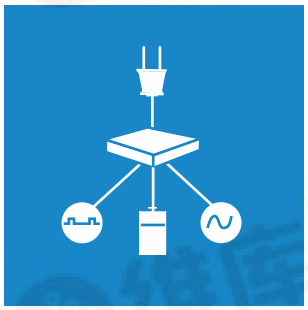
查询IMP2525A-2BN供应商 捷多邦，专业PCB打样工厂，24小时加急出货



POWER MANAGEMENT

USB Power Switch

USB UNIVERSAL SERIAL BUS

IMP2524/27

Quad USB High-Side Power Switch with Fault Detection

IMP2525

USB High-Side Power Switch

IMP2525A

Low-Resistance, USB High-Side Power Switch

IMP2526

Dual USB High-Side Power Switch

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USB Power Switch Product Guide

ISO 9001 Registered

Product Selection Guide

Part Number	Type	Package	Switch "ON" Resistance	Enable Logic	Undervoltage Lockout	Current Limit	Thermal Shutdown	Fault Flag
IMP2524-1BWM	Quad	16-pin, SO	0.14Ω	HIGH	•	•	•	•
IMP2524-2BWM	Quad	16-pin, SO	0.14Ω	LOW	•	•	•	•
IMP2524-1BN	Quad	16-pin, DIP	0.14Ω	HIGH	•	•	•	•
IMP2524-2BN	Quad	16-pin, DIP	0.14Ω	LOW	•	•	•	•
IMP2525A-1BM	Single	8-pin, SO	0.070Ω	HIGH	•	•	•	•
IMP2525A-2BM	Single	8-pin, SO	0.070Ω	LOW	•	•	•	•
IMP2525A-1BN	Single	8-pin, DIP	0.070Ω	HIGH	•	•	•	•
IMP2525A-2BN	Single	8-pin, DIP	0.070Ω	LOW	•	•	•	•
IMP2525-1BM	Single	8-pin, SO	0.14Ω	HIGH	•	•	•	•
IMP2525-2BM	Single	8-pin, SO	0.14Ω	LOW	•	•	•	•
IMP2525-1BN	Single	8-pin, DIP	0.14Ω	HIGH	•	•	•	•
IMP2525-2BN	Single	8-pin, DIP	0.14Ω	LOW	•	•	•	•
IMP2526-1BM	Dual	8-pin, SO	0.14Ω	HIGH	•	•	•	•
IMP2526-2BM	Dual	8-pin, SO	0.14Ω	LOW	•	•	•	•
IMP2526-1BN	Dual	8-pin, DIP	0.14Ω	HIGH	•	•	•	•
IMP2526-2BN	Dual	8-pin, DIP	0.14Ω	LOW	•	•	•	•
IMP2527-1BWM	Quad	16-pin, SO	0.30Ω	HIGH	•	•	•	•
IMP2527-2BWM	Quad	16-pin, SO	0.30Ω	LOW	•	•	•	•
IMP2527-1BN	Quad	16-pin, DIP	0.30Ω	HIGH	•	•	•	•
IMP2527-2BN	Quad	16-pin, DIP	0.30Ω	LOW	•	•	•	•

USBSEL01

All devices are pin-compatible with the MIC2525/2526 devices. Compared to the Micrel MIC2525, the enhanced IMP2525A has a 50% lower "ON" resistance.

Product Cross Reference Guide

Micrel Part Number	IMP Part Number	Type	Package	Switch "ON" Resistance
MIC2524-1BWM	**IMP2524-1BWM**	Quad	16-pin, SO	0.14Ω
MIC2524-2BWM	**IMP2524-2BWM**	Quad	16-pin, SO	0.14Ω
MIC2524-1BN	**IMP2524-1BN**	Quad	16-pin, DIP	0.14Ω
MIC2524-2BN	**IMP2524-2BN**	Quad	16-pin, DIP	0.14Ω
MIC2525A-1BM	**IMP2525A-1BM**	Single	8-pin, SO	0.070Ω vs. 0.14Ω for Micrel 2525
MIC2525A-2BM	**IMP2525A-2BM**	Single	8-pin, SO	0.070Ω vs. 0.14Ω for Micrel 2525
MIC2525A-1BN	**IMP2525A-1BN**	Single	8-pin, DIP	0.070Ω vs. 0.14Ω for Micrel 2525
MIC2525A-2BN	**IMP2525A-2BN**	Single	8-pin, DIP	0.070Ω vs. 0.14Ω for Micrel 2525
MIC2525-1BM	**IMP2525-1BM**	Single	8-pin, SO	0.14Ω
MIC2525-2BM	**IMP2525-2BM**	Single	8-pin, SO	0.14Ω
MIC2525-1BN	**IMP2525-1BN**	Single	8-pin, DIP	0.14Ω
MIC2525-2BN	**IMP2525-2BN**	Single	8-pin, DIP	0.14Ω
MIC2526-1BM	**IMP2526-1BM**	Dual	8-pin, SO	0.14Ω
MIC2526-2BM	**IMP2526-2BM**	Dual	8-pin, SO	0.14Ω
MIC2526-1BN	**IMP2526-1BN**	Dual	8-pin, DIP	0.14Ω
MIC2526-2BN	**IMP2526-2BN**	Dual	8-pin, DIP	0.14Ω
MIC2527-1BWM	**IMP2527-1BWM**	Quad	16-pin, SO	0.30Ω
MIC2527-2BWM	**IMP2527-2BWM**	Quad	16-pin, SO	0.30Ω
MIC2527-1BN	**IMP2527-1BN**	Quad	16-pin, DIP	0.30Ω
MIC2527-2BN	**IMP2527-2BN**	Quad	16-pin, DIP	0.30Ω

Quad USB High-Side Power Switch with Fault Detection

The IMP2524 and IMP2527 are complete power management solutions for bus-powered and self-powered USB hubs. Each device contains four independent power switches and fault detection logic. The IMP2524 channel resistance is a low 140mΩ maximum and the IMP2527 channel resistance is 300Ω maximum. Both device operate with voltage inputs from 2.7V to 5.5V

The IMP2524/2527 conform to the new USB 1.1 standard. Fault current is limited to 750mA typically, and a flag output for each switch conveys fault information to the local USB controller. The IMP252x "Soft-Start" function ramps the ON-current to eliminate any excessive voltage drop on the input side that could occur when capacitive loads are charged.

Self-monitoring features include thermal shutdown to prevent catastrophic switch failure from high-current loads and undervoltage lockout (UVLO) that insures that the device remains OFF unless there is sufficient supply voltage present.

The switch Enable input logic can interface with both 3.3V and 5V logic. Both active-HIGH (-1 devices) and active-LOW (-2 devices) enable logic versions are available. Supply current is a low 0.75µA when disabled and just 110µA when enabled

The quad IMP2524/7 devices are available in 16-pin DIP and 16-pin SO packages and are pin compatible replacements for the Micrel MIC2524-1/-2 and MIC2527-1/2 devices. IMP offers a complete family of USB power management products. For single-switch applications see the IMP2525 and IMP2525A data sheets. The single-switch IMP2525A features a 0.07Ω switch resistance. For dual-switch applications, refer to the IMP2526 data sheet.

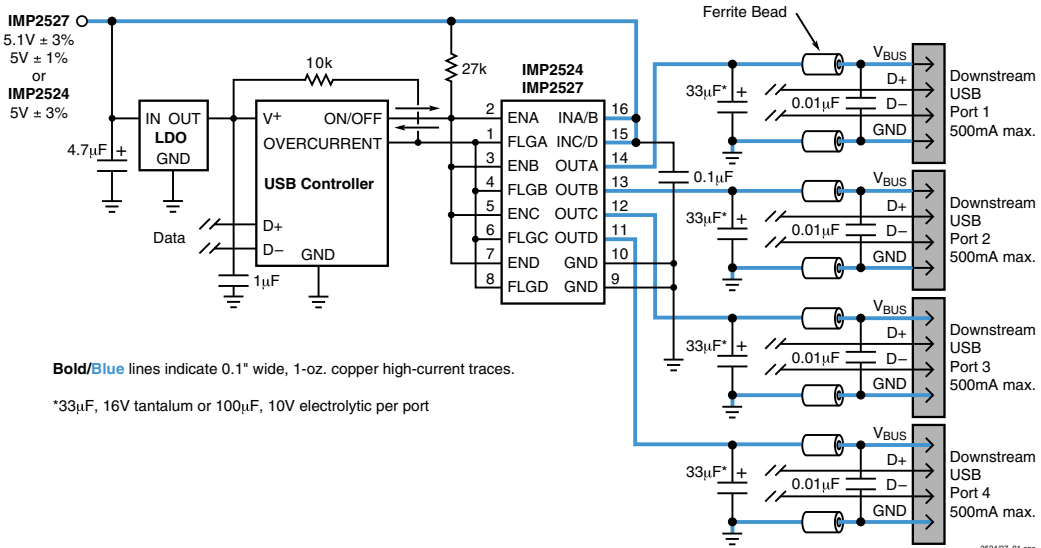
Key Features

- USB Rev. 1.1 and 2.0 Compliant
- Four independent switches
- 2.7V to 5.5V input operation
- Low MOSFET ON resistance
  - IMP2524: 0.1Ω, 0.14Ω maximum
  - IMP2527: 0.2Ω, 0.3Ω maximum
- 500mA continuos load current per switch
- Low supply current
  - 110µA ON-state current, 0.75µA OFF-state current
- 1.25A maximum current limit, 750mA typical
- Thermal shutdown 2.4V undervoltage lockout (UVLO)
- Open-drain flag output
  - Undervoltage
  - Current limit
  - Thermal shutdown
- Output can be force higher than input
- Active HIGH(-1) and active LOW(-2) enable
- 16-pin SO and DIP packages, Die available
- Pin compatible with the Micrel MIC2524 and MIC2527

Applications

- USB host and self-powered hubs
- USB video monitors
- USB printers

Typical Application

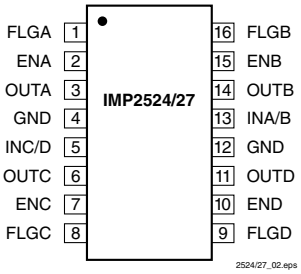


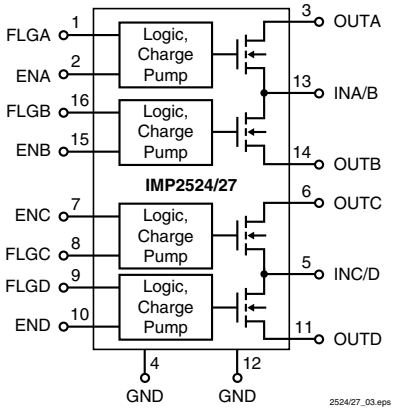
Bold/Blue lines indicate 0.1" wide, 1-oz. copper high-current traces.

*33µF, 16V tantalum or 100µF, 10V electrolytic per port

Pin Configuration

SO/DIP





Pin Descriptions

Pin Number	Name	Function
1	FLGA	Fault Flag A output. This open-drain output goes into an active-LOW state in response to under-voltage, current limit or thermal shutdown conditions.
2	ENA	Enable A Input. This pin is the Channel B MOSFET switch driver control logic input. Both active-HIGH (-1 suffix) and active-LOW (-2 suffix) logic devices are available.
3	OUTA	Channel-A switch output (MOSFET Source). The output pin drives the load into ON and OFF states.
4	GND	Ground. Power supply return for the internal circuitry of the IC. Connect both pins 4 and 6 together.
5	INC/D	Channel C and D positive power supply input voltage. This is the switching MOSFET drain connection. It is the channel C and channel D supply voltage input for the logic and the charge-pump circuit.
6	OUTC	Channel-C switch output (MOSFET Source). The output pin drives the load into ON and OFF states.
7	ENC	Enable C Input. This pin is the Channel B MOSFET switch driver control logic input. Both active-HIGH (-1 suffix) and active-LOW (-2 suffix) logic devices are available.
8	FLGC	Fault Flag C output. This open-drain output goes into an active-LOW state in response to under-voltage, current limit or thermal shutdown conditions.
9	FLGD	Fault Flag D output. This open-drain output goes into an active-LOW state in response to under-voltage, current limit or thermal shutdown conditions.
10	END	Enable D Input. This pin is the Channel B MOSFET switch driver control logic input. Both active-HIGH (-1 suffix) and active-LOW (-2 suffix) logic devices are available.
11	OUTD	Channel-D switch output (MOSFET Source). The output pin drives the load into ON and OFF states.
12	GND	Ground. Power supply return for the internal circuitry of the IC. Connect both pins 4 and 6 together.
13	INA/B	Channel A and B positive power supply input voltage. This is the switching MOSFET drain connection. It is the channel A and channel B supply voltage input for the logic and the charge-pump circuit.
14	OUTB	Channel-B switch output (MOSFET Source). The output pin drives the load into ON and OFF states.
15	ENB	Enable B Input. This pin is the Channel-B MOSFET switch driver control logic input. Both active-HIGH (-1 suffix) and active-LOW (-2 suffix) logic devices are available.
16	FLGB	Fault Flag B output. This open-drain output goes into an active-LOW state in response to under-voltage, current limit or thermal shutdown conditions.

