

KA5x02xx-SERIES

KA5H0265RC, KA5M0265R, KA5L0265R,
KA5H02659RN/KA5M02659RN, KA5H0280R,
KA5M0280R

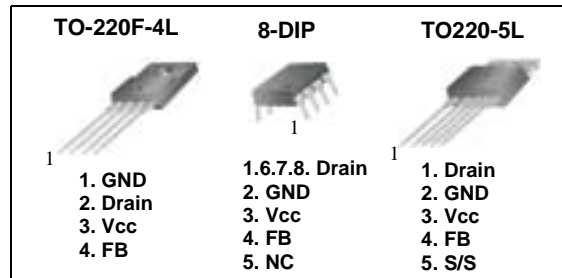
Fairchild Power Switch(FPS)

Features

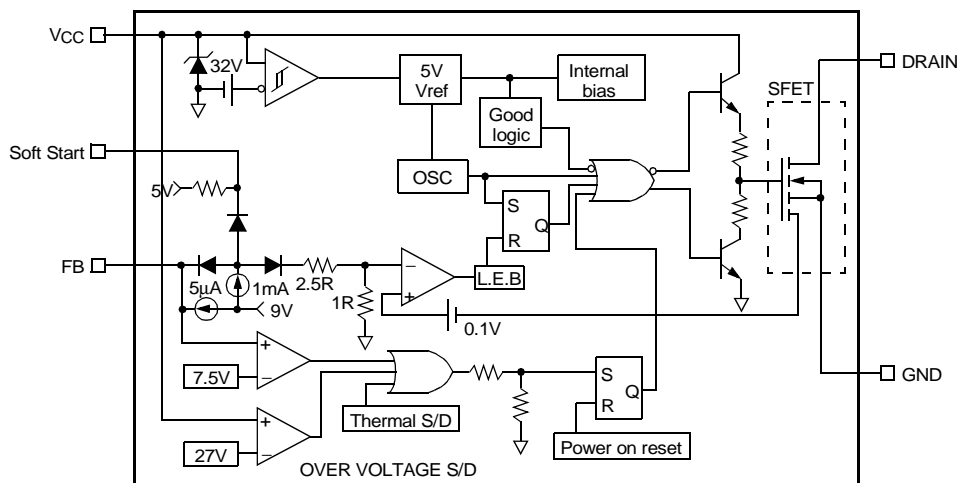
- Precision fixed operating frequency (100/67/50KHz)
- Pulse by pulse current limiting
- Over current protection
- Over voltage protection (Min. 25V)
- Internal thermal shutdown function
- Under voltage lockout
- Internal high voltage sense FET
- Auto-restart mode

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) consist of high voltage power SenseFET and current mode PWM IC. Included 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, 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, 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



Absolute Maximum Ratings

(Ta=25°C, unless otherwise specified)

| Characteristic | Symbol | Value | Unit |
|--|---------------------|-------------------------|------|
| KA5x0265xRx | | | |
| Maximum Drain Voltage | V _{D,MAX} | 650 | V |
| Drain-Gate Voltage (R _{GS} =1MΩ) | V _{DGR} | 650 | V |
| Gate-Source (GND) Voltage | V _{GS} | ±30 | V |
| Drain Current Pulsed ⁽¹⁾ | I _{DM} | 8.0 | ADC |
| Continuous Drain Current (T _C =25°C) | I _D | 2.0 | ADC |
| Continuous Drain Current (T _C =100°C) | I _D | 1.3 | ADC |
| Single Pulsed Avalanche Energy ⁽²⁾ | E _{AS} | 68 | mJ |
| Maximum Supply Voltage | V _{CC,MAX} | 30 | V |
| Analog Input Voltage Range | V _{FB} | -0.3 to V _{SD} | V |
| Total Power Dissipation | P _D | 42 | W |
| | Derating | 0.33 | W/°C |
| Operating Junction Temperature. | T _J | +160 | °C |
| Operating Ambient Temperature. | T _A | -25 to +85 | °C |
| Storage Temperature Range. | T _{STG} | -55 to +150 | °C |
| KA5x0280R | | | |
| Maximum Drain Voltage | V _{D,MAX} | 800 | V |
| Drain-Gate Voltage (R _{GS} =1MΩ) | V _{DGR} | 800 | V |
| Gate-Source (GND) Voltage | V _{GS} | ±30 | V |
| Drain Current Pulsed ⁽¹⁾ | I _{DM} | 8.0 | ADC |
| Continuous Drain Current (T _C =25°C) | I _D | 2.0 | ADC |
| Continuous Drain Current (T _C =100°C) | I _D | 1.3 | ADC |
| Single Pulsed Avalanche Energy ⁽²⁾ | E _{AS} | 90 | mJ |
| Maximum Supply Voltage | V _{CC,MAX} | 30 | V |
| Analog Input Voltage Range | V _{FB} | -0.3 to V _{SD} | V |
| Total Power Dissipation | P _D | 35 | W |
| | Derating | 0.28 | W/°C |
| Operating Junction Temperature. | T _J | +160 | °C |
| Operating Ambient Temperature. | T _A | -25 to +85 | °C |
| Storage Temperature Range. | T _{STG} | -55 to +150 | °C |

