General Description

The TP6062FX is a low voltage, single P- MOSFET high- side Power switch, optimized for self- powered and bus-powered Universal Serial Bus (USB) applications. This switch operates with inputs ranging from 2.5V to 5.5V, making it ideal for both3V and 5V systems. The switch's low RDS(ON), 80mΩ meets USB Voltage Drop requirements. A built-in P-channel MOSFET with true shutdown function to eliminate any reversed current flow across the switch when it is poweredoff.

When the output voltage is higher than input voltage, the power switch is turned off by internal outputreverse- voltage comparator. FLG is an open-drain output report over- current or over temperature event. In addition, FLG also has typical 2.5ms deglitch timeout period and reports output reverse- voltage condition.

Features

- Integrated 80mΩ Power MOSFET
- Low Supply Current
- 30uA Typical at Switch On State0.1
- uA Typical at Switch Off State Wide
- Input Voltage Range:2.5V to5.5V
  Reverse Current Flow Blocking
- Deglitched Open-Drain
- Over- Current Flag Output(FLG) Continuous Load
- Current Thermal Shutdown
- Protection
- Hot Plug-In Application (Soft-Start)
- Output discharge function
- TP6062FX: Auto output discharge function
  SOT23-5 Package
-

Applications

- USB Bus/Self Powered
- Hubs Battery-Charger Circuits
- Personal Communication Devices
- Notebook Computer

Typical Application Circuit

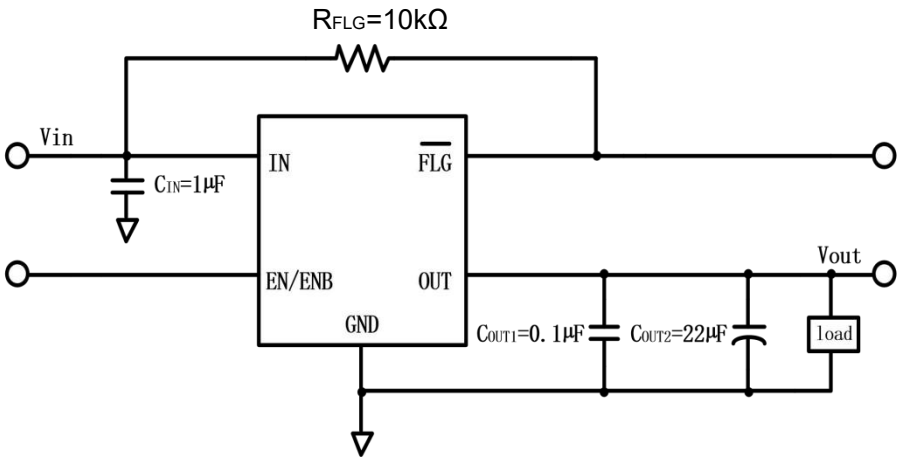
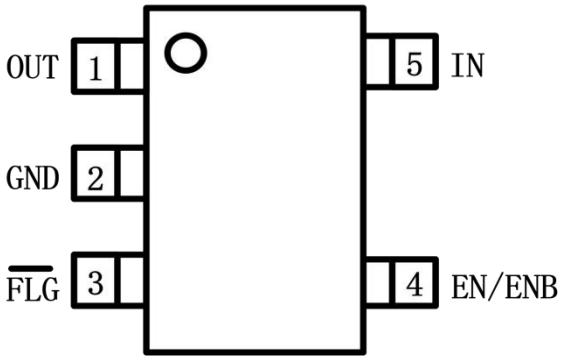


Figure 1. Basic Application Circuit

Pin Configuration

SOT23-5



Part Number	Mark	Description
TP6062FX	TP6062F 或6KHxxx	Active High

Pin Functions

PIN No.	NAME	FUNCTION
1	OUT	Switch Output: Output MOSFET Source of switch. Typically connect to switched side of load.
2	GND	IC ground connection
3	$\overline{\text{FLG}}$	Over-Current: Open-Drain Fault Flag Output.
4	EN	Enable: Logic level enable input. Make sure EN pin never floating.
5	IN	Input Supply: Output MOSFET Drain, which also supplies IC's internal circuitry. Connect to positive supply.

