

**GENERAL DESCRIPTION**

The SP2526A device is a dual +3.0V to +5.5V USB Supervisory Power Control Switch ideal for self-powered and bus-powered Universal Serial Bus (USB) applications.

Each switch has low on-resistance (110mΩ typical) and can supply 500mA minimum. The fault currents are limited to 1.0A typical and the flag output pin for each switch is available to indicate fault conditions to the USB controller. The thermal shutdown feature will prevent damage to the device when subjected to excessive current loads. The undervoltage lockout feature will ensure that the device will remain off unless there is a valid input voltage present.

The SP2526A is offered in a RoHS compliant "green"/halogen free 8-pin NSOIC package.

**APPLICATIONS**

- **Self Powered USB 2.0 and 3.0 Hubs**
- **USB Compliant V<sub>BUS</sub> Power Distribution**
- **Audio-Video Equipments**
- **Generic Power Switching**

**FEATURES**

- **+3.0V to +5.5V Input Voltage Range**
- **Two Independent Power Switches**
- **Two Error Flag Outputs, Open Drain**
- **2.6V Undervoltage Lockout**
- **1.25A Short Circuit Current Limit**
- **150mΩ Maximum On-Resistance**
- **110µA On-State Supply Current**
- **1µA Shutdown Current**
- **Output can be Forced Higher than Input (Off-State)**
- **Thermal Shutdown**
- **1ms Soft Start Power Up, Fast Turn Off**
- **Active-high Version: SP2526A-1**
- **Active-low Version: SP2526A-2**
- **RoHS Compliant, Green/Halogen Free 8-Pin NSOIC Package**

**TYPICAL APPLICATION DIAGRAM**

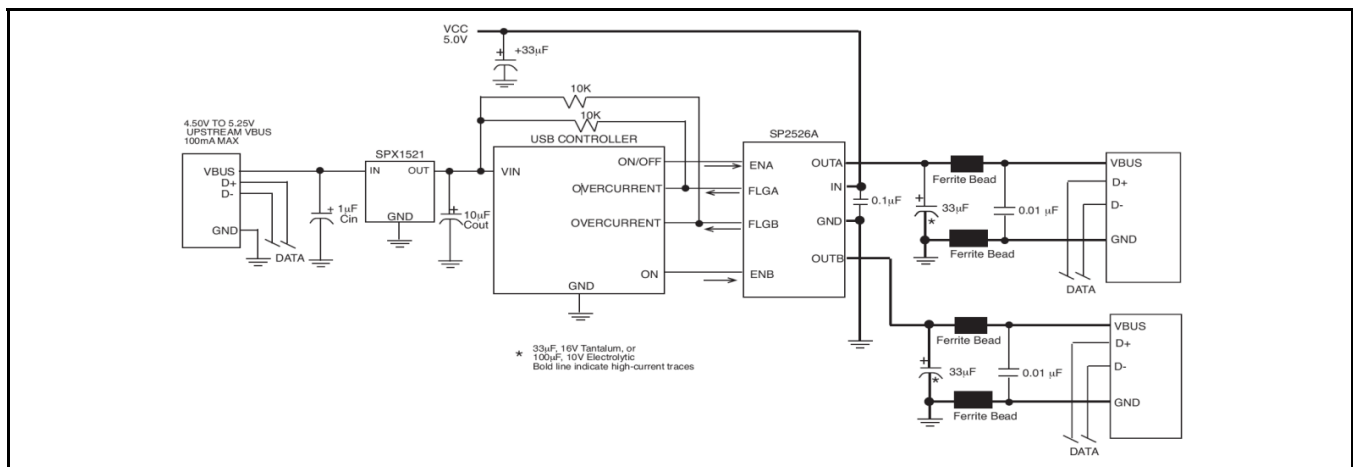


Fig. 1: SP2526A Application Diagram – Two Port Self Powered Hub



**ABSOLUTE MAXIMUM RATINGS**

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

Supply Voltage  $V_{IN}$  ..... 7.0V  
 Fault Flag Voltage  $V_{FLG}$ ..... 7.0V  
 Fault Flag Current  $I_{FLG}$  .....50mA  
 Enable Input  $V_{EN}$ ..... -0.3V to 15V  
 Storage Temperature ..... -65°C to 150°C  
 Soldering Temperature (10sec) ..... 260°C  
 Maximum Junction Temperature..... 125°C  
 Power Dissipation (NSOIC-8) .....  
 (derate 6.14mW/°C above 70°C)..... 500mW

