ON Semiconductor®

Farnell®
AN AVNET COMPANY

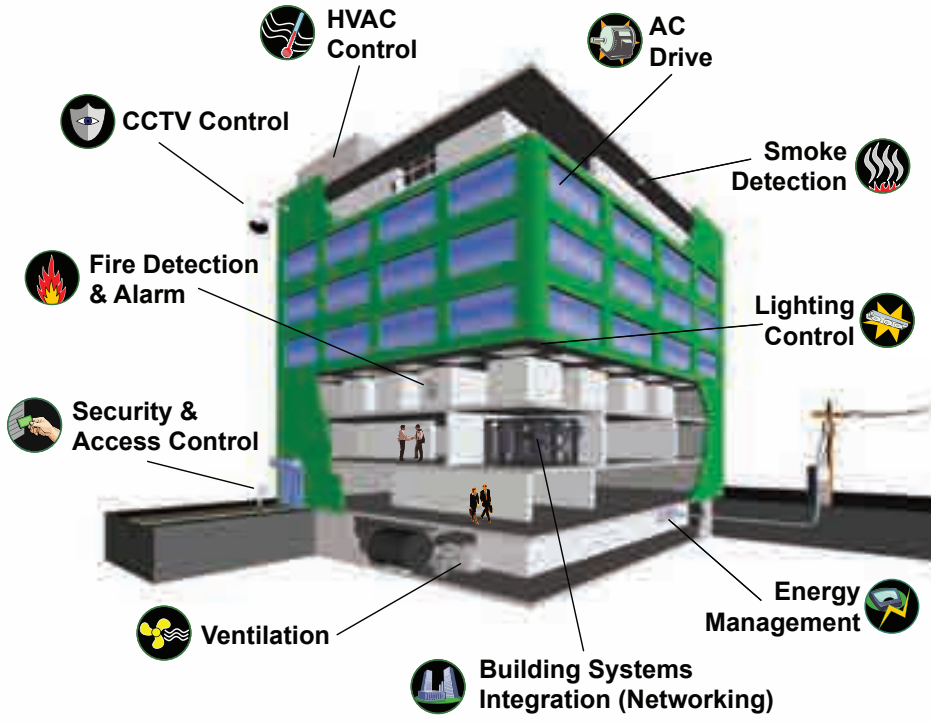
TRANSFORM YOUR THINKING

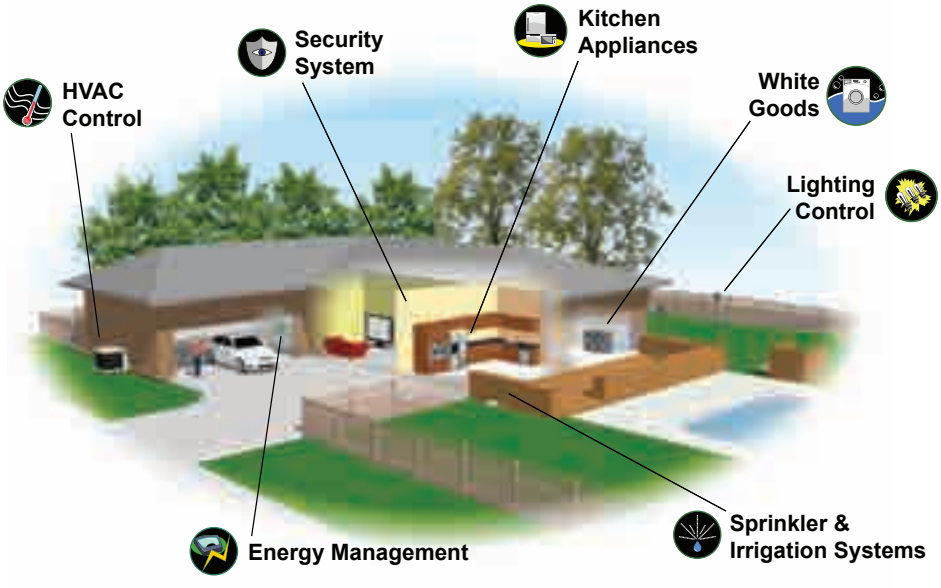
Enabling Industry 4.0 through intelligent power & sensing solutions from ON Semiconductor

Industrial Solutions

ON Semiconductor has a complete portfolio of rugged, reliable products that meet the needs of industrial grade applications.

- Power Management
- Temperature Monitoring & Control
- Motion & Speed Control
- Electro-Mechanical Break Control
- Switching & Valve Control
- Communications & Connectivity
- Sensing & Sensor Interface
- Electrical Protection
- Oscillator Startup
- Capacitance Discharge

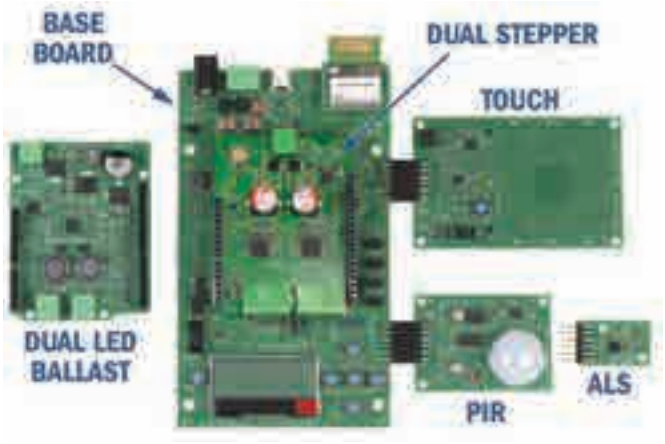




IoT Development Kit

Features

- Comprehensive portfolio of sensors, connectivity and actuator devices
- Individual API for each and every device
- Complex C++ Code examples adapted to multiple applications
- Eclipse based integrated development environment
- Full documentation of system hardware (schematics and layout files) and software design
- Cloud software
- Ready to use for fast turnaround from concept to production



Markets & Applications

Smart Home | Predictive Maintenance | Smart Building | Smart Lighting | Smart Cities | Asset Tracking | Personal IoT

Module Capabilities

Baseboard	BB-GEVK
Wireless Connectivity: SIGFOX™ EU	EU-SIGFOX-GEVB
Wireless Connectivity: SIGFOX™ US	US-SIGFOX-GEVB
Wired Connectivity: Power over Ethernet	POE-GEVB
Wired Connectivity: CAN	CAN-GEVB
Wireless Connectivity: Bluetooth® Low Energy	BLE-IOT-GEVB

Sensor: PIR motion	PIR-GEVB
Sensor: Ambient light	ALS-GEVB
Sensor: Multi Sensor (ALS, IMU, ENV)	MULTI-SENSE-GEVB
Sensor: Touch/proximity/level	TS-GEVB
Sensor: Smart Passive Sensor	SPS-READER-GEVK
Actuator: Dual stepper motor	D-STPR-GEVK
Actuator: Dual LED + ballast	D-LED-B-GEVK
Actuator: BLDC motor control + power stage	BLDC-GEVB

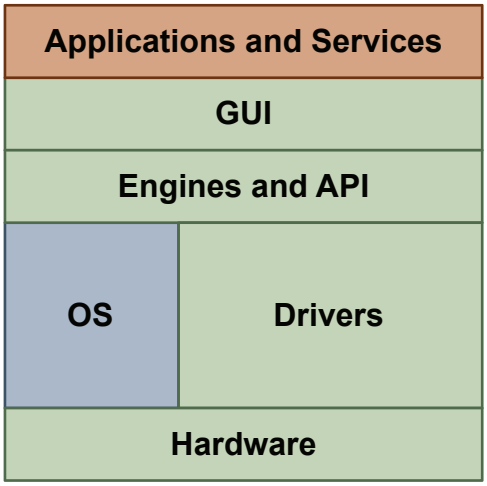
IoT Development Kit

Software

Development Environment (IDE)	**Eclipse + CDT + GNU Arm® for Eclipse**
Supported Operating Systems	**Windows®**
Baseboard Processor	**Arm Cortex®-M3**
Shield Boards	**Connectivity, Sensors, Actuators**
Operating System / RTOS	**Arm Mbed™**
Toolchain	**GNU tools for Arm**
Debugger	**gdb**
Libraries	**Mbed, ON Semiconductor shield board libraries**
IoT/Cloud Platform Support	**Carriots, IBM Bluemix and compatible with most commercial cloud platforms**
IoT Protocols	**REST, MQTT, HTTP**
Connectivity Protocols	**SIGFOX, Thread, Bluetooth 5, PoE, Wi-Fi®, CAN, Zigbee®**

APIs and Examples

- 21 Application Programming Interfaces (API)
- 28 simple application examples
- 12 complex application examples



For videos, tools, and more information visit

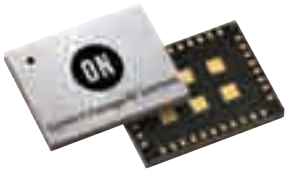
www.onsemi.com/idk

Comprehensive Sigfox™ Solutions

sigfox

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; AT version is fully CE certified out of the box
- Rich partner network of pre-certified modules



Device	AT	API	Sigfox Region	Frequency (MHz)	GPIO	Package
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®, Thread™, 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	EnOcean®, KNX®, M-Bus, 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	-133 @ 0.2 kbps	QFN-28
AX5243	EnOcean, KNX, M-Bus, 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	-135 @ 0.1 kbps	QFN-20
AX5051	EnOcean, ZigBee, KNX, M-Bus, 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	EnOcean, ZigBee, KNX, M-Bus, 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	EnOcean, KNX, M-Bus, Proprietary	400 - 700 800 - 940	1 – 600	Configurable	64	8	21	QFN-40
AX8052F143	EnOcean, KNX, M-Bus, Proprietary	27 - 1050	0.1 - 125	Configurable	64	8	19	QFN-40
AX8052F151	EnOcean, KNX, M-Bus, Proprietary	400 - 700 800 - 940	1 – 600	Configurable	64	8	21	QFN-40
AXM0F243	EnOcean, KNX, M-Bus, Proprietary	27 - 1050	1 – 600	Configurable	64	8	20	QFN-40
NCS36510	ZigBee, Thread, Proprietary	2400	250	Configurable	640	48	18	QFN-40

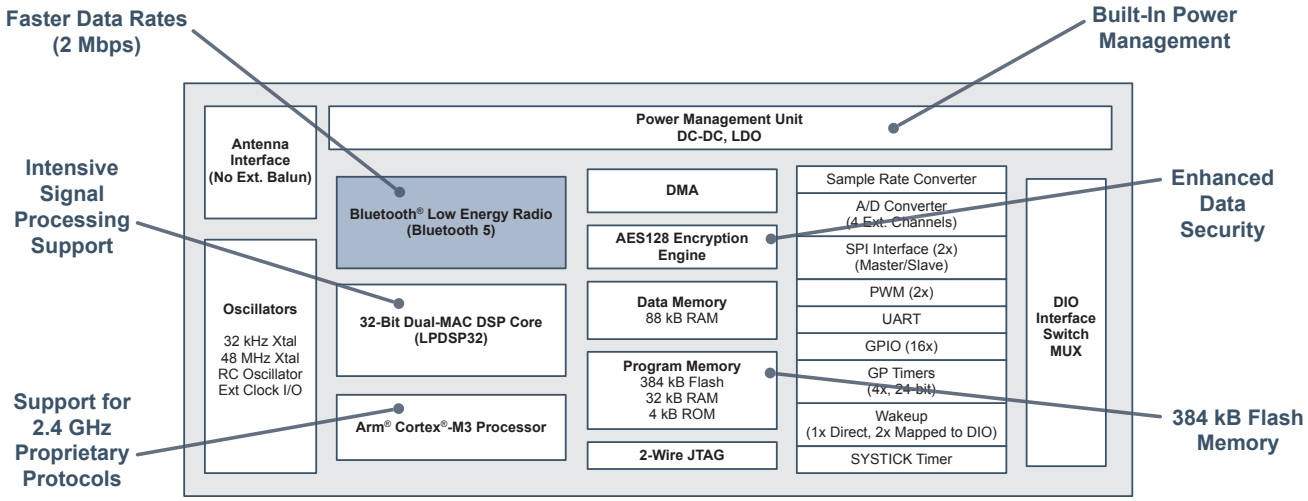
RSL10 Bluetooth® Low Energy Technology Radio SoCs

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.

Key Features

- Industry's lowest power (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, System-in-Package



Development Tools

Software Development Kit (SDK)

- Eclipse-based software with a C Development Toolkit (CDT)
- GNU toolchain for programming the Arm Cortex-M3 processor
- Bluetooth low energy protocols, precompiled sample code and libraries, technical documentation

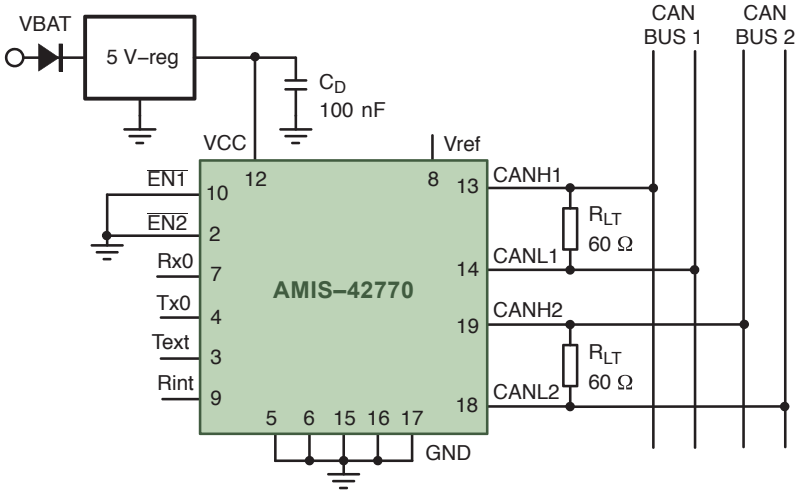
RSL10 Development Board

- 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

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
AMIS42770	Dual	High-Speed CAN Repeater	SOIC-20
AMIS42670	Single	High-Speed CAN Transceiver for Long Networks	SOIC-8

KNX Transceivers

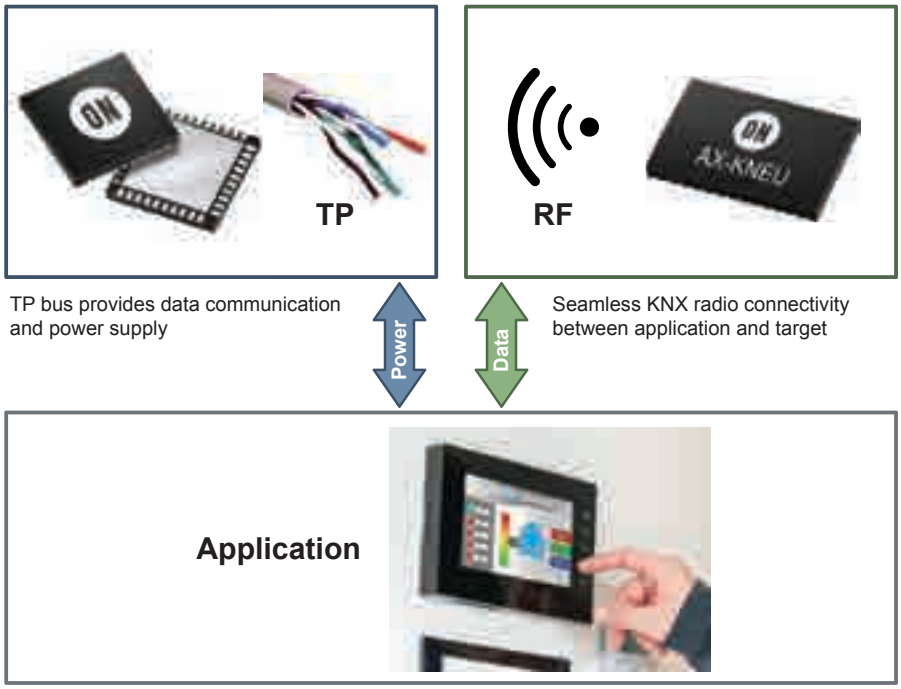
KNX is a standardized (EN 50090, ISO/IEC 14543), OSI-based network communications protocol for intelligent buildings. KNX is the successor to, and convergence of, three previous standards: the European Home Systems Protocol (EHS), BatiBUS, and the European Installation Bus (EIB or Instabus).

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



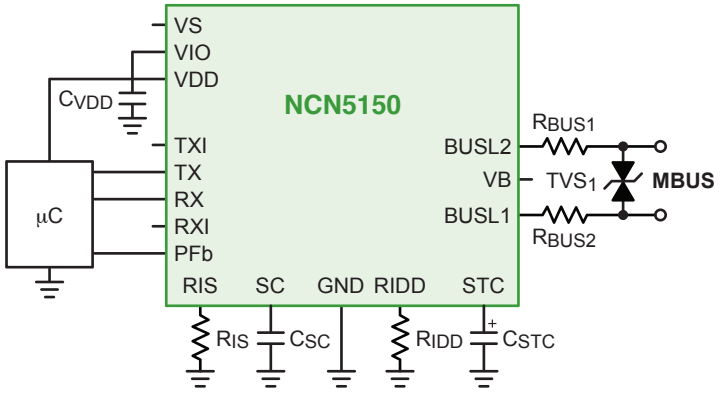
RF	AX8052F143
Multi/Ready	✔
High Sensitivity	✔
Ultra Low Receive and Standby Current	✔
PHY + MAC	✔

Twisted Pair	NCN5120	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 µA/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

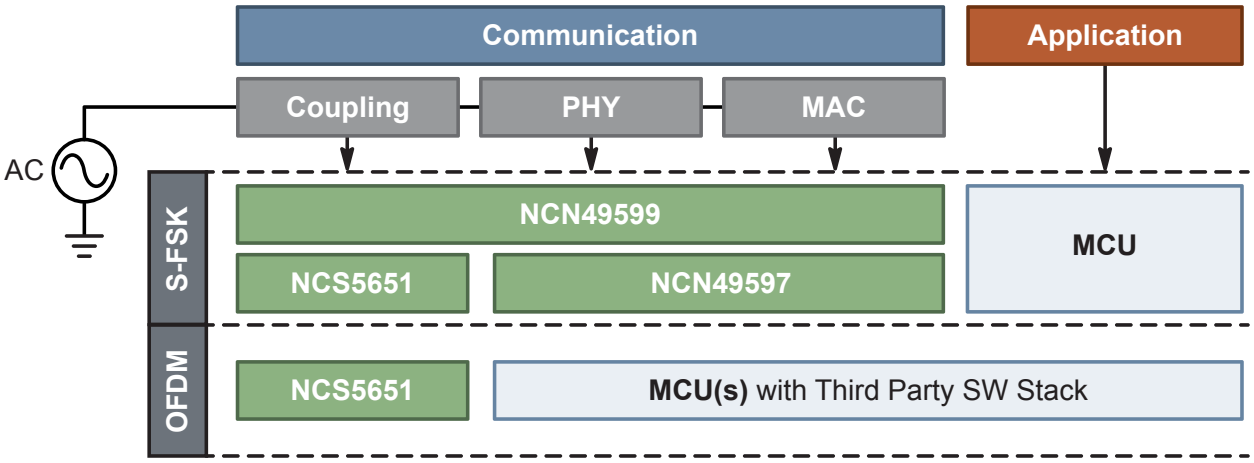
M-Bus Transceivers

Device	Frequency (MHz)	Data Rate (kbps)	Voltage Supply (V)	Power Consumption	TX Power (dBm)	RX Sensitivity (dBm)	Package
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

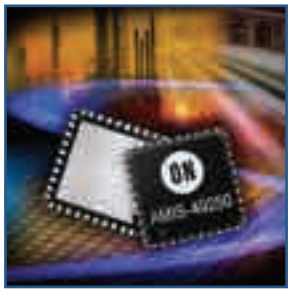
Device	Protocol Supported	Frequency (MHz)	Data Rate (kbps)	Peripheral Interface	Flash (kB)	RAM (kB)	GPIO	Package
AX8052F143	EnOcean, KNX, M-Bus, Proprietary	27-1050	0.1 - 125	AT command via UART	64	8	19	QFN-40

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 Iout = 1.5 A	QFN-20 EP

Modems



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

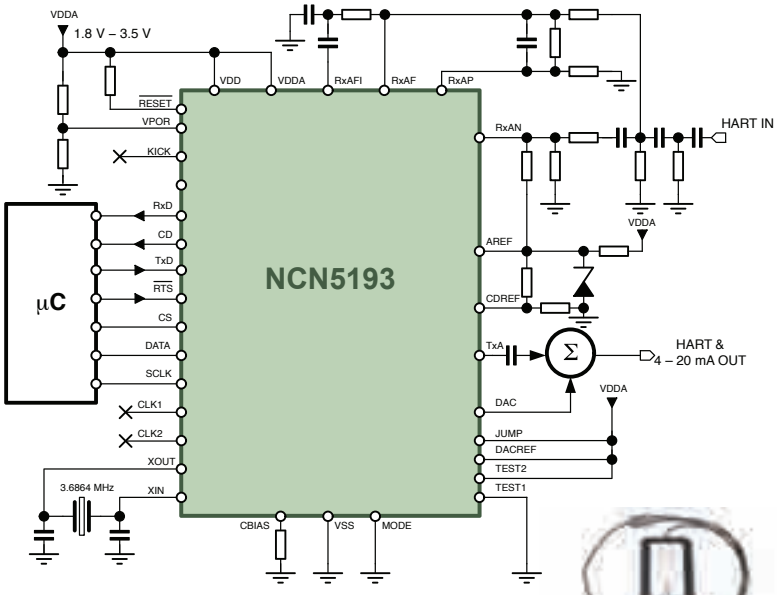
- Compatible to both FOUNDATION Fieldbus H1 (Type 111 and Type 112 per FF-816) and PROFIBUS PA standards
- Enables Fieldbus to completely power field devices using the integrated power supply block
- Data rate: 31.25 kbps voltage mode
- Low current consumption 500 μA typ
- LQFP-44 and NQFP-44 packages

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
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



