

# KA5L0565R

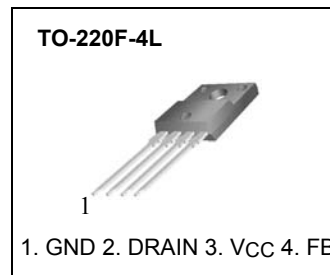
## Fairchild Power Switch(FPS™)

### Features

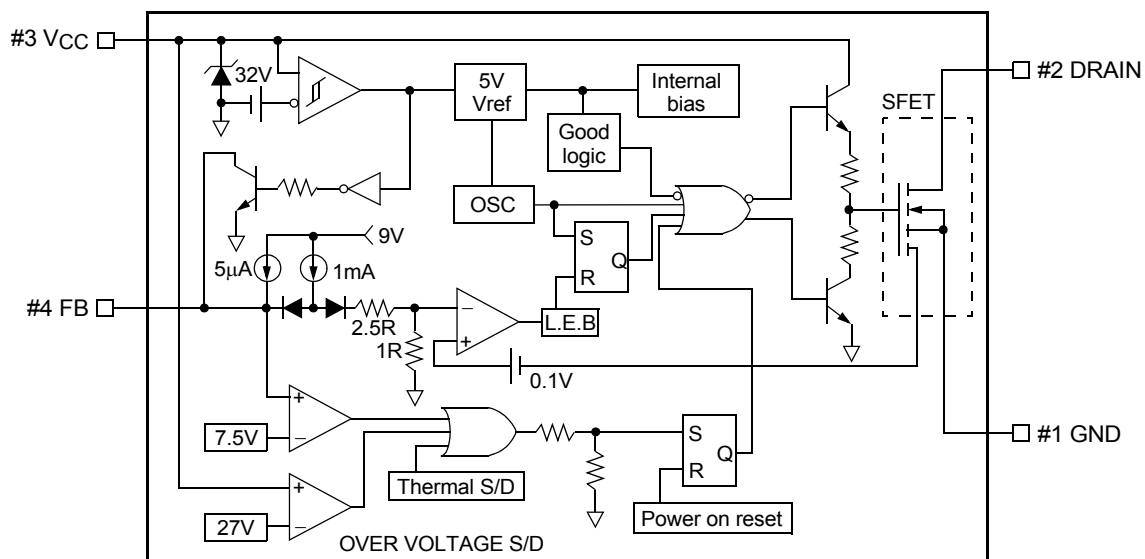
- Precision Fixed Operating Frequency (50kHz)
- Low Start-up Current(Typ. 100uA)
- Pulse by Pulse Current Limiting
- Over Current Protection
- Over Voltage Protection (Min. 25V)
- Internal Thermal Shutdown Function
- Under Voltage Lockout
- Internal High Voltage Sense FET
- Auto-Restart Mode

### 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) consists of a high voltage power SenseFET and a current mode PWM IC. Included PWM controller integrates the fixed frequency oscillator, the under voltage lock-out, the leading edge blanking, the optimized gate turn-on/turn-off driver, the thermal shutdown protection, the over voltage protection, and the temperature compensated precision current sources for the loop compensation and the fault protection circuitry. Compared to a discrete MOSFET and a PWM controller or an RCCsolution, a Fairchild Power Switch(FPS) can reduce the 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 the cost effective design in a flyback converter.



