



# Networking & Telecom Solutions

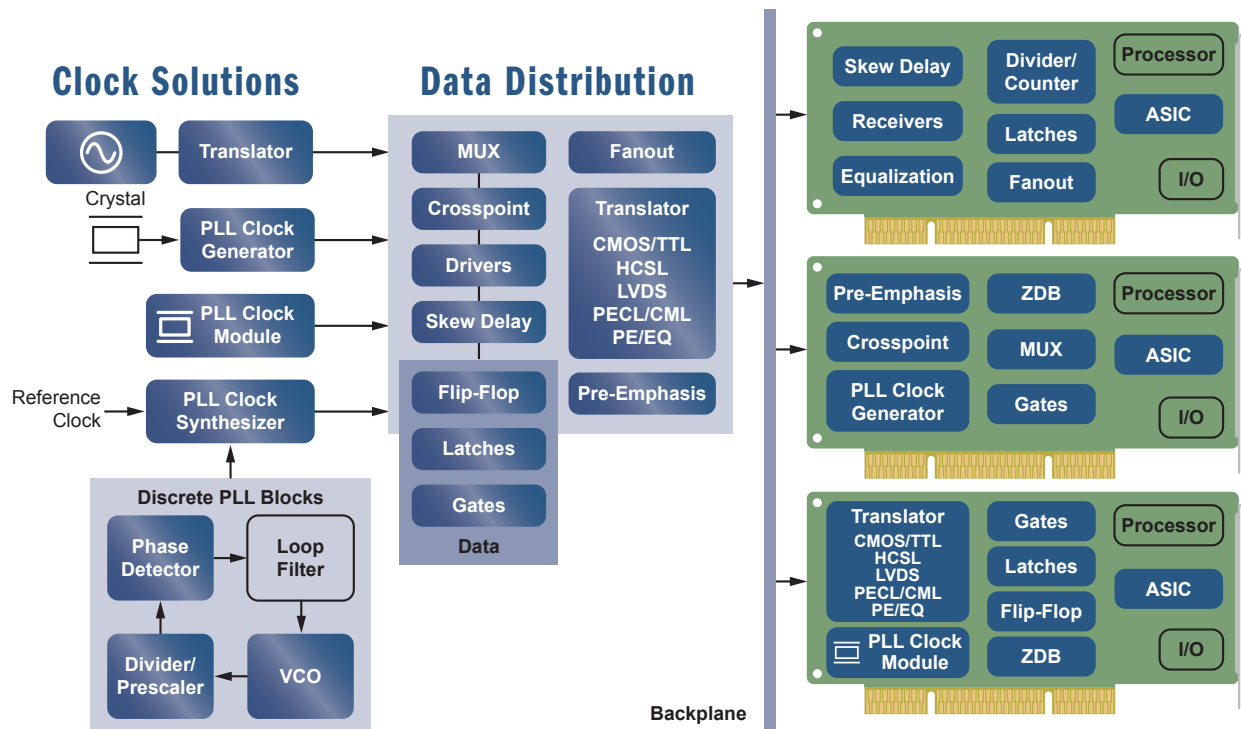
*Power management, protection, and timing solutions for communications infrastructure from ON Semiconductor.*



[www.onsemi.com](http://www.onsemi.com)



## Timing and Data Distribution Subsystem



ON Semiconductor provides a complete portfolio of timing and data management solutions for all aspects of the clock tree. System designers can optimize their clock circuits with industry leading clock distribution devices, demonstrating the industry's lowest jitter and skew. A broad product portfolio, with multiple output and interface options, allows system designers to build clock circuits that satisfy their specific application requirements. ON Semiconductor utilizes CMOS, Bipolar, and SiGe technology to leverage the best performance for any given application. For further details by device, function, or parametrics, refer to our website at [www.onsemi.com](http://www.onsemi.com).

Expanding on more than 30 years of experience as the world's leader in high performance ECL-based clock distribution, ON Semiconductor has extended its expertise into ultra low jitter PLL clock synthesis and generation. The new PureEdge™ PLL devices utilize a fully differential architecture that enables performance that satisfies the timing requirements for the most demanding applications.

### Performance Capabilities

- Differential design for reduced noise
- ECL, PECL, CML, LVDS, HSTL, HCSSL, LVTTTL/LVCMOS outputs for flexible interfacing
- Maximum clock rates >10 GHz
- Maximum data rates >12 Gbps
- Typical jitter as low as 30 fs
- Integrated termination resistors for simplified circuit design
- Edge rates as low as 28 ps
- Low phase noise floor  $\leq -174$  dBc/Hz
- Low skew

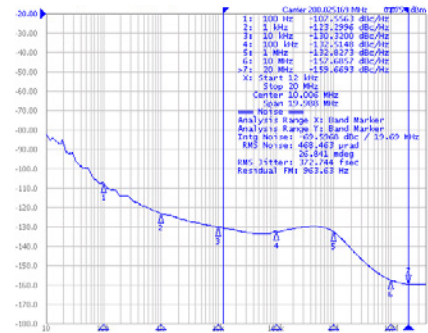


## PLL Clock Synthesizers/Generators



### Features

- Based on phase-locked-loop techniques with zero PPM synthesis error
- Low jitter for high accuracy clock signals
- Available in industrial temperature range -40°C to +85°C
- Supports output interfaces: LVPECL, LVDS, HCSL, LVTTTL/LVCMOS
- Multiple PLLs and multiple output options

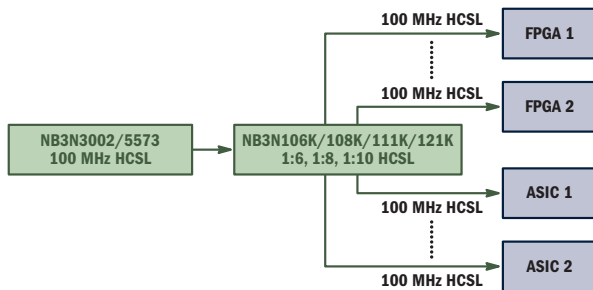


NB3N5573 Typical Phase Noise at Fc = 200 MHz

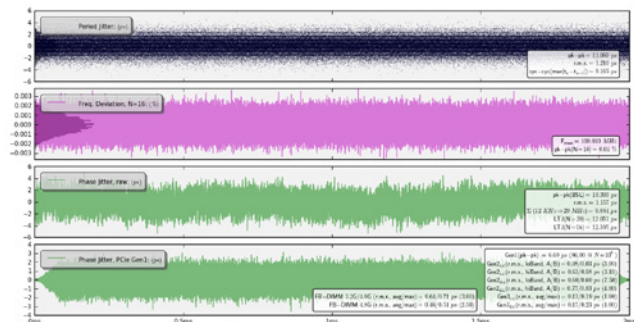
| Device    | Input (MHz) | Output (MHz)   | Application               | Input Level |     |      |        |     | Output Level | Vcc Typ (V) | Package(s) |
|-----------|-------------|----------------|---------------------------|-------------|-----|------|--------|-----|--------------|-------------|------------|
|           |             |                |                           | XTAL        | CML | CMOS | LVPECL | TTL |              |             |            |
| NB3N3002  | 25          | 25/125/200     | CPU/DIMM, PCIe Gen 1,2,3  | ✓           |     | ✓    |        | ✓   | HCSL         | 3.3         | TSSOP-16   |
| NB3N5573  | 25          | 25/100/125/200 | CPU/DIMM, PCIe Gen 1,2,3  | ✓           |     | ✓    |        | ✓   | HCSL         | 3.3         | TSSOP-16   |
| NB3N51032 | 25          | 25/100/125/200 | CPU/DIMM, PCIe Gen 1,2,3  | ✓           |     | ✓    |        | ✓   | HCSL         | 3.3         | TSSOP-16   |
| NB3N3020  | 5 to 27     | 5 to 210       | Network GigE              | ✓           | ✓   | ✓    | ✓      |     | ECL, LVTTTL  | 3.3         | TSSOP-16   |
| NB3N501   | 2 to 50     | 13 to 160      | Networking, Consumer, STB | ✓           |     |      |        |     | CMOS         | 3.3, 5      | SOIC-8     |
| NB3N502   | 2 to 50     | 14 to 120      | Networking, Consumer, STB | ✓           |     | ✓    |        |     | LVC MOS      | 3.3, 5      | SOIC-8     |
| NB4N507A  | 5 to 52     | 50 to 200      | Networking, Consumer, STB | ✓           |     | ✓    |        |     | ECL          | 3.3, 5      | SOIC-16    |
| NB3N508S  | 27          | 216            | VCXO Set Top Box          | ✓           |     | ✓    |        |     | LVDS         | 3.3         | TSSOP-16   |
| NB3N511   | 1 to 50     | 14 to 200      | Networking, Consumer, STB | ✓           |     |      |        |     | CMOS         | 3.3, 5      | SOIC-8     |
| NB3N51034 | 25          | 100/200        | CPU/DIMM, PCIe Gen 1,2,3  | ✓           |     | ✓    |        |     | HCSL         | 3.3         | TSSOP-20   |
| NB3N51044 | 25          | 100/125        | CPU/DIMM, PCIe Gen 1,2,3  | ✓           |     | ✓    |        |     | HCSL         | 3.3         | TSSOP-28   |
| NB3N51054 | 25          | 100            | CPU/DIMM, PCIe Gen 1,2,3  | ✓           |     |      |        |     | HCSL         | 3.3         | TSSOP-24   |

### PCIe Timing Solutions

- PCIe clock synthesizers with single, dual, and quad outputs
- PCIe buffers with 1:6, 1:8, 1:10, and 1:21 fanouts
- Solutions for one, two, six, eight, ten, and twenty-one channel applications available
- Ultra low skew
- Small propagation delay variation (up to 21 output)
- Jitter compliant with PCIe Gen 1,2, 3 specification
- Direct device interface eliminates external termination components and simplifies BOM



PCIe Gen 1, 2, 3 Clock Generation and Distribution



Jitter Results After Fanout

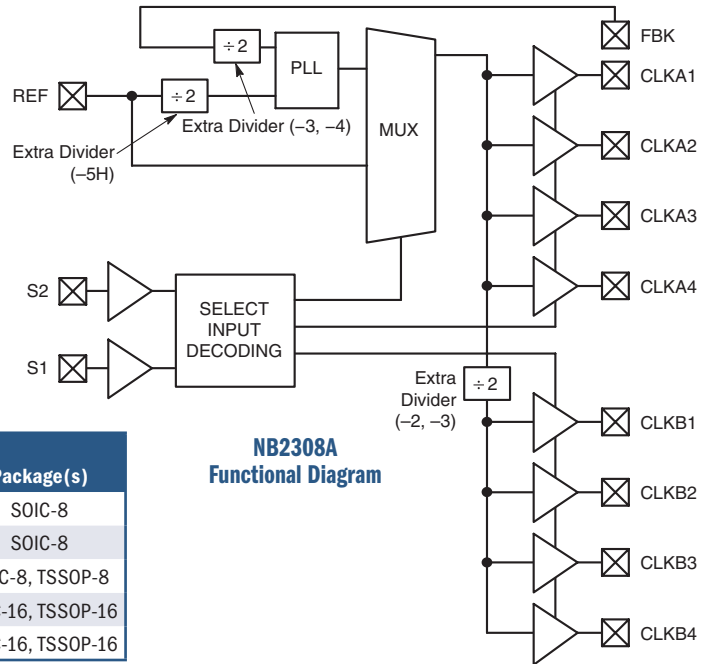
## Zero Delay Buffers



### Features

- Industry standard functions and pin-outs
- Zero input-output propagation delay, adjustable by capacitive load
- Multiple configurations available for maximum flexibility
- Operating frequency to 133 MHz for CPU and PCI compatibility

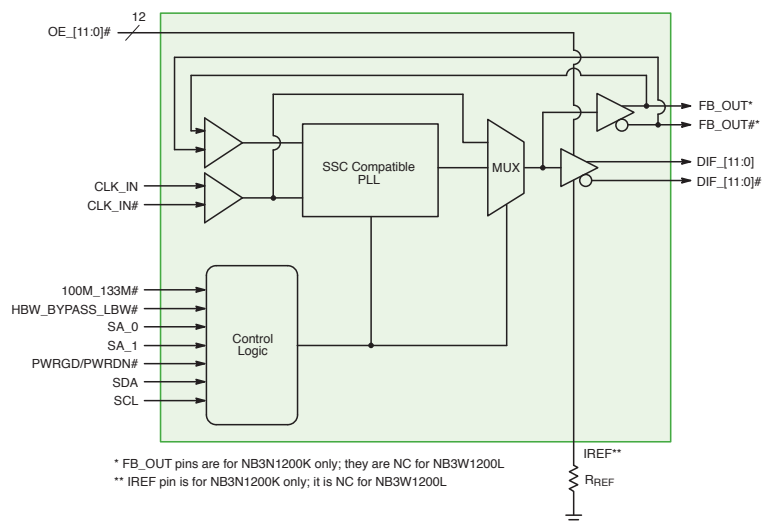
| Device   | Input Level | Output Level | VCC Typ (V) | f <sub>Max</sub> Typ (MHz) | Channels | t <sub>Skew 0-0</sub> Max (ps) | Package(s)        |
|----------|-------------|--------------|-------------|----------------------------|----------|--------------------------------|-------------------|
| NB3N2302 | CMOS        | CMOS         | 3.3, 5      | 133                        | 2        | 250                            | SOIC-8            |
| NB2304A  | CMOS        | CMOS         | 3.3         | 133.3                      | 4        | 200                            | SOIC-8            |
| NB2305A  | CMOS        | CMOS         | 3.3         | 133.3                      | 5        | 250                            | SOIC-8, TSSOP-8   |
| NB2308A  | CMOS        | CMOS         | 3.3         | 133.3                      | 8        | 200                            | SOIC-16, TSSOP-16 |
| NB2309A  | CMOS        | CMOS         | 3.3         | 133.3                      | 9        | 250                            | SOIC-16, TSSOP-16 |



## PCIe Zero Delay Buffers

### Features

- Differential SRC clock support
- NB3N1900K, NB3N1200K: DB1900Z and DB1200Z compliant with 19 and 12 output pairs respectively
- NB3W1200L, NB3W800L: DB1200ZL and DB800ZL compliant with 12 and 8 low power NMOS push-pull output pairs respectively
- NB3W1900L: 19 low power NMOS push-pull output pairs
- Optimized for 100 MHz and 133 MHz to meet PCIe\* Gen 2/Gen 3 and Intel QPI phase jitter specifications
- Spread spectrum compatible for low EMI
- Pseudo-external fixed-feedback for low input-to-output delay variation
- Individual OE control pin for each output
- SMBUS programmability for power down mode, PLL BW modes, PLL/Bypass mode & frequency selection



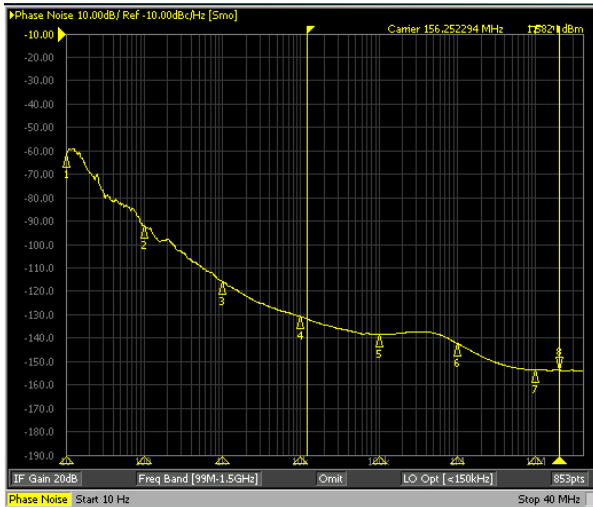
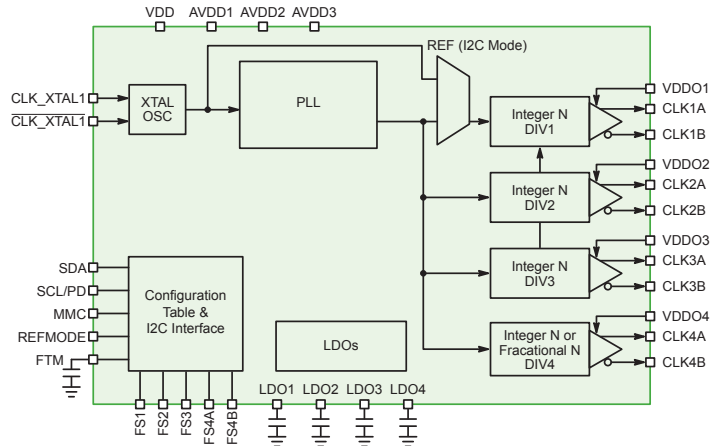
\* FB\_OUT pins are for NB3N1200K only; they are NC for NB3W1200L  
 \*\* IREF pin is for NB3N1200K only; it is NC for NB3W1200L