HART® COMMUNICATION PROTOCOL

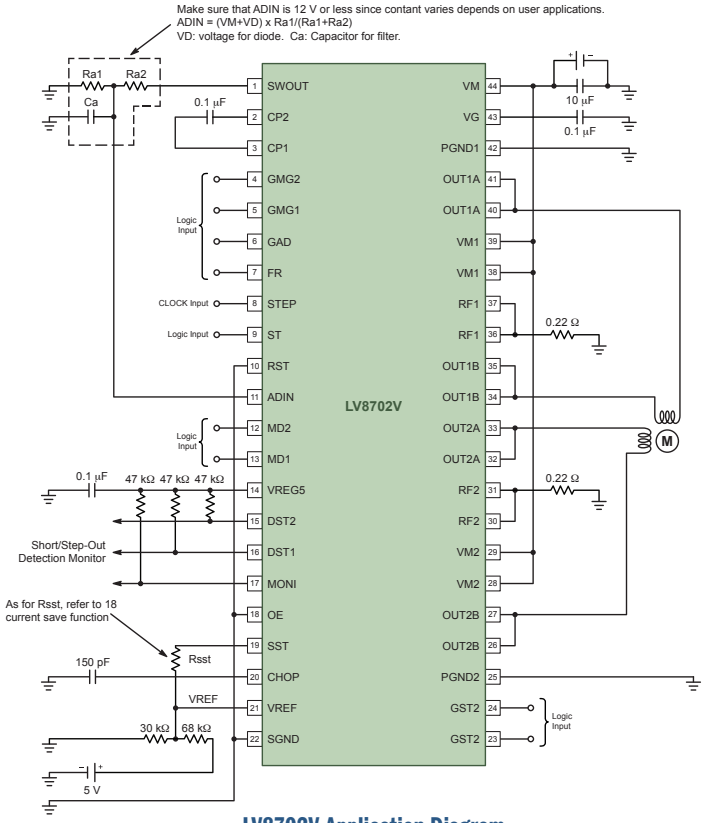
Stepper Motor Drivers for Motion Control

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
- IO max=2.5 A
- Built-in thermal shut down circuit

Applications

- Printer
- Surveillance camera (CCTV)
- Scanner
- Textile machine



LV8702V Application Diagram

Device	Type	V_M Max (V)	V_{CC} Max (V)	I_O Max (A)	I_O Peak Max (A)	Max Step Resolution	Control Type	Features	Package
AMIS-30422	Stepper	30	40	Note 1	Note 1	1/128	Clock	Note 3, 4, 5	NQFP-48
AMIS-30543	Stepper	30	40	3.2	6	1/128	Clock	Note 3, 4, 5	NQFP-32
AMIS-30624	Stepper	30	40	0.8	0.8	1/128	I2C	Note 3, 4, 5	NQFP-32, SOIC-20W
LC898240	Stepper Controller	Note 7	Note 7	–	–	1/16	Clock; SPI	Note 7	SQFP-48
LV8417CS	Brush DC	10.5	5.5	–	3.8	–	Parallel	Note 3	WLP-9
LV8548MC	Stepper/2x Brush DC	16	16	–	1	1/2	Parallel	Note 3	SOIC-10NB
LV8549MC	Stepper	16	16	–	1	1	Parallel	Note 3	SOIC-10NB
LV8702V	Stepper	36	Note2	2.5	3	1/4	Clock	Note 3, 5, OCP	SSOP-44J
LV8711T	Stepper / 2xBrush DC	18	6	0.8	1	1/2	Parallel	Note 3, OCP	TSSOP-24
LV8713T	Stepper	18	6	0.8	1	1/32	Clock	Note 3	TSSOP-24
LV8714TA	2xStepper / 4xBrush DC	18	6	1.5	1.75	Over 1/256	Parallel	Note 3, 6, OCP	TQFP-48EP
LV8729V	Stepper	36	Note 2	1.8	2.5	1/128	Clock	Note 3, OCP	SSOP-44K
LV8731V	Stepper/2x Brush DC	36	Note 2	2	2.5	1/16	Clock; Parallel	Note 3, OCP	SSOP-44K
LV8734V	Stepper / 2xBrush DC	36	Note 2	1.5	1.75	1/8	Clock; Parallel	Note 3, OCP	SSOP-44K
LV8736V	Stepper / 2xBrush DC	36	Note 2	1	1.5	1/8	Clock; Parallel	Note 3, OCP	SSOP-44K
LV8740V	Stepper / 2xBrush DC	38	Note 2	2.5	3	1/4	Clock; Parallel	Note 3, OCP	SSOP-44J
LV8760T	Brush DC	38	6	3	4	–	Parallel	Note 3, OCP	TSSOP-20J

NOTE 1: Function of external MOSFETs
NOTE 2: Single power supply (only VM pin)
NOTE 3: Integrated active flyback, under-voltage, over temperature
NOTE 4: Integrated under temperature, safe position upon loss of communication
NOTE 5: Integrated BEMF output for stall or step loss detection
NOTE 6: Integrated constant-current control without high power resistor
NOTE 7: Current controller for a stepper IC / A_{VDD} Max = D_{VDD1} Max = 4.6 V, D_{VDD2} Max = 6.0 V

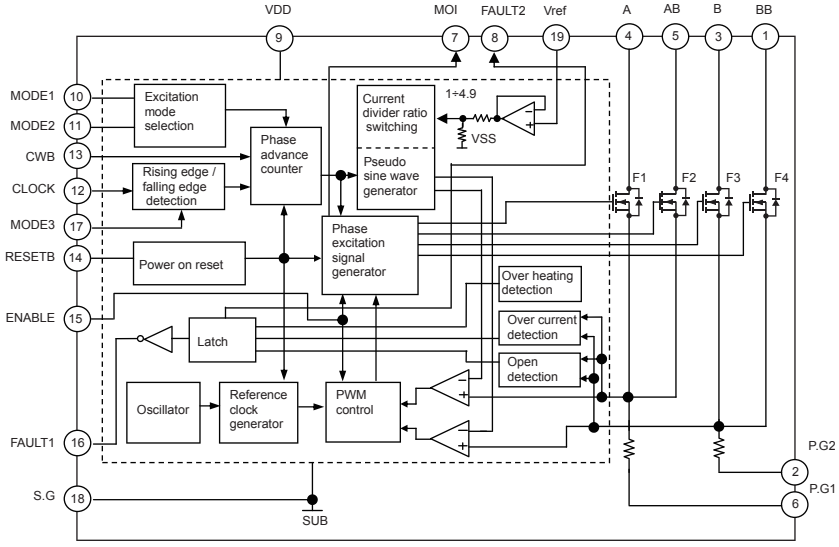
Stepper Motor Drivers for Motion Control

Key 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

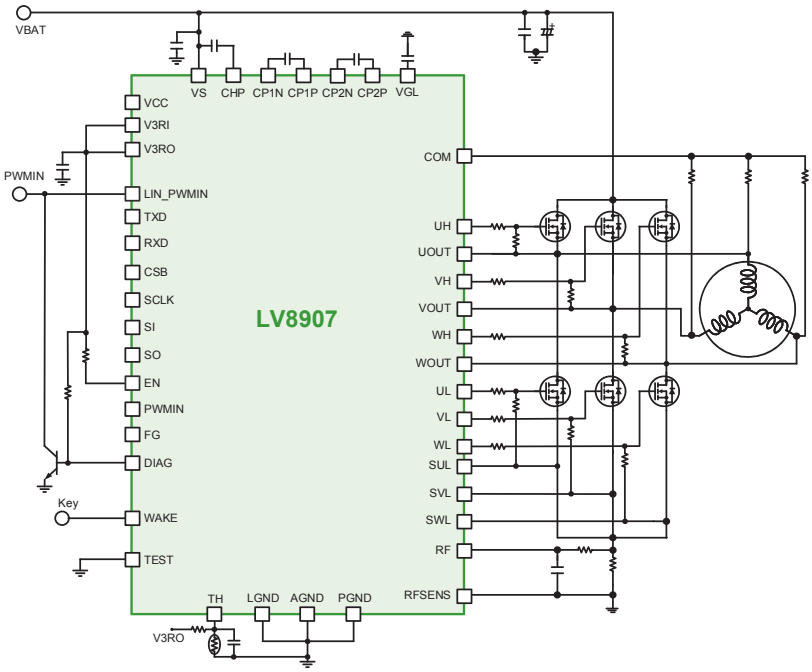
CONTROL & DRIVE

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
									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
- V_{IN} of 5.5 – 20 V
- SQFP-48 package



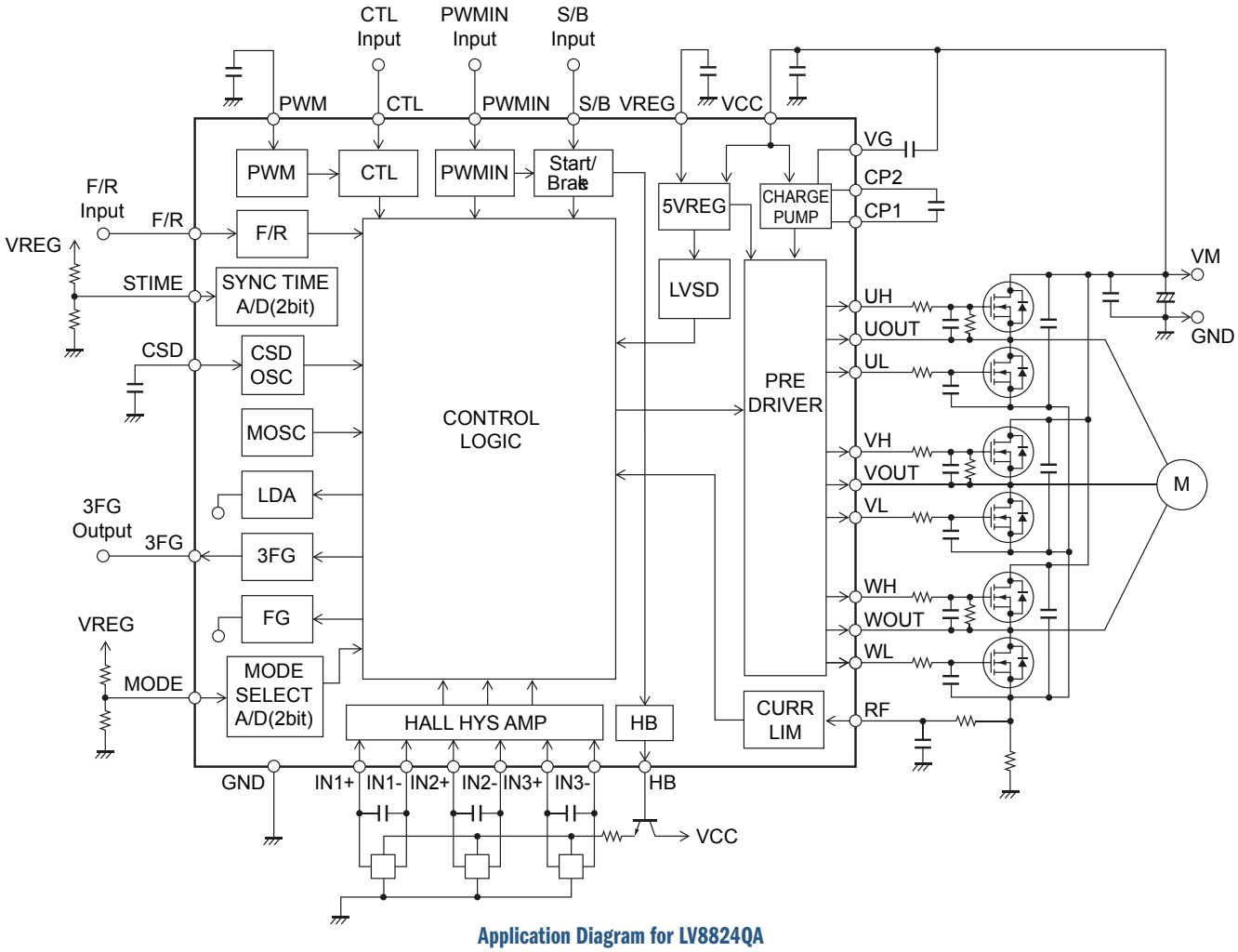
Standalone Configuration Application Diagram

Device	Description	V_{CC} Max (V)	V_M Max (V)	P_O Max (W)	I_O Max (mA)	Communication Sensor	Package
LB11696V	Brushless DC 3-Phase Motor Controller	17	–	–	30	120-deg/3-Hall	SSOP-30
LB8503V	Speed Controller	6.5	17	–	–	–	SSOP-16
LV8121V	Brushless DC 3-Phase Motor Driver	35	35	1.7	3,500	120-deg/3-Hall	SSOP-44
LV8139JA	Brushless DC 3-Phase Motor Controller	16.5	–	–	30	180-deg/3-Hall	SSOP-30
LV8805SV	Brushless DC 3-Phase Motor Driver	15	–	0.3 - 0.95	1,200	120-deg/Hall Sensorless	SSOP-20
LV8806QA	Brushless DC 3-Phase Motor Driver	6	6	0.8	700	120-deg/Hall Sensorless	QFN-16
LV8811G/13G	Brushless DC 3-Phase Motor Driver	16	16	2.5	2,000	180-deg/1-Hall	TSSOP-20
LV8814J	Brushless DC 3-Phase Motor Driver	16	16	1.31	2,000	180-deg/1-Hall	SSOP-20
LV8824QA	Brushless DC 3-Phase Motor Pre-driver	33	–	1.45	50	120-deg/3-Hall	VQFN-32
LV8827LFQA	Brushless DC 3-Phase Motor Driver	35	35	1.35	1,500	120-deg/3-Hall	VQFN-24
LV8907UW	Brushless DC 3-Phase Motor Pre-driver	–	20	–	50	150-deg/Hall Sensorless	SQFP-48
LV88551JA	Brushless DC 1-Phase Motor Pre-driver	16	16	–	50	1-Hall	SSOP-20J
LV88561JA	Brushless DC 1-Phase Motor Pre-driver	16	–	–	50	1-Hall	SSOP-20J

Brushless DC Motor Control

LV8824QA Features

- Speed control and synchronous rectification using direct PWM input and DC voltage
- 3-Hall FG output
- Latch type constraint protection
- Forward/reverse switching circuit, Hall bias pin
- Power save circuit
- Integrated current limit; low-voltage protection; thermal shutdown circuit
- Charge pump circuit(external N-Channel/N-Channel), 5 V regulator output
- Start/stop circuit (short brake when motor is to be stopped)



Application Diagram for LV8824QA

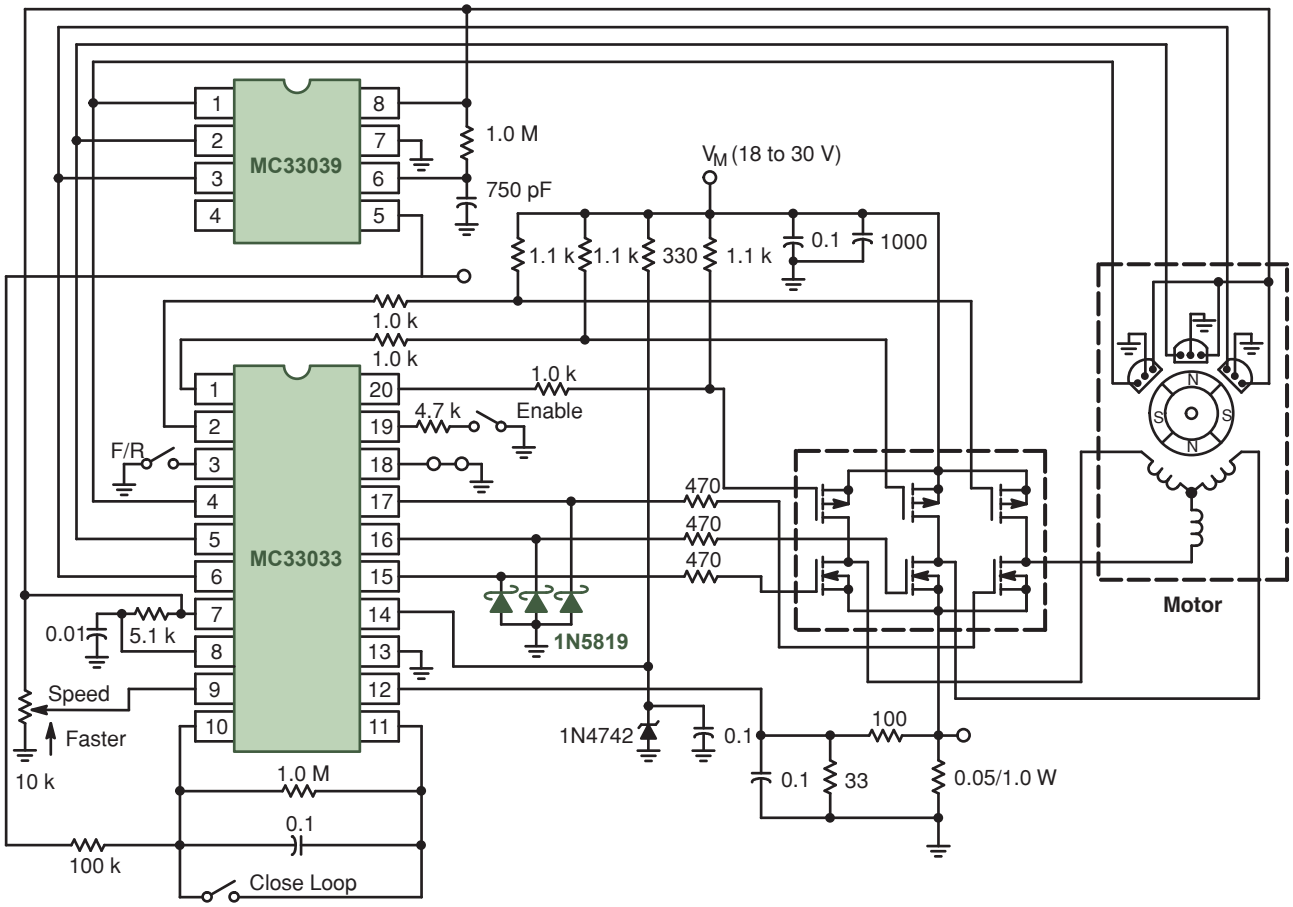
Brushless DC Motor Control

MC33033/5 Features

- Rotor position decoder for proper commutation sequencing
- Temperature compensated reference capable of supplying sensor power
- Frequency programmable sawtooth oscillator
- Three open collector top drivers
- Three high current totem pole bottom drivers

MC33039 Features

- Digital detection of each input transition for improved low speed motor operation
- Operation down to 5.5 V for direct powering from MC33035 reference
- Internal shunt regulator allows operation from a non-regulated voltage source
- Inverter output for easy conversion between 60°/300° and 120°/240° sensor phasing conventions



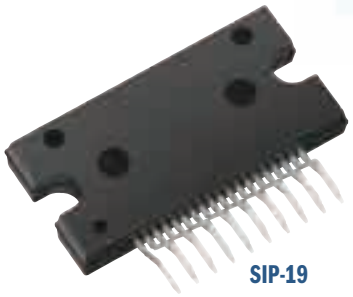
Application Diagram for MC33033 and MC33039

Brush DC Motor Control

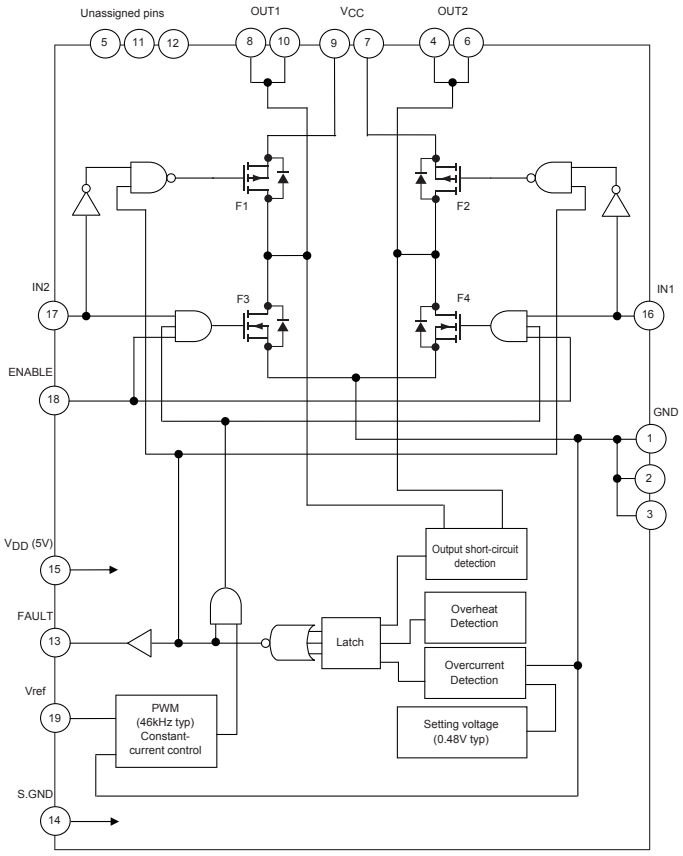
Key Features

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

SIP-19S



SIP-19



Block Diagram for STK681-332-E

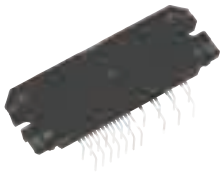
Device	Type	V_M Max (V)	V_{CC} Max (V)	I_O Max (A)	I_O Peak Max (A)	Control Type	Current Sense	Fault Detection			Package
								Overcurrent	Thermal	UVLO	
STK681-332-E	Brush DC	52	5.25	8.5	12	Parallel PWM	External Resistor	Yes	Yes	Yes	SIP-19S
STK681-360-E	Brush DC	52	5.25	5.8	8	Parallel PWM	Fully Integrated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

Intelligent Power Modules (IPM) for Inverter Designs

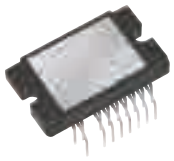
Features

- 3-phase IGBT & MOSFET inverter including controllers for gate drive
- Support wide range of power ratings
- Single grounded power supply supported
- Protection functions such as under voltage and over current
- Optimized for low EMI
- High noise immunity
- High short-circuit and latch ruggedness
- Low thermal resistance
- DIP and SIP solutions

