

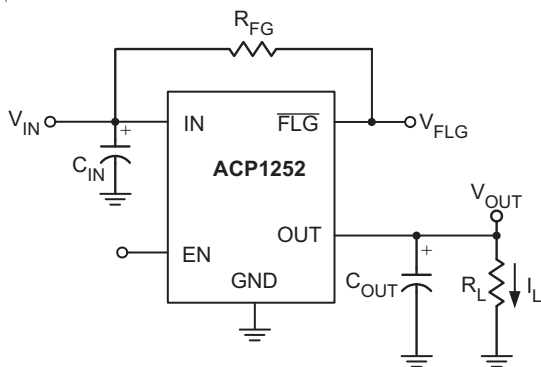
### ■ GENERAL DESCRIPTION

The ACP1252 is a current limit power switch designed for load-switching applications. The current limit threshold be set at an accurate 2.1A. The integrated current-limiting circuit protects the input supply against large currents which may cause the supply to fall out of regulation. They offer current and thermal limiting and short circuit protection as well as controlled rise time and under-voltage lockout functionality. A 8ms deglitch capability on the open-drain Flag output prevents false over-current reporting and does not require any external components.

### ■ FEATURES

- 2.7V to 5.5V Input Voltage Range
- 2.1A Accurate Current Limiting Threshold
- Fast Transient Response:
- Max 1 $\mu$ A quiescent current with shutdown
- Low 90m $\Omega$  Typical RDS(ON)
- Reverse Current Blocking
- Thermal Shutdown and Over-current Protection
- Fault report with 8ms typical blanking time
- -40 to 85 $^{\circ}$ C Operation Temperature range
- Available in SOT23-5L and DFN2018-6L package

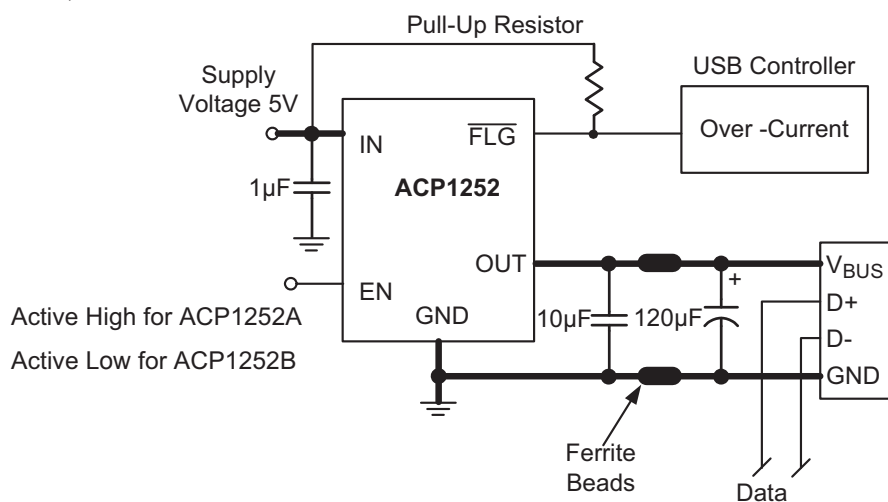
### ■ TEST CIRCUIT



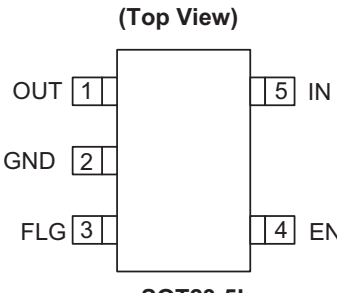
### ■ APPLICATION

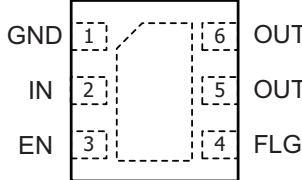
- USB Bus
- Self Powered Hubs
- USB Peripherals
- STB, LCD TV, Printer
- Notebook computers
- GPS, PDA, MID
- Hot-Plug Supply

### ■ TYPICAL APPLICATION CIRCUIT



### ■ PIN CONFIGURATION AND DESCRIPTION

SOT23-5L	Pin	Symbol	Description
 <p>(Top View)</p> <p>SOT23-5L</p>	1	OUT	Voltage output pin. This is the pin to the P-channel MOSFET drain connection.
	2	GND	Ground
	3	FLG	Over-current and over-temperature fault report; open-drain flag is active low when triggered
	4	EN	Enable input, active high
	5	IN	Voltage input pin.

