

KA1L0380B/KA1L0380RB/ KA1M0380RB/KA1H0380RB

Fairchild Power Switch(FPS)

Features

- Precision fixed operating frequency
- KA1L0380B/KA1L0380RB (50KHz)
- KA1M0380RB (67KHz)
- KA1H0380RB (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 (KA1L0380RB/KA1M0380RB/KA1H0380RB)

Description

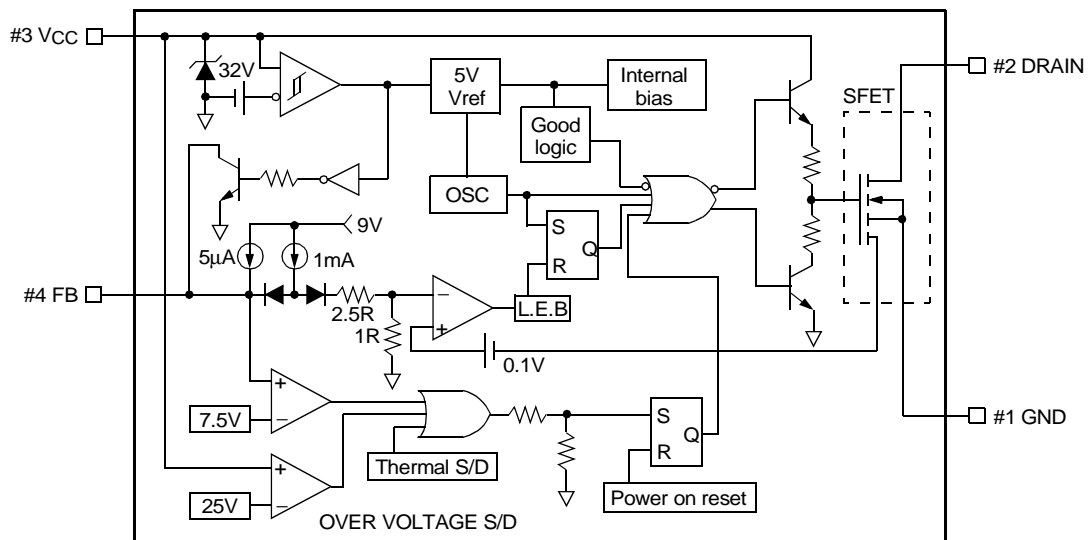
The Fairchild Power Switch(FPS) product family is specially designed for an off line SMPS with minimal external components. The Fairchild Power Switch(FPS) consist of high voltage power SenseFET and current mode PWM controller IC. PWM controller features integrated fixed oscillator, under voltage lock 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



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

Internal Block Diagram



Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Maximum Drain voltage ⁽¹⁾	V _{D,MAX}	800	V
Drain Gate voltage (R _{GS} =1MΩ)	V _{DGR}	800	V
Gate source (GND) voltage	V _{GS}	±30	V
Drain current pulsed ⁽²⁾	I _{DM}	12	ADC
Single pulsed avalanche energy ⁽³⁾	E _{AS}	95	mJ
Avalanche current ⁽⁴⁾	I _{AS}	6	A
Continuous drain current (T _C =25°C)	I _D	3.0	ADC
Continuous drain current (T _C =100°C)	I _D	2.1	ADC
Maximum Supply voltage	V _{CC,MAX}	30	V
Input voltage range	V _{FB}	-0.3 to V _{SD}	V
Total power dissipation	P _D	35	W
	Derating	0.28	W/°C
Operating ambient temperature	T _A	-25 to +85	°C
Storage temperature	T _{STG}	-55 to +150	°C

Notes:

1. T_j=25°C to 150°C
2. Repetitive rating: Pulse width limited by maximum junction temperature
3. L=51mH, V_{DD}=50V, R_G=25Ω, starting T_j=25°C
4. L=13μH, starting T_j=25°C

Electrical Characteristics (SFET part)

