

Dual-Channel USB High-Side Power Switch

Description

The FP6862 is dual high-side MOSFET switches with independent enable and error flag functions, optimized for general-purpose power distribution and Universal Serial Bus (USB) requiring circuit protection.

The FP6862 supports the following USB requirements: each switch channel supplies up to 1A as required by USB downstream devices; the low on-resistance switch meets the USB voltage drop requirements.

Both switches employ soft-start circuit that minimizes inrush current in applications where highly capacitive loads are employed.

A fault status output flag is asserted during over-current, thermal shutdown or UVLO conditions. Under voltage lockout (UVLO) to ensure that the device remains off unless there is a valid input voltage present and 3.3V or 5V logic compatible enable single inputs.

Features

- 100mΩ (5V Input) On-Resistance Per Channel
- 2.7V to 5.5V Operating Range
- 1A Minimum Continuous Current Per Channel
- Short Circuit Protection with Thermal Shutdown
- Thermally Isolated Channels
- Under Voltage Lockout (UVLO)
- Reverse Current Flow Blocking
- Soft-Start Circuit
- Enable Active Low or Active High
- RoHS Compliant

Applications

- USB Peripheral
- General Purpose Power Switching
- ACPI Power Distribution
- Notebook PC
- PDA
- PC Card Hot Swap

Pin Assignments

SO Package (SOP-8)

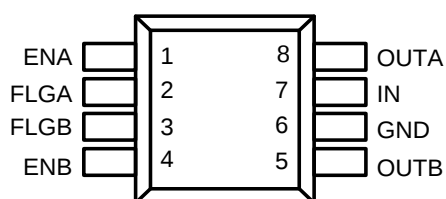
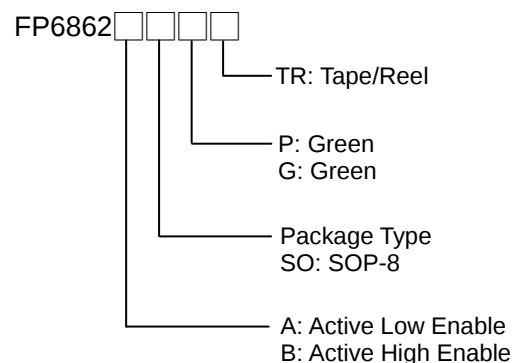


