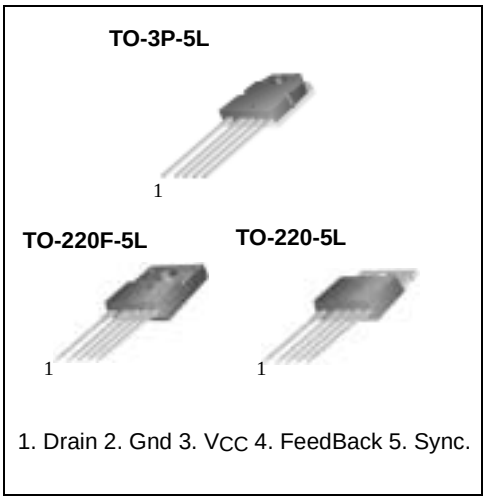
KA5S-SERIES

KA5S0765C/KA5S09654QT/KA5S0965/ KA5S12656/KA5S1265

Fairchild Power Switch(FPS)

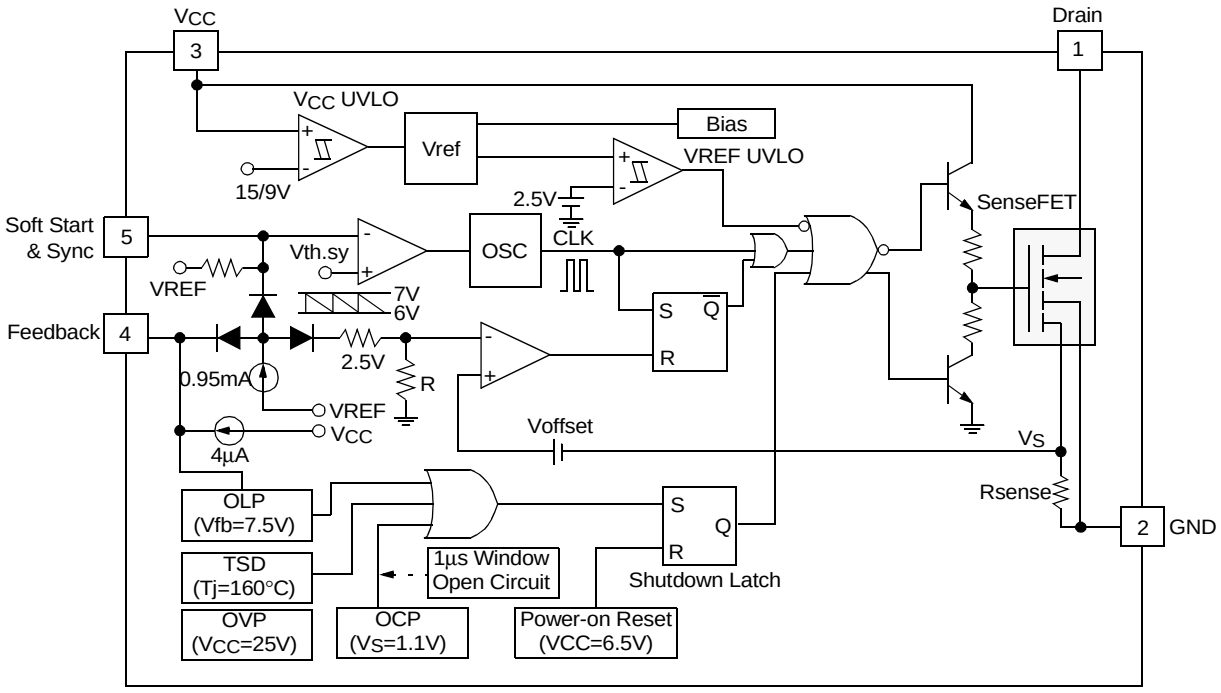
Features

- Wide Operating Frequency Range Up to 150Khz
- Lowest Cost SMPS Solution
- Lowest External Components
- Low Start-up Current (max:170uA)
- Low Operating Current (max:12mA)
- Internal High Voltage SenseFET
- Over Voltage Protection With Latch Mode (Min23V)
- Over Load Protection With Latch Mode
- Over Current Protection With Latch Mode
- Internal Thermal Protection With Latch Mode
- Pulse By Pulse Over Current Limiting
- Under Voltage Lockout With Hysteresis
- External Sync. Terminal



1. Drain 2. Gnd 3. V_{CC} 4. FeedBack 5. Sync.

Internal Block Diagram



Rev.1.0.2

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Absolute Maximum Ratings

(Ta=25°C, unless otherwise specified)

Characteristic	Symbol	Value	Unit
KA5S0765C			
Maximum drain voltage	$V_{D,MAX}$	650	V
Drain-gate voltage(R_{GS}=1MΩ)	V_{DGR}	650	V
Gate-source(GND) voltage	V_{GS}	±30	V
Drain current pulsed[1]	I_{DM}	28	ADC
Continuous drain current (Tc = 25°C)	I_D	7.0	ADC
Continuous drain current (Tc = 100°C)	I_D	5.6	ADC
Single pulsed avalanch current[3](Energy [2])	$I_{AS}(E_{AS})$	20(570)	A(mJ)
Maximum supply voltage	$V_{CC,MAX}$	30	V
Input voltage range	V_{FB}	-0.3 to V_{CC}	V
	V_{SS}	-0.3 to 8	V
Total power dissipation	P_D (Watt H/S)	135	W
	Derating	1.1	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
KA5S09654QT			
Maximum drain voltage	$V_{D,MAX}$	650	V
Drain-gate voltage(R_{GS}=1MΩ)	V_{DGR}	650	V
Gate-source(GND) voltage	V_{GS}	±30	V
Drain current pulsed[1]	I_{DM}	49	ADC
Continuous drain current (Tc = 25°C)	I_D	9.0	ADC
Continuous drain current (Tc = 100°C)	I_D	5.7	ADC
Single pulsed avalanch current[3](Energy [2])	$I_{AS}(E_{AS})$	25(660)	A(mJ)
Maximum supply voltage	$V_{CC,MAX}$	30	V
Input voltage range	V_{FB}	-0.3 to V_{CC}	V
	V_{SS}	-0.3 to 8	V
Total power dissipation	P_D (Watt H/S)	160	W
	Derating	1.28	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

Absolute Maximum Ratings (Continued)

(Ta=25°C, unless otherwise specified)