(Ta=25°C unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain source breakdown voltage	BV _{DSS}	V _{GS} =0V, I _D =50μA	800	-	-	V
Zero gate voltage drain current	I _{DSS}	V _{DS} =Max., Rating, V _{GS} =0V	-	-	50	μA
		V _{DS} =0.8Max., Rating, V _{GS} =0V, T _C =125°C	-	-	200	μA
Static drain-source on resistance ^(Note)	R _{DS(ON)}	V _{GS} =10V, I _D =1.5A	-	4.0	5.0	Ω
Forward transconductance ^(Note)	g _{fs}	V _{DS} =15V, I _D =1.5A	1.5	2.5	-	S
Input capacitance	C _{iss}	V _{GS} =0V, V _{DS} =25V, f=1MHz	-	779	-	pF
Output capacitance	C _{oss}		-	75.6	-	
Reverse transfer capacitance	C _{rss}		-	24.9	-	
Turn on delay time	t _{d(on)}	V _{DD} =0.5BV _{DSS} , I _D =3.0A (MOSFET switching time are essentially independent of operating temperature)	-	40	-	nS
Rise time	t _r		-	95	-	
Turn off delay time	t _{d(off)}		-	150	-	
Fall time	t _f		-	60	-	
Total gate charge (gate-source+gate-drain)	Q _g	V _{GS} =10V, I _D =3.0A, V _{DS} =0.5BV _{DSS} (MOSFET switching time are essentially independent of operating temperature)	-	-	34	nC
Gate source charge	Q _{gs}		-	7.2	-	
Gate drain (Miller) charge	Q _{gd}		-	12.1	-	

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	KA1L0380B	45	50	55	kHz
		KA1L0380RB	45	50	55	
		KA1M0380RB	61	67	73	
		KA1H0380RB	90	100	110	
Frequency change with temperature ⁽²⁾	$\Delta F/\Delta T$	-25°C ≤ Ta ≤ +85°C	-	±5	±10	%
Maximum duty cycle	Dmax	KA1L0380B	74	77	80	%
		KA1L0380RB	74	77	80	
		KA1M0380RB	74	77	80	
		KA1H0380RB	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	I _{delay}	Ta=25°C, 5V ≤ Vfb ≤ VSD	4.0	5.0	6.0	μA
REFERENCE SECTION						
Output voltage ⁽¹⁾	Vref	Ta=25°C	4.80	5.00	5.20	V
Temperature Stability ⁽¹⁾⁽²⁾	Vref/ΔT	-25°C ≤ Ta ≤ +85°C	-	0.3	0.6	mV/°C
CURRENT LIMIT (SELF-PROTECTION) SECTION						
Peak Current Limit	I _{OVER}	Max. inductor current	1.89	2.15	2.41	A
PROTECTION SECTION						
Thermal shutdown temperature (Tj) ⁽¹⁾	TSD	-	140	160	-	°C
Over voltage protection voltage	VOVP	-	23	25	28	V
TOTAL DEVICE SECTION						
Start Up current	I _{START}	VCC=14V	0.1	0.3	0.45	mA
Operating supply current (control part only)	I _{OP}	Ta=25°C	6	12	18	mA
VCC zener voltage	VZ	ICC=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 $T_a=25^\circ\text{C}$)