Figure 1. Pin Assignment of FP6862

Ordering Information



Typical Application Circuit

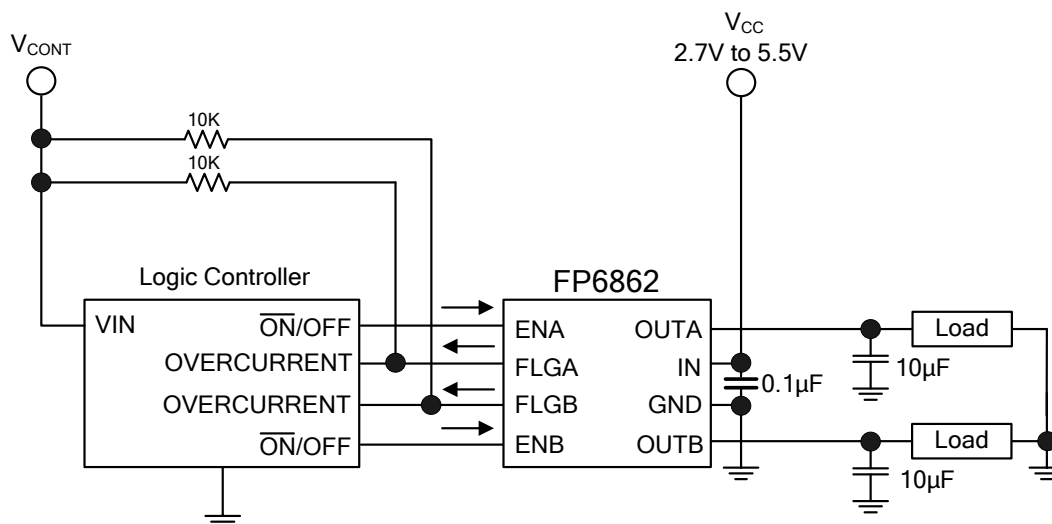


Figure 2. Typical Application Circuit of FP6862

Functional Pin Description

Pin Name	Pin No.	Pin Function
ENA	1	Switch A Enable (Input): Logic-compatible, enable input. Active high or active low.
FLGA	2	Fault Flag A (Output): Active-low, open-drain output. Indicates UVLO, over current or thermal shutdown.
FLGB	3	Fault Flag B (Output): Active-low, open-drain output. Indicates UVLO, over current or thermal shutdown.
ENB	4	Switch B Enable (Input): Logic-compatible, enable input. Active high or active low.
OUTB	5	Switch B (Output).
GND	6	Ground.
IN	7	Switch and IC Power Input.
OUTA	8	Switch A (Output).

Block Diagram

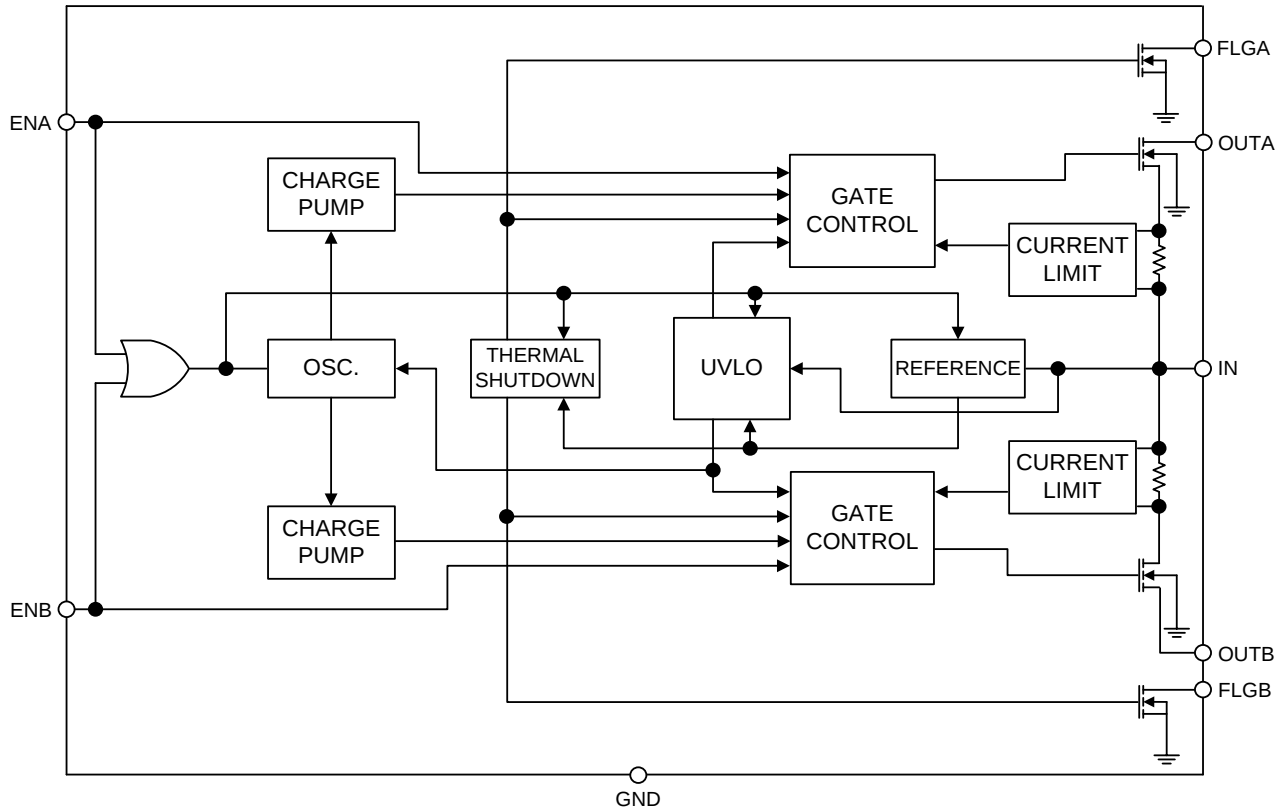


Figure 3. Block Diagram of FP6862

Absolute Maximum Ratings

- Supply Voltage (IN) ----- -0.3V to +6V
- Fault Flag Voltage (FLG) ----- +6V
- Fault Flag Current (I_{FLG}) ----- 25mA
- Output Voltage (OUT) ----- +6V
- Output Current (I_{OUT}) ----- Internal Limited
- Enable Input (EN) ----- -0.3V to +6V
- Power dissipation @ $T_A=25^{\circ}\text{C}$, (P_D)
 - SOP-8 ----- 0.63W
- Package Thermal Resistance, (θ_{JA})
 - SOP-8 ----- 160°C/W
- Maximum Junction Temperature (T_J) ----- +150°C
- Storage Temperature Range (T_{STG}) ----- -65°C to +130°C
- Lead Temperature (Soldering, 10 sec.) ----- 260°C

