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FAN3989

USB/Charger Detection Device with Load Switch

Features

- Charger/USB Detection Device with Load Switch
- Charger/USB Device Detection Flag
- Over/Under-Voltage Detection Flag
- Load Switch Output, Up to 1.5A Charge Current
- V_{BUS} Supply: 2.7V to 20V
- C_{ON} : 1.5pF
- Package: 8-Lead MLP

Applications

- Mobile Phones
- Handheld Devices

Related Resources

- [AN-5067 — PCB Land Pattern Design and Surface Mount Guidelines for MLP Packages](#)

Description

The FAN3989 is a USB connection monitoring device used to determine if a standard USB device is connected or a battery-charging device is connected.

The FAN3989 sets the FLAG1 pin to logic HIGH or LOW as an indicator to the system controller that a standard USB device or a charger is connected to the USB port. The FAN3989 also monitors the V_{BUS} for over- or under-voltage conditions. The FLAG2 pin is set LOW if V_{BUS} is less than 3.3V or greater than 6.0V. The internal load switch control pin is set HIGH if V_{BUS} is less than 3.3V or greater than 6.0V, turning off the PMOS switch.

The FAN3989 is available in a very small 8-lead MLP package suitable for small board space applications, like mobile phones.

Ordering Information

| Part Number | Operating Temperature Range | Package | Packing Method | Quantity |
|--------------|-----------------------------|--------------------------------------|----------------|----------|
| FAN3989MLP8X | -40°C to +85°C | 8-Lead Molded Leadless Package (MLP) | Reel | 3000 |

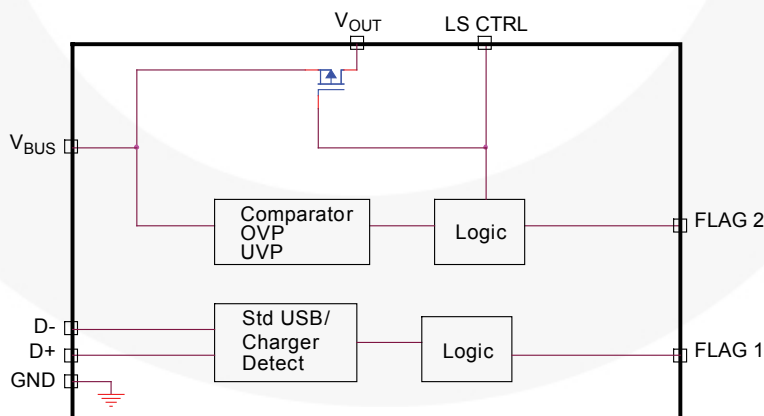


Figure 1. Block Diagram

Pin Configuration

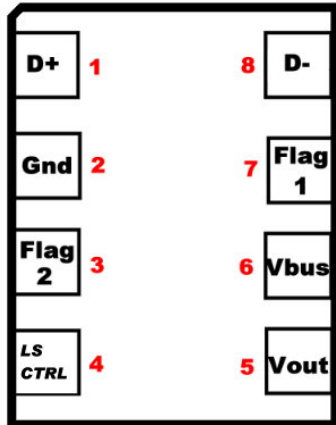


Figure 2. Pin Configuration (Top View)

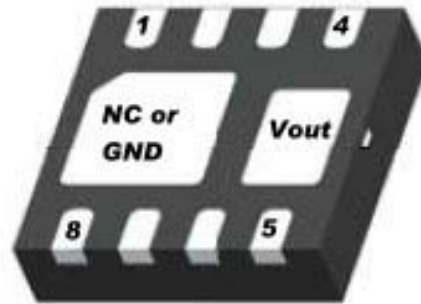


Figure 3. Pin Configuration (Bottom View)