Characteristic	Symbol	Value	Unit
KA5S0965			
Maximum Drain Voltage	$V_{D,MAX}$	650	V
Drain-Gate Voltage(R_{GS}=1MΩ)	V_{DGR}	650	V
Gate-Source(GND) Voltage	V_{GS}	±30	V
Drain Current Pulsed(1)	I_{DM}	36	ADC
Continuous Drain Current (Tc = 25°C)	I_D	9.0	ADC
Continuous Drain Current (Tc = 100°C)	I_D	5.8	ADC
Single Pulsed Avalanch Current(3)(Energy (2))	I_{AS}(E_{AS})	28(950)	A(mJ)
Maximum Supply Voltage	$V_{CC,MAX}$	30	V
Input Voltage Range	V_{FB}	-0.3 to V_{CC}	V
	V_{SS}	-0.3 to 8	V
Total Power Dissipation	P_D (Watt H/S)	170	W
	Derating	1.33	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
KA5S12656			
Maximum Drain Voltage	$V_{D,MAX}$	650	V
Drain-Gate Voltage(R_{GS}=1MΩ)	V_{DGR}	650	V
Gate-Source(GND) Voltage	V_{GS}	±30	V
Drain Current Pulsed(1)	I_{DM}	48	ADC
Continuous Drain Current (Tc = 25°C)	I_D	12	ADC
Continuous Drain Current (Tc = 100°C)	I_D	8.4	ADC
Single Pulsed Avalanch Current(3)(Energy (2))	I_{AS}(E_{AS})	30(785)	A(mJ)
Maximum Supply Voltage	$V_{CC,MAX}$	30	V
Input Voltage Range	V_{FB}	-0.3 to V_{CC}	V
	V_{SS}	-0.3 to 8	V
Total Power Dissipation	P_D (Watt H/S)	160	W
	Derating	1.28	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

Absolute Maximum Ratings (Continued)

(Ta=25°C, unless otherwise specified)

Characteristic	Symbol	Value	Unit
KA5S1265			
Maximum Drain Voltage	$V_{D,MAX}$	650	V
Drain-Gate Voltage(R_{GS}=1MΩ)	V_{DGR}	650	V
Gate-Source(GND) Voltage	V_{GS}	±30	V
Drain Current Pulsed(1)	I_{DM}	48	ADC
Continuous Drain Current (Tc = 25°C)	I_D	12	ADC
Continuous Drain Current (Tc = 100°C)	I_D	8.4	ADC
Single Pulsed Avalanch Current(3)(Energy (2))	I_{AS}(E_{AS})	30(785)	A(mJ)
Maximum Supply Voltage	$V_{CC,MAX}$	30	V
Input Voltage Range	V_{FB}	-0.3 to V_{CC}	V
	V_{SS}	-0.3 to 8	V
Total Power Dissipation	P_D (Watt H/S)	160	W
	Derating	1.28	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

Note:

1. Repetitive rating : Pulse width limited by maximum junction temperature
2. L = 10mH, V_{DD} =50V, R_G = 27Ω, starting Tj = 25°C
3. L = 13uH, starting Tj = 25°C

Electrical Characteristics (SFET Part)

(Ta = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
KA5S0765C						
Drain-source breakdown voltage	BV_{DSS}	V_{GS}=0V, I_D=50μA	650	-	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS}=Max., Rating, V_{GS}=0V	-	-	50	μA
		V_{DS}=0.8Max., Rating, V_{GS}=0V, T_C=125°C	-	-	200	μA
Static drain-source on resistance(1)	R_{DS}(on)	V_{GS}=10V, I_D=4.0A	-	1.25	1.6	Ω
Forward transconductance(1)	gfs	V_{DS}=15V, I_D=4.0A	3.0	-	-	S
Input capacitance	Ciss	V_{GS}=0V, V_{DS}=25V, f = 1MHz	-	1600	-	pF
Output capacitance	Coss		-	310	-	
Reverse transfer capacitance	Crss		-	120	-	
Turn on delay time	td(on)	V_{DD}=0.5BV_{DSS}, I_D=7.0A (MOSFET switching time are essentially independent of operating temperature)	-	25	-	nS
Rise time	tr		-	55	-	
Turn off delay time	td(off)		-	80	-	
Fall time	tf		-	50	-	
Total gate charge (gate-source+gate-drain)	Qg	V_{GS}=10V, I_D=7.0A, V_{DS}=0.5BV_{DSS}(MOSFET Switching time are Essentially independent of Operating temperature)	-	-	72	nC
Gate-source charge	Qgs		-	9.3	-	
Gate-drain (Miller) charge	Qgd		-	29.3	-	
KA5S09654QT						
Drain-source breakdown voltage	BV_{DSS}	V_{GS}=0V, I_D=50μA	650	-	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS}=Max., Rating, V_{GS}=0V	-	-	200	μA
		V_{DS}=0.8Max., Rating, V_{GS}=0V, T_C=125°C	-	-	300	μA
Static drain-source on resistance(1)	R_{DS}(on)	V_{GS}=10V, I_D=4.5A	-	1.1	1.2	Ω
Forward transconductance(1)	gfs	V_{DS}=50V, I_D=4.5A	3.0	-	-	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}=0.5BV_{DSS}, I_D=9.0A (MOSFET switching time are 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=9.0A, V_{DS}=0.5BV_{DSS}(MOSFET Switching time are Essentially independent of Operating temperature)		45	-	nC
Gate-source charge	Qgs		-	8	-	
Gate-drain (Miller) charge	Qgd		-	22	-	

Electrical Characteristics (SFET Part; Continued)