Note1 : Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.

Recommended Operating Conditions

- Supply Voltage (V_{IN}) ----- +2.7V to +5.5V
- Operation Temperature Range ----- -40°C to +85°C

Electrical Characteristics

$V_{IN}=+5V$, $T_A=25^{\circ}C$, unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Current	I_{DD}	FP6862A, $V_{ENA}=V_{ENB}<0.3V$		110	160	μA
		FP6862B, $V_{ENA}=V_{ENB}>1.1V$				
Shutdown Current	I_{SD}	FP6862A, $V_{ENA}=V_{ENB}>1.1V$		0.75	5	μA
		FP6862B, $V_{ENA}=V_{ENB}<0.3V$				
Enable Input Threshold	V_{EN}	$V_{EN}=\text{Logic "0"}$	1.1		0.3	V
		$V_{EN}=\text{Logic "1"}$				
Enable Input Current	I_{EN}	$V_{EN}=0$ to $5.5V$	-1	0.01	1	μA
Enable Input Capacitance (Note3)	C_{EN}			1		pF
Switch Resistance (Note3)	R_{DS-ON}	$R_L=10\Omega$		100	150	m Ω
Output Leakage Current	I_{LEAK}				10	μA
Output Turn-on Delay Time (Note3)	T_{ON}	$R_L=10\Omega$, $C_L=1\mu F$ (Fig.6)		100		μs
Output Turn-on Rise Time (Note3)	T_R	$R_L=10\Omega$, $C_L=1\mu F$ (Fig.6)		1.0	2.5	ms
Output Turn-off Delay Time (Note3)	T_{OFF}	$R_L=10\Omega$, $C_L=1\mu F$ (Fig.6)		0.8	20	μs
Output Turn-off Fall Time (Note3)	T_F	$R_L=10\Omega$, $C_L=1\mu F$ (Fig.6)		0.8	20	μs
Continuous Load Current	I_{OUT}	Each channel	1			A
Current Limit Threshold	I_{LIMIT}	Ramped load applied to output (Fig.7)	1.1	1.6	2.1	A
Under Voltage Lockout Threshold	V_{UVLO}	V_{IN} Rising		2.5		V
		V_{IN} Falling		2.3		
Error Flag Output Resistance (Note3)	R_{FLAG}	$V_{IN}=5V$, $I_L=10mA$		20	40	Ω
		$V_{IN}=3.3V$, $I_L=10mA$		25	50	
Error Flag Off Current	$I_{LEAKAGE}$	$V_{FLG}=5V$		0.01	1	μA
Over-Temperature Threshold (Note 2,3)	T_{SD}	T_j increasing, each channel		140		$^{\circ}C$
		T_j decreasing, each channel		120		
		T_j increasing, both channels		160		
		T_j decreasing, both channels		150		

Note 2 : If there is a over-load fault on one channel causes die reaches approximately $140^{\circ}C$, that channel will shutdown. If the die reaches approximately $160^{\circ}C$, both channels will shutdown.

Note3 : Guarantee by design.

