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# KA5x03xx-SERIES

# KA5H0365R, KA5M0365R, KA5L0365R KA5H0380R, KA5M0380R, KA5L0380R Fairchild Power Switch(FPS)

#### **Features**

- Precision Fixed Operating Frequency (100/67/50kHz)
- Low Start-up Current(Typ. 100uA)
- Pulse by Pulse Current Limiting
- Over Current Protection
- Over Voltage Protection (Min. 25V)
- Internal Thermal Shutdown Function
- Under Voltage Lockout
- Internal High Voltage Sense FET
- · Auto-Restart Mode

### **Applications**

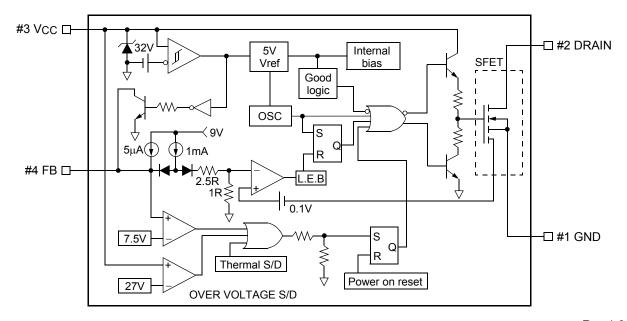
- SMPS for VCR, SVR, STB, DVD & DVCD
- SMPS for Printer, Facsimile & Scanner
- · Adaptor for Camcorder

### **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) consists of a high voltage power SenseFET and a current mode PWM IC. Included PWM controller integrates the fixed frequency oscillator, the under voltage lock-out, the leading edge blanking, the optimized gate turn-on/turn-off driver, the thermal shutdown protection, the over voltage protection, and the temperature compensated precision current sources for the loop compensation and the fault protection circuitry. Compared to a discrete MOSFET and a PWM controller or an RCCsolution, a Fairchild Power Switch(FPS) can reduce the total component count, design size and weight and at the same time increase efficiency, productivity, and system reliability. It has a basic platform well suited for the cost effective design in either a flyback converter or a forward converter



### **Internal Block Diagram**



# **Absolute Maximum Ratings**

(Ta=25°C, unless otherwise specified)

Characteristic	Symbol	Value	Unit		
KA5H0365R, KA5M0365R, KA5L0365R					
Drain-Gate Voltage (R <sub>GS</sub> =1MΩ)	VDGR	650	V		
Gate-Source (GND) Voltage	Vgs	±30	V		
Drain Current Pulsed (1)	IDM	12.0	ADC		
Continuous Drain Current (T <sub>C</sub> =25°C)	ID	3.0	ADC		
Continuous Drain Current (Tc=100°C)	ID	2.4	ADC		
Single Pulsed Avalanche Energy (2)	Eas	358	mJ		
Maximum Supply Voltage	VCC,MAX	30	V		
Analog Input Voltage Range	VFB	-0.3 to V <sub>SD</sub>	V		
Total Dawer Dissination	PD	75	W		
Total Power Dissipation	Derating	0.6	W/°C		
Operating Junction Temperature.	TJ	+150	°C		
Operating Ambient Temperature.	TA	-40 to +85	°C		
Storage Temperature Range.	TSTG	-55 to +150	°C		
KA5H0380R, KA5M0380R, KA5L0380R					
Drain-Gate Voltage (R <sub>GS</sub> =1MΩ)	VDGR	800	V		
Gate-Source (GND) Voltage	Vgs	±30	V		
Drain Current Pulsed (1)	I <sub>DM</sub>	12.0	ADC		
Continuous Drain Current (T <sub>C</sub> =25°C)	ID	3.0	ADC		
Continuous Drain Current (T <sub>C</sub> =100°C)	ID	2.1	ADC		
Single Pulsed Avalanche Energy (2)	Eas	95	mJ		
Maximum Supply Voltage	VCC,MAX	30	V		
Analog Input Voltage Range	VFB	-0.3 to V <sub>SD</sub>	V		
Total Power Dissipation	PD 75		W		
Total Fower Dissipation	Derating	0.6	W/°C		
Operating Junction Temperature.	TJ	+150	°C		
Operating Ambient Temperature.	TA	-40 to +85	°C		
Storage Temperature Range.	TSTG	-55 to +150	°C		