Note:

1. Repetitive rating: Pulse width limited by maximum junction temperature
2. L=51mH, starting T_J=25°C

Electrical Characteristics (SFET part)

(Ta=25°C unless otherwise specified)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---------|---|------|------|------|------|
| KA5x0265xRx | | | | | | |
| Drain-source breakdown voltage | BVDSS | VGS=0V, ID=50μA | 650 | - | - | V |
| Zero gate voltage drain current | IDSS | VDS=Max. Rating, VGS=0V | - | - | 50 | μA |
| | | VDS=0.8Max. Rating, VGS=0V, TC=125°C | - | - | 200 | μA |
| Static drain-source on resistance ^(note) | RDS(ON) | VGS=10V, ID=0.5A | - | 5.0 | 6.0 | Ω |
| Forward transconductance ^(note) | gfs | VDS=50V, ID=0.5A | 1.5 | 2.5 | - | S |
| Input capacitance | Ciss | VGS=0V, VDS=25V, f=1MHz | - | 550 | - | pF |
| Output capacitance | Coss | | - | 38 | - | |
| Reverse transfer capacitance | Crss | | - | 17 | - | |
| Turn on delay time | td(on) | VDD=0.5BVDSS, ID=1.0A (MOSFET switching time are essentially independent of operating temperature) | - | 20 | - | nS |
| Rise time | tr | | - | 15 | - | |
| Turn off delay time | td(off) | | - | 55 | - | |
| Fall time | tf | | - | 25 | - | |
| Total gate charge (gate-source+gate-drain) | Qg | VGS=10V, ID=1.0A, VDS=0.5BVDSS (MOSFET switching time are essentially independent of operating temperature) | - | - | 35 | nC |
| Gate-source charge | Qgs | | - | 3 | - | |
| Gate-drain (Miller) charge | Qgd | | - | 12 | - | |
| KA5x0280R | | | | | | |
| Drain-source breakdown voltage | BVDSS | VGS=0V, ID=50μA | 800 | - | - | V |
| Zero gate voltage drain current | IDSS | VDS=Max. Rating, VGS=0V | - | - | 50 | μA |
| | | VDS=0.8Max. Rating, VGS=0V, TC=125°C | - | - | 200 | μA |
| Static drain-source on resistance ^(note) | RDS(ON) | VGS=10V, ID=0.5A | - | 5.6 | 7.0 | Ω |
| Forward transconductance ^(note) | gfs | VDS=50V, ID=0.5A | 1.5 | 2.5 | - | S |
| Input capacitance | Ciss | VGS=0V, VDS=25V, f=1MHz | - | 250 | - | pF |
| Output capacitance | Coss | | - | 52 | - | |
| Reverse transfer capacitance | Crss | | - | 25 | - | |
| Turn on delay time | td(on) | VDD=0.5BVDSS, ID=1.0A (MOSFET switching time are essentially independent of operating temperature) | - | 21 | - | nS |
| Rise time | tr | | - | 28 | - | |
| Turn off delay time | td(off) | | - | 77 | - | |
| Fall time | tf | | - | 24 | - | |
| Total gate charge (gate-source+gate-drain) | Qg | VGS=10V, ID=1.0A, VDS=0.5BVDSS (MOSFET switching time are essentially independent of operating temperature) | - | - | 60 | nC |
| Gate-source charge | Qgs | | - | 15 | - | |
| Gate-drain (Miller) charge | Qgd | | - | 20 | - | |