Timing Diagrams

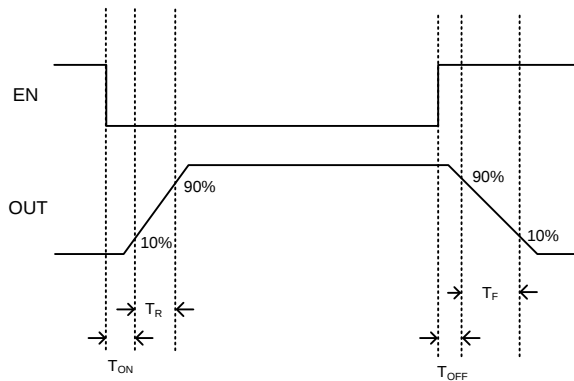


Figure 4. Active Low Version (FP6862A)
Switch On/Off timing Diagram

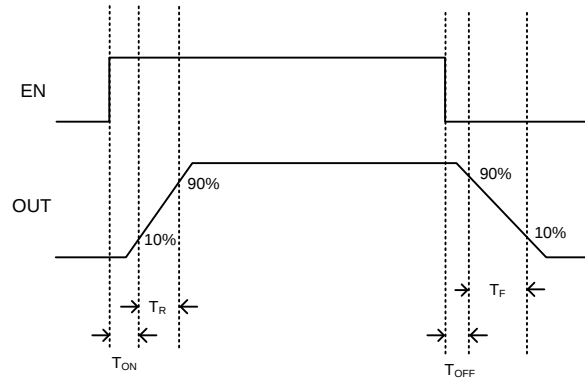


Figure 5. Active High Version (FP6862B)
Switch On/Off timing diagram

Test Circuit

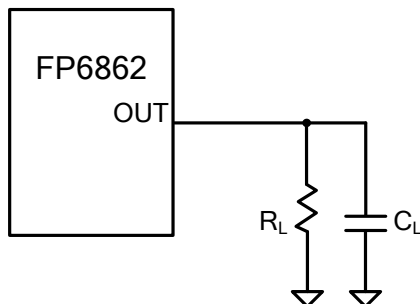


Figure 6. Turn-on/off Test Circuit

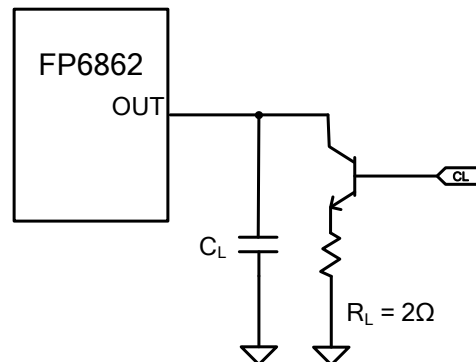


Figure 7. Step to Current Limit Test Circuit

Typical Performance Characteristics

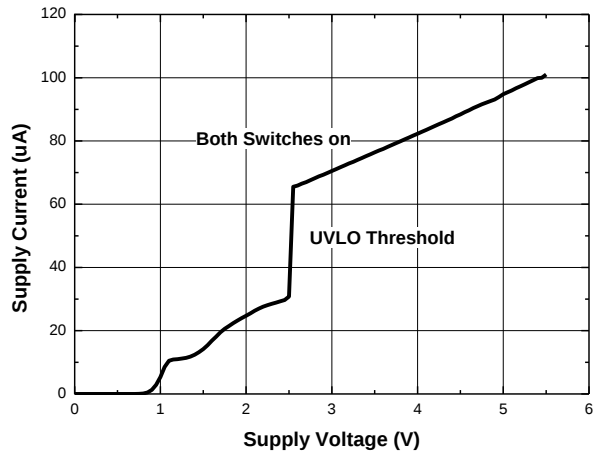


Figure 8. On-State Supply Current vs. Supply Voltage

