

PRELIMINARY - February 18, 2000

TEL:805-498-2111 FAX:805-498-3804 WEB:http://www.semtech.com

DESCRIPTION

USB power distribution switches are high-side n-channel MOSFET switches with built-in overcurrent protection and low on-state resistance. The SC5826 switch is designed to meet the USB requirements for power switching and maintenance-free fault protection for self-powered & bus-powered hub applications. The SC5826 features low on-state resistance to meet the USB requirement for voltage drop and regulation. The switch is controlled by an enable input that is compatible with 3V and 5V logic. The enable input is available with an active high or active low input for maximum design flexibility. The device provides short circuit current limiting at a value of less than 1.6A, well below the USB limit of 5A. During an overcurrent condition the device provides a fault notification to signal the USB controller. An integrated thermal protection circuit automatically shuts the switch off when the junction temperature reaches its thermal limit. The switch remains off until the junction temperature drops approximately 10°C. The switch will continue to cycle on and off until the fault is removed. Inrush current limiting prevents the voltage drop on an upstream port when the switch is enabled. An undervoltage lockout circuit guarantees the switch is initially off during start-up.

FEATURES

- Designed to meet **USB specification 1.1** power management requirements
- 500mA continuous load current
- High-side MOSFET switch with low $R_{DS(ON)}$
- Short-circuit current protection
- Internal thermal shutdown
- Undervoltage lockout
- Logic overcurrent output
- Soft start circuit with slow turn-on time

APPLICATIONS

- Universal Serial Bus (USB) power management
- Self-powered or bus-powered USB hubs
- Root hubs in desktop PCs & servers
- Notebook PCs
- Peripherals

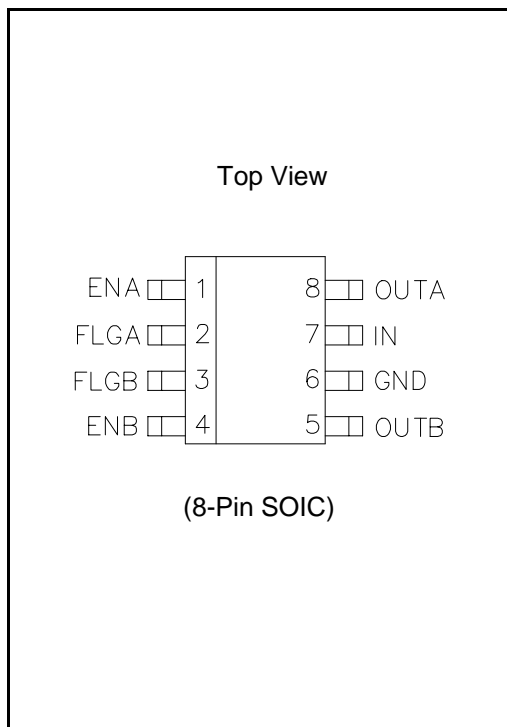
ORDERING INFORMATION

DEVICE ⁽¹⁾	ENABLE	PACKAGE
SC5826-1CS	Active High	SO-8
SC5826-2CS	Active Low	SO-8

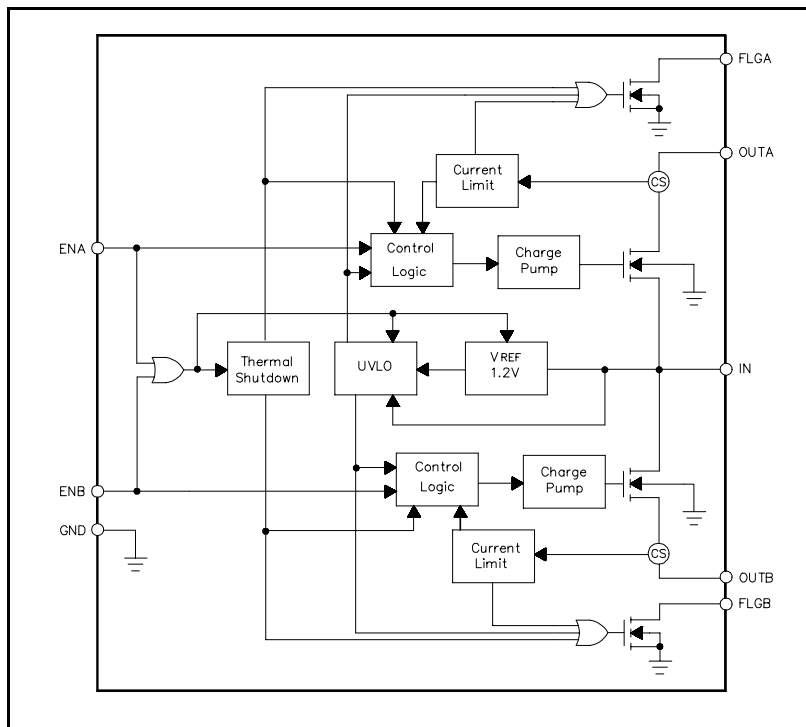
Note:

(1) Add suffix 'TR' for tape and reel.