**NB3N1200K Simplified Block Diagram**

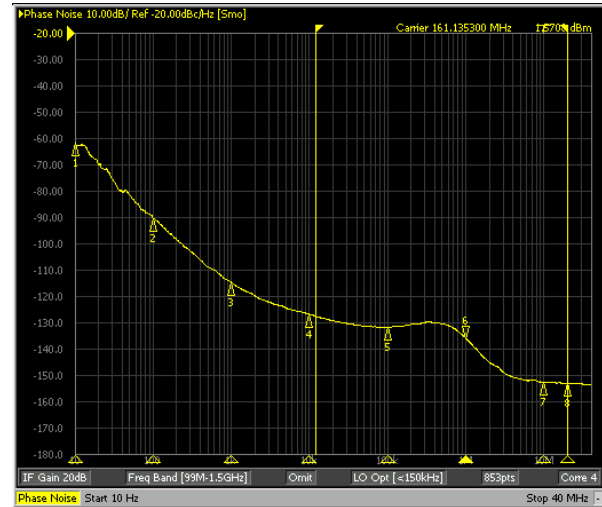
## Low Noise, Programmable Multi-Rate Clock Generator

### NB3H5150 Features

- Uses 25 MHz Crystal or reference input
- External Loop Filter is not required
- User programmable frequencies with four Independent Output Pairs:
  - CLK(1:3) are derived from Integer-N dividers, and CLK4 is derived from either an Integer-N divider or a Fractional-N divider
  - Several different output frequencies can be selected through I2C/SMBus interface or Frequency Select (FSn) pins
- Each output pair can be configured either as two LVCMOS outputs (or) a differential LVPECL pair
- Input supply voltage supports 3.3V or 2.5V operation
- Each output pair has an independent supply voltage rail (VDDOx):
  - For LVCMOS outputs, the supply voltage rail supports 1.8V, 2.5V or 3.3V operation
  - For LVPECL output pairs, the supply voltage rail supports 2.5V or 3.3V operation
- PLL Bypass Mode and Power Down Mode
- QFN-32 package
- -40°C to +85°C Ambient Operation Temp



**Integer-N Output RMS Phase Jitter = 233 fs !!**  
**Integer-N Output Phase Noise (Max) = 300 fs**  
**Integration range = 12 kHz - 20 MHz**



**Fractional-N Output RMS Phase Jitter = 371 fs !!**  
**Fractional-N Output Phase Noise (Max) = 1 ps**  
**Integration range = 12 kHz - 20 MHz**

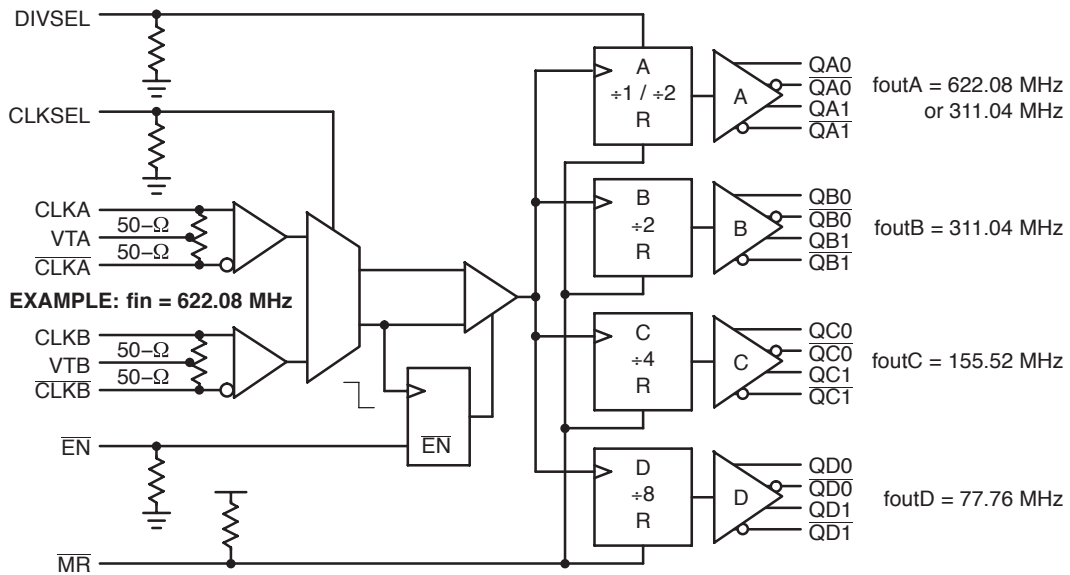
## Dividers and Counters



### Features

- Low jitter and skew for highly accurate phase matching
- Multiple outputs and ratios combined for integrated circuit designs
- Supports interface and voltage translation

| Device   | Input Level |      |        |      | Output Level | VCC Typ (V) | f <sub>Max</sub> Typ (GHz) | Div Ratios        | Package(s) |
|----------|-------------|------|--------|------|--------------|-------------|----------------------------|-------------------|------------|
|          | CML         | CMOS | LVPECL | LVDS |              |             |                            |                   |            |
| NB4L339  | ✓           |      | ✓      | ✓    | ECL          | 2.5, 3.3    | 0.7                        | 1 or 2; 2; 4; 8   | QFN-32     |
| NB7V32M  | ✓           |      | ✓      | ✓    | CML          | 1.8, 2.5    | 10                         | 2                 | QFN-16     |
| NB7N017M | ✓           |      | ✓      | ✓    | CML          | 3.3         | 3.5                        | 2 to 256          | QFN-16     |
| NB7L32M  | ✓           |      | ✓      | ✓    | CML          | 2.5, 3.3    | 14                         | 2                 | QFN-16     |
| NB6N239S | ✓           | ✓    | ✓      | ✓    | LVDS         | 3.3         | 3                          | 1/2/4/8; 2/4/8/16 | QFN-16     |
| NB6L239  | ✓           | ✓    | ✓      | ✓    | ECL          | 2.5, 3.3    | 3                          | 1/2/4/8; 2/4/8/16 | QFN-16     |

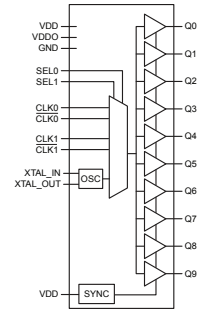


NB4L339 Functional Diagram

# Clock and Data Distribution

## Features

- Complete portfolio of fanout buffers, multiplexers, cross point switches
- Supporting frequencies from DC to 12 GHz/Gbps
- Device noise floor as low as -174 dBc
- Pre-Emphasis and Equalization blocks available
- Offer new direct X-tal interface capabilities
- Industry leading additive jitter as low as 30 fs typical
- Industry leading output-to-output skew as low as 3 ps minimum
- Wide offering of voltage and interface translation:
  - ECL, PECL, CML, LVPECL, LVDS, M-LVDS, HSTL, HCSL, LVCMOS/LVTTL
- Power supply 1.5 V, 1.8 V, 2.5 V, 3.3 V, 5.0 V



**NB3F8L3010C**  
Functional Diagram

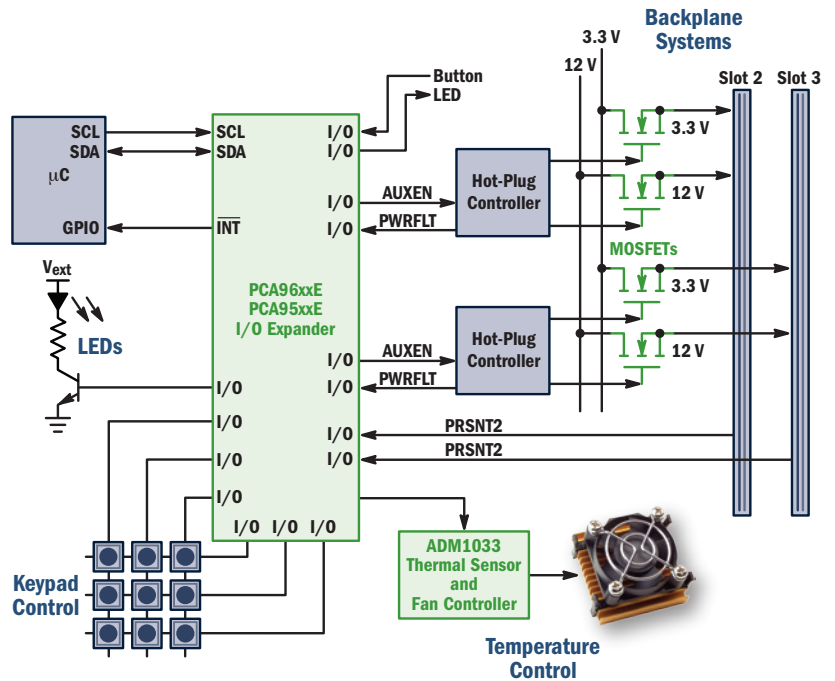
| Device                       | Outputs per Channel | Output Level          | Input Level |      |        |      |      |      |      |     | V <sub>cc</sub> Typ (V) | t <sub>skew</sub> 0-0 (ps) | f <sub>Max</sub> Typ (GHz) | Package(s)             |
|------------------------------|---------------------|-----------------------|-------------|------|--------|------|------|------|------|-----|-------------------------|----------------------------|----------------------------|------------------------|
|                              |                     |                       | CML         | CMOS | LVPECL | HCSL | HSTL | LVDS | XTAL | TTL |                         |                            |                            |                        |
| NB3N106K/08K<br>NB3N111K/21K | 6, 8, 10, 21        | HCSL                  |             | ✓    | ✓      | ✓    | ✓    | ✓    | ✓    | ✓   | 3.3                     | 100                        | 0.4                        | QFN-52, QFN-32, QFN-24 |
| NB3L83948C                   | 12                  | CMOS                  |             | ✓    |        | ✓    | ✓    | ✓    |      | ✓   | 2.5, 3.3                | 25                         | 0.35                       | LQFP-32                |
| NB3V8312C                    | 12                  | CMOS                  |             | ✓    |        |      |      |      |      | ✓   | 1.8, 2.5, 3.3           | 150                        | 0.25                       | LQFP-32                |
| NB3F8L3010C                  | 10                  | CMOS                  |             | ✓    | ✓      | ✓    | ✓    | ✓    | ✓    | ✓   | 1.5, 1.8, 2.5, 3.3      | 55                         | 0.2                        | QFN-32                 |
| NB3M8T3910G                  | 10                  | HCSL, CMOS, LVDS, ECL |             |      | ✓      | ✓    |      | ✓    |      |     | 2.5, 3.3                | 50                         | 1.4                        | QFN-48                 |
| NB7L111M                     | 10                  | CML                   | ✓           | ✓    | ✓      |      |      | ✓    |      | ✓   | 2.5, 3.3                | 20                         | 5.5                        | QFN-52                 |
| NB7L1008/M                   | 8                   | ECL/CML               | ✓           |      | ✓      |      |      | ✓    |      |     | 2.5, 3.3                | 20/25                      | 7/8                        | QFN-32                 |
| NB7V585M                     | 6                   | CML                   | ✓           |      | ✓      |      |      | ✓    |      |     | 1.8, 2.5                | 30                         | 7                          | QFN-32                 |
| NB7V586M                     | 6                   | CML                   | ✓           |      | ✓      |      |      | ✓    |      |     | 1.8                     | 30                         | 6                          | QFN-32                 |
| NB7VQ1006M                   | 6                   | CML                   | ✓           |      | ✓      |      |      | ✓    |      |     | 1.8, 2.5                | 1                          | 7.5                        | QFN-24                 |
| NB3F8L3005C                  | 5                   | CMOS                  |             | ✓    | ✓      | ✓    | ✓    | ✓    | ✓    | ✓   | 1.5, 1.8, 2.5, 3.3      | 55                         | 0.2                        | QFN-32                 |
| NB3L853141                   | 5                   | ECL                   | ✓           | ✓    | ✓      | ✓    | ✓    | ✓    |      | ✓   | 2.5, 3.3                | 30                         | 700                        | TSSOP-20               |
| NBSG14                       | 5                   | ECL                   | ✓           | ✓    | ✓      |      |      | ✓    |      | ✓   | 2.5, 3.3                | 15                         | 12                         | QFN-16, BGA-16         |
| NB3M8302C/04C                | 2, 4                | CMOS, TTL             |             | ✓    |        |      |      |      |      | ✓   | 2.5, 3.3                | 45, 85                     | 0.2                        | SOIC-8                 |
| NB3N853501E                  | 4                   | ECL                   |             | ✓    |        |      |      |      |      |     | 3.3                     | 30                         | 0.266                      | TSSOP-20               |
| NB3N853531E                  | 4                   | ECL                   |             | ✓    |        |      |      |      | ✓    | ✓   | 3.3                     | 30                         | 0.266                      | TSSOP-20               |
| NB6HQ14M                     | 4                   | CML                   | ✓           | ✓    | ✓      |      |      | ✓    |      | ✓   | 2.5                     | 3                          | 5                          | QFN-16                 |
| NB6L14/M                     | 4                   | ECL/CML               | ✓           | ✓    | ✓      |      |      | ✓    |      | ✓   | 2.5, 3.3                | 20                         | 3                          | QFN-16                 |
| NB6L14S/N14S                 | 4                   | LVDS                  | ✓           | ✓    | ✓      |      | ✓    | ✓    |      | ✓   | 2.5/3.3                 | 20                         | 2                          | QFN-16                 |
| NB7HQ14M                     | 4                   | CML                   | ✓           |      | ✓      |      |      | ✓    |      |     | 2.5                     | 15                         | 7                          | QFN-16                 |
| NB7L14/M                     | 4                   | ECL/CML               | ✓           | ✓    | ✓      |      |      | ✓    |      | ✓   | 2.5, 3.3                | 15                         | 7/8                        | QFN-16                 |
| NB4L339                      | 2                   | ECL                   | ✓           |      | ✓      |      |      | ✓    |      |     | 2.5, 3.3                | 60                         | 0.7                        | QFN-32                 |
| NB4N11M                      | 2                   | CML                   | ✓           | ✓    | ✓      |      |      | ✓    |      | ✓   | 3.3                     | 25                         | 2.5                        | TSSOP-8                |
| NB6L11                       | 2                   | ECL                   | ✓           | ✓    | ✓      |      |      | ✓    |      | ✓   | 2.5, 3.3                | 15                         | 6                          | TSSOP-8, SOIC-8        |
| NB6L11M                      | 2                   | CML                   | ✓           | ✓    | ✓      |      |      | ✓    |      | ✓   | 2.5, 3.3                | 15                         | 2                          | QFN-16                 |
| NB6L11S                      | 2                   | LVDS                  | ✓           | ✓    | ✓      |      | ✓    | ✓    |      | ✓   | 3.3                     | 25                         | 2                          | QFN-16                 |
| NB6L611                      | 2                   | ECL                   | ✓           | ✓    | ✓      |      |      | ✓    |      | ✓   | 2.5, 3.3                | 15                         | 3                          | QFN-16                 |
| NB7L11M                      | 2                   | CML                   | ✓           | ✓    | ✓      |      |      | ✓    |      | ✓   | 2.5, 3.3                | 15                         | 8                          | QFN-16                 |
| NB7L72M                      | 2                   | CML                   | ✓           | ✓    | ✓      |      |      | ✓    |      | ✓   | 2.5, 3.3                | 10                         | 8.5                        | QFN-16                 |
| NB7L572                      | 2                   | CML                   | ✓           | ✓    | ✓      |      |      | ✓    |      | ✓   | 2.5, 3.3                | 15                         | 7                          | QFN-32                 |
| NB3L8504S                    | 4                   | LVDS                  | ✓           |      | ✓      | ✓    | ✓    | ✓    |      |     | 2.5, 3.3                | 50                         | 0.7                        | TSSOP-16               |
| NB3L8543S                    | 4                   | LVDS                  | ✓           |      | ✓      | ✓    | ✓    | ✓    |      |     | 2.5, 3.3                | 40                         | 0.65                       | TSSOP-20               |
| NB3L8533                     | 4                   | LVPECL                | ✓           |      | ✓      | ✓    | ✓    | ✓    |      |     | 2.5, 3.3                | 30                         | 0.65                       | TSSOP-20               |
| NB3L208K                     | 8                   | HCSL                  |             |      | ✓      | ✓    |      | ✓    |      |     | 2.5, 3.3                | 100                        | 0.35                       | QFN-32                 |
| NB3U1548C                    | 4                   | LVCMOS, LVTTL         |             | ✓    |        |      |      |      |      | ✓   | 1.5, 1.8, 2.5, 3.3      | 250                        | 0.16                       | TSSOP-8, SOIC-8        |
| NB3N4666C*                   | 4                   | LVCMOS, LVTTL         |             |      | ✓      | ✓    |      | ✓    |      |     | 3.3                     | 50                         | 0.2                        | TSSOP-16, QFN-16       |
| NB3V1102C/3C<br>NB3V1104C/6C | 2, 3, 4, 6          | LVCMOS                |             | ✓    |        |      |      |      |      |     | 1.8, 2.5, 3.3           | 50                         | 0.25                       | TSSOP-14, 8            |
| NB7VQ572M                    | 2                   | CML                   | ✓           |      | ✓      |      |      | ✓    |      |     | 1.8, 2.5                | 15                         | 5                          | QFN-32                 |
| NBSG11                       | 2                   | ECL                   | ✓           | ✓    | ✓      |      |      | ✓    |      | ✓   | 2.5, 3.3                | 15                         | 12                         | QFN-16, BGA-16         |
| NB6L56                       | 1                   | ECL                   | ✓           |      | ✓      |      |      | ✓    |      |     | 2.5, 3.3                | 25                         | 2.5                        | QFN-32                 |

