KA5Q0740RT

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 (Vsync: Min. 11V)
- Internal Thermal Shutdown Function
- Under Voltage Lockout
- Internal High Voltage Sense FET
- Auto-Restart Mode

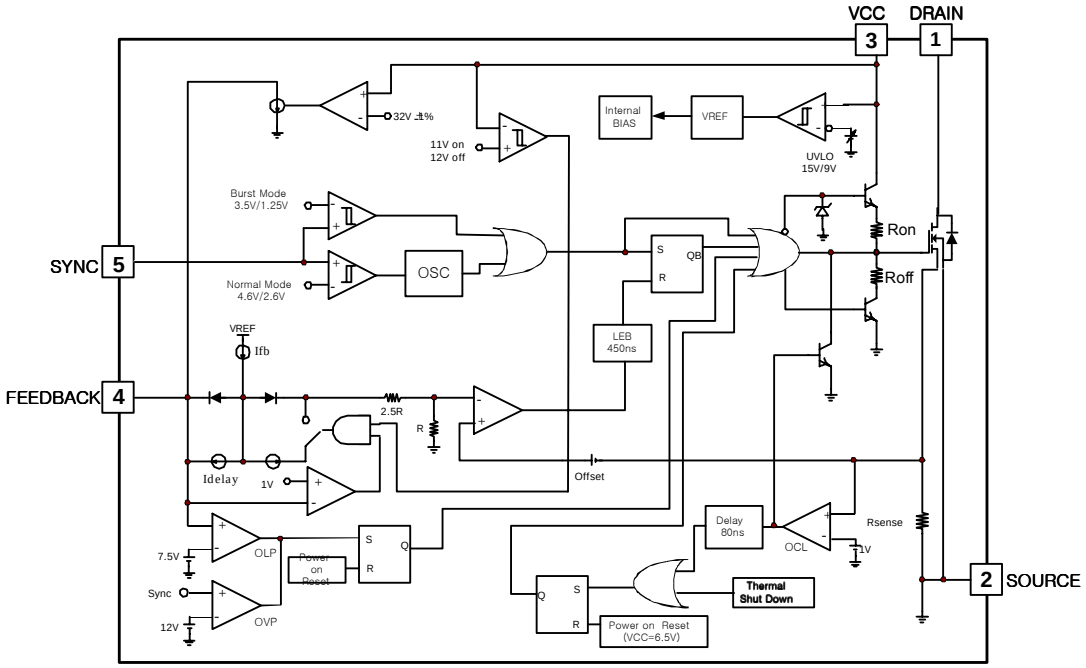
Description

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. V_{CC}
4. Feedback 5. Sync

Internal Block Diagram



Absolute Maximum Ratings

(Ta=25°C, unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-source Voltage	V_{DSS}	400	V
Drain-Gate Voltage (R_{GS}=1MΩ)	V_{DGR}	400	V
Gate-Source (GND) Voltage	V_{GS}	±30	V
Drain Current Pulsed (2)	I_{DM}	18.4	A_{DC}
Single Pulsed Avalanch Current(3)(Energy (2))	$I_{AS}(E_{AS})$	20(360)	A(mJ)
Continuous Drain Current (Tc = 25°C)	I_D	4.6	A_{DC}
Continuous Drain Current (T_C=100°C)	I_D	2.9	A_{DC}
Supply Voltage	V_{CC}	40	V
Analog Input Voltage Range	V_{sync}	-0.3 to 13V	V
	V_{FB}	-0.3 to V_{CC}	V
Total Power Dissipation	P_D	42	W
	Derating	0.33	W/°C
Operating Junction Temperature	T_J	+160	°C
Operating Ambient Temperature	T_A	-25 to +85	°C
Storage Temperature Range	T_{STG}	-55 to +150	°C
Thermal Resistance	R_{thjc}	2.98	°C/W
ESD Capability, HBM Model (All pins)	-	2.0	kV
ESD Capability, Machine Model (All pins)	-	300	V

Notes:

