



High Density Computing Solutions



Comprehensive solutions for servers, cloud computing, edge computing, 5G networks, and communications infrastructure from ON Semiconductor.



Expertise, Solutions, Products

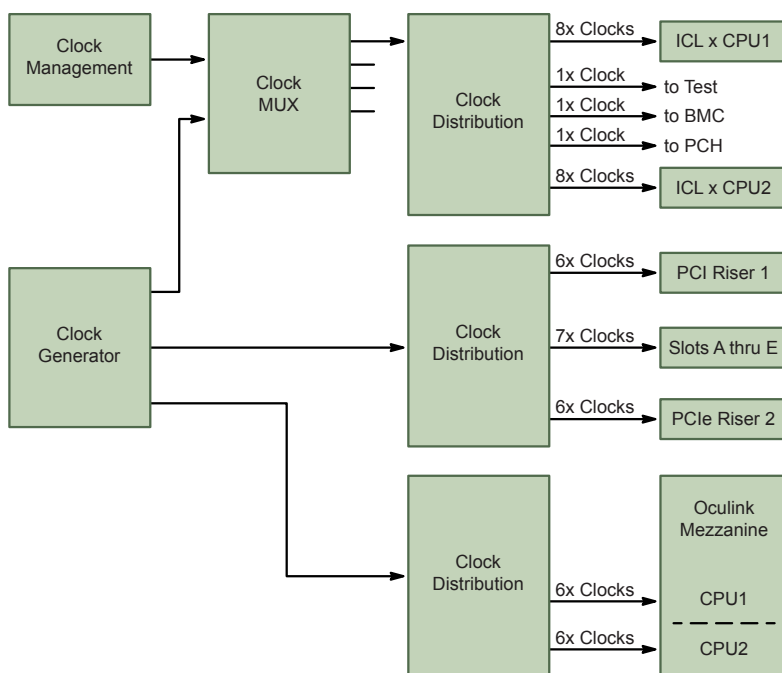
ON Semiconductor provides a comprehensive portfolio of semiconductor devices for a wide range of high density computing and communications infrastructure. The company provides solutions for power management, data integrity, and sensing and feedback.

Our power devices are built around our best-in-class medium voltage MOSFET technology to deliver the lowest losses for the application. Our MOSFETs are available in different versions to trade-off switching loss and conductor loss, to optimize for the power conversion topology, algorithm, and load profile. Additionally, we provide MOSFETs in a wide variety of packaging to provide flexibility to the designer to optimize heatsinking, size, or cost.

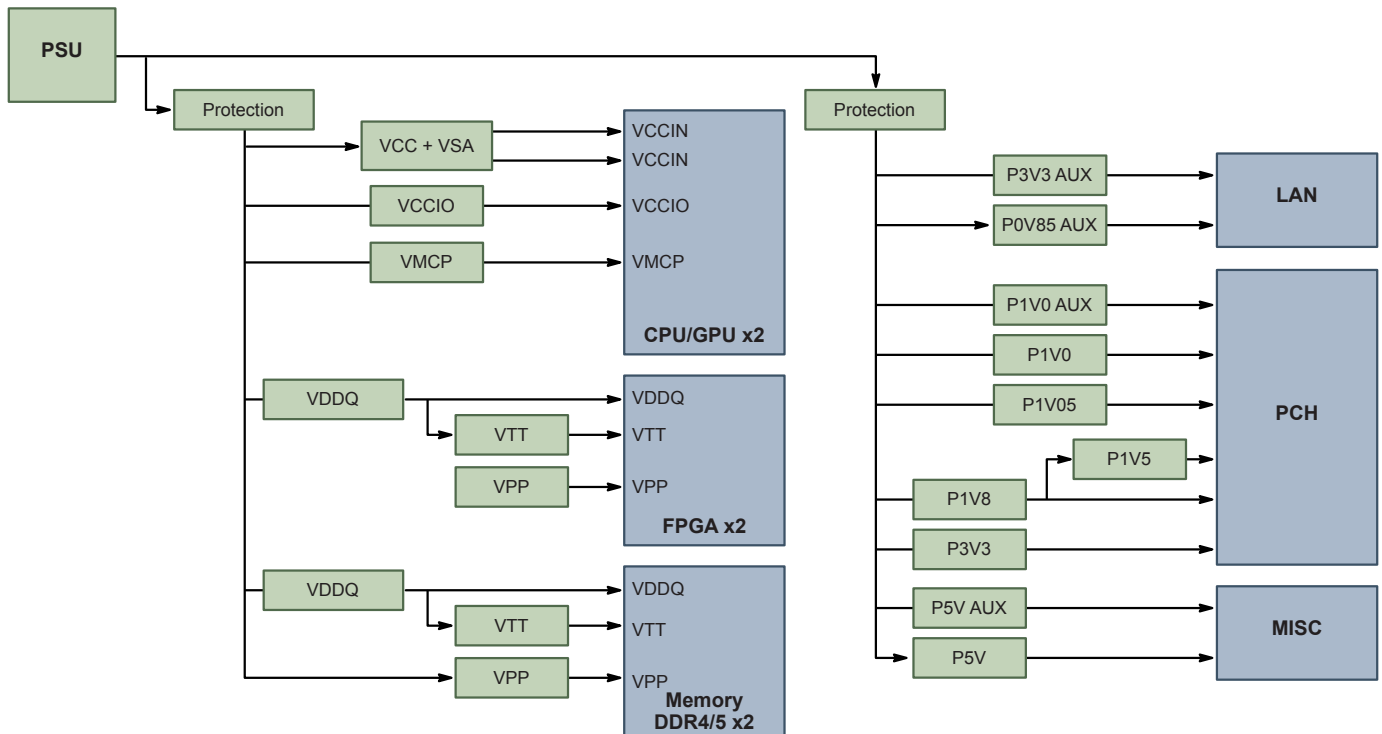
Multiphase and buck controllers, power stages, and point-of-load devices for every voltage and power level fill out the core of ON Semiconductor DC-DC products. Additionally, eFuses and load switches provide hot swap and bus protection to power rails for a variety of voltages.

Clock generation, clock distribution, and redriivers support high-speed data integrity and timing throughout any design. Finally, high precision op-amps and standard logic are available to fill out the sensing and feedback needed to monitor and control a system.

Timing Solutions for Servers

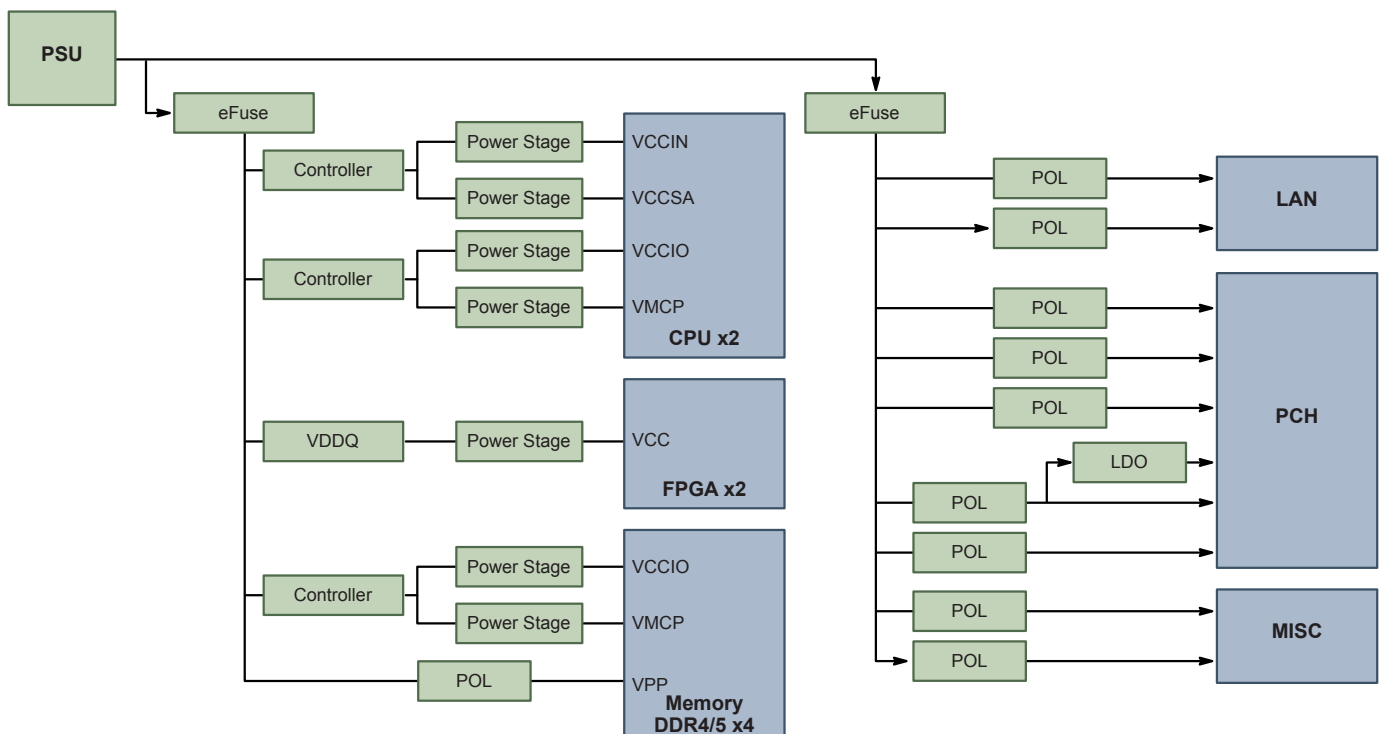


Power Management Solutions for Server Racks

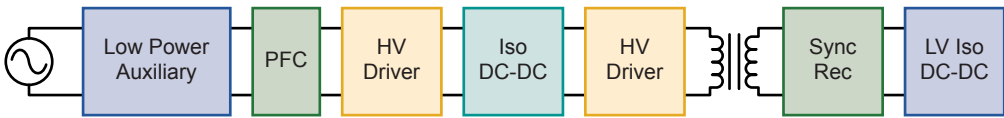


EXPERTISE

Power Management Solutions for Servers



Cloud Server Power Supply



Auxiliary Power Controllers (AC or DC Input)

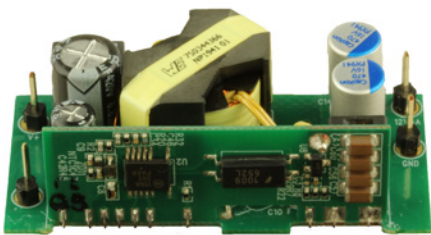
Device	Controller Type	Switching Frequency (kHz)	HV Startup (V)	Packages
NCP1342	QR Flyback	Up to 350	700	SOIC-7, SOIC-9
NCP1568	Active Clamp Flyback	Up to 1,000	700	TSSOP-16

PFC Controllers

Device	Controller Type	Switching Frequency (kHz)	HV Startup (V)	Packages
NCP1680	Totem Pole PFC	Up to 400	No	SOIC-16
NCP1618	Multimode PFC	Up to 130	700	SOIC-9
NCP1632	Interleaved PFC	Up to 500	No	SOIC-16

High Voltage Driver

Device	Driver Type	Current (A)	Packages
NCP51530	700 V H/L Side MOS	3/3.5	SOIC-8, DFN-10 4x4
NCP51561	2-Channel Isolated MOS/SiC	4.5/9	SOIC16-WB
NCP51820	650 V GaN H/L Side	1/2	QFN-15 4x4



- Topology Active Clamp Flyback
- Output Power: 48 W, 12 V Output
- Power Density: 48 W/in3
- Input Voltage: 120 V to 400 V DC Input
- Efficiency: >94%
- Dimensions: 40 x 24 x 17 mm

NCP1568DC48WGEVB High Density Server Auxiliary Power Demo Board

Cloud Server Power Supply

Isolated DC-DC Controllers

Device	Controller Type	Switching Frequency (kHz)	HV Startup (V)	Packages
NCP4390	Resonant	Up to 690	No	SOIC-16
NCP13992	Resonant	Up to 750	600	SOIC-16

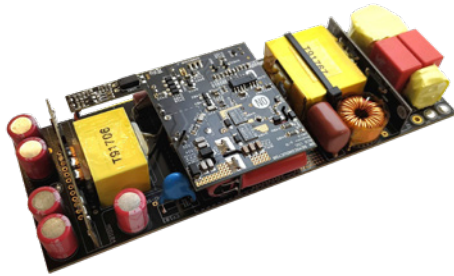
Synchronous Rectification

Device	Voltage (V)	Drive Capability Source/Sink (A)	Packages
NCP4306	200	2/7	TSOP-6, SOIC-8, DFN-8
NCP4307*	200	2/7	TSOP-6, DFN-8
NCP4318	200	1.5/4.5	SOIC-8

Low Voltage Drivers

Device	Driver Type	Current (A)	Packages
NCP51810	150 V GaN H/L Side	1/2	QFN15 4x4
NCP51513*	130 V MOS Half-Bridge	2/3	DFN10 3x3
FAN8811	100 V MOS H/L Side	3/6	WDFN10 4x4

* Pending 3Q21.



- Output Power: 300 W
- Power Density: 32 W/in³
- Topology: PFC + LLC + SR
- Dimensions: 55 x 159 x 18 mm

NCP13992UHD300WGEVB GaN-Based, Ultra-High Power Density Adapter

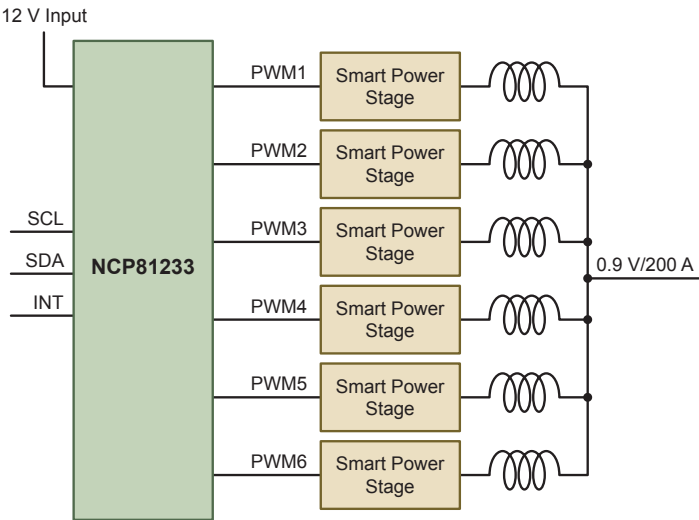
Multiphase Controllers

for Core Processors, DDR Memory, FPGAs

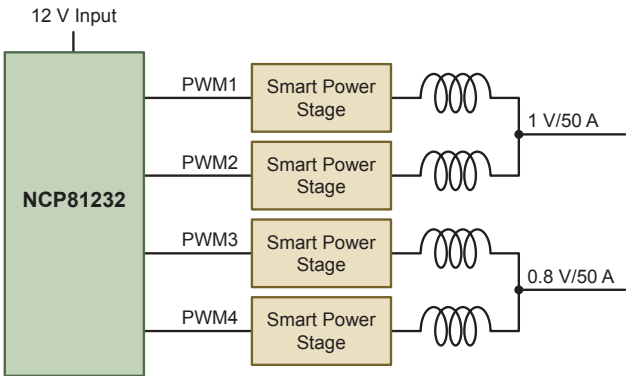
Features

- Support up to 8 phases
- Remote sense for output accuracy
- Dual-edge modulation for good load transient
- Supports DCR or IMON sensing from power stage

POWER MANAGEMENT



NCP81233 Supports Up to 6 Phase Solution, I2C Interface for Configuration and Telemetry



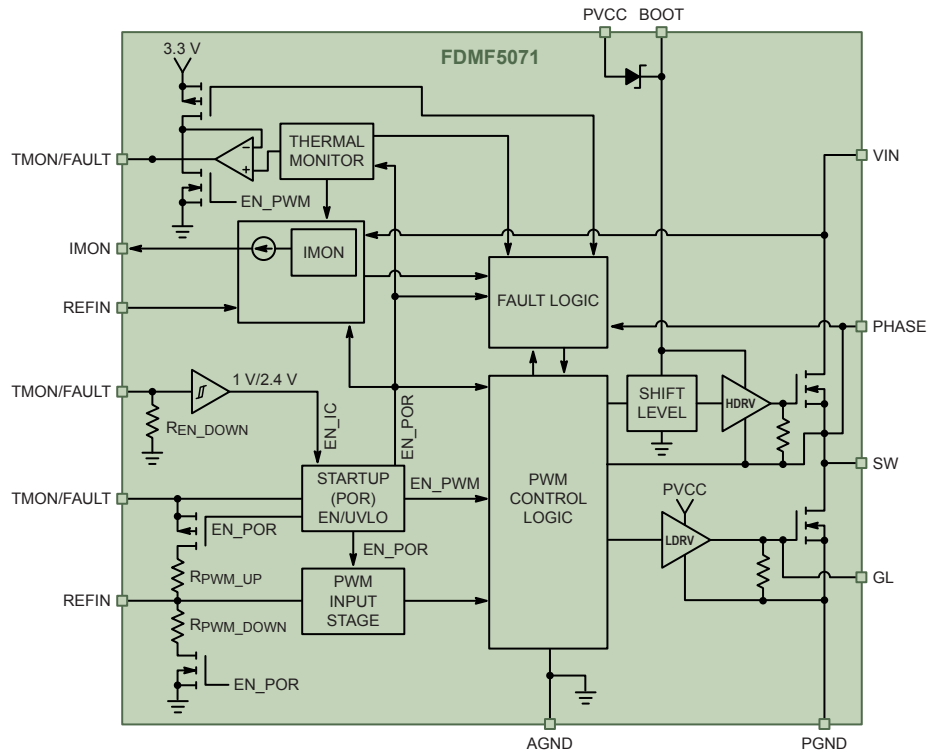
NCP81232 Supports Up to 4 Phases with 2 Control Loops (Can Be Paralleled for Single Output)