2524/27t01

Ordering Information

Pin Number	Enable Logic	Typical "ON" Resistance	Temperature Range	Pins-Package
IMP2524-1BWM	Active HIGH	100mΩ	–40° C to +85° C	16-SO
IMP2524-2BWM	Active LOW	100mΩ	–40° C to +85° C	16-SO
IMP2524-1BN	Active HIGH	100mΩ	–40° C to +85° C	16-DIP
IMP2524-2BN	Active LOW	100mΩ	–40° C to +85° C	16-DIP
IMP2527-1BWM	Active HIGH	200mΩ	–40° C to +85° C	16-SO
IMP2527-2BWM	Active LOW	200mΩ	–40° C to +85° C	16-SO
IMP2527-1BN	Active HIGH	200mΩ	–40° C to +85° C	16-DIP
IMP2527-2BN	Active LOW	200mΩ	–40° C to +85° C	16-DIP

Absolute Maximum Ratings

Supply Voltage . . . . . +8.0V
Fault Flag Voltage . . . . . +8.0V
Fault Flag Current 50mA
Output Voltage . . . . . +8.0V
Output Current . . . . . Internally Limited
Enable Input . . . . . –0.3V to 12V
Storage Temperature . . . . . –65°C to +150°C
Lead Temperature (Soldering, 5 sec.) . . . . . 260°C
Package Thermal Resistance
SO (θ_{JA}) . . . . . 160°C/W
DIP(θ_{JA}) . . . . . 130°C/W

Note: All voltages are referenced to GND.

These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability.

Electrical Characteristics

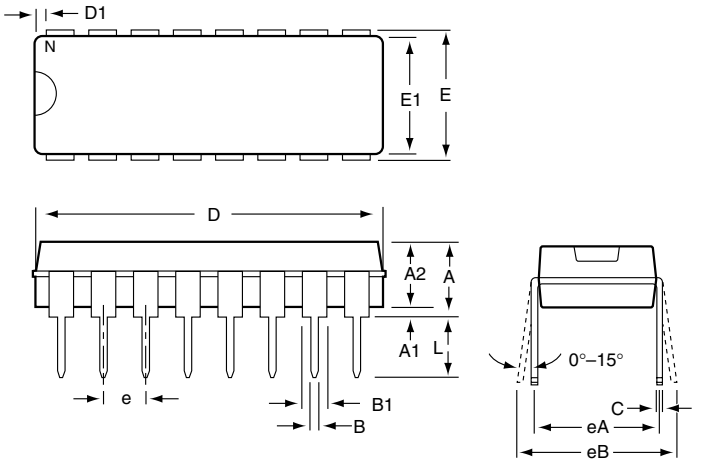
Unless otherwise noted, V_{IN} = 5V and T_A = 25°C.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Supply Voltage Range	V_{IN}	T_A = –40°C to +85°C	2.7		5.5	V
Operating Temperature Range	T_A		–40		85	°C
Supply Current Switch OFF	$I_{IN\ OFF}$	Switch OFF, No load $V_{ENOFF} \le 0.8V$, $V_{ENON} \ge 2.4V$ IMP2524/27-1 $V_{ENON} \le 0.8V$, $V_{ENOFF} \ge 2.4V$ IMP2524/27-2		0.75	10	µA
Supply Current Switch ON	$I_{IN\ ON}$	Switch ON, No load $V_{ENOFF} \le 0.8V$, $V_{ENON} \ge 2.4V$ IMP2524/27-1 $V_{ENON} \le 0.8V$, $V_{ENOFF} \ge 2.4V$ IMP2524/27-2		110	320	µA
Enable Input Threshold	V_{ENH}	LOW to HIGH (“0” to “1”) Enable Voltage, Note 1		2.1	2.4	V
	V_{ENL}	HIGH to LOW (“1” to “0”) Enable Voltage, Note 1	0.8	1.9		
Enable Input Current	I_{EN}	V_{EN} = 2.4V		0.01	1	µA
		V_{EN} = 0.8V		0.01	1	
Enable Input Capacitance	C_{EN}			1		pF
Switch ON Resistance	R_{ON}	IMP2524: I_{OUT} = 500mA each switch		0.10	0.14	Ω
		IMP2527: I_{OUT} = 500mA each switch		0.20	0.30	
Continuous Load Current	I_L	Each output	0.5			A
Output Turn-On Delay	T_{DON}	R_L = 10Ω each output		0.25		ms
Output Turn-On Rise Time	T_{RON}	R_L = 10Ω each output		1		ms
Output Turn-Off Delay	T_{DOFF}	R_L = 10Ω each output		1	20	µs
Output Turn-Off Fall Time	T_{FOFF}	R_L = 10Ω each output		1	20	µs
Output Leakage Current	I_{OFF}				10	µA
Short-circuit Current Limit	I_{SC}		0.50	0.75	1.25	A
Overtemperature Shutdown Threshold		T_J increasing		135		°C
		T_J decreasing		125		
Error Flag Output Resistance	R_{FLAG}	V_{IN} = 5V, I_L = 10mA		10		Ω
		V_{IN} = 3.3V, I_L = 10mA		15		
Error Flag Output Current	I_{FLAG}	V_{FLAG} = 5V		0.01	1	µA
UVLO Threshold	V_{UVLO}	V_{IN} Increasing		2.5		V
		V_{IN} Decreasing		2.3		

Notes 1. Switch OFF is $V_{EN} \le 0.8V$ and Switch ON is $V_{EN} \ge 2.4V$ for the IMP2524/27-1. Switch OFF is $V_{EN} \ge 2.4V$ and Switch ON is $V_{EN} \le 0.8V$ for the IMP2524/27-2. The Enable input has approximately 200mV of hysteresis.

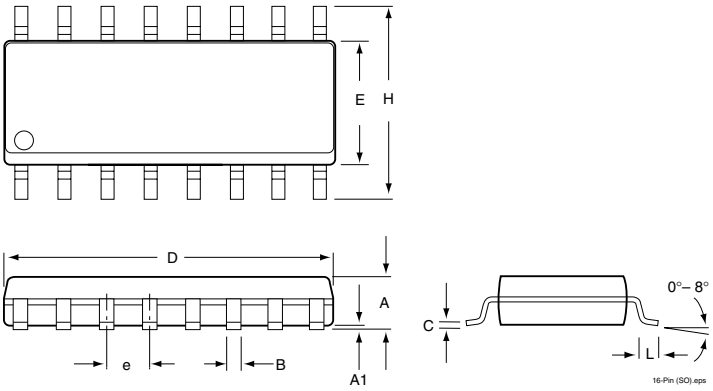
Package Dimensions

Plastic DIP (16-Pin)



Plastic DIP (16-Pin).eps

SO (16-Pin)



16-Pin (SO).eps

	Inches		Millimeters	
	Min	Max	Min	Max
Plastic DIP (16-Pin)*				
A	——	0.200	——	5.08
A1	0.015	——	0.38	——
A2	0.125	0.175	3.18	4.45
B	0.016	0.022	0.41	0.56
B1	0.045	0.065	1.14	1.65
C	0.008	0.012	0.20	0.30
D	0.745	0.765	18.92	19.43
D1	0.005	0.080	0.13	2.03
E	0.300	0.325	7.62	8.26
E1	0.240	0.310	6.10	7.87
e	0.100	——	2.54	——
eA	0.300	——	7.62	——
eB	——	0.400	——	10.16
L	0.115	0.150	2.92	3.81
SO (16-Pin)**				
A	0.926	0.1043	2.35	2.65
A1	0.0040	0.0118	0.10	0.30
B	0.013	0.020	0.33	0.51
C	0.0091	0.0125	0.23	0.32
D	0.3977	0.4133	10.10	10.50
E	0.2914	0.2662	7.40	7.60
e	0.050 BSC		1.27 BSC	
H	0.394	0.419	10.00	10.65
L	0.016	0.050	0.40	1.27

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** JEDEC Drawing MO-058AB*
*** JEDEC Drawing MS-013AA*

ISO 9001 Registered

USB UNIVERSAL SERIAL BUS

IMP2525

POWER MANAGEMENT

USB High-Side Power Switch

– Single switch
– 0.14Ω "ON" resistance at 3V
– MIC2525 pin compatible

The IMP2525 high-side power switch IC is designed for self-powered and bus-powered Universal Serial Bus (USB) power supply and power management applications. The IMP2525 conforms to USB standards with a low output switch ON-resistance (R_{ON}) and minimal voltage drop across the switch. The fault current is limited to 750mA typically, and a flag output conveys fault conditions to the local USB controller. The IMP2525 provides a "Soft-Start" function that ramps up the ON-current to eliminate any excessive voltage drop on the input side that could occur due to charging a capacitive load in bus-powered applications. Self-monitoring features include thermal shutdown to prevent catastrophic switch failure from high-current loads and undervoltage lockout (UVLO) that insures that the device remains off unless there is a valid supply voltage present. The Enable input logic can be interfaced with both 3.3V and 5V logic. Both active-HIGH and active-LOW enable logic versions are available. The IMP2525 devices are available in 8-pin DIP and 8-pin SO packages.

IMP offers a complete family of USB power management products. For dual-switch applications see the IMP2526 data sheet and for quad-switch application, see the IMP2524. The single-switch IMP2525A features a 50% lower switch resistance, 0.07Ω.

