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# KA1M0680B/KA1M0680RB/ KA1H0680B/KA1H0680RFB

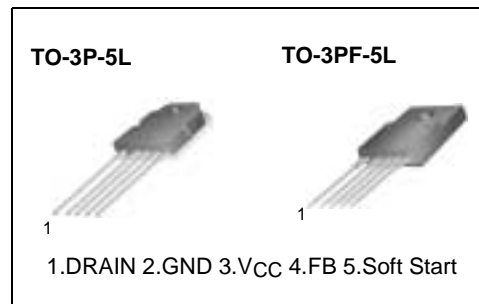
## Fairchild Power Switch(FPS)

### Features

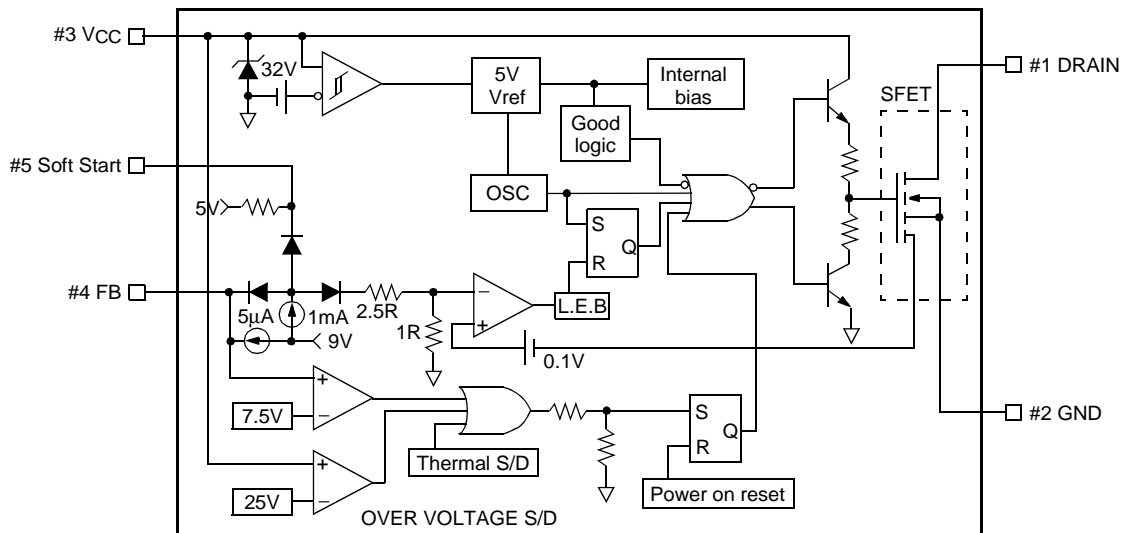
- Precision fixed operating frequency
- KA1M0680B,KA1M0680RB (67KHz)
- KA1H0680B,KA1H0680RFB (100KHz)
- Pulse by pulse over current limiting
- Over load protection
- Over voltage protection (Min. 23V)
- Internal thermal shutdown function
- Under voltage lockout
- Internal high voltage sense FET
- Latch up mode (KA1M0680B,KA1H0680B)
- Auto restart (KA1M0680RB,KA1H0680RFB)
- 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 controller IC. PWM controller features integrated fixed oscillator, under voltage lock out, leading edge blanking, optimized gate turn-on/turn-off driver, thermal shut down protection, over voltage protection, temperature compensated precision current sources for loop compensation and fault protection circuit. compared to discrete MOSFET and controller or RCC switching converter solution, a Fairchild Power Switch(FPS) can reduce total component count, design size, weight and at the same time increase & efficiency, productivity, and system reliability. It has a basic platform well suited for cost effective design in either a flyback converter or a forward converter.