(Ta = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
KA5S0965						
Drain-source breakdown voltage	BV_{DSS}	V_{GS}=0V, I_D=50μA	650	-	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS}=Max., Rating, V_{GS}=0V	-	-	50	μA
		V_{DS}=0.8Max., Rating, V_{GS}=0V, T_C=125°C	-	-	200	μA
Static drain-source on resistance(1)	R_{DS}(on)	V_{GS}=10V, I_D=4.5A	-	0.96	1.2	Ω
Forward transconductance(1)	gfs	V_{DS}=50V, I_D=4.5A	5.0	-	-	S
Input capacitance	Ciss	V_{GS}=0V, V_{DS}=25V, f = 1MHz	-	1750	-	pF
Output capacitance	Coss		-	190	-	
Reverse transfer capacitance	Crss		-	78	-	
Turn on delay time	td(on)	V_{DD}=0.5BV_{DSS}, I_D=9.0A (MOSFET switching time are essentially independent of operating temperature)	-	20	50	nS
Rise time	tr		-	23	55	
Turn off delay time	td(off)		-	85	180	
Fall time	tf		-	30	70	
Total gate charge (gate-source+gate-drain)	Qg	V_{GS}=10V, I_D=9.0A, V_{DS}=0.5BV_{DSS}(MOSFET Switching time are Essentially independent of Operating temperature)	-	74	95	nC
Gate-source charge	Qgs		-	12	-	
Gate-drain (Miller) charge	Qgd		-	35	-	
KA5S12656						
Drain-source breakdown voltage	BV_{DSS}	V_{GS}=0V, I_D=50μA	650	-	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS}=Max., Rating, V_{GS}=0V	-	-	50	μA
		V_{DS}=0.8Max., Rating, V_{GS}=0V, T_C=125°C	-	-	200	μA
Static drain-source on resistance(1)	R_{DS}(on)	V_{GS}=10V, I_D=6.0A	-	0.72	0.9	Ω
Forward transconductance(1)	gfs	V_{DS}=50V, I_D=4.0A	5.7	-	-	S
Input capacitance	Ciss	V_{GS}=0V, V_{DS}=25V, f = 1MHz	-	2700	-	pF
Output capacitance	Coss		-	300	-	
Reverse transfer capacitance	Crss		-	61	-	
Turn on delay time	td(on)	V_{DD}=0.5BV_{DSS}, I_D=12.0A (MOSFET switching time are essentially independent of operating temperature)	-	18	-	nS
Rise time	tr		-	37	-	
Turn off delay time	td(off)		-	88	-	
Fall time	tf		-	36	-	
Total gate charge (gate-source+gate-drain)	Qg	V_{GS}=10V, I_D=12.0A, V_{DS}=0.5BV_{DSS}(MOSFET Switching time are Essentially independent of Operating temperature)	-	-	140	nC
Gate-source charge	Qgs		-	20	-	
Gate-drain (Miller) charge	Qgd		-	69	-	

Electrical Characteristics (SFET Part; Continued)

(Ta = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
KA5S1265						
Drain-source breakdown voltage	BV_{DSS}	V_{GS}=0V, I_D=50μA	650	-	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS}=Max., Rating, V_{GS}=0V	-	-	50	μA
		V_{DS}=0.8Max., Rating, V_{GS}=0V, T_C=125°C	-	-	200	μA
Static drain-source on resistance(1)	R_{DS}(on)	V_{GS}=10V, I_D=6.0A	-	0.72	0.9	Ω
Forward transconductance(1)	gfs	V_{DS}=50V, I_D=4.0A	5.7	-	-	S
Input capacitance	Ciss	V_{GS}=0V, V_{DS}=25V, f = 1MHz	-	2700	-	pF
Output capacitance	Coss		-	300	-	
Reverse transfer capacitance	Crss		-	61	-	
Turn on delay time	td(on)	V_{DD}=0.5BV_{DSS}, I_D=12.0A (MOSFET switching time are essentially independent of operating temperature)	-	18	-	nS
Rise time	tr		-	37	-	
Turn off delay time	td(off)		-	88	-	
Fall time	tf		-	36	-	
Total gate charge (gate-source+gate-drain)	Qg	V_{GS}=10V, I_D=12.0A, V_{DS}=0.5BV_{DSS}(MOSFET Switching time are Essentially independent of Operating temperature)	-	-	140	nC
Gate-source charge	Qgs		-	20	-	
Gate-drain (Miller) charge	Qgd		-	69	-	

Note:

1. Pulse Test : Pulse width ≤ 300uS, Duty Cycle ≤ 2%

2.MOSFET Switching Time are Essentially Independent of Operating Temperature

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

Electrical Characteristics (CONTROL Part)

(V_{CC}=16V, Tamb = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
UVLO SECTION						
Start Threshold Voltage	V_{START}	V_{FB}=GND	14	15	16	V
StopThreshold 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 ≤ V_{CC} ≤ 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}	V_{FB} ≥ 6.9V	6.9	7.5	8.1	V
Shutdown Delay Current	I_{DELAY}	V_{FB}=5V	3.0	4.0	5.0	μA
SYNC. & SOFTSTART SECTION						
Softstart Voltage	V_{SS}	V_{FB}=2V	4.7	5.0	5.3	V
Softstart Current	I_{SS}	V_{SS}=0V	0.75	0.95	1.15	mA
Sync High Threshold Voltage(Note3)	V_{SYNCH}	V_{CC}=16V , V_{FB}=5V	-	7.0	-	V
Sync Low Threshold Voltage(Note3)	V_{SYNCL}	V_{CC}=16V , V_{FB}=5V	-	6.0	-	V
CURRENT LIMIT(SELF-PROTECTION)SECTION						
Peak Current Limit (Note4)	I_{OVER}	**KA5S0765C**	3.52	4.0	4.48	A
		KA5S09654QT	3.52	4.0	4.48	
		KA5S0965	5.28	6.0	6.72	
		KA5S12656	5.28	6.0	6.72	
		KA5S1265	7.04	8.0	8.96	
PROTECTION SECTION						
Over Voltage Protcetion	V_{OVP}	V_{CC} ≥ 24V	23	25	28	V
Over Current Latch voltage(Note3)	V_{OCL}	-	0.9	1.0	1.1	V
Thermal Shutdown Tempature(Note2)	TSD	-	140	160	-	°C
TOTAL DEVICE SECTION						
Start Up Current	I_{START}	V_{FB}=GND, V_{CC}=14V	-	0.1	0.17	mA
Operating Supply Current(Note1)	I_{OP}	V_{FB}=GND, V_{CC}=16V	-	7	12	mA
	$I_{OP(MIN)}$	V_{FB}=GND, V_{CC}=12V				
	$I_{OP(MAX)}$	V_{FB}=GND, V_{CC}=30V				

Note:

1. These parameters is the Current Flowing in the Control IC.
2. These parameters, although guaranteed, are not 100% tested in production
3. These parameters, although guaranteed, are tested in EDS(wafer test) process
4. These parameters are indicated Inductor Current.

Typical Performance Characteristics

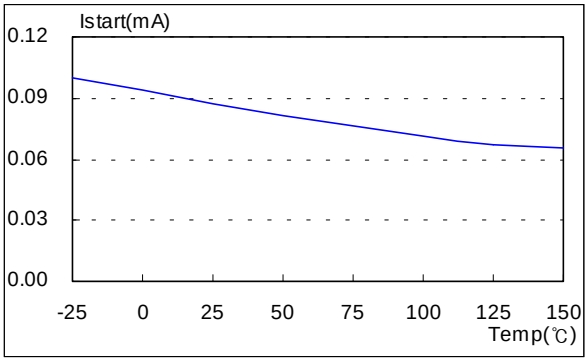


Figure 1. Start Up Current vs. Temp.