Device	Phases	VR Compatibility	Controller Algorithm	Digital Interface	Package
NCP81233	Up to 6	Universal	Dual-Edge	I2C	QFN-52
NCP81232	Up to 4	Universal	Dual-Edge	I2C	QFN-40
NCP81234	Up to 2	Universal	Dual-Edge	I2C	QFN-28

Power Stages for Efficient Power Conversion

Features

- Integrated driver with high- and low-side MOSFETs
- Integrated bootstrap diode
- Higher switching frequency enables use of smaller inductors and capacitors
- 65% lower BOM, 45% smaller footprint, simplified layout, compared to discrete solutions

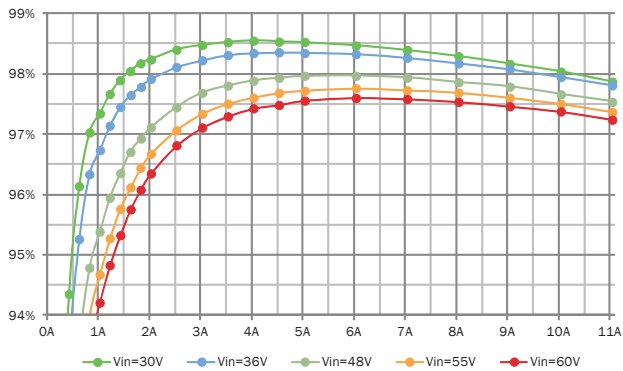


FDMF5071 Functional Block Diagram

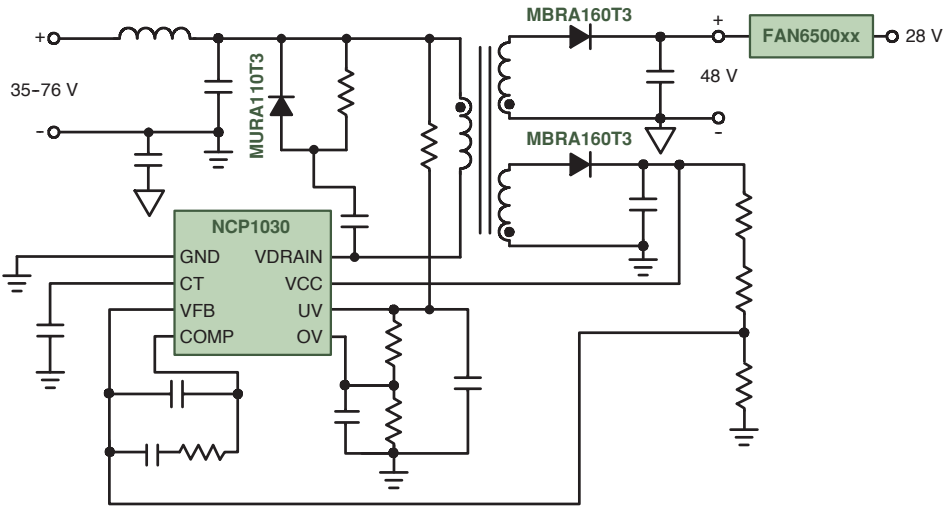
Device	Integrated Current Sensing	IOUT (A)	Package
NCP303150	IMON	80 (peak)	PQFN-39
FDMF5062	IMON	74 (peak)	PQFN-39*
FDMF5071	IMON	99 (peak)	PQFN-39*
FDMF5085	IMON	108 (peak)	PQFN-39*
NCP303152	IMON	90 (peak)	PQFN-39
NCP303160	IMON	90 (peak)	PQFN-39
NCP302155	DCR	55 (average)	PQFN-31
NCP302150	DCR	45 (average)	PQFN-31
NCP302045	—	45 (average)	PQFN-31
NCP302040	—	40 (average)	PQFN-31
NCP5369	—	40 (continuous)	QFN-40
NCP302035	—	35 (average)	PQFN-31

* Universal footprint.

DC-DC Power Conversion



FAN65008B Efficiency – VOUT = 28 V, Fsw = 300 kHz

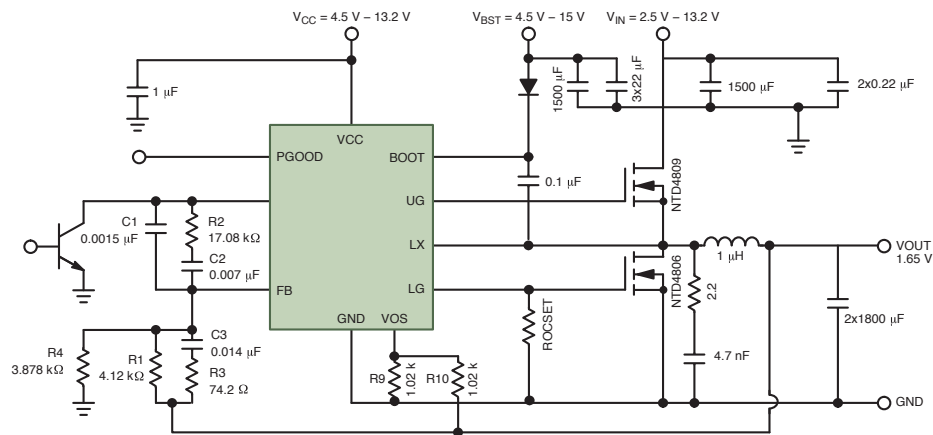


Non-Isolated Bias Supply

48 V DC-DC Power Conversion

Device	Topology	Control Mode	Vcc Min (V)	Vcc Max (V)	Io Typ (A)	fsw Typ (kHz)	Package(s)
FAN65004B	Step-Down	Voltage Mode	4.5	65	6	100 - 1000	PQFN-35
FAN65004C	Step-Down	Voltage Mode	4.5	65	6	100 - 1000	PQFN-35
FAN65005A	Step-Down	Voltage Mode	4.5	65	8	100 - 1000	PQFN-35
FAN65008B	Step-Down	Voltage Mode	4.5	65	10	100 - 1000	PQFN-35
NCP1030	Flyback, Step-Down, Step-Up	Voltage Mode	8	200	0.5	300	Micro8
NCP1031	Flyback, Step-Down, Step-Up	Voltage Mode	8	200	1	Up to 1000	DFN-8, SOIC-8
NCP1032	Flyback	Voltage Mode	8	200		1000	WDFN-8
NCP1034	Step-Down	Voltage Mode	8	100		500	SOIC-16

DC-DC Power Conversion



NCP1589A Application Diagram

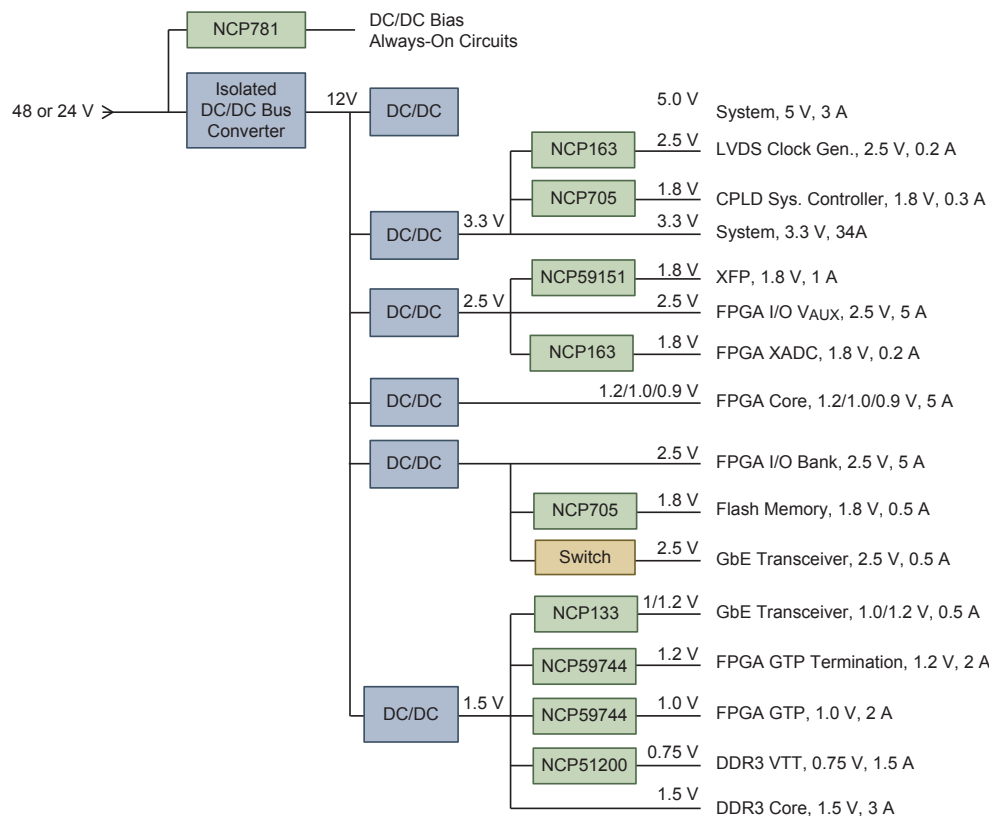
12 V DC-DC Power Conversion

Device	Topology	V _{CC} Min (V)	V _{CC} Max (V)	I _O Typ (A)	f _{sw} Typ (kHz)	Package(s)
NCP3101C	Step-Down	2.7	18	6	275	QFN-40
NCP5269	Step-Down	3.3	28	—	300 - 600	QFN-20
NCP3170	Step-Down	4.5	1.8	3	500/1000	SOIC-8
NCP5212	Step-Down	4.5	27	—	300	QFN-16
NCP5212T	Step-Down	4.5	27	—	300	QFN-16
NCP5217	Step-Down	4.5	27	—	300	QFN-14
NCP5222	Step-Down	4.5	27	—	300	QFN-28
NCP3235	Step-Down	4.5	23	15	500/1000	QFN-40
NCP3232N	Step-Down	4.5	21	15	500	QFN-40
NCP3284	Step-Down	4.5	18	30	500/600/800/1000	PQFN-37
NCP3284A	Step-Down	4.5	18	35	500/600/800/1000	PQFN-37
NCP3230	Step-Down	4.5	18	30	500	QFN-40
NCP3170A/B	Step-Down	4.5	18	3	500/1000	SOIC-8
NCP3233	Step-Down	3.0	21	20	500	QFN-40
NCP1579	Step-Down	4.5	13.2	—	275	SOIC-8
NCP1587	Step-Down	4.5	13.2	—	250 - 300	SOIC-8
NCP1587A	Step-Down	4.5	13.2	—	180 - 220	SOIC-8
NCP1589A	Step-Down	4.5	13.2	—	—	DFN-10
NCP1589D	Step-Down	4.5	13.2	—	—	DFN-10
NCP1589L	Step-Down	4.5	13.2	—	—	DFN-10
NCP5230	Step-Down	4.5	13.2	—	—	QFN-16

Low V DC-DC Power Conversion

Device	Topology	V _{CC} Min (V)	V _{CC} Max (V)	I _O Typ (A)	f _{sw} Typ (kHz)	Package(s)
NCP6324	Step-Down	2.5	5.5	2	3000	WDFN-8
NCP3135	Step-Down	2.9	5.5	5	1100	QFN-16
NCP3136	Step-Down	2.9	5.5	6	1100	QFN-16
NCP3133A	Step-Down	2.9	5.5	3	1100	QFN-16
NCP1592	Step-Down	3.0	6.0	6	280 - 700	TSSOP-28
NCP1593	Step-Down	4.0	5.5	3	1000	DFN-10
NCP1595C	Step-Down	4.0	5.5	1.5	1000	DFN-6

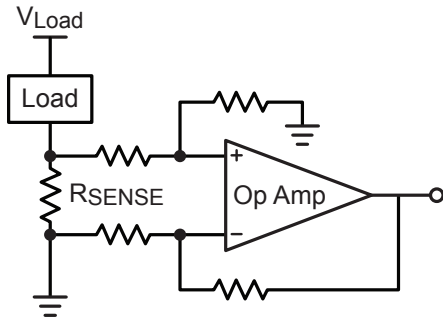
Linear Voltage Regulators



Device	I _O Typ	Function	Features	Package
NCP785A	10 mA	High Voltage LDO	Up to 450 V V _{IN} ; High PSRR	SC-89
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
NCP711	100 mA	Ultra-low Noise LDO	18 V low I _q =1uA with PG	SOT-23-5, WDFN-6
NCP781	100 mA	High Voltage LDO	Up to 150 V V _{IN} , High PSRR	DFN-6
NCP730	150 mA	Ultra-low Noise LDO	38 V low I _q =1uA with PG	SOT-23-5, WDFN-6
NCP160	250 mA	Ultra-high PSRR	92 db PSRR; Low Noise	WLCSP-4, XDFN-4
NCP163	250 mA	Ultra-low Noise	92 db PSRR; 6.5 μVrms Noise	WLCSP-4, XDFN-4
NCP703	300 mA	Ultra-low Noise LDO	Ultra-low noise; High PSRR	SOT-23-5, WDFN-6
NCP718	300 mA	Ultra-low Quiescent Current LDO	Ultra-low quiescent current; Wide input voltage range	WDFN-6, TSOT-23-5
NCP161	450 mA	Ultra-high PSRR	92 db PSRR; Low Noise	WLCSP-4, XDFN-4
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
NCP705	500 mA	Ultra-low Noise LDO	Ultra-low noise; High PSRR	WDFN-6
NCP708	1 A	Precision LDO	1% Accuracy, Soft start	UDFN-6
NCP186	1 A	Precision LDO	1% Accuracy, Fast transient response, Ultra low VDO	XDFN-8
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
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
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

Current Sensing Solutions Using Amplifiers

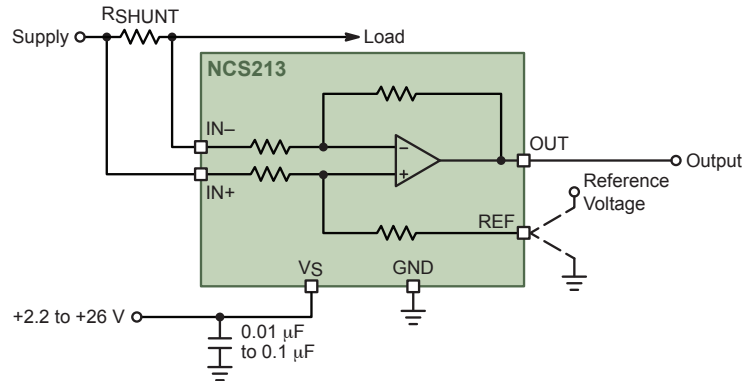
As part of an expansive portfolio, amplifiers from ON Semiconductor offer precision performance over time and temperature, making them ideal for current sensing in system monitoring and protection circuits.