### Internal Block Diagram



Rev.1.0.2

## Absolute Maximum Ratings

| Parameter                                        | Symbol              | Value                   | Unit |
|--------------------------------------------------|---------------------|-------------------------|------|
| Maximum Drain voltage <sup>(1)</sup>             | V <sub>D,MAX</sub>  | 800                     | V    |
| Drain Gate voltage (R <sub>GS</sub> =1MΩ)        | V <sub>DGR</sub>    | 800                     | V    |
| Gate source (GND) voltage                        | V <sub>GS</sub>     | ±30                     | V    |
| Drain current pulsed <sup>(2)</sup>              | I <sub>DM</sub>     | 24.0                    | ADC  |
| Single pulsed avalanche energy <sup>(3)</sup>    | E <sub>AS</sub>     | 455                     | mJ   |
| Avalanche current <sup>(4)</sup>                 | I <sub>AS</sub>     | 16                      | A    |
| Continuous drain current (T <sub>C</sub> =25°C)  | I <sub>D</sub>      | 6.0                     | ADC  |
| Continuous drain current (T <sub>C</sub> =100°C) | I <sub>D</sub>      | 4.0                     | ADC  |
| Maximum Supply voltage                           | V <sub>CC,MAX</sub> | 30                      | V    |
| Input voltage range                              | V <sub>FB</sub>     | -0.3 to V <sub>SD</sub> | V    |
| Total power dissipation                          | P <sub>D</sub>      | 150                     | W    |
|                                                  | Derating            | 1.21                    | W/°C |
| Operating ambient temperature                    | T <sub>A</sub>      | -25 to +85              | °C   |
| Storage temperature                              | 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=24mH, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, starting T<sub>j</sub>=25°C
4. L=13μH, 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> =50μA                                                                                                                                  | 800  | -    | -    | V    |
| Zero gate voltage drain current                     | I <sub>DSS</sub>    | V <sub>DS</sub> =Max., Rating,<br>V <sub>GS</sub> =0V                                                                                                                      | -    | -    | 50   | μA   |
|                                                     |                     | V <sub>DS</sub> =0.8Max., Rating,<br>V <sub>GS</sub> =0V, T <sub>C</sub> =125°C                                                                                            | -    | -    | 200  | μA   |
| Static drain source on resistance <sup>(note)</sup> | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =4.0A                                                                                                                                 | -    | 1.6  | 2.0  | Ω    |
| Forward transconductance <sup>(note)</sup>          | g <sub>fs</sub>     | V <sub>DS</sub> =15V, I <sub>D</sub> =4.0A                                                                                                                                 | 1.5  | 2.5  | -    | S    |
| Input capacitance                                   | C <sub>iss</sub>    | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V,<br>f=1MHz                                                                                                                       | -    | 1600 | -    | pF   |
| Output capacitance                                  | C <sub>oss</sub>    |                                                                                                                                                                            | -    | 140  | -    |      |
| Reverse transfer capacitance                        | C <sub>rss</sub>    |                                                                                                                                                                            | -    | 42   | -    |      |
| Turn on delay time                                  | t <sub>d(on)</sub>  | V <sub>DD</sub> =0.5BV <sub>DSS</sub> , I <sub>D</sub> =6.0A<br>(MOSFET switching<br>time are essentially<br>independent of<br>operating temperature)                      | -    | 60   | -    | nS   |
| Rise time                                           | t <sub>r</sub>      |                                                                                                                                                                            | -    | 150  | -    |      |
| Turn off delay time                                 | t <sub>d(off)</sub> |                                                                                                                                                                            | -    | 300  | -    |      |
| Fall time                                           | t <sub>f</sub>      |                                                                                                                                                                            | -    | 130  | -    |      |
| Total gate charge<br>(gate-source+gate-drain)       | Q <sub>g</sub>      | V <sub>GS</sub> =10V, I <sub>D</sub> =6.0A,<br>V <sub>DS</sub> =0.5BV <sub>DSS</sub> (MOSFET<br>switching time are<br>essentially independent of<br>operating temperature) | -    | 70   | -    | nC   |
| Gate source charge                                  | Q <sub>gs</sub>     |                                                                                                                                                                            | -    | 16   | -    |      |
| Gate drain (Miller) charge                          | Q <sub>gd</sub>     |                                                                                                                                                                            | -    | 27   | -    |      |

**Note:**

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

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

## Electrical Characteristics (CONTROL part)

(Ta=25°C unless otherwise specified)

