



BRD8071/D
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Energy Efficient Innovations

Industrial Solutions



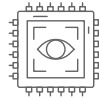
Connectivity, control, sensing, clock distribution, power, and protection solutions for industrial applications from ON Semiconductor.



Broad Portfolio for Industrial Applications

ON Semiconductor's broad portfolio is focused on power electronics, imaging, sensing and communication solutions for a range of key industrial applications. We provide the complete solution of rugged, reliable products to meet the needs of industrial grade applications.

EXPERTISE



Industry 4.0

- Machine Vision
- Automation & Robotics
- Asset Tracking
- HMI

Energy Infrastructure

- Solar & Storage
- EV Charges

Building Automation

- Lighting
- HVAC Control
- Access Control

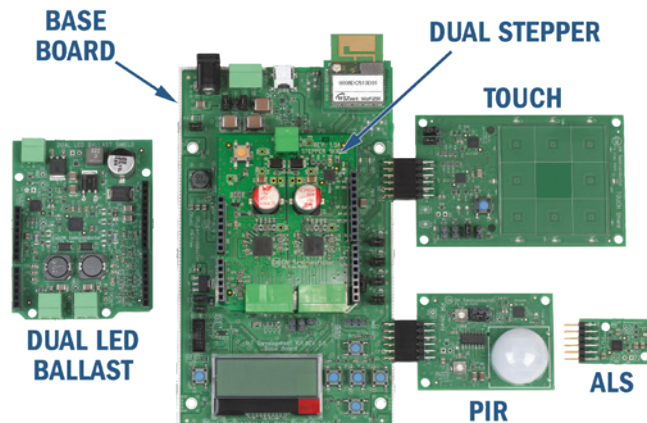
Security & Surveillance



IoT Development Kit

Features

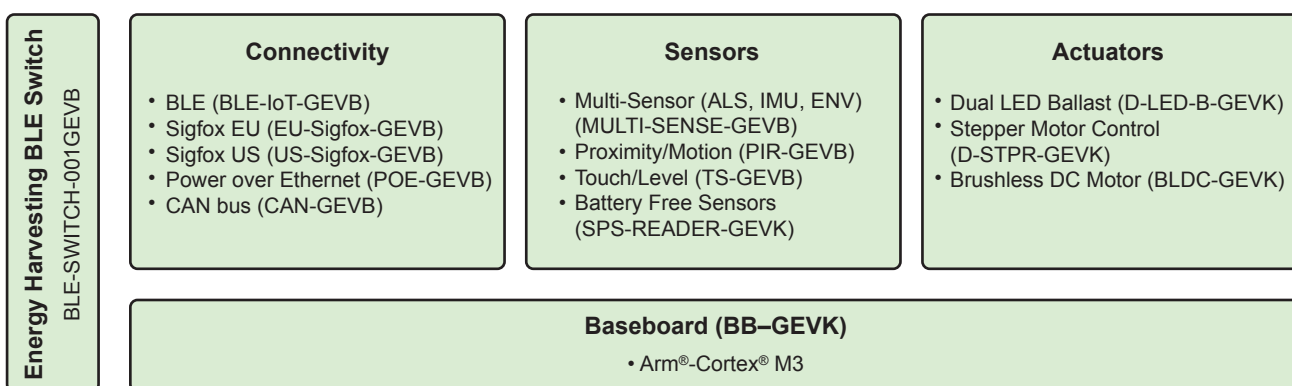
- Comprehensive portfolio of sensors, connectivity and actuators
- Arm® Cortex®-M3 Processor, ARM Mbed Operating System
- Eclipse based IDE with 40+ IoT use case examples
- Secure Cloud Connectivity (AWS, IBM, Azure, Google® Cloud, etc.)
- Mobile Application for Bluetooth Low Energy use cases
- Detailed documentation of system hardware (BoM, schematics and layout files) and software design



Markets & Applications



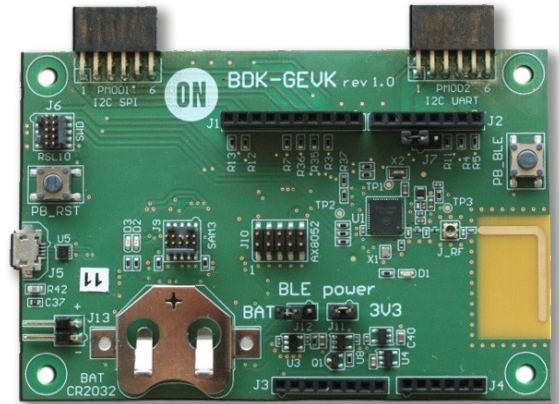
Modules



Bluetooth IoT Development Kit

Features

- Features Industry's Lowest Power Bluetooth 5 radio
 - 62.5 nW Deep Sleep
 - 7 mW Peak Receiving
- Configurable mobile application supporting cloud connectivity
 - Compatible with AWS, Azure, Bluemix or custom cloud services
- Ready-to-Use Sample Code
- Easily Connect to Other IoT Development Kit Shield Boards
 - Complete range of options for sensing (proximity, motion, touch), and control (dual LED, stepper motor, brushless DC)

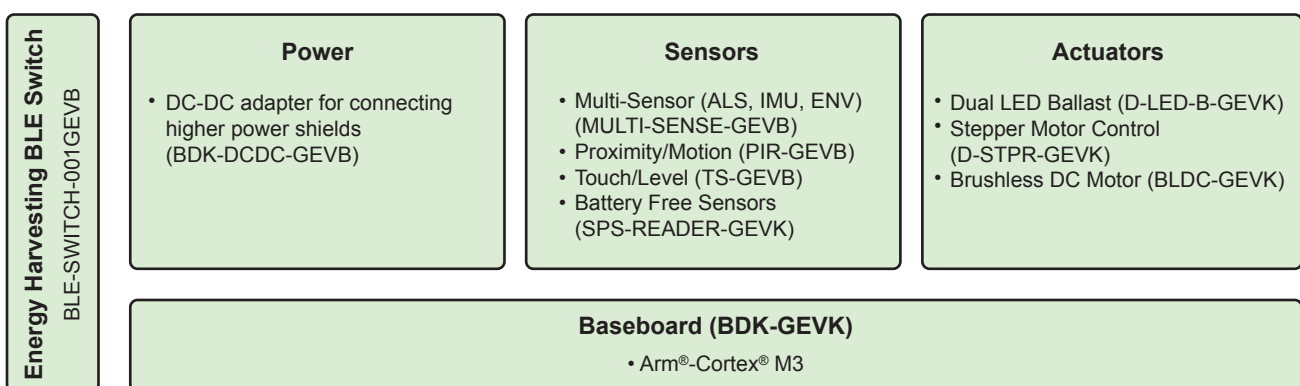


EXPERTISE

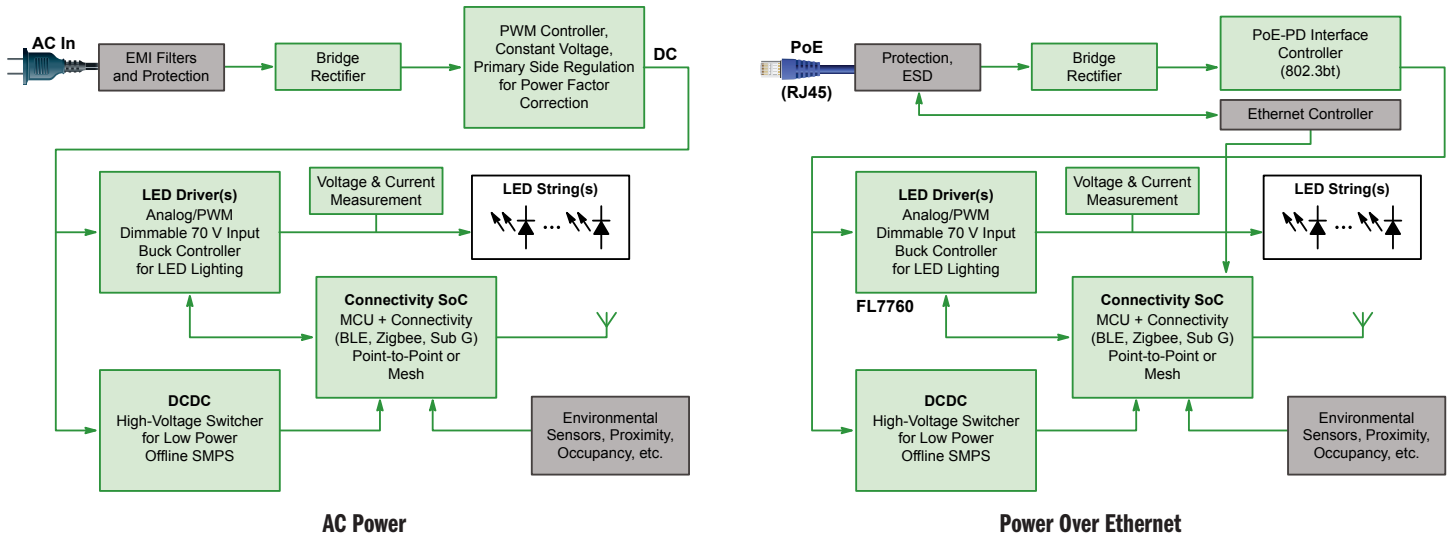
Markets & Applications



Modules



Connected Lighting



Key Products & Features

Connectivity

- RSL10 Bluetooth 5 Radio System-on-Chip (SoC)
 - Supports Firmware Over The Air (FOTA) updates
- NCS36510 Low Power System-on-Chip for 2.4 GHz
 - AES 128/256 encryption engine; true random number generator, supports IEEE 802.15.4
- NCP1096 PoE-PD Interface Controller
 - Supports IEEE 803.3af/at and 802.3bt

Power Management

- FL7740 Constant-Voltage Primary-Side Regulation PWM Controller for Power Factor Correction
 - Power factor >0.9 at high line
- FDMQ8205A GreenBridge™ High Efficiency Bridge Rectifier
 - Compatible with IEEE 802.3at

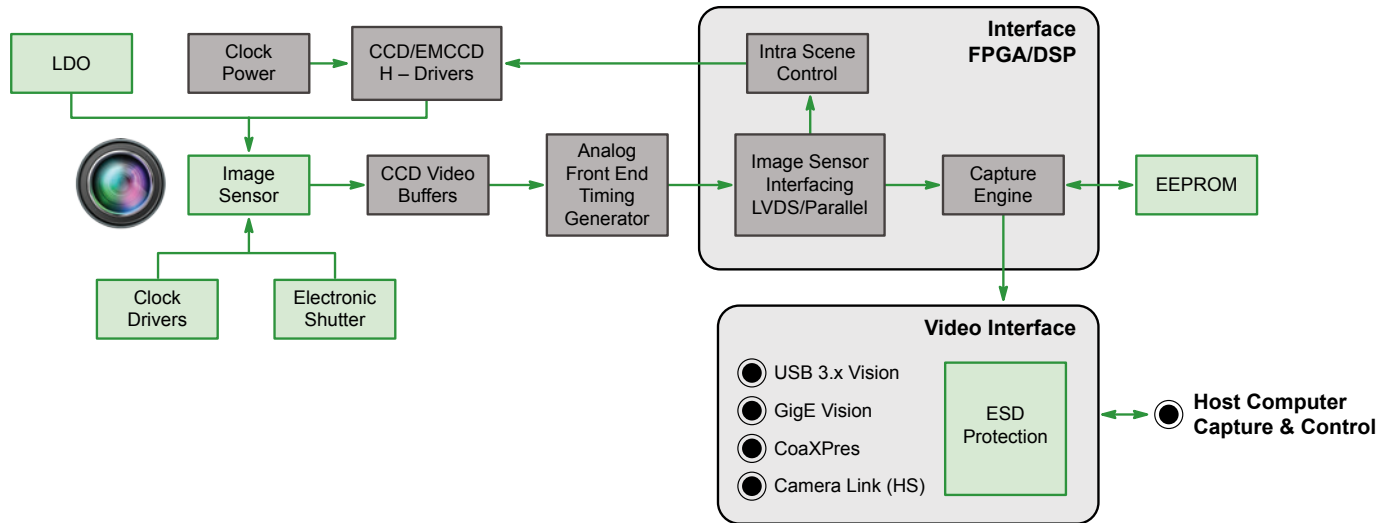
LED Drive

- FL7760 High-Side Sensing Constant Current Buck Controller for High Switching Frequency LED Driver
 - Wide PWM dimming duty range to 0.02% @ 2 kHz

Protection

- NSP4201MR6 ESD and Surge Protection Device
 - Compliant with IEC 61000-4-2 (ESD) ± 30 kV (Contact); IEC 61000-4-5 (Lightning) 25 A (8/20 μ s)

Machine Vision



Key Products & Features

Image Sensors: ARxxx & XGS series

- Global Shutter and Rolling Shutter families
- Widest range global shutter from VGA to 45 MP
- Color, mono, and near infra red support
- High frame rate >800 fps
- ROI support
- MIPI and LVDS interface
- Industry leading development tool support

Image Sensor Coprocessors

- HDR with ALTM
- Dewarp, up to 165 degrees
- Spatial Transform Engine Software Add-on
- Overlays
- GPIOs, up to 5

Low Dropout (LDO) Regulators

- Ultrafast transient response
- Low noise without bypass capacitor
- Low ground current independent of load
- Fixed & Adjustable Output Voltage versions
- PSRR >65 dB

EEPROM

- 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, available to -40°C and +125°C

ESD Protection

- IEC 61000-4-2 compliant
- Low clamping voltage
- Low capacitance


```
graph LR; ES[Energy Source<br/>(CR2032, AA, etc.)] --> LS[Load Switch]; LS --> BLE[Bluetooth Low Energy SoC<br/>(MCU + Connectivity Tx/Rx)]; ES_S[Environmental/<br/>Motion Sensing] --> BLE; BLE <--> SE[Secure Element]; BLE --> Ant[Antenna];
```

The diagram illustrates the system architecture. It features an Energy Source (CR2032, AA, etc.) connected to a Load Switch, which in turn connects to a Bluetooth Low Energy SoC (MCU + Connectivity Tx/Rx). An Environmental/Motion Sensing component is also connected to the SoC. The SoC is bidirectionally connected to a Secure Element and has an antenna for wireless communication.

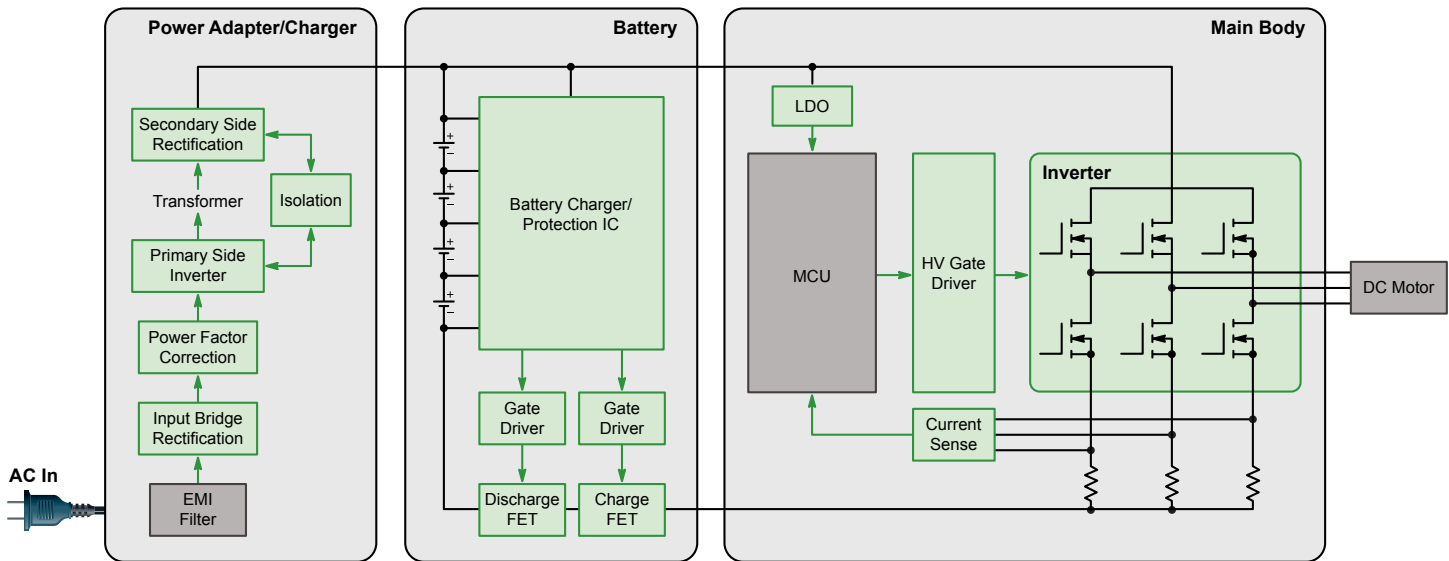
Connectivity

- ## Power Management

- ## Sensing

- Page 6

Power Tools



EXPERTISE

Key Products & Features

30–60 V MOSFETs: *NTMFS4Cxxx*, *NTMFS5Cxxx*, *NTD5Cxxx*

- Trench FET technology optimized for motor drive applications
- Industry's lowest $R_{DS(ON)}$: Example SO8-FL
 - 30 V = 0.67 m Ω - NTMFS4C020N
 - 40 V = 0.67 m Ω - NTMFS5C404N
 - 60 V = 1.2 m Ω - NTMFS5C604N
- Wide portfolio of package options including SO8-FL, μ 8FL, PQFN-8, Dual Cool, TOLL, D2PAK-7L

80 – 150 V MOSFETs: *FGH75T65SQD*, *NXH350N100H4Q2*

- Industry's lowest Q_{rr} and softest body-diode
- Very low $R_{DS(ON)}$: Example SO8-FL
 - 80 V = 2.5 m Ω - FDMS2D5N08C
 - 100 V = 3.2 m Ω - FDMS86180
 - 120 V = 4.0 m Ω - FDMS4D0N12C
 - 150 V = 8.8 m Ω - FDMS8D8N15C
- Wide portfolio of package options including SO8-FL, μ 8FL, PQFN-8, Dual Cool, TOLL, D2PAK-7L

Current Sense Amplifiers: *NCS2007x*, *NCS21xR*

- High-side and low-side current sensing
- Low offset zero-drift architecture
- Low value current sense resistors for better power efficiency
- Temperature sensitive applications

Gate Drivers: *FAN8811*, *NCP81080*

- Drives two N-Channel MOSFETs in high & low side
- Integrated Bootstrap Diode for high side gate drive
- FAN8811:
 - 3 A source, 6 A sink output current capability
 - Bootstrap supply voltage range up to 100 V
- NCP81080:
 - 0.5 A source, 0.8 A sink output current capability
 - Bootstrap supply voltage range up to 180 V

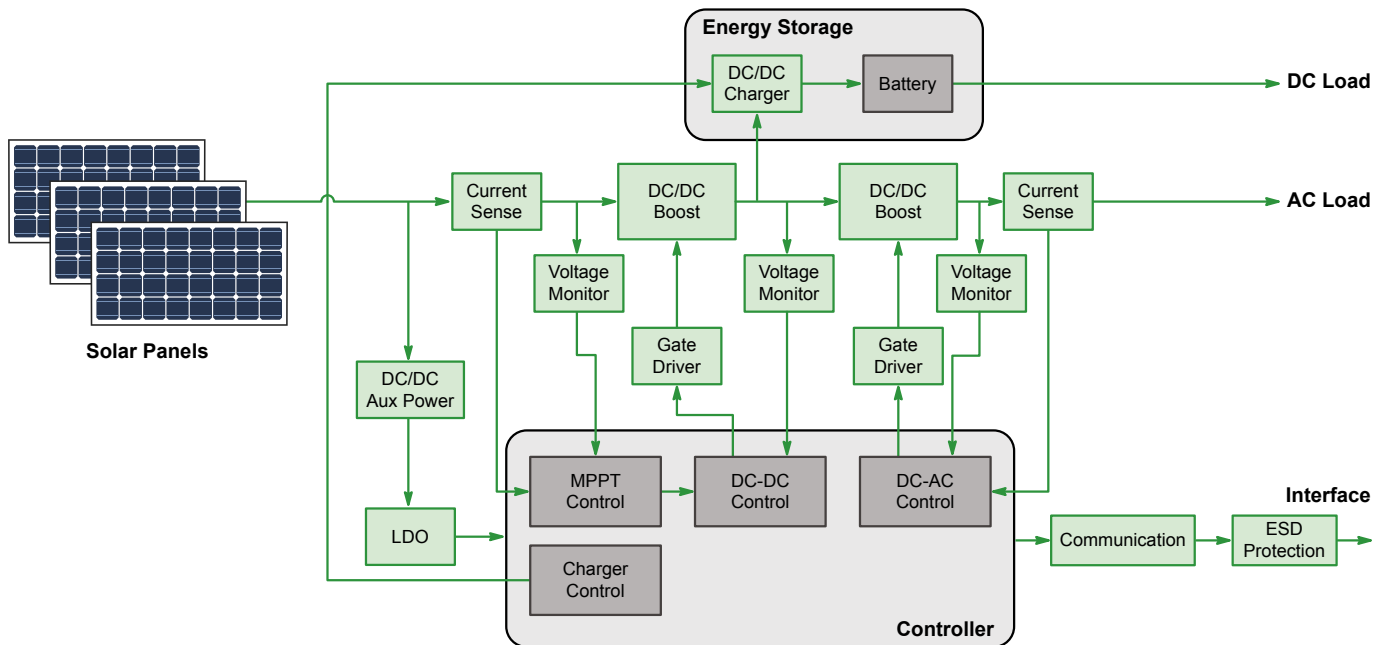
Battery Charger: *NCP1871*

- SMBus host-controlled NVDC-1 2S-4S battery charge controller
- Instant-on works with no battery or deeply discharged battery
- Ultra-low quiescent current of 10 μ A
- Automatic supplement mode with BATFET control
- Supports battery LEARN function, shipping mode, and hard system reset

LDO: *NCP730*

- 2.7–38 V input voltage, 1.2–24 V output voltage
- Capable of sourcing 200 mA peak output current
- Quiescent current 1 μ A typical
- Shutdown current 100 nA typical
- Power good output option and built-in soft start circuit

Solar Inverter with Energy Storage



Key Products & Features

Boost PIMs: NXH80B120L2Q0, NXH40B120MNQ1

- Integration of leading edge Silicon and SiC devices
- Range of pin compatible full silicon to full SiC options
- Solderable & Press-Fit pin options
- Pre-applied TIM (thermal interface material) option

Discrete IGBTs: FGH75T65SQD, NGTB40N120FL3

- 650 V Best-in-class performance
- Best-in-class performance in existing 1200 V High Speed IGBTs
- SCR IGBT lineup with outstanding power loss performance
- Various options for co-pack diodes and packages

SiC MOSFETs: NTH4L020N120SC1, NTHL020N090SC1

- 900 & 1200 voltage nodes, 20 – 160 mΩ
- Wide package offering including die/wafer
- Designed for ruggedness and speed

SiC Diodes: FFSP4065BDN, FFSH50120A, NDSH25170A

- 650, 1200, 1700 voltage nodes
- Wide package offering including die/wafer
- Designed for ruggedness

Current Sense Amplifiers: NCS2007x, NCS21xR

- High-side and low-side current sensing
- Low offset zero-drift architecture
- Low value current sense resistors for better power efficiency
- Temperature sensitive applications

Inverter PIMs: NXH160T120L2Q1, NXH350N100H4Q2

- Integration of leading edge Silicon and SiC devices; for example, 1000 V low $V_{CE(SAT)}$ IGBTs with 1200 V SiC diodes for optimized solution in 1500 V decentralized solar inverters
- Variety of topologies including T-Type NPC & I-Type NPC
- Solderable & Press-Fit pin options
- Pre-applied TIM (thermal interface material) option

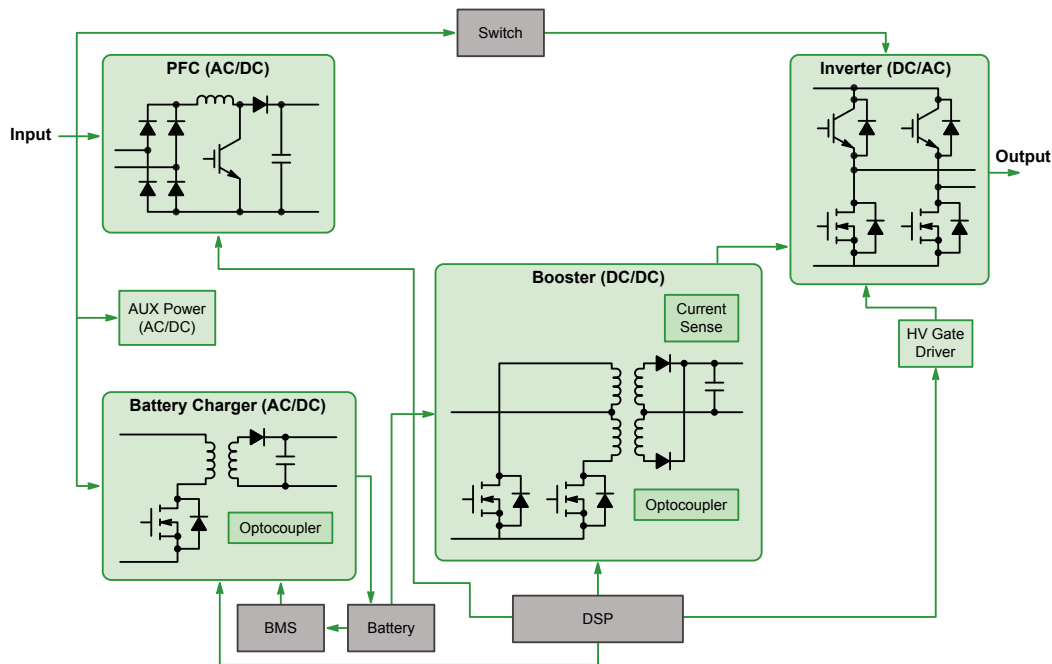
High Voltage Gate Drivers: NCD5700x, NCD570x

- Family of rail-to-rail high current drivers for lower system losses
- External (opto/silicon) or built-in galvanic isolation in multiple packages for design flexibility
- DESAT, Miller Clamp, TSD, and fault reporting to prevent catastrophic failures
- Input signal conditioning and high noise immunity for reliable operation

Optocouplers: FOD8163, FOD8342, FOD8320

- High common mode noise rejection (CMR) (>20 kV/μs)
- Fixed isolation gap for a consistent high input to output isolation voltage
- Up to 2.5 A output drive gate driver optocouplers

Uninterruptible Power Supplies (UPS)



Key Products & Features

High Voltage MOSFETs (SuperFET®): *NTxyyyyN65S3*

- 3 types: Easy Drive (S3), FRFET (S3F), Fast (S3Hx)
- Low on-resistance and low gate charge performance
- Low conduction loss & fast switching speeds
- Withstand extreme dv/dt rate and higher avalanche energy

Discrete IGBTs: *FGH75T65SQD, NGTB40N120FL3*

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- 650, 1200, 1700 voltage nodes
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- Designed for ruggedness

High Voltage Rectifiers: *RHRGxxxxx, ISL9R3060G2*

- Ultrafast with low V_F
- Hyperfast with a balanced design of V_F and Q_{RR}
- Stealth with small I_{RRM} and soft recovery

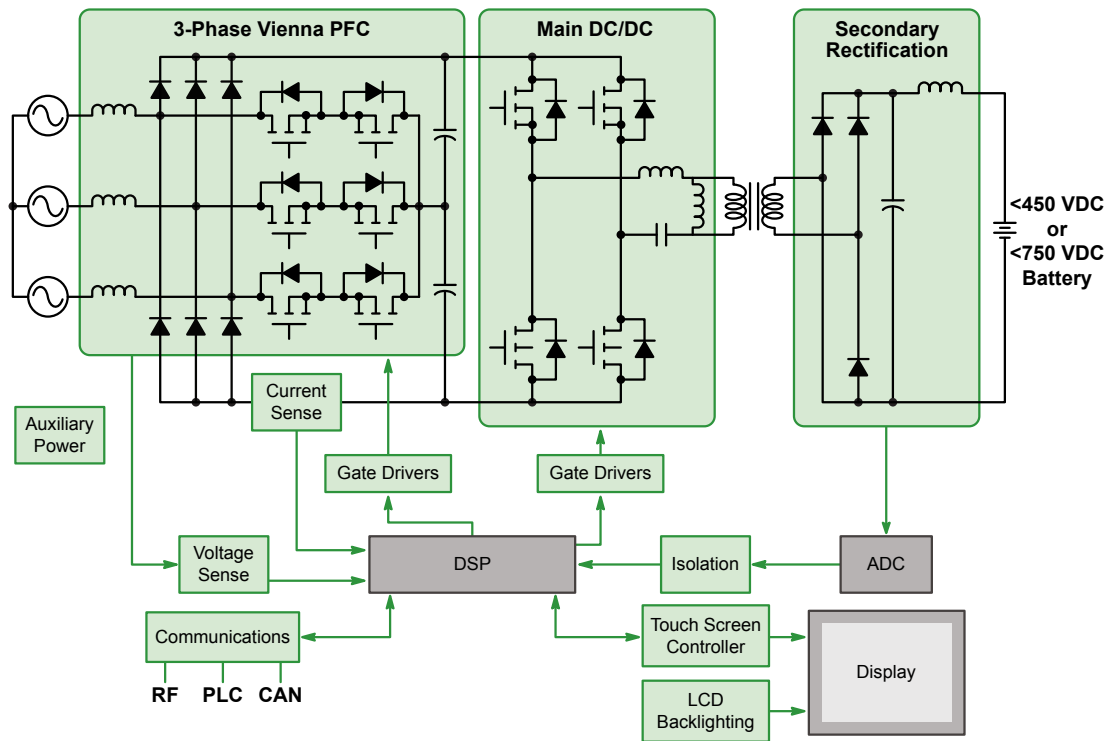
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EV Charging Stations