Current Sensing Solution with External Gain Setting Resistors

NCSx333 Zero Drift Op Amp
 $V_{OS} = 10 \mu V$
 50 mV Shunt Drop
 Only 0.02% Offset Error

NCS200xx Low Power Op Amp
 $V_{OS} = 4 mV$
 50 mV Shunt Drop
 8% Offset Error



Current Sensing Solution with Integrated Gain Setting Resistors

NCS21x Current Sense Amplifiers
 $V_{OS} = 35 \mu V$
 50 mV Shunt Drop
 0.07% Offset Error

Zero Drift Current Sense Amplifiers (Integrated and Precision Performance)

Device	Channels	V_S Min (V)	V_S Max (V)	Input CM Range (V)	GBW (kHz)	V_{OS} Max (μV)	V_{OS} Drift ($\mu V/^\circ C$)	Gain Error (%)	CMRR (dB)	Features	Package
NCS21x	1	2.2	26	2.2 to 26	14	35	0.5	1	140	Low V_{OS}	SOT-363

Low Voltage, Zero Drift Amplifiers (High Precision)

Device	Channels	V_S Min (V)	V_S Max (V)	I_Q /Channel (μA)	GBW (kHz)	V_{OS} Max (μV)	V_{OS} Drift ($\mu V/^\circ C$)	CMRR (dB)	Features	Package
NCS21911	1	4	36	600	2000	2.5	0.085	120	Low V_{OS} , Low Drift	TSOP-5/SOT-23-5
NCS325	1	1.8	5.5	21	350	50	0.02	110	Low V_{OS}	SOT-23
NCSx333	1, 2, 4	1.8	5.5	21	350	10	0.03	120	Low V_{OS}	SOT-23-5, SC-70-5, DFN-8, Micro8, SOIC-8, SOIC-14

Low Voltage Amplifiers (Standard)

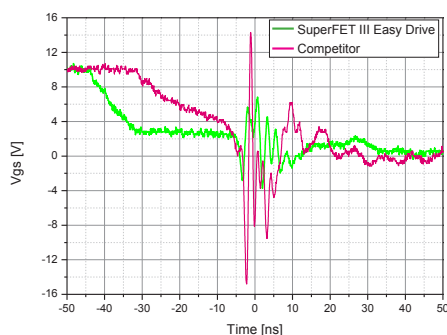
Device	Channels	V_S Min (V)	V_S Max (V)	I_Q /Channel (μA)	GBW (MHz)	V_{OS} Max (mV)	V_{OS} Drift ($\mu V/^\circ C$)	I_B (nA)	CMRR (dB)	Rail-to-Rail	Features	Package
NCS2009x	1, 2	1.8	5.5	20	0.35	4	1	0.001	80	I/O	Low I_Q & V_{OS}	SOT-23-5, SC-70-5, UDFN-6, Micro8, TSSOP-8, SO-8
NCS2008x	1, 2	1.8	5.5	50	1.2	4	1	0.001	80	I/O	Low I_Q & V_{OS}	SOT-23-5, SC-70-5, UDFN-6, Micro8, TSSOP-8, SO-8
NCS2006x	1, 2	1.8	5.5	140	3	4	1	0.001	80	I/O	Low I_Q & V_{OS}	SOT-23-5, SC-70-5, UDFN-6, Micro8, TSSOP-8, SO-8
NCS2003x	1, 2, 4	1.7	5.5	275	7	5	2	0.001	80	Output	Fast Slew Rate, Low V_S & I_B	SOT-23-5, SOT-553, Micro8, SOIC-8, TSSOP-8
NCS2007x	1, 2, 4	2.7	36	400	3	4	2	0.005	110	Output	Wide V_S range	SOT-553, TSOP-5, Micro8, SO-8, TSSOP-8

Wide Selection of High Voltage Power MOSFETs

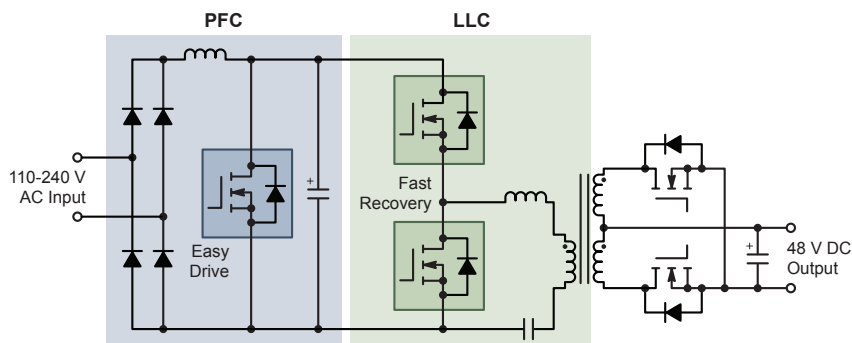
ON Semiconductor offers an expansive portfolio of Power MOSFETs, utilizing advanced SuperJunction technology. Devices enable increased system level efficiency through low switching and low conduction losses, and are available in a range of standard and innovative packages.

Features

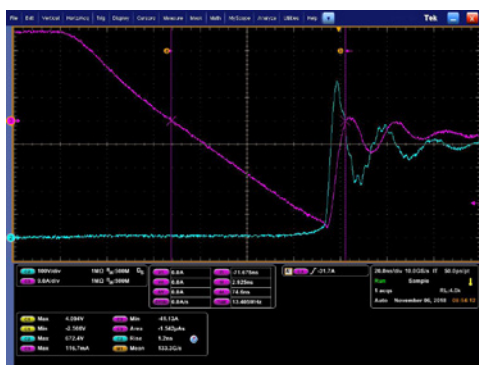
- SuperFET® III Easy Drive
 - Outstanding ease of use and low EMI
 - Excellent Figure-of-Merit ($R_{DS(ON)}$ Max X Q_g Typ)
 - Well balanced switching behavior
 - $V_{(BR)DSS}$ of 650 V at $T_j = 25^\circ\text{C}$, 700 V at $T_j = 150^\circ\text{C}$
 - Robust body diode
- SuperFET® III FRFET®
 - No need additional circuit in LLC resonant converter
 - Improving system reliability
 - Best in class body diode performance (t_{rr} , Q_{rr} , robustness)
 - Soft recovery and low peak V_{DS} during body diode turn-off transient
 - $V_{(BR)DSS}$ of 650 V at $T_j = 25^\circ\text{C}$, 700 V at $T_j = 150^\circ\text{C}$



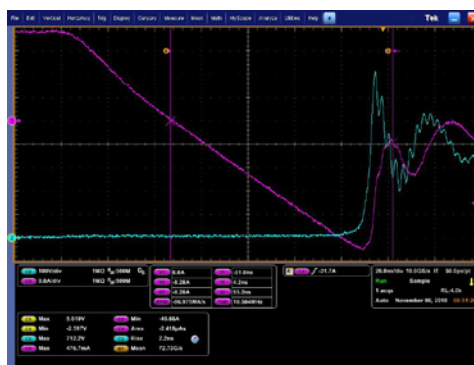
Gate oscillation during turn-off transient



AC-DC Rectifier Typical Block Diagram



SuperFET III Fast Recovery



Best Competitor

Body Diode Performance

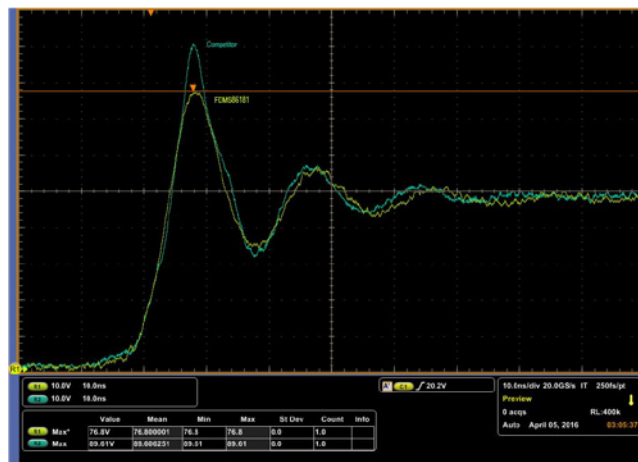
Device	Voltage Range	Current Range	Features	Functions	Packages
SuperJunction MOSFET	600 – 800 V	1.6 – 75 A	• Outstanding ease of use and low EMI • Excellent FOM ($R_{DS(ON)}$ max. X Q_g typ.) • Well balanced switching behavior • Robust body diode • Soft recovery and small Q_{rr} for FRFET	High voltage switch for industrial power supply	D2PAK, DPAK, IPAK, TO-220, TO-220F, TO-247, Power88

Wide Selection of Medium Voltage Power MOSFETs

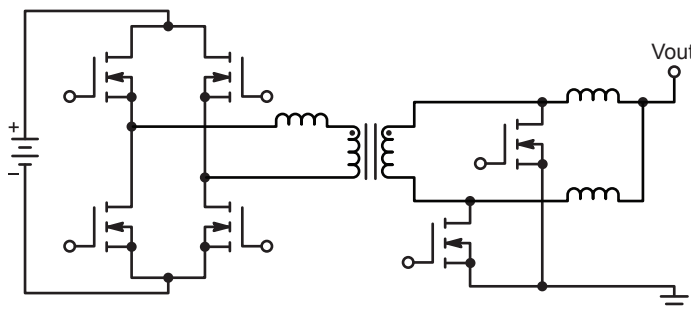
ON Semiconductor offers an expansive portfolio of Power MOSFETs, utilizing advanced shielded gate technology. Devices enable increased system level efficiency through low conduction and low switching losses, and are available in a range of standard and innovative packages.

Features

- T6 and T8, 40 to 80 V technology
- 80 V to 120 V PTNG
 - Optimised low $R_{DS(ON)}$ and Q_g
 - Ultra soft body diode with PTNG
 - Lowest $R_{DS(ON)}$ in SO-8FL with T6
 - Provides low ringing
 - Improved EMI performance
 - Lower conduction losses
 - Lower switching losses
 - Best in class body diode
 - Soft recovery and small Q_{rr}
 - Ultra low gate resistance for fast switching



Overshoot Reduction Enabled by Shielded Gate MOSFET Technology



Isolated DC-DC Schematic

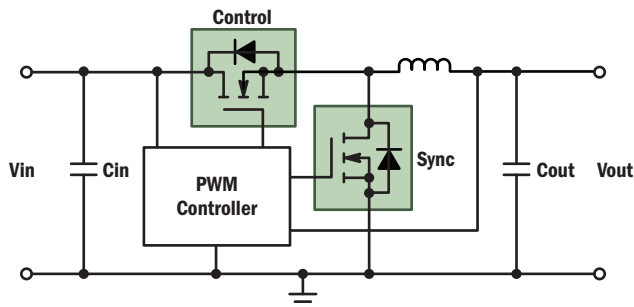
Device	Voltage Range	Current Range	Features	Functions	Packages
Medium Voltage MOSFET	40 - 250 V	2 - 52 A	• Outstanding switching performance and low EMI • Excellent FOM ($R_{DS(ON)}$ max. X Q_g typ.) • Well balanced switching behavior • Robust body diode • Soft recovery and small Q_{rr}	Primary and secondary MOSFET for DC-DC power supply	TO-220, D2PAK, DPAK, TOLL, SO-8FL, μ 8FL, Power56, Power33, Power22, SO-8, SSOT-6, SSOT-3

N-Channel MOSFETs for Power Conversion

Non-Isolated Topology "Buck" DC-DC

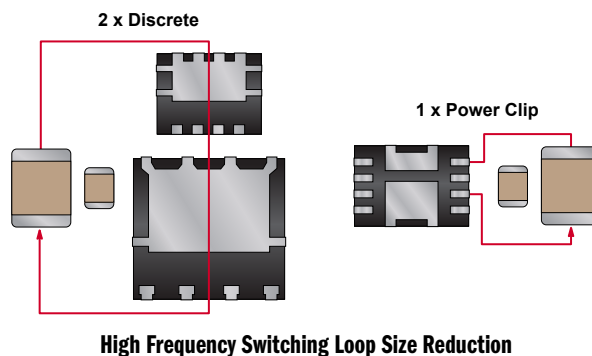
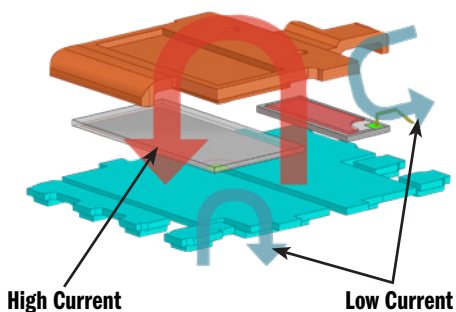
Features

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



Increasing Power Density with PowerClip Dual MOSFETs

- Single optimized clip reduces interconnect parasitics
 - Up to 40 A in 5x6 mm & 25 A in 3x3 mm
- Flipped low side die reduces source inductance & improves thermals



Device	Package	I_{max} (A)	BV_{DSS} (V)	$V_{GS Max}$ (V)	$R_{DS(ON)}$ Max @ $V_{GS} = 4.5 V$ (m Ω)		Q_g Typ @ $V_{GS} = 4.5 V$ (nC)		C_{oss} Typ (pF)
					High Side	Low Side	High Side	Low Side	Low Side
FDPC8012S	Power Clip 33	15-20	25	12	7	2.2	8	25	885
FDPC8013S		10-15	30	20	9.6	2.7	6	21	997
FDPC3D5N025X9D		10	25	12	3.7	3.7	17	17	612
FDPC8016S	Power Clip 56	20-30	25	12	4.7	1.7	11	31	1195
FDPC8014S		>30	25	12	4.7	1.4	11	43	1720
FDPC8014AS		>30	25	12	4.7	1.2	11	44	2170
FDMS001N025DSD		>30	25	16	4	1.1	10	35	1810
NTMFD0D9N02P1E		>30	25	16	3.8	0.95	9	30	1355
FDMS1D2N03DSD		>30	30	16	4	1.2	11	39	1845
FDPC5018SG		25	30	12	6.5	2	8	28	1210
FDPC5030SG		20	30	12	6.5	3	8	18	801

Electronic Fuses for Inrush Current Limiting on Power Buses

3-12 V Power Bus Hot Plug Protection

Features

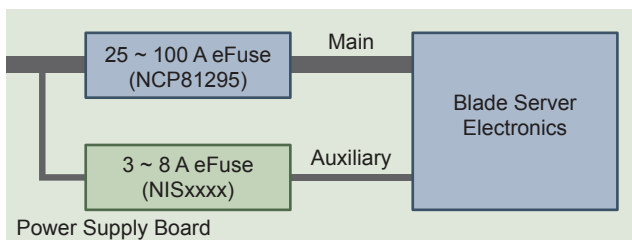
- Low RDS(ON)
- Adjustable current limits
- Overvoltage protection
- Thermal shutdown
- Slew rate control
- Real time current monitoring
- Tri-state enable and/or digital enable
- Multiple eFuses can work in parallel to drive higher power loads

Applications/Markets

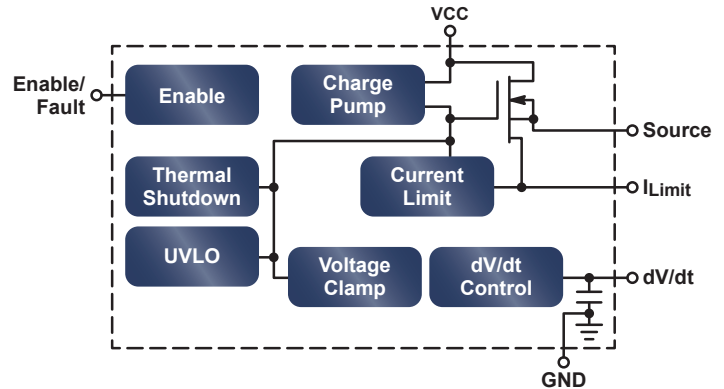
- Server Backplane Protection
- SSD/HDD Protection
- Hot-pluggable Fans



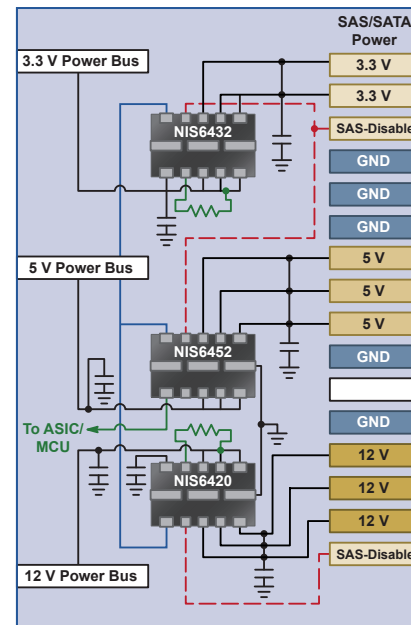
Hot-Plugged Fans



Servers



Typical Feature Set for eFuse



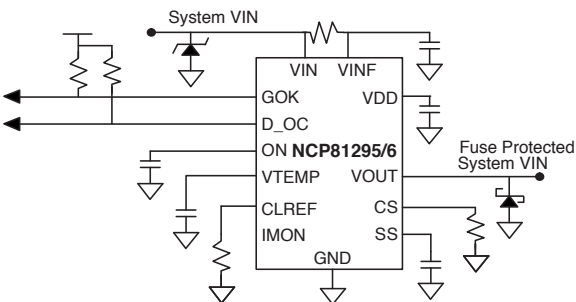
SSD/HDD Protection

Device	Nominal Voltage (V)	Input Voltage (V)	Output Clamping Voltage (V)	Continuous Current (A)	Trip Current (A)	RDS(ON) (mΩ)	Package
NIS6432	3.3	-0.3 to 14	3.9	5	Adjustable	42	WQFN-12
NIS6452	5	-0.3 to 14	6.5	5	Adjustable	42	WQFN-12
NIS6150	5	-0.3 to 10	6.1/6.9	1	Adjustable	135	WDFNW-10
NIS6350	5	-0.3 to 10	6.1/6.9	3	Adjustable	36	WDFNW-10
NIS5420	12	-0.6 to 18	13.5/15	4.6	Adjustable	39	DFN-10
NIS3320	12	-0.6 to 18	N/A	1	Fixed	95	TSOP-5
NIS6420	12	-0.3 to 16	N/A	5	Adjustable	42	WQFN-12
NIS4461	24	-0.6 to 30	N/A	3.6	Adjustable	44	DFN-10

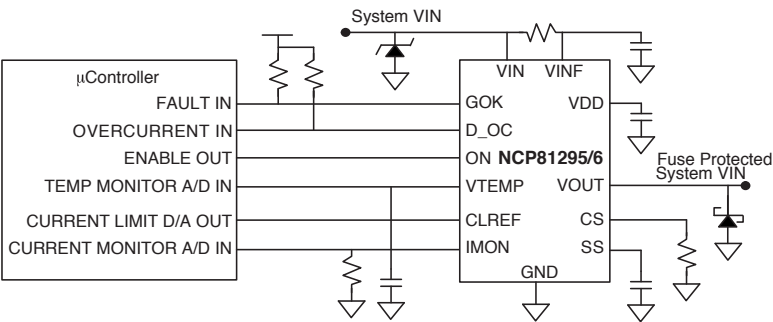
Hot Swap with Internal MOSFET and IMON Output

