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KA5Q0565RT Fairchild Power Switch(FPS)

Features

- Quasi Resonant Converter Controller
- Internal Burst Mode Controller for Stand-by Mode
- Pulse by Pulse Current Limiting
- Over Current Latch Protection
- Over Voltage Protection (Vcc: Min. 27V)
- 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. The integrated PWM controller includes the fixed oscillator, the under voltage lock out, the leading edge blanking, the optimized gate turn-on/turn-off driver, the thermal shut down protection, the over voltage protection, and the temperature compensated precision current sources for loop compensation and fault protection circuitry. Compared to a discrete MOSFET and a controller or a RCC switching converter solutions, a Fairchild Power Switch(FPS) can reduce the total number of components, design size, and weight, so it will improve efficiency, productivity, and system reliability. It has a basic platform well suited for cost-effective design in a quasi-resonant converter as a C-TV power supply.



Internal Block Diagram



Absolute Maximum Ratings

(Ta=25°C, unless otherwise specified)

| Parameter | Symbol | Value | Unit |
|--|----------|-------------|-------|
| Drain-source Voltage | VDSS | 650 | V |
| Drain-Gate Voltage (R_{GS} =1 $M\Omega$) | Vdgr | 650 | V |
| Gate-Source (GND) Voltage | VGS | ±30 | V |
| Drain Current Pulsed ⁽²⁾ | IDM | 11 | ADC |
| Single Pulsed Avalanch Current ⁽³⁾ (Energy ⁽²⁾) | IAS(EAS) | 13(400) | A(mJ) |
| Continuous Drain Current (Tc = 25°C) | ID | 2.8 | ADC |
| Continuous Drain Current (T _C =100°C) | ID | 1.7 | ADC |
| Supply Voltage | Vcc | 30 | V |
| Input Voltage Range | VFB | -0.3 to Vcc | V |
| Total Power Dissipation | PD | 38 | W |
| Total Power Dissipation | Derating | 0.3 | W/°C |
| Operating Junction Temperature | TJ | +160 | °C |
| Operating Ambient Temperature | TA | -25 to +85 | °C |
| Storage Temperature Range | TSTG | -55 to +150 | °C |
| Thermal Resistance | Rthjc | 3.29 | °C/W |
| ESD Capability, HBM Model (All pins) | - | 2.0 | kV |
| ESD Capability, Machine Model (All pins) | - | 300 | V |

Notes:

1. Tj = 25°C to 150°C

2. Repetitive rating: Pulse width limited by maximum junction temperature

3. L = 30mH, V_DD = 50V, R_G = 25 Ω , starting T_j = 25°C

4. L = 13uH, starting T_j = $25^{\circ}C$

Electrical Characteristics (SFET Part)

(Ta=25°C unless otherwise specified)

| Parameter | Symbol | Condition | Min. | Тур. | Max. | Unit |
|---|---------|---|------|------|------|------|
| Drain-Source Breakdown Voltage | BVDSS | V _{GS} = 0V, I _D = 50µA | 650 | - | - | V |
| Zero Gate Voltage Drain Current | IDSS | VDS = Max, Rating, VGS = 0V | - | - | 200 | μA |
| | | V _{DS} = 0.8*Max., Rating V _{GS} = 0V, T _C = 85°C | - | - | 300 | μA |
| Static Drain-source on Resistance (Note) | RDS(ON) | V _{GS} = 10V, I _D = 2.3A | - | 1.8 | 2.2 | Ω |
| Input Capacitance | Ciss | | - | 780 | - | |
| Output Capacitance | Coss | V _{GS} = 0V, V _{DS} = 25V, f = 1MHz | - | 90 | - | pF |
| Reverse Transfer Capacitance | Crss | | - | 40 | - | |
| Turn on Delay Time | td(on) | V _{DD} = 0.5BV _{DSS} , I _D = 7.0A (MOSFET switching time are essentially independent of operating | - | 15 | 40 | |
| Rise Time | tr | | - | 45 | 100 | nS |
| Turn Off Delay Time | td(off) | | - | 60 | 130 | 113 |
| Fall Time | tf | temperature) | - | 40 | 90 | |
| Total Gate Charge (Gate-Source+Gate-Drain) | Qg | V _{GS} = 10V, I _D = 7.0A, V _{DS} = 0.5B V _{DSS} (MOSFET | - | 43 | 55 | _ |
| Gate-Source Charge | Qgs | Switching time are Essentially | - | 4.0 | - | nC |
| Gate-Drain (Miller) Charge | Qgd | independent of operating temperature) | - | 7.3 | - | |

Note:

1. Pulse test : Pulse width $\leq 300 \mu S,\,duty \leq 2\%$

Electrical Characteristics (Continued)