PIN CONFIGURATION



BLOCK DIAGRAM



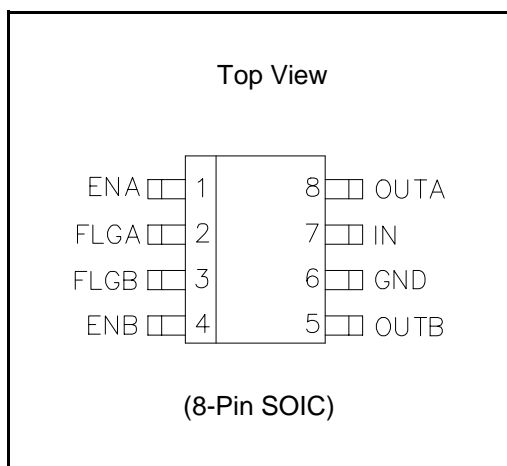
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ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Maximum	Units
Input Voltage Range	V_{IN}	-0.3 to +7	V
Output Voltage Range	V_{OUT}	-0.3 to +7	V
Enable Input	V_{EN}	-0.3 to +7	V
Continuous Output Current	I_O	Internally Limited	mA
Operating Ambient Temperature Range	T_A	-40 to +85	°C
Operating Junction Temperature Range	T_J	-40 to +125	°C
Storage Temperature Range	T_{STG}	-65 to +150	°C
Lead Temperature (Soldering) 10 seconds	T_L	300	°C

PIN DESCRIPTION

Pin #	Pin Name	Pin Function
1, 4	ENA/ENB	Enable input: TTL compatible switch enable input.
2, 3	FLGA/FLGB	Error flag output: FLG is asserted active low during fault condition.
6	GND	Ground.
7	IN	Input voltage: Output MOSFET Drain. Connect to supply voltage.
5, 8	OUTA/OUTB	Power switch output: Output MOSFET Source. Connect to switched side of load.

PIN CONFIGURATION


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ELECTRICAL CHARACTERISTICS⁽¹⁾⁽²⁾

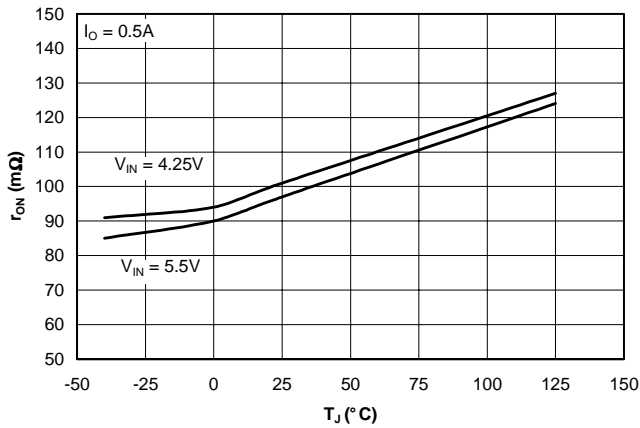
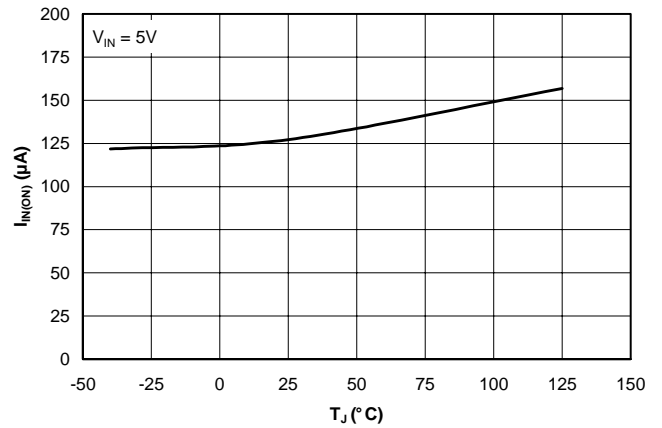
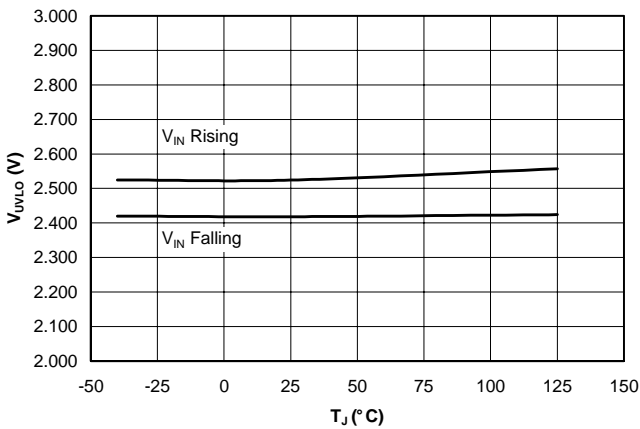
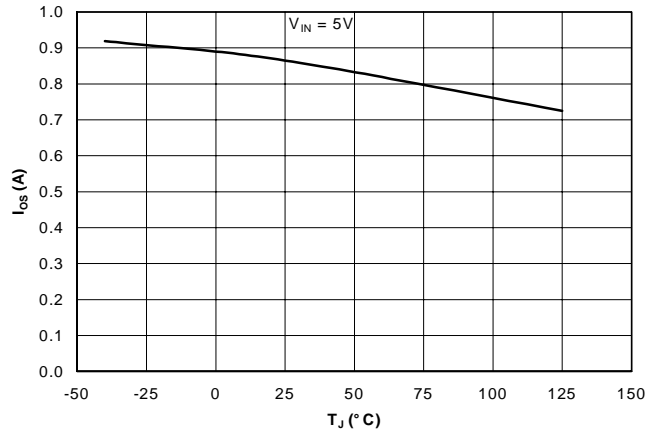
 Unless specified: $T_A = 25^\circ\text{C}$, $V_{IN} = 5\text{V}$, $I_{OA}/I_{OB} = 500\text{mA}$ (Switches ON).