Absolute Maximum Ratings (Note 1)

Input Supply Voltage ..... -0.3V to 7V
Operating Temperature Range ..... -40°C to +85°C
EN Voltages ..... -0.3V to VIN+0.3V
Junction Temperature ..... 125°C
VOUT Voltage.....-0.3V to (VIN+0.3V)
Lead Temperature(Soldering, 10s).....+300° C
Storage Temperature Range.....-65 to 150°C

Recommended Operating Conditions

IN.....2.5V to 5.5V
EN/ENB.....-0.3V to (VIN+0.3V)
OUT， FLG.....0~5.5V
Junction Temperature Range.....-40°C to 125°C
Ambient Temperature Range.....-40°C to 85°C

Electrical Characteristics

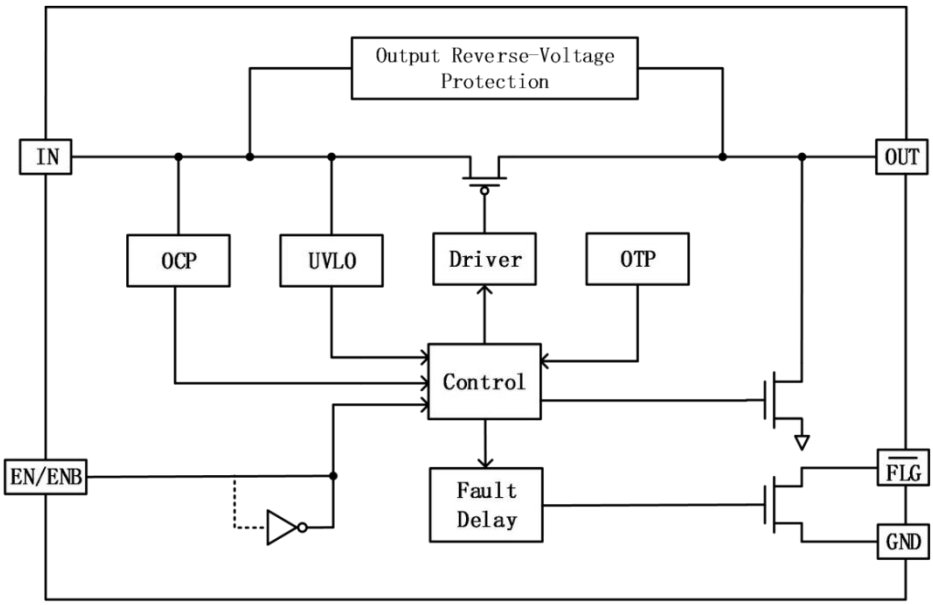
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
IN section						
V_{IN}	Input voltage		2.5		5.5	V
I_Q	Supply current, Enable	V_{IN}=5.5V, No load on OUT		30	60	μA
I_{SHDN}	Shutdown current, Disable	V_{IN}=5.5V, No load on OUT		0.1	1	μA
V_{UVLO_ON}	Under voltage lockout exit	V_{IN} rising from 0-5V			2.4	V
V_{UVLO_HYS}	UVLO Hysteresis			100		mV
EN section						
V_{EN_H}	High-level enable voltage		2			V
V_{EN_L}	High-level disable voltage				0.8	V
I_{EN}	EN input current	V_{EN}=5.5V or 0V			1	μA
T_{ON}	Turn on time			0.75		ms
OUT section						
I_{LIMIT}	Current Limit	Current Ramp(< 0. 1A/ms) On V_{OUT}	1.1	1.3	1.5	A
R_{DIS}	OUT Shutdown Discharge Resistance		25		45	Ω
FLG(Fault flag) section						
$I_{FLG\_leakage}$		Off-state leakage			1	μA
T_{FLG_DELAY}	FLG Delay Time			12		ms
R_{FLG}	FLG Low Resistance			30	50	Ω
Power switch						
$R_{DS(ON)}$	FET RON	I_{OUT}=1A		80		mΩ
Thermal Shutdown						
T_{SD}	Thermal Shutdown Temperature			150		℃
T_{SD_HYS}	Thermal Shutdown Hysteresis			20		℃