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 |
|---|----------------------|---|------|------|------|-------|
| UVLO SECTION | | | | | | |
| Start Threshold Voltage | V _{START} | V _{FB} =GND | 14 | 15 | 16 | V |
| Stop Threshold Voltage | V _{STOP} | V _{FB} =GND | 8.4 | 9 | 9.6 | V |
| OSCILLATOR SECTION | | | | | | |
| Initial accuracy | F _{OSC} | KA5H0265xRx KA5H0280R | 90 | 100 | 110 | kHz |
| Initial accuracy | F _{OSC} | KA5M0265xRx KA5M0280R | 61 | 67 | 73 | kHz |
| Initial accuracy | F _{OSC} | KA5L0265R | 45 | 50 | 55 | kHz |
| Frequency change with temperature ⁽²⁾ | ΔF/ΔT | -25°C ≤ Ta ≤ +85°C | - | ±5 | ±10 | % |
| Maximum duty cycle | D _{max} | KA5H0265xRx KA5H0280R | 62 | 67 | 72 | % |
| Maximum duty cycle | D _{max} | KA5M0265xRx KA5M0280R KA5L0265R | 72 | 77 | 82 | % |
| FEEDBACK SECTION | | | | | | |
| Feedback source current | I _{FB} | Ta=25°C, 0V ≤ V _{fb} ≤ 3V | 0.7 | 0.9 | 1.1 | mA |
| Shutdown feedback voltage | V _{SD} | V _{fb} ≤ 6.5V | 6.9 | 7.5 | 8.1 | V |
| Shutdown delay current | I _{delay} | Ta=25°C, 5V ≤ V _{fb} ≤ V _{SD} | 4 | 5 | 6 | μA |
| SOFT START SECTION | | | | | | |
| Soft Start Voltage | V _{SS} | KA5H0265RC | 4.7 | 5.0 | 5.3 | V |
| Soft Start Current | I _{SS} | | 0.8 | 1.0 | 1.2 | mA |
| REFERENCE SECTION | | | | | | |
| Output voltage ⁽¹⁾ | V _{ref} | Ta=25°C | 4.80 | 5.00 | 5.20 | V |
| Temperature Stability ⁽¹⁾⁽²⁾ | V _{ref} /ΔT | -25°C ≤ Ta ≤ +85°C | - | 0.3 | 0.6 | mV/°C |
| CURRENT LIMIT(SELF-PROTECTION)SECTION | | | | | | |
| Peak Current Limit | I _{OVER} | KA5x02659RN | 0.79 | 0.9 | 1.01 | A |
| Peak Current Limit | I _{OVER} | KA5x0265Rx KA5x0280R | 1.05 | 1.2 | 1.34 | A |
| PROTECTION SECTION | | | | | | |
| Over voltage protection | V _{OVP} | V _{CC} ≥ 24V | 25 | 27 | 29 | V |
| Thermal shutdown temperature (T _j) ⁽¹⁾ | T _{SD} | - | 140 | 160 | - | °C |
| TOTAL DEVICE SECTION | | | | | | |
| Start Up Current | I _{START} | V _{CC} =14V | - | 100 | 170 | μA |
| Operating supply current (control part only) | I _{OPR} | V _{CC} ≤ 28 | - | 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 $T_a=25^\circ\text{C}$)

