

PC Power Supply Supervisors

SG6516

FEATURES

- Two 12V sense input pins: VS12 and VS12B
- Over-Voltage Protection (OVP) for 3.3V, 5V, and two 12V
- Over-Current Protection (OCP) for 3.3V, 5V, and two 12V
- Under-Voltage Protection (UVP) for 3.3V, 5V, and two 12V
- Open-drain output for PGO and FPO pins
- 300ms power-good delay
- 300ms turn-on delay for 3.3V, 5V, and two 12V
- 2.8ms PSON control to FPO turn-off delay
- 48ms PSON control delay
- No lockup during the fast AC power on/off
- Wide supply voltage range from 4V to 15V

DESCRIPTION

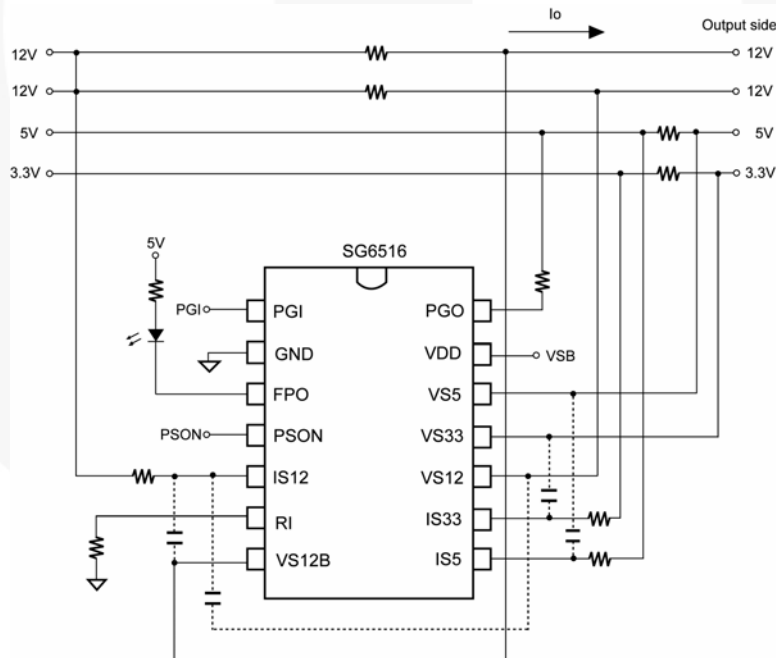
SG6516 is designed to provide the voltage and current supervisor function, remote on/off (PSON) function,

power-good (PGO) indicator function, and fault protection (FPO) function for switching power systems.

For supervisor, it provides over-voltage protection (OVP) for 3.3V, 5V, and two 12V; over-current protection (OCP) for 3.3V, 5V, and two 12V; under-voltage protection (UVP) for 3.3V, 5V, and two 12V. When 3.3V, 5V, or 12V voltage decreases to 2.3V, 3.5V, and 9V respectively, the under-voltage protection (UVP) function is enabled. FPO is set to high to turn off the PWM controller IC. The voltage difference across external current shunt is used for OCP functions. An external resistor can be used to adjust protection threshold.

The power supply is turned on after a 48ms delay time when PSON signal is set from high to low. To turn off the power supply, the PSON signal is set from low to high with the delay time 48ms. The PGI circuitry provides a power-down warning signal for PGO. When PGI input is lower than the internal 1.25V reference voltage, the PGO signal is pulled low.

TYPICAL APPLICATION

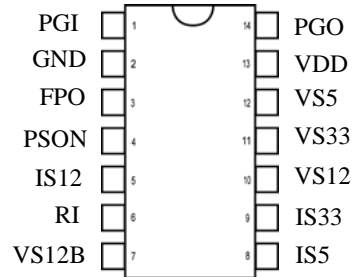


MARKING INFORMATION



T: D = DIP, S = SOP  
 P: Z = Lead Free  
 Null=regular package  
 XXXXXXXX: Wafer Lot  
 Y: Year; WW: Week  
 V: Assembly Location