| Parameter                                                     | Symbol               | Condition                                       | Min. | Typ. | Max. | Unit  |
|---------------------------------------------------------------|----------------------|-------------------------------------------------|------|------|------|-------|
| <b>UVLO SECTION</b>                                           |                      |                                                 |      |      |      |       |
| Start threshold voltage                                       | V <sub>START</sub>   | -                                               | 14   | 15   | 16   | V     |
| Stop threshold voltage                                        | V <sub>STOP</sub>    | After turn on                                   | 9    | 10   | 11   | V     |
| <b>OSCILLATOR SECTION</b>                                     |                      |                                                 |      |      |      |       |
| Initial accuracy                                              | F <sub>OSC</sub>     | KA1M0680B                                       | 61   | 67   | 73   | kHz   |
|                                                               |                      | KA1M0680RB                                      | 61   | 67   | 73   |       |
|                                                               |                      | KA1H0680B                                       | 90   | 100  | 110  |       |
|                                                               |                      | KA1H0680RFB                                     | 90   | 100  | 110  |       |
| Frequency change with temperature <sup>(2)</sup>              | ΔF/ΔT                | -25°C ≤ Ta ≤ +85°C                              | -    | ±5   | ±10  | %     |
| Maximum duty cycle                                            | D <sub>max</sub>     | KA1M0680B                                       | 74   | 77   | 80   | %     |
|                                                               |                      | KA1M0680RB                                      | 74   | 77   | 80   |       |
|                                                               |                      | KA1H0680B                                       | 64   | 67   | 70   |       |
|                                                               |                      | KA1H0680RFB                                     | 64   | 67   | 70   |       |
| <b>FEEDBACK SECTION</b>                                       |                      |                                                 |      |      |      |       |
| Feedback source current                                       | I <sub>FB</sub>      | Ta=25°C, 0V ≤ V <sub>fb</sub> ≤ 3V              | 0.7  | 0.9  | 1.1  | mA    |
| Shutdown Feedback voltage                                     | V <sub>SD</sub>      | -                                               | 6.9  | 7.5  | 8.1  | V     |
| Shutdown delay current                                        | I <sub>delay</sub>   | Ta=25°C, 5V ≤ V <sub>fb</sub> ≤ V <sub>SD</sub> | 4.0  | 5.0  | 6.0  | μA    |
| <b>SOFT START SECTION</b>                                     |                      |                                                 |      |      |      |       |
| Soft Start Voltage                                            | V <sub>SS</sub>      | V <sub>FB</sub> = 2V                            | 4.7  | 5.0  | 5.3  | V     |
| Soft Start Current                                            | I <sub>SS</sub>      | Sync & S/S=GND                                  | 0.8  | 1.0  | 1.2  | mA    |
| <b>REFERENCE SECTION</b>                                      |                      |                                                 |      |      |      |       |
| Output voltage <sup>(1)</sup>                                 | V <sub>ref</sub>     | Ta=25°C                                         | 4.80 | 5.00 | 5.20 | V     |
| Temperature Stability <sup>(1)(2)</sup>                       | V <sub>ref</sub> /ΔT | -25°C ≤ Ta ≤ +85°C                              | -    | 0.3  | 0.6  | mV/°C |
| <b>CURRENT LIMIT (SELF-PROTECTION) SECTION</b>                |                      |                                                 |      |      |      |       |
| Peak Current Limit                                            | I <sub>OVER</sub>    | Max. inductor current                           | 3.52 | 4.00 | 4.48 | A     |
| <b>PROTECTION SECTION</b>                                     |                      |                                                 |      |      |      |       |
| Thermal shutdown temperature (T <sub>j</sub> ) <sup>(1)</sup> | T <sub>SD</sub>      | -                                               | 140  | 160  | -    | °C    |
| Over voltage protection voltage                               | V <sub>OVP</sub>     | -                                               | 23   | 25   | 28   | V     |
| <b>TOTAL DEVICE SECTION</b>                                   |                      |                                                 |      |      |      |       |
| Start Up current                                              | I <sub>START</sub>   | V <sub>CC</sub> =14V                            | 0.1  | 0.3  | 0.45 | mA    |
| Operating supply current (control part only)                  | I <sub>OP</sub>      | Ta=25°C                                         | 6    | 12   | 18   | mA    |
| V <sub>CC</sub> zener voltage                                 | V <sub>Z</sub>       | I <sub>CC</sub> =20mA                           | 30   | 32.5 | 35   | V     |

**Note:**

1. These parameters, although guaranteed, are not 100% tested in production
2. These parameters, although guaranteed, are tested in EDS (wafer test) process

## Typical Performance Characteristics

(These characteristic graphs are normalized at  $T_a=25^\circ\text{C}$ )