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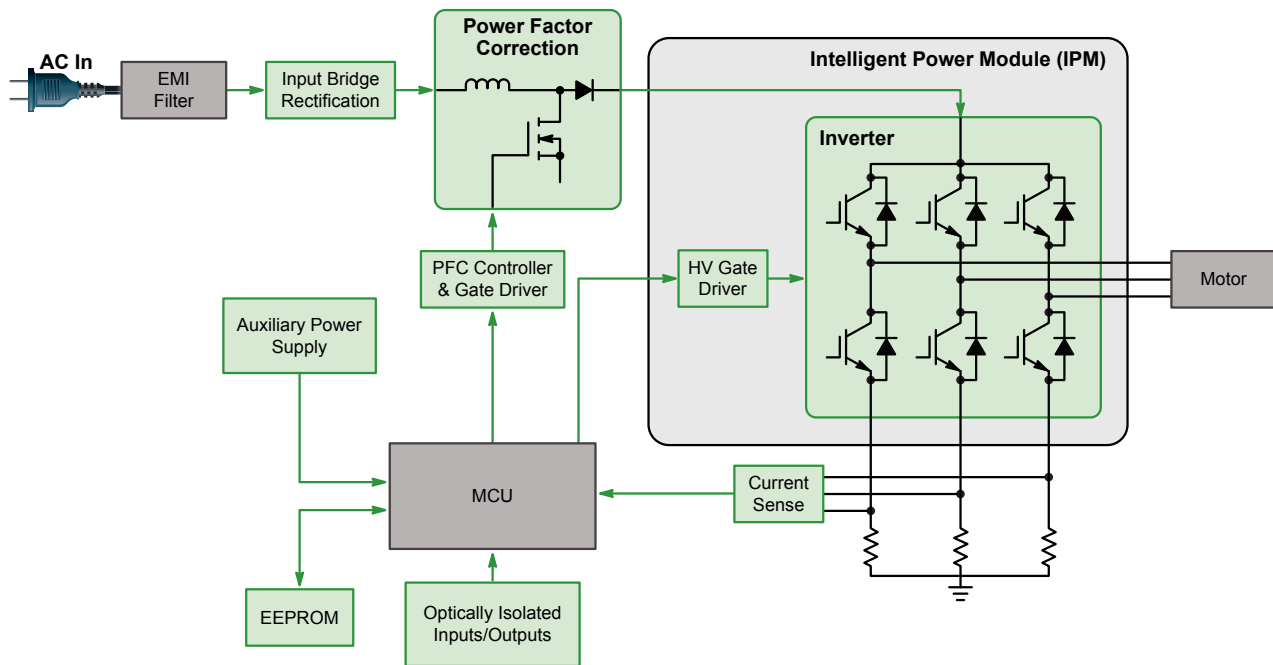
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Pumps & Fans



Key Products & Features

Intelligent Power Modules (IPM): NFALxxyL5B

- Inverter stage with integrated gate drives; PFC options
- Integration of high performance Silicon IGBTs & MOSFETs along with cutting-edge SiC devices
- Broad product coverage from 50 W to 10 kW across multiple packages, utilizing different substrates including isolated DBC

Discrete IGBTs: FGH75T65SQD, NGTB40N120FL3

- 650 V Best-in-class performance
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PFC Controller: NCP16xx, FAN967x

- CCM, CrCM, CRM mode options available
- Array features including programmable soft-start, UVLO, SAG protection, programmable operation frequency, overcurrent protection, overvoltage protection, brown-out protection

SiC MOSFETs: NTH4L020N120SC1, NTHL020N090SC1

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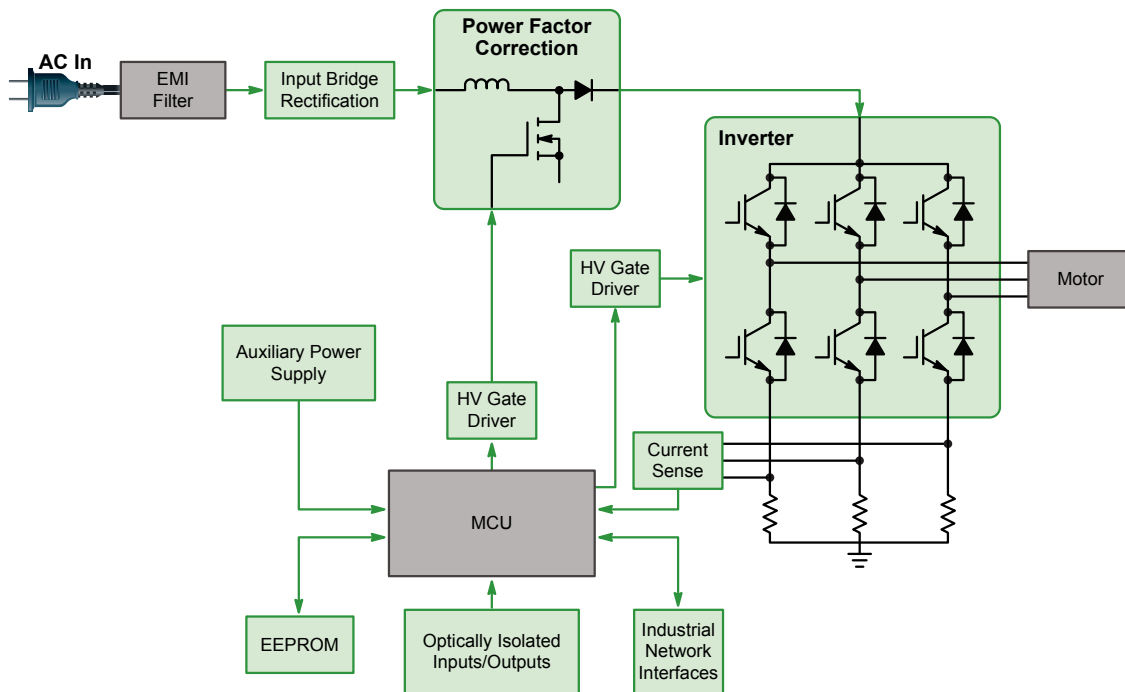
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Industrial Motor Drives



Key Products & Features

Transfer-Molded PIMs (TM-PIM): NXHxxC120L2C2

- CIB (Converter, Inverter, Brake) & CI options
- Transfer-molded package providing increased robustness & reliability over gel-filled modules
- Compact package; 6 mm clearance to avoid heatsink shaping

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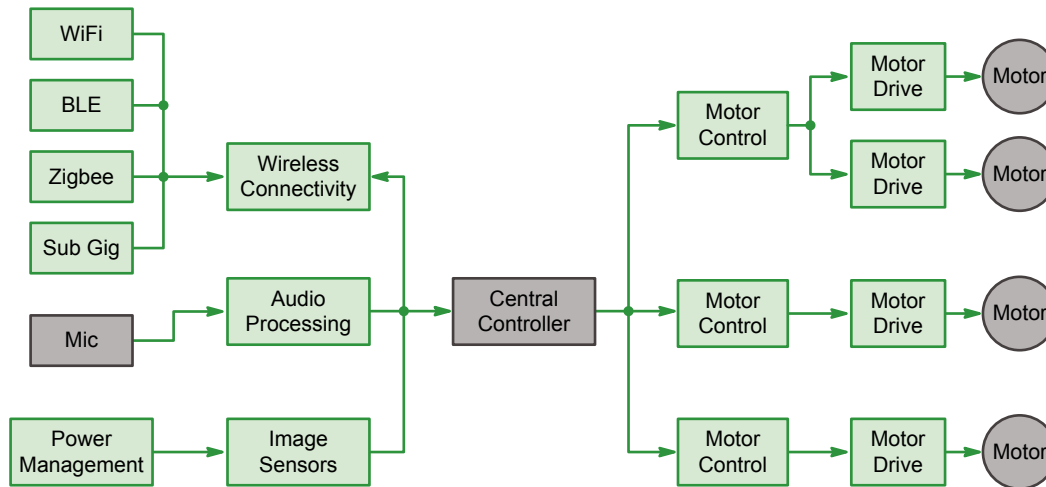
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Robotics



Key Products & Features

Wireless Connectivity

- **WiFi®:** QV842, 802.11ac 4x4 streams, 2.4/5 GHz, 1.7 Gbps (5 GHz) and 600 Mbps (2.4 GHz) Max Phy Rate
- **BLE:** RSL10, Lowest Power BLE in the industry, ARM Cortex-M3, LP32DSP, MESH, system-on-chip
- **Zigbee®:** NCS36510, 2.4 GHz 802.15.4 RF with ARM Cortex-M3, 4 kB RAM, 640KB Flash
- **Sub Gig:** AXMOF243, Software Defined Radio, 27 - 1050 MHz, -135 dbm sensitivity, Arm Cortex M0

Image Sensors

- **AR0144:** 1 MP, 1/4" 3.0 μ m Global Shutter, 1280 (H) x 800 (V), 2-Lane D-Phy MIPI CSI-2
- **AR0430:** 4 MP, 2 μ m, 1/3.1" 4:3, 208 mW @ 120 fps to 8 mW @ 1f ps, MIPI D-PHY & C-PHY
- **ARX3A0:** 0.3 MP, 2.2 μ m, 1/10.3" ultra fast Electronic Rolling Shutter 360 fps, MIPI 1 or 2-Lane D-PHY
- **AR1335:** 13 MP, 1/3.2" CMOS, 4208 (H) x 3120 (V) [4:3] Electronic Rolling Shutter
- **XGS12000:** 12.6 MP, 1/12, 4096 x 3072 resolution Global Shutter with 68.4 Dynamic Range

Power Management

- **NCP163:** LDO, 2.2 - 5.5 V input, PSRR 92 dB, Noise 6.5 μ V/VRMS, 250 mA, 1.2 - 5.14 V output
- **NCP6324:** Synchronous Buck Converter, 3 MHz, 2.0 A, 2.5 - 5.5 V input, 0.6 V - VIN output

Audio Processing

- **LC823455:** Local Voice Recognition, BF, AEC, NC, Dual Cortex-M3 + LP32DSP, 4-channel mic, 4 MB SRAM, 256 KB Audio Buffer, 12-bit ADC, hardware mixer and 6 band EQ, 32-bit and 192 kHz audio processing
- **FAN3852:** Pre-amp, ADC digitizes (PDM) Electret Condenser Microphone (ECM)

Motor Drive

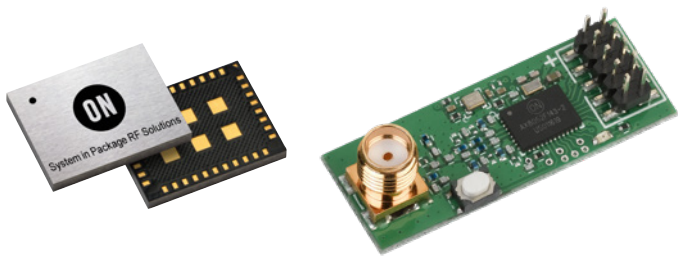
- **NCP81075:** HS/LS 180 V Gate Driver for BLDC Motor Drive, 4 A sink/source, 8/7 ns rise/fall into 1 nF load
- **FDMT80080DC:** 80 V N-channel MOSFET for BLDC, 1.35 m Ω , 254 A, 8 x 8 Dual Cool package
- **NCS211R:** 26 V $\pm$ 35 μ V (max) offset, 0.5 μ V/°C drift, HS/LS current sense operational amplifier
- **NCP51820:** High speed 650 V eGaN HS/LS gate driver, 1/2 A source/sink, 1 ns rise/fall times
- **NCP51705:** Single LS SiC MOSFET driver, 6 A source/sink, negative voltage drive for fast turn off

Comprehensive Sigfox™ Solutions



Product Features

- ON Semiconductor is a leading Sigfox device supplier
- Sigfox verified solution for all global Sigfox regions
- Reference designs are Sigfox verified and the design files are available for hassle-free copy and paste replication
- Sigfox solution provided as a modem controlled by AT commands or as a system on chip (SoC) controlled by software API
- Multi-protocol support
- New System-in-Package module for ultra-miniature applications; fully CE certified out of the box



Device	AT	API	Sigfox Region	Frequency (MHz)	GPIO	Package(s)
AX-SIP-SFEU-x-yy	✓		RC1	868	10	SIP-38
AX-SIP-SFEU-API-x-yy		✓	RC1	868	10	SIP-38
AX-SFEU-x-yy	✓		RC1	868	10	QFN-40
AX-SFEU-API-x-yy		✓	RC1	868	10	QFN-40
AX-SFUS-x-yy	✓		RC2/RC4 (LATAM)	902/920	10	QFN-40
AX-SFUS-API-x-yy		✓	RC2/RC4 (LATAM)	902/920	10	QFN-40
AX-SFJK-x-yy	✓		RC3	923	10	QFN-40
AX-SFJK-API-x-yy		✓	RC3	923	10	QFN-40
AX-SFAZ-x-yy	✓		RC4	920	10	QFN-40
AX-SFAZ-API-x-yy		✓	RC4	920	10	QFN-40

Ultra Low Power Radio Solutions

Sub-GHz Radio Features

- Highly flexible software defined sub-GHz radios for proprietary or standards based networking from 27 MHz to 1.05 GHz
- RadioLab – full featured radio configurator and code generator GUI
- CodeBlocks – full featured software development environment and toolchain with seamless integration of RadioLab and software stacks
- Available as either stand-alone transceivers or combined with MCU (8052 or Arm Cortex-M0+) in a SoC
- Multi-protocol support

2.4 GHz Radio Features

- Highly optimized for ultra low power consumption
- Hardware defined IEEE 802.15.4 Radio SoC
- Arm® Cortex®-M3 with 640 kB FLASH and 48 kB RAM
- Advanced power management and security hardware acceleration
- Industry leading receive current of 3.6 mA
- Supports Zigbee and proprietary (any 802.15.4 software stack)



RF Transceivers

Device	Protocol Supported	Frequency (MHz)	Data Rate (kbps)	Voltage Supply (V)	Power Consumption	TX Power (dBm)	RX Sensitivity (dBm)	Package
AX5043	Proprietary	27 – 1050	0.1 – 125	1.8 – 3.6	RX 6.5 – 9.5 mA TX 7.5 mA @ 0 dBm	0 to 16	-137 @ 0.1 kbps	QFN-28
AX5243	Proprietary	27 – 1050	0.1 – 125	1.8 – 3.6	RX 6.5 – 9.5 mA TX 7.5 mA @ 0 dBm	0 to 16	-137 @ 0.1 kbps	QFN-20
AX5051	Proprietary	433/868/915	1 – 350	2.2 – 3.6	RX 16 – 21 mA TX 11 – 45 mA	0 to 16	-116	QFN-28
AX5031	Proprietary	433/868/915	1 – 350	2.2 – 3.6	RX 16 – 21 mA TX 11 – 45 mA	0 to 16	–	QFN-20

RF SoCs

Device	Protocol Supported	Frequency (MHz)	Data Rate (kbps)	Peripheral Interface	Flash (kB)	RAM (kB)	GPIO	Package
AX8052F131	Proprietary	400 – 700 800 – 940	1 – 600	Configurable	64	8	21	QFN-40
AX8052F143	Proprietary, Sigfox	27 – 1050	0.1 – 125	Configurable	64	8	19	QFN-40
AX8052F151	Proprietary	400 – 700 800 – 940	1 – 600	Configurable	64	8	21	QFN-40
AXM0F243	Proprietary	27 – 1050	1 – 600	Configurable	64	8	20	QFN-40
NCS36510	Proprietary, Zigbee®	2400 – 2480	250	Configurable	640	48	18	QFN-40

RSL10 Bluetooth® Low Energy Technology Radio SoCs

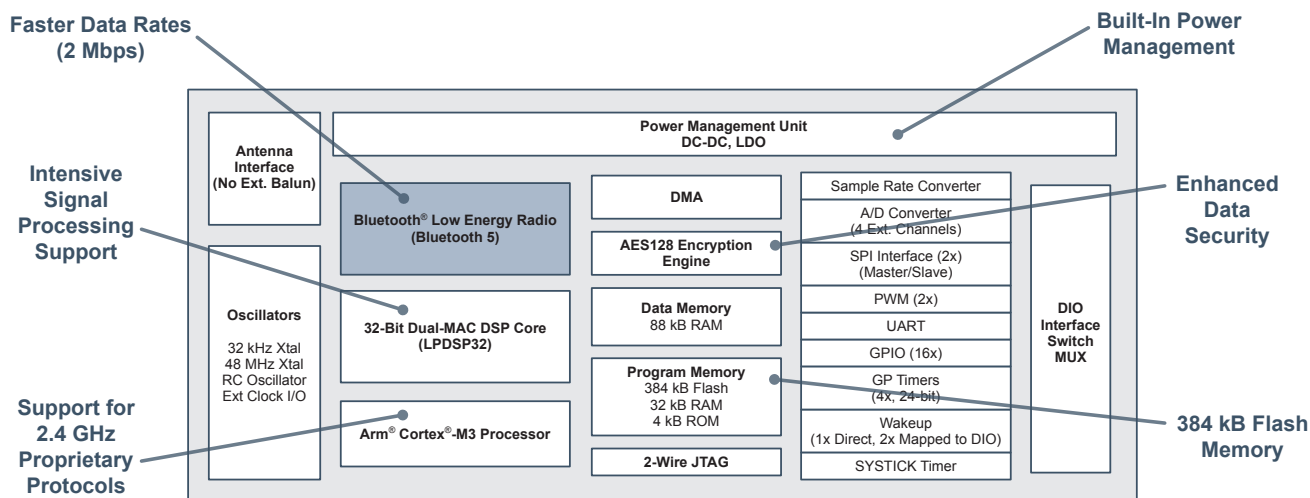
With so many options for wireless available, what sets the RSL10 radio SoC family apart? Simple. It offers the industry's lowest power Bluetooth Low Energy technology. Supporting 2 Mbps data rates provided by Bluetooth 5 (twice the speed as with previous Bluetooth generations), RSL10 enables advanced wireless functionality without compromising battery life. RSL10 can be easily integrated into any device.

SoC Features

- Industry's lowest power consumption (62 nW in Deep Sleep, 7 mW in Receive Mode)
- Supports Bluetooth Low Energy and 2.4 GHz proprietary protocols
- Flexible Voltage Supply Range (1.1 - 3.3 V)
- IP protection feature
- Available packages WLCSP-51, QFN-48

SIP Features

- All-in-one solution
- RSL10 radio SoC
- Integrated antenna, filtering, power management, passives
- Fully certified to worldwide regulatory standards
- Bluetooth SIG, FCC (USA), CE (Europe), IC (Canada), KCC (Korea), MIC (Japan)



Development Tools

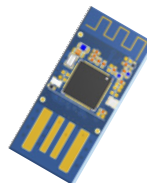
Software Development Kit (SDK)

- IDE support for Eclipse, Keil, and IAR
- Bluetooth Low Energy protocols, precompiled sample code and libraries, technical documentation
- Support for Bluetooth Mesh networking



RSL10 Development Board

- Compliance with Arduino form factor
- Integrated PCB antenna
- On-board J-link adapter for easy debugging



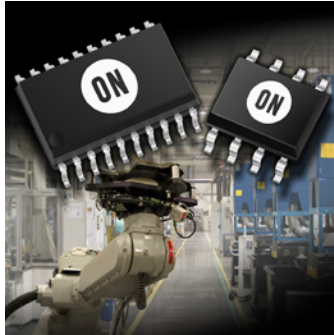
RSL10 USB Dongle

- Provided with Bluetooth Low Energy Explorer software to help verify or diagnose wireless connections during development

Mobile Apps

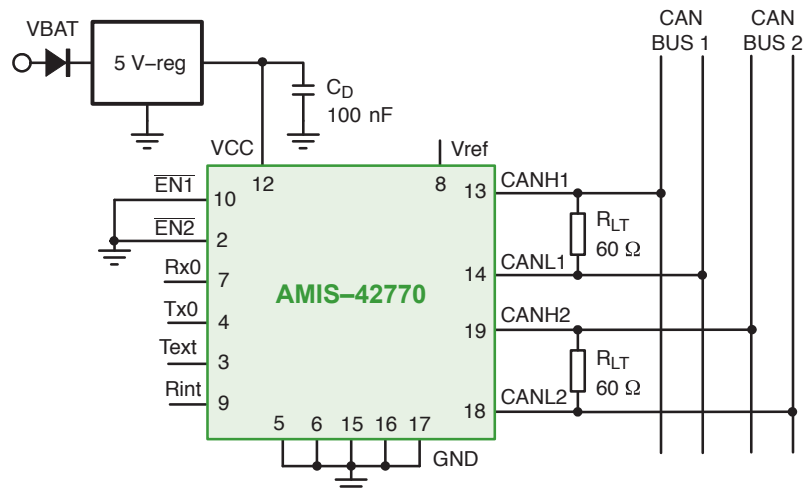
- Bluetooth Mesh networking for Android®
- FOTA (Firmware over the Air) for Android and iOS®

CAN Transceivers for Long Networks, >500 m



Features

- ISO 11898-2 compliant
- Up to 1 Mb/s communication speed
- Delivers low transmit data rate in networks exceeding 1 km
- Functional in 12 V and 24 V systems



CAN Transceivers



Device	Type	Description	Package (s)
AMIS42770	Dual	High-Speed CAN Repeater	SOIC-20
AMIS42670	Single	High-Speed CAN Transceiver for Long Networks	SOIC-8

KNX Transceivers

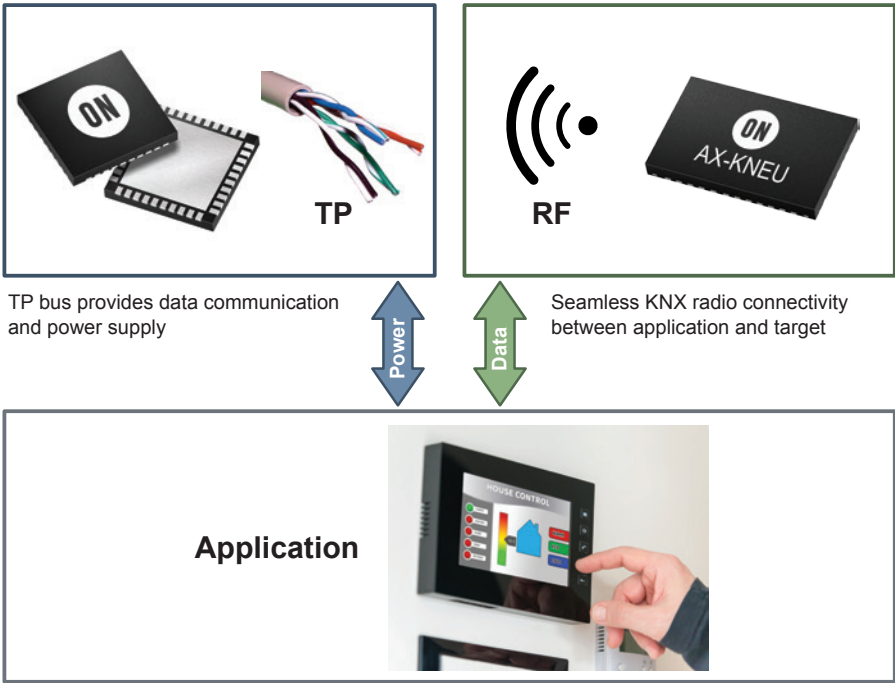
KNX is a standardized (EN 50090, ISO/IEC 14543), OSI-based network communications protocol for intelligent buildings. KNX is the successor to, and convergence of, three previous standards: the European Home Systems Protocol (EHS), BatiBUS, and the European Installation Bus (EIB or Instabus).

KNX Open Standards

- EN 50090: European Standard
- ISO/IEC 14543-3: International Standard
- GB/Z 20965: Chinese Standard
- ANSI/ASHRAE 135: US Standard

Applications

- Connects appliances and sensors, especially for climate and light control – wired or wireless – to the 9600 Baud KNX twisted pair (TP) bus inside a building



RF	AX8052F143
Multi/Ready	✓
High Sensitivity	✓
Ultra Low Receive and Standby Current	✓
PHY + MAC	✓

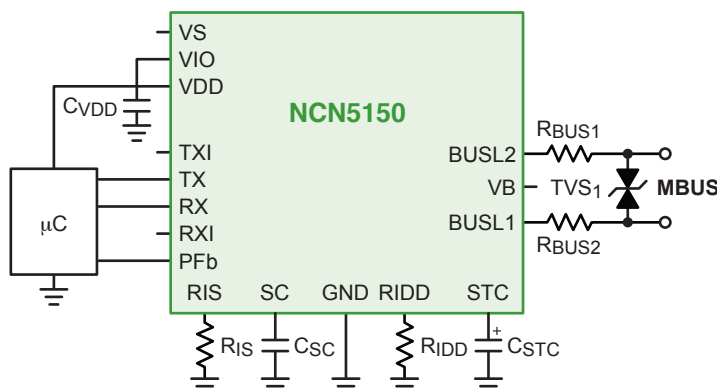


Twisted Pair	NCN5121	NCN5110	NCN5130
Efficiency Increase	✓	✓	✓
10/20 mA Bus Current Consumption	✓		
5 to 40 mA Bus Current Consumption		✓	✓
KNX Bus Current Limitation	✓	✓	✓
PHY + MAC Layer (TPUART Compatible)	✓		✓
PHY Layer (Analog Only)		✓	
3.3 V Fixed DC/DC	✓	✓	✓
Adjustable DC/DC	✓	✓	✓
20 V LDO	✓	✓	✓
Analog Monitor Output	✓		✓

M-BUS Transceivers

Wired M-Bus Features

- Satisfies physical requirements for M-BUS, described in EN 13757-2 and EN 1434-3
- UART communication speeds up to 38400 baud
- Integrated 3.3 V VDD LDO regulator (extended peak current of 15 mA)
- Supports powering slave device from the bus or from external power supply
- SOIC-16 and QFN-20 packages



General Application Diagram

AX8052F143 Wireless M-Bus System on Chip

- Ultra-low-power AX8052 MCU
- CPU active mode 150 μ A/MHz
- Low-power sleep modes with RAM retention
- High performance narrow-band RF transceiver
- Wide frequency range
- Large amount of memory

Wireless M-Bus Transceivers

- Ultra-low-power
- 50 nA deep sleep current
- 500 nA power-down current
- High sensitivity & selectivity
- -126 dBm @ 1 kbps, 868 MHz, FSK
- Constant Tx output power over $V_{DD} = 1.8 - 3.6$ V

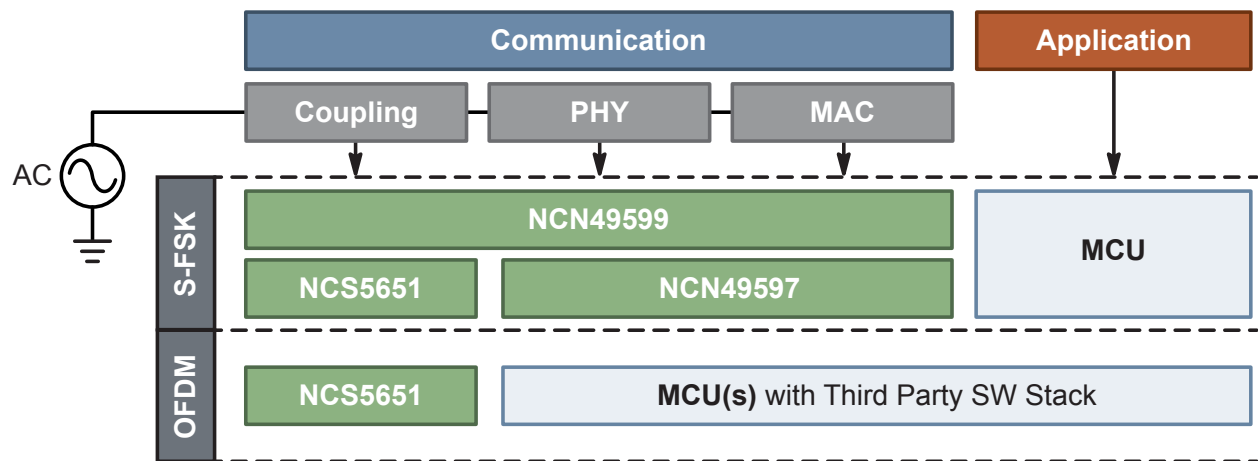
M-Bus Transceivers

Device	Frequency (MHz)	Data Rate (kbps)	Voltage Supply (V)	Power Consumption	TX Power (dBm)	RX Sensitivity (dBm)	Package(s)
AX5043	27 - 1050	0.1 - 125	1.8 - 3.6	RX 6.5 - 9.5 mA; TX 7.5 mA @ 0 dBm	0 to 16	-133 @ 0.2 kbps; -126 @ 1 kbps; -106 @ 100 kbps	QFN-28
AX5243	27 - 1050	0.1 - 125	1.8 - 3.6	RX 6.5 - 9.5 mA; TX 7.5 mA @ 0 dBm	0 to 16	-135 @ 0.1 kbps; -126 @ 1 kbps; -107 @ 100 kbps	QFN-20

M-Bus System on Chip

Device	Protocol Supported	Frequency (MHz)	Data Rate (kbps)	Peripheral Interface	Flash (kB)	RAM (kB)	GPIO	Package(s)
AX8052F143	EnOcean, KNX, M-Bus, Proprietary	27-1050	0.1 - 125	AT command via UART	64	8	19	QFN-40

PLC Modems/Power Line Driver



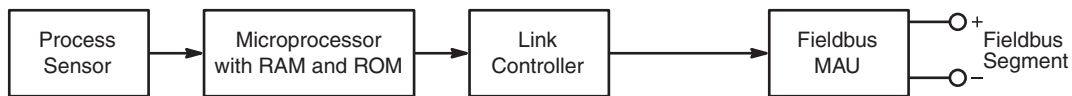
	Device	Function	Features		Package(s)
Smart Grid Modem	NCN49599	PLC S-FSK Modem; A - D Band	- ARM Cortex M0 - Baud rate: 4800 Bauds - S-FSK modulation	- Hardware embedded MAC + PHY - Embedded 1.2 A, 2-stage power amplifier with current limitation and thermal protection	QFN-56
	NCN49597	PLC S-FSK Modem; A - D Band	- ARM Cortex M0 - Baud rate: 4800 Bauds	- S-FSK modulation - Hardware embedded MAC + PHY	QFN-52
Power Amplifier	NCS5651	Power Line Driver; Class AB	- Low distortion power line driver with optimized interface for PLC modems - Capability to drive 2.0 A peak into reactive loads	- Current shutdown minimizes power consumption during power down state - Rail-to-Rail Drop of Only ± 1 V with $I_{out} = 1.5$ A	QFN-20 EP

Modems



AMIS-49200 & AMIS-49250 Fieldbus Physical Layer Medium Access Units

- Compatible to both FOUNDATION Fieldbus H1 (Type 111 and Type 112 per FF-816) and PROFIBUS PA standards
- Enables Fieldbus to completely power field devices using the integrated power supply block
- Data rate: 31.25 kbps voltage mode
- Low current consumption 500 μ A typ
- LQFP-44 and NQFP-44 packages

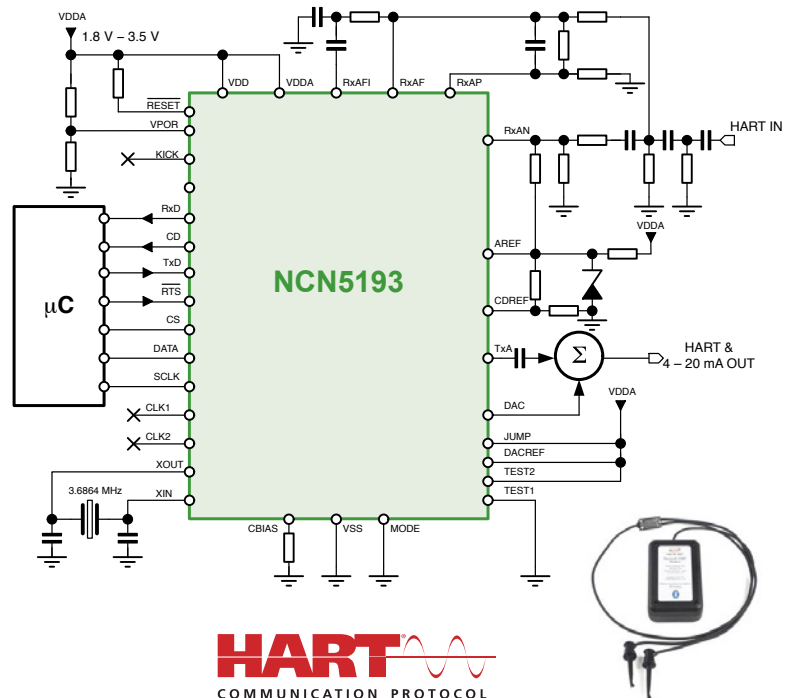


Industrial HART Protocol Modems

- Single-chip, half-duplex 1200 bps FSK modem
- Bell 202 shift frequencies of 1200 Hz and 2200 Hz
- Transmit-signal wave shaping
- Receive band-pass filter

HART Modems

Device	Input Frequency	DAC	Temp Range (°C)	Package(s)
NCN5193	460.8 kHz, 920 kHz, or 1.8 MHz	Integrated 16-bit Sigma-Delta	-40 to +85	QFN-32
NCN5192	460.8 kHz, 920 kHz, or 1.8 MHz	Integrated 16-bit Sigma-Delta	-40 to +85	QFN-32
A5191HRT	460.8 kHz	External	-40 to +85	QFN-32, LQFP-32, PLCC-28



Mainstream CMOS Image Sensors

The mainstream CMOS imaging sensor portfolio from ON Semiconductor provides options for all image sensing industrial solutions, from security cameras to lighting control. With a combination of rolling shutter and global shutter options, you can choose the correct sensor for your end application and know it will have a high quality image for viewing or machine vision.