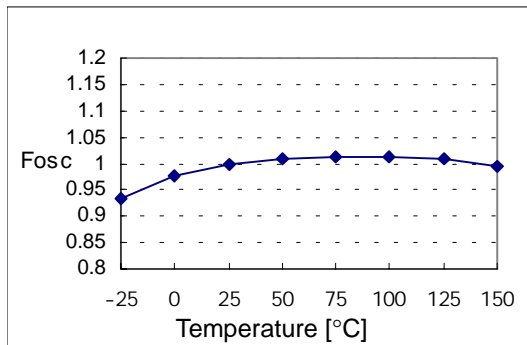


Figure 1. Operating Frequency

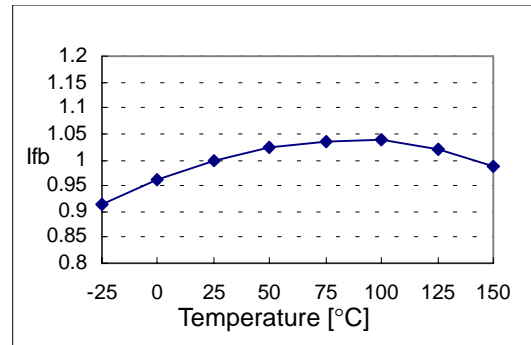


Figure 2. Feedback Source Current

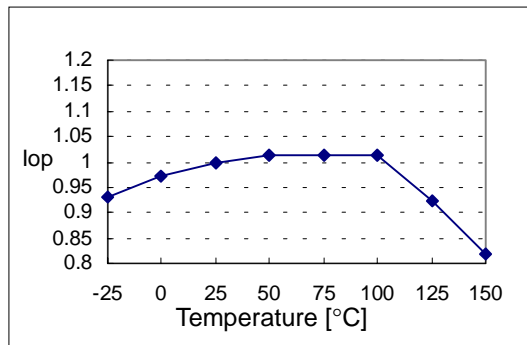


Figure 3. Operating Supply Current

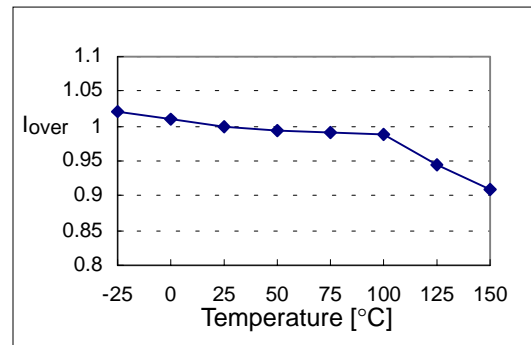


Figure 4. Peak Current Limit

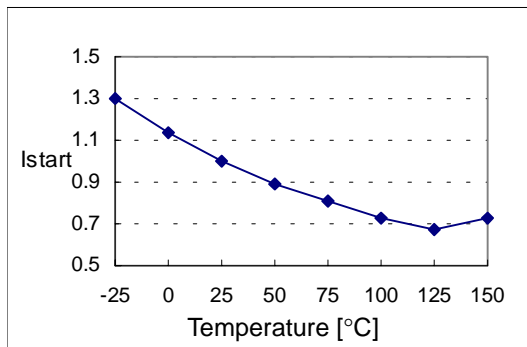


Figure 5. Start up Current

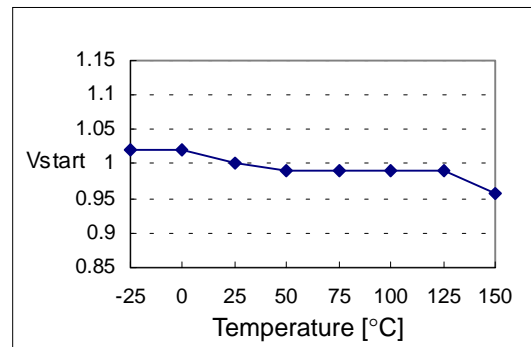


Figure 6. Start Threshold Voltage

Typical Performance Characteristics (Continued)

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

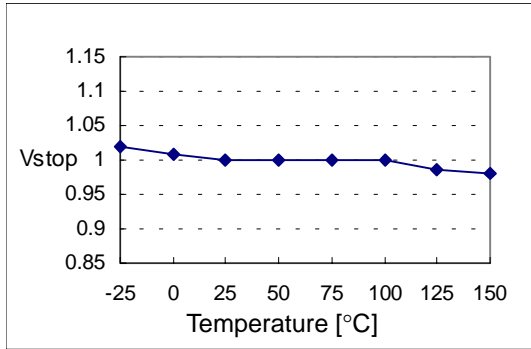


Figure 7. Stop Threshold Voltage

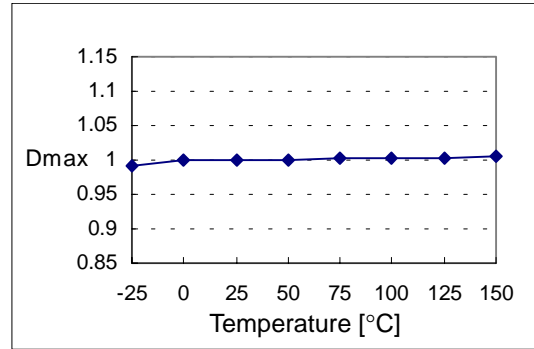


Figure 8. Maximum Duty Cycle

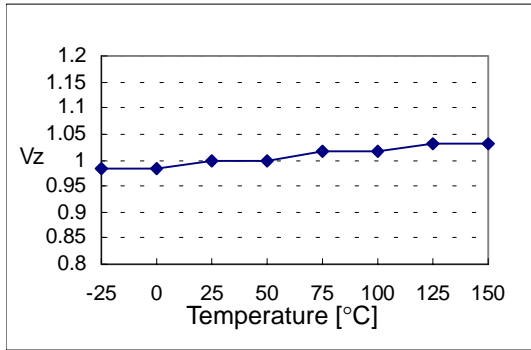


Figure 9. VCC Zener Voltage

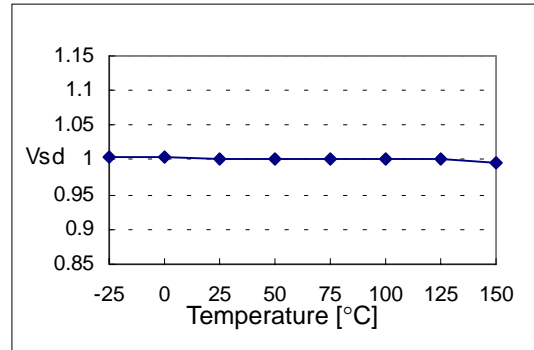


Figure 10. Shutdown Feedback Voltage

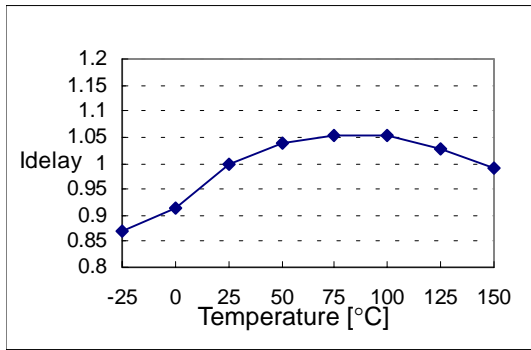


Figure 11. Shutdown Delay Current

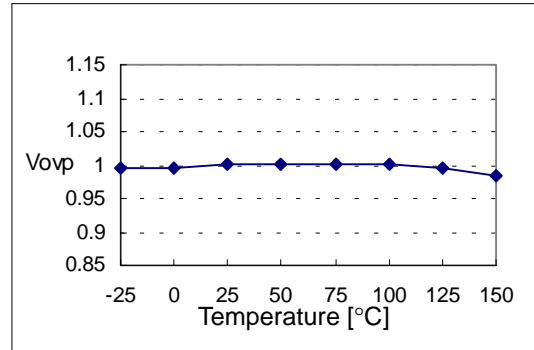


Figure 12. Over Voltage Protection

Typical Performance Characteristics (Continued)