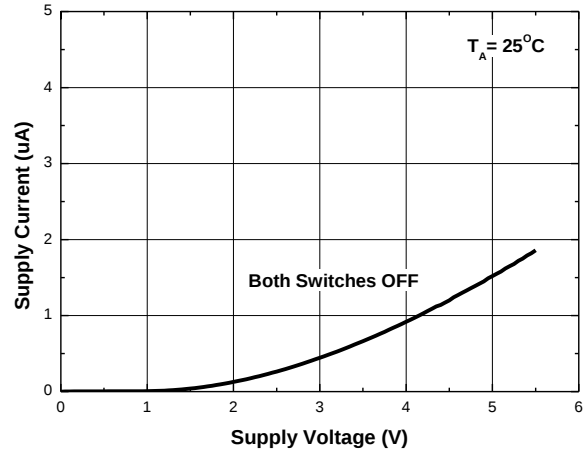


Figure 9. Off-State Supply Current vs. Supply Voltage

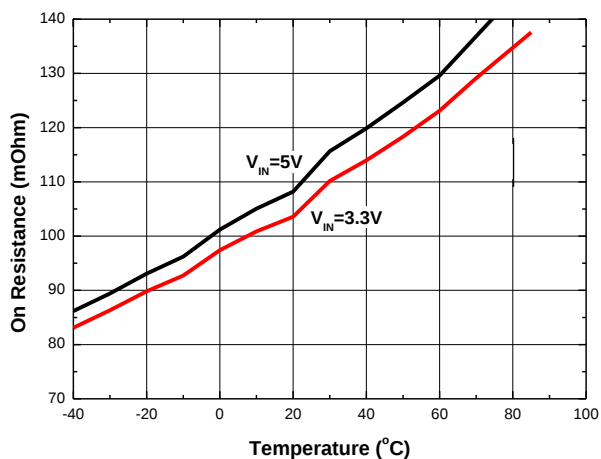


Figure 10. On Resistance vs. Temperature

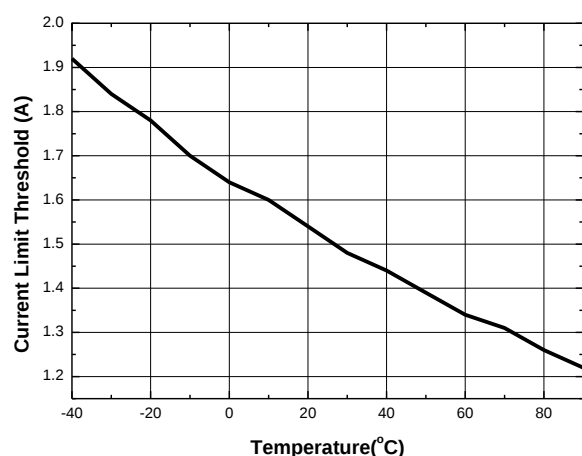


Figure 11. Current Limit Threshold vs. Temperature

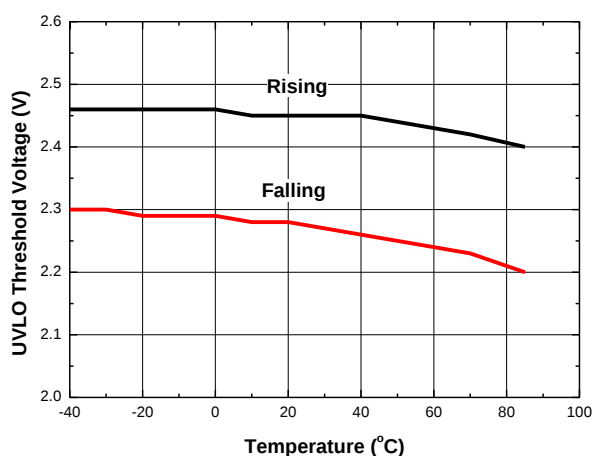


Figure 12. UVLO Threshold Voltage vs. Temperature

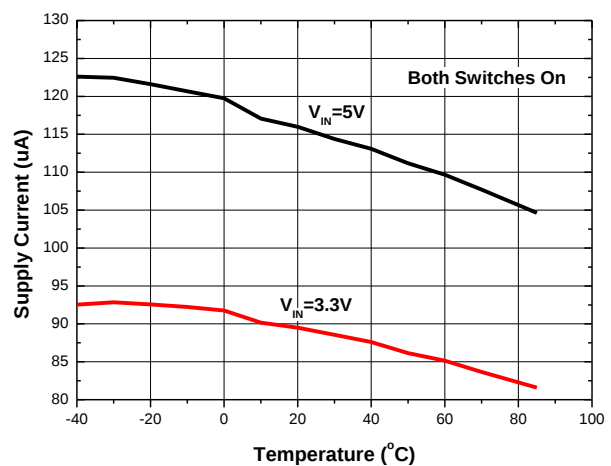


Figure 13. Supply Current vs. Temperature

Typical Performance Characteristics (Continued)