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Power Switch						
On Resistance	r_{ON}	$4.25\text{V} \leq V_{IN} \leq 5.50\text{V}$		100	140	m Ω
Output Leakage Current	$I_{L(OFF)}$	$V_O = 5.5\text{V}$, Switches OFF			1	μA
Output Turn On Rise Time	t_R	$C_O = 1\mu\text{F}$, $R_O = 10\Omega$		1		ms
Output Turn Off Fall Time	t_F	$C_O = 1\mu\text{F}$, $R_O = 10\Omega$		0.1	1	ms
Enable Input						
High Level Input Voltage	$V_{EN(HI)}$	$4.25\text{V} \leq V_{IN} \leq 5.50\text{V}$	2.4			V
Low Level Input Voltage	$V_{EN(LO)}$	$4.25\text{V} \leq V_{IN} \leq 5.50\text{V}$			0.8	V
Input Current	I_{EN}	EN = V_{IN} , OUTA/B = OPEN		0	1	μA
		EN = 0V, $I_{OA}/I_{OB} = 0\text{mA}$, OUTA/B = OPEN		0	1	
Output Turn On Delay	$t_{D(ON)}$			0.25		ms
Output Turn Off Delay	$t_{D(OFF)}$			25	50	μs
Current Limit						
Short Circuit Current Limit	I_{OS}	$V_{OA}/V_{OB} = \text{GND}$, Switches ON	0.65	0.90	1.60	A
Supply Current						
Outputs Off	$I_{IN(OFF)}$	Switches OFF		0.02	1	μA
Outputs On	$I_{IN(ON)}$	$I_{OA}/I_{OB} = 0\text{mA}$		130	200	μA
Undervoltage Lockout						
UVLO Threshold	V_{UVLO}		2.2		2.7	V
Hysteresis	V_{HYST}			90		mV
Error Flag						
Output Resistance	r_{FLG}	$I_{FLG} = 10\text{mA}$, $V_{OA}/V_{OB} = \text{GND}$, Switches ON		10	50	Ω
Leakage Current (Off)	I_{FLG}	$V_{FLG} = 5.0\text{V}$, Switches OFF		0.01	1	μA
Over Temperature Protection						
High Trip Level	T_{HI}			160		$^\circ\text{C}$
Hysteresis	T_{HYST}			10		$^\circ\text{C}$

NOTE:

- (1) For SC5826-1, Switch OFF is $V_{EN} \leq 0.8\text{V}$ and Switch ON is $V_{EN} \geq 2.4\text{V}$ ("Active High").
 For SC5826-2, Switch ON is $V_{EN} \leq 0.8\text{V}$ and Switch OFF is $V_{EN} \geq 2.4\text{V}$ ("Active Low").
 For testing purposes EN will be 0V or V_{IN} as applicable, unless otherwise specified.
- (2) This device is ESD sensitive. Use of standard ESD handling precautions is required.

