

# FS6S1565RB

## Fairchild Power Switch(FPS)

### Features

- Wide operating frequency range up to 150Khz
- Internal Burst mode Controller for Stand-by mode
- Pulse by pulse over current limiting
- Over current protection(Auto restart mode)
- Over voltage protection (Auto restart mode)
- Over load protection(Auto restart mode)
- Internal thermal shutdown function(Auto restart mode)
- Under voltage lockout
- Internal high voltage sense FET
- External sync terminal/Soft start

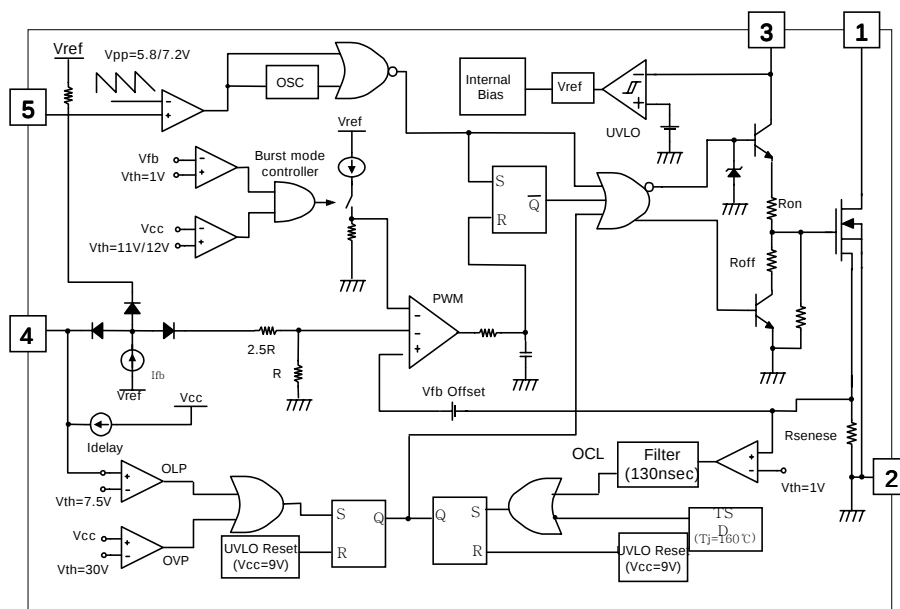
### Description

The Fairchild Power Switch(FPS) product family is specially designed for an off-line SMPS with minimal external components. The Fairchild Power Switch(FPS) consist of high voltage power SenseFET and current mode PWM IC. Included PWM controller features integrated fixed oscillator, under voltage lock out, optimized gate turn-on/turn-off driver, thermal shut down protection, over voltage protection, and temperature compensated precision current sources for loop compensation and fault protection circuitry. compared to discrete MOSFET and controller or RCC switching converter solution, a Fairchild Power Switch(FPS) can reduce total component count, design size, and weight and at the same time increase efficiency, productivity, and system reliability. It has a basic platform well suited for cost effective monitor power supply.

TO-3P-5L



### Internal Block Diagram



## Absolute Maximum Ratings

(Ta=25°C, unless otherwise specified)

| Parameter                                        | Symbol                    | Value                   | Unit |
|--------------------------------------------------|---------------------------|-------------------------|------|
| Drain-source(GND) voltage <sup>(1)</sup>         | V <sub>DSS</sub>          | 650                     | V    |
| Drain-Gate Voltage (R <sub>GS</sub> =1MΩ)        | V <sub>DGR</sub>          | 650                     | V    |
| Gate-source (GND) Voltage                        | V <sub>GS</sub>           | ±30                     | V    |
| Drain current pulsed <sup>(2)</sup>              | I <sub>DM</sub>           | 60                      | ADC  |
| Single pulsed avalanche energy <sup>(3)</sup>    | E <sub>AS</sub>           | 1040                    | mJ   |
| Single Pulsed Avalanche current <sup>(4)</sup>   | I <sub>AS</sub>           | 37                      | A    |
| Continuous drain current (T <sub>C</sub> = 25°C) | I <sub>D</sub>            | 15                      | ADC  |
| Continuous drain current (T <sub>C</sub> =100°C) | I <sub>D</sub>            | 9.5                     | ADC  |
| Supply voltage                                   | V <sub>CC</sub>           | 35                      | V    |
| Input Voltage Range                              | V <sub>FB</sub>           | −0.3 to V <sub>CC</sub> | V    |
|                                                  | V <sub>S_S</sub>          | −0.3 to 10              | V    |
| Total Power Dissipation                          | P <sub>D</sub> (Watt H/S) | 270                     | W    |
|                                                  | Derating                  | 2.17                    | W/°C |
| Operating junction temperature                   | T <sub>j</sub>            | +160                    | °C   |
| Operating Ambient Temperature                    | T <sub>A</sub>            | −25 to +85              | °C   |
| Storage Temperature range                        | T <sub>STG</sub>          | −55 to +150             | °C   |

### Notes:

1. T<sub>j</sub>=25°C to 150°C
2. Repetitive rating: Pulse width limited by maximum junction temperature
3. L=8.5mH, starting T<sub>j</sub>=25°C
4. L=13uH, starting T<sub>j</sub>=25°C