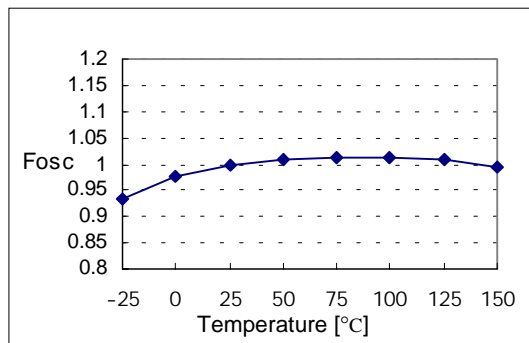


Figure 1. Operating Frequency

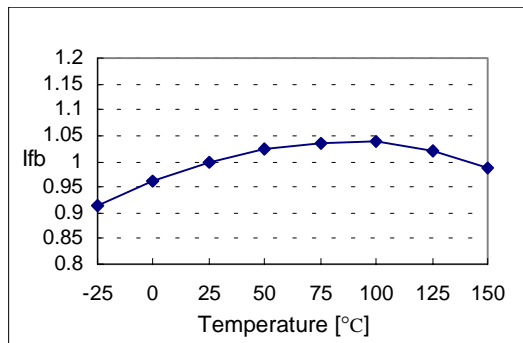


Figure 2. Feedback Source Current

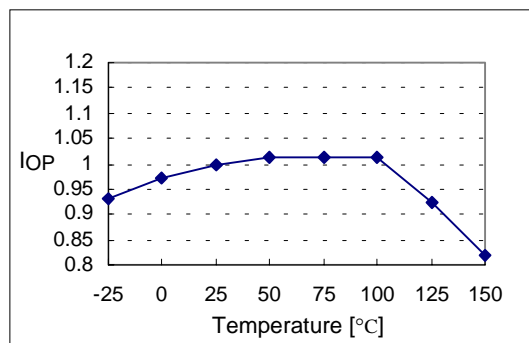


Figure 3. Operating Supply Current

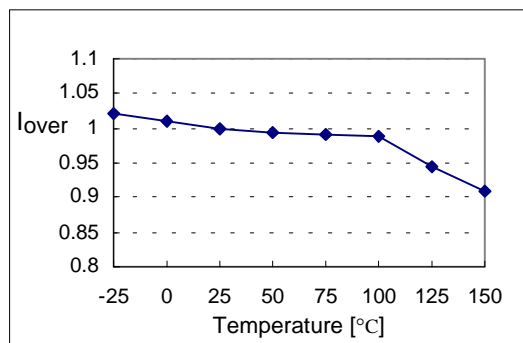


Figure 4. Peak Current Limit

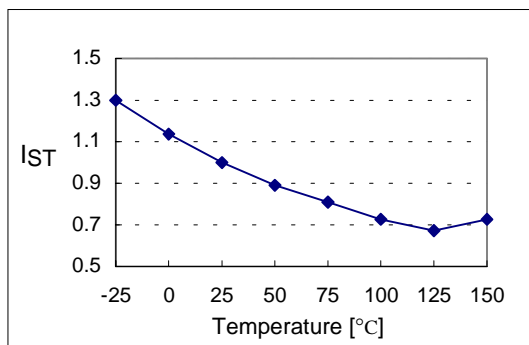


Figure 5. Start up Current

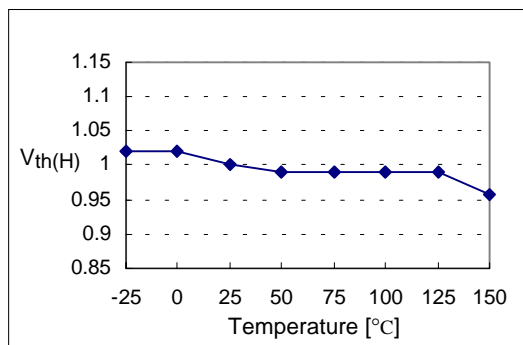


Figure 6. Start Threshold Voltage

## Typical Performance Characteristics (Continued)

(These characteristic graphs are normalized at Ta=25°C)

