FAIRCHILD SEMICONDUCTOR®

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FS6S0965RCB

Fairchild Power Switch(FPS)

Features

- Wide Operating Frequency Range up to 150kHz
- Lowest Cost SMPS Solution
- Lowest External Components
- Low Start up Current (Max:170uA)
- Low Operating Current (Max:15mA)
- Internal High Voltage SenseFET
- Built-in Auto Restart Circuit
- Over Voltage Protection (Auto Restart Mode)
- Over Load Protection (Auto Restart Mode)
- Over Current Protection (Auto Restart Mode)
- Internal Thermal Protection(Auto Restart Mode)
- Pulse By Pulse Over Current Limiting
- Internal Burst Mode Controller for Stand-by Mode
- Under Voltage Lockout With Hysteresis
- External Sync. Terminal

Application

- Monitor SMPS

Description

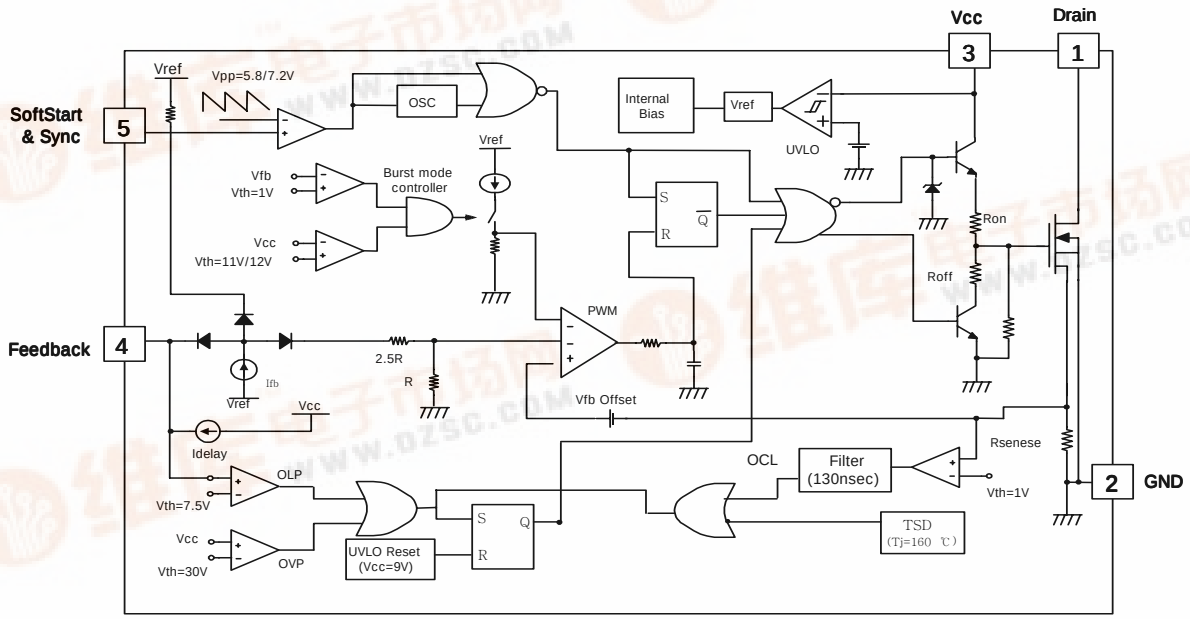
The Fairchild Power Switch(FPS) product family are specially designed for an off line SMPS with minimal external components. The Fairchild Power Switch(FPS) consists of a high voltage power SenseFET and a current mode PWM IC. Included PWM controller features the integrated fixed oscillator, the under voltage lockout, 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 the loop compensation and the fault protection circuitry. Compared to a discrete MOSFET and a controller or a RCC switching converter solution, 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 monitor power supply.

