

# KA1H0165RN/KA1H0165R

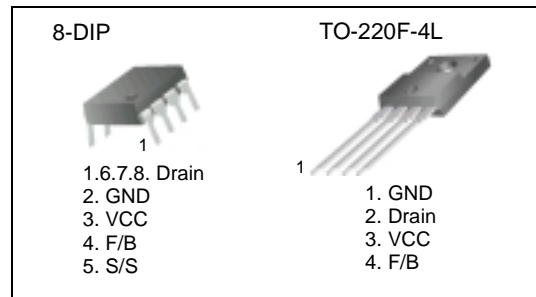
## Fairchild Power Switch(SPS)

### Features

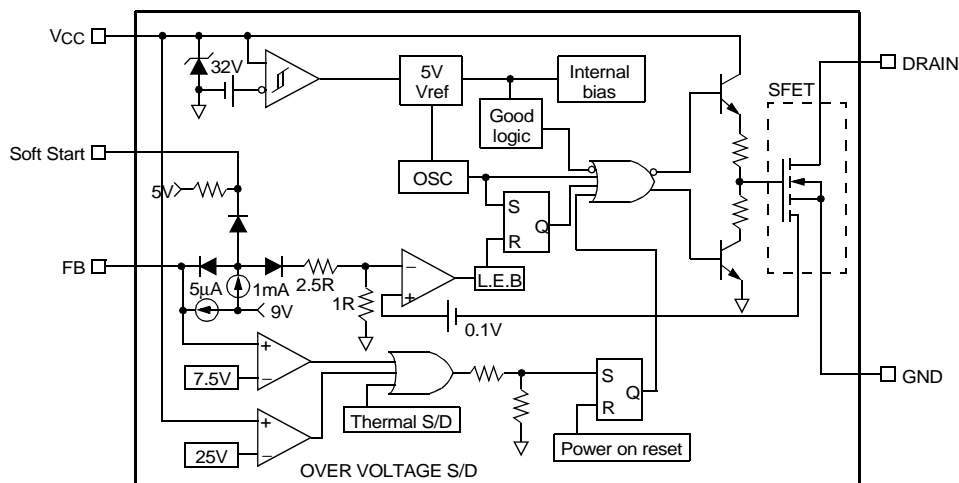
- Precision fixed operating frequency (100KHz)
- Pulse by pulse over current limiting
- Over load protection
- Over voltage protection (Min. 23V)
- Internal thermal shutdown function
- Under voltage lockout
- Internal high voltage sense FET
- Auto restart

### Description

The SPS product family is specially designed for an off-line SMPS with minimal external components. The SPS 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 SPS 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

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>	4.0	ADC
Single pulsed avalanche energy <sup>(3)</sup>	E <sub>AS</sub>	95	mJ
Continuous drain current (T <sub>C</sub> =25°C)	I <sub>D</sub>	1.0	ADC
Continuous drain current (T <sub>C</sub> =100°C)	I <sub>D</sub>	0.7	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>	40	W
	Derating	0.32	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=80mH, 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> =0.5A	-	8	10	Ω
Forward transconductance <sup>(note)</sup>	g <sub>fs</sub>	V <sub>DS</sub> =50V, I <sub>D</sub> =0.5A	0.5	-	-	S
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz	-	250	-	pF
Output capacitance	C <sub>oss</sub>		-	25	-	
Reverse transfer capacitance	C <sub>rss</sub>		-	10	-	
Turn on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> =0.5BV <sub>DSS</sub> , I <sub>D</sub> =1.0A (MOSFET switching time are essentially independent of operating temperature)	-	12	-	nS
Rise time	t <sub>r</sub>		-	4	-	
Turn off delay time	t <sub>d(off)</sub>		-	30	-	
Fall time	t <sub>f</sub>		-	10	-	
Total gate charge (gate-source+gate-drain)	Q <sub>g</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =1.0A, V <sub>DS</sub> =0.5BV <sub>DSS</sub> (MOSFET switching time are essentially independent of operating temperature)	-	-	21	nC
Gate-source charge	Q <sub>gs</sub>		-	3	-	
Gate-drain (Miller) charge	Q <sub>gd</sub>		-	9	-	