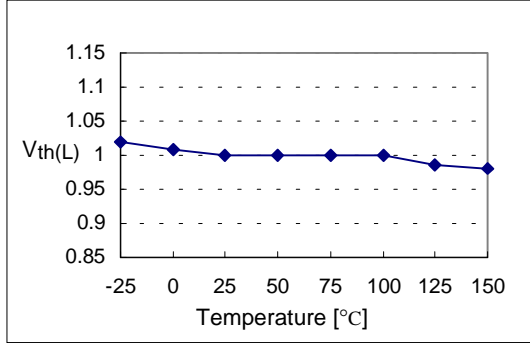


Figure 7. Stop Threshold Voltage

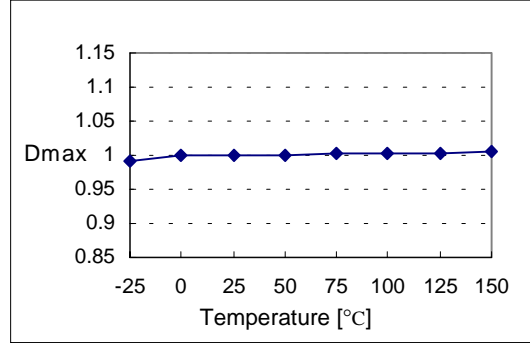


Figure 8. Maximum Duty Cycle

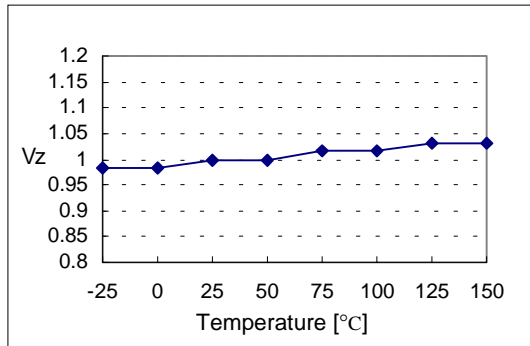


Figure 9. VCC Zener Voltage

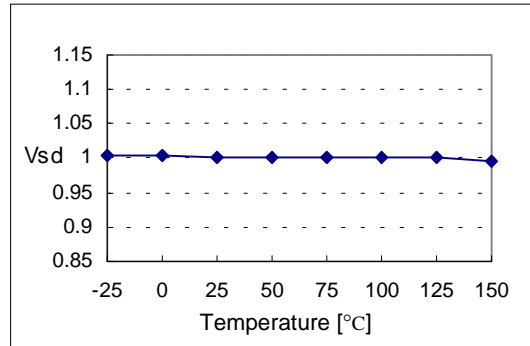


Figure 10. Shutdown Feedback Voltage

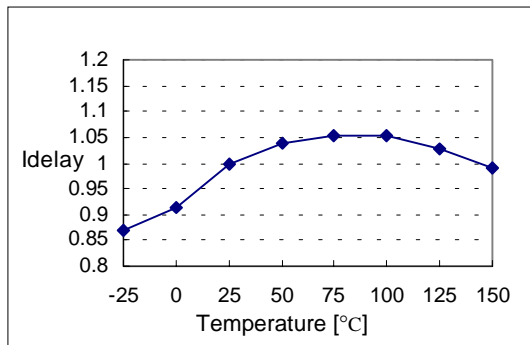


Figure 11. Shutdown Delay Current