Pin Definitions

| Pin# | Name | Type | Description |
|------|-----------|--------|---|
| 1 | D+ | Input | USB Data Input |
| 2 | GND | Input | Device Ground |
| 3 | Flag2 | Output | Over-/Under-Voltage Flag Output |
| 4 | LSCTRL | Output | PMOS Switch Control – Pull-Up Connection to V_{BUS} |
| 5 | V_{OUT} | Output | Voltage Out – Connection also on Package DAP (see <i>PCB Layout Guideline section</i>) |
| 6 | V_{BUS} | Input | Power Input from Charger, USB Device, or Handheld Battery |
| 7 | Flag1 | Output | Charger / Standard USB Device Detect Flag |
| 8 | D- | Input | USB Data Input |

Truth Table

| Connection State | V_{BUS} | D- | D+ | FLAG1 | FLAG2 | LS CTRL | Description |
|-------------------|-----------|-------------|-------------|-------|-------|---------|----------------------------------|
| STD USB Device | 0V | R to GND | R to VDD | LOW | LOW | HIGH | Load switch open |
| STD USB Device | 5V | R to GND | R to VDD | LOW | HIGH | LOW | Load switch closed |
| USB Charger | 5V | Short to D+ | Short to D- | HIGH | HIGH | LOW | Normal state, load switch closed |
| V_{BUS} GT 6V | GT 6V | Short to D+ | Short to D- | HIGH | LOW | HIGH | Load switch open |
| V_{BUS} LT 3.3V | LT 3.3V | Short to D+ | Short to D- | HIGH | LOW | HIGH | Load switch open |
| PC Charger | 5V | Open | Open | LOW | HIGH | LOW | Load switch closed |

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol | Parameter | Min. | Max. | Unit |
|----------|------------------------|------|--------------|------|
| V_S | DC Supply Voltage | -0.3 | 20.0 | V |
| V_{IO} | Analog and Digital I/O | -0.3 | $V_{CC}+0.3$ | V |

Reliability Information

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|---------------|---|------|------|------|------|
| T_J | Junction Temperature | | | +150 | °C |
| T_{STG} | Storage Temperature Range | -65 | | +150 | °C |
| Θ_{JA} | Thermal Resistance, JEDEC Standard, Multilayer Test Boards, Still Air | | 41 | | °C/W |

Electrostatic Discharge Information

| Symbol | Parameter | Max. | Unit |
|--------|-----------------------------------|------|------|
| ESD | Human Body Model, JESD22-A114 | 3 | kV |
| | Charged Device Model, JESD22-C101 | 1 | |

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|----------|-----------------------------|------|------|------|------|
| T_A | Operating Temperature Range | -40 | | +85 | °C |
| V_{CC} | Supply Voltage Range | 2.7 | 5.0 | 20.0 | V |

DC Electrical Characteristics

$T_A = 25^\circ\text{C}$, $V_{CC} = 5.0\text{V}$, unless otherwise noted.

