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# KA5L0565R

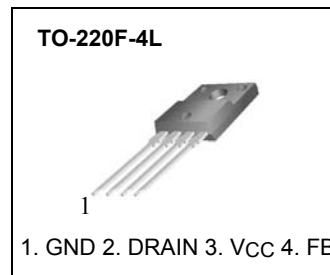
## Fairchild Power Switch(FPS™)

### Features

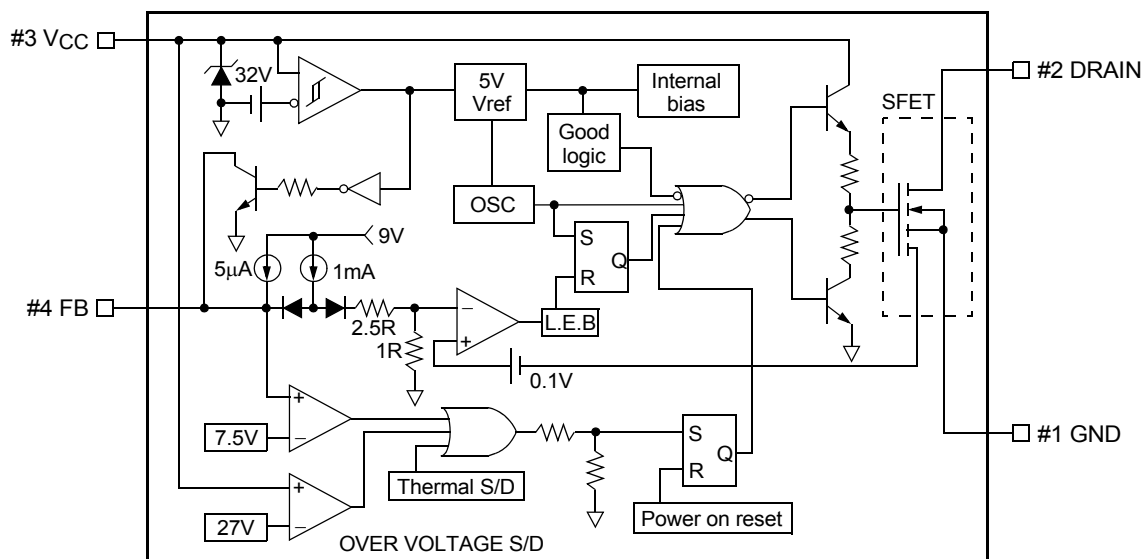
- Precision Fixed Operating Frequency (50kHz)
- Low Start-up Current(Typ. 100uA)
- Pulse by Pulse Current Limiting
- Over Current Protection
- Over Voltage Protection (Min. 25V)
- Internal Thermal Shutdown Function
- Under Voltage Lockout
- Internal High Voltage Sense FET
- Auto-Restart Mode

### 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 RCC solution, 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