Features

- Superior image quality with advanced pixel technology
- Low power for battery operation
- Great low light performance
- Resolution choice, including via capability from VGA to 4K (UHD)

Device	Sensor/ SOC	Resolution (MP)	Optical Format	Frame Rate	Pixel Size (μm)	Shutter Type ¹	CFA	Operating Temp (°C)
MT9V115	SOC	VGA	1/13"	30 fps	1.75	ERS	Color	-30 to +70
ASX340CS	SOC	VGA	1/4"	60 fps	5.6	ERS	Color	-30 to +70
ASX370CS	SOC	VGA	1/7"	30 fps	3.0	ERS	Color	-30 to +70
ARX3A0	Sensor	VGA	1/10"	Up to 360 fps	2.2	PGS	Mono	-30 to +70
MT9V024	Sensor	WVGA	1/3"	60 fps	6.0	GS	Color, Mono	-40 to +105
MT9V034	Sensor	WVGA	1/3"	60 fps	6.0	GS	Color, Mono	-30 to +70
AR0141CS	Sensor	1.2	1/4"	1.2 45 fps, 720P 60 fps	3.0	ERS	Color	-30 to +85
AR0144CS	Sensor	1	1/4"	60 fps	3.0	GS	Color, Mono	-40 to +85
AR0130CS	Sensor	1.2	1/3"	1.2 45 fps, 720P 60 fps	3.75	ERS	Color, Mono	-30 to +70
AR0134CS	Sensor	1.2	1/3"	1.2 54 fps, 720 60 fps	3.75	GS	Color, Mono	-30 to +70
AR0135CS	Sensor	1.2	1/3"	1.2 60 fps, 720 60 fps	3.75	GS	Color, Mono	-30 to +70
MT9M114	SOC	1.3	1/6"	1.3 30 fps, VGA 75 fps	1.9	ERS	Color	-30 to +70
AR0237CS	Sensor	2.1	1/2.7"	1080P 60 fps	3	ERS	Color	-30 to +85
AR0237IR	Sensor	2.1	1/2.7"	1080P 60 fps	3	ERS	RGB-IR	-30 to +85
AR0238	Sensor	2.1	1/2.7"	1080P 60 fps	3	ERS	Color	-30 to +85
AR0239	Sensor	2.1	1/2.7"	1080P 90 fps	3	ERS	Color	-30 to +85
AR0261	Sensor	2.1	1/6"	1080P 60 fps	1.4	ERS	Color	-30 to +70
AS0260	SOC	2.1	1/6"	30 fps	1.4	ERS	Color	-30 to +70
AR0221	Sensor	2.1	1/1.8"	60 fps	4.2	ERS	Color	-30 to +85
AR0330	Sensor	3.5	1/3"	1080P 60 fps	2.2	ERS, GRR	Color	-30 to +70
AR0430	Sensor	4	1/3"	120 fps	2	ERS	Color	-30 to +70
AR0431	Sensor	4	1/3"	120 fps	2	ERS	Color	-30 to +70
AR0521	Sensor	5	1/2.5"	60 fps	2.2	ERS	Color, Mono	-30 to +85
AR0522	Sensor	5	1/2.5"	60 fps	2.2	ERS	Color, Mono	-30 to +85
AR01011HS	Sensor	10	1"	60 fps	3.4	ERS	Color	-30 to +70
AR1335	Sensor	13	1/3.2"	13 30 fps, 1080P 60 fps	1.1	ERS, GRR	Color, Mono	-30 to +70
AR1337	Sensor	13	1/3.2"	13 30 fps, 1080P 60 fps	1.1	ERS, GRR	Color	-30 to +70
AR1630	Sensor	16	1/3"	30 fps	1	ERS	Color	-30 to +70
AR1820HS	Sensor	18	1/2.3"	18 24 fps, 1080P 120 fps	1.25	ERS, GRR	Color	-30 to +70

1. ERS = Electronic Rolling Shutter, GRR = Global Reset Release, GS = Global Shutter, PGS = Pseudo Global Shutter

Co-Processors for Mainstream CMOS Image Sensors

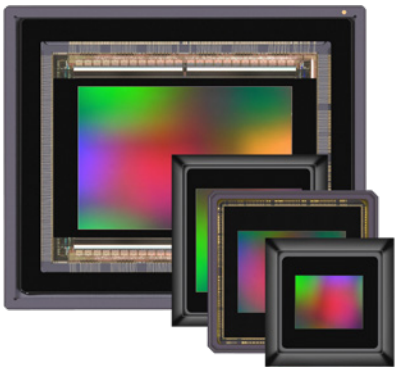
Available Features

- HDR with ALTM
- Dewarp, up to 165 degrees
- Spatial Transform Engine Software Add-on
- Overlays
- GPIOs, up to 5
- Color Pipe
 - Demosaic
 - Gamma correction
 - Auto white balance
 - Defect correction
 - Noise reduction
 - Auto exposure
 - Flicker detection

Device	Resolution (MP)	Frame Rate (fps)	Video	Output Format	Package(s)
AP0100CS	1	45	1.2 MP/45 fps; 720p/60 fps	NTSC/PAL; YUV	VFBGA-100
AP0101CS	1	45	1.2 MP/45 fps; 720p/60 fps	SMPTE 296M; YUV	VFBGA-81
AP1302	13	30	13 MP/30 fps; 1080p/120 fps	JPEG; RAW; RGB565; RGB888; YUV	VFBGA-120

XGS Global Shutter CMOS Image Sensors

XGS image sensors provide superior global shutter imaging performance with high image uniformity and low noise, enabling them to excel in the most demanding industrial imaging applications. A low power footprint and compact package enable 29 x 29 mm² camera designs for resolutions up to 16 megapixels. High frame rates and available speed grades allow imaging performance to be matched to specific applications. In addition, the common architecture used throughout the family combines with the use of common packages to allow a single camera design to be leveraged across the entire family of devices.



Device	Resolution (MPix)	Pixel Count (H x V)	Pixel (μm)	Diagonal (mm)	Lens	CFA ¹	FPS Max	Evaluation Kit
XGS 45000**	44.7	8192 x 5460	3.2	31.5	Super 35 mm	C/M	48	✓
XGS 30000**	29.8	5460 x 5460	3.2	24.7	APS-C	C/M	48	
XGS 20000**	20.3	4500 x 4500	3.2	20.4	4/3"	C/M	58	
XGS 16000*	16.8	4096 x 4096	3.2	18.5	1.1"	C/M	65	✓
XGS 12000	12.6	4096 x 3072	3.2	16.4	1"	C/M	90	✓
XGS 9400	9.4	3072 x 3072	3.2	13.9	1/1.2"	C/M	90	
XGS 8000	8.8	4096 x 2160	3.2	14.8	1/1.1"	C/M	128	
XGS 5000*	5.3	2592 x 2048	3.2	10.6	2/3"	C/M	132	✓
XGS 3000*	3.1	2048 x 1538	3.2	8.2	1/2"	C/M	175	
XGS 2000*	2.3	1920 x 1200	3.2	7.2	1/2.2"	C/M	220	

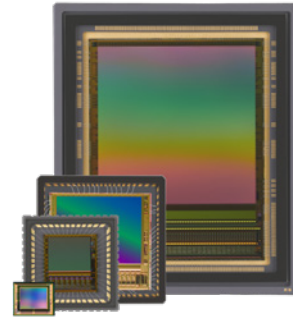
1. CFA Options - Bayer Color (C), Monochrome (M). * Pending 2Q20. ** Pending 3Q20.

PYTHON Global Shutter CMOS Image Sensors

With resolutions from VGA to 26 megapixels, the PYTHON family of image sensors addresses the needs of general purpose industrial imaging applications such as machine vision inspection and motion monitoring, security, surveillance, and intelligent transportation systems (ITS). Combining flexibility in configuration and resolution with high speed and high sensitivity, these devices capture fast moving scenes without distortion by combining low read noise and high sensitivity with frame rates up to 815 fps.

Features

- CDS global shutter technology with low noise performance
- True HW scalable family concept
- High configurability and fast adaptability
- Quadratic speed increase with ROI windowing
- Multiple regions of interest
- High dynamic range
- Color, Monochrome, and Enhanced NIR configurations
- Standard and protective tape configurations
- Low power, cost efficient configurations



Device	Resolution (MPix)	Pixel Count (H x V)	Pixel (μm)	Diagonal (mm)	Lens	CFA ¹	FPS Max	Evaluation Kit
PYTHON 300	0.3	640 x 480	4.8	3.8	1/4"	C/M/NIR	815	✓
PYTHON 480	0.5	800 x 600	4.8	4.8	1/3.6"	C/M	120	✓
PYTHON 500	0.5	800 x 600	4.8	4.8	1/3.6"	C/M/NIR	545	✓
PYTHON 1300	1.3	1280 x 1024	4.8	7.9	1/2"	C/M/NIR	210	✓
PYTHON 2000	2.3	1920 x 1200	4.8	10.9	2/3"	C/M/NIR	225	✓
PYTHON 5000	5.3	2592 x 2048	4.8	15.9	1"	C/M/NIR	100	✓
PYTHON 12K	12.5	4096 x 3072	4.5	23.0	4/3	C/M/NIR	160	✓
PYTHON 16K	16.8	4096 x 4096	4.5	26.1	APS-H	C/M/NIR	120	✓
PYTHON 25K	26.2	5120 x 5120	4.5	32.6	APS-H	C/M/NIR	80	✓

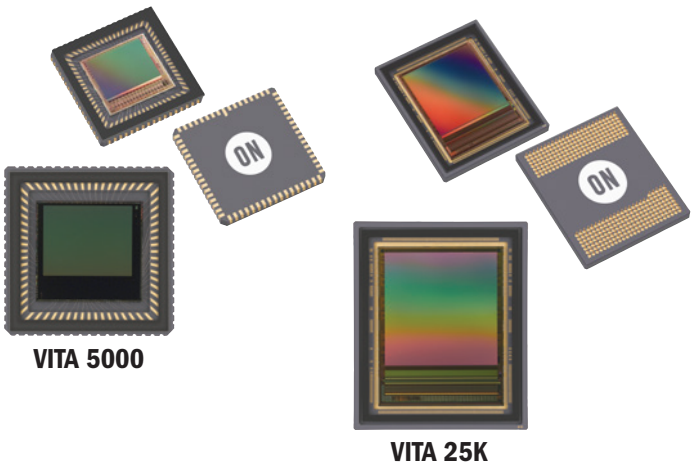
1. CFA Options - Bayer Color (C), Monochrome (M), Enhanced NIR (NIR).

Versatile CMOS Image Sensors

VITA image sensors combine flexibility in configuration and resolution with high speed and high sensitivity, addressing a wide range of customer requirements in a cost-effective family of rolling/global shutter CMOS image sensors. A flexible read-out architecture makes them well suited for machine vision, intelligent transportation systems and surveillance, and other applications that demand high functionality, while delivering excellent image quality.

Features

- 1.3 to 26 Megapixels
- Pipelined and triggered global shutter with dual readout
- Rolling shutter with CDS
- Quadratic speed increase with ROI windowing
- Multiple regions of interest



Device	Resolution (MPix)	Pixel Count (H x V)	Pixel (μm)	Diagonal (mm)	Lens	CFA ¹	FPS Max
VITA 1300	1.3	1280 x 1024	4.8	7.9	1/2"	C/M	150
VITA 2000	2.3	1920 x 1200	4.8	10.9	2/3"	C/M	92
VITA 5000	5.3	2592 x 2048	4.8	15.9	1"	C/M	75
VITA 12K	12.6	4096 x 3072	4.5	23.0	4/3"	C/M	160
VITA 16K	16.8	4096 x 4096	4.5	26.1	APS-H	C/M	125
VITA 25K	26.2	5120 x 5120	4.5	32.6	APS-H	C/M	72

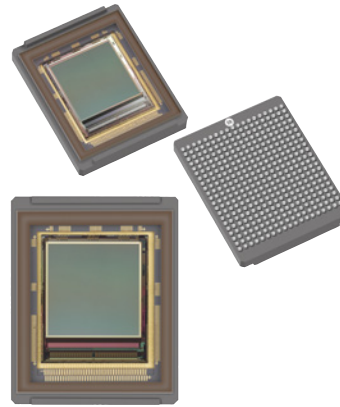
1. CFA Options – Bayer Color (C), Monochrome (M).

High Speed CMOS Image Sensors

LUPA devices offer global shutter imaging with multiple megapixel resolution and frame rates up to 500 fps. These features, combined with a power consumption as low as 150 mW with absolutely no blooming or lag, create a perfect foundation for highly reliable, high sensitivity image sensors.

Features

- Frame rates up to 500 fps at several megapixel resolutions
- Unprecedented sensitivity
- Pipelined global shutter
- Low power dissipation
- High resolution
- No blooming or image lag
- Mono and color variants



LUPA 3000

Device	Resolution (MPix)	Pixel Count (H x V)	Pixel (μm)	Diagonal (mm)	Lens	CFA ¹	FPS Max
LUPA 300	0.3	640 x 480	9.9	7.9	1/2"	C	250
LUPA 1300-2	1.3	1280 x 1024	14	22.9	1"	C/M	500
LUPA 3000	3	1696 x 1710	8	19.3	1"	C/M	485

1. CFA Options – Bayer Color (C), Monochrome (M).

Radiation Tolerant Image Sensors

Radiation hardened CMOS images play an important role in high-radiation environments where normal CMOS or CCD imagers cannot survive, and where CRT image tubes are too expensive, too heavy or too large. STAR and HAS image sensors are designed using radiation-tolerant design techniques to allow high tolerance against total dose effects. All devices feature qualified radiation tolerance up to 300 krad, and include on-chip Fixed Pattern Noise (FPN) correction and a programmable gain amplifier.

Applications

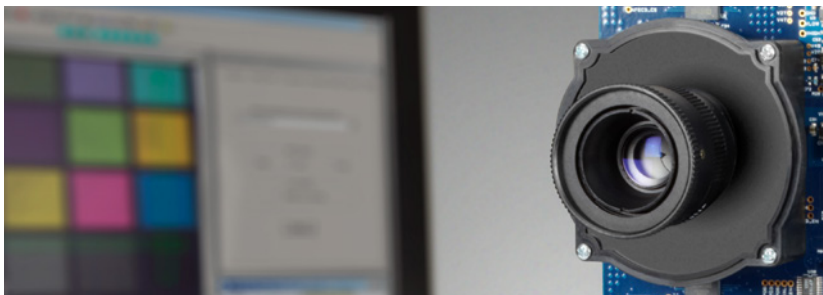
- GNC guidance, navigation, and control applications
- AOCS attitude and orbit control systems
- Nuclear power plant inspection



Device	Resolution (Mpix)	Pixel Count	Pixel (μm)	Diagonal (mm)	ADC	CFA	FPS Max
STAR250	0.3	512 x 512	25	18.1	10-bit	M	30
STAR1000	1.0	1024 x 1024	15	21.7	10-bit	M	11
HAS2	1.0	1024 x 1024	18	26.1	12-bit	M	10

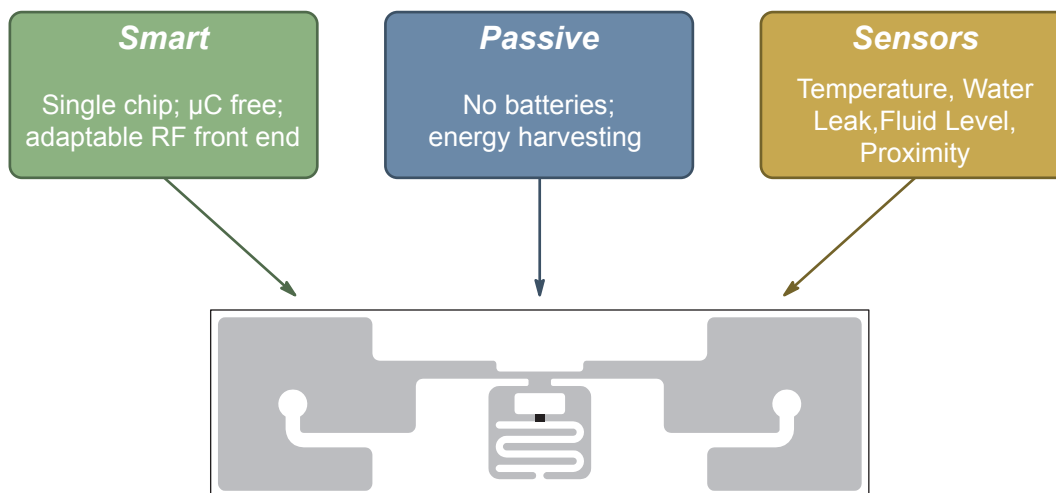
Evaluation Support

ON Semiconductor provides supporting hardware and software to qualified engineering teams to accelerate product development. From support for detailed product evaluation, to tools that facilitate FPGA programming and provide detailed reference designs, these kits contain everything necessary to simplify and accelerate your camera designs.



Energy Harvesting Wireless Sensors

*Introducing the World's First Battery-Free, μ C-Free Sensor Tag
Breakthrough Sensor Technology Implemented on RFID*



Features	Benefits
• Battery-free and wireless	➔ Ideal for locations with limited access • underground, within walls, intrusive to body, within boxes, toxic or dangerous locations
• Ultra-thin	➔ Ideal for space-constrained applications • Within doorways, within RFID tags, peel and stick, bandages
• Low cost to scale	➔ Effective where multiple sensors are required • Disposable products, multiple data points, increasing needs over time

Device	Description	Feature	Form Factor
SPSXM001FOM	Moisture sensor	Low sensitivity	Flexible PET, for metal surfaces
SPSXM002PET	Moisture sensor	Low sensitivity	Flexible PET, for non-metal surfaces
SPSXF001PET	Moisture sensor	High sensitivity	Flexible PET, for non-metal surfaces
SPSXT001PET	Temperature sensor	$\pm 1^\circ\text{C}$ accuracy	Flexible PET, for non-metal surfaces
SPSPRDA2-P	UHF reader antenna	Off-axis dipole radiation pattern	ABS plastic dome
SPSPRDR1-8	SPS UHF reader	USB or Ethernet connectivity	Rugged metal case, 8 RF ports with RP-SMA connectors



SPSPRDR1-8 UHF Reader Hub

- High performance, 8 port reader
- USB, Ethernet, and WiFi connectivity
- Fully certified for regulatory compliance
- Options for different geographic regions

Capacitive Touch Sensors

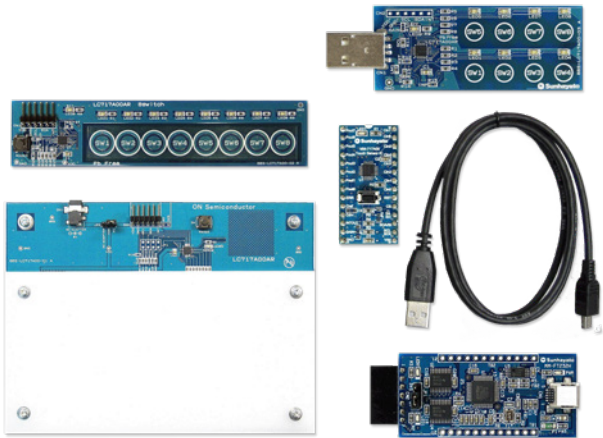
Features

- Differential capacitive detection down to femtofarad level using mutual capacitance
- High noise immunity for improved stability and reliability
- Adhesive free for simplified manufacturing flow
- Calibration function for adaptability



HMI Applications

Evaluation Kits



LC717A00ARGEVK

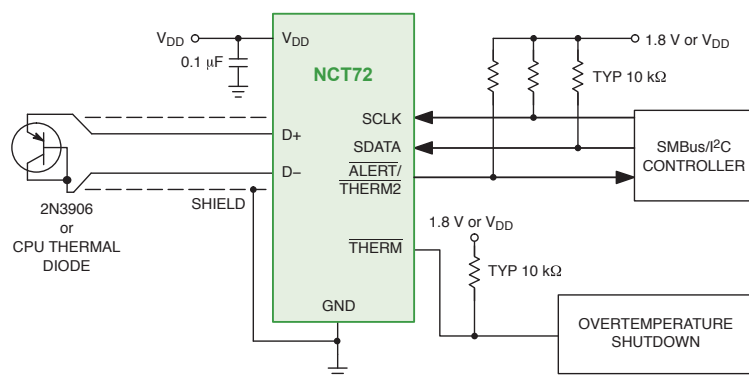


LC717A30UJGEVK

LC717A30URGEVK Available

Device	Proximity/Gesture Sensing (cm)	Sensing Inputs	Sensing Outputs	Interface Control	VDD (V)	Package
LC717A00AJ	0-10	8	8	I2C, SPI	2.6 - 5.5	SSOP-30
LC717A00AR	0-10	8	8	I2C, SPI	2.6 - 5.5	VCT-28
LC717A10AJ	0-10	16	0	I2C, SPI	2.6 - 5.5	SSOP-30
LC717A10AR	0-10	16	0	I2C, SPI	2.6 - 5.5	VCT-28
LC717A10PJ	0-10	16	0	I2C, SPI	2.6 - 5.5	SSOP-30
LC717A30UJ	0-20	8	0	I2C, SPI	2.6 - 5.5	SSOP-30
LC717A30UR	0-20	8	0	I2C, SPI	2.6 - 5.5	VCT-28

Temperature Monitors with Series Resistance Cancellation



Features

- On-chip and remote temperature sensor
- 0.25°C resolution/1°C accuracy on remote channel
- 1°C resolution/1°C accuracy on local channel
- Series resistance cancellation up to 1.5 kΩ (NCT72)
- Extended, switchable temperature measurement range 0°C to +127°C (default) or -64°C to +191°C

Device	Supply Range (V)	Interface	Number of Addresses	Temperature Sensors	Temperature Sensor Accuracy (°C)	Temperature Range (°C)	Package(s)
NCT375	3.0 - 5.5	SMBus	8	1 Local	±1	-55 to +125	Micro8, SOIC-8, DFN-8
NCT72	2.8 - 3.6	I2C/SMBus	2	1 Local; 1 Remote	±1	-40 to +125	WDFN-8, DFN-8

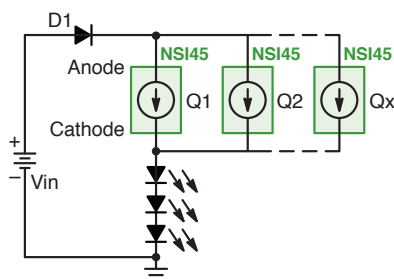
Constant Current Regulator (CCRs) Linear LED Drivers for Displays and Channel Letters

Features

- Low startup voltage
- Tight current regulation regardless of V_f variation
- Negative temperature coefficient protects LEDs

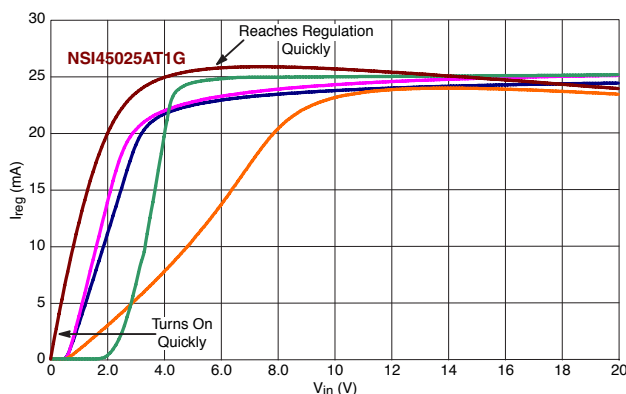
Resources

- Sample Kit: CCR2KIT/S



Device	Max Anode-to-Cathode Voltage (V_{AK}) (V)	Voltage Overhead ($V_{in} - V_{LEDs}$) (V)	Constant Current I_{reg} (@ $V_{AK} = 7.5$ V) (mA)	Current Tolerance Over Voltage	Max Junction Temperature ($^{\circ}C$)	Package(s)
NSI45xxx	45	1.8	Fixed: 15, 20, 25, 30	$\pm 15\%$, $\pm 10\%$	150	SOD-123, SOT-223
NSI50xxx	50	1.8	Fixed: 10, 350	$\pm 10\%$	175	SMC, DPAK
NSIC20xx	120	1.8	Fixed: 20, 30, 50	$\pm 15\%$	175	SMB
NSI45xxxJ	45	1.8	Adjustable: 20 to 40, 35 to 70, 60 to 100, 90 to 160	$\pm 15\%$	150	SOT-223, DPAK
NSI50150AD	50	1.8	150 to 350	$\pm 10\%$	175	DPAK

NOTE: xxx in the device number represents the current level.

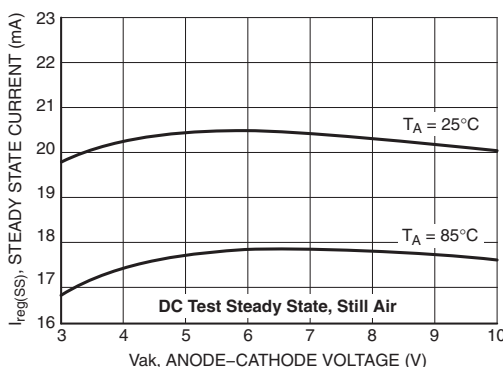
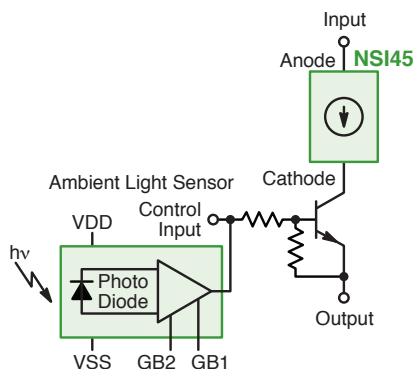


NSI45025 vs Competing Devices @ 25 mA

Linear LED Driver Solutions

Linear solutions are the preferred approach for many lighting applications, as they are simple, straightforward to design, and allow the LEDs to be driven with a tightly regulated current, regardless of LED forward voltage or input supply variation. Because the LED drivers are linear, they must be matched to the power dissipation requirements of the application. ON Semiconductor offers a wide range of constant current linear LED drivers whose current levels span from 10 mA to 1 A.