## Electrical Characteristics (SFET part)

(Ta=25°C unless otherwise specified)

| Parameter                                           | Symbol              | Condition                                                                                                                                                    | Min. | Typ. | Max. | Unit |
|-----------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Drain-source breakdown voltage                      | BV <sub>DSS</sub>   | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                                                                                                                 | 650  | -    | -    | V    |
| Zero gate voltage drain current                     | I <sub>DSS</sub>    | V <sub>DS</sub> = 650V, V <sub>GS</sub> = 0V                                                                                                                 | -    | -    | 200  | μA   |
|                                                     |                     | V <sub>DS</sub> = 520V<br>V <sub>GS</sub> = 0V, T <sub>C</sub> = 125°C                                                                                       | -    | -    | 300  | μA   |
| Static drain-source on resistance <sup>(note)</sup> | R <sub>DS(ON)</sub> | V <sub>GS</sub> = 10V, I <sub>D</sub> = 7.5A                                                                                                                 | -    | 0.5  | 0.65 | Ω    |
| Forward transconductance <sup>(note)</sup>          | g <sub>fs</sub>     | V <sub>DS</sub> = 50V, I <sub>D</sub> = 7.5A                                                                                                                 | -    | -    | -    | S    |
| Input capacitance                                   | C <sub>iss</sub>    | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V,<br>f = 1MHz                                                                                                     | -    | 2580 | -    | pF   |
| Output capacitance                                  | C <sub>oss</sub>    |                                                                                                                                                              | -    | 270  | -    |      |
| Reverse transfer capacitance                        | C <sub>rss</sub>    |                                                                                                                                                              | -    | 50   | -    |      |
| Turn on delay time                                  | t <sub>d(on)</sub>  | V <sub>DD</sub> = 325V, I <sub>D</sub> = 15A<br>(MOSFET switching<br>time are essentially<br>independent of<br>operating temperature)                        | -    | 50   | -    | nS   |
| Rise time                                           | t <sub>r</sub>      |                                                                                                                                                              | -    | 155  | -    |      |
| Turn off delay time                                 | t <sub>d(off)</sub> |                                                                                                                                                              | -    | 270  | -    |      |
| Fall time                                           | t <sub>f</sub>      |                                                                                                                                                              | -    | 125  | -    |      |
| Total gate charge<br>(gate-source+gate-drain)       | Q <sub>g</sub>      | V <sub>GS</sub> = 10V, I <sub>D</sub> = 15A,<br>V <sub>DS</sub> = 520V (MOSFET<br>Switching time are<br>Essentially independent of<br>Operating temperature) | -    | 90   | -    | nC   |
| Gate source charge                                  | Q <sub>gs</sub>     |                                                                                                                                                              | -    | 15   | -    |      |
| Gate drain (Miller) charge                          | Q <sub>gd</sub>     |                                                                                                                                                              | -    | 45   | -    |      |
| Single Pulsed Avalanche current <sup>(1)</sup>      | I <sub>AS</sub>     | V <sub>CC</sub> = V <sub>FB</sub> = V <sub>SS</sub> = GND                                                                                                    | -    | 37   | -    | A    |

### Note:

Pulse test : Pulse width ≤ 300μS, duty 2%

$$S = \frac{1}{R}$$

1. L=13uH, starting T<sub>j</sub>=25°C

## Electrical Characteristics

(Ta=25°C unless otherwise specified)

| Parameter                          | Symbol  | Condition                | Min. | Typ. | Max. | Unit |
|------------------------------------|---------|--------------------------|------|------|------|------|
| <b>UVLO SECTION</b>                |         |                          |      |      |      |      |
| Start threshold voltage            | VSTART  | VFB = GND                | 14   | 15   | 16   | V    |
| Stop threshold voltage             | VSTOP   | VFB = GND                | 8    | 9    | 10   | V    |
| <b>SENSEFET SECTION</b>            |         |                          |      |      |      |      |
| Drain to PKG Breakdown voltage     | BVpkg   | 60HZ AC, Ta = 25°C       | 3500 | -    | -    | V    |
| Drain to Source Breakdown voltage  | BVdss   | Vdrain = 650V, Ta = 25°C | 650  | -    | -    | V    |
| Drain to Source Leakage current    | Idss    | Vdrain = 650V, Ta = 25°C | -    | -    | 300  | uA   |
| <b>OSCILLATOR SECTION</b>          |         |                          |      |      |      |      |
| Initial Frequency                  | FOSC    | -                        | 22   | 25   | 28   | kHz  |
| Voltage Stability                  | FSTABLE | 12V ≤ Vcc ≤ 23V          | 0    | 1    | 3    | %    |
| Temperature Stability (note4)      | ΔFOSC   | -25°C ≤ Ta ≤ 85°C        | 0    | ±5   | ±10  | %    |
| Maximum duty cycle                 | DMAX    | -                        | 92   | 95   | 98   | %    |
| Minimum Duty Cycle                 | DMIN    | -                        | -    | -    | 0    | %    |
| <b>FEEDBACK SECTION</b>            |         |                          |      |      |      |      |
| Feedback source current            | IFB     | VFB = GND                | 0.7  | 0.9  | 1.1  | mA   |
| Shutdown Feedback voltage          | VSD     | Vfb ≥ 6.9V               | 6.9  | 7.5  | 8.1  | V    |
| Shutdown delay current             | Idelay  | VFB = 5V                 | 1.6  | 2.0  | 2.4  | μA   |
| <b>PROTECTION SECTION</b>          |         |                          |      |      |      |      |
| Over Voltage Protection            | VOVP    | Vsync ≥ 11V              | 27   | 30   | 33   | V    |
| Over Current Latch Voltage (Note2) | VOCL    | -                        | 0.9  | 1.0  | 1.1  | V    |
| Thermal Shutdown Temp.(Note4)      | TSD     | -                        | 140  | 160  | -    | °C   |

