

# KA1M0565R/KA1H0565R

## Fairchild Power Switch(FPS)

### Features

- Precision fixed operating frequency
- KA1M0565R (67KHz),KA1H0565R (100KHz)
- Pulse by pulse over current limiting
- Over load protection
- Over voltage protection (Min. 23V)
- Internal thermal shutdown function
- Under voltage lockout
- Internal high voltage sense FET
- Auto restart

### Description

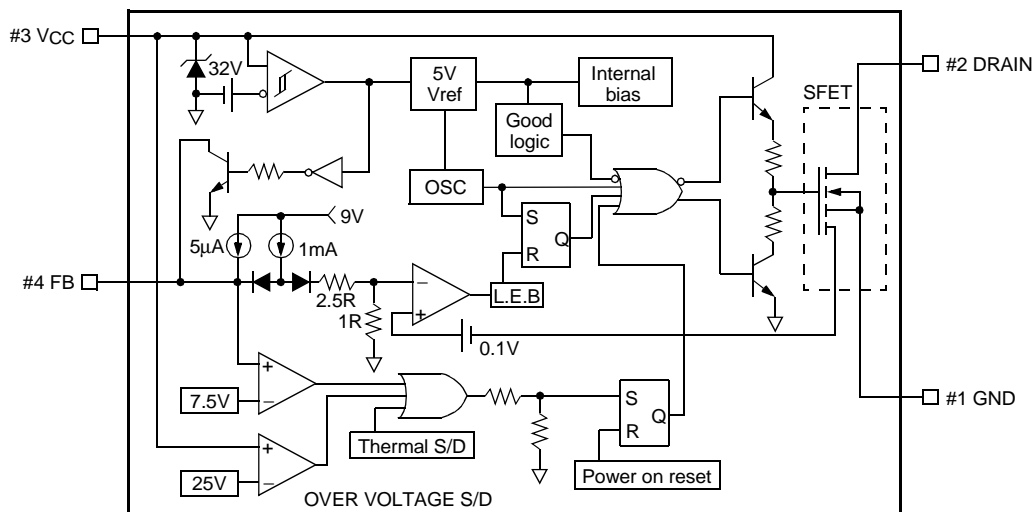
The Fairchild Power Switch(FPS) product family is specially designed for an off-line SMPS with minimal external components. The Fairchild Power Switch(FPS) consist of high voltage power SenseFET and current mode PWM controller IC. PWM controller features integrated fixed oscillator, under voltage lock out, leading edge blanking, optimized gate turn-on/turn-off driver, thermal shut down protection, over voltage protection, temperature compensated precision current sources for loop compensation and fault protection circuit. 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.

TO-220F-4L

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1. GND 2. DRAIN 3. VCC 4. FB

### Internal Block Diagram



Rev.1.0.2

## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Maximum Drain voltage <sup>(1)</sup>	V <sub>D,MAX</sub>	650	V
Drain Gate voltage (R <sub>GS</sub> =1MΩ)	V <sub>DGR</sub>	650	V
Gate-source (GND) voltage	V <sub>GS</sub>	±30	V
Drain current pulsed <sup>(2)</sup>	I <sub>DM</sub>	20	ADC
Single pulsed avalanche energy <sup>(3)</sup>	E <sub>AS</sub>	230	mJ
Continuous drain current (T <sub>C</sub> =25°C)	I <sub>D</sub>	5.0	ADC
Continuous drain current (T <sub>C</sub> =100°C)	I <sub>D</sub>	3.5	ADC
Maximum Supply voltage	V <sub>CC,MAX</sub>	30	V
Input voltage range	V <sub>FB</sub>	−0.3 to V <sub>SD</sub>	V
Total power dissipation	P <sub>D</sub>	140	W
	Derating	1.11	W/°C
Operating ambient temperature	T <sub>A</sub>	−25 to +85	°C
Storage temperature	T <sub>STG</sub>	−55 to +150	°C

### Notes:

1. T<sub>J</sub>=25°C to 150°C
2. Repetitive rating: Pulse width limited by maximum junction temperature
3. L=30mH, V<sub>DD</sub>=50V, R<sub>G</sub>= 27Ω, starting T<sub>J</sub>=25°C