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Units |
|-------------------------------|-----------------------------------|---|------|------|------|---------------|
| Supply | | | | | | |
| V_S | Supply Voltage Range | V_S Range | 2.7 | 5.0 | 20.0 | V |
| I_{CC} | Quiescent Supply Current | $V_S = +5.0\text{V}$, D+ D- Shorted | | 1.2 | 2.0 | mA |
| t_{SUPPLY} | Power-Up Stabilization Time | $V_S = +5.0\text{V}$, D+ D- Shorted | | 10 | | ms |
| Input Characteristics | | | | | | |
| C_{D+} | Input Capacitance | | | 1.5 | 2.0 | pF |
| C_{D-} | Input Capacitance | | | 1.5 | 2.0 | pF |
| $I_{off\ D+}$ | Off Leakage Current | $V_{BUS} = 0\text{V}$ or 5V V_{IN} on D+ = 5V | | 1 | | μA |
| $I_{off\ D-}$ | Off Leakage Current | $V_{BUS} = 0\text{V}$ or 5V V_{IN} on D- = 5V | | 1 | | μA |
| Output Characteristics | | | | | | |
| OV_{DETECT} | Over-Voltage Threshold Detect | $V_S = +5.0\text{V}$, Flag2 = LOW | 5.8 | 6.2 | 6.5 | V |
| OV_{HYST} | Over-Voltage Hysteresis | Voltage Sweep through Upper and Lower Trip Points | | 100 | | mV |
| UV_{DETECT} | Under-Voltage Threshold Detect | $V_S = +5.0\text{V}$, Flag2 = LOW | 3.0 | 3.3 | 3.6 | V |
| UV_{HYST} | Under-Voltage Hysteresis | Voltage Sweep through Upper and Lower Trip Points | | 100 | | mV |
| $V_{OH\ FLAG1/FLAG2}$ | Minimum HIGH Output Voltage | $V_S = +5.0\text{V}$, $I_{OH} = -20\mu\text{A}$ | 2.4 | | | V |
| $V_{OL\ FLAG1/FLAG2}$ | Maximum LOW Output Voltage | $V_S = +5.0\text{V}$, $I_{OL} = 20\mu\text{A}$ | | | 0.3 | V |
| $V_{OL\ LS_CTRL}$ | Maximum LOW Output Voltage | $V_S = +5.0\text{V}$, $I_{OL} = 100\mu\text{A}$ | | | 0.3 | V |
| VB_{DSS} | Drain Source Breakdown Voltage | $V_{GS} = 0\text{V}$, $I_D = -250\mu\text{A}$ | -20 | | | V |
| R_{DSON} | Static Drain-Source On Resistance | $V_{GS} = -5.0\text{V}$, $I_P = 1\text{A}$ | | 186 | | m Ω |
| C_{iss} | Input Capacitance | $V_{DS} = -10\text{V}$, $V_{GS} = 0\text{V}$, $f = 1.0\text{MHz}$ | | 330 | | pF |
| C_{oss} | Output Capacitance | | | 80 | | pF |
| $t_{d(on)}$ | PMOS Turn-On Delay Time | $V_{DD} = -5\text{V}$, $I_P = -0.5\text{A}$, | | 5 | | μs |
| $t_{d(off)}$ | PMOS Turn-Off Delay Time | $V_{GS} = -4.5\text{V}$, $R_{GEN} = 6\Omega$ | | 14 | | μs |

Typical Performance Characteristics

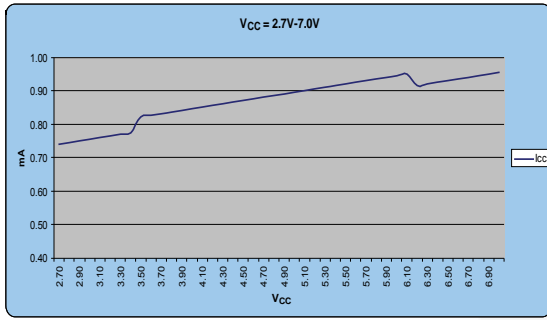


Figure 4. I_{CC} vs. V_{CC} (2.7V-7.0V) No Load

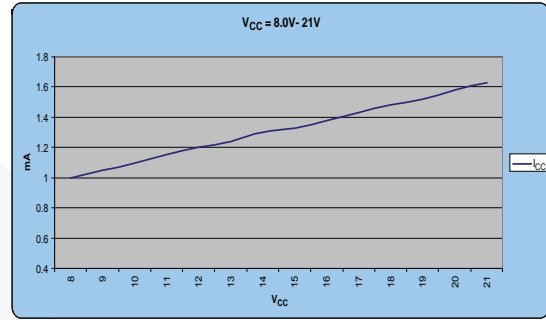


Figure 5. I_{CC} vs. V_{CC} (8.0V-21V) No Load

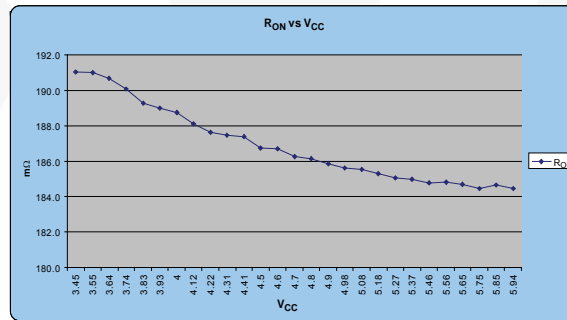


Figure 6. R_{ON} vs. V_{CC} (10Ω Load)