(Ta=25°C unless otherwise specified)

| Parameter | Symbol | Condition | Min. | Тур. | Max. | Unit | | |
|------------------------------------|--------------------|-----------------------------------|------|------|------|------|--|--|
| UVLO SECTION | | | | | | | | |
| Start Threshold Voltage | VSTART | V _{FB} = GND | 14 | 15 | 16 | V | | |
| Stop Threshold Voltage | VSTOP | V _{FB} = GND | 8 | 9 | 10 | V | | |
| OSCILLATOR SECTION | OSCILLATOR SECTION | | | | | | | |
| Initial Frequency | Fosc | - | 18 | 20 | 22 | kHz | | |
| Voltage Stability | FSTABLE | $12V \le Vcc \le 23V$ | 0 | 1 | 3 | % | | |
| Temperature Stability (Note2) | ΔFosc | -25°C ≤ Ta ≤ 85°C | 0 | ±5 | ±10 | % | | |
| Maximum Duty Cycle | DMAX | - | 92 | 95 | 98 | % | | |
| Minimum Duty Cycle | DMIN | - | - | - | 0 | % | | |
| FEEDBACK SECTION | | | | | | | | |
| Feedback Source Current | IFB | V _{FB} = GND | 0.7 | 0.9 | 1.1 | mA | | |
| Shutdown Feedback Voltage | VSD | $V f b \ge 6.9 V$ | 6.9 | 7.5 | 8.1 | V | | |
| Shutdown Delay Current | IDELAY | VFB = 5V | 4 | 5 | 6 | μA | | |
| PROTECTION SECTION | | | | | | | | |
| Over Voltage Protection | VCCOVP | $V_{CC} \ge 26V$ | 27 | 30 | 33 | V | | |
| Over Current Latch Voltage (Note2) | Vocl | - | 0.9 | 1.0 | 1.1 | V | | |
| Thermal Shutdown Temp. | TSD | - | 140 | 160 | - | °C | | |
| SYNC SECTION | | | | | | | | |
| Normal Sync High Threshold Voltage | VNSH | V _{CC} = 16V, Vfb = 5V | 4.0 | 4.6 | 5.2 | V | | |
| Normal Sync Low Threshold Voltage | VNSL | V _{CC} = 16V, Vfb = 5V | 2.3 | 2.6 | 2.9 | V | | |
| Burst Sync High Threshold Voltage | VBSH | V _{CC} = 10.5V, Vfb = 0V | 3.2 | 3.6 | 4.0 | V | | |
| Burst Sync Low Threshold Voltage | VBSL | VCC = 10.5V, Vfb = 0V | 1.1 | 1.3 | 1.5 | V | | |

Note:

1. These parameters is the current flowing in the Control IC.

2. These parameters, although guaranteed, are tested in EDS(wafer test) process.

3. These parameters indicate Inductor Current.

Electrical Characteristics (Continued)

(Ta=25°C unless otherwise specified)

| Parameter | Symbol | Condition | Min. | Тур. | Max. | Unit | |
|---------------------------------------|----------|----------------------------------|------|------|------|------|--|
| BURST MODE SECTION | | | | | | | |
| Burst Mode Low Threshold Voltage | VBURL | Vfb = 0V | 10.4 | 11.0 | 11.6 | V | |
| Burst Mode High Threshold Voltage | VBURH | Vfb = 0V | 11.4 | 12.0 | 12.6 | V | |
| Burst Mode Enable Feedback Voltage | VBEN | Vcc = 10.5V | 0.7 | 1.0 | 1.3 | V | |
| Burst Mode Peak Current Limit | IBU_PK | Vcc = 10.5V | 0.65 | 0.85 | 1.1 | А | |
| CURRENT LIMIT(SELF-PROTECTION)SECTION | | | | | | | |
| Peak Current Limit(Note3) | lрк | - | 3.08 | 3.5 | 3.92 | А | |
| TOTAL DEVICE SECTION | | | | | | | |
| Start Up Current | ISTART | Vfb = GND, V _{CC} = 14V | - | 0.1 | 0.2 | mA | |
| | IOP | Vfb = GND, V _{CC} = 16V | | | | | |
| Operating Supply Current (Note1) | IOP(MIN) | Vfb = GND, V _{CC} = 10V | - | 10 | 18 | mA | |
| | IOP(MAX) | Vfb = GND, V_{CC} = 28V | | | | | |

Note:

1. These parameters is the current flowing in the Control IC.

2. These parameters, although guaranteed, are tested in EDS(wafer test) process.

3. These parameters indicate Inductor Current.



Typical Performance Characteristics







Figure 5. Initial Frequency

Figure 4. Operating Current



Figure 6. Maximum Duty



1.20

1.12

1.04

0.96

0.88







Figure 9. Over Voltage Protection









Figure 8. Feedback Source Current





Figure 12. Burst Mode Enable Feedback Voltage

Typical Performance Characteristics (Continued)













Figure 14. Burst Mode High Threshold Voltage







Figure 18. Primary Mode Gain



Typical Performance Characteristics (Continued)



1.10

1.06

1.02

0.98

0.94

0.90

-25℃

0°C

25℃



Figure 20. Burst Mode Peak Current Limit





50℃ 75℃ Temp.(℃)

Figure 21. Normal Mode Sync. Low Threshold Voltage

Typical Performance Characteristics (MOSFET Part)

100*°*C

125℃ 150℃







Figure 23. Transient Thermal Response Curve

T Part)

Package Dimensions

TO-220F-5L



TO-220F-5L(Forming)



Ordering Information

| Product Number | Package | Operating Temp. |
|----------------|---------------------|-----------------|
| KA5Q0565RTTU | TO-220F-5L | -25°C to +85°C |
| KA5Q0565RTYDTU | TO-220F-5L(Forming) | -23 C 10 +63 C |

TU : Non Forming Type YDTU : Forming Type

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