## Electrical Characteristics (SFET part)

(Ta=25°C unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain source breakdown voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =50μA	650	-	-	V
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> =Max., Rating, V <sub>GS</sub> =0V	-	-	50	μA
		V <sub>DS</sub> =0.8Max., Rating, V <sub>GS</sub> =0V, T <sub>C</sub> =125°C	-	-	200	μA
Static drain source on resistance <sup>(note)</sup>	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =2.5A	-	1.76	2.2	Ω
Forward transconductance <sup>(note)</sup>	g <sub>fs</sub>	V <sub>DS</sub> =50V, I <sub>D</sub> =2.5A	2.5	-	-	S
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz	-	1457	-	pF
Output capacitance	C <sub>oss</sub>		-	130	-	
Reverse transfer capacitance	C <sub>rss</sub>		-	38.8	-	
Turn on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> =0.5BV <sub>DSS</sub> , I <sub>D</sub> =5.0A (MOSFET switching time are essentially independent of operating temperature)	-	-	60	nS
Rise time	t <sub>r</sub>		-	-	150	
Turn off delay time	t <sub>d(off)</sub>		-	-	300	
Fall time	t <sub>f</sub>		-	-	130	
Total gate charge (gate-source+gate-drain)	Q <sub>g</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =5.0A, V <sub>DS</sub> =0.5BV <sub>DSS</sub> (MOSFET switching time are essentially independent of operating temperature)	-	-	56	nC
Gate source charge	Q <sub>gs</sub>		-	10.3	-	
Gate drain (Miller) charge	Q <sub>gd</sub>		-	22.3	-	

### 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	VSTART	-	14	15	16	V
Stop threshold voltage	VSTOP	After turn on	9	10	11	V
OSCILLATOR SECTION						
Initial accuracy	FOSC	KA1M0565R	61	67	73	kHz
		KA1H0565R	90	100	110	
Frequency change with temperature <sup>(2)</sup>	ΔF/ΔT	−25°C ≤ Ta ≤ +85°C	-	±5	±10	%
Maximum duty cycle	Dmax	KA1M0565R	74	77	80	%
		KA1H0565R	64	67	70	
FEEDBACK SECTION						
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
REFERENCE SECTION						
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
CURRENT LIMIT (SELF-PROTECTION) SECTION						
Peak Current Limit	I <sub>OVER</sub>	Max. inductor current	3.08	3.5	3.92	A
PROTECTION SECTION						
Thermal shutdown temperature (Tj) <sup>(1)</sup>	TSD	-	140	160	-	°C
Over voltage protection voltage	VOVP	-	23	25	28	V
TOTAL DEVICE SECTION						
Start Up current	I <sub>START</sub>	V <sub>CC</sub> =14V	0.1	0.3	0.4	mA
Operating supply current (control part only)	I <sub>OP</sub>	Ta=25°C	6	12	18	mA
V <sub>CC</sub> zener voltage	V <sub>Z</sub>	I <sub>CC</sub> =20mA	30	32.5	35	V