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

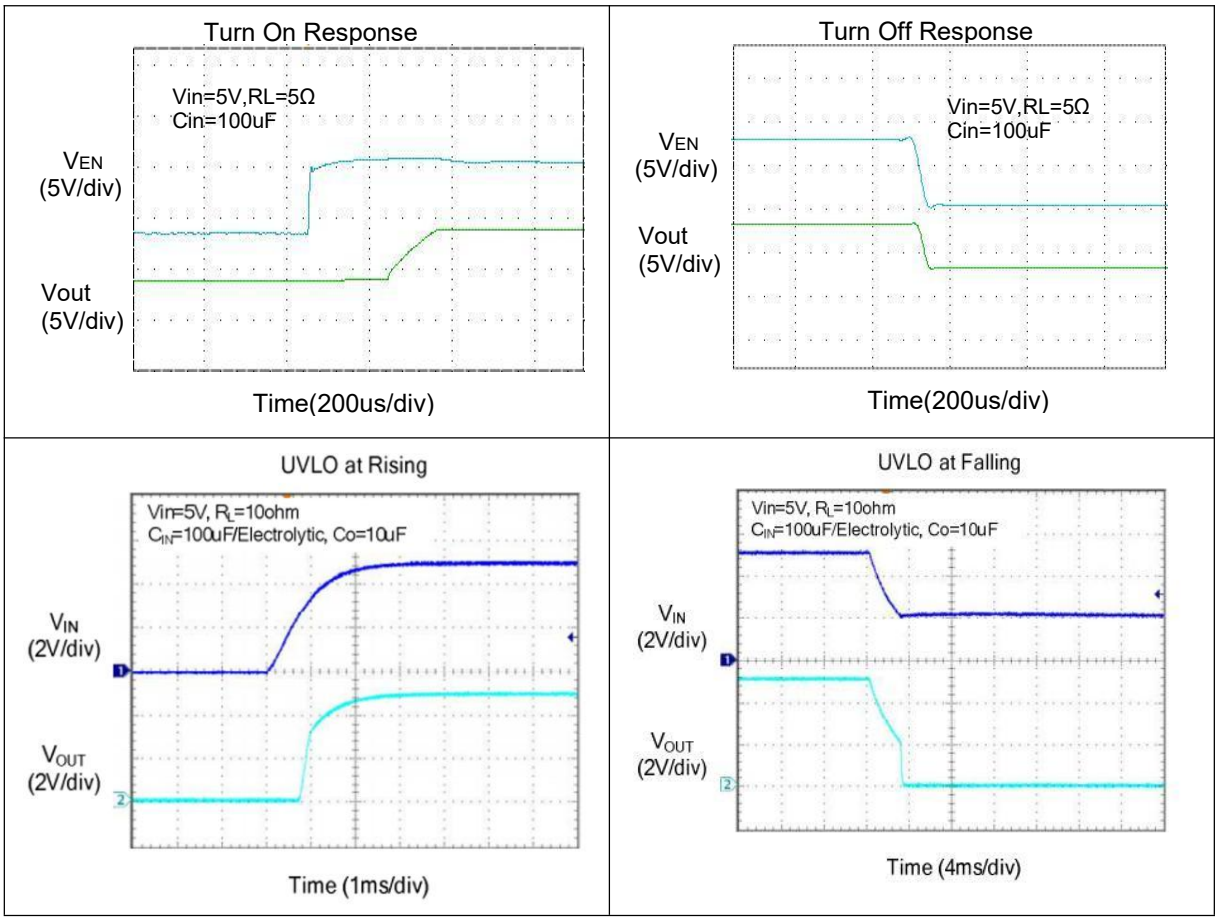
Note 2: T_J is calculated from the ambient temperature T_A and power dissipation P_D according to the following formula: T_J = TA + (PD) x (250°C/W).

Note 3: 100% production test at +25°C. Specifications over the temperature range are guaranteed by design and characterization.

