

# KA1M0965R

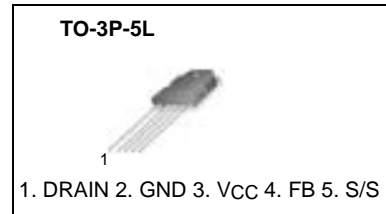
## Fairchild Power Switch(FPS)

### Features

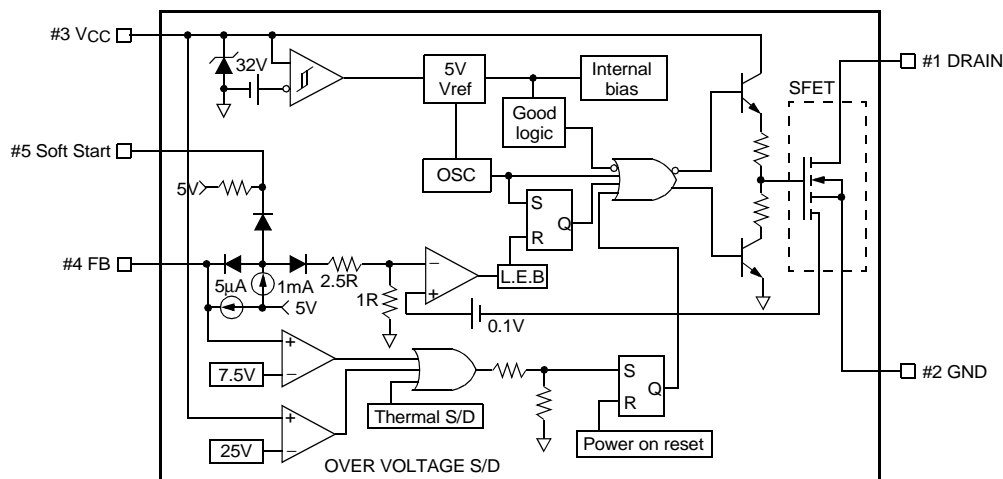
- Precision Fixed Operating Frequency (67kHz)
- Pulse by Pulse Over Current Limiting
- Over Load Protection
- Over Voltage Protection (Min. 23V)
- Internal Thermal Shutdown Function
- Under Voltage Lockout
- Internal High Voltage Sense FET
- Auto Restart
- Soft Start

### 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 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.



### Internal Block Diagram



Rev.1.0.3

## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
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>	36.0	ADC
Single Pulsed Avalanche Energy <sup>(3)</sup>	E <sub>AS</sub>	950	mJ
Continuous Drain Current (T <sub>C</sub> =25°C)	I <sub>D</sub>	9.0	ADC
Continuous Drain Current (T <sub>C</sub> =100°C)	I <sub>D</sub>	5.8	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>	170	W
	Darting	1.33	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 = 20mH, 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	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 <sup>(Note)</sup>	RDS(ON)	VGS=10V, ID=4.5A	-	0.96	1.2	Ω
Forward Transconductance <sup>(Note)</sup>	gfs	VDS=15V, ID=4.5A	5.0	-	-	S
Input Capacitance	Ciss	VGS=0V, VDS=25V, f=1MHz	-	1750	-	pF
Output Capacitance	Coss		-	190	-	
Reverse Transfer Capacitance	Crss		-	78	-	
Turn on Delay Time	td(on)	VDD=0.5BVDSS, ID=9.0A (MOSFET switching time are essentially independent of operating temperature)	-	20	50	nS
Rise Time	tr		-	23	55	
Turn Off Delay Time	td(off)		-	85	180	
Fall Time	tf		-	30	70	
Total Gate Charge (Gate-Source+Gate-Drain)	Qg	VGS=10V, ID=9.0A, VDS=0.5BVDSS (MOSFET switching time are essentially independent of operating temperature)	-	74	75	nC
Gate-Source Charge	Qgs		-	12	-	
Gate-Drain (Miller) Charge	Qgd		-	35.4	-	