\* Pending 4Q15

## Cascadable I/O Expanders

### Key Features

- I2C and SMBus interfaces
- 1 MHz SCL clock frequency
- 30 mA SDA sink capability



| Device   | I/O | Cascadable                      | Vcc Min (V) | Vcc Max (V) | Interrupt Output | I/O Pullups | LED Blink/PWM | Package                    |
|----------|-----|---------------------------------|-------------|-------------|------------------|-------------|---------------|----------------------------|
| PCA9535E | 16  | 64 Programmable Slave Addresses | 1.65        | 5.5         | ✓                |             |               | QFN-24, SOIC-24, TSSOP-24  |
| PCA9655E | 16  | 64 Programmable Slave Addresses | 1.65        | 5.5         | ✓                |             |               | QFN-24, SOIC-24, TSSOP-24  |
| PCA9654E | 8   | 8 Slave ID Addresses            | 1.65        | 5.5         | ✓                | ✓           |               | SOIC-16, WQFN-16, TSSOP-16 |

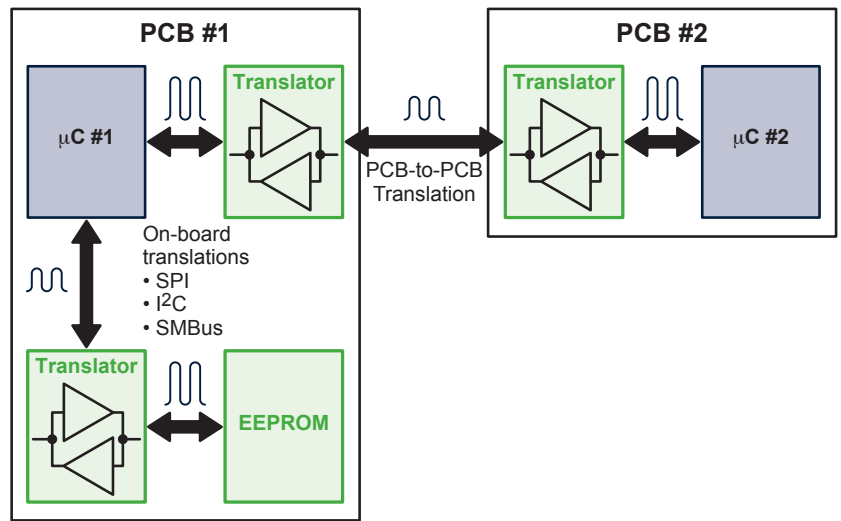


## Logic Translators

Dual supply voltage logic translators connect ICs and PCBs together that operate at different supply voltages.

### Key Features

- Industry's first devices with independent power supplies ( $V_L < V_{CC}$ ,  $V_L = V_{CC}$ , or  $V_L > V_{CC}$ )
- High 100 pF capacitive drive capability
- Overvoltage tolerant enable and I/O pins
- Non-preferential power-up sequencing
- Power-off protection

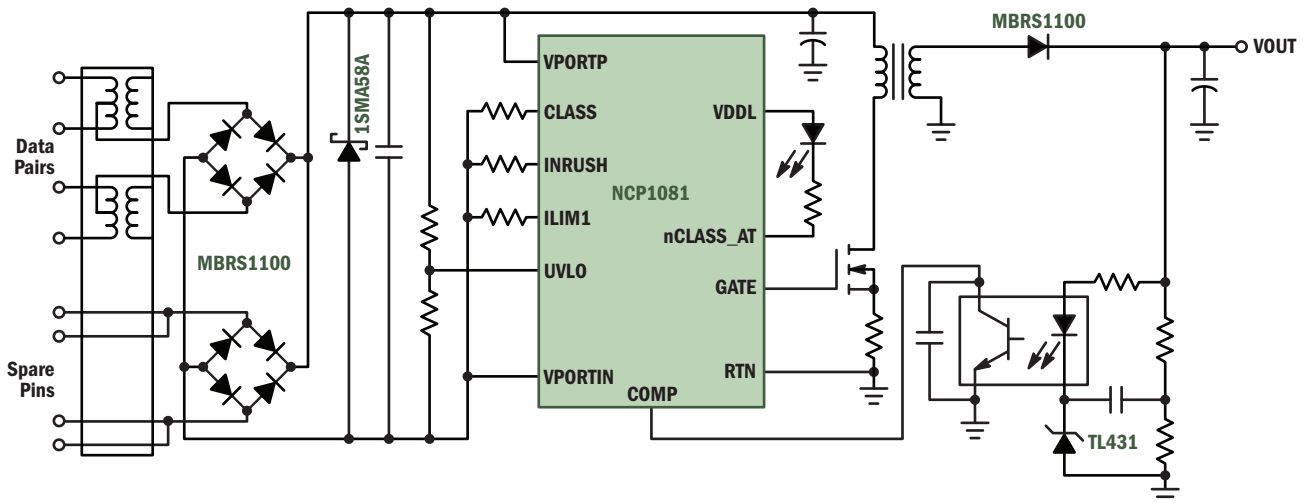


|                                       | Unidirectional Translator   | Autosense Bidirectional Translator (Push-Pull Output)   | Autosense Bidirectional Translator (Open-Drain Output)   | Bidirectional Translator (with Direction Pin)  |
|---------------------------------------|---|---|--|--|
| Block Diagram                         |   |   |  |  |
| Attributes                            | <ul style="list-style-type: none"> <li>• High Data Rate</li> <li>• Low Power Consumption</li> </ul>   | <ul style="list-style-type: none"> <li>• High Data Rate</li> <li>• Low Power Consumption</li> </ul>   | <ul style="list-style-type: none"> <li>• High Data Rate</li> <li>• Low Power Consumption</li> <li>• Flexible PCB Design</li> </ul>   | <ul style="list-style-type: none"> <li>• High Data Rate</li> <li>• Low Power Consumption</li> <li>• Flexible PCB Design</li> </ul>   |
| Trade-Offs                            | <ul style="list-style-type: none"> <li>• Fixed Input &amp; Output Pins</li> </ul>   | <ul style="list-style-type: none"> <li>• Modest Output Current</li> </ul>   | <ul style="list-style-type: none"> <li>• Modest Bandwidth</li> </ul>   | <ul style="list-style-type: none"> <li>• Directional Control Pin Required</li> </ul>   |
| Applications                          | <ul style="list-style-type: none"> <li>• SPI</li> <li>• GPIO</li> </ul>   | <ul style="list-style-type: none"> <li>• SPI</li> <li>• GPIO</li> </ul>   | <ul style="list-style-type: none"> <li>• I2C, SMBus, PMBus</li> <li>• GPIO</li> <li>• SDIO Cards</li> <li>• 1-Wire Bus</li> </ul>  | <ul style="list-style-type: none"> <li>• GPIO</li> </ul>   |
| Sample Device (I/O Channels, Package) | <ul style="list-style-type: none"> <li>• NLSV1T34 (1-Bit, ULLGA-6)</li> <li>• NLSV1T240/244 (1-Bit, UDFN-6)</li> <li>• NLSV2T240/244 (2-Bit, UDFN-8)</li> <li>• NLSV4T240/244 (4-Bit, UDFN-12)</li> <li>• NLSV4T3234 (4-Bit, CSP-11)</li> <li>• NLSV8T240/244 (8-Bit, UDFN-20)</li> </ul> | <ul style="list-style-type: none"> <li>• NLSX3012 (2-Bit, UDFN-8)</li> <li>• NLSX3014 (4-Bit, UQFN-12)</li> <li>• NLSX3013 (8-Bit, CSP-20)</li> <li>• NLSX3018 (8-Bit, UDFN-20)</li> <li>• NLSX4014 (4-Bit, UQFN-12)</li> <li>• NLSX5011 (1-Bit, ULLGA-6, UDFN-6)</li> <li>• NLSX5012 (2-Bit, UDFN-8)</li> <li>• NLSX5014 (4-Bit, UDFN-12)</li> </ul> | <ul style="list-style-type: none"> <li>• NLSX3373 (2-Bit, UDFN-8)</li> <li>• NLSX3378 (4-Bit, CSP-12)</li> <li>• NLSX4373 (2-Bit, UDFN-8)</li> <li>• NLSX4378 (4-Bit, CSP-12)</li> </ul> | <ul style="list-style-type: none"> <li>• NLSV1T45 (1-Bit, ULLGA-6)</li> <li>• NLSV2T245 (2-Bit, UQFN-10)</li> <li>• NLSV2T3236 (2-Bit, UQFN-10)</li> <li>• NLA16T245 (16-Bit, TSSOP-48)</li> </ul> |

## Power over Ethernet

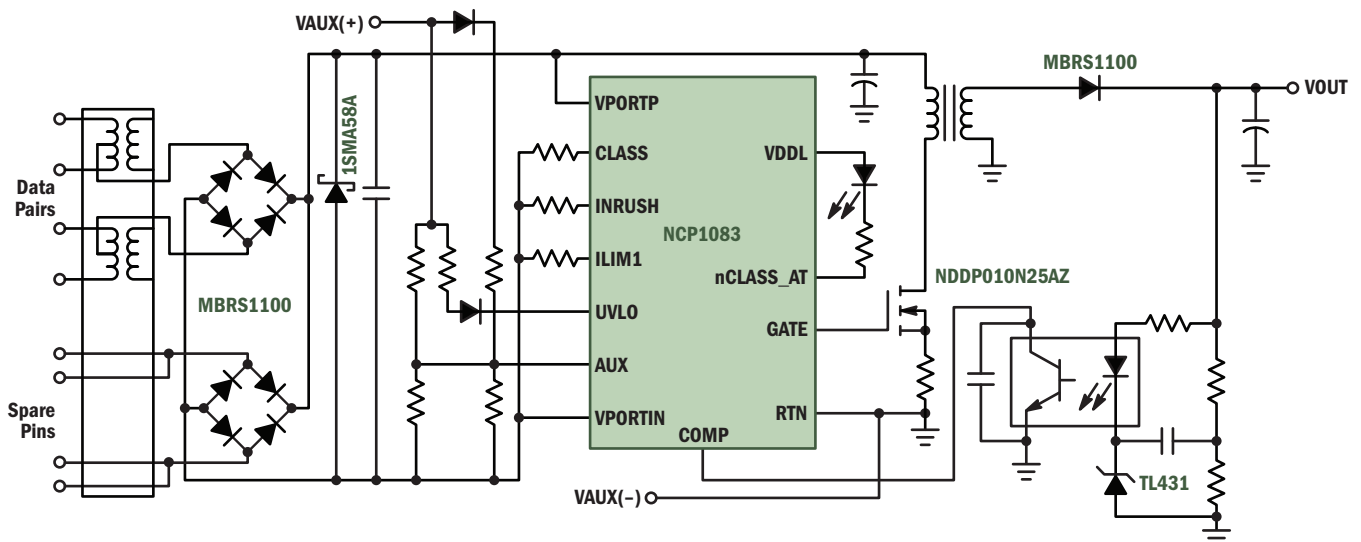
### IEEE 802.3at, 40 W

- Delivers 25.5 W for PoE+ IEEE 802.3at (Draft 4.0) and up to 40 W in proprietary applications
- Supports IEEE two event classification
- Integrated multi-topology dc-dc converter controller implements highly efficient power conversion at low output voltages
- Best in-class cable ESD and thermal characteristics



### IEEE 802.3at + Auxiliary, 40 W

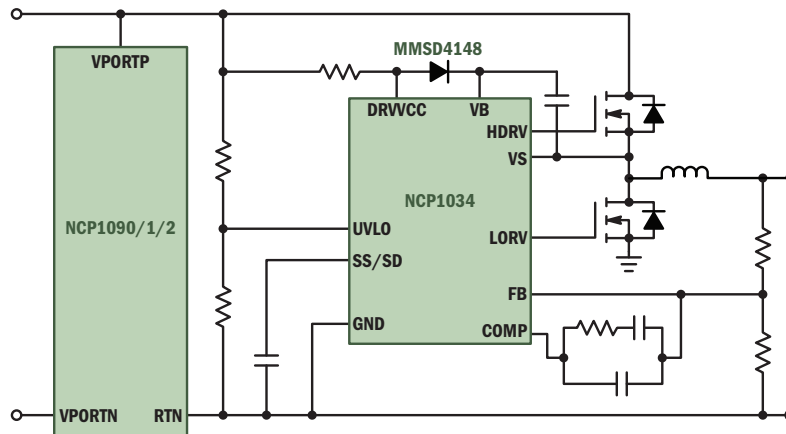
- Auxiliary input voltage range from 9.0 V to 57 V
- Integrated multi-topology dc-dc converter controller implements highly efficient power conversion at low output voltages in conjunction with auxiliary voltage input
- Delivers 25.5 W for PoE+ IEEE 802.3at (Draft 4.0) and up to 40 W in proprietary applications
- Supports IEEE two event classification
- Best-in-class cable ESD and thermal characteristics



## Power over Ethernet

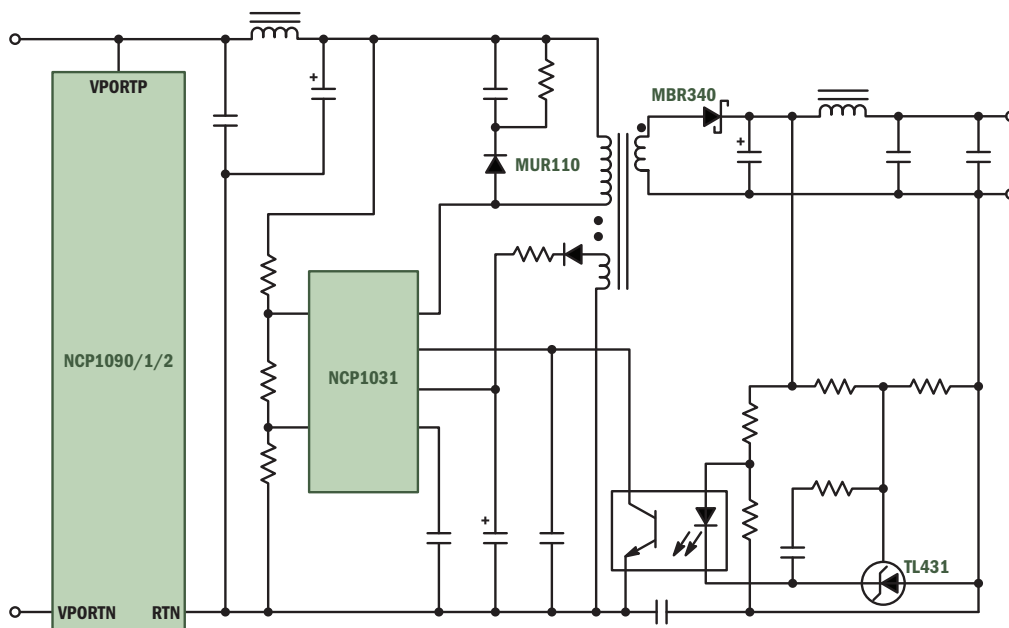
### IEEE 802.3at (Non-Isolated), up to 40 W