## Electrical Characteristics (Continued)

(Ta=25°C unless otherwise specified)

| Parameter                                    | Symbol   | Condition             | Min. | Typ. | Max. | Unit |
|----------------------------------------------|----------|-----------------------|------|------|------|------|
| <b>Sync &amp; SOFTSTART SECTION</b>          |          |                       |      |      |      |      |
| Softstart Vortage                            | VSS      | Vfb = 2               | 4.7  | 5.0  | 5.3  | V    |
| Softstart Current                            | ISS      | Vss = V               | 0.8  | 1.0  | 1.2  | mA   |
| Sync High Threshold Voltage                  | VSYNCH   | Vcc = 16V, Vfb = 5V   | -    | 7.2  | -    | V    |
| Sync Low Threshold Voltage                   | VSYNCL   | Vcc = 16V, Vfb = 5V   | -    | 5.8  | -    | V    |
| <b>BURST MODE SECTION</b>                    |          |                       |      |      |      |      |
| Burst mode Low Threshold Voltage             | VBURL    | Vfb = 0V              | 10.4 | 11.0 | 11.6 | V    |
| Burst mode High Threshold Voltage            | VBURH    | Vfb = 0V              | 11.4 | 12.0 | 12.6 | V    |
| Burst mode Enable Feedback Voltage (Note4)   | VBEN     | Vcc = 10.5V           | 0.7  | 1.0  | 1.3  | V    |
| Burst mode Peak Current Limit (Note3)        | lBU_PK   | Vcc = 10.5V           | 0.6  | 0.85 | 1.1  | V    |
| Burst mode Frequency                         | FBUR     | Vcc = 10.5V, Vfb = 0V | 40   | 50   | 60   | KHz  |
| <b>CURRENT LIMIT(SELF-PROTECTION)SECTION</b> |          |                       |      |      |      |      |
| Peak Current Limit (Note3)                   | IOVER    | -                     | 8.5  | 9.7  | 10.9 | A    |
| <b>TOTAL DEVICE SECTION</b>                  |          |                       |      |      |      |      |
| Start Up current                             | ISTART   | Vfb = GND, VCC = 14V  | -    | 0.1  | 0.17 | mA   |
| Operating supply current (Note1)             | IOP      | Vfb = GND, VCC = 16V  | -    | 10   | 15   | mA   |
|                                              | IOP(MIN) | Vfb = GND, VCC = 10V  |      |      |      |      |
|                                              | IOP(MAX) | Vfb = GND, VCC = 28V  |      |      |      |      |

### Notes:

- (1) These parameters is the current flowing in the Control IC.
- (2) These parameters, although guaranteed, are tested in EDS(wafer test) process.
- (3) These parameters indicate Inductor Current.
- (4) These parameters, although guranteed at the design, are not tested in massing production.