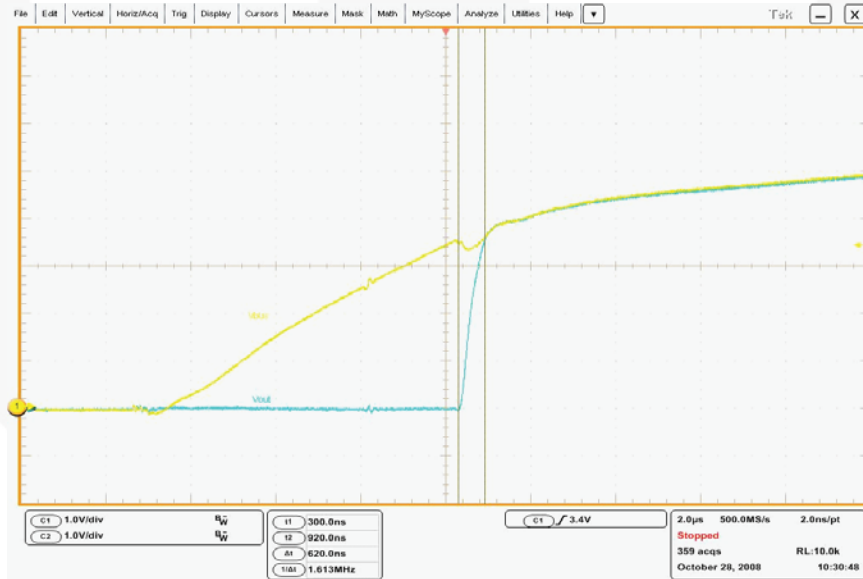


Figure 7. Turn-On Time

Typical Performance Characteristics (Continued)