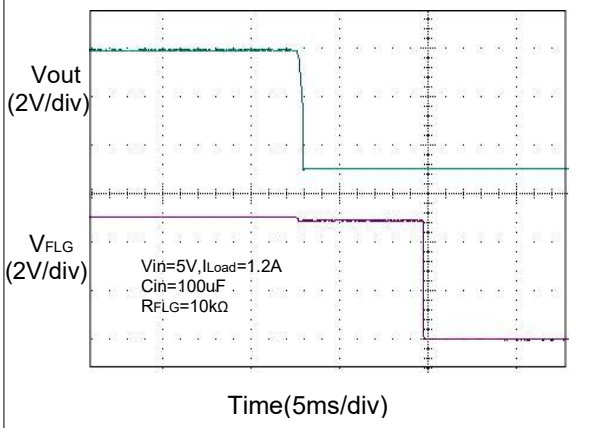
Functional Block Diagram



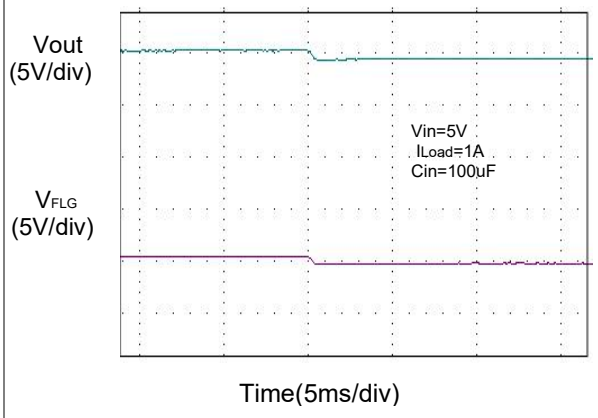
Typical Operating Characteristics



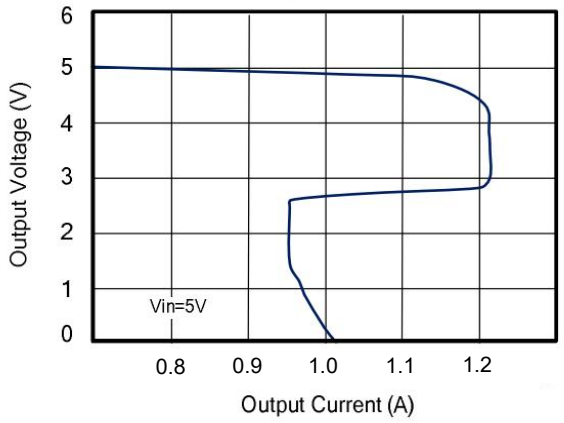
Output Voltage Response during Over Load