Features

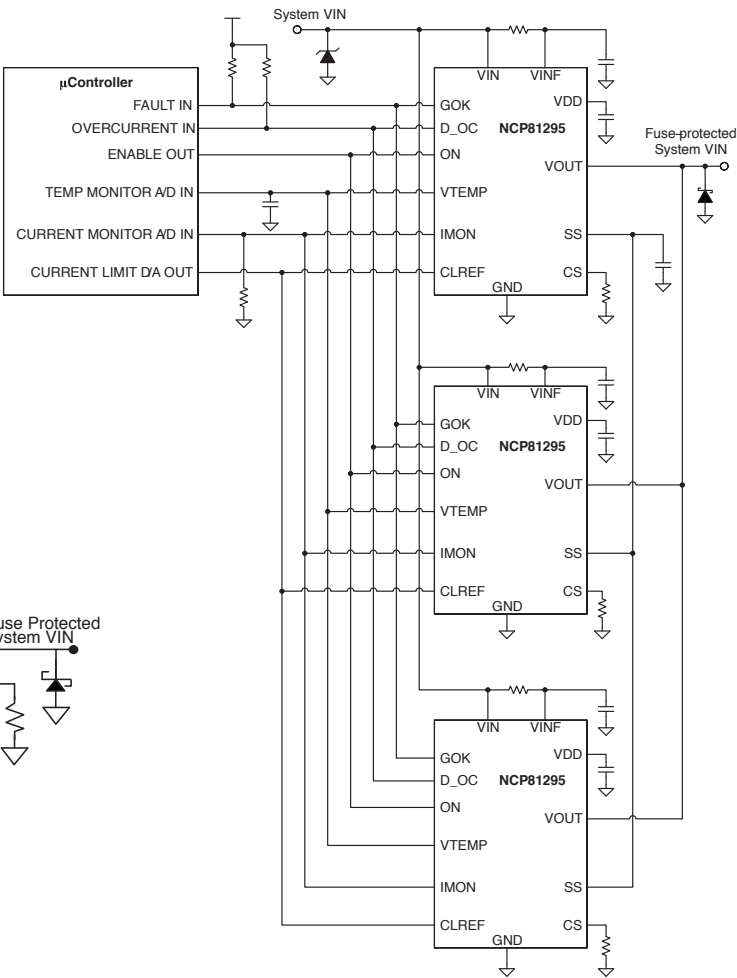
- Hot swap controller with integrated 0.65 mΩ MOSFET for reduced footprint
- IMON output provides proportional current signal with SENSEFET technology, eliminating sensing resistor and associated power losses
- Able to parallel devices for higher current with added SOA production during soft start



Stand-Alone Single eFuse



Single eFuse with Controller



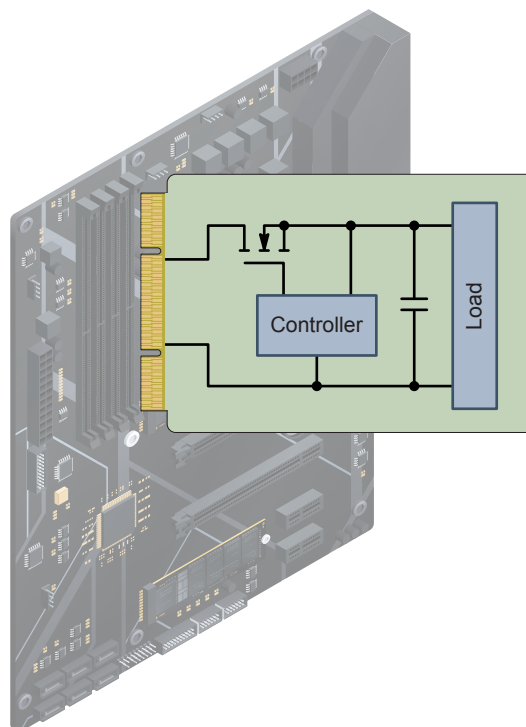
Parallel Fuse Operation with Controller

Device	Fault	Vcc Max (V)	Io Typ (A)	Package(s)
NCP81295	Latch Off	18	50	LQFN-32
NCP81292	Auto-Retry	18	50	LQFN-32

Hot Swap MOSFETs

Features

- Wide SOA to improve inrush current management
- Ultra-low $R_{DS(ON)}$ to improve system efficiency
- Advanced SO-8 FL package, 5 x 6 mm, to improve thermal performance

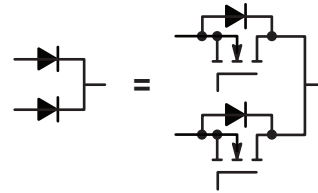


Device	Configuration	V_{DS} (V)	V_{GS} (V)	$R_{DS(ON)}$		C_{iss} (pF)	Q_g (nC)	Package
				$V_{GS} @ 10\text{ V Max}$ (m Ω)	$V_{GS} @ 4.5\text{ V Max}$ (m Ω)			
NTMFS0D55N03CG	Single	30	± 20	0.55	0.8	13786	201	SO-8 FL
NTMFS0D7N03CG	Single	30	± 20	0.65	1	12300	147	SO-8 FL
NTMFS0D9N03CG	Single	30	± 20	0.9	1.4	9550	131	SO-8 FL
NTMFS1D15N03CG	Single	30	± 20	1.15	1.7	7300	94	SO-8 FL
NTMFS1D7N03CG	Single	30	± 20	1.7	2.4	3590	92	SO-8 FL

ORing MOSFETs

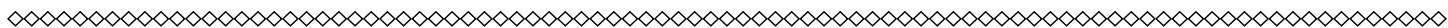
Features

- Ultra low $R_{DS(ON)}$ for low conduction loss
- 25 V and 30 V for IM bus ORing
- 100 V for 48 V bus ORing
- Much more efficient and reliable solution than power diodes



MOSFETs as ORing Diodes

Device	Configuration	V_{DS} (V)	V_{GS} (V)	$R_{DS(ON)}$		Q_g (nC)	Q_{gd} (nC)	Package
				$V_{GS} @ 10 V$	$V_{GS} @ 4.5 V$			
				Max (mΩ)	Max (mΩ)			
NTMFS4H01N	Single	25	20	0.7	0.9	39	8.5	S08-FL
NTMFS4H02N	Single	25	20	1.3	1.9	26	5.8	S08-FL
FDMS8050	Single	30	20	0.65	0.9	93	18	Power56
NTMFS4C020N	Single	30	20	0.7	1	63	13	S08-FL
FDMC8010	Single	30	20	1.3	1.8	32	9.5	Power33
NTTFS4C02N	Single	30	20	2.3	3.1	20	4	U8FL
NTMFS5C404NL	Single	40	20	0.67	1	81	23.8	S08-FL
NTMFS5H400NL	Single	40	20	0.8	1.1	54	13	S08-FL
NTMFS5C604NL	Single	60	20	1.2	1.7	52	12.7	S08-FL
NTMFS5H600NL	Single	60	20	1.3	1.7	40	6.5	S08-FL
NTMFS6H800N	Single	80	20	2.1	—	85	16	S08-FL
FDMS86180	Single	100	20	3.2	—	60	12	Power56



Advanced P-Channel MOSFETs for Power Load Switch

Features

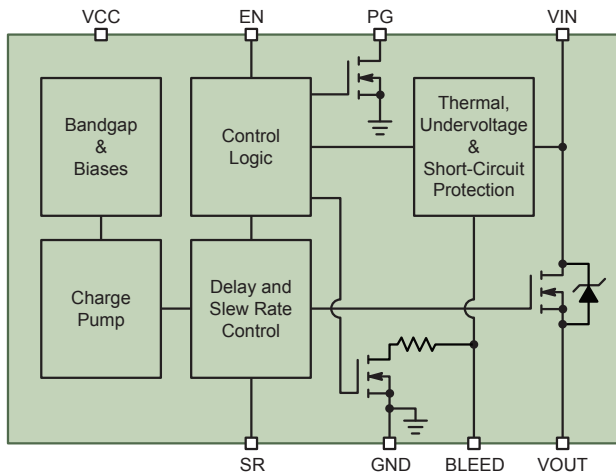
- Ultra low $R_{DS(ON)}$ to improve system efficiency
- Advanced package technology for space saving and excellent thermal conduction

Device	Configuration	Polarity	V_{DS} (V)	V_{GS} (V)	$R_{DS(ON)}$		Q_g (nC)	C_{iss} (pF)	Package
					$V_{GS} @ 10 V$	$V_{GS} @ 4.5 V$			
					Max (mΩ)	Max (mΩ)			
FDMC610P	Single	P	12	8	—	3.9	71	890	Power33
NTLUS3C18PZ	Single	P	12	10	—	24	16	1570	UDFN-6
FDMC4D9P20X8	Single	P	20	12	—	4.9	78	7535	PQFN-8
FDMA008P20LZ	Single	P	20	8	—	13	28	3131	PQFN-6
FDMA6676PZ	Single	P	30	25	13.5	27	20	1440	PQFN-6
NTLUD3A50PZ	Dual	P	20	8	—	48	10.4	920	UDFN-6

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



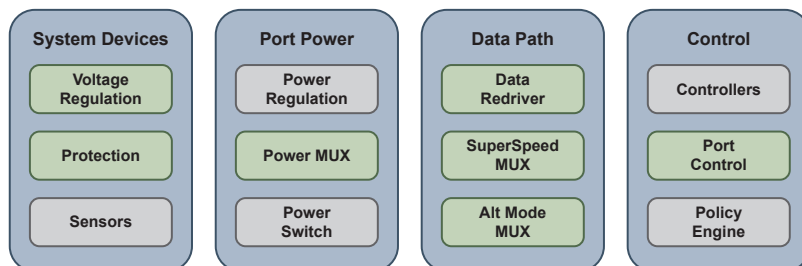
NCP45xxx Integrated Load Switch Features

- 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 _{on} (mΩ)	I Max (A)	V _I Min (V)	V _I Max (V)	I _Q (μA)	Discharge	Slew Rate (μs)	Features	Package(s)
Smart Load Switch	NCP333	55 at 3.3 V	1.5	1.2	5.5	1	Auto	95	—	WLCSP-4
	FPF1504	15 at 3.3 V	1.5	1	3.6	0.1	Auto	130	—	WLCSP-4
	NCP433	50 at 1.8 V	1.5	1	3.6	0.6	Auto	20	—	WLCSP-4
	NCP335	47 at 3.3 V	2	1.2	5.5	1	Auto	71	—	WLCSP-4
	NCP435	43 at 1.8 V	2	1	3.6	0.6	Auto	61	—	WLCSP-4
	FPF1204	45 at 5.5 V	2.2	1.2	5.5	1.5	Auto	100	—	WLCSP-4
	NCP330	26 at 3.3 V	3	1.8	5.5	100	—	2000	Reverse blocking	TDFN-4
	NCP337	23 at 3.3 V	3	1.2	5.5	1	Auto	810	—	WLCSP-6
	NCP339	26 at 3.3 V	3	1.2	5.5	2	—	2700	Reverse blocking	WLCSP-6
	FPF1038	20 at 5.5 V	3.5	1.2	5.5	5.5	—	2700	—	WLCSP-6
	FPF1039	20 at 5.5 V	3.5	1.2	5.5	5.5	Auto	2700	—	WLCSP-6
	FPF2411	10 at 5.0 V	6	2.3	5.5	1	—	3000	Reverse blocking	WLCSP-12
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

USB-C for PC/Laptop

PC/Laptop form factors are getting smaller, thinner, and lighter with the adaptation of the USB Type-C connectors. ON Semiconductor offers multiport solutions compatible with the USB Type-C Port Controller Protocol and Power Delivery 3.0.



Block Diagram

System Devices

Function	Device	Description
Voltage Regulation	NCP81231	Buck Controller, USB Power Delivery and Type-C Applications
	NCP81239	Buck-Boost Controller, USB Power Delivery and Type-C Applications
Protection	ESD8704	High Speed Data Line Protection, Unidirectional (3.3 V - USB 3.x)
	ESDL1531	High Speed Data Line Protection, Bidirectional (4 V - USB), 0.2 pF
	ESDL2011	High Speed Data Line Protection, Bidirectional (1 V - Thunderbolt 3.0), 0.2 pF
	ESDL2031	High Speed Data Line Protection, Bidirectional (4 V - USB), 0.35 pF
	ESDM1051	ESD Protection Diode, CC and SBU Protection (5.5 V - USB 3.x), 21 pF
	ESDM1131	High Speed Data Line Protection, Bidirectional (3.3 V - USB 2.0), 4 pF
	ESDM3551	ESD Protection Diode, CC and SBU Protection (5.5 V - USB 3.x), 21 pF
	FSUSB242	USB Type-C Port Protection Switch
	FUSB252	High Speed Digital (HSD) Port Protection Switch with Type-C CC
	NIS6350	Electronic Fuse, 5 V
	NSPM2052	ESD and Surge Protection Device, Vbat and Vbus Applications, 5 V
	NSPU3051	ESD Protection Diode, CC and SBU Protection (5.5 V - USB 3.x), 21 pF
	NSPU5201	ESD and Surge Protection, Unidirectional, 20 V, 140 A
	NCS210	Current Sense Amplifier, Bidirectional Zero-Drift, 1% Max. Gain Error, 60 μ V Offset
	NCS211	Current Sense Amplifier, Bidirectional Zero-Drift, 1% Max. Gain Error, 60 μ V Offset
	NCS213	Current Sense Amplifier, Bidirectional Zero-Drift, 1% Max. Gain Error, 100 μ V Offset
	NCS214	Current Sense Amplifier, Bidirectional Zero-Drift, 1% Max. Gain Error, 60 μ V Offset

Port Power

Function	Device	Description
Power MUX	FPF2595	Load Switch, Over-Voltage, Over-Current Protection with Adjustable Current-Limit Control, IntelliMAX™ 28 V
	FPF2895C	Current Limit Load Switch with OVP and TRCB, 28 V, 5 A

Data Path

Function	Device	Description
Data Redriver	NB7NPQ7222M	USB 3.1, One Port Linear High Gain Redriver, 3.3 V
	NB7NPQ7042M	USB 3.1, Two Port Linear High Gain Redriver, 3.3 V
	NB7NPQ1002M	USB 3.1, One Port Linear Redriver, 3.3 V
	NB7NPQ1204M	USB 3.1, Two Port Linear Redriver, 3.3 V
	NB7VPQ904M	USB Type-C, DisplayPort™ Linear Redriver, 1.8 V, 10 Gbps
SuperSpeed Mux	FUSB340	USB 3.1 SuperSpeed Switch, 10 Gbps
Alt Mode MUX	FSA44825	Analog Audio Switch with Protection Function, USB Type-C
	FSA4480	Analog Audio Switch with Protection Function, USB Type-C

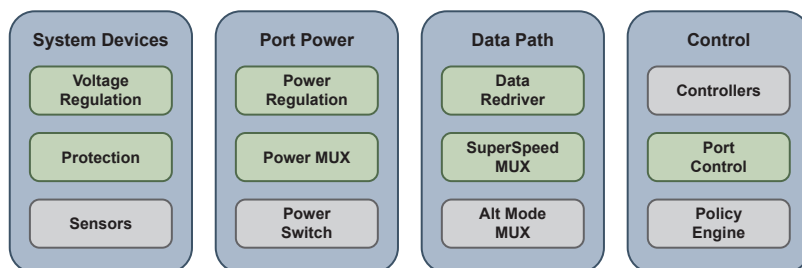
Control

Function	Device	Description
Port Control	FUSB302B	Programmable USB Type-C Controller with PD (Default SNK)
	FUSB303	Autonomous USB Type-C Controller with I2C and GPIO Control
	FUSB307B	USB Type-C Port Controller with USB-PD



USB-C for Docking Station

Greater adaptation of USB-C (Type-C) has caused manufactures to introduce many USB-C devices, including for mobile PCs, tablets, and docking stations. There are various USB-C universal docking stations to connect multiple laptop platforms and peripherals. ON Semiconductor provides docking station solutions including the USB-C Data Hub (USB protocol & signal conditioning), as well as the charging capability for the USB-C systems that support USB Power Delivery/Alternate mode protocol.



