# FS6S0765RCH

## 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 SenseFET(CFET)
- Eternal 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 shutdown protection, over voltage protection, and temperature compensated precision current sources for loop compensation and fault protection circuitry. Compared with discrete MOSFET and controller or RCC switching converter solution, the 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-220-5L**

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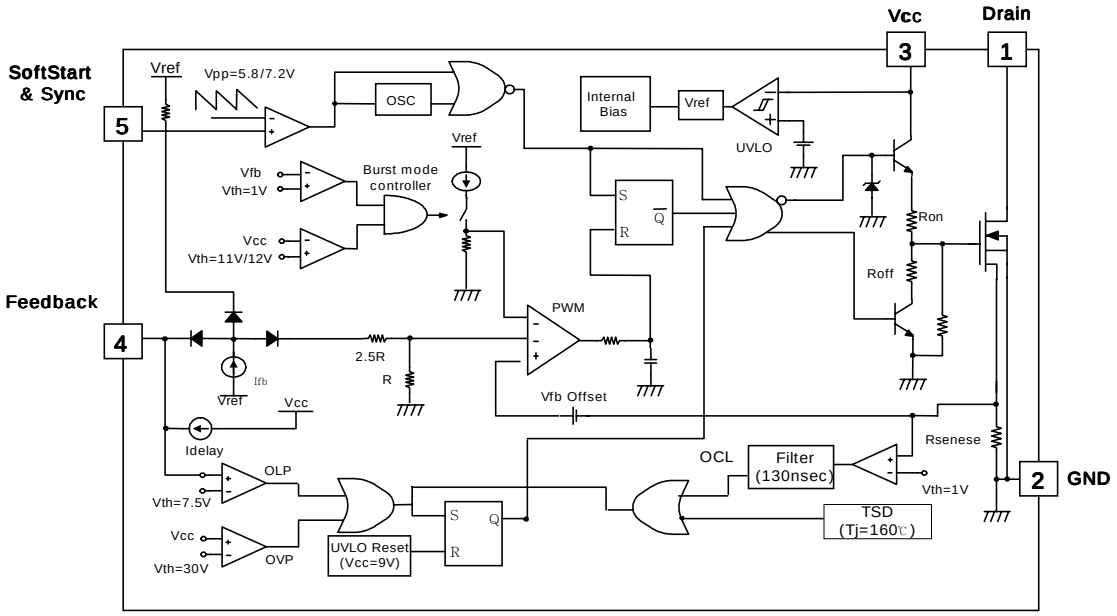
1. Drain 2. GND 3. $V_{CC}$
4. Feedback 5. Soft Start & Sync.

## Internal Block Diagram




Rev.1.0.0

## Absolute Maximum Ratings

(Ta=25°C, unless otherwise specified)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-Source(GND) Voltage (1) | $V_{DSS}$ | 650 | V |
| Drain-Gate Voltage ($R_{GS}$=1MΩ) | $V_{DGR}$ | 650 | V |
| Gate-Source (GND) Voltage | $V_{GS}$ | ±30 | V |
| Drain Current Pulsed (2) | $I_{DM}$ | 28 | $A_{DC}$ |
| Single Pulsed Avalanche Energy (3) | $E_{AS}$ | 370 | mJ |
| Single Pulsed Avalanche Current (4) | $I_{AS}$ | 17 | A |
| Continuous Drain Current (Tc = 25°C) | $I_D$ | 7 | $A_{DC}$ |
| Continuous Drain Current ($T_C$=100°C) | $I_D$ | 4.5 | $A_{DC}$ |
| Supply Voltage | $V_{CC}$ | 35 | V |
| Input Voltage Range | $V_{FB}$ | -0.3 to Vcc | V |
| | $V_{S\_S}$ | -0.3 to 10 | V |
| Total Power Dissipation | $P_D$(Watt H/S) | 145 | W |
| | Darting | 1.16 | W/°C |
| Operating Junction Temperature | $T_j$ | +150 | °C |
| Operating Ambient Temperature | $T_A$ | -25 to +85 | °C |
| Storage Temperature Range | $T_{STG}$ | -55 to +150 | °C |