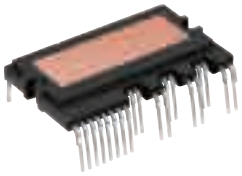
SPM-34 Package



SIP-1A Package

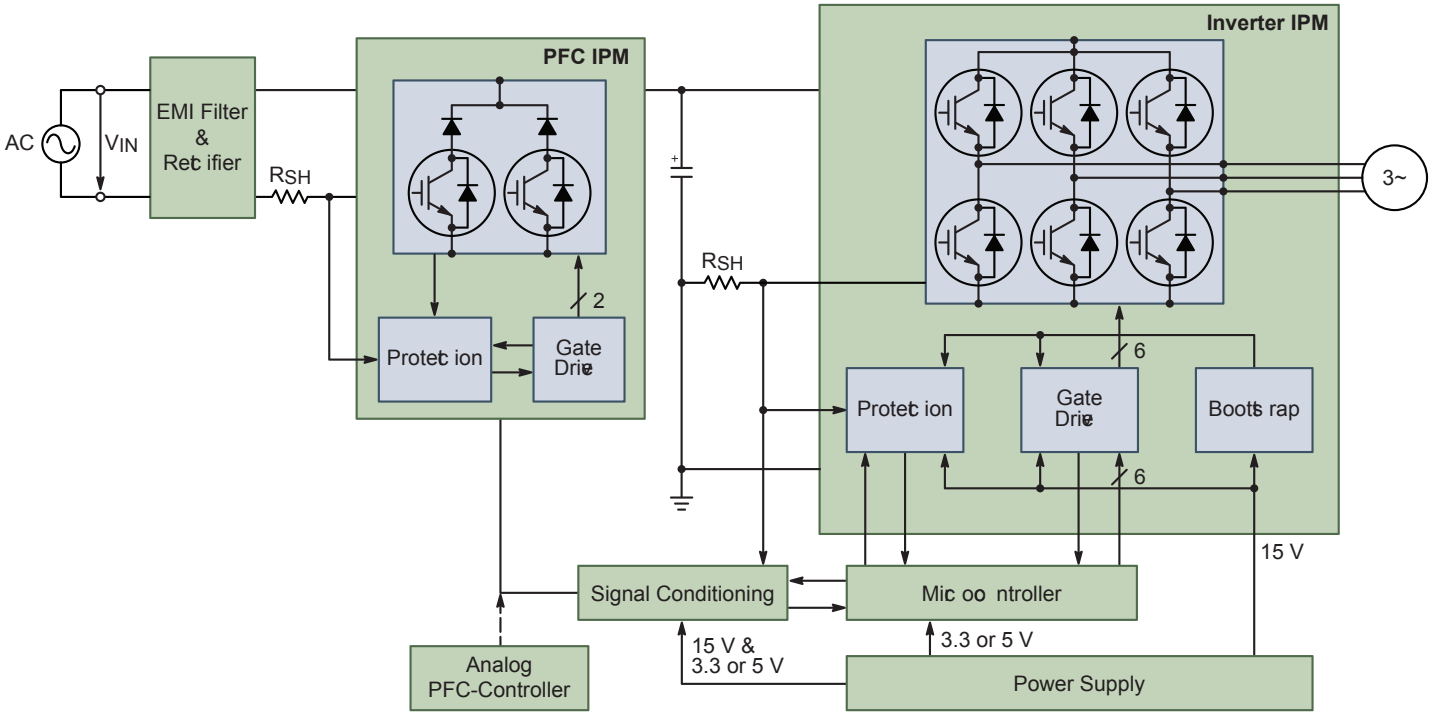


DIPS-3 Package



SPM-3V Package

SPM-2V Package



Application Block Diagram

Intelligent Power Modules (IPM) for Inverter Designs

Inverter IPMs

Device	Type	V_{CE} Max (V)	I_C Max (A)	Substrate	Package
STK554U362A/C-E	3 Emitter Pins	600	10	IMST	SIP-1A
STK554U392A/C-E	3 Emitter Pins	600	15	IMST	SIP-1A
STK5Q4U352J-E	3 Emitter Pins	600	8	DBC	DIP-S3
STK5Q4U362J-E	3 Emitter Pins	600	10	DBC	DIP-S3
FNA40560	3 Emitter Pins, fc = 5 kHz optimized	600	5	Ceramic	SPM-45H
FNB40560	3 Emitter Pins, fc < 20 kHz optimized	600	5	Ceramic	SPM-45H
FNA40860	3 Emitter Pins, fc = 5 kHz optimized	600	8	Ceramic	SPM-45H
FNA41060	3 Emitter Pins, fc = 5 kHz optimized	600	10	Ceramic	SPM-45H
FNB41060	3 Emitter Pins, fc < 20 kHz optimized	600	10	Ceramic	SPM-45H
FNA41560T	3 Emitter Pins, fc = 5 kHz optimized	600	15	Ceramic	SPM-45H
FNC42060F	3 Emitter Pins, fc = 5 kHz optimized	600	20	Ceramic	SPM-45H
FNB43060T	3 Emitter Pins, fc < 20 kHz optimized	600	30	Ceramic	SPM-45H
FSBB15CH60D	3 Emitter Pins	600	15	DBC	SPM-3V
FSBB20CH60D	3 Emitter Pins	600	20	DBC	SPM-3V
FNB33060T	3 Emitter Pins	600	30	DBC	SPM-3V
FNB34060T	3 Emitter Pins	600	40	DBC	SPM-3V
FNB35060T	3 Emitter Pins	600	50	DBC	SPM-3V
FNA23060	3 Emitter Pins	600	30	DBC	SPM-34
FNA25060	3 Emitter Pins	600	50	DBC	SPM-34
FNA27560	3 Emitter Pins	600	75	DBC	SPM-34
FSBB10CH120D/F	3 Emitter Pins	1200	10	DBC	SPM-3V
FSBB15CH120D/F	3 Emitter Pins	1200	15	DBC	SPM-3V
FSBB20CH120D/F	3 Emitter Pins	1200	20	DBC	SPM-3V
FNB21012A	3 Emitter Pins	1200	10	DBC	SPM-34
FNB22512A	3 Emitter Pins	1200	25	DBC	SPM-34
FNB23512A	3 Emitter Pins	1200	35	DBC	SPM-34

PFC IPMs

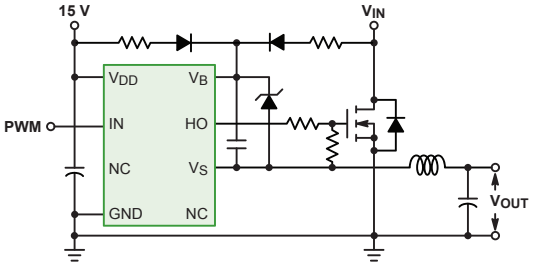
Device	Type	V_{CE} Max (V)	I_C Max (A)	Substrate	Package
FBA42060	Single Boost	600	20	Ceramic	SPM-45H
FPAB20BH60B	Single Boost	600	20	DBC	SPM-3V
FPAB30BH60B	Single Boost	600	30	DBC	SPM-3V
FPDB40PH60B	Bridgeless PFC	600	40	DBC	SPM-3V
FPDB60PH60B	Bridgeless PFC	600	60	DBC	SPM-3V
FPAM30LH60	2-phase Interleaved PFC	600	30	DBC	SPM-2V
FPAM50LH60	2-phase Interleaved PFC	600	50	DBC	SPM-2V

High Voltage Gate Drivers (HVICs)

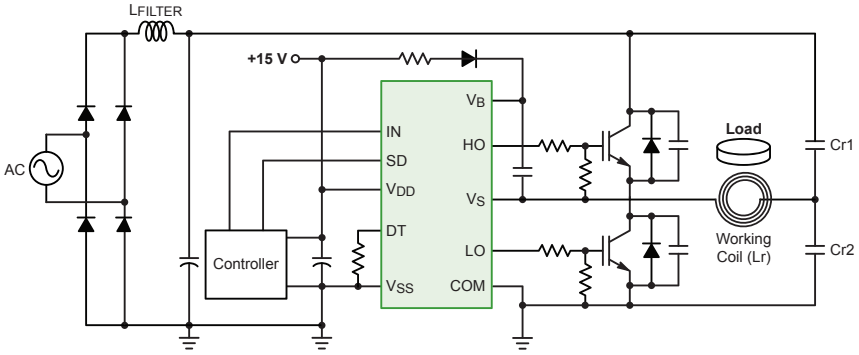
High voltage gate drivers (HVICs) from ON Semiconductor improve system reliability by utilizing an innovative common-mode dv/dt noise canceling circuit that provides excellent noise immunity. With a voltage capability up to 700 V and a very fast switching speed (dv/dt = 50 V/ns max), the devices are 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 V
- Matched propagation delay below 50 ns
- UVLO functions
- TTL compatible input threshold levels



High-Side Application Diagram



Half-Bridge Application Diagram

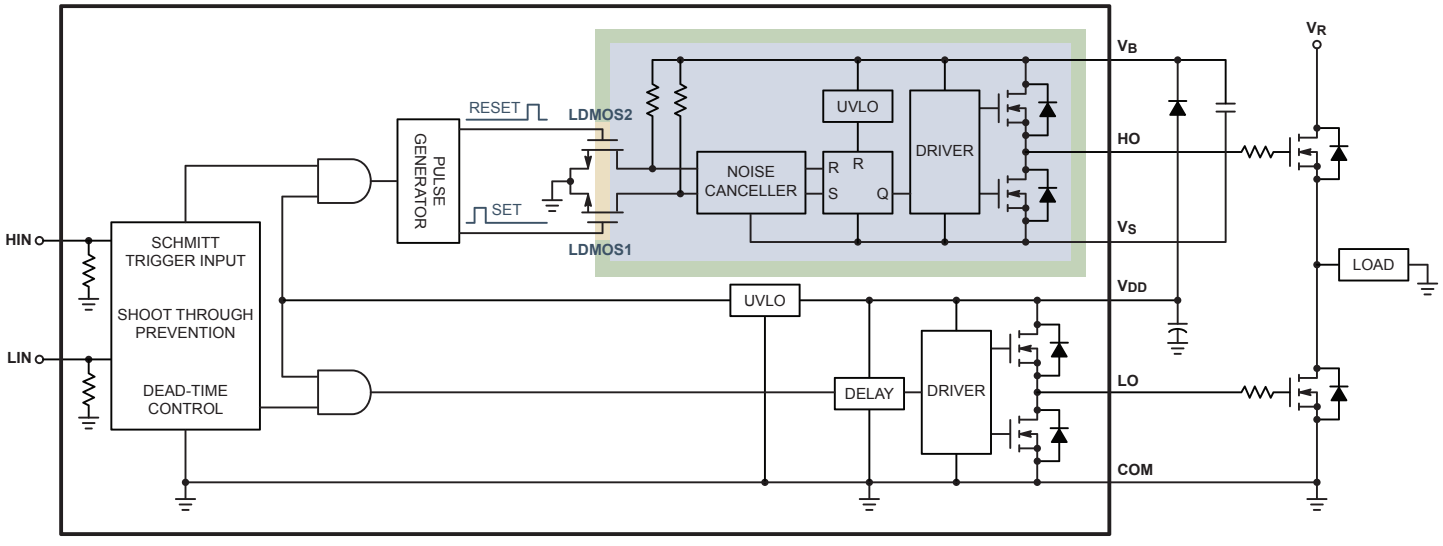
High-Side Drivers

Device	Circuit		Offset Voltage (V)	Output Current		Delay Time		Shut Down	OCP	Typical Dead Time (ns)	Package
	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
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
	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)

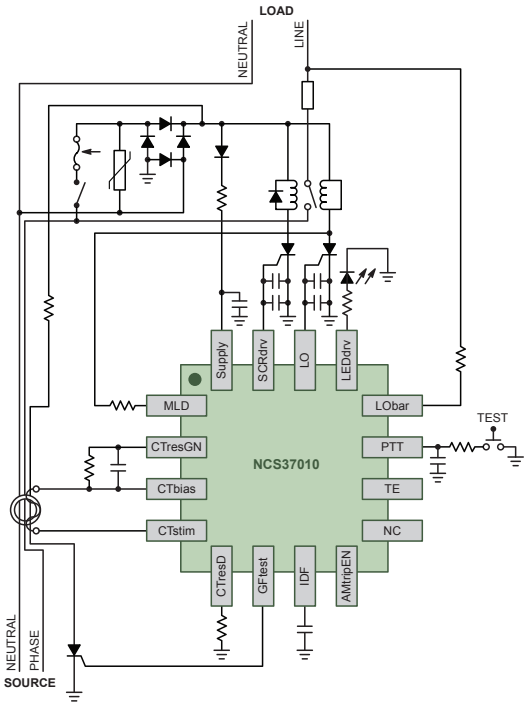
Half Bridge Drivers

Device	Circuit		Offset Voltage (V)	Output Current		Delay Time		Shut Down	OCP	Typical Dead Time (ns)	Package
	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
FAN7389	3-Phase Half-Bridge	6 to 6	600	350	650	500	500	Yes	Yes	300	SOP-28
FAN73892	3-Phase Half-Bridge	6 to 6 (inverting)	600	350	650	500	500	Yes	Yes	290	SOP-28
FAN73893	3-Phase Half-Bridge (MOSFET Target)	6 to 6 (inverting)	600	350	650	500	500	Yes	Yes	320	SOP-28
FAN73894	3-Phase Half-Bridge (IGBT Target)	6 to 6 (inverting)	600	350	650	500	500	Yes	Yes	320	SOP-28
FAN73895	3-Phase Half-Bridge (MOFET Target)	6 to 6	600	350	650	500	500	Yes	Yes	320	SOP-28
FAN73896	3-Phase Half-Bridge (IGBT Target)	6 to 6	600	350	650	500	500	Yes	Yes	320	SOP-28
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

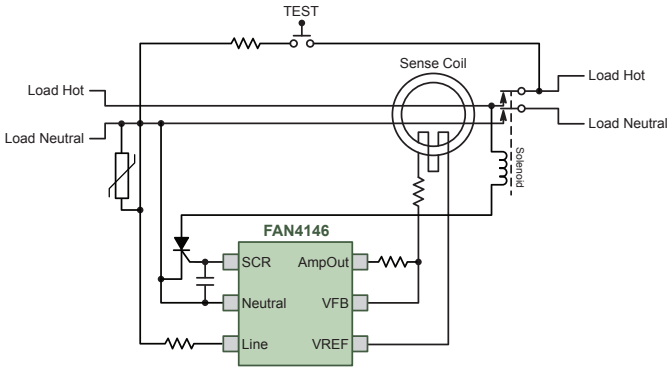
Ground Fault Circuit Interrupter (GFCI), Residual Current Device (RCD), and Earth Leakage Circuit Breaker (ELCB)

Features

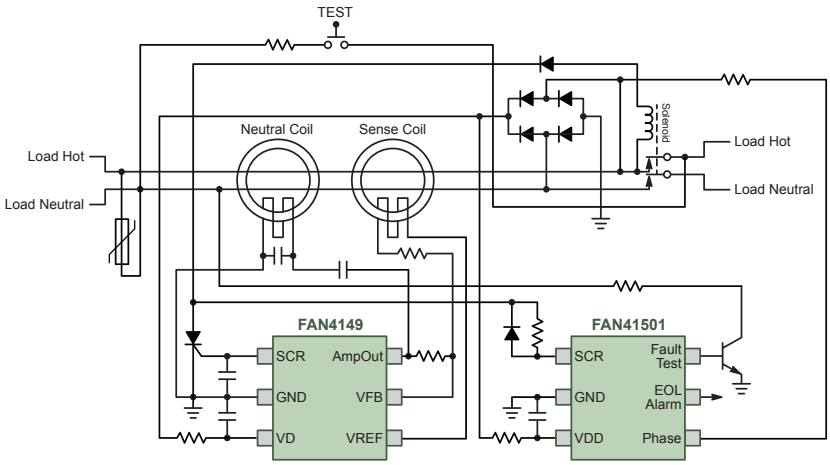
- Broad selection of GFCI controllers for industrial applications
- Proprietary solutions for impedance measurement with single coil and self-test monitoring
- Industrial grade reliability and quality
- Customized solutions available



NCS37010 Single-Coil UL943 Self-Test



FAN4146E Application

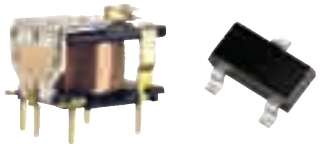


FAN419 + FAN41501 Dual-Coil UL943 Self-Test

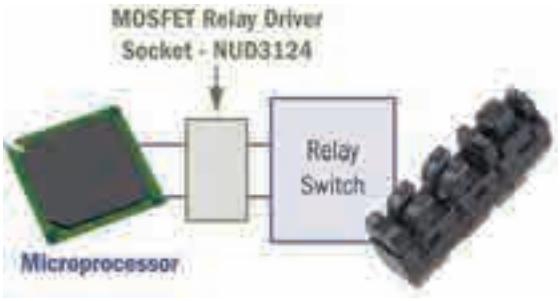
Device	Device	Differential Fault	Grounded-Neutral Fault	Device	Current Transformer	Mechanical Lockout	Electronic Lockout	T_A Max (°C)	Device	Package
NCS37010	Self Test GFCI controller	✓	✓	UL943, UL2231	Single coil		✓	–40 to +85	North America, Highly integrated solution with ST	QFN-16, TSSOP-16
FAN4149	Self Test GFCI controller	✓	✓	UL943, UL2231	Dual coil			–35 to +85	North America, FAN4149 + FAN41501 combination for ST GFCI	SOT-23-6LD
FAN41501	Self Test monitoring IC	✓	✓	UL943, UL2231	N/A			–35 to +85	North America, FAN4149 + FAN41501 combination for ST GFCI	SSOT-6
FAN4146E	ALCI/RCD/ELB controller	✓		UL943B, IEC61008/9, GB20044	Single coil			–35 to +85	Worldwide Use, Compact solution for appliances	SSOT-6
KA2803B	RCD/ELB controller	✓		IEC61008/9, GB20044	Single coil			–25 to +80	Worldwide Use, M54123 replacement	SOP-8

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

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



24 V Relay Driver Socket



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

Relay Drivers

Device	Configuration	Circuit Type *	Voltage (V)	Current (mA)	Package
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.

Low Noise Operational Amplifiers for I/O Buffering and Signal Conditioning

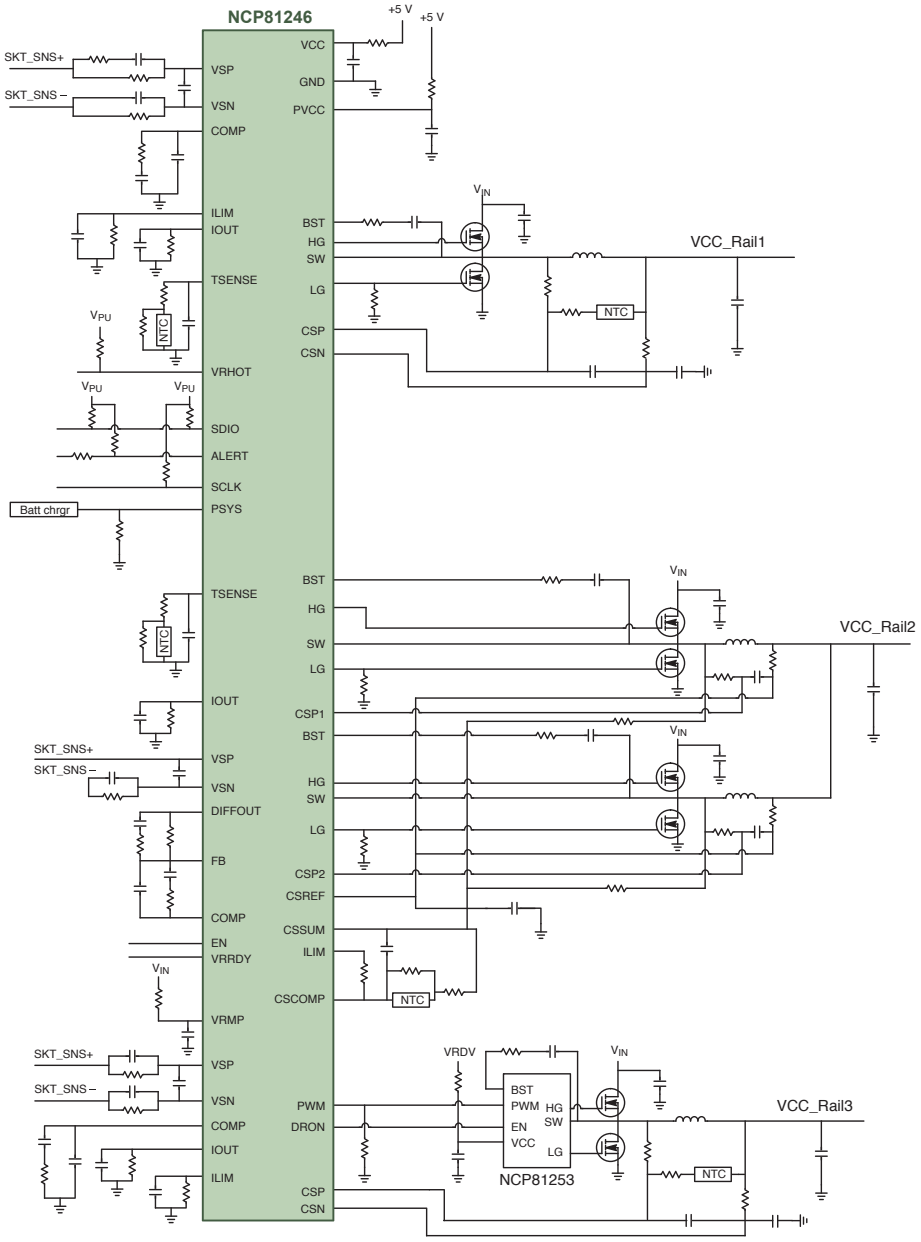
Low Noise Operational Amplifiers

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
MC33171/2/4	1, 2, 4	3	44	180	1.8	4.5	10	20	90	32	-	PDIP-8, SO-8, PDIP-14, SOIC-14, TSSOP-14
LM7301	1	1.8	32	0.6	4	6	2	65	88	30	I/O	SOT-23-5
MC33071/2/4	1, 2, 4	3	44	1.6	4.5	3	10	100	97	32	-	PDIP-8, SOIC-8, WQFN-10, PDIP-14, SOIC-14, TSSOP-14
MC33178/9	2, 4	4	36	0.4	5	3	2	100	110	7.5	-	PDIP-8, SOIC-8, Micro8, PDIP-14, SOIC-14, TSSOP-14
NCS2005	1	1.8	32	1.4	8	5	2	50	120	53	I/O	SOT-23-5
LM833	2	10	36	2	15	5	2	300	100	4.5	-	PDIP-8, SOIC-8
MC33078/9	2, 4	5	18	2.1	16	2	2	300	100	4.5	-	PDIP-8, SOIC-8, PDIP-14, SOIC-14
MC33272/4	2, 4	3	36	2.2	24	1	2	300	100	18	-	PDIP-8, SOIC-8, PDIP-14, SOIC-14, TSSOP-14
MC33077	2	2.5	18	1.75	37	1	2	280	107	4.4	-	PDIP-8, SOIC-8
NCS20074	4	2.7	36	0.41	3	3	2	0.005	111	20	Output	SOIC-14, TSSOP14
NCS325	1	1.8	5.5	0.02	0.35	0.05	0.02	0.05	110	100	I/O	SOT-23-5