1. T_j = 25°C to 150°C
2. Repetitive rating: Pulse width limited by maximum junction temperature
3. L = 30mH, V_{DD} = 50V, R_G = 25Ω, starting T_j = 25°C
4. L = 13uH, 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	400	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = Max, Rating, V_{GS} = 0V	-	-	200	μA
		V_{DS}= 0.8*Max., Rating V_{GS} = 0V, T_C = 85°C	-	-	300	μA
Static Drain-source on Resistance (Note)	$R_{DS(ON)}$	V_{GS} = 10V, I_D = 2.3A	-	0.9	1.1	Ω
Input Capacitance	Ciss	V_{GS} = 0V, V_{DS} = 25V, f = 1MHz	-	710	-	pF
Output Capacitance	Coss		-	90	-	
Reverse Transfer Capacitance	Crss		-	10	-	
Turn on Delay Time	td(on)	V_{DD}= 0.5BV_{DSS}, I_D= 7.0A (MOSFET switching time are essentially independent of operating temperature)	-	15	-	nS
Rise Time	tr		-	55	-	
Turn Off Delay Time	td(off)		-	55	-	
Fall Time	tf		-	50	-	
Total Gate Charge (Gate-Source+Gate-Drain)	Qg	V_{GS} = 10V, I_D = 7.0A, V_{DS} = 0.5B V_{DSS} (MOSFET Switching time are Essentially independent of operating temperature)	-	20	26	nC
Gate-Source Charge	Qgs		-	4.0	-	
Gate-Drain (Miller) Charge	Qgd		-	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
UVLO SECTION						
Start Threshold Voltage	V_{START}	V_{FB} = GND	14	15	16	V
Stop Threshold Voltage	V_{STOP}	V_{FB} = GND	8	9	10	V
OSCILLATOR SECTION						
Initial Frequency	F_{OSC}	-	18	20	22	kHz
Voltage Stability	F_{STABLE}	12V ≤ Vcc ≤ 23V	0	1	3	%
Temperature Stability (Note2)	ΔF_{OSC}	-25°C ≤ Ta ≤ 85°C	0	±5	±10	%
Maximum Duty Cycle	D_{MAX}	-	92	95	98	%
Minimum Duty Cycle	D_{MIN}	-	-	-	0	%
FEEDBACK SECTION						
Feedback Source Current	I_{FB}	V_{FB} = GND	0.7	0.9	1.1	mA
Shutdown Feedback Voltage	V_{SD}	Vfb ≥ 6.9V	6.9	7.5	8.1	V
Shutdown Delay Current	I_{DELAY}	V_{FB} = 5V	4	5	6	μA
PROTECTION SECTION						
Over Voltage Protection	V_{OVP}	Vsync ≥ 11V	11	12	13	V
Over Current Latch Voltage (Note2)	V_{OCL}	-	0.9	1.0	1.1	V
Thermal Shutdown Temp.	T_{SD}	-	140	160	-	°C

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
SYNC SECTION						
Normal Sync High Threshold Voltage	V_{NSH}	Vcc = 16V, Vfb = 5V	4.0	4.6	5.2	V
Normal Sync Low Threshold Voltage	V_{NSL}	Vcc = 16V, Vfb = 5V	2.3	2.6	2.9	V
Burst Sync High Threshold Voltage	V_{BSH}	Vcc = 10.5V, Vfb = 0V	3.2	3.6	4.0	V
Burst Sync Low Threshold Voltage	V_{BSL}	Vcc = 10.5V, Vfb = 0V	1.1	1.3	1.5	V
BURST MODE SECTION						
Burst mode Low Threshold Voltage	V_{BURL}	Vfb = 0V	10.4	11.0	11.6	V
Burst mode High Threshold Voltage	V_{BURH}	Vfb = 0V	11.4	12.0	12.6	V
Burst mode Enable Feedback Voltage	V_{BEN}	Vcc = 10.5V	0.7	1.0	1.3	V
Burst mode Peak Current Limit	I_{BU_PK}	Vcc = 10.5V	0.65	0.85	1.1	A
PRIMARY SIDE REGULATION SECTION						
Primary Regulation Threshold Voltage	V_{PR}	Ifb = 700uA, Vfb = 4V	32.0	32.5	33.0	V
Primary Regulation Transconductance	G_{PR}	-	2.0	2.6	-	mA/V
CURRENT LIMIT(SELF-PROTECTION)SECTION						
Peak Current Limit(Note3)	I_{PK}	-	4.4	5.0	5.6	A
TOTAL DEVICE SECTION						
Start Up Current	I_{START}	Vfb = GND, V_{CC} = 14V	-	0.1	0.2	mA
Operating Supply Current (Note1)	I_{OP}	Vfb = GND, V_{CC} = 16V	-	10	18	mA
	$I_{OP(MIN)}$	Vfb = GND, V_{CC} = 10V				
	$I_{OP(MAX)}$	Vfb = GND, V_{CC} = 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