**Note:**

1. $T_j$ = 25°C to 150°C
2. Repetitive rating: Pulse width limited by maximum junction temperature
3. L = 14mH, starting $T_j$ = 25°C
4. L = 13uH, starting $T_j$ = 25°C

## Electrical Characteristics (SenseFET part)

(Ta=25°C unless otherwise specified)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$ = 0V, $I_D$ = 250μA | 650 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 650V, $V_{GS}$ = 0V | - | - | 200 | μA |
| | | $V_{DS}$= 520V<br>$V_{GS}$ = 0V, $T_C$ = 125°C | - | - | 300 | μA |
| Static Drain-Source on Resistance (note) | $R_{DS(ON)}$ | $V_{GS}$ = 10V, $I_D$ = 3.5A | - | 1.4 | 1.6 | Ω |
| Forward Transconductance | gfs | $V_{DS}$ = 40V, $I_D$ = 3.5A | - | 8 | - | mho |
| Input Capacitance | Ciss | $V_{GS}$ = 0V, $V_{DS}$ = 25V,<br>f = 1MHz | - | 1415 | - | pF |
| Output Capacitance | Coss | | - | 100 | - | |
| Reverse Transfer Capacitance | Crss | | - | 15 | - | |
| Turn on Delay Time | td(on) | $V_{DD}$= 325V, $I_D$= 6.5A<br>(MOSFET switching time is essentially independent of operating temperature) | - | 25 | - | nS |
| Rise Time | tr | | - | 60 | - | |
| Turn Off Delay Time | td(off) | | - | 115 | - | |
| Fall Time | tf | | - | 65 | - | |
| Total Gate Charge (Gate-Source+Gate-Drain) | Qg | $V_{GS}$ = 10V, $I_D$ = 6.5A,<br>$V_{DS}$ = 520V (MOSFET switching time is essentially independent of operating temperature) | - | 40 | - | nC |
| Gate Source Charge | Qgs | | - | 7 | - | |
| Gate Drain (Miller) Charge | Qgd | | - | 12 | - | |

**Note:**

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

## Electrical Characteristics (Continued)

(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 | 9 | 10 | V |
| **OSCILLATOR SECTION** | | | | | | |
| Initial Frequency | $F_{OSC}$ | - | 22 | 25 | 28 | kHz |
| Voltage Stability | $F_{STABLE}$ | 12V ≤ Vcc ≤ 23V | 0 | 1 | 3 | % |
| Temperature Stability (2) | $\Delta F_{OSC}$ | -25°C ≤ Ta ≤ 85°C | 0 | ±5 | ±10 | % |
| Maximum Duty Cycle | $D_{MAX}$ | - | 92 | 95 | 98 | % |
| Minimum Duty Cycle | $D_{MIN}$ | - | - | - | 0 | % |
| **FEEDBACK SECTION** | | | | | | |
| Feedback Source Current | $I_{FB}$ | $V_{FB}$ = GND | 0.7 | 0.9 | 1.1 | mA |
| Shutdown Feedback Voltage | $V_{SD}$ | Vfb ≥ 6.9V | 6.9 | 7.5 | 8.1 | V |
| Shutdown Delay Current | Idelay | $V_{FB}$ = 5V | 1.6 | 2.0 | 2.4 | µA |
| **PROTECTION SECTION** | | | | | | |
| Over Voltage Protection | $V_{OVP}$ | $V_{CC}$ ≥ 27V | 27 | 30 | 33 | V |
| Over Current Latch Voltage (1) | $V_{OCL}$ | - | 0.9 | 1.0 | 1.1 | V |
| Thermal Shutdown Temp.(2) | $T_{SD}$ | - | 140 | 160 | - | °C |

