

# KA5x0165Rx-SERIES

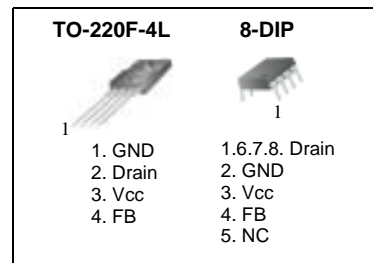
KA5H0165R/RN, KA5M0165R/RN, KA5L0165R/RN,  
KA5H0165RVN  
Fairchild Power Switch(FPS)

## Features

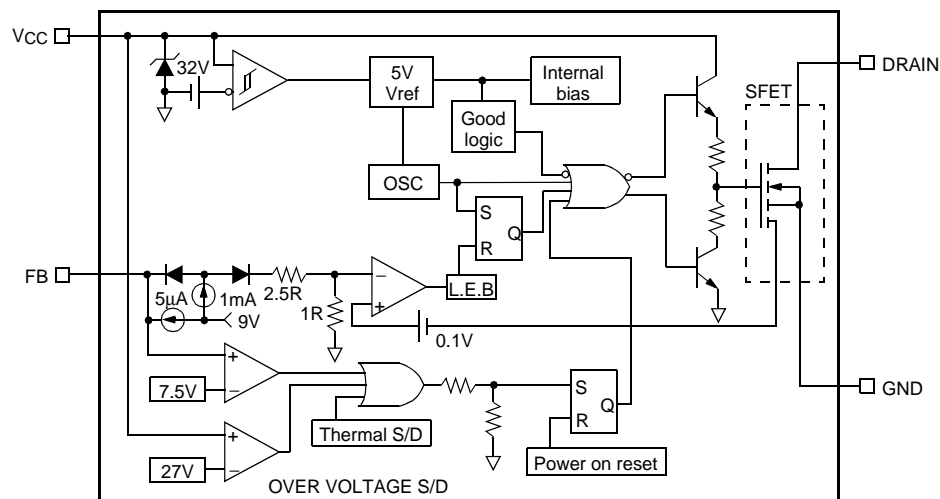
- Precision Fixed Operating Frequency (100/67/50kHz )
- Low Start-up Current (Typ. 100uA)
- Pulse by Pulse Current Limiting
- Over Load Protection
- Over Voltage Protection (Min. 25V)
  - except KA5H0165RVN
- Internal Thermal Shutdown Function
- Under Voltage Lockout
- Internal High Voltage Sense FET
- Auto-Restart Mode

## 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 IC. Included 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, and temperature compensated precision current sources for loop compensation and fault protection circuitry compared to discrete MOSFET and controller or RCC switching converter solution, The Fairchild Power Switch(FPS) can reduce total component count, design size, weight and at the same time increase efficiency, productivity, and system reliability. It is well suited for cost effective design of flyback converters.



## Internal Block Diagram



Rev.1.0.5

## Absolute Maximum Ratings

(Ta=25°C, unless otherwise specified)

Characteristic	Symbol	Value	Unit
Drain-Gate Voltage (RGS=1MΩ)	VDGR	650	V
Gate-Source (GND) Voltage	VGS	±30	V
Drain Current Pulsed <sup>(1)</sup>	IDM	4.0	ADC
Continuous Drain Current (TC=25°C)	ID	1.0	ADC
Continuous Drain Current (TC=100°C)	ID	0.7	ADC
Single Pulsed Avalanche Energy <sup>(2)</sup>	EAS	95	mJ
Maximum Supply Voltage	VCC,MAX	30	V
Analog Input Voltage Range	VFB	-0.3 to VSD	V
Total Power Dissipation	PD	40	W
	Derating	0.32	W/°C
Operating Junction Temperature.	TJ	+160	°C
Operating Ambient Temperature.	TA	-25 to +85	°C
Storage Temperature Range.	TSTG	-55 to +150	°C

**Note:**

1. Repetitive rating: Pulse width limited by maximum junction temperature
2. L=24mH, starting Tj=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> =0.5B V <sub>DSS</sub> , I <sub>D</sub> =1.0A (MOSFET switching time is 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> =0.5B V <sub>DSS</sub> (MOSFET switching time is 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:

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	VFB=GND	14	15	16	V
Stop Threshold Voltage	VSTOP	VFB=GND	8.2	8.8	9.4	V
<b>OSCILLATOR SECTION</b>						
Initial Accuracy	FOSC	<b>KA5H0165Rxx</b>	90	100	110	kHz
Initial Accuracy	FOSC	<b>KA5M0165Rx</b>	61	67	73	kHz
Initial Accuracy	FOSC	<b>KA5L0165Rx</b>	45	50	55	kHz
Frequency Change With Temperature <sup>(2)</sup>	$\Delta F/\Delta T$	-25°C ≤ Ta ≤ +85°C	-	±5	±10	%
Maximum Duty Cycle	Dmax	<b>KA5H0165Rxx</b>	62	67	72	%
Maximum Duty Cycle	Dmax	<b>KA5M0165Rx</b> <b>KA5L0165Rx</b>	72	77	82	%
<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	Vfb ≥ 6.5V	6.9	7.5	8.1	V
Shutdown Delay Current	Idelay	Ta=25°C, 3V ≤ Vfb ≤ VSD	4	5	6	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	0.53	0.6	0.67	A
<b>PROTECTION SECTION</b>						
Thermal Shutdown Temperature <sup>(1)</sup>	TSD	-	140	160	-	°C
Over Voltage Protection	VOVP	except <b>KA5H0165RVN</b>	25	27	29	V
<b>TOTAL STANDBY CURRENT SECTION</b>						
Start-up Current	I <sub>START</sub>	VCC=14V	-	100	170	μA
Operating Supply Current (Control Part Only)	I <sub>OP</sub>	VCC ≤ 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 (wafer test) process