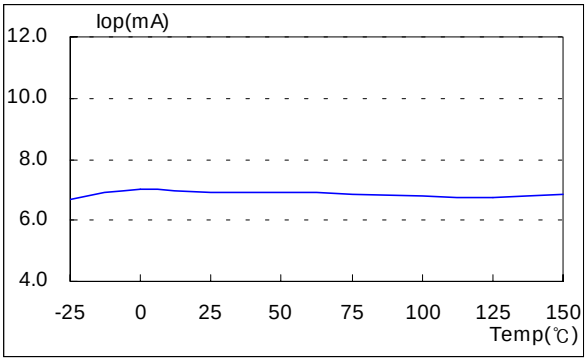


Figure 2. Operating Supply Current vs. Temp.

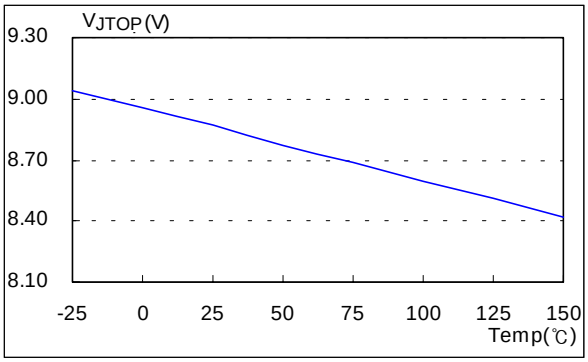


Figure 3. Stop Threshold Voltage

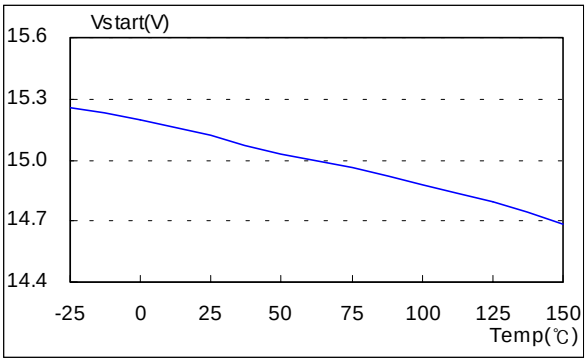


Figure 4. Start Threshold Voltage

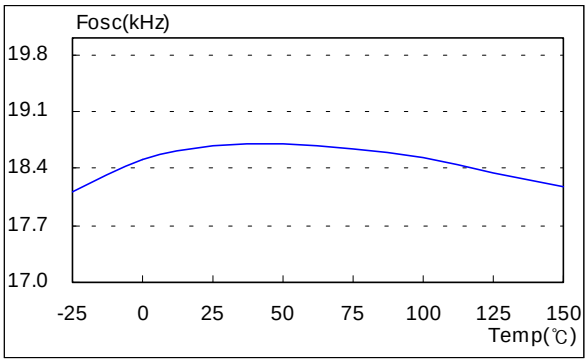


Figure 5. Inital Frequency VS. Temp

Typical Performance Characteristics(Continued)

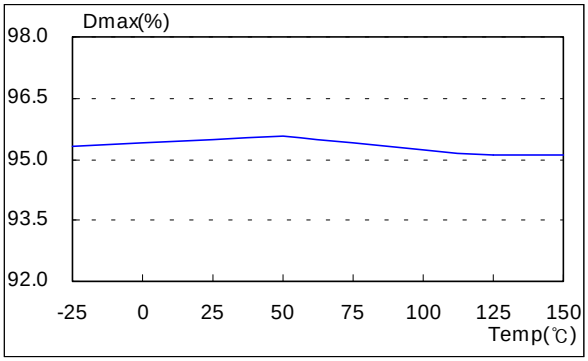


Figure 6. Maximum Duty vs. Temp.

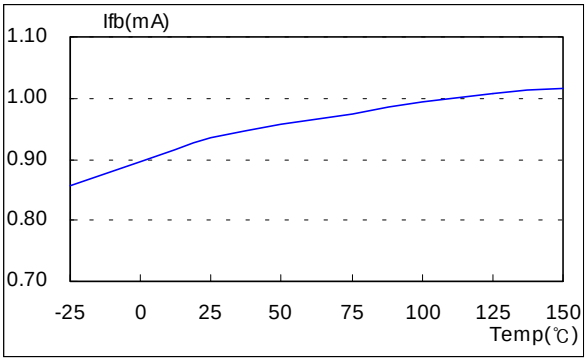


Figure 7. Feedback Source Current vs. Temp.

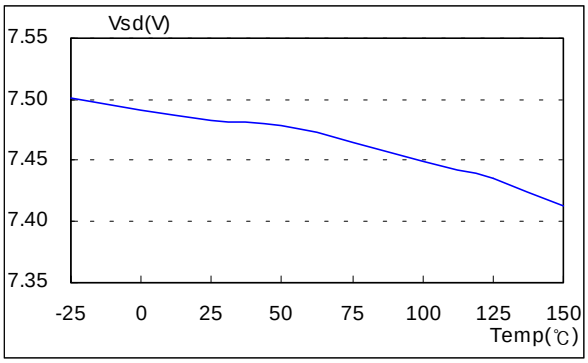


Figure 8. Shutdown Feedback Volatge vs. Temp.

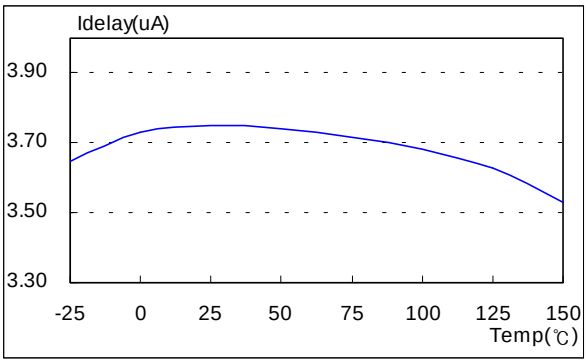


Figure 9. Shutdown Delay Current vs. Temp.

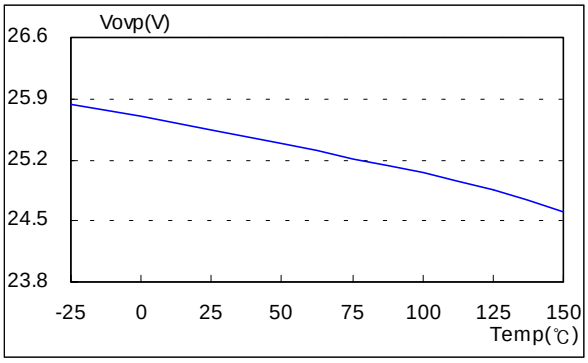


Figure 10. Over Volatge Protection vs. Temp.