**Note:**

1. These parameters, although guaranteed, are tested in EDS(wafer test) process.
2. These parameters, although guaranteed at the design, are not tested in mass production

## Electrical Characteristics (Continued)

(Ta=25°C unless otherwise specified)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **SYNC & SOFTSTART SECTION** | | | | | | |
| Softstart Voltage | $V_{SS}$ | Vfb = 2 | 4.7 | 5.0 | 5.3 | V |
| Softstart Current | $I_{SS}$ | Vss = V | 0.8 | 1.0 | 1.2 | mA |
| Sync High Threshold Voltage | $V_{SH}$ | Vcc = 16V, Vfb = 5V | - | 7.2 | - | V |
| Sync Low Threshold Voltage | $V_{SL}$ | Vcc = 16V, Vfb = 5V | - | 5.8 | - | V |
| **BURST MODE SECTION** | | | | | | |
| Burst Mode Low Threshold Voltage | $V_{BURL}$ | Vfb = 0V | 10.4 | 11.0 | 11.6 | V |
| Burst Mode High Threshold Voltage | $V_{BURH}$ | Vfb = 0V | 11.4 | 12.0 | 12.6 | V |
| Burst Mode Enable Feedback Voltage(3) | $V_{BEN}$ | Vcc = 10.5V | 0.7 | 1.0 | 1.3 | V |
| Burst Mode Peak Current Limit(2) | $I_{BU\_PK}$ | Vcc = 10.5V | 0.45 | 0.6 | 0.75 | V |
| Burst Mode Frequency | $F_{BUR}$ | Vcc = 10.5V, Vfb = 0V | 40 | 50 | 60 | KHz |
| **CURRENT LIMIT(SELF-PROTECTION)SECTION** | | | | | | |
| Peak Current Limit(2) | $I_{OVER}$ | - | 3.52 | 4.0 | 4.48 | A |
| **TOTAL DEVICE SECTION** | | | | | | |
| Start Up Current | $I_{START}$ | Vfb = GND, $V_{CC}$ = 14V | - | 0.1 | 0.17 | mA |
| Operating Supply Current (1) | $I_{OP}$ | Vfb = GND, $V_{CC}$ = 16V | - | 10 | 15 | mA |
| | $I_{OP(MIN)}$ | Vfb = GND, $V_{CC}$ = 10V | | | | |
| | $I_{OP(MAX)}$ | Vfb = GND, $V_{CC}$ = 28V | | | | |

**Note:**

1. These parameters are the current flowing in the control IC.
2. These parameters indicate Inductor current.
3. These parameters, although guaranteed at the design, are not tested in mass production.