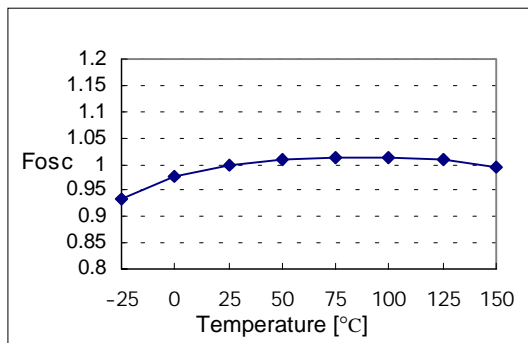


Figure 1. Operating Frequency

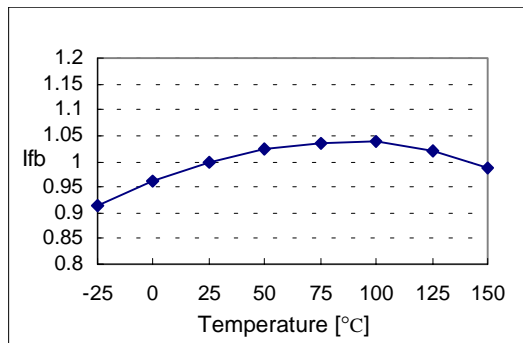


Figure 2. Feedback Source Current

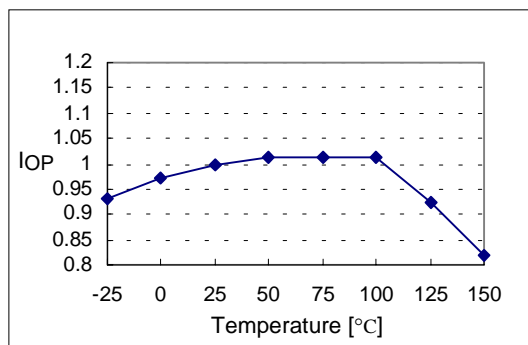


Figure 3. Operating Supply Current

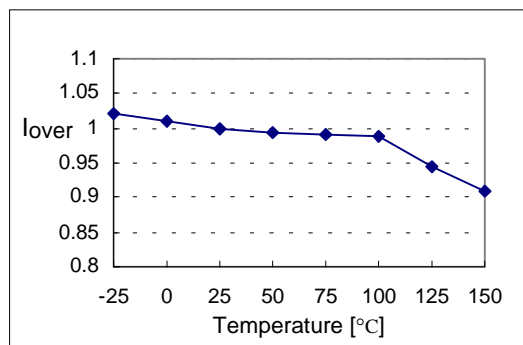


Figure 4. Peak Current Limit

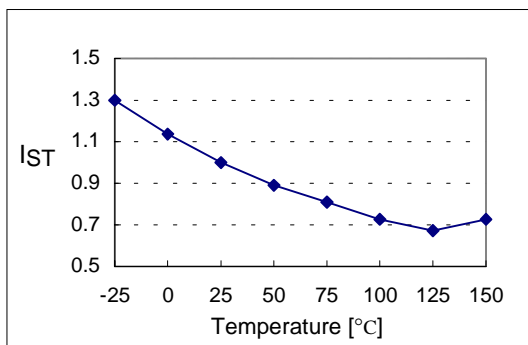


Figure 5. Start up Current

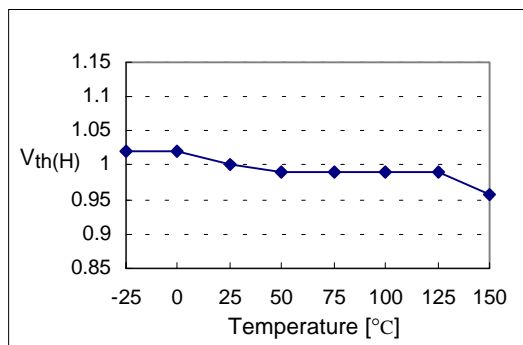


Figure 6. Start Threshold Voltage

Typical Performance Characteristics (Continued)

