

# KA1L0365R/KA1M0365R/KA1H0365R

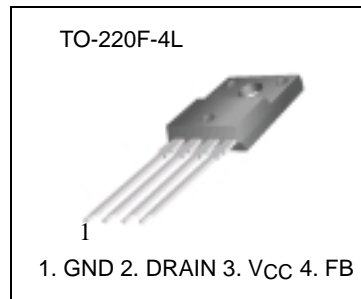
## Fairchild Power Switch(SPS)

### Features

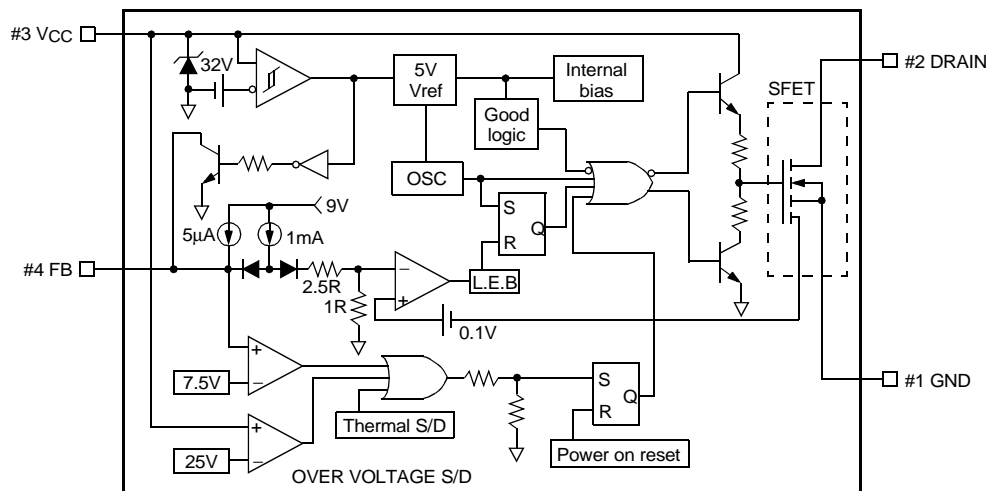
- Precision fixed operating frequency
- KA1L0365R(50KHz),KA1M0365R(67KHz),KA1H0365R (100KHz)
- Pulse by pulse over current limiting
- Over load protection
- Over voltage protection (Min. 23V)
- Internal thermal shutdown function
- Under voltage lockout
- Internal high voltage sense FET
- Auto restart

### 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>	12	ADC
Single pulsed avalanche energy <sup>(3)</sup>	E <sub>AS</sub>	358	mJ
Continuous drain current (T <sub>C</sub> =25°C)	I <sub>D</sub>	3.0	ADC
Continuous drain current (T <sub>C</sub> =100°C)	I <sub>D</sub>	2.4	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>	75	W
	Derating	0.6	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=41mH, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, 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> =1.5A	-	3.6	4.5	Ω
Forward transconductance <sup>(note)</sup>	g <sub>fs</sub>	V <sub>DS</sub> =50V, I <sub>D</sub> =1.5A	2.0	-	-	S
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz	-	720	-	pF
Output capacitance	C <sub>oss</sub>		-	40	-	
Reverse transfer capacitance	C <sub>rss</sub>		-	40	-	
Turn on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> =0.5BV <sub>DSS</sub> , I <sub>D</sub> =3.0A (MOSFET switching time are essentially independent of operating temperature)	-	150	-	nS
Rise time	t <sub>r</sub>		-	100	-	
Turn off delay time	t <sub>d(off)</sub>		-	150	-	
Fall time	t <sub>f</sub>		-	42	-	
Total gate charge (gate-source+gate-drain)	Q <sub>g</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =3.0A, V <sub>DS</sub> =0.5BV <sub>DSS</sub> (MOSFET switching time are essentially independent of operating temperature)	-	-	34	nC
Gate-source charge	Q <sub>gs</sub>		-	7.3	-	
Gate-drain (Miller) charge	Q <sub>gd</sub>		-	13.3	-	

**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
<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	KA1L0365R	45	50	55	kHz
		KA1M0365R	61	67	73	
		KA1H0365R	90	100	110	
Frequency change with temperature <sup>(2)</sup>	$\Delta F/\Delta T$	-25°C≤Ta≤+85°C	-	±5	±10	%
Maximum duty cycle	Dmax	KA1L0365R	74	77	80	%
		KA1M0365R	74	77	80	
		KA1H0365R	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	I <sub>delay</sub>	Ta=25°C, 5V≤Vfb≤VSD	4.0	5.0	6.0	μA
<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	I <sub>OVER</sub>	Max. inductor current	1.89	2.15	2.41	A
<b>PROTECTION SECTION</b>						
Thermal shutdown temperature (Tj) <sup>(1)</sup>	TSD	-	140	160	-	°C
Over voltage protection voltage	V <sub>OVP</sub>	-	23	25	28	V
<b>TOTAL DEVICE SECTION</b>						
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