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

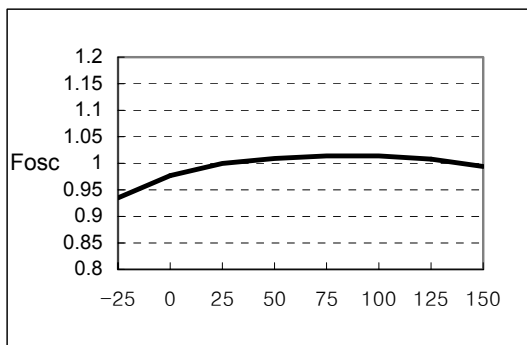


Figure 1. Operating Frequency

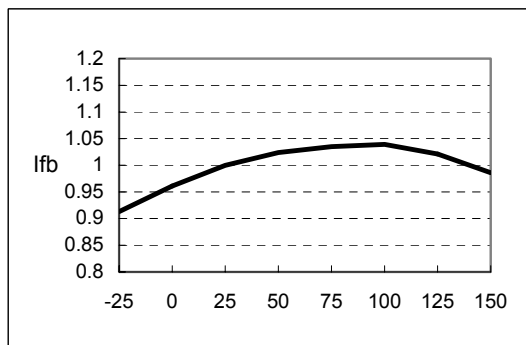


Figure 2. Feedback Source Current

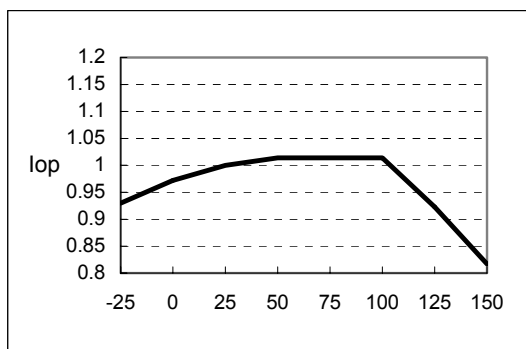


Figure 3. Operating Supply Current

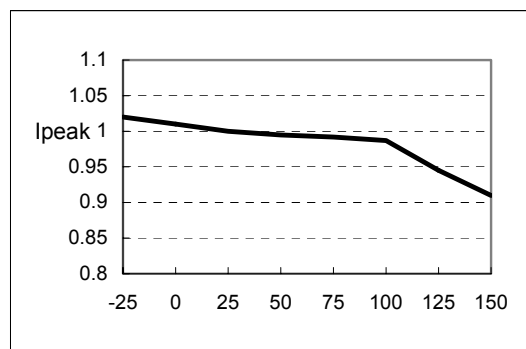


Figure 4. Peak Current Limit

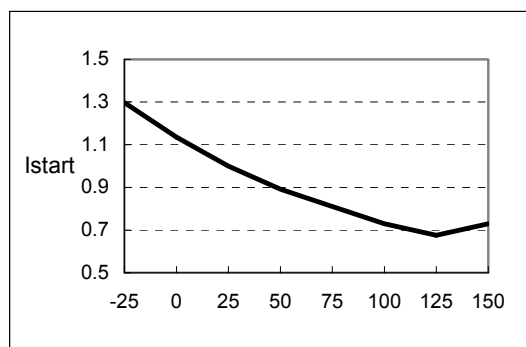


Figure 5. Start up Current

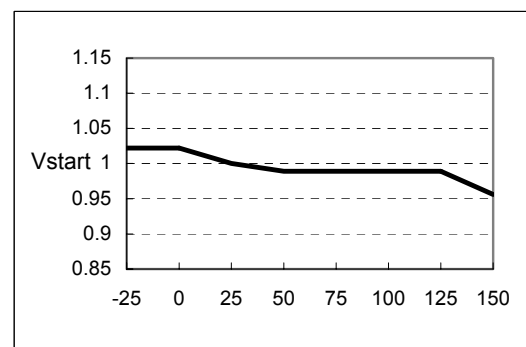


Figure 6. Start Threshold Voltage