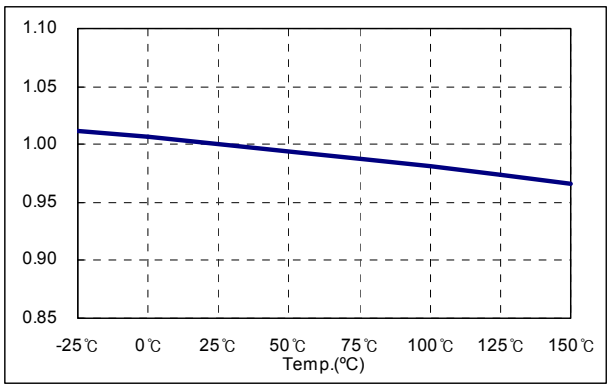


Figure 1. Start Voltage

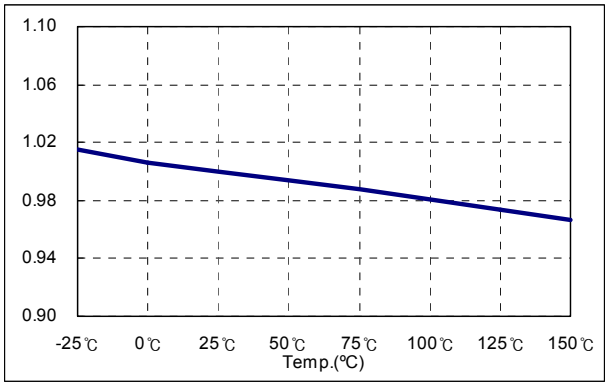


Figure 2. Stop Voltage

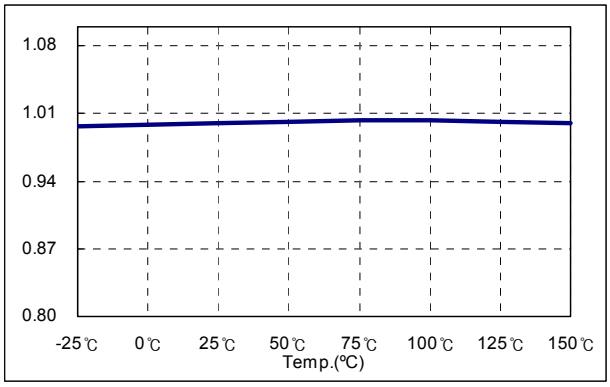


Figure 3. Stand by Current

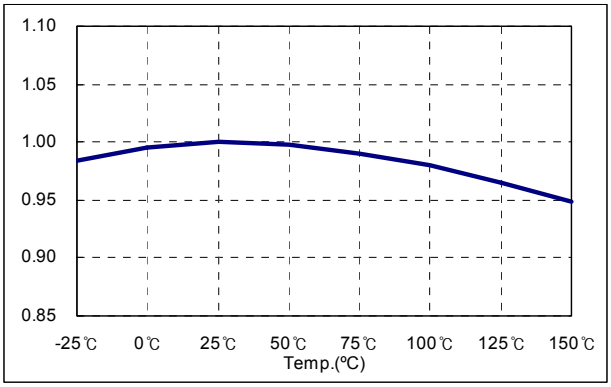


Figure 4. Operating Current

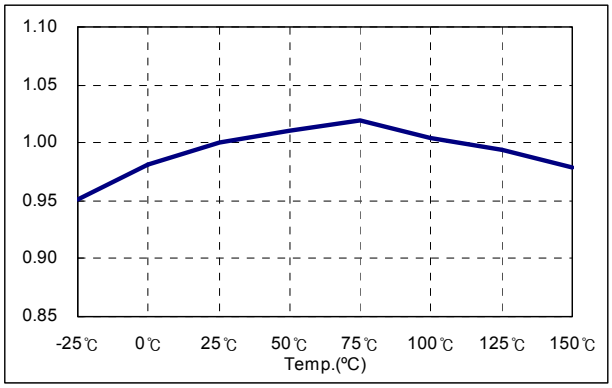


Figure 5. Initial Frequency

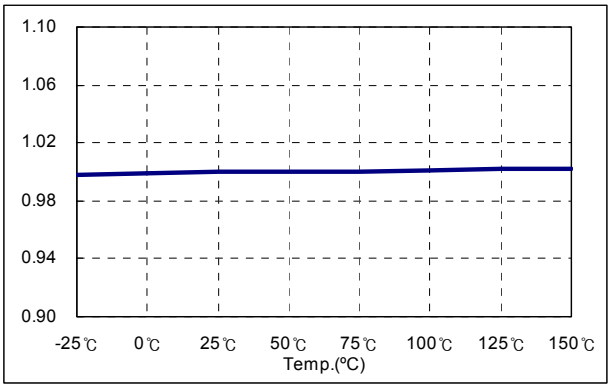


Figure 6. Maximum Duty

Typical Performance Characteristics (Continued)