**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
<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	90	100	110	kHz
Frequency change with temperature <sup>(2)</sup>	$\Delta F/\Delta T$	-25°C≤Ta≤+85°C	-	±5	±10	%
Maximum duty cycle	Dmax	-	64	67	70	%
<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 ( KA1H0165RN)</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	0.53	0.6	0.67	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

## Typical Performance Characteristics

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



Figure 1. Operating Frequency

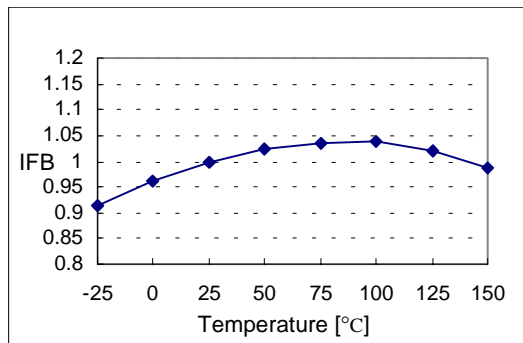


Figure 2. Feedback Source Current

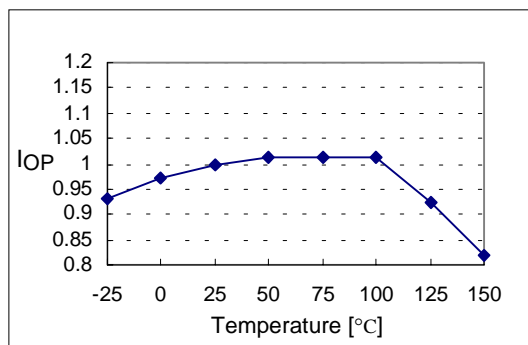


Figure 3. Operating Supply Current

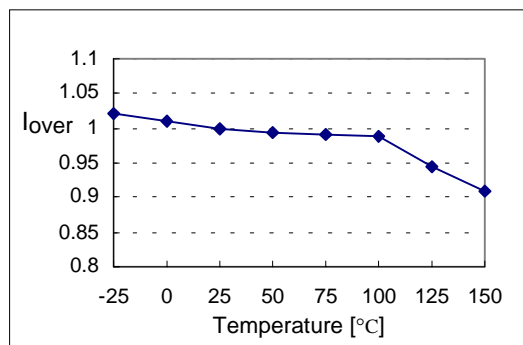


Figure 4. Peak Current Limit

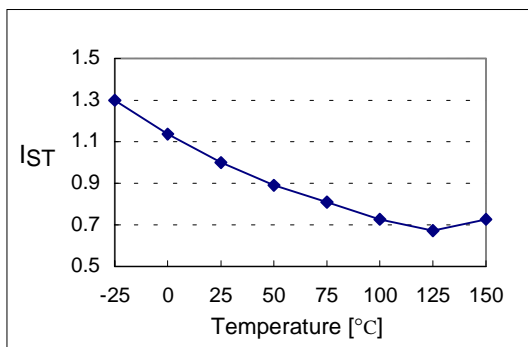


Figure 5. Start up Current

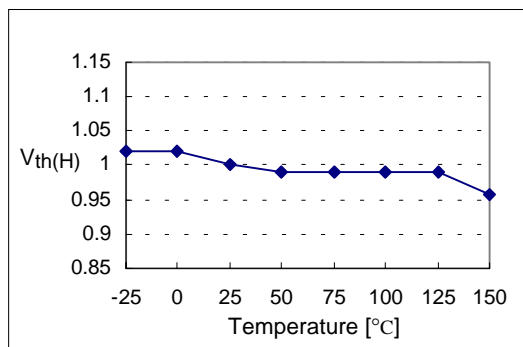


Figure 6. Start Threshold Voltage

## 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



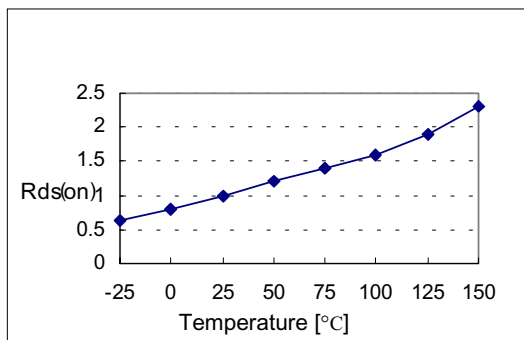
Figure 11. Shutdown Delay Current



Figure 12. Over Voltage Protection

## Typical Performance Characteristics (Continued)

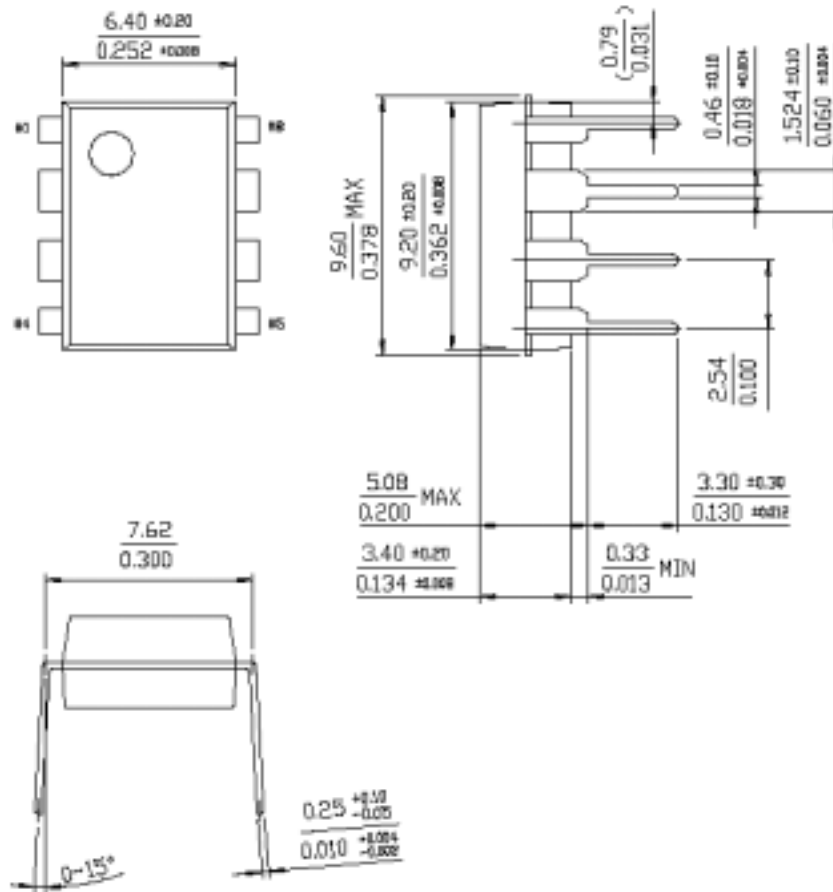
(These characteristic graphs are normalized at  $T_a=25^\circ\text{C}$ )