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TYPICAL CHARACTERISTICS
On Resistance vs. Junction Temperature vs. Input Voltage

Supply Current (Outputs On) vs. Junction Temperature

UVLO Threshold vs. Junction Temperature

Short Circuit Output Current vs. Junction Temperature


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DETAILED DESCRIPTION

The SC5826 HotSwitch™ is a dual port, high-side switch optimized for power control & distribution in Universal Serial Bus (USB) applications. It features an n-channel power MOSFET with a low on-state resistance for meeting USB voltage regulation requirements. It is available with active high (SC5826-1) or active low (SC5826-2) inputs.

In/Out

The input is the supply voltage connection to the drain of the power switch MOSFET. The output is connected to the source of the MOSFET. Under normal operating conditions when the power switch is enabled, current flows from the input to the output towards the load. The power switch is designed to sustain a minimum load current of 500mA in accordance with USB specifications.

Charge Pump

An internal charge pump powers the MOSFET gate drive circuit and provides the necessary voltage to pull the gate above the source.

Control Logic

The gate drive circuit controls the gate voltage of the MOSFET power switch. The gate drive circuit also controls the rise & fall times of the power switch output voltage. The typical "soft start" or output voltage rise time is 1ms.

Enable Input

A logic signal at the enable (EN) pin activates the power MOSFET switch. A logic 1 (SC5826-1) or logic 0 (SC5826-2) will bias the charge pump, gate drive, and control circuitry turning on the power switch. A logic signal of opposite polarity turns off the switch. If both outputs are off, the device powers down. The enable input is compatible with 3V & 5V logic levels.

Error Flag

The error flag (FLG) output is an n-channel, open drain MOSFET. The FLG pin is an active low during short circuit, undervoltage, or thermal shutdown conditions. The output remains low until the fault condition is removed.