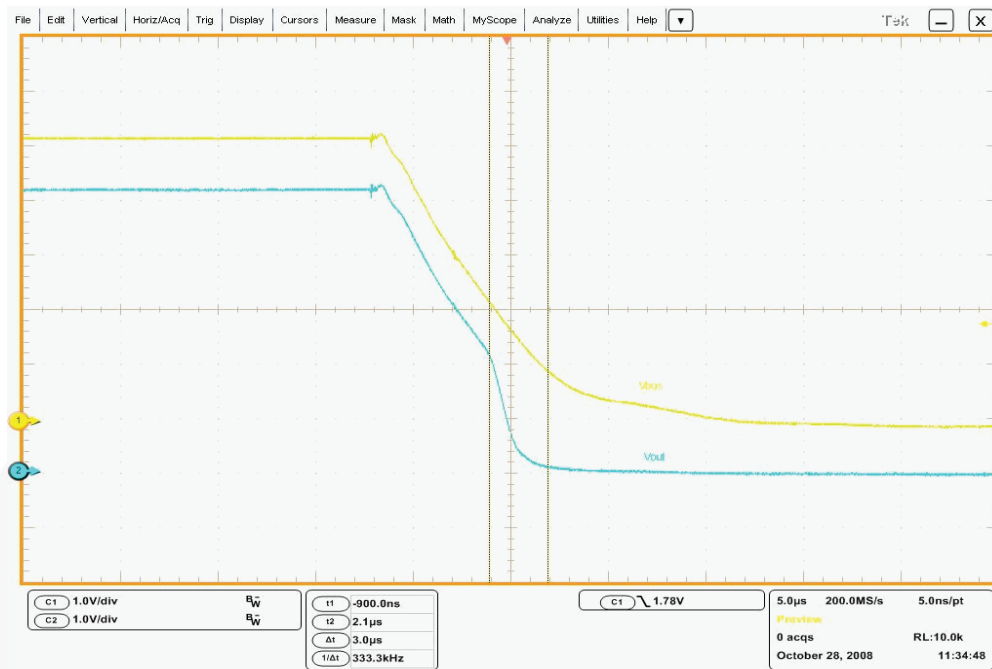


Figure 8. Turn-Off Time

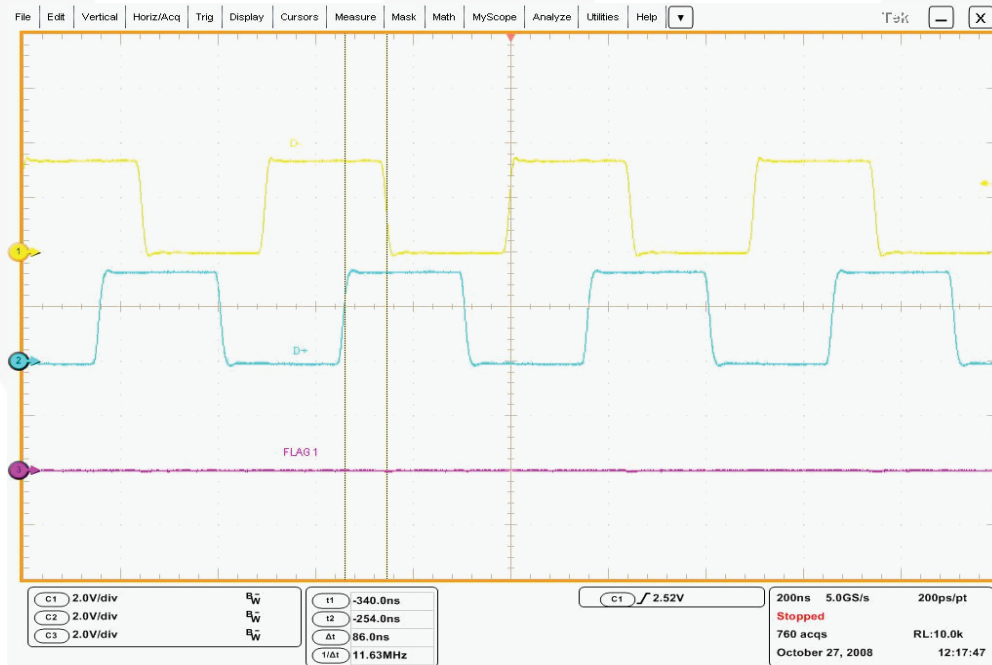


Figure 9. No Fault on Flag 1, Skew=65ns

Typical Performance Characteristics (Continued)