IMVP8 Multiphase Controllers for Embedded Applications

Features

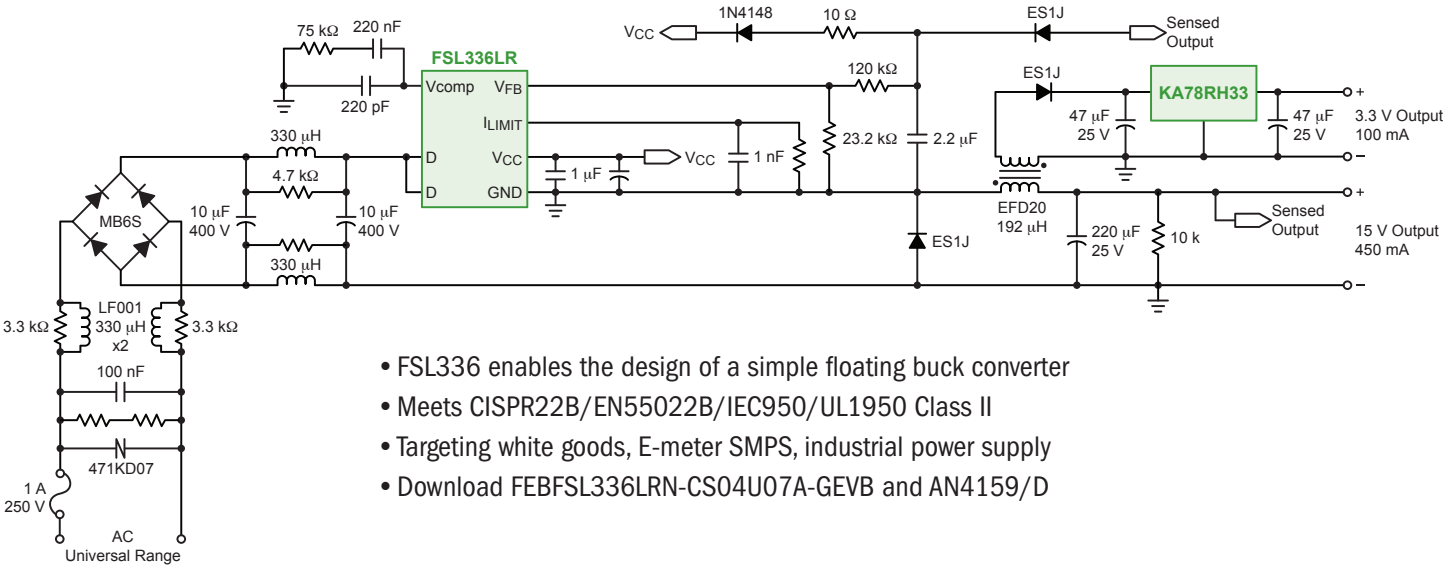
- Dual-edge pulse width modulation
- Single phase RPM mode
- Fastest initial response to dynamic load events
- True differential voltage sensing
- Differential inductor DCR current sensing
- Input voltage feed forward
- Adaptive voltage positioning
- Pin-programmable controller configuration
- Integrated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



Device	Description	Driver / MOSFETs	Package
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
NCP81248	1 + 2 + 1 IMVP8 Controller		QFN-48
NCP81145	5 V Driver	–	DFN-8
NCP81146	12 V Driver	–	DFN-8

Compact Power Delivery with Switching Regulators

Non-Isolated Multi Output 7.08 W Buck Converter with FSL336 – the Lowest RDS(ON) Switcher



- FSL336 enables the design of a simple floating buck converter
- Meets CISPR22B/EN55022B/IEC950/UL1950 Class II
- Targeting white goods, E-meter SMPS, industrial power supply
- Download FEBFSL336LRN-CS04U07A-GEVB and AN4159/D

Device	Output Power Max (W)	Mode	Power Switch Voltage (V)	Peak Current Limit (mA)	$R_{DS(on)}$ Typ (Ω)	HV Startup Min (V)	Frequency Options (kHz)	Dynamic Self Supply	Fsw Foldback	Brown-in Brownout	Line OVP	Topology	Package
NCP1060	4	Current	700	Adj	34	21	60,100	Yes	Yes	Yes	No	Buck/Non-iso Flyback/Flyback	SOIC-10, PDIP-7
NCP1063	11	Current	700	Adj	11	21	60,100	Yes	Yes	Yes	No	Buck/Non-iso Flyback/Flyback	PDIP-7, SOIC-16
NCP1070	4	Current	700	250	22	30	65,100,130	Yes	Yes	Yes	No	Flyback	SOT-223, PDIP-7
NCP1071	5	Current	700	350	22	30	65,100,130	Yes	Yes	Yes	No	Flyback	SOT-223, PDIP-7
NCP1072	11	Current	700	350	11	30	65,100,130	Yes	Yes	Yes	No	Flyback	SOT-223, PDIP-7
NCP1075A/B	15	Current	700	350	13	30	65,100,130 (only B)	Yes	Yes	Yes	Yes	Flyback	PDIP-7 A&B
NCP1076A/B	20	Current	700	650	4.7	30	65,100,130 (only B)	Yes	Yes	Yes	Yes	Flyback	PDIP-7 A&B
NCP1077A/B	20	Current	700	850	4.7	30	65,100,130 (only B)	Yes	Yes	Yes	Yes	Flyback	PDIP-7 A&B
NCP1079A/B	30	Current	700	1050	2.7	30	65,100,130 (only B)	Yes	Yes	Yes	Yes	Flyback	PDIP-7 A&B
FSL106	10	Current	650	Adj	11.5	35	67, 100	No	No	No	No	Flyback	DIP-8
FSL116	14	Current	650	Adj	7.3	35	50, 100	No	No	No	No	Flyback	DIP-8
FSL126	17	Current	650	Adj	4.9	35	67, 100	No	No	No	No	Flyback	DIP-8
FSL136	20	Current	650	Adj	3.5	35	67, 100	No	No	No	No	Flyback	DIP-8, LSOP-8
FSL146	26	Current	650	Adj	2.1	26	67	No	No	No	No	Flyback	DIP-8
FSL156	30	Current	650	Adj	1.8	26	67	No	No	No	No	Flyback	DIP-8
FSL117	10	Current	700	800	8.8	26	67	No	No	No	Yes	Flyback	DIP-8
FSL137	20	Current	700	1300	4	26	67	No	No	No	Yes	Flyback	DIP-8
FSL126MRT	25	Current	650	1,200	4.9	26	67	No	No	No	No	Flyback	TO-220F6
FSL136MRT	35	Current	650	2,150	3.5	26	67	No	No	No	No	Flyback	TO-220F6
FSL176MRT	70	Current	650	3,500	1.3	26	67	No	No	No	No	Flyback	TO-220F6
FSL128MRT	25	Current	800	1200	6.3	26	67	No	No	No	No	Flyback	TO-220F6
FSL138MRT	35	Current	800	2150	4	26	67	No	No	No	No	Flyback	TO-220F6
FSL336	20	Current	650	Adj	3.5	13	50	Yes	Yes	No	No	Buck/Non-iso Flyback	DIP-7, LSOP-7
FSL337	20	Current	700	Adj	3.5	13	50	Yes	Yes	No	No	Buck/Non-iso Flyback	DIP-7, LSOP-7
FSL4110	9	Current	1000	520	10	26	50	Yes	No	No	Yes	Flyback	DIP-7, LSOP-7

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
NCP502	80	12	1.5 - 5.0	40	600 mV (min)	55	SOT-23, SC-70
NCP3335A	500	12	1.5 - 5.0	31	340 mV (typ)	55	DFN-10, Micro8
NCP715	50	24	1.2 - 5.0	3.2	230 mV (typ)	60 @ 100 KHz	XDFN-6, SC-70-5
NCP716B	150	24	3.0, 3.3, 5.0	3.2	700 mV (typ)	55	TSOP-5
NCP718	300	24	1.2 - 5.0	4	300 mV (typ)	60	TSOP-5, WDFN-6
LP2950	100	30	3.0, 3.3, 5.0	93	350 mV	48	DPAK-3, TO-92
LM2931	100	40	5.0, Adj	400	160 mV	90	TO-220, DPAK-3, DPAK-5, TO-92, SOT-223
NCP781	100	150	3.3, 5.0, 15, Adj	25	4 V (typ)	83 @ 1 KHz	DFN-6
NCP786L	5	450	1.5 - 15	10	–	70	SOT-223
NCP786A	10	450	1.27 - 15	10	–	90 @ 100 KHz	DFN-6

High Current LDO Regulators

Device	I_O Typ (A)	V_{in} Max (V)	V_{out} (V)	I_q	V_{DO} (V)	PSRR (dB)	Package
NCP59800	1	2.2 - 6.0	0.8 - 5	60 μA	0.2	63	DFN-8
NCP59748	1.5	0.8 - 5.5	0.8 - 3.6	50 μA	0.06	60	DFN-10, QFN-20
NCP59150	1.5	2.24 - 13.5	1.8 - 5.0	15 mA	0.3	62	D2PAK, DFN-8
NCP5662	2	18	1.2 - 3.3, Adj	–	1	65	D2PAK, DFN-8
NCP59749	3	0.8 - 5.5	0.8 - 3.6	50 μA	0.06	60	QFN-20
NCP59744	3	0.8 - 5.5	0.8 - 3.6	50 μA	0.115	60	QFN-20
NCP58300	3	13.5	1.24 - 12.9	50 mA	0.37	–	D2PAK

Standard Linear Regulators

Device	I_O Typ (A)	V_{in} Max (V)	V_{out} (V)	V_{DO} (V)	Package
KA78xx, MC78xx	1	35	5 - 24	2	TO-220, DPAK, D2PAK
KA78Rxx	1	35	3.3, 5, 8, 9, 12, 15	0.5	TO-220-4
KA278Rxx	2	35	3.3, 5, 12	0.5	TO-220-4
KA378Rxx	3	35	3.3, 5, 12	0.5	TO-220-4
KA78RH33	0.8	15	3.3	1	DPAK
MC78Lxx	0.1	30	5, 8, 9, 12, 15, 18, 24	1.7	TO-92, SOT-89, SOIC-8
NCP1117	1	18	1.5, 1.8, 2.5, 3.3, 5	1.3	SOT-223, DPAK
LM317	1.5	40	Adj	2.2	TO-220, D2PAK

DC-DC Controllers and Regulators

DC-DC Regulators

Device	V_{in} (V)		Topology	Frequency (kHz)	Output Current (A)	Package
	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
CS51411/2/3/4	4.5	40	Buck	260	1.5	SOIC-8, DFN-18
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
CS5171/2/3/4	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
NCP3155	4.7	24	Buck	500 / 1000	3.0	SOIC-8
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
NCP3134	2.9	5.5	Buck	2200	4.0	QFN-16
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
NCP4060	16	80	Buck	100 - 500	6.0	QFN-20
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
FAN2306	4.5	18	Buck	200-1000	6.0	PQFN-34
FAN23SV06	7	18	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

DC-DC Controllers and Regulators

DC-DC Regulators (cont.)

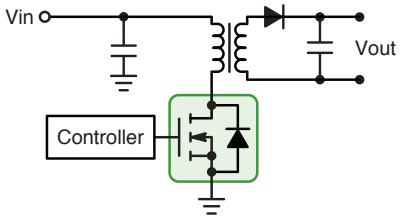
Device	V_{in} (V) Min	V_{in} (V) Max	Topology	Frequency (kHz)	Output Current (A)	Package
FAN2365A	4.5	24	Buck	200-1000	15	PQFN-34
FAN23SV65A	7	24	Buck	200-1000	15	PQFN-34
NCP3232	4.5	21	Buck	500	15	QFN-40
NCP3235	4	20	Buck	550	15	QFN-40
FAN2315A	4.5	18	Buck	200-1000	15	PQFN-34
FAN23SV15MA	7	18	Buck	200-1000	15	PQFN-34
FAN23SV70A	7	24	Buck	200-1000	20	PQFN-34
NCP3233	3	21	Buck	500	20	QFN-40
FAN23SV20MA	7	18	Buck	200-1000	20	PQFN-34
NCP3233	3	16	Buck	300/500/1100	20	QFN-40
NCP3231	4.5	18	Buck	500	25	QFN-40
NCP3230	4.5	18	Buck	500	30	QFN-40

DC-DC Controllers

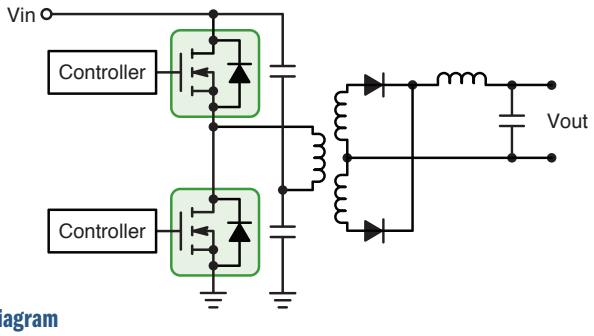
Device	V_{in} (V) Min	V_{in} (V) Max	Isolated	Frequency (kHz)	Control Mode	Package
NCP1034	8	100	No	25 - 500	Voltage	SOIC-16
CS5124	7.7	75	Yes	400	Current	SOIC-8
CS51022	3.3	72	Yes	200 - 1000	Current	SOIC-16, TSSOP-16
CS51221	3.3	72	Yes	200 - 1000	Voltage	SOIC-16, TSSOP-16
NCP1294	3.3	72	Yes	200 - 1000	Voltage	SOIC-16, TSSOP-16
TL494	7	40	No	40 - 200	Voltage	SOIC-16, PDIP-16
TL594	7	40	No	40 - 300	Voltage	SOIC-16, PDIP-16, TSSOP-16
SG3525	8	35	No	100 - 400	Voltage	SOIC-16, PDIP-16
NCP3011	4.5	28	No	400	Voltage	TSSOP-14
NCP3020A/B	4.5	28	No	300/600	Voltage	SOIC-8
NCP3030	4.7	28	No	1200/2400	Voltage	SOIC-8
NCP81231	4.5	28	No	150 - 1200	Current	QFN-32
NCP81239	4.5	28	No	150 - 1200	Current	QFN-32
CS51031	4.5	16	No	200 - 700	Hysteretic	SOIC-8
NCP1587	4.5	13.2	No	275	Voltage	SOIC-8
NCP1589	4.5	13.2	No	300/600	Hysteretic	SOIC-8

Power MOSFETs for AC Drive

Flyback Power Supply



Half Bridge Power Supply



Application Diagram

Features

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

Source Voltage	Device	V_{DSS} (V)	I_D (A)	$R_{DS(on)}$ @ 10 V		C_{iss} (pF)	Q_g (nC)	G-S Protect Diode	Package
				Typ (Ω)	Max (Ω)				
-240 Vac	BFL4026	900	5	2.8	3.6	650	33	–	TO-220F
380 to 480 Vac	2SK4177	1500	2	10	13	380	37.5	Built in	TO-263(D2PAK)
	2SK3748	1500	4	5	7	790	80	Built in	TO-3PF
	NDFPD1N150C	1500	0.1	100	150	80	4.2	–	TO-220F
	NDFP03N150C	1500	2.5	8	10.5	650	34	–	TO-220F
	NDTL03N150C	1500	2.5	8	10.5	650	34	–	TO-3P
	NDUL03N150C	1500	2.5	8	10.5	650	34	–	TO-3PF
	NDUL09N150C	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

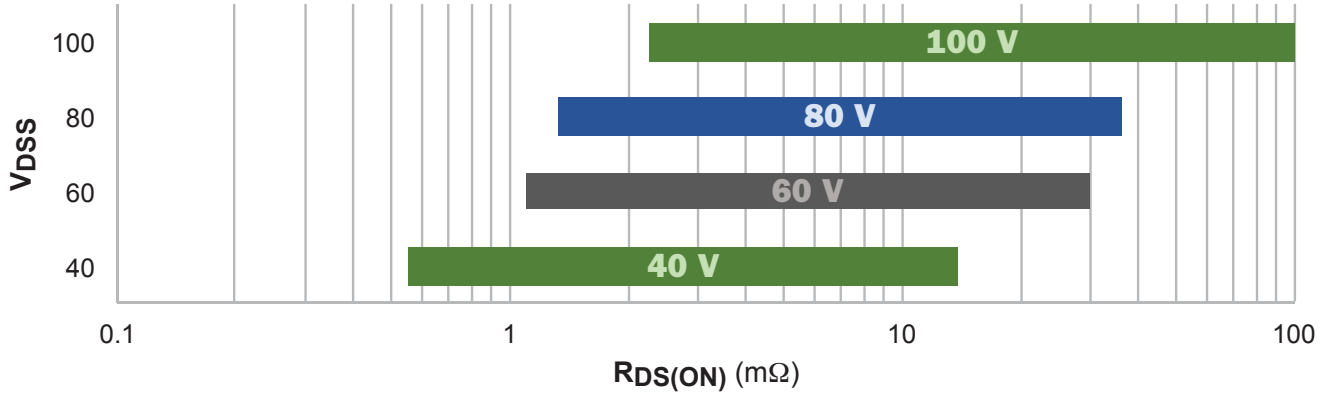
MOSFETs for Energy Storage Systems

Device	Channel	V_{DSS} (V)	$R_{DS(ON)}$ @ 10 V Max (mΩ)	$Q_{G(TOT)}$ (nC)	Package
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
FDB!D7N10CL7	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.

TO-Leadless | D2PAK 7L | DualCool® Power88 | SO-8 FL | µ8FL

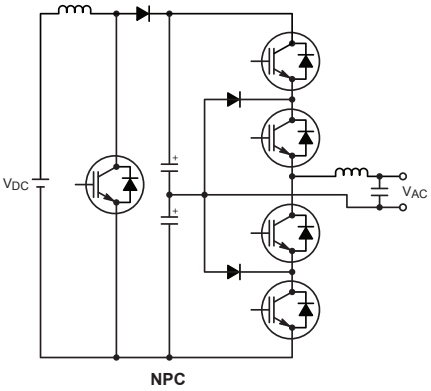


N-Channel Power MOSFETs

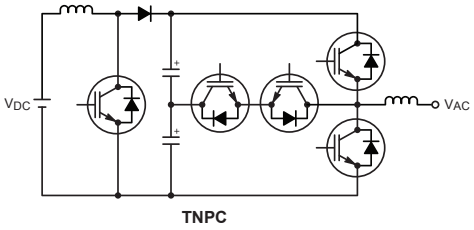
Device	Type	VDSS (V)	RDS(ON) (mΩ)	QG(TOT) (nC)	Package
FDBL0065N40	Single	40	0.65	220	TO-LL (H-PSOF)
FDBL0110N60	Single	60	1.1	170	TO-LL (H-PSOF)
FDBL0150N80	Single	80	1.4	172	TO-LL (H-PSOF)
FDBL0200N100	Single	100	2	95	TO-LL (H-PSOF)
FDBL0630N150	Single	150	6.3	70	TO-LL (H-PSOF)
FDB0105N407L	Single	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)
FDB0630N1507L	Single	150	6.4	97	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	VDSS (V)	RDS(ON) (mΩ)	QG(TOT) (nC)	Package
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
FDMC8360L	Single	40	2.1	57	Power33
NTTFS5C453NL	Single	40	3	35	u8FL
FDMC86570L	Single	60	4.3	63	Power33
FDMC86340	Single	80	6.5	38	Power33
FDMC86184	Single	100	8.5	21	Power33
FDMT80040DC	Single	40	0.56	241	PQFN-8 (Power88)
FDMT80060DC	Single	60	1.1	170	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)

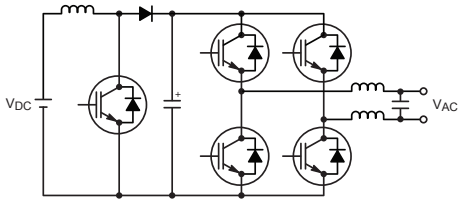
IGBTs for UPS and Solar



NPC



TNPC



FB

IGBT Features for UPS and Solar

- High figure of merit
- Fast switching
- Low T_{rr}/Q_{rr} soft diode
- T_{jmax} = 175°C