### 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

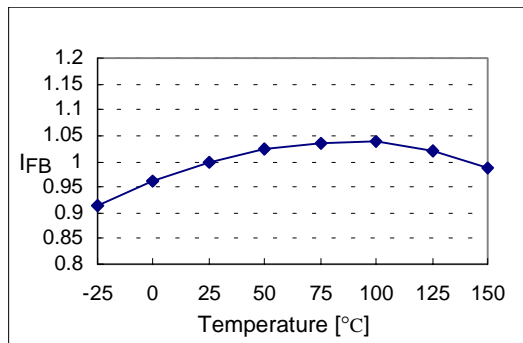


Figure 2. Feedback Source Current

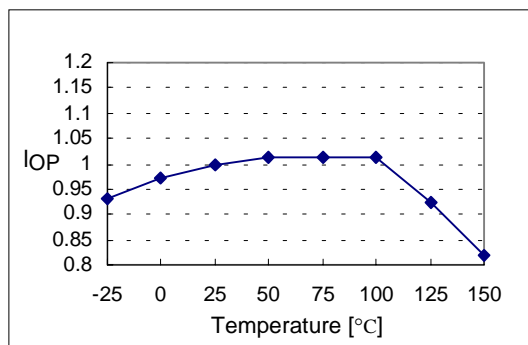


Figure 3. Operating Supply Current

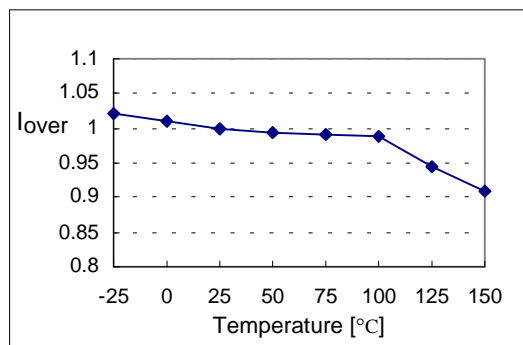


Figure 4. Peak Current Limit



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



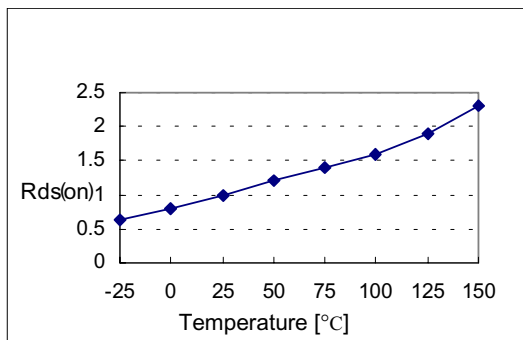
Figure 11. Shutdown Delay Current



Figure 12. Over Voltage Protection

## Typical Performance Characteristics (Continued)

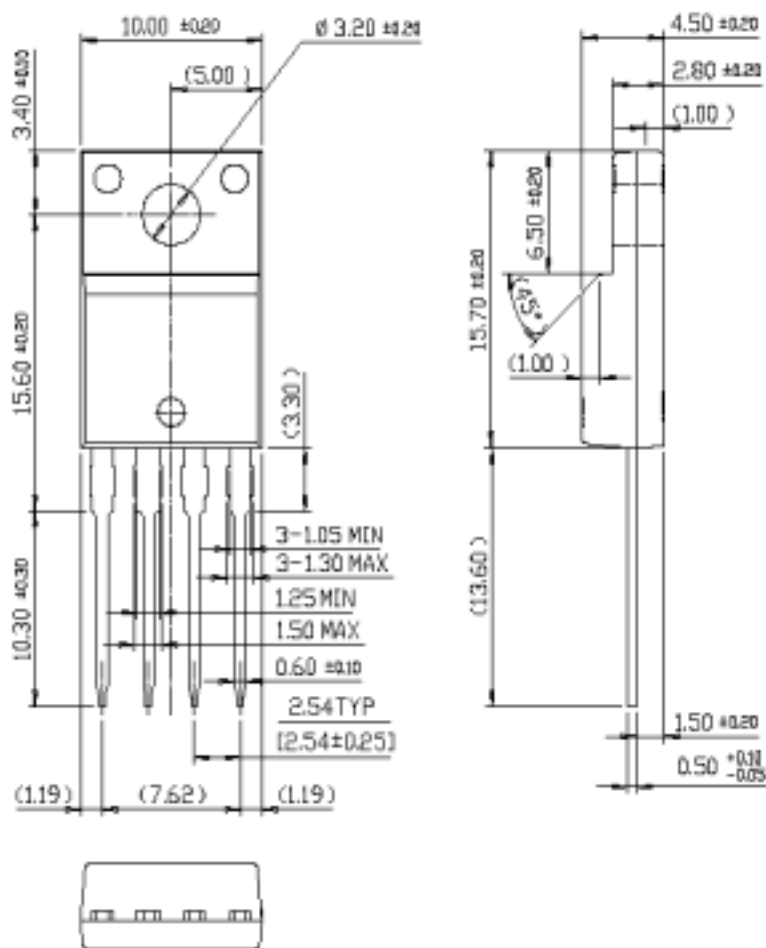
(These characteristic graphs are normalized at  $T_a=25^\circ\text{C}$ )