# Typical Performance Characteristics

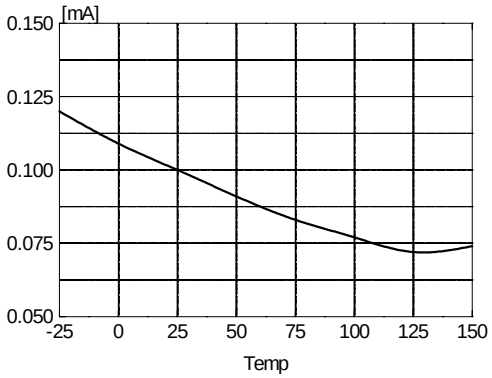



**Figure 1. Start Up Current vs. Temp.**

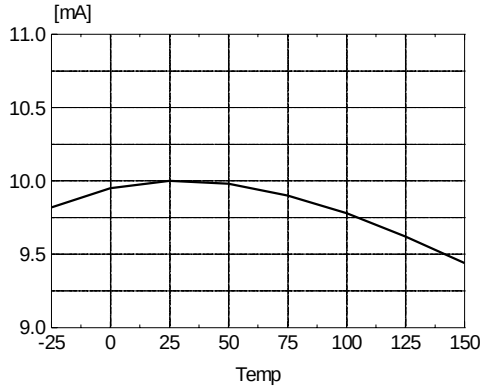



**Figure 2. Operating Current vs. Temp.**

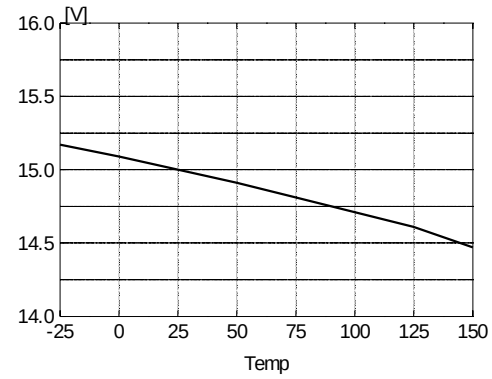



**Figure 3. Start Threshold Voltage vs. Temp.**

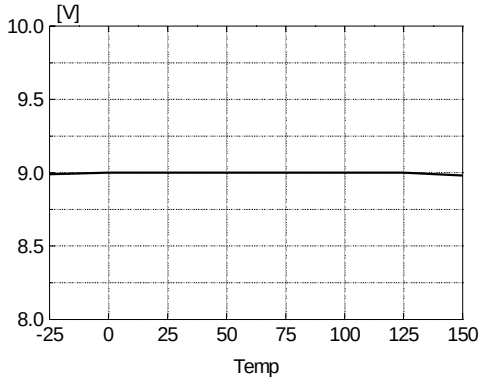



**Figure 4. Stop Threshold Voltage vs. Temp.**

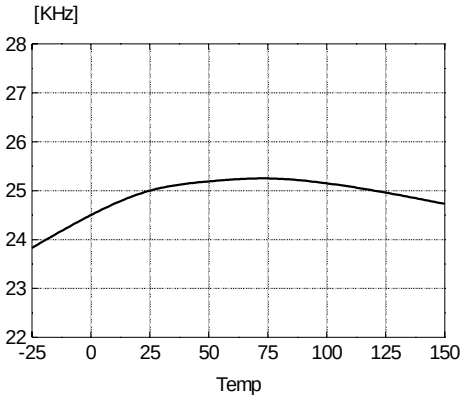