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

# Package Dimensions

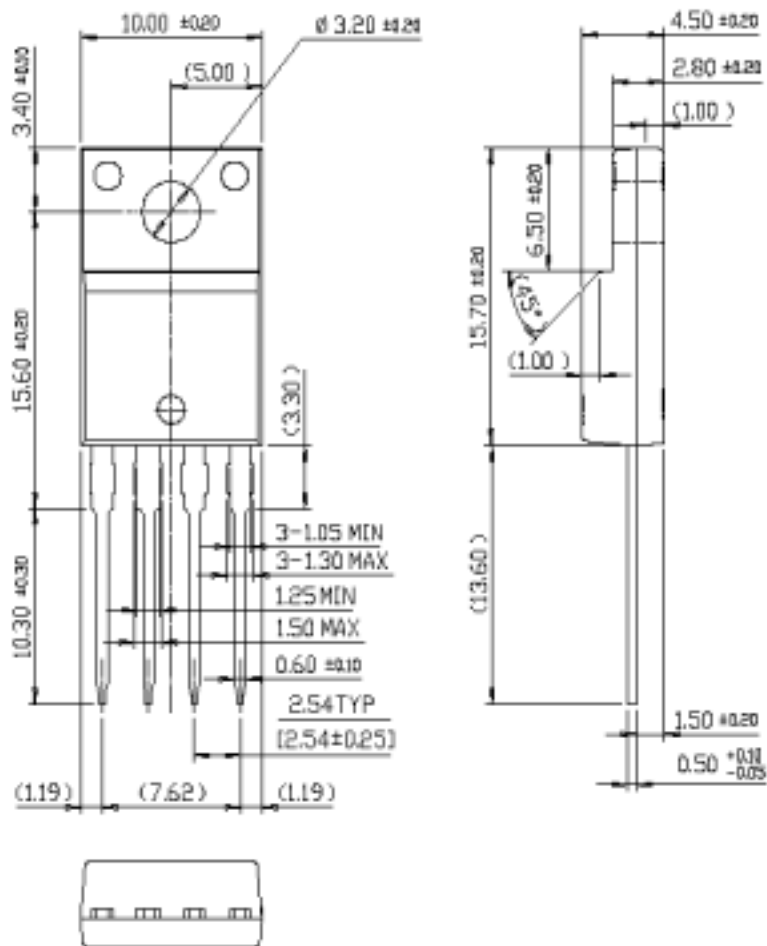
## 8-DIP





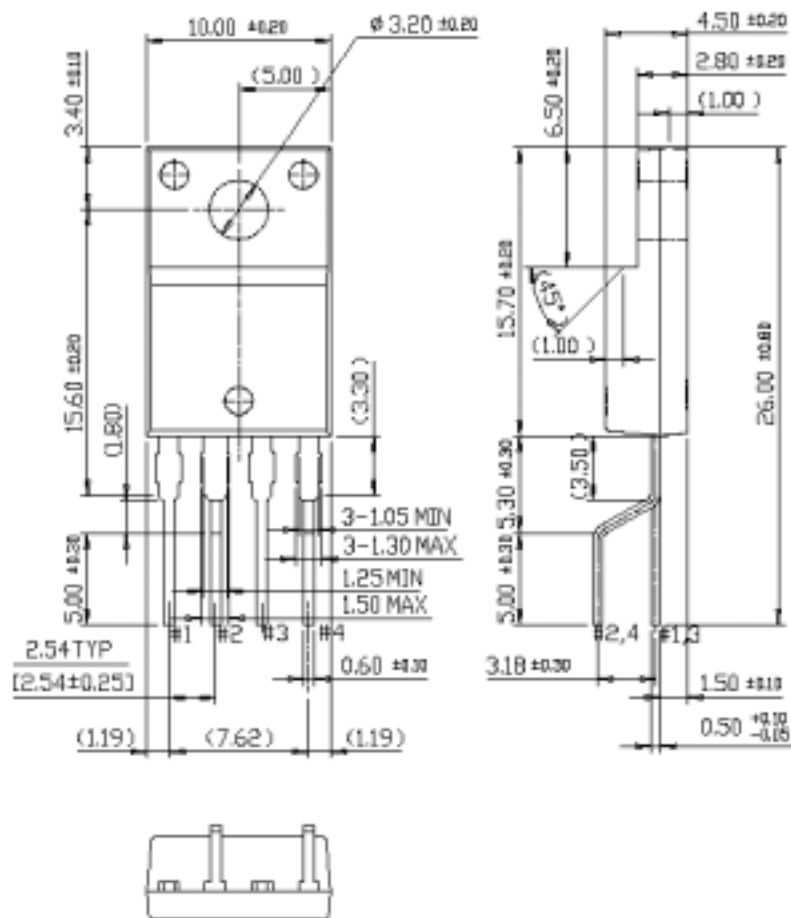
# Package Dimensions (Continued)

## TO-220F-4L



Package Dimensions (Continued)

TO-220F-4L(Forming)



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## Ordering Information

Product Number	Package	Rating	Operating Temperature
KA1H0165RN	8-DIP	650V, 1A	-25°C to +85°C
KA1H0165R-TU	TO-220F-4L	650V, 1A	-25°C to +85°C
KA1H0165R-YDTU			

TU : Non Forming Type

YDTU : Forming Type

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