**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	9	10	11	V
<b>OSCILLATOR SECTION</b>						
Initial Accuracy	FOSC	Ta=25°C	61	67	73	kHz
Frequency Change With Temperature <sup>(2)</sup>	$\Delta F/\Delta T$	-25°C ≤ Ta ≤ +85°C	-	±5	±10	%
Maximum Duty Cycle	Dmax	-	74	77	80	%
<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>SOFT START SECTION</b>						
Soft Start Voltage	VSS	VFB =2V	4.7	5.0	5.3	V
Soft Start Current	ISS	Sync & S/S=GND	0.8	1.0	1.2	mA
<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	IOVER	Max. inductor current	5.28	6.00	6.72	A
<b>PROTECTION SECTION</b>						
Thermal Shutdown Temperature (Tj) <sup>(1)</sup>	TSD	-	140	160	-	°C
Over Voltage Protection Voltage	VOVP	-	23	25	28	V
<b>TOTAL DEVICE SECTION</b>						
Start-Up Current	ISTART	VCC=14V	0.1	0.3	0.4	mA
Operating Supply Current (Control Part Only)	IOP	Ta=25°C	6	12	18	mA
VCC Zener Voltage	VZ	ICC=20mA	30	32.5	35	V

**Notes:**

1. These parameters, although guaranteed, are not 100% tested in production
2. These parameters, although guaranteed, are tested in EDS (wafer test) process
3. The amplitude of the sync. pulse is recommended to be between 2V and 3V for stable sync. function.