PIN CONFIGURATION



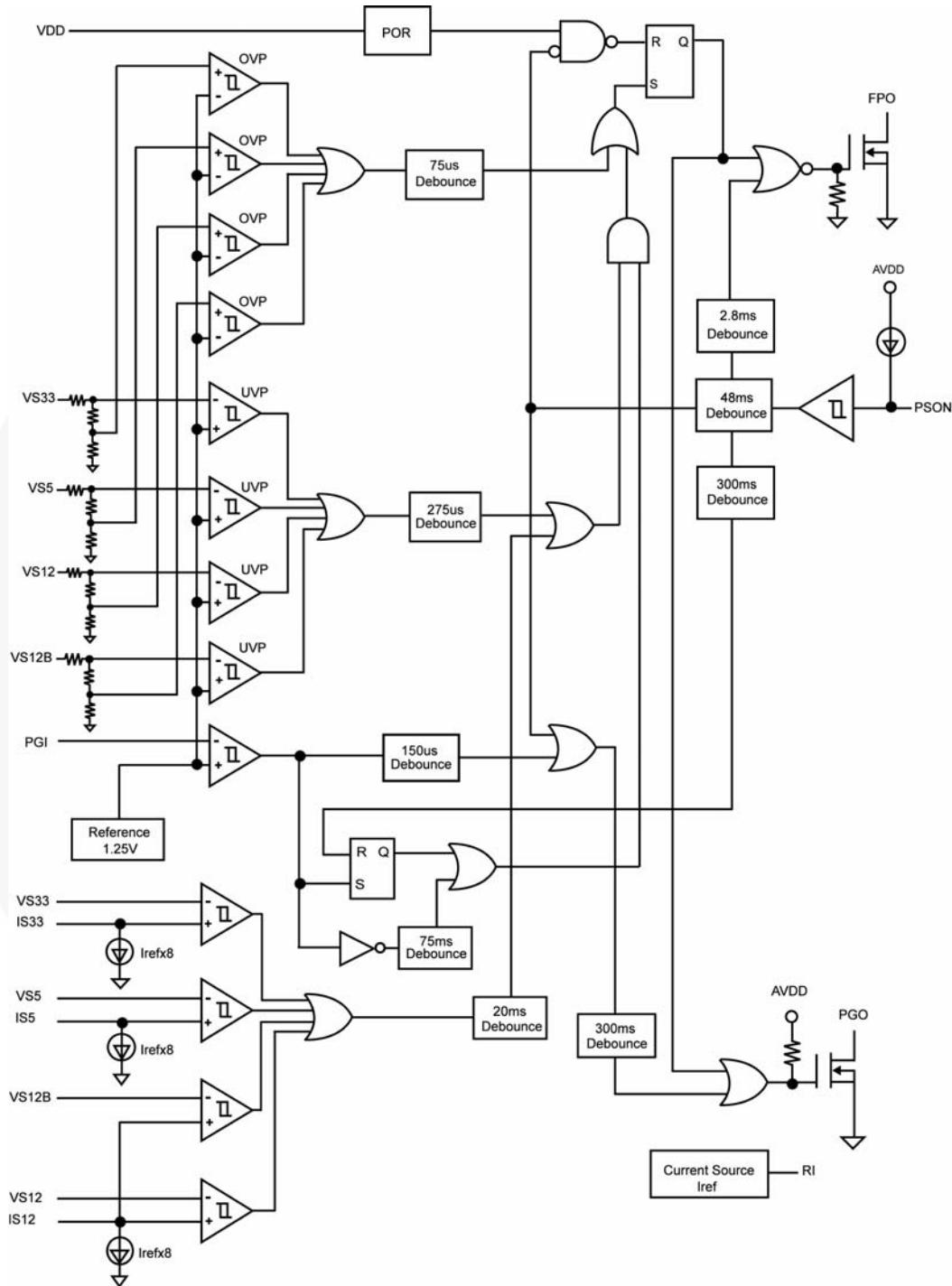
ORDERING INFORMATION

| Part Number | Pb-Free | Package Type       |
|-------------|---------|--------------------|
| SG6516DZ    |         | 14 pin DIP Plastic |
| SG6516SZ    |         | 14 pin SOP Plastic |