**Figure 5. Initial Frequency vs. Temp.**

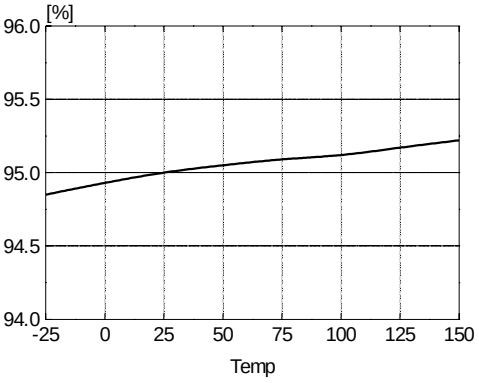



**Figure 6. Maximum Duty vs. Temp.**

## Typical Performance Characteristics (Continued)

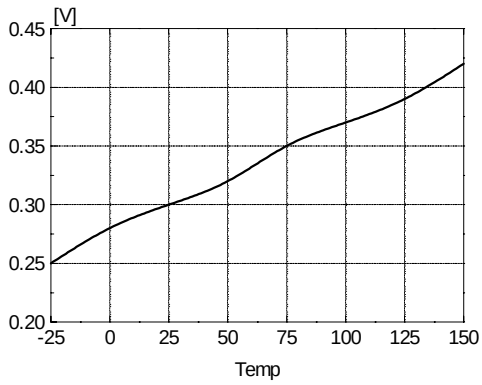



**Figure 7. Feedback Offset Voltage vs. Temp.**

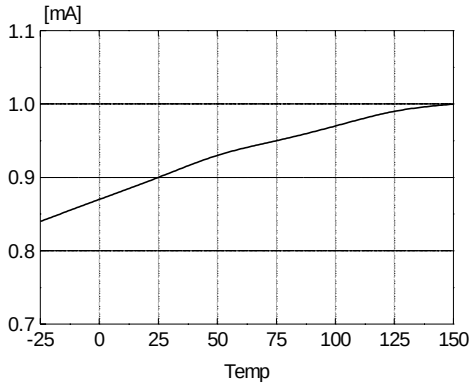



**Figure 8. Feedback Source Current vs. Temp.**

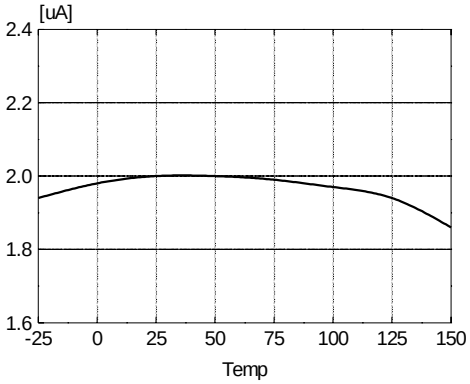