- Non-isolated application for simple cost effective solution
- Programmable overcurrent protection
- Flexibility to scale output MOSFETs for power requirement



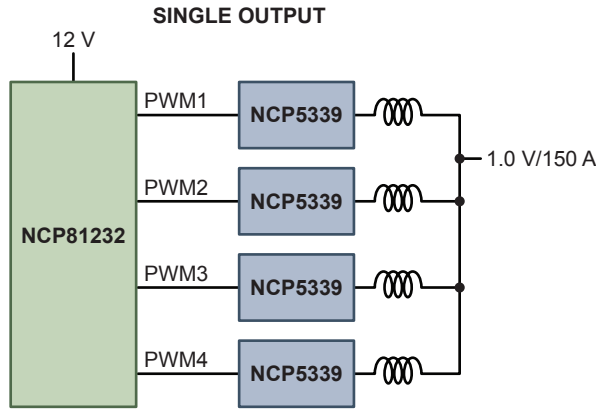
### IEEE 802.3af, 3 W

- Integrated PWM controller and Power Device for up to 7.5 W requirements
- Up to 1 MHz switching frequency for high power density design
- Can be configured in any single-ended topology such as forward or flyback

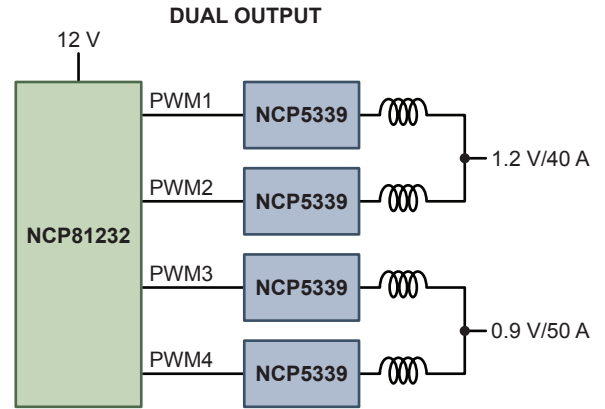


## Multiphase Controllers with Dual Control Loops

for Powering CPUs, FPGAs, Core Processors, DSPs, and DDR Memory



Multi-phase controller can be configured as 4+0, 3+0, or 3+1 (dual output) for design optimization



Multi-phase controller in a 2+2 configuration (up to 4 phases) driving DrMOS power stages

### Features

- Delivers single output (4 phases) or dual output with 8 combinations for greater flexibility
- Remote voltage sense for output accuracy
- Compatible with NCP81162 phase doubler for higher current capability
- Fixed frequency architecture (voltage mode with dual edge modulation) with excellent load transient response
- Dual differential current sensing supports DCR sensing or Iout from DrMOS

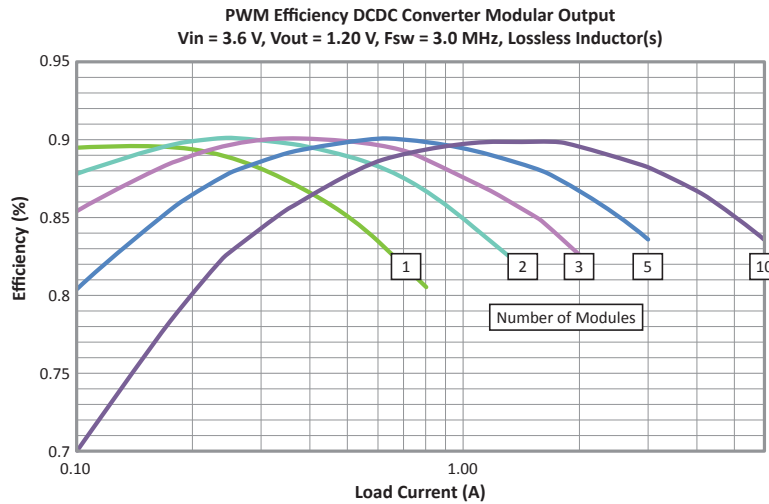
| Device    | Function                     | Package |
|-----------|------------------------------|---------|
| NCP81232  | 4-Phase Dual Loop Controller | QFN-40  |
| NCP81234* | 2-Phase Dual Loop Controller | QFN-28  |
| NCP5338   | 40 A DrMOS                   | QFN-40  |
| NCP5339*  | 50 A DrMOS                   | QFN-40  |

\* Pending 1Q16.

## ARM® Core DC-DC Converters

### Key Features

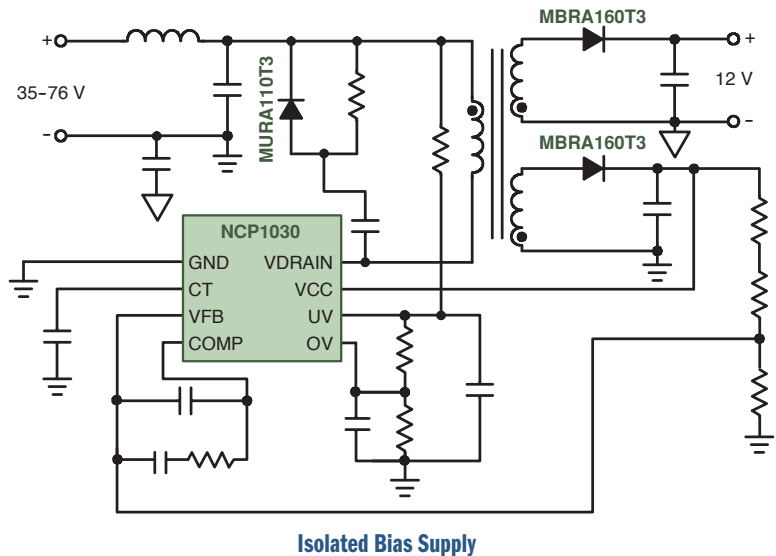
- High regulating performance from 0.6 V to 1.4 V
  - Modular efficiency with fragmented power stage
  - Dynamic voltage scaling per output steps of 6.25 mV by I2C
  - Tight accuracy of  $\pm 1\%$ , due to differential sensing
- Fast transient response
  - Proprietary PFM to PWM transition with equivalent performance to PWM only
  - Thermally handle high peak current demands up to 10 ms
  - Flexible design to transient handling output capacitor from 22  $\mu\text{F}$  to 100  $\mu\text{F}$



| Device    | $V_{in}$ (V) | $V_{out}$ (V) | $I_{out}$ (A) | $f_{sw}$ (MHz) | Control                | Features                                  | Package  |
|-----------|--------------|---------------|---------------|----------------|------------------------|---|----------|
| NCP6338   | 2.3 - 5.5    | 0.6 - 1.4     | 6.0           | 3.0            | I <sup>2</sup> C; VSEL | Modular power stage; Differential sensing | WLCSP-30 |
| NCP6336B  | 2.3 - 5.5    | 0.6 - 1.4     | 5.0           | 2.74           | I <sup>2</sup> C       | Transient load helper                     | WLCSP-20 |
| NCP6356B* | 2.5 - 5.5    | 0.6 - 1.4     | 5.0           | 3.0            | I <sup>2</sup> C; VSEL | Adaptive Constant On Time                 | WLCSP-20 |
| NCP6335   | 2.3 - 5.5    | 0.6 - 1.4     | 4.0           | 3.0            | I <sup>2</sup> C; VSEL | Transient load helper                     | WLCSP-20 |
| NCP6343   | 2.3 - 5.5    | 0.6 - 1.4     | 3.5           | 3.0            | I <sup>2</sup> C       | Dynamic voltage scaling                   | WLCSP-15 |

\* Pending 4Q15

## DC-DC Power Conversion



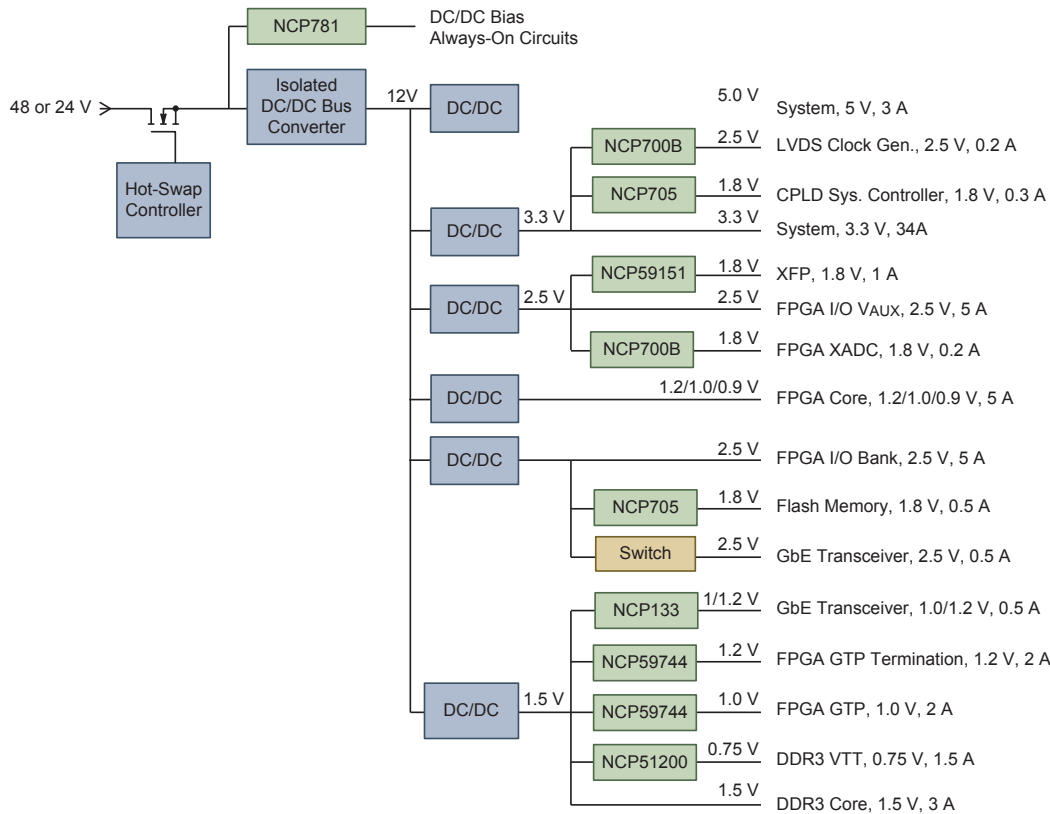
### Regulators

| Device   | Topology                    | I <sub>o</sub> Typ (A) | f <sub>sw</sub> Typ (kHz) | V <sub>cc</sub> Min (V) | V <sub>cc</sub> Max (V) | Features                                      | Package (s)   |
|----------|-----------------------------|------------------------|---------------------------|-------------------------|-------------------------|---|---------------|
| NCP3231  | Step-Down                   | 20                     | 500                       | 4.5                     | 18                      | 0.6 V internal voltage reference @ up to 25 A | QFN-40        |
| NCP3233  | Step-Down                   | 20                     | 500                       | 3.0                     | 16                      | 0.6 V internal voltage reference @ up to 20 A | QFN-40        |
| NCP3232N | Step-Down                   | 15                     | 500                       | 4.5                     | 21                      | 0.6 V internal voltage reference @ up to 15 A | QFN-40        |
| NCP1592  | Step-Down                   | 6.0                    | Up to 700                 | 3.0                     | 6.0                     | Output down to 0.891 V with 1.0% accuracy     | TSSOP-28      |
| NCP3135  | Step-Down                   | 5.0                    | 1100                      | 2.9                     | 5.5                     | 5 A continuous output                         | QFN-16        |
| NCP3133A | Step-Down                   | 3.0                    | 1000                      | 2.9                     | 5.5                     | 3 A continuous output; internal soft start    | QFN-16        |
| NCP3170A | Step-Down                   | 3.0                    | 500                       | 4.5                     | 18                      | Output down to 0.8 V                          | SOIC-8        |
| NCP3170B | Step-Down                   | 3.0                    | 1000                      | 4.5                     | 18                      | Output down to 0.8 V                          | SOIC-8        |
| NCP1032  | Flyback; Forward; Step-Down | 1.0                    | Up to 1000                | -                       | 200                     | Integrated 200 V switch; internal soft start  | WDFN-8        |
| NCP1031  | Flyback; Forward; Step-Down | 1.0                    | Up to 1000                | -                       | 200                     | Integrated 200 V switch                       | DFN-8, SOIC-8 |
| NCP1030  | Flyback; Forward; Step-Down | 0.5                    | 300                       | -                       | 200                     | 2nd side bias supply                          | Micro8        |

### PWM Controllers

| Device   | Topology   | V <sub>cc</sub> Min (V) | V <sub>cc</sub> Max (V) | f <sub>sw</sub> Typ (kHz) | Features                                  | Package (s)                |
|----------|--|-------------------------|-------------------------|---------------------------|---|----------------------------|
| CS5124   | Flyback; Forward; Step-Down                                  | 7.6                     | 75                      | 400                       | Small package                             | SOIC-8                     |
| NCP1034  | Step-Down  | 8.0                     | 100                     | Up to 500                 | Non-isolated buck                         | SOIC-16                    |
| NCP1294  | Flyback; Forward; Buck-Boost; Boost                          | 3.3                     | 7.5                     | Up to 1000                | Enhanced UC384x                           | SOIC-16, TSSOP-16          |
| NCP3011  | Step-Down  | 4.7                     | 28                      | 400                       | EN, PG, SYNC                              | TSSOP-14                   |
| NCP3020  | Step-Down  | 4.7                     | 28                      | 300; 600                  | Capable of 20 A output                    | SOIC-8                     |
| NCP81232 | Multiphase Step-Down   | 4.5                     | 20                      | 1200                      | Compatible to 3.3/5 V DrMOS, Dual Outputs | QFN-40                     |
| TL494    | Flyback; Forward; Half-Bridge; Push-Pull; Step-Down; Step-Up | 7.0                     | 40                      | Up to 200                 | Versatile controller                      | PDIP-16, SOIC-16           |
| TL594    | Flyback; Forward; Half-Bridge; Push-Pull; Step-Down; Step-Up | 7.0                     | 40                      | Up to 300                 | Versatile controller                      | PDIP-16, SOIC-16, TSSOP-16 |