**OPERATING RATINGS**

Ambient Temperature Range ..... -40°C to 85°C

**ELECTRICAL SPECIFICATIONS**

Specifications with standard type are for an Operating Ambient Temperature of  $T_A = 25^\circ\text{C}$  only; limits applying over the full Operating Junction Temperature range are denoted by a “•”. Minimum and Maximum limits are guaranteed through test, design, or statistical correlation. Typical values represent the most likely parametric norm at  $T_A = 25^\circ\text{C}$ , and are provided for reference purposes only. Unless otherwise indicated,  $V_{IN} = 5.0\text{V}$ ,  $T_A = 25^\circ\text{C}$ .

| Parameter                           | Min. | Typ. | Max. | Units            | Conditions                                   |
|-------------------------------------|------|------|------|------------------|--|
| Supply Current                      |      | 0.75 | 5.0  | $\mu\text{A}$    | $V_{EN} = \text{Logic "0"}$ OUT =open        |
|                                     |      | 110  | 160  |                  | $V_{EN} = \text{Logic "1"}$ OUT =open        |
| Enable Input Voltage                | 0.8  | 1.7  |      | V                | $V_{EN} = \text{Logic "0"}$                  |
|                                     |      | 2.0  | 2.4  |                  | $V_{EN} = \text{Logic "1"}$                  |
| Enable Input Current                |      | 0.01 | 1    | $\mu\text{A}$    | $V_{EN} = \text{Logic "0"}$                  |
|                                     |      | 0.01 | 1    |                  | $V_{EN} = \text{Logic "1"}$                  |
| Enable Input Capacitance            |      | 1    |      | pF               |  |
| Output MOSFET Resistance            |      | 110  | 150  | $\text{m}\Omega$ |  |
| Output turn-on delay                |      | 100  |      | $\mu\text{s}$    | $R_L = 10\Omega$ , each output               |
| Output turn-on rise time            |      | 1000 | 4000 | $\mu\text{s}$    | $R_L = 10\Omega$ , each output               |
| Output turn-off delay               |      | 0.8  | 20   | $\mu\text{s}$    | $R_L = 10\Omega$ , each output               |
| Output turn-off fall time           |      | 0.7  | 20   | $\mu\text{s}$    | $R_L = 10\Omega$ , each output               |
| Output Leakage Current              |      |      | 10   | $\mu\text{A}$    |  |
| Current limit threshold             | 0.6  | 1.0  | 1.25 | A                |  |
| Over temperature shutdown threshold |      | 135  |      | $^\circ\text{C}$ | Temperature $T_J$ raising                    |
|                                     |      | 125  |      |                  | Temperature $T_J$ decreasing                 |
| Error Flag Output Resistance        |      | 10   | 25   | $\Omega$         | $V_{IN} = 5\text{V}$ , $I_L = 10\text{mA}$   |
|                                     |      | 15   | 40   |                  | $V_{IN} = 3.3\text{V}$ , $I_L = 10\text{mA}$ |
| Error Flag Current                  |      | 0.01 | 1    | $\mu\text{A}$    | $V_{FLAG} = 5\text{V}$                       |
| UVLO threshold                      |      | 2.6  |      | V                | $V_{IN}$ increasing                          |
|                                     |      | 2.4  |      |                  | $V_{IN}$ decreasing                          |