### Internal Block Diagram



Rev.1.0.0

## Absolute Maximum Ratings

| Parameter  | Symbol        | Value            | Unit          |
|--|---------------|------------------|---------------|
| Drain-Gate Voltage ( $R_{GS}=1M\Omega$ )                                 | $V_{DGR}$     | 650              | V             |
| Gate-Source (GND) Voltage  | $V_{GS}$      | $\pm 30$         | V             |
| Drain Current Pulsed <sup>(2)</sup>                                      | $I_{DM}$      | 20               | ADC           |
| Single Pulsed Avalanche Current <sup>(3)</sup> ( Energy <sup>(2)</sup> ) | $I_{AS}(EAS)$ | 13(400)          | A(mJ)         |
| Continuous Drain Current ( $T_C=25^\circ C$ )                            | $I_D$         | 5.0              | ADC           |
| Continuous Drain Current ( $T_C=100^\circ C$ )                           | $I_D$         | 3.5              | ADC           |
| Maximum Supply Voltage   | $V_{CC,MAX}$  | 30               | V             |
| Input Voltage Range  | $V_{FB}$      | -0.3 to $V_{SD}$ | V             |
| Total Power Dissipation  | $P_D$         | 38               | W             |
|  | Darting       | 0.3              | W/ $^\circ C$ |
| Operating Ambient Temperature  | $T_A$         | -25 to +85       | $^\circ C$    |
| Storage Temperature  | $T_{STG}$     | -55 to +150      | $^\circ C$    |

### Notes:

- $T_j = 25^\circ C$  to  $150^\circ C$
- Repetitive rating: Pulse width limited by maximum junction temperature
- $L = 30mH$ ,  $V_{DD} = 50V$ ,  $R_G = 27\Omega$ , starting  $T_j = 25^\circ C$

## Electrical Characteristics (SenseFET part)

(Ta=25°C unless otherwise specified)

| Parameter   | Symbol  | Condition   | Min. | Typ. | Max. | Unit |
|---|---------|---|------|------|------|------|
| Drain-Source Breakdown Voltage                      | BVDSS   | VGS=0V, ID=50μA   | 650  | -    | -    | V    |
| Zero Gate Voltage Drain Current                     | IDSS    | VDS=Max., Rating,<br>VGS=0V   | -    | -    | 50   | μA   |
|   |         | VDS=0.8Max., Rating,<br>VGS=0V, TC=125°C  | -    | -    | 200  | μA   |
| Static Drain-Source on Resistance <sup>(Note)</sup> | RDS(ON) | VGS=10V, ID=2.5A  | -    | 1.76 | 2.2  | Ω    |
| Forward Transconductance <sup>(Note)</sup>          | gfs     | VDS=50V, ID=2.5A  | 2.5  | -    | -    | S    |
| Input Capacitance                                   | Ciss    | VGS=0V, VDS=25V,<br>f=1MHz  | -    | 1457 | -    | pF   |
| Output Capacitance                                  | Coss    |   | -    | 130  | -    |      |
| Reverse Transfer Capacitance                        | Crss    |   | -    | 38.8 | -    |      |
| Turn on Delay Time                                  | td(on)  | VDD=0.5BVDSS, ID=5.0A<br>(MOSFET switching<br>time are essentially<br>independent of<br>operating temperature)          | -    | -    | 60   | nS   |
| Rise Time   | tr      |   | -    | -    | 150  |      |
| Turn Off Delay Time                                 | td(off) |   | -    | -    | 300  |      |
| Fall Time   | tf      |   | -    | -    | 130  |      |
| Total Gate Charge<br>(Gate-Source+Gate-Drain)       | Qg      | VGS=10V, ID=5.0A,<br>VDS=0.5BVDSS (MOSFET<br>switching time are<br>essentially independent of<br>operating temperature) | -    | -    | 56   | nC   |
| Gate-Source Charge                                  | Qgs     |   | -    | 10.3 | -    |      |
| Gate-Drain (Miller) Charge                          | Qgd     |   | -    | 22.3 | -    |      |