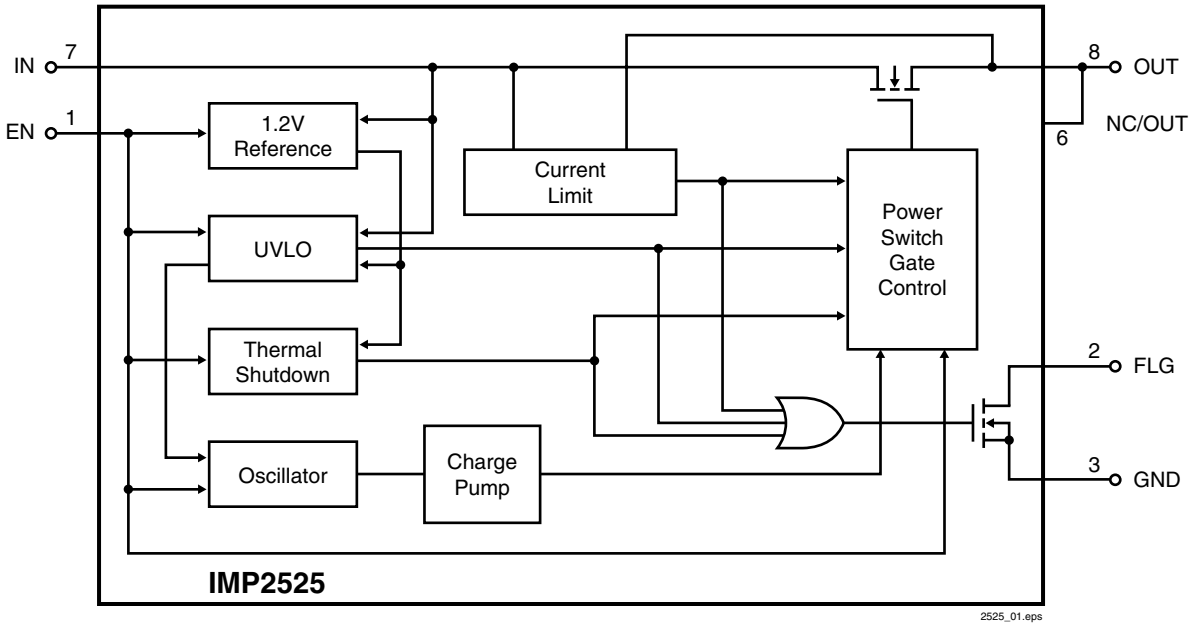
Key Features

- Meets or exceeds USB Rev. 1.1 and 2.0 specification
- Low MOSFET R_{ON} (0.14Ω at 3V)
- 2.7V to 5.5V input operation
- Current limiting
- Soft-start turn-on (1ms) prevents turn-on glitches
- 500mA continuous load current
- MOSFET short-circuit current limit (1.25A max)
- Low supply current
  - 110µA ON state current, 1µA OFF state current
- Active-LOW or Active-HIGH Enable input
- 3.3V or 5V logic compatibility
- Fault Flag indicates three fault conditions:
  - Undervoltage
  - Current limit
  - Thermal shutdown
- Open-drain Fault Flag output
- 2.4V Undervoltage Lockout (UVLO)
- Pin compatible with the Micrel MIC2525

Applications

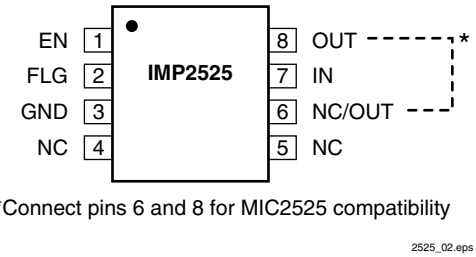
- USB power management
- USB hosts and self-powered hubs
- Battery-charger circuits and power supplies

Block Diagrams



Pin Configuration

SO/DIP



*Connect pins 6 and 8 for MIC2525 compatibility

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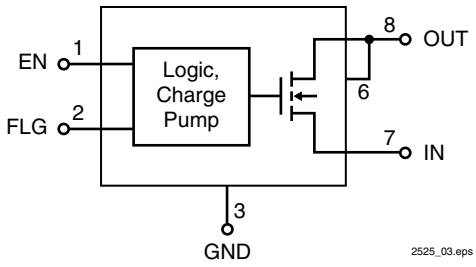

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Pin Descriptions

Pin Number	Name	Function
1	EN	Enable input. This pin is the MOSFET switch driver logic input. Both active-HIGH (-1 suffix) and active-LOW (-2 suffix) logic devices are available.
2	FLG	Fault flag output. This open-drain output goes into an active-LOW state in response to undervoltage, current limit or thermal shutdown conditions.
3	GND	Ground. Power supply return for the internal circuitry of the IC.
4, 5	NC	No connection. These pins have no internal connections to the device.
6	NC/OUT	No connection. This pin has no internal connection to the device. Connect pins 6 and 8 to maintain pin-compatibility with the MIC2525.
7	IN	Positive power supply voltage input. This is the switching MOSFET drain connection as well as the positive supply for the IC.
8	OUT	MOSFET source. The output pin supplies power to the load.

Ordering Information

Part Number	Enable Logic	Temperature Range	Pins-Package
IMP2525-1BM	Active HIGH	–40°C to +85°C	8-SO
IMP2525-2BM	Active LOW	–40°C to +85°C	8-SO
IMP2525-1BN	Active HIGH	–40°C to +85°C	8-DIP
IMP2525-2BN	Active LOW	–40°C to +85°C	8-DIP

Absolute Maximum Ratings

Supply Voltage . . . . . +6.0V
Fault Flag Voltage . . . . . +6.0V
Fault Flag Current 50mA
Output Voltage . . . . . +6.0V
Output Current . . . . . Internally Limited
Enable Input . . . . . –0.3V to 12V
Storage Temperature . . . . . –65°C to +150°C
Lead Temperature (Soldering, 5 sec.) . . . . . 260°C
Package Thermal Resistance
SO (θ_{JA}) . . . . . 120°C/W
DIP(θ_{JA}) . . . . . 130°C/W

Note: All voltages are referenced to GND.

These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability.

Electrical Characteristics

Unless otherwise noted, V_{IN} = 5V and T_A = 25°C.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Supply Voltage Range	V_{IN}	T_A = –40°C to +85°C	2.7		5.5	V
Operating Temperature Range	T_A		–40		85	°C
Supply Current Switch OFF	$I_{IN\ OFF}$	Switch OFF, No load $V_{ENOFF} \le 0.8V$, $V_{ENON} \ge 2.4V$ IMP2525-1 $V_{ENON} \le 0.8V$, $V_{ENOFF} \ge 2.4V$ IMP2525-2		0.75	5	µA
Supply Current Switch ON	$I_{IN\ ON}$	Switch ON, No load $V_{ENOFF} \le 0.8V$, $V_{ENON} \ge 2.4V$ IMP2525-1 $V_{ENON} \le 0.8V$, $V_{ENOFF} \ge 2.4V$ IMP2525-2		110	160	µA
Enable Input Threshold	V_{ENH}	LOW to HIGH (“0” to “1”) Enable Voltage, Note 1, 2		2.1	2.4	V
	V_{ENL}	HIGH to LOW (“1” to “0”) Enable Voltage, Note 1, 2	0.8	1.9		
Enable Input Current	I_{EN}	V_{EN} = 0V to 5.5V	–1	±0.01	1	µA
Enable Input Capacitance	C_{EN}			1		pF
Switch ON Resistance	R_{ON}	V_{IN} = 5V, I_{OUT} = 500mA		0.1	0.14	Ω
		V_{IN} = 3.3V, I_{OUT} = 500mA		0.14	0.18	
Output Turn-On Delay	T_{DON}	R_L = 10Ω		0.25		ms
Output Turn-On Rise Time	T_{RON}	R_L = 10Ω		1		ms
Output Turn-Off Delay	T_{DOFF}	R_L = 10Ω, Note 2		1	20	µs
Output Turn-Off Fall Time	T_{FOFF}	R_L = 10Ω, Note 2		1	20	µs
Output Leakage Current	I_{OFF}				10	µA
Short-circuit Current Limit	I_{SC}		0.50	0.75	1.25	A
Overtemperature Shutdown		T_J increasing		135		°C
Threshold		T_J decreasing		125		
Error Flag Output Resistance	R_{FLAG}	V_{IN} = 5V, I_L = 10mA		10	25	Ω
		V_{IN} = 3.3V, I_L = 10mA		15	40	
Error Flag Output Current	I_{FLAG}	V_{FLAG} = 5V		0.01	1	µA
UVLO Threshold	V_{UVLO}	V_{IN} Increasing		2.5		V
		V_{IN} Decreasing		2.3		

Notes 1. *Switch OFF is $V_{EN} \le 0.8V$ and Switch ON is $V_{EN} \ge 2.4V$ for the IMP2525-1. Switch OFF is $V_{EN} \ge 2.4V$ and Switch ON is $V_{EN} \le 0.8V$ for the IMP2525-2. The Enable input has approximately 200mV of hysteresis.*

2. *Over operating temperature range, –40°C ≤ T_A ≤ 85°C.*

Detailed Descriptions

The IMP2525 is a high-side N-channel MOSFET switch that interfaces with a USB controller by means of a Switch-Enable input and a Fault-Flag output. The Enable input turns ON the power MOSFET with either a logic "1" for the IMP2525-1 or logic "0" for the IMP2525-2. Any one of three fault conditions will activate the open-drain Fault-Flag Output to alert the controller that the power MOSFET has been turned OFF.

Input and Output

The IN (input) pin is the power supply connection to the logic circuitry and the "High-Side" of the switch (the Drain of the power MOSFET). The OUT (output) pin is the "Low-Side" of the switch (the Source of the power MOSFET). In a typical circuit, current flows through the switch from IN to OUT toward the load.

The switch is referred to as a "High-Side" switch since it drives the positive (or high) side of the load. The output MOSFET source can be forced to a higher voltage than the drain ($V_{OUT} > V_{IN}$) when the output is OFF with little leakage current. If, however, V_{IN} drops below 2.3V, reverse current may flow out the IN pin regardless of the enable state.

When the power switch is ON, current can flow in either direction.

Fault Flag - FLG Pin

The Fault Flag pin, FLG, connects to an N-channel, open-drain MOSFET and goes LOW ("0") for an occurrence of one or more of three conditions: undervoltage, current limit, or thermal shutdown. The FLG output MOSFET is capable of sinking a 10mA load to typically 100mV above ground. *Table 1* gives the states of the FLG and OUT pins when a fault condition is detected.

Thermal Shutdown

Thermal shutdown is active when the output switch is enabled (turned ON). Thermal shutdown shuts off the output MOSFET and sets the Fault Flag if the on-chip temperature sensor exceeds 135°C. The switch is held OFF until the die temperature drops to 125°C or below. This 10°C of hysteresis will result in ON-OFF short-circuit cycling if the short-circuit condition is not removed or the bus-controller does turn off the switch with the Enable input. Over temperature detection is active only if the chip is enabled.

Undervoltage Lockout

The Undervoltage lockout (UVLO) prevents the output MOSFET from being put into the ON state until the positive supply voltage, V_{IN}, exceeds 2.5V. When the output switch is in the ON state and the positive supply voltage drops below 2.3V, the UVLO circuitry will assert the Fault Flag, FLG, and shut OFF the output MOSFET. The FLG output will only assert an active LOW state when the MOSFET switch is in the ON state. Undervoltage detection is active only if the chip is enabled.

Current Limiting

Current limiting is achieved by sensing the voltage drop from Drain-to-Source of the power MOSFET. When the internal threshold is exceeded the power MOSFET is turned OFF.

Table 1. Fault Flag Conditions - Switch Enabled

Condition	Cause	FLG pin "0" Until	Switch State (FLG = "0")
Thermal Shutdown	$T_J > 135°C$	$T_J \leq 125°C$	Turns OFF
Undervoltage Lockout (UVLO)	$V_{IN} < 2.3V$	$V_{IN} > 2.5V$	Turns OFF
Current Limiting	$I_O > 0.5A$ (step load) $I_O > 0.63A$ (ramped load)	Enable off or Thermal Shutdown	Stays ON

Application Information

Supply Filtering

IMP strongly recommends the use of a 0.1µF to 1µF bypass capacitor to control transients on the power supply pin. This capacitor, connected from IN to GND, should be in close proximity to the IMP2525 for maximum transient suppression. The lack of suitable bypassing can result in ringing on the IN input when transients occur. This ringing, due to supply lead inductance, could damage IMP2525 control circuitry if the 8V maximum input rating is exceeded.

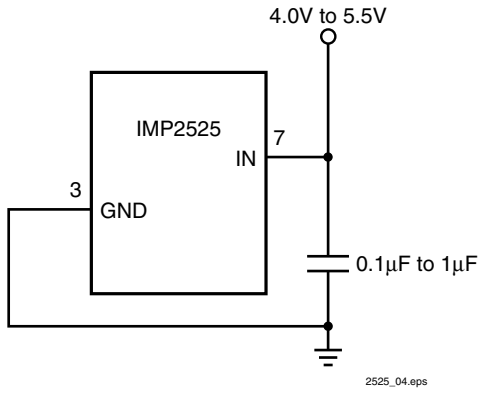


Figure 1. Supply Bypassing

Enable Input

As with any logic input, the enable pin, EN, must be driven to a definitive logic state at all times. Floating the input can result in spurious operation. Do not drive EN below GND.