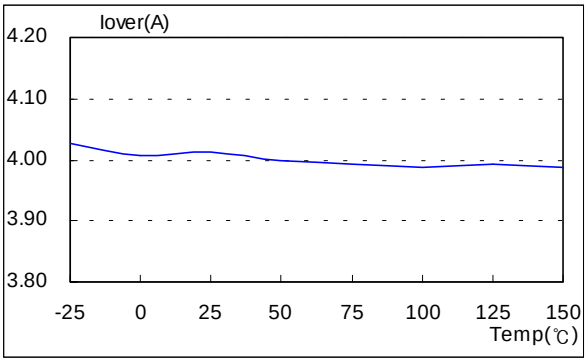


Figure 11. Peak Current Limit

Typical Performance Characteristics(Continued)

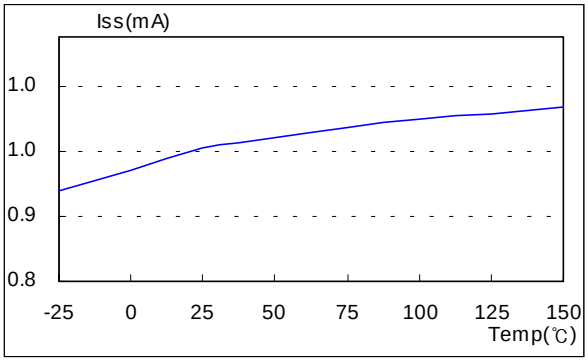


Figure 12. Soft Start Current vs. Temp.

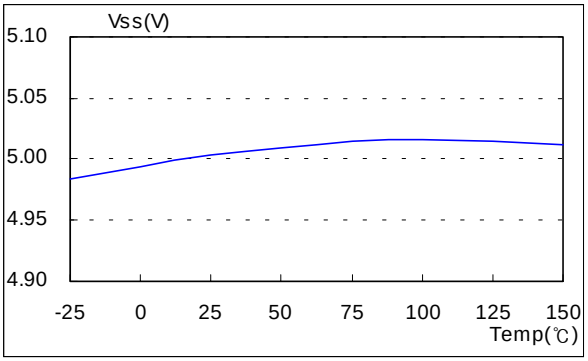
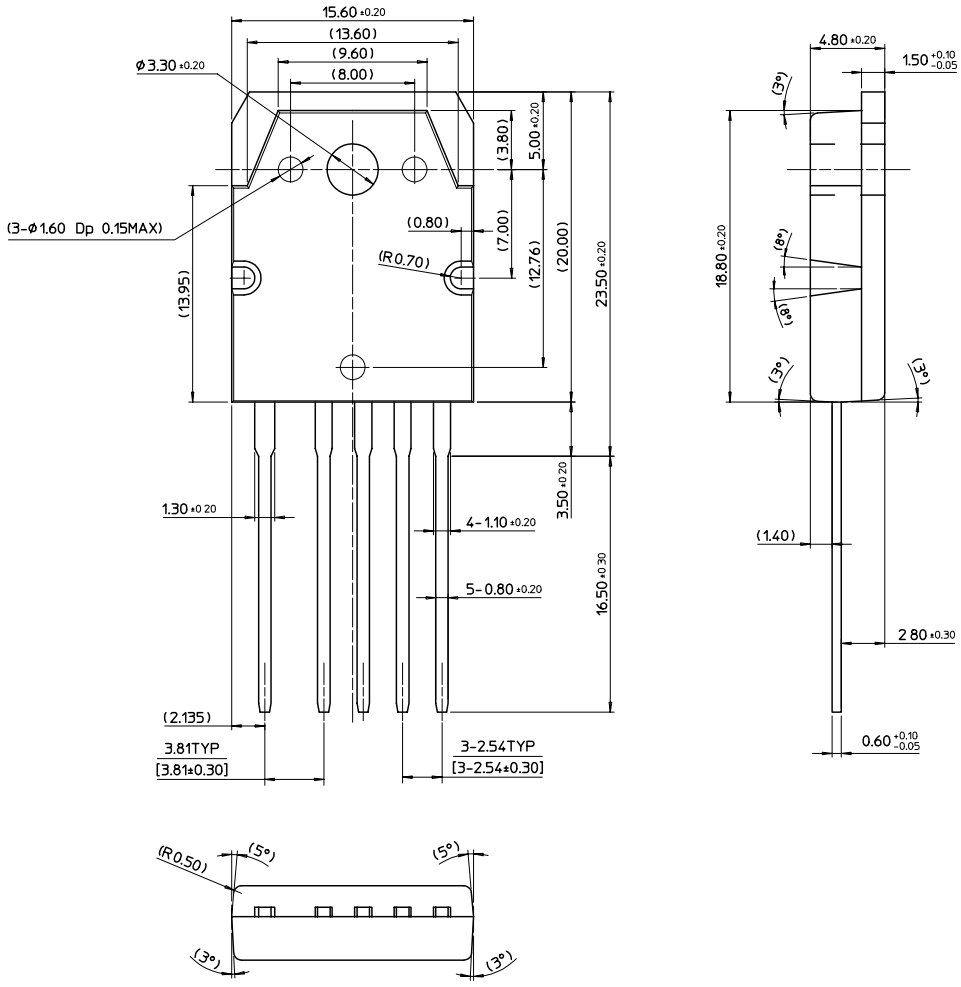


Figure 13. Soft Start Voltage vs. Temp.