#### Note:

<sup>1.</sup> Repetitive rating: Pulse width limited by maximum junction temperature

<sup>2.</sup> L = 51mH, starting Tj =  $25^{\circ}$ C

<sup>3.</sup> L =  $13\mu H$ , starting Tj =  $25^{\circ}C$ 

# **Electrical Characteristics (SenseFET Part)**

(Ta = 25°C unless otherwise specified)

Parameter	Symbol	Condition	Min.	Тур.	Max.	Unit		
KA5H0365R, KA5M0365R, KA5L0365R								
Drain-Source Breakdown Voltage	BVDSS	V <sub>G</sub> S=0V, I <sub>D</sub> =50μA	650	-	-	V		
Zero Gate Voltage Drain Current		V <sub>DS</sub> =Max. Rating, V <sub>GS</sub> =0V	-	-	50	μΑ		
	IDSS	V <sub>DS</sub> =0.8Max. Rating, V <sub>GS</sub> =0V, T <sub>C</sub> =125°C	-	-	200	μА		
Static Drain-Source on Resistance (Note)	RDS(ON)	VGS=10V, ID=0.5A	-	3.6	4.5	Ω		
Forward Transconductance (Note)	gfs	V <sub>DS</sub> =50V, I <sub>D</sub> =0.5A	2.0	-	-	S		
Input Capacitance	Ciss			720	-			
Output Capacitance	Coss	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz	-	40	-	pF		
Reverse Transfer Capacitance	Crss	1 1141112	-	40	-			
Turn On Delay Time	td(on)	V <sub>DD</sub> =0.5BV <sub>DSS</sub> , I <sub>D</sub> =1.0A	-	150	-	- nS		
Rise Time	tr	(MOSFET switching	-	100	-			
Turn Off Delay Time	td(off)	time is essentially independent of	-	150	-			
Fall Time	tf	operating temperature)	-	42	-			
Total Gate Charge (Gate-Source+Gate-Drain)	Qg	V <sub>GS</sub> =10V, I <sub>D</sub> =1.0A, V <sub>DS</sub> =0.5BV <sub>DS</sub> S (MOSFET	-	-	34	nC		
Gate-Source Charge	Qgs	switching time is essentially	-	7.3	-			
Gate-Drain (Miller) Charge	Qgd	independent of operating temperature)	-	13.3	-			
KA5H0380R, KA5M0380R, KA5L0380R								
Drain-Source Breakdown Voltage	BVDSS	V <sub>G</sub> S=0V, I <sub>D</sub> =50μA	800	-	-	V		
		V <sub>DS</sub> =Max. Rating, V <sub>GS</sub> =0V	-	-	250	μА		
Zero Gate Voltage Drain Current	IDSS	V <sub>DS</sub> =0.8Max. Rating, V <sub>GS</sub> =0V, T <sub>C</sub> =125°C	-	-	1000	μΑ		
Static Drain-Source on Resistance (Note)	RDS(ON)	V <sub>G</sub> S=10V, I <sub>D</sub> =0.5A	-	4.0	5.0	Ω		
Forward Transconductance (Note)	gfs	VDS=50V, ID=0.5A	1.5	2.5	-	S		
Input Capacitance	Ciss	., .,,,,	-	779	-			
Output Capacitance	Coss	VGS=0V, VDS=25V, f=1MHz	-	75.6	-	pF		
Reverse Transfer Capacitance	Crss	1 1141112	-	24.9	-			
Turn On Delay Time	td(on)	V <sub>DD</sub> =0.5BV <sub>DSS</sub> , I <sub>D</sub> =1.0A	-	40	-			
Rise Time	tr	(MOSFET switching	-	95	-	~C		
Turn Off Delay Time	td(off)	time is essentially independent of	-	150	-	nS		
Fall Time	tf	operating temperature)	-	60	-			
Total Gate Charge (Gate-Source+Gate-Drain)	Qg	V <sub>GS</sub> =10V, I <sub>D</sub> =1.0A, V <sub>DS</sub> =0.5BV <sub>DS</sub> S (MOSFET	-	-	34			
Gate-Source Charge	Qgs	switching time is		7.2	-	nC		
Gate-Drain (Miller) Charge	Qgd	essentially independent of operating temperature)	-	12.1	-			

