6-Channel Secondary Monitoring IC
PS232S

6-Channel Secondary Monitoring IC

General Description

PS232S is specially designed for switching power supply system. Four important functions of PS232S are the followings: over-voltage protection, over-current protection, under-voltage protection and power good signal generating.

OVP/UVP (Over-Voltage/Under-Voltage Protection) monitors 3.3V, 5V and quartic 12V to protect our power supply and PC, FPO/ goes to high when one of these supply voltages exceeds their normal operation voltage range.

OCP (Over Current Protection) monitors IS33, IS5, IS12A, IS12B, IS12C, IS12D input current sense. An adjustable over-current condition composed of Iref and “protection current range resistor” helps users design OCP easily.

An additional protection input pin provides the flexibility for design protection circuit.

Power good signal generating notifies personal computer when power supply is ready or power supply is going to shutdown, therefore it can provide a reliable power supply environment.

Features

- Over/Under-voltage protection and lock out
- Over-current protection and lock out
- Additional protection input
- Fault protection output with open drain output stage
- Open drain power good output signal for power good input
- Built-in 300mS power good delay
- AC on 75ms delay for UV/OC protection
- 38mS PSON/ control de-bounce
- Wide power supply range (3.8V~16V)
- Special care for AC power off
Timing Chart

Vcc

PSON/

FPO/

PGI

VS12A IS12A
VS12B IS12B
VS12C IS12C
VS12D IS12D
VSS IS5
VS33 IS33
Pext

PGO

AC turn on

UVP/OVP/OCP turn on

PSON/ turn on

PSON/ turn off

PSON/ turn on

AC turn off

Pext protect

1.25V

0.63V

1.13V

VPGI

OVP

OVP/UVP/OCP

OVP

T_3

T_4

T_5

T_6

T_7

T_8
## Pin Descriptions

<table>
<thead>
<tr>
<th>Pin No</th>
<th>PIN NAME</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PGI</td>
<td>Power good input signal pin</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>FPO/</td>
<td>Inverted fault protection output, open drain output stage</td>
</tr>
<tr>
<td>4</td>
<td>PSON/</td>
<td>Remote ON/OFF control input pin</td>
</tr>
<tr>
<td>5</td>
<td>IS12A</td>
<td>12V(1) over current protection input pin</td>
</tr>
<tr>
<td>6</td>
<td>RI</td>
<td>Current sense setting</td>
</tr>
<tr>
<td>7</td>
<td>IS12B</td>
<td>12V(2) over current protection input pin</td>
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<tr>
<td>8</td>
<td>VS12B</td>
<td>12V(2) over/under voltage protection input pin</td>
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<tr>
<td>9</td>
<td>VS12C</td>
<td>12V(3) over/under voltage protection input pin</td>
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<tr>
<td>10</td>
<td>VS12D</td>
<td>12V(4) over/under voltage protection input pin</td>
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<td>11</td>
<td>IS12D</td>
<td>12V(4) over current protection input pin</td>
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<tr>
<td>12</td>
<td>IS12C</td>
<td>12V(3) over current protection input pin</td>
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<tr>
<td>13</td>
<td>Pext</td>
<td>External protection detect input pin</td>
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<tr>
<td>14</td>
<td>IS5</td>
<td>5.0V over current protection input pin</td>
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<tr>
<td>15</td>
<td>IS33</td>
<td>3.3V over current protection input pin</td>
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<tr>
<td>16</td>
<td>VS12A</td>
<td>12V(1) over/under voltage protection input pin</td>
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<tr>
<td>17</td>
<td>VS33</td>
<td>3.3V over/under voltage protection input pin</td>
</tr>
<tr>
<td>18</td>
<td>VS5</td>
<td>5.0V over/under voltage protection input pin</td>
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<tr>
<td>19</td>
<td>VCC</td>
<td>Power supply</td>
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<tr>
<td>20</td>
<td>PGO</td>
<td>Power good output signal pin, open drain output stage</td>
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## Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rating</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Storage Temperature ($T_{stg}$)</td>
<td>-40 to +125</td>
<td>°C</td>
</tr>
<tr>
<td>Operating Temperature ($T_{opr}$)</td>
<td>-30 to +90</td>
<td>°C</td>
</tr>
<tr>
<td>Supply Voltage ($V_{CC}$)</td>
<td>VCC</td>
<td>-0.5 to +16.0</td>
</tr>
<tr>
<td>Input Voltage Range ($V_{I}$)</td>
<td>VS12, IS12(A,B,C,D)</td>
<td>-0.5 to +16.0</td>
</tr>
<tr>
<td></td>
<td>VS5, IS5</td>
<td>-0.5 to +9.0</td>
</tr>
<tr>
<td></td>
<td>VS33, IS33</td>
<td>-0.5 to +7.0</td>
</tr>
<tr>
<td></td>
<td>PGI</td>
<td>-0.5 to +16.0</td>
</tr>
<tr>
<td></td>
<td>PSON/, Pext</td>
<td>-0.5 to Vcc+0.5</td>
</tr>
<tr>
<td>Output Voltage Range ($V_{O}$)</td>
<td>FPO/</td>
<td>-0.5 to +16.0</td>
</tr>
<tr>
<td></td>
<td>PGO</td>
<td>-0.5 to Vcc+0.5</td>
</tr>
<tr>
<td>Output Current for RI ($I_{RI}$)</td>
<td>RI</td>
<td>12.5 to 62.5</td>
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Electrical Characteristics, $V_{cc}=12V$, $T_a = $ Full range. (unless otherwise specified)