DFN2018-6L	Pin	Symbol	Description
 <p>(Top View)</p> <p>DFN2018-6L</p>	1	GND	Ground
	2	IN	Voltage input pin.
	3	EN	Enable input, active high
	4	FLG	Over-current and over-temperature fault report; open-drain flag is active low when triggered
	5	OUT	Voltage output pin. All output pins must be tied together.
	6	OUT	Function Same to pin 5

### ■ ORDERING INFORMATION

Standard Part NO.	Enable	Package	Mini. Q'ty
ACP1252A-BTRAL	Active high	SOT23-5L	3000pcs
ACP1252B-BTRAL	Active Low	SOT23-5L	3000pcs
ACP1252A-ZTRAL	Active high	DFN2018-6L	3000pcs
ACP1252B-ZTRAL	Active Low	DFN2018-6L	3000pcs

Remark: for marking information, please see sample or contact our sales for more detail information.

### ■ ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Ratings	Unit
ESD HBM	Human Body Model ESD Protection	4	KV
ESD MM	Machine Model ESD Protection	300	V
V <sub>IN</sub>	Input Voltage	6.5	V
V <sub>OUT</sub>	Output Voltage	V <sub>IN</sub> + 0.3	V
V <sub>EN</sub>	Enable Voltage	6.5	V
T <sub>J</sub>	Operating Junction Temperature Range	-40 ~ 125	°C
T <sub>ST</sub>	Storage Temperature Range	-65 ~ 150	°C
T <sub>A</sub>	Operating Ambient Temperature	-40 ~ 85	°C