Constant Current Regulators – Dimming with External BRT



Linear LED Driver Solutions (continued)

Fixed Linear LED Drivers

Device	Channel Output Current (mA)	Operating Voltage Range (V)	Typical Current Tolerance	Number of Channels	Dimming Control	Typical Dropout (V)	Operating Temperature Range (°C)	Package(s)	Features
NSI50350AS	350	1.8 to 50	±10%	1	Ext	1.8	-40 to +125	SMC	AEC-Q101 qualified
NSI50350AD	350	1.8 to 50	±10%	1	Ext	1.8	-40 to +125	DPAK	AEC-Q101 qualified
NSIC2050JB	50	1.8 to 120	±15%	1	Ext	1.8	-40 to +125	SMB	AEC-Q101 qualified
NSIC2030JB	30	1.8 to 120	±15%	1	Ext	1.8	-40 to +125	SMB	AEC-Q101 qualified
NSI45030Z	30	1.8 to 45	±15%	1	Ext	1.8	-40 to +125	SOT-223	AEC-Q101 qualified
NSI45030AZ	30	1.8 to 45	±10%	1	Ext	1.8	-40 to +125	SOT-223	AEC-Q101 qualified
NSI45030A	30	1.8 to 45	±10%	1	Ext	1.8	-40 to +125	SOD-123	AEC-Q101 qualified
NSI45030	30	1.8 to 45	±15%	1	Ext	1.8	-40 to +125	SOD-123	AEC-Q101 qualified
NSI45025Z	25	1.8 to 45	±15%	1	Ext	1.8	-40 to +125	SOT-223	AEC-Q101 qualified
NSI45025AZ	25	1.8 to 45	±10%	1	Ext	1.8	-40 to +125	SOT-223	AEC-Q101 qualified
NSI45025A	25	1.8 to 45	±10%	1	Ext	1.8	-40 to +125	SOD-123	AEC-Q101 qualified
NSI45025	25	1.8 to 45	±15%	1	Ext	1.8	-40 to +125	SOD-123	AEC-Q101 qualified
NSI45020	20	1.8 to 45	±15%	1	Ext	1.8	-40 to +125	SOD-123	AEC-Q101 qualified
NSI45020A	20	1.8 to 45	±10%	1	Ext	1.8	-40 to +125	SOD-123	AEC-Q101 qualified
NSIC2020JB	20	1.8 to 120	±15%	1	Ext	1.8	-40 to +125	SMB	AEC-Q101 qualified
NSI45015W	15	1.8 to 45	±20%	1	Ext	1.8	-40 to +125	SOD-123	AEC-Q101 qualified
NSI50010Y	10	1.8 to 50	±30%	1	Ext	1.8	-40 to +125	SOD-123	AEC-Q101 qualified

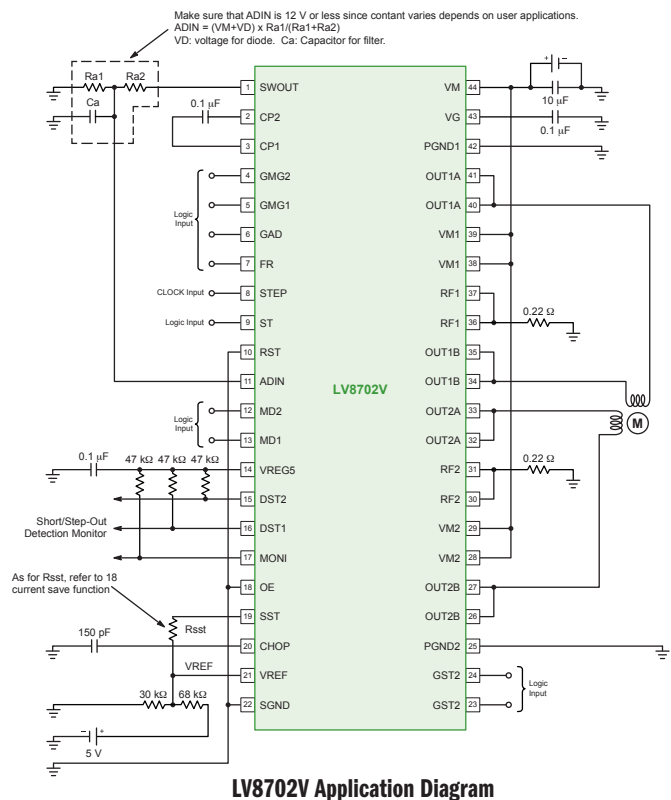
Adjustable Linear LED Drivers

Device	Channel Output Current (mA)	Operating Voltage Range (V)	Typical Current Tolerance	Number of Channels	Dimming Control	Typical Dropout (V)	Operating Temperature Range (°C)	Package(s)	Features
NSI50150AD	150 to 350	1.8 to 50	±10%	1	Ext	1.8	-40 to +125	DPAK	AEC-Q101 qualified
NSI45090JD	90 to 160	1.8 to 45	±15%	1	Ext	1.8	-40 to +125	DPAK	AEC-Q101 qualified
NSI45060JD	60 to 100	1.8 to 45	±15%	1	Ext	1.8	-40 to +125	DPAK	AEC-Q101 qualified
NSI45035JZ	35 to 70	1.8 to 45	±15%	1	Ext	1.8	-40 to +125	SOT-223	AEC-Q101 qualified
NSI45020JZ	20 to 40	1.8 to 45	±15%	1	Ext	1.8	-40 to +125	SOT-223	AEC-Q101 qualified
NSM4002MR6	1 to 200	1.4 to 45	±3%	1	Ext	1.4	-40 to +125	SC-74	Can be used with an external transistor
NUD4001	500	2.0 to 30 (60 V Surge)	±3%	1	Ext	1.4	-40 to +125	SOIC-8	Can be used with an external transistor
NUD4011	70	5 to 200	±3%	1	Ext	5	-40 to +125	SOIC-8	Can be used with an external transistor
NCV7680	35	6 to 16	±10% @ 35 mA	8	Ext	1	-40 to +125	SOIC-16 EP	AEC-Q101 qualified
LV5237JA	Constant mode 5 to 100 Open drain 100	VDD 3.3 - 12.8 LED 0.7 - 42	±7%	9	PWM 256 steps	0.7	-25 to +85	SSOP-24	General purpose
LV52511	Constant mode 5 to 100 Open drain 100	VDD 3.3 - 20 LED 0.7 - 41	±7%	24	PWM 256 steps	0.7	-25 to +85	QFN-48	General purpose

Stepper Motor Drivers for Motion Control

Features

- Built-in 1 channel PWM current control stepper motor driver (bipolar type)
- Ron (High-side Ron: 0.3 Ω , Low-side Ron: 0.25 Ω , total: 0.55 Ω , Ta = 25°C, IO = 2.5 A)
- Micro-step mode is configurable as follows: full step/half step full-torque/half step/quarter step
- Excitation step moves forward only with step signal input
- Built-in output short protection circuit (latch method)
- Control power supply is unnecessary
- Built-in high-efficient drive function (supports half step full-torque/half step/quarter step excitation mode)
- Built-in step-out detection function (Step-out detection may not be accurate during high speed rotation)
- BiCDMOS process IC
- Built-in thermal shut down circuit

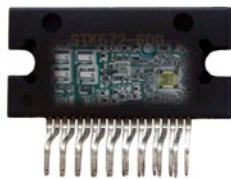


Drive	Device	Channels	V _S for Control System (V)	V _S for Drive System (V)	V _M Max (V)	I _O Max (A)	x2 DC Motor Control	Parallel Input	CLK input	Step Resolution	Half Step Resolution @ Full Torque	Package
Saturation	LV8411GR	4	2.5 - 5.5	2.5 - 5.5	6.0	0.4	✓	✓		—	✓	VCT-24
	LV8413GP	2	2.5 - 5.5	2.5 - 5.5	6.0	0.4	✓	✓		—	✓	VCT-16
	LB1973JA	2	1.8 - 7.5	1.8 - 7.5	8.0	1.0		✓		—	✓	SSOP-16
	LB1836M	2	2.5 - 9.0	1.8 - 9.0	10.5	1.0	✓	✓		—	✓	MFP-14S
	LV8402GP	2	2.8 - 5.5	1.5 - 15	16	1.4	✓	✓		—	✓	VCT-24
	LB1948MC	2	2.5 - 16	2.5 - 16	20	0.8	✓	✓		—	✓	MFP-10SK
	LV8548MC	2	4.0 - 16	4.0 - 16	20	1.0	✓	✓		—	✓	SOIC-10
	LB1909MC	2	2.5 - 16	2.5 - 16	20	0.8		✓		—		SOIC-10
	LV8549MC	2	4.0 - 16	4.0 - 16	20	1.0		✓		—		SOIC-10
PWM Constant Current	LV8414CS	4	2.5 - 5.5	2.5 - 5.5	6.0	0.4			✓	1/2, 1/64	✓	WLP-32J
	LV8716QA	2	2.7 - 10.5	2.7 - 10.5	12.6	1.0	✓	✓		—	✓	QFN-16
	LV8711T	2	2.7 - 5.5	4.0 - 16	18	0.8	✓	✓		—	✓	TSSOP-24
	LV8712T	2	2.7 - 5.5	4.0 - 16	18	0.8			✓	1/2, 1/4, 1/8		TSSOP-24
	LV8713T	2	2.7 - 5.5	4.0 - 16	18	0.8			✓	1/2, 1/16, 1/32		TSSOP-24
	LV8714TA	2	4.0 - 16.5	4.0 - 16.5	18	1.5	✓	✓		—	✓	TQFP-48EP
	LV8735V	2	9.0 - 32	9.0 - 32	36	1.0	✓	✓	✓	1/2, 1/8, 1/16		SSOP-44K
	LV8736V	2	9.0 - 32	9.0 - 32	36	1.0	✓	✓	✓	1/2, 1/4, 1/8		SSOP-44K
	LV8734V	2	9.0 - 32	9.0 - 32	36	1.5	✓	✓	✓	1/2, 1/4, 1/8		SSOP-44K
	LV8731V	2	8.0 - 32	8.0 - 32	36	2.0	✓	✓	✓	1/2, 1/4, 1/16		SSOP-44K
	LV8740V	2	9.0 - 35	9.0 - 35	38	2.5	✓	✓	✓	1/2, 1/4		SSOP-44J
	LV8746V	2	9.0 - 35	9.0 - 35	38	1.0		✓	✓	1/2, 1/4	✓	SSOP-44K
	LV8729V	2	9.0 - 32	9.0 - 32	36	1.8			✓	1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128		SSOP-44K
	LV8702V	2	9.0 - 32	9.0 - 32	36	2.5			✓	1/2, 1/4	✓	SSOP-44J

Stepper Motor Drivers for Motion Control

Features

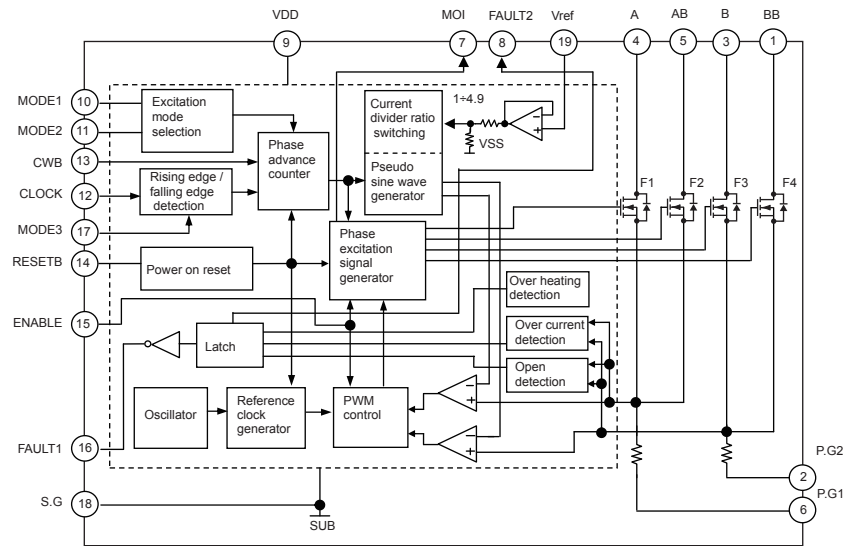
- For Unipolar Stepper Motor Drive by IPM (Intelligent Power Module)
- Current Sense, Fault Detections are Fully integrated
- Pin-compatible line up



SIP-19



SIP-19S



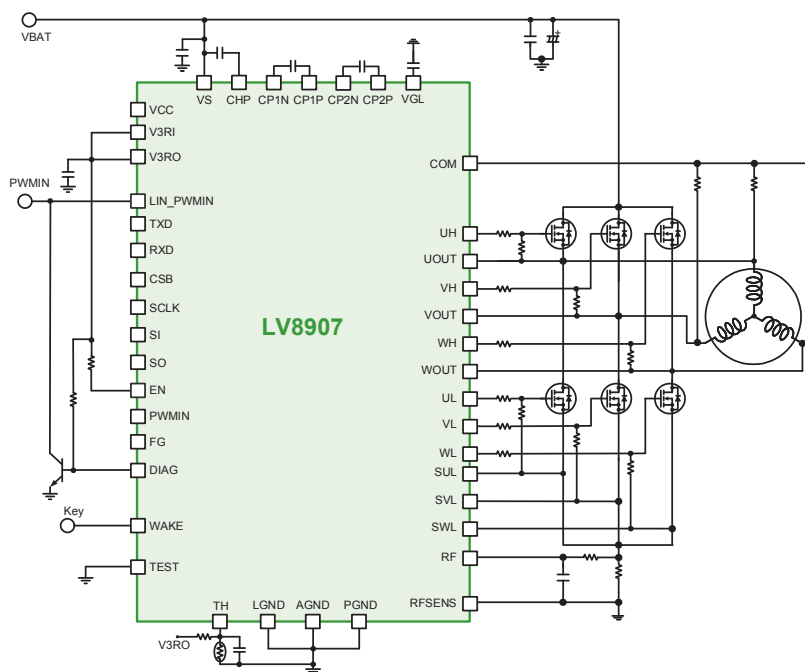
Block Diagram for STK672-440BN-E

Device	Type	V _M Max (V)	V _{CC} Max (V)	I _O Max (A)	I _O Peak Max (A)	Step Resolution	Control Type	Current Sense	Fault Detection			Package(s)
									Overcurrent	Thermal	UVLO	
STK672-430AN-E	Stepper	52	5.25	2.5	10	1/16	Clock	Fully Integrated	Yes	Yes	Yes	SIP-19
STK672-432AN-E	Stepper	52	5.25	2.5	10	1/16	Clock	Fully Integrated	Yes	Yes	Yes	SIP-19S
STK672-432BN-E	Stepper	52	5.25	2.5	10	1/16	Clock	Fully Integrated	Yes	Yes	Yes	SIP-19S
STK672-440AN-E	Stepper	52	5.25	3.5	20	1/16	Clock	Fully Integrated	Yes	Yes	Yes	SIP-19
STK672-440BN-E	Stepper	50	5.25	3.5	20	1/16	Clock	Fully Integrated	Yes	Yes	Yes	SIP-19
STK672-442AN-E	Stepper	52	5.25	3.5	20	1/16	Clock	Fully Integrated	Yes	Yes	Yes	SIP-19S
STK672-442BN-E	Stepper	50	5.25	3.5	20	1/16	Clock	Fully Integrated	Yes	Yes	Yes	SIP-19S
STK672-630AN-E	Stepper	52	5.25	2.65	10	1/2	Clock	Fully Integrated	Yes	Yes	Yes	SIP-19
STK672-632AN-E	Stepper	52	5.25	2.65	10	1/2	Clock	Fully Integrated	Yes	Yes	Yes	SIP-19S
STK672-640AN-E	Stepper	52	5.25	4	20	1/2	Clock	Fully Integrated	Yes	Yes	Yes	SIP-19
STK672-642AN-E	Stepper	52	5.25	4	20	1/2	Clock	Fully Integrated	Yes	Yes	Yes	SIP-19S
STK672-732AN-E	Stepper	52	5.25	2.65	10	1/2	Parallel	Fully Integrated	Yes	Yes	Yes	SIP-19S
STK672-740AN-E	Stepper	52	5.25	4	20	1/2	Parallel	Fully Integrated	Yes	Yes	Yes	SIP-19

Brushless DC Motor Control

LV8907UW Features

- Integrated sensor-less control
- Integrated gate drivers for external power MOSFETs
- Integrated LIN transceiver and LDO
- Integrated protection (Under-voltage, Over-temperature, Over-current, Locked Rotor, PWM Fault)
- Operation up to 175°C junction temperature
- OTP for configuration and standalone operation
- SPI for real-time control
- VIN of 5.5 – 20 V



Standalone Configuration Application Diagram

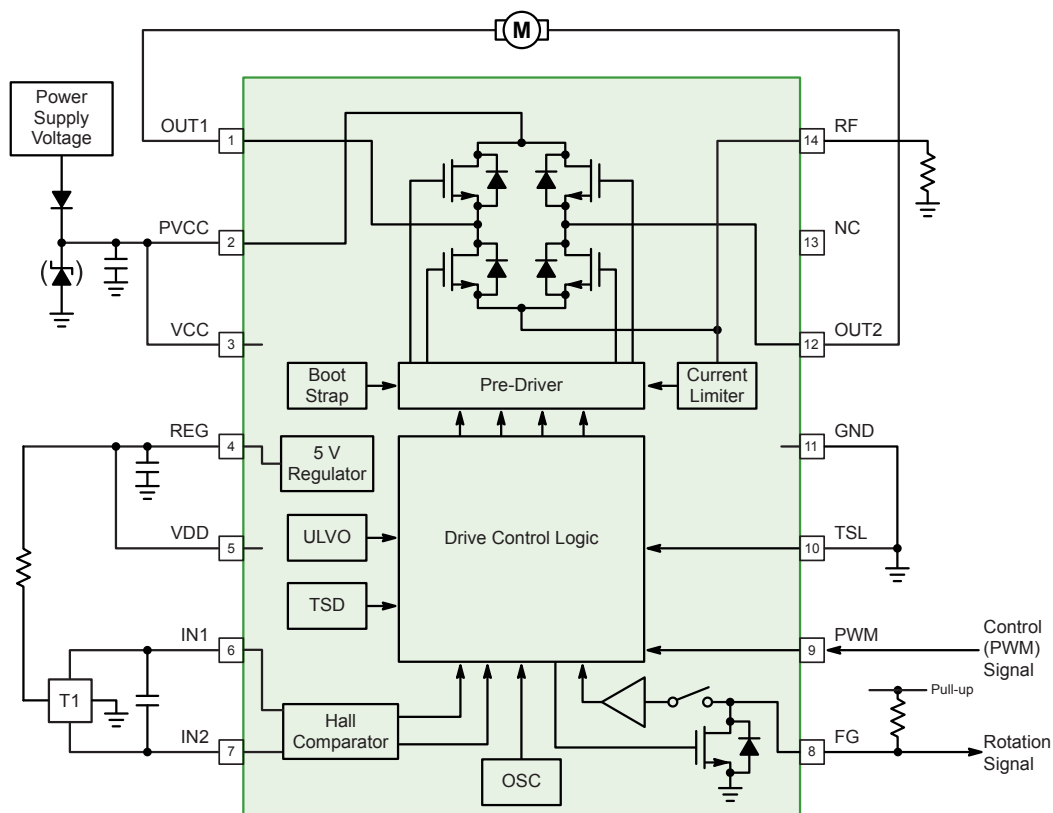
Drive	Device	Phases	Speed Control	Communication	Required Number of Hall Sensors	V _{CC} Min (V)	V _{CC} Max (V)	Motor Current Max (A)	Input Control	Start/Stop	Soft Start	Current Limiter	Forward/Reverse	Package
Controller	LV8310H	1	Closed Loop	PWM-SW	1	3.9	16	Note 1	PWM		✓	✓		TSSOP-16
	LB11867FV	1	Open Loop	Soft-SW	1	5.5	16	Note 1	Analog		✓	✓		SSOP-16
	LB11867RV	1	Open Loop	Soft-SW	1	5.5	16	Note 1	Analog		✓	✓		SSOP-16
	LV8139JA	3	Open Loop	180°	3	9.5	16.5	Note 1	Analog			✓	✓	SSOP-30
	LV8907UW	3	Closed Loop	150°	Note 2	6.0	20	Note 1	PWM	✓	✓	✓	✓	SQFP-48
	LB11620T	3	Open Loop	120°	3	8.0	17	Note 1	Analog, PWM			✓	✓	TSSOP-24
	LB11696V	3	Open Loop	120°	3	8.0	17	Note 1	Analog, PWM	✓		✓	✓	SSOP-30
	LV8824QA	3	Open Loop	120°	3	7.0	33	Note 1	Analog, PWM	✓		✓	✓	VQFN-32U
	LV8104V	3	Closed Loop	120°	3	16	28	Note 1	Clock	✓		✓	✓	SSOP-44
Driver	LV11961HA	1	Open Loop	PWM-SW	1	3.6	16	1.0	Analog		✓			HSSOP-14
	LV8068V	1	Open Loop	BTL-PWM	1	6.0	16	1.2	Analog, PWM			✓		SSOP-16
	LV8316H	1	Closed Loop	PWM-SW	1	3.9	16	2.0	PWM		✓	✓		TSSOP-14 EP
	LV8344C	1	Open Loop	PWM-SW	1	6.0	34	0.5	PWM		✓	✓		TSSOP-14 EP
	LV8827LFQA	3	Open Loop	120°	3	8.0	35	1.5	PWM	✓		✓	✓	VQFN-24N
	LV8112VB	3	Closed Loop	120°	3	10	35	2.5	Clock			✓	✓	SSOP-44K
	LV8702V	2	2	2	9.0 - 32	9.0 - 32	36	2.5	2.5		✓		✓	SSOP-44J

1. Depends on the external driver. 2. Sensorless (BEMF zero cross detection).

Brushless DC Motor Control

LV8344C* Features

- Selectable soft start or direct output PWM duty control in start-up
- Single-phase full wave driver with open-loop output duty-cycle control
- Embedded power MOSFETs, I_O Peak max = 1.0 A
- PWM duty cycle input (25 Hz to 80 kHz)
- PWM soft switching phase transition
- Soft PWM duty cycle transitions (changing the target output-duty gradually)
- Integrated protection: current limit, over current, thermal protection, locked rotor, automatic recovery
- FG or RD or RDA signal output selectable
- Dynamic lead angle adjustment with respect to rotation speed
- Parameter setting by serial communication
- Embedded EEPROM as NVM
- Parameter setting to the NVM



Application Diagram

* Pending 2Q20.

Brushed DC Motor Control

LV8760 Features

- Forward/reverse H-bridge motor driver, 1-channel
- Integrated current limiter
- Integrated thermal protection
- Integrated short-circuit protection

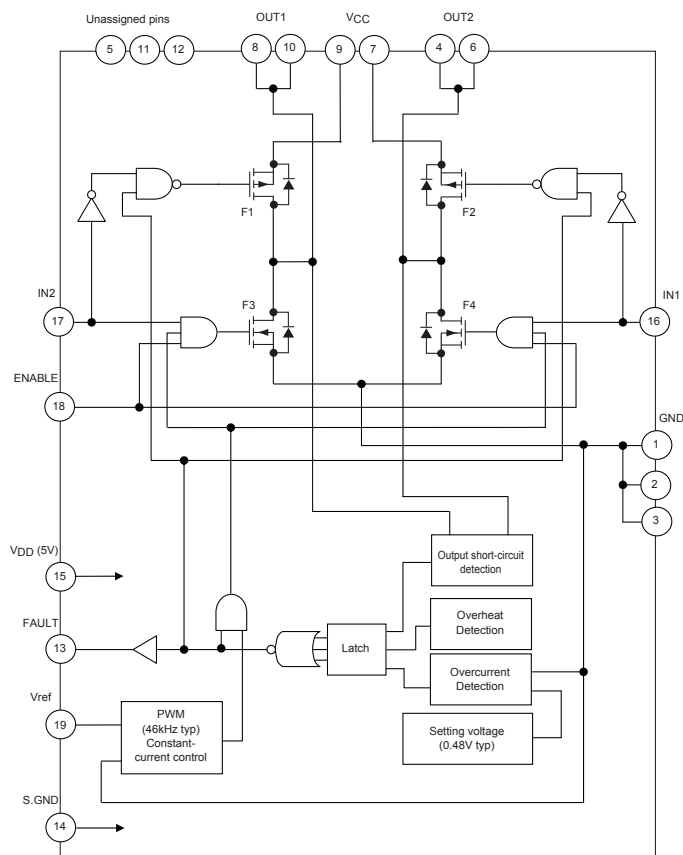
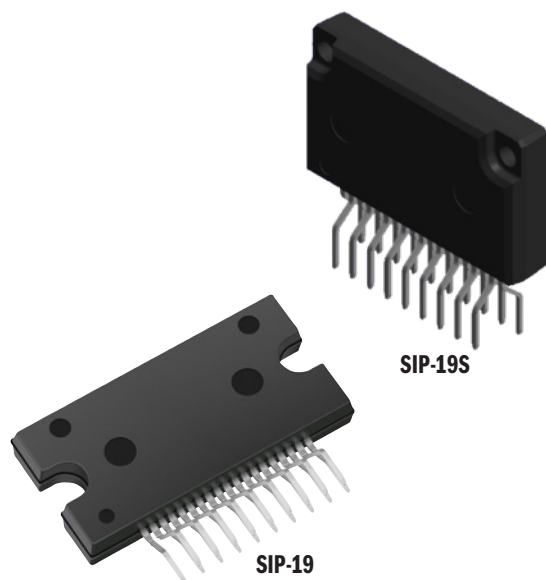
Drive	Device	Channels	V _S for Control System (V)	V _S for Drive System (V)	V _M for Drive System (V)	I _O Max (A)	CLK Input	Over Current Protection	Warning Output	Current Limiter	Package
Saturation	LB1938FA	1	2.2 - 10	2.2 - 10	10.5	0.8					Micro8
	LB1930MC	1	2.2 - 10.8	2.2 - 10.8	11	1.0					SOIC-10
	LV8417CS	1	2.7 - 5.5	2.0 - 10.5	12.6	1.0					WLP-9
	LB1843V	1	3.0 - 9.0	2.2 - V _{CC}	10.5	0.8			✓	✓	SSOP-20
	LV8760T	1	3.0 - 5.5	9.0 - 35	38	3.0		✓		PWM	TSSOP-20J
	LV8761V	1	3.0 - 5.5	9.0 - 35	38	3.0		✓	✓	PWM	SSOP-36J
	LB1948MC	2	2.5 - 16	2.5 - 16	20	0.8					MFP-10SK
	LV8548MC	2	4.0 - 16	4.0 - 16	20	1.0					SOIC-10
	LB1836M	2	2.5 - 9.0	1.8 - 9.0	10.5	1.0					MFP-14S
	LV8413GP	2	2.5 - 5.5	2.5 - 5.5	6.0	0.4					VCT-16
	LV8411GR	4	2.5 - 5.5	2.5 - 5.5	6.0	0.4					VCT-24
	LV8402GP	2	2.8 - 5.5	1.5 - 15	16	1.4					VCT-24
PWM Constant Current	LV8716QA	2	2.7 - 10.5	2.7 - 10.5	12.6	1.0					QFN-16
	LV8711T	2	2.5 - 5.5	4.0 - 16	18	0.8		✓	✓		TSSOP-24
	LV8714TA	2	4.0 - 16.5	4.0 - 16.5	18	1.5		✓			TQFP-48EP
	LV8735V	2	9.0 - 32	9.0 - 32	36	1.0	✓	✓	✓		SSOP-44K
	LV8736V	2	9.0 - 32	9.0 - 32	36	1.0	✓	✓	✓		SSOP-44K
	LV8734V	2	9.0 - 32	9.0 - 32	36	1.5	✓	✓	✓		SSOP-44K
	LV8731V	2	8.0 - 32	8.0 - 32	36	2.0	✓	✓	✓		SSOP-44K
	LV8732V	2	9.0 - 32	9.0 - 32	36	2.0	✓	✓	✓		SSOP-44K
	LV8740V	2	9.0 - 35	9.0 - 35	38	2.5	✓	✓	✓		SSOP-44J

Note: All devices include Parallel Input and Thermal Shutdown

Brush DC Motor Control

Features

- No need for dead time design
- Built-in Sensing resistor
STK681-360
- Built-in Protective Functions
STK681-332
- PWM operation
STK681-332/-360



Block Diagram for STK681-332-E

Device	Type	V _M Max (V)	V _{CC} Max (V)	I _O Max (A)	I _O Peak Max (A)	Control Type	Current Sense	Fault Detection			Package(s)
								Overcurrent	Thermal	UVLO	
STK681-332-E	Brush DC	52	5.25	8.5	12	Parallel PWM	External Resistor	Yes	Yes	Yes	SIP-19S
STK681-360-E	Brush DC	52	5.25	5.8	8	Parallel PWM	Fully Integrated	Yes	Yes	No	SIP-19

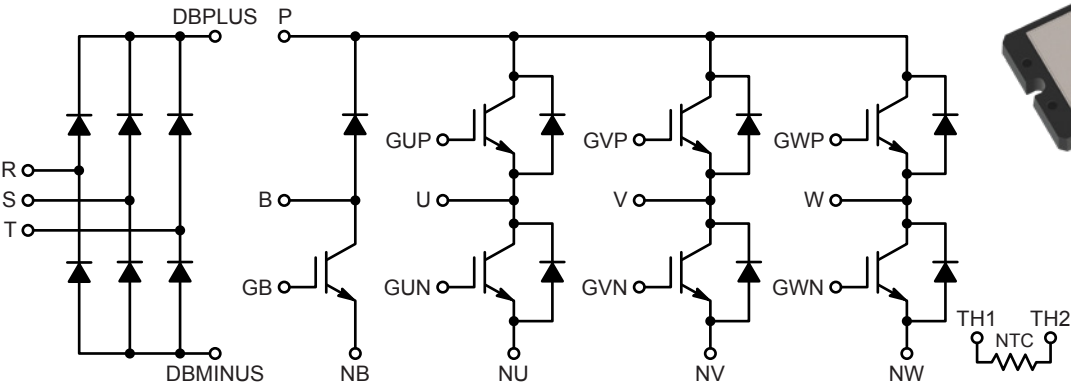
Transfer Molded PIMs (TM-PIM) for Motor Control

Features

- Low thermal resistance
- 6 mm clearance distance from pin to heatsink
- Compact 73 mm x 40 mm x 8 mm package
- Solderable pins

Benefits

- Improved power capability
- Simple heatsink construction without shaping
- Thinner than standard 12 mm or 17 mm packages; smaller than standard 17 mm packages
- High reliability contacts in corrosive atmosphere environments



Device	Configuration	VBR Max (V)	Rated Current (A)	VCE(SAT) Typ (V)
NXH25C120L2C2SG	CIB	1200	25	1.7
NXH35C120L2C2S1G	CI	1200	35	1.8
NXH35C120L2C2SG	CIB	1200	35	1.8
NXH35C120L2C2ESG*	CIB	1200	35	1.8
NXH50C120L2C2ES1G*	CI	1200	50	1.8
NXH50C120L2C2ESG*	CIB	1200	50	1.8

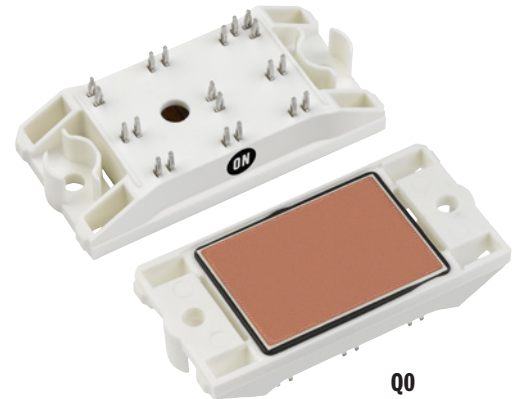
* DBC with enhanced thermal conductivity.

Power Integrated Modules (PIM) for Energy Infrastructure

Power Integrated Modules are used for DC-AC stages of solar inverters, energy storage systems, uninterruptible power supplies (UPS), and motor drive applications. They consist of state of the art IGBT technology, and Silicon Carbide (SiC) MOSFETs and Diodes. Solderable and press-fit pin options are available, along with Thermal Interface Material (TIM).

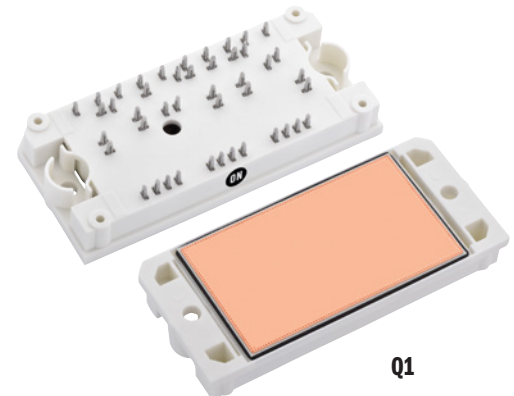
IGBT PIMs

Device	Configuration	Package
NXH80B120L2Q0	2 Channel Boost	Q0
NXH80T120L2Q0	T-Type NPC Inverter	Q0
NXH160T120L2Q1	Split T-Type NPC Inverter	Q1
NXH25T120L2Q1	3 Channel T-Type NPC Inverter	Q1
NXH40T120L3Q1	3 Channel T-Type NPC Inverter	Q1
NXH160T120L2Q2F2S1	Split T-Type NPC Inverter	Q2
NXH160T120L2Q2F2SG	Split T-Type NPC Inverter	Q2
NXH450N65L4Q2	I-Type NPC Inverter	Q2



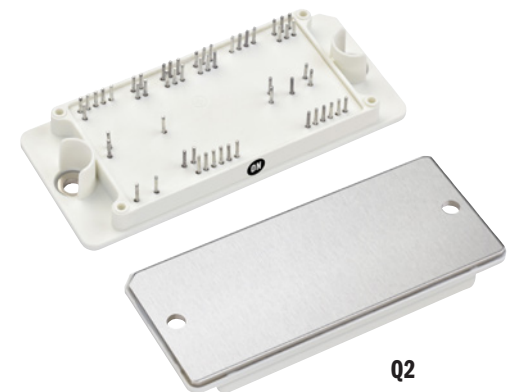
Si/SiC Hybrid PIMs

Device	Configuration	Package
NXH100B120H3Q0	2 Channel Boost	Q0
NXH80B120H2Q0	2 Channel Boost	Q0
NXH240B120H3Q1	3 Channel Boost	Q1
NXH450B100H4Q2	3 Channel Symmetric Boost	Q2
NXH200T120H3Q2	Split T-Type NPC Inverter	Q2
NXH350N100H4Q2	I-Type NPC Inverter	Q2



Full SiC PIMs

Device	Configuration	Package
NXH40B120MNQ0	2 Channel Boost	Q0
NXH80B120MNQ0	2 Channel Boost	Q0
NXH40B120MNQ1	3 Channel Boost	Q1

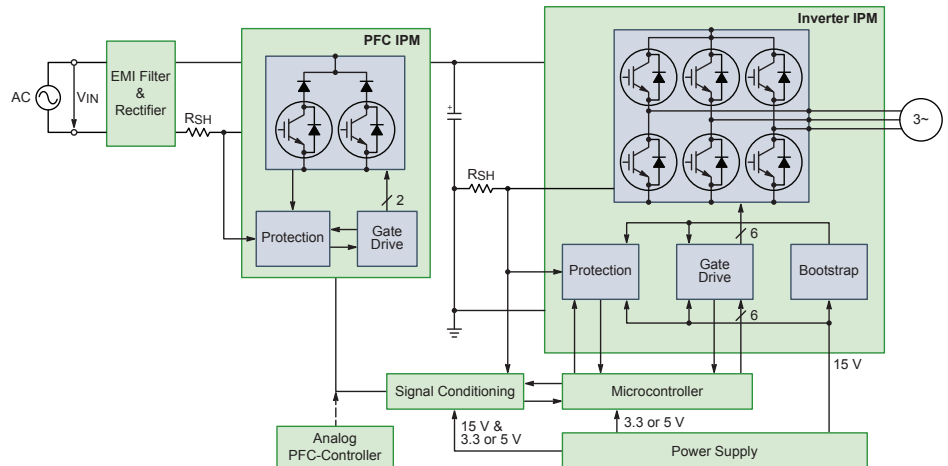


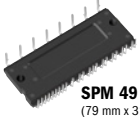
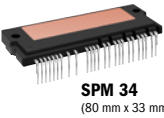
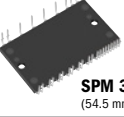
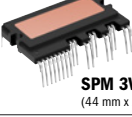
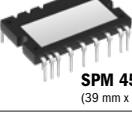
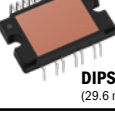
Intelligent Power Modules (IPM) for Inverter Designs

As a vertically integrated supplier, ON Semiconductor designs, develops, manufactures, assembles, and tests a broad portfolio (50 W to 10 kW) of power modules, utilizing internally sourced silicon and packages.

