

# KA5Q0565RT

## Fairchild Power Switch(FPS)

### Features

- Quasi Resonant Converter Controller
- Internal Burst Mode Controller for Stand-by Mode
- Pulse by Pulse Current Limiting
- Over Current Latch Protection
- Over Voltage Protection (Vcc: Min. 27V)
- Internal Thermal Shutdown Function
- Under Voltage Lockout
- Internal High Voltage Sense FET
- Auto-Restart Mode

### Description

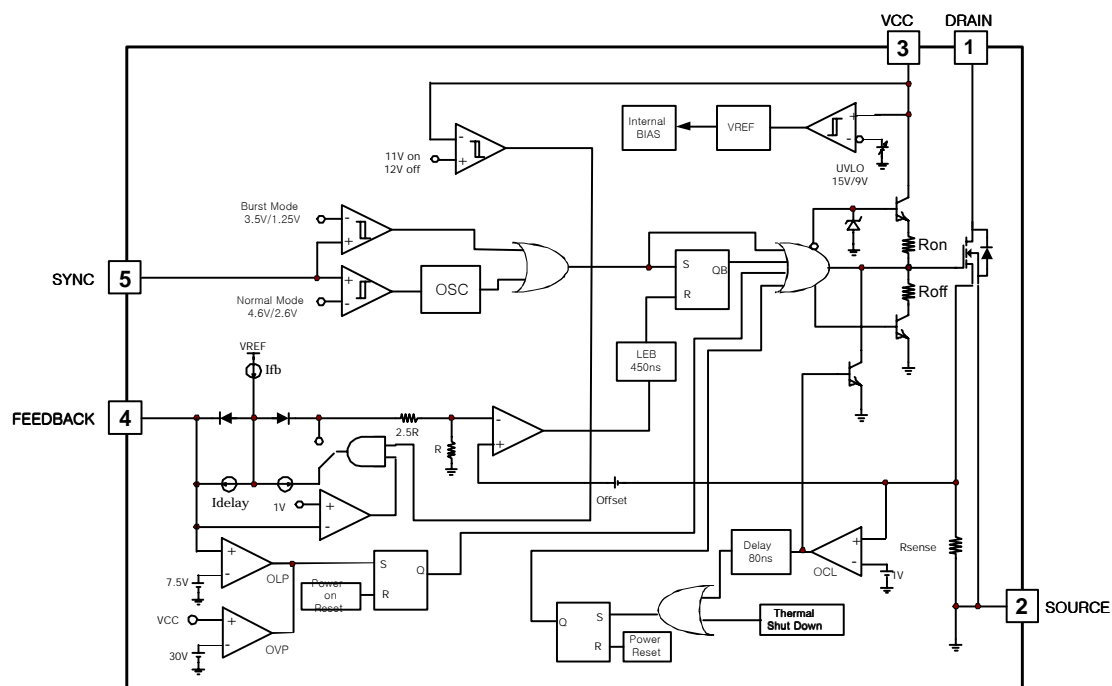
The Fairchild Power Switch(FPS) product family is specially designed for an off-line SMPS with minimal external components. The Fairchild Power Switch(FPS) consists of a high voltage power SenseFET and a current mode PWM IC. The integrated PWM controller includes the fixed oscillator, the under voltage lock out, the leading edge blanking, the optimized gate turn-on/turn-off driver, the thermal shut down protection, the over voltage protection, and the temperature compensated precision current sources for loop compensation and fault protection circuitry. Compared to a discrete MOSFET and a controller or a RCC switching converter solutions, a Fairchild Power Switch(FPS) can reduce the total number of components, design size, and weight, so it will improve efficiency, productivity, and system reliability. It has a basic platform well suited for cost-effective design in a quasi-resonant converter as a C-TV power supply.

TO-220F-5L



1. Drain 2. GND 3. VCC
4. Feedback 5. Sync

### Internal Block Diagram



Rev.1.0.4

## Absolute Maximum Ratings

(Ta=25°C, unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-source Voltage	V <sub>DSS</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>	11	ADC
Single Pulsed Avalanch Current <sup>(3)</sup> (Energy <sup>(2)</sup> )	I <sub>AS</sub> (EAS)	13(400)	A(mJ)
Continuous Drain Current (T <sub>c</sub> = 25°C)	I <sub>D</sub>	2.8	ADC
Continuous Drain Current (T <sub>C</sub> =100°C)	I <sub>D</sub>	1.7	ADC
Supply Voltage	V <sub>CC</sub>	30	V
Input Voltage Range	V <sub>FB</sub>	-0.3 to V <sub>CC</sub>	V
Total Power Dissipation	P <sub>D</sub>	38	W
	Derating	0.3	W/°C
Operating Junction Temperature	T <sub>J</sub>	+160	°C
Operating Ambient Temperature	T <sub>A</sub>	-25 to +85	°C
Storage Temperature Range	T <sub>STG</sub>	-55 to +150	°C
Thermal Resistance	R <sub>thjc</sub>	3.29	°C/W
ESD Capability, HBM Model (All pins)	-	2.0	kV
ESD Capability, Machine Model (All pins)	-	300	V