Fault Flag Output

Soft Start

The IMP2525 provides a “Soft-Start” function that ramps up the ON-current to eliminate any excessive voltage drop that could occur due to charging a capacitive load in bus-powered applications. The "Soft-Start" results from a switch ON resistance, R_{ON}, that is ramped down from a high impedance to 0.14Ω in milliseconds. This R_{ON} ramping reduces the inrush current and related transients occur when charging capacitive loads; a requirement for meeting the USB voltage drop standards for bus-powered applications (see *Figure 2*). In circuits with large load capacitances, C_{BULK}, exceeding 10µF, the soft-start circuit shown in *Figure 3* can be used to limit the inrush start-up current to USB transient specifications. The current limiting feature of the IMP2525 provides this high-load, soft-start operation.

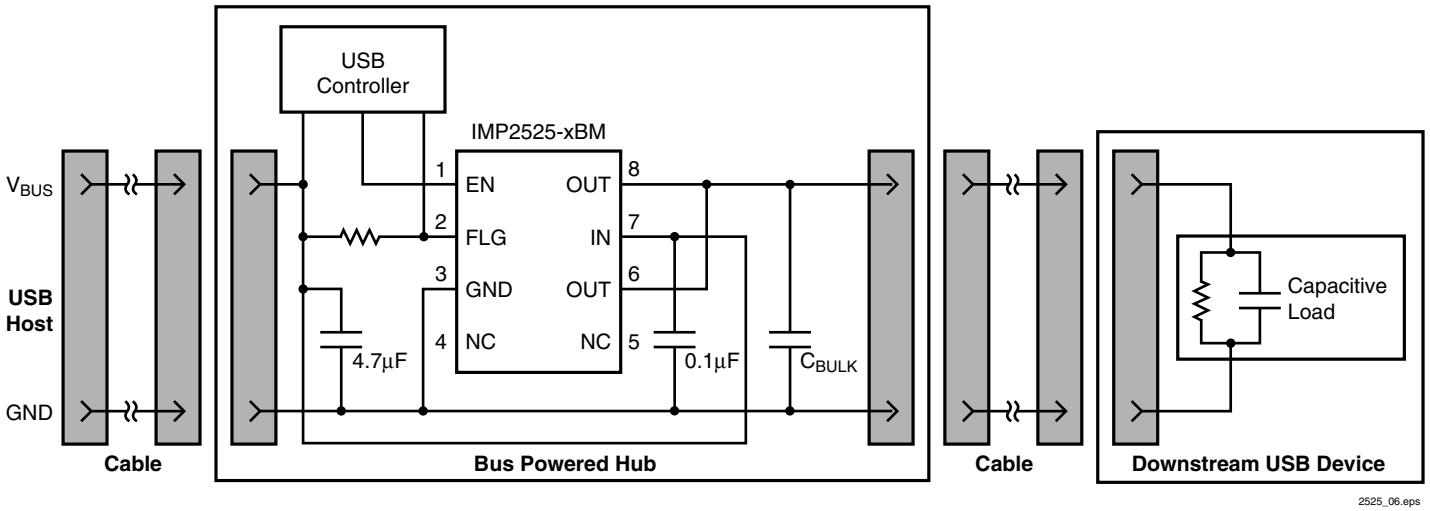


Figure 2. Soft-Start Application

Application Information

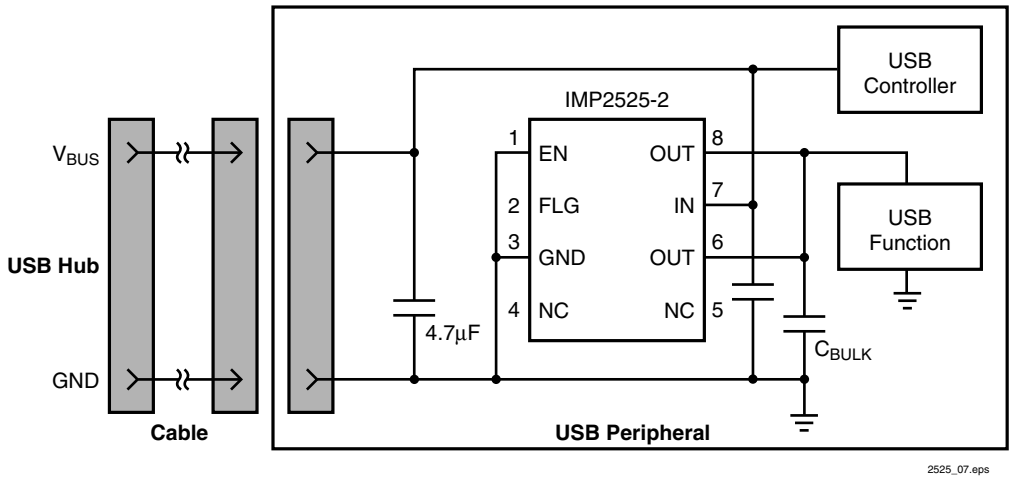


Figure 3. Inrush Current-Limit Application

Transient Overcurrent Filter

If a heavy capacitive load is suddenly connected to the output, the switch current-limiting function may cause the fault-flag to go low for 10µs to 200µs as the switch, in a constant current mode, charges the capacitance. If this transient over-current fault reporting is not wanted, a simple 1ms RC low-pass filter in series with the fault flag circuit will prevent this momentary flag (*Figure 4*).

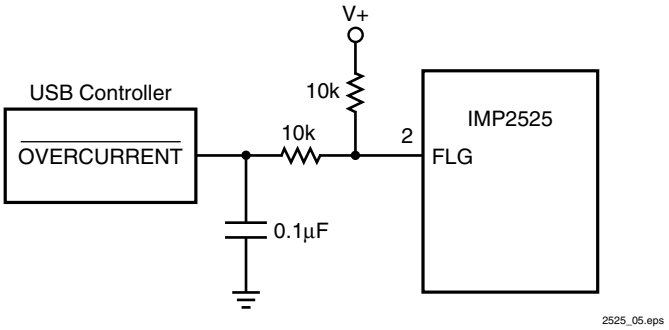


Figure 4. Transient Filter

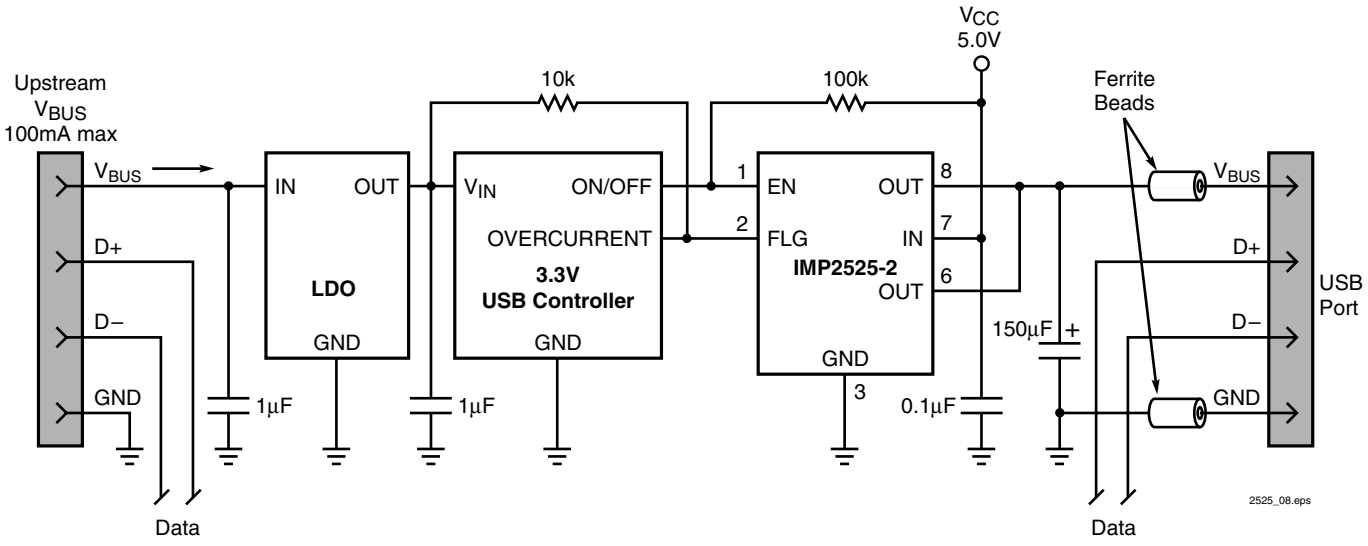
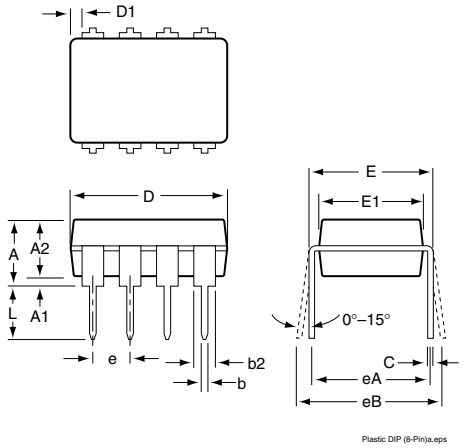


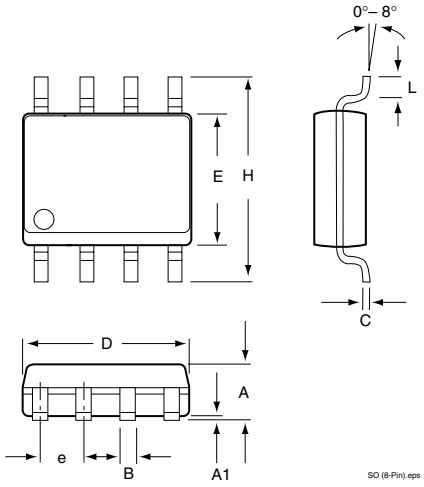
Figure 5. Single-Port Self-Powered Hub Application

Package Dimensions

Plastic DIP (8-Pin)



SO (8-Pin)



	Inches		Millimeters	
	Min	Max	Min	Max
Plastic DIP (8-Pin)*				
A	———	0.210	——	5.33
A1	0.015	———	0.38	———
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.36	0.56
b2	0.045	0.070	1.14	1.78
b3	0.030	0.045	0.80	1.14
D	0.355	0.400	9.02	10.16
D1	0.005	———	0.13	———
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.100	———	2.54	
eA	0.300	———	7.62	
eB	———	0.430	———	10.92
eC	———	0.060		
L	0.115	0.150	2.92	3.81
SO (8-Pin)**				
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.013	0.020	0.33	0.51
C	0.007	0.010	0.19	0.25
e	0.050		1.27	
E	0.150	0.157	3.80	4.00
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27
D	0.189	0.197	4.80	5.00

** JEDEC Drawing MS-001BA*
*** JEDEC Drawing MS-012AA*

Notes

Project

ISO 9001 Registered

USB UNIVERSAL SERIAL BUS

IMP2525A

POWER MANAGEMENT

Low-Resistance USB High-Side Power Switch

- Single switch
- 0.07Ω "ON" resistance at 3V
- 50% lower resistance than MIC2525
- MIC2525 pin compatible

The IMP2525A high-side power switch IC is designed for self-powered and bus-powered Universal Serial Bus (USB) power supply and power management applications. The IMP2525A conforms to USB standards with a low output switch ON-resistance (R_{ON}) and minimal voltage drop across the switch. Switch resistance is 50% lower than the MIC2525. The fault current is limited to 1.5A typically, and a flag output conveys fault conditions to the local USB controller. The IMP2525A provides a "Soft-Start" function that ramps up the ON-current to eliminate any excessive voltage drop on the input side that could occur due to charging a capacitive load in bus-powered applications. Self-monitoring features include thermal shutdown to prevent catastrophic switch failure from high-current loads and undervoltage lockout (UVLO) that insures that the device remains off unless there is a valid supply voltage present. The Enable input logic can be interfaced with both 3.3V and 5V logic. Both active-HIGH and active-LOW enable logic versions are available. The IMP2525A devices are available in 8-pin DIP and 8-pin SO packages.

IMP offers a complete family of USB power management products. For dual-switch applications see the IMP2526 data sheet and for quad-switch application, see the IMP2524. The single-switch IMP2525 matches the performance of the Micrel MIC2525.