### Note:

2. 
$$s = \frac{1}{R}$$

<sup>1.</sup> Pulse test: Pulse width  $\leq 300 \mu S, \, \text{duty} \leq 2\%$ 

# Electrical Characteristics (Control Part) (Continued)

(Ta = 25°C unless otherwise specified)

Characteristic	Symbol	Test condition	Min.	Тур.	Max.	Unit		
UVLO SECTION			1					
Start Threshold Voltage	VSTART	V <sub>FB</sub> =GND	14	15	16	V		
Stop Threshold Voltage	VSTOP	V <sub>FB</sub> =GND	8.4	9	9.6	V		
OSCILLATOR SECTION								
Initial Accuracy	Fosc	KA5H0365R KA5H0380R	90	100	110	kHz		
Initial Accuracy	Fosc	KA5M0365R KA5M0380R	61	67	73	kHz		
Initial Accuracy	Fosc	KA5L0365R KA5L0380R	45	50	55	kHz		
Frequency Change With Temperature (2)	-	-25°C≤Ta≤+85°C	-	±5	±10	%		
Maximum Duty Cycle	Dmax	KA5H0365R KA5H0380R	62	67	72	%		
Maximum Duty Cycle	Dmax	KA5M0365R KA5M0380R KA5L0365R KA5L0380R	72	77	82	%		
FEEDBACK SECTION								
Feedback Source Current	IFB	Ta=25°C, 0V <u>&lt;</u> Vfb <u>&lt;</u> 3V	0.7	0.9	1.1	mA		
Shutdown Feedback Voltage	V <sub>SD</sub>	Vfb≥6.5V	6.9	7.5	8.1	V		
Shutdown Delay Current	Idelay	Ta=25°C, 5V≤Vfb≤VsD	4	5	6	μА		
REFERENCE SECTION								
Output Voltage (1)	Vref	Ta=25°C	4.80	5.00	5.20	V		
Temperature Stability (1)(2)	Vref/∆T	-25°C≤Ta≤+85°C	-	0.3	0.6	mV/°C		
CURRENT LIMIT(SELF-PROTECTION)SECTION								
Peak Current Limit	Iover	Max. inductor current	1.89	2.15	2.41	Α		
PROTECTION SECTION								
Over Voltage Protection	Vovp	VCC <u>&gt;</u> 24V	25	27	29	V		
Thermal Shutdown Temperature (Tj) (1)	T <sub>SD</sub>	-	140	160	-	°C		
TOTAL STANDBY CURRENT SECTION								
Start-up Current	ISTART	V <sub>CC</sub> =14V	-	100	170	μА		
Operating Supply Current (Control Part Only)	lop	V <sub>CC</sub> ≤28	-	7	12	mA		

### Note:

- 1. These parameters, although guaranteed, are not 100% tested in production
- 2. These parameters, although guaranteed, are tested in EDS(water test) process

### **Typical Performance Characteristics(SenseFET part)**

(KA5H0365R, KA5M0365R, KA5L0365R)