## Typical Performance Characteristics

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

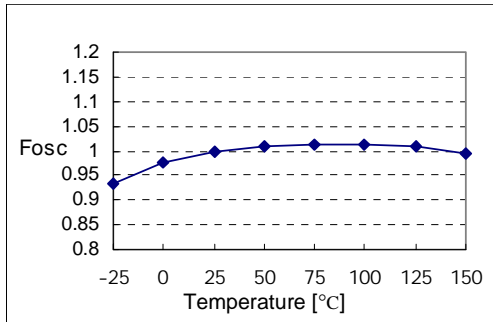


Figure 1. Operating Frequency

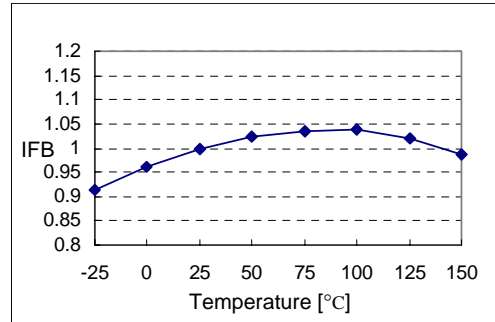


Figure 2. Feedback Source Current

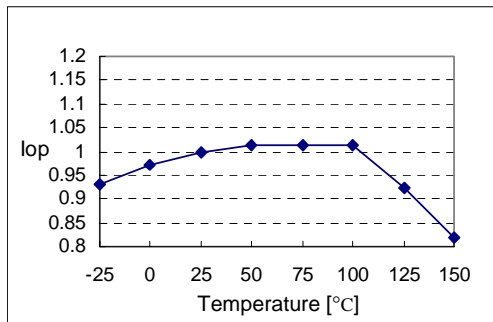


Figure 3. Operating Supply Current

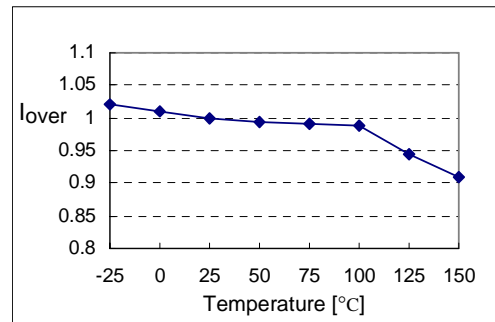


Figure 4. Peak Current Limit

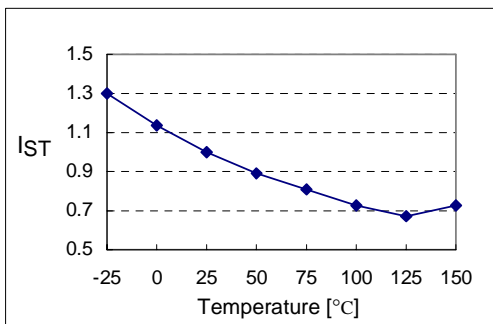


Figure 5. Start up Current

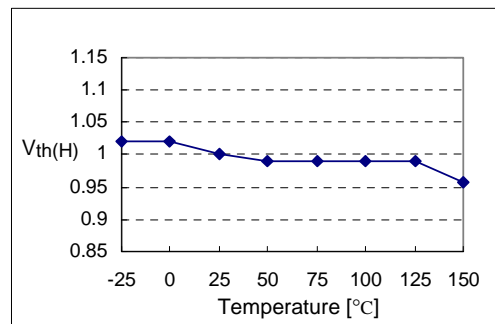
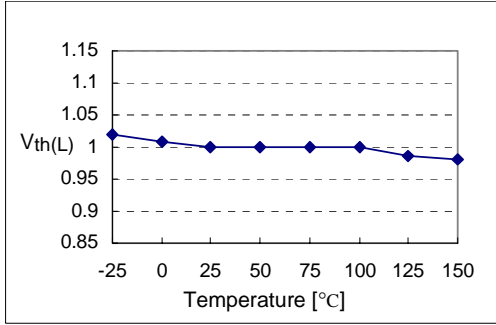


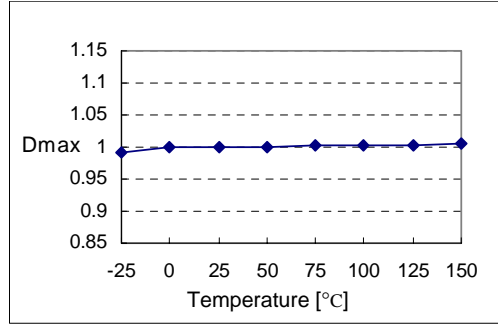
Figure 6. Start Threshold Voltage

**Typical Performance Characteristics** (Continued)

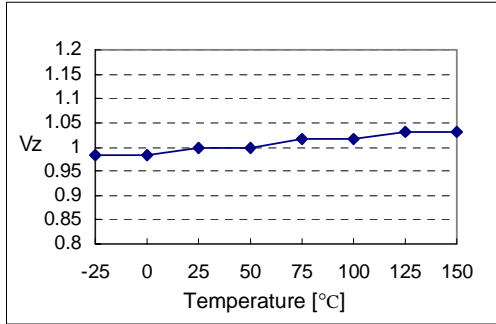
(These characteristic graphs are normalized at Ta=25°C)