TO-220-5L

1

1. Drain 2. Gnd 3. Vcc 4. Feedback 5. Sync

Internal Block Diagram



Absolute Maximum Ratings

(Ta=25°C, unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-Gate Voltage (R_{GS}=1MΩ)	V_{DGR}	650	V
Gate-Source (GND) Voltage	V_{GS}	±30	V
Drain Current Pulsed (2)	I_{DM}	32.4	A_{DC}
Single Pulsed Avalanche Energy (3)	E_{AS}	515	mJ
Single Pulsed Avalanche Current (4)	I_{AS}	25	A
Continuous Drain Current (Tc = 25°C)	I_D	8.1	A_{DC}
Continuous Drain Current (T_C=100°C)	I_D	5.1	A_{DC}
Supply Voltage	V_{CC}	35	V
Input Voltage Range	V_{FB}	-0.3 to V_{CC}	V
	V_{S_S}	-0.3 to 10	V
Total Power Dissipation	P_D(Watt H/S)	155	W
	Derating	1.243	W/°C
Operating Junction Temperature	T_j	+150	°C
Operating Ambient Temperature	T_A	-25 to +85	°C
Storage Temperature Range	T_{STG}	-55 to +150	°C

Notes:

1. Tj=25°C to 150°C
2. Repetitive rating: Pulse width limited by maximum junction temperature
3. L=14.5mH, starting Tj=25°C
4. L=13uH, starting Tj=25°C

Electrical Characteristics (SenseFET 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=250μA	650	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=650V, V_{GS}=0V	-	-	200	μA
		V_{DS}=520V V_{GS}=0V, T_C=125°C	-	-	300	μA
Static Drain-Source On Resistance (1)	$R_{DS(ON)}$	V_{GS}=10V, I_D=1.8A	-	1.0	1.2	Ω
Forward Transconductance (2)	gfs	V_{DS}=50V, I_D=1.8A	-	-	-	S
Input Capacitance	Ciss	V_{GS}=0V, V_{DS}=25V, f = 1MHz	-	1300	-	pF
Output Capacitance	Coss		-	135	-	
Reverse Transfer Capacitance	Crss		-	25	-	
Turn On Delay Time	td(on)	V_{DD}=325V, I_D=6.5A (MOSFET switching time is essentially independent of operating temperature)	-	25	-	nS
Rise Time	tr		-	75	-	
Turn Off Delay Time	td(off)		-	130	-	
Fall Time	tf		-	70	-	
Total Gate Charge (Gate-Source+Gate-Drain)	Qg	V_{GS}=10V, I_D=6.5A, V_{DS}=520V (MOSFET switching time is essentially independent of operating temperature)	-	45	60	nC
Gate-Source Charge	Qgs		-	8	-	
Gate-Drain (Miller) Charge	Qgd		-	21	-	

Notes:

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

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

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}	-	22	25	28	kHz
Voltage Stability	F_{STABLE}	12V ≤ Vcc ≤ 23V	0	1	3	%
Temperature Stability (4)	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	Idelay	V_{FB}=5V	1.6	2.0	2.4	µA
SYNC & SOFTSTART SECTION						
Softstart Vortage	V_{SS}	Vfb=2	4.7	5.0	5.3	V
Softstart Current	I_{SS}	Vss=V	0.8	1.0	1.2	mA
Sync High Threshold Voltage	V_{SYNCH}	Vcc=16V,Vfb=5V	-	7.2	-	V
Sync Low Threshold Voltage	V_{SYNCL}	Vcc=16V,Vfb=5V	-	5.8	-	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(4)	V_{BEN}	Vcc=10.5V	0.7	1.0	1.3	V
Burst Mode Peak Current Limit(3)	I_{BU_PK}	Vcc=10.5V	0.45	0.6	0.75	V
Burst Mode Frequency	F_{BUR}	Vcc=10.5V, Vfb=0V	40	50	60	kHz
CURRENT LIMIT(SELF-PROTECTION)SECTION						
Peak Current Limit(3)	I_{OVER}	-	5.28	6.0	6.72	A
PROTECTION SECTION						
Over Voltage Protection	V_{OVP}	Vcc≥ 27V	27	30	33	V
Over Current Latch Voltage (2)	V_{OCL}	-	0.9	1.0	1.1	V
Thermal Shutdown Temperature(4)	T_{SD}	-	140	160	-	°C
TOTAL DEVICE SECTION						
Start Up Current	I_{START}	Vfb=GND, V_{CC}=14V	-	0.1	0.17	mA
Operating Supply Current (1)	I_{OP}	Vfb=GND, V_{CC}=16V	-	10	15	mA
	$I_{OP(MIN)}$	Vfb=GND, V_{CC}=10V				
	$I_{OP(MAX)}$	Vfb=GND, V_{CC}=28V				