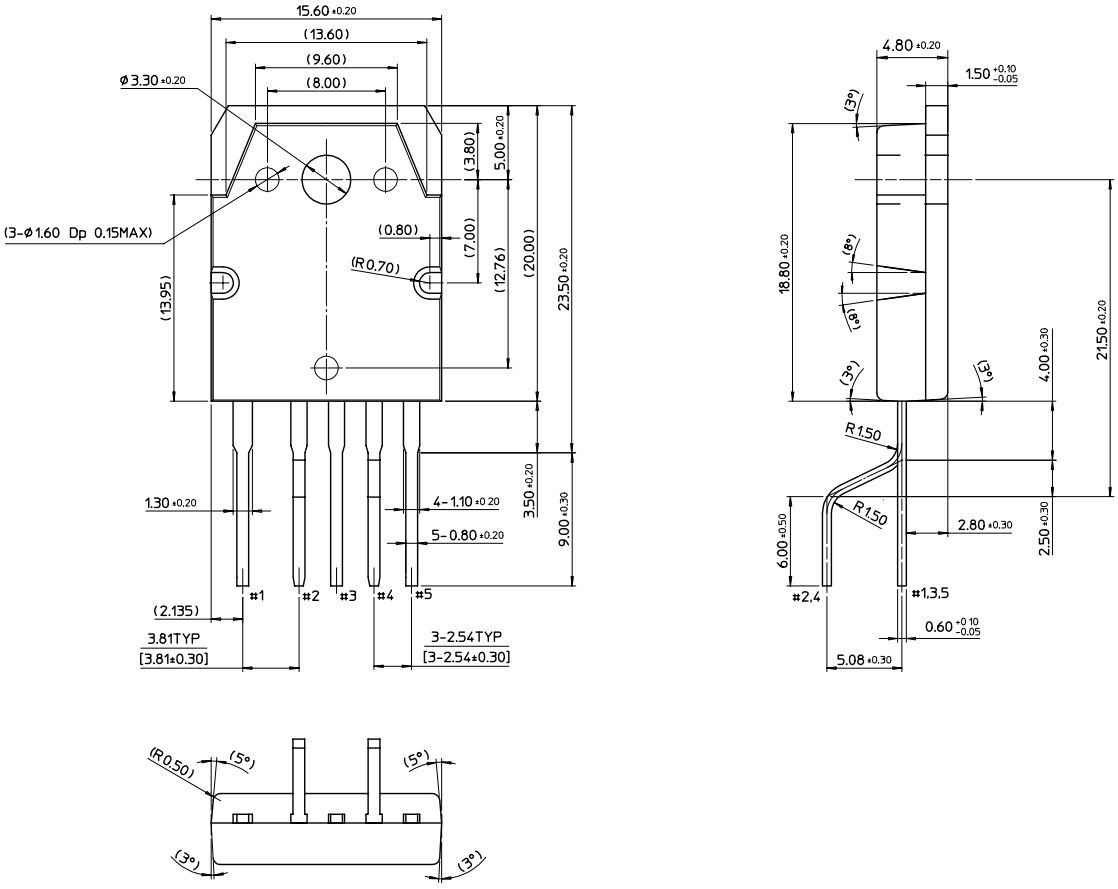
Package Dimensions

TO-3P-5L



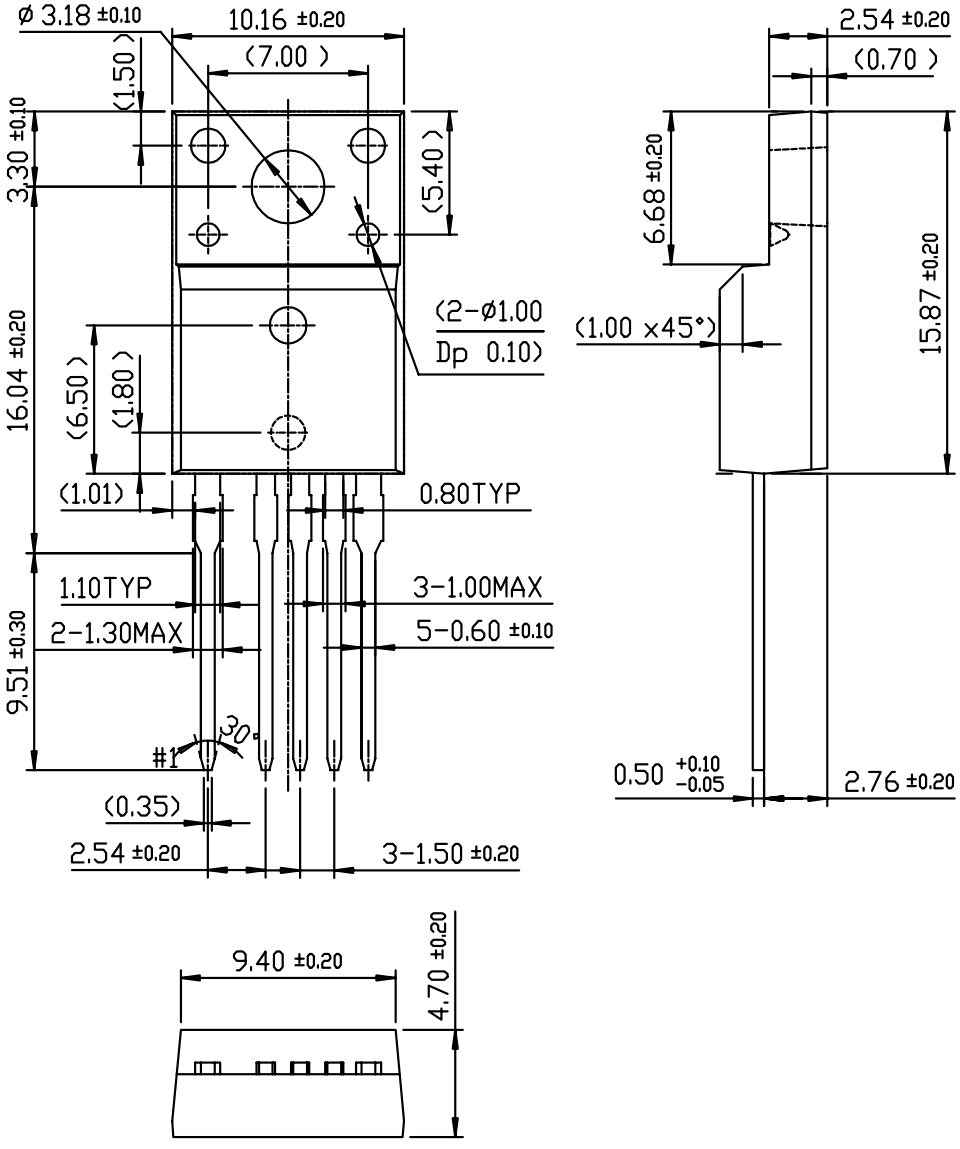
Package Dimensions (Continued)

TO-3P-5L (Forming)