System Devices

Block Diagram

Function	Device	Description
Voltage Regulation	NCP81599	4-Switch Buck Boost Controller for USB-PD Power Delivery and Type-C Applications
Protection	FUSB252	High Speed Digital (HSD) Port Protection Switch with Type-C CC
	ESD8704	High Speed Data Line Protection, Unidirectional (3.3 V - USB 3.x)
	ESD8708	High Speed Data Line Protection, Unidirectional (3.3 V - Ethernet)
	ESDL2011	High Speed Data Line Protection, Bidirectional (1 V - Thunderbolt 3.0), 0.2 pF
	ESDL2031	High Speed Data Line Protection, Bidirectional (4 V - USB), 0.35 pF
	ESDL1531	High Speed Data Line Protection, Bidirectional (4 V - USB), 0.2 pF
	ESDM1131	High Speed Data Line Protection, Bidirectional (3.3 V, USB 2.0) 4 pF
	ESDM3551	ESD Protection Diode, CC and SBU Protection (5.5 V - USB 3.x), 21 pF
	ESDM1051	ESD Protection Diode, CC and SBU Protection (5.5 V - USB 3.x), 21 pF
	NSPU3051	ESD and Surge Protection, CC, SBU and Vbus Lines, (5.5V - USB 3.x), 80 pF
	NSPM2052	ESD and Surge Protection Device, Vbat and Vbus Applications, 5 V
	NSPU5132	ESD and Surge Protection Device, Unidirectional, 13.5 V, 200 A
	NSPU5201	ESD and Surge Protection, Unidirectional, 20 V, 140 A
	NIS6350	Electronic Fuse, 5 V, 46 mΩ
	NIS5020	Electronic Fuse, 12 V, 14 mΩ

Data Path

Function	Device	Description
Data Redriver	NB7NPQ7222M	USB 3.1, One Port Linear High Gain Redriver, 3.3 V
	NB7NPQ7042M	USB 3.1, Two Port Linear High Gain Redriver, 3.3 V
	NB7NPQ1102M	USB 3.1, One Port Linear Redriver, 3.3 V
	NB7NPQ1204M	USB 3.1, Two Port Linear Redriver, 3.3 V
	NB7VPQ904M	USB Type-C, DisplayPort™ Linear Redriver, 1.8 V, 10 Gbps
	NB7NQ621M	
SuperSpeed Mux	FUSB340	USB 3.1 SuperSpeed Switch, 10 Gbps

Port Power

Function	Device	Description
Power Regulation	NCP1342	High Frequency Quasi-Resonant Flyback Controller
	NCP1345*	USB PD Optimized QR Controller
	NCP1568	Active Clamp Flyback Controller with ZVS
	NCP4306	Secondary Side Synchronous Rectification Driver
	NCP4307*	Secondary Side SR Driver with VCC Management
	FAN65008B	Synchronous PWM Buck Regulator, Voltage Mode, 65 V, 10 A
Power MUX	FPF2595	Load Switch, Over-Voltage, Over-Current Protection with Adjustable Current-Limit Control, IntelliMAX™ 28 V
	FPF2895C	Current Limit Load Switch with OVP and TRCB, 28 V, 5 A

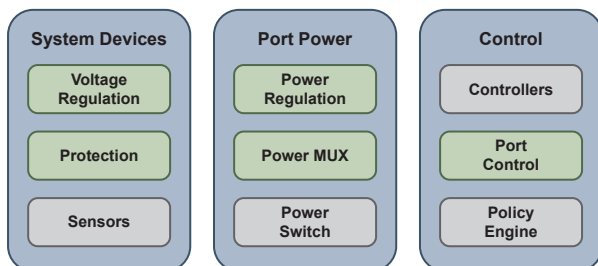
* Pending 3Q21.

Control

Function	Device	Description
Port Control	FUSB302B	Programmable USB Type-C Controller with PD (Default SNK)
	FUSB302T	Programmable USB Type-C Controller with PD (Default SRC)
	FUSB303	Autonomous USB Type-C Controller with I2C and GPIO Control
	FUSB307B	USB Type-C Port Controller with USB-PD
	FUSB308BV	USB Type-C Port Controller with USB-PD

USB-C for Power Adapters

ON Semiconductor provides power adapter solutions compatible with the latest USB-C (Type-C) and Power Delivery (PD) specifications. Our solutions are integrated, compact, highly efficient solutions that consume minimal quiescent current to minimize heat dissipation.



Block Diagram



System Devices

Function	Device	Description
Voltage Regulation	FAN6291QH	Secondary-Side Adaptive Charging Controller, Synchronous Rectifier and USB Type-C Control
	NIS6350	Electronic Fuse, 5 V, 46 mΩ
Protection	NIS5020	Electronic Fuse, 12 V, 14 mΩ
	ESD5581	ESD Protection, Bidirectional, 5 V, 10 pF, 6 Am
	ESDM3551	ESD Protection Diode, CC and SBU Protection (5.5 V - USB 3.x), 21 pF
	NSPU3051	ESD and Surge Protection, CC, SBU and Vbus Lines, (5.5V - USB 3.x), 80 pF
	NSPM2052	ESD and Surge Protection Device, Vbat and Vbus Applications, 5 V, 120 A
	NSPM0061	ESD and Surge Protection, 6.3 V, 70 A
	NSPM0101	ESD and Surge Protection, 10 V, 60 A, 1.6 x 1.0 m
	NSPU5132	ESD and Surge Protection Device, Unidirectional, 13.5 V, 200 A
	NSPU5201	ESD and Surge Protection Device, Unidirectional, 20 V, 140 A
	NCS210	Current Sense Amplifier, Bidirectional Zero-Drift, 1% Max. Gain Error, 60 μV Offset
	NCS211	Current Sense Amplifier, Bidirectional Zero-Drift, 1% Max. Gain Error, 60 μV Offset
	NCS213	Current Sense Amplifier, Bidirectional Zero-Drift, 1% Max. Gain Error, 100 μV Offset
	NCS214	Current Sense Amplifier, Bidirectional Zero-Drift, 1% Max. Gain Error, 60 μV Offset
	NCS2333	Precision Operational Amplifier, Low Power, Zero-Drift, 30 μV Offset

Control

Function	Device	Description
Port Control	FUSB3307	Autonomous USB Type-C Controller with PD
	FUSB15101	Programmable USB Type-C Controller with PD. MCU Integrated

AC-DC Power Conversion

Function	Device	Description
Power Regulation	NCP1342	High Frequency Quasi-Resonant Flyback Controller
	NCP1345*	USB PD Optimized High Frequency QR Controller
	NCP1568	Active Clamp Flyback Controller with ZVS
	NCP51530	High Frequency, 700 V- 2 A High and Low Side Driver
	NCP4306	Secondary Side Synchronous Rectification Driver
	NCP4307*	Secondary Side Synchronous Rectification Driver for USB PD
	NCP1622	CrM Power Factor Controller
	NCP1623*	CrM Power Factor Controller with Boost Follower

* Pending 3Q21.

Port Power

Function	Device	Description
Power Regulation	FAN65008B	Synchronous PWM Buck Regulator, Voltage Mode, 65 V, 10 A
Power MUX	FPF2595	Load Switch, Over-Voltage, Over-Current Protection with Adjustable Current-Limit Control, IntelliMAX™ 28 V
	FPF2895C	Current Limit Load Switch with OVP and TRCB, 28 V, 5 A

USB 3.x Type A Connector

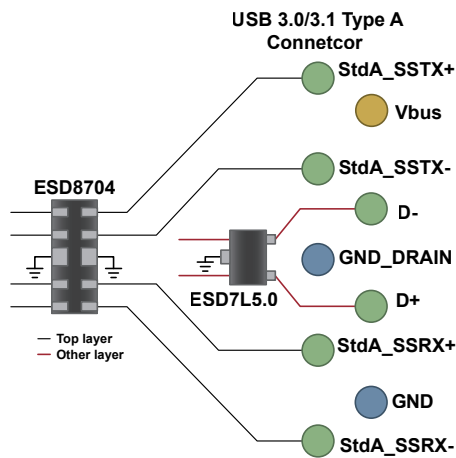
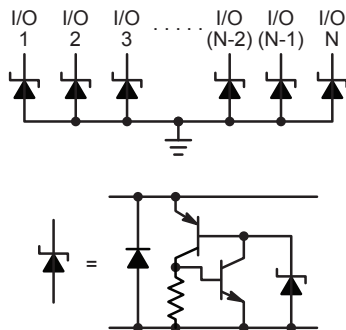
Two SuperSpeed Pairs, One High Speed Pair, V_{CC} , Low Capacitance ESD Protection

Key Requirement

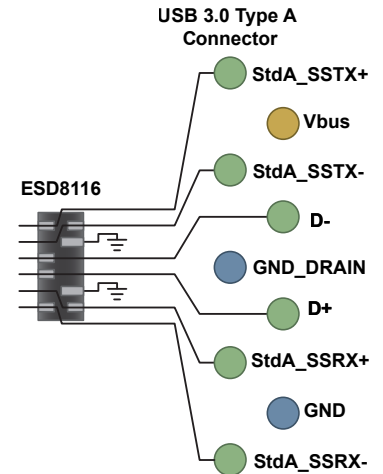
- Cap < 0.7 pF

Features

- 0.35 pF
- Flow through routing
- Industry leading low clamping voltage versus competitors

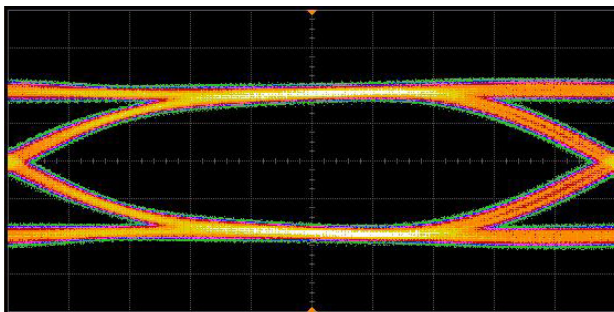


ESD8704 – 0.35 pF, 2 Layer Routing
(ESD8704; ESD7L5.0 for D+, D- Lines)

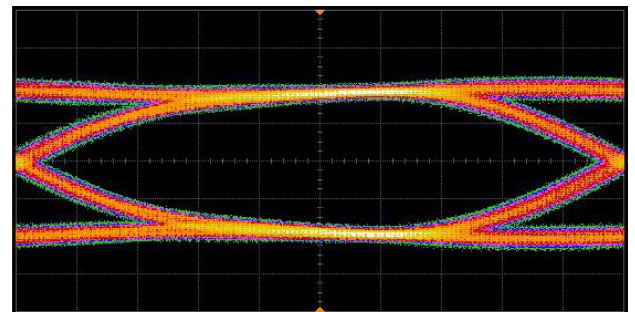


ESD8116 – 0.30 pF, 1 Layer Routing

Device	Interface	Data Lines	Capacitance (pF)	Package	Size (mm)
ESD8704	USB 3.x	2 Pair (Tx, Rx)	0.35	UDFN-10	2.5 x 1.0
ESD7L	USB 3.x	1 Pair (D+/-)	0.5	SOT-723	1.2 x 1.2
ESD8504	USB 3.0	2 Pair (Tx, Rx)	0.4	UDFN-10	2.5 x 1.0
ESD8104	USB 3.0	2 Pair (Tx, Rx)	0.3	UDFN-10	2.5 x 1.0
ESD8116	USB 3.0	3 Pair (Tx, Rx, D+/-)	0.3	UDFN-8	2.0 x 1.2
ESDL3552	USB 3.x	1 Pair (Tx, Rx, D+/-)	0.25	X4DFN-3	0.62 x 0.32
ESDL2011	USB 3.x	Single Line (Tx, Rx)	0.17	DSN-2	0.6 x 0.3
ESDL2031	USB 3.x	Single Line (Tx, Rx, D+/-)	0.4	X4DFN-2	0.6 x 0.3
ESD8011	USB 3.x	Single Line	0.10	X3DFN-2	0.62 x 0.32
ESD8111	USB 3.x	Single Line	0.20	WLCSP-2	0.6 x 0.3
ESD8006	USB 3.0	3 Pair (Tx, Rx, D+/-)	0.25	UDFN-8	3.3 x 1.0
ESDL1531	USB 3.x	Single Line (Tx, Rx, D+/-)	0.15	X4DFN-2	0.445 x 0.24



Without ESD



With ESD

USB 3.0 @ 5 Gb/s

USB 2.0

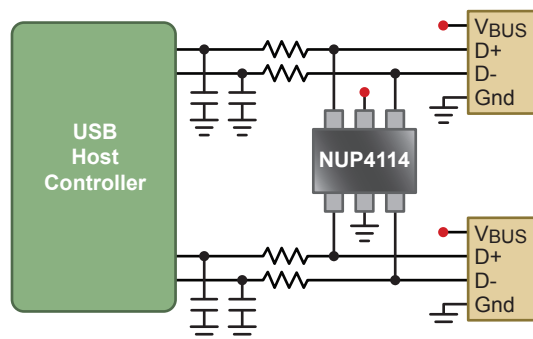
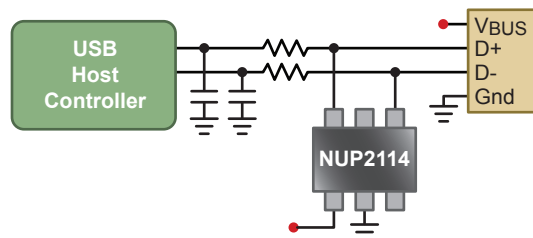
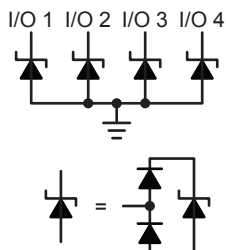
One High Speed Pair, V_{CC} , Low Capacitance ESD Protection

Key Requirement

- Cap < 5 pF

Features

- 0.35 - 3.0 pF
- Multi-part solutions available
- Industry leading low clamping voltage



Device	Data Lines	Capacitance (pF)	Package	Size (mm)
NUP2114UPX	1 Pair (D+/-) + Vbus	0.8	SOT-553	1.2 x 1.6
NUP2114UCM	1 Pair (D+/-) + Vbus	0.8	TSOP-6	3.0 x 2.75
ESDL3552	1 Pair (Tx, Rx, D+/-)	0.25	X4DFN-3	0.62 x 0.32
NUP4114UPX	2 Pair (D+/-) + Vbus	0.5	SOT-563	1.6 x 1.6
NUP4114UCL	2 Pair (D+/-) + Vbus	0.5	SC-88	2.0 x 2.1
NUP4114H	2 Pair (D+/-) + Vbus	0.5	TSOP-6	3.0 x 2.75
ESDL2031	Single Line (Tx, Rx, D+/-)	0.4	X4DFN-2	0.6 x 0.3
ESDL1531	Single Line (Tx, Rx, D+/-)	0.2	X4DFN-2	0.445 x 0.24
ESD7L5.0	2	0.5	SOT-723	1.2 x 1.2
ESD8351MUT	1	0.37	X3DFN-2	0.6 x 0.3
ESD8351P2T	1	0.37	SOD-923	1.0 x 0.6
ESD9L5.0	1	0.5	SOD-923	1.0 x 0.6

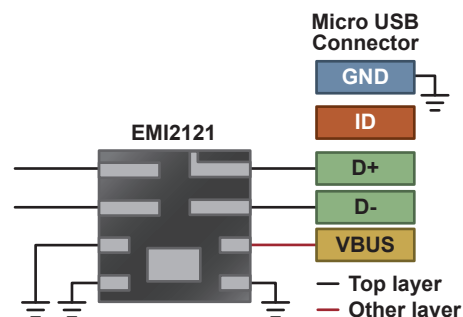
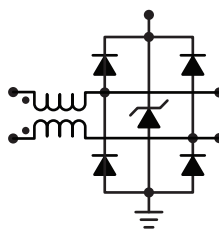
One High Speed Pair, V_{CC} , Common Mode Filter + ESD Protection

Key Requirement

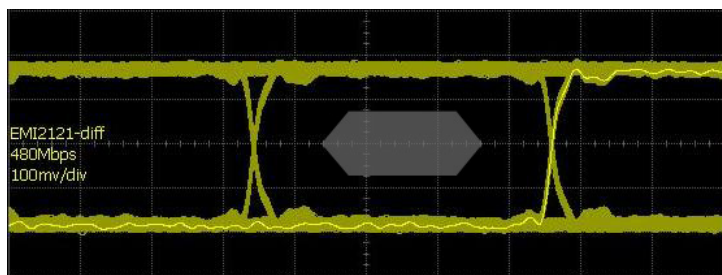
- Cap < 5 pF
- Common Mode Filtering

Features

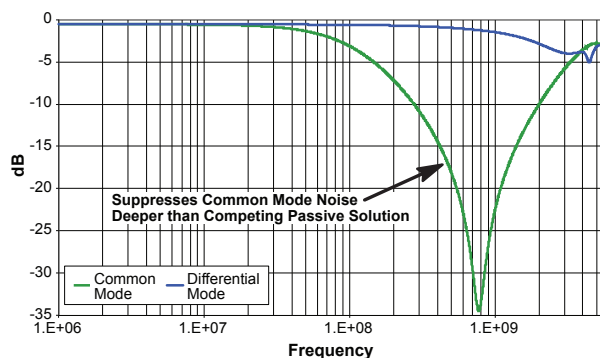
- 0.5 - 0.8 pF
- Integrated EMI suppression with ESD protection
- Industry leading low clamping voltage



Device	Pairs	Capacitance @ 2.5 V (pF)	CM Attenuation @ 800 MHz (-dB)	DM Bandwidth F3dB (GHz)	Package	Size (mm)
EMI2121	1	0.9	-25	2.5	WQFN-8	2.2 x 2.0 x 0.75



USB 2.0 @ 480 Mb/s



Thunderbolt

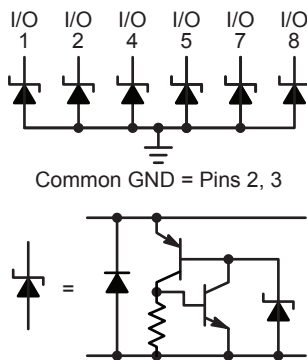
Four High Speed Pairs, up to Six Additional Lines, Low Capacitance ESD