### Power Supply Section

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td></td>
<td>3.8</td>
<td>5.0</td>
<td>16.0</td>
<td>V</td>
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<tr>
<td>Supply Current</td>
<td>$V_{PDON} = 5V$</td>
<td>4.5</td>
<td>5.0</td>
<td></td>
<td>mA</td>
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<tr>
<td>Power On Reset Threshold Voltage ($V_{POR}$)</td>
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<td>3.2</td>
<td>3.4</td>
<td>3.6</td>
<td>V</td>
</tr>
<tr>
<td>Power On Reset Hysteresis ($V_{HYST}$)</td>
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<td>-0.15</td>
<td>-0.3</td>
<td>-0.45</td>
<td>V</td>
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### Over-Voltage Section

<table>
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<th>Parameter</th>
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<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Over-Voltage Threshold</td>
<td>VS33</td>
<td>3.7</td>
<td>3.9</td>
<td>4.1</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>VS5</td>
<td>5.7</td>
<td>6.1</td>
<td>6.5</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>VS12A/B/C/D</td>
<td>13.1</td>
<td>13.8</td>
<td>14.5</td>
<td>V</td>
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### Under-Voltage Section

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under-Voltage Threshold</td>
<td>VS33</td>
<td>2.0</td>
<td>2.2</td>
<td>2.4</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>VS5</td>
<td>3.3</td>
<td>3.5</td>
<td>3.7</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>VS12A/B/C/D</td>
<td>8.5</td>
<td>9.0</td>
<td>9.5</td>
<td>V</td>
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</table>

### PGI, Analog Input

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold Voltage for start $T_{d1}$</td>
<td></td>
<td>1.16</td>
<td>1.25</td>
<td>1.33</td>
<td>V</td>
</tr>
<tr>
<td>Threshold Voltage for start $T_{d2}$</td>
<td></td>
<td>0.60</td>
<td>0.63</td>
<td>0.75</td>
<td>V</td>
</tr>
<tr>
<td>Threshold Voltage for mask OC,UV</td>
<td></td>
<td>1.05</td>
<td>1.13</td>
<td>1.21</td>
<td>V</td>
</tr>
<tr>
<td>Hysteresis ($V_{HYST}$)*</td>
<td></td>
<td>-20</td>
<td>-50</td>
<td>-80</td>
<td>mV</td>
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</tbody>
</table>

* All of the comparator for PGI input in block diagram.
### Electrical Characteristics (Continued)

#### PGO, Open Drain Digital Output

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leakage Current (I\textsubscript{LKG})</td>
<td>(V_{\text{PGO}}=5\text{V})</td>
<td>5</td>
<td></td>
<td></td>
<td>uA</td>
</tr>
<tr>
<td>Low Level Output Voltage (V\textsubscript{OL})</td>
<td>(I_{\text{SINK}}=10\text{mA})</td>
<td>0.3</td>
<td></td>
<td></td>
<td>V</td>
</tr>
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</table>

#### FPO\textsubslash/, Open Drain Digital Output

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leakage Current (I\textsubscript{LKG})</td>
<td>(V_{\text{FPO}}=5\text{V})</td>
<td>5</td>
<td></td>
<td></td>
<td>uA</td>
</tr>
<tr>
<td>Low Level Output Voltage (V\textsubscript{OL})</td>
<td>(I_{\text{SINK}}=20\text{mA})</td>
<td>0.4</td>
<td></td>
<td></td>
<td>V</td>
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#### PSON\textsubslash/, Analog Input

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold Voltage</td>
<td></td>
<td>1.16</td>
<td>1.25</td>
<td>1.33</td>
<td>V</td>
</tr>
<tr>
<td>Hysteresis (V\textsubscript{HYST})</td>
<td></td>
<td>20</td>
<td>50</td>
<td>80</td>
<td>mV</td>
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</table>

#### External Protection Detect Section

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold(V\textsubscript{TH})</td>
<td></td>
<td>2.5</td>
<td>2.6</td>
<td>2.7</td>
<td>V</td>
</tr>
<tr>
<td>Hysteresis (V\textsubscript{HYST})</td>
<td></td>
<td>20</td>
<td>50</td>
<td>80</td>
<td>mV</td>
</tr>
</tbody>
</table>