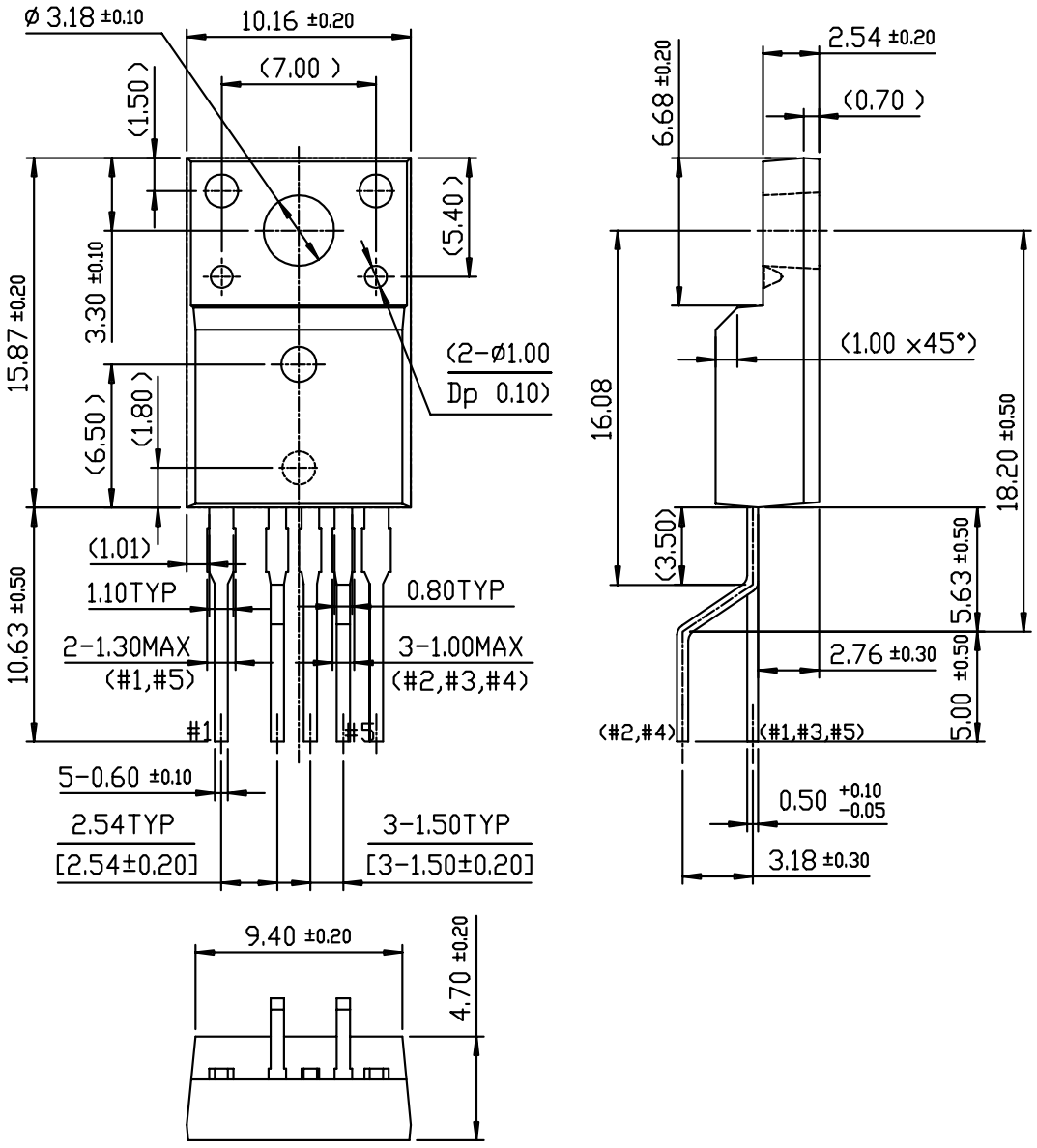
Package Dimensions (Continued)

TO-220F-5L



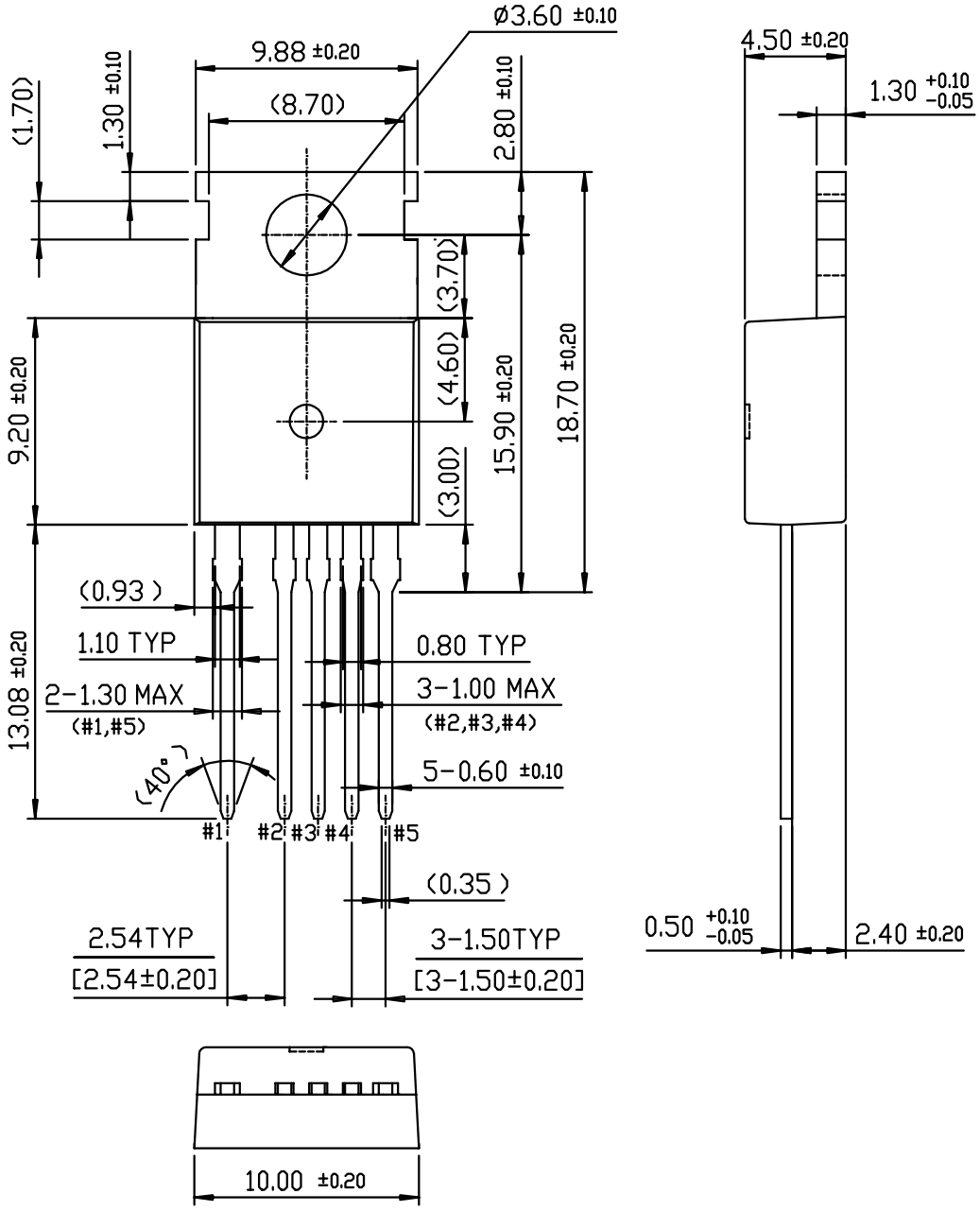
Package Dimensions (Continued)