## Typical Performance Characteristics

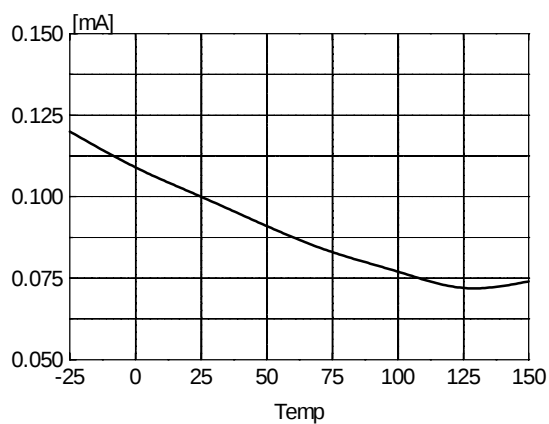


Figure 1. Start Up Current vs. Temp

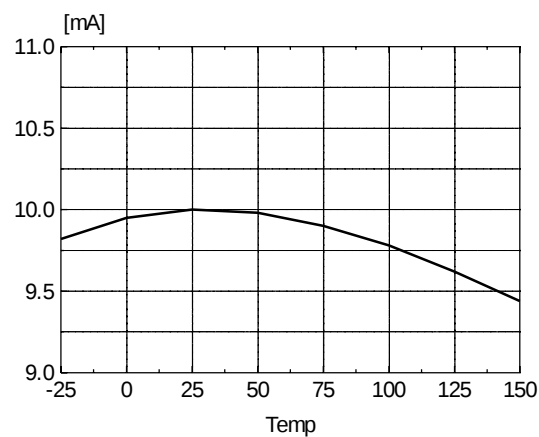


Figure 2. Operating Current vs. Temp

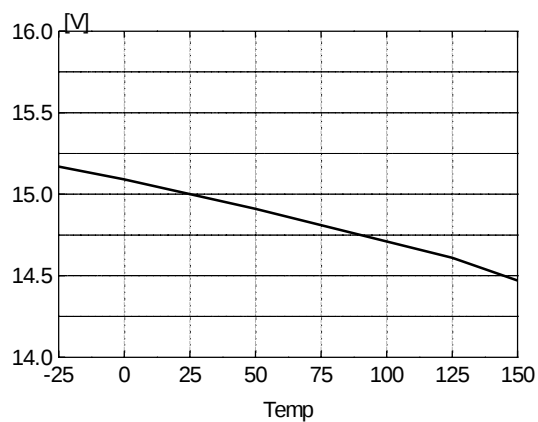


Figure 3. Start Threshold Voltage vs. Temp

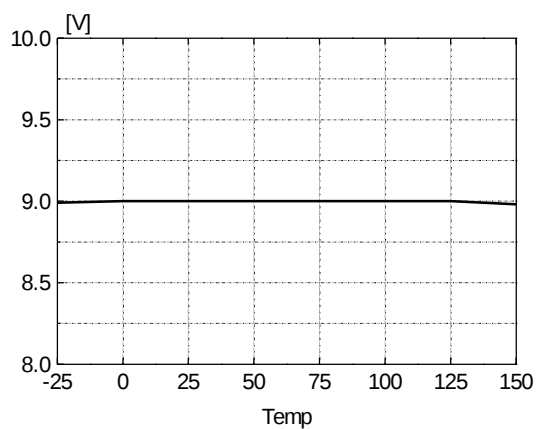


Figure 4. Stop Threshold Voltage vs. Temp

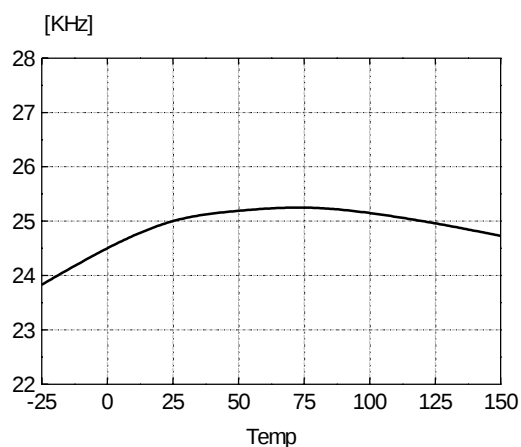


Figure 5. Initial Frequency vs. Temp

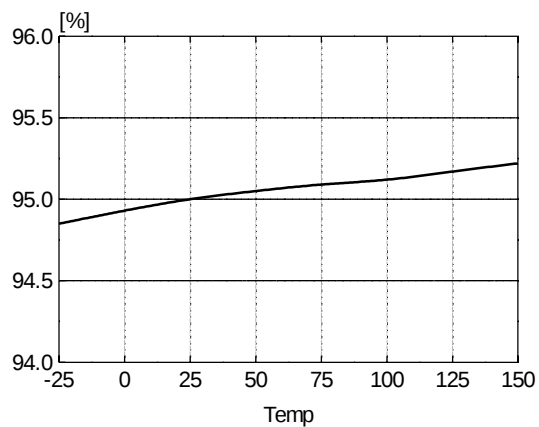


Figure 6. Maximum Duty vs. Temp