**BLOCK DIAGRAM**

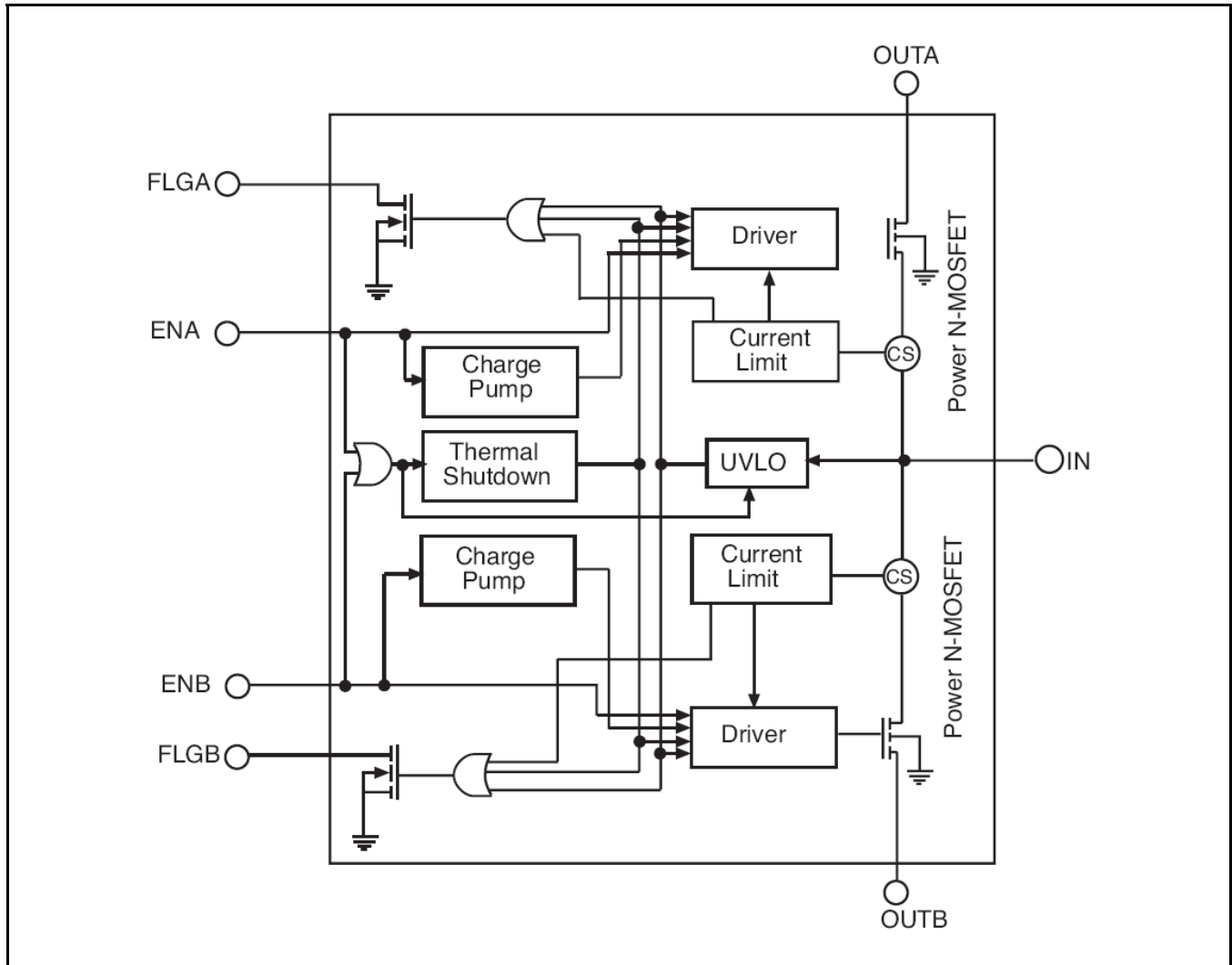


Fig. 2: SP2526A Block Diagram

**PIN ASSIGNMENT**

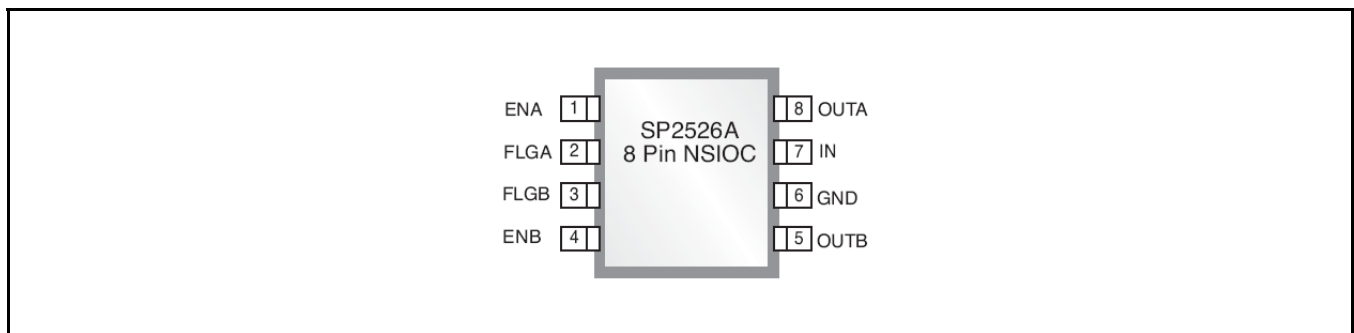


Fig. 3: SP2526A Pin Assignment



**PIN DESCRIPTION**

| Name | Pin Number | Description  |
|------|------------|--|
| ENA  | 1          | Enable Input for channel A.<br>Active High for SP2526A-1 and Active Low for SP2526A-2  |
| FLGA | 2          | An active-low and open-drained fault flag output for channel A. It can indicate current limit ENA is active. In normal mode operation (ENA and/or ENB is active), it also can indicate thermal shutdown or under voltage |
| FLGB | 3          | An active-low and open-drained fault flag output for channel B. It can indicate current limit ENA is active. In normal mode operation (ENA and/or ENB is active), it also can indicate thermal shutdown or under voltage |
| ENB  | 1          | Enable Input for channel B.<br>Active High for SP2526A-1 and Active Low for SP2526A-2  |
| OUTB | 5          | Output for Channel B. This is the output pin of the MOSFET source of channel B, typically connected to the switched side of the load   |
| GND  | 6          | Ground   |
| IN   | 7          | Power Supply Input   |
| OUTA | 8          | Output for Channel A. This is the output pin of the MOSFET source of channel A, typically connected to the switched side of the load   |