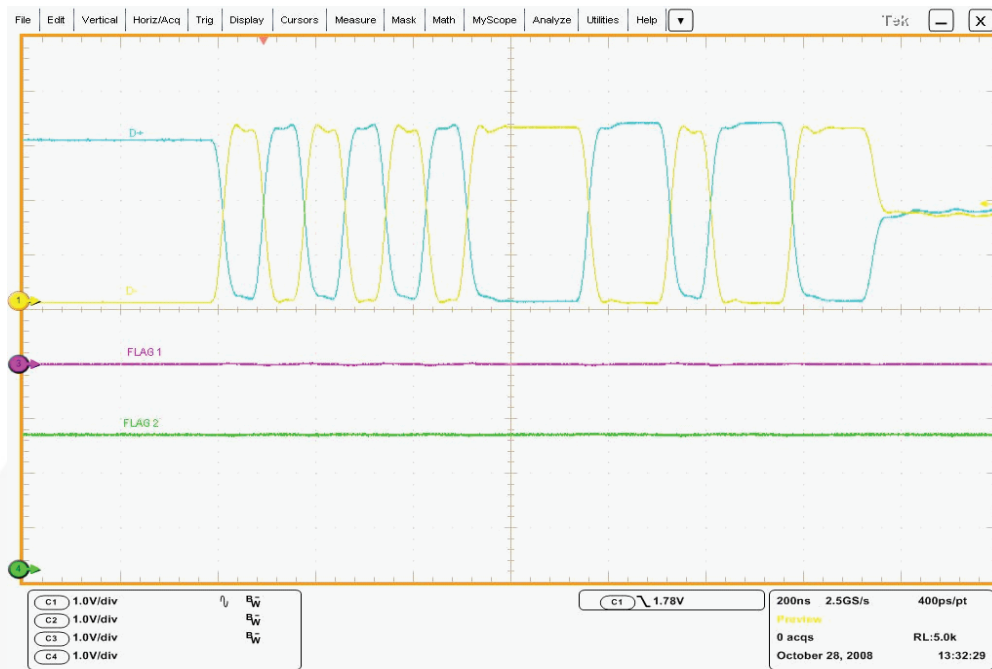


Figure 10. PC Data Running D+/D- (Flag 1 and Flag 2 at Correct Levels)



Figure 11. Standard USB Charger Plug-In

Applications Information (Continued)