### Notes:

1. T<sub>J</sub> = 25°C to 150°C
2. Repetitive rating: Pulse width limited by maximum junction temperature
3. L = 30mH, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25Ω, starting T<sub>J</sub> = 25°C
4. L = 13uH, 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	-	-	200	μA
		V <sub>DS</sub> = 0.8*Max., Rating V <sub>GS</sub> = 0V, T <sub>C</sub> = 85°C	-	-	300	μA
Static Drain-source on Resistance <sup>(Note)</sup>	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 2.3A	-	1.8	2.2	Ω
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V, f = 1MHz	-	780	-	pF
Output Capacitance	C <sub>oss</sub>		-	90	-	
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> = 7.0A (MOSFET switching time are essentially independent of operating temperature)	-	15	40	nS
Rise Time	t <sub>r</sub>		-	45	100	
Turn Off Delay Time	t <sub>d(off)</sub>		-	60	130	
Fall Time	t <sub>f</sub>		-	40	90	
Total Gate Charge (Gate-Source+Gate-Drain)	Q <sub>g</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 7.0A, V <sub>DS</sub> = 0.5B V <sub>DSS</sub> (MOSFET Switching time are Essentially independent of operating temperature)	-	43	55	nC
Gate-Source Charge	Q <sub>gs</sub>		-	4.0	-	
Gate-Drain (Miller) Charge	Q <sub>gd</sub>		-	7.3	-	

### Note:

1. Pulse test : Pulse width ≤ 300μS, duty ≤ 2%

**Electrical Characteristics** (Continued)

(Ta=25°C unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
<b>UVLO SECTION</b>						
Start Threshold Voltage	V <sub>START</sub>	V <sub>FB</sub> = GND	14	15	16	V
Stop Threshold Voltage	V <sub>STOP</sub>	V <sub>FB</sub> = GND	8	9	10	V
<b>OSCILLATOR SECTION</b>						
Initial Frequency	F <sub>OSC</sub>	-	18	20	22	kHz
Voltage Stability	F <sub>STABLE</sub>	12V ≤ V <sub>CC</sub> ≤ 23V	0	1	3	%
Temperature Stability (Note2)	ΔF <sub>OSC</sub>	-25°C ≤ Ta ≤ 85°C	0	±5	±10	%
Maximum Duty Cycle	D <sub>MAX</sub>	-	92	95	98	%
Minimum Duty Cycle	D <sub>MIN</sub>	-	-	-	0	%
<b>FEEDBACK SECTION</b>						
Feedback Source Current	I <sub>FB</sub>	V <sub>FB</sub> = GND	0.7	0.9	1.1	mA
Shutdown Feedback Voltage	V <sub>SD</sub>	V <sub>fb</sub> ≥ 6.9V	6.9	7.5	8.1	V
Shutdown Delay Current	I <sub>DELAY</sub>	V <sub>FB</sub> = 5V	4	5	6	μA
<b>PROTECTION SECTION</b>						
Over Voltage Protection	V <sub>CCOVP</sub>	V <sub>CC</sub> ≥ 26V	27	30	33	V
Over Current Latch Voltage (Note2)	V <sub>OCL</sub>	-	0.9	1.0	1.1	V
Thermal Shutdown Temp.	T <sub>SD</sub>	-	140	160	-	°C
<b>SYNC SECTION</b>						
Normal Sync High Threshold Voltage	V <sub>NSH</sub>	V <sub>CC</sub> = 16V, V <sub>fb</sub> = 5V	4.0	4.6	5.2	V
Normal Sync Low Threshold Voltage	V <sub>NSL</sub>	V <sub>CC</sub> = 16V, V <sub>fb</sub> = 5V	2.3	2.6	2.9	V
Burst Sync High Threshold Voltage	V <sub>BSH</sub>	V <sub>CC</sub> = 10.5V, V <sub>fb</sub> = 0V	3.2	3.6	4.0	V
Burst Sync Low Threshold Voltage	V <sub>BSL</sub>	V <sub>CC</sub> = 10.5V, V <sub>fb</sub> = 0V	1.1	1.3	1.5	V

**Note:**

1. These parameters is the current flowing in the Control IC.
2. These parameters, although guaranteed, are tested in EDS(wafer test) process.
3. These parameters indicate Inductor Current.