## Typical Performance Characteristics (Continued)

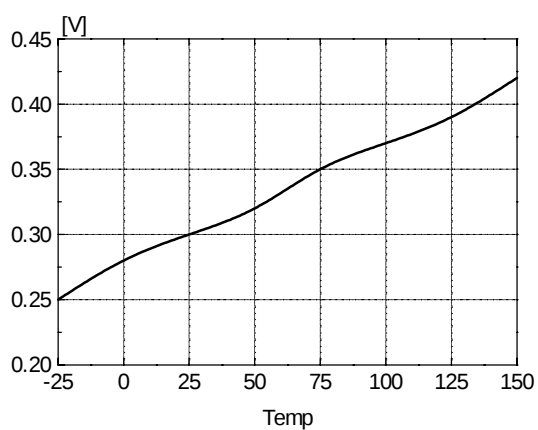


Figure 7. Feedback Offset Voltage vs. Temp

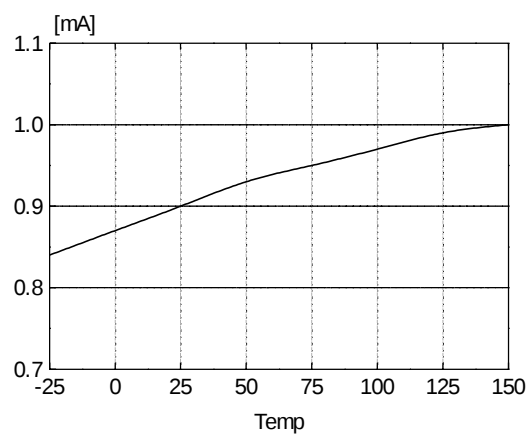


Figure 8. Feedback Source Current vs. Temp

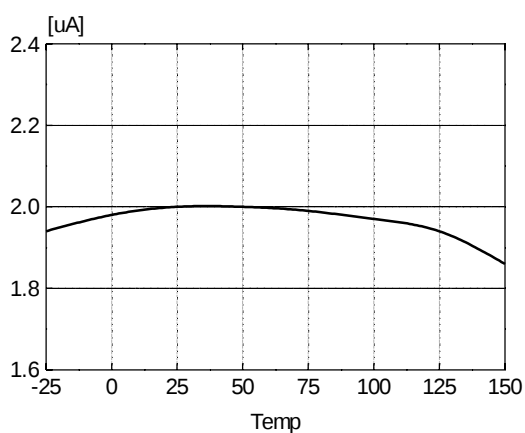


Figure 9. ShutDown Delay Current vs. Temp

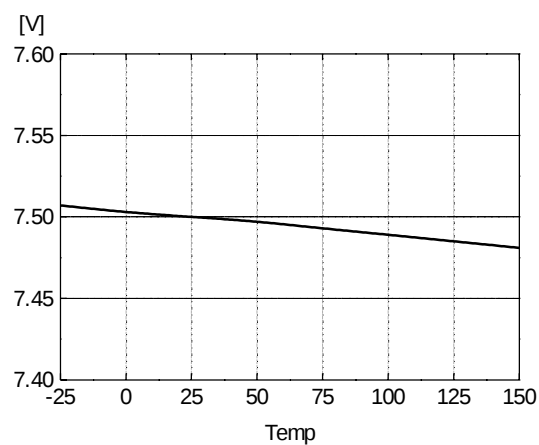


Figure 10. ShutDown Feedback Voltage vs. Temp

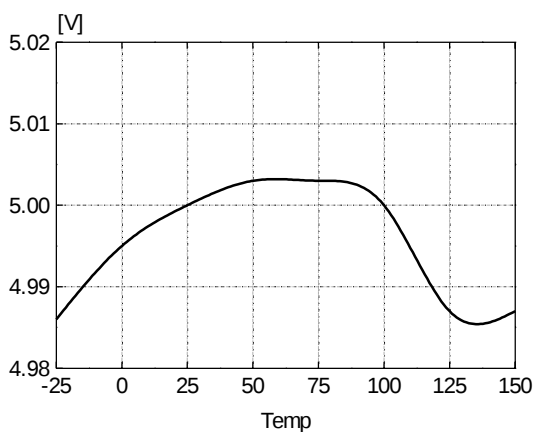


Figure 11. Softstart Voltage vs. Temp

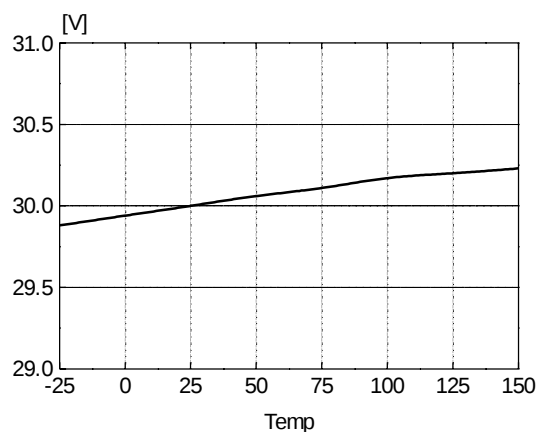


Figure 12. OverVoltage Protection vs. Temp

Typical Performance Characteristics (Continued)