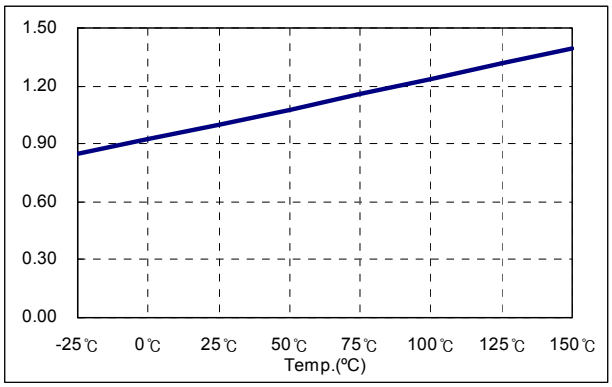


Figure 7. Feedback Offset Voltage

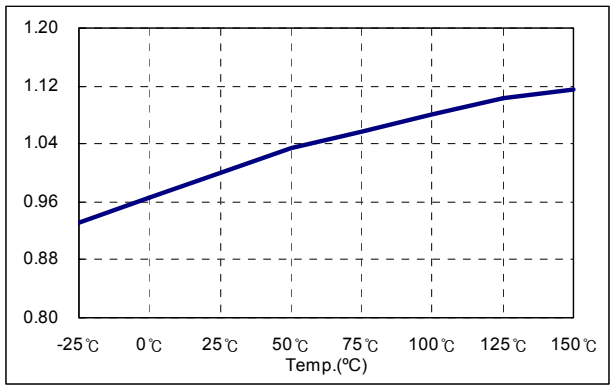


Figure 8. Feedback Source Current

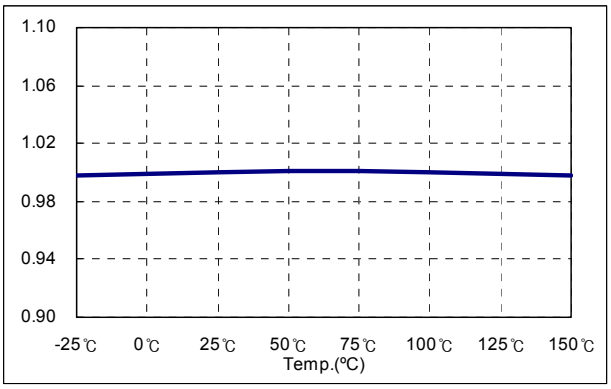


Figure 9. Over Voltage Protection

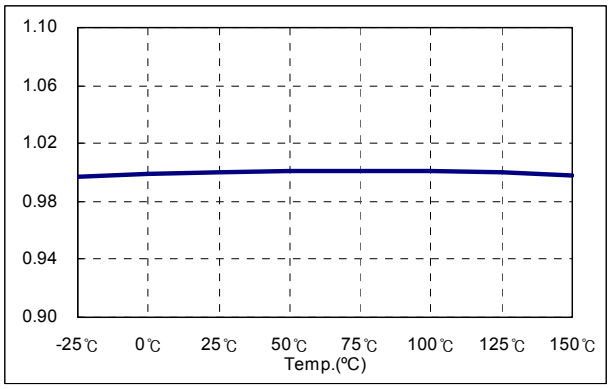


Figure 10. Shutdown Feedback Voltage

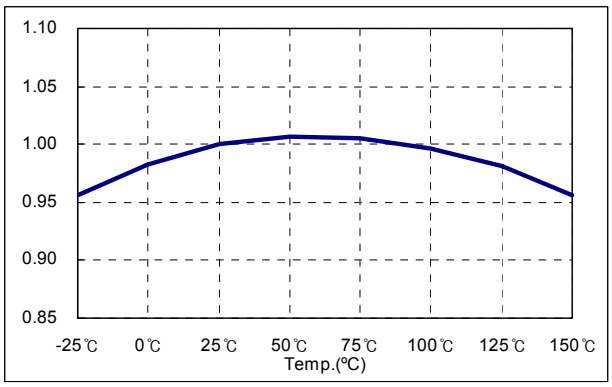


Figure 11. ShutDown Delay Current

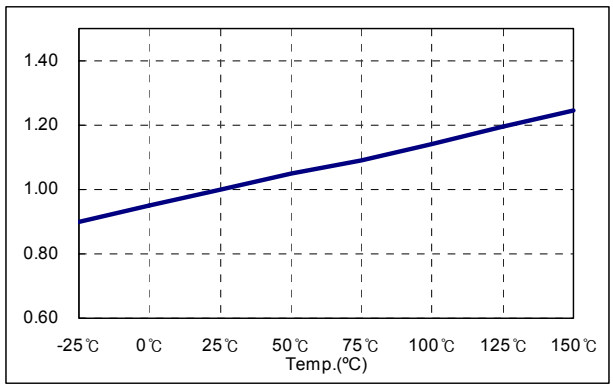


Figure 12. Burst Mode Enable Feedback Voltage

Typical Performance Characteristics (Continued)