**Figure 9. Shutdown Delay Current vs. Temp.**

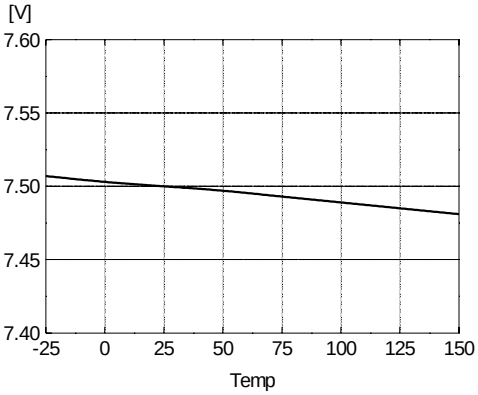



**Figure 10. Shutdown Feedback Voltage vs. Temp.**

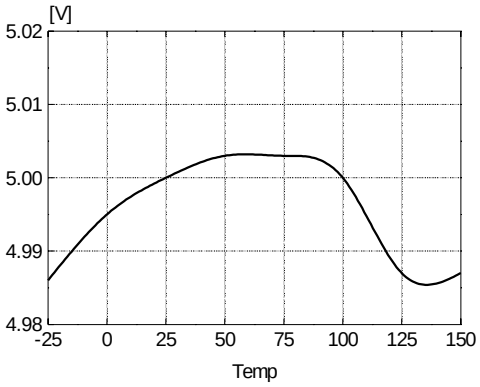



**Figure 11. Softstart Voltage vs. Temp.**

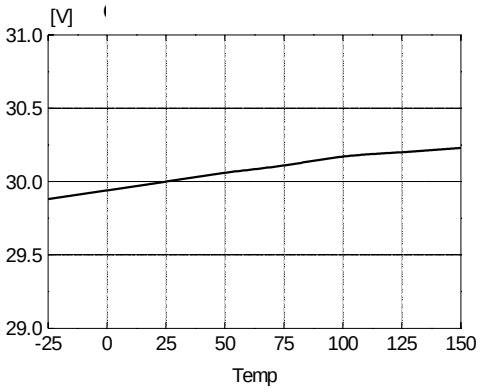



**Figure 12. Over Voltage Protection vs. Temp.**

## Typical Performance Characteristics (Continued)

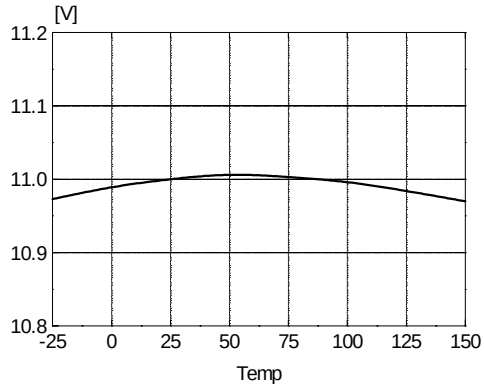



**Figure 13. Burst Mode Low Voltage vs. Temp.**

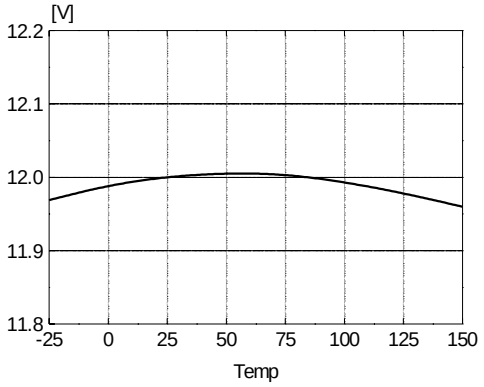