## Electrical Characteristics (Continued)

(Ta=25°C unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
<b>BURST MODE SECTION</b>						
Burst Mode Low Threshold Voltage	VBURL	Vfb = 0V	10.4	11.0	11.6	V
Burst Mode High Threshold Voltage	VBURH	Vfb = 0V	11.4	12.0	12.6	V
Burst Mode Enable Feedback Voltage	VBEN	Vcc = 10.5V	0.7	1.0	1.3	V
Burst Mode Peak Current Limit	IBU_PK	Vcc = 10.5V	0.65	0.85	1.1	A
<b>CURRENT LIMIT(SELF-PROTECTION)SECTION</b>						
Peak Current Limit(Note3)	IPK	-	3.08	3.5	3.92	A
<b>TOTAL DEVICE SECTION</b>						
Start Up Current	ISTART	Vfb = GND, VCC = 14V	-	0.1	0.2	mA
Operating Supply Current (Note1)	IOP	Vfb = GND, VCC = 16V	-	10	18	mA
	IOP(MIN)	Vfb = GND, VCC = 10V				
	IOP(MAX)	Vfb = GND, VCC = 28V				

### Note:

1. These parameters is the current flowing in the Control IC.
2. These parameters, although guaranteed, are tested in EDS(wafer test) process.
3. These parameters indicate Inductor Current.