Device	V_{CES} (V)	I_C @ T_C = 100°C (A)	$V_{CE(sat)}$ (V)	E_{off} (mJ)	T_{sc} (ms)	Co-Packaged Diode	I_F @ T_C = 100°C (A)	Package
FGAF20N60SMD	600	20	1.70	0.141 @ IC = 20 A, RG = 10 Ω	–	Yes	10	TO-3PF
FGAF40N60SMD	600	40	1.90	0.26 @ IC = 40 A, RG = 6 Ω	–	Yes	20	TO-3PF
FGA30T65SHD	650	30	1.60	0.167 @ IC = 30 A, RG = 6 Ω	–	Yes	20	TO-3P
NGTB35N65FL2	650	35	1.70	0.28 @ IC = 35 A, RG = 10 Ω	5	Yes	35	TO-247
NGTG35N65FL2	650	35	1.70	0.28 @ IC = 35 A, RG = 10 Ω	5	No	–	TO-247
FGA40T65SHD	650	40	1.60	0.297 @ IC = 40 A, RG = 6 Ω	–	Yes	20	TO-3P
FGH40T65SQD	650	40	1.60	0.084 @ IC = 20 A, RG = 6 Ω	–	Yes	20	TO-247
FGA50T65SHD	650	50	1.60	0.384 @ IC = 50 A, RG = 6 Ω	–	Yes	30	TO-3P
FGH50T65SQD	650	50	1.60	0.088 @ IC = 25 A, RG = 4.7 Ω	–	Yes	30	TO-247
NGTB50N65FL2	650	50	1.80	0.46 @ IC = 50 A, RG = 10 Ω	–	Yes	50	TO-247
NGTB50N65FL2WAG	650	50	1.80	0.55 @ IC = 50 A, RG = 10 Ω	–	Yes	50	TO-247 4L
FGH60T65SQD	650	60	1.60	0.61 @ IC = 60 A, RG = 6 Ω	–	Yes	30	TO-247
NGTB60N65FL2	650	60	1.64	0.66 @ IC = 60 A, RG = 10 Ω	–	Yes	60	TO-247
FGH75T65SQD	650	75	1.60	0.181 @ IC = 37.5 A, RG = 4.7 Ω	–	Yes	50	TO-247
FGH75T65SQDNL4	650	75	1.5	1.26 @ IC = 75 A, RG = 10 Ω	–	Yes	75	TO-247-4L
FGH75T65SQDT	650	75	1.60	0.608 @ IC = 37.5 A, RG = 15 Ω	–	Yes	75	TO-247
FGH75T65SQDTL4	650	75	1.60	0.608 @ IC = 37.5 A, RG = 15 Ω	–	Yes	75	TO-247 4L
NGTB75N65FL2WAG	650	75	1.60	1.2 @ IC = 75 A, RG = 10 Ω	–	Yes	75	TO-247 4L
NGTB75N65FL2WG	650	75	1.60	1.1 @ IC = 75 A, RG = 10 Ω	5	Yes	75	TO-247
FGY100T65SCDT	650	100	1.60	3.7 @ IC = 100 A, RG = 4.7 Ω	5	Yes	100	TP-247
FGH40T70SHD	700	40	1.70	0.271 @ IC = 40 A, RG = 6 Ω	–	Yes	20	TO-247
FGH15T120SMD	1200	15	1.80	0.46 @ IC = 5 A, RG = 34 Ω	–	Yes	15	TO-247
NGTB15N120FL2	1200	15	2.00	0.37 @ IC = 15 A, RG = 10 Ω	10	Yes	15	TO-247
FGH25T120SMD	1200	25	1.80	0.56 @ IC = 25 A, RG = 23 Ω	–	Yes	25	TO-247
NGTB25N120FL2	1200	25	2.00	0.6 @ IC = 25 A, RG = 10 Ω	10	Yes	25	TO-247
NGTB25N120FL2WAG	1200	25	2.00	0.66 @ IC = 25 A, RG = 10 Ω	–	Yes	25	TO-247 4L
NGTB25N120FL3	1200	25	1.70	0.7 @ IC = 25 A, RG = 10 Ω	–	Yes	25	TO-247
NGTB30N120FL2	1200	30	2.00	0.7 @ IC = 30 A, RG = 10 Ω	10	Yes	30	TO-247
NGTB30N120L2	1200	30	1.70	1.4 @ IC = 30 A, RG = 10 Ω	10	Yes	30	TO-247
FGH40T120SQDNL4	1200	40	1.75	1.8 @ IC = 75 A, RG = 10 Ω	–	Yes	40	TO-247-4L
FGY40T120SMD	1200	40	1.80	1.1 @ IC = 40 A, RG = 10 Ω	–	Yes	40	TO-247
NGTB40N120FL2	1200	40	2.00	1.1 @ IC = 40 A, RG = 10 Ω	10	Yes	40	TO-247
NGTB40N120FL2WAG	1200	40	2.10	1.1 @ IC = 40 A, RG = 10 Ω	–	Yes	40	TO-247 4L
NGTB40N120FL3	1200	40	1.70	1.1 @ IC = 40 A, RG = 10 Ω	–	Yes	40	TO-247
NGTB40N120L3	1200	40	1.55	1.5 @ IC = 40 A, RG = 10 Ω	–	Yes	40	TO-247
NGTB50N120FL2WAG	1200	50	2.25	1.4 @ IC = 50 A, RG = 10 Ω	–	Yes	50	TO-247 4L

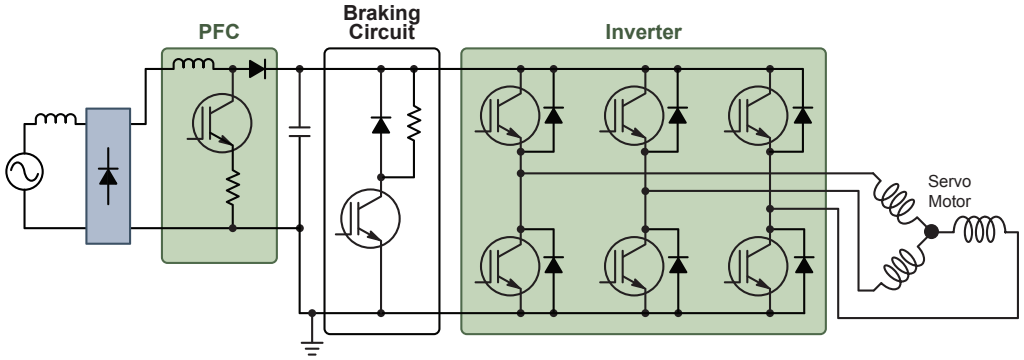
IGBTs for Motor Control

Key Features for Inverters

- Low V_{cesat}
- Low V_f
- Short circuit ruggedness
- T_{jmax} = 175°C

Key Features for PFC

- Fast switching for >20 kHz
- Positive temperature coefficient for easy paralleling
- T_{jmax} = 175°C



Device	V_{CES} (V)	I_C @ T_C = 100°C (A)	$V_{CE(sat)}$ (V)	E_{off} (mJ)	T_{sc} (ms)	Co-Packaged Diode	I_F @ T_C = 100°C (A)	Package
FGAF40N60SMD	600	40	1.90	0.26 @ IC = 40 A, RG = 6 Ω		Yes	20	TO-3PF
FGAF20N60SMD	600	20	1.70	0.141 @ IC = 20 A, RG = 10 Ω		Yes	10	TO-3PF
NGTB20N60T2TF1G	600	20	1.45	0.22 @ IC = 20 A, RG = 30 Ω		Yes	20	TO-3PF
NGTG20N60L2TF1G	600	20	1.45	0.22 @ IC = 20 A, RG = 30 Ω		No		TO-3PF
NGTB15N60R2FG	600	14	1.85	220 @ IC = 15 A, RG = 30 Ω	10	Yes	14	TO-220F
NGTG12N60TF1G	600	12	1.50	220 @ IC = 12 A, RG = 30 Ω	5	No		TO-3PF
NGTB10N60FG	650	10	1.50	220 @ IC = 10 A, RG = 30 Ω	5	Yes	10	TO-220F
FGA6065ADF	650	60	1.70	0.52 @ IC = 60 A, RG = 6 Ω		Yes	30	TO-3P
FGA5065ADF	650	50	1.80	0.309 @ IC = 50 A, RG = 6 Ω		Yes	20	TO-3P
FGA4060ADF	650	40	1.80	0.25 @ IC = 40 A, RG = 6 Ω		Yes	10	TO-3P
FGA3060ADF	650	30	1.80	0.165 @ IC = 30 A, RG = 6 Ω		Yes	3	TO-3P
NGTB40N65IHRTG	650	40	1.55	0.42 @ IC = 40 A, RG = 10 Ω		No	40	TO-3P
NGTB40N65IHRWG	650	40	1.55	0.42 @ IC = 40 A, RG = 10 Ω		No	40	TO-247
NGTB15N60R2FG	600	14	1.85	0.22 @ Ic = 15 A, Rg = 30 Ω	10	No	15	TO-220F
FGP15N60UNDF	600	15	2.20	0.067 @ IC = 15 A, RG = 10 Ω	10	Yes	15	TO-220
NGTB10N60R2DT4G	600	10	1.70	0.14 @ IC = 10 A, RG = 30 Ω	5	No	10	DPAK
FGPF10N60UNDF	600	10	2.00	0.05 @ IC = 10 A, RG = 10 Ω	10	Yes	10	TO-220F
FGP10N60UNDF	600	10	2.00	0.05 @ IC = 10 A, RG = 10 Ω	10	Yes	10	TO-220
FGB7N60UNDF	600	7	1.90	0.104 @ IC = 7 A, RG = 10 Ω	10	Yes	7	D2PAK
NGTB05N60R2DT4G	600	8	1.65	0.06 @ IC = 5 A, RG = 30 Ω	5	NO	5	DPAK
FGB5N60UNDF	600	5	1.90	0.07 @ IC = 5 A, RG = 10 Ω	10	Yes	5	D2PAK
NGTB03N60R2DT4G	600	4.5	1.70	0.027 @ IC = 3 A, RG = 30 Ω	5	No	3	DPAK
FGD3N60UNDF	600	3	2.00	0.03 @ IC = 3 A, RG = 10 Ω	10	Yes	3	DPAK
FGY100T65SCDT	650	100	1.60	3.7 @ IC = 100 A, RG = 4.7 Ω	5	Yes	100	TP-247
NGTB75N65FL2	650	75	1.70	1.1 @ IC = 75 A, RG = 10 Ω	5	Yes	75	TO-247
NGTB60N65FL2	650	60	1.64	0.66 @ IC = 60 A, RG = 10 Ω	5	Yes	60	TO-247
NGTB50N65FL2	650	50	1.80	0.46 @ IC = 50 A, RG = 10 Ω	5	Yes	50	TO-247
NGTB35N65FL2	650	35	1.70	0.28 @ IC = 35 A, RG = 10 Ω	5	Yes	35	TO-247

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.

Key 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	1.8	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	ERS	Color	-30 to +70
MT9V024	Sensor	WVGA	1/3"	60 fps	6	GS	Color, Mono	-40 to +105
MT9V034	Sensor	WVGA	1/3"	60 fps	6	GS	Color, Mono	-30 to +70
AR0141CS	Sensor	1.2	1/4"	1.2 45 fps, 720P 60 fps	3	ERS	Color	-30 to +85
AR0144CS	Sensor	1	1/4"	60 fps	3	GS	Color, Mono	-40 to +85
AR0130CS	Sensor	1.2	1/3"	1.2 45 fps, 720P 60 fps	3.8	ERS	Color, Mono	-30 to +70
AR0134CS	Sensor	1.2	1/3"	1.2 54 fps, 720 60 fps	3.8	GS	Color, Mono	-30 to +70
AR0135CS	Sensor	1.2	1/3"	1.2 60 fps, 720 60 fps	3.8	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
AR0221	Sensor	2.1	1/1.7"	1080P 60 fps	4.2	ERS	Color	-30 to +85
AR023Z	Sensor	2.1	1/2.7"	1080P 60 fps	3	ERS	Color	-30 to +85
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
AR0330	Sensor	3.5	1/3"	1080P 60 fps	2.2	ERS	Color	-30 to +70
AR0430	Sensor	4	1/3"	120fps	2	ERS	Color	-30 to +70
AR0431	Sensor	4	1/3"	120fps	2	ERS	Color	-30 to +85
AR0521	Sensor	5	1/2.5"	60fps	2.2	ERS	Color, Mono	-30 to +85
AR0522	Sensor	5	1/2.5"	60fps	2.2	ERS	Color, Mono	-30 to +85
AR01011HS	Sensor	10	1"	60fps	3.4	ERS	Color	-30 to +70
AR1335	Sensor	13	1/3.2"	13 30 fps, 1080P 60 fps	1.1	ERS	Color	-30 to +70
AR1337	Sensor	13	1/3.2"	13 30 fps, 1080P 60 fps	1.1	ERS	Color	-30 to +70
AR1630	Sensor	16	1/3.1"	16 30 fps, 1080P 120 fps	1	ERS	Color	-30 to +70
AR1820HS	Sensor	18	1/2.3"	18 24 fps, 1080P 120 fps	1.25	ERS	Color	-30 to +70

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

Co-Processors for Mainstream CMOS Image Sensors

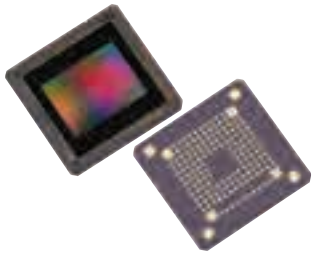
Available Features

- 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	Resoution (MP)	Frame Rate (fps)	Video	Output Format	Package
AP0100AT	1	45	720p/60 fts, NTSC/PAL	YUV	VFBGA-100
AP0100CS	1	45	1.2 MP/45 fps; 720p/60 fps	NTSC/PAL; YUV	VFBGA-100
AP0101AT	1	45	1.2 MP/45 fts; 720p/60 fps	SMPTE 296M; YUV	VFBGA-81
AP0101CS	1	45	1.2 MP/45 fps; 720p/60 fps	SMPTE 296M; YUV	VFBGA-81
AP0102AT	1	–	1.2 MP/45 fps; 720p/60 fps; 1080p/30 fps	RGB; YUV	VFBGA-100
AP0200AT	2	30	1.2 MP/45 fps; 720p/60 fps; 1080p/30 fps	H.264; MJPEG	VFBGA-100
AP0201AT	2	30	1.2 MP/45 fps; 720p/60 fps; 1080p/30 fps	H.264; MJPEG	VFBGA-100
AP0202AT	2	30	1.2 MP/45 fps; 720p/60 fps; 1080p/30 fps	RGB565; RGB888; YUV	VFBGA-100
AP1302	13	30	13 MP/30 fps; 1080p/120 fps	JPEG; RAW; RGB565; RGB888; YUV	VFBGA-120

X-Class CMOS Image Sensor Platform

The X-Class image sensor platform enables a new dimension in camera design by supporting multiple CMOS pixel architectures within the same image sensor frame. This allows a single camera design not only to support multiple product resolutions but also different pixel functionality through a common high bandwidth, low power interface, allowing camera manufacturers to leverage existing parts inventory and accelerate time to market for new camera designs.



The initial devices in this platform are based on the advanced 3.2 µm XGS Global Shutter CMOS pixel that features superior imaging performance, high image uniformity, and low noise. Available speed grades match imaging performance to application, with a compact package that enables 29 x 29 mm^2 camera designs.

Device	Resolution (MPix)	Pixel Count (H x V)	Pixel (µm)	Diagonal (mm)	Lens	CFA[1]	FPS Max	Evaluation Kit
XGS 8000	8.8	4096 x 2160	3.2	14.8	1 /1.1"	C/M	130	✓
XGS 12000	12.6	4096 x 3072	3.2	16.4	1"	C/M	87	✓

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

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	✓

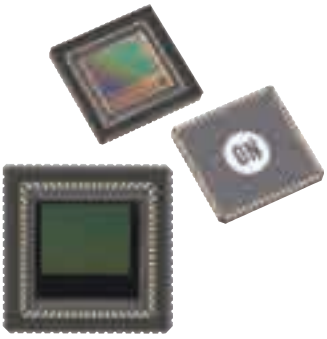
1. CFA Options – Bayer Color (C), Monochrome (M), Enhanced NIR (NIR).

Versatile CMOS Image Sensors

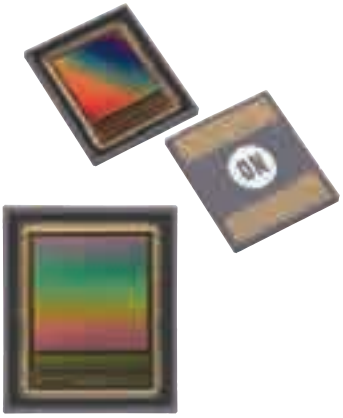
VITA image sensors combine flexibility in configuration and resolution with high speed and high sensitivity, addressing a wide range of customer requirements in a cost-effective family of rolling/global shutter CMOS image sensors. A flexible read-out architecture makes them well suited for machine vision, 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



VITA 5000



VITA 25K

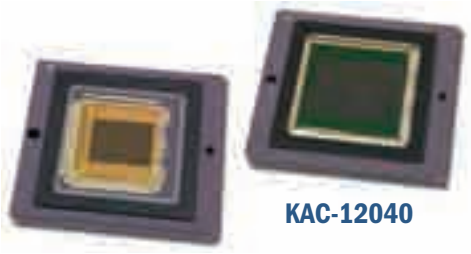
Device	Resolution (MPix)	Pixel Count (H x V)	Pixel (µm)	Diagonal (mm)	Lens	CFA[1]	FPS Max	Evaluation Kit
VITA 1300	1.3	1280 x 1024	4.8	7.9	1/2”	C/M	150	✓
VITA 2000	2.3	1920 x 1200	4.8	10.9	2/3”	C/M	90	✓
VITA 5000	5.3	2592 x 2048	4.8	15.9	1”	C/M	75	✓
VITA 12K	12.6	4096 x 3072	4.5	23.0	4/3”	C/M	160	✓
VITA 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	80	✓

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

KAC image sensors provide both global shutter and low noise rolling shutter modes, combined with programmable bit depth (8 to 14 bit) with a flexible readout architecture that supports interspersed video streams. These features enable the use of multiple regions of interest that can simultaneously monitor both wide areas and local regions, making these devices ideal for machine vision, surveillance, ITS, and analytical microscopy.

Features

- Global shutter, low noise rolling shutter
- Programmable bit depth
- Interspersed video streams
- Multiple regions of interest
- High frame rates
- High NIR sensitivity



KAC-12040

KAC-06040

Device	Resolution (MPix)	Pixel Count (H x V)	Pixel (µm)	Diagonal (mm)	Lens	CFA[1]	FPS Max	Evaluation Kit
KAC-06040	6	2832 x 2128	4.7	16.7	1”	C/M	160	✓
KAC-12040	12	4000 x 3000	4.7	23.5	4/3”	C/M	70	✓

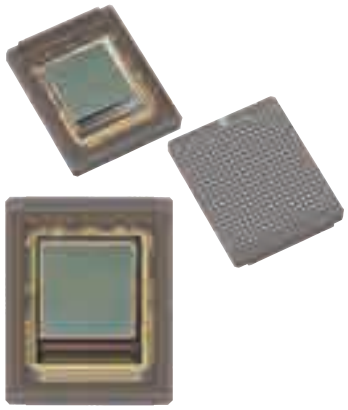
1. CFA Options – Bayer Color (C), Monochrome (M).

High Speed CMOS Image Sensors

LUPA devices offer multiple megapixel resolution with 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	Evaluation Kit
LUPA 300	0.3	640 x 480	9.9	7.9	1/2”	C/M	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).

Full Frame CCD Image Sensors

From the intricacies of microscopy to the far reaches of astrophotography, Full Frame CCD image sensors deliver high performance results. With high quantum efficiency across the entire visible spectrum, these sensors are ideal for demanding imaging applications that can accommodate a mechanical shutter or strobe illumination, such as electronic still photography, medical X-ray, and inspection.

Features

- High resolution
- Support for large sensor formats
- Simple, two-phase clocking
- Very low dark current for long exposures
- Vertical and horizontal binning

Full Frame CCD Image Sensors

Device	Resolution (MPix)	Pixel Count	Pixel (μm)	Diagonal (mm)	Lens	CFA[1]	FPS Max	Evaluation Kit
KAF-0261	VGA	512 x 512	20.0	14.5	1”	M	15.0	✓
KAF-0402	WVGA	768 x 512	9.0	8.3	1/2"	M	20.0	✓
KAF-1001	1.0	1024 x 1024	24.0	34.8	APS-H	M	3.0	✓
KAF-1603	1.6	1536 x 1024	9.0	16.6	1”	M	2.2	✓
KAF-3200	3.3	2184 x 1510	6.8	18.0	4/3”	M	2.5	✓
KAF-4320	4.3	2084 x 2084	24.0	70.7	645	M	2.0	✓
KAF-6303	6.3	3088 x 2056	9.0	33.4	APS-H	M	0.6	✓
KAF-8300	8.3	3326 x 2504	5.4	22.5	4/3”	M	2.9	✓
KAF-09001	9.1	3024 x 3024	12.0	51.3	645 1.3x	M	5.0	
KAF-09000	9.3	3056 x 3056	12.0	51.9	645 1.3x	M	0.4	
KAF-16200	16.2	4500 x 3600	6.0	34.6	APS-H	C/M	1.5	
KAF-16801	16.8	4096 x 4096	9.0	52.1	645 1.3x	M	0.4	✓
KAF-16803	16.8	4096 x 4096	9.0	52.1	645 1.3x	M	0.2	
KAF-40000	40.0	7304 x 5478	6.0	54.8	645 1.3x	C	1.3	
KAF-50100	50.1	8176 x 6132	6.0	61.3	645 1.1x	M	1.0	

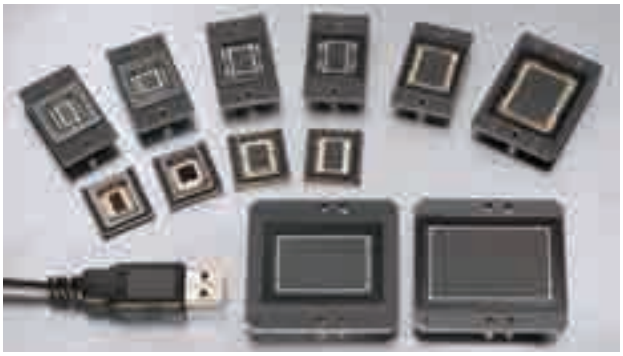
1. CFA Options – Bayer Color (C), Monochrome (M).

Interline Transfer CCD Image Sensors

With an integrated electronic shutter, Interline Transfer CCD image sensors provide real time imaging in applications where a mechanical shutter or strobe illumination is either not required or desired. With progressive scan readouts, they are particularly well suited for machine vision, microscopy, fluoroscopy, and other applications that demand the highest imaging performance. Most 5.5 μm and 7.4 μm devices share common pin-out and electrical connections, allowing a single camera design to support a full family of products.