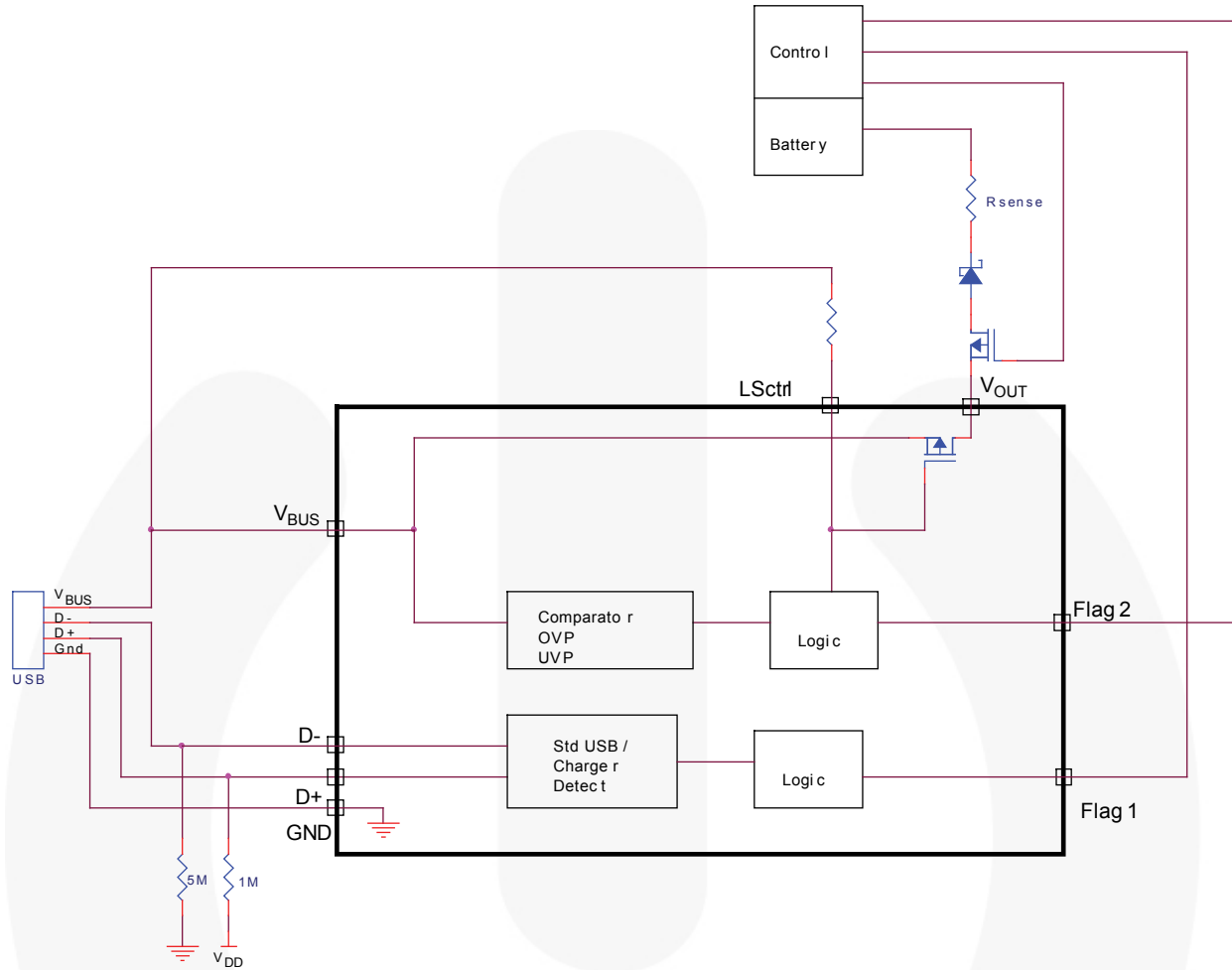


Figure 13. Mobile Phone Battery Charging System without USB Interface

The FAN3989 sets the FLAG1 pin to logic HIGH or LOW as an indicator to the system controller that a standard USB device or a charger is connected to the USB port. The FAN3989 also monitors the V_{BUS} for over- or under-voltage conditions. If V_{BUS} is less than 3.3V or greater than 6.0V, the FLAG2 pin is set LOW and the internal load switch control pin is set HIGH, turning off the PMOS switch.

Where a USB transceiver is not incorporated or there is a switch between the USB port and the FAN3989, external resistors are used to set the correct input logic states on the D+ and D- inputs. A 5MΩ pull-down on the D- line and a 1MΩ pull-up to V_{DD} on the D+ line are recommended. If a charger is plugged into

the USB port (D+ and D- shorted), the voltage divider of 1M and 5M put a voltage of 2.3V on the D+D- inputs and flag1 is HIGH, indicating a charger is connected to port.

If the USB port is connected to a standard USB device, the D+ input is pulled up to V_{DD} and is in parallel with the 1.5KΩ on a USB transceiver with a parallel R value of 1.497KΩ. The D- input is connected to a 15KΩ pull-down by the USB device and in parallel with 5MΩ with a parallel R value of 14.955KΩ. This condition forces flag1 LOW. If D+ and D- are open (floating), D+ is pulled to V_{DD} and D- floats LOW, which forces flag1 LOW.

PCB Layout Guidelines

Please also see Fairchild Semiconductor applications note AN-5067 — PCB Land Pattern Design and Surface Mount Guidelines for MLP Packages

Pad1

This exposed DAP is connected to the internal FET drain and labeled V_{OUT} on the device. The pad should be connected to V_{OUT} pin of the device or left floating. It

should never be connected to the ground, power plane, or Pad2.

Pad2

This exposed DAP is connected to an internal die substrate that is at a ground potential. The pad should be left floating or can be connected to ground plane. This pad should never be connected to Pad1 or the power plane.