### Note:

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

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

**Electrical Characteristics (Control Part)** (Continued)

(Ta=25°C unless otherwise specified)

| Parameter  | Symbol              | Condition               | Min. | Typ. | Max. | Unit  |
|--|---------------------|-------------------------|------|------|------|-------|
| <b>UVLO SECTION</b>                              |                     |                         |      |      |      |       |
| Start Threshold Voltage                          | VSTART              | -                       | 14   | 15   | 16   | V     |
| Stop Threshold Voltage                           | VSTOP               | After turn on           | 8.4  | 9    | 9.6  | V     |
| <b>OSCILLATOR SECTION</b>                        |                     |                         |      |      |      |       |
| Initial Accuracy                                 | FOSC                | <b>KA5L0565R</b>        | 45   | 50   | 55   | kHz   |
| Frequency Change With Temperature <sup>(2)</sup> | $\Delta F/\Delta T$ | -25°C ≤ Ta ≤ +85°C      | -    | ±5   | ±10  | %     |
| Maximum Duty Cycle                               | Dmax                | <b>KA5L0565R</b>        | 72   | 77   | 82   | %     |
| <b>FEEDBACK SECTION</b>                          |                     |                         |      |      |      |       |
| Feedback Source Current                          | IFB                 | Ta=25°C, 0V ≤ Vfb ≤ 3V  | 0.7  | 0.9  | 1.1  | mA    |
| Shutdown Feedback Voltage                        | VSD                 | -                       | 6.9  | 7.5  | 8.1  | V     |
| Shutdown Delay Current                           | Idelay              | Ta=25°C, 5V ≤ Vfb ≤ VSD | 4.0  | 5.0  | 6.0  | μA    |
| <b>REFERENCE SECTION</b>                         |                     |                         |      |      |      |       |
| Output Voltage <sup>(1)</sup>                    | Vref                | Ta=25°C                 | 4.80 | 5.00 | 5.20 | V     |
| Temperature Stability <sup>(1)(2)</sup>          | Vref/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   | 1.76 | 2.00 | 2.24 | A     |
| <b>PROTECTION SECTION</b>                        |                     |                         |      |      |      |       |
| Thermal Shutdown Temperature (Tj) <sup>(1)</sup> | TSD                 | -                       | 140  | 160  | -    | °C    |
| Over Voltage Protection Voltage                  | VOVP                | -                       | 25   | 27   | 29   | V     |
| <b>TOTAL DEVICE SECTION</b>                      |                     |                         |      |      |      |       |
| Start Up Current                                 | I <sub>START</sub>  | VCC=14V                 | -    | 100  | 170  | uA    |
| Operating Supply Current<br>(Control Part Only)  | I <sub>OP</sub>     | Ta=25°C                 | -    | 7    | 12   | mA    |