## Typical Performance Characteristics

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

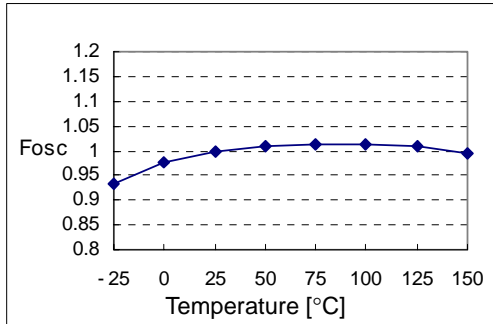


Figure 1. Operating Frequency

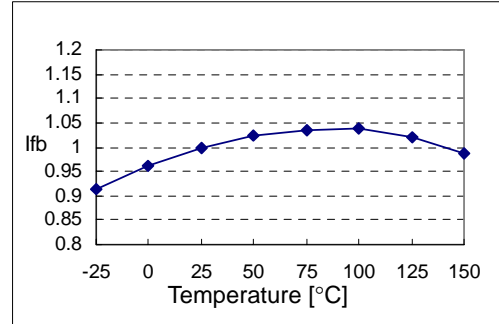


Figure 2. Feedback Source Current

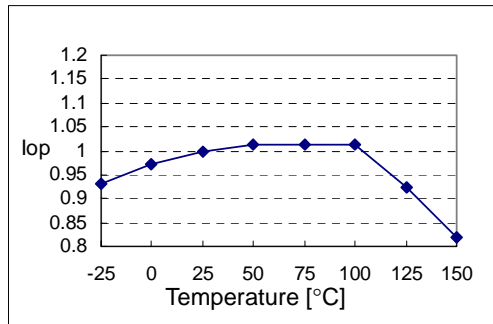


Figure 3. Operating Supply Current

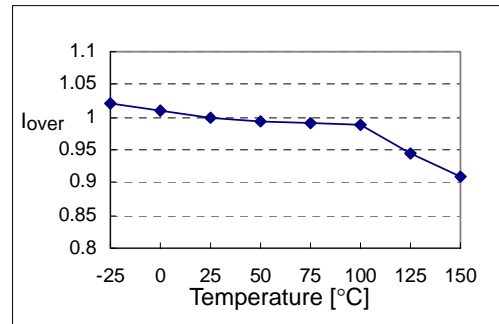


Figure 4. Peak Current Limit

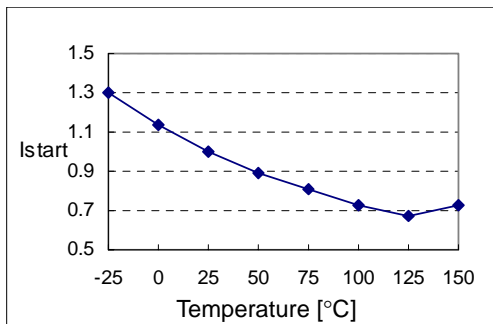


Figure 5. Start up Current

