**ON Semiconductor®**

ON

*Selection. Service. Support.*
*Power Solutions from ON Semiconductor*

# USB Solutions

Covering protection, filtering and switching devices from ON Semiconductor.

# *Integrated Solutions for USB Line Protection and Termination*

**ON Semiconductor provides a selection of integrated solutions for USB line protection and termination. Integrated IC solutions combine diodes with resistive and capacitive elements into a single package, providing:**
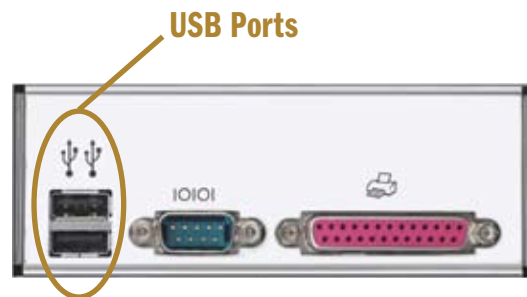
- improved parametric stability
- board space reduction
- reduced parasitic inductance
- simplified supply chain
- component count reduction
- lower overall system cost

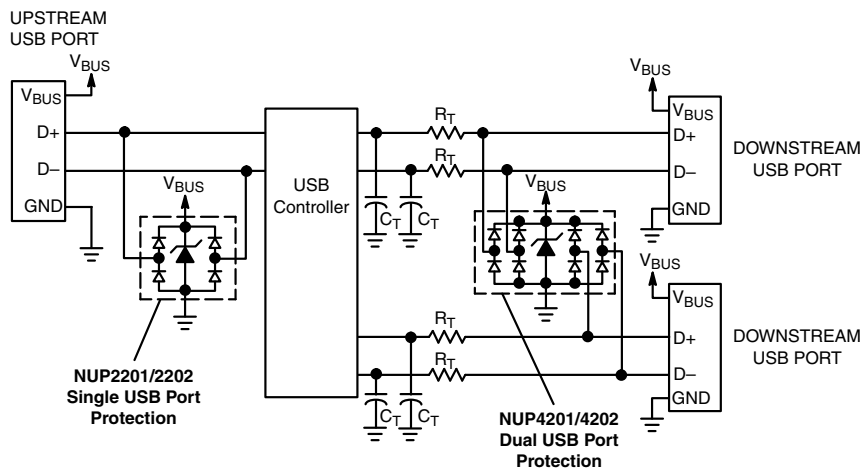**Related Application Notes** (download from www.onsemi.com)
- ESD Protection for Dual USB 2.0 Port Using the Low Capacitance TVS Diode Array, NUP4201DR2 Device – download AND8082/D
- EMI Filtering, USB Upstream Line Termination and ESD Protection Using the STF202 Device – download AND8074/D
- MicroIntegration Technology Solutions for Protection in High Speed I/O Data Lines – download AND8104/D
- Design Considerations for ESD/EMI Filters: (Almost Everything You Wanted to Know About EMI Filters and Were Afraid to Ask) – down load AND8200/D
- Solving EMI and ESD Problems with Integrated Passive Device Low Pass Pi Filters - download AND8026/D

## Speed of Data Transport

| Port | Speed |
|------|-------|
| Serial Port | 0.115 Mbit/s |
| Standard Parallel Port | 0.92 Mbit/s |
| USB 1.1 | |
|    Low Speed | 1.5 Mbit/s |
|    High Speed | 12 Mbit/s |
| USB 2.0 | |
|    Low Speed | 1.5 Mbit/s |
|    Full Speed | 12 Mbit/s |
|    High Speed | 480 Mbit/s |

**USB Ports**
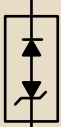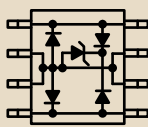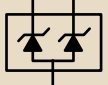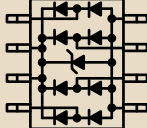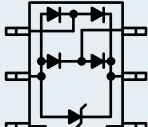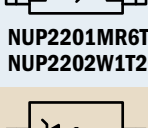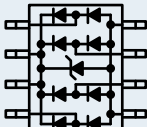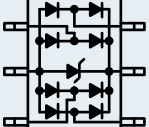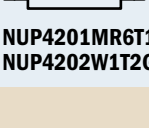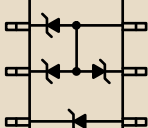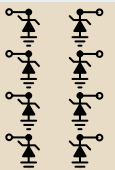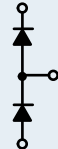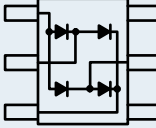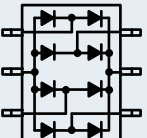
## Typical USB Line Protection Application