PIN DESCRIPTIONS

| Pin No. | Pin Name | Type         | Description   |
|---------|----------|--------------|---|
| 1       | PGI      | Analog input | Power-good input. For ATX SMPS, it detects AC line voltage through the main transformer.  |
| 2       | GND      | Supply       | Ground.   |
| 3       | FPO      | Logic output | Fault protection output. Output signal to control the primary PWM IC through an opto-coupler. When FPO is low, the PWM IC is enabled.   |
| 4       | PSON     | Logic input  | Remote on/off logic input from CPU or main board. The power supply is turned on/off after a 48ms delay.   |
| 5       | IS12     | Analog input | 12V over-current protection sense input. For typical application, this pin is connected to the positive end of a current shunt through one resistor. When the voltage on IS12 is higher than that of VS12 by 5mV, OCP is enabled. |
| 6       | RI       | Analog input | Reference setting. One external resistor, $R_i$ , connected between the RI and GND pins determines a reference current, $I_{REF} = 1.25/R_i$ , for OCP programming.   |
| 7       | VS12B    | Analog input | Second 12V over/under-voltage control sense input.  |
| 8       | IS5      | Analog input | 5V over-current protection sense input.   |
| 9       | IS33     | Analog input | 3.3V over-current protection sense input.   |
| 10      | VS12     | Analog input | 12V over/under-voltage control sense input.   |
| 11      | VS33     | Analog input | 3.3V over/under-voltage control sense input.  |
| 12      | VS5      | Analog input | 5V over/under-voltage control sense input.  |
| 13      | VDD      | Supply       | Supply voltage. 4V ~ 15V. For ATX SMPS, it is connected to 5V-standby and 12V through diodes respectively.  |
| 14      | PGO      | Logic output | Power-good logic output, 0 or 1(open-drain). Power good=1, the power supply is good for operation. The power-good delay is 300ms.   |

BLOCK DIAGRAM



**FUNCTION TABLE**

| PGI       | PSON | UVP 12V & OCP | OVP | FPO | PGO |
|-----------|------|---------------|-----|-----|-----|
| PGI<1.25V | L    | No            | No  | L   | L   |
| PGI<1.25V | L    | No            | Yes | H   | L   |
| PGI<1.25V | L    | Yes           | No  | L   | L   |
| PGI<1.25V | L    | Yes           | Yes | H   | L   |
| PGI>1.25V | L    | No            | No  | L   | H   |
| PGI>1.25V | L    | No            | Yes | H   | L   |
| PGI>1.25V | L    | Yes           | No  | H   | L   |
| PGI>1.25V | L    | Yes           | Yes | H   | L   |
| X         | H    | X             | X   | H   | L   |