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

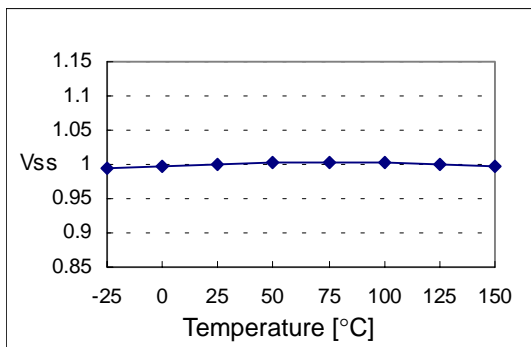


Figure13. Soft Start Voltage

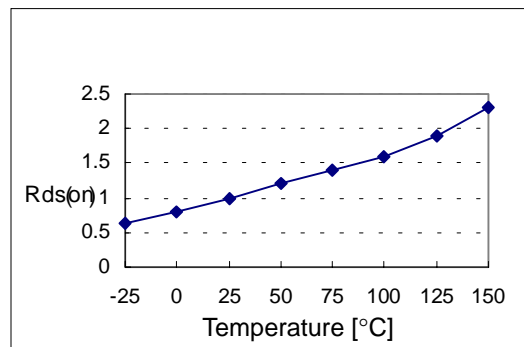
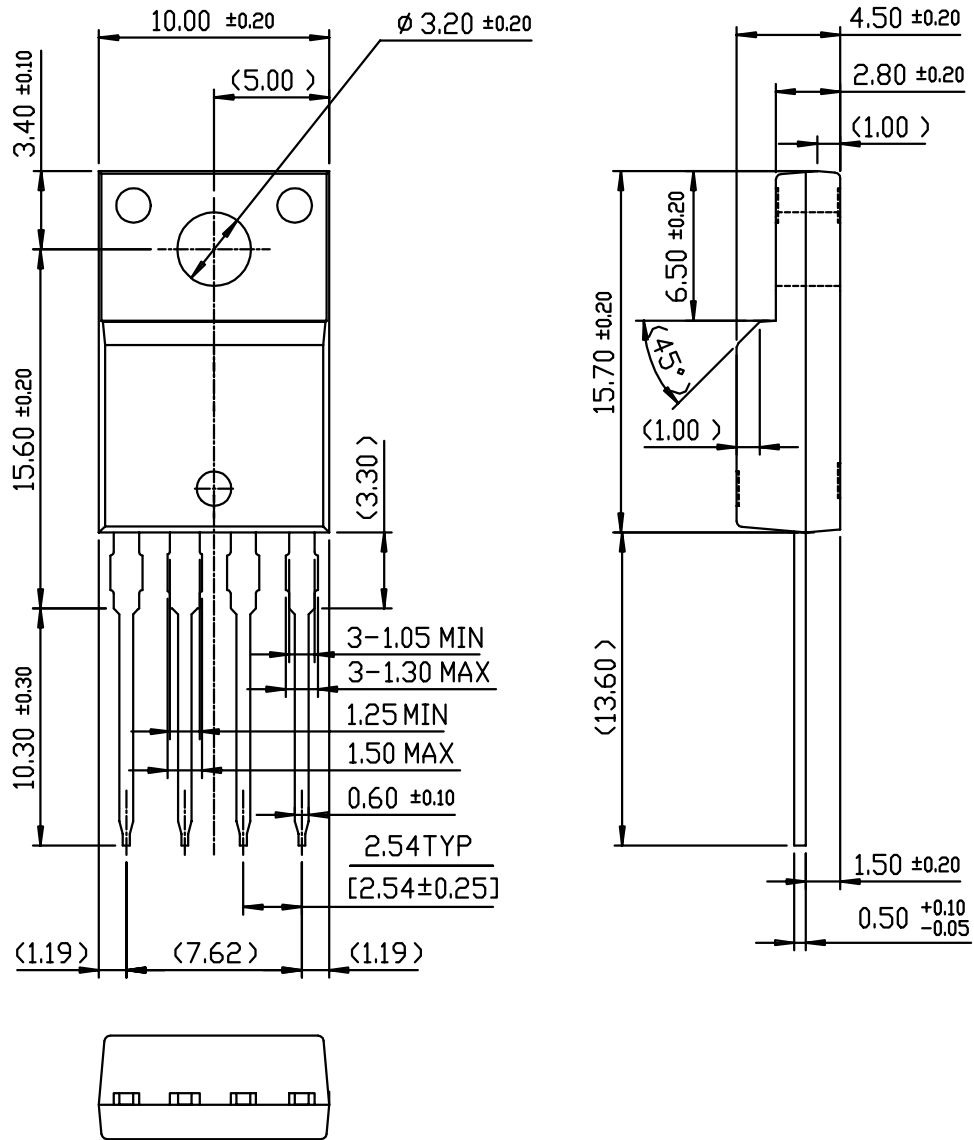