UPSTREAM USB PORT

$V_{BUS}$   D+   D−   GND

$V_{BUS}$

**NUP2201/2202 Single USB Port Protection**

USB Controller

$R_T$   $R_T$   $C_T$   $C_T$

$V_{BUS}$   D+   D−   GND   DOWNSTREAM USB PORT

$V_{BUS}$

**NUP4201/4202 Dual USB Port Protection**

$V_{BUS}$   D+   D−   GND   DOWNSTREAM USB PORT

# USB Line Protection Devices
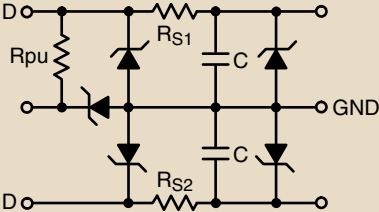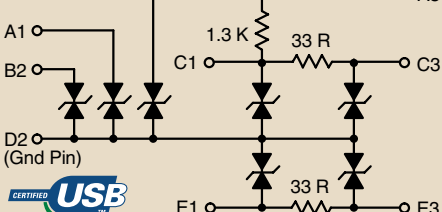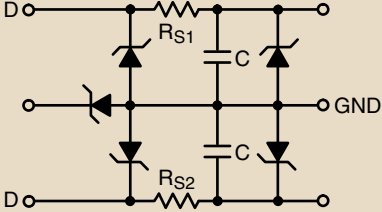
Integrated protection devices for USB from ON Semiconductor can replace up to 9 discrete devices, minimize board space and simplify board layouts. Our portfolio includes Low-, Full- and High-Speed USB solutions. All of our devices are IEC61000-4-2 compliant.

| | 1-Line (1/2 Port) | 2-Lines (1 Port) | 4-Lines (2 Ports) | |
|---|---|---|---|---|
| Low & Full Speed I/O Lines + V$_{BUS}$ | SOT-23 **SL05T1G** ℗; SOD-923 **ESD9A5.0ST5G** ℗ | SO-8 **LC03–6R2**; SOT-723 **ESD7A5.0DT5G*** ℗ | SO-8 **SRDA05–4R2** | |
| Low, Full & High Speed I/O Lines + V$_{BUS}$ | – | TSOP-6 / SC-88 **NUP2201MR6T1G** ℗ **NUP2202W1T2G** ℗ | SO-8 **NUP4201DR2** | TSOP-6 / SC-88 **NUP4201MR6T1G** ℗ **NUP4202W1T2G** ℗ |
| Low, Full & High Speed I/O Lines | – | SOT-563 **NUP4060AXV6T1G** ℗ | DFN-8 **NUP8010MNT1G** ℗ | |
| Low, Full & High Speed I/O Lines | SOT-23 **NUP1301ML3T1G** ℗ | SC-88 **NUP2301MW6T1G** ℗ | TSOP-6 **NUP4301MR6T1G** ℗ **NUP4304MR6T1G** ℗ | |
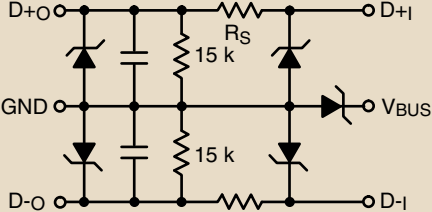
℗ = Symbol denotes 2nd level interconnect Pb-Fee (lead) content.
 * = Coming soon.

# USB Filter Devices

Integrated protection and termination devices for USB from ON Semiconductor can replace up to 11 devices by combining TVS diodes with resistive and capacitive elements. They are suitable for Low- and Full-Speed USB solutions. All of our devices are IEC61000-4-2 Level 4 compliant.

| Upstream Filters | OTG (On-The-Go) | Upstream/Downstream Filters |
|---|---|---|
|  |  |  |
| **STF202-22T1G** [Pb]<br>TSOP-6<br><br>**NUF2221W1T2G** [Pb]<br><br>SC-88<br>SOT-363<br>**NUF2015W1T2G** [Pb] | <br>Flip-Chip<br>**NUF2222FCT1G** [Pb] |  SOT-563<br>**NUF2030XV6T1G** [Pb]<br>30 pF (typ) @ 2.5 V<br>**NUF2042XV6T1G** [Pb]<br>42 pF (typ) @ 2.5 V<br><br> SC-88 SOT-363<br>**NUF2240W1T1G** [Pb]<br>17 pF (typ) @ 2.5 V |

[Pb] = Symbol denotes 2nd level interconnect Pb-Fee (lead) content.

| Downstream Filter |
|---|
|  |
|  TSOP-6<br>**NUF2101MT1G** [Pb]<br>55 pF (typ) @ 0 V |

[Pb] = Symbol denotes 2nd level interconnect Pb-Fee (lead) content.