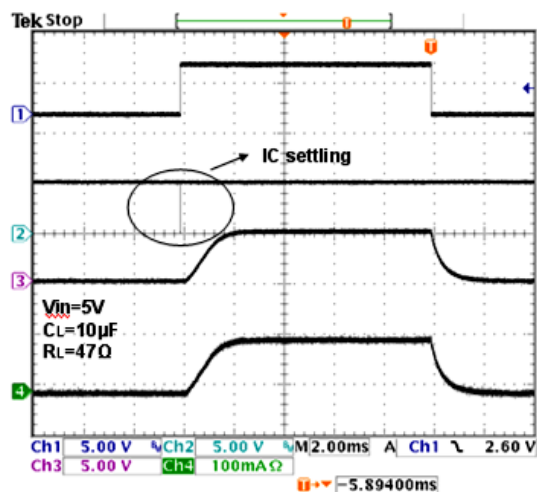


Figure 14. CHA,CHB Turn-on and Turn-off Synchronously

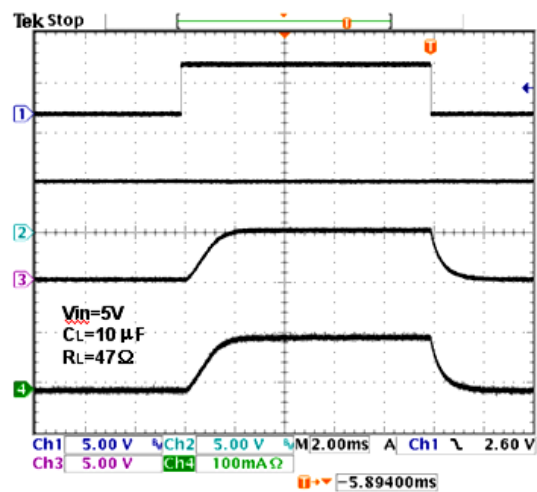


Figure 15. CHA Turn-on, CHB Turn-on and Turn off

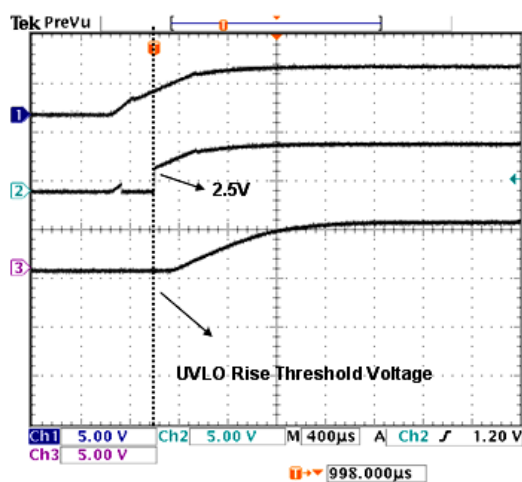


Figure 16. UVLO - VIN Rising

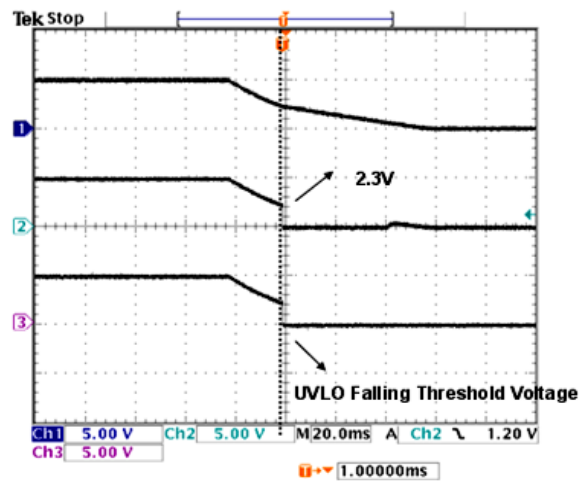


Figure 17. UVLO - VIN Falling

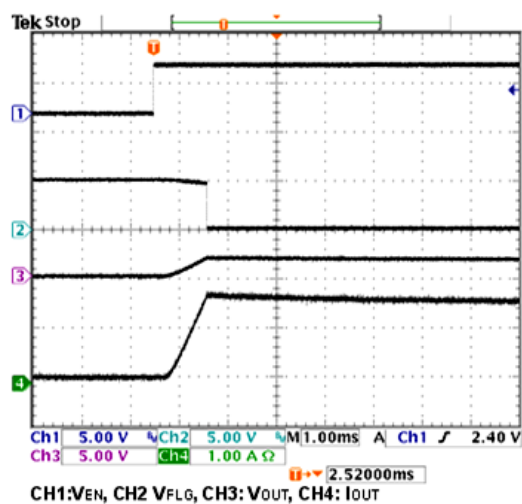


Figure 18. Enable to Current Limit (RL = 2Ω)