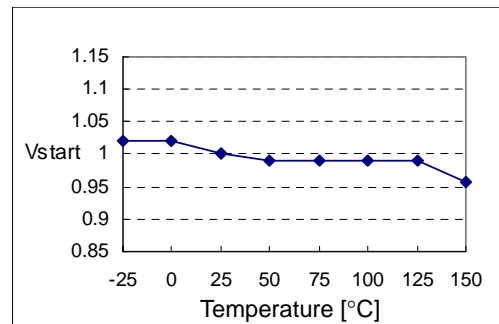


Figure 6. Start Threshold Voltage

## Typical Performance Characteristics (Continued)

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

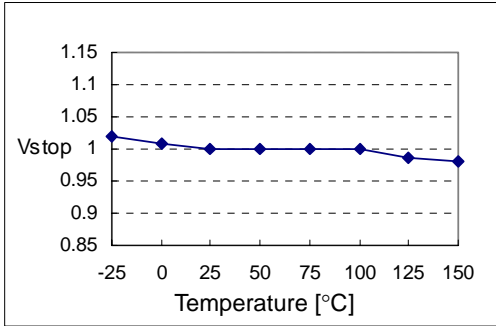


Figure 7. Stop Threshold Voltage

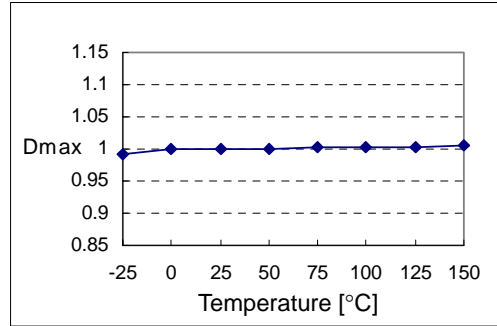


Figure 8. Maximum Duty Cycle

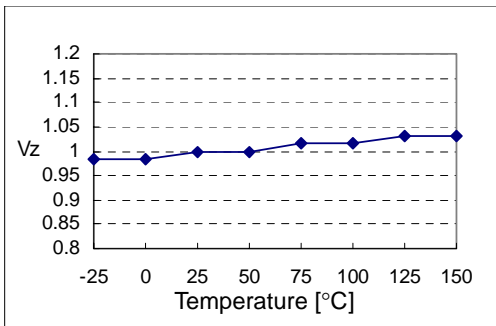


Figure 9. VCC Zener Voltage

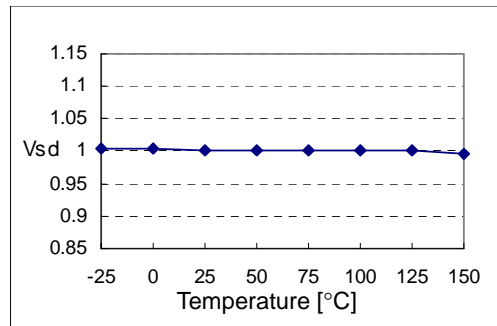