Figure 14. Static Drain-Source on Resistance

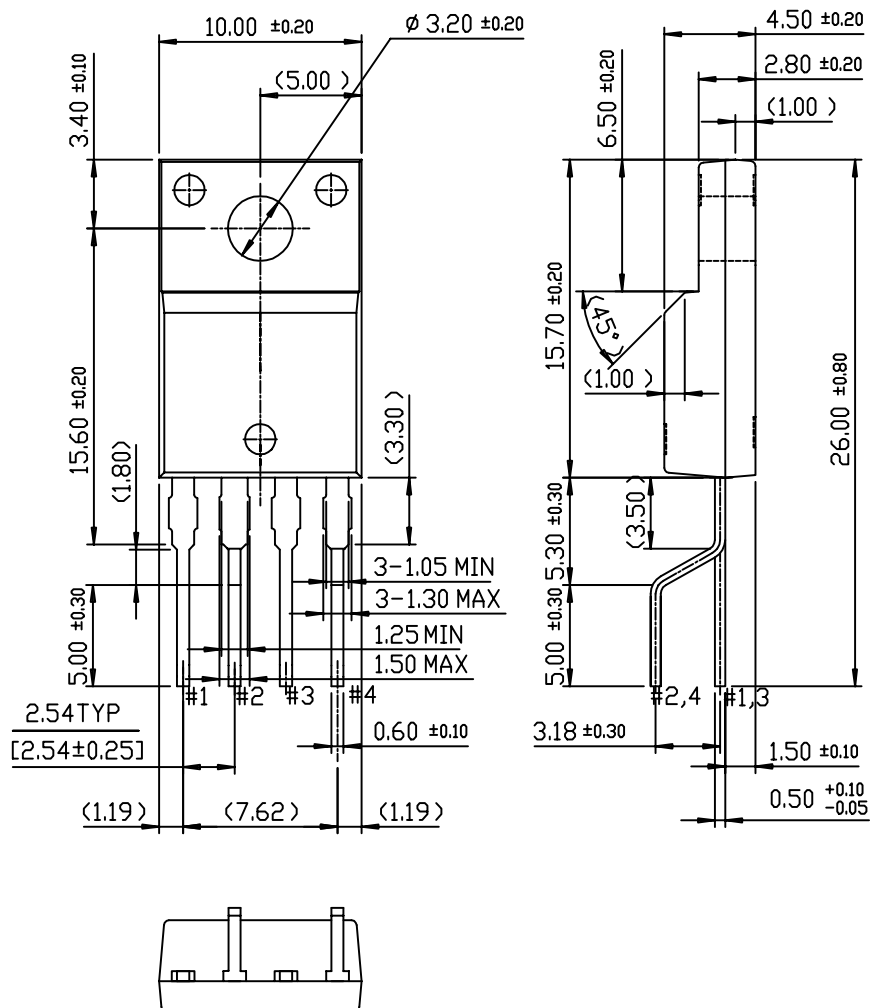
Package Dimensions

TO-220F-4L



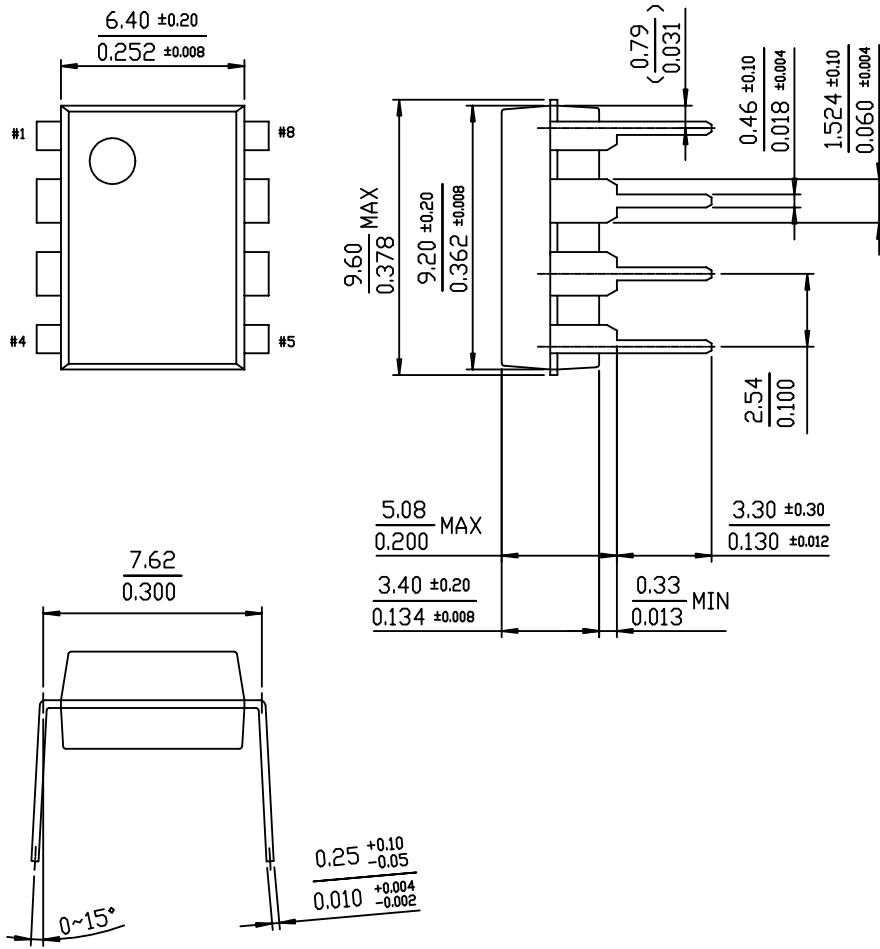
Package Dimensions (Continued)