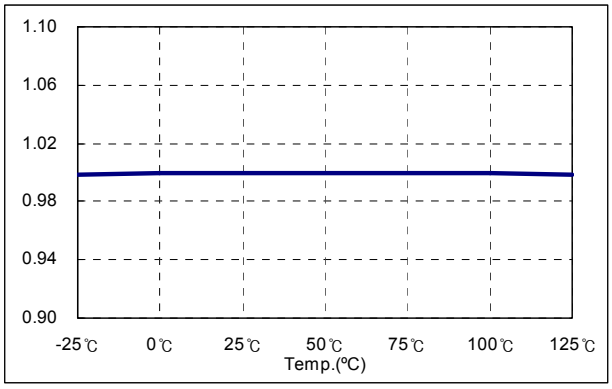


Figure 13. Burst Mode Low Threshold Voltage

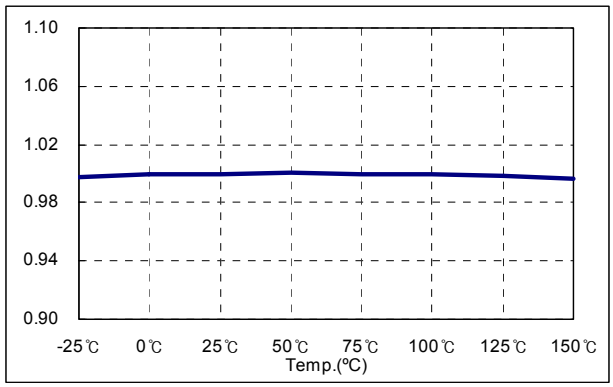


Figure 14. Burst Mode High Threshold Voltage

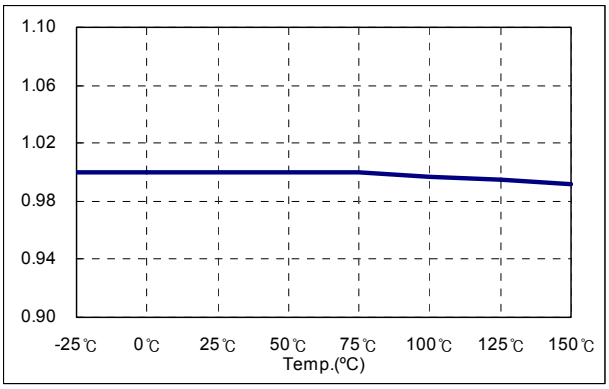


Figure 15. Burst Mode Sync. High Threshold Voltage

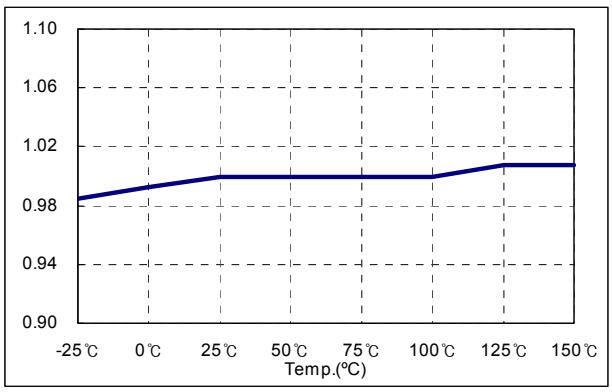


Figure 16. Burst Mode Sync. Low Threshold Voltage

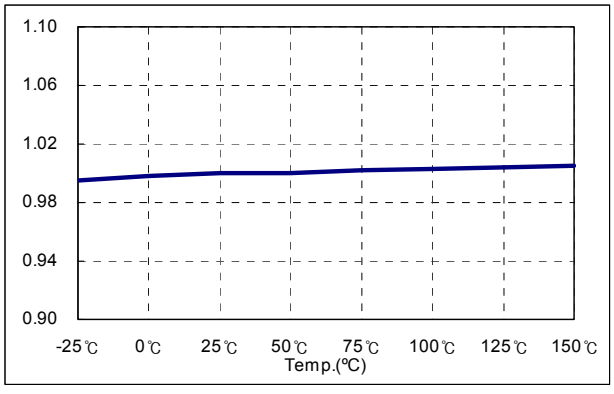


Figure 17. Primary Voltage

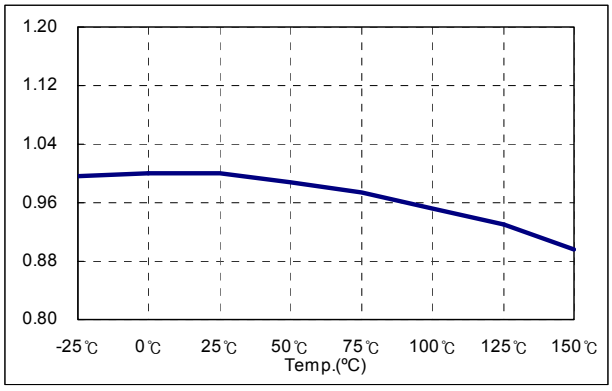