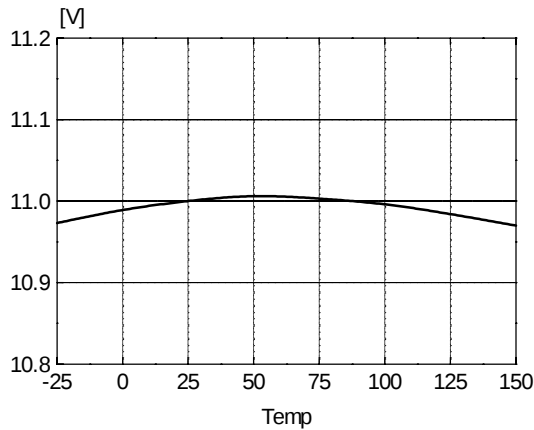


Figure 13. Burst Mode Low Voltage vs. Temp

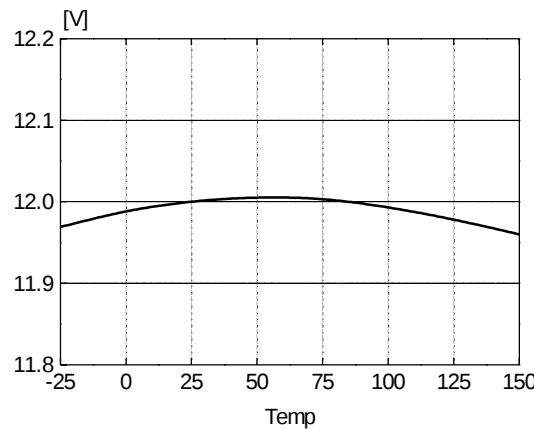


Figure 14. Burst Mode High Voltage vs. Temp

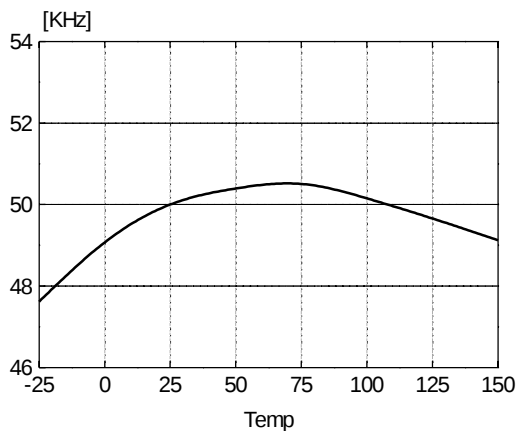


Figure 15. Burst Mode Frequency vs. Temp

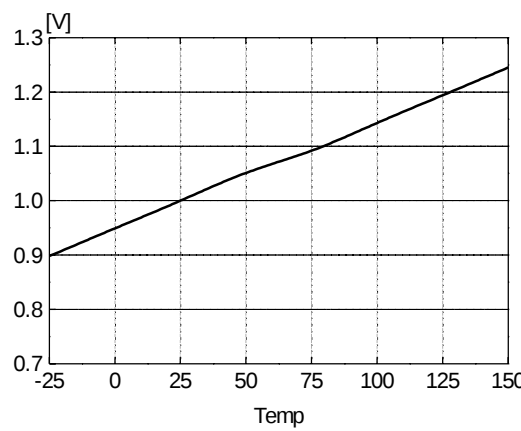


Figure 16. Burst ModeEnable Voltage vs. Temp

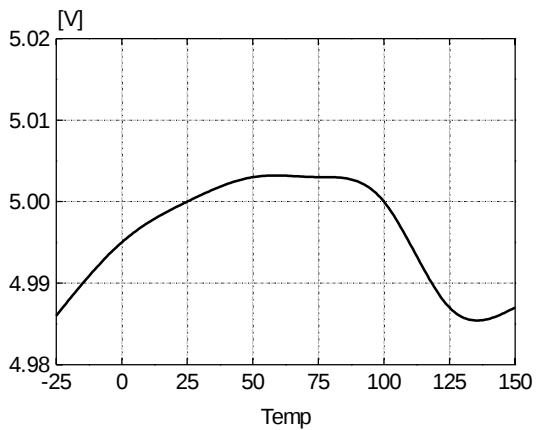


Figure 17. Softstart Voltage vs. Temp

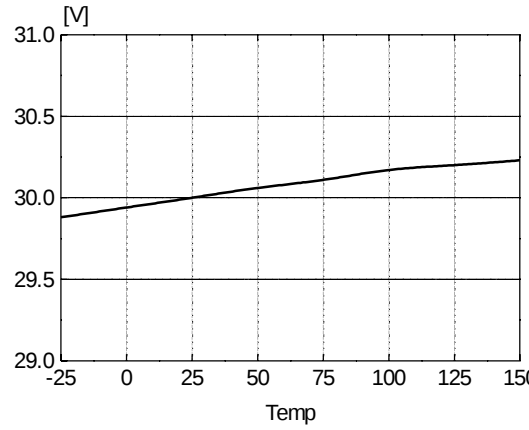


Figure 18. OverVoltage Protection vs. Temp

