

MAX16970/MAX16971

3A Automotive Hi-Speed USB Protectors with Apple iPhone/iPad and USB 2.0 Charge Detection

General Description

The MAX16970/MAX16971 provide high-ESD and short-circuit protection for the low-voltage internal USB data and USB power line in automotive radio, navigation, connectivity, and USB hub applications. The devices support both Hi-Speed USB (480Mbps) and full-speed USB (12Mbps) operation. In addition, the devices also include integrated circuitry to enable fast-charging for consumer devices adhering to either the Apple method or the Hi-Speed USB host-charger port-detection protocol and support USB On-The-Go (OTG).

The short-circuit protection features include short-to-battery on the protected HVBUS, HVD+, and HVD- outputs, as well as short-to-HVBUS on the protected HVD+ and HVD- outputs. The devices are capable of a short-to-battery condition of up to +18V. Short-to-GND and overcurrent protection are also provided on the HVBUS output to protect the internal BUS power rail from overcurrent faults.

Each device features high-ESD protection to $\pm 15\text{kV}$ Air Gap method and $\pm 8\text{kV}$ Contact method on all protected HVBUS, HVD+, and HVD- outputs.

Each device features two low 4.0Ω on-resistance Hi-Speed USB switches, a current-limited low-voltage $31\text{m}\Omega$ BUS switch, and provides an integrated high-voltage external power-switch controller. The BUS switch can start up into large capacitive noncompliant USB loads. The devices also feature an enable input, a fault output, integrated Apple iPhone®/iPad® fast-charging termination resistors, and an integrated host-charger port-detection circuit adhering to the USB 2.0 battery charging specification version 1.2.

The devices are available in 16-pin QSOP and 16-pin (4mm x 4mm) TQFN packages and operate over the -40°C to $+105^\circ\text{C}$ temperature range. The MAX16970GEEA/V+ and MAX16971GEEA/V+ are drop-in compatible with MAX16969DGEE/V+ and MAX16969BGEE/V+, respectively.

iPhone and iPad are registered trademarks of Apple, Inc.

Benefits and Features

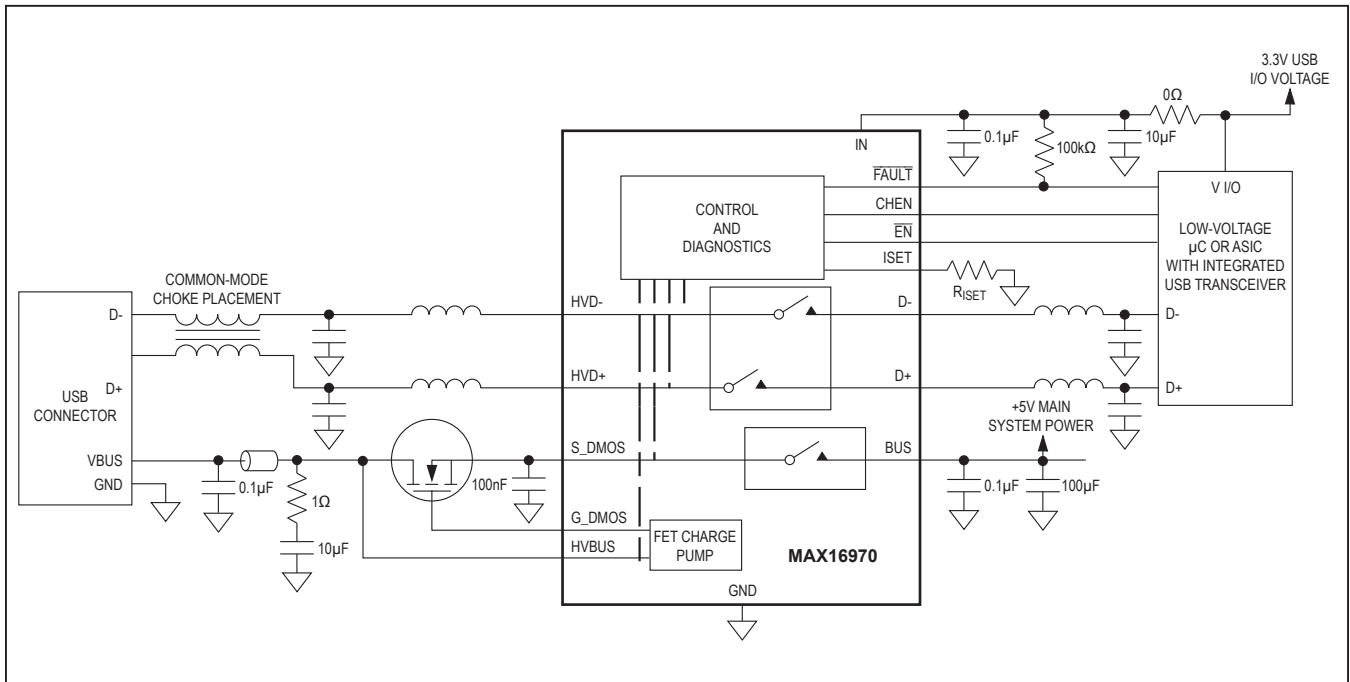
- Minimized Voltage Drop on Bus Line Due to Industry-Leading $\text{RDS}_{(\text{ON})}$ Helps Meet USB Voltage Specifications at Device Connector
 - Current-Limited $31\text{m}\Omega$ (typ) BUS Switch with High-Capacitive Load Capability
- Robust Overvoltage and ESD Protection for Automotive Environment Saves on External Protection Components
 - Short-to-Battery and Short-to-GND Protection on Protected HVBUS Output
 - Short-to-Battery and Short-to-HVBUS Protection on Protected HVD+ and HVD- Outputs
 - Two 4.0Ω (typ) R_{ON} USB 2.0 Data Switches
 - Integrated Overcurrent and Short-Circuit Autoretry
 - High ESD Protection (HVD+, HVD-, HVBUS)
 - $\pm 15\text{kV}$ Human Body Model
 - $\pm 15\text{kV}$ IEC 61000-4-2 Air Gap
 - $\pm 8\text{kV}$ IEC 61000-4-2 Contact
 - 20ms Fault-Blanking Timeout Period
- Automatic Transitioning of Charge Modes Through Intelligent State Machine for Seamless Device Integration
 - Integrated Apple iPhone 1.0A Dedicated Charging Mode
 - Integrated Apple iPad 2.1A Dedicated Charging Mode
 - USB-IF BC1.2 Charging Downstream Port (CDP) and Dedicated Charging Port (DCP) Modes
 - Chinese Telecommunication Industry-Standard YD/T 1591-209
 - USB On-The-Go (OTG) Support
- Drop-In Pin Compatibility with MAX16919/MAX16969 in 16-Pin QSOP Package
- AEC-Q100 Qualified