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

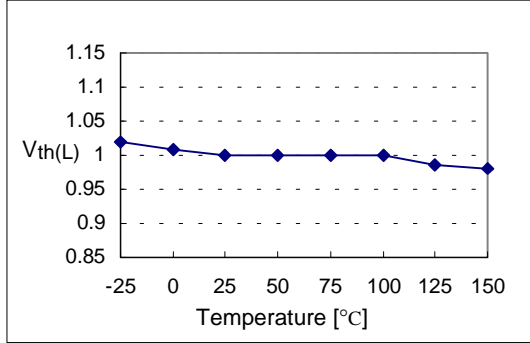


Figure 7. Stop Threshold Voltage



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

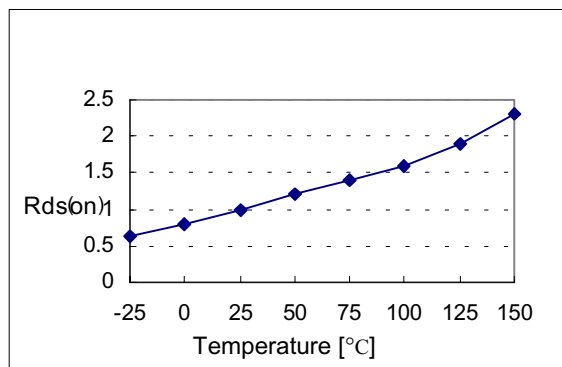
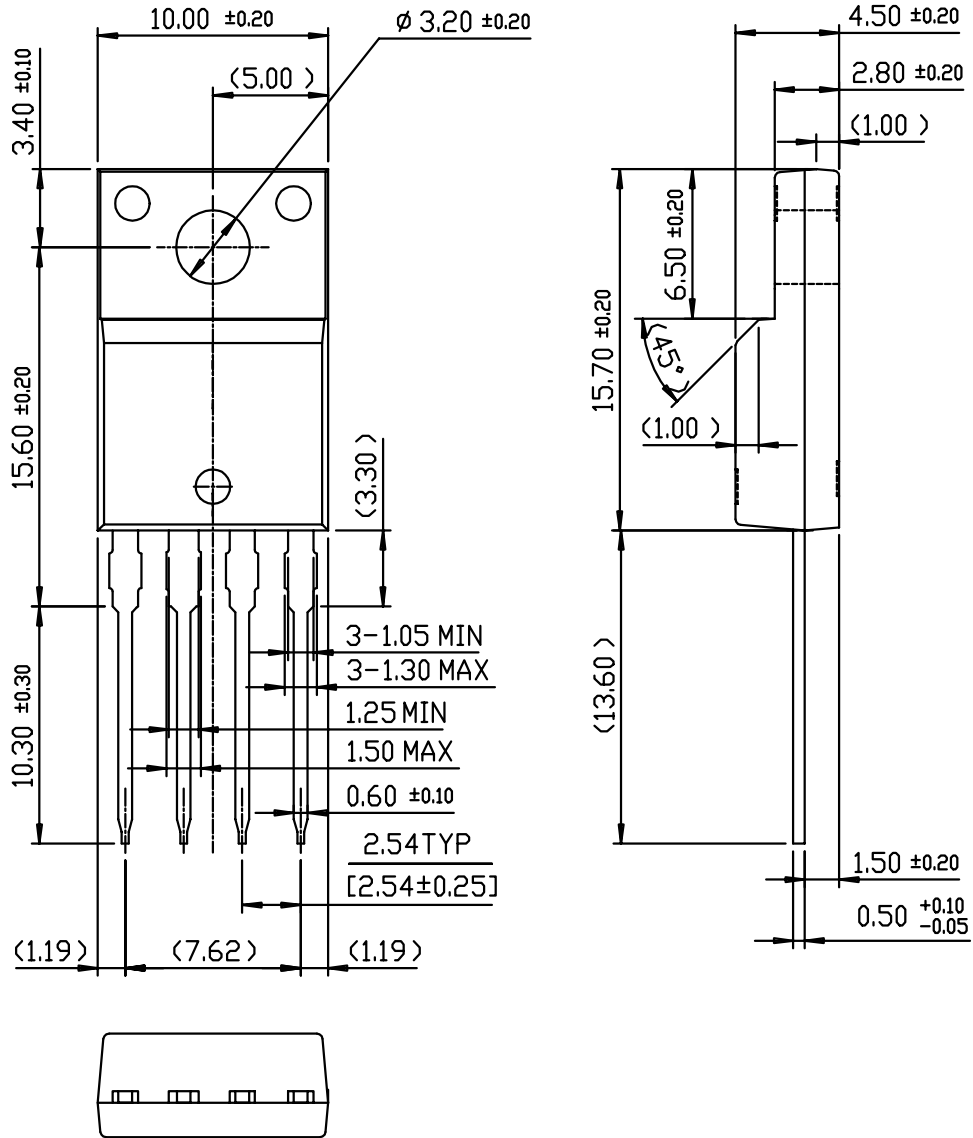