**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  $T_a=25^\circ\text{C}$ )

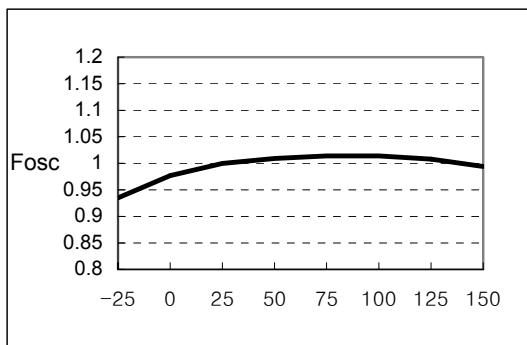


Figure 1. Operating Frequency

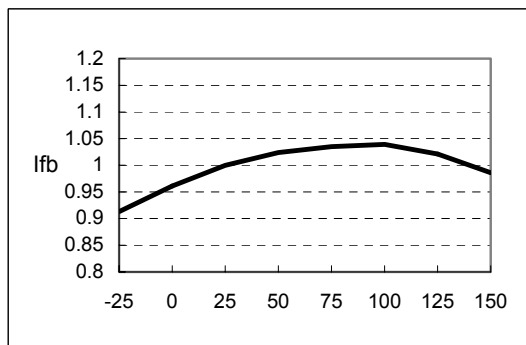


Figure 2. Feedback Source Current

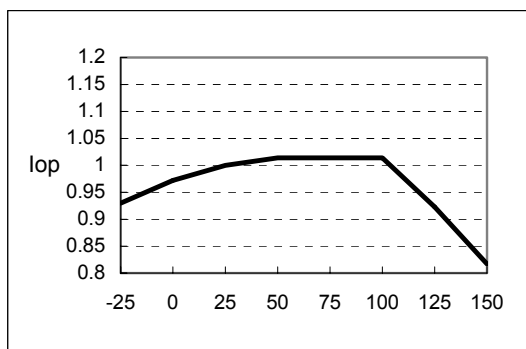


Figure 3. Operating Supply Current

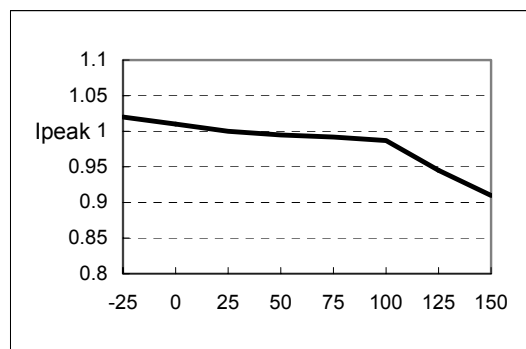


Figure 4. Peak Current Limit

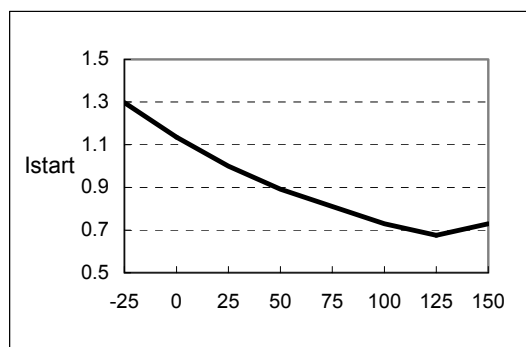


Figure 5. Start up Current

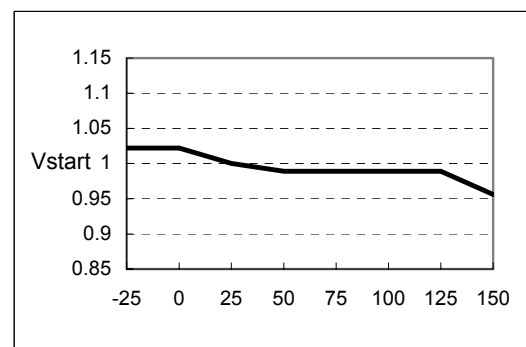
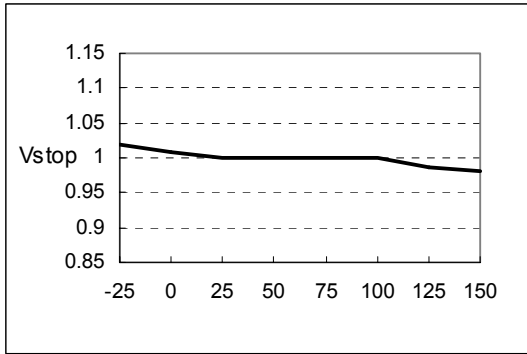