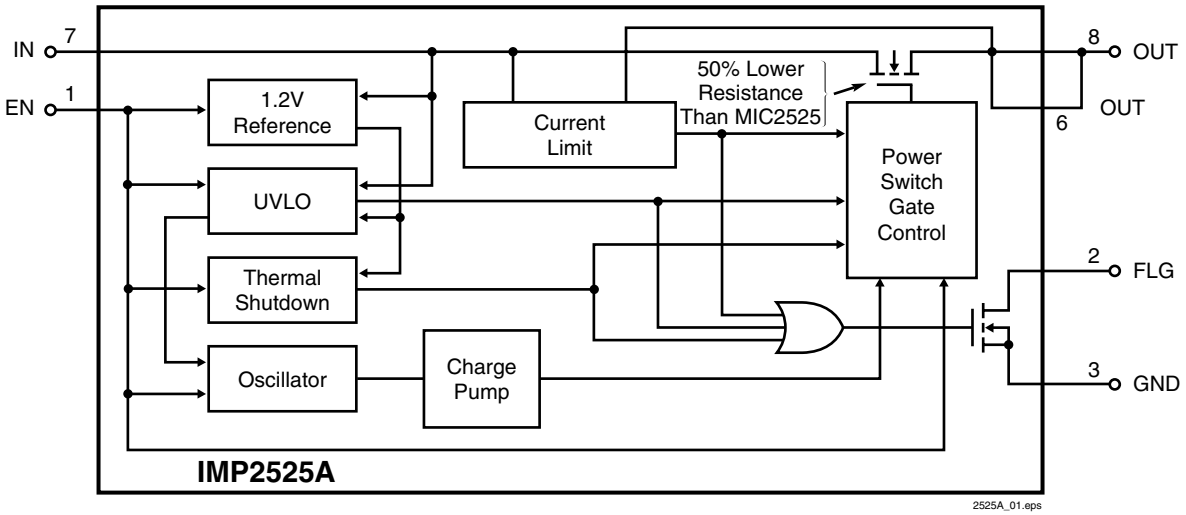
Key Features

- Meets or exceeds USB Rev. 1.1 and 2.0 specification
- Low MOSFET R_{ON} (0.07Ω at 3V)
- Pin compatible with the Micrel MIC2525
  - 50% lower than MIC2525
- 2.7V to 5.5V input operation
- Current limiting
- Soft-start turn-on (1ms) prevents turn-on glitches
- 500mA continuous load current
- MOSFET short-circuit current limit (2.5A max)
- Low supply current
  - 110µA ON state current, 1µA OFF state current
- Active-LOW or Active-HIGH Enable input
- 3.3V or 5V logic compatibility
- Open-drain Fault Flag indicates three fault conditions:
  - Undervoltage
  - Current limit
  - Thermal shutdown
- 2.4V Undervoltage Lockout (UVLO)

Applications

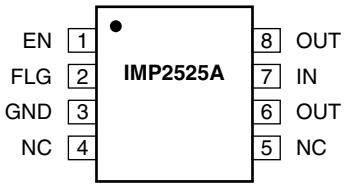
- USB power management
- USB hosts and self-powered hubs
- Battery-charger circuits and power supplies

Block Diagrams



Pin Configuration

SO/DIP



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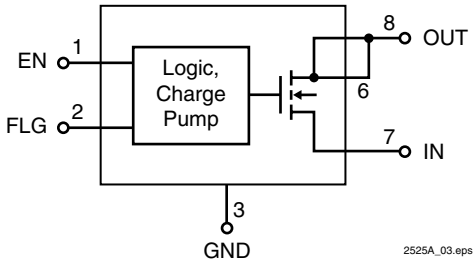

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Pin Descriptions

Pin Number	Name	Function
1	EN	Enable input. This pin is the MOSFET switch driver logic input. Both active-HIGH (-1 suffix) and active-LOW (-2 suffix) logic devices are available.
2	FLG	Fault flag output. This open-drain output goes into an active-LOW state in response to undervoltage, current limit or thermal shutdown conditions.
3	GND	Ground. Power supply return for the internal circuitry of the IC.
4, 5	NC	No connection. These pins have no internal connections to the device.
6	OUT	MOSFET source. The output pin supplies power to the load.
7	IN	Positive power supply voltage input. This is the switching MOSFET drain connection as well as the positive supply for the IC.
8	OUT	MOSFET source. The output pin supplies power to the load.

Ordering Information

Part Number	Enable Logic	Temperature Range	Pins-Package
IMP2525A-1BM	Active HIGH	−40°C to +85°C	8-SO
IMP2525A-2BM	Active LOW	−40°C to +85°C	8-SO
IMP2525A-1BN	Active HIGH	−40°C to +85°C	8-DIP
IMP2525A-2BN	Active LOW	−40°C to +85°C	8-DIP

Absolute Maximum Ratings

Supply Voltage . . . . . +6.0V
Fault Flag Voltage . . . . . +6.0V
Fault Flag Current 50mA
Output Voltage . . . . . +6.0V
Output Current . . . . . Internally Limited
Enable Input . . . . . –0.3V to 12V
Storage Temperature . . . . . –65°C to +150°C
Lead Temperature (Soldering, 5 sec.) . . . . . 260°C
Package Thermal Resistance
SO (θ_{JA}) . . . . . 120°C/W
DIP(θ_{JA}) . . . . . 130°C/W

Note: All voltages are referenced to GND.

These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability.

Electrical Characteristics

Unless otherwise noted, V_{IN} = 5V and T_A = 25°C.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Supply Voltage Range	V_{IN}	T_A = –40°C to +85°C	2.7		5.5	V
Operating Temperature Range	T_A		–40		85	°C
Supply Current Switch OFF	$I_{IN\ OFF}$	Switch OFF, No load $V_{ENOFF} \le 0.8V$, $V_{ENON} \ge 2.4V$ IMP2525A-1 $V_{ENON} \le 0.8V$, $V_{ENOFF} \ge 2.4V$ IMP2525A-2		0.75	5	µA
Supply Current Switch ON	$I_{IN\ ON}$	Switch ON, No load $V_{ENOFF} \le 0.8V$, $V_{ENON} \ge 2.4V$ IMP2525A-1 $V_{ENON} \le 0.8V$, $V_{ENOFF} \ge 2.4V$ IMP2525A-2		110	160	µA
Enable Input Threshold	V_{ENH}	LOW to HIGH (“0” to “1”) Enable Voltage, Note 1, 2		2.1	2.4	V
	V_{ENL}	HIGH to LOW (“1” to “0”) Enable Voltage, Note 1, 2	0.8	1.9		
Enable Input Current	I_{EN}	V_{EN} = 0V to 5.5V	–1	±0.01	1	µA
Enable Input Capacitance	C_{EN}			1		pF
Switch ON Resistance	R_{ON}	V_{IN} = 5V, I_{OUT} = 500mA		0.05	0.07	Ω
		V_{IN} = 3.3V, I_{OUT} = 500mA		0.07	0.09	
Output Turn-On Delay	T_{DON}	R_L = 10Ω		0.25		ms
Output Turn-On Rise Time	T_{RON}	R_L = 10Ω		1		ms
Output Turn-Off Delay	T_{DOFF}	R_L = 10Ω, Note 2		1	20	µs
Output Turn-Off Fall Time	T_{FOFF}	R_L = 10Ω, Note 2		1	20	µs
Output Leakage Current	I_{OFF}				10	µA
Short-circuit Current Limit	I_{SC}		1.0	1.5	2.5	A
Overtemperature Shutdown		T_J increasing		135		°C
Threshold		T_J decreasing		125		
Error Flag Output Resistance	R_{FLAG}	V_{IN} = 5V, I_L = 10mA		10	25	Ω
		V_{IN} = 3.3V, I_L = 10mA		15	40	
Error Flag Output Current	I_{FLAG}	V_{FLAG} = 5V		0.01	1	µA
UVLO Threshold	V_{UVLO}	V_{IN} Increasing		2.5		V
		V_{IN} Decreasing		2.3		

Notes 1. Switch OFF is $V_{EN} \le 0.8V$ and Switch ON is $V_{EN} \ge 2.4V$ for the IMP2525A-1. Switch OFF is $V_{EN} \ge 2.4V$ and Switch ON is $V_{EN} \le 0.8V$ for the IMP2525A-2. The Enable input has approximately 200mV of hysteresis.

2. Over operating temperature range, –40°C ≤ T_A ≤ 85°C.

Detailed Descriptions

The IMP2525A is a high-side N-channel MOSFET switch that interfaces with a USB controller by means of a Switch-Enable input and a Fault-Flag output. The Enable input turns ON the power MOSFET with either a logic "1" for the IMP2525-1 or logic "0" for the IMP2525-2. Any one of three fault conditions will activate the open-drain Fault-Flag Output to alert the controller that the power MOSFET has been turned OFF.

Input and Output

The IN (input) pin is the power supply connection to the logic circuitry and the "High-Side" of the switch (the Drain of the power MOSFET). The OUT (output) pin is the "Low-Side" of the switch (the Source of the power MOSFET). In a typical circuit, current flows through the switch from IN to OUT toward the load.

The switch is referred to as a "High-Side" switch since it drives the positive (or high) side of the load. The output MOSFET source can be forced to a higher voltage than the drain ($V_{OUT} > V_{IN}$) when the output is OFF with little leakage current. If, however, V_{IN} drops below 2.3V, reverse current may flow out the IN pin regardless of the enable state.

When the power switch is ON, current can flow in either direction.

Fault Flag - FLG Pin

The Fault Flag pin, FLG, connects to an N-channel, open-drain MOSFET and goes LOW ("0") for an occurrence of one or more of three conditions: undervoltage, current limit, or thermal shutdown. The FLG output MOSFET is capable of sinking a 10mA load to typically 100mV above ground. *Table 1* gives the states of the FLG and OUT pins when a fault condition is detected.

Thermal Shutdown

Thermal shutdown is active when the output switch is enabled (turned ON). Thermal shutdown shuts off the output MOSFET and sets the Fault Flag if the on-chip temperature sensor exceeds 135°C. The switch is held OFF until the die temperature drops to 125°C or below. This 10°C of hysteresis will result in ON-OFF short-circuit cycling if the short-circuit condition is not removed or the bus-controller does turn off the switch with the Enable input. Over temperature detection is active only if the chip is enabled.

Undervoltage Lockout

The Undervoltage lockout (UVLO) prevents the output MOSFET from being put into the ON state until the positive supply voltage, V_{IN}, exceeds 2.5V. When the output switch is in the ON state and the positive supply voltage drops below 2.3V, the UVLO circuitry will assert the Fault Flag, FLG, and shut OFF the output MOSFET. The FLG output will only assert an active LOW state when the MOSFET switch is in the ON state. Undervoltage detection is active only if the chip is enabled.

Current Limiting

Current limiting is achieved by sensing the voltage drop from Drain-to-Source of the power MOSFET. When the internal threshold is exceeded the power MOSFET is turned OFF.

Table 1. Fault Flag Conditions - Switch Enabled

Condition	Cause	FLG pin "0" Until	Switch State (FLG = "0")
Thermal Shutdown	$T_J > 135°C$	$T_J \leq 125°C$	Turns OFF
Undervoltage Lockout (UVLO)	$V_{IN} < 2.3V$	$V_{IN} > 2.5V$	Turns OFF
Current Limiting	$I_O > 1.0A$ (step load) $I_O > 1.25A$ (ramped load)	Enable off or Thermal Shutdown	Stays ON

Application Information

Supply Filtering

IMP strongly recommends the use of a 0.1µF to 1µF bypass capacitor to control transients on the power supply pin. This capacitor, connected from IN to GND, should be in close proximity to the IMP2525A for maximum transient suppression. The lack of suitable bypassing can result in ringing on the IN input when transients occur. This ringing, due to supply lead inductance, could damage IMP2525A control circuitry if the 8V maximum input rating is exceeded.