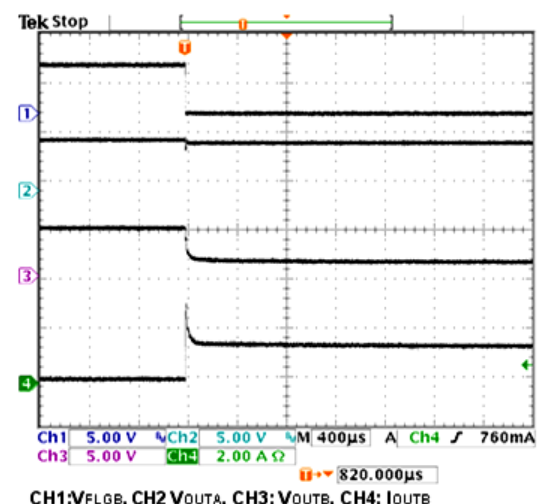


Figure 19. Independent Current limit (Step to current limit)

Typical Performance Characteristics (Continued)

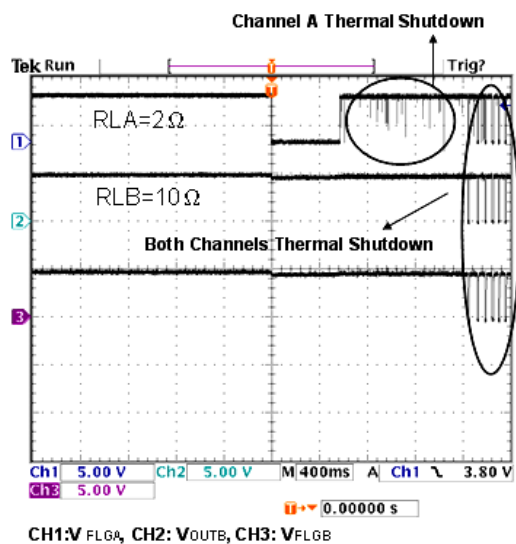


Figure 20. Independent Thermal Shutdown

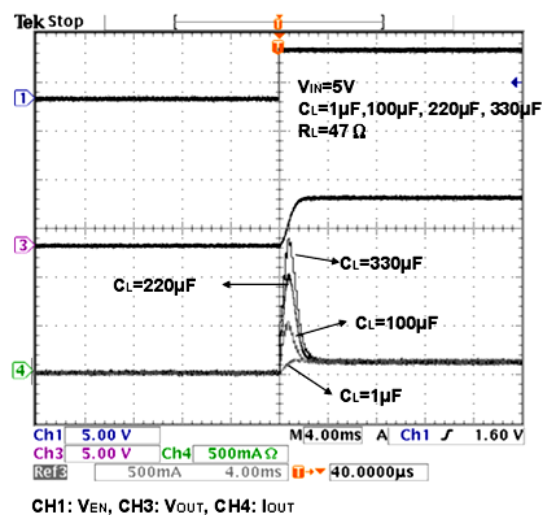


Figure 21. Inrush Current Response

Application Information

The FP6862 is a dual, current-limited switch designed for USB applications. It has two independent switches, each with its own enable control input. Each switch has an error-flag output to notify the USB controller when the current-limit, short-circuit, under voltage lockout (UVLO) or thermal shutdown occurs.

The FP6862 operates from 2.7V to 5.5V input voltage range and guarantees a minimum 1A output current. Independent current-limit and thermal shutdown circuits permit each switch to operate independently, improving system robustness.

UVLO and Input-Voltage Requirement

Under Voltage Lockout (UVLO) circuit prevents the output switch from turning on until input voltage exceeds approximately 2.5V.

Reverse Current Blocking

The USB specification does not allow an output device to source current back into the USB port. However, the FP6862 are designed to safely power noncompliant devices. When disable, each output is switched to a high-impedance state, blocking reverse current flow from the output back to the input. The switch is bi-directional when enable.

Error Flag

The FP6862 provides an open drain error flag output for each switch. For most applications, connect FLG and IN through a 10k Ω pull-up resistor. FLG goes low when any following conditions occur:

1. The input voltage is below the UVLO threshold.
2. The thermal shutdown occurs.
3. The switch is in current-limit and short-circuit conditions.