## Typical Performance Characteristics

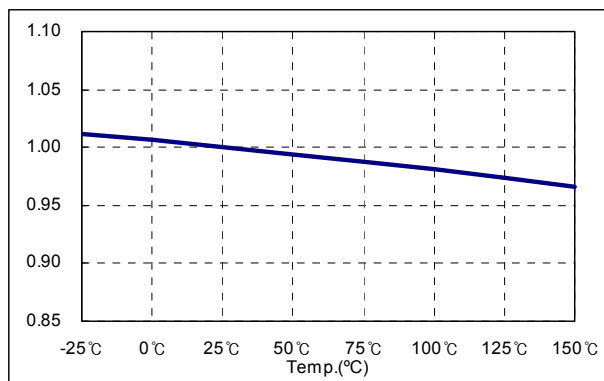


Figure 1. Start Voltage

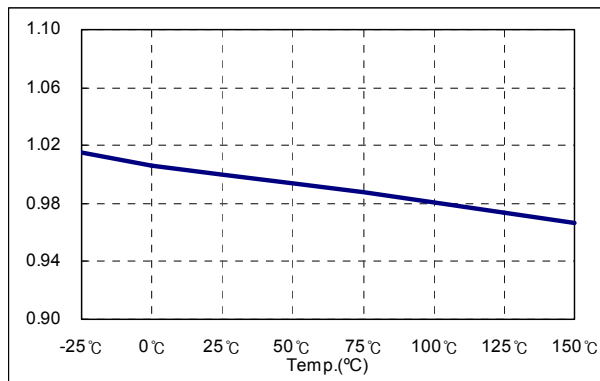


Figure 2. Stop Voltage

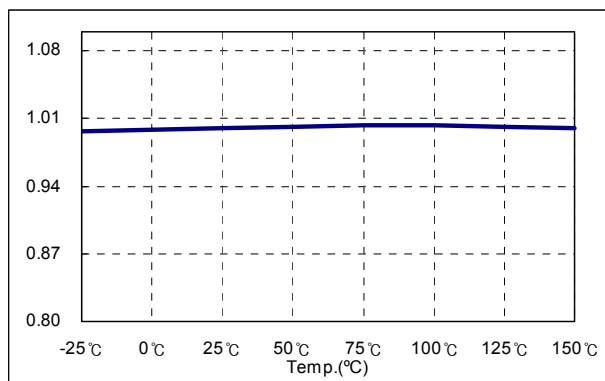


Figure 3. Stand by Current

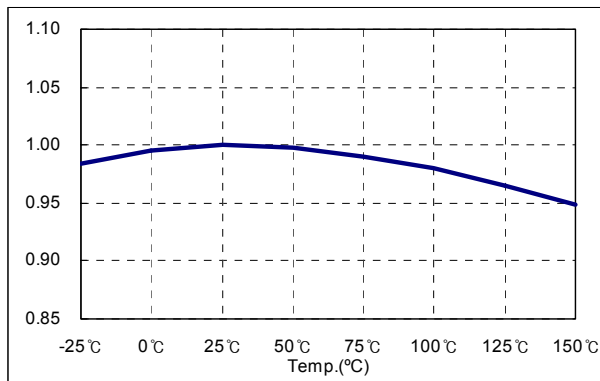


Figure 4. Operating Current

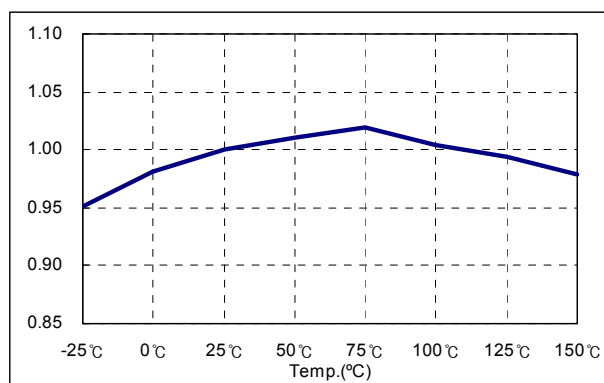


Figure 5. Initial Frequency

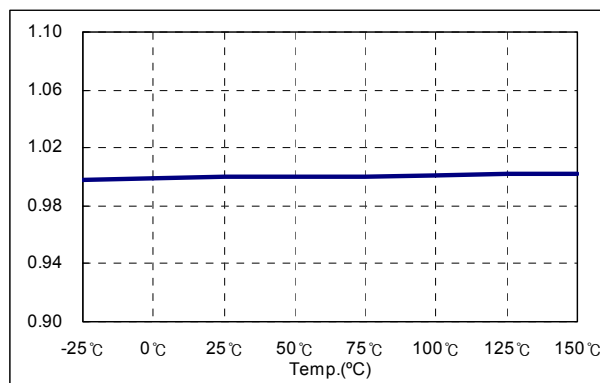


Figure 6. Maximum Duty

## Typical Performance Characteristics (Continued)

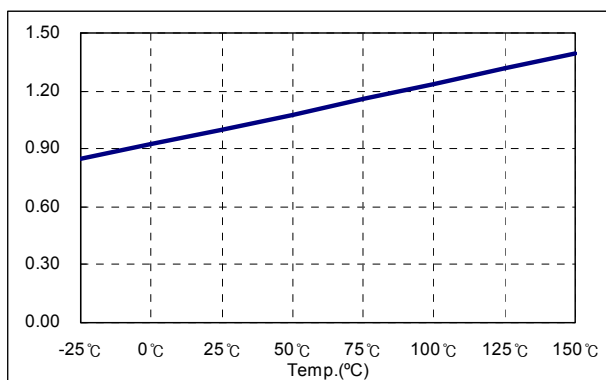