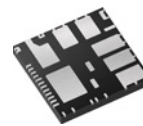
Features

- Broad portfolio AQG & AECQ automotive grade reliability
- Supports SCR silicon technology; short circuit rated @ $>3 \mu\text{s}$
- Extremely low losses with stable EMI characteristics
- Ultra-low $R_{\text{th(j-c)}}$ via DBC/ceramic substrate

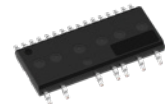


Package	Device	Voltage (V)	Current (A)
 SPM 49 (79 mm x 31 mm x 8 mm)	NFALxx12L5B(T)	1200	10, 25, 35, 50
	NFALxx65L5B(T)	650	50, 75
 SPM 34 (80 mm x 33 mm x 8 mm)	FNA2xx12A	1200	10, 25, 35, 50
	FNA2xx60	600	30, 50, 75
 SPM 31 (54.5 mm x 31 mm x 5.6 mm)	NFAMxx12L5B(T)	1200	5, 10, 20
	NFAMxx65L4B(T)	650	20, 30, 50
 SPM 3V (44 mm x 26.8 mm x 5.5 mm)	FSBBxxCH120D(F)	1200	10, 15, 20, 50
	FSBBxxCH60D	600	15, 20
	FNB3xx60T	600	30, 40, 50
 SPM 45 (39 mm x 23 mm x 4.5 mm)	FNA4xx60	600	5, 8, 10, 15
	FNC4xx60	600	20
	FNB(D)4xx60	600	20, 30
 DIPS-6 (29.6 mm x 18.2 mm x 4.3 mm)	NFAQxx60L33T	600	8, 10

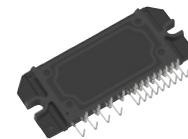
Other Available Packages



SPM-7



SPM-5



SIP-2A Converter + Inverter



SIP-K



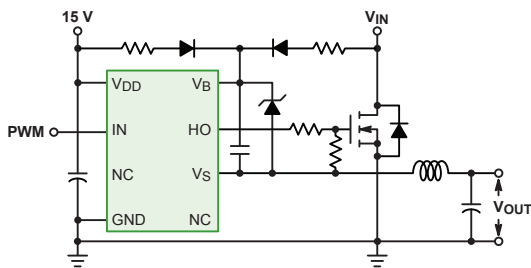
SPM-45H

High Voltage Gate Drivers (HVICs)

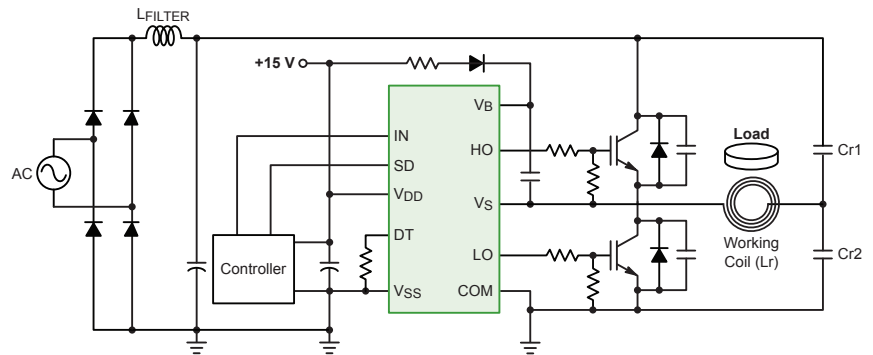
High voltage gate drivers (HVICs) from ON Semiconductor improve system reliability by utilizing an innovative common-mode dv/dt noise canceling circuit that provides excellent noise immunity. With a voltage capability up to 700 V and a very fast switching speed ($dv/dt = 50 \text{ V/ns}$ max), the devices are optimal for driving MOSFETs and IGBTs in a wide array of applications.

Features

- Better noise immunity (due to noise canceling circuit over high dv/dt common-mode noise)
- Low power consumption (IQBS/IQCC are lower than competitor's device)
- dVs/dt transient immunity voltage level (50 V/ns)
- Extended allowable negative V_S swing to -9.8 V for signal propagation @ $V_{CC} = V_{BS} = 15 \text{ V}$
- Matched propagation delay below 50 ns
- UVLO functions
- TTL compatible input threshold levels



High-Side Application Diagram



Half-Bridge Application Diagram

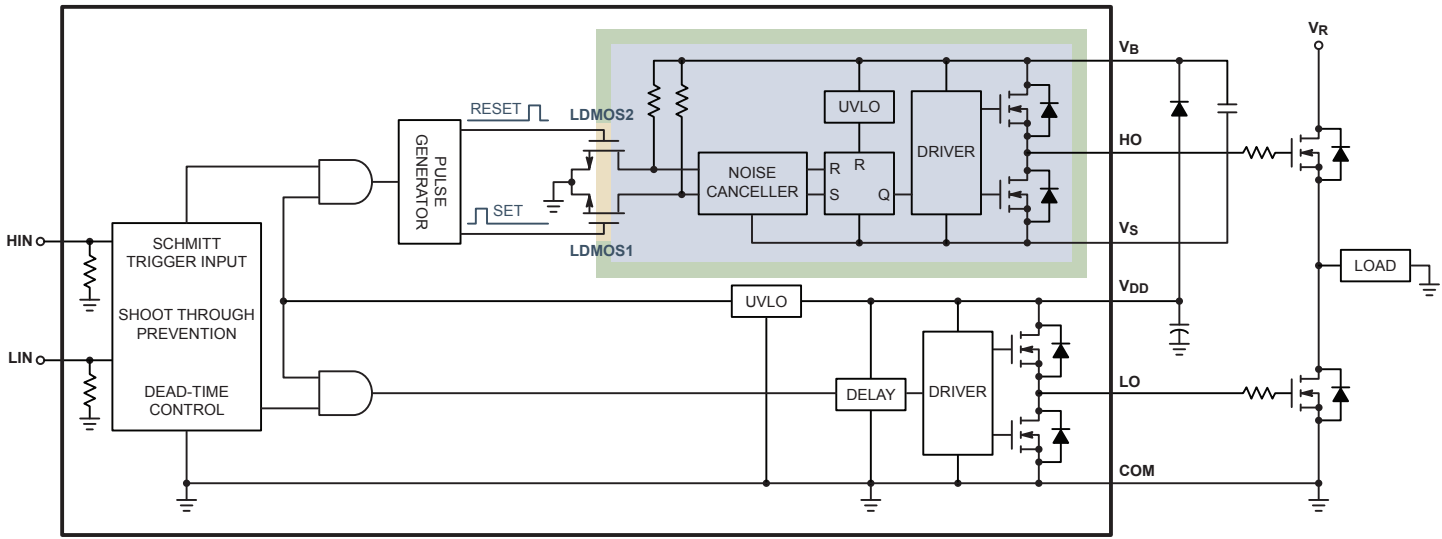
High-Side Drivers

Device	Circuit		Offset Voltage (V)	Output Current		Delay Time		Shut Down	OCP	Typical Dead Time (ns)	Package(s)
	Type	Input to Output		Source (mA)	Sink (mA)	Ton (ns)	Toff (ns)				
FAN7361	High-Side	1 to 1	600	250	500	120	90	No	No	No	SOP-8
FAN73611	High-Side	1 to 1	600	250	500	120	90	No	No	No	SOP-8
FAN7362	High-Side	1 to 1	600	250	500	120	90	No	No	No	SOP-8
FAN7371	High-Side	1 to 1	600	4000	4000	150	150	No	No	No	SOP-8
FAN73711	High-Side	1 to 1	600	4000	4000	150	150	No	No	No	SOP-8
FAN7385	2Ch High side	2 to 2	600	350	650	110	110	No	No	No	SOP-14
TND523SS	High-Side	1 to 1	600	200	400	90	85	No	No	No	SOP-8
TND524VS	High-Side	1 to 1	600	200	400	90	85	No	No	No	VEC-8

High Voltage Gate Drivers (HVICs)

High-Side & Low-Side Drivers

Device	Circuit		Offset Voltage (V)	Output Current		Delay Time		Shut Down	OCP	Typical Dead Time (ns)	Package(s)
	Type	Input to Output		Source (mA)	Sink (mA)	Ton (ns)	Toff (ns)				
FAN7382	High & Low-Side	2 to 2	600	350	650	170	200	No	No	No	DIP-8, SOP-8, SOP-14
FAN7390	High & Low-Side	2 to 2	600	4500	4500	140	140	No	No	No	SOP-8, SOP-14
FAN7390A	High & Low-Side	2 to 2	600	4500	4500	140	140	No	No	No	SOP-14
FAN73901	High & Low-Side	2 to 2	600	2500	2500	140	140	No	No	No	SOP-8
FAN7391	High & Low-Side	2 to 2	600	4500	4500	150	150	No	No	No	SOP-14
FAN7392	High & Low-Side	2 to 2	600	3000	3000	130	150	Yes	No	No	WSOP-16
FAN7842	High & Low-Side	2 to 2	200	350	650	170	200	No	No	No	SOP-8
FAN8811	High & Low-Side	2 to 2	100	3000	6000	30	28	No	No	No	WDFN -10
NCP5106A	High & Low-Side	2 to 2	600	250	500	100	100	No	No	No	DIP-8, SOP-8, DFN-10
NCP5109A	High & Low-Side	2 to 2	200	250	500	100	100	No	No	No	SOP-8, DFN-10
NCP5181	High & Low-Side	2 to 2	600	1400	2200	100	100	No	No	No	DIP-8, SOP-8
NCP5183	High & Low-Side	2 to 2	600	4300	4300	120	120	No	No	No	SOP-8
NCP51530A	High & Low-Side	2 to 2	700	2200	1700	60	60	No	No	No	SOIC-8, DFN-10
NCP51530B	High & Low-Side	2 to 2	700	2200	1700	25	25	No	No	No	SOIC-8, DFN-10



HVIC Driver Block Diagram

CONTROL & DRIVE

High Voltage Gate Drivers (HVICs)

Half Bridge Drivers

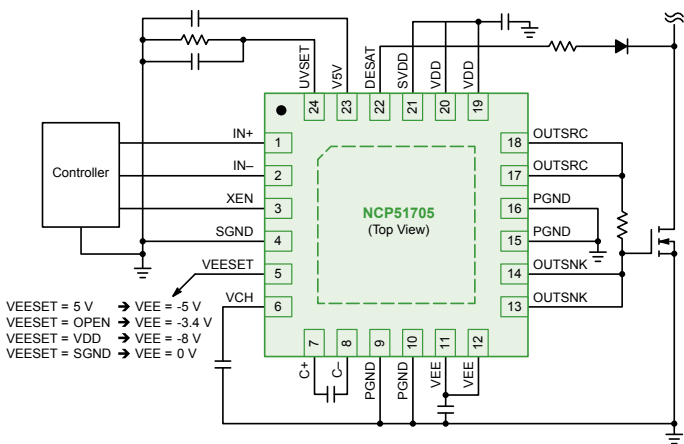
Device	Circuit		Offset Voltage (V)	Output Current		Delay Time		Shut Down	OCP	Typical Dead Time (ns)	Package(s)
	Type	Input to Output		Source (mA)	Sink (mA)	Ton (ns)	Toff (ns)				
FAN7380	Half-Bridge	2 to 2	600	90	180	135	130	No	No	100	SOP-8
FAN7383	Half-Bridge	1 to 2	600	350	650	500	170	Yes	No	Variable	SOP-14
FAN73832	Half-Bridge	1 to 2	600	350	650	580	180	Yes	No	Variable	SOP-8
FAN73833	Half-Bridge	2 to 2	600	350	650	150	140	No	No	450	SOP-8
FAN7384	Half-Bridge	2 to 2	600	250	500	180	170	Yes	Yes	120	SOP-14
FAN7387	Self Osc.	1 to 2	600	350	650	550	160	Yes	No	Variable	SOP-8
FAN7388	3-Phase Half-Bridge	6 to 6	600	350	650	130	150	No	No	270	SOP-20
FAN73893	3-Phase Half-Bridge (MOSFET Target)	6 to 6 (inverting)	600	350	650	500	500	Yes	Yes	320	SOIC-28W
FAN73894	3-Phase Half-Bridge (IGBT Target)	6 to 6 (inverting)	600	350	650	500	500	Yes	Yes	320	SOIC-28W
FAN73895	3-Phase Half-Bridge (MOFET Target)	6 to 6	600	350	650	500	500	Yes	Yes	320	SOIC-28W
FAN73896	3-Phase Half-Bridge (IGBT Target)	6 to 6	600	350	650	500	500	Yes	Yes	320	SOIC-28W
FAN73912	Half Bridge	2 to 2	1200	2000	3000	500	550	Yes	No	330	WSOP-16
FAN7393A	Half Bridge	1 to 2	600	2500	2500	530	130	Yes	No	Variable	SOP-14
FAN73932	Half Bridge	1 to 2	600	2500	2500	600	200	Yes	No	400	SOP-8
FAN73933	Half Bridge	2 to 2	600	2500	2500	160	160	No	No	Variable	SOP-14
FAN7888	3-Phase Half-Bridge	6 to 6	200	350	650	130	150	No	No	270	SOP-20
FL73282	Half Bridge	2 to 2	900	350	650	150	150	No	No	170	SOP-8
NCP1392B	Half Bridge	1 to 2	600	500	1000	N/A	N/A	No	No	610	SOP-8
NCP1392D	Half Bridge	1 to 2	600	500	1000	N/A	N/A	No	No	305	SOP-8
NCP1393B	Half Bridge	1 to 2	600	1000	1500	N/A	N/A	No	No	610	SOP-8
NCP5104	Half Bridge	1 to 2	600	250	500	620	100	Yes	No	520	DIP-8, SOP-8
NCP5106B	Half Bridge	2 to 2	600	250	500	100	100	No	No	100	DIP-8, SOP-8, DFN-10
NCP5109B	Half Bridge	2 to 2	200	250	500	100	100	No	No	100	SOP-8, DFN-10
NCP5111	Half Bridge	1 to 2	600	250	500	750	100	No	No	650	DIP-8, SOP-8
NCP5304	Half Bridge	2 to 2	600	250	500	100	100	No	No	100	DIP-8, SOP-8

Fully Integrated, 6 A SiC MOSFET Gate Driver

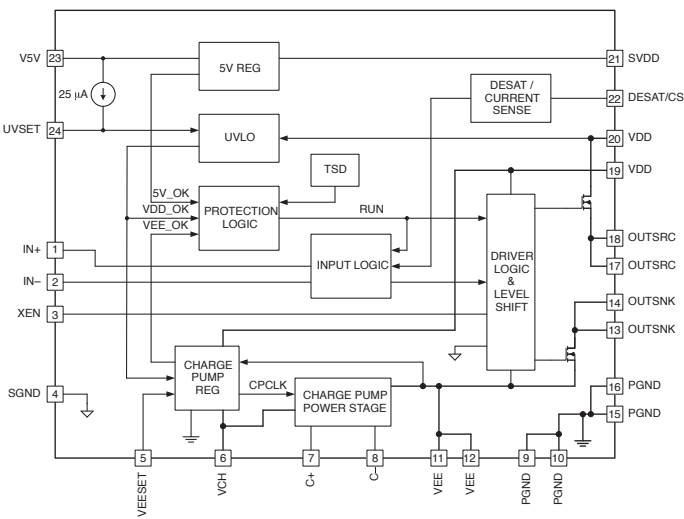
The NCP51705 driver is designed to primarily drive SiC MOSFET transistors. For the lowest possible conduction losses, the driver is capable to deliver the maximum allowable gate voltage to the SiC MOSFET device. For improved reliability, dV/dt immunity and even faster turnoff, the NCP51705 can utilize its on-board charge pump to generate a user selectable negative voltage rail.

Features

- Adjustable, on-board regulated negative charge pump
- Negative voltage drive for fast turn-off
- 5 V reference/bias rail
- Adjustable UVLO levels



Typical Application Diagram



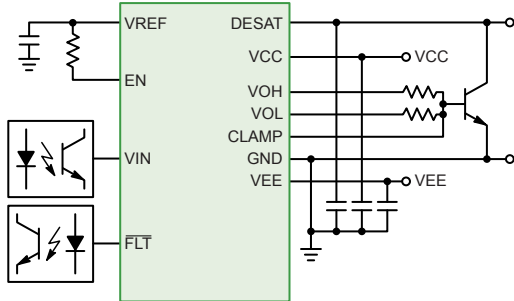
NCP51705 Internal Block Diagram

Device	Output Current		Delay Time		Shutdown	Typical Dead Time (ns)	Package
	Source (mA)	Sink (mA)	T _{on} (ns)	T _{off} (ns)			
NCP51705	6000	6000	25	25	Yes	Variable	QFN-24

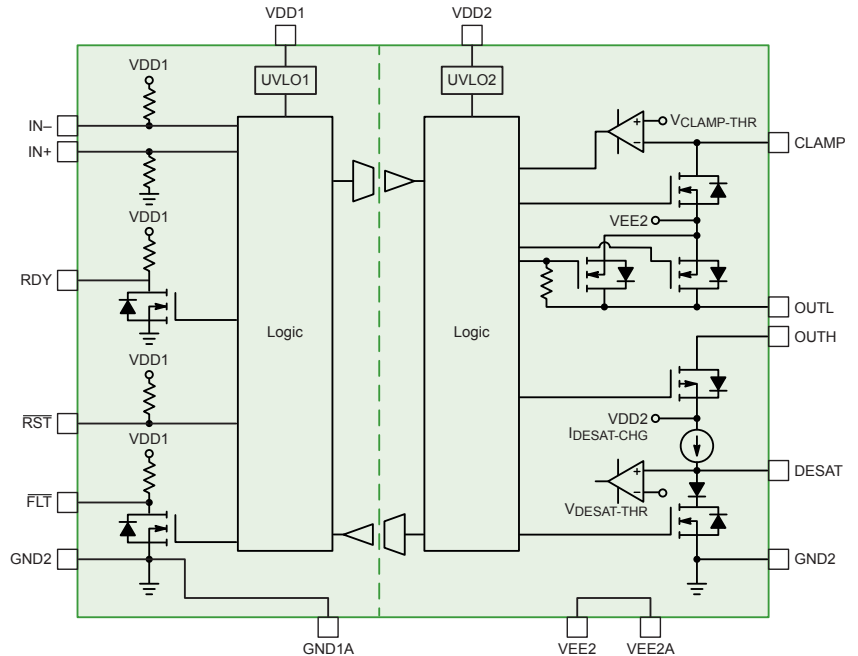
IGBT Gate Drivers for High Voltage and High Power Applications

Features

- High current output (+4 A/-6 A) at Miller Plateau for higher system efficiency
- Short propagation delays with accurate matching for improved system reliability
- UVLO, DESAT, Miller Clamp, Negative VEE for system protection
- 5 V reference for external reference
- Galvanic isolation with >5 kV withstand and 1400 V working voltage



NCD5700



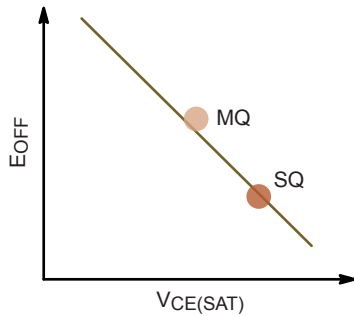
NCD57000/1

Device	No of Channels	Isolation	Differential Input	DESAT w/ FLT	Miller Clamp	VEE	Split Output	Package
NCD5700/2	1			✓	✓	✓	✓	SOIC-16
NCD5701/3A	1			✓	✓			SOIC-8
NCD5701/3B	1			✓		✓		SOIC-8
NCD5701/3C	1			✓			✓	SOIC-8
NCD57000/1	1	✓	✓	✓	✓			SOIC-16W
NCD57080A	1	✓	✓		✓			SOIC-8 NB
NCD57080B*	1	✓	✓			✓		SOIC-8 NB
NCD57080C	1	✓	✓				✓	SOIC-8 NB
NCD57090A*	1	✓	✓		✓			SOIC-8 WB
NCD57090B*	1	✓	✓			✓		SOIC-8 WB
NCD57090C*	1	✓	✓				✓	SOIC-8 WB
NCD57084*	1	✓		✓				SOIC-8 NB
NCD57085*	1	✓		CS w/FLT				SOIC-8 NB
NCD57252*	2	✓						SOIC-16W
NCD57200/1*	2							SOIC-8

* Pending 2Q20.

IGBTs for Energy Infrastructure

ON Semiconductor offers an expansive portfolio of advanced technology IGBTs that improves the efficiency in a variety of leading power conversion topologies.



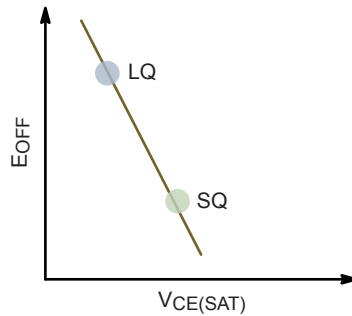
FS4 650 V IGBTs

Mid Speed
 $V_{CE(SAT)} 1.45 \text{ V}$
 $E_{OFF} 16 \mu\text{J/A}$

Featured Products

- FGH75T65SQD
- FGH40T65SQD
- FGHL75T65MQD
- PCFG75T65SQF

High Speed
 $V_{CE(SAT)} 1.6 \text{ V}$
 $E_{OFF} 5 \mu\text{J/A}$



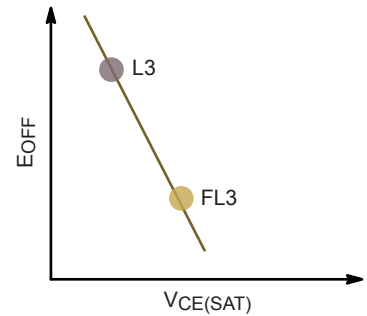
FS4 950 V IGBTs

Low Speed
 $V_{CE(SAT)} 1.55 \text{ V}$
 $E_{OFF} 37 \mu\text{J/A}$

Featured Products

- FGY75T95SQDT
- FGY75T95LQDT

High Speed
 $V_{CE(SAT)} 1.7 \text{ V}$
 $E_{OFF} 27 \mu\text{J/A}$



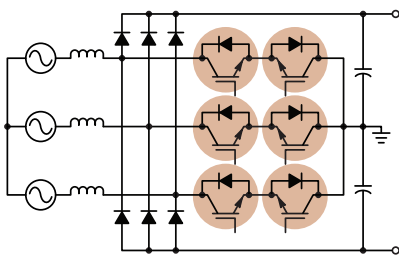
UFS 1200 V IGBTs

Low Speed
 $V_{CE(SAT)} 1.55 \text{ V}$
 $E_{OFF} 37 \mu\text{J/A}$

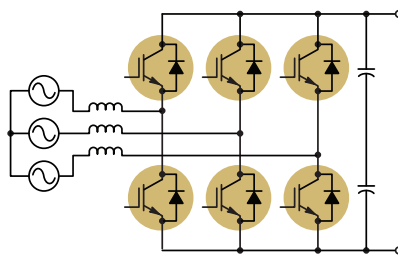
Featured Products

- FGH40T120SQDNL4
- FGY75T120SQDN
- NGTB25N120FL3
- NGTB40N120FL3
- NGTB40N120L3

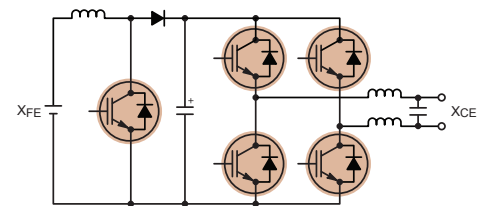
High Speed
 $V_{CE(SAT)} 1.7 \text{ V}$
 $E_{OFF} 27 \mu\text{J/A}$



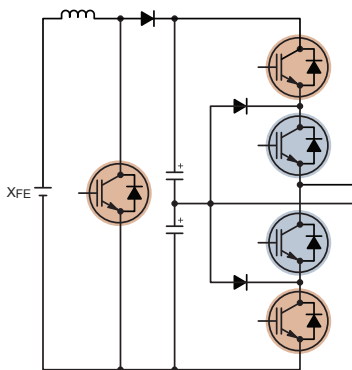
Vienna



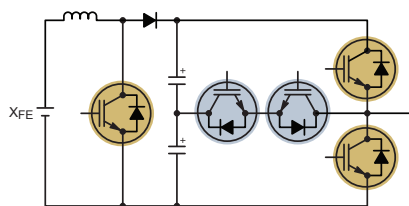
3-Phase H/B Rectifier



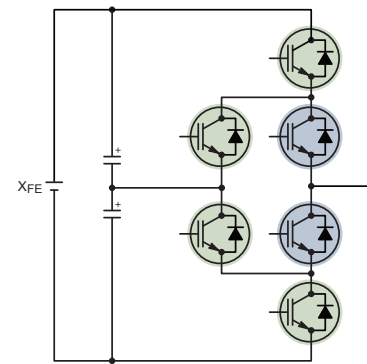
F/B



NPC



TNPC



ANPC

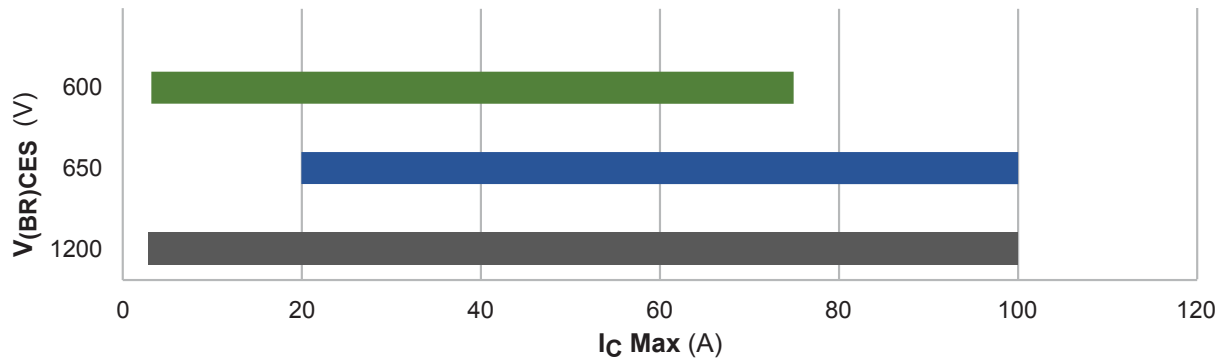
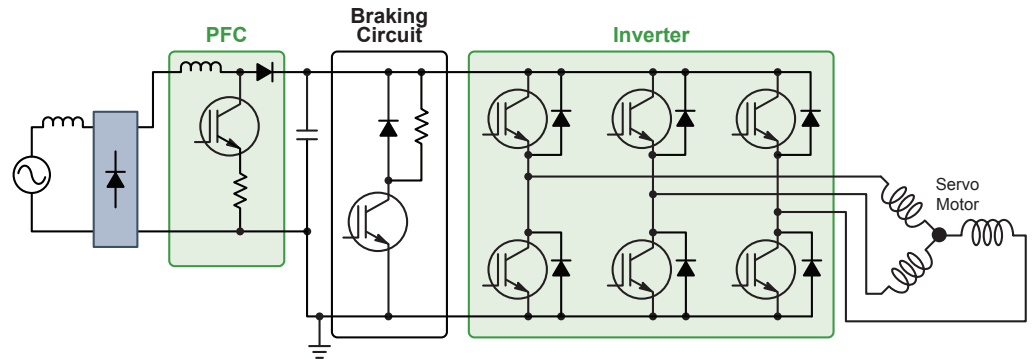
IGBTs for Motor Control

Features for Inverters

- Low V_{cesat}
- Low V_f
- Short circuit ruggedness
- $T_{jmax} = 175^{\circ}\text{C}$

Features for PFC

- Fast switching for $>20\text{ kHz}$
- Positive temperature coefficient for easy paralleling
- $T_{jmax} = 175^{\circ}\text{C}$



Short Circuit Withstand Rating: 10 μs

Device	V_{CES} Typ (V)	I_C Max (A)	$V_{CE(sat)}$ (V)	Co-Packaged Diode	Package
FGD3N60UNDF	600	3	2	Yes	DPAK
FGPF10N60UNDF	600	10	2	Yes	TO-220FP
NGTB15N60R2FG	600	15	1.85	Yes	TO-220FP
NGTB15N120FL2	1200	15	2	Yes	TO-247
NGTG15N120FL2	1200	15	2	No	TO-247
NGTB25N120FL2	1200	25	2	Yes	TO-247
NGTG25N120FL2	1200	25	2	No	TO-247
NGTB30N120FL2	1200	30	2	Yes	TO-247
NGTB40N120FL2	1200	40	2	Yes	TO-247
NGTG40N120FL2	1200	40	2	No	TO-247
NGTB50N120FL2	1200	50	2.2	Yes	TO-247