#### Switching Characteristics, V\textsubscript{cc}=12V, \(T\_a\) = Full range.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGI to PGO Delay Time (T\textsubscript{d1})</td>
<td></td>
<td>200</td>
<td>300</td>
<td>480</td>
<td>mS</td>
</tr>
<tr>
<td>Short Circuit Delay Time (T\textsubscript{d2})</td>
<td></td>
<td>49</td>
<td>75</td>
<td>114</td>
<td>mS</td>
</tr>
<tr>
<td>PGO to FPO/ Delay Time (T\textsubscript{d3})</td>
<td></td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>mS</td>
</tr>
<tr>
<td>Under Voltage Delay Time (T\textsubscript{d4})</td>
<td></td>
<td>0.6</td>
<td>1</td>
<td>1.4</td>
<td>mS</td>
</tr>
<tr>
<td>Over Current Delay Time (T\textsubscript{s4})</td>
<td></td>
<td>13</td>
<td>20</td>
<td>27</td>
<td>mS</td>
</tr>
<tr>
<td>Over Voltage Delay Time (T\textsubscript{s5})</td>
<td></td>
<td>47</td>
<td>73</td>
<td>110</td>
<td>uS</td>
</tr>
<tr>
<td>Pext Delay Time (T\textsubscript{ar})</td>
<td></td>
<td>24</td>
<td>38</td>
<td>52</td>
<td>mS</td>
</tr>
<tr>
<td>PSON/ De-bounce Time (T\textsubscript{ar})</td>
<td></td>
<td>24</td>
<td>38</td>
<td>52</td>
<td>mS</td>
</tr>
<tr>
<td>PGO Noise De-glitch Time (T\textsubscript{sz2})</td>
<td></td>
<td>47</td>
<td>73</td>
<td>110</td>
<td>uS</td>
</tr>
</tbody>
</table>
Application

Typical 6 rails SPS

Notes:
1. Zener diode or resistor or both of them can be used in component X.
2. The bypass capacitor Cby suggests to be 0.1μF~10μF and layout nearby pin VCC.
3. The recommend sense values of R_{S12(1)}, R_{S12(2)}, R_{S5} and R_{S33} are \geq 0.002\ Ω.
4. Over-Current Protection design example:
   (1) \( I_{ref} = 20\ \mu{A}, \quad R_I = \frac{V_{RI}}{I_{RI}} = \frac{1.25}{20\ \mu} = 62.5\ K(\Omega) \)
   (2) \( R_{S5}=0.002\ \Omega, \quad \Delta V_{5V} = 0.002 \times I_{+5V} = R_{OC5} \times 8 \times I_{ref} \)
   (3) If +5V OCP trip point is 20A, \( R_{OC5} = \frac{0.002 \times 20}{8 \times 20\ \mu} = 250(\Omega) \)
Package Specification

(20-pin DIP)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Dimension in mm</th>
<th>Dimension in Inch</th>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Min</td>
<td>Normal</td>
<td>Max</td>
</tr>
<tr>
<td>A1</td>
<td>0.38</td>
<td>0.015</td>
<td>0.210</td>
</tr>
<tr>
<td>b1</td>
<td>7.29</td>
<td>9.53</td>
<td>9.36</td>
</tr>
<tr>
<td>b</td>
<td>1.52</td>
<td>0.06</td>
<td>0.06</td>
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<tr>
<td>D</td>
<td>24.89</td>
<td>26.16</td>
<td>26.92</td>
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<tr>
<td>E1</td>
<td>6.01</td>
<td>6.30</td>
<td>6.55</td>
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<tr>
<td>e</td>
<td>2.18</td>
<td>2.54</td>
<td>2.90</td>
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<tr>
<td>E</td>
<td>7.62</td>
<td>3.00</td>
<td>3.15</td>
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<tr>
<td>L</td>
<td>2.54</td>
<td>3.81</td>
<td>0.100</td>
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<tr>
<td>θ°</td>
<td>0°</td>
<td>7°</td>
<td>15°</td>
</tr>
</tbody>
</table>

6-Channel Secondary Monitoring IC
Version: A.003
Package Specification

(20-pin SOP)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Dimension in mm</th>
<th>Dimension in inch</th>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2.36 2.64</td>
<td>0.093 0.104</td>
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<tr>
<td>A₁</td>
<td>0.10 0.30</td>
<td>0.004 0.012</td>
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</tr>
<tr>
<td>b</td>
<td>0.41 BSC</td>
<td>0.016 BSC</td>
<td></td>
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<tr>
<td>e</td>
<td>1.27 BSC</td>
<td>0.050 BSC</td>
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<tr>
<td>D</td>
<td>12.60 12.90</td>
<td>0.496 0.508</td>
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<tr>
<td>H</td>
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<td>0.394 0.419</td>
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<td>7.39 7.59</td>
<td>0.291 0.299</td>
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<tr>
<td>L</td>
<td>0.41 1.27</td>
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</tr>
<tr>
<td>e</td>
<td>0°</td>
<td>8°</td>
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</table>
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