Figure 7. Feedback Offset Voltage

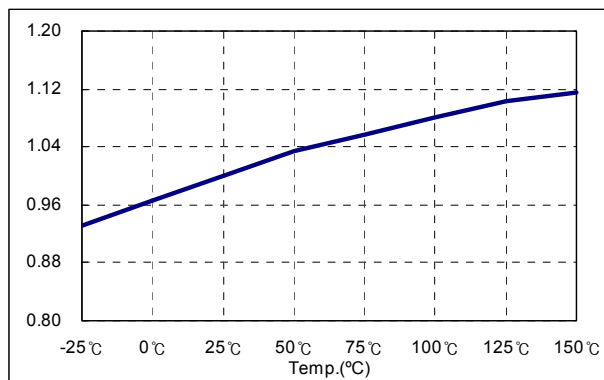


Figure 8. Feedback Source Current

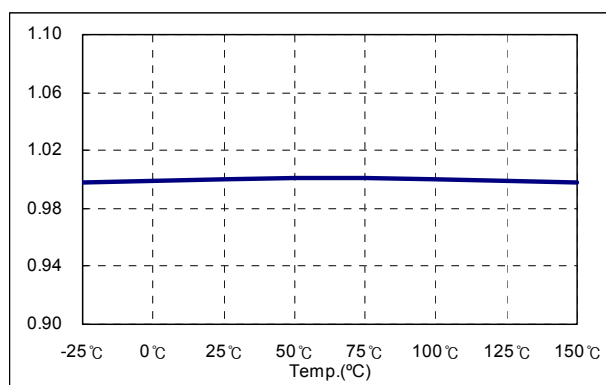


Figure 9. Over Voltage Protection

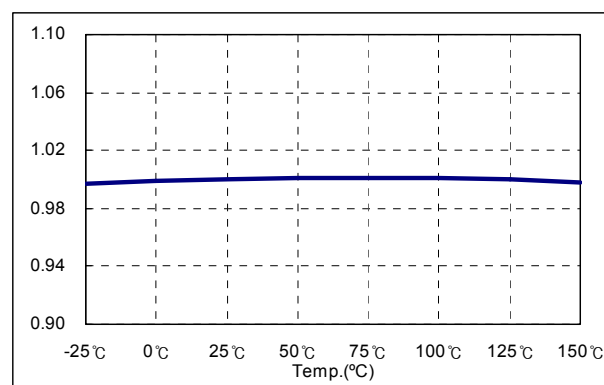


Figure 10. Shutdown Feedback Voltage

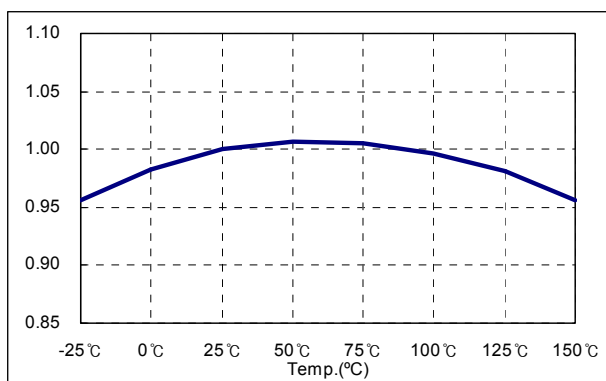


Figure 11. ShutDown Delay Current

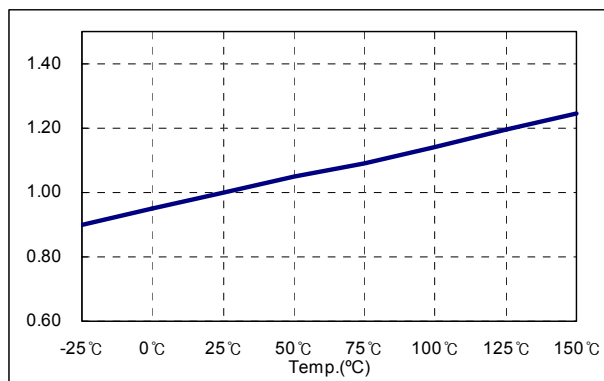


Figure 12. Burst Mode Enable Feedback Voltage

## Typical Performance Characteristics (Continued)

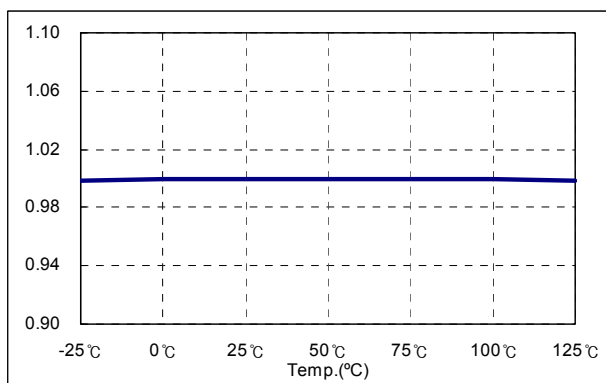