## Linear Voltage Regulators



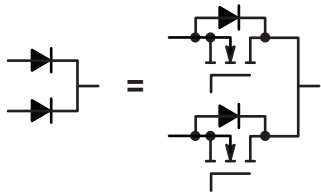
| Device   | I <sub>o</sub> Typ | Function   | Features   | Package          |
|----------|--------------------|--|--|------------------|
| NCP715   | 50 mA              | Ultra-low Quiescent Current LDO                    | Ultra-low quiescent current; Wide input voltage range  | SC-70-5, DFN-6   |
| NCP716   | 80 mA              | Ultra-low Quiescent Current LDO                    | Ultra-low quiescent current; Wide input voltage range  | WDFN-6           |
| NCP700B  | 200 mA             | Ultra-low Noise LDO                                | High PSRR; Ultra-low noise   | SOT-23-5, WDFN-6 |
| NCP702   | 200 mA             | Ultra-low Noise LDO                                | High PSRR; Ultra-low noise   | SOT-23-5, WDFN-6 |
| NCP703   | 300 mA             | Ultra-low Noise LDO                                | Ultra-low noise; High PSRR   | SOT-23-5, WDFN-6 |
| NCP705   | 500 mA             | Ultra-low Noise LDO                                | Ultra-low noise; High PSRR   | WDFN-6           |
| NCP133   | 500 mA             | Ultra-Low Dropout Voltage Regulator with Bias Rail | Typical dropout: 140 mV @ 500 mA; High PSRR; Very fast transient response  | XDFN-6           |
| NCP59800 | 1 A                | Low Noise, RF LDO                                  | Typical dropout: 200 mV @ 1 A; High PSRR; Ultra-low noise  | DFN-8            |
| NCP59748 | 1.5 A              | Ultra-Low Dropout Voltage Regulator with Bias Rail | Typical dropout: 60 mV @ 500 mA; High PSRR; Very fast transient response   | DFN-10, QFN-20   |
| NCP59744 | 3 A                | Ultra-Low Dropout Voltage Regulator with Bias Rail | Typical dropout: 115 mV @ 3 A; High PSRR; Very fast transient response   | QFN-20           |
| NCP59749 | 3 A                | Ultra-Low Dropout Voltage Regulator with Bias Rail | Typical dropout: 120 mV @ 3 A; High PSRR; Very fast transient response   | DFN-10, QFN-20   |
| NCP51200 | 3 A                | DDR3 Termination Regulator                         | Fast load transient response; Soft start; Remote sensing   | DFN-10           |
| NCP51401 | 3 A                | DDR4 Termination Regulator                         | Fast load transient response; Soft start; Remote sensing   | DFN-10           |
| NCP59749 | 3 A                | Ultra-Low Dropout Voltage Regulator with Bias Rail | Typical dropout: 120 mV @ 3 A; High PSRR; Very fast transient response   | DFN-10, QFN-20   |
| NCP58302 | 3 A                | Adjustable True LDO Linear Voltage Regulator       | Typical dropout: 250 mV @ 3 A, 370 mV @ 3 A; Maximum voltage input 18 V; Stable with tantalum capacitors on the output | D2PAK-5          |

## MOSFETs for Power Conversion

### ORing MOSFETs

#### Features

- Low  $R_{DS(on)}$  for low conduction loss
- 30 V for IM bus ORing
- 100 V for 48 V bus ORing



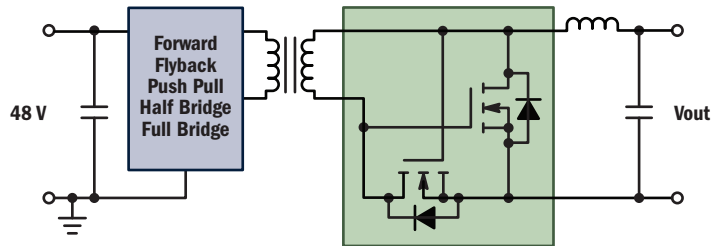
MOSFETs as ORing Diodes

| Device       | Configuration | Polarity | $V_{DS}$ (V) | $V_{GS}$ (V) | $R_{DS(on)}$ m $\Omega$ |                  | $Q_g$ (nC) | $Q_{gd}$ (nC) | $R_G$ ( $\Omega$ ) | Package |
|--------------|---------------|----------|--------------|--------------|-------------------------|------------------|------------|---------------|--------------------|---------|
|              |               |          |              |              | $V_{GS} = 10$ V         | $V_{GS} = 4.5$ V |            |               |                    |         |
|              |               |          |              |              | Typ                     | Typ              |            |               |                    |         |
| NTMFS4H01N   | Single        | N        | 25           | 20           | 0.55                    | 0.76             | 39         | 8.5           | 1.2                | S08-FL  |
| NTMFS4H01NF  | Int. Schottky | N        | 25           | 20           | 0.56                    | 0.79             | 37.8       | 8             | 1.3                | S08-FL  |
| NTMFS4H013NF | Single        | N        | 25           | 20           | 0.72                    | 1.1              | 26         | 5.8           | 1                  | S08-FL  |
| NTMFS4H02N   | Single        | N        | 25           | 20           | 1.1                     | 1.7              | 18         | 4.2           | 1                  | S08-FL  |
| NTMFS4H02NF  | Int. Schottky | N        | 25           | 20           | 1.1                     | 1.6              | 18.7       | 4.3           | 1                  | S08-FL  |
| NTMFS4C01N   | Single        | N        | 30           | 20           | 0.71                    | 0.94             | 63         | 13            | 1                  | S08-FL  |
| NTMFS5C404NL | Single        | N        | 40           | 20           | 0.56                    | 0.85             | 81         | 23.8          | --                 | S08-FL  |
| NTMFS5C410NL | Single        | N        | 40           | 20           | 0.71                    | 1                | 66         | 22            | --                 | S08-FL  |
| NTMFS5C604NL | Single        | N        | 60           | 20           | 0.93                    | 1.25             | 52         | 12.7          | --                 | S08-FL  |
| NTMFS5C612NL | Single        | N        | 60           | 20           | 1.2                     | 1.65             | 41         | 10.9          | --                 | S08-FL  |

### Isolated Topology DC-DC (Bricks)

#### Features

- Low  $R_{DS(on)}$  for low conduction loss
- Low capacitance for low switching loss
- Integrated Schottky for low diode loss



| Device       | Configuration | Polarity | $V_{DS}$ (V) | $V_{GS}$ (V) | $R_{DS(on)}$ m $\Omega$ |                  | $Q_g$ (nC) | $Q_{gd}$ (nC) | $C_{iss}$ (pF) | $C_{rss}$ (pF) | $R_G$ ( $\Omega$ ) | Application                   | Package |
|--------------|---------------|----------|--------------|--------------|-------------------------|------------------|------------|---------------|----------------|----------------|--------------------|-------------------------------|---------|
|              |               |          |              |              | $V_{GS} = 10$ V         | $V_{GS} = 4.5$ V |            |               |                |                |                    |                               |         |
|              |               |          |              |              | Typ                     | Typ              |            |               |                |                |                    |                               |         |
| NTMFS4H01N   | Single        | N        | 25           | 20           | 0.55                    | 0.76             | 39         | 8.5           | 5693           | 212            | 1.2                | Secondary Synchronous         | S0-8FL  |
| NTMFS4H01NF  | Int. Schottky | N        | 25           | 20           | 0.56                    | 0.79             | 37.8       | 8             | 5538           | 175.3          | 1.3                |                               | S0-8FL  |
| NTMFS4H013NF | Single        | N        | 25           | 20           | 0.72                    | 1.1              | 26         | 5.8           | 3923           | 114            | 1                  |                               | S0-8FL  |
| NTMFS4H02N   | Single        | N        | 25           | 20           | 1.1                     | 1.7              | 18         | 4.2           | 2651           | 103            | 1                  |                               | S0-8FL  |
| NTMFS4H02NF  | Int. Schottky | N        | 25           | 20           | 1.1                     | 1.6              | 18.7       | 4.3           | 2652           | 94             | 1                  |                               | S0-8FL  |
| NTTFS4H05N   | Single        | N        | 25           | 20           | 2.5                     | 3.8              | 8.7        | 1.88          | 1205           | 45             | 1                  |                               | u8FL    |
| NTTFS4H07N   | Single        | N        | 25           | 20           | 3.8                     | 5.8              | 5.7        | 1.26          | 771            | 34             | 1                  |                               | u8FL    |
| NTMFS4C05N   | Single        | N        | 30           | 20           | 2.7                     | 4                | 14         | 5             | 1972           | 59             | 1                  |                               | S0-8FL  |
| NTMFS4C06N   | Single        | N        | 30           | 20           | 3.2                     | 4.8              | 11.6       | 4             | 1683           | 40             | 1                  |                               | S0-8FL  |
| NTMFS4C08N   | Single        | N        | 30           | 20           | 4.6                     | 6.8              | 8.4        | 3.3           | 1113           | 39             | 1                  |                               | S0-8FL  |
| NTTFS4C05N   | Single        | N        | 30           | 20           | 2.9                     | 4.1              | 14.5       | 5.5           | 1988           | 71             | 1                  | u8FL                          |         |
| NTMFS5C404NL | Single        | N        | 40           | 20           | 0.56                    | 0.85             | 81         | 23.8          | 12168          | 79.8           | --                 | S0-8FL                        |         |
| NTMFS5C410NL | Single        | N        | 40           | 20           | 0.71                    | 1                | 66         | 22            | 8862           | 116            | --                 | S0-8FL                        |         |
| NTMFS5C430NL | Single        | N        | 40           | 20           | 1.2                     | 1.7              | 32         | 9             | 4300           | 72             | --                 | S0-8FL                        |         |
| NTMFS5C423NL | Single        | N        | 40           | 20           | 1.6                     | 2.4              | 23         | 6.7           | 3100           | 60             | --                 | Control/Synchronous           | S0-8FL  |
| NTMFS5C442NL | Single        | N        | 40           | 20           | 2.2                     | 3.4              | 22         | 6.7           | 3000           | 28             | --                 | Primary/Secondary Synchronous | S0-8FL  |
| NTMFS5C604NL | Single        | N        | 60           | 20           | 0.93                    | 1.25             | 52         | 12.7          | 8900           | 40             | --                 |                               | S0-8FL  |
| NTMFS5C612NL | Single        | N        | 60           | 20           | 1.2                     | 1.65             | 41         | 10.9          | 6660           | 45             | --                 |                               | S0-8FL  |
| NTMFS5C646NL | Single        | N        | 60           | 20           | 3.8                     | 5                | 15.7       | 5.1           | 2164           | 17             | --                 |                               | S0-8FL  |
| NTMFS5C670NL | Single        | N        | 60           | 20           | 5.4                     | 7.2              | 9.2        | 1.5           | 1400           | 15             | --                 | S0-8FL                        |         |

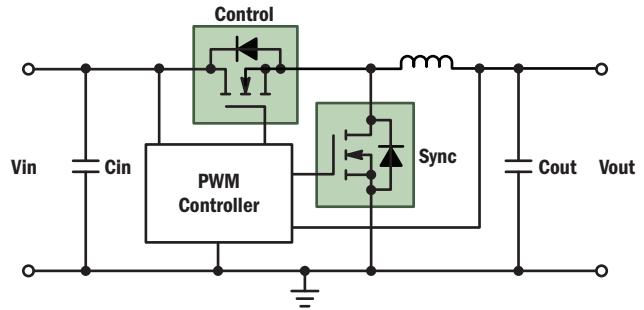


## MOSFETs for Power Conversion

### Non-Isolated Topology “Buck” DC-DC

#### Features

- Low  $R_{DS(on)}$  for low conduction loss
- Low capacitance for low switching loss
- Integrated Schottky for enhanced light load efficiency

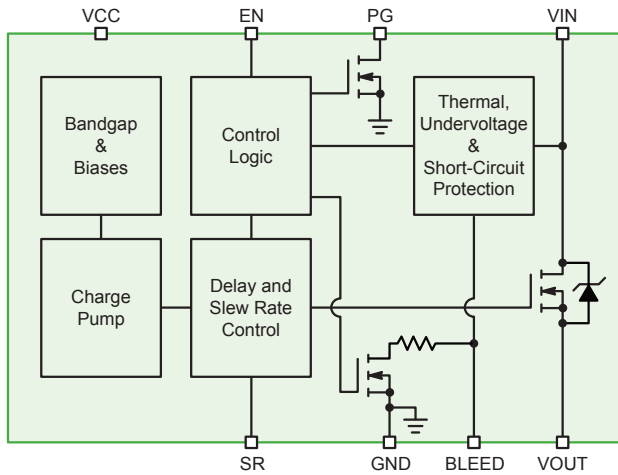


| Device       | Configuration | VDS (V) | VES (V) | RDS(ON) mΩ |            | Qg (nC) | Qgd (nC) | Ciss (pF) | Crss (pF) | RG (Ω) | Application         | Package |
|--------------|---------------|---------|---------|------------|------------|---------|----------|-----------|-----------|--------|---------------------|---------|
|              |               |         |         | VGS= 10 V  | VGS= 4.5 V |         |          |           |           |        |                     |         |
|              |               |         |         | Typ        | Typ        |         |          |           |           |        |                     |         |
| NTMFS4H01N   | Single        | 25      | 20      | 0.55       | 0.76       | 39      | 8.5      | 5693      | 212       | 1.2    | Synchronous Side    | SO-8FL  |
| NTMFS4H01NF  | Int. Schottky | 25      | 20      | 0.56       | 0.79       | 37.8    | 8        | 5538      | 175.3     | 1.3    | Synchronous Side    | SO-8FL  |
| NTMFS4H013NF | Single        | 25      | 20      | 0.72       | 1.1        | 26      | 5.8      | 3923      | 114       | 1      | Synchronous Side    | SO-8FL  |
| NTMFS4H02N   | Single        | 25      | 20      | 1.1        | 1.7        | 18      | 4.2      | 2651      | 103       | 1      | Synchronous Side    | SO-8FL  |
| NTMFS4H02NF  | Int. Schottky | 25      | 20      | 1.1        | 1.6        | 18.7    | 4.3      | 2652      | 94        | 1      | Synchronous Side    | SO-8FL  |
| NTTFS4H05N   | Single        | 25      | 20      | 2.5        | 3.8        | 8.7     | 1.88     | 1205      | 45        | 1      | Synchronous Side    | u8FL    |
| NTTFS4H07N   | Single        | 25      | 20      | 3.8        | 5.8        | 5.7     | 1.26     | 771       | 34        | 1      | Synchronous Side    | u8FL    |
| ATP202       | Single        | 30      | 20      | 9          | 14         | 27      | 4        | 1650      | 160       | —      | Control Side        | ATPAK   |
| NTMFS4C05N   | Single        | 30      | 20      | 2.7        | 4          | 14      | 5        | 1972      | 59        | 1      | Synchronous Side    | SO-8FL  |
| NTMFS4C06N   | Single        | 30      | 20      | 3.2        | 4.8        | 11.6    | 4        | 1683      | 40        | 1      | Synchronous Side    | SO-8FL  |
| NTMFS4C08N   | Single        | 30      | 20      | 4.6        | 6.8        | 8.4     | 3.3      | 1113      | 39        | 1      | Synchronous Side    | SO-8FL  |
| NTMFS4C09N   | Single        | 30      | 20      | 4.6        | 6.8        | 10.9    | 5.4      | 1252      | 126       | 1      | Synchronous Side    | SO-8FL  |
| NTMFS4C10N   | Single        | 30      | 20      | 5.8        | 8.9        | 9.8     | 3.7      | 987       | 162       | 1      | Synchronous Side    | SO-8FL  |
| NTMFS4C13N   | Single        | 30      | 20      | 7.3        | 11.4       | 7.8     | 3.7      | 770       | 127       | 1      | Synchronous Side    | SO-8FL  |
| NTTFS4C05N   | Single        | 30      | 20      | 2.9        | 4.1        | 14.5    | 5.5      | 1988      | 71        | 1      | Control Side        | u8FL    |
| NTTFS4C08N   | Single        | 30      | 20      | 4.7        | 7.2        | 8.4     | 3.3      | 1113      | 39        | 1      | Control Side        | u8FL    |
| NTTFS4C10N   | Single        | 30      | 20      | 5.9        | 8.8        | 10.1    | 6.1      | 993       | 163       | 1      | Control Side        | u8FL    |
| NTTFS4C13N   | Single        | 30      | 20      | 7.5        | 11.2       | 7.8     | 3.7      | 770       | 127       | 1      | Control Side        | u8FL    |
| NTMFS5C404NL | Single        | 40      | 20      | 0.56       | 0.85       | 81      | 23.8     | 12168     | 79.8      | —      | Synchronous Side    | SO-8FL  |
| NTMFS5C410NL | Single        | 40      | 20      | 0.71       | 1          | 66      | 22       | 8862      | 116       | —      | Synchronous Side    | SO-8FL  |
| NTMFS5C423NL | Single        | 40      | 20      | 1.6        | 2.4        | 23      | 6.7      | 3100      | 60        | —      | Control/Synchronous | SO-8FL  |
| NTMFS5C430NL | Single        | 40      | 20      | 1.2        | 1.7        | 32      | 9        | 4300      | 72        | —      | Control/Synchronous | SO-8FL  |
| NTMFS5C442NL | Single        | 40      | 20      | 2.2        | 3.4        | 22      | 6.7      | 3000      | 28        | —      | Control Side        | SO-8FL  |

## Advanced Load Switches

ON Semiconductor provides a comprehensive range of load switches, suitable for a variety of different power trees.