TO-220F-5L(Forming)



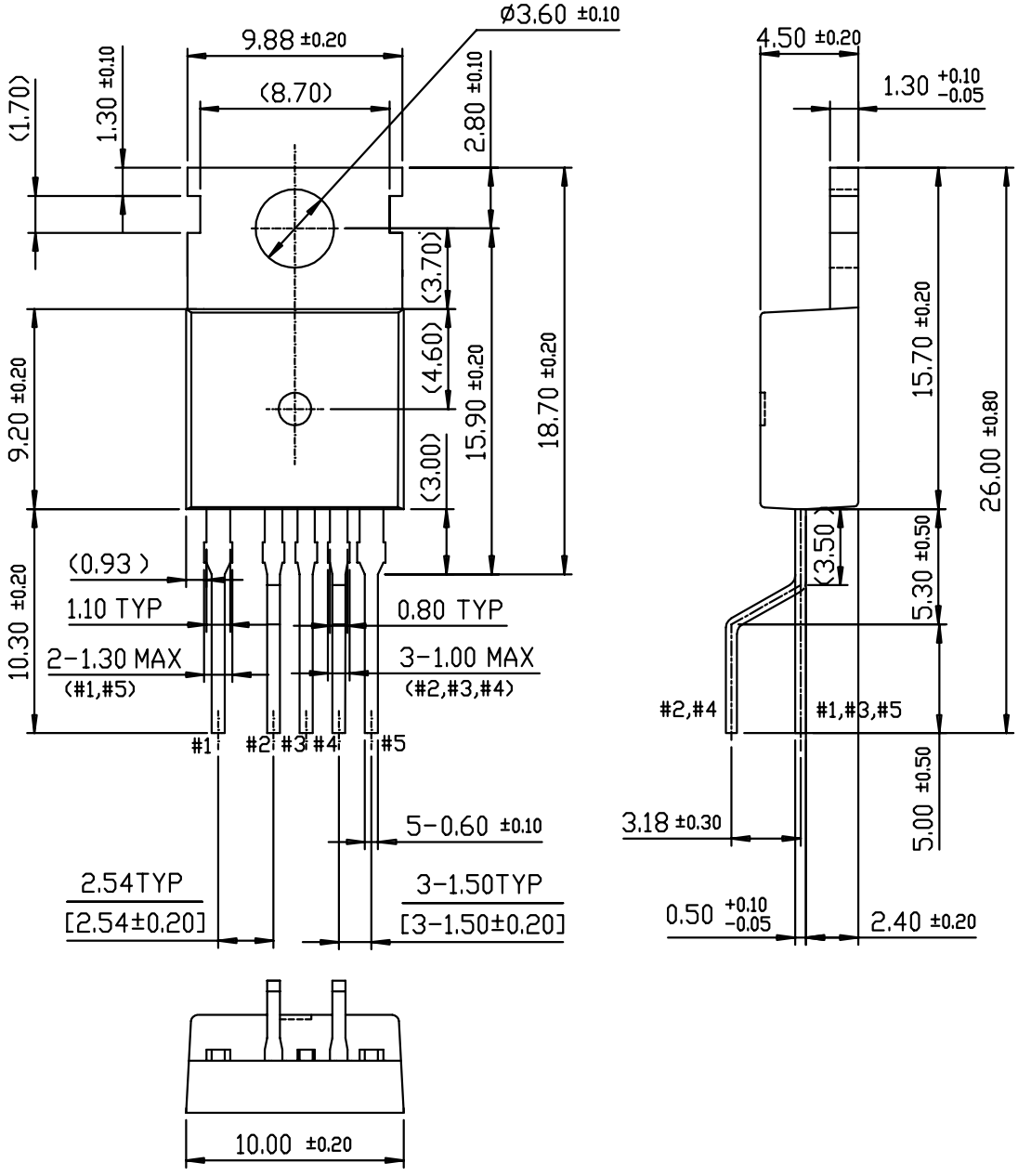
Package Dimensions (Continued)

TO-220-5L

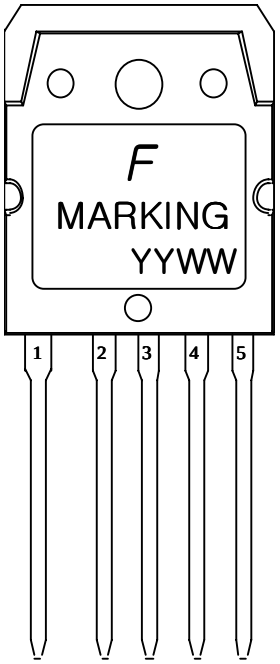


Package Dimensions (Continued)

TO-220-5L(Forming)



TOP Mark and Pinout Information



Pin No.	Symbol	Description
1	Drain	SenseFET Drain
2	GND	Ground (Source)
3	V_{CC}	Control Part Supply Input
4	F/B	PWM Non Inverting Input
5	S/S	Soft start & External Sync.

Device	MARKING
KA5S0765C	5S0765C
KA5S09654QT	5S09654
KA5S0965	5S0965
KA5S12656	5S12656
KA5S1265	5S1265

Notes ;

(1) F ; Fairchild Semiconductor

(2) 5S0765C, 5S09654, 5S0965, 5S12656, 5S1265; Device Marking Name

(3) YY: Last Two Digit of Calender Year

(4) WW: Patweek Based on Fairchild Semiconductor Work Month Calender

Ordering Information

Product Number	Package	Marking Code	BVdss	Rds(on)
KA5S0765C-TU	TO-220-5L	5S0765C	650V	1.6Ω
KA5S0765C-YDTU	TO-220-5L(Forming)			
KA5S09654QT-TU	TO-220F-5L	5S09654	650V	1.1Ω
KA5S09654QT-YDTU	TO-220F-5L(Forming)			
KA5S0965-TU	TO-3P-5L	5S0965	650V	1.2Ω
KA5S0965-YDTU	TO-3P-5L(Forming)			
KA5S12656-TU	TO-3P-5L	5S12656	650V	0.9Ω
KA5S12656-YDTU	TO-3P-5L(Forming)			
KA5S1265-TU	TO-3P-5L	5S1265	650V	0.9Ω
KA5S1265-YDTU	TO-3P-5L(Forming)			

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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