TO-220F-4L(Forming)



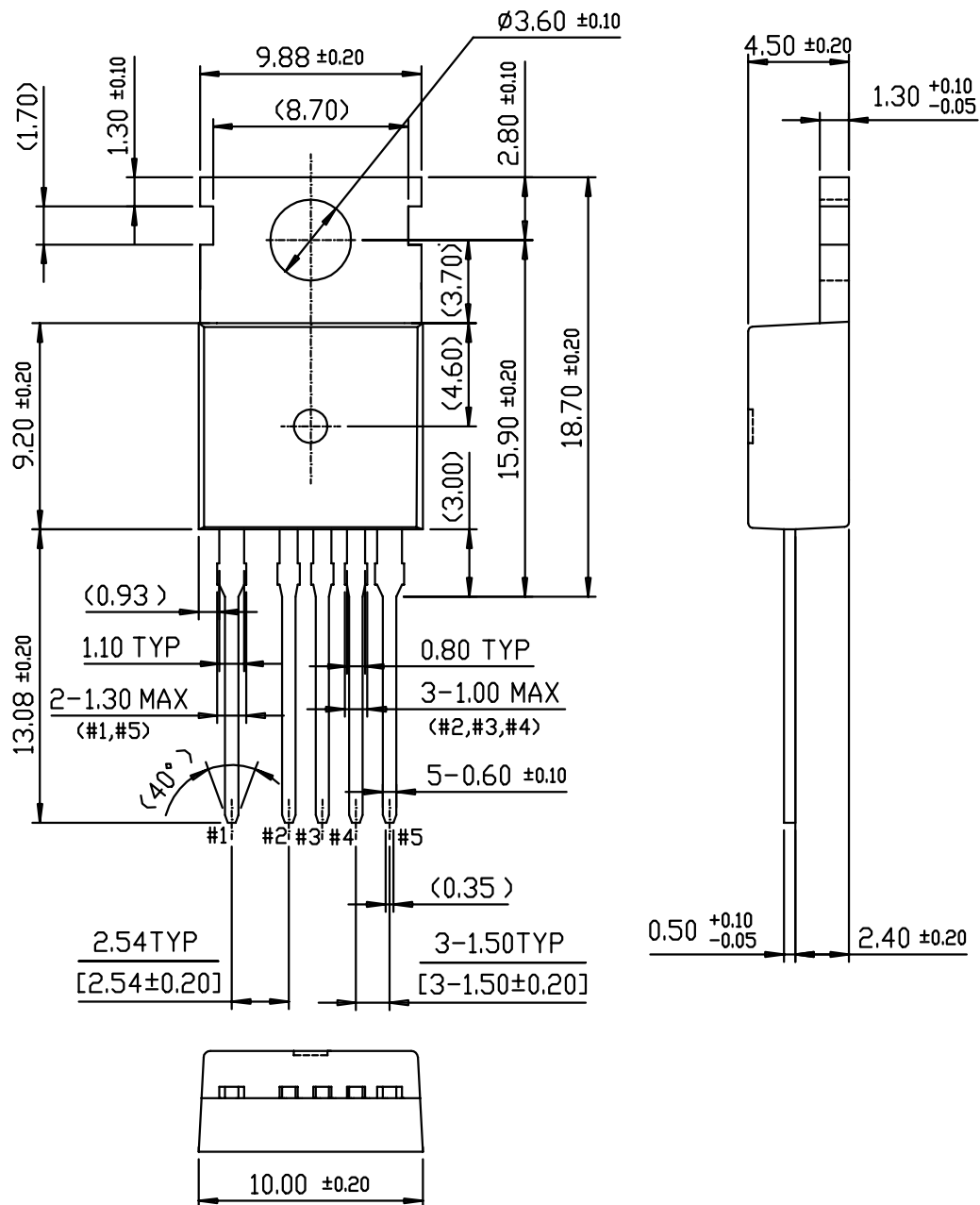
Package Dimensions (Continued)