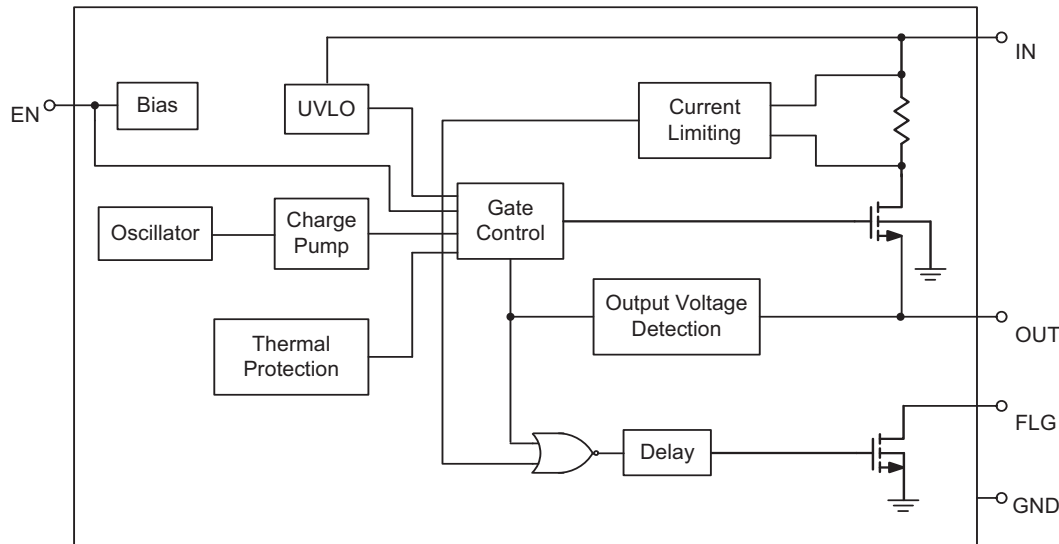
### ■ ELECTRICAL CHARACTERISTICS

(V<sub>IN</sub> = 5V, T<sub>A</sub> = +25°C, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Unit
V <sub>UVLO</sub>	Input UVLO		1.7		2.5	V
I <sub>SHDN</sub>	Input Shutdown Current	Disabled, I <sub>OUT</sub> = 0		0.5	1	μA
I <sub>Q</sub>	Input Quiescent Current	Enabled, I <sub>OUT</sub> = 0		50	75	μA
I <sub>LEAK</sub>	Input Leakage Current	Disabled, OUT grounded		0.1	1	μA
I <sub>REV</sub>	Reverse Leakage Current	Disabled, V <sub>IN</sub> = 0V, V <sub>OUT</sub> = 5V, I <sub>REV</sub> at V <sub>IN</sub>		0.1	1	μA
R <sub>DS(ON)</sub>	Switch on-resistance	V <sub>IN</sub> = 5V, I <sub>OUT</sub> = 1.5A, -40°C ≤ T <sub>A</sub> ≤ 85°C		95	140	mΩ
		V <sub>IN</sub> = 3.3V, I <sub>OUT</sub> = 1.5A, -40°C ≤ T <sub>A</sub> ≤ 85°C		120	170	mΩ
I <sub>SH</sub>	Short-Circuit Current Limit	Enabled into short circuit, C <sub>L</sub> = 120μF		2.0		A
I <sub>L</sub>	Over-Load Current Limit	V <sub>IN</sub> = 5V, V <sub>OUT</sub> = 4.0V, C <sub>L</sub> = 120μF, -40°C ≤ T <sub>A</sub> ≤ 85°C	1.6	2.1	2.6	A
I <sub>Trig</sub>	Current limiting trigger threshold	Output Current Slew rate (<100A/s), C <sub>L</sub> = 120μF		2.6		A
V <sub>IL</sub>	EN Input Logic Low Voltage	V <sub>IN</sub> = 2.7V to 5.5V			0.8	V
V <sub>IH</sub>	EN Input Logic High Voltage	V <sub>IN</sub> = 2.7V to 5.5V	2			V
I <sub>SINK</sub>	EN Input leakage	V <sub>EN</sub> = 5V			1	μA
T <sub>D(ON)</sub>	Output turn-on delay time	C <sub>L</sub> = 1μF, R <sub>load</sub> = 10Ω		0.05		ms
T <sub>R</sub>	Output turn-on rise time	C <sub>L</sub> = 1μF, R <sub>load</sub> = 10Ω		0.60	1.5	ms
T <sub>D(OFF)</sub>	Output turn-off delay time	C <sub>L</sub> = 1μF, R <sub>load</sub> = 10Ω		0.05		ms
T <sub>F</sub>	Output turn-off fall time	C <sub>L</sub> = 1μF, R <sub>load</sub> = 10Ω		0.05	0.1	ms
R <sub>FLG</sub>	FLG output FET on-resistance	I <sub>FLG</sub> = 10mA		20	40	Ω
T <sub>Blank</sub>	FLG blanking time	C <sub>IN</sub> = 10μF, C <sub>L</sub> = 22μF	4	8	15	ms
R <sub>DIS</sub>	Discharge resistance	V <sub>IN</sub> = 5V, disabled, I <sub>OUT</sub> = 1mA		100		Ω
T <sub>DIS</sub>	Discharge Time	C <sub>L</sub> = 1μF, V <sub>IN</sub> = 5V, disabled to V <sub>OUT</sub> < 0.5V		0.6		ms
T <sub>SHDN</sub>	Thermal Shutdown Threshold	Enabled, R <sub>load</sub> = 1kΩ		140		°C
T <sub>HYS</sub>	Thermal Shutdown Hysteresis			25		°C
θ <sub>JA</sub>	Thermal Resistance Junction-to-Ambient	SOT25-5L		170		°C/W
		DFN2018-6L		70		°C/W

### ■ APPLICATION INFORMATION

#### • Function Block



#### • Discharge Function

When enable is de-asserted, the discharge function is active. The output capacitor is discharged through an internal NMOS that has a discharge resistance of 100Ω. Hence, the output voltage drops down to zero. The time taken for discharge is dependent on the RC time constant of the resistance and the output capacitor.

#### • FLG Response

The FLG open-drain output goes active low for any of the two conditions: Over-Current or Over-Temperature. The time from when a fault condition is encountered to when the FLG output goes low is 8ms (TYP). The FLG output remains low until both over-current and over-temperature conditions are removed. Connecting a heavy capacitive load to the output of the device can cause a momentary Over-current condition, which does not trigger the FLG due to the 8ms deglitch timeout. The 8ms timeout is also applicable for Over-current recovery and Thermal recovery.

#### • Thermal Protection

Thermal protection prevents the IC from damage when the die temperature exceeds safe margins. This mainly occurs when heavy-overload or short-circuit faults are present for extended periods of time. The ACP1252 implements thermal sensing to monitor the operating junction temperature of the power distribution switch. Once the die temperature rises to approximately 140°C, the Thermal protection feature gets activated as follows: The internal thermal sense circuitry turns the power switch off and the FLG output is asserted thus preventing the power switch from damage. Hysteresis in the thermal sense circuit allows the device to cool down to approximately 25°C before the output is turned back on. The built-in thermal hysteresis feature avoids undesirable oscillations of the thermal protection circuit. The switch continues to cycle in this manner until the load fault is removed, resulting in a pulsed output.