Figure 18. Primary Mode Gain

Typical Performance Characteristics (Continued)

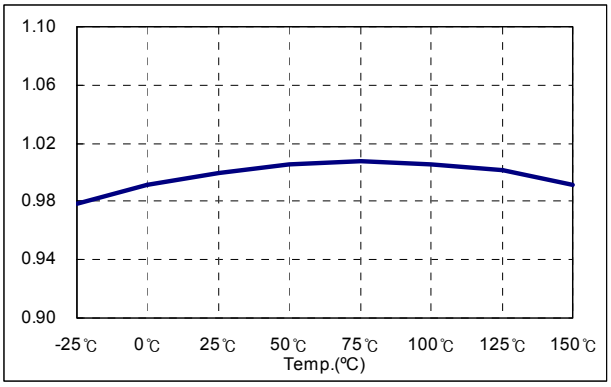


Figure 19. Peak Current Limit

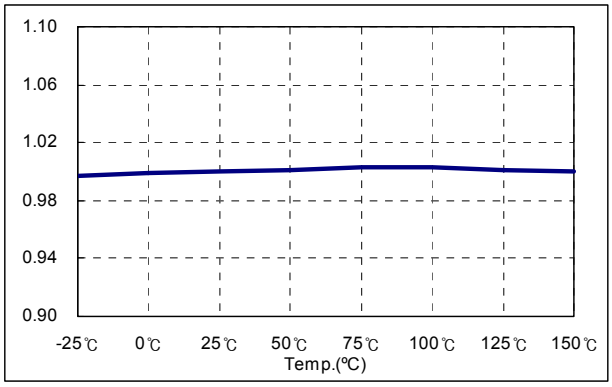


Figure 20. Burst Mode Peak Current Limit

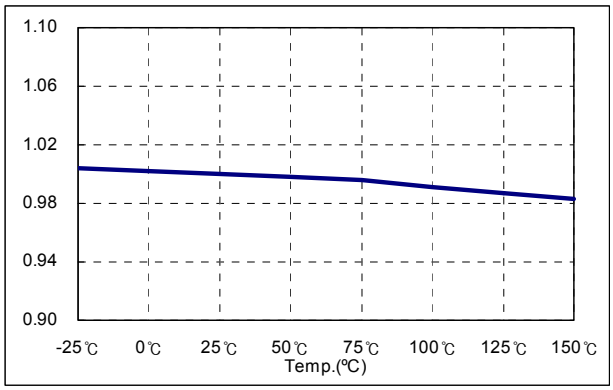


Figure 21. Normal Mode Sync. High Threshold Voltage

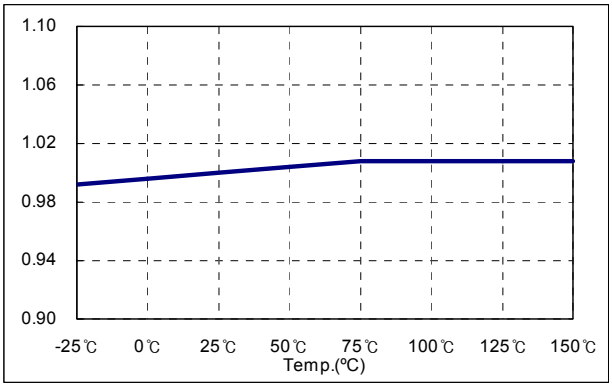


Figure 21. Normal Mode Sync. Low Threshold Voltage

Typical Performance Characteristics(MOSFET Part)