x = Don't care

FPO = L: Fault IS NOT latched

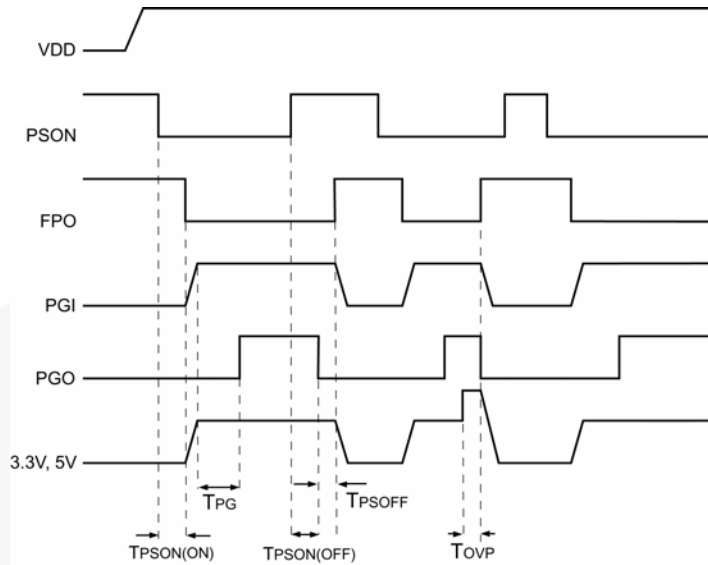
FPO = H: Fault IS latched

PGO = L: Fault

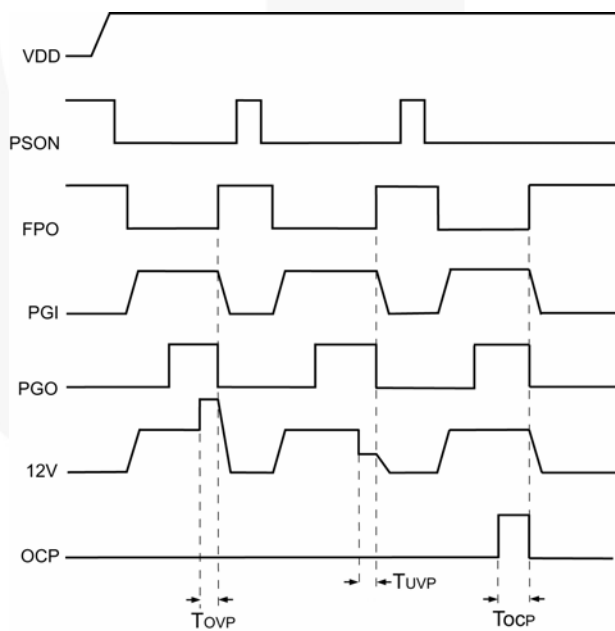
PGO = H: No fault

**TIMING DIAGRAM**

**PSON On/Off and 3.3V, 5V OVP Function**



**12V OVP/UVP and OCP Function**



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**ABSOLUTE MAXIMUM RATINGS**

| Symbol           | Parameter  | Value                           | Unit         |
|------------------|--|---------------------------------|--------------|
| V <sub>DD</sub>  | DC Supply Voltage                                    | 16                              | V            |
| V <sub>IN</sub>  | Input Voltage  | PSON, VS33, VS5, PGI, IS33, IS5 | -0.3 to 7.0  |
|                  |  | VS12, VS12B, IS12               | -0.3 to 15.0 |
| V <sub>OUT</sub> | Output Voltage                                       | 8                               | V            |
| P <sub>D</sub>   | Power Dissipation                                    | 400                             | mW           |
| T <sub>J</sub>   | Operating Free Junction Temperature Range            | -40 to +125                     | °C           |
| T <sub>STG</sub> | Storage Temperature Range                            | -55 to +150                     | °C           |
| T <sub>L</sub>   | Lead Temperature (Wave Soldering, 10 Seconds)        | 260                             | °C           |
| ESD              | Electrostatic Discharge Capability, Human Body Model | 4.5                             | KV           |
|                  | Electrostatic Discharge Capability, Machine Model    | 200                             | V            |

\* All voltage values, except differential voltages, are given with respect to GND pin.

\*Stresses above those listed may cause permanent damage to the device.

**RECOMMENDED OPERATING CONDITIONS**

| Symbol            | Parameter                           | Test Conditions | Value      | Unit |
|-------------------|-------------------------------------|-----------------|------------|------|
| V <sub>DD</sub>   | DC Supply Voltage                   |                 | 4 to 15    | V    |
| T <sub>OPER</sub> | Operating Ambient Temperature Range |                 | -25 to +85 | °C   |

**ELECTRICAL CHARACTERISTICS**

V<sub>DD</sub>=12V, T<sub>A</sub>=25°C, unless otherwise noted.

**V<sub>DD</sub> Section**

| Symbol           | Parameter                               | Test Conditions | Min. | Typ. | Max. | Unit |
|------------------|---|-----------------|------|------|------|------|
| I <sub>DD1</sub> | Supply Current                          | PSON = Low      |      | 1.7  | 2.6  | mA   |
| I <sub>DD2</sub> | Supply Current                          | PSON = High     |      | 1.0  | 1.5  | mA   |
| T <sub>R</sub>   | Supply Voltage Rising Time              |                 | 1    |      |      | ms   |
| V <sub>ST</sub>  | V <sub>DD</sub> Start Threshold Voltage |                 |      |      | 4.0  | V    |