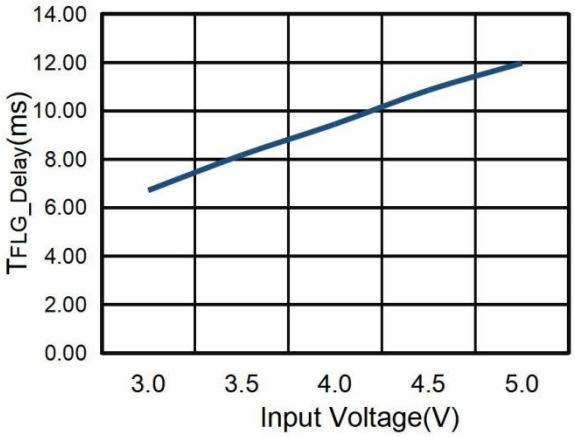
FLG Response during Load



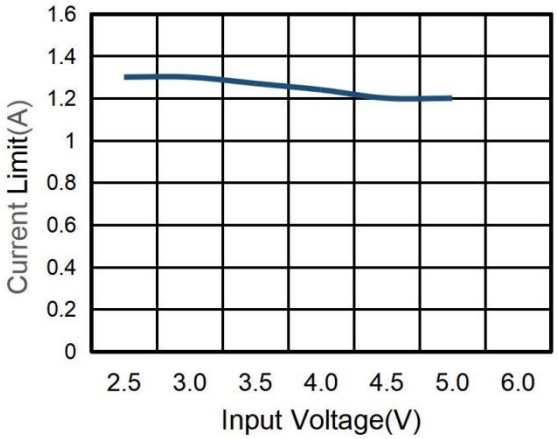
Output Voltage vs. Output Current



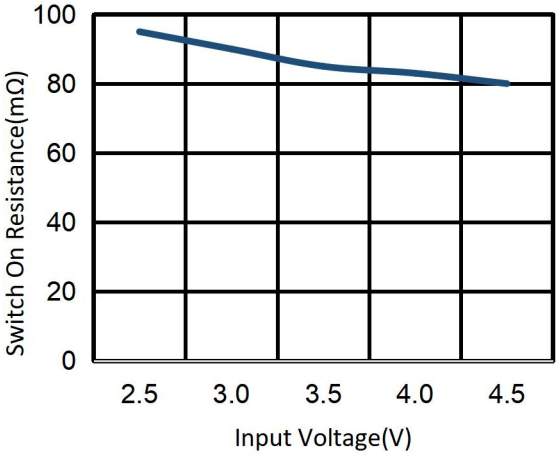
TFLG_Delay VS. Input Voltage

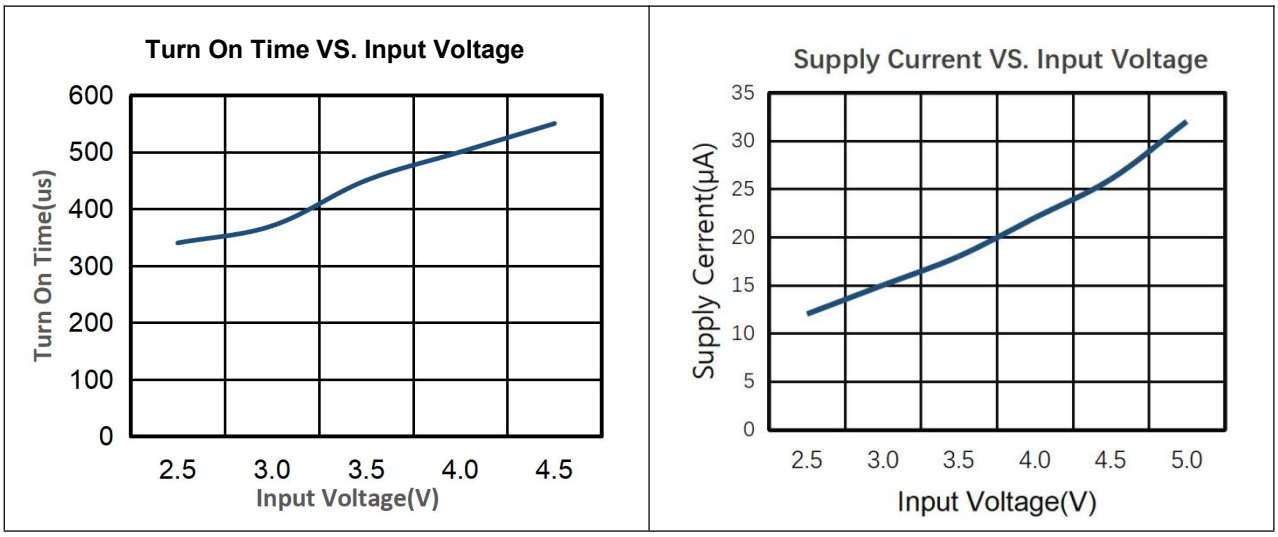


Current Limit VS. Input Voltage



Switch On Resistance VS. Input Voltage




Turn On Time VS. Input Voltage
Turn On Time(us)
600
500
400
300
200
100
0
2.5
3.0
3.5
4.0
4.5
Input Voltage(V)
Supply Current VS. Input Voltage
Supply Cerrent(μA)
35
30
25
20
15
10
5
0
2.5
3.0
3.5
4.0
4.5
5.0
Input Voltage(V)

Application Information

The TP6062FX is current-limited, power distribution switches using P-channel MOSFETS for applications where short circuits or heavy capacitive loads will be encountered and provide up to rated of continuous load current. Additional device shutdown features include over temperature protection and reverse-voltage protection. The driver controls the gate voltage of the power switch. The driver incorporates circuitry that controls the rise and fall times of the output voltage to limit large current and voltage surges and provides built-in soft-start functionality. The TP6062FX enters constant current mode when the load exceeds the current-limit threshold.