Figure 13. Static Drain-Source on Resistance

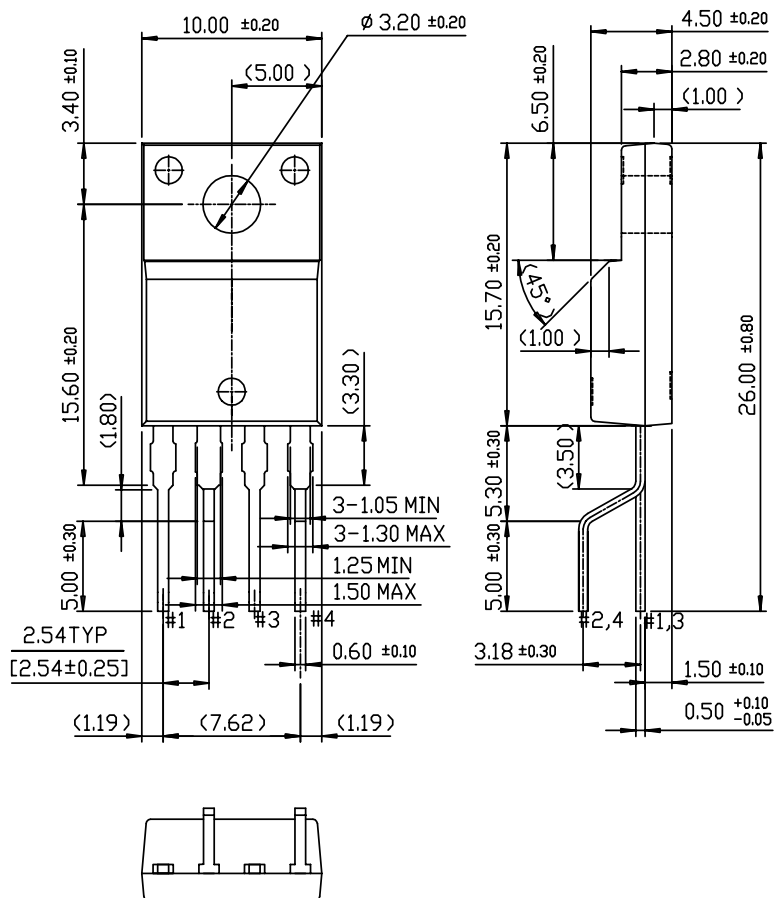
Package Dimensions

TO-220F-4L



Package Dimensions (Continued)

TO-220F-4L(Forming)



Ordering Information

Product Number	Package	Rating	Fosc
KA1L0380B-TU	TO-220F-4L	800V, 3A	50kHz
KA1L0380B-YDTU	TO-220F-4L(Forming)		
KA1L0380RB-TU	TO-220F-4L	800V, 3A	50kHz
KA1L0380RB-YDTU	TO-220F-4L(Forming)		
KA1M0380RB-TU	TO-220F-4L	800V, 3A	67kHz
KA1M0380RB-YDTU	TO-220F-4L(Forming)		
KA1H0380RB-TU	TO-220F-4L	800V, 3A	100kHz
KA1H0380RB-YDTU	TO-220F-4L(Forming)		

TU : Non Forming Type

YDTU : Forming Type

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