**Over-Voltage and Over-Current Protection**

| Symbol              | Parameter  | Test Conditions                      | Min.  | Typ.  | Max.  | Unit |
|---------------------|--|--------------------------------------|-------|-------|-------|------|
| V <sub>OVP</sub>    | Over-Voltage Protection VS33   |                                      | 3.7   | 3.9   | 4.1   | V    |
|                     | Over-Voltage Protection VS5  |                                      | 5.7   | 6.1   | 6.5   |      |
|                     | Over-Voltage Protection VS12, VS12B  |                                      | 13.2  | 13.8  | 14.4  |      |
| I <sub>REF</sub>    | Ratio of Current Sense Sink Current to Current Sense Setting Pin (RI) Source Current | R <sub>i</sub> = 30KΩ, 0.1% Resistor | 7.6   | 8.0   | 8.4   |      |
| V <sub>OFFSET</sub> | OCP Comparator Input Offset Voltage  |                                      | -5    |       | 5     | mV   |
| I <sub>LKG</sub>    | Leakage Current (FPO)  | V(FPO) = 5V                          |       |       | 5     | μA   |
| V <sub>OLFPO</sub>  | Low-Level Output Voltage (FPO)   | I <sub>SINK</sub> 20mA               |       |       | 0.4   | V    |
| T <sub>OVP</sub>    | OVP Delay Time   |                                      | 33    | 75    | 110   | μs   |
| T <sub>OCP</sub>    | OCP Delay Time   |                                      |       | 20    |       | ms   |
| V <sub>RI</sub>     | RI Pin Voltage   |                                      | 1.237 | 1.250 | 1.262 | V    |
| I <sub>RI</sub>     | Output Current RI  |                                      | 12.5  |       | 62.5  | μA   |
| I <sub>LKG12</sub>  | Leakage Current VS12,VS12B   |                                      |       | 93    |       | μA   |
| T <sub>ST-OCP</sub> | Start-up OCP / UVP Protection Time   | PGI < 1.25V, FPO=Low                 | 200   | 300   | 450   | ms   |

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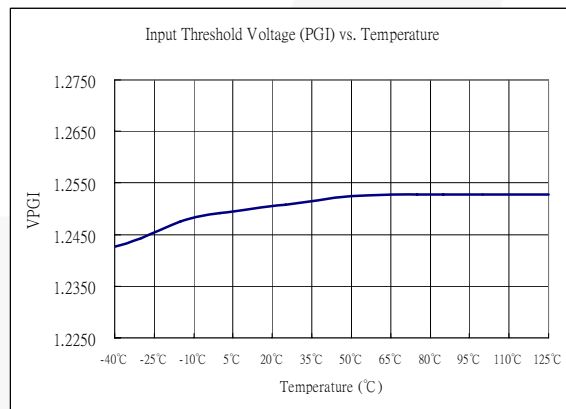
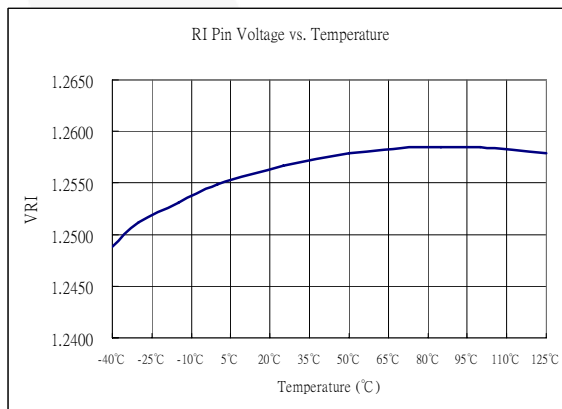
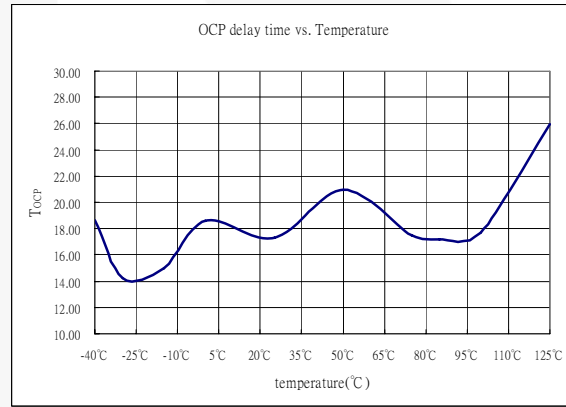
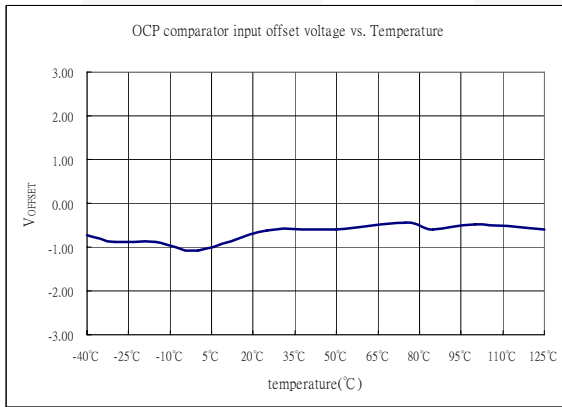
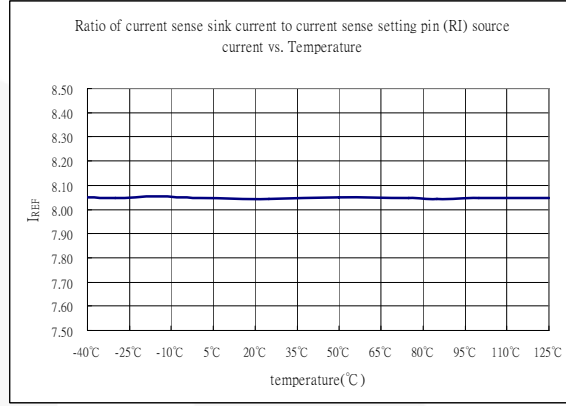
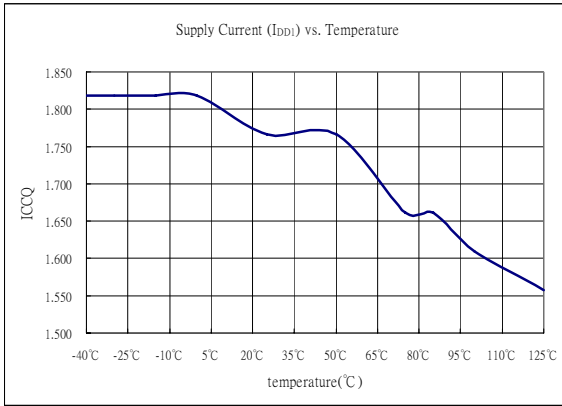
Under-Voltage Protection and PGI, PGO