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

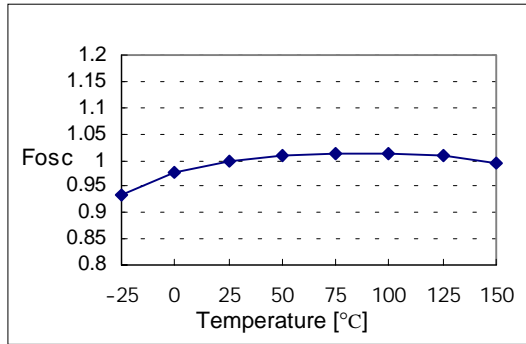


Figure 1. Operating Frequency

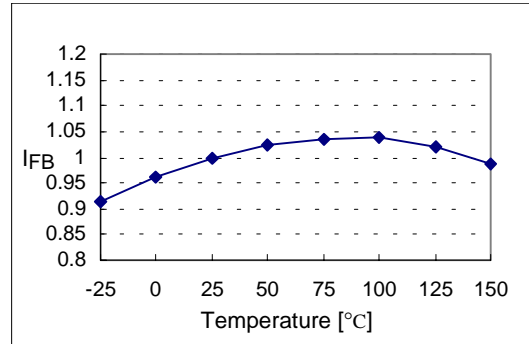


Figure 2. Feedback Source Current

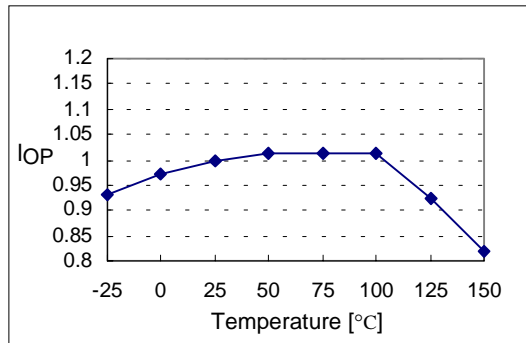


Figure 3. Operating Supply Current

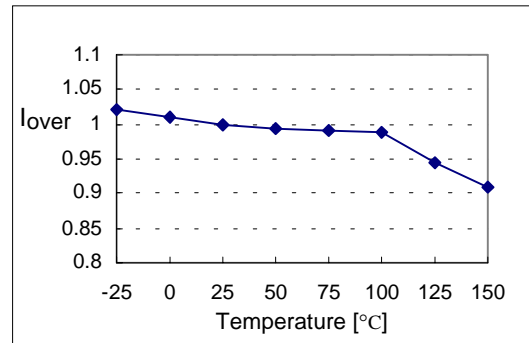


Figure 4. Peak Current Limit

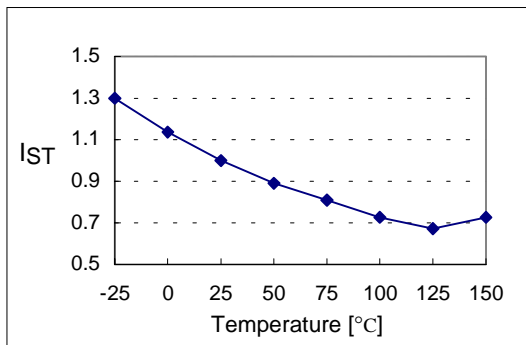


Figure 5. Start up Current

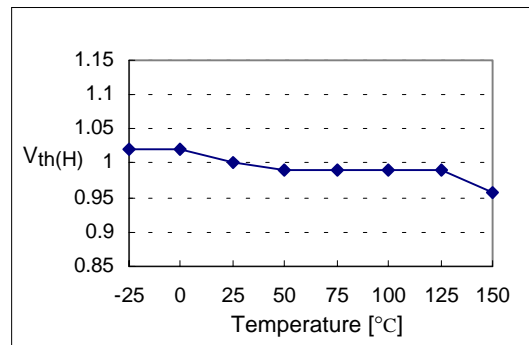


Figure 6. Start Threshold Voltage