## Typical Performance Characteristics (Continued)

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

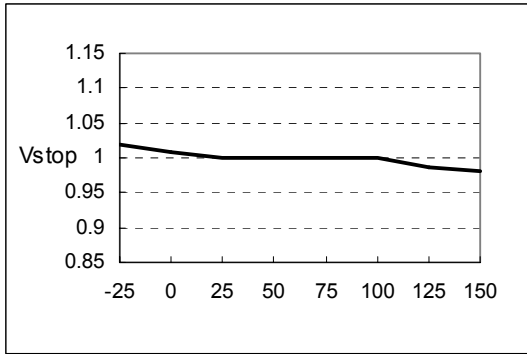


Figure 7. Stop Threshold Voltage

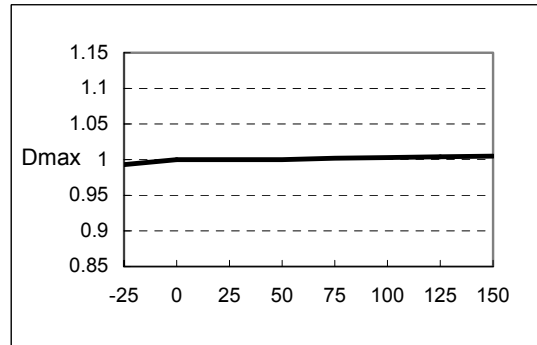


Figure 8. Maximum Duty Cycle

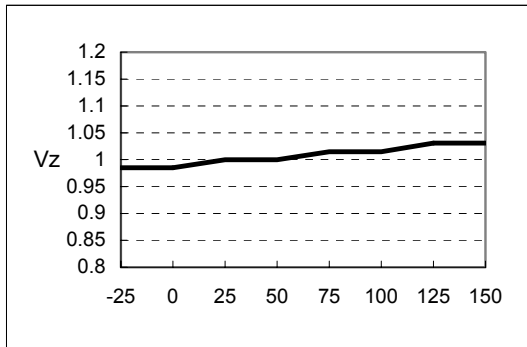


Figure 9. VCC Zener Voltage

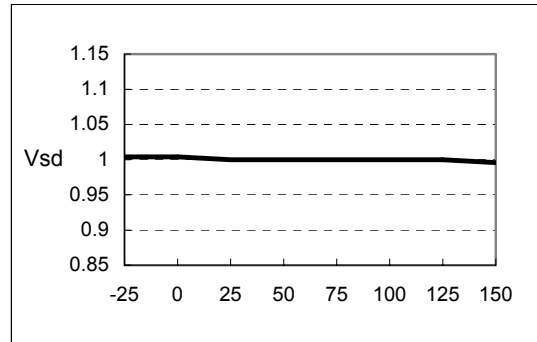


Figure 10. Shutdown Feedback Voltage

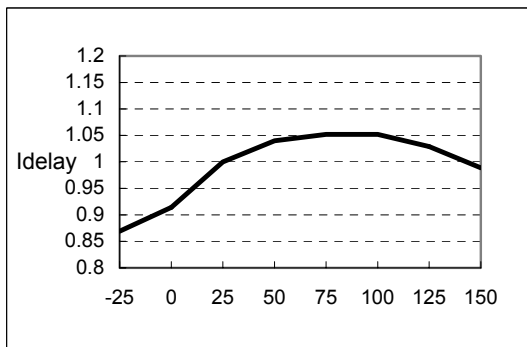


Figure 11. Shutdown Delay Current

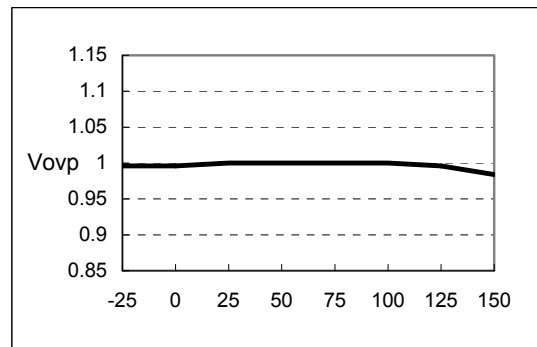
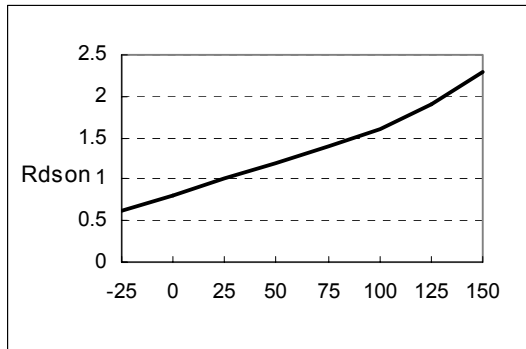