Supply Filtering

A 0.1 μ F to 1 μ F bypass capacitor positioned close to V_{IN} and GND of the FP6862 is strongly recommended to control supply transients. Without a bypass capacitor, an output short may cause sufficient ringing on the input to damage internal control circuitry.

Error Flag

An error flag is an open-drain output of an N-channel MOS. Flag output is pulled low to signal the following fault conditions: Supply voltage under UVLO threshold voltage, current limit, short circuit or thermal shutdown.

Current Limit

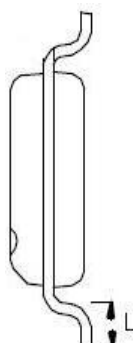
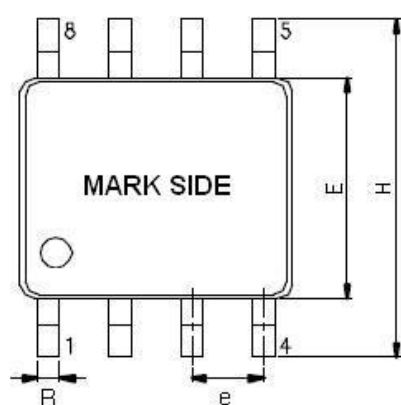
The current limit threshold is preset internally. It protects the output switch from damage due to undesirable short circuit conditions or excess inrush current often encountered during hot plug-in.

Thermal Shutdown

Thermal shutdown is employed to protect the device from damage when the die temperature exceeds safe margins mainly due to short-circuit or current-limit. FP6862 features independent thermal shutdown for each switch channel, allowing one switch to deliver power even if the other switch has a fault condition. Thermal shutdown shuts off the output switch which in current-limit or short-circuit and asserts the FLG output if the die temperature reaches 140°C and the other channel is not affected. However, if the die temperature exceeds 160°C, both channels will be shut off.

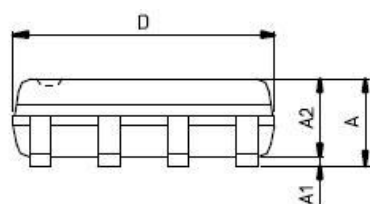
Outline Information

SOP-8 Package (Unit: mm)

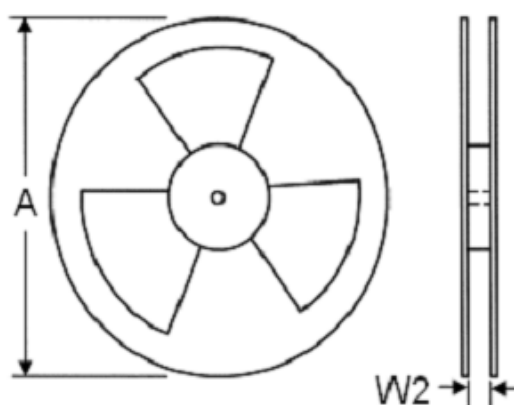
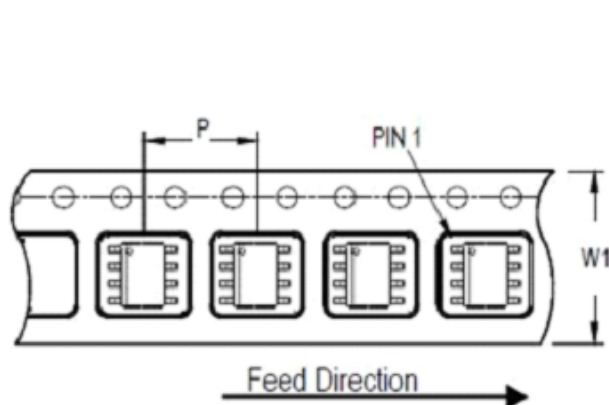


SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
A2	1.25	1.50
B	0.31	0.51
D	4.80	5.00
E	3.80	4.00
e	1.20	1.34
H	5.80	6.20
L	0.40	1.27

Note : Followed From JEDEC MO-012-E.



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			
12	8	13	330	12.4	400~1000	2,500

Life Support Policy

Fitipower's products are not authorized for use as critical components in life support devices or other medical systems.