Features

- Progressive scan with electronic shutter and anti-blooming support
- High resolution
- High sensitivity
- Low image lag and smear



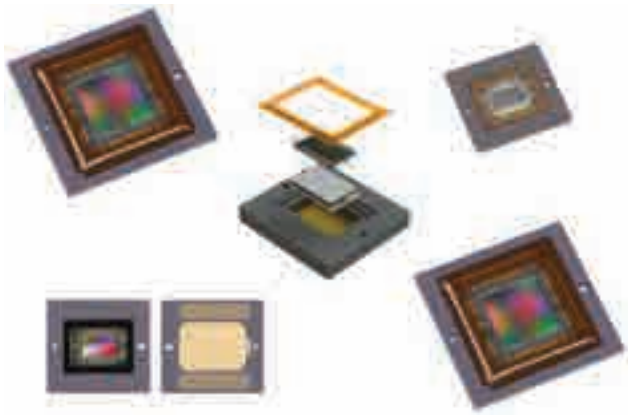
5.5 μm Interline Transfer CCD Image Sensors

Device	Resolution (MPix)	Pixel Count	Pixel (μm)	Diagonal (mm)	Lens	CFA[1]	FPS Max	Enhanced NIR	Evaluation Kit
KAI-0330	VGA	648 x 484	9	7.3	1/2"	C/M	120		✓
KAI-0340	VGA	640 x 480	7.4	5.9	1/3"	C/M	210		✓
KAI-0373	WVGA	768 x 484	11.6 x 13.6	11.1	2/3"	M	30		
KAI-01150[2]	0.9	1280 x 720	5.5	8.1	1/2"	C/M/S	138		✓
KAI-1003	1	1024 x 1024	12.8	18.5	4/3"	M	30		✓
KAI-1010	1	1008 x 1018	9	12.9	1"	M	30		
KAI-1020	1	1000 x 1000	7.4	10.5	2/3"	C/M	50		✓
KAI-01050[2]	1	1024 x 1024	5.5	8	1/2"	C/M	120		✓
KAI-2020	1.9	1600 x 1200	7.4	14.8	1"	C/M	30		✓
KAI-02050[2]	1.9	1600 x 1200	5.5	11.1	2/3"	C/M	68		✓
KAI-02170[2]	2.1	1920 x 1080	7.4	16.3	1"	C/M/S	60		✓
KAI-02150[2]	2.1	1920 x 1080	5.5	12.1	2/3"	C/M/S	64		✓
KAI-04070[2]	4.2	2048 x 2048	7.4	21.4	4/3"	C/M/S	28		✓
KAI-04050[2]	4.1	2336 x 1752	5.5	16.1	1"	C/M/S	32		✓
KAI-08051[2]	8.1	3296 x 2472	5.5	22.7	4/3"	C/M/S	16		✓
KAI-08052[2]	8.1	3296 x 2472	5.5	22.7	4/3"	C/M/S	16	✓	✓
KAI-08670	8.6	3600 x 2400	7.4	32.0	APS-H	C/M/S	12		✓
KAI-11002	10.7	4008 x 2672	9	43.4	35 mm	C/M	5		✓
KAI-16000	15.8	4872 x 3248	7.4	43.3	35 mm	C/M	3		
KAI-16050[2]	16	4896 x 3264	5.5	32.4	APS-H	C/M/S	8		✓
KAI-16070[2]	15.7	4864 x 3232	7.4	43.2	35 mm	C/M/S	8		✓
KAI-29050[2]	28.8	6576 x 4384	5.5	43.5	35 mm	C/M/S	4		✓
KAI-29052[2]	28.8	6576 x 4384	5.5	43.5	35 mm	C/M/S	4	✓	✓
KAI-43140	43.1	8040 x 5360	4.5	43.5	35 mm	C/M/S	4		✓
KAI-47051	46.8	8856 x 5280	5.5	56.7	645 1.1x	C/M/S	7		

1. CFA Options – Bayer Color (C), Monochrome (M), and Sparse CFA (S). 2. Pin and Electrically Compatible.

Interline Transfer EMCCD Image Sensors

Combining the high sensitivity of an electron-multiplied output register with the pixel uniformity and resolution scalability available from Interline Transfer CCDs, KAE devices enable the capture of scenes with widely varying lighting conditions – from sunlight to starlight – in a single image and from a single camera. Multiple configurations are available in the family, including options for different resolutions and pixel sizes, light sensitivity, integrated cooling, and sealed or taped cover glass. This flexibility and performance make Interline Transfer EMCCD image sensors ideal for light starved applications such as surveillance, scientific imaging, medical imaging, and intelligent transportation systems.



Features

- Up to 92 dB dynamic range with sub-electron noise
- Intra-scene switchable gain
- Global shutter image capture
- Excellent image uniformity and MTF

Device	Resolution (MPix)	Pixel Count	Pixel (μm)	Diagonal (mm)	Lens	CFA	FPS Max	Enhanced NIR	Evaluation Kit
KAE-02150	2.1	1920 x 1080	5.5	12.1	2/3"	C/M	30		✓
KAE-02152	2.1	1920 x 1080	5.5	12.1	2/3"	C/M	30	✓	✓
KAE-04471	4.4	2096 x 2096	7.4	21.9	4/3"	C/M	15		✓
KAE-08151	8.2	2856 x 2856	5.5	22.2	4/3"	C/M	8		✓
KAE-08152	8.2	2856 x 2856	5.5	22.2	4/3"	C/M	8	✓	✓

Linear CCD Image Sensors

Linear CCD image sensors combine high resolution with high dynamic range, making them ideal for use in applications such as flatbed scanners, high-speed document scanners and copiers, machine vision cameras, and satellite imaging.

Features

- High dynamic range
- Pinned photodiodes for low lag and low dark current
- Channel independent electronic exposure control
- Single output per color, including multi-readout register architectures
- High data rates

Linear CCD Image Sensors

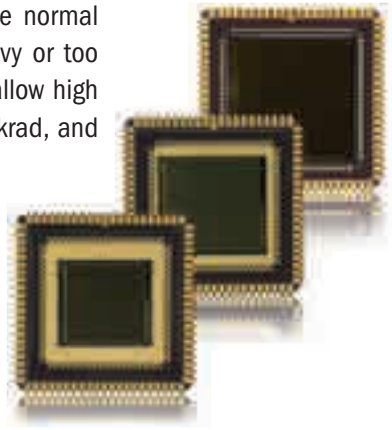
Device	Pixel Count	Pixel (μm)	Diagonal (mm)	CFA[1]	Evaluation Kit
KLI-2113	2098 x 3	14	29.4	C/M	✓
KLI-4104	8160 x 1, 4080 x 3	5.0, 10.0	40.8	Luma+C/M	✓
KLI-8023	8002 x 3	9	72	C/M	✓

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

SENSING

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 inspection

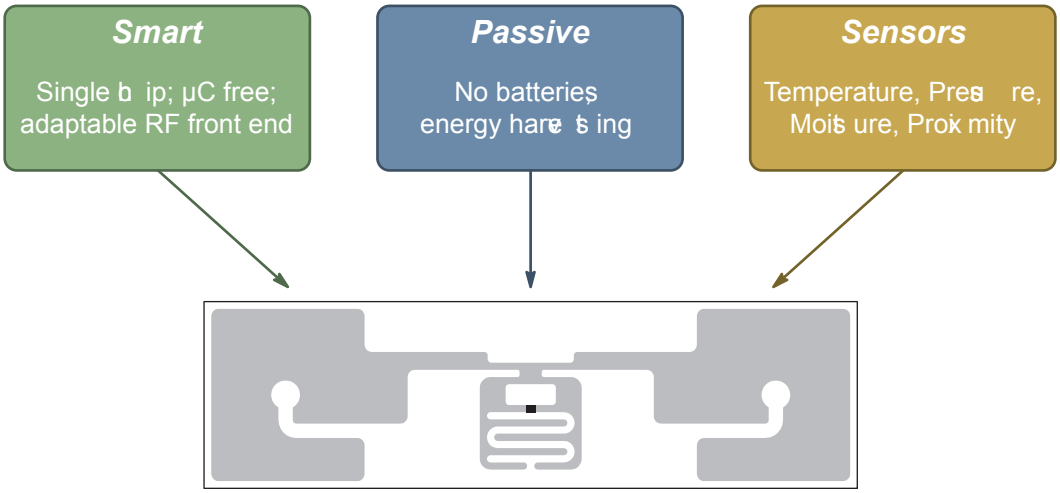
Device	Resolution (Mpix)	Pixel Count	Pixel (μm)	Diagonal (mm)	ADC	CFA	FPS Max
STAR250	0.3	512 x 512	25	18.1	10-bit	M	30
STAR1000	1.0	1024 x 1024	15	21.7	10-bit	M	11
HAS2	1.0	1024 x 1024	18	26.1	12-bit	M	10

Evaluation Support

ON Semiconductor provides supporting hardware and software to qualified engineering teams to accelerate product development. These kits contain everything necessary to build a working prototype with test functionality.

Battery-Free Wireless Sensors

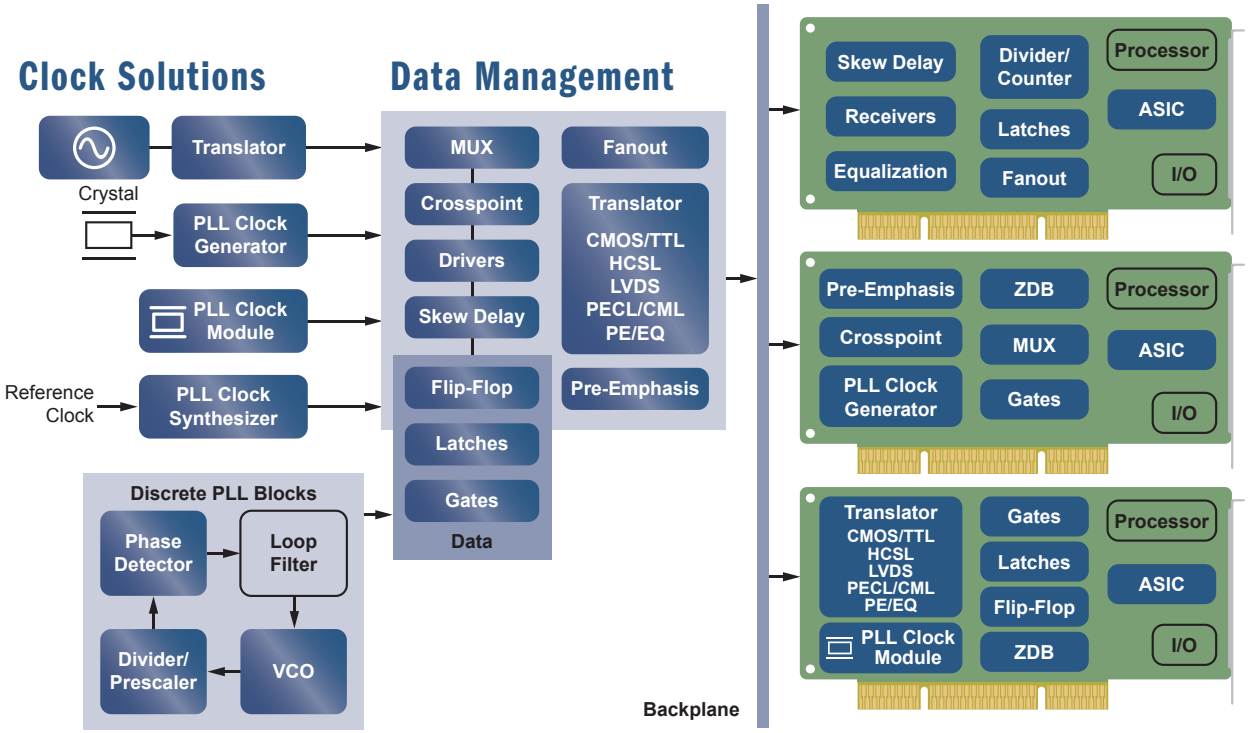
Introducing the World's First Battery-Free, µC-Free Sensor Tag
Breakthrough Sensor Technology Implemented on RFID



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	Sensing Functions	Sensor Reading Sensitivity	Surface Placement	Form Factor
SPS1M001FOM	Moisture	Low Sensitivity	Metal	Flexible PET
SPS1M002PET	Moisture	Low Sensitivity	Non-Metal	Flexible PET
SPS1F001PET	Fluid Level	High Sensitivity	Non-Metal	Flexible PET
SPS1T001PET	Temperature	0 to +50°C (±0.3°C) or -40 to 85°C (±1°C)	Non-Metal	Flexible PET
SPS1T001PCB	Temperature	0 to +50°C (±0.3°C) or -40 to 85°C (±1°C)	Metal	Hard Tag PCB
SPS1T001CER	Temperature	0 to +50°C (±0.3°C) or -40 to 85°C (±1°C)	Metal	Hard Tag Ceramic

Timing and Data Distribution Subsystem



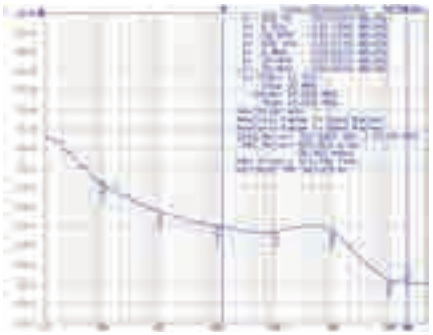
ON Semiconductor provides a complete portfolio of timing and data management solutions for all aspects of the clock tree. System designers can optimize their clock circuits with industry leading clock distribution devices, demonstrating the industry's lowest jitter and skew. A broad product portfolio,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



NB3N5573 Typical Phase Noise at Fc = 200 MHz

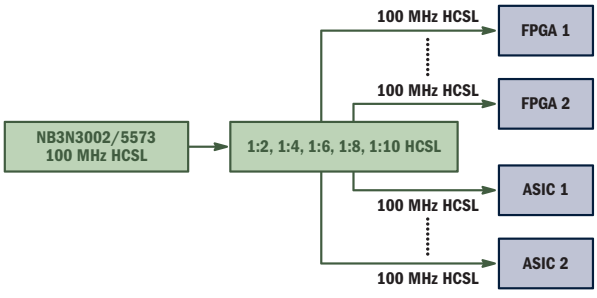
Features

- 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, LVTTL/LVCMOS
- Multiple PLLs and multiple output options

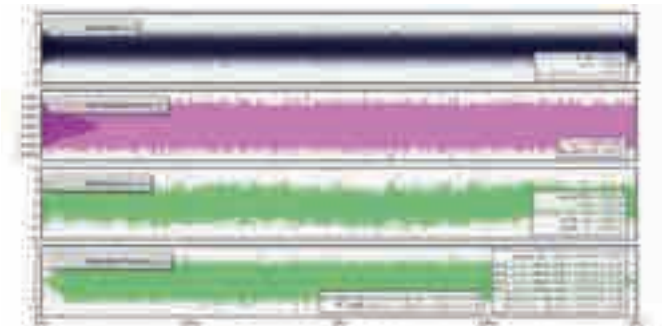
Device	Input (MHz)	Output (MHz)	Application	Input Level					Output Level	Vcc Typ (V)	Package(s)
				XTAL	CML	CMOS	LVPECL	TTL			
NB3N3002	25	25/125/200	CPU/DIMM, PCIe Gen 1,2,3	✓		✓		✓	HCSL	3.3	TSSOP-16
NB3N5573	25	25/100/125/200	CPU/DIMM, PCIe Gen 1,2,3	✓		✓		✓	HCSL	3.3	TSSOP-16
NB3N3020	5 to 27	5 to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

PCIe Timing Solutions

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



PCIe Gen 1, 2, 3 Clock Generation and Distribution

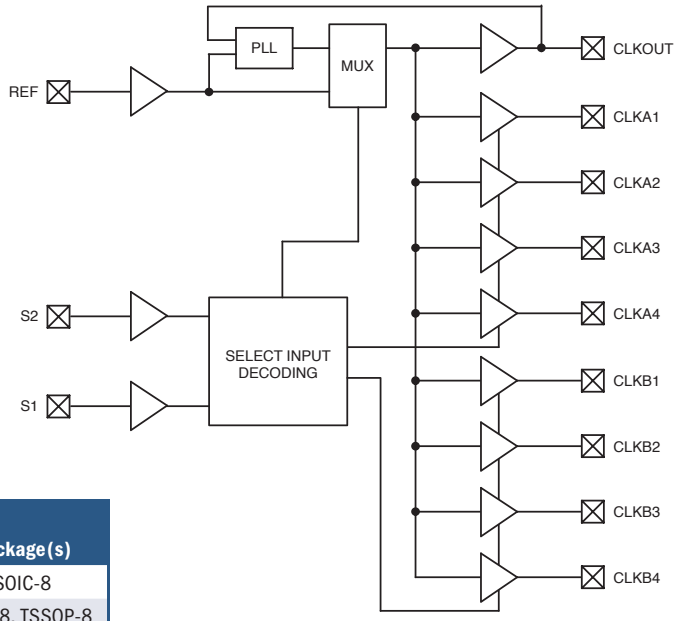


Jitter Results After Fanout

Zero Delay Buffers

Features

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



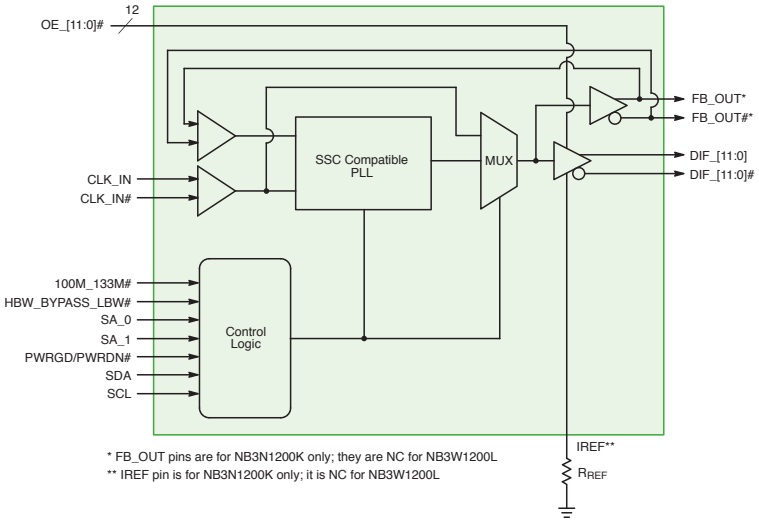
NB2309A Functional Diagram

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

PCIe Zero Delay Buffers

Features

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

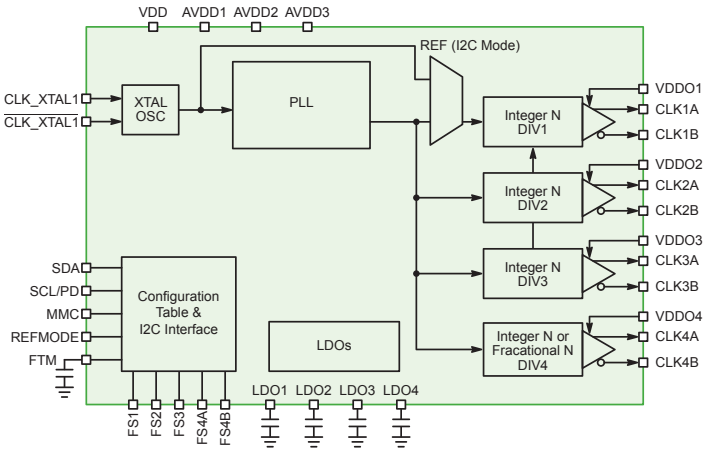


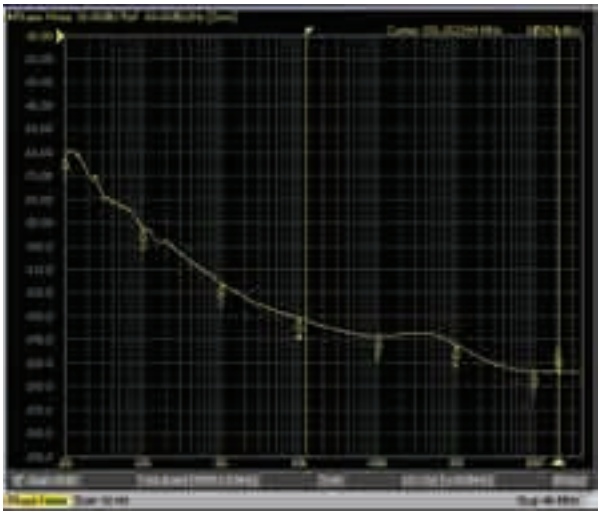
NB3N1200K Simplified Block Diagram

Low Noise, Programmable Multi-Rate Clock Generator

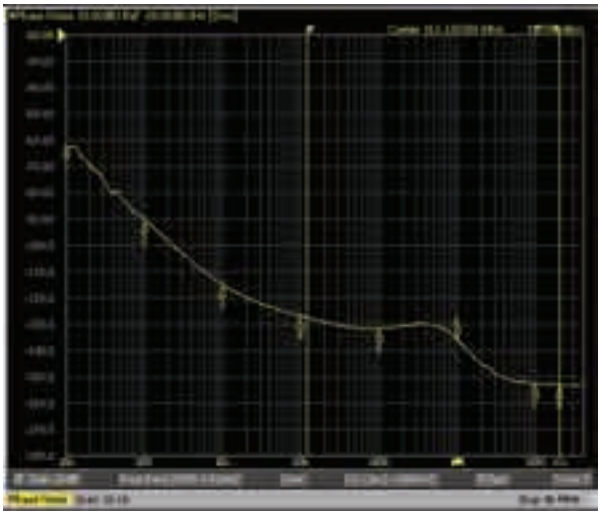
NB3H5150 Features

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

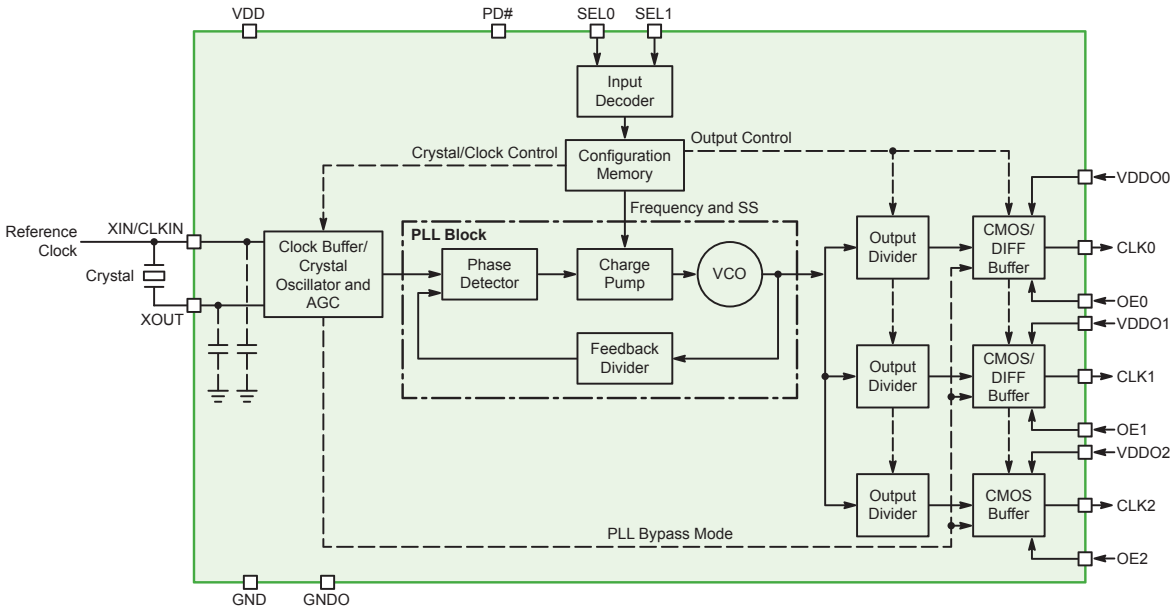


Fractional-N Output RMS Phase Jitter = 371 fs !!
Fractional-N Output Phase Noise (Max) = 1 ps
Integration range = 12 kHz - 20 MHz

