CS</sub> (off) vs. Temperature

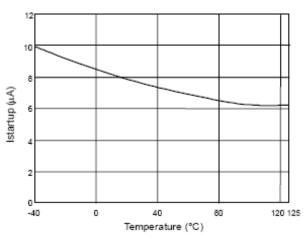


Fig. 9 Startup Current (Istartup) vs. Temperature

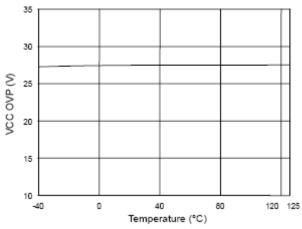


Fig. 10 VCC OVP vs. Temperature

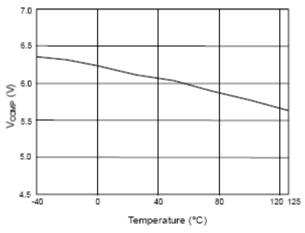


Fig. 11 V<sub>COMP</sub> open loop voltage vs. Temperature

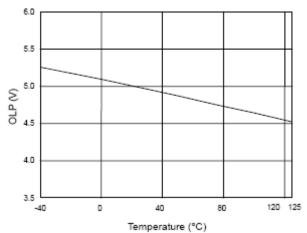
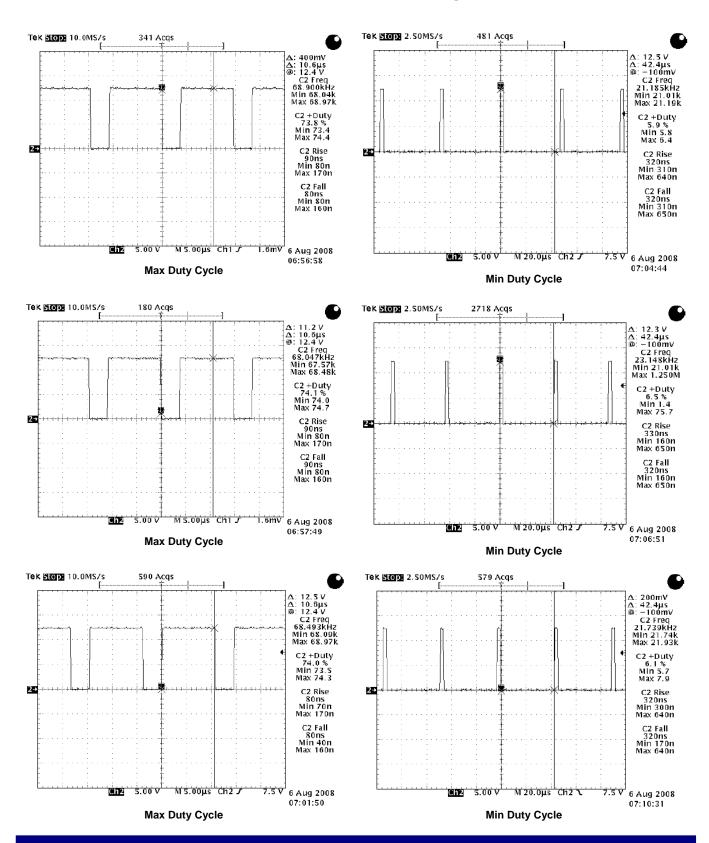
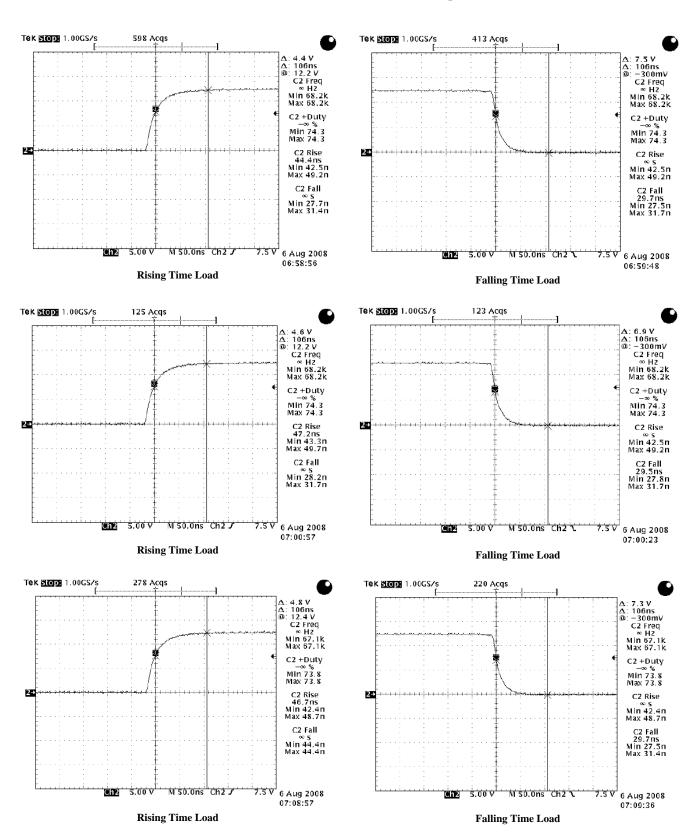