Figure 13. Burst Mode Low Threshold Voltage

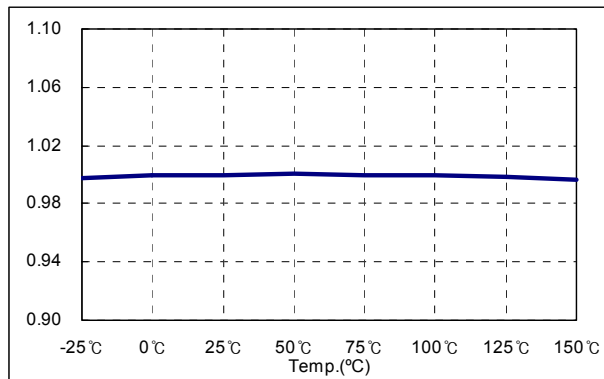


Figure 14. Burst Mode High Threshold Voltage

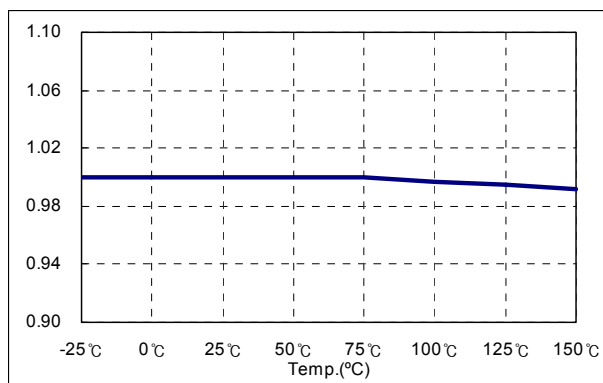


Figure 15. Burst Mode Sync. High Threshold Voltage

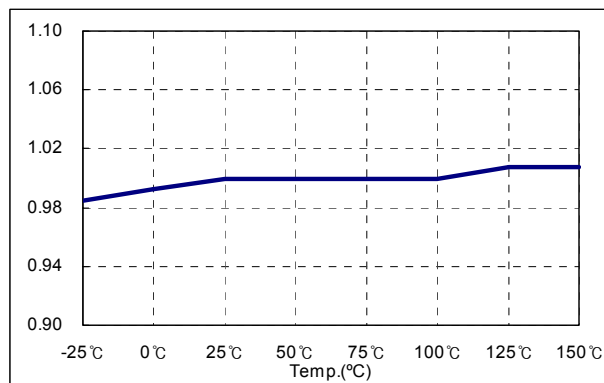


Figure 16. Burst Mode Sync. Low Threshold Voltage

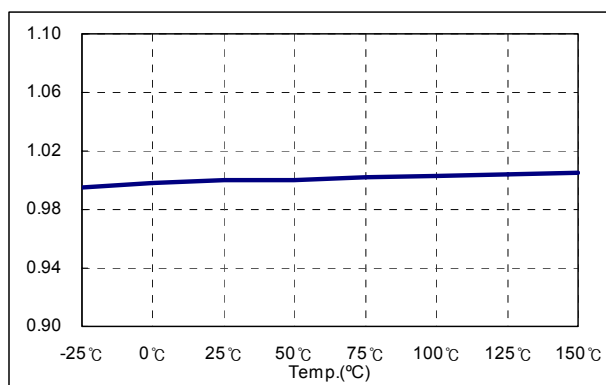


Figure 17. Primary Voltage

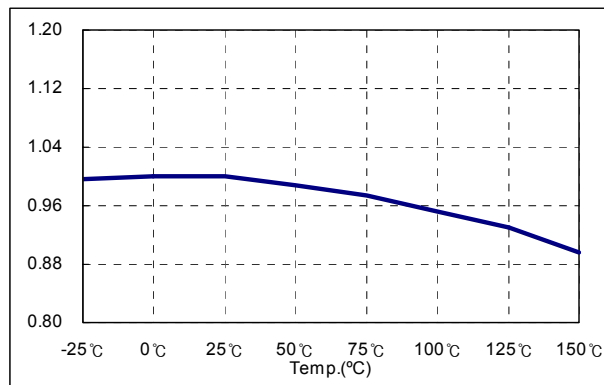


Figure 18. Primary Mode Gain



## Typical Performance Characteristics (Continued)

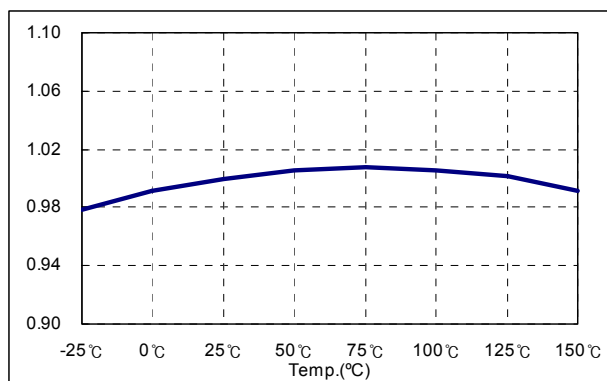