- Copackaged MOSFET plus CMOS controllers – value-added features plus high performance
- Monolithic CMOS smart load switches – value added features, low cost
- Discrete MOSFETs – simple, high performance



### NCP45xxx Integrated Load Switch Feature

- Simple/clean design
- No current consumption in standby power mode
- Small PCB footprint
- Low RDS(ON) due to charge pump driving NMOS
- Adjustable soft-start time (SR)
- Adjustable integrated discharge
- Fault protection
- Power rail monitoring & sequencing

| Type                              | Device   | r <sub>on</sub> (mΩ) | I Max (A) | V <sub>I</sub> Min (V) | V <sub>I</sub> Max (V) | I <sub>q</sub> (μA) | Discharge | Slew Rate (μs) | Features          | Package(s) |
|-----------------------------------|----------|----------------------|-----------|------------------------|------------------------|---------------------|-----------|----------------|-------------------|------------|
| Smart Load Switch                 | NCP330   | 26 at 3.3 V          | 3         | 1.8                    | 5.5                    | 100                 | -         | 2000           | Reverse blocking  | TDFN-4     |
|                                   | NCP333   | 55 at 3.3 V          | 1.5       | 1.2                    | 5.5                    | 1                   | Auto      | 95             | -                 | WLCSP-4    |
|                                   | NCP334   | 47 at 3.3 V          | 2         | 1.2                    | 5.5                    | 1                   | -         | 71             | -                 | WLCSP-4    |
|                                   | NCP335   | 47 at 3.3 V          | 2         | 1.2                    | 5.5                    | 1                   | Auto      | 71             | -                 | WLCSP-4    |
|                                   | NCP336   | 23 at 3.3 V          | 3         | 1.2                    | 5.5                    | 1                   | -         | 810            | -                 | WLCSP-6    |
|                                   | NCP337   | 23 at 3.3 V          | 3         | 1.2                    | 5.5                    | 1                   | Auto      | 810            | -                 | WLCSP-6    |
|                                   | NCP338   | 27 at 1.8 V          | 2         | 1                      | 3.6                    | 0.6                 | Auto      | 20             | -                 | WLCSP-6    |
|                                   | NCP339   | 26 at 3.3 V          | 3         | 1.2                    | 5.5                    | 2                   | -         | 2700           | Reverse blocking  | WLCSP-6    |
|                                   | NCP432   | 50 at 1.8 V          | 1.5       | 1                      | 3.6                    | 0.6                 | -         | 20             | -                 | WLCSP-4    |
|                                   | NCP433   | 50 at 1.8 V          | 1.5       | 1                      | 3.6                    | 0.6                 | Auto      | 20             | -                 | WLCSP-4    |
|                                   | NCP434   | 43 at 1.8 V          | 2         | 1                      | 3.6                    | 0.6                 | -         | 61             | -                 | WLCSP-4    |
|                                   | NCP435   | 43 at 1.8 V          | 2         | 1                      | 3.6                    | 0.6                 | Auto      | 61             | -                 | WLCSP-4    |
|                                   | NCP436   | 23 at 1.8 V          | 3         | 1                      | 3.6                    | 1                   | -         | 27             | -                 | WLCSP-6    |
|                                   | NCP437   | 23 at 1.8 V          | 3         | 1                      | 3.6                    | 1                   | Auto      | 27             | -                 | WLCSP-6    |
| ecoSWITCH™ Integrated Load Switch | NCP45524 | 18.0                 | 6         | 0.5                    | 13.5                   | -                   | Adj       | -              | Power good        | DFN-8      |
|                                   | NCP45525 | 18.0                 | 6         | 0.5                    | 13.5                   | -                   | Adj       | Adj            | -                 | DFN-8      |
|                                   | NCP45560 | 2.4                  | 24        | 0.5                    | 13.5                   | -                   | Adj       | Adj            | Power good; Fault | DFN-12     |
|                                   | NCP45540 | 3.3                  | 20        | 0.5                    | 13.5                   | -                   | Adj       | Adj            | Power good; Fault | DFN-12     |
|                                   | NCP45541 | 3.3                  | 20        | 0.5                    | 13.5                   | -                   | Adj       | Adj            | Power good        | DFN-12     |
|                                   | NCP45520 | 9.5                  | 10.5      | 0.5                    | 13.5                   | -                   | Adj       | -              | Power good; Fault | DFN-8      |
|                                   | NCP45521 | 9.5                  | 10.5      | 0.5                    | 13.5                   | -                   | Adj       | Adj            | Fault             | DFN-8      |

# Thermal Management

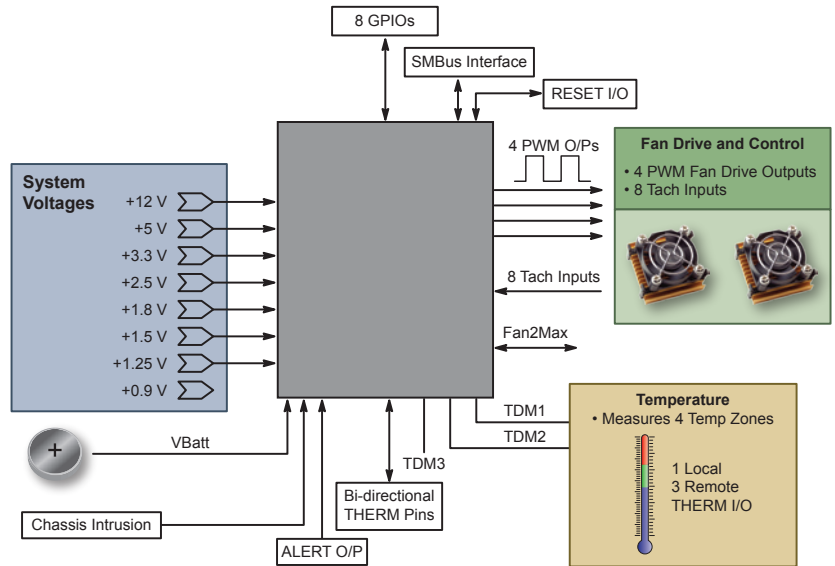
## Extensive Portfolio

**Local Sensors** provide temperature information at the device location

**Remote Sensors** provide temperature information of a transistor located at a different position on the board; also includes local sensor capability

**Fan Controllers** integrate the temperature sensor with a fan controller/monitor

**System Monitors** integrate combinations of remote and/or local temperature sensing, voltage monitoring, fan control & monitoring, reset control, and GPIO functions

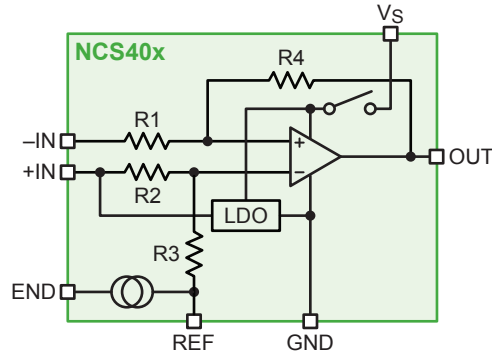
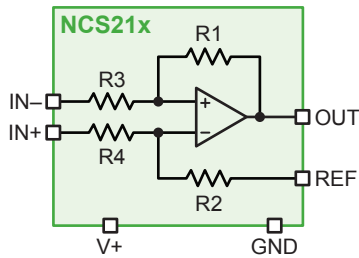


|                        | Device  | Supply Range (V) | Temperature Range (°C) | Local Accuracy (°C) | Interface | Number of Addresses | SRC (Ω) | Remote Accuracy | Remote Channels | Fan Channels | TACH Channels | Voltage Monitoring Channels | GPIOs | Package               |
|------------------------|---------|------------------|------------------------|---------------------|-----------|---------------------|---------|-----------------|-----------------|--------------|---------------|-----------------------------|-------|-----------------------|
| <b>System Monitors</b> | ADM1026 | 3 - 5.5          | -40 to +120            | ±3                  | I2C/SMBUS | 3                   | —       | ±3              | 2               | 8            | 8             | 19                          | 17    | LQFP-48               |
|                        | ADT7462 | 3 - 5.5          | -40 to +125            | ±2.25               | I2C/SMBUS | 2                   | 2 k     | ±2.25           | 3               | 4            | 8             | 13                          | 8     | LFCSOP-32             |
|                        | NCT80   | 2.8 - 5.75       | -40 to +125            | ±2                  | I2C/SMBUS | 8                   | —       | —               | —               | —            | 2             | 7                           | 1     | TSSOP-24              |
|                        | ADT7476 | 3 - 3.6          | -40 to +120            | ±1.5                | I2C/SMBUS | 3                   | —       | ±1.5            | 2               | 3            | 4             | 5                           | —     | QSOP-24               |
| <b>Fan Controllers</b> | ADT7473 | 3 - 3.6          | -40 to +120            | ±1.5                | I2C/SMBUS | 3                   | 3 k     | ±1.5            | 2               | 3            | 4             |                             |       | QSOP-16               |
|                        | ADT7475 | 3 - 3.6          | -40 to +120            | ±1.5                | I2C/SMBUS | 1                   | —       | ±1.5            | 2               | 3            | 4             |                             |       | QSOP-16               |
|                        | ADM1033 | 3 - 3.6          | -40 to +120            | ±1                  | I2C/SMBUS | 8                   | 1 k     | ±1              | 1               | 1            | 1             |                             |       | QSOP-16               |
|                        | ADM1034 | 3 - 3.6          | -40 to +120            | ±1                  | I2C/SMBUS | 8                   | 1 k     | ±1              | 2               | 2            | 2             |                             |       | QSOP-16               |
| <b>Remote Sensors</b>  | NCT72   | 2.8 - 3.6        | -40 to +125            | ±1                  | I2C/SMBUS | 2                   | 1.5 k   | ±1              | 1               |              |               |                             |       | DFN-8, WDFN-8         |
|                        | NCT218  | 1.4 - 2.75       | -40 to +125            | ±1.75               | I2C/SMBUS | 2                   | 150     | ±1              | 1               |              |               |                             |       | WDFN-8, WLCSOP-8      |
|                        | NCT210  | 3 - 5.5          | -55 to +125            | ±1                  | I2C/SMBUS | 9                   | —       | ±3              | 2               |              |               |                             |       | QSOP-16               |
|                        | ADM1032 | 3 - 5.5          | -40 to +125            | ±3                  | I2C/SMBUS | 2                   | —       | ±1              | 1               |              |               |                             |       | SOIC-8, MSOP-8        |
|                        | ADT7461 | 3 - 5.5          | -40 to +125            | ±3                  | I2C/SMBUS | 2                   | 3 k     | ±1              | 1               |              |               |                             |       | SOIC-8, MSOP-8        |
|                        | ADT7481 | 3 - 3.6          | -40 to +125            | ±1                  | I2C/SMBUS | 2                   | —       | ±1              | 2               |              |               |                             |       | MSOP-10               |
|                        | ADT7483 | 3 - 3.6          | -40 to +125            | ±1                  | I2C/SMBUS | 9                   | —       | ±1              | 2               |              |               |                             |       | QSOP-16               |
| <b>Local Sensors</b>   | NCT375* | 3 - 5.5          | -55 to +125            | ±1                  | I2C/SMBUS | 8                   |         |                 |                 |              |               |                             |       | DFN-8, SOIC-8, Micro8 |
|                        | NCT475* | 3 - 5.5          | -55 to +125            | ±1                  | I2C/SMBUS | 4                   |         |                 |                 |              |               |                             |       | CSP-6                 |
|                        | NCT203  | 1.4 - 2.75       | -40 to +125            | ±1.75               | I2C/SMBUS | 1                   |         |                 |                 |              |               |                             |       | DFN-8, SOIC-8, Micro8 |

\* Pending 4Q15.

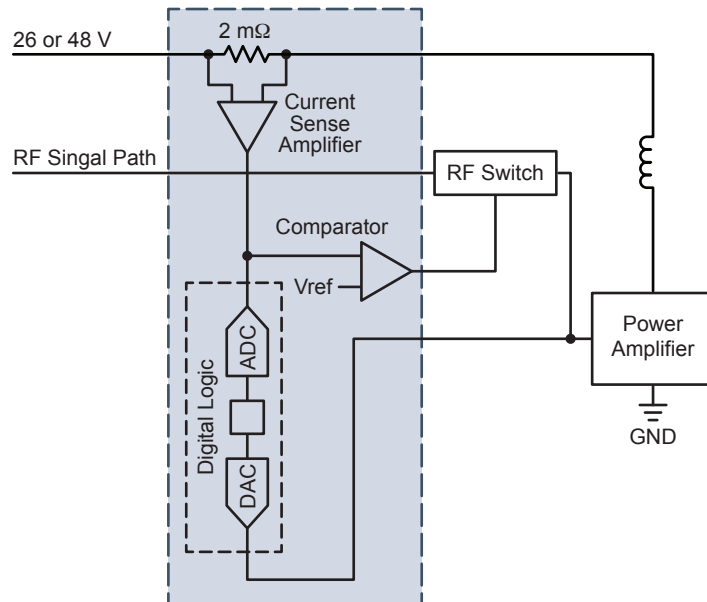
## Current Sensing with Zero-Drift, Precision Op Amps

| Device  | Channels | V <sub>S</sub> Min (V) | V <sub>S</sub> Max (V) | Input CM Range (V)                           | I <sub>Q</sub> / Channel (μA) | GBW (kHz) | V <sub>OS</sub> Max (μV) | V <sub>OS</sub> Drift (μV/°C) | Gain Error (%) | CMRR (dB) | e <sub>p-p</sub> (μVpp) | Features            | Package |
|---------|----------|------------------------|------------------------|--|-------------------------------|-----------|--------------------------|-------------------------------|----------------|-----------|-------------------------|---------------------|---------|
| NCS21x  | 1        | 2.7                    | 26                     | 2.7 to 26                                    | 65                            | 14        | 35                       | 0.5                           | 1              | 140       | -                       | Low V <sub>OS</sub> | SOT-363 |
| NCS40x  | 1        | 4.0                    | 5.5                    | 4.0 to 80                                    | 800                           | 500       | 200                      | 0.1                           | 0.35           | 110       | 23                      | Low V <sub>OS</sub> | Micro8™ |
| NCS325  | 1        | 1.8                    | 5.5                    | V <sub>SS</sub> -0.1 to V <sub>DD</sub> +0.1 | 21                            | 350       | 50                       | 0.02                          | -              | 110       | 1                       | Low V <sub>OS</sub> | SOT-23  |
| NCSx333 | 1, 2     | 1.8                    | 5.5                    | V <sub>SS</sub> -0.1 to V <sub>DD</sub> +0.1 | 21                            | 350       | 10                       | 0.03                          | -              | 120       | 1                       | Low V <sub>OS</sub> | Various |



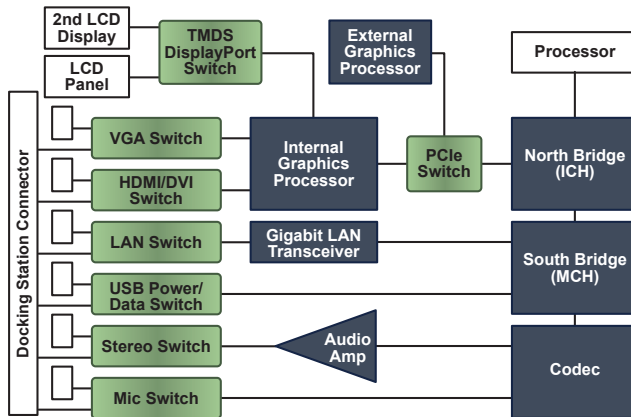
| Device | Gain | R3 - R4 | R1 - R2 |
|--------|------|---------|---------|
| NCS213 | 50   | 20 kΩ   | 1 mΩ    |
| NCS215 | 75   | 13.3 kΩ | 1 mΩ    |
| NCS214 | 100  | 10 kΩ   | 1 mΩ    |
| NCS210 | 200  | 5 kΩ    | 1 mΩ    |
| NCS211 | 500  | 2 kΩ    | 1 mΩ    |
| NCS212 | 1000 | 1 kΩ    | 1 mΩ    |

| Device | Gain | R3 - R4 | R1 - R2 |
|--------|------|---------|---------|
| NCS400 | 14   | 1050 kΩ | 75 kΩ   |
| NCS401 | 20   | 1.5 mΩ  | 75 kΩ   |
| NCS402 | 50   | 1.2 mΩ  | 30 kΩ   |
| NCS403 | 100  | 1.5 mΩ  | 15 kΩ   |



## Switching Devices

ON Semiconductor offers a range of switching devices for high speed interface in servers, desktop computing, notebook and netbook computers. Applications include PCI Express, DisplayPort, Gigabit Ethernet and USB 2.0.