8-DIP



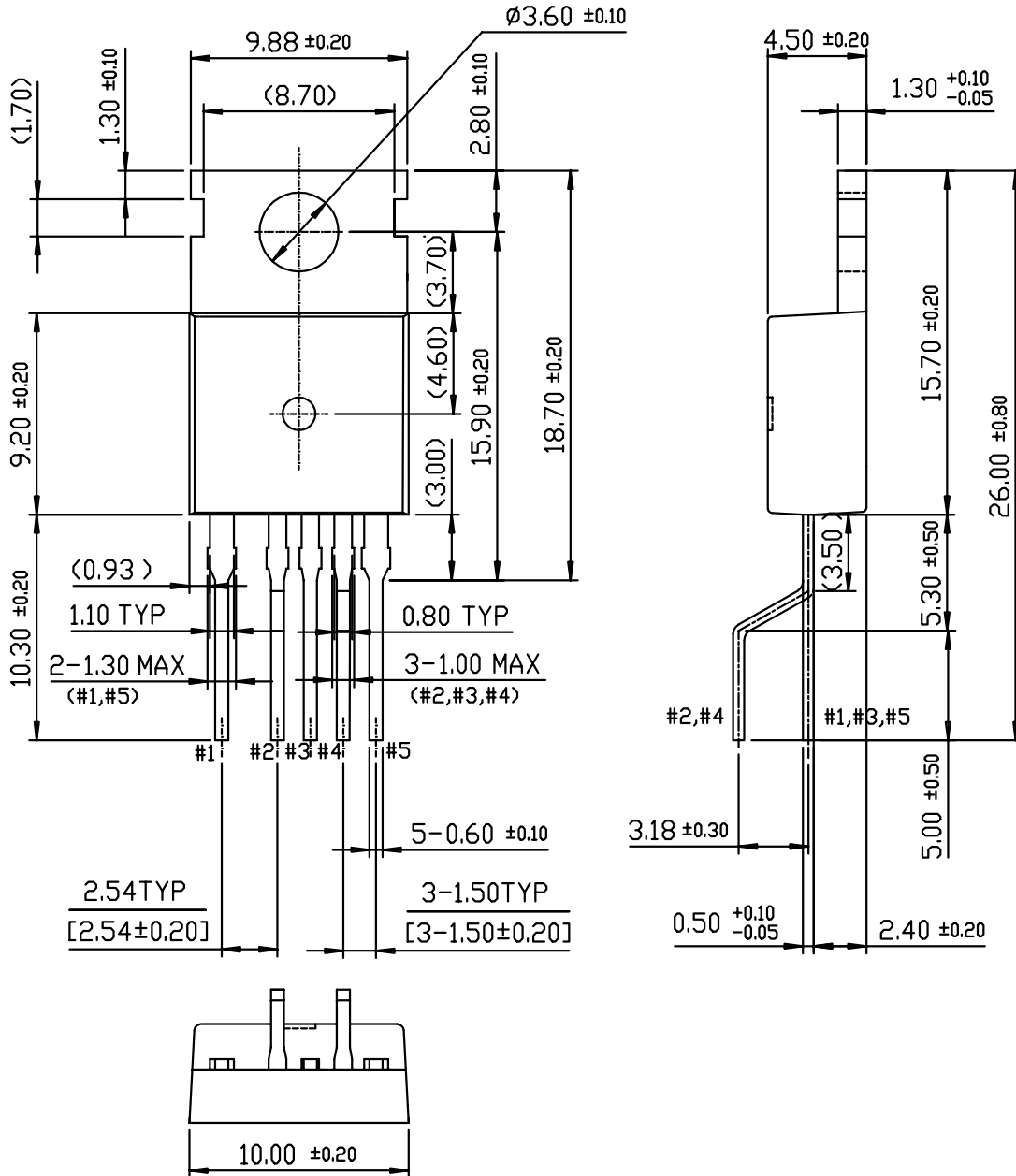
Package Dimensions (Continued)

TO-220-5L



Package Dimensions (Continued)

TO-220-5L(Forming)



Ordering Information

| Product Number | Package | Marking Code | BV _{DSS} | FOSC | RDS(on) |
|-----------------|---------------------|--------------|-------------------|--------|---------|
| KA5H0265RC-TU | TO-220-5L | 5H0265RC | 650V | 100kHz | 5Ω |
| KA5H0265RC-YDTU | TO-220-5L(Forming) | | | | |
| KA5M0265R-TU | TO-220F-4L | 5M0265R | 650V | 67kHz | 5Ω |
| KA5M0265R-YDTU | TO-220F-4L(Forming) | | | | |
| KA5L0265R-TU | TO-220F-4L | 5L0265R | 650V | 50kHz | 5Ω |
| KA5L0265R-YDTU | TO-220F-4L(Forming) | | | | |

| Product Number | Package | Marking Code | BV _{DSS} | FOSC | RDS(on) |
|----------------|---------------------|--------------|-------------------|--------|---------|
| KA5H0280R-TU | TO-220F-4L | 5H0280R | 800V | 100kHz | 5.6Ω |
| KA5H0280R-YDTU | TO-220F-4L(Forming) | | | | |
| KA5M0280R-TU | TO-220F-4L | 5M0280R | 800V | 67kHz | 5.6Ω |
| KA5M0280R-YDTU | TO-220F-4L(Forming) | | | | |
| Product Number | Package | Marking Code | BV _{DSS} | FOSC | RDS(on) |
| KA5H02659RN | 8-DIP | 5H02659R | 650V | 100kHz | 5Ω |
| KA5M02659RN | 8-DIP | 5M02659R | 650V | 67kHz | 5Ω |

TU : Non Forming Type

YDTU : Forming Type

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