Key Requirement

- Capacitance < 0.4 pF

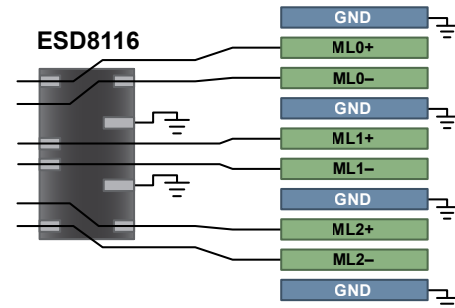
Features

- Capacitance of 0.35 pF or lower
- Integrated solution in 2.0 x 1.2 mm package
- Grounds between pairs to reduce cross-talk
- Flow-through routing
- Industry leading clamping voltage

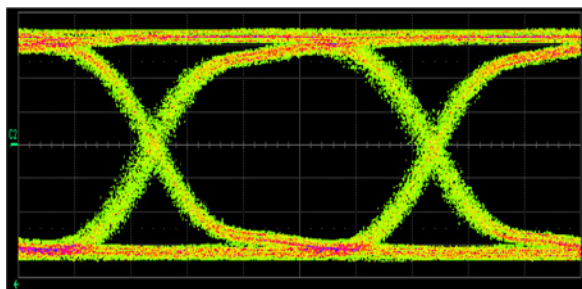
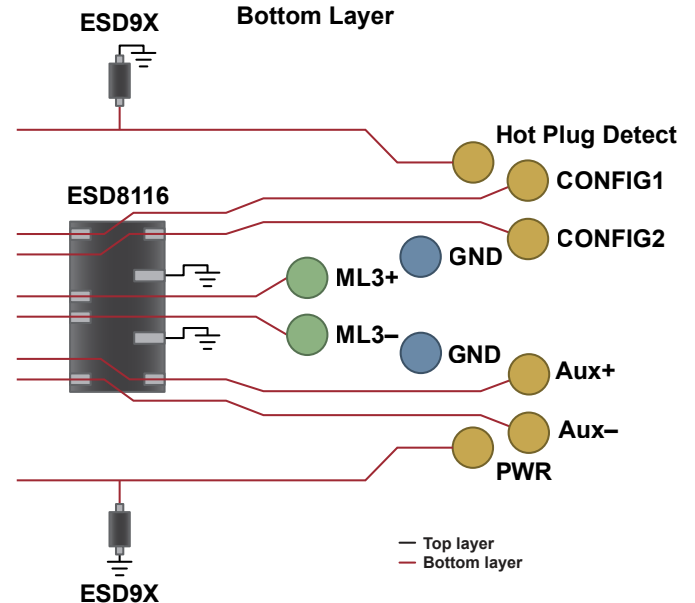


Device	Data Lines	Capacitance (pF)	Package	Size (mm)
ESD8006	3 Pair	0.25	UDFN-8	3.3 x 1.0
ESD8116	3 Pair	0.30	UDFN-8	2.0 x 1.2
ESD8011	Single Line	0.10	X3DFN-2	0.62 x 0.32
ESDL2011	Single Line	0.17	X4DFN-2	0.6 x 0.3
ESDL1531	Single Line	0.20	X4DFN-2	0.445 x 0.24

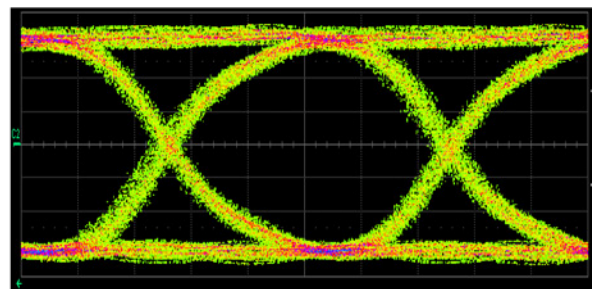
Thunderbolt Connector Top Layer



Thunderbolt Connector Bottom Layer



Without ESD8116



With ESD8116

Thunderbolt @ 10 Gb/s

HDMI, Display Port

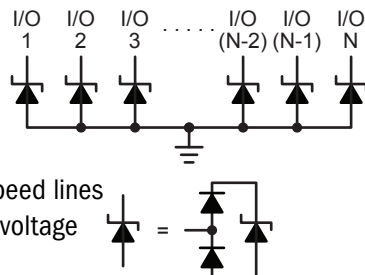
Four High Speed Pairs, Up to Six Additional Interface Lines, Low Capacitance ESD

Key Requirement

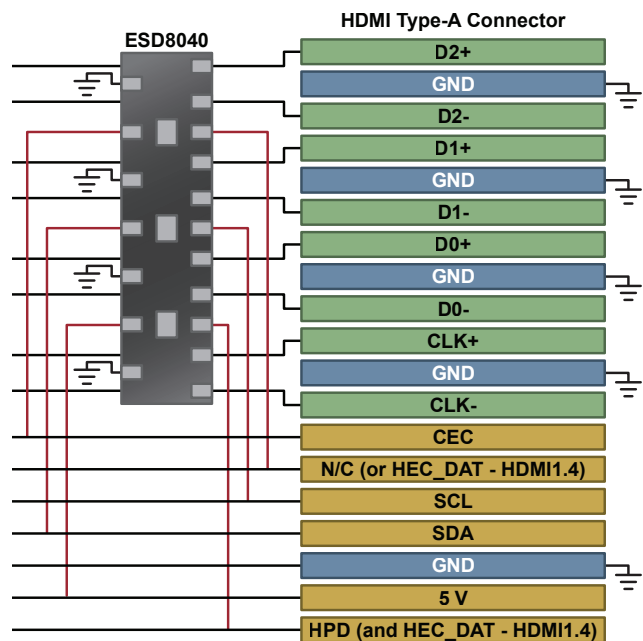
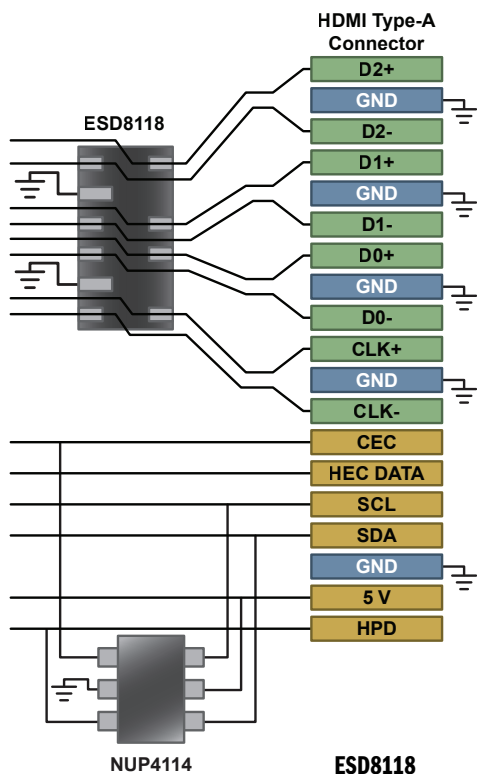
- Cap < 0.5 pF

Features

- 0.3 pF ESD protection
- Flow through routing in high speed lines
- Industry leading low clamping voltage

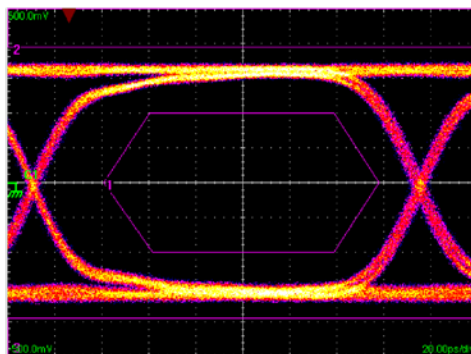


Device	Data Lines	Capacitance (pF)	Package	Size (mm)
ESDL2031	1 (TMDS)	0.4	X4DFN-2	0.6 x 0.3
ESD8104	4 (TMDS)	0.3	UDFN-10	2.5 x 1.0
ESD8118	8 (TMDS)	0.3	UDFN-10	3.2 x 1.2
ESD8040	14 (TMDS + Low Speed + Power)	0.3	UDFN-18	5.5 x 1.5
NUP4114UPX	5 (4 Low Speed + Power)	0.5	SOT-563	1.6 x 1.6
NUP4114UCL	5 (4 Low Speed + Power)	0.5	SC-88	2.0 x 2.1
NUP4114H	5 (4 Low Speed + Power)	0.5	TSOP-6	3.0 x 2.75

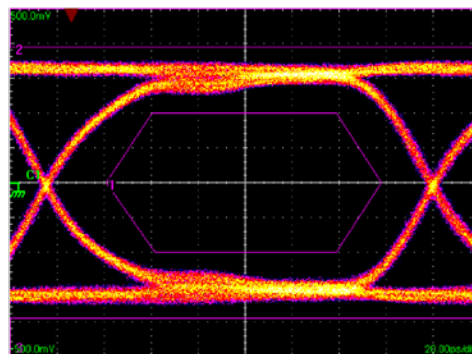


- MediaGuard fully integrated solution
- Includes ethernet protection (HDMI1.4)
- Backdrive current protection

— Top layer
— Other layer



Without ESD



With ESD

HDMI 2.0 @ 6 Gb/s

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

Four Pairs, Low Capacitance Surge and ESD Protection

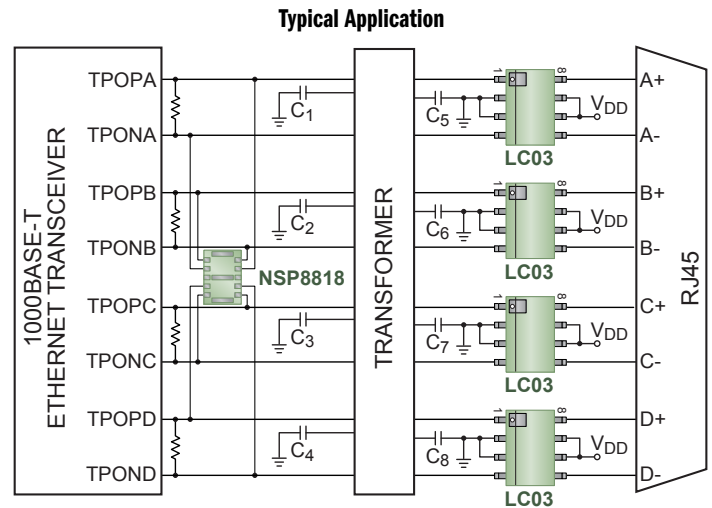
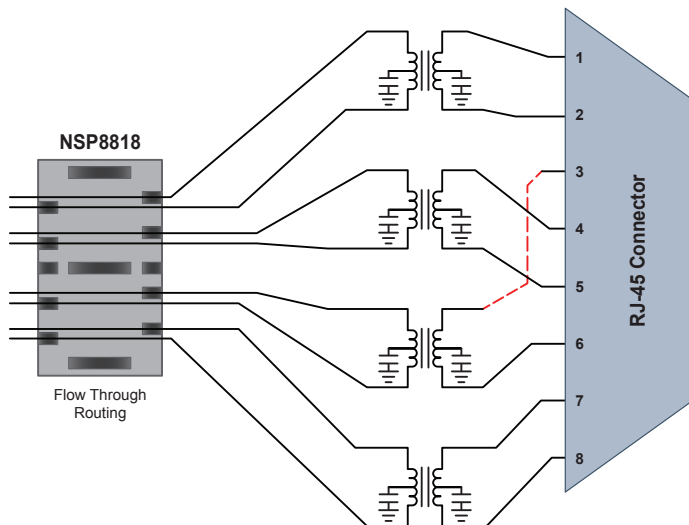
The 1000BASE-T or Gigabit Ethernet interface operating at higher bitrates is susceptible to ESD strikes, cable-discharge events and lightning-induced transients. Our products help meet IEC 61000-4-5, GR-1089-CORE and other Standards.

Features

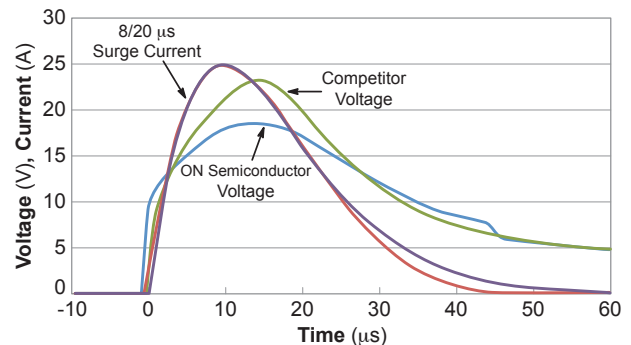
- Line-to-line capacitance < 3 pF
- V_{clamp} (25 A surge) < 11 V
- IEC 61000-4-2 rating > 30 kV
- No latching danger
- Surge rating maintained to 125°C

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: NSP8818
Protection against metallic (transverse) strikes



Line-to-Line Surge

Surge Protection Devices

Device	V _{DC} Max (V)	Line Transient Max (V)	Surge I _{PP} , 8/20 μs (A)	Typical Line-Line Capacitance (pF)	ESD Contact Rating (kV)	Package
LC03-6	6.7	7	100	8	±30	SOIC-8
NSP4201	5	6	25	1.5	±30	TSOP-6
NUP4114H	5	5	12*	0.4	±13	TSOP-6
SRDA05	5	7	23	5	±8	SOIC-8
ESD8708	3.3	6	7.5	0.18	±30	UDFN-14
SRDA3.3	3.3	5	25	4	±8	SOIC-8
NSP8814	3	3.2	35	1.5	±30	UDFN-8
NSP8818	3	3.2	35	1.5	±30	UDFN-10

* On Pin 5.

T1/E1, T3/E3, and xDSL Ports

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

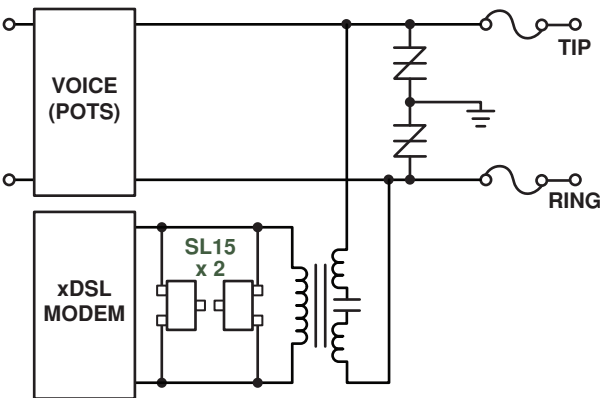
T1/E1 links (< 2 Mbps), T3/E3 links (< 43 Mbps) and xDSL lines (< 52 Mbps) are susceptible to ESD strikes, cable-discharge events and lightning-induced transients.

Surge Protection Features

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

Benefits

- Surge protection devices provide high levels of tertiary protection without latching

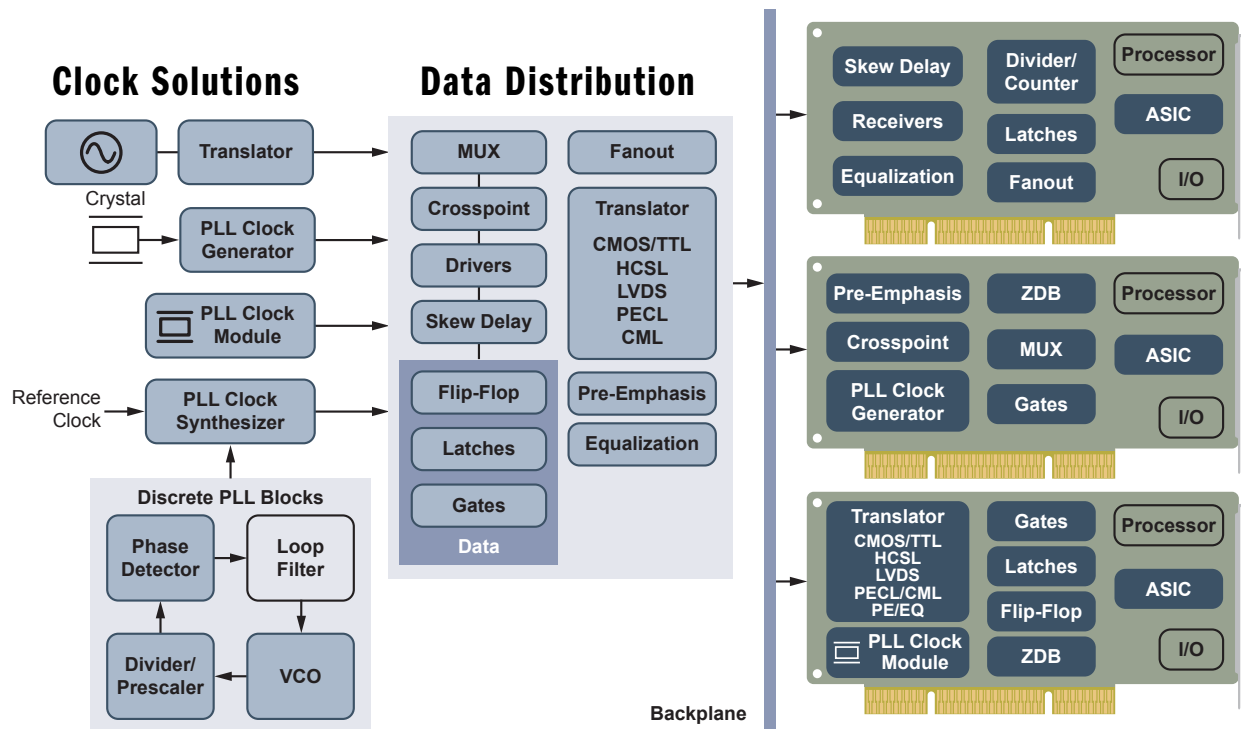


Typical xDSL + POTS Application

Surge Protection Devices

Device	VDC Max (V)	Surge Ipp, 8/20 μs (A)	Line-Line Capacitance (pF)	ESD Contact Rating (kV)	Package
SRDA3.3	3.3	25	4.0	±8	SOIC-8
SRDA05	5.0	23	5.0	±8	SOIC-8
LC03-6	5.0	100	8.0	±30	SOIC-8
SL05 to SL24	5 to 24	5 to 17	3.5	±8	SOT-23

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.