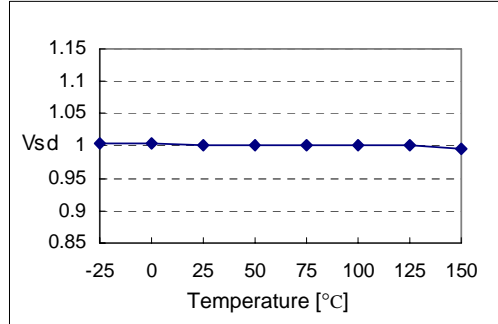
**Figure 7. Stop Threshold Voltage**



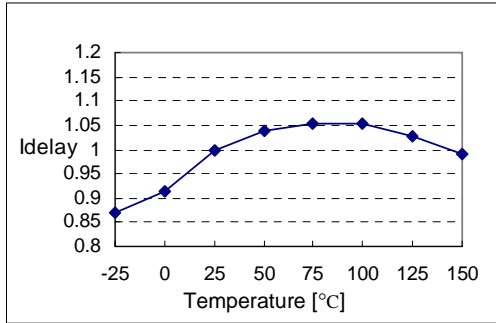
**Figure 8. Maximum Duty Cycle**



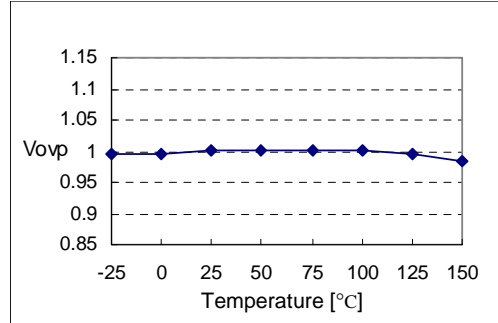
**Figure 9. VCC Zener Voltage**



**Figure 10. Shutdown Feedback Voltage**



**Figure 11. Shutdown Delay Current**



**Figure 12. Over Voltage Protection**

## Typical Performance Characteristics (Continued)

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

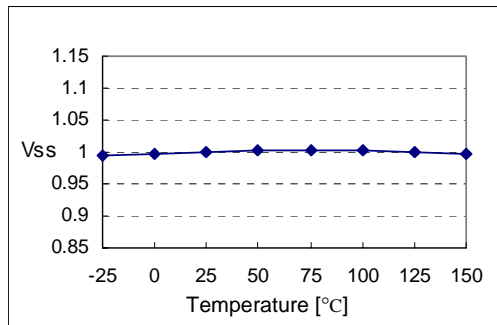


Figure 13. Soft Start Voltage

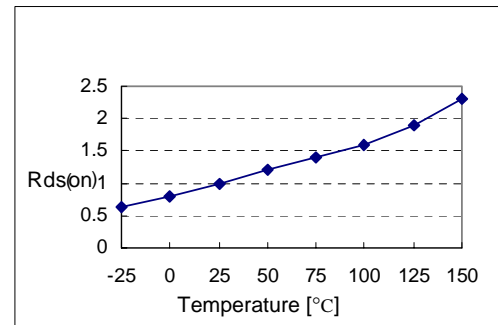
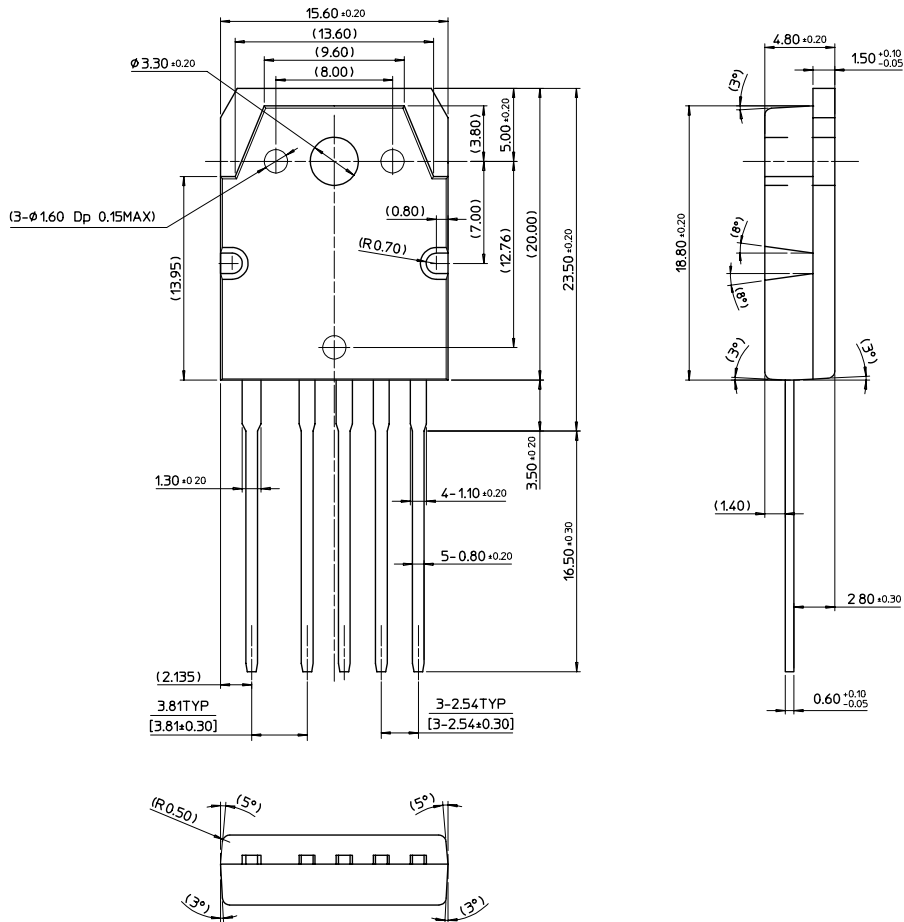


Figure 14. Static Drain Source on Resistance

# Package Dimensions

## TO-3P-5L







## Ordering Information

Product Number	Package	Rating	Operating Temperature
KA1M0965RTU	TO-3P-5L	650V, 9A	-25°C to +85°C
KA1M0965RYDTU	TO-3P-5L(Forming)		

TU : Non Forming Type

YDTU : Forming Type

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