## Typical Performance Characteristics (Continued)

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

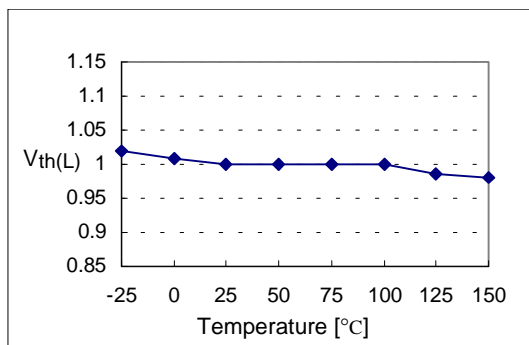


Figure 7. Stop Threshold Voltage

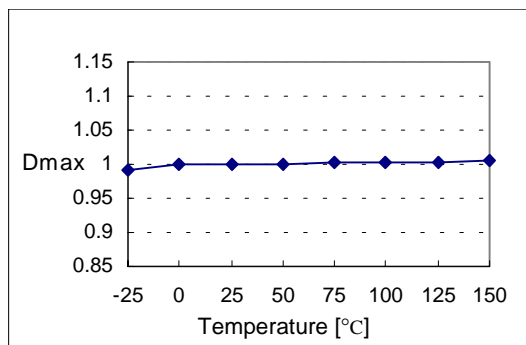


Figure 8. Maximum Duty Cycle

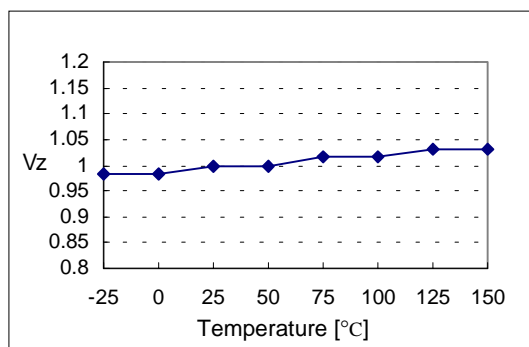


Figure 9. VCC Zener Voltage

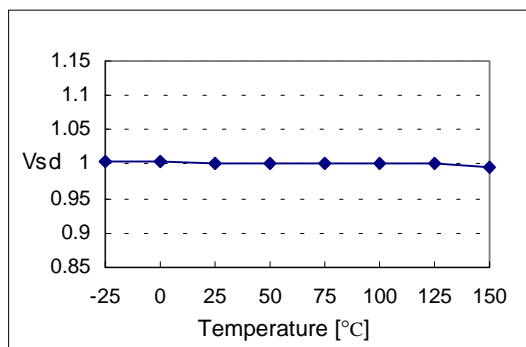


Figure 10. Shutdown Feedback Voltage

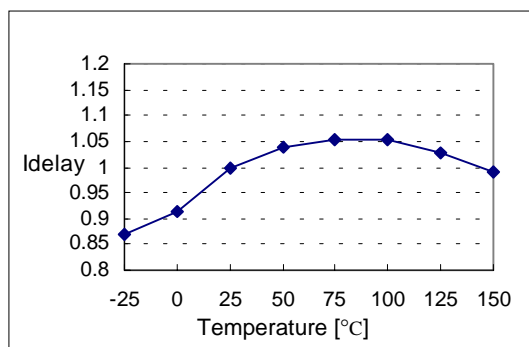


Figure 11. Shutdown Delay Current

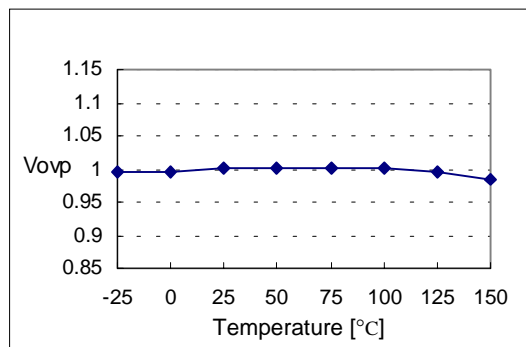
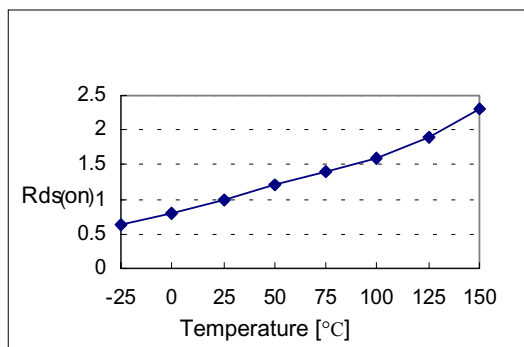