Figure 19. Peak Current Limit

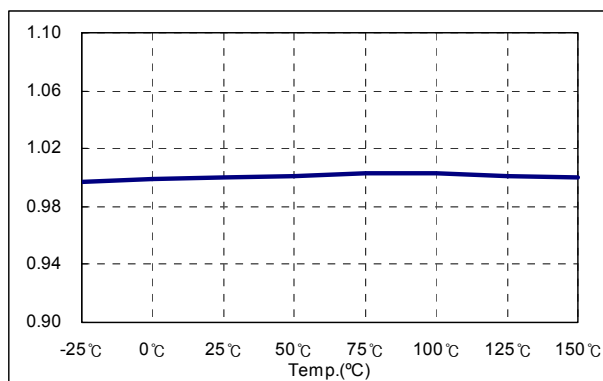


Figure 20. Burst Mode Peak Current Limit

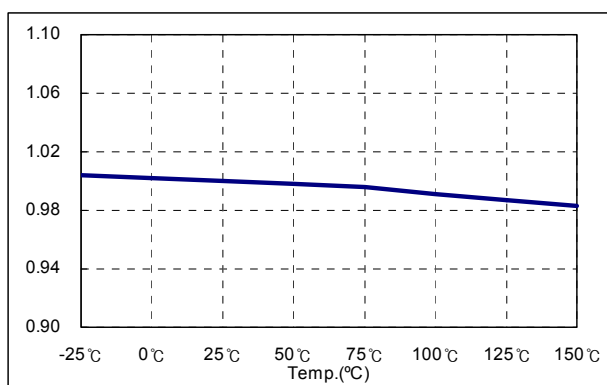


Figure 21. Normal Mode Sync. High Threshold Voltage

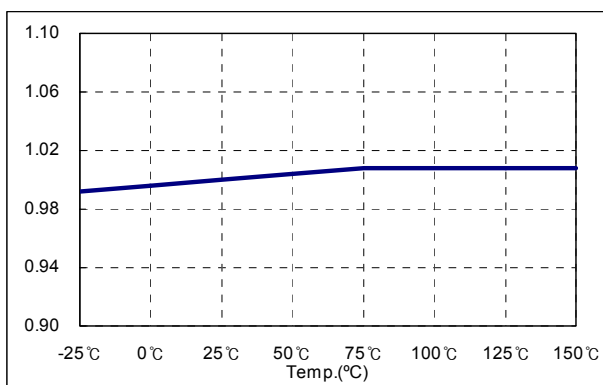


Figure 21. Normal Mode Sync. Low Threshold Voltage

## Typical Performance Characteristics (MOSFET Part)

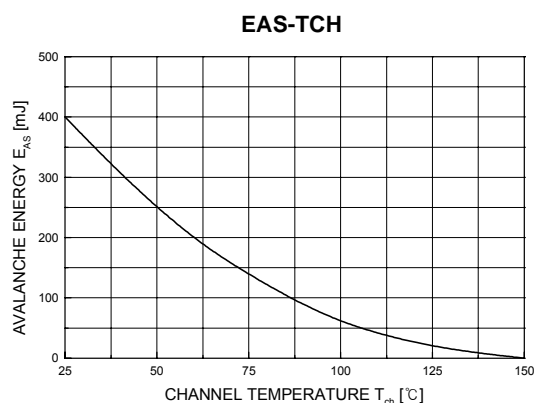
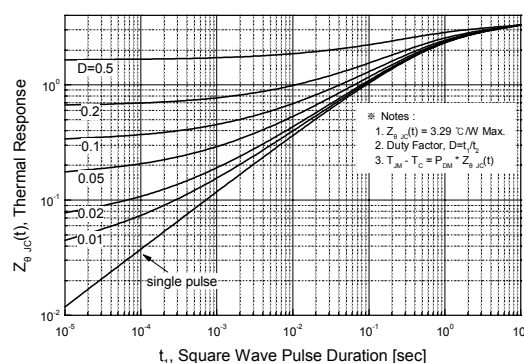
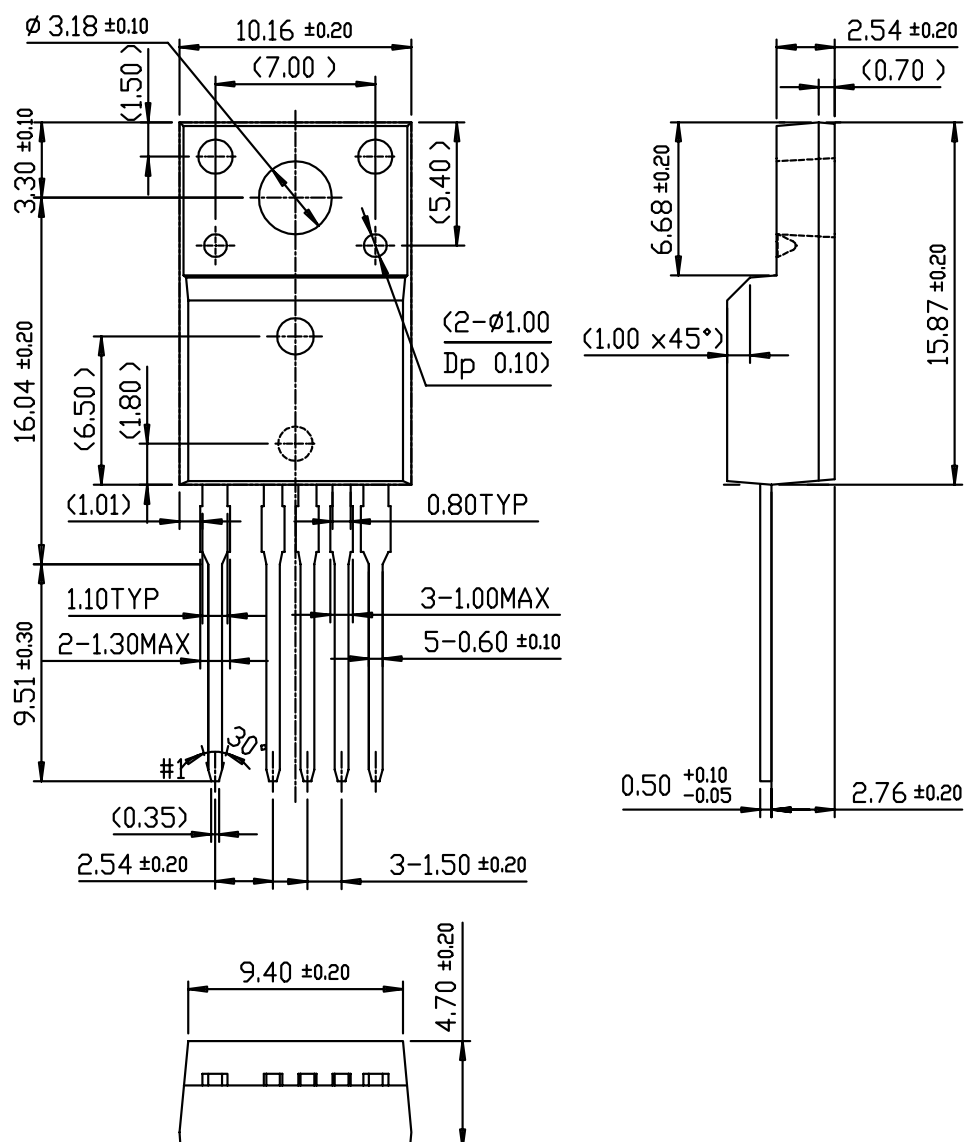
Figure 22. Temperature ( $T_C$ ) vs. Eas Curve