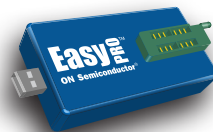
### Server Implementation

| Device    | Interface                 | Data Rate | No Channels | Quiescent Current |
|-----------|---------------------------|-----------|-------------|-------------------|
| NCN3612B  | PCIe 3.0, DisplayPort 1.2 | 8 Gb/s    | 12          | 250 $\mu$ A       |
| NCN3411   | PCIe 3.0                  | 8 Gb/s    | 8           | 200 $\mu$ A       |
| NCN2612B  | PCIe 2.0, DisplayPort 1.1 | 5 Gb/s    | 12          | 250 $\mu$ A       |
| NS3L500   | Gigabit Ethernet          | 1 Gb/s    | 11          | 250 $\mu$ A       |
| NCN1188   | USB 2.0 / MHL             | 2.25 Gb/s | 2           | 21 $\mu$ A        |
| NS5S1153  | USB 2.0                   | 480 Mb/s  | 2           | 21 $\mu$ A        |
| NLAS7242  | USB 2.0                   | 480 Mb/s  | 2           | 1 $\mu$ A         |
| NLAS52231 | Audio                     | 36 MHz    | 2           | 1 $\mu$ A         |
| NLAS4684  | Audio                     | 9.5 MHz   | 2           | 180 nA            |

## EEPROMs for Configuration and Calibration

### Features

- Broad density range: 1 kb to 2 Mb
- Wide operating Vcc range: 1.8/1.7 V to 5.5 V
- High endurance: 1 million program/erase cycles
- Wide temperature range: industrial and extended



EasyPRO™ is a user-friendly, portable programming tool for ON Semiconductor serial EEPROMs (I<sup>2</sup>C, SPI, Microwire)

### EEPROMs

| Data Transmission Standard | Device    | Density | Organization*      | Vcc Min (V) | Vcc Max (V) | fCLK Max (MHz)                                      | Package(s)  |
|----------------------------|-----------|---------|--------------------|-------------|-------------|---|---|
| I <sup>2</sup> C           | CAT24M01  | 1 Mb    | 128k x 8           | 1.8         | 5.5         | 1   | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT24C512 | 512 kb  | 64k x 8            | 1.8         | 5.5         | 1   | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT24C256 | 256 kb  | 32k x 8            | 1.8         | 5.5         | 1   | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT24C128 | 128 kb  | 16k x 8            | 1.8         | 5.5         | 1   | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT24C64  | 64 kb   | 8k x 8             | 1.7         | 5.5         | 1   | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT24C32  | 32 kb   | 4k x 8             | 1.7         | 5.5         | 1   | SOIC-8, TSSOP-8, UDFN-8; WLCSP-5                    |
|                            | CAT24C16  | 16 kb   | 2k x 8             | 1.7         | 5.5         | 0.4   | SOIC-8, TSSOP-8, UDFN-8, TSOT23-5, WLCSP-4, WLCSP-5 |
|                            | CAT24C08  | 8 kb    | 1k x 8             | 1.7         | 5.5         | 0.4   | SOIC-8, TSSOP-8, UDFN-8, TSOT23-5, WLCSP-4, WLCSP-5 |
|                            | CAT24C04  | 4 kb    | 512 x 8            | 1.7         | 5.5         | 0.4   | SOIC-8, TSSOP-8, UDFN-8, TSOT23-5, WLCSP-4, WLCSP-5 |
| CAT24C02                   | 2 kb      | 256 x 8 | 1.7                | 5.5         | 0.4         | SOIC-8, TSSOP-8, UDFN-8, TSOT23-5, WLCSP-4, WLCSP-5 |   |
| SPI                        | CAT25M02  | 2 Mb    | 256k x 8           | 1.7         | 5.5         | 10  | SOIC-8  |
|                            | CAT25M01  | 1 Mb    | 128k x 8           | 1.8         | 5.5         | 10  | SOIC-8, TSSOP-8                                     |
|                            | CAT25512  | 512 kb  | 64k x 8            | 1.8         | 5.5         | 20  | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT25256  | 256 kb  | 32k x 8            | 1.8         | 5.5         | 20  | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT25128  | 128 kb  | 16k x 8            | 1.8         | 5.5         | 20  | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT25640  | 64 kb   | 8k x 8             | 1.8         | 5.5         | 20  | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT25320  | 32 kb   | 4k x 8             | 1.8         | 5.5         | 20  | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT25160  | 16 kb   | 2k x 8             | 1.8         | 5.5         | 20  | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT25080  | 8 kb    | 1k x 8             | 1.8         | 5.5         | 20  | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT25040  | 4 kb    | 512 x 8            | 1.8         | 5.5         | 20  | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT25020  | 2 kb    | 256 x 8            | 1.8         | 5.5         | 20  | SOIC-8, TSSOP-8, UDFN-8                             |
| CAT25010                   | 1 kb      | 128 x 8 | 1.8                | 5.5         | 20          | SOIC-8, TSSOP-8, UDFN-8                             |   |
| Microwire                  | CAT93C86  | 16 kb   | 2k x 8 / 1k x 16   | 1.8         | 5.5         | 3   | SOIC-8  |
|                            | CAT93C86B | 16 kb   | 2k x 8 / 1k x 16   | 1.8 / 1.65  | 5.5         | 4   | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT93C76  | 8 kb    | 1k x 8 / 512 x 16  | 1.8         | 5.5         | 3   | SOIC-8, TSSOP-8                                     |
|                            | CAT93C76B | 8 kb    | 1k x 8 / 512 x 16  | 1.8 / 1.65  | 5.5         | 4   | SOIC-8, TSSOP-8, UDFN-8                             |
|                            | CAT93C66  | 4 kb    | 512 x 8 / 256 x 16 | 1.8         | 5.5         | 2   | SOIC-8, TSSOP-8                                     |
|                            | CAT93C56  | 2 kb    | 256 x 8 / 128 x 16 | 1.8         | 5.5         | 2   | SOIC-8, TSSOP-8                                     |
|                            | CAT93C46  | 1 kb    | 128 x 8 / 64 x 16  | 1.8         | 5.5         | 2   | SOIC-8, TSSOP-8                                     |
|                            | CAT93C46B | 1 kb    | 128 x 8 / 64 x 16  | 1.8 / 1.65  | 5.5         | 4   | SOIC-8, TSSOP-8, UDFN-8                             |

\* Organization for Microwire devices is selectable.

### Application Specific EEPROMs

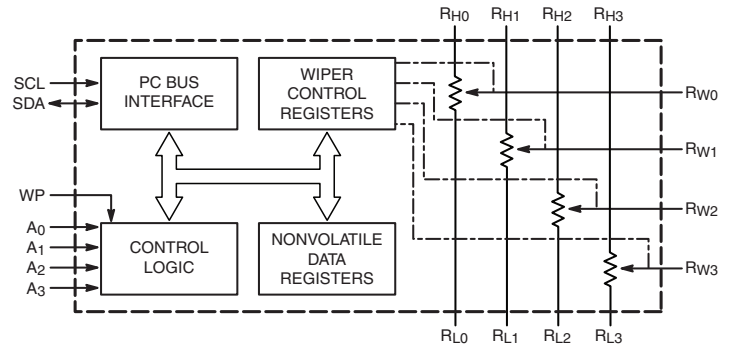
| Data Transmission Standard | Device    | Density | Organization | Vcc Min (V) | Vcc Max (V) | fCLK Max (MHz) | Package(s)              | Notes   |
|----------------------------|-----------|---------|--------------|-------------|-------------|----------------|-------------------------|---|
| I <sup>2</sup> C           | CAT24C208 | 8 kb    | 1024 x 8     | 2.5         | 5.5         | 0.4            | SOIC-8                  | VESA™ dual-port serial EEPROM                         |
| I <sup>2</sup> C           | CAT34C04* | 4 kb    | 512 x 8      | 1.7         | 5.5         | 1              | UDFN-8                  | Serial Presence Detect (SPD) I2C EEPROM for DDR4 DIMM |
| I <sup>2</sup> C/SMBus     | CAT34TS04 | 4 kb    | 512 x 8      | 2.2         | 5.5         | 1              | TDFN-8, UDFN-8          | 4 kb SPD EEPROM w/ Temperature Sensor for DDR4 DIMM   |
| I <sup>2</sup> C           | CAT34C02  | 2 kb    | 256 x 8      | 1.7         | 5.5         | 0.4            | UDFN-8, TDFN-8, TSSOP-8 | Serial Presence Detect (SPD) I2C EEPROM for DDR3 DIMM |
| I <sup>2</sup> C/SMBus     | CAT34TS02 | 2 kb    | 256 x 8      | 3.0         | 3.6         | 0.4            | TDFN-8, UDFN-8          | 2 kb SPD EEPROM w/ Temperature Sensor for DDR3 DIMM   |

\* Pending 4Q15.

## Digital Potentiometers (POTs) for Trimming and Calibration

### Features

- No drift over time or temperature
- No changes due to mechanical stress or shock
- Systems can be calibrated real-time, in the field
- Broad portfolio provides for selection of optimal number of pots and taps

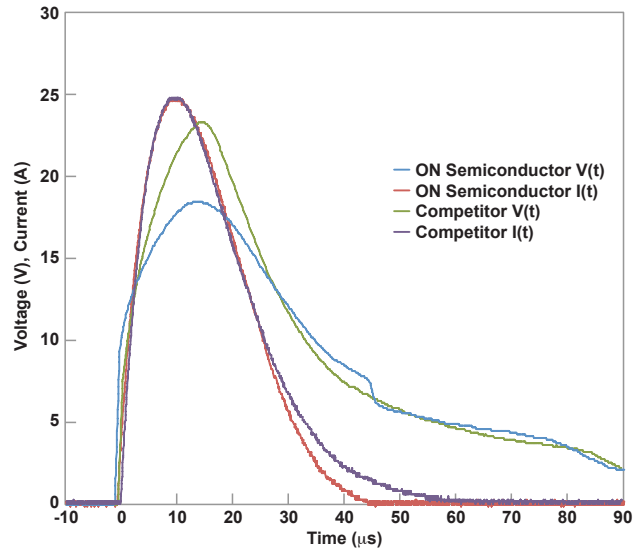


| Device      | Number of Pots | Number of Taps | Resistance (kΩ)  | Buffered Wiper | Interface        | Volatile | Non-Volatile | Packages                                |
|-------------|----------------|----------------|------------------|----------------|------------------|----------|--------------|---|
| CAT5120/1/2 | 1              | 16             | 10, 50, 100      |                | UP/DOWN          | ✓        |              | SOT-23-6, SC-70-6                       |
| CAT5110     | 1              | 32             | 10, 50, 100      |                | UP/DOWN          | ✓        |              | SOT-23-6, SC-70-6                       |
| CAT5112     | 1              | 32             | 10, 50, 100      | ✓              | UP/DOWN          |          | ✓            | PDIP-8, SOIC-8, MSOP-8, TSSOP-8         |
| CAT5114     | 1              | 32             | 10, 50, 100      |                | UP/DOWN          |          | ✓            | PDIP-8, SOIC-8, MSOP-8, TDFN-8, TSSOP-8 |
| CAT5115     | 1              | 32             | 10, 50, 100      |                | UP/DOWN          | ✓        |              | PDIP-8, SOIC-8, MSOP-8, TSSOP-8         |
| CAT5118/9   | 1              | 32             | 10, 50, 100      |                | UP/DOWN          | ✓        |              | SOT-23-5, SC-70-5                       |
| CAT5123/4   | 1              | 32             | 10, 50, 100      |                | UP/DOWN          | ✓        |              | SOT-23-5                                |
| CAT5125     | 1              | 32             | 10, 50, 100      |                | UP/DOWN          | ✓        |              | SOT-23-6                                |
| CAT5126     | 1              | 32             | 10, 50, 100      |                | UP/DOWN          |          | OTP          | MSOP-8, TDFN-8                          |
| CAT5127     | 1              | 32             | 10, 50, 100      |                | UP/DOWN          |          | ✓            | MSOP-8, TDFN-8                          |
| CAT5128     | 1              | 32             | 10, 50, 100      |                | UP/DOWN          | ✓        |              | SOT-23-8                                |
| CAT5129     | 1              | 32             | 10, 50, 100      |                | UP/DOWN          |          | ✓            | TSOT-23-6                               |
| CAT5111     | 1              | 100            | 10, 50, 100      | ✓              | UP/DOWN          |          | ✓            | PDIP-8, SOIC-8, MSOP-8, TSSOP-8         |
| CAT5113     | 1              | 100            | 1, 10, 50, 100   |                | UP/DOWN          |          | ✓            | PDIP-8, SOIC-8, MSOP-8, TSSOP-8         |
| CAT5116     | 1              | 100            | 32 (Log Taper)   |                | UP/DOWN          |          | ✓            | PDIP-8, SOIC-8, MSOP-8, TSSOP-8         |
| CAT5132     | 1              | 128            | 10, 50, 100      |                | I <sup>2</sup> C |          | ✓            | MSOP-10                                 |
| CAT5133     | 1              | 128            | 10, 50, 100      |                | UP/DOWN          |          | ✓            | MSOP-10                                 |
| CAT5137     | 1              | 128            | 50               |                | I <sup>2</sup> C |          | ✓            | SC-88-6, SC-70-6                        |
| CAT5138     | 1              | 128            | 10               |                | I <sup>2</sup> C |          | ✓            | SC-88-6, SC-70-6                        |
| CAT5140     | 1              | 256            | 50, 100          |                | I <sup>2</sup> C |          | ✓            | MSOP-8                                  |
| CAT5171     | 1              | 256            | 50, 100          |                | I <sup>2</sup> C |          | ✓            | SOT-23-8                                |
| CAT5172     | 1              | 256            | 50               |                | SPI              |          | ✓            | SOT-23-8                                |
| CAT5221     | 2              | 64             | 2.5, 10, 50, 100 |                | I <sup>2</sup> C |          | ✓            | SOIC-20, TSSOP-20                       |
| CAT5411     | 2              | 64             | 2.5, 10, 50, 100 |                | SPI              |          | ✓            | SOIC-24, TSSOP-24                       |
| CAT5419     | 2              | 64             | 2.5, 10, 50, 100 |                | I <sup>2</sup> C |          | ✓            | SOIC-24, TSSOP-24                       |
| CAT5261     | 2              | 256            | 50, 100          |                | SPI              |          | ✓            | SOIC-24, TSSOP-24                       |
| CAT5269     | 2              | 256            | 50, 100          |                | I <sup>2</sup> C |          | ✓            | SOIC-24, TSSOP-24                       |
| CAT5271     | 2              | 256            | 50, 100          |                | I <sup>2</sup> C |          | ✓            | MSOP-10                                 |
| CAT5273     | 2              | 256            | 50               |                | I <sup>2</sup> C |          | ✓            | MSOP-10                                 |
| CAT5241     | 4              | 64             | 2.5, 10, 50, 100 |                | I <sup>2</sup> C |          | ✓            | SOIC-20, TSSOP-20                       |
| CAT5401     | 4              | 64             | 2.5, 10, 50, 100 |                | SPI              |          | ✓            | SOIC-24, TSSOP-24                       |
| CAT5409     | 4              | 64             | 2.5, 10, 50, 100 |                | I <sup>2</sup> C |          | ✓            | SOIC-24, TSSOP-24                       |
| CAT5251     | 4              | 256            | 50, 100          |                | SPI              |          | ✓            | SOIC-24, TSSOP-24                       |
| CAT5259     | 4              | 256            | 50, 100          |                | I <sup>2</sup> C |          | ✓            | SOIC-24, TSSOP-24                       |

## Surge Protection

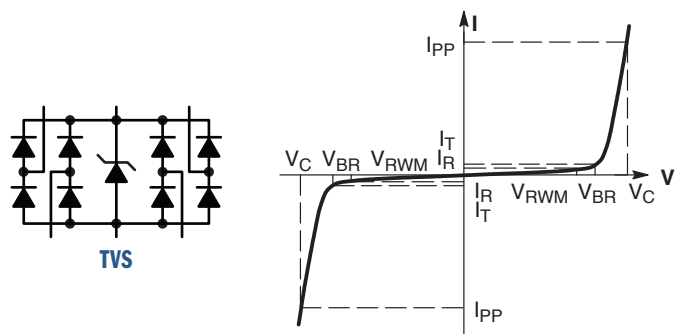
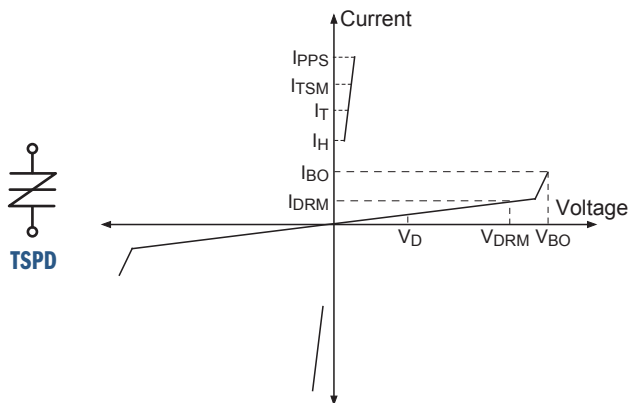
ON Semiconductor provides solutions for protecting against surge strikes, induced by a lightning strike or power-cross fault. Common interfaces found in a wide variety of consumer and telecommunications/networking equipment are the RJ45 interface for the 10/100BASE-T and 1000BASE-T Ethernet protocols and the RJ11 interface for xDSL protocols. RJ45 consists of four pairs of differential data lines, each carrying a maximum data rate of 250 Mbps in a 1000BASE-T configuration, while RJ11 consists of a single differential data pair. These interfaces are often surge rated to an intra-building standard. Protection for these interfaces mainly consist of ensuring that transverse (metallic or differential) surge strikes do not damage sensitive downstream chips such as PHYs. Differential protection is achieved by connecting shunt protection elements from line-to-line (for each pair of lines) that transfer the incoming hostile surge energy back towards the source. This is different from common mode protection as elements are connected line-to-GND and shunt the surge energy to GND.