**Figure 14. Burst Mode High Voltage vs. Temp.**

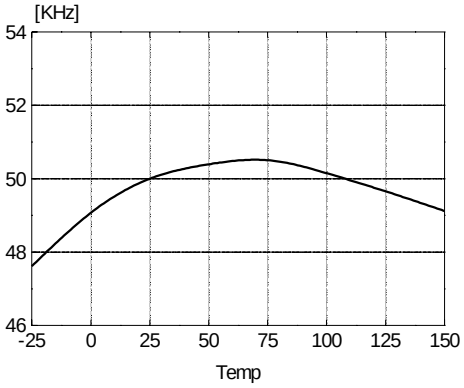



**Figure 15. Burst Mode Frequency vs. Temp.**

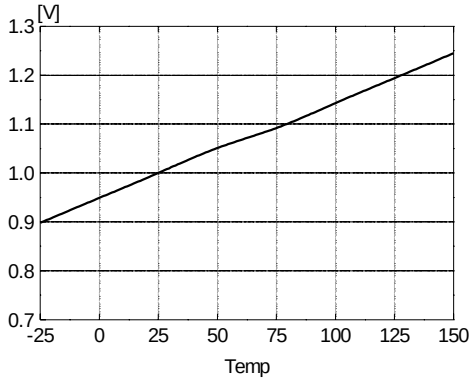



**Figure 16. Burst Mode Enable Voltage vs. Temp.**

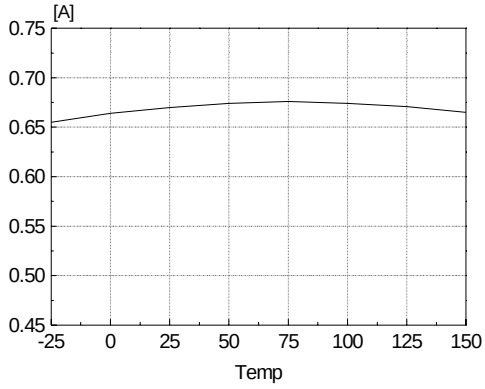



**Figure 17. Burst Mode Peak Current vs. Temp.**

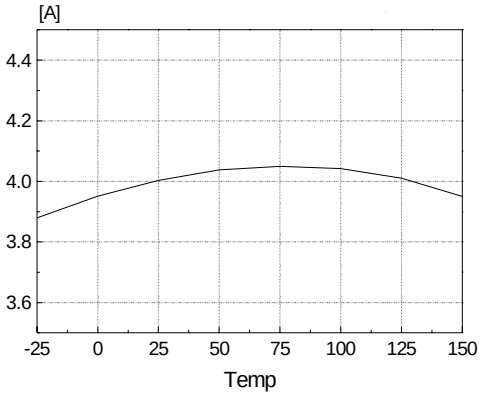
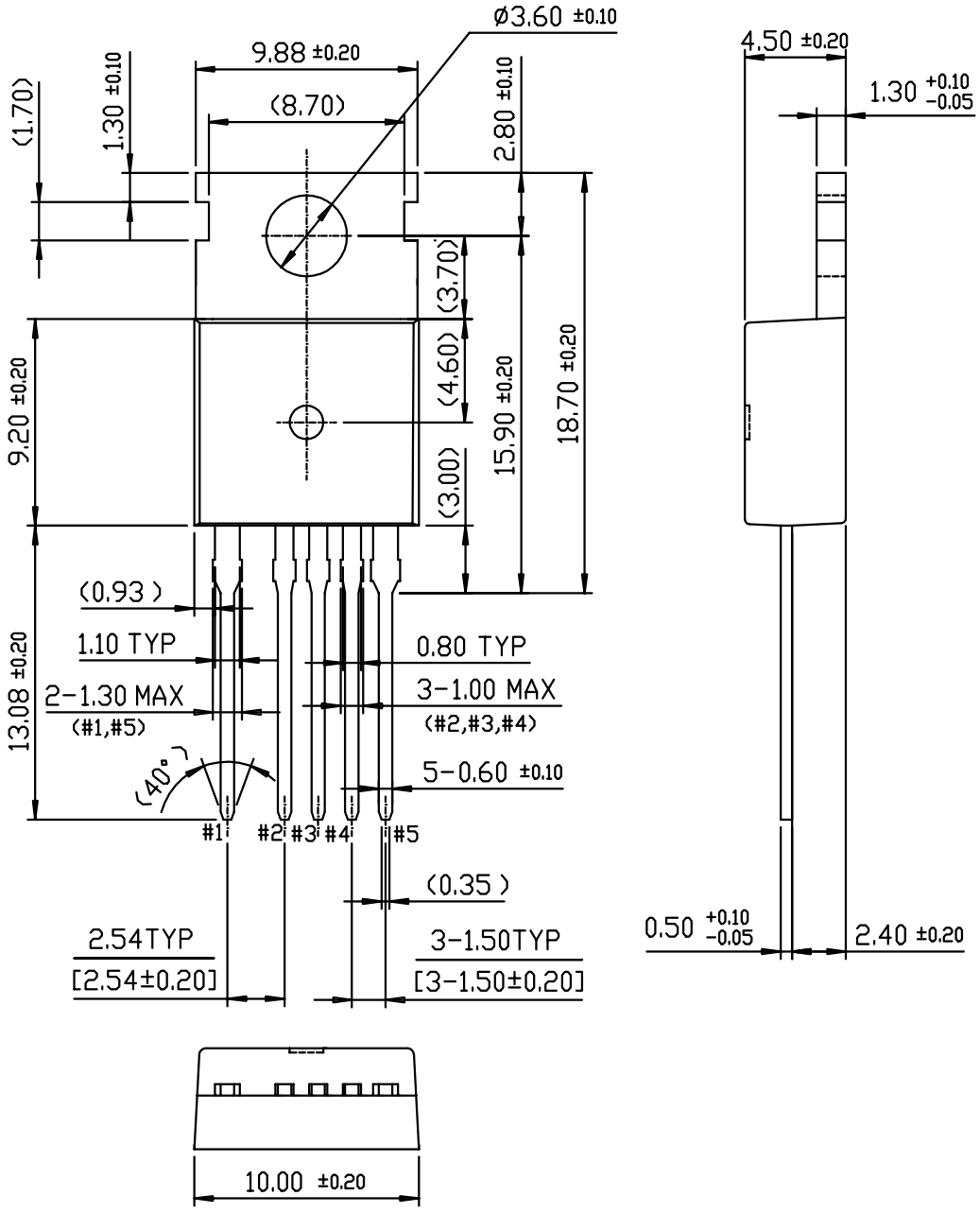