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

# Package Dimensions

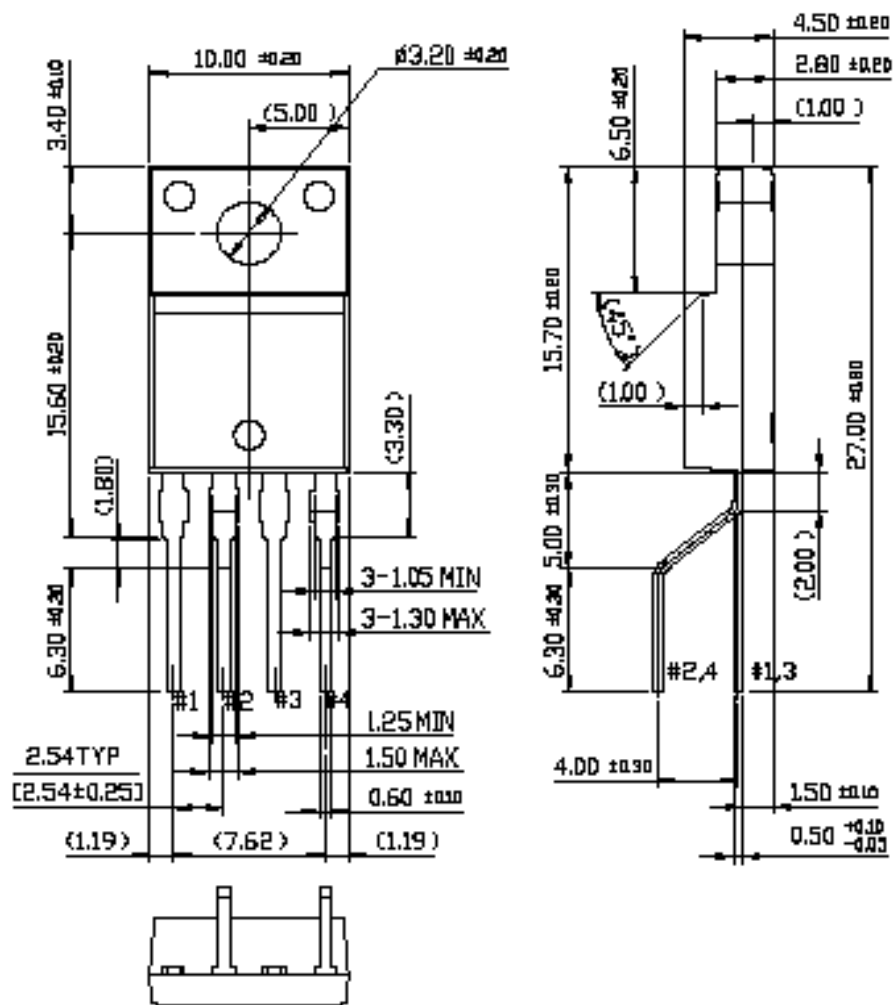
## TO-220F-4L





Package Dimensions (Continued)

TO-220F-4L (Forming)



## Ordering Information

Product Number	Package	Rating	Fosc
KA1L0365R-TU	TO-220F-4L	650V, 3A	50kHz
KA1L0365R-YDTU	TO-220F-4L(Forming)		
KA1M0365R-TU	TO-220F-4L	650V, 3A	67kHz
KA1M0365R-YDTU	TO-220F-4L(Forming)		
KA1H0365R-TU	TO-220F-4L	650V, 3A	100kHz
KA1H0365R-YDTU	TO-220F-4L(Forming)		

TU : Non Forming Type

YDTU : Forming Type



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