Figure 10. Shutdown Feedback Voltage

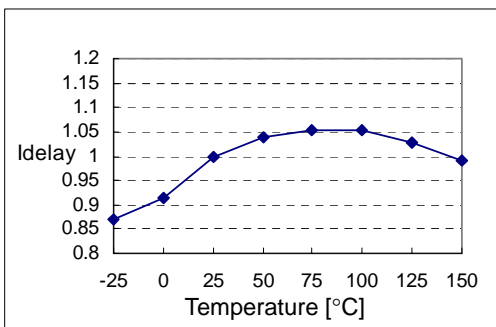


Figure 11. Shutdown Delay Current

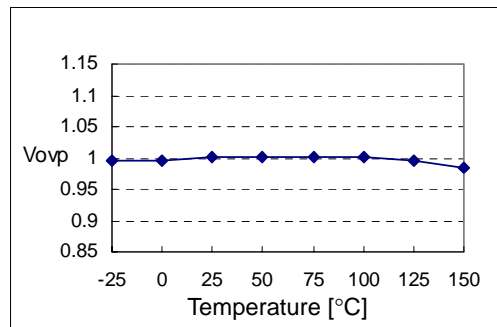


Figure 12. Over Voltage Protection

**Typical Performance Characteristics** (Continued)

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

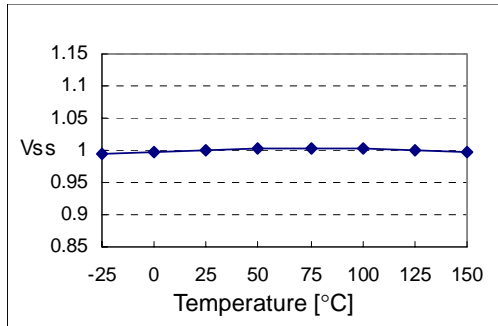


Figure13. Soft Start Voltage

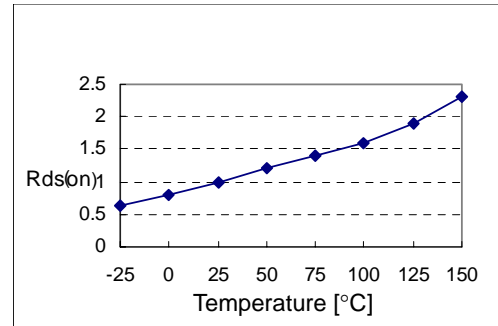
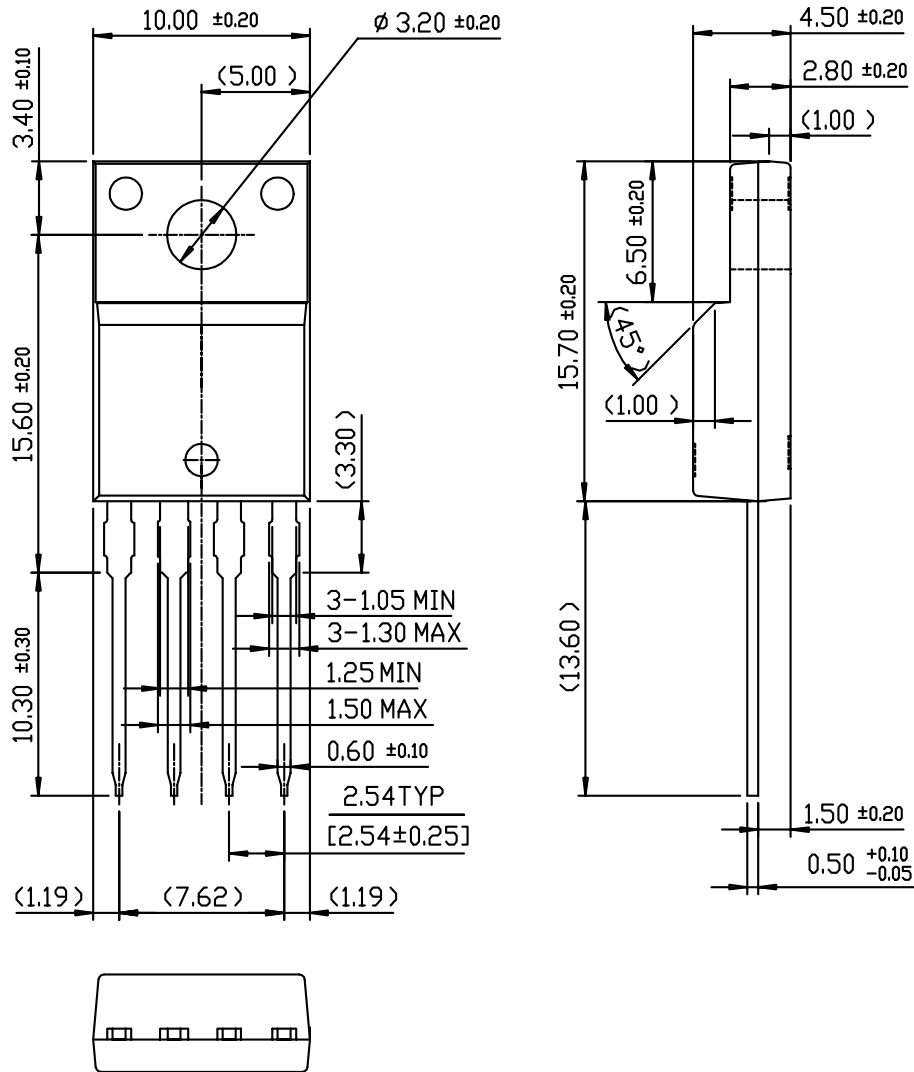