Note:

1. These parameters are the current flowing in the control IC.
2. These parameters, although guaranteed, are tested in the EDS(wafer test) process.
3. These parameters indicate the inductor current.
4. These parameters, although guranteed at the design, are not tested in the mass production

Typical Performance Characteristics

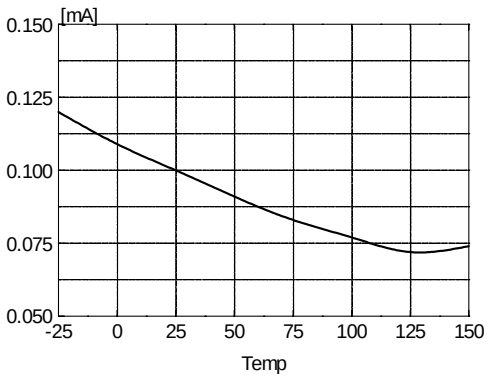


Figure 1. Start Up Current vs. Temp.

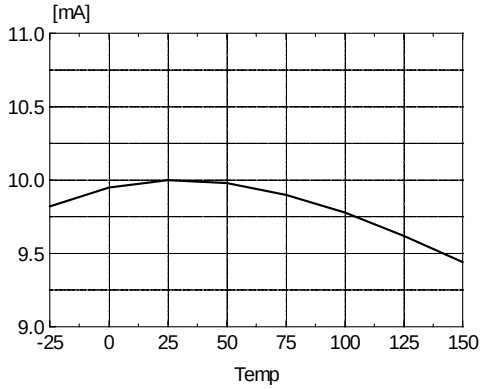


Figure 2. Operating Current vs. Temp.

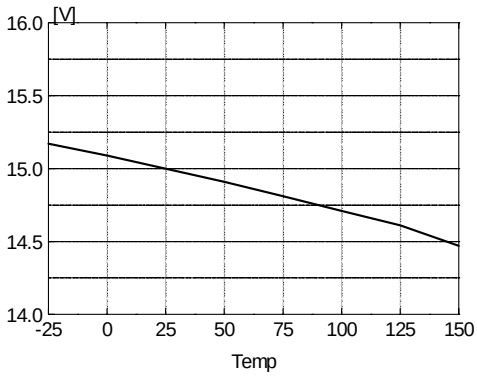


Figure 3. Start Threshold Voltage vs. Temp.

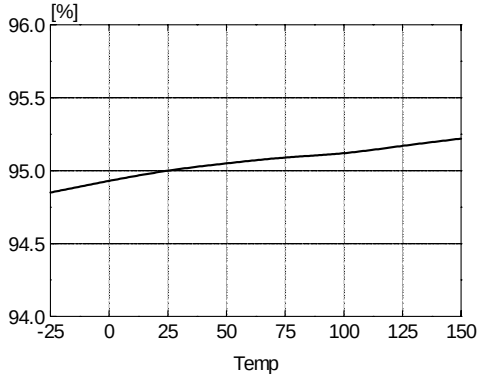


Figure 4. Stop Threshold Voltage vs. Temp.

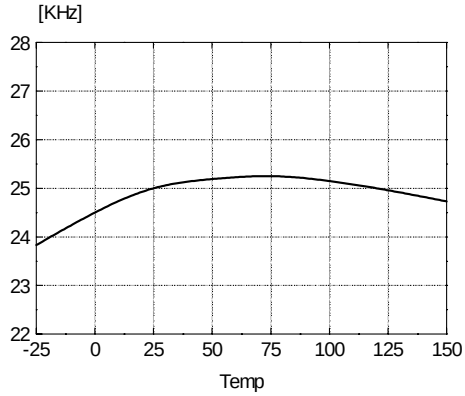


Figure 5. Initial Frequency vs. Temp.

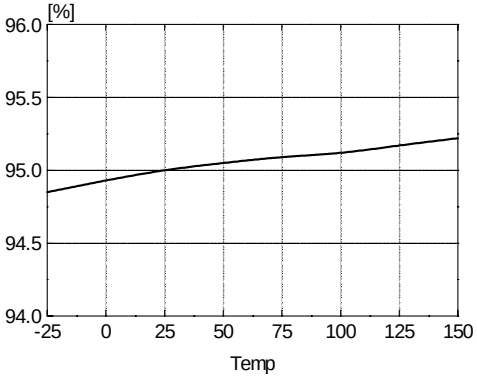


Figure 6. Maximum Duty vs. Temp.