Figure 12. Over Voltage Protection

## Typical Performance Characteristics (Continued)

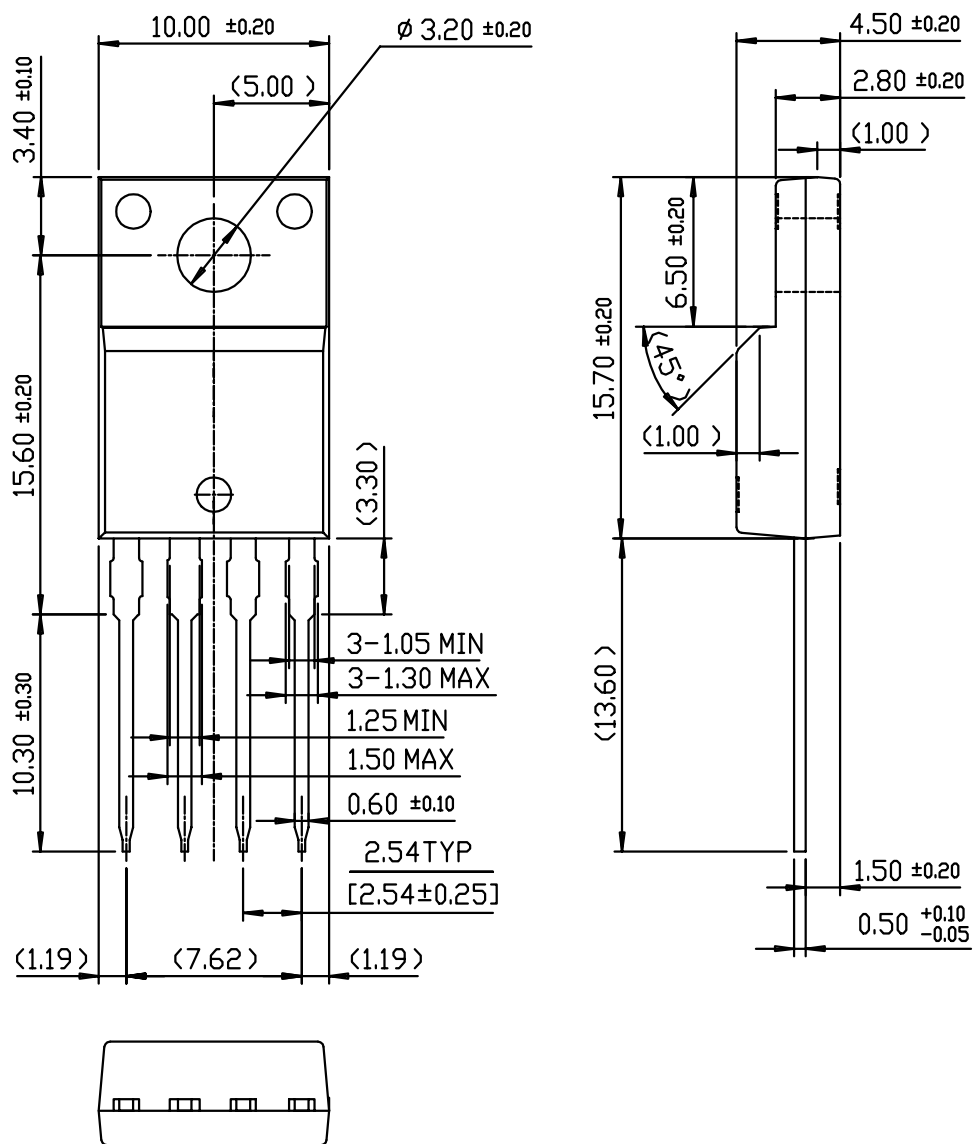
(These characteristic graphs are normalized at  $T_a=25^{\circ}\text{C}$ )



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

## Package Dimensions

## TO-220F-4L





Technical drawing of the 254TYP connector, showing dimensions in millimeters (mm).

**Front View (Left):**

- Overall width:  $10.00 \pm 0.20$
- Top pin spacing:  $3.40 \pm 0.10$
- Pin diameter:  $\varnothing 3.20 \pm 0.20$
- Pin pitch (center-to-center):  $(5.00)$
- Pin length:  $15.60 \pm 0.20$
- Pin diameter at base:  $(1.80)$
- Pin diameter at top:  $(3.30)$
- Pin diameter at bottom:  $3-1.05 \text{ MIN}$  and  $3-1.30 \text{ MAX}$
- Pin diameter at base (alternative):  $1.25 \text{ MIN}$  and  $1.50 \text{ MAX}$
- Pin diameter at base (alternative):  $0.60 \pm 0.10$
- Pin diameter at base (alternative):  $(1.19)$
- Pin diameter at base (alternative):  $(7.62)$
- Pin diameter at base (alternative):  $(1.19)$

**Side View (Right):**

- Overall height:  $26.00 \pm 0.80$
- Top pin spacing:  $4.50 \pm 0.20$
- Pin pitch (center-to-center):  $(1.00)$
- Pin length:  $15.70 \pm 0.20$
- Pin diameter at base:  $(1.00)$
- Pin diameter at top:  $(3.50)$
- Pin diameter at base (alternative):  $5.00 \pm 0.30$
- Pin diameter at base (alternative):  $5.30 \pm 0.30$
- Pin diameter at base (alternative):  $3.18 \pm 0.30$
- Pin diameter at base (alternative):  $1.50 \pm 0.10$
- Pin diameter at base (alternative):  $0.50^{+0.10}_{-0.05}$

**Top View (Bottom):**

- Overall width:  $2.54 \text{ TYP}$  and  $[2.54 \pm 0.25]$
- Pin diameter at base:  $0.60 \pm 0.10$
- Pin diameter at base (alternative):  $(1.19)$
- Pin diameter at base (alternative):  $(7.62)$
- Pin diameter at base (alternative):  $(1.19)$

## Ordering Information

Product Number	Package	Rating	Fosc
KA1M0565R-TU	TO-220F-4L	650V, 5A	67kHz
KA1M0565R-YDTU	TO-220F-4L(Forming)		
KA1H0565R-TU	TO-220F-4L	650V, 5A	100kHz
KA1H0565R-YDTU	TO-220F-4L(Forming)		

TU : Non Forming Type

YDTU : Forming Type

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