Figure 14. Static Drain-Source on Resistance

Package Dimensions

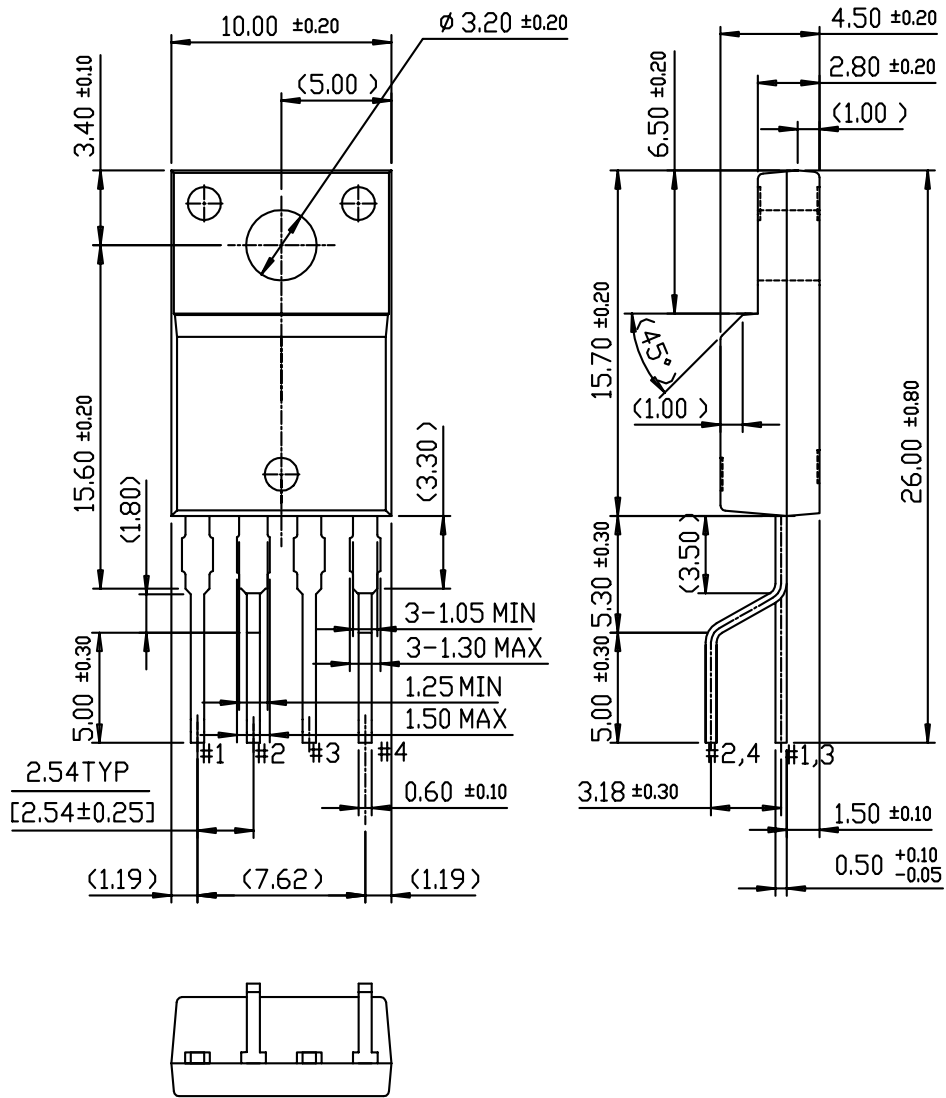
TO-220F-4L





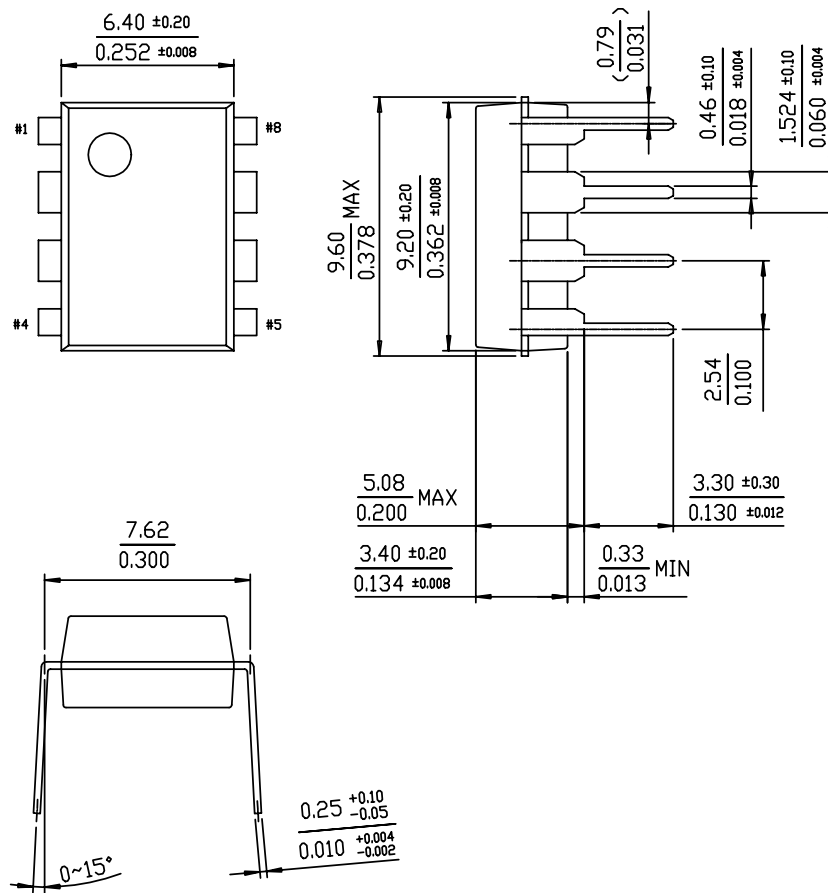
Package Dimensions (Continued)

TO-220F-4L(Forming)



Package Dimensions (Continued)

8-DIP



## Ordering Information

Product Number	Package	Marking Code	BV <sub>DSS</sub>	Fosc	RDS(on)
KA5H0165RTU	TO-220F-4L	5H0165R	650V	100kHz	8Ω
KA5H0165RYDTU	TO-220F-4L(Forming)				
KA5M0165RTU	TO-220F-4L	5M0165R	650V	67kHz	8Ω
KA5M0165RYDTU	TO-220F-4L(Forming)				
KA5L0165RTU	TO-220F-4L	5L0165R	650V	50kHz	8Ω
KA5L0165RYDTU	TO-220F-4L(Forming)				
KA5H0165RN	8-DIP	5H0165R	650V	100kHz	8Ω
KA5M0165RN	8-DIP	5M0165R	650V	67kHz	8Ω
KA5L0165RN	8-DIP	5L0165R	650V	50kHz	8Ω

Product Number	Package	Marking Code	BV <sub>DSS</sub>	Fosc	RDS(on)
KA5H0165RVN	8-DIP	5H0165RV	650V	100kHz	8Ω

TU : Non Forming Type

YDTU : Forming Type

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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