Typical Performance Characteristics (Continued)

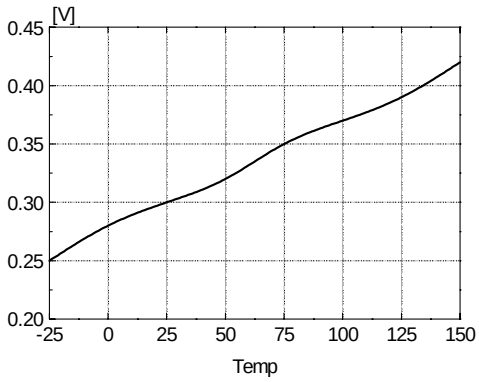


Figure 7. Feedback Offset Voltage vs. Temp.

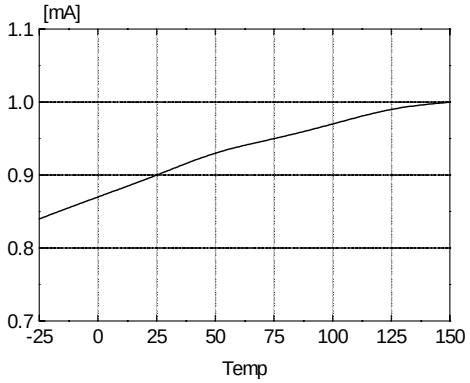


Figure 8. Feedback Source Current vs. Temp.

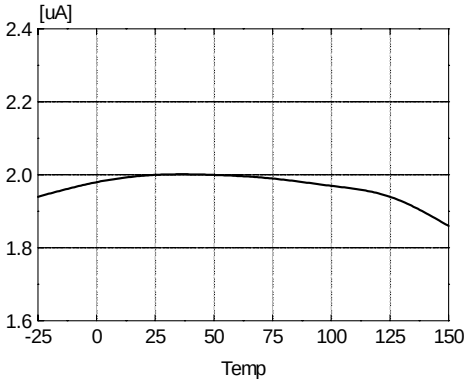


Figure 9. Shutdown Delay Current vs. Temp.

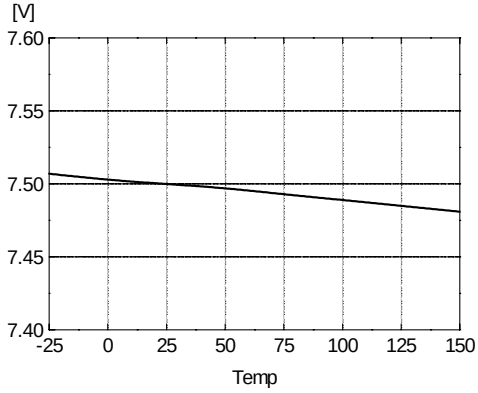


Figure 10. Shutdown Feedback Voltage vs. Temp.

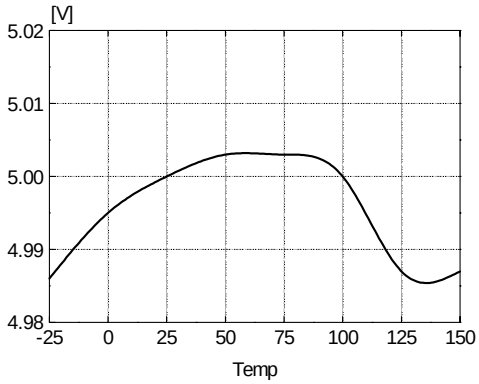


Figure 11. Softstart Voltage vs. Temp.

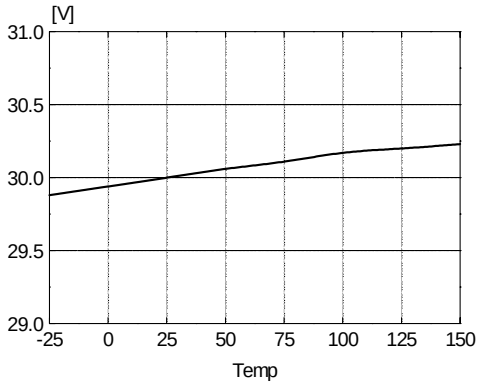


Figure 12. Over Voltage Protection vs. Temp.