| Symbol               | Parameter                            | Test Conditions                               | Min.  | Typ.  | Max.  | Unit |
|----------------------|--------------------------------------|---|-------|-------|-------|------|
| V <sub>PGI</sub>     | Input Threshold Voltage PGI          |   | 1.225 | 1.250 | 1.275 | V    |
| V <sub>UVP</sub>     | Under-Voltage Protection VS33        |   | 2.1   | 2.3   | 2.5   | V    |
|                      | Under-Voltage Protection VS5         |   | 3.3   | 3.5   | 3.7   |      |
|                      | Under-Voltage Protection VS12, VS12B |   | 8.5   | 9.0   | 9.5   |      |
| T <sub>OND</sub>     | Under-Voltage Turn-on Delay Time     |   | 49    | 75    | 114   | ms   |
| T <sub>UVP</sub>     | UVP Delay Time                       | PGI > 1.25V                                   | 175   | 275   | 375   | μs   |
| I <sub>LKG-PGO</sub> | Leakage Current (PGO)                | PGO = 5V                                      |       |       | 5     | μA   |
| V <sub>OL-PGO</sub>  | Low-Level Output Voltage (PGO)       | V <sub>DD</sub> = 12V, I <sub>SINK</sub> 10mA |       |       | 0.4   | V    |
| T <sub>PG</sub>      | Timing PG Delay                      | PGI to PGO                                    | 200   | 300   | 450   | ms   |
| T <sub>ND1</sub>     | Noise Deglitch Time                  | PGI to PGO                                    | 90    | 150   | 210   | μs   |

PSON Control

| Symbol             | Parameter                  | Test Conditions          | Min. | Typ. | Max. | Unit |
|--------------------|----------------------------|--------------------------|------|------|------|------|
| I <sub>PSON</sub>  | Input Pull-up Current      | PSON = 0V                |      | 120  |      | μA   |
| V <sub>IH</sub>    | High-Level Input Voltage   |                          | 2    |      |      | V    |
| V <sub>IL</sub>    | Low-Level Input Voltage    |                          |      |      | 0.8  | V    |
| T <sub>PSON</sub>  | Timing PSON to On/Off      | On (PSON Low to FPO Low) | 34   | 48   | 67   | ms   |
|                    |                            | Off (PSON High PGO Low)  | 34   | 48   | 67   |      |
| T <sub>PSOFF</sub> | Timing PGO Low to FPO high |                          | 1.6  | 2.8  | 4.5  | ms   |

TYPICAL CHARACTERISTICS





**APPLICATION NOTE**

**Over-Current Protection (OCP)**

The SG6516 provides over-current protection for the 3.3V, 5V, and two 12V rails. Whenever an OCP condition occurs at any of the voltage rails, PGO is low and FPO is open. The internal OCP comparators have a

very small offset voltage ( $\pm 5mV$ ). The sink currents of IS33, IS5, and IS12 are eight times the current at the RI pin. Below is an example demonstrating how to set OCP.