**ORDERING INFORMATION**

| Part Number      | Temperature Range              | Marking                    | Package | Packing Quantity | Note 1                         | Note 2                |
|------------------|--------------------------------|----------------------------|---------|------------------|--------------------------------|-----------------------|
| SP2526A-1EN-L    | -40°C ≤ T <sub>A</sub> ≤ +85°C | Sipex<br>2526A-1E<br>YYWWL | NSOIC8  | Bulk             | RoHS Compliant<br>Halogen Free | Enable<br>Active high |
| SP2526A-1EN-L/TR | -40°C ≤ T <sub>A</sub> ≤ +85°C |                            |         | 2.5K/Tape & Reel |                                |                       |
| SP2526A-2EN-L    | -40°C ≤ T <sub>A</sub> ≤ +85°C | Sipex<br>2526A-2E<br>YYWWL | NSOIC8  | Bulk             | RoHS Compliant<br>Halogen Free | Enable Active<br>Low  |
| SP2526A-2EN-L/TR | -40°C ≤ T <sub>A</sub> ≤ +85°C |                            |         | 2.5K/Tape & Reel |                                |                       |

“YY” = Year - “WW” = Work Week - “X” = Lot Number

**TYPICAL PERFORMANCE CHARACTERISTICS**

All data taken at  $V_{IN} = 5.0V$ ,  $T_A = 25^\circ C$ , unless otherwise specified - Schematic and BOM from Application Information section of this datasheet.