OmniClock Programmable Clock Synthesizers

Key Features

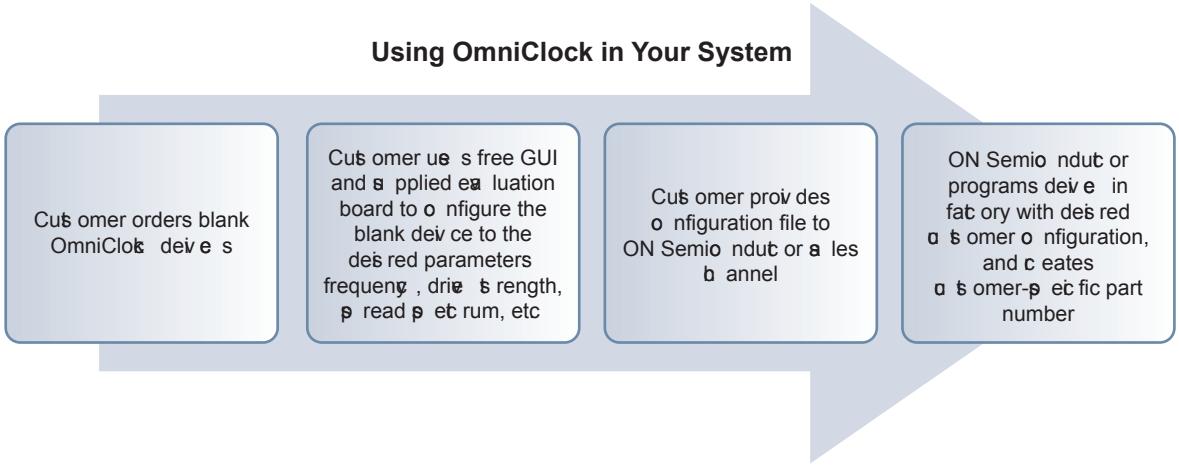
- Single PLL
- Input Frequency Range:
  - Crystal: 3 – 50 MHz (low cost ESR crystal compatible)
  - Clock: 3 – 200 MHz (single-ended only)
- Up to 3 single-ended (LVCMOS/LVTTL) outputs, or up to 1 differential (LVPECL, LVDS, HCSL or CML) output + 1 single-ended (LVCMOS/LVTTL) output
- Output Frequency Range: 8 kHz (Min), 200 MHz (Max)
- Programmable Spread Spectrum Capabilities for EMI Suppression
  - Center Spread (0.125% steps): ± 0.125% to ± 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 ±10%; 2.5 V ± 10%; 1.8 V ± 0.1 V
- Temperature Range: -40°C to +85°C
- Available in QFN-16 (3 mm x 3 mm) and WDFN-8 (2 mm x 2 mm) packages

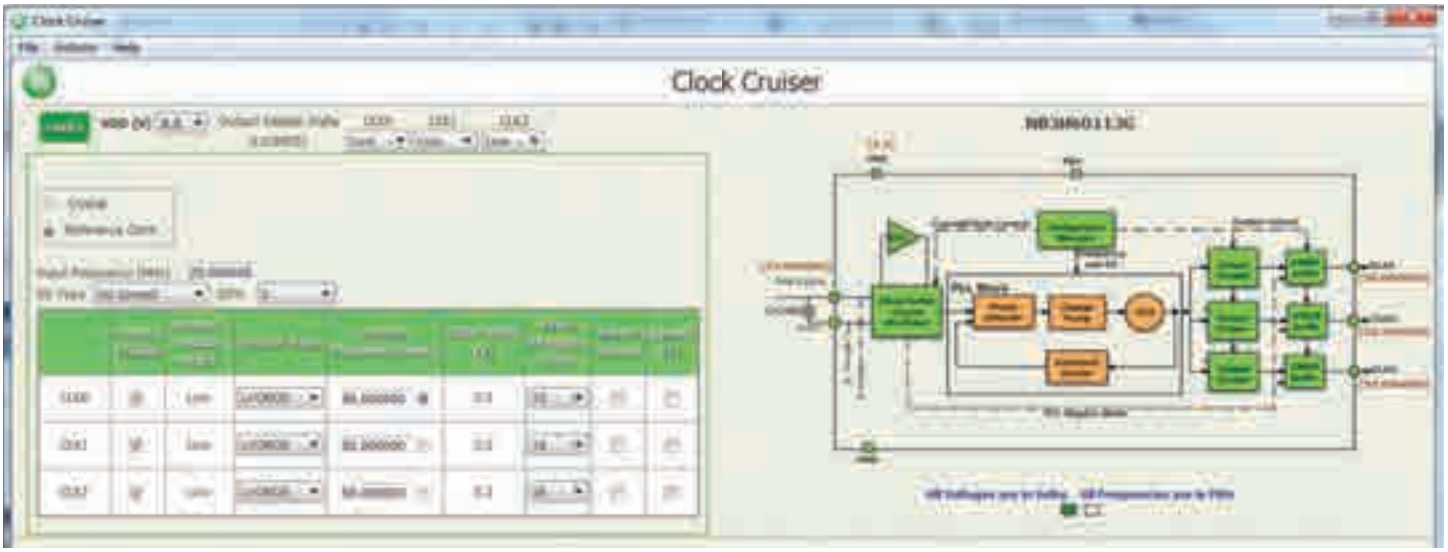


Block Diagram

OmniClock Programmable Clock Synthesizers

Using OmniClock in Your System





Configuration GUI

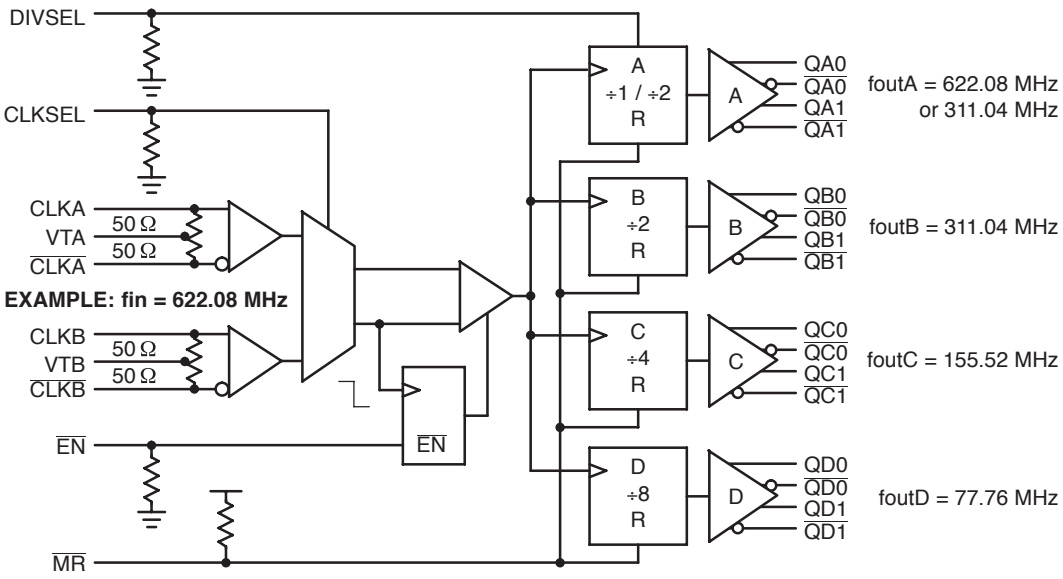
Device	Individual OE	Individual V_{ddo}	Supply Voltage (V)	Number of Configurations	Number of Outputs	Package
NB3H63143G	Yes	Yes	2.5 / 3.3	4	3	QFN-16
NB3H60113G	No	No	2.5 / 3.3	1	3	DFN-8
NB3V63143G	Yes	Yes	1.8	4	3	QFN-16
NB3V60113G	No	No	1.8	1	3	DFN-8

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					
NB4L339	✓		✓	✓	ECL	2.5, 3.3	0.7	1 or 2; 2; 4; 8	QFN-32
NB7V32M	✓		✓	✓	CML	1.8, 2.5	10	2	QFN-16
NB7N017M	✓		✓	✓	CML	3.3	3.5	2 to 256	QFN-16
NB7L32M	✓		✓	✓	CML	2.5, 3.3	14	2	QFN-16
NB6N239S	✓	✓	✓	✓	LVDS	3.3	3	1/2/4/8; 2/4/8/16	QFN-16
NB6L239	✓	✓	✓	✓	ECL	2.5, 3.3	3	1/2/4/8; 2/4/8/16	QFN-16

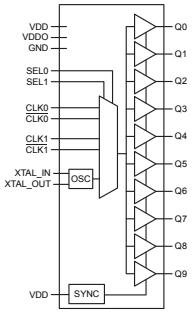


NB4L339 Functional Diagram

Clock and Data Distribution

Features

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



NB3F8L3010C Functional Diagram

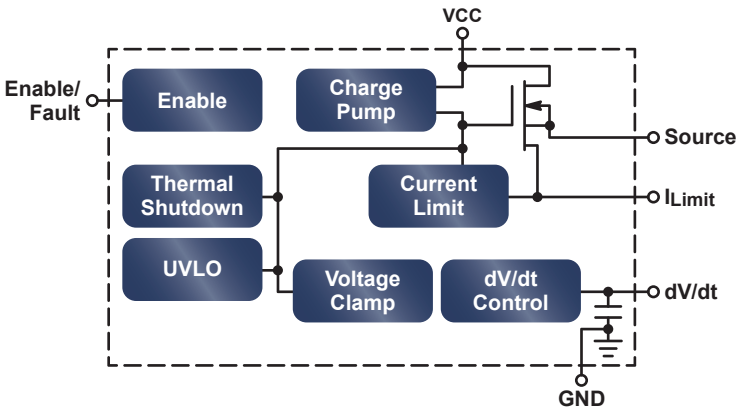
Device	Outputs per Channel	Output Level	Input Level								Vcc Typ (V)	t_{Skew} 0-0 (ps)	f_{Max} Typ (GHz)	Package(s)
			CML	CMOS	LVPECL	HCSL	HSTL	LVDS	XTAL	TTL				
NB3N106K/08K NB3N111K/21K NB3L202K/04K	2, 4, 6, 8, 10, 21	HCSL		✓	✓	✓	✓	✓		✓	3.3	100	0.4	QFN-52, QFN-32, QFN-24, QFN-16
NB3L83948C	12	CMOS		✓		✓	✓	✓		✓	2.5, 3.3	25	0.35	LQFP-32
NB3V8312C	12	CMOS		✓						✓	1.8, 2.5, 3.3	150	0.25	LQFP-32
NB3F8L3010C	10	CMOS		✓	✓	✓	✓	✓	✓	✓	1.5, 1.8, 2.5, 3.3	55	0.2	QFN-32
NB3M8T3910G	10	HCSL, CMOS,LVDS, ECL			✓	✓		✓			2.5, 3.3	50	1.4	QFN-48
NB7L111M	10	CML	✓	✓	✓			✓		✓	2.5, 3.3	20	5.5	QFN-52
NB7L1008/M	8	ECL/CML	✓		✓			✓			2.5, 3.3	20/25	7/8	QFN-32
NB7V585M	6	CML	✓		✓			✓			1.8, 2.5	30	7	QFN-32
NB7V586M	6	CML	✓		✓			✓			1.8	30	6	QFN-32
NB7VQ1006M	6	CML	✓		✓			✓			1.8, 2.5	1	7.5	QFN-24
NB3F8L3005C	5	CMOS		✓	✓	✓	✓	✓	✓	✓	1.5, 1.8, 2.5, 3.3	55	0.2	QFN-32
NB3L853141	5	ECL	✓	✓	✓	✓	✓	✓		✓	2.5,3.3	30	700	TSSOP-20
NBSG14	5	ECL	✓	✓	✓			✓		✓	2.5, 3.3	15	12	QFN-16, BGA-16
NB3M8302C/04C	2, 4	CMOS, TTL		✓						✓	2.5, 3.3	45, 85	0.2	SOIC-8
NB3N853501E	4	ECL		✓							3.3	30	0.266	TSSOP-20
NB3N853531E	4	ECL		✓					✓	✓	3.3	30	0.266	TSSOP-20
NB6HQ14M	4	CML	✓	✓	✓			✓		✓	2.5	3	5	QFN-16
NB6L14/M	4	ECL/CML	✓	✓	✓			✓		✓	2.5, 3.3	20	3	QFN-16
NB6L14S/N14S	4	LVDS	✓	✓	✓		✓	✓		✓	2.5/3.3	20	2	QFN-16
NB7HQ14M	4	CML	✓		✓			✓			2.5	15	7	QFN-16
NB7L14/M	4	ECL/CML	✓	✓	✓			✓		✓	2.5, 3.3	15	7/8	QFN-16
NB4L339	2	ECL	✓		✓			✓			2.5, 3.3	60	0.7	QFN-32
NB4N11M	2	CML	✓	✓	✓			✓		✓	3.3	25	2.5	TSSOP-8
NB6L11	2	ECL	✓	✓	✓			✓		✓	2.5, 3.3	15	6	TSSOP-8, SOIC-8
NB6L11M	2	CML	✓	✓	✓			✓		✓	2.5, 3.3	15	2	QFN-16
NB6L11S	2	LVDS	✓	✓	✓		✓	✓		✓	3.3	25	2	QFN-16
NB6L611	2	ECL	✓	✓	✓			✓		✓	2.5, 3.3	15	3	QFN-16
NB7L11M	2	CML	✓	✓	✓			✓		✓	2.5, 3.3	15	8	QFN-16
NB7L72M	2	CML	✓	✓	✓			✓		✓	2.5, 3.3	10	8.5	QFN-16
NB7L572	2	CML	✓	✓	✓			✓		✓	2.5, 3.3	15	7	QFN-32
NB3L8504S	4	LVDS	✓		✓	✓	✓	✓			2.5, 3.3	50	0.7	TSSOP-16
NB3L8543S	4	LVDS	✓		✓	✓	✓	✓			2.5, 3.3	40	0.65	TSSOP-20
NB3L8533	4	LVPECL	✓		✓	✓	✓	✓			2.5, 3.3	30	0.65	TSSOP-20
NB3L208K	8	HCSL			✓	✓		✓			2.5, 3.3	100	0.35	QFN-32
NB3U1548C	4	LVCMOS, LVTTL		✓						✓	1.5, 1.8, 2.5, 3.3	250	0.16	TSSOP-8, SOIC-8
NB3N4666C	4	LVCMOS, LVTTL			✓	✓		✓			3.3	50	0.2	TSSOP-16, QFN-16
NB3V1102C/3C NB3V1104C/6C	2, 3, 4, 6	LVCMOS		✓							1.8, 2.5, 3.3	50	0.25	TSSOP-14,8
NB7VQ572M	2	CML	✓		✓			✓			1.8, 2.5	15	5	QFN-32
NBSG11	2	ECL	✓	✓	✓			✓		✓	2.5, 3.3	15	12	QFN-16, BGA-16
NB6L56	1	ECL	✓		✓		✓	✓			2.5, 3.3	25	2.5	QFN-32

Electronic Fuses for Motor, Pump, Relay, and In-Box LED

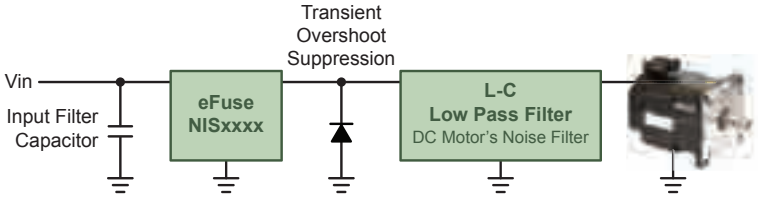
3 – 12 V Power Bus Hot Plug Protection

Features

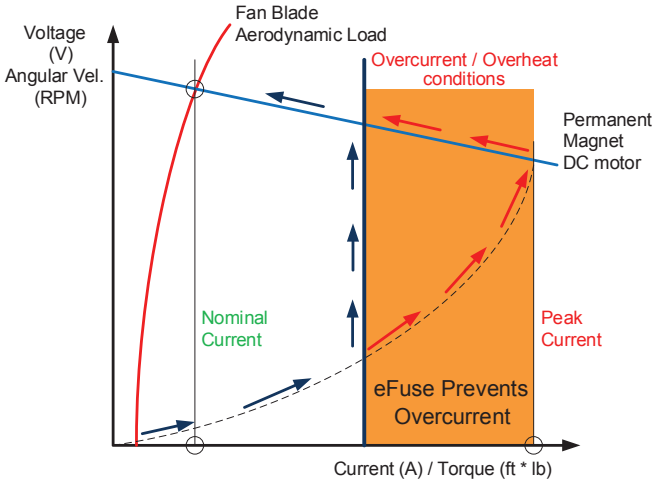
- Low $R_{DS(ON)}$, high operating and trip currents (I_{OP}, I_{TRIP})
- Overvoltage protection
- Precise I_{TRIP} control
- Slew rate control
- Thermal shut-down
- EN pin for synchronizing multiple eFuses
- Outperforms poly-fuses:
  - Tighter spec tolerances
  - Lower resistance
  - Shorter trip-time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



Typical Feature Set for eFuse



Typical Application Block Diagram



DC Motor I/V Characteristics

Device	Nominal Voltage (V)	Input Voltage (V)	Vclamp (V)	Continuous Current (A)	Trip Current (A)	$R_{DS(ON)}$ (mΩ)	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	**	✓	DFN-10
NIS5820*	12	-0.3 to 22	14	8	Adjustable	24	✓	✓	WDFN-10
NIS5020*	12	-0.3 to 22	14	10	Adjustable	14	✓	✓	WDFN-10
NIS5021*	12	-0.3 to 22	14	12	Adjustable	14	✓	✓	WDFN-10

* Pending 3Q18. ** Auto-retry available on NIS5132MN2.

ESD and Surge Protection for Industrial Networks

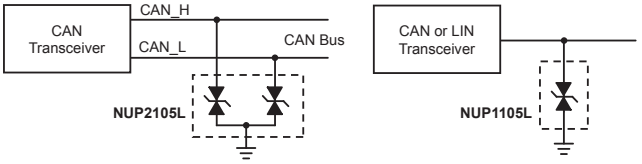
Zener Voltage Regulators

Device	Power (W)	V_Z (V)	V_Z Tolerance (%)	Package
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_{rwm} Max (V)	Line-to-Line Capacitance (pF)	Peak Surge Current* Max (A)	Package
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	SO-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).



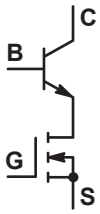
PROTECTION

Emitter-Switched Bipolar/MOSFET Cascode Transistors

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 $R_{DS(ON)}$
- 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_{CEO} Min (V)	V_{CBO} (V)	V_{EBO} (V)	V_{BE} (sat) (V)	hFE Min	hFE Max	fT Min (MHz)	P_{TM} Max (W)	Package
FJP2160DTU	NPN	0.75	2	800	1600	12	1.2	20	35	5	100	TO-220-3
FJPF2145TU	NPN	2	5	800	1100	7	1.5	20	40	15	40	TO-220-3 FP
FJP2145TU	NPN	2	5	800	1100	7	1.5	20	40	15	120	TO-220-3
FJAFS1510ATU	NPN	0.5	6	750	1550	6	-	15	-	15.4	60	TO-3PF-3L

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.

