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.
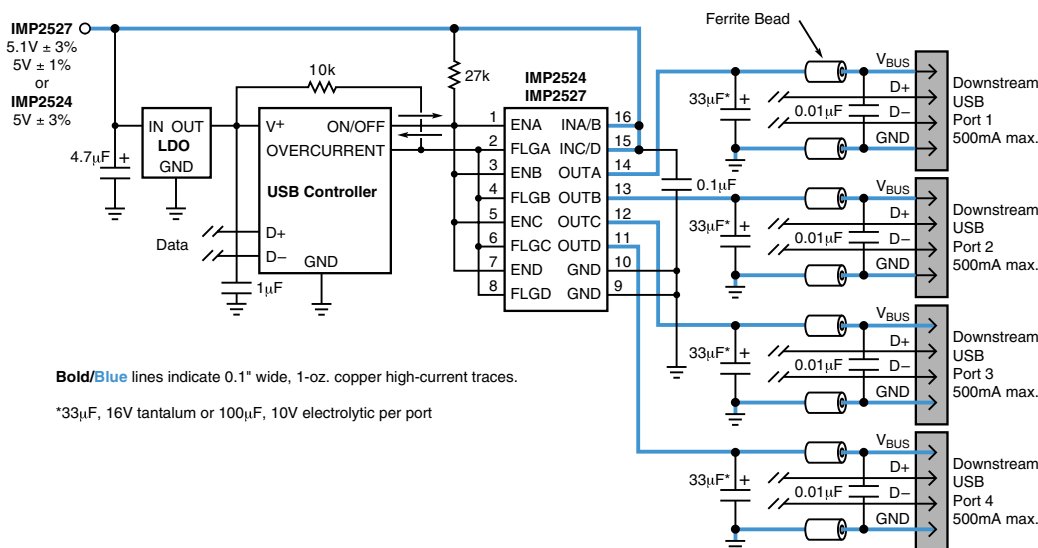
Key Features

- USB Rev. 1.1 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

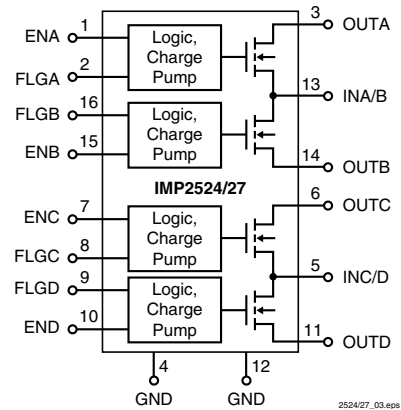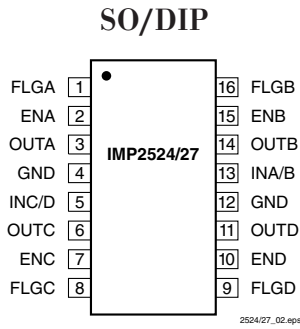## Applications

- 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


```
FLGA  1        16  FLGB
ENA   2        15  ENB
OUTA  3        14  OUTB
GND   4  IMP2524/27  13  INA/B
INC/D 5        12  GND
OUTC  6        11  OUTD
ENC   7        10  END
FLGC  8         9  FLGD
```

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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

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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 $V_{ENOFF} \leq$ 0.8V, $V_{ENON} \geq$ 2.4V IMP2524/27-1 $V_{ENON} \leq$ 0.8V, $V_{ENOFF} \geq$ 2.4V IMP2524/27-2		0.75	10	μA
Supply Current Switch ON	$I_{IN\ ON}$	Switch ON, No load $V_{ENOFF} \leq$ 0.8V, $V_{ENON} \geq$ 2.4V IMP2524/27-1 $V_{ENON} \leq$ 0.8V, $V_{ENOFF} \geq$ 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 $V_{EN} \leq$ 0.8V and Switch ON is $V_{EN} \geq$ 2.4V for the IMP2524/27-1. Switch OFF is $V_{EN} \geq$ 2.4V and Switch ON is $V_{EN} \leq$ 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)

SO (16-Pin).eps
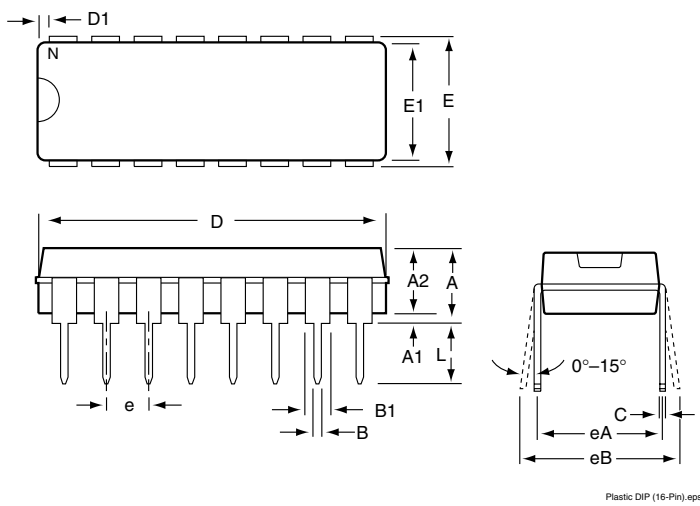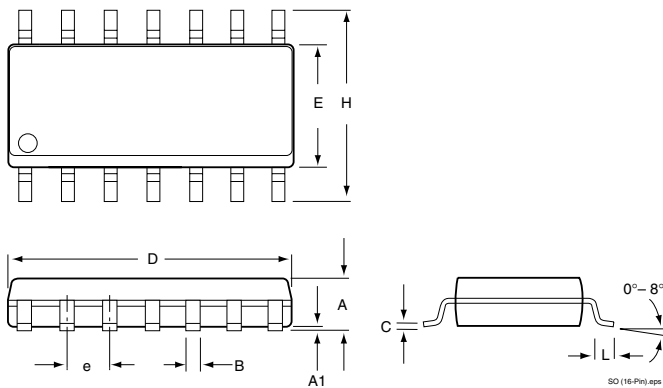
	Inches		Millimeters	
	Min	**Max**	**Min**	**Max**
Plastic DIP (16-Pin)*				
A	——	0.200	——	5.08
A1	0.015	——	0.38	——
A2	0.125	0.175	3.18	4.45
B	0.016	0.022	0.41	0.56
B1	0.045	0.065	1.14	1.65
C	0.008	0.012	0.20	0.30
D	0.745	0.765	18.92	19.43
D1	0.005	0.080	0.13	2.03
E	0.300	0.325	7.62	8.26
E1	0.240	0.310	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

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

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ISO 9001 Registered

2005 Daily Silver IMP
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