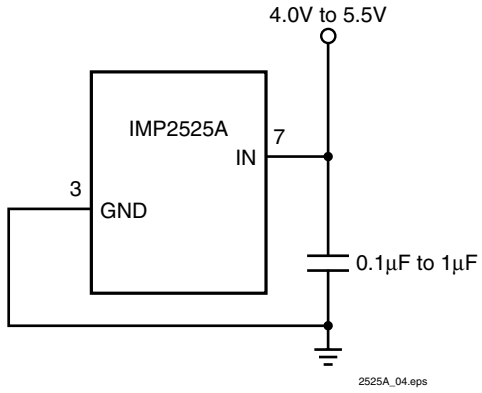


Figure 1. Supply Bypassing

Enable Input

As with any logic input, the enable pin, EN, must be driven to a definitive logic state at all times. Floating the input can result in spurious operation. Do not drive EN below GND.

Fault Flag Output

Soft Start

The IMP2525A provides a “Soft-Start” function that ramps up the ON-current to eliminate any excessive voltage drop that could occur due to charging a capacitive load in bus-powered applications. The "Soft-Start" results from a switch ON resistance, R_{ON}, that is ramped down from a high impedance to 0.07Ω in milliseconds. This R_{ON} ramping reduces the inrush current and related transients occur when charging capacitive loads; a requirement for meeting the USB voltage drop standards for bus-powered applications (see *Figure 2*). In circuits with large load capacitances, C_{BULK}, exceeding 10µF, the soft-start circuit shown in *Figure 3* can be used to limit the inrush start-up current to USB transient specifications. The current limiting feature of the IMP2525A provides this high-load, soft-start operation.

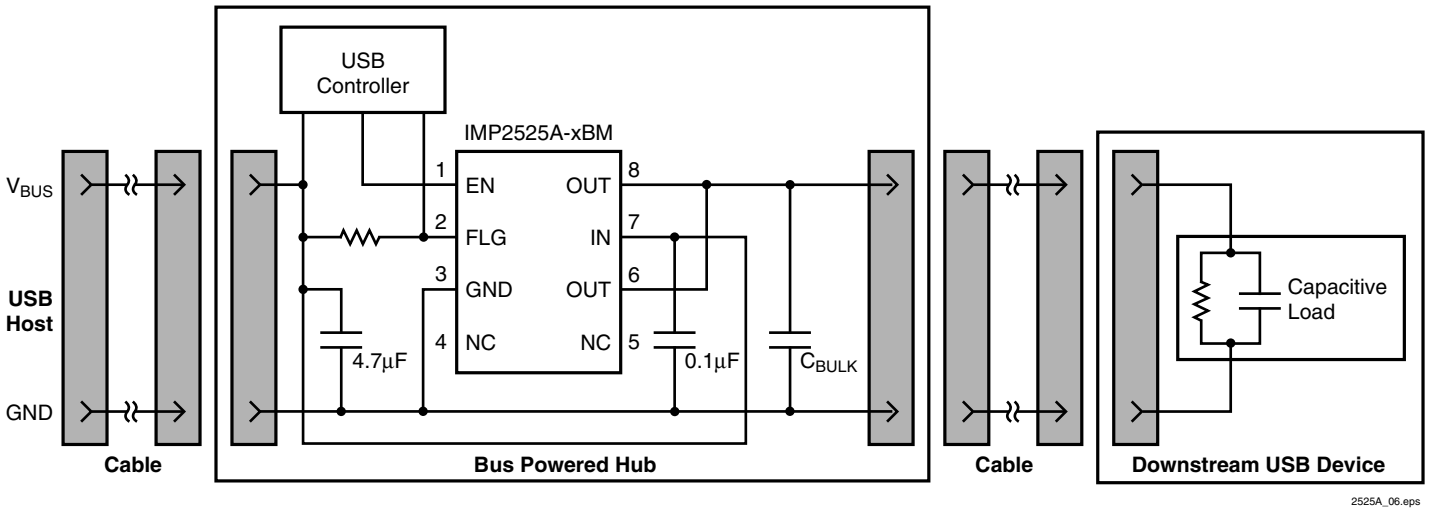


Figure 2. Soft-Start Application

Application Information

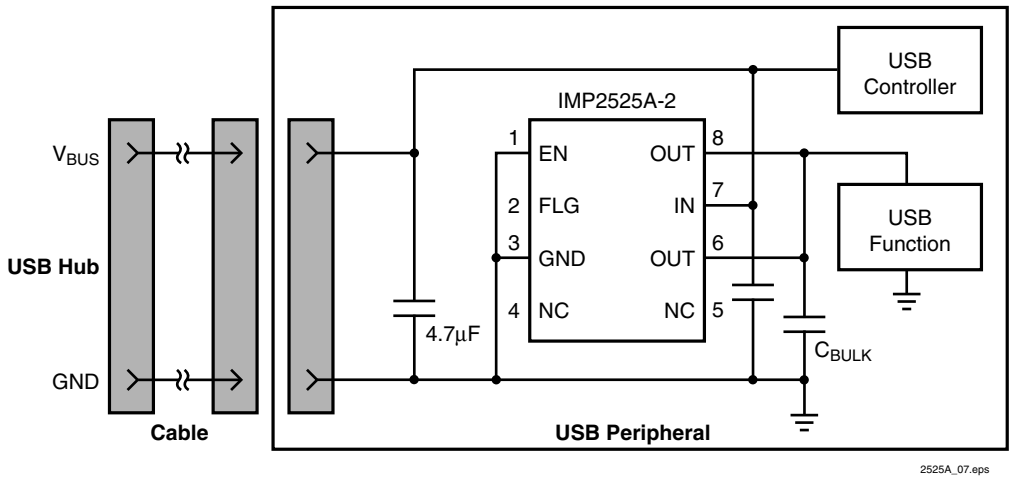


Figure 3. Inrush Current-Limit Application

Transient Overcurrent Filter

If a heavy capacitive load is suddenly connected to the output, the switch current-limiting function may cause the fault-flag to go low for 10µs to 200µs as the switch, in a constant current mode, charges the capacitance. If this transient over-current fault reporting is not wanted, a simple 1ms RC low-pass filter in series with the fault flag circuit will prevent this momentary flag (*Figure 4*).

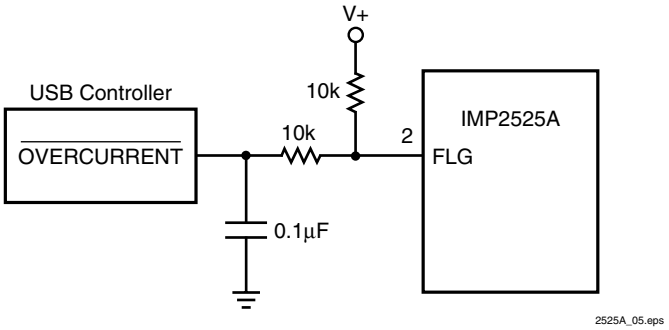


Figure 4. Transient Filter

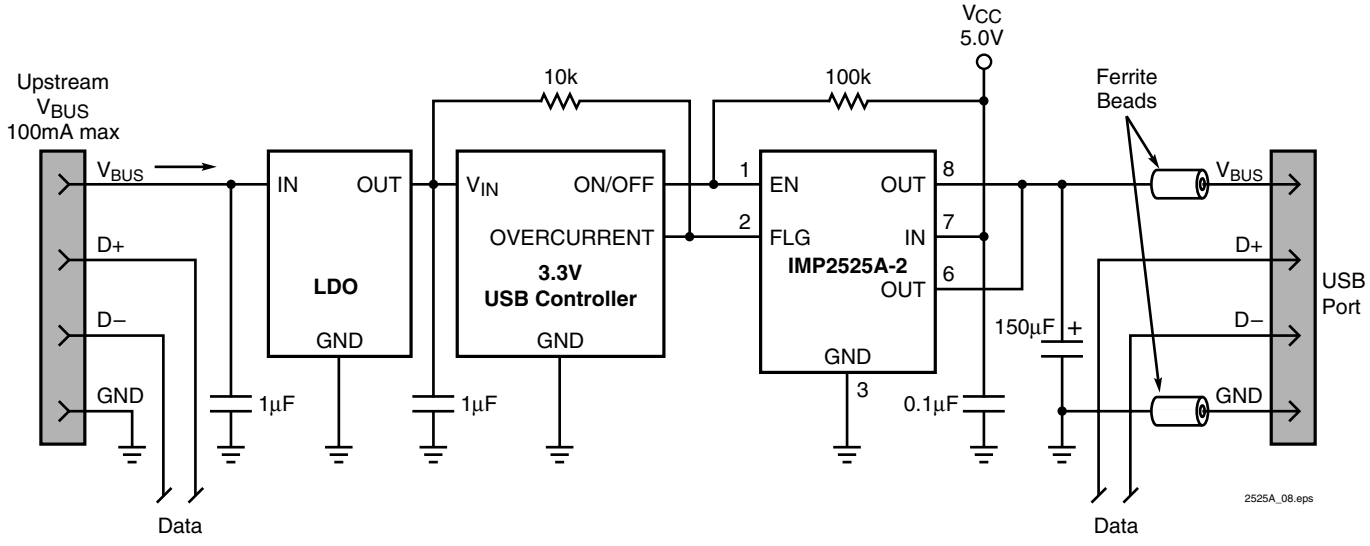
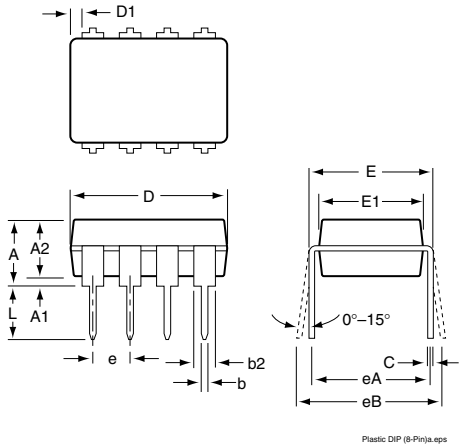


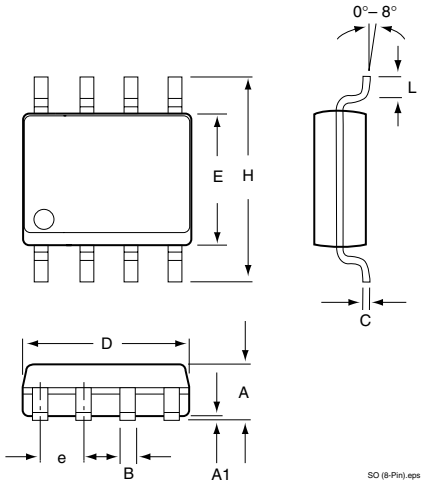
Figure 5. Single-Port Self-Powered Hub Application

Package Dimensions

Plastic DIP (8-Pin)



SO (8-Pin)



	Inches		Millimeters	
	Min	Max	Min	Max
Plastic DIP (8-Pin)*				
A	———	0.210	——	5.33
A1	0.015	———	0.38	———
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.36	0.56
b2	0.045	0.070	1.14	1.78
b3	0.030	0.045	0.80	1.14
D	0.355	0.400	9.02	10.16
D1	0.005	———	0.13	———
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.100	———	2.54	
eA	0.300	———	7.62	
eB	———	0.430	———	10.92
eC	———	0.060		
L	0.115	0.150	2.92	3.81
SO (8-Pin)**				
A	0.053	0.069	1.35	1.75
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B	0.013	0.020	0.33	0.51
C	0.007	0.010	0.19	0.25
e	0.050		1.27	
E	0.150	0.157	3.80	4.00
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27
D	0.189	0.197	4.80	5.00

** JEDEC Drawing MS-001BA*
*** JEDEC Drawing MS-012AA*

Notes

Project

ISO 9001 Registered

USB UNIVERSAL SERIAL BUS

IMP2526

POWER MANAGEMENT

Dual USB High-Side Power Switch

– Dual switch
– 0.14Ω /0.1Ω "ON" resistance at 3/5V
– MIC2526 pin compatible

The IMP2526 dual high-side power switch IC is designed for self-powered and bus-powered Universal Serial Bus (USB) power supply and general purpose power management applications. ON resistance is a low 100mΩ at 5V input and 140mΩ at 3V input.