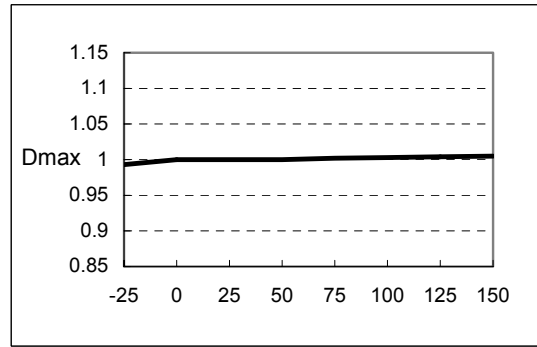
Figure 6. Start Threshold Voltage

**Typical Performance Characteristics** (Continued)

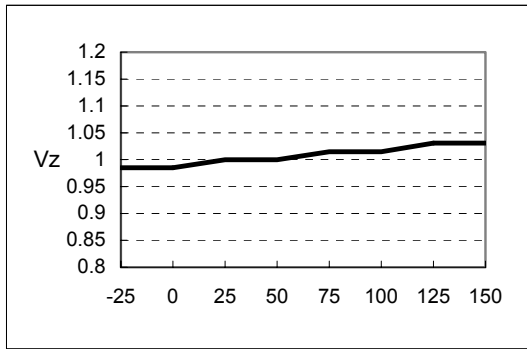
(These characteristic graphs are normalized at  $T_a=25^\circ\text{C}$ )