Applications

- Automotive Radio and Navigation
- USB Hub
- Automotive Connectivity
- Telematics

Typical Operating Circuit and Ordering Information appear at end of data sheet.

Typical Operating Circuit



Ordering Information

PART	PIN-PACKAGE	ENABLE INPUT LOGIC	SUPPORTED MODES
MAX16970 GEEA/V+	16 QSOP	Low	1A/DCP
MAX16970GEEB/V+	16 QSOP	Low	1A/2.1A/DCP, OTG
MAX16970GT E B/V+	16 TQFN-EP*	Low	1A/2.1A/DCP, OTG
MAX16971 GEEA/V+	16 QSOP	High	1A/DCP
MAX16971GEEB/V+	16 QSOP	High	1A/2.1A/DCP, OTG
MAX16971GT E B/V+	16 TQFN-EP*	High	1A/2.1A/DCP, OTG

Note: All devices operate over the -40°C to +105°C temperature range and support CDP/HS modes.

V denotes an automotive qualified part.

+Denotes a lead(Pb)-free/RoHS-compliant package.

*EP = Exposed pad.

Chip Information

PROCESS: BiCMOS

Package Information

For the latest package outline information and land patterns (footprints), go to www.maximintegrated.com/packages. Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

PACKAGE TYPE	PACKAGE CODE	OUTLINE NO.	LAND PATTERN NO.
16 QSOP	E16+11C	21-0055	90-0167
16 TQFN	T1644+4C	21-0139	90-0070

ABRIDGED DATA SHEET

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Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/13	Initial release	—
1	5/14	Updated current-limited BUS switch value in <i>General Description</i> , <i>Features</i> , and <i>Detailed Description</i> sections; removed future product references from <i>Ordering Information</i> ; updated EC table limits for <i>Bus Power On-Resistance</i> , based on new character data taken with copper wires	1, 4, 19
2	1/15	Updated package codes in <i>Package Information</i> table	27
3	2/15	Updated the <i>Benefits and Features</i> section; removed future product designations from <i>Ordering Information</i>	1
4	9/16	Corrected TQFN pin 12 name (from BUS to IN) in <i>Pin Configurations</i>	17

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at www.maximintegrated.com.

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