The IMP2526 conforms to the new USB Revision 1.1 standard. Fault current is limited to 750mA typically, and a flag output for each switch conveys fault information to the local USB controller. The IMP2526 "Soft-Start" function ramps the ON-current to eliminate any excessive voltage drop on the input side that could occur when capacitive loads are charged.

Self-monitoring features include thermal shutdown to prevent catastrophic switch failure from high-current loads and undervoltage lockout (UVLO) that insures that the device remains OFF unless there is a sufficient supply voltage present.

The switch Enable input logic can interface with both 3.3V and 5V logic. Both active-HIGH (-1 devices) and active-LOW (-2 devices) enable logic versions are available. Supply current is a low 0.75µA when disabled and just 110µA when enabled.

The IMP2526 devices are available in 8-pin DIP and 8-pin SO packages and are pin compatible replacements for the Micrel MIC2526-1/-2. IMP offers a complete family of USB power management products. For single-switch applications see the IMP2525 and IMP2525A data sheets. The single-switch IMP2525A features a 50% lower switch resistance, 0.07Ω. For quad-switch applications, refer to the IMP2524 data sheet.

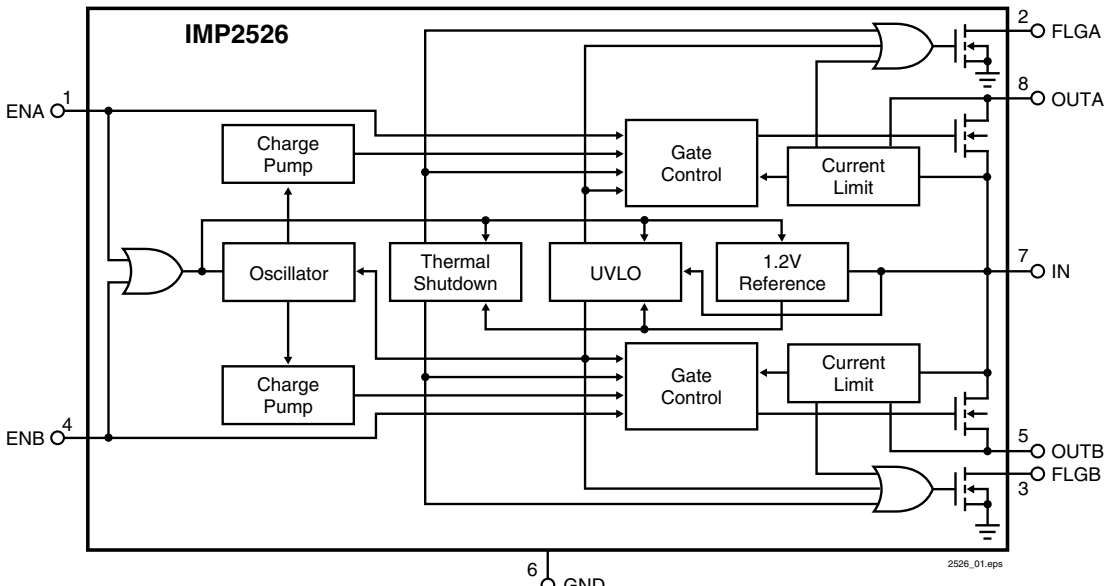
Key Features

- USB Rev. 1.1 and 2.0 compliant
- 2.7V to 5.5V input operation
- Low MOSFET ON resistance (0.1Ω at 5V)
- Low supply current
  - 110µA ON state current, 1µA OFF state current
- 500mA continuous load current per switch
- 1.25A maximum current limit, 750mA typical
- Thermal shutdown 2.4V undervoltage lockout (UVLO)
- Open-drain flag output
  - Undervoltage
  - Current limit
  - Thermal shutdown
- Active HIGH(-1) and active LOW(-2) enable
- Pin compatible with the Micrel MIC2526

Applications

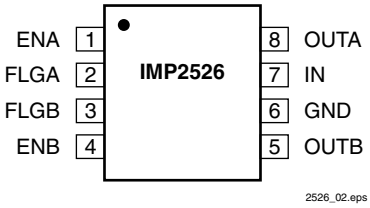
- USB host and self-powered hubs
- Bus-powered hubs
- Hot plug-in power supplies
- Battery chargers

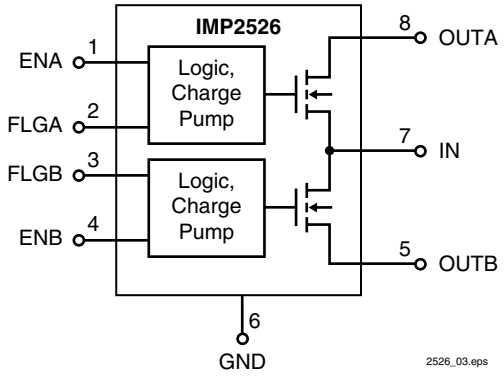
Block Diagrams



Pin Configuration

SO/DIP





Pin Descriptions

Pin Number	Name	Function
1, 4	ENA, ENB	Enable input. This pin is the MOSFET switch driver logic input. Both active-HIGH (-1 suffix) and active-LOW (-2 suffix) logic devices are available.
2, 3	FLGA, FLGB	Fault flag output. This open-drain output goes into an active-LOW state in response to undervoltage, current limit or thermal shutdown conditions.
6	GND	Ground. Power supply return for the internal circuitry of the IC.
7	IN	Positive power supply voltage input. This is the switching MOSFET drain connection as well as the positive supply for the IC.
8, 5	OUTA, OUTB	MOSFET source. The output pin supplies power to the load.

Ordering Information

Part Number	Enable Logic	Temperature Range	Pins-Package
IMP2526-1BM	Active HIGH	−40°C to +85°C	8-SO
IMP2526-2BM	Active LOW	−40°C to +85°C	8-SO
IMP2526-1BN	Active HIGH	−40°C to +85°C	8-DIP
IMP2526-2BN	Active LOW	−40°C to +85°C	8-DIP

Absolute Maximum Ratings

Supply Voltage . . . . . +6.0V
Fault Flag Voltage . . . . . +6.0V
Fault Flag Current 50mA
Output Voltage . . . . . +6.0V
Output Current . . . . . Internally Limited
Enable Input . . . . . –0.3V to 12V
Storage Temperature . . . . . –65°C to +150°C
Lead Temperature (Soldering, 5 sec.) . . . . . 260°C
Package Thermal Resistance
SO (θ_{JA}) . . . . . 120°C/W
DIP(θ_{JA}) . . . . . 130°C/W

Note: All voltages are referenced to GND.

These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability.

Electrical Characteristics

Unless otherwise noted, V_{IN} = 5V and T_A = 25°C.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Supply Voltage Range	V_{IN}	T_A = –40°C to +85°C	2.7		5.5	V
Operating Temperature Range	T_A		–40		85	°C
Supply Current Switch OFF	$I_{IN\ OFF}$	Switch OFF, No load $V_{ENOFF} \le 0.8V$, $V_{ENON} \ge 2.4V$ IMP2526-1 $V_{ENON} \le 0.8V$, $V_{ENOFF} \ge 2.4V$ IMP2526-2		0.75	5	µA
Supply Current Switch ON	$I_{IN\ ON}$	Switch ON, No load $V_{ENOFF} \le 0.8V$, $V_{ENON} \ge 2.4V$ IMP2526-1 $V_{ENON} \le 0.8V$, $V_{ENOFF} \ge 2.4V$ IMP2526-2		110	160	µA
Enable Input Threshold	V_{ENH}	LOW to HIGH (“0” to “1”) Enable Voltage, Note 1		2.1	2.4	V
	V_{ENL}	HIGH to LOW (“1” to “0”) Enable Voltage, Note 1	0.8	1.9		
Enable Input Current	I_{EN}	V_{EN} = 0V to 5.5V	–1	±0.01	1	µA
Enable Input Capacitance	C_{EN}			1		pF
Switch ON Resistance	R_{ON}	V_{IN} = 5V, I_{OUT} = 500mA		0.10	0.14	Ω
		V_{IN} = 3.3V, I_{OUT} = 500mA		0.14	0.18	
Output Turn-On Delay	T_{DON}	R_L = 10Ω each output		0.25		ms
Output Turn-On Rise Time	T_{RON}	R_L = 10Ω each output		1		ms
Output Turn-Off Delay	T_{DOFF}	R_L = 10Ω each output		1	20	µs
Output Turn-Off Fall Time	T_{FOFF}	R_L = 10Ω each output		1	20	µs
Output Leakage Current	I_{OFF}				10	µA
Short-circuit Current Limit	I_{SC}		0.50	0.75	1.25	A
Overtemperature Shutdown		T_J increasing		135		°C
Threshold		T_J decreasing		125		
Error Flag Output Resistance	R_{FLAG}	V_{IN} = 5V, I_L = 10mA		10	25	Ω
		V_{IN} = 3.3V, I_L = 10mA		15	40	
Error Flag Output Current	I_{FLAG}	V_{FLAG} = 5V		0.01	1	µA
UVLO Threshold	V_{UVLO}	V_{IN} Increasing		2.5		V
		V_{IN} Decreasing		2.3		

Notes 1. Switch OFF is $V_{EN} \le 0.8V$ and Switch ON is $V_{EN} \ge 2.4V$ for the IMP2526-1. Switch OFF is $V_{EN} \ge 2.4V$ and Switch ON is $V_{EN} \le 0.8V$ for the IMP2526-2. The Enable input has approximately 200mV of hysteresis.

Detailed Descriptions

The IMP2526 dual high-side N-channel MOSFET switch interfaces with a USB controller by means of a Switch-Enable input and a Fault-Flag output. The Enable input, with either a logic "1" for the IMP2526-1 or logic "0" for the IMP2526-2, turns the power MOSFET ON. Any one of three fault conditions will activate the open-drain Fault-Flag Output to alert the controller that the power MOSFET has been turned OFF.

Input and Output

The IN (input) pin is the power supply connection to the logic circuitry and the "High-Side" of the switch (the Drain of the power MOSFET). The OUTA/B (output) pin is the "Low-Side" of the switch (the Source of the power MOSFET). In a typical circuit, current flows through the switch from IN to OUT toward the load. The switch is referred to as a "High-Side" switch since it drives the positive (or high) side of the load. The output MOSFET source can be forced to a higher voltage than the drain ($V_{OUT} > V_{IN}$) when the output is OFF with little leakage current. If, however, V_{IN} drops below 2.3V, reverse current may flow out the IN pin regardless of the enable state. When the power switch is ON, current can flow in either direction.

Fault Flag - FLG Pin

The Fault Flag pin, FLGA/B, connects to an N-channel, open-drain MOSFET and goes LOW ("0") for an occurrence of one or more of three conditions: undervoltage, current limit, or thermal shutdown. The FLG output MOSFET is capable of sinking a 10mA load to typically 100mV above ground. Both flags may be wire-NORed to a common pull-up resistor.

Table 1 gives the states of the FLG and OUT pins when a fault condition is detected.

Thermal Shutdown

Thermal shutdown is active when the output switch is enabled (turned ON). Thermal shutdown shuts off the output MOSFET and sets the Fault Flag if the on-chip temperature sensor exceeds 135°C. The switch is held OFF until the die temperature drops to 125°C or below. This 10°C of hysteresis will result in ON-OFF short-circuit cycling if the short-circuit condition is not removed or the bus-controller does turn off the switch with the Enable input. Over temperature detection is active only if the chip is enabled.

Undervoltage Lockout

The Undervoltage lockout (UVLO) prevents the output MOSFET from being put into the ON state until the positive supply voltage, V_{IN}, exceeds 2.5V. When the output switch is in the ON state and the positive supply voltage drops below 2.3V, the UVLO circuitry will assert the Fault Flag, FLG, and shut OFF the output MOSFET. The FLG output will only assert an active LOW state when the MOSFET switch is in the ON state. Undervoltage detection is active only if the chip is enabled.

Current Limiting

Current limiting is achieved by sensing the voltage drop from Drain-to-Source of the power MOSFET. When the internal threshold is exceeded the power MOSFET is turned OFF.