Figure 12. Over Voltage Protection

**Typical Performance Characteristics** (Continued)

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

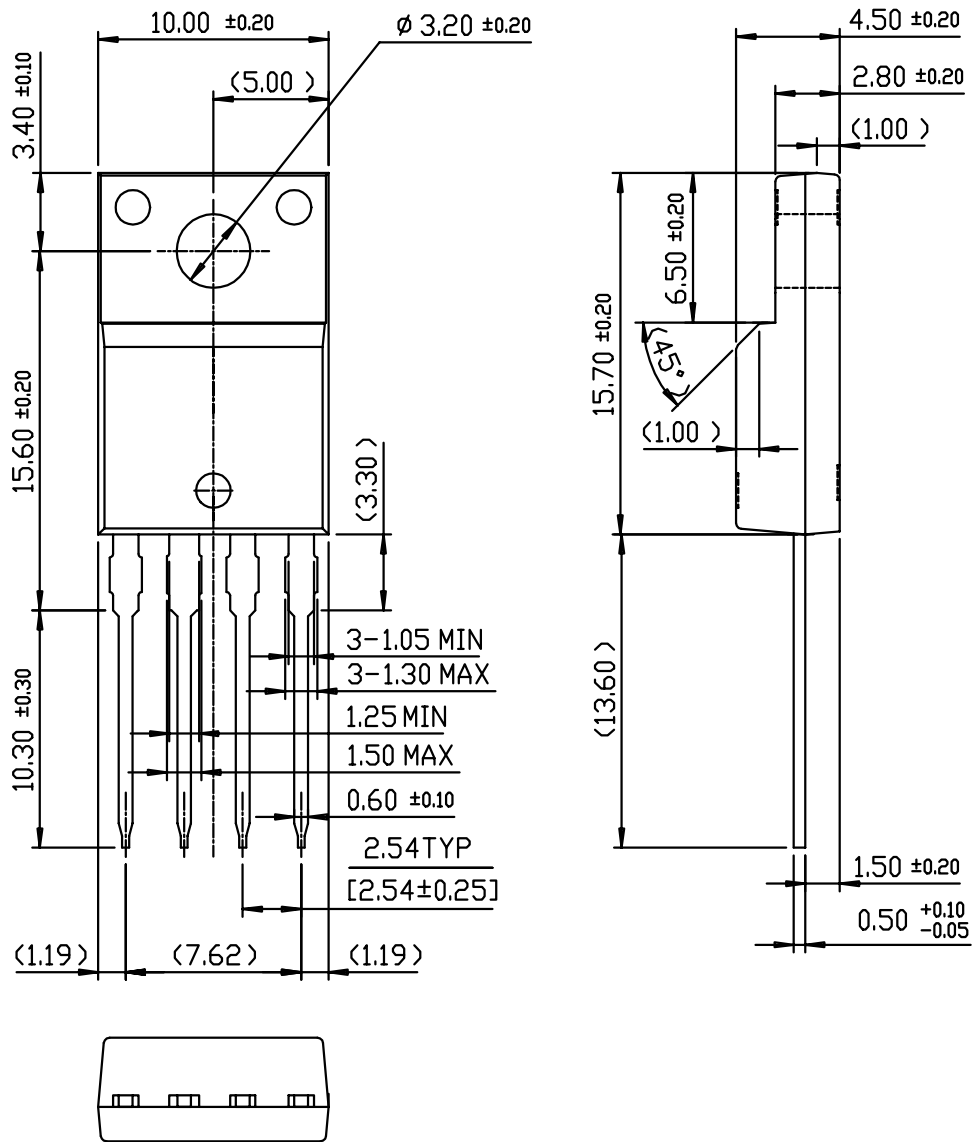


**Figure 13. Static Drain-Source on Resistance**



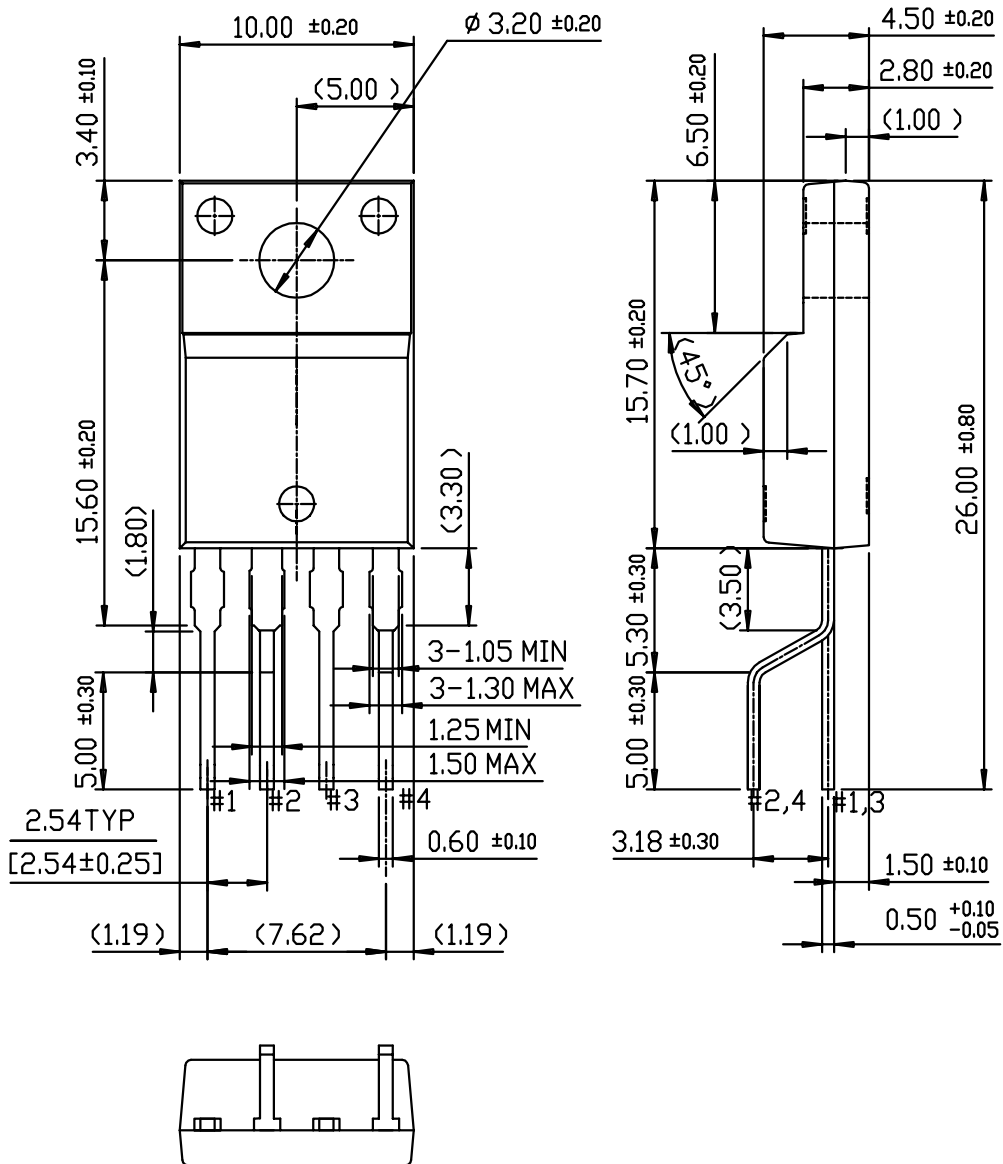
# Package Dimensions

## 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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