Fig. 12 OLP-Trip Level vs. Temperature

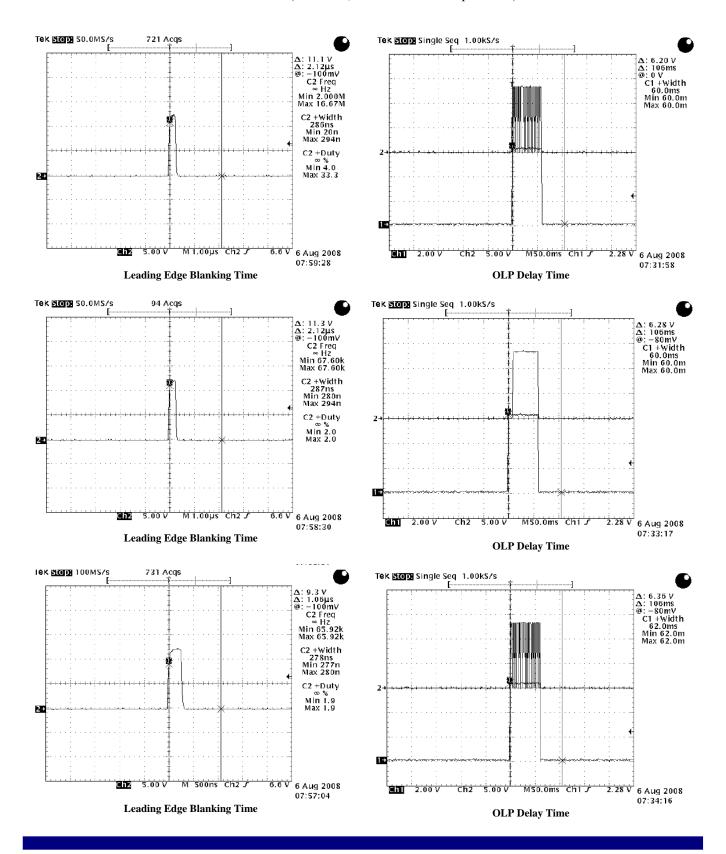






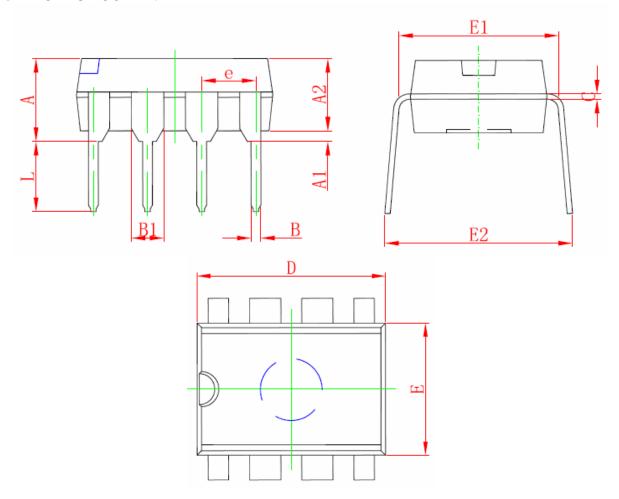








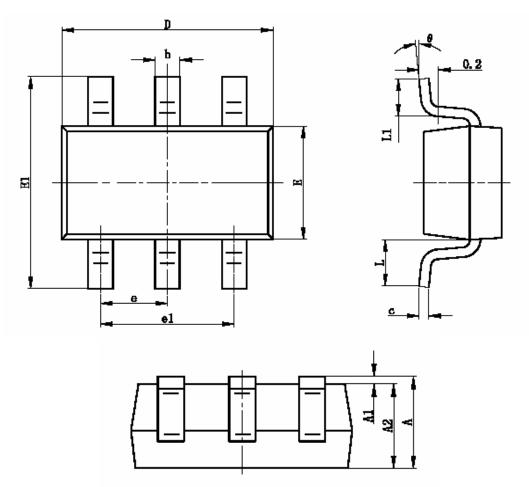
# **DIP- 8P PACKAGE OUTLINE**



|        | Dimensions In Millimeters |              | Dimensions In Inches |        |
|--------|---------------------------|--------------|----------------------|--------|
| Symbol | Min                       | Max          | Min                  | Max    |
| Α      | 3. 710                    | 4. 310       | 0. 146               | 0. 170 |
| A1     | 0. 510                    |              | 0. 020               |        |
| A2     | 3. 200                    | 3. 600       | 0. 126               | 0. 142 |
| В      | 0. 380                    | 0. 570       | 0. 015               | 0. 022 |
| B1     | 1. 524                    | 1. 524 (BSC) |                      | (BSC)  |
| С      | 0. 204                    | 0. 360       | 0.008                | 0. 014 |
| D      | 9. 000                    | 9. 400       | 0. 354               | 0. 370 |
| Е      | 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 |



# SOT-23-6L PACKAGE OUTLINE



| Symbol | Dimensions In Millimeters |          | Dimensions In Inches |       |  |
|--------|---------------------------|----------|----------------------|-------|--|
| Symbol | Min                       | Max      | Min                  | Max   |  |
| А      | 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 |  |
| С      | 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 |  |
| е      | 0.950TYP                  |          | 0.037TYP             |       |  |
| e1     | 1.800                     | 2.000    | 0.071                | 0.079 |  |
| L      | 0.700                     | 0.700REF |                      | BREF  |  |
| 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