Figure 23. Transient Thermal Response Curve

# TO-220F-5L



Technical drawing of a connector assembly showing three views: front, side, and top.

**Front View Dimensions:**

- Overall width:  $10.16 \pm 0.20$
- Overall height:  $15.87 \pm 0.20$
- Top flange width:  $\phi 3.18 \pm 0.10$
- Top flange thickness:  $1.50$
- Central circular feature diameter:  $\langle 7.00 \rangle$
- Central circular feature depth:  $\langle 5.40 \rangle$
- Four smaller circular features:  $\langle 2-\phi 1.00 \rangle$ ,  $D_p 0.10$
- Bottom flange width:  $\langle 6.50 \rangle$ ,  $\langle 1.80 \rangle$
- Bottom flange thickness:  $\langle 1.01 \rangle$
- Bottom flange features:  $1.10 \text{ TYP}$ ,  $0.80 \text{ TYP}$
- Bottom flange dimensions:  $2-1.30 \text{ MAX}$  ( $\#1, \#5$ ),  $3-1.00 \text{ MAX}$  ( $\#2, \#3, \#4$ )
- Bottom flange thickness:  $5-0.60 \pm 0.10$
- Bottom flange features:  $2.54 \text{ TYP}$ ,  $3-1.50 \text{ TYP}$
- Bottom flange dimensions:  $[2.54 \pm 0.20]$ ,  $[3-1.50 \pm 0.20]$

**Side View Dimensions:**

- Overall height:  $16.08$
- Top flange thickness:  $6.68 \pm 0.20$
- Top flange width:  $2.54 \pm 0.20$
- Top flange features:  $\langle 0.70 \rangle$
- Bottom flange thickness:  $\langle 3.50 \rangle$
- Bottom flange features:  $\langle 1.00 \times 45^\circ \rangle$
- Bottom flange dimensions:  $2.76 \pm 0.30$
- Bottom flange features:  $\langle \#2, \#4 \rangle$ ,  $\langle \#1, \#3, \#5 \rangle$
- Bottom flange thickness:  $5.00 \pm 0.50$
- Bottom flange features:  $0.50^{+0.10}_{-0.05}$
- Bottom flange dimensions:  $3.18 \pm 0.30$
- Bottom flange features:  $5.63 \pm 0.50$
- Bottom flange dimensions:  $18.20 \pm 0.50$

**Top View Dimensions:**

- Overall width:  $9.40 \pm 0.20$
- Overall height:  $4.70 \pm 0.20$

## Ordering Information

Product Number	Package	Operating Temp.
KA5Q0565RTTU	TO-220F-5L	-25°C to +85°C
KA5Q0565RTYDTU	TO-220F-5L(Forming)	

TU : Non Forming Type

YDTU : Forming Type

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