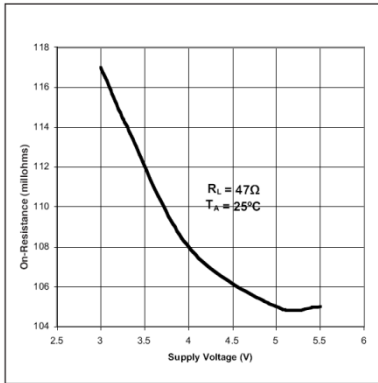


Fig. 4: Output On-Resistance vs Supply Voltage

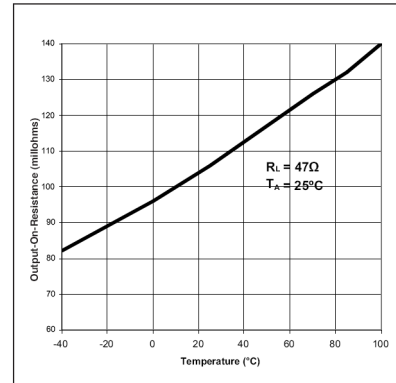


Fig. 5: Output On-Resistance vs Temperature

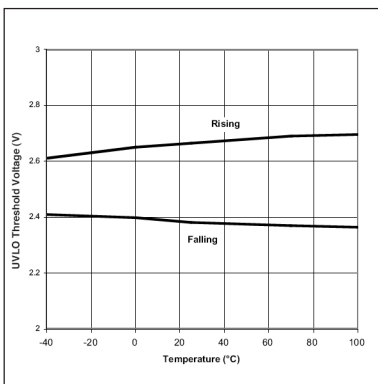


Fig. 6: UVLO Threshold vs Temperature

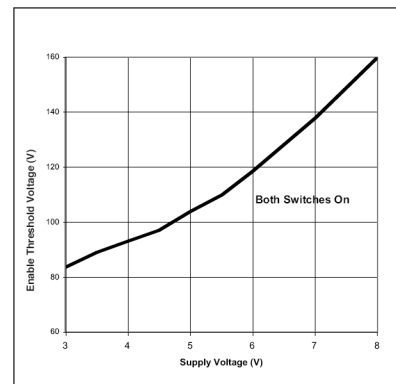


Fig. 7: On-state Supply Current vs Supply Voltage

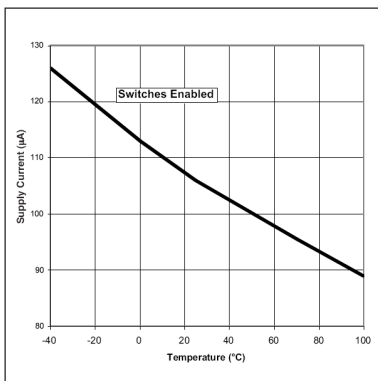


Fig. 8: On-state Supply Current vs Temperature

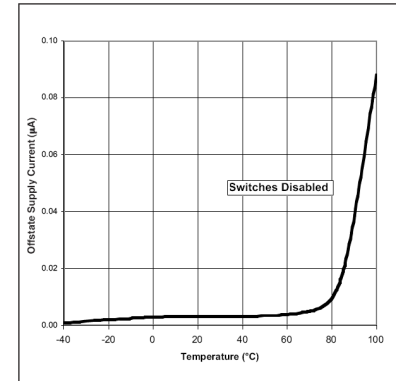


Fig. 9: Off-state Supply Current vs Temperature

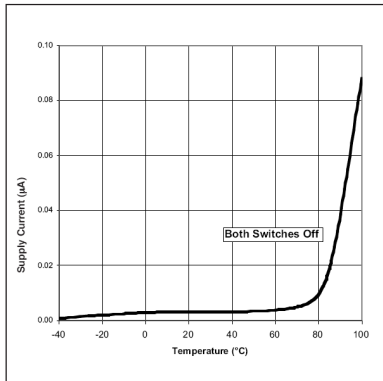


Fig. 10: Off-state Supply Current vs Supply Voltage

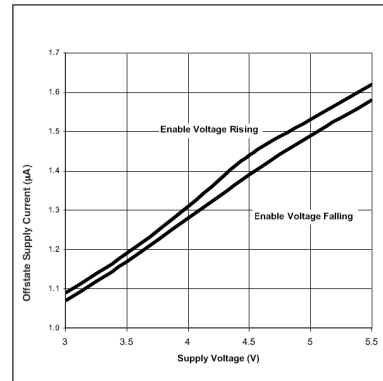


Fig. 11: Control Threshold vs Supply Voltage

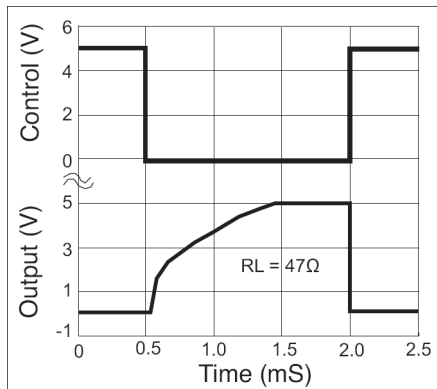


Fig. 12: Turn-on/Turn-off Characteristics

## APPLICATION INFORMATION

### ERROR FLAG

An open-drained output of an N-channel MOSFET, the FLG output is pulled low to signal the following fault conditions: input undervoltage, output current limit, and thermal shutdown.

### CURRENT LIMIT

The current limit threshold is preset internally. It protects the output MOSFET switches from damage resulting from undesirable short circuit conditions or excess inrush current, which is often encountered during hot plug-in. The low limit of the current limit threshold of the SP2526A allows a minimum current of 0.6A through the MOSFET switches. A current limit condition will signal the Error Flag.