If:

$$I_1 \cdot R_1 > (I_{RI} \cdot 8) \cdot R_2, \text{ then} \tag{1}$$

OCP active.

To select an R2 resistor:

If

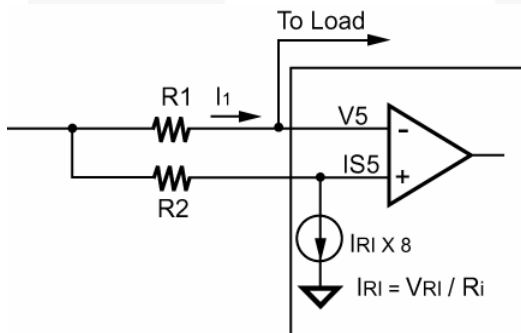
$$R_1 = 5m\Omega, R_i = 30K, \text{ and} \tag{2}$$

$$\text{OCP protection level is } 35A, \text{ then} \tag{3}$$

$$R_2 = (I_1 \cdot R_1) / (I_{RI} \cdot 8) \tag{4}$$

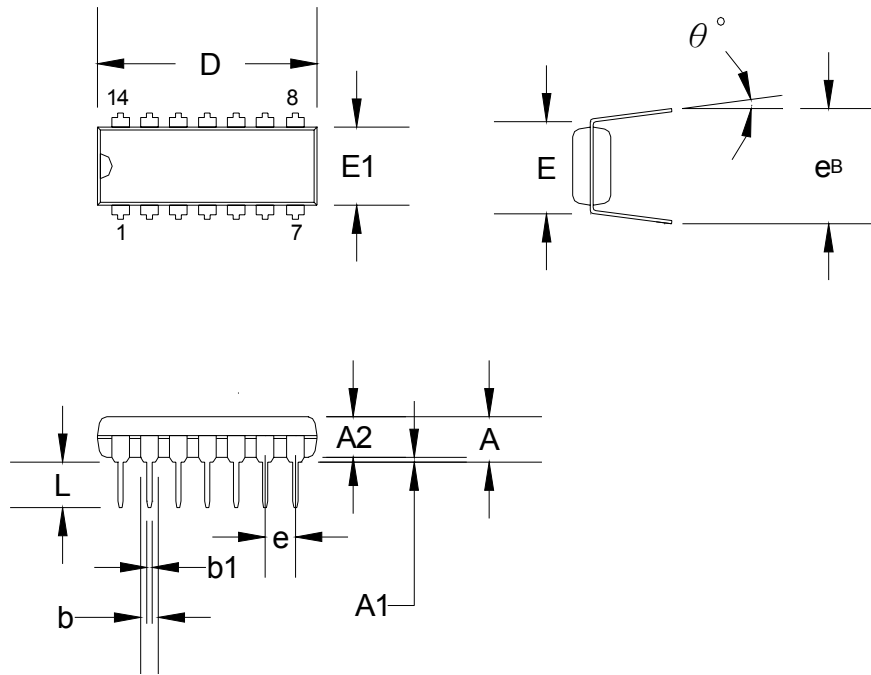
$$= (35A \cdot 5m\Omega) / \{(1.25V/30K) \cdot 8\} \tag{5}$$