Input and Output

IN (input) is the power supply connection to the logic circuitry and the drain of the output MOSFET. OUT(output) is the source of the output MOSFET. In a typical application, current flows through the witch from IN to OUT toward the load. OUT pin must be connected together to the load.

FLG Function

The $\overline{\text{FLG}}$ open-drain output is asserted temperature exceeds 150°C regardless of (active low) when an over current condition is encountered after a 12ms deglitch timeout. The $\overline{\text{FLG}}$ output remains asserted until the over-current condition is removed. Over temperature condition is whether the power-switch is in current limit. Hysteresis is built into both thermal sensors, and the switch turns on after the device has cooled approximately 20°C (Thermal shutdown thresholdalso reported by $\overline{\text{FLG}}$ open-drain output. hysteresis in current-limit is 20°C). The In addition, $\overline{\text{FLG}}$ is also asserted (activeswitch continues to cycle off and on until low) in output reverse-voltage condition when the output reverse-voltage condition is removed. the fault is removed. The open-drain $\overline{\text{FLG}}$ is asserted (active low) immediately during an over temperature shutdown condition.

EN, the Enable Input

EN must be driven logic high or logic low for a clearly defined input. Floating the input may cause unpredictable operation. EN should not be allowed to go negative with respect to GND.

Soft Start for Hot Plug-In Applications

In order to eliminate the upstream voltage droop caused by the large inrush current during hot- pulg events, the “soft-start” feature effectively isolates the power source from extremely large capacitive loads, satisfying the USB voltage droop requirements.

Thermal Considerations

The TP6062FX protects itself with two independent thermal sensing circuits that monitor the operating temperature of the power-switch and disables operation if the temperature exceeds recommended operating conditions. The device operates in constant-current mode during an over-current conditions, which increases the voltage drop across power-switch. The power dissipation in the package is proportional to the voltage drop across the power-switch, so the junction temperature rises during an over-current condition. The first thermal sensor turns off the power-switch when the die temperature

exceeds 130°C and the part is in current limit . The second thermal sensor turns off the power-switch when the die.

PCB Layout Guide

For best performance of the TP6062FX, the following guidelines must be strictly followed:

(1) Keep all VBUS traces as short and wide as possible and use at least 2 ounce copper for all VBUS traces.

(2) Place a ground plane under all the circuitry to lower both resistance and inductance for improving DC and transient performance.

(3) A low-ESR 100μF aluminum electrolytic or tantalum capacitor between VOUT and GND is strongly recommended.