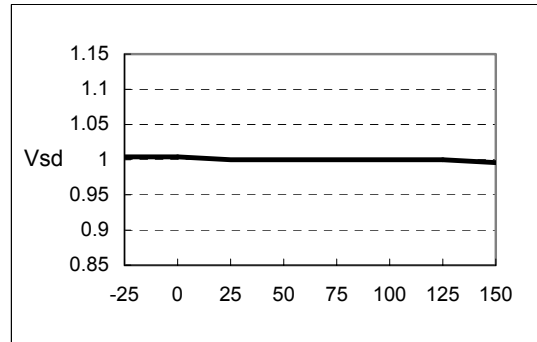
**Figure 7. Stop Threshold Voltage**



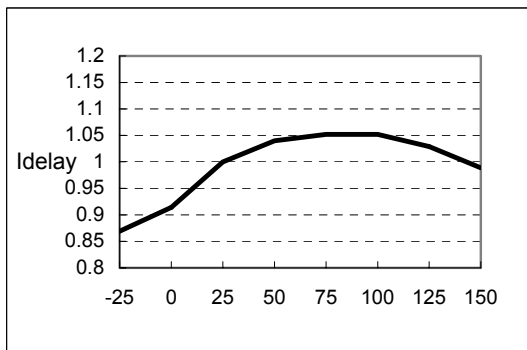
**Figure 8. Maximum Duty Cycle**



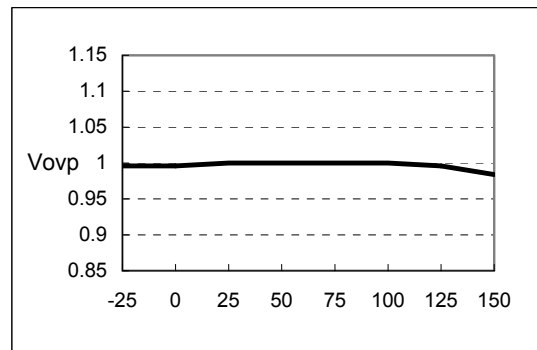
**Figure 9. VCC Zener Voltage**



**Figure 10. Shutdown Feedback Voltage**



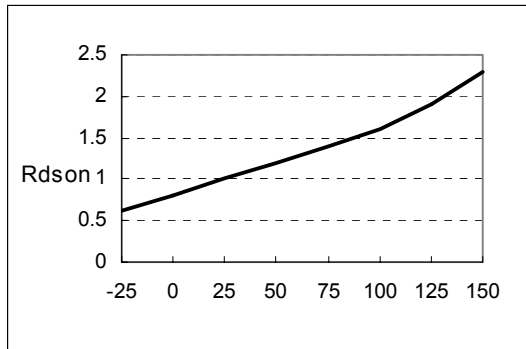
**Figure 11. Shutdown Delay Current**



**Figure 12. Over Voltage Protection**

**Typical Performance Characteristics** (Continued)

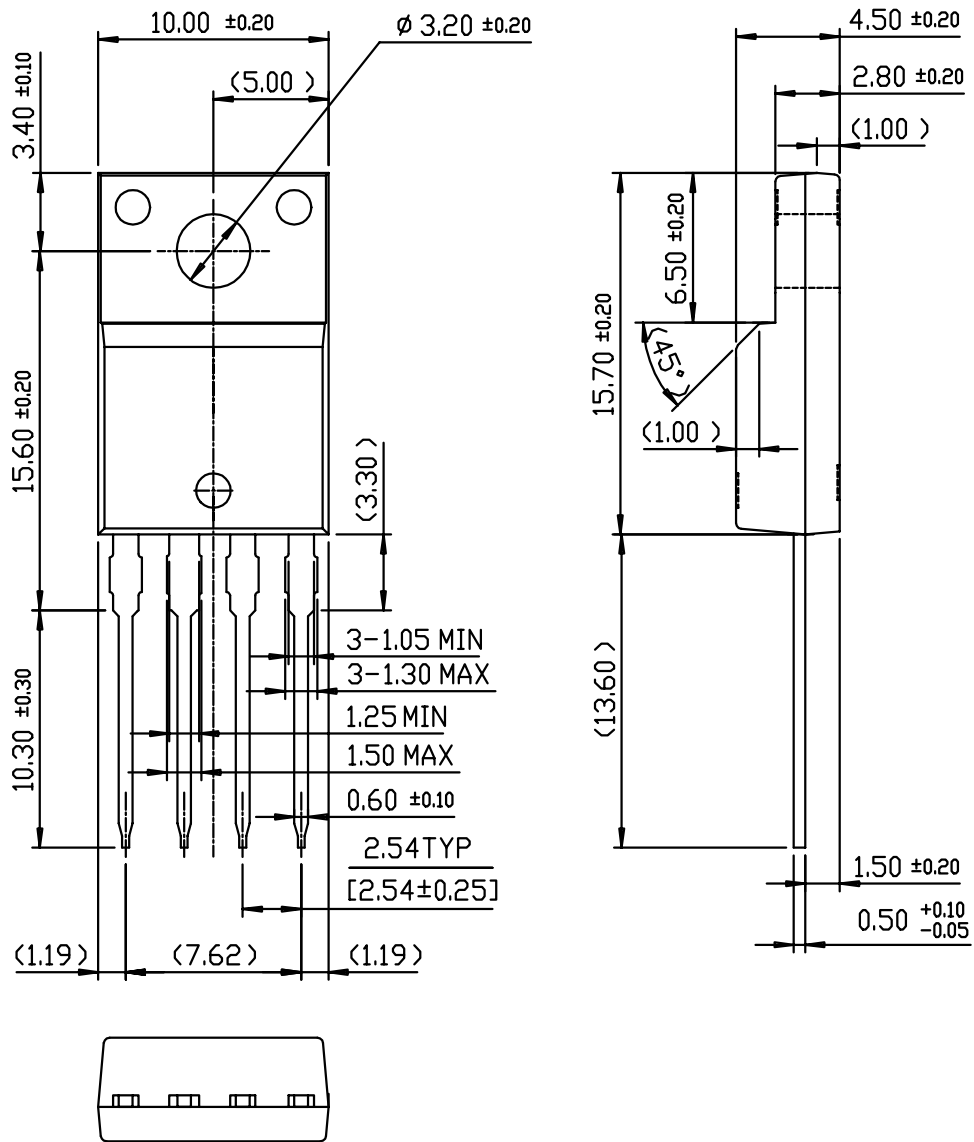
(These characteristic graphs are normalized at  $T_a=25^\circ\text{C}$ )