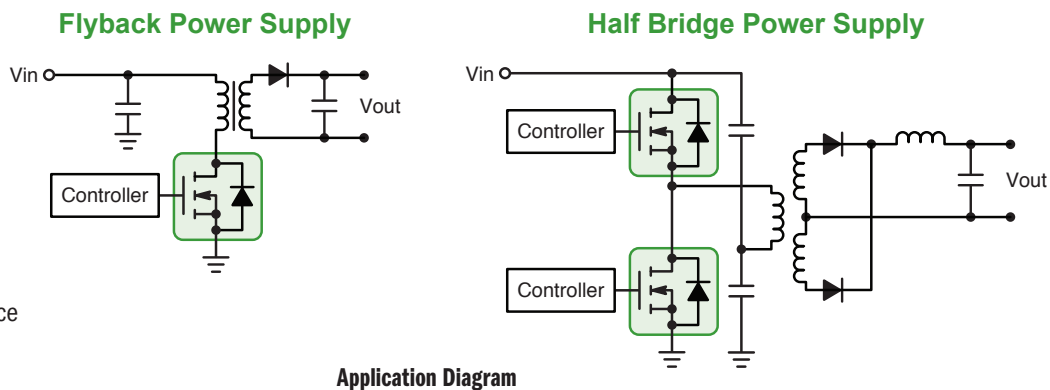
Short Circuit Withstand Rating: 5 μs

Device	V_{CES} Typ (V)	I_C Max (A)	$V_{CE(sat)}$ (V)	Co-Packaged Diode	Package
NGTB03N60R2DT4G	600	4.5	1.7	Yes	DPAK
NGTB05N60R2DT4G	600	8	1.65	Yes	DPAK
NGTB10N60R2DT4G	600	10	1.7	Yes	DPAK
NGTB10N60FG	600	10	1.5	Yes	TO-220FP
NGTG12N60TF1G	600	12	1.4	No	TO-3PF
NGTB15N60S1	600	15	1.5	Yes	TO-220
NGTG15N60S1	600	15	1.5	No	TO-220
NGTB30N60L2WG	600	30	1.4	Yes	TO-247
NGTB35N60FL2	600	35	1.7	Yes	TO-247
NGTB50N60L2	600	50	1.5	Yes	TO-247
NGTB35N65FL2	650	35	1.7	Yes	TO-247
NGTG35N65FL2	650	35	1.7	No	TO-247
NGTB40N65FL2	650	40	1.7	Yes	TO-247
NGTB50N65FL2	650	50	1.8	Yes	TO-247
NGTB60N65FL2	650	60	1.64	Yes	TO-247
NGTB75N65FL2	650	75	1.7	Yes	TO-247
FGY100T65SCDT	650	100	1.5	Yes	TO-247

Power MOSFETs for AC Drive

Features

- High reliability
- Low power dissipation
- High avalanche resistance
- High-speed switching



Application Diagram

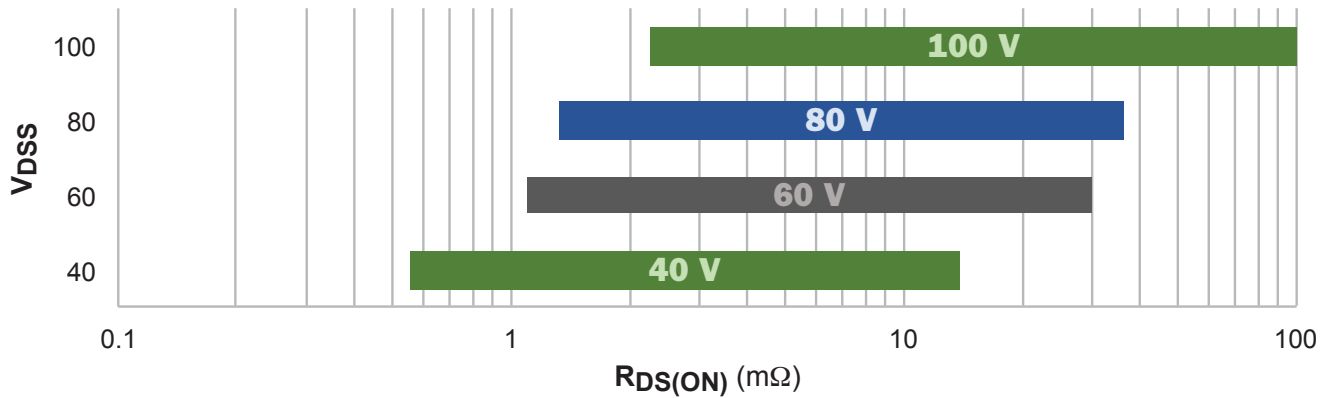
Source Voltage	Device	V_{DS} (V)	I_D (A)	$R_{DS(ON)}$ @ 10 V		C_{iss} (pF)	Q_g (nC)	Package(s)
				Typ (Ω)	Max (Ω)			
-240 Vac	BFL4026	900	5	2.8	3.6	650	33	TO-220F
380 to 480 Vac	NDFPD1N150C	1500	0.1	100	150	80	4.2	TO-220F
	NDFP03N150C	1500	2.5	8	10.5	650	34	TO-220F
	NDTLO3N150C	1500	2.5	8	10.5	650	34	TO-3P
	NDULO3N150C	1500	2.5	8	10.5	650	34	TO-3PF
	NDULO9N150C	1500	9	2.2	3.0	2025	114	TO-3PF
590 to 690 Vac	WPH4003	1700	3	8.2	10.5	850	48	TO-3PF

MOSFETs for Energy Storage Systems

Device	Channel	V_{DS} (V)	$R_{DS(ON)}$ @ 10 V Max (m Ω)	$Q_g(TOT)$ (nC)	Package(s)
BMS3004	P	-75	8.5	300	TO-220F-3SG (SC-67)
SMP3003	P	-75	8	280	TO-263
NTMFS6H800N	N	80	2.1	85	S0-8FL (DFN-5)
FDMT1D3N08B	N	80	1.35	186	PQFN-8 (Power88)
FDBL0150N80	N	80	1.4	172	TO-LL (H-PSOF)
FDB0190N807L	N	80	1.9	178	D2-PAK7L (TO-263)
NTMFS10N3D2C	N	100	3.2	60	PQFN-8
FDB1D7N10CL7	N	100	1.7	116	D2-PAK7L (TO-263)
FDBL0200N100	N	100	2	95	TO-LL (H-PSOF)
FDBL0630N150	N	150	6.3	70	TO-LL (H-PSOF)
FDB0630N1507L	N	150	6.3	97	D2-PAK7L (TO-263)

Power MOSFETs for Motor Control

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



N-Channel Power MOSFETs

Device	Type	V_{DS} (V)	$R_{DS(ON)}$ ($m\Omega$)	$Q_G(TOT)$ (nC)	Package(s)
FDBL0065N40	Single	40	0.65	220	TO-LL (H-PSOF)
FDBL0110N60	Single	60	1.1	170	TO-LL (H-PSOF)
FDBL0150N80	Single	80	1.4	172	TO-LL (H-PSOF)
FDBL0200N100	Single	100	2	95	TO-LL (H-PSOF)
FDBL0630N150	Single	150	6.3	70	TO-LL (H-PSOF)
FDB0105N407L	Single	40	0.8	208	D2-PAK 7L (TO-263)
FDB0170N607L	Single	60	1.4	173	D2-PAK 7L (TO-263)
FDB0165N807L	Single	80	1.6	217	D2-PAK 7L (TO-263)
FDB1D7N10CL7	Single	100	1.7	116	D2-PAK 7L (TO-263)
FDMD85100	Half Bridge	100	9.9	22	PQFN-8
FDMD8580	Half Bridge	80	4.6	57	PQFN-8
FDMD8560L	Half Bridge	60	3.2	92	PQFN-8
FDMD8540L	Half Bridge	40	1.5	81	PQFN-8
FDMD82100	Half Bridge	100	19	12	PQFN-12
FDMD8280	Half Bridge	80	8.2	31	PQFN-12
FDMD8260L	Half Bridge	60	5.8	49	PQFN-12
FDMD8240L	Half Bridge	40	2.6	40	PQFN-12

Device	Type	V_{DS} (V)	$R_{DS(ON)}$ ($m\Omega$)	$Q_G(TOT)$ (nC)	Package(s)
NTMFS5C404NLT	Single	40	0.67	181	SO-8FL (DFN-5)
NTMFS5C604NL	Single	60	1.2	52	SO-8FL (DFN-5)
NTMFS6H800N	Single	80	2.2	82	SO-8FL (DFN-5)
FDMS86180	Single	100	3.2	60	Power56
NTTFS2D1N04HL	Single	40	2.1	20.7	Power33
NTTFS5C453NL	Single	40	3	35	u8FL
NTTFS3D7N06HL	Single	60	3.9	15.1	Power33
NTTFS5D9N08H	Single	80	5.9	20	Power33
FDMC86184	Single	100	8.5	21	Power33
NTMTS0D4N04CLT	Single	40	0.4	165	PQFN-8 (Power88)
NTMTS0D7N06CLT	Single	60	0.68	103	PQFN-8 (Power88)
FDMT80080DC	Single	80	1.35	195	PQFN-8 (Power88)
FDMT800100DC	Single	100	2.95	79	PQFN-8 (Power88)
FDMT800120DC	Single	120	4.2	76	PQFN-8 (Power88)
FDMT800150DC	Single	150	6.5	77	PQFN-8 (Power88)

Silicon Carbide (SiC) MOSFETs and Diodes

System Benefits

- High efficiency
- Faster operating frequency
- Increased power density
- Reduced EMI

Device Features

- No reverse recovery current
- Temperature independent switching characteristics
- Excellent thermal performance



SiC Diodes

Device	Voltage (V)	Current (A)	Package(s)
FFSxyy65z	650	4, 6, 8, 10, 12, 16, 20, 30, 40, 50	TO-220, TO-247, DPAK, D2PAK, PQFN-4
FFSxyy120z	1200	5, 8, 10, 15, 20, 30, 40, 50	TO-220, TO-247, DPAK, D2PAK
NDSHxx170A	1700	5, 10, 15, 25	TO-247

SiC MOSFETs

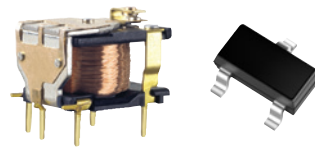
Device	Voltage (V)	RDS(ON) Typ (mΩ)	Package(s)
NTxyyN90SC1	900	20, 60	TO-247-3L, TO-247-4L, D2PAK
NTxyyN120SC1	1200	20, 40, 80, 160	TO-247-3L, TO-247-4L, D2PAK

Integrated, Reliable Drive Circuits for Motors and Electro-mechanical Relays

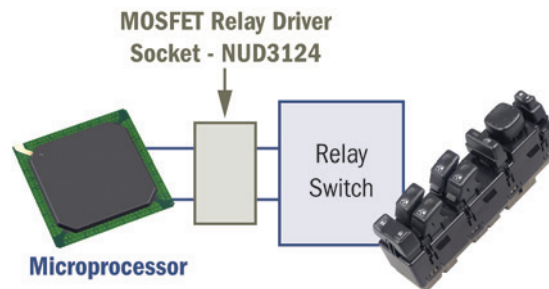
Features

- Integrates diodes, resistors and capacitors into one circuit
- Delivers additional current to the relay coil and protects against ESD
- Meets IEC61000-4-4 Electrical Fast Transient (EFT) test standards

**Most relays mounted to a PCB
require a relay driver circuit!**



24 V Relay Driver Socket



Relay Drivers

Device	Configuration	Circuit Type *	Voltage (V)	Current (mA)	Package(s)
MDC3105	Single	Bipolar-Clamp	5	500	SOT-23
MDC3105D	Dual	Bipolar-Clamp	5	500	SC-74
NUD3105	Single	MOSFET	5	500	SOT-23
NUD3105D	Dual	MOSFET	5	500	SC-74
NUD3112	Single	MOSFET	12	500	SOT-23
NUD3112D	Dual	MOSFET	12	500	SC-74
NUD3124	Single	MOSFET	24	150	SOT-23
NUD3124D	Dual	MOSFET	24	150	SC-74
NUD3160	Single	MOSFET	60	150	SOT-23
NUD3160D	Dual	MOSFET	60	150	SC-74

* **Bipolar:** the driver circuit consists of a transistor combined with resistors and diodes.

MOSFET: the driver circuit consists of a MOSFET combined with resistors and diodes.

Power-Over-Ethernet (PoE) Controllers

for Wireless Access Points, Small Cells, Surveillance Cameras, PoS Terminals, Digital Signage

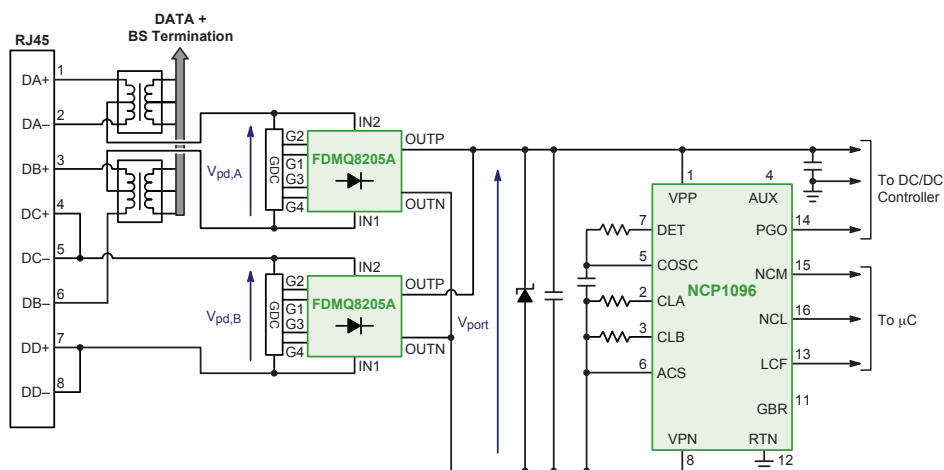
ON Semiconductor offers a complete portfolio of interface controllers for emerging PoE applications. The front-end PD device is compliant with IEEE802.3af, IEEE802.3at, and the new IEEE802.3bt standards, and power is provided using two-pair and four-pair configurations to meet all requirements. The portfolio includes ASSPs PD chips with (NCP108x) and without (NCP109x) integrated PWM controllers, which can convert PoE input power to one or more output voltages in a Powered Device.

Features – NCP1095, NCP1096

- Fully compliant with new IEEE 802.3bt for high power up to 90 W PoE
- Supports Autoclass
- Integrated low RDS(ON) pass-switch (NCP1096)
- Support for Short MPS
- Pass Switch disabling input for rear auxiliary supply operation
- 135 mA typical inrush current limiting
- Full backward compatibility with IEEE 802.3af/at

Complete building blocks for a highly efficient PoE Powered Device

- PoE-PD Interface controller – NCP1095, NCP1096
- Active MOSFET bridge – Greenbridge™2 FDMQ8205A
- Downstream DC-DC controller – NCP1566 Active Clamp Forward Converter
- Supplementary discrete components

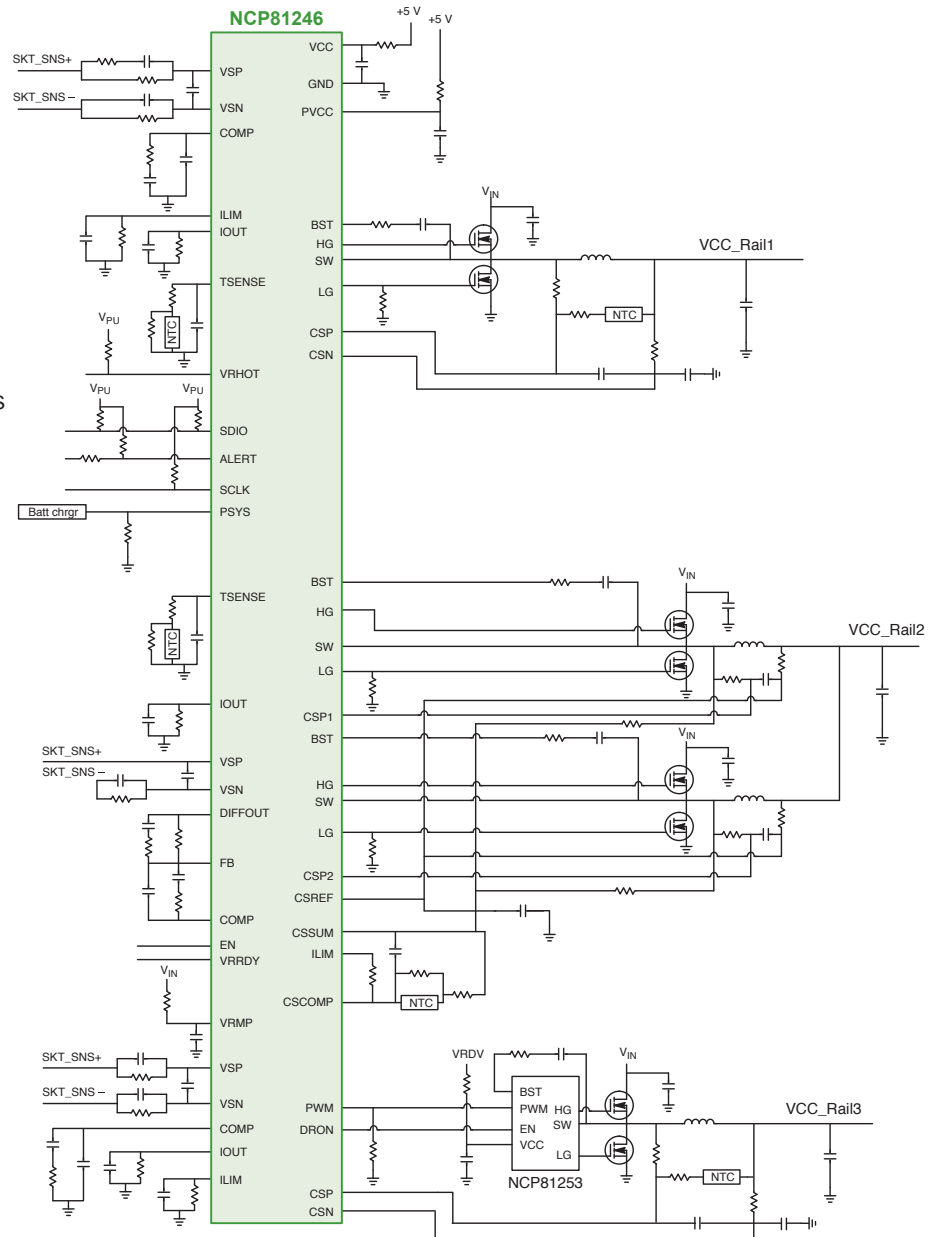


Device	Description	Topology	Control Mode	V _{CC} Min (V)	V _{CC} Max (V)	P _d Typ (W)	R _{on} Typ (Ω)	Package(s)
NCP1080	PoE PD Controller and DC-DC Converter	Flyback	Current	0	57	15	0.6	TSSOP-20
NCP1081	PoE PD Controller and DC-DC Converter	Flyback	Current	0	57	40	0.6	TSSOP-20
NCP1082	PoE PD Controller and DC-DC Converter, with Auxiliary Supply Support	Flyback	Current	0	57	15	0.6	TSSOP-20
NCP1083	PoE PD Controller and DC-DC Converter, with Auxiliary Supply Support	Flyback	Current	0	57	40	0.6	TSSOP-20
NCP1090	PoE PD Interface Controller	—	—	0	57	15	0.5	SOIC-8, TSSOP-8
NCP1091	PoE PD Interface Controller with Programmable UVLO	—	—	0	57	15	0.5	SOIC-8, TSSOP-8
NCP1092	PoE PD Interface Controller with Vaux Support	—	—	0	57	15	0.5	SOIC-8, TSSOP-8
NCP1093	PoE PD Interface Controller	—	—	0	57	25	0.5	DFN-10
NCP1094	PoE PD Interface Controller with Vaux Support	—	—	0	57	25	0.5	DFN-10
NCP1095	802.3bt PoE PD Interface Controller with External Hot Swap Transistor	—	—	0	57	100	—	TSSOP-16
NCP1096	802.3bt PoE PD Interface Controller with Internal Hot Swap Transistor	—	—	0	57	100	0.07	TSSOP-16 EP

IMVP8 Multiphase Controllers for Embedded Applications

Features

- Dual-edge pulse width modulation
- Single phase RPM mode
- Fastest initial response to dynamic load events
- True differential voltage sensing
- Differential inductor DCR current sensing
- Input voltage feed forward
- Adaptive voltage positioning
- Pin-programmable controller configuration
- Integrated OVP, UVP, OCP
- Operating temperature range:
-40°C to +125°C



Device	Description	Driver/MOSFETs	Package(s)
NCP81243	3 + 2 IMVP8 Controller		QFN-52
NCP81245	3 + 3 + 1 IMVP8 Controller		QFN-52
NCP81246	1 + 2 + 1 IMVP8 Controller	3x Integrated 5 V Drivers	QFN-52
NCP81247	4 + 2 IMVP8 Controller		QFN-52
NCP81248	1 + 2 + 1 IMVP8 Controller		QFN-48
NCP81145	5 V Driver	—	DFN-8
NCP81146	12 V Driver	—	DFN-8

DC-DC Controllers and Regulators

DC-DC Regulators

Device	V _{in} (V)		Topology	Frequency (kHz)	Output Current (A)	Package(s)
	Min	Max				
LM2574	4.75	40	Buck	52	0.5	D2PAK, TO-220
LM2594	4.75	40	Buck	150	0.5	SOIC-8, PDIP-8
NCP1030	10	200	Buck, Boost	300	1.0	Micro8
LM2575	4.75	40	Buck	52	1.0	D2PAK, TO-220
LM2595	4.75	40	Buck	150	1.0	D2PAK, TO-220
CS51414	4.5	40	Buck	260	1.5	SOIC-8
NCP3063	3	40	Buck, Boost, Inverting, Buck/Boost	up to 250	1.5	DFN-8, SOIC-8, PDIP-8
NCP3064	3	40	Buck, Boost, Inverting, Buck/Boost	up to 250	1.5	DFN-8, SOIC-8, PDIP-8
NCP3065	3	40	Buck, Boost, Inverting, Buck/Boost	up to 250	1.5	DFN-8, SOIC-8, PDIP-8
NCP3066	3	40	Buck, Boost, Inverting, Buck/Boost	up to 250	1.5	DFN-8, SOIC-8, PDIP-8
MC34063A	3	40	Buck, Boost, Inverting, Buck/Boost	up to 100	1.5	DFN-8, SOIC-8, PDIP-8
CS5171/2/3	2.7	30	Boost	280/560	1.5	SOIC-8
NCP1595	4	5.5	Buck	1200	1.5	DFN-6
NCP1031	10	200	Buck, Boost	300	2.0	Micro8
NCP1597	4	5.5	Buck	1200	2.0	DFN-6
MC34166	7.5	40	Step-up/Step-down	72	3.0	D2PAK, TO-220
LM2576	4.75	40	Buck	52	3.0	D2PAK, TO-220
LM2596	4.75	40	Buck	150	3.0	D2PAK, TO-220
NCP3170	4.5	18	Buck	500/1000	3.0	SOIC-8
NCP1599	2.7	5.5	Buck	1200	3.0	DFN-6, DFN-10
NCP1593	4	5.5	Buck	1000	3.0	DFN-10
NCP3133	2.9	5.5	Buck	1100	3.0	QFN-16
MC34163	2.5	40	Buck, Boost, Inverting, Buck/Boost	up to 100	3.4	SOIC-16, PDIP-16
NCP3163	2.5	40	Buck, Boost, Inverting, Buck/Boost	up to 300	3.4	SOIC-16WB, DFN-18
FAN23SV04TA	7	18	Buck	200-1000	4.0	PQFN-34
NCP1594A	2.9	6.0	Buck	500 - 2000	4.0	WQFN-24
MC34167	7	40	PWM Step-down	72	5.0	D2PAK, TO-220
NCP3135	2.9	5.5	Buck	1100	5.0	QFN-16
NCP3136	2.9	5.5	Buck	1100	5.0	QFN-16
NCP4060A	16	80	Buck	100 - 500	6.0	QFN-19
FAN65004B	4.5	65	Buck	100 - 1000	6.0	PQFN-35
FAN2356A	4.5	24	Buck	200-1000	6.0	PQFN-34
FAN23SV56A	7	24	Buck	200-1000	6.0	PQFN-34
NCP1592	3	6	Buck	350/550/280/700	6.0	TSSOP-28 EP
FAN65005A	4.5	65	Buck	100 - 1000	8.0	PQFN-35
FAN65008B	4.5	65	Buck	100 - 1000	10	PQFN-35
FAN2360A	4.5	24	Buck	200-1000	10	PQFN-34
FAN23SV60A	7	24	Buck	200-1000	10	PQFN-34
FAN2310A	4.5	18	Buck	200-1000	10	PQFN-34
FAN23SV10MA	7	18	Buck	200-1000	10	PQFN-34
FAN2365A	4.5	24	Buck	200-1000	15	PQFN-34
FAN23SV65A	7	24	Buck	200-1000	15	PQFN-34
NCP3232	4.5	21	Buck	500	15	QFN-40
NCP3235	4	20	Buck	550	15	QFN-40
FAN2315A	4.5	18	Buck	200-1000	15	PQFN-34

DC-DC Controllers and Regulators

DC-DC Regulators (cont.)

Device	V _{in} (V)		Topology	Frequency (kHz)	Output Current (A)	Package
	Min	Max				
FAN23SV15MA	7	18	Buck	200-1000	15	PQFN-34
FAN23SV70A	7	24	Buck	200-1000	20	PQFN-34
FAN23SV20MA	7	18	Buck	200-1000	20	PQFN-34
NCP3233	3	16	Buck	300/500/1000	20	QFN-40
NCP3231	4.5	18	Buck	500	25	QFN-40
NCP3230	4.5	18	Buck	500	30	QFN-40
NCP3284	4.5	18	Buck	500/600/800/1000	30	PQFN-37

DC-DC Controllers

Device	V _{in} (V)		Isolated	Topology	Frequency (kHz)	Control Mode	Package(s)
	Min	Max					
NCP1342	16	700	Yes	QR Flyback	Variable	Current	SOIC-8 NB, SOIC-9 NB
NCP1568	16	700	Yes	Active Clamp Flyback	100 - 1000	Current	TSSOP-16
NCP12700	9	200	Yes	Flyback	100 - 1000	Current	MSOP-10, WQFN-10
NCP1566	13	120	Yes	Active Clamp Flyback	100 - 1000	Current or Voltage	QFN-24
NCP1034	8	100	No	Buck	25 - 500	Voltage	SOIC-16
CS5124	7.7	75	Yes	Flyback	400	Current	SOIC-8
CS51022	3.3	72	Yes	Flyback	200 - 1000	Current	SOIC-16, TSSOP-16
CS51221	3.3	72	Yes	Flyback	200 - 1000	Voltage	SOIC-16, TSSOP-16
NCP1294	3.3	72	Yes	Flyback	200 - 1000	Voltage	SOIC-16, TSSOP-16
TL494	7	40	No	Buck	40 - 200	Voltage	SOIC-16, PDIP-16
TL594	7	40	No	Buck	40 - 300	Voltage	SOIC-16, PDIP-16, TSSOP-16
SG3525	8	35	No	Half-Bridge	100 - 400	Voltage	SOIC-16, PDIP-16
NCP3011	4.5	28	No	Buck	400	Voltage	TSSOP-14
NCP3020A/B	4.5	28	No	Buck	300/600	Voltage	SOIC-8
NCP3030	4.7	28	No	Buck	1200/2400	Voltage	SOIC-8
NCP81231	4.5	28	No	Buck	150 - 1200	Current	QFN-32
NCP81239	4.5	28	No	Buck-Boost	150 - 1200	Current	QFN-32
NCP5269	3.3	28	No	Buck	300/400/600	Voltage	QFN-20
NCP81232	4.5	20	No	Buck	200 - 1200	Dual Edge	QFN-40
NCP81233	4.5	20	No	Buck	200 - 1200	Dual Edge	QFN-52
CS51031	4.5	16	No	Buck	200 - 700	Hysteretic	SOIC-8
NCP1587	4.5	13.2	No	Buck	275	Voltage	SOIC-8

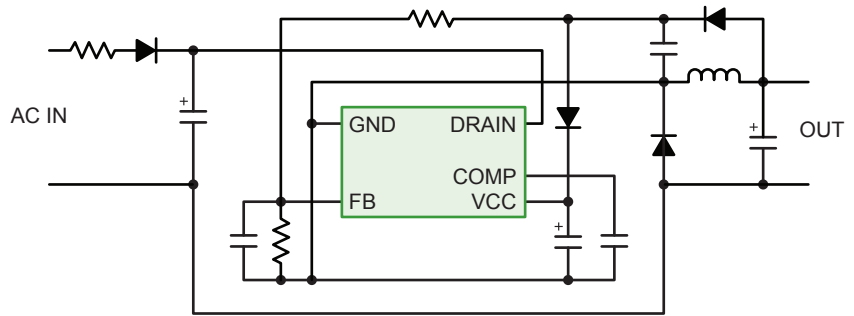
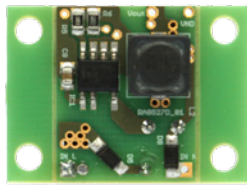


Compact Power Delivery with Switching Regulators

NCP10671 Small Form Factor Buck Converter

Features

- Low standby power
- Complete portfolio for 1 – 50 W
- Integrated controller and MOSFETs