$$= 525\Omega$$



PACKAGE INFORMATION

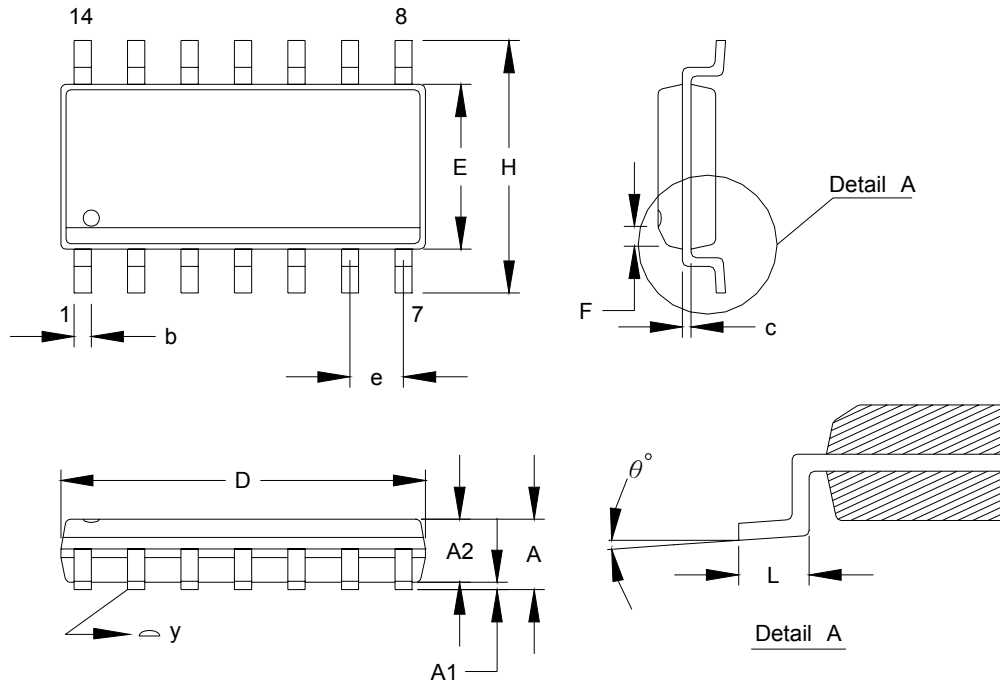
14 PINS – DIP (D)



Dimension:

| Symbol         | Millimeter |        |        | Inch  |       |       |
|----------------|------------|--------|--------|-------|-------|-------|
|                | Min.       | Typ.   | Max.   | Min.  | Typ.  | Max.  |
| A              |            |        | 5.334  |       |       | 0.210 |
| A1             | 0.381      |        |        | 0.015 |       |       |
| A2             | 3.175      | 3.302  | 3.429  | 0.125 | 0.130 | 0.135 |
| b              |            | 1.524  |        |       | 0.060 |       |
| b1             |            | 0.457  |        |       | 0.018 |       |
| D              | 18.669     | 19.050 | 19.685 | 0.735 | 0.750 | 0.775 |
| E              |            | 7.620  |        |       | 0.300 |       |
| E1             | 6.223      | 6.350  | 6.477  | 0.245 | 0.250 | 0.255 |
| e              |            | 2.540  |        |       | 0.100 |       |
| L              | 2.921      | 3.302  | 3.810  | 0.115 | 0.130 | 0.150 |
| e <sub>B</sub> | 8.509      | 9.017  | 9.525  | 0.335 | 0.355 | 0.375 |
| θ°             | 0°         | 7°     | 15°    | 0°    | 7°    | 15°   |

14 PINS – SOP (S)




Dimension:

| Symbol         | Millimeter |           |       | Inch   |           |        |
|----------------|------------|-----------|-------|--------|-----------|--------|
|                | Min.       | Typ.      | Max.  | Min.   | Typ.      | Max.   |
| A              | 1.473      | 1.626     | 1.727 | 0.058  | 0.064     | 0.068  |
| A1             | 0.101      |           | 0.254 | 0.004  |           | 0.010  |
| A2             | 1.371      |           | 1.473 | 0.054  |           | 0.058  |
| b              | 0.330      | 0.406     | 0.508 | 0.013  | 0.016     | 0.020  |
| c              | 0.190      | 0.203     | 0.249 | 0.0075 | 0.008     | 0.0098 |
| D              | 8.534      | 8.661     | 8.484 | 0.336  | 0.341     | 0.344  |
| E              | 3.810      | 3.912     | 3.988 | 0.150  | 0.154     | 0.157  |
| e              |            | 1.270     |       |        | 0.050     |        |
| H              | 5.791      | 5.994     | 5.690 | 0.228  | 0.236     | 0.244  |
| L              | 0.381      | 0.635     | 1.270 | 0.015  | 0.025     | 0.050  |
| F              |            | 0.381X45° |       |        | 0.015X45° |        |
| y              |            |           | 0.101 |        |           | 0.004  |
| $\theta^\circ$ | 0°         |           | 8°    | 0°     |           | 8°     |



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| FPS <sup>™</sup>                     |  | SuperSOT <sup>™</sup> -3               | VCX <sup>™</sup>                 |
| FRFET <sup>®</sup>                   | PDP-SPM <sup>™</sup>  | SuperSOT <sup>™</sup> -6               |                                  |
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|--------------------------|------------------------|--|
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