For lower data-rates (10/100BASE-T, xDSL), ON Semiconductor offers a combination of crowbar devices known as thyristor surge protector devices (TSPD), and transient voltage suppressor (TVS) devices similar to those used in ESD protection. TSPDs offer the advantage of lower clamping voltages and possess higher surge current capability, for both common and differential mode protection.



Example of V & I plots in an 8/20 µs surge

TVS clamping devices support surge levels for the 8/20 µs pulse and are commonly used on the tertiary or PHY-side to capture and safely dissipate any residual surge pulses. Pictured in the figure above is a time-domain plot of the 8/20 µs surge current applied to the TVS from ON Semiconductor. Also shown are time-domain response voltages, clearly showing the superiority of the ON Semiconductor solution in comparison to a competing device.



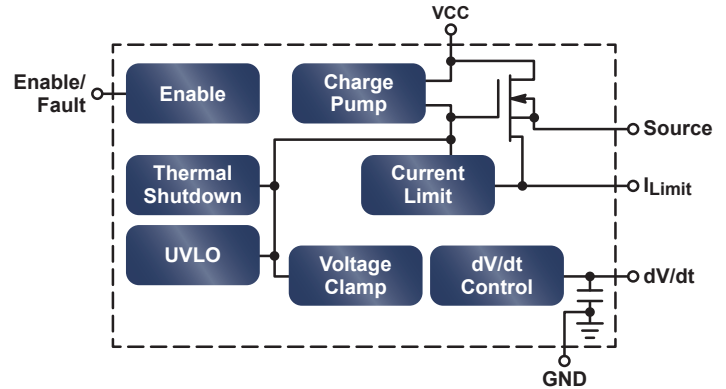


# Electronic Fuses for Inrush Current Limiting on Power Buses

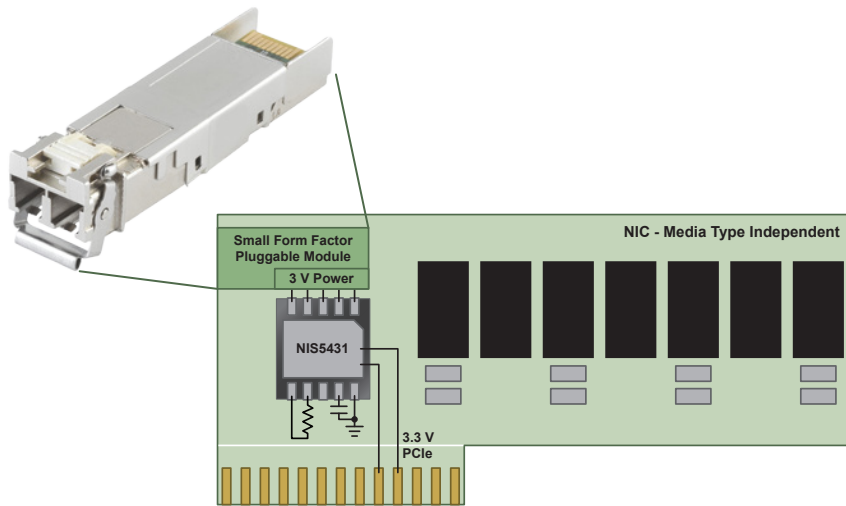
## 3-12 V Power Bus Hot Plug Protection

### Features

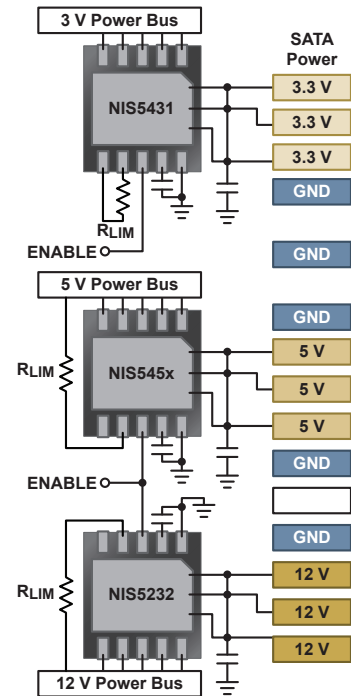
- Low RDS(ON), high operating and trip currents (IOP, ITRIP)
- Overvoltage protection
- Precise ITRIP control
- Slew rate control
- Thermal shut-down
- EN pin for synchronizing multiple eFuses
- Outperforms poly-fuses:
  - Tighter spec tolerances
  - Lower resistance
  - Shorter trip-time
  - Superior repeatability
- High efficiency with high current capability
- eFuses in parallel achieve practically any desired level of IOP and ITRIP



Typical Feature Set for eFuse



Network Interface Card Application



Hard Drive/Solid State Drive Application

| Device   | Input Voltage (V) | Output Clamping Voltage (V) | ITRIP Trip Current (A) | RDS(ON) (mΩ) | Adjustable ITRIP | Auto Recovery | Latching | Package |
|----------|-------------------|-----------------------------|------------------------|--------------|------------------|---------------|----------|---------|
| NIS5112  | -0.6 to 18        | 15                          | 2.5                    | 28           | Yes              | Yes           | Yes      | SOIC-8  |
| NIS5132  | -0.6 to 18        | 15                          | 3.5                    | 44           | Yes              | Yes           | Yes      | DFN-10  |
| NIS5232  | -0.6 to 18        | 15                          | 4                      | 44           | Yes              | No            | Yes      | DFN-10  |
| NIS5135  | -0.6 to 18        | 6.65                        | 3.5                    | 68           | Yes              | Yes           | Yes      | DFN-10  |
| NIS5451* | -0.6 to 14        | 5.5                         | 1.6                    | 40           | Yes              | No            | Yes      | WDFN-10 |
| NIS5452  | -0.6 to 14        | 5.85                        | 2.1                    | 40           | Yes              | No            | Yes      | WDFN-10 |
| NIS5431  | -0.6 to 14        | 3.85                        | 1.6                    | 45           | Yes              | No            | Yes      | WDFN-10 |

\* Pending 4Q15.

## Ethernet: 10/100BASE-T, 1000BASE-TX, and Gigabit

### Surge/ESD Protection for Four Pairs

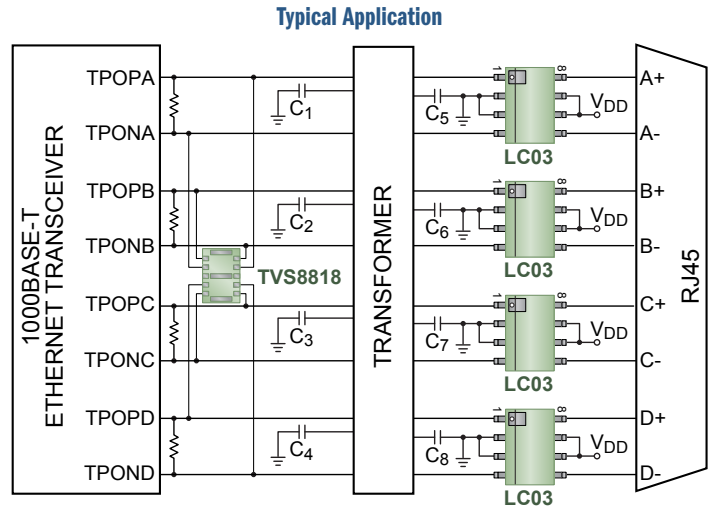
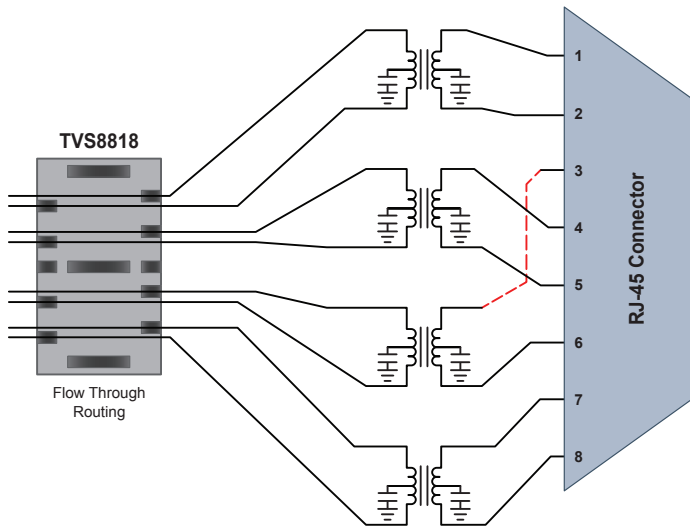
The 1000BASE-T or Gigabit Ethernet interface operating at higher bitrates is susceptible to ESD strikes, cable-discharge events and lightning-induced transients. Our products help meet IEC 61000-4-5, GR-1089-CORE and other Standards.

#### Features

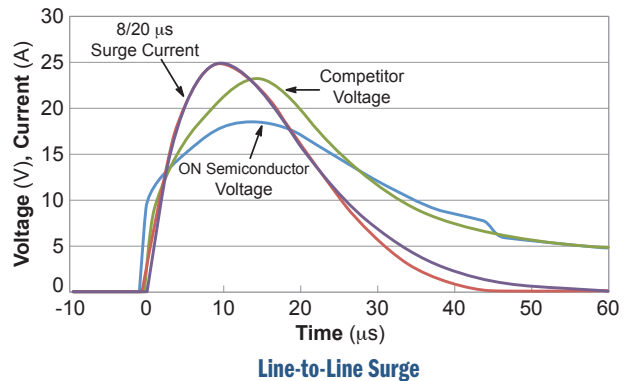
- Line-to-line capacitance < 3 pF
- $V_{clamp}$  (25 A surge) < 11 V
- IEC 61000-4-2 rating > 30 kV
- No latching danger
- Surge rating maintained to 125°C

#### Benefits

- Compatible with Gb Ethernet and beyond
- Enhanced protection for downstream electronics
- Accommodates operating transients above 3.3 V
- Small form-factor allows integration into connectors



Line Side : LC03-6 (optional)  
Transformer Side: TVS8818  
Protection against metallic (transverse) strikes



#### Transient Voltage Suppressors

| Device    | V <sub>DC</sub> Max (V) | Line Transient Max (V) | Surge I <sub>pp</sub> , 8/20 μs (A) | Typical Line-Line Capacitance (pF) | ESD Contact Rating (kV) | Package |
|-----------|-------------------------|------------------------|-------------------------------------|------------------------------------|-------------------------|---------|
| LC03-6    | 6.7                     | 7.0                    | 100                                 | 8.0                                | ±30                     | SOIC-8  |
| TVS8814** | 3.0                     | 3.2                    | 35                                  | 1.5                                | ±30                     | UDFN-8  |
| TVS8818** | 3.0                     | 3.2                    | 35                                  | 1.5                                | ±30                     | UDFN-10 |
| SRDA3.3   | 3.3                     | 5.0                    | 25                                  | 4.0                                | ±8                      | SOIC-8  |
| SRDA05    | 5.0                     | 7.0                    | 23                                  | 5.0                                | ±8                      | SOIC-8  |
| NUP4114H  | 5.0                     | 5.0                    | 12*                                 | 0.4                                | ±13                     | TSOP-6  |

\* On Pin 5. \*\* Pending 4Q15.

## T1/E1, T3/E3, and xDSL Ports

Surge protection for GR-1089, TIA-968-A, ITU-T and IEC 61000-4-5

T1/E1 links (< 2 Mbps), T3/E3 links (< 43 Mbps) and xDSL lines (< 52 Mbps) are susceptible to ESD strikes, cable-discharge events and lightning-induced transients.

### TVS Features

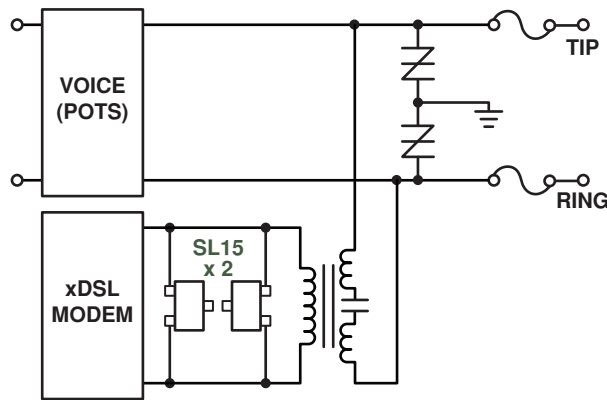
- Capable of all T1/E1 and xDSL voltages with a variety of capacitance values, for driver-side protection

### Benefits

- Required data-rates are supported by TSPDs
- TVS devices provide high levels of tertiary protection without latching

### TSPD Features

- $C_{line} < 14 \text{ pF}$  for 50 A surge under  $8/20 \mu\text{s}$  (NP0080TA series)



Typical xDSL + POTS Application

### Thyristor Surge Protection Devices

| Device          | $V_{DRM}$ (V) | $V_{BO}$ (V) | $V_T$ (V) | $C_0$ (pF) | $I_H$ (mA) | Surge $I_{pp}$ , 10/1000 $\mu\text{s}$ (A) | Package |
|-----------------|---------------|--------------|-----------|------------|------------|--|---------|
| NP0080TA Series | 8-16          | 9.5-18       | –         | 11-13      | 50         | 50 (8/20 $\mu\text{s}$ )                   | TSOP-5  |

### Transient Voltage Suppressors

| Device       | $V_{DC \text{ Max}}$ (V) | Surge $I_{pp}$ , 8/20 $\mu\text{s}$ (A) | Line-Line Capacitance (pF) | ESD Contact Rating (kV) | Package |
|--------------|--------------------------|---|----------------------------|-------------------------|---------|
| SRDA3.3      | 3.3                      | 25                                      | 4.0                        | $\pm 8$                 | SOIC-8  |
| SRDA05       | 5.0                      | 23                                      | 5.0                        | $\pm 8$                 | SOIC-8  |
| LC03-6       | 5.0                      | 100                                     | 8.0                        | $\pm 30$                | SOIC-8  |
| SL05 to SL24 | 5 to 24                  | 5 to 17                                 | 3.5                        | $\pm 8$                 | SOT-23  |

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- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- 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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