#### • Reverse Current Protection

In a normal MOSFET switch, current can flow in reverse direction (from the output side to the input side) when the output side voltage is higher than the input side, even when the switch is turned off. A reverse-current blocking feature is implemented in the ACP1252 to prevent such back currents. This circuit is activated by the difference between the output voltage and the input voltage. When the switch is disabled, this feature blocks reverse current flow from the output back to the input.

**■ APPLICATION INFORMATION**(continued)**• Under-voltage Lockout (UVLO)**

Under-voltage lockout function (UVLO) guarantees that the internal power switch is initially off during start-up. The UVLO functions only when the switch is enabled. Even if the switch is enabled, the switch is not turned ON until the power supply has reached at least 1.9V. Whenever the input voltage falls below approximately 1.9V, the power switch is turned off. This facilitates the design of hot-insertion systems where it is not possible to turn off the power switch before input power is removed.

**• Over-current and Short Circuit Protection**

An internal sensing FET is employed to check for over-current conditions. Unlike current-sense resistors, sense FETs do not increase the series resistance of the current path. When an overcurrent condition is detected, the device maintains a constant output current and reduces the output voltage accordingly. Complete shutdown occurs only if the fault stays long enough to activate thermal limiting.

**• Generic Hot-Plug Applications**

In many applications it may be necessary to remove modules or PC boards while the main unit is still operating. These are considered hot-plug applications. Such implementations require the control of current surges as seen by the main power supply and the card being inserted. The most effective way to control these surges is to limit and slowly ramp up the current and voltage being applied to the card, similar to the way in which a power supply normally turns on. Due to the controlled rise and fall times of the ACP1252, these devices can be used to provide a softer start-up to devices being hot-plugged into a powered system. The UVLO feature of the ACP1252 also ensures that the switch is off after the card has been removed, and that the switch is off during the next insertion. By placing the device between the VCC input and the rest of the circuitry, the input power reaches these devices first after insertion. The typical rise time of the switch is approximately 1ms, providing a slow voltage ramp at the output of the device. This implementation controls the system surge current and provides a hot-plugging mechanism for any device.

**• Power Dissipation and Junction Temperature**

The low on-resistance of the internal MOSFET allows the small surface-mount packages to pass large current. Using the maximum operating ambient temperature ( $T_A$ ) and  $R_{DS(ON)}$ , the power dissipation can be calculated by:

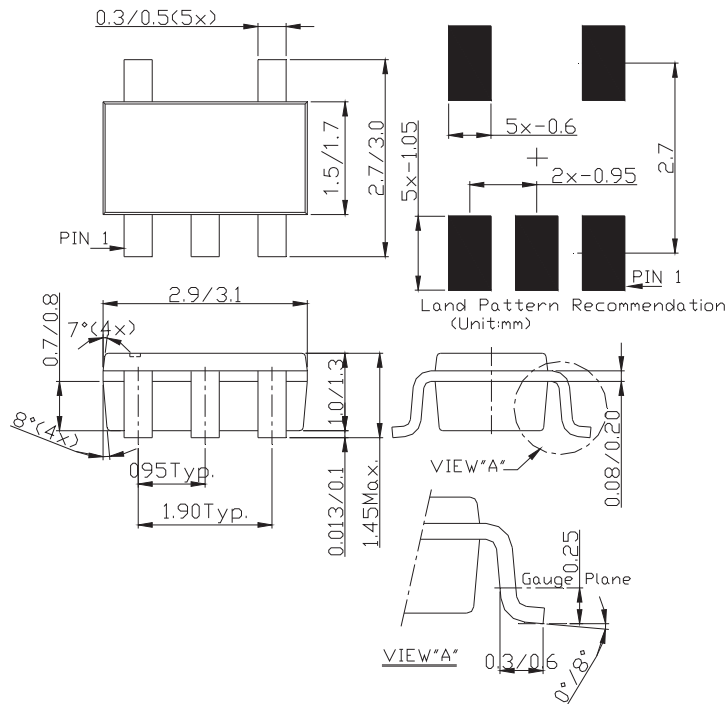
$$P_D = R_{DS(ON)} \times I^2$$

The junction temperature can be calculated by:  $T_J = P_D \times R_{\theta JA} + T_A$

Remark:  $T_A$  = Ambient temperature ;  $R_{\theta JA}$  = Thermal resistance;  $P_D$  = Total power dissipation

### PAKAGE INFORMATION

#### SOT23-5L



#### DFN2018-6L