Typical Performance Characteristics (Continued)

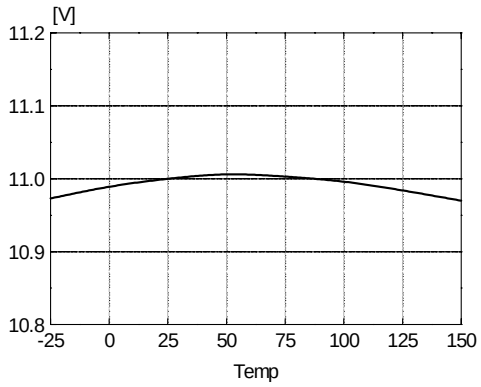


Figure 13. Burst Mode Low Voltage vs. Temp.

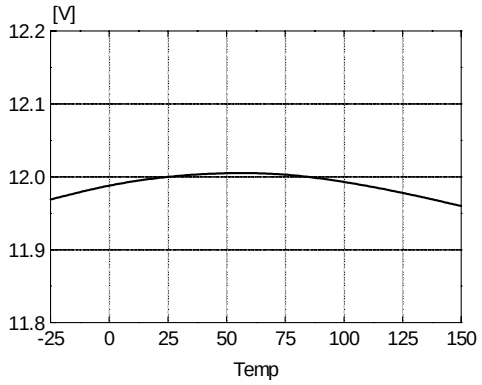


Figure 14. Burst Mode High Voltage vs. Temp.

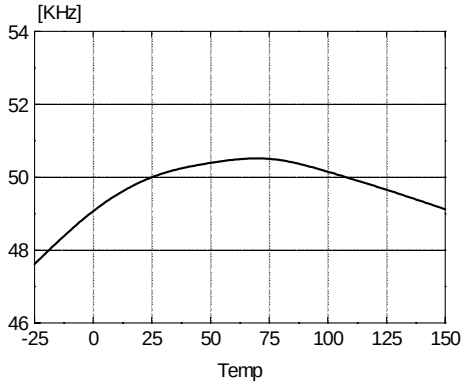


Figure 15. Burst Mode Frequency vs. Temp.

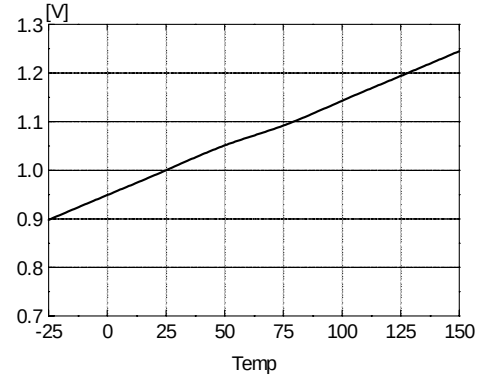


Figure 16. Burst Mode Enable Voltage vs. Temp.

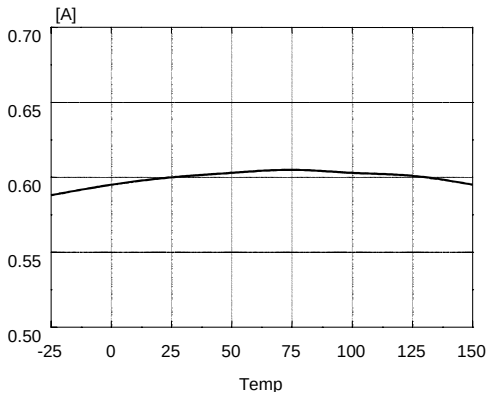


Figure 17. Burst Mode Peak Current vs. Temp.