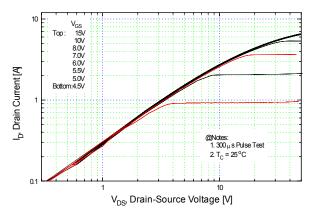


Figure 1. Output Characteristics

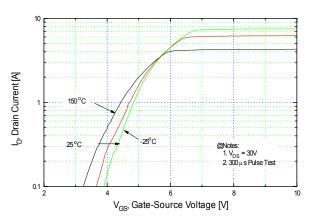


Figure 2. Transfer Characteristics

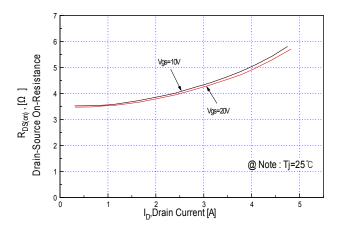


Figure 3. On-Resistance vs. Drain Current

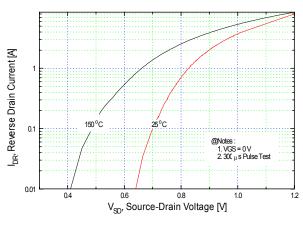


Figure 4. Source-Drain Diode Forward Voltage

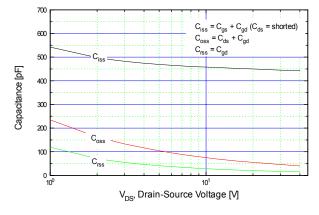


Figure 5. Capacitance vs. Drain-Source Voltage

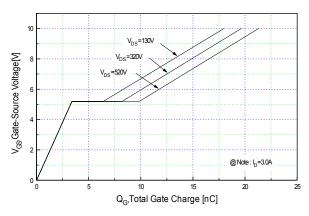


Figure 6. Gate Charge vs. Gate-Source Voltage

(KA5H0365R, KA5M0365R, KA5L0365R)

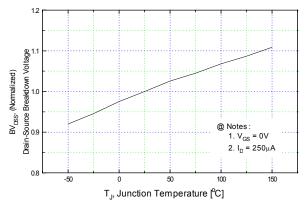
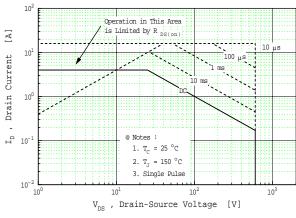


Figure 7. Breakdown Voltage vs. Temperature





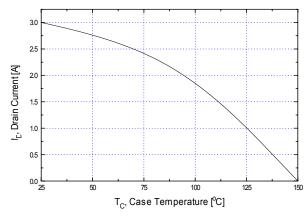


Figure 9. Max. Safe Operating Area

Figure 10. Max. Drain Current vs. Case Temperature

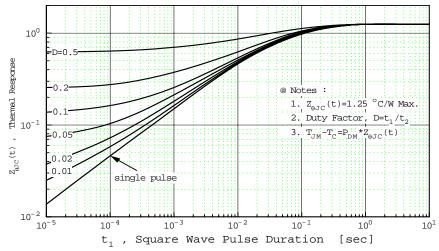


Figure 11. Thermal Response

(KA5H0380R, KA5M0380R, KA5L0380R)

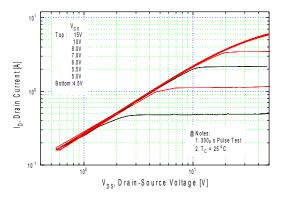


Figure 1. Output Characteristics

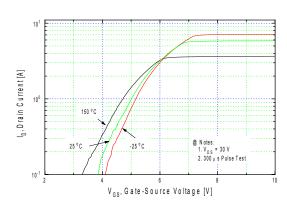


Figure 2. Thansfer Characteristics

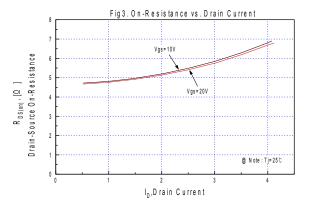


Figure 3. On-Resistance vs. Drain Current

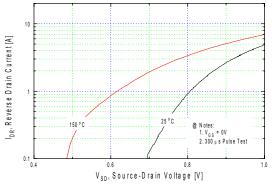


Figure 4. Source-Drain Diode Forward Voltage

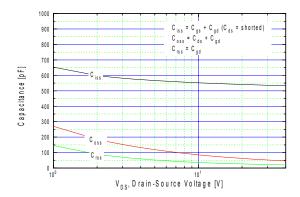


Figure 5. Capacitance vs. Drain-Source Voltage

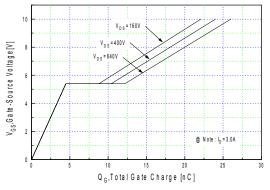
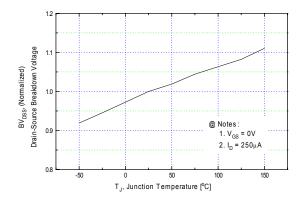


Figure 6. Gate Charge vs. Gate-Source Voltage

(KA5H0380R, KA5M0380R, KA5L0380R)

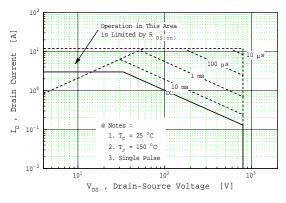


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Figure 7. Breakdown Voltage vs. Temperature