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. PureEdge™ PLL devices utilize a fully differential architecture that enables performance that satisfies the timing requirements for the most demanding applications.

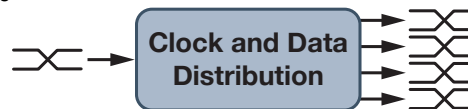
Performance Capabilities

- Differential design for reduced noise
- ECL, PECL, CML, LVDS, M-LVDS, HSTL, HCSL, LVTTTL/LVCMOS outputs for flexible interfacing
- Maximum clock rates >10 GHz
- Maximum data rates >12 Gbps
- Typical additive phase RMS jitter, as low as 30 fs for buffers
- Typical phase RMS jitter of 200 fs for clock generators
- Integrated termination resistors for simplified circuit design
- Edge rates as low as 28 ps
- Low phase noise floor ≤ -174 dBc/Hz
- Low output-output skew

Clock and Data Distribution

Features

- Complete portfolio of fanout buffers, multiplexers, cross point switches
- Supporting frequencies from DC to 12 GHz/Gbps
- PCIe buffers with 1:2, 1:4, 1:6, 1:8, 1:10 and 1:21 fanouts
- PCIe Gen 1, Gen 2, Gen 3, Gen 4 Jitter Compliant
- Pre-Emphasis and Equalization blocks available
- Offer new direct X-tal interface capabilities
- Industry leading additive jitter as low as 30 fs typical
- Device noise floor as low as -174 dBc
- Industry leading output-to-output skew as low as 3 ps minimum
- Direct device interface eliminates external termination components and simplifies BOM

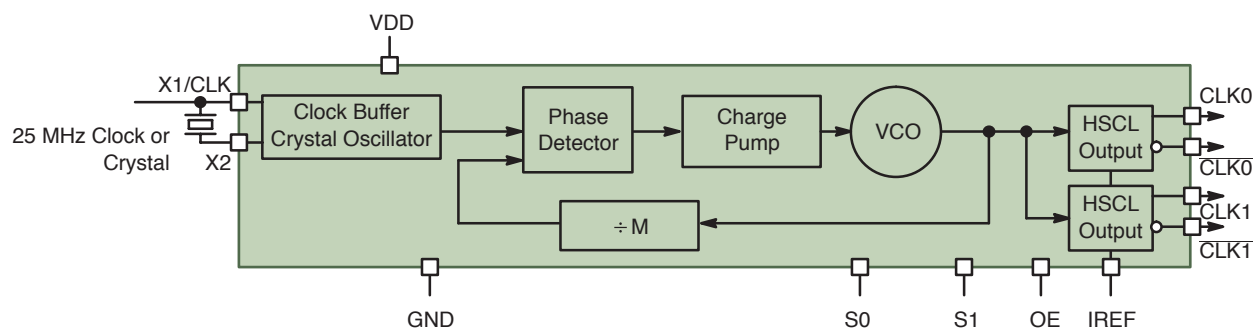


Device	Outputs per Channel	Output Level	Input Level								Vcc Typ (V)	tSkew 0-0 (ps)	fMax Typ (GHz)	Package(s)
			CML	CMOS	LVPECL	HCSL	HSTL	LVDS	XTAL	TTL				
NB3N106K/108K NB3N111K/121K NB3L202K/204K	6, 8, 10, 21	HCSL		✓	✓	✓	✓	✓		✓	3.3	100	0.4	QFN-52, QFN-32, QFN-24
NB3L208K	2, 4	HCSL		✓	✓	✓	✓	✓		✓	2.5, 3.3	100	0.4	QFN-16
NB3M8T3910G	8	HCSL			✓	✓		✓			2.5, 3.3	100	0.35	QFN-32
NB3M8T3910G	10	HCSL, CMOS, LVDS, ECL			✓	✓		✓			2.5, 3.3	50	1.4	QFN-48
NB6L11S	2	LVDS	✓	✓	✓		✓	✓		✓	2.5	25	2	QFN-16
NB6L14S/6N14S	4	LVDS	✓	✓	✓	✓	✓	✓		✓	2.5/3.3	20	2	QFN-16
NB3L8504S	4	LVDS			✓	✓	✓	✓			2.5, 3.3	50	0.7	TSSOP-16
NB3L8543S	4	LVDS	✓		✓	✓	✓	✓			2.5, 3.3	40	0.65	TSSOP-20
NB3V1102C/1103C NB3V1104C/1106C	2, 3, 4, 6	CMOS		✓							1.8, 2.5, 3.3	50	0.25	TSSOP-14, TSSOP-8
NB3M8302C/8304C	2, 4	CMOS, LVTTTL		✓						✓	2.5, 3.3	45, 85	0.2	SOIC-8
NB3U1548C	4	CMOS, LVTTTL		✓						✓	1.5, 1.8, 2.5, 3.3	250	0.16	TSSOP-8, SOIC-8
NB3N4666C	4	CMOS, LVTTTL			✓	✓		✓			3.3	250	0.2	TSSOP-16
NB3F8L3005C	5	CMOS		✓	✓	✓	✓	✓	✓	✓	1.5, 1.8, 2.5, 3.3	55	0.2	QFN-24
NB3H83905C	6	CMOS, LVTTTL		✓					✓	✓	1.8, 2.5, 3.3	80	100	TSSOP-16, SOIC-16, QFN-20
NB3F8L3010C	10	CMOS		✓	✓	✓	✓	✓	✓	✓	1.5, 1.8, 2.5, 3.3	55	0.2	QFN-32
NB3L83948C	12	CMOS		✓	✓	✓	✓	✓		✓	2.5, 3.3	100	0.35	LQFP-32
NB3V8312C	12	CMOS		✓						✓	1.8, 2.5, 3.3	150	0.25	LQFP-32, QFN-32
NB4N11M	2	CML	✓	✓	✓			✓		✓	3.3	25	2.5	TSSOP-8
NB6L11M	2	CML	✓	✓	✓			✓		✓	2.5, 3.3	15	4	QFN-16
NB7L72M	2	CML	✓	✓	✓			✓		✓	2.5, 3.3	10	7	QFN-16
NB7VQ572M	2	CML	✓		✓			✓			1.8, 2.5, 3.3	15	6	QFN-32
NB6HQ14M	4	CML	✓	✓	✓			✓		✓	2.5	15	5	QFN-16
NB7HQ14M	4	CML	✓		✓			✓			2.5	15	7	QFN-16
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	25	7.5	QFN-24
NB6L14/6L14M	4	ECL/CML	✓	✓	✓			✓		✓	2.5, 3.3	20	3	QFN-16
NB7L14	4	ECL/CML	✓	✓	✓			✓		✓	2.5, 3.3	15	7/8	QFN-16
NB7L1008/7L1008M	8	ECL/CML	✓		✓			✓			2.5, 3.3	20/25	7/8	QFN-32
NB6L56	1	ECL	✓		✓			✓			2.5, 3.3	25	2.5	QFN-32
NB6L611	2	ECL	✓	✓	✓			✓		✓	2.5, 3.3	15	3	QFN-16
NB7L572	2	ECL	✓	✓	✓			✓		✓	2.5, 3.3	15	7	QFN-32
NB3N853501E	4	ECL		✓						✓	3.3	30	0.266	TSSOP-20
NB3N853531E	4	ECL		✓					✓	✓	3.3	30	0.266	TSSOP-20
NB4L339	4	ECL	✓		✓			✓			2.5, 3.3	60	0.7	QFN-32
NB3L8533	4	ECL	✓		✓	✓	✓	✓			2.5, 3.3	30	0.65	TSSOP-20
NB3L853141	5	ECL		✓	✓	✓	✓	✓		✓	2.5, 3.3	30	700	TSSOP-20

Clock Synthesizers for High Performance Computing

Features

- Uses 25 MHz fundamental mode parallel resonant crystal
- PCI-e Gen 1, 2, 3, and 4 jitter complaint HCSL differential outputs
- NB3N50134 features configurable spread spectrum outputs
- NB3N51044 features individual OE control signal for each output, PLL bypass mode and an Input multiplexer
- NB3N51054 features I²C interface for OE control and configurable spread spectrum outputs
- 3.3 V supply



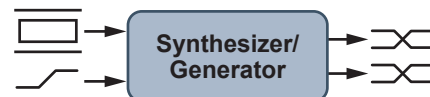
NB3N5573 Simplified Logic Diagram

Device	Number of Inputs	Input Type	f _{in} Typ (MHz)	Number of Outputs	Output Type	f _{out} Typ (MHz)	Spread Spectrum Outputs	Package
NB3N3002	1	Crystal; LVCMOS; LVTTTL	25	1	HCSL	25; 100; 125; 200	No	TSSOP-16
NB3N5573	1	Crystal; LVCMOS; LVTTTL	25	2	HCSL	25; 100; 125; 200	No	TSSOP-16
NB3N51032	1	Crystal; LVCMOS; LVTTTL	25	2	HCSL	25; 100; 125; 200	Yes	TSSOP-16
NB3N51034	1	Crystal; LVCMOS; LVTTTL	25	4	HCSL	100; 200	Yes	TSSOP-20
NB3N51044	2	Crystal; LVCMOS; LVTTTL	25	4	HCSL	100; 125	No	TSSOP-28
NB3N51054	1	Crystal; LVCMOS; LVTTTL	25	4	HCSL	100	Yes	TSSOP-24

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, HCSSL, LVTTTL/LVCMOS
- Multiple PLLs and multiple output options

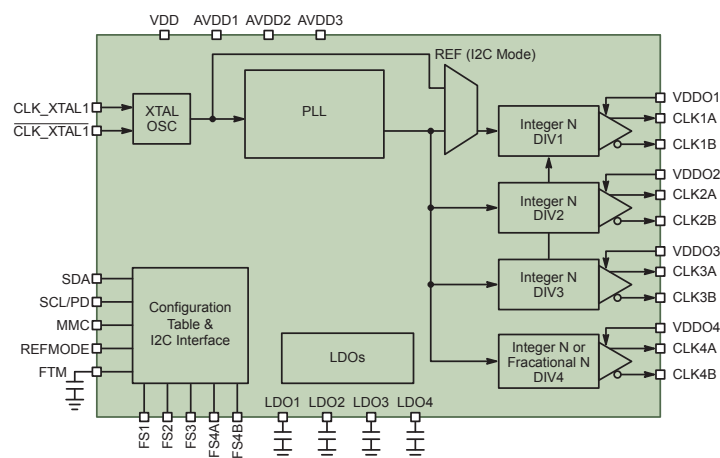


Device	Input (MHz)	Output (MHz)	Application	Input Level					Output Level	Vcc Typ (V)	Package(s)
				XTAL	CML	CMOS	LVPECL	TTL			
NB3N3020	5 to 27	5 to 210	Network GigE	✓	✓	✓	✓		ECL, LVTTTL	3.3	TSSOP-16
NB3N502	5 to 27	14 to 120	Networking, Consumer, STB	✓		✓			LVC MOS	3.3	SOIC-8
NB4N507A	10 to 27	50 to 200	Networking, Consumer, STB	✓		✓			ECL	3.3, 5	SOIC-16
NB3N508S	27	216	VCXO Set Top Box	✓		✓			LVDS	3.3, 5	TSSOP-16
NB3N511	1 to 50	14 to 200	Networking, Consumer, STB	✓					CMOS	3.3, 5	SOIC-8
NB3H5150	25	25 to 250	Networking, Telecom	✓	✓	✓	✓	✓	ECL, CMOS	3.3, 2.5	QFN-32
NB3H5150-01	25	25 to 250	Networking, Telecom	✓	✓	✓	✓	✓	ECL, CMOS	3.3, 2.5	QFN-32

Programmable Multi-Rate Clock Generators

NB3H5150, NB3H5150-01 Features

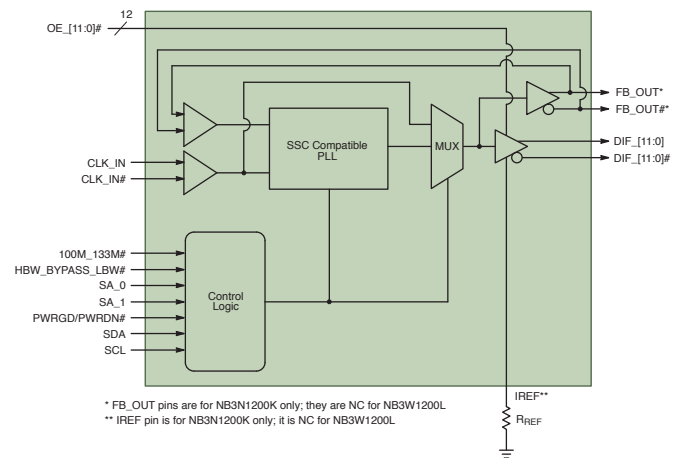
- Uses 25 MHz Crystal or reference input
- External Loop Filter is not required
- User programmable frequencies with four independent output pairs
- Each output pair can be configured either as two LVCMOS outputs (or) a differential LVPECL pair
- Supports 3.3 V or 2.5 V supply voltage operation
- Each output pair has an independent supply voltage rail (VDDOx); 3.3 V, 2.5 V, 1.8 V
- I2C enabled PLL Bypass Mode and Power Down Mode
- Free GUI software to configure device for different frequencies and output types using evaluation board
- Each device preconfigured with different default frequencies, that may be overridden using I2C/SMBus interface



PCIe-Compliant Zero Delay Buffers

Features

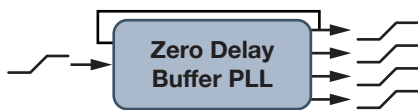
- Differential SRC clock support
- NB3N1900K, NB3N1200K: DB1900Z and DB1200Z compliant with 19 and 12 HCSL output pairs respectively
- NB3W1900L, NB3W1200L, NB3W800L: DB1900ZL, DB1200ZL, and DB800ZL compliant with 19, 12, and 8 low power NMOS push-pull output pairs respectively
- Optimized for 100 MHz and 133 MHz to meet PCIe Gen 2, Gen 3, Gen 4, and Intel QPI and UPI 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



NB3N1200K/NB3W1200L Simplified Block Diagram

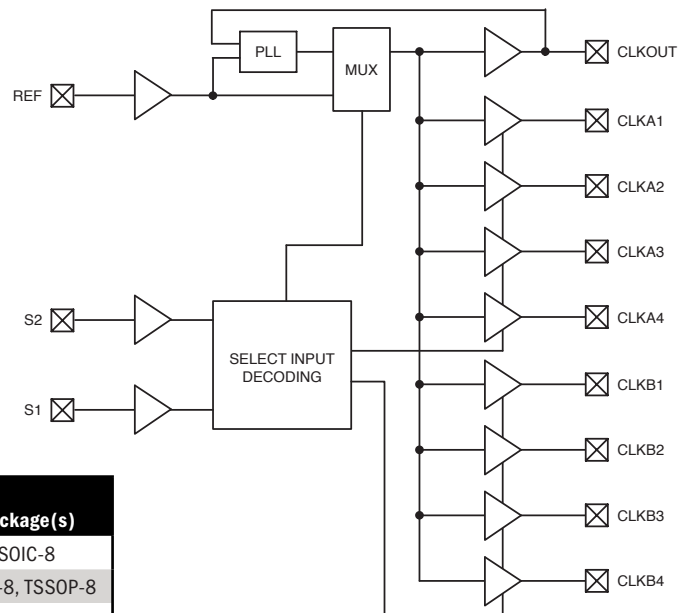
Device	Channels	Output	tJitter(Cy-Cy) Typ (ps)	tSkew(I-o) Max (ps)	tSkew(o-o) Max (ps)	Edge Rate Max (V/ns)	Package
NB3W800L	8	Low power NMOS push-pull	34	±100	50	4	QFN-48
NB3N1200K	12	HCSL	50	±100	50	4	QFN-64
NB3W1200L	12	Low power NMOS push-pull	50	±100	50	4	QFN-64
NB3N1900K	19	HCSL	50	±100	85	4	QFN-72
NB3W1900L	19	Low power NMOS push-pull	50	±100	85	4	QFN-72

General Purpose 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



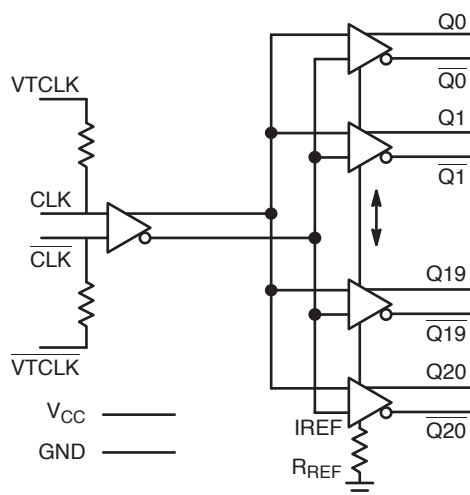
NB2309A Functional Diagram

Device	Input Level	Output Level	VCC Typ (V)	fMax Typ (MHz)	Channels	tSkew 0-0 Max (ps)	Package(s)
NB2304A	CMOS	CMOS	3.3	133.3	4	200	SOIC-8
NB2305A	CMOS	CMOS	3.3	133.3	5	250	SOIC-8, TSSOP-8
NB2309A	CMOS	CMOS	3.3	133.3	9	250	SOIC-16, TSSOP-16

