

## 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  $4.0\Omega$  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  $-40^\circ\text{C}$  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

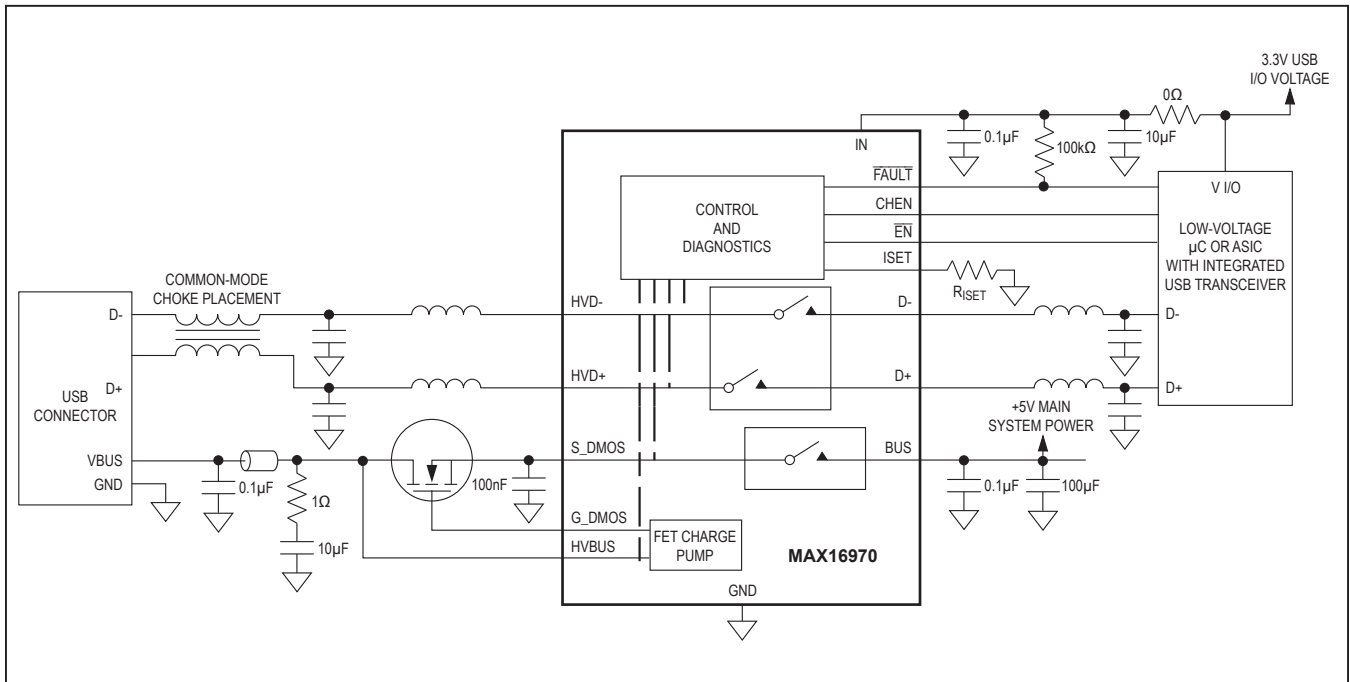
- Minimized Voltage Drop on Bus Line Due to Industry-Leading  $\text{RDS}_{(\text{ON})}$  Helps Meet USB Voltage Specifications at Device Connector
  - Current-Limited  $31\text{m}\Omega$  (typ) BUS Switch with High-Capacitive Load Capability
- Robust Overvoltage and ESD Protection for Automotive Environment 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  $4.0\Omega$  (typ)  $\text{R}_{\text{ON}}$  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
<b>MAX16970</b> GEEA/V+	16 QSOP	Low	1A/DCP
MAX16970GEEB/V+	16 QSOP	Low	1A/2.1A/DCP, OTG
MAX16970GT <b>E</b> B/V+	16 TQFN-EP*	Low	1A/2.1A/DCP, OTG
<b>MAX16971</b> GEEA/V+	16 QSOP	High	1A/DCP
MAX16971GEEB/V+	16 QSOP	High	1A/2.1A/DCP, OTG
MAX16971GT <b>E</b> 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](http://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	<a href="#">21-0055</a>	<a href="#">90-0167</a>
16 TQFN	T1644+4C	<a href="#">21-0139</a>	<a href="#">90-0070</a>

# 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](http://www.maximintegrated.com).

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