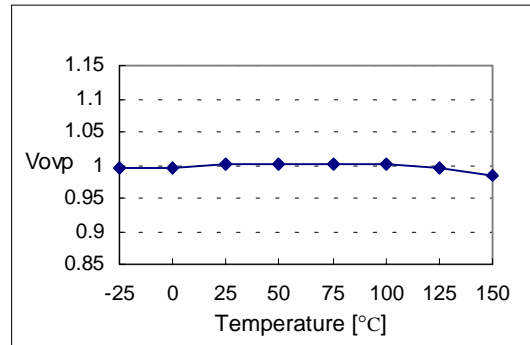


Figure 12. Over Voltage Protection

## Typical Performance Characteristics (Continued)

(These characteristic graphs are normalized at  $T_a=25^\circ\text{C}$ )

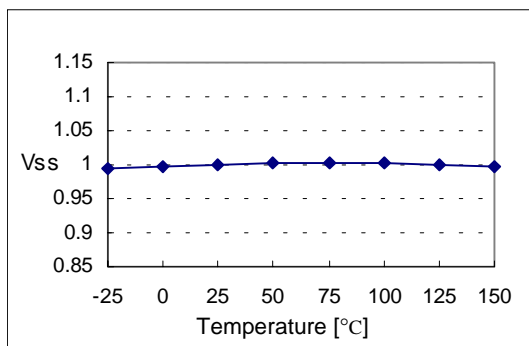


Figure 13. Soft Start Voltage

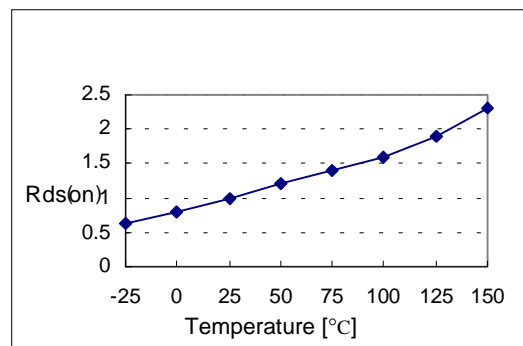
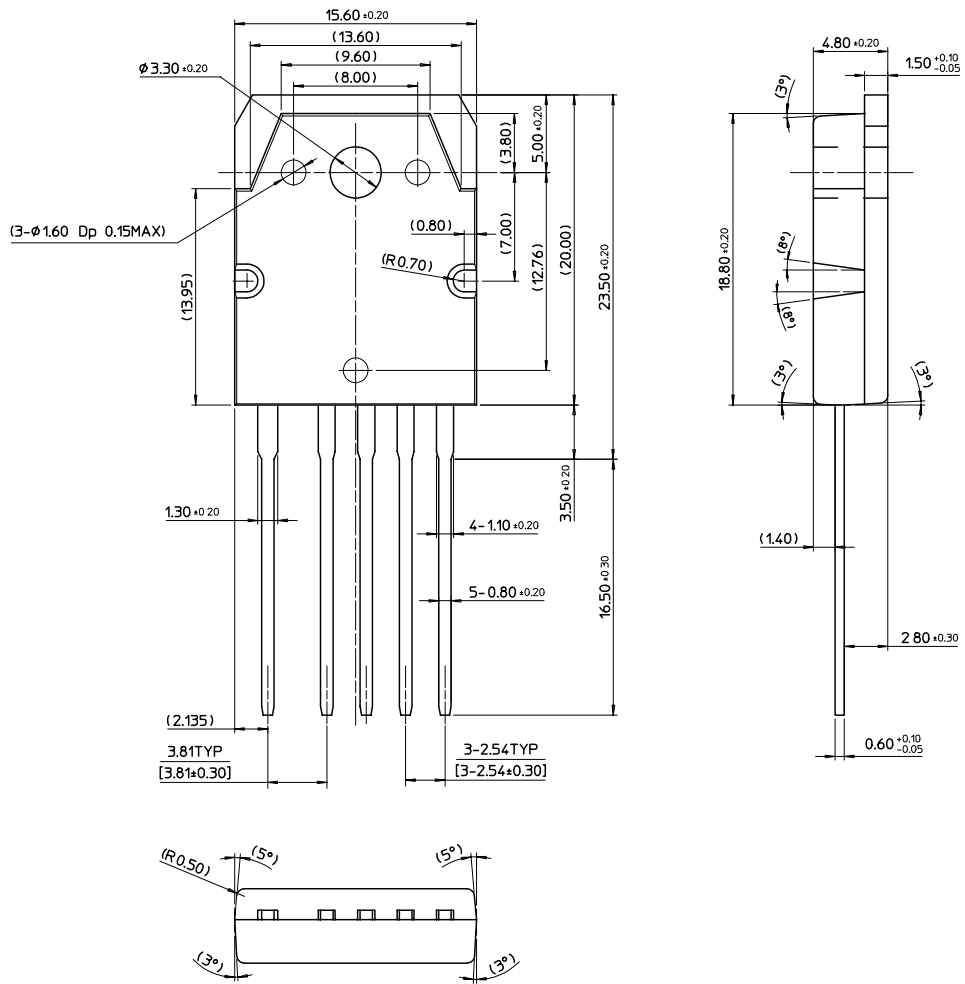