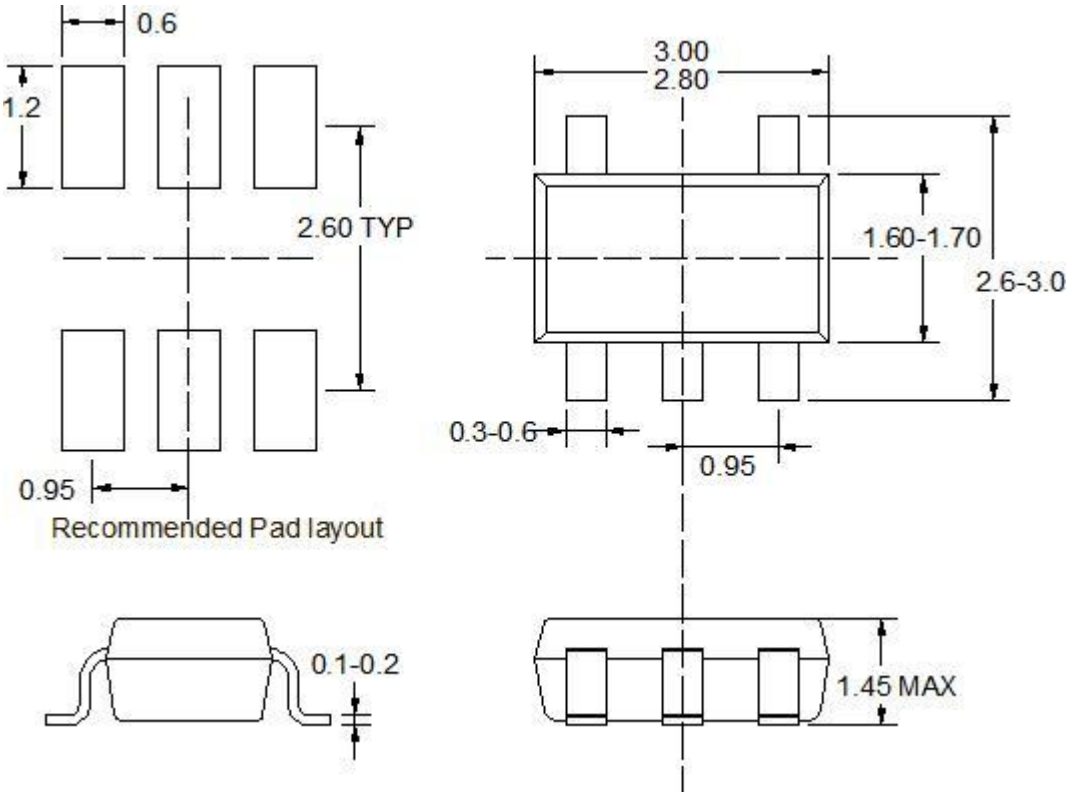
(4) Locate the output capacitor as close to the connectors as possible to lower the impedance (mainly inductance) between the port and the capacitor for improving the transient performance.

(5) The input and output capacitors should be placed closed to the IC and connected to the ground plane to reduce the noise coupling.

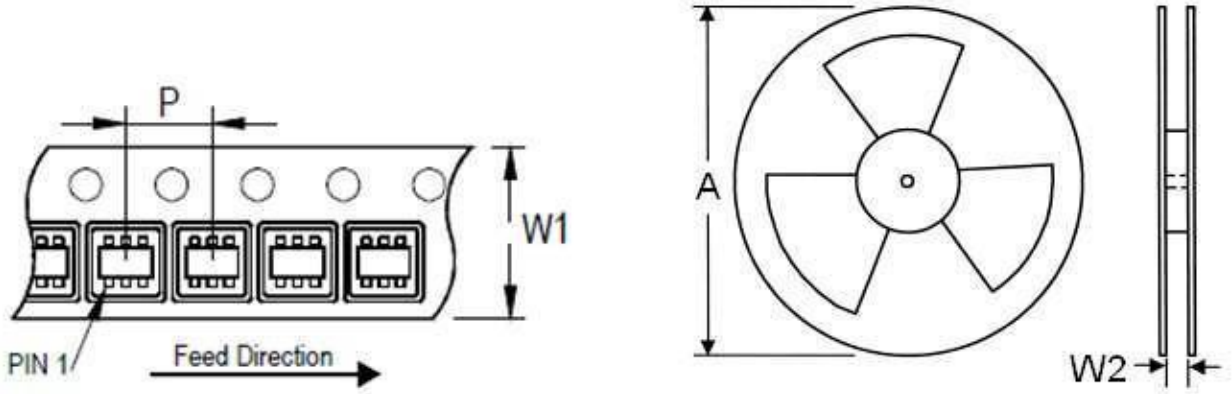
(6) Locate the ceramic bypass capacitors as close as possible to the VIN and VOUT pins of the TP6062FX.

Package Information

SOT23-5



Carrier Dimensions



Tape Size (W1) mm	Pocket Pitch (P) mm	Reel Size (A)		Reel Width (W2) mm	Empty Cavity Length mm	Units per Reel
		in	mm			
8	4	7	180	8.4	300~1000	3,000

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