### THERMAL SHUTDOWN

When the chip temperature exceeds 135°C for any reason other than overcurrent fault of either one of the two MOSFETs, the thermal shutdown function turns off both MOSFET switches and signals the error flag. A hysteresis of 10°C prevents the MOSFETs from turning back on until the chip temperature drops below 125°C. However, if thermal shutdown is triggered by chip temperature rise resulting from overcurrent fault condition of either one of the MOSFET switches, the thermal shutdown function will only turn off the switch that is in overcurrent condition and the other switch can still remain its normal operation. In other words, the thermal shutdown function of the two switches is independent of each other in the case of overcurrent fault.

### SUPPLY FILTERING

A 0.1µF to 1µF bypass capacitor from IN to GND, located near the device, is strongly recommended to control supply transients. Without a bypass capacitor, an output short

may cause ringing on the input (from supply lead inductance) which can damage internal control circuitry.

### TRANSIENT REQUIREMENTS

USB supports dynamic attachment (hot plugin) of peripherals. A current surge is caused by the input capacitance of a downstream device. Ferrite beads are recommended in series with all power and ground connector pins. Ferrite beads reduce EMI and limit the inrush current during hot-attachment by filtering high-frequency signals.

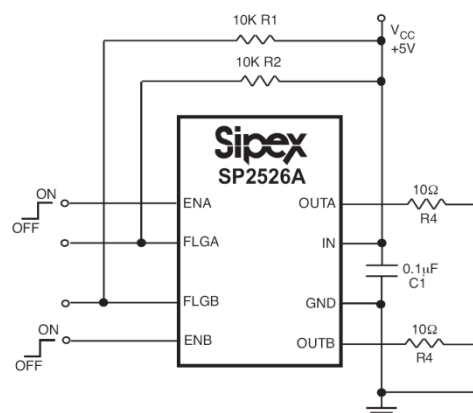
### SHORT CIRCUIT TRANSIENT

Bulk capacitance provides the short-term transient current needed during a hot-attachment event. A 33µF/16V tantalum or a 100µF/10V electrolytic capacitor mounted close to the downstream connector at each port should provide sufficient transient drop protection.