Table 1. Fault Flag Conditions - Switch Enabled

Condition	Cause	FLG pin "0" Until	Switch State (FLG = "0")
Thermal Shutdown	$T_J > 135°C$	$T_J \leq 125°C$	Turns OFF
Undervoltage Lockout (UVLO)	$V_{IN} < 2.3V$	$V_{IN} > 2.5V$	Turns OFF
Current Limiting	$I_O > 0.5A$ (step load) $I_O > 0.63A$ (ramped load)	Enable off or Thermal Shutdown	Stays ON*

** The switch and Fault Flag behavior during current-limiting is more complex than shown by this table. The detailed discussion on each of these fault conditions gives additional information.*

Application Information

Supply Filtering

IMP strongly recommends the use of a 0.1µF to 1µF bypass capacitor to control transients on the power supply pin. This capacitor, connected from IN to GND, should be in close proximity to the IMP2526 for maximum transient suppression. The lack of suitable bypassing can result in ringing on the IN input when transients occur. This ringing, due to supply lead inductance, could damage IMP2526 control circuitry if the 8V maximum input rating is exceeded.

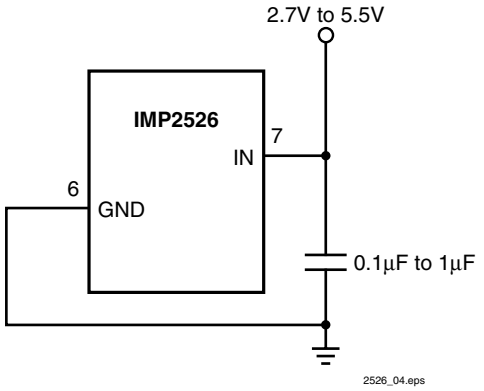


Figure 1. Supply Bypassing

Enable Input

As with any logic input, the enable pins, ENA/ENB, must be driven to a definitive logic state at all times. Floating the input can result in spurious operation. Do not drive ENA/ENB below GND.

Fault Flag Output

Soft Start

The IMP2526 provides a "Soft-Start" function that ramps up the ON-current to eliminate any excessive voltage drop that could occur due to charging a capacitive load in bus-powered applications. The "Soft-Start" results from a switch ON resistance, R_{ON}, that is ramped down from a high impedance to 0.14Ω in milliseconds. This R_{ON} ramping reduces the inrush current and related transients occur when charging capacitive loads; a requirement for meeting the USB voltage drop standards for bus-powered applications (see *Figure 2*). In circuits with large load capacitances, C_{BULK}, exceeding 10µF, the soft-start circuit shown in *Figure 3* can be used to limit the inrush start-up current to USB transient specifications. The current limiting feature of the IMP2526 provides this high-load, soft-start operation.

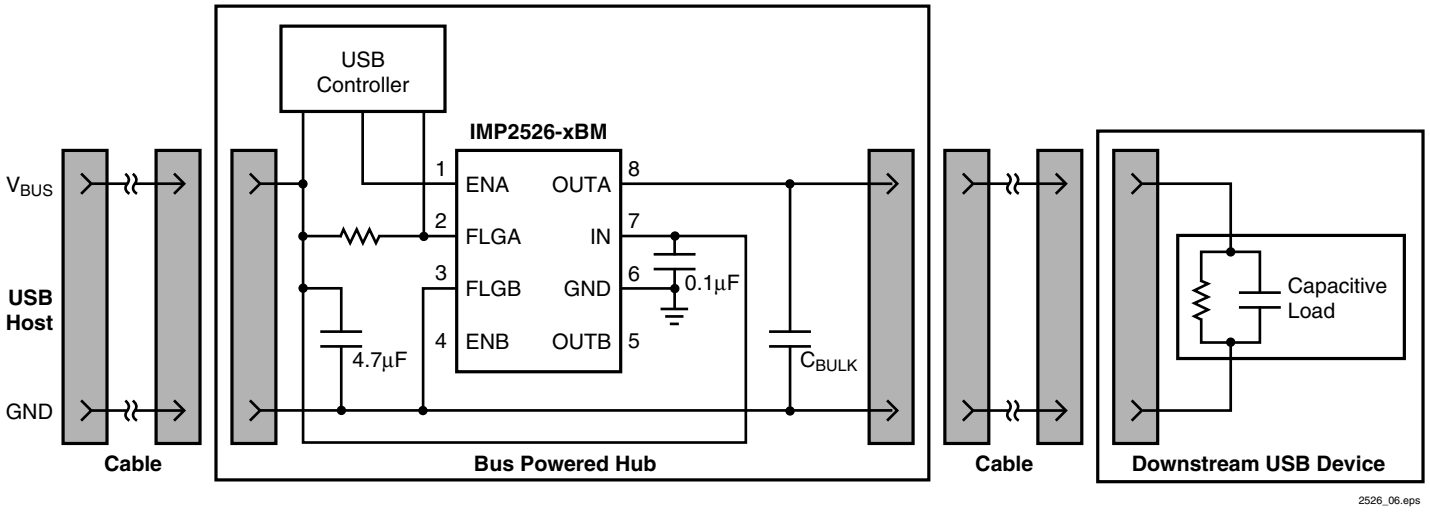


Figure 2. Soft-Start Application

Application Information

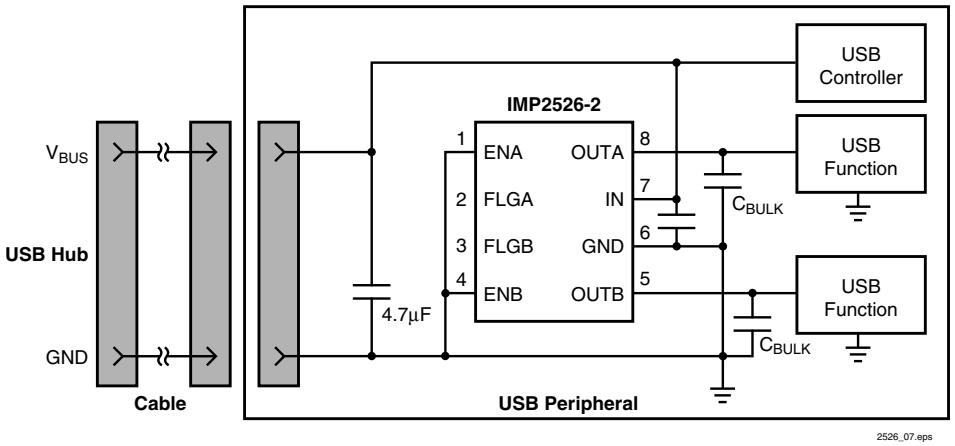


Figure 3. Inrush Current-Limit Application

Transient Overcurrent Filter

If a heavy capacitive load is suddenly connected to the output, the switch current-limiting function may cause the fault-flag to go low for 10µs to 200µs as the switch, in a constant current mode, charges the capacitance. If this transient over-current fault reporting is not wanted, a simple 1ms RC low-pass filter in series with the fault flag circuit will prevent this momentary flag (*Figure 4*).

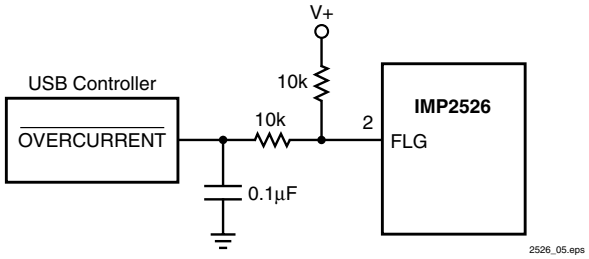


Figure 4. Transient Filter

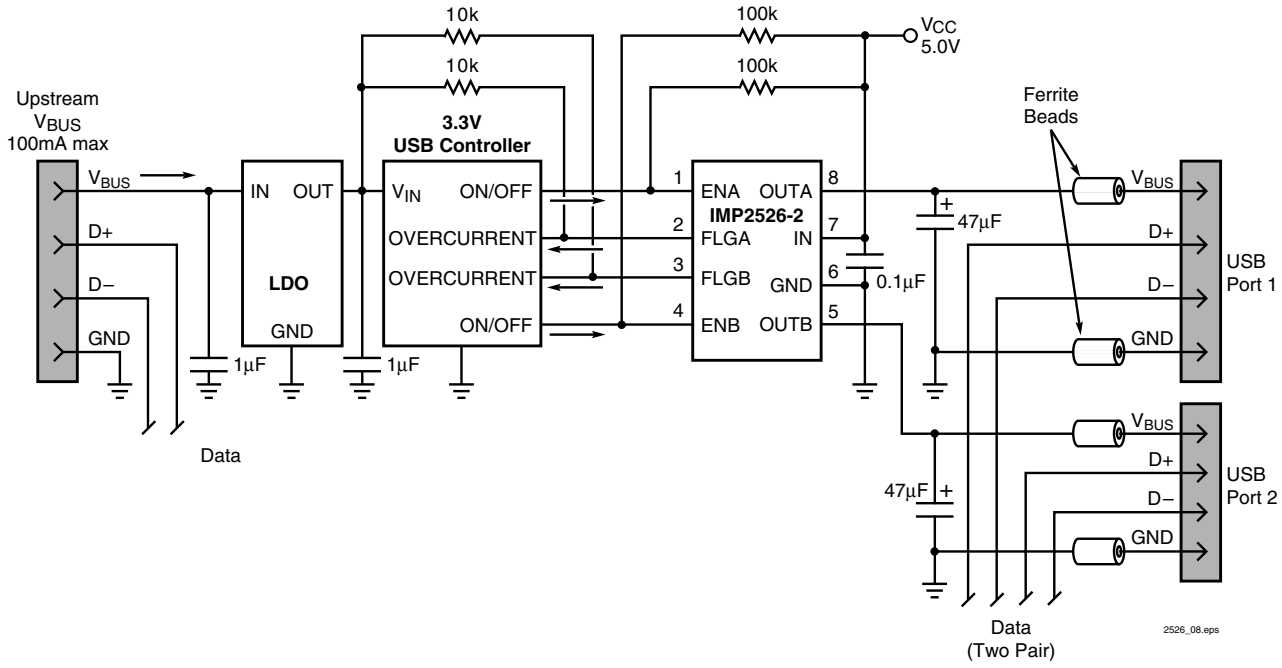
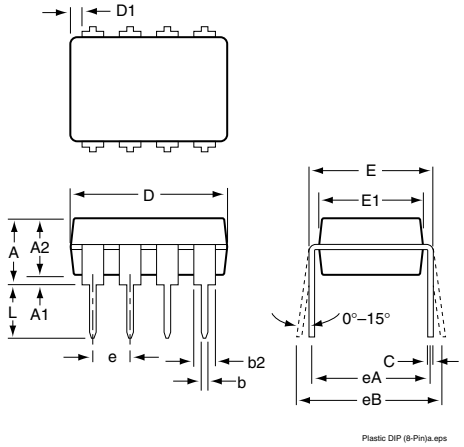


Figure 5. Single-Port Self-Powered Hub Application

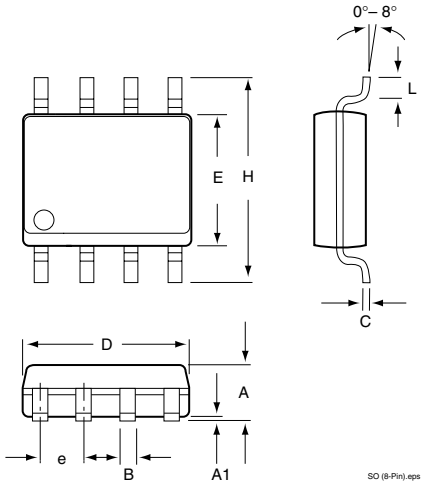
Package Dimensions

Plastic DIP (8-Pin)



Plastic DIP (8-Pin)a.eps

SO (8-Pin)



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e	0.100	———	2.54	
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eC	———	0.060		
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A	0.053	0.069	1.35	1.75
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D	0.189	0.197	4.80	5.00

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Notes

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