2.0



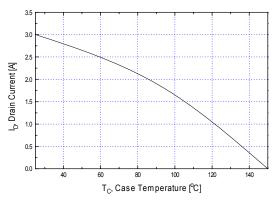


Figure 9. Max. Safe Operating Area

Figure 10. Max. Drain Current vs. Case Temperature

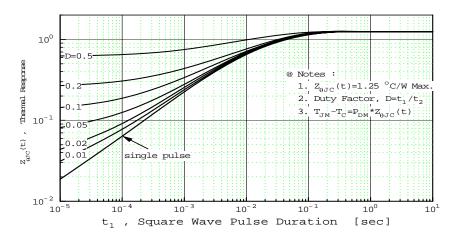


Figure 11. Thermal Response

### Typical Performance Characteristics (Control Part) (Continued)

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

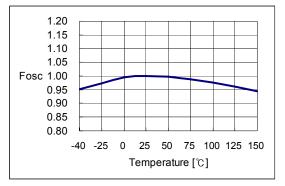
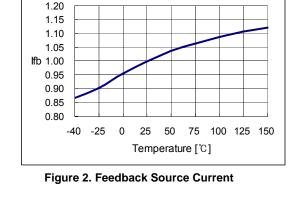


Figure 1. Operating Frequency



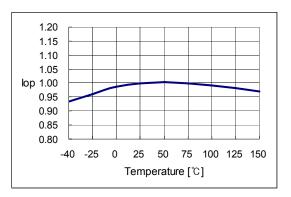


Figure 3. Operating Supply Current

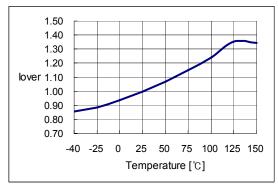


Figure 4. Peak Current Limit

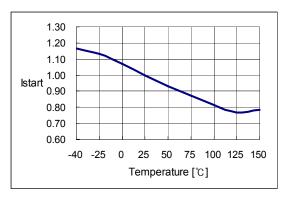


Figure 5. Start up Current

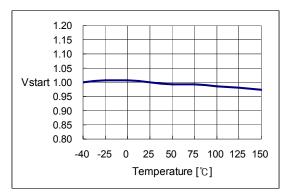


Figure 6. Start Threshold Voltage

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

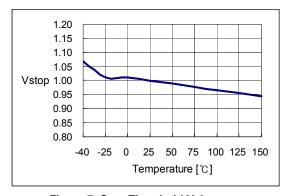


Figure 7. Stop Threshold Voltage

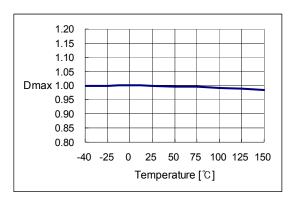


Figure 8. Maximum Duty Cycle

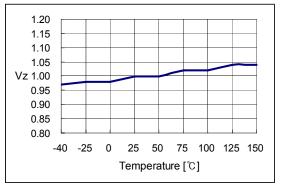


Figure 9. VCC Zener Voltage

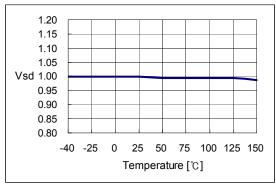


Figure 10. Shutdown Feedback Voltage

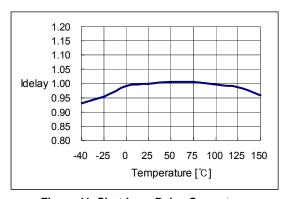


Figure 11. Shutdown Delay Current

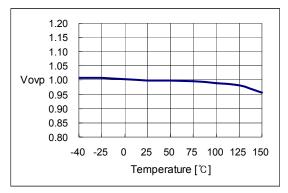


Figure 12. Over Voltage Protection

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

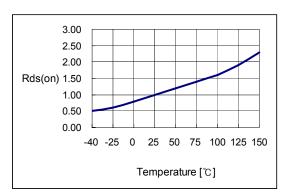
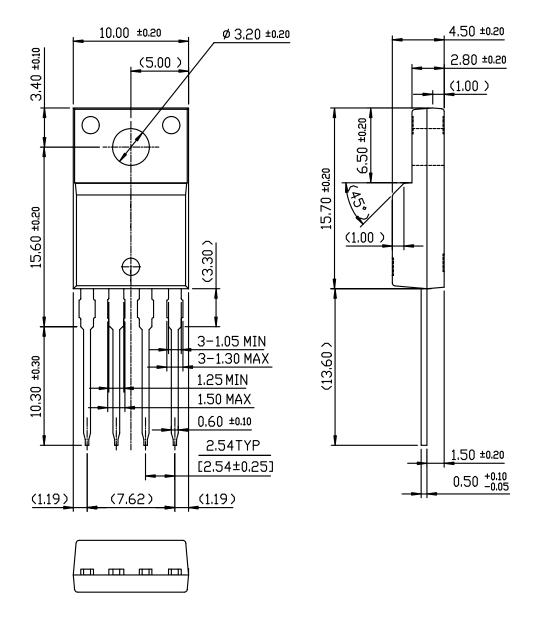


Figure 13. Static Drain-Source on Resistance

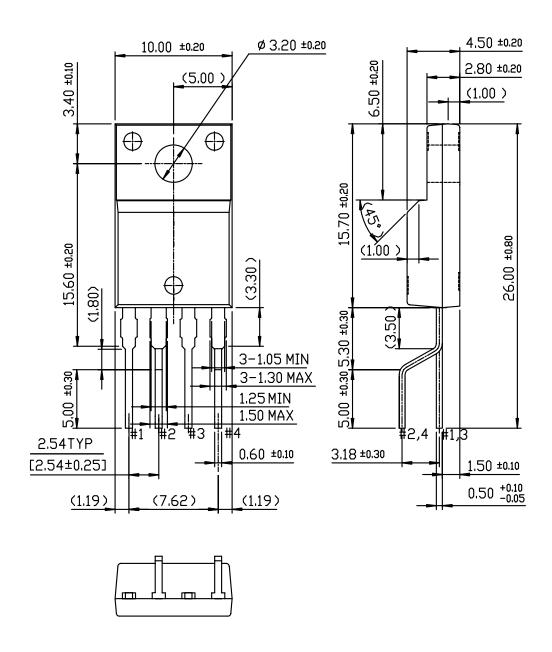