Figure 14. Static Drain-Source on Resistance



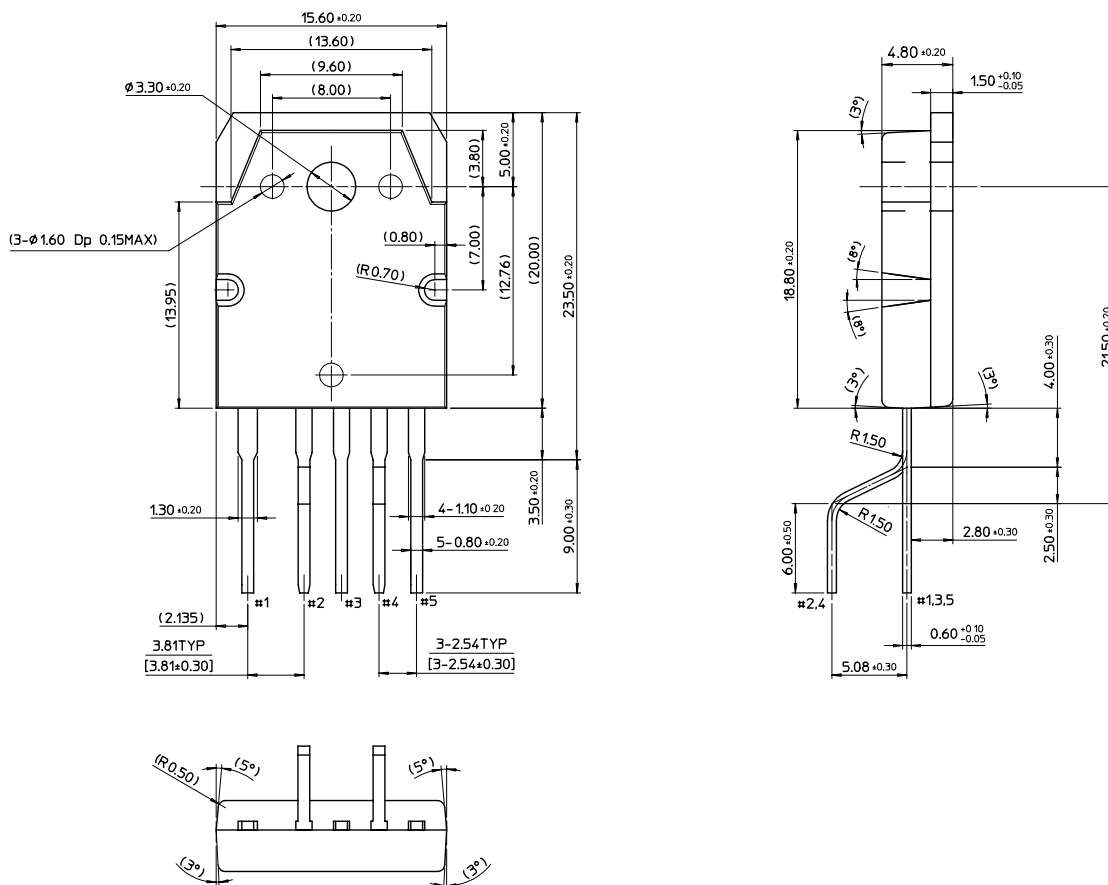
# Package Dimensions

## TO-3P-5L



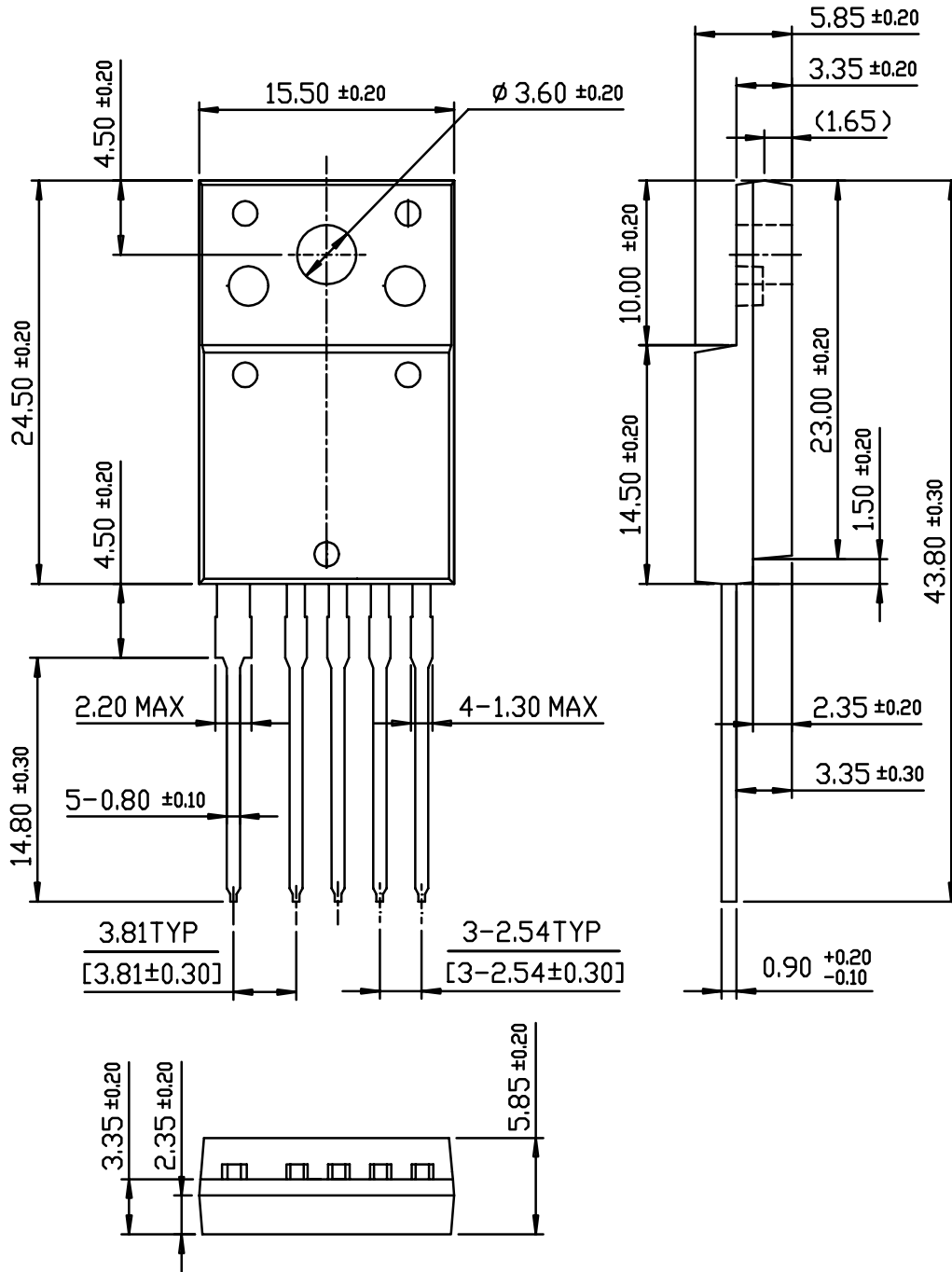
Package Dimensions (Continued)

TO-3P-5L (Forming)