### PRINTED CIRCUIT LAYOUT

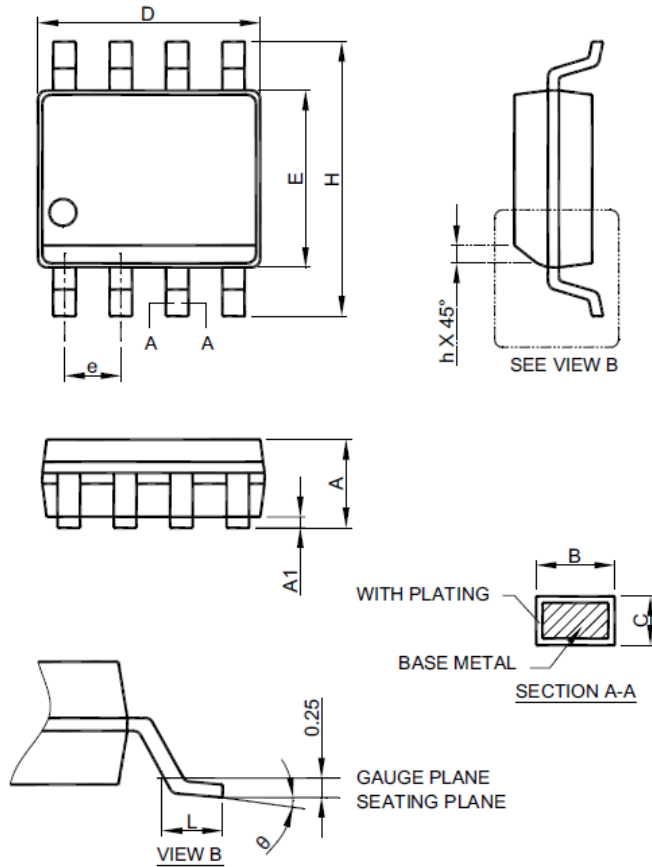
The Power circuitry of USB printed circuit boards requires a customized layout to maximize thermal dissipation and to minimize voltage drop and EMI.

### TEST CIRCUIT



**PACKAGE SPECIFICATION**

**8-PIN NSOIC**



- Note: 1. Refer to JEDEC MS-012AA.  
 2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side .  
 3. Dimension "E" does not include inter-lead flash or protrusions.  
 4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

| SYMBOL   | 8 PIN SOICN |      |
|----------|-------------|------|
|          | MILLIMETERS |      |
|          | MIN.        | MAX. |
| A        | 1.35        | 1.75 |
| A1       | 0.10        | 0.25 |
| B        | 0.33        | 0.51 |
| C        | 0.19        | 0.25 |
| D        | 4.80        | 5.00 |
| E        | 3.80        | 4.00 |
| e        | 1.27 BSC    |      |
| H        | 5.80        | 6.20 |
| h        | 0.25        | 0.50 |
| L        | 0.40        | 1.27 |
| $\theta$ | 0°          | 8°   |





**REVISION HISTORY**

| <b>Revision</b> | <b>Date</b> | <b>Description</b>            |
|-----------------|-------------|-------------------------------|
| 2.0.0           | 11/19/2010  | Reformat of datasheet         |
| 2.1.1           | 11/04/2011  | Updated package specification |
|                 |             |                               |

**FOR FURTHER ASSISTANCE**

Email: [customersupport@exar.com](mailto:customersupport@exar.com)  
Exar Technical Documentation: <http://www.exar.com/TechDoc/default.aspx?>

**EXAR CORPORATION**

**HEADQUARTERS AND SALES OFFICES**

48720 Kato Road  
Fremont, CA 94538 – USA  
Tel.: +1 (510) 668-7000  
Fax: +1 (510) 668-7030  
[www.exar.com](http://www.exar.com)



**NOTICE**

EXAR Corporation reserves the right to make changes to the products contained in this publication in order to improve design, performance or reliability. EXAR Corporation assumes no responsibility for the use of any circuits described herein, conveys no license under any patent or other right, and makes no representation that the circuits are free of patent infringement. Charts and schedules contained here in are only for illustration purposes and may vary depending upon a user's specific application. While the information in this publication has been carefully checked; no responsibility, however, is assumed for inaccuracies.

EXAR Corporation does not recommend the use of any of its products in life support applications where the failure or malfunction of the product can reasonably be expected to cause failure of the life support system or to significantly affect its safety or effectiveness. Products are not authorized for use in such applications unless EXAR Corporation receives, in writing, assurances to its satisfaction that: (a) the risk of injury or damage has been minimized; (b) the user assumes all such risks; (c) potential liability of EXAR Corporation is adequately protected under the circumstances.

Reproduction, in part or whole, without the prior written consent of EXAR Corporation is prohibited.