### **Package Dimensions**

TO-220F-4L



### Package Dimensions (Continued)

# TO-220F-4L(Forming)



# **Ordering Information**

Product Number	Package	Marking Code	BVDSS	Fosc	RDS(on)	
KA5H0365RTU	TO-220F-4L	5H0365R	650V	100kHz	$3.6\Omega$	
KA5H0365RYDTU	TO-220F-4L(Forming)	31103031	030 V	TOOKITZ	3.052	
KA5M0365RTU	TO-220F-4L	5M0365R	650V	67kHz	3.6Ω	
KA5M0365RYDTU	TO-220F-4L(Forming)	310030313	030 V	07 KI 12		
KA5L0365RTU	TO-220F-4L	5L0365R	650V	50kHz	3.6Ω	
KA5L0365RYDTU	TO-220F-4L(Forming)	3L0303R	030 V	SUKHZ	3.012	
Product Number	Package	Marking Code	BVDSS	Fosc	RDS(on)	
Product Number KA5H0380RTU	Package TO-220F-4L				, ,	
		Marking Code 5H0380R	BVDSS 800V	Fosc 100kHz	<b>RDS(on)</b> 4.6Ω	
KA5H0380RTU	TO-220F-4L	5H0380R	800V	100kHz	4.6Ω	
KA5H0380RYDTU	TO-220F-4L TO-220F-4L(Forming)				, ,	
KA5H0380RYDTU KA5H0380RYDTU KA5M0380RTU	TO-220F-4L TO-220F-4L(Forming) TO-220F-4L	5H0380R	800V	100kHz	4.6Ω	

TU :Non Forming Type YDTU : Forming type





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Dual Cool™ MegaBuck™
EcoSPARK® MICROCOUPLER™
EfficientMax™ MicroFET™

ESBC™

MicroPak™

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MillerDrive™

MotionMax™

Motion-SPM™

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FAST® OptoHiT™
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Power-SPM<sup>TM</sup>
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Definition of Terms					
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