**Figure 13. Static Drain-Source on Resistance**

# Package Dimensions

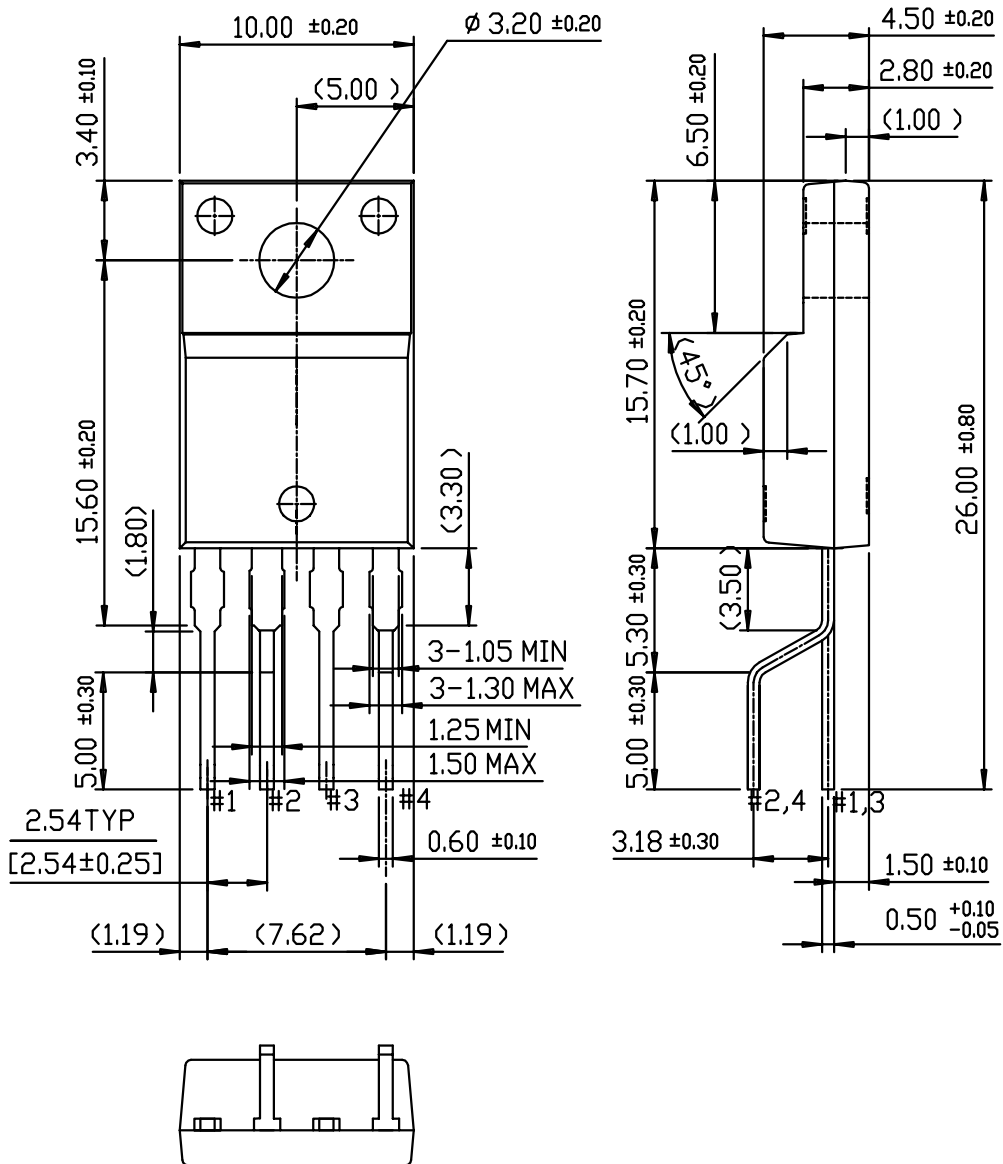
## TO-220F-4L





Package Dimensions (Continued)

TO-220F-4L(Forming)



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## Ordering Information

| Product Number | Package             | Rating   | Fosc  |
|----------------|---------------------|----------|-------|
| KA5L0565RTU    | TO-220F-4L          | 650V, 5A | 50kHz |
| KA5L0565RYDTU  | TO-220F-4L(Forming) |          |       |

TU : Non Forming Type

YDTU : Forming Type

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.