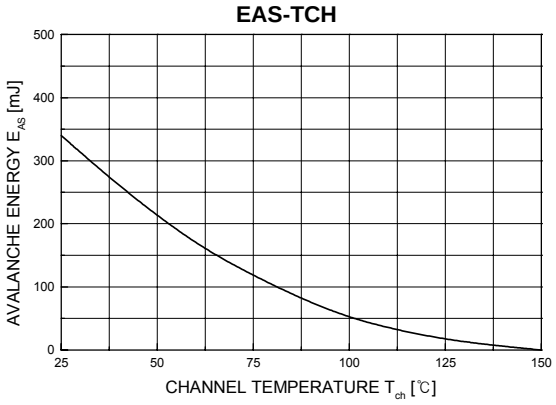


Figure 22. Temperature (T_C) vs. Eas Curve

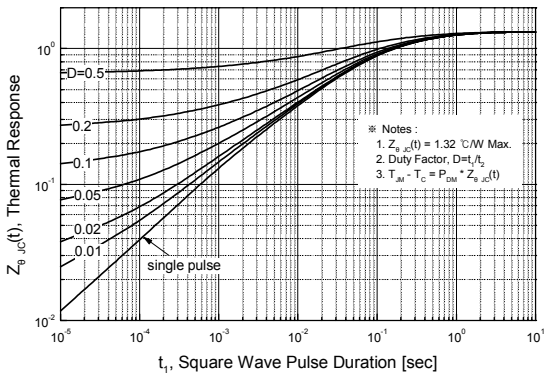
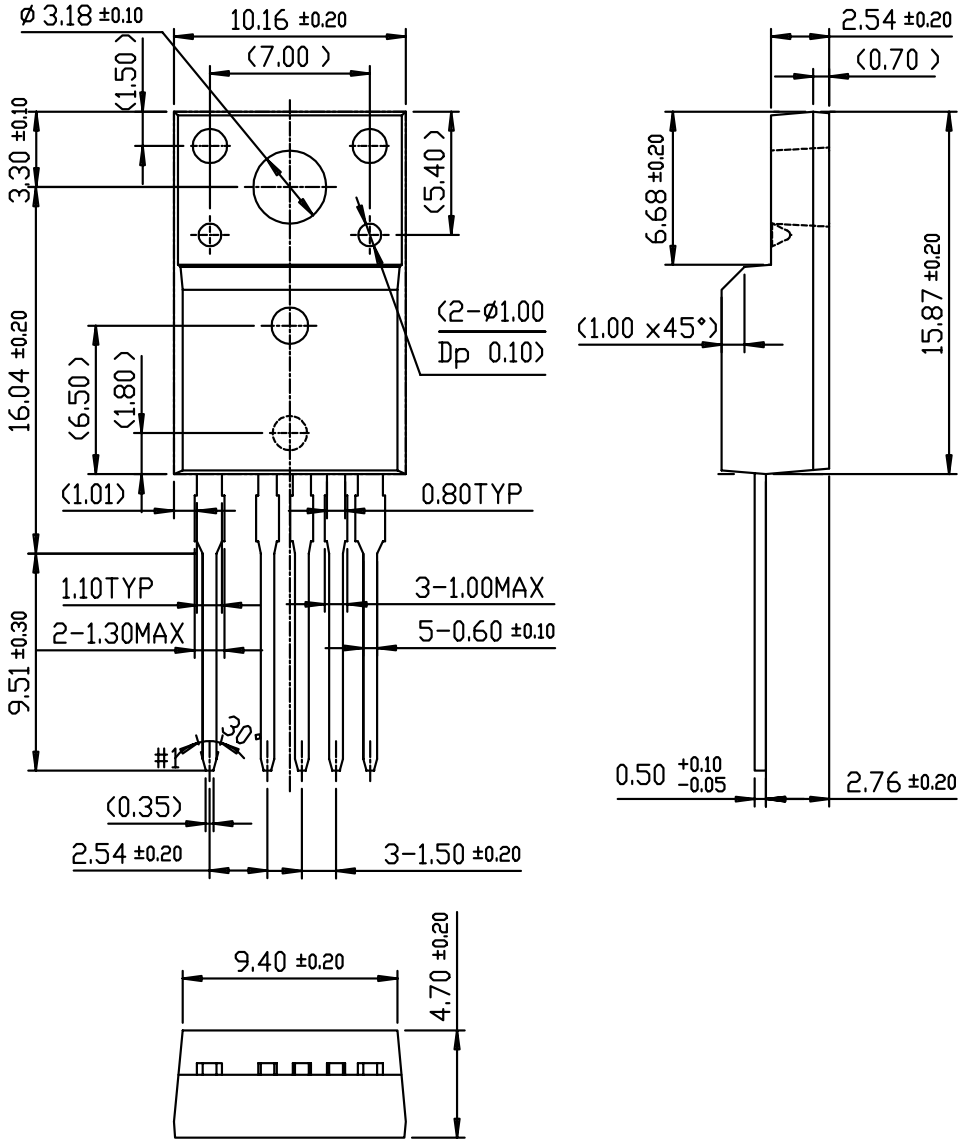