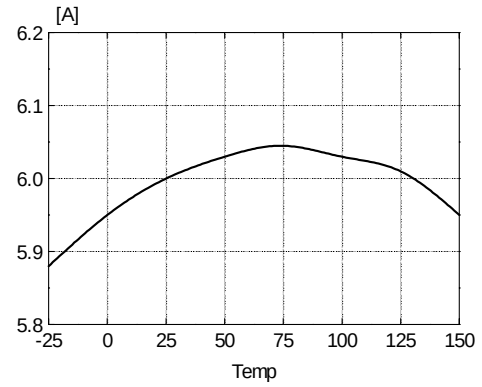
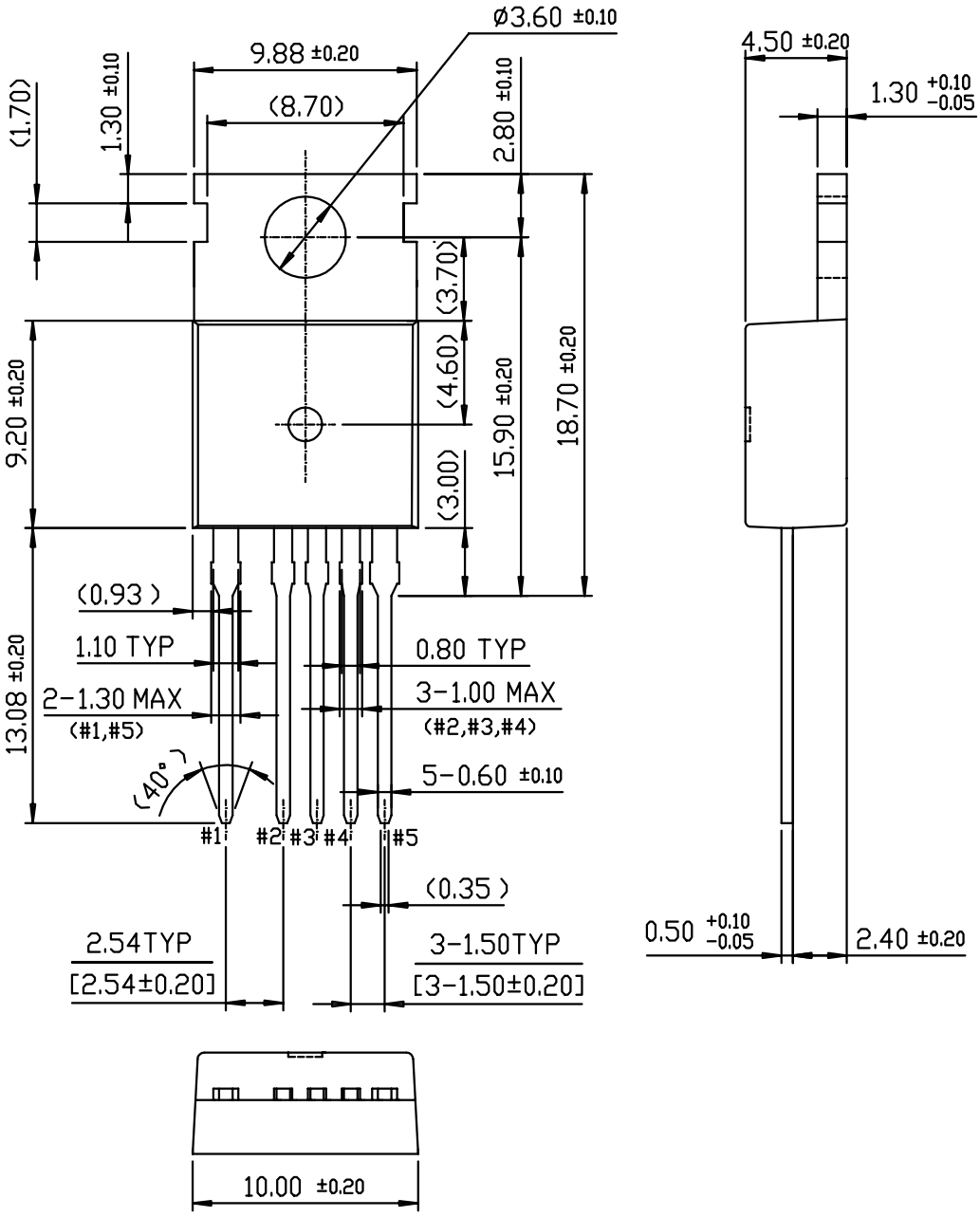


Figure 18. Over Current Limit vs. Temp.