## Typical Performance Characteristics (Continued)

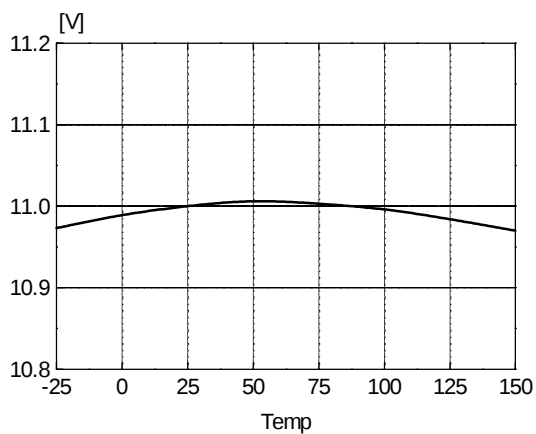


Figure 19. Burst Mode Low Voltage vs. Temp

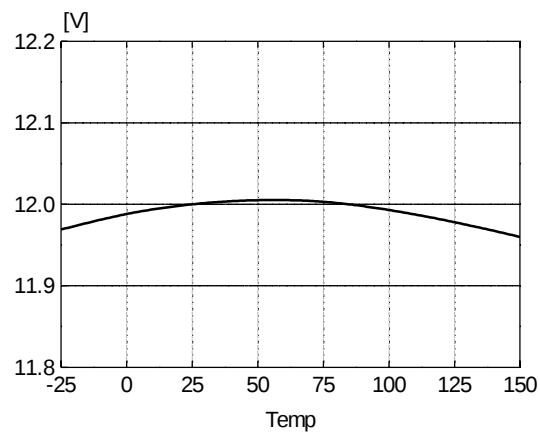


Figure 20. Burst Mode High Voltage vs. Temp

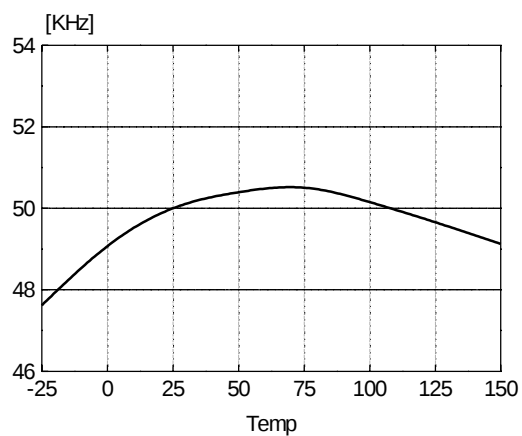


Figure 21. Burst Mode Frequency vs. Temp

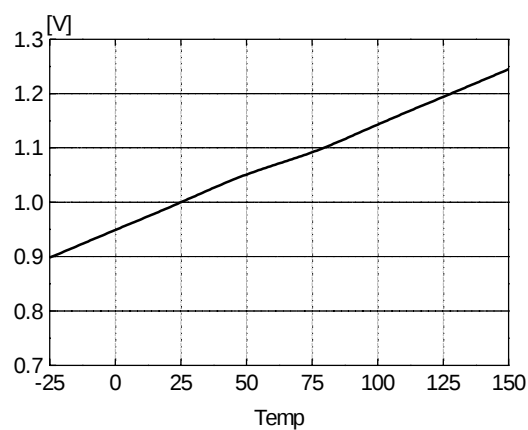


Figure 22. Burst Mode Enable Voltage vs. Temp

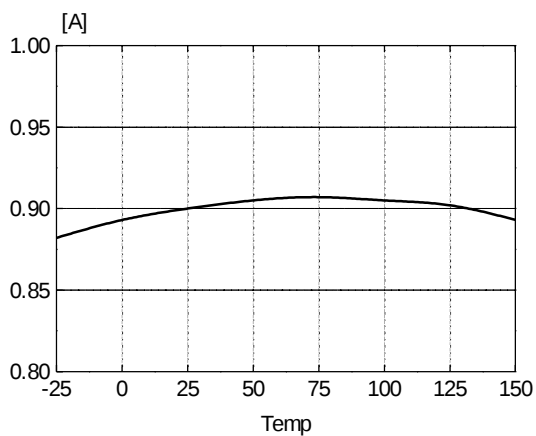


Figure 23. Burst Mode Peak Current vs. Temp

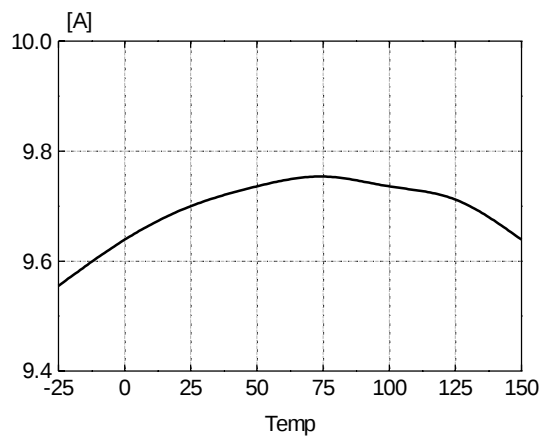
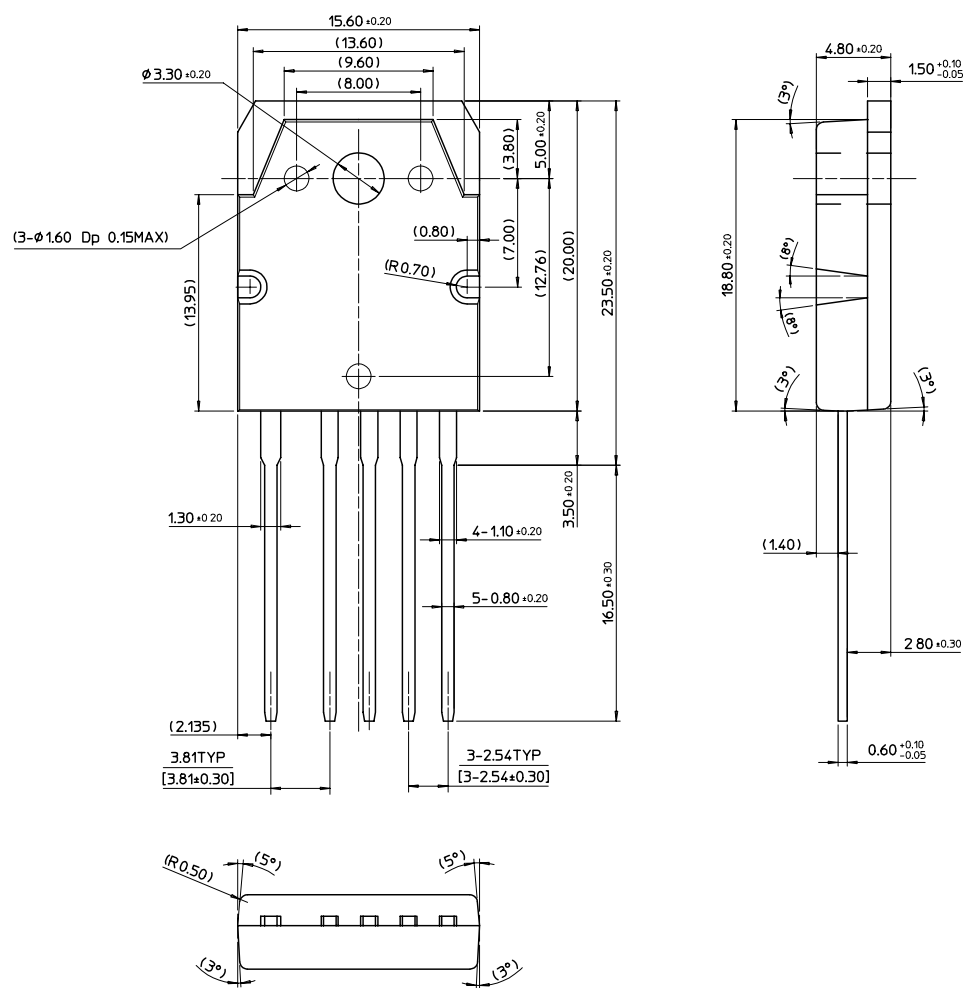