NCP10671 Non-Isolated Application

Device	P _{OUT} (W)	I _{LIMIT} (mA)	Topology	BV _{DS} (V)	R _{DS(ON)} Max (Ω)	Frequency Options (kHz)	Brown-In/ Out	Line OVP	F _{SW} Foldback	Dynamic Self Supply	Package(s)
NCP10670	1.5	100	Buck/Non-isolated Flyback/Flyback	700	41	60, 100	No	No	No	Yes	SOIC-7
NCP10671	3.7	250	Buck/Non-isolated Flyback/Flyback	700	41	60, 100	No	No	No	Yes	SOIC-7
NCP10672	7.8	780	Buck/Non-isolated Flyback/Flyback	700	14	60, 100	No	No	No	Yes	SOIC-7
NCP1060	4	Adj.	Buck/Non-isolated Flyback/Flyback	700	41	60, 100	Yes	No	Yes	Yes	SOIC-10, PDIP-7
NCP1063	11	Adj.	Buck/Non-isolated Flyback/Flyback	700	14	60, 100	Yes	No	Yes	Yes	PDIP-7, SOIC-16
NCP1070	4	250	Flyback	700	32	65, 100, 130	Yes	No	Yes	Yes	SOT-223, PDIP-7
NCP1071	5	350	Flyback	700	32	65, 100, 130	Yes	No	Yes	Yes	SOT-223, PDIP-7
NCP1072	11	350	Flyback	700	16	65, 100, 130	Yes	No	Yes	Yes	SOT-223, PDIP-7
NCP1075A/B	15	350	Flyback	700	17	65, 100, 130 (only B)	Yes	Yes	Yes	Yes	PDIP-7
NCP1076A/B	20	650	Flyback	700	6.8	65, 100, 130 (only B)	Yes	Yes	Yes	Yes	PDIP-7
NCP1077A/B	20	850	Flyback	700	6.8	65, 100, 130 (only B)	Yes	Yes	Yes	Yes	PDIP-7
NCP1079A/B	30	1050	Flyback	700	3.9	65, 100, 130 (only B)	Yes	Yes	Yes	Yes	PDIP-7
FSL106	10	Adj.	Flyback	650	20	67, 100	No	No	No	No	PDIP-8
FSL116	14	Adj.	Flyback	650	10	50, 100	No	No	No	No	PDIP-8
FSL126	17	Adj.	Flyback	650	6	67, 100	No	No	No	No	PDIP-8
FSL136	20	Adj.	Flyback	650	4	67, 100	No	No	No	No	PDIP-8, LSOP-8
FSL146	26	Adj.	Flyback	650	2.6	67	No	No	No	No	PDIP-8
FSL156	30	Adj.	Flyback	650	2.2	67	No	No	No	No	PDIP-8
FSL117	10	800	Flyback	700	10	67	No	No	No	No	PDIP-8
FSL137	20	1300	Flyback	700	4.75	67	No	No	No	No	PDIP-8
FSL126MRT	25	1200	Flyback	650	6	67	No	No	No	No	TO-220F6
FSL136MRT	35	2150	Flyback	650	4	67	No	No	No	No	TO-220F6
FSGM0465	48	1800	Flyback	650	2.6	66	No	No	No	No	TO-220F6
FSL176MRT	70	3500	Flyback	650	1.6	67	No	No	No	No	TO-220F6
FSL128MRT	25	1200	Flyback	800	7.3	67	No	No	No	No	TO-220F6
FSL138MRT	35	2150	Flyback	800	5	67	No	No	No	No	TO-220F6
FSL306	7	Adj.	Buck/Non-isolated Flyback/Flyback	650	18	50	No	No	Yes	Yes	PDIP-7, LSOP-7
FSL336	20	Adj.	Buck/Non-isolated Flyback/Flyback	650	4	50	No	No	Yes	Yes	PDIP-7, LSOP-7
FSL337	20	Adj.	Buck/Non-isolated Flyback/Flyback	700	4	50	No	No	Yes	Yes	PDIP-7, LSOP-7
FSL4110	9	520	Flyback	1000	10	50	No	Yes	No	Yes	PDIP-7, LSOP-7
FSL518A/H	12	460/600	Buck/Non-isolated Flyback/Flyback	800	8	100, 130	Yes	Yes	Yes	Yes	PDIP-7
FSL538A/H	17	660/860	Buck/Non-isolated Flyback/Flyback	800	4.6	100, 130	Yes	Yes	Yes	Yes	PDIP-7
NCP10970	5	350	Buck + LDO	670	23	65	No	No	No	Yes	SOIC-16

Rugged Linear Voltage Regulators

Wide & High Input Voltage LDO Regulators

Device	I _O Typ (mA)	V _{in} Max (V)	V _{out} (V)	I _q (μA)	V _{DO}	PSRR (dB)	Package(s)
NCP786L	5	450	Adj	10	—	70	SOT-223
NCP786A	10	450	Adj	10	—	65	DFN-6
NCP715	50	24	1.2 - 5.3	3.2	230 mV (typ)	50	XDFN-6, SC-70-5, TSOP-5
NCP502	80	12	1.5 - 5.0	40	600 mV (min)	55	TSOP-5, SC-70-5
NCP716	80	24	3.0, 3.3, 5.0	3.2	700 mV	55	TSOP-5
LM2931	100	40	5.0, Adj	400	160 mV (typ)	90	TO-220, DPAK-3, DPAK-5, TO-92, SOT-223
LP2950	100	30	3.0, 3.3, 5.0	93	350 mV	40	DPAK-3, TO-92
NCP781	100	150	3.3, 5.0, 15, Adj	25	4 V (typ)	83	DFN-6
NCP716B	150	24	3.0, 3.3, 5.0	3.2	700 mV (typ)	55	TSOP-5
NCP730	150	38	1.2 - 2.4	1	290 mV	80	TSOP-5, WDFN-6
NCP718	300	24	1.2 - 5.0, Adj	4	285 mV (typ)	60	TSOT-23-5, WDFN-6
NCP3335A	500	12	1.5 - 5.0, Adj	190	340 mV (typ)	55	DFN-10, Micro8

High Current LDO Regulators

Device	I _O Typ (A)	V _{in} Max (V)	V _{out} (V)	I _q	V _{DO} (V)	PSRR (dB)	Package(s)
NCP59800	1	6.0	Adj	60 μA	0.2	63	DFN-8
NCP59748	1.5	6.0	Adj	1 mA	0.06	60	DFN-10, QFN-20
NCP59150	1.5	18	1.8 - 5.0, Adj	1.2 mA	0.3	62	D2PAK, DFN-8
NCP5662	2	18	1.2 - 3.3, Adj	—	1	65	D2PAK, DFN-8
NCP59749	3	6.0	Adj	1 mA	0.12	60	QFN-20
NCP59744	3	6.0	Adj	1 mA	0.115	72	QFN-20, DFN-10
NCP58300	3	18	1.24 - 12.9	1.2 mA	0.37	—	D2PAK

Standard Linear Regulators

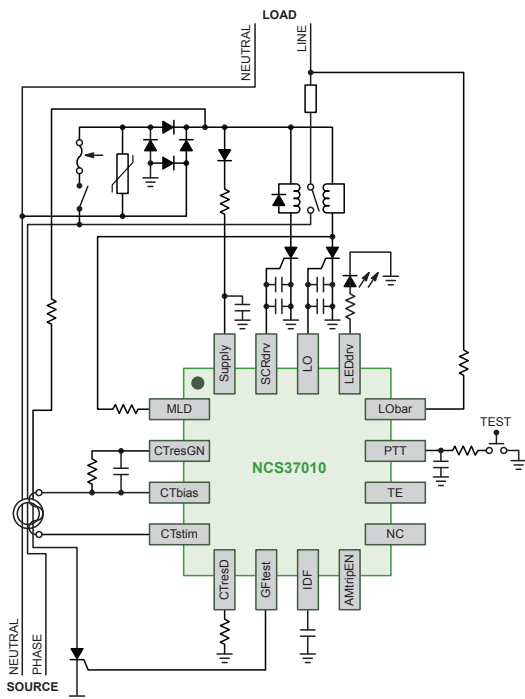
Device	I _O Typ (A)	V _{in} Max (V)	V _{out} (V)	V _{DO} (V)	Package(s)
MC78Lxx	0.1	30	5, 8, 9, 12, 15, 18, 24	1.7	TO-92, SOT-89, SOIC-8
KA78RH33	0.8	15	3.3	1	DPAK
KA78Rxx	1	35	3.3, 5, 8, 9, 12, 15	0.5	TO-220-4
KA78xx, MC78xx	1	35	24-May	2	TO-220, DPAK, D2PAK
NCP1117	1	20	1.5 - 12, Adj	1.3	SOT-223, DPAK
LM317	1.5	40	Adj	2.2	TO-220, D2PAK
KA278Rxx	2	35	3.3, 5, 12	0.5	TO-220-4
KA378Rxx	3	35	3.3, 5, 12	0.5	TO-220-4

Ground Fault/Earth Leakage Detection and Protection

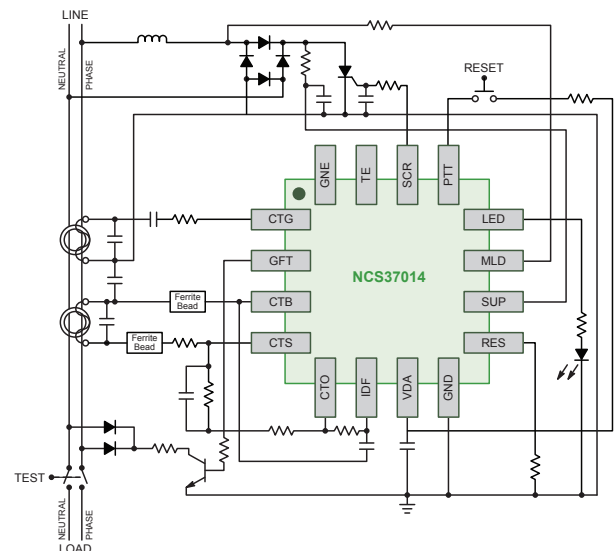
Features

- Broad selection of GFCI controllers for a variety of applications
- Proprietary solutions for Ground Fault and Grounded Neutral Fault sensing
- Auto-monitoring (Self-Test) functions enabled for updated UL943/B
- Industrial grade reliability and quality
- Customized solutions available

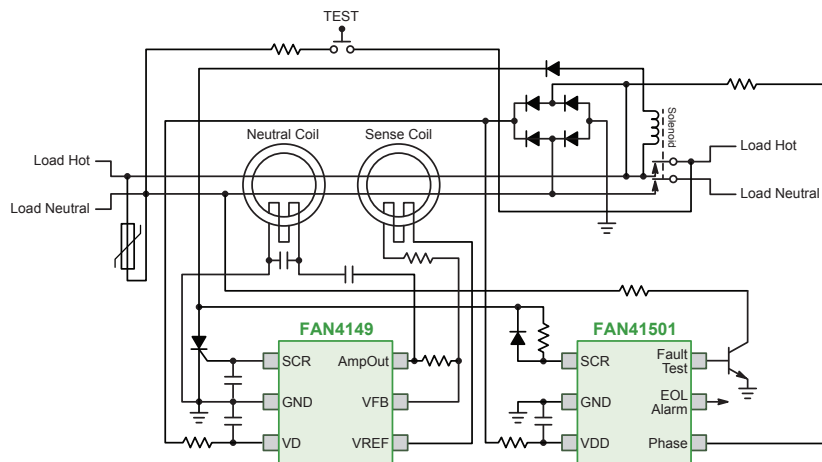
Self-Test GFCI Solutions



NCS37010 with a Single Coil for Both GN and GNF Sensing



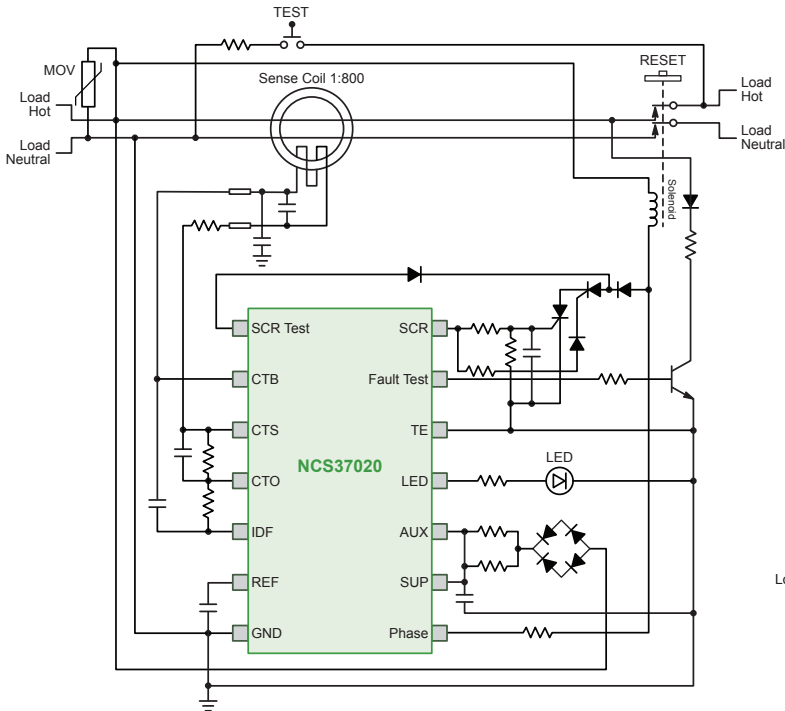
NCS37014 with Two Coils for Low Power Consumption



FAN4149 + FAN41501 Combination with Two Coils for Ease of Design

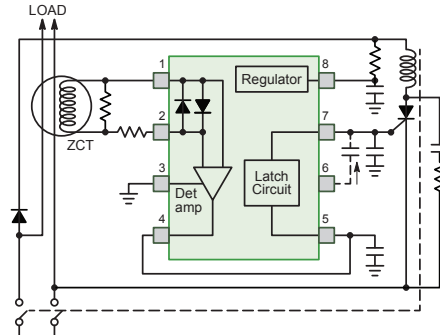
Ground Fault/Earth Leakage Detection and Protection

Self-Test ALCI/RCD Solution



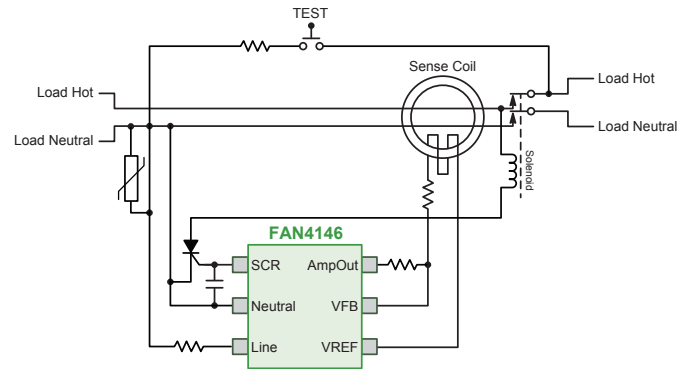
NCS37020 for Single Coil Self-Test

Residual Current Device



KA2803B for M54123 Equivalent KA2803C with Extended Operating Temperature

General Purpose



FAN4146E

Device	Function	Differential Fault	Ground-Neutral Fault	Electrical Standard	Current Transformer	Electronic Lockout	Operating Temperature (°C)	Device	Package(s)
NCS37010	Self Test GFCI Controller	✓	✓	UL943, UL2231	Single coil	✓	-40 to +85	Receptacle, circuit breaker, portable power plug	QFN-16, TSSOP-16
NCS37014	Self Test GFCI Controller	✓	✓	UL943, UL2231	Dual coil		-40 to +95	Receptacle, circuit breaker, portable power plug	QFN-16
FAN4149	Self Test GFCI Controller	✓	✓	UL943, UL2231	Dual coil		-35 to +85	Receptacle, circuit breaker, portable power plug	SOT-23-6
FAN41501	Self Test Monitor	✓	✓	UL943, UL2231	N/A		-35 to +85	Receptacle, circuit breaker, portable power plug	SSOT-6
NCS37020	Self Test ALCI Controller	✓		UL943B	Single coil		0 to +70	Portable appliances, products requiring self-test	TSSOP-14
FAN4146E	ALCI/RCD/ELB Controller	✓		IEC 61008/9, GB/T 16916/7	Single coil		-35 to +85	General use, compact solution for appliances	SSOT-6
KA2803B	RCD/ELB Controller	✓		IEC 61008/9, GB/T 16916/7	Single coil		-25 to +80	General use, circuit breaker, portable power plug	SOP-8, DIP-8
KA2803C	RCD/ELB Controller	✓		IEC 61008/9, GB/T 16916/7	Single coil		-25 to +100	General use, circuit breaker, portable power plug	SOP-8

Features

- [illegible]

```
graph TD; A[Input Power Supply +24 V] --> B[Central Processing Unit]; B --> C[Analog/Digital Inputs]; B --> D[Analog/Digital Outputs]; C --> B; D --> B;
```

The diagram illustrates the system architecture, showing the flow of data and power between various components. The main components are:

- Input Power Supply (+24 V):** This block contains three sub-components: **Schottky**, **eFuse**, and **ESD/Surge**.
- Central Processing Unit:** This block contains two sub-components: **ESD/Surge** and **ESD/Surge**.
- Analog/Digital Inputs:** This block contains three sub-components: **eFuse**, **Schottky**, and **ESD/Surge**.
- Analog/Digital Outputs:** This block contains three sub-components: **eFuse**, **Schottky**, and **ESD/Surge**.

The flow of data and power is as follows:

- The **Input Power Supply (+24 V)** provides power to the **Central Processing Unit**.
- The **Central Processing Unit** sends data to the **Analog/Digital Inputs** and receives data from the **Analog/Digital Outputs**.
- The **Analog/Digital Inputs** send data to the **Central Processing Unit**.
- The **Analog/Digital Outputs** send data to the **Central Processing Unit**.

Device	Nominal Voltage (V)	Input Voltage (V)	Vclamp (V)	Continuous Current (A)	Trip Current (A)	RDS(ON) (mΩ)	Reverse-Current Blocking	IMON (ISENSE pin)	Auto-Retry	Latch	Package
NIS5135	5	-0.6 to 18	6.65	3.6	Adjustable	68			✓	✓	DFN-10
NIS5232	12	-0.6 to 18	15	4.2	Adjustable	44			✓↑	✓	DFN3-10
NIS5420	12	-0.6 to 18	14	4.2	Adjustable	44		✓	✓	✓	WDFN-10
NIS5820	12	-0.3 to 18	14	8	Adjustable	24			✓	✓	WDFN-10
NIS5020	12	-0.3 to 18	14	10	Adjustable	14			✓	✓	WDFN-10
NIS5021	12	-0.3 to 18	14	12	Adjustable	14			✓	✓	WDFN-10
NIS6150	5	-0.3 to 10	6.1, 6.9	1	Adjustable	140	✓	✓	✓	✓	WDFNW-10
NIS6350	5	-0.3 to 10	6.1, 6.9	3	Adjustable	70			✓	✓	WDFNW-10
NIS6432	3.3	-0.3 to 14	4	3.5	Adjustable	46	✓	✓	✓	✓	WQFN-12
NIS6452	3 – 5	-0.3 to 14	6.65	3.5	Adjustable	46	✓	✓	✓	✓	WQFN-12

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ESD and Surge Protection for Industrial Networks

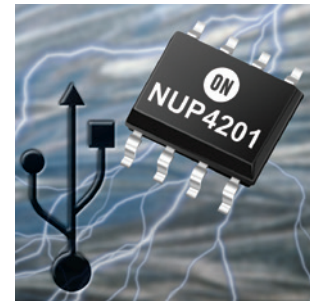
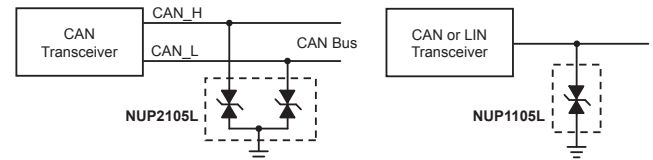
Zener Voltage Regulators

Device	Power (W)	V _Z (V)	V _Z Tolerance (%)	Package(s)
BZX84 Series	0.225	2.4 - 75	2, 5	SOT-23
MMBZ Series	0.225	2.4 - 91	5	SOT-23
MMSZ Series	0.5	1.8 - 91	5	SOD-123
1SMA59 Series	1.5	3.3 - 68	5	SMA
1SMB59 Series	3	3.3 - 200	5	SMB
1N59 Series	3	3.3 - 200	5	Surmetic 30
1N53 Series	5	3.3 - 200	5	Surmetic 40

Network Dataline Protection

Device	Application	V _{rrm} Max (V)	Line-to-Line Capacitance (pF)	Peak Surge Current* Max (A)	Package(s)
NUP3105L	HS CAN	32	30	8	SOT-23
NUP2125	HS CAN	24	5	3	SOT-323
NUP2115L	FlexRay	24	5	3	SOT-23
NUP2105L	HS CAN	24	15	8	SOT-23
NUP1105L	LIN, LS CAN	24	30	8	SOT-23
SM12T	RS-232	12	48	12	SOT-23
NUP4201	USB2.0 FS	5	2.5	25	S0-8
NSP4201	USB2.0 FS	5	1.5	25	TSOP-6
NSP8814/8	10/100/1000BASE-T Ethernet, Gb Ethernet	5	1.5	25	UDFN-10

* on VP pin (pin 5).



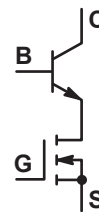
PROTECTION

Emitter-Switched Bipolar/MOSFET Cascode Transistor

For high-voltage and high-switching frequency

Features

- Low input capacitance: ~470 pF (FET input C)
- No "Miller" feedback capacitance
- 15 pF @ 200 V output capacitance (FJP2160)
- Breakdown voltage: >1600 V
- Moderate switching speed: >150 KHz
- Rise-time/fall-time: ~50 - 100 ns
- Square RBSOA for improved reliability
- Low equivalent RDS(ON)
- Little or no influence from static dv/dt (low input Z and no Miller "C")
- Avalanche tested



Device	Polarity	V _{CE(SAT)} Max (V)	I _C Cont. (A)	V _{CE0} Min (V)	V _{CB0} (V)	V _{EB0} (V)	V _{BE} (sat) (V)	hFE Min	hFE Max	fT Min (MHz)	PTM Max (W)	Package(s)
FJFP2145TU	NPN	2	5	800	1100	7	1.5	20	40	15	40	T0-220-3 FP

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.

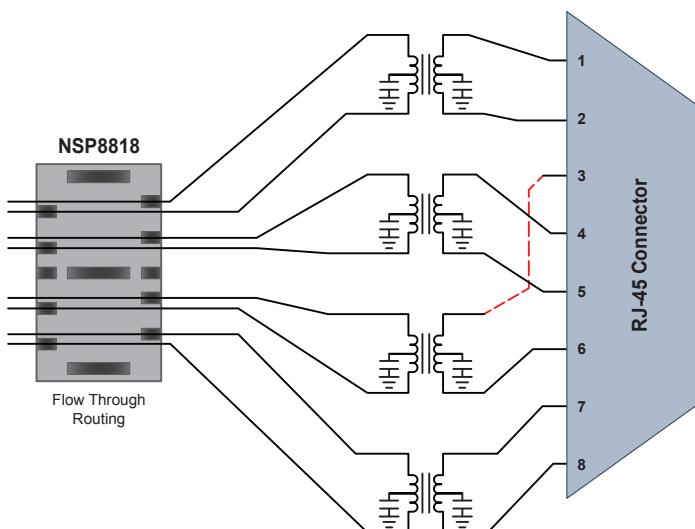
Features

- 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

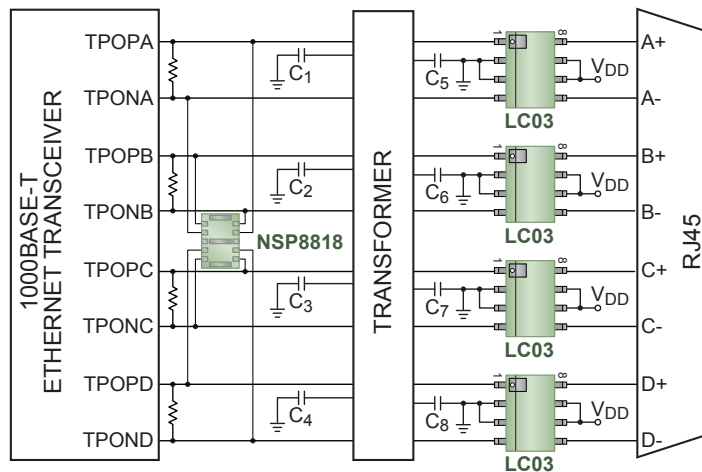
Benefits

- 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

PROTECTION



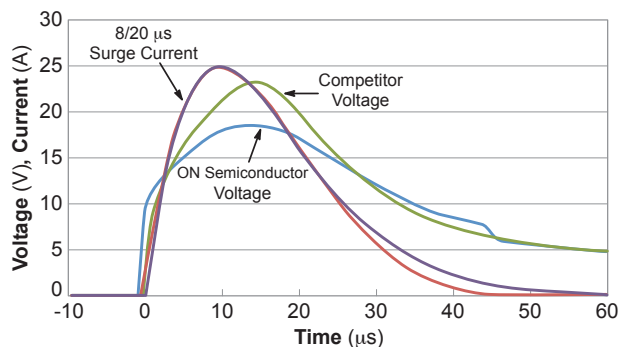
Typical Application



Line Side : LC03-6 (optional)

Transformer Side: NSP8818

Protection against metallic (transverse) strikes



Line-to-Line Surge

Surge Suppressors

Device	$V_{\text{DC Max}}$ (V)	Line Transient Max (V)	Surge I_{pp} , 8/20 μs (A)	Typical Line-Line Capacitance (pF)	ESD Contact Rating (kV)	Package(s)
LC03-6	6.7	7.0	100	8.0	± 30	SOIC-8
NSP8814	3.0	3.2	35	1.5	± 30	UDFN-8
NSP8818	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
NSP4201	5.0	6.0	2.5	1.5	± 30	TSOP-6

USB® 2.0 Protection

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

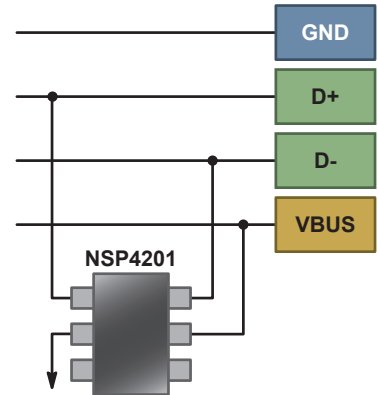
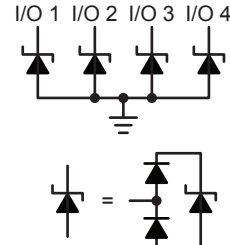
Key Requirement

- Cap < 5 pF

Features

- 0.5 - 3.0 pF
- 4 low speed + 1 VBUS integrated – can protect up to 2 USB ports
- Industry leading low clamping voltage

Device	Data Lines	Capacitance (pF)	Package(s)	Size (mm)
NUP4114UCL	2 Pair + Power	0.50	SC-88	2.0 x 2.1
NUP4114UPX	2 Pair + Power	0.80	SOT-563	1.6 x 1.6
NUP4114H	2 Pair + Power	0.80	TSOP-6	3.0 x 2.75
NSP4201	2 Pair + Power	3.0	TSOP-6	3.0 x 2.75
NUP3115	1 Pair + ID + Power (D+, D-, ID, VBUS)	0.80	UDFN-6	1.6 x 1.6
ESD7L5.0	1 Pair (D+, D-)	0.50	SOT-723	1.2 x 1.2
ESD7481	Single Line 0201	0.25	X3DFN-2	0.62 x 0.32



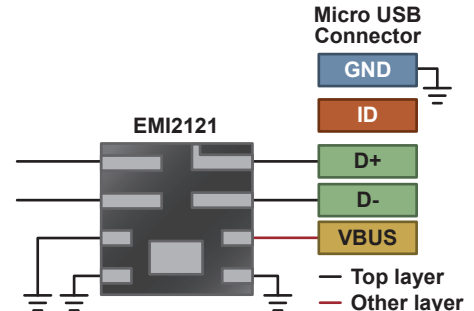
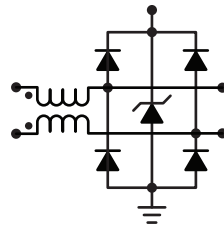
One High Speed Pair, V_{CC}, Common Mode Filter + ESD Protection

Key Requirement

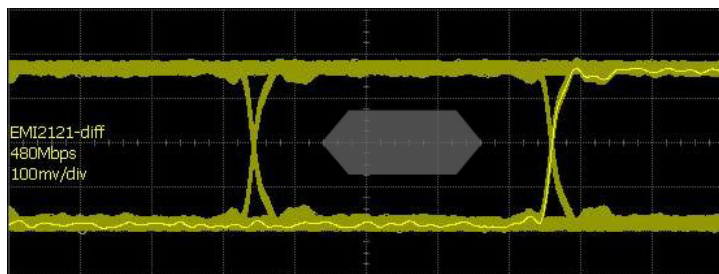
- Cap < 1.5 pF
- Common Mode Filtering

Features

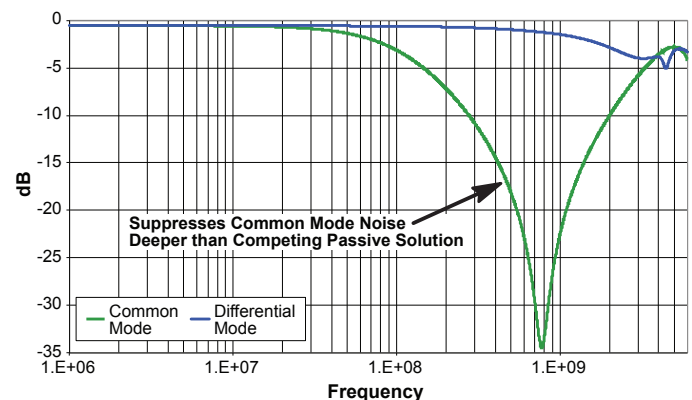
- 0.5 - 0.8 pF
- Integrated EMI suppression with ESD protection
- Industry leading low clamping voltage



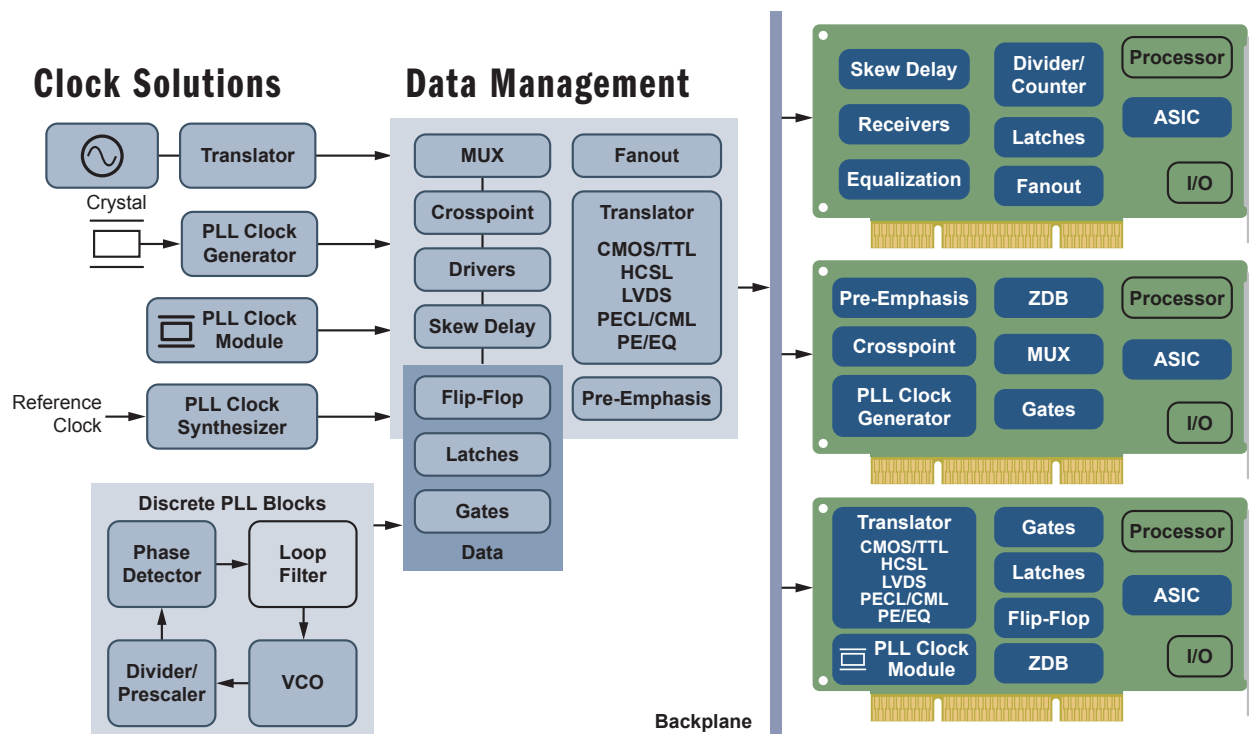
Device	Data Lines	Capacitance @ 2.5 V (pF)	CM Attenuation @ 800 MHz (-dB)	DM Bandwidth F3dB (GHz)	Package(s)	Size (mm)
EMI2121	1 Pair + Power (D+, D-, VBUS)	0.9	-25	2.5	WQFN	2.2 x 2.0 x 0.75
EMI2124	1 Pair + ID + Power (D+, D-, ID, VBUS)	0.9	-25	2.5	WQFN	2.2 x 2.0 x 0.75



USB 2.0 @ 480 Mb/s



Timing and Data Distribution Subsystem

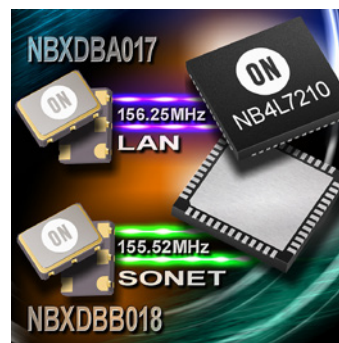


ON Semiconductor provides a complete portfolio of timing and data management solutions for all aspects of the clock tree. System designers can optimize their clock circuits with industry leading clock distribution devices, demonstrating the industry's lowest jitter and skew. A broad product portfolio, 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.