The integrated solution from ON Semiconductor delivers improved insertion losses since there are lower parasitics compared to discrete solutions which use multiple packages.



**Multiple Discretes**

**ON Semiconductor Integrated ICs Solutions**
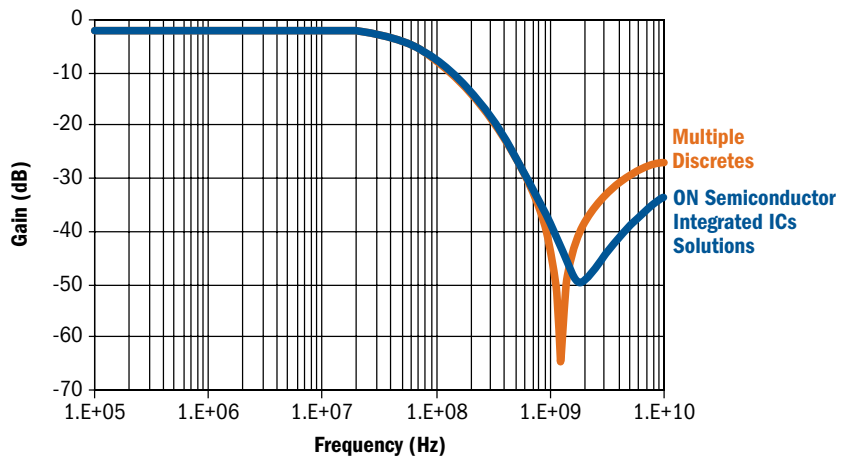
## NLAS7222A Dual SPDT Switch
## <7 pF On Switch Capacitance

**NLAS7222A Dual SPDT WQFN-10 Package**
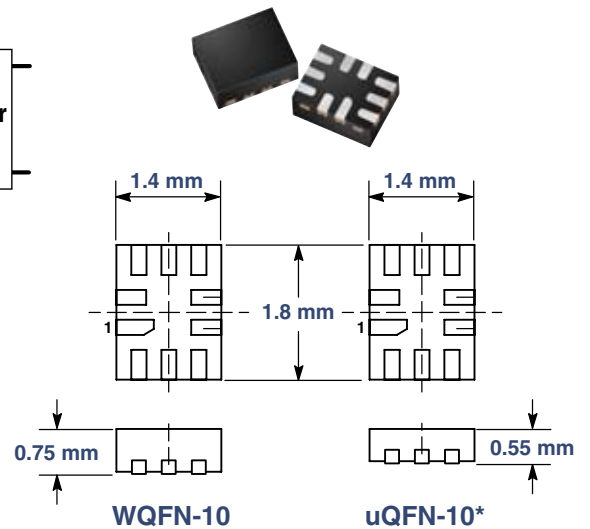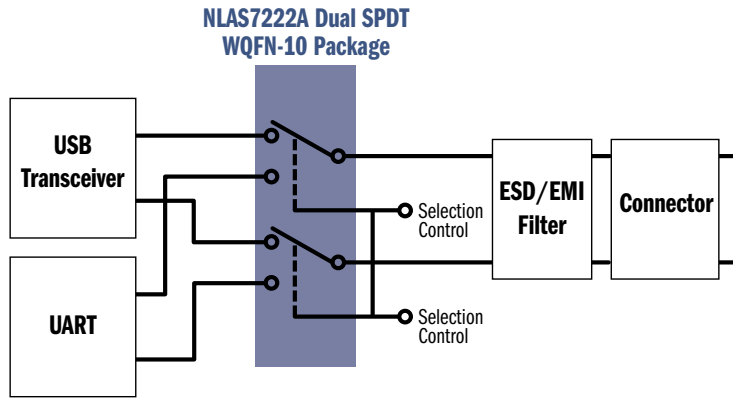


### Key Performance Characteristics

- Passes USB 2.0 High Speed Signals
- 6.5 $\Omega$ Typical $R_{DSon}$ @ 3.0 V
- 500 MHz Bandwidth
- Low Crosstalk: -45 dB @ 250 MHz
- Smallest Package in the Industry

**1.4 mm**     **1.4 mm**

**1.8 mm**

**0.75 mm**     **0.55 mm**

**WQFN-10**     **uQFN-10***

| Device | Configuration | R$_{ON}$ Max (Ω) | C Typ (pF) | Package |
|--------|---------------|------------------|------------|---------|
| **NLAS7222A** | Dual SPDT | 9 | 6.5 | WQFN-10, uDFN-10* |
| **NLAS4717EP** | Dual SPDT | 4.5 | 38 | Flip-Chip 10 |

* Coming Soon

**USB Switching Applications**

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