**Figure 18. Peak Current Limit vs. Temp.**

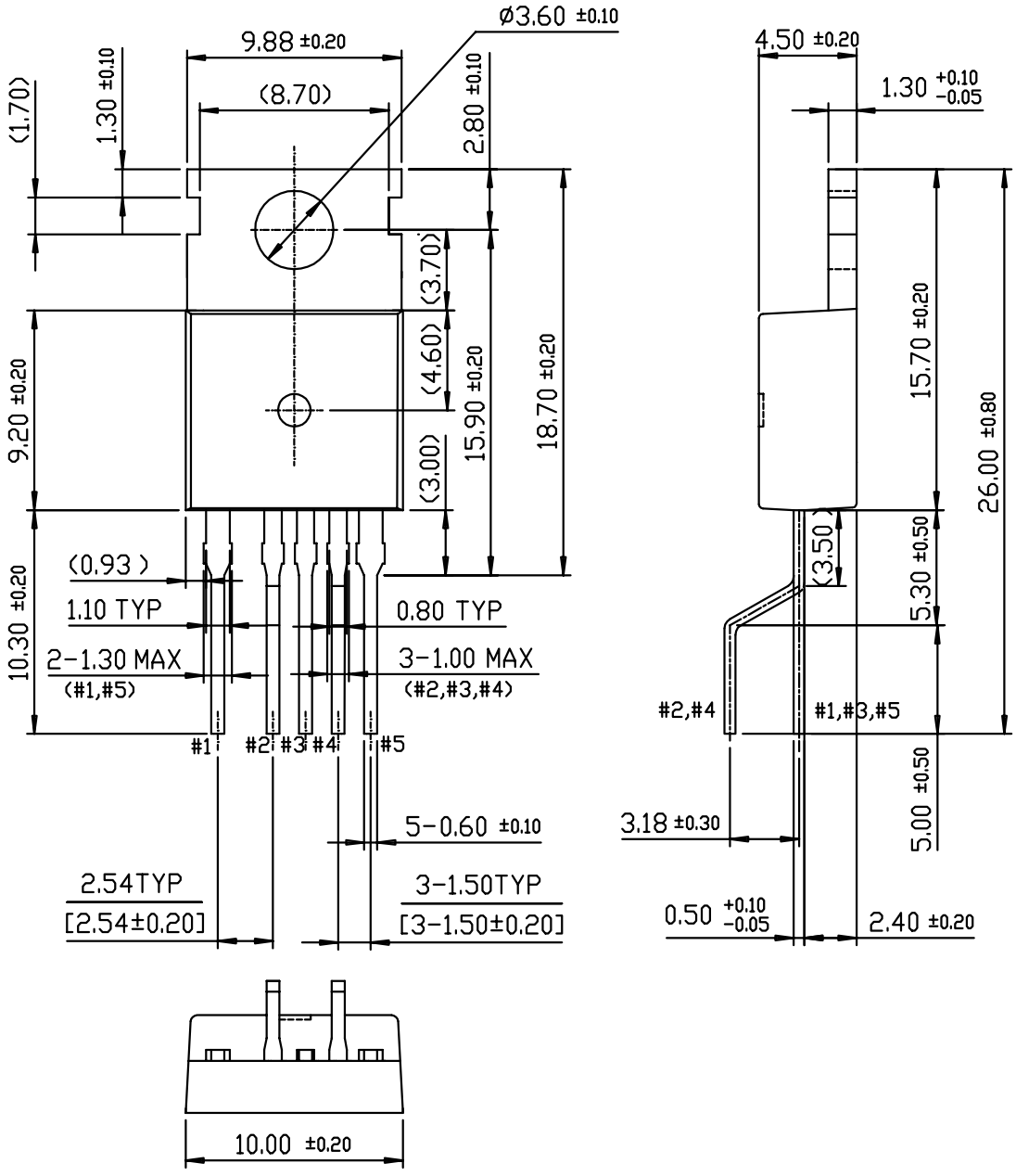
## Package Dimensions

# TO-220-5L



## Package Dimensions (Continued)

# TO-220-5L(Forming)



## Ordering Information

| Product Number | Package | Marking Code | BVdss | Rds(on) |
|---|---|---|---|---|
| FS6S0765RCHTU | TO-220-5L | 6S0765RCH | 650V | 1.4 |
| FS6S0765RCHYDTU | TO-220-5L(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.



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