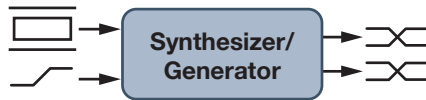
Expanding on more than 30 years of experience as the world's leader in high performance ECL-based clock distribution, ON Semiconductor has extended its expertise into ultra low jitter PLL clock synthesis and generation. The new PureEdge™ PLL devices utilize a fully differential architecture that enables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

Performance Capabilities

- Differential design for reduced noise
- ECL, PECL, CML, LVDS, HSTL, HCST, 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 ≤ -174 dBc/Hz
- Low skew

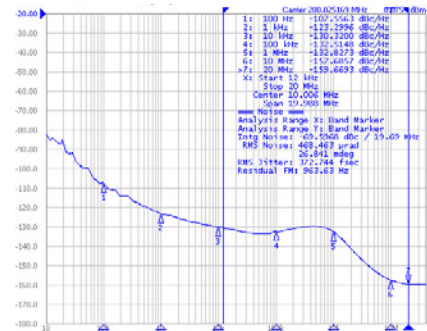


PLL Clock Synthesizers/Generators



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



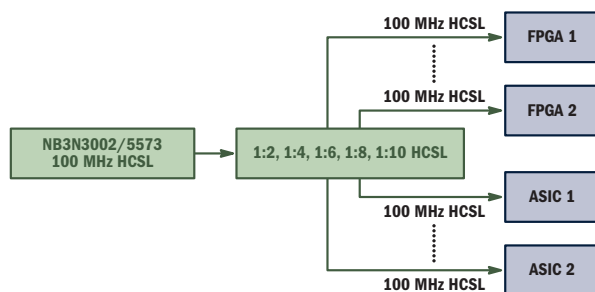
NB3N5573 Typical Phase Noise at Fc = 200 MHz

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 1,2,3,4	✓		✓		✓	HCSL	3.3	TSSOP-16
NB3N5573	25	25/100/125/200	CPU/DIMM, PCIe Gen 1,2,3,4	✓		✓		✓	HCSL	3.3	TSSOP-16
NB3N3020	5 to 27	5 to 210	Network GigE	✓	✓	✓	✓		ECL, LVTTTL	3.3	TSSOP-16
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 1,2,3,4	✓		✓			HCSL	3.3	TSSOP-20
NB3N51044	25	100/125	CPU/DIMM, PCIe Gen 1,2,3,4	✓		✓			HCSL	3.3	TSSOP-28
NB3N51054	25	100	CPU/DIMM, PCIe Gen 1,2,3,4	✓					HCSL	3.3	TSSOP-24
NBA3N5573	25	25 to 200	CPU/DIMM, PCIe Gen 1,2,3,4	✓		✓			HCSL	3.3	QFNW-16

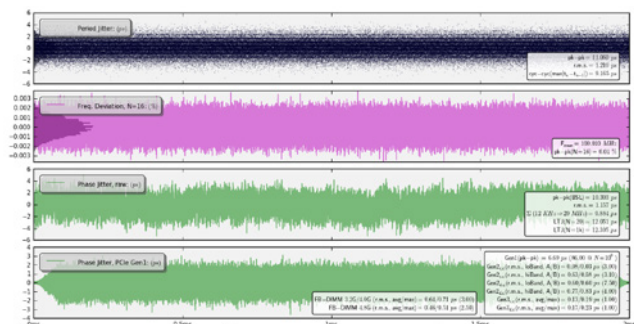
PCIe Timing Solutions

- PCIe clock synthesizers with single, dual, and quad outputs
- PCIe buffers with 1:2, 1:4, 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, 4 specification
- Direct device interface eliminates external termination components and simplifies BOM

CLOCK DISTRIBUTION

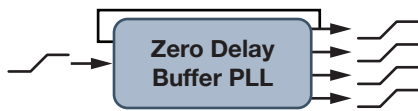


PCIe Gen 1, 2, 3, 4 Clock Generation and Distribution



Jitter Results After Fanout

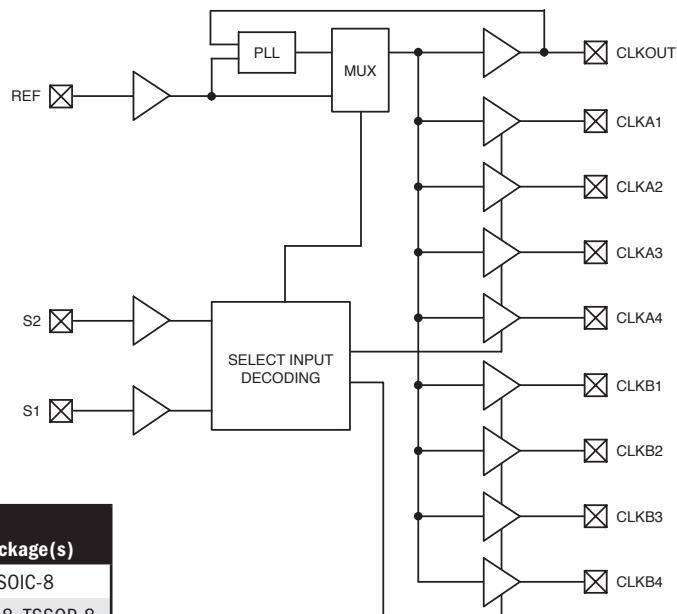
Zero Delay Buffers



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 _{Max} Typ (MHz)	Channels	t _{Skew 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

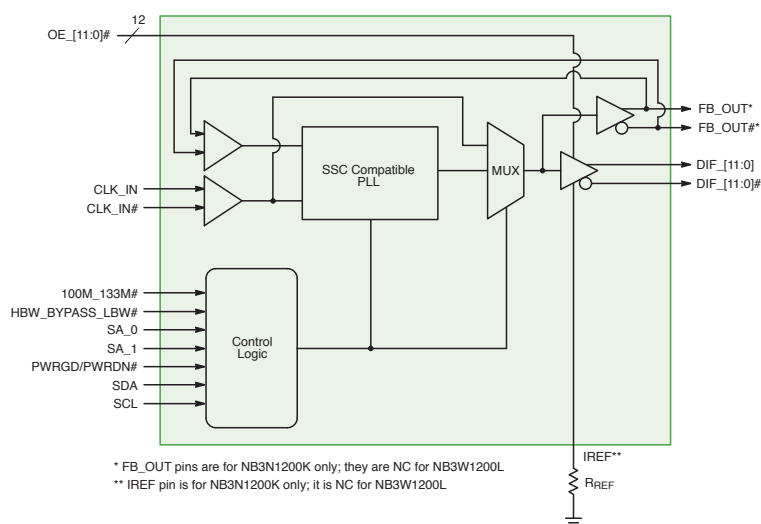


NB2309A Functional Diagram

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/Gen 4 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



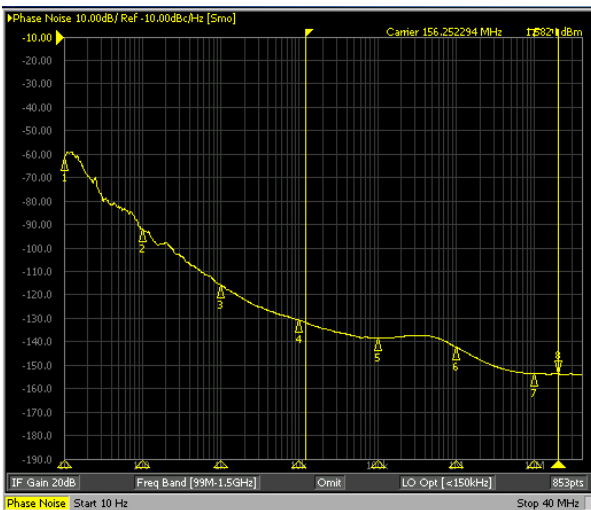
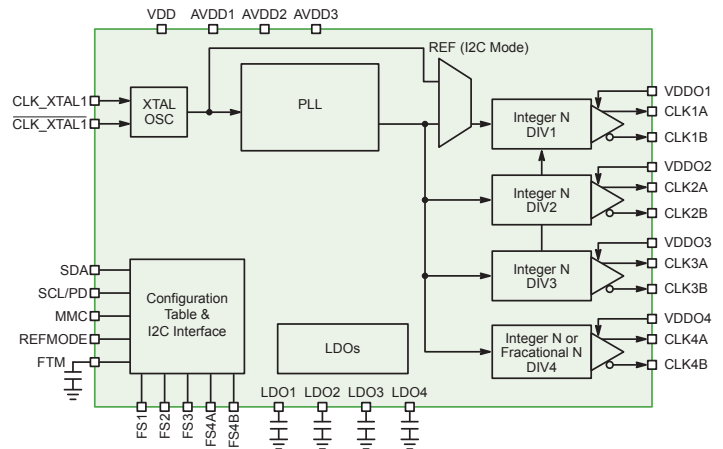
NB3N1200K Simplified Block Diagram

* FB_OUT pins are for NB3N1200K only; they are NC for NB3W1200L
 ** IREF pin is for NB3N1200K only; it is NC for NB3W1200L

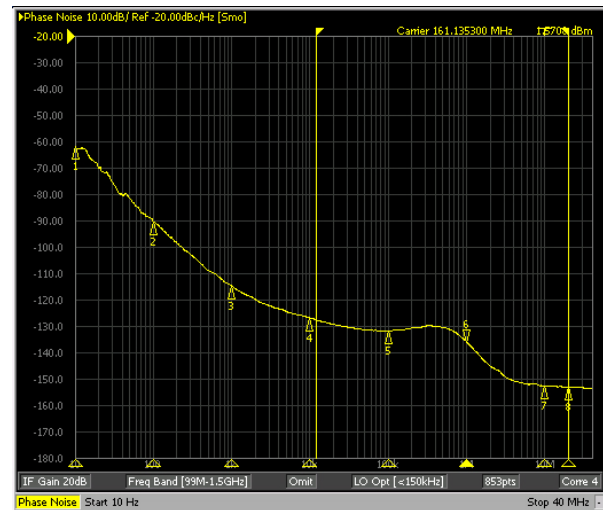
Low Noise, Programmable Multi-Rate Clock Generator

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
- 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
- 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

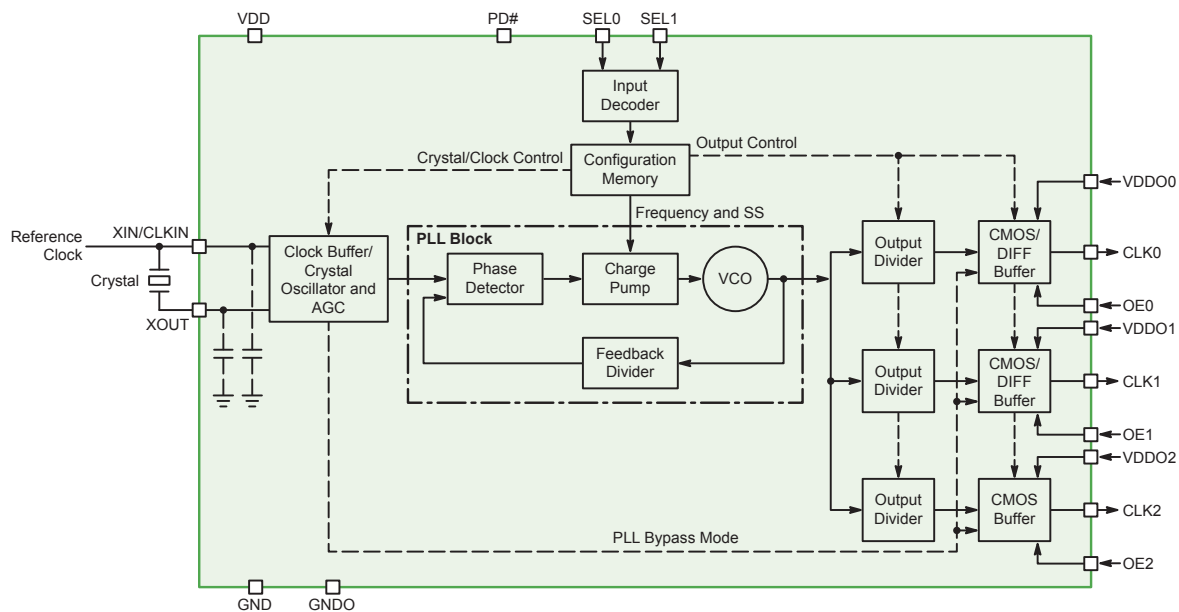


Fractional-N Output RMS Phase Jitter = 371 fs !!
Fractional-N Output Phase Noise (Max) = 1 ps
Integration range = 12 kHz - 20 MHz

OmniClock Programmable Clock Synthesizers

Features

- Single PLL
- Input Frequency Range:
 - Crystal: 3 – 50 MHz (low cost ESR crystal compatible)
 - Clock: 3 – 200 MHz (single-ended only)
- Up to 3 single-ended (LVCMOS/LVTTL) outputs, or up to 1 differential (LVPECL, LVDS, HCSL or CML) output + 1 single-ended (LVCMOS/LVTTL) output
- Output Frequency Range: 8 kHz (Min), 200 MHz (Max)
- Programmable Spread Spectrum Capabilities for EMI Suppression
 - Center Spread (0.125% steps): $\pm 0.125\%$ to $\pm 3\%$
 - Down Spread (0.25% steps): -0.25% to -4%
 - Modulation Rate: 30 kHz – 130 kHz
- PLL Bypass mode
- Individual Output Enable pin for each output and Power Down Capability
- Individual Output Voltage pins per output, allowing setting of output voltage (1.8 V, 2.5 V or 3.3 V; equal to or less than VDD)
- Automatic Gain Control (Crystal Power Limiting)
- Programmable internal input crystal load capacitors
- Programmable Output Drive current
- Up to 4 independent configurations using SELx pins
- Supply Voltage: 3.3 V $\pm 10\%$; 2.5 V $\pm 10\%$; 1.8 V ± 0.1 V
- Temperature Range: -40°C to $+85^{\circ}\text{C}$
- Available in QFN-16 (3 mm x 3 mm) and WDFN-8 (2 mm x 2 mm) packages



Block Diagram

OmniClock Programmable Clock Synthesizers

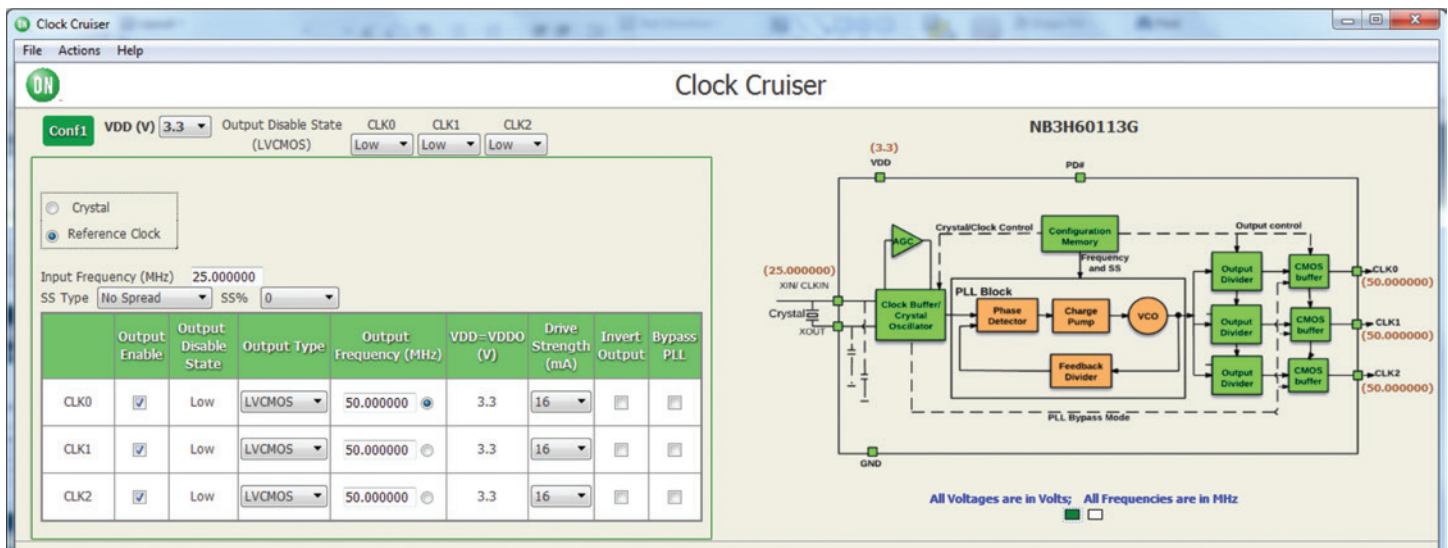
Using OmniClock in Your System

Customer orders blank OmniClock devices

Customer uses free GUI and supplied evaluation board to configure the blank device to the desired parameters: frequency, drive strength, spread spectrum, etc.

Customer provides configuration file to ON Semiconductor sales channel

ON Semiconductor programs device in factory with desired customer configuration, and creates customer-specific part number



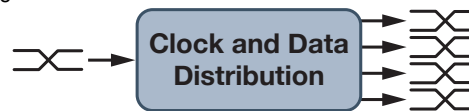
Configuration GUI

Device	Individual OE	Individual V _d do	Supply Voltage (V)	Number of Configurations	Number of Outputs	Package(s)
NB3H63143G	Yes	Yes	2.5/3.3	4	3	QFN-16
NB3H60113G	No	No	2.5/3.3	1	3	DFN-8
NB3V63143G	Yes	Yes	1.8	4	3	QFN-16
NB3V60113G	No	No	1.8	1	3	DFN-8

Clock and Data Distribution

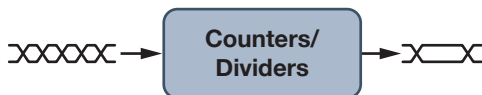
Features

- 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	6, 8, 10, 21	HCSL		✓	✓	✓	✓	✓		✓	3.3	100	0.4	QFN-52, QFN-32, QFN-24
NB3L202K/204K	2, 4	HCSL		✓	✓	✓	✓	✓		✓	2.5, 3.3	100	0.4	QFN-16
NB3L208K	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
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

Dividers and Counters



Features

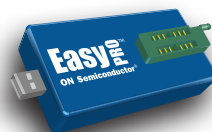
- Low jitter and skew for highly accurate phase matching
- Multiple outputs and ratios combined for integrated circuit designs
- Supports interface and voltage translation

Device	Input Level				Output Level	VCC Typ (V)	f _{Max} Typ (GHz)	Div Ratios	Package(s)
	CML	CMOS	LVPECL	LVDS					
NB7V32M	✓		✓	✓	CML	1.8, 2.5	10	2	QFN-16
NB7L32M	✓		✓	✓	CML	2.5, 3.3	14	2	QFN-16

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



EasyPRO™ is a user-friendly, portable programming tool for ON Semiconductor serial EEPROMs (I2C, SPI, Microwire)

EEPROMs

Data Transmission Standard	Density	Organization*	V _{CC} Min (V)	V _{CC} Max (V)	f _{CLK} Max (MHz)	Package(s)
I2C	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, WLCSP-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				
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.

Operational Amplifiers for I/O Buffering and Signal Conditioning

Low Noise Operational Amplifiers

Device	Channels	V _S Min (V)	V _S Max (V)	I _Q /Ch (mA)	GBW (MHz)	V _{OS} Max (mV)	V _{OS} Drift (μV/°C)	I _B (nA)	CMRR (dB)	e _N (nV/√Hz)	Rail-to-Rail	Package(s)
NE5532/4	1, 2	6	40	8	10	2	5	1500	70	3.5	–	SOIC-8
MC33077	2	5	36	2.25	37	1	2	1000	85	4.4	–	SOIC-8
LM833	2	5	36	4	15	5	2	1000	80	4.5	–	SOIC-8
MC33078/9	2, 4	10	36	2.5	16	2	2	750	80	4.5	–	SOIC-8, SOIC-14
MC33178/9	2, 4	4	36	0.7	5	3	2	500	80	7.5	–	SOIC-8, MSOP-8, TSSOP-14, SOIC-14
NCS20166*	1	3	5.5	1.25	10	0.55	1	0.6	77	10	I/O	SC-70-5
LMV821/4	1, 4	2.7	5.5	0.4	5.6	3.5	1	245	72	11	Out	SC-70-5, TSSOP-14, SOIC-14
MC33272A/4A	2, 4	3	36	1.375	24	1	2	650	80	18	–	SOIC-8, TSSOP-14, SOIC-14
NCS20061/2/4	1, 2, 4	1.8	5.5	0.2	3	3.5	1	0.3	55	20	I/O	SC-70-5, SOT-23-5, MSOP-8, TSSOP-8, SOIC-8, SOIC-14
NCS2003/32/34	1,2,4	1.7	5.5	0.375	5	4	2	1	70	20	Out	SOT-23-5, SOT-553, MSOP-8, TSSOP-8, SOIC-8, SOIC-14
NCS21911	1	4	36	0.57	2	0.025	0.02	0.5	130	22	Out	SOT-23-5
NCS20071/2/4	1, 2, 4	2.7	36	0.54	3	3.5	2	0.2	110	30	Out	SOT-23-5, SOT-553, MSOP-8, TSSOP-8, SOIC-8, TSSOP-14, SOIC-14

* Pending 2Q20.

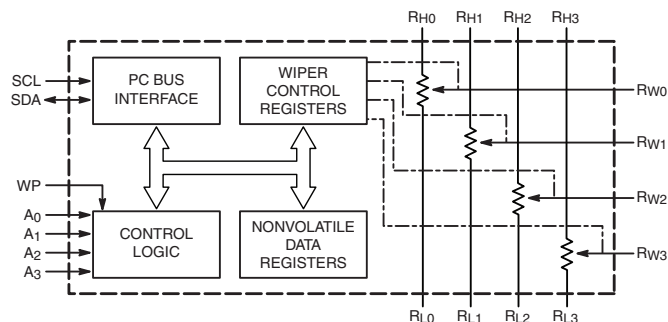
Current Sense Amplifiers

Device	Gain (V/V)	Gain Error Max (%)	V _S Min (V)	V _S Max (V)	V _{CM} (V)	I _Q Typ (mA)	Bandwidth Typ (-3dB)	V _{OS} Max (mV)	V _{OS} Drift Max (μV/°C)	CMRR Typ (dB)	Package(s)
NCS199A1R/2R/3R	50/100/200	±1.5	2.2	26	-0.3 to 26	0.04	0.09	0.15	0.5	120	SC-88-6/SC-70-6/SOT-363-6
NCS210R/1R/3R/4R	50/100/200/500	±1	2.2	26	-0.3 to 26	0.04	0.04	±0.035	0.5	125	SC-88-6/SC-70-6/SOT-363-6, UQFN-10

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	Package(s)
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
N57M5114	1	32			UP/DOWN		✓	SOIC-8, MSOP-8, TDFN-8, TSSOP-8
N57L5125	1	32			UP/DOWN	✓		SOIC-8, MSOP-8, TDFN-8, TSSOP-8
N57M5127	1	32			UP/DOWN		✓	SOIC-8, MSOP-8, TDFN-8, TSSOP-8
N57L5128	1	32			UP/DOWN	✓		SOT-23-8
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 ² C		✓	MSOP-10
CAT5133	1	128	10, 50, 100		UP/DOWN		✓	MSOP-10
CAT5137	1	128	50		I ² C		✓	SC-88-6, SC-70-6
CAT5138	1	128	10		I ² C		✓	SC-88-6, SC-70-6
CAT5140	1	256	50, 100		I ² C		✓	MSOP-8
CAT5171	1	256	50, 100		I ² C		✓	SOT-23-8
CAT5172	1	256	50		SPI		✓	SOT-23-8
CAT5221	2	64	2.5, 10, 50, 100		I ² 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 ² C		✓	SOIC-24, TSSOP-24
CAT5261	2	256	50, 100		SPI		✓	SOIC-24, TSSOP-24
CAT5269	2	256	50, 100		I ² C		✓	SOIC-24, TSSOP-24
CAT5271	2	256	50, 100		I ² C		✓	MSOP-10
CAT5273	2	256	50		I ² C		✓	MSOP-10
CAT5241	4	64	2.5, 10, 50, 100		I ² 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 ² C		✓	SOIC-24, TSSOP-24
CAT5251	4	256	50, 100		SPI		✓	SOIC-24, TSSOP-24
CAT5259	4	256	50, 100		I ² C		✓	SOIC-24, TSSOP-24

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	Package(s)
		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	Vcc		tpd (nS)	Iout (mA)	Input Logic Level	Package(s)
			Min (V)	Max (V)				
HC	1	MC74HC1G/NC7S	2	6	6.5 @ VCC = 5 V	±5.2 @ VCC = 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 @ VCC = 5 V	±2 @ VCC = 6 V	TTL	
VHC	1	MC74VHC1G/NLU1G/NL17SH	1.65	5.5	3.8 @ VCC = 4.5 V	±8 @ VCC = 4.5 V	CMOS	
	2	NLU2G						
	3	NLU3G						
VHCT	1	MC74VHCT1G/NLU1GT/NL17SHT	4.5	5.5	3.6 @ VCC = 4.5 V	±8 @ VCC = 4.5 V	TTL	
	2	NLU2GT						
	3	NLU3GT						
LCX	1	NL17SZ/NC7SZ/NLX1G	1.65	5.5	2.4 @ VCC = 3 V	±24 @ VCC = 3 V	CMOS	
	2	NC27WZ/NC7WZ/NLX2G						
	3	NL37WZ/NC7NZ/NLX3G						
VCX	1	NL17SV/NC7SV	0.9	3.6	1.0 @ VCC = 3 V	±24 @ VCC = 3 V	LVTTL	
SG	1	NL17SGxx	0.9	3.6	2.2 @ VCC = 3 V	±8 @ VCC = 3 V	LVTTL	
SP	1	NC7SP	0.9	3.6	3.0 @ VCC = 3 V	±2.6 @ VCC = 3 V	LVTTL	
	2	NC7WP						
	3	NC7NP						
AUP	1	74AUP1G	0.8	3.6	2.9 @ VCC = 3 V	±4 @ VCC = 3 V	Schmitt	
	1	74AUP1T	2.3	3.6	3.3 @ VCC = 3 V	±4 @ VCC = 3 V	Schmitt	

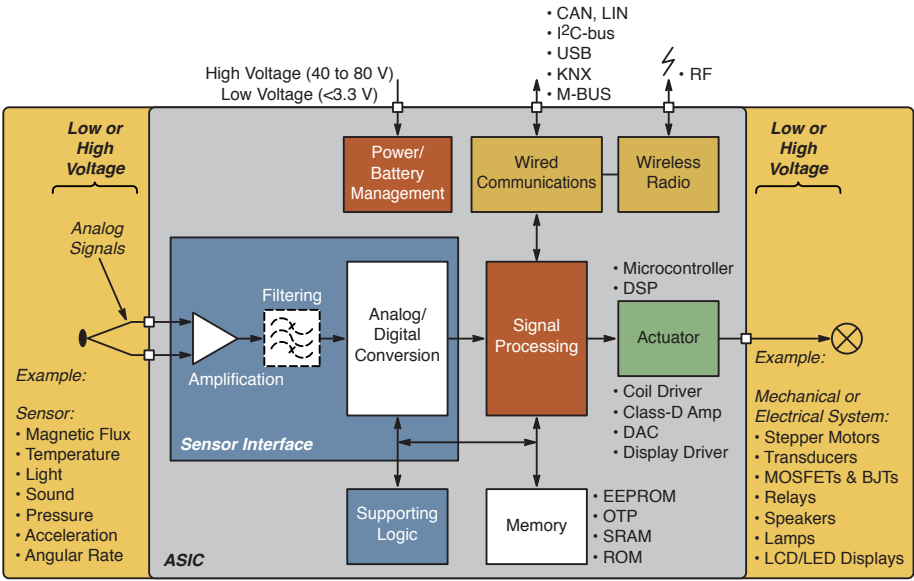
Mixed-Signal ASIC Development Services

Value Proposition

- Experienced resources and assets to bring customers’ design objectives successfully to market
- Ability to integrate customers’ IP into single-chip solution, thereby protecting the IP
- Flexible cost models to reduce customers’ total cost

Design Engineering

- Approximately 200 expert mixed-signal designers with extensive SoC and SiP experience
- Robust custom development process
- Dedicated project managers track & report development progress
- Flexible customer development engagement, from full turnkey to subcontractor production services
- Design expertise in:
 - » Sensor interface
 - » Wireless systems
 - » Energy management
 - » Building & home control



IP & Fab Processes

- ≥55 nm, analog-focused CMOS/BCDMOS process technologies utilizing internal fabs and external foundry partners
- Low, medium, high voltages – ≤1 V to 90 V
- Low current optimization – active & standby
- Low noise design – “count the electrons”
- High temperature – ≤200°C (profile, for selected technologies)
- Integrated low power wireless
- Non-Volatile Memory (EEPROM, OTP), RAM & ROM
- Embedded digital IP
- Robust ESD protection
- Extensive building block ‘starting points’ consisting of amplifiers, references, DACs, ADCs, linear & switching regulators, power management, etc.

Category	Mixed Signal Intellectual Property (IP)
Serial Interfaces	USB 3.0/2.0/1.1, HDMI, MIPI, I2C, SPI, CAN, UART
Microprocessors	Arm, RCore DSP, R8051, AMBA/AHB/APB Peripherals
Memory	SRAM, DPRAM, ROM, EEPROM, OTP, FLASH
Clocking	Oscillators, PLLs, DLLs
Communication	Wireless (Proprietary & Standards), Wired (KNX, PLC and others)
Encryption	ECC, AES, 3-DES, DES, RSA
Data Converters	DAC, ADC (8 - 20 bits, 1 KSPS - 120 MSPS)
Wireless IP	PGA, LNA, PLLs, Correlators, DSP
Power Management	Efficient Switching Regulators, LDOs, Charge Pumps, Thermal Protection
References	Precision Bandgaps, Current References, Temperature Sensors
Analog and High Voltage Interfaces	High-Voltage Drivers, Display and LCD Drivers, Class D Amplifiers
Signal Conditioning	PGA, Instrumentation Amps, Digital and Analog Filters

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