Figure 23. Transient Thermal Response Curve

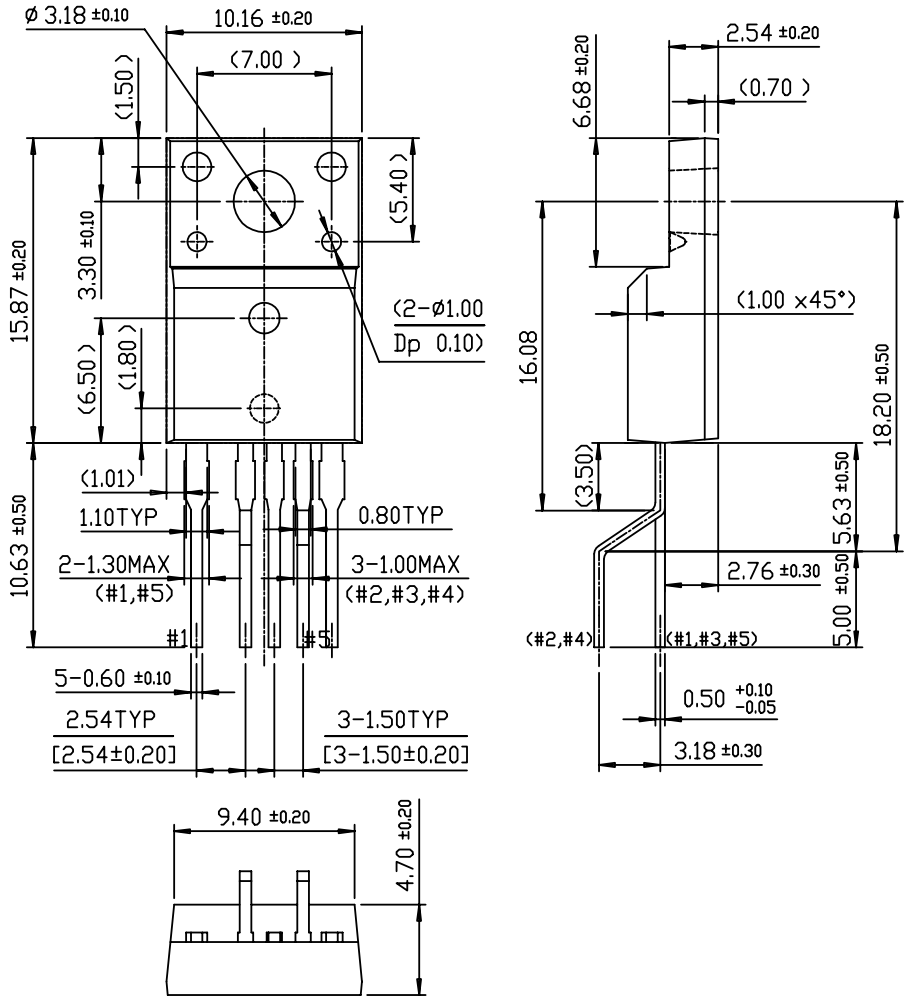
Package Dimensions

TO-220F-5L



Package Dimensions (Continued)

TO-220F-5L(Forming)



Ordering Information

Product Number	Package	Operating Temp.
KA5Q0740RTTU	TO-220F-5L	-25°C to +85°C
KA5Q0740RTYDTU	TO-220F-5L(Forming)	

TU : Non Forming Type
YDTU : Forming Type