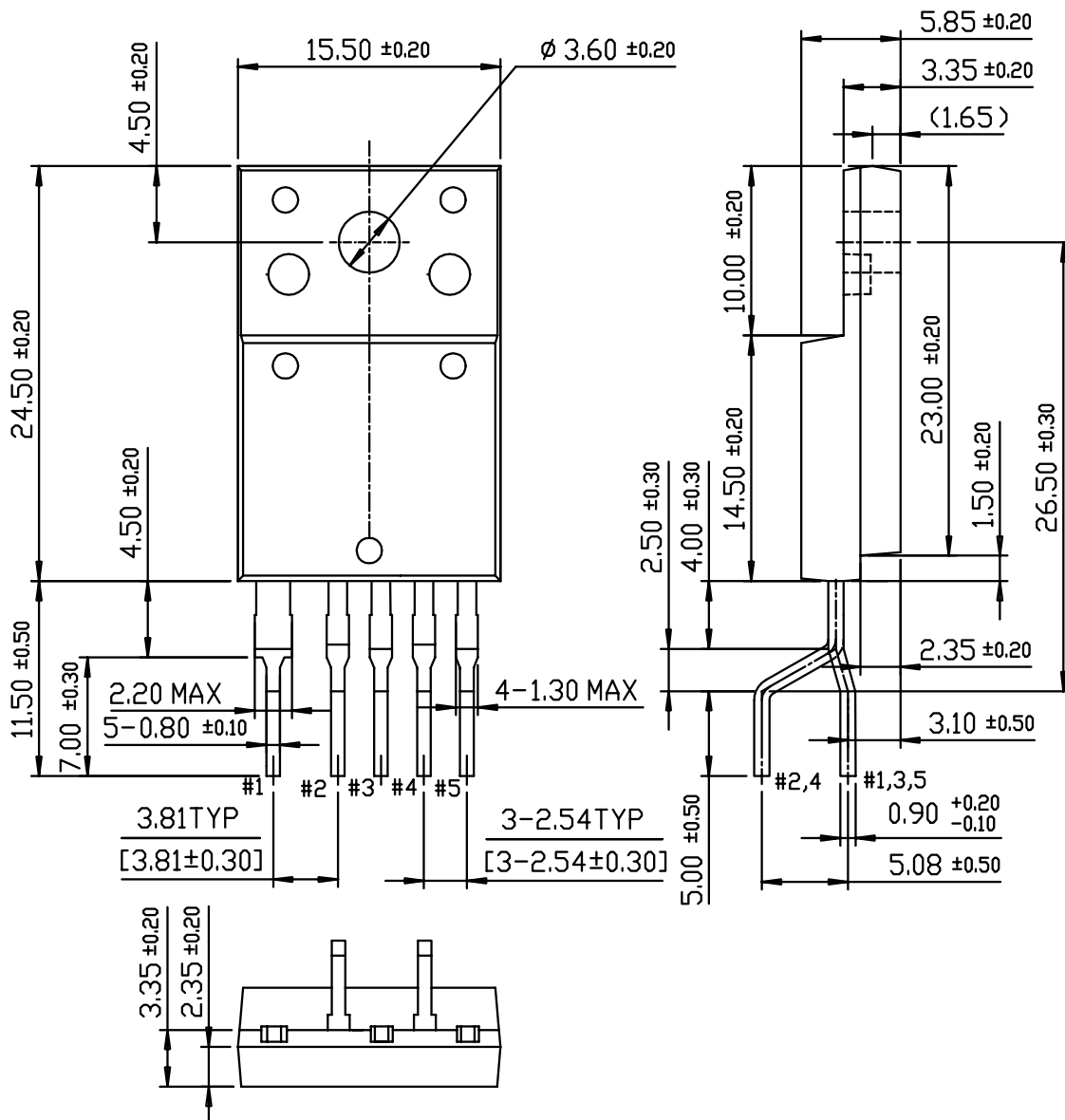
Package Dimensions (Continued)

TO-3PF-5L



Package Dimensions (Continued)

TO-3PF-5L(Forming)



## Ordering Information

| Product Number   | Package            | Rating   | Fosc   | Latch/Auto        |
|------------------|--------------------|----------|--------|-------------------|
| KA1M0680B-TU     | TO-3P-5L           | 800V, 6A | 67kHz  | Latch up mode     |
| KA1M0680B-YDTU   | TO-3P-5L(Forming)  |          |        |                   |
| KA1M0680RB-TU    | TO-3P-5L           | 800V, 6A | 67kHz  | Auto restart mode |
| KA1M0680RB-YDTU  | TO-3P-5L(Forming)  |          |        |                   |
| KA1H0680B-TU     | TO-3P-5L           | 800V, 6A | 100kHz | Latch up mode     |
| KA1H0680B-YDTU   | TO-3P-5L(Forming)  |          |        |                   |
| KA1H0680RFB-TU   | TO-3PF-5L          | 800V, 6A | 100kHz | Auto restart mode |
| KA1H0680RFB-YDTU | TO-3PF-5L(Forming) |          |        |                   |

TU : Non Forming Type

YDTU : Forming Type

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