Thermal Sense

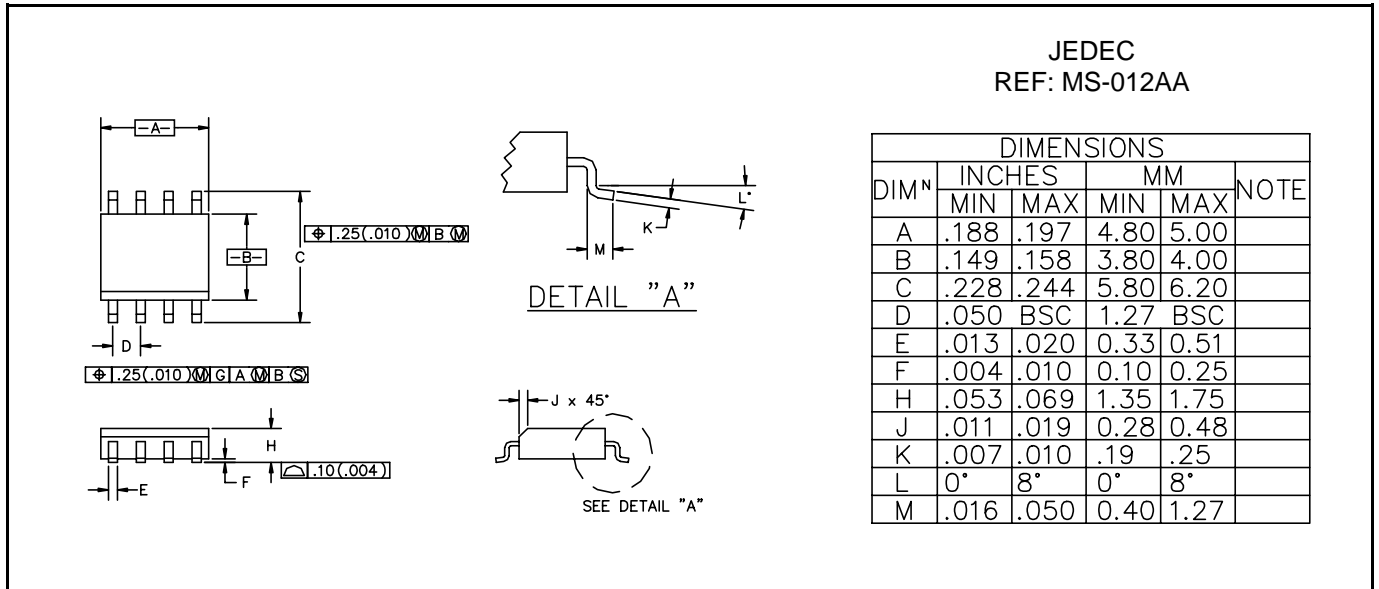
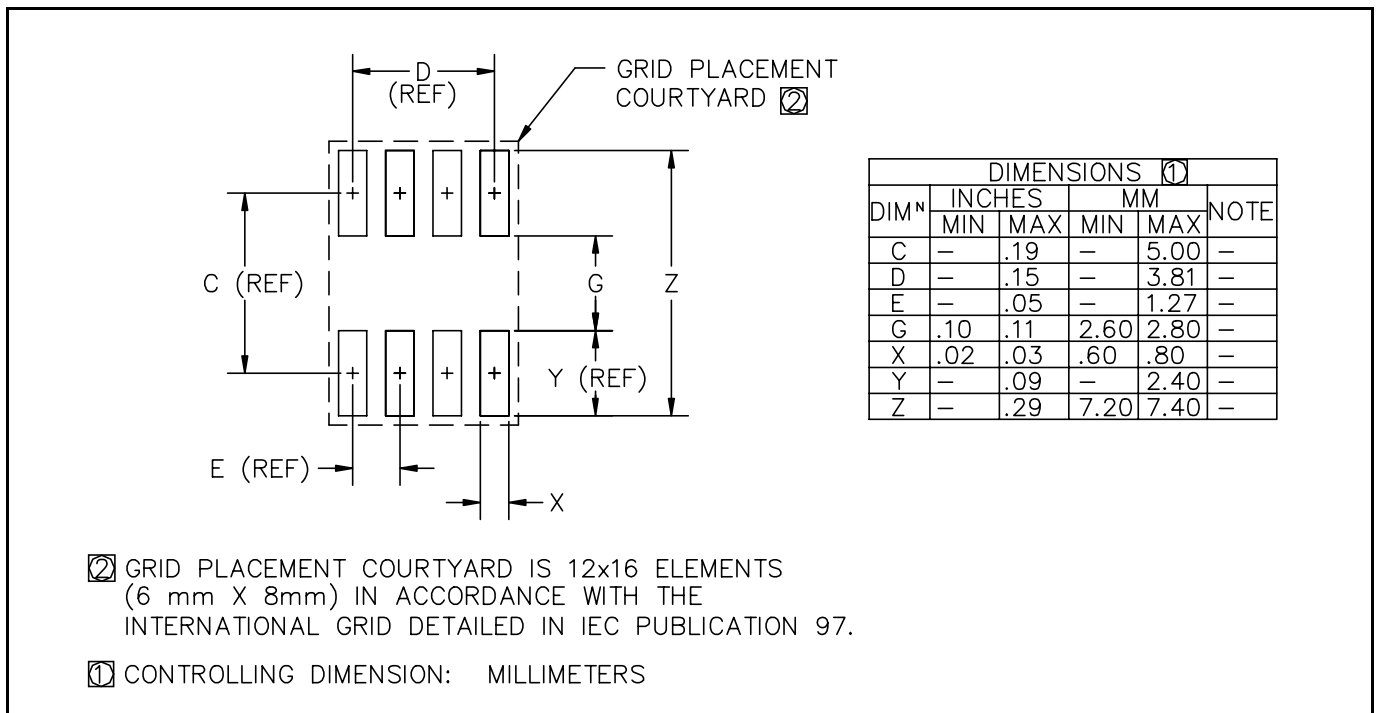
An internal thermal shutdown circuit turns off the power switch output MOSFET when the die junction temperature exceeds 160°C. The output FLG pin is asserted to a logic low signaling a fault condition. A built in hys-

teresis prevents the switch from turning on until the die temperature has cooled approximately 10°C. The switch will continue to cycle on and off until the fault condition is removed. The thermal sense circuit functions only when the switch is enabled.

Undervoltage Lockout

An undervoltage lockout circuit monitors the input voltage and prevents the power switch MOSFET from turning on until the input voltage (IN) exceeds 2.5V (typical). If the input voltage falls 90mV (typical) below that point after the switch has been turned on, the undervoltage lockout turns off the power switch output MOSFET and asserts the FLG output to logic low. The undervoltage lockout functions only when the switch is enabled.

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OUTLINE DRAWING - SO-8

LAND PATTERN - SO-8


ECN00-886