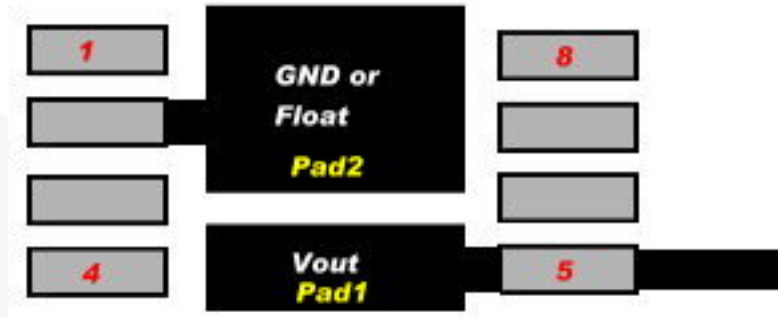
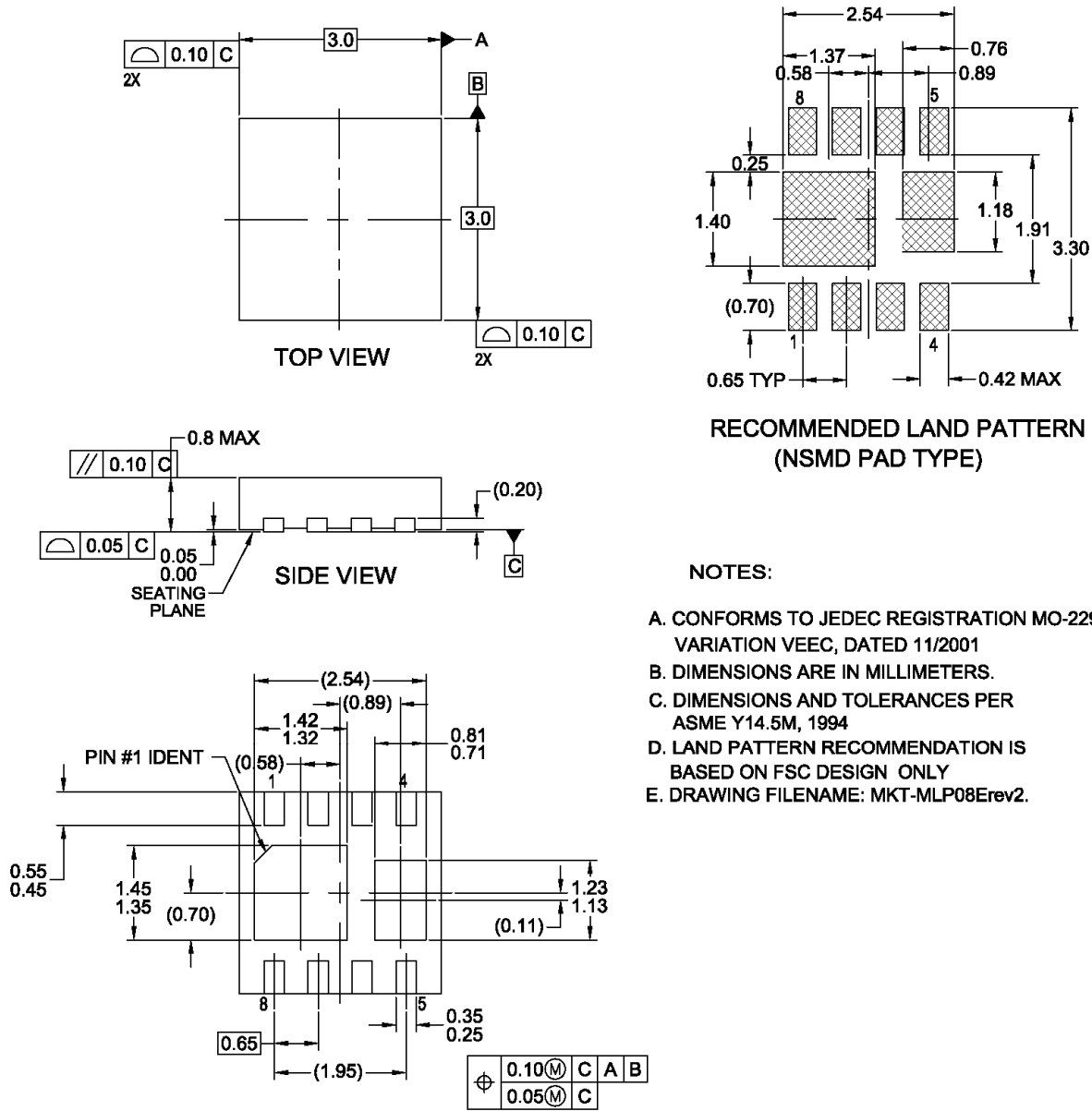


Figure 14. PCD / Pad Layout

Physical Dimensions



RECOMMENDED LAND PATTERN (NSMD PAD TYPE)

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- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
- D. LAND PATTERN RECOMMENDATION IS BASED ON FSC DESIGN ONLY
- E. DRAWING FILENAME: MKT-MLP08Erev2.

Figure 15. 8-Lead Molded Leadless Package (MLP)





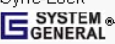
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- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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