Figure 24. Over Current Limit vs. Temp

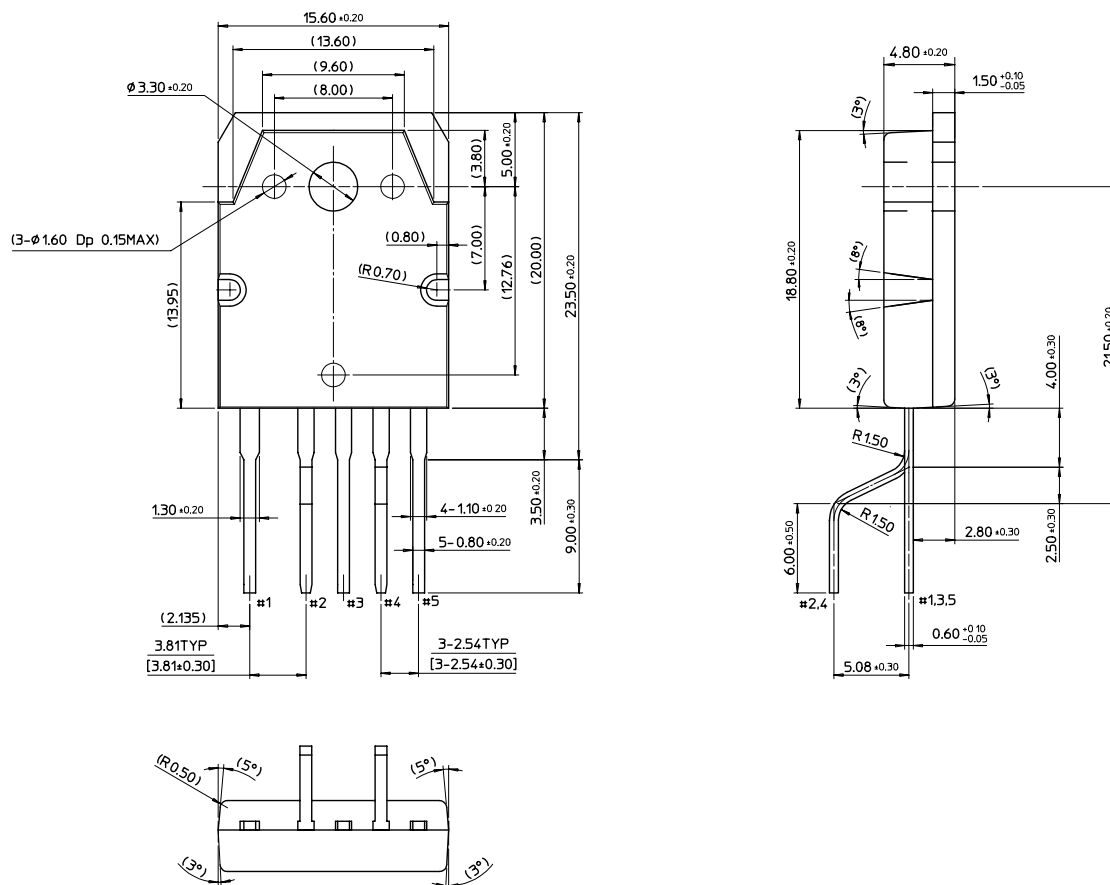
## Package Dimensions

## TO-3P-5L



## Package Dimensions

### TO-3P-5L (Forming)



## Ordering Information

| Product Number  | Package           | Marking Code | BVdss | Rds(on) |
|-----------------|-------------------|--------------|-------|---------|
| FS6S1565RB-TU   | TO-3P-5L          | 6S1565RB     | 650V  | 0.5     |
| FS6S1565RB-YDTU | TO-3P-5L(Forming) |              |       |         |

TU : Non Forming Type

YDTU : Forming Type

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