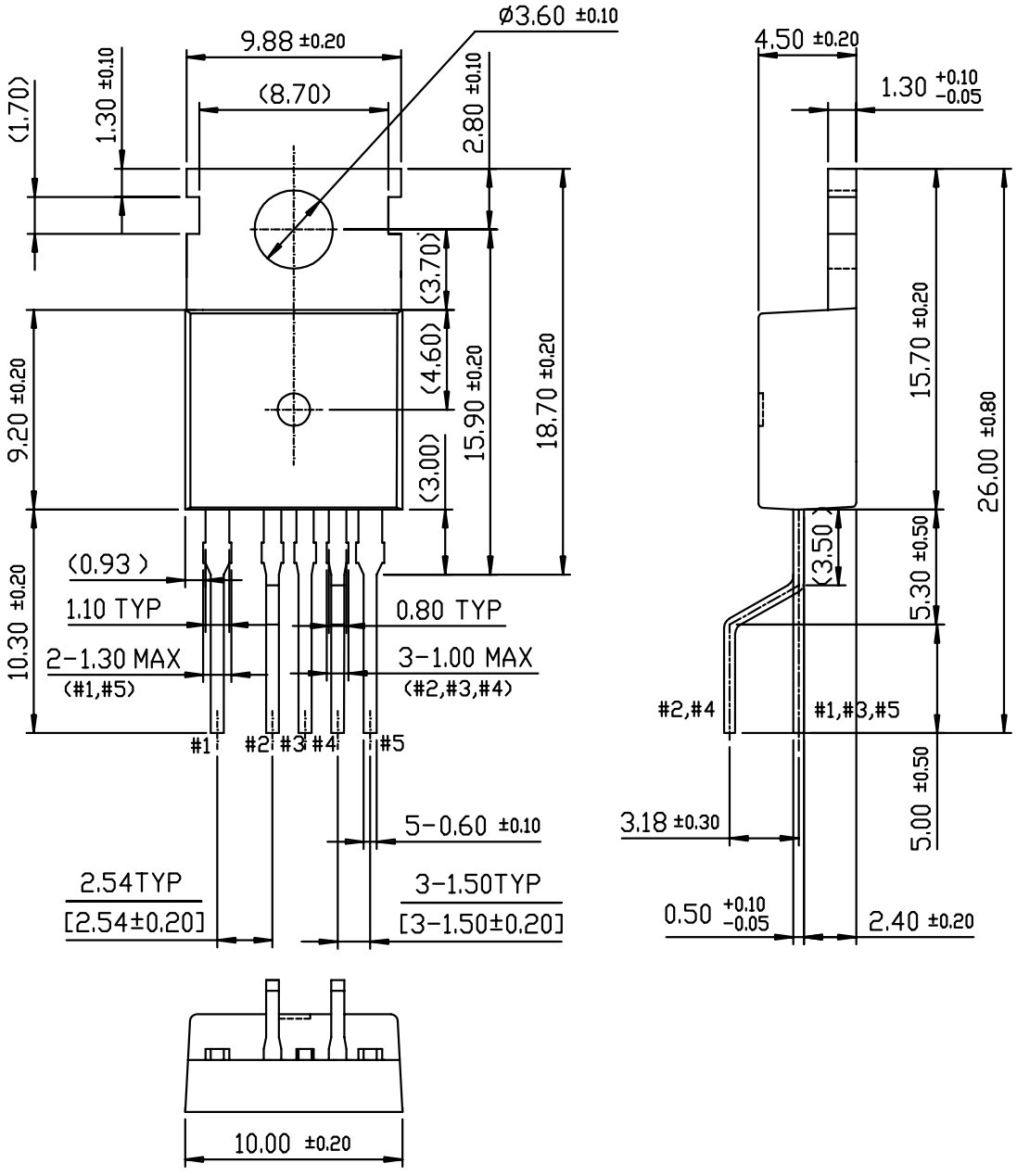
Package Dimensions

TO-220-5L



Package Dimensions (Continued)

TO-220-5L(Forming)



Ordering Information

Product Number	Package	Marking Code	BVdss	Rds(on)
FS6S0965RCBTU	TO-220-5L	6S0965RCB	650V	1.0
FS6S0965RCBYDTU	TO-220-5L(Forming)			

TU : Non Forming Type
YDTU : Forming Type