Fanout Buffers for High Performance Computing

Features

- DC up to 400 MHz
- Accepts LVPECL, LVDS, HCSL, and single-ended inputs
- Typical input clock frequencies: 100, 133, 156.25, 166, 322.26, or 400 MHz
- Typical propagation delay: 800 ps
- HCSL differential outputs
- Integrated 50 Ω input termination resistors
- IREF pin enables setting of output drive
- Additive phase jitter 0.1 ps typical @ 100 MHz; PCI-e Gen 4 jitter complaint
- Additive phase jitter 80 fs maximum @ 156.25 MHz with NB3L208K, NB3L204K, NB3L202K; DB800H, DB400H, DB200H compliant



NB3N121K Logic Diagram

Device	Ratio	Additive $t_{\text{jitter(RMS) Typ}}$ (ps)	$t_{\text{skew(o-o) Max}}$ (ps)	$t_{\text{pd Typ}}$ (ns)	$t_{\text{r}} \& t_{\text{f Max}}$ (ps)	$f_{\text{maxClock Typ}}$ (MHz)	Package
NB3L202K	1:2	0.046	30	1	125	350	QFN-16
NB3L204K	1:4	0.046	30	1	125	350	QFN-24
NB3N106K	1:6	0.1	100	0.8	400	400	QFN-24
NB3L208K	1:8	0.046	30	1	125	350	QFN-32
NB3N108K	1:8	0.1	100	0.8	400	400	QFN-32
NB3N111K	1:10	0.1	100	0.8	400	400	QFN-32
NB4N111K	1:10	<1	100	0.8	700	400	QFN-32
NB3N121K	1:21	0.1	100	0.8	700	400	QFN-52
NB4N121K	1:21	<1	50	0.8	700	200	QFN-52
NB3M8T3910G	3:1:10	0.05	50	1	300	1400	QFN-48

EEPROMs for Configuration and Calibration

Features

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

EEPROMs

Data Transmission Standard	Density	Organization*	V _{CC} Min (V)	V _{CC} Max (V)	f _{CLK} Max (MHz)	Package(s)
I ² C	1 Mb	128k x 8	1.7, 1.8	5.5	0.4, 1	US8, SOIC-8, TSSOP-8, UDFN-8, TSOT23-5, WLCSP-4, WLCSP-5
	512 kb	64k x 8				
	256 kb	32k x 8				
	128 kb	16k x 8				
	64 kb	8k x 8				
	32 kb	4k x 8				
	16 kb	2k x 8				
	8 kb	1k x 8				
	4 kb	512 x 8				
	2 kb	256 x 8				
SPI	2 Mb	256k x 8	1.7, 1.8	5.5	10, 20	SOIC-8, TSSOP-8, UDFN-8
	1 Mb	128k x 8				
	512 kb	64k x 8				
	256 kb	32k x 8				
	128 kb	16k x 8				
	64 kb	8k x 8				
	32 kb	4k x 8				
	16 kb	2k x 8				
	8 kb	1k x 8				
	4 kb	512 x 8				
	2 kb	256 x 8				
	1 kb	128 x 8				
Microwire	16 kb	2k x 8 / 1k x 16	1.65, 1.8	5.5	2, 3, 4	SOIC-8, TSSOP-8, UDFN-8
	16 kb	2k x 8 / 1k x 16				
	8 kb	1k x 8 / 512 x 16				
	8 kb	1k x 8 / 512 x 16				
	4 kb	512 x 8 / 256 x 16				
	2 kb	256 x 8 / 128 x 16				
	1 kb	128 x 8 / 64 x 16				
	1 kb	128 x 8 / 64 x 16				

* Organization for Microwire devices is selectable.

Supervisory Features

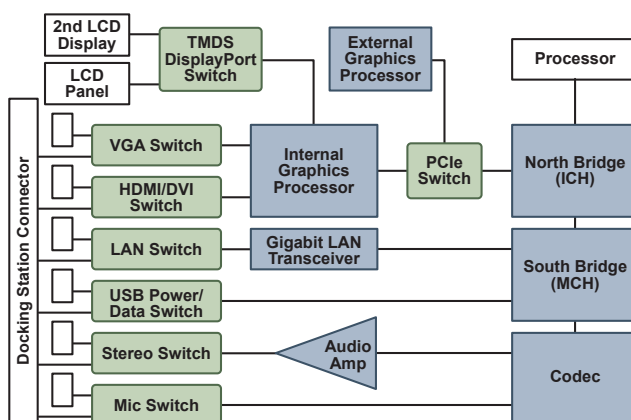
- ## 16 kb Serial EEPROM Features

-
- The block diagram illustrates the internal architecture of the AT24C02. It features a central **EEPROM** block connected to an **I2C Bus**. The EEPROM is interfaced with a **Write Protect** block, which in turn connects to a **Watchdog Timer**. The Watchdog Timer has two external inputs: **WDI** (Watchdog Input) and **WP** (Write Protect). The Watchdog Timer also provides a signal to the **Write Protect** block. The **Write Protect** block is connected to a **Delay Generator**, which produces the **RESET** signal. Additionally, the **Write Protect** block is connected to a comparator (represented by a triangle with a double line) that takes **VCC** and **VREF** as inputs.

Device	Watchdog Timer	Manual Reset	Write Protect	Package
N84C161	SDA	✓	✓	SOIC-8
N84C162	—	✓	✓	SOIC-8
N84C163	—	✓	✓	SOIC-8

High Speed Data Switching

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.



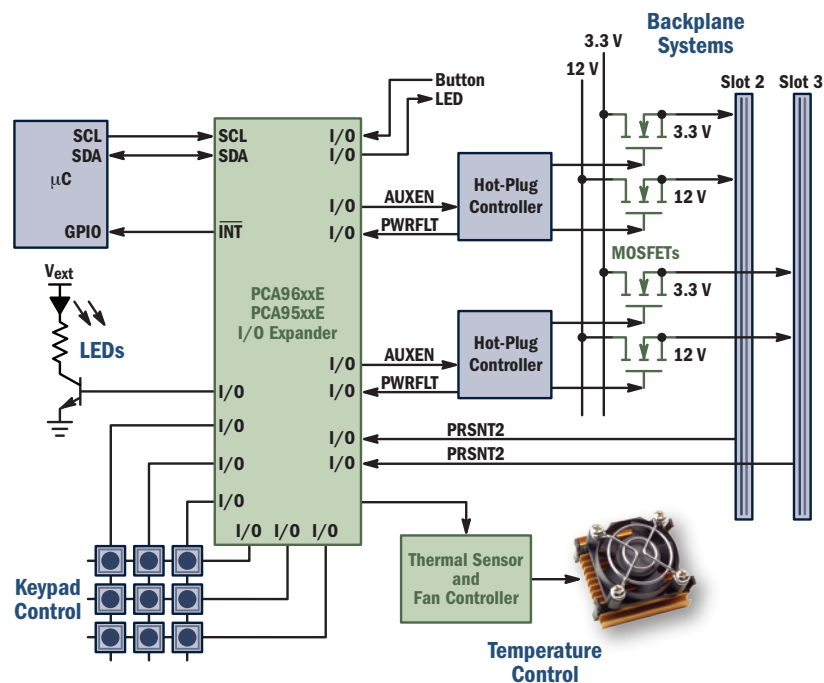
Device	Interface	Data Rate	No Channels	Quiescent Current	Package(s)
FUSB340	USB 3.1 Superspeed	10 Gb/s	2	12 μ A	X2QFN-18
NCN1188	USB 2.0 / MHL	2.25 Gb/s	2	21 μ A	UQFN-12
FSA4476	Audio	950 MHz	2	25 μ A	WLCSP-25
FSA1153	USB 2.0 / Audio / UART	650 MHz	2	21 μ A	WLCSP-12
FSA4480	Audio	600 MHz	2	60 μ A	WLCSP-25
NS5S1153	USB 2.0	480 Mb/s	2	21 μ A	UQFN-10
NLAS7242	USB 2.0	480 Mb/s	2	1 μ A	UQFN-10
FSUSB42	USB 2.0	480 Mb/s	2	1 μ A	UMLP-10, MSOP-10
NLAS4684	Audio	9.5 MHz	2	180 nA	Flip-Chip-10, DFN-10, Micro10
FSA4485	Audio	1 GHz	2	60 μ A	WLCSP-25



Cascadable I/O Expanders

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	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

Standard Logic and MiniGate™

Available logic functions

- Logic Gates, Buffers, Flip-Flops
- Arithmetic Functions
- Bus Transceivers
- Latches and Registers
- Multiplexers and Analog Switches
- Logic Level Translators

Standard Logic Family	Device Prefix	V _{CC}		t _{PD} (nS)	I _{OUT} (mA)	Input Logic Level	Packages
		Min (V)	Max (V)				
Metal Gate	MC14	3	18	50 @ V _{CC} = 15 V	±4.2 @ V _{CC} = 15 V	CMOS	SOIC, TSSOP, QFN
AC	MC74AC/74AC	2	6	6 @ V _{CC} = 5 V	±24 @ V _{CC} = 4.5 V	CMOS	
ACT	MC74ACT/74ACT	4.5	5.5	5.5 @ V _{CC} = 5 V	±24 @ V _{CC} = 4.5 V	TTL	
HC	MC74HC/MM74HC	2	6	13 @ V _{CC} = 6 V	±5.2 @ V _{CC} = 6 V (Std) ±7.8 @ V _{CC} = 6 V (Bus Driver)	CMOS	
HCT	MC74HCT/MM74HCT	4.5	5.5	15 @ V _{CC} = 5 V	±4.0 @ V _{CC} = 4.5 V (Std) ±6.0 @ V _{CC} = 4.5 V (Bus Driver)	TTL	
LCX	MC74LCX/74LCX	2.3	3.6	5.5 @ V _{CC} = 3 V	±24 @ V _{CC} = 3 V	LVTTL	
LVX	MC74LVX/74LVX	2	3.6	6.6 @ V _{CC} = 3 V	±4 @ V _{CC} = 3 V	LVTTL	
VCX	MC74VCX/74VCX	1.65	3.6	3.5 @ V _{CC} = 3 V	±24 @ V _{CC} = 3 V	LVTTL	
VHC	MC74VHC/74VHC	2	5.5	5.2 @ V _{CC} = 4.5 V	±8 @ V _{CC} = 4.5 V	CMOS	
VHCT	MC74VHCT/74VHCT	4.5	5.5	3.6 @ V _{CC} = 4.5 V	±8 @ V _{CC} = 4.5 V	TTL	
LVT	74LVT	2.7	3.6	3.6 @ V _{CC} = 3.0 V	-32/64 @ V _{CC} = 3.0 V	TTL	

MiniGate Family	Number of Gates	Device Prefix	V _{CC}		t _{PD} (nS)	I _{OUT} (mA)	Input Logic Level	Packages
			Min (V)	Max (V)				
HC	1	MC74HC1G/NC7S	2	6	6.5 @ V _{CC} = 5 V	±5.2 @ V _{CC} = 6 V	CMOS	TSOP, SC-88, SC-74, SOT-553, SOT-953, US8, UDFN, UQFN, MicroPak
HCT	1	NC7ST	4.5	5.5	6.5 @ V _{CC} = 5 V	±2 @ V _{CC} = 6 V	TTL	
VHC	1	MC74VHC1G/NLU1G/NL17SH	1.65	5.5	3.8 @ V _{CC} = 4.5 V	±8 @ V _{CC} = 4.5 V	CMOS	
	2	NLU2G						
	3	NLU3G						
VHCT	1	MC74VHCT1G/NLU1GT/NL17SHT	4.5	5.5	3.6 @ V _{CC} = 4.5 V	±8 @ V _{CC} = 4.5 V	TTL	
	2	NLU2GT						
	3	NLU3GT						
LCX	1	NL17SZ/NC7SZ/NLX1G	1.65	5.5	2.4 @ V _{CC} = 3 V	±24 @ V _{CC} = 3 V	CMOS	
	2	NC27WZ/NC7WZ/NLX2G						
	3	NL37WZ/NC7NZ/NLX3G						
VCX	1	NL17SV/NC7SV	0.9	3.6	1.0 @ V _{CC} = 3 V	±24 @ V _{CC} = 3 V	LVTTL	
SG	1	NL17SGxx	0.9	3.6	2.2 @ V _{CC} = 3 V	±8 @ V _{CC} = 3 V	LVTTL	
SP	1	NC7SP	0.9	3.6	3.0 @ V _{CC} = 3 V	±2.6 @ V _{CC} = 3 V	LVTTL	
	2	NC7WP						
	3	NC7NP						
AUP	1	74AUP1G	0.8	3.6	2.9 @ V _{CC} = 3 V	±4 @ V _{CC} = 3 V	Schmitt	
	1	74AUP1T	2.3	3.6	3.3 @ V _{CC} = 3 V	±4 @ V _{CC} = 3 V	Schmitt	

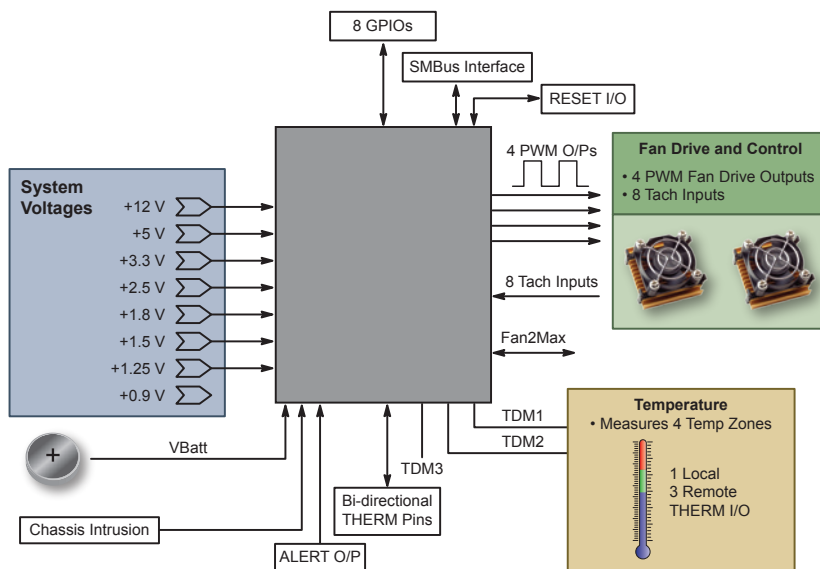
Thermal Management

Extensive Portfolio

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
System Monitors	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	LFCSP-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
Fan Controllers	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
Remote Sensors	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, WLCSP-8
	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

Signal Conditioning

Device	Description	Channel	Features	Applications	Package (mm x mm)
NB7NPQ7022M	3.3 V, One Port USB 3.1 Gen2 Linear High Gain Redriver	Dual Channel Single Port	Smaller Package, Optimized Performance	Single Port Type-A Single Port Type-C with External 2:1 MUX	μQFN-16 3 x 3
NB7NPQ7222M	3.3 V, One Port USB 3.1 Gen2 Linear High Gain Redriver	Dual Channel Single Port	Updated State Machine, Optimized Performance and ESD	Single Port Type-A Single Port Type-C with External 2:1 MUX	μQFN-16 3 x 3
NB7NPQ7042M	3.3 V, 2 Port USB 3.1 Gen2 Linear High Gain Redriver	Quad Channel (Dual Port)	Smaller Package, Competitive Pricing, Optimized Performance	Single Port Type-A Single/Dual Port Type-C with External 2:1 MUX	X2QFN-34 3.1 x 4.3
NB7NPQ1102M	3.3 V, One Port USB 3.1 Gen2 Linear Redriver	Dual Channel Single Port	Updated State Machine, Optimized Performance and ESD	Single Port Type-A Single Port Type-C with External 2:1 MUX	TQFN-30 2.5 x 4.5
NB7NPQ1104M	3.3 V, Two Port USB 3.1 Gen2 Linear Redriver	Quad Channel (Dual Port)	Improved ESD and State Machine Update, Optimized Performance and ESD	Dual Port Type-A Single/Dual Port Type-C with External 2:1 MUX	WQFN-4 23.5 x 9
NB7VPQ904M	1.8 V, USB Type-C™ DisplayPort™ ALT Mode 10 Gbps Linear Re-Driver	Quad Channel ALT Mode	Market leader, First 1.8 V USB DP Alt Mode Redriver, Small Size, Optimized Power and Flexible Programmability via GUI	Single Port Type-C with DP- ALT Mode Support	X2QFN-32 2.85 x 4.5
NB7NQ621M	3.3 V, Dual-Mode HDMI/DisplayPort™ 12 Gbps Level Shifter/Redriver	Quad Channel (Single DP or HDMI Port)	Market leader, First HDMI2.1 Signal Conditioner, Small Size, Optimized Power and Flexible Programmability via GUI	Single HDMI or Display Port	X2QFN-38 4.05 x 4.5

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