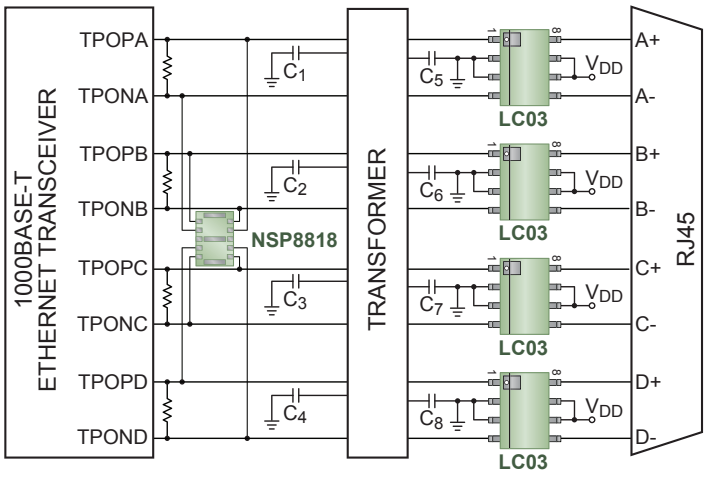
Features

- 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

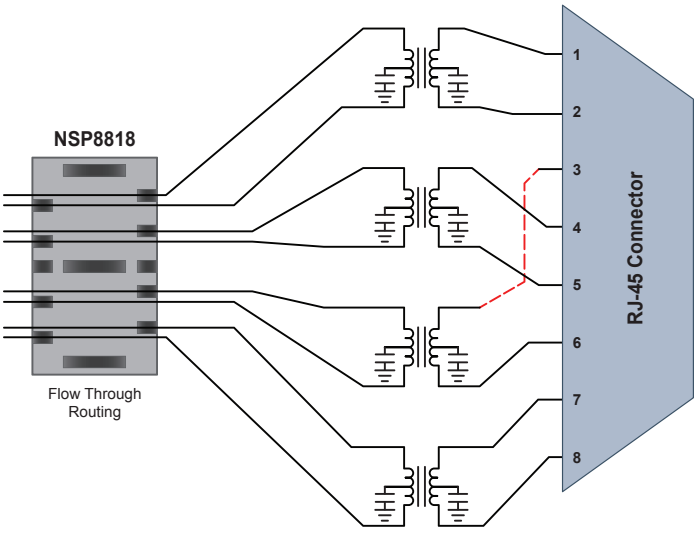
Benefits

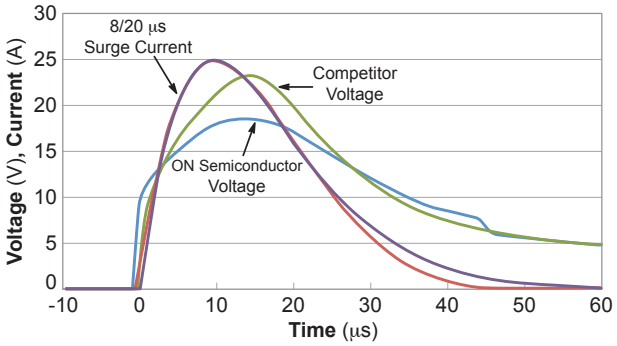
- Compatible with Gb Ethernet and beyond
- Enhanced protection for downstream electronics
- Accommodates operating transients above 3.3 V
- Small form-factor allows integration into connectors

Typical Application



Line Side : LC03-6 (optional)
Transformer Side: NSP8818
Protection against metallic (transverse) strikes





Line-to-Line Surge

Surge Suppressors

Device	V_{DC} Max (V)	Line Transient Max (V)	Surge I_{PP}, 8/20 µs (A)	Typical Line-Line Capacitance (pF)	ESD Contact Rating (kV)	Package
LC03-6	6.7	7.0	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

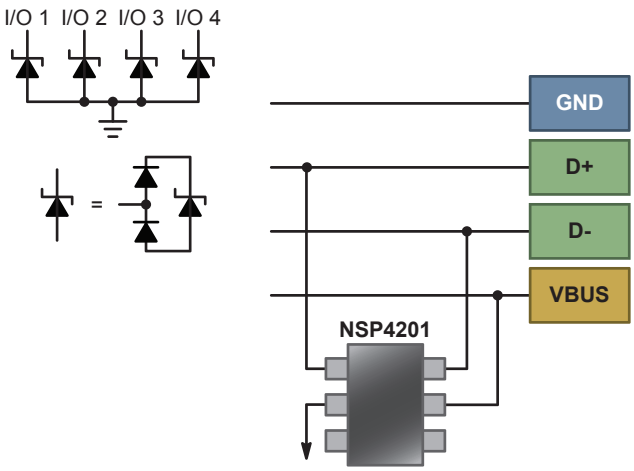
One High Speed Pair, V_{CC}, Low Capacitance ESD Protection

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	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
ESD7451	Single Line 0402	0.25	XDFN-2	1.0 x 0.6
ESD7481	Single Line 0201	0.25	X3DFN-2	0.62 x 0.32

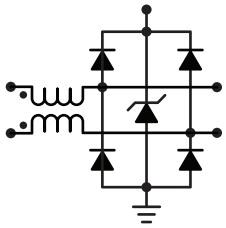
One High Speed Pair, V_{CC}, Common Mode Filter + ESD Protection

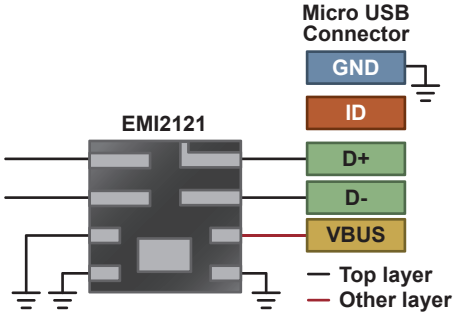
Key Requirement

- Cap < 1.5 pF
- Common Mode Filtering

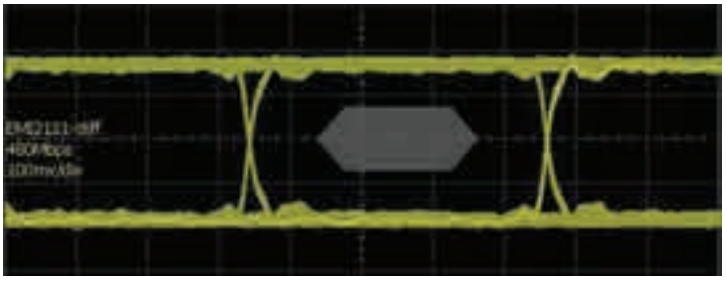
Features

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

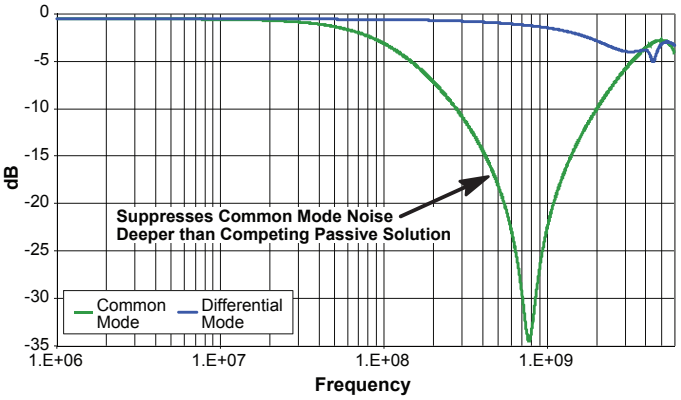




Device	Data Lines	Capacitance @ 2.5 V (pF)	CM Attenuation @ 800 MHz (-dB)	DM Bandwidth F3dB (GHz)	Package	Size (mm)
EMI2121	1 Pair + Power (D+, D-, VBUS)	0.9	-25	2.5	WQFN	2.2 x 2.0 x 0.75
EMI2124	1 Pair + ID + Power (D+, D-, ID, VBUS)	0.9	-25	2.5	WQFN	2.2 x 2.0 x 0.75



USB 2.0 @ 480 Mb/s



General and LCD MCUs

MCU Features

- Pins: 10 – 100
- ROM: 4 – 768 KBytes
- RAM: 256 – 48,640 Bytes
- ADC: 3 – 16 channels
- Operation Voltage: 1.8 – 5.5 (V)
- Stand-by IDD: 0.02 µA
- RTC (Clock) IDD: 0.45 µA (with low power model)

Device	Type	ROM (kByte)	RAM (Byte)	I/Os	PWMs	UARTs	ADC	LVD	POR	Features	Package
LC87F2608A	8-bit General	8	512	11	3	–	12/8-bit x 3ch	✓	✓	Highspeed 12bitPWM,Analog-Comparator	MFP-10SK
LC87F2708A	8-bit General	8	512	11	3	–	12/8-bit x 7ch	✓	✓	Highspeed 12bitPWM,Analog-Comparator	MFP-14S
LC87F0N04A	8-bit General	4.5	128	12	3	–	10/8-bit x 6ch	✓	✓	MCPWM ,Hi-speed ADC(10bit),Analog comparator x 2	SSOP-16
LC87F2R04A	8-bit General	4.5	128	21	–	–	12/8-bit x 8ch	✓	✓	Small scale 8bit MCU; Timer,SIO,Remote Control Receiver Circuit	SSOP-24
LC87FBK08A	8-bit General	8	256	21	2	–	12/8-bit x 8ch	✓	✓	High accuracy internal OSC (±3.0%); Support Mask Type	SSOP-24
LC87FBG08A	8-bit General	8	256	21	4	1	12/8-bit x 9ch	✓	✓	High accuracy internal OSC(±2.0%),all operation is minimum 1.8V	SSOP-24,VCT-24
LC87F0K08A	8-bit General	8	384	9	–	1	12/8-bit x 5ch	✓	✓	IGBT control circuit(PPGx1),Analog comparator x 8,Amplifier x 2	DIP-24S
LC87F0G08A	8-bit General	8	256	18	3	–	12/8-bit x 7ch	✓	✓	VCPWM(12-bit x 2ch), High speed PWM(8/10- bits x 1ch), OP-AMP(x20),Analog comparator x1	SSOP-24
LC87FBL08A	8-bit General	8	256	26	4	–	12/8-bit x 11ch	✓	✓	High accuracy internal OSC (±3.0%)	QFP-36
LC87FBH08A	8-bit General	8	256	26	4	1	12/8-bit x 10ch	✓	✓	High accuracy internal OSC(±2.0%),All operation is minimum 1.8V	QFP-36
LC87F2416A	8-bit General	16	512	26	4	1	12/8-bit x 10ch	✓	✓	Timer,SIO,Remote Control Receiver Circuit	QFP-36
LC87F0A08A	8-bit General	8	256	28	2		12/8-bit x 8ch	✓	✓	Amplifier, Analog comparator, Constant current output port	QFP-36
LC87F0808A	8-bit General	8	256	28	8	1	10/8-bit x 10ch	✓	✓	MCPWM ,Hi-speed ADC(10bit),Analog comparator/Amplifier x 2	QFP-36
LC87F2J32A	8-bit General	32	1024	41	4	1	12/8-bit x 14ch	✓	✓	Premium market segment	SQFP-48,QIP-48E
LC87F2W48A	8-bit General	50	1536	40	4	1	12/8-bit x 14ch	✓		Premium market segment	SQFP-48
LC87F7J32A	8-bit LCD	32	1024	50	4	1	12/8-bit x 12ch	✓	✓	24 x 4 segment driver,Support 5V/3V for LCD-panel	QIP-64E
LC87F7932B	8-bit LCD	32	2048	51	2	1	12/8-bit x 7ch		✓	32 x 4 segment driver,RTC,Low-Power Consumption	QIP-64E, SQFP-64
LC87F5M64A	8-bit General	64	2048	55	4	2	8-bit x 11ch			Timer,SIO,Remote Control Receiver Circuit	QIP-64E
LC87F5R96B	8-bit General	96	4096	55	4	2	8-bit x 11ch			Timer,SIO,Remote Control Receiver Circuit	QIP-64E
LC87FC096A	8-bit General	98	4096	55	6	2	12/8-bit x 11ch			Single master I2C/8-bit synchronous SIO	QIP-64E
LC87F5JC8A	8-bit General	128	4096	55	4	1	8-bit x 11ch			Premium market segment	QIP-64E
LC88F58B0A	16-bit General	128	6144	54	4	2	12/8-bit x 11ch		✓	SMIIC,USM	SQFP-64
LC87F2C64A	8-bit General	64	2048	73	6	2	12/8-bit x 16ch	✓	✓	RTC,Low-Power Consumption	QFP-80,TQFP-80J
LC87F76C8A	8-bit LCD	128	4096	71	4	1	12-bit x 12ch			32 x 4 segment driver	QFP-80,TQFP-80J
LC87F7DC8A	8-bit LCD	128	4096	91	4	2	12-bit x 15ch			54 x 4 segment driver,Many segment drivers	QIP-100E, TQFP-100
LC87F5WC8A	8-bit General	128	4096	89	6	2	8-bit x 15ch			Timer,SIO,Remote Control Receiver Circuit	QIP-100E
LC87F7NC8A	8-bit LCD	128	8192	91	4	2	12-bit x 15ch			54 x 4 segment driver,Large scale Memory	QIP-100E
LC87F7NJ2A	8-bit LCD	192	8192	91	4	2	12-bit x 15ch			54 x 4 segment driver,Large scale Memory	QIP-100E
LC87F7NP6A	8-bit LCD	256	8192	91	4	2	12-bit x 15ch			54 x 4 segment driver,Large scale Memory	QIP-100E
LC87F5VP6A	8-bit General	256	10240	89	6	2	8-bit x 15ch			Large scale memory	QIP-100E,TQFP-100
LC88FC2D0B	16-bit General	256	24576	90	4	3	12/8-bit x 16ch	✓	✓	SMIICx2,SLIICx1,RTC,CRC calculation circuit	TQFP-100
LC88FC2F0B	16-bit General	384	24576	90	4	3	12/8-bit x 16ch	✓	✓	SMIICx2,SLIICx1,RTC,CRC calculation circuit	TQFP-100
LC88FC2H0B	16-bit General	512	24576	90	4	3	12/8-bit x 16ch	✓	✓	SMIICx2,SLIICx1,RTC,CRC calculation circuit	TQFP-100
LC88FC3H0A	16-bit General	512	48640	90	4	3	12/8-bit x 16ch	✓	✓	SMIICx2,SLIICx1,RTC,CRC calculation circuit	TQFP-100
LC88FC3J0A	16-bit General	640	48640	90	4	3	12/8-bit x 16ch	✓	✓	SMIICx2,SLIICx1,RTC,CRC calculation circuit	TQFP-100
LC88FC3K0A	16-bit General	768	48640	90	4	3	12/8-bit x 16ch	✓	✓	SMIICx2,SLIICx1,RTC,CRC calculation circuit	TQFP-100

* Mask ROM Device; Contact ON Semiconductor for additional information.

MCUs for USB

MCU Features

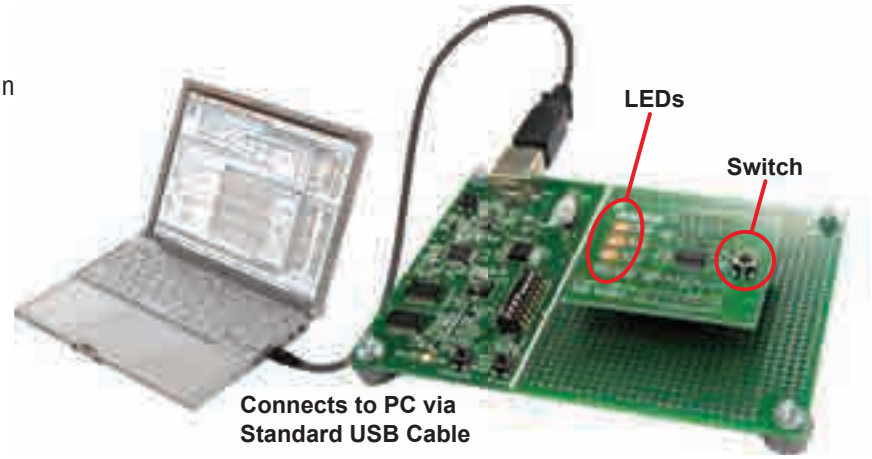
- USB 2.0 full-speed/low speed functions
- USB device function/USB host function
- Integrated voltage regulator
- USB D+ line pull-up function

Device	Type	ROM (kByte)	RAM (Byte)	I/Os	PWMs	UARTs	ADC	LVD	POR	Features	Package
LC87F1M16A	8-bit USB	16	1024	38	4	2	12/8-bit x 20ch	✓	✓	UART & SCUART, high current driver, USB-Device	SQFP-48
LC87F1A32A	8-bit USB	32	2048	39	4	1	12/8-bit x 12ch			IR reciever, USB-Device	SQFP-48
LC87F1D64A	8-bit USB	64	4096	39	4	2	12/8-bit x 12ch			USB-Device	SQFP-48
LC87F1K64A	8-bit USB	64	8192	39	4	1	12-bit x 12ch	✓	✓	USB-Host x 2, Audio I/F	SQFP-48
LC87F17C8A	8-bit USB	128	8192	36	4	1	12-bit x 12ch	✓	✓	USB 2.0 Full Speed Host/Device x 2, Audio I/F	SQFP-48
LC87F1HC8A	8-bit USB	128	16384	39	4	1	8-bit x 12ch			USB-Host, Audio I/F	SQFP-48
LC87F1JJ2A	8-bit USB	192	16384	39	4	1	8-bit x 12ch			USB-Host, Audio I/F	SQFP-48
LC87F1JJ4A	8-bit USB	192	20480	39	4	1	8-bit x 12ch			USB-Host, Audio I/F	SQFP-48
LC87F1JJ8A	8-bit USB	192	24576	39	4	1	8-bit x 12ch			USB-Host, Audio I/F	SQFP-48

MCU Starter Kit for Software Development

Trial kit includes Main Board, Sub Board, and Development Environment CD. With Main Board as a base, it is possible to connect different Sub Boards with different pin numbers.

- 8 bit Easy Micon Development Tool
  Sub Board Line Up: 16-pin, 24-pin, 36-pin, 48-pin
- 16 bit Xstromy16 Development Tool
  Sub Board Line Up: 48-pin, 64-pin, 100-pin



MCU On-Chip Debugger System

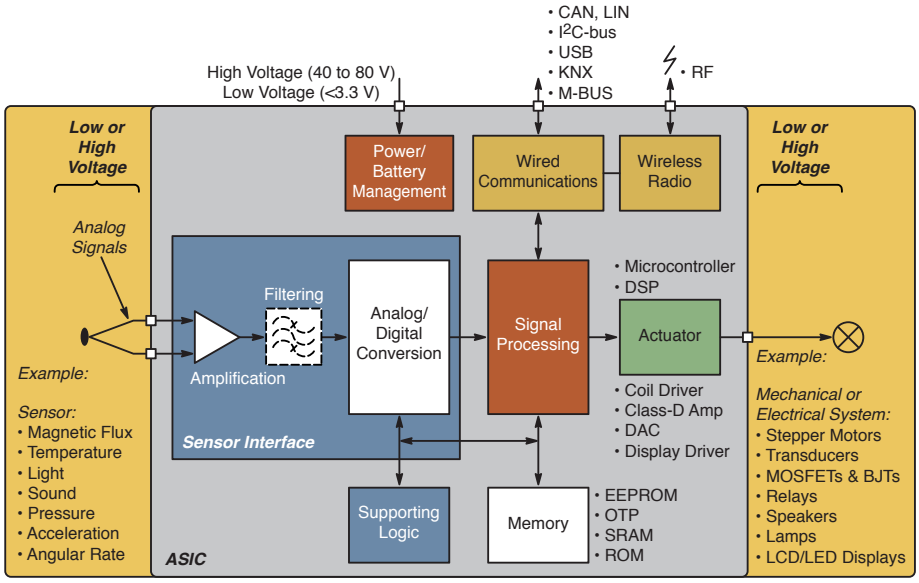
- Software development with 1 wire communication
- Reduction of development time with Real Time Display function, Break function, and Trace function

PROCESSING

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

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 (I^2C, SPI, Microwire)

EEPROMs

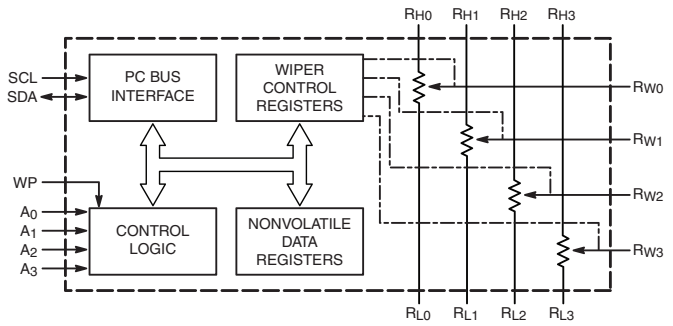
Data Transmission Standard	Density	Organization*	V_{CC} Min (V)	V_{CC} Max (V)	f_{CLK} Max (MHz)	Package(s)
I^2C	1 Mb	128k x 8	1.7, 1.8	5.5	0.4, 1	US8, SOIC-8, TSSOP-8, UDFN-8, TSOT23-5, WLCSP-4, WLCSP-5, WLCSP-8
	512 kb	64k x 8				
	256 kb	32k x 8				
	128 kb	16k x 8				
	64 kb	8k x 8				
	32 kb	4k 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.

Digital Potentiometers (POTs) for Trimming and Calibration

Features

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



Device	Number of Pots	Number of Taps	Resistance (kΩ)	Buffered Wiper	Interface	Volatile	Non-Volatile	Packages
CAT5120/1/2	1	16	10, 50, 100		UP/DOWN	✓		SOT-23-6, SC-70-6
CAT5110	1	32	10, 50, 100		UP/DOWN	✓		SOT-23-6, SC-70-6
CAT5112	1	32	10, 50, 100	✓	UP/DOWN		✓	PDIP-8, SOIC-8, MSOP-8, TSSOP-8
CAT5114	1	32	10, 50, 100		UP/DOWN		✓	PDIP-8, SOIC-8, MSOP-8, TDFN-8, TSSOP-8
CAT5115	1	32	10, 50, 100		UP/DOWN	✓		PDIP-8, SOIC-8, MSOP-8, TSSOP-8
CAT5118/9	1	32	10, 50, 100		UP/DOWN	✓		SOT-23-5, SC-70-5
CAT5123/4	1	32	10, 50, 100		UP/DOWN	✓		SOT-23-5
CAT5125	1	32	10, 50, 100		UP/DOWN	✓		SOT-23-6
CAT5126	1	32	10, 50, 100		UP/DOWN	OTP		MSOP-8, TDFN-8
CAT5127	1	32	10, 50, 100		UP/DOWN		✓	MSOP-8, TDFN-8
CAT5128	1	32	10, 50, 100		UP/DOWN	✓		SOT-23-8
CAT5129	1	32	10, 50, 100		UP/DOWN		✓	TSOT-23-6
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		I²C		✓	MSOP-10
CAT5133	1	128	10, 50, 100		UP/DOWN		✓	MSOP-10
CAT5137	1	128	50		I2C		✓	SC-88-6, SC-70-6
CAT5138	1	128	10		I2C		✓	SC-88-6, SC-70-6
CAT5140	1	256	50, 100		I2C		✓	MSOP-8
CAT5171	1	256	50, 100		I2C		✓	SOT-23-8
CAT5172	1	256	50		SPI		✓	SOT-23-8
CAT5221	2	64	2.5, 10, 50, 100		I²C		✓	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		I²C		✓	SOIC-24, TSSOP-24
CAT5261	2	256	50, 100		SPI		✓	SOIC-24, TSSOP-24
CAT5269	2	256	50, 100		I²C		✓	SOIC-24, TSSOP-24
CAT5271	2	256	50, 100		I2C		✓	MSOP-10
CAT5273	2	256	50		I2C		✓	MSOP-10
CAT5241	4	64	2.5, 10, 50, 100		I²C		✓	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		I²C		✓	SOIC-24, TSSOP-24
CAT5251	4	256	50, 100		SPI		✓	SOIC-24, TSSOP-24
CAT5259	4	256	50, 100		I²C		✓	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} Min (V)	V_{CC} Max (V)	t_{PD} (nS)	I_{OUT} (mA)	Input Logic Level	Packages
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)	CMOS	
					±7.8 @ V_{CC} = 6 V (Bus Driver)		
HCT	MC74HCT/MM74HCT	4.5	5.5	15 @ V_{CC} = 5 V	±4.0 @ V_{CC} = 4.5 V (Std)	TTL	
					±6.0 @ V_{CC} = 4.5 V (Bus Driver)		
LCX	MC74LCX/74LCX	2.3	3.6	5.5 @ V_{CC} = 3 V	±24 @ V_{CC} = 3 V	LVTTL	
LVX	MC74LVX/74LVX	2	3.6	6.6 @ V_{CC} = 3 V	±4 @ V_{CC} = 3 V	LVTTL	
VCX	MC74VCX/74VCX	1.65	3.6	3.5 @ V_{CC} = 3 V	±24 @ V_{CC} = 3 V	LVTTL	
VHC	MC74VHC/74VHC	2	5.5	5.2 @ V_{CC} = 4.5 V	±8 @ V_{CC} = 4.5 V	CMOS	
VHCT	MC74VHCT/74VHCT	4.5	5.5	3.6 @ V_{CC} = 4.5 V	±8 @ V_{CC} = 4.5 V	TTL	
LVT	74LVT	2.7	3.6	3.6 @ V_{CC} = 3.0 V	-32/64 @ V_{CC} = 3.0 V	TTL	

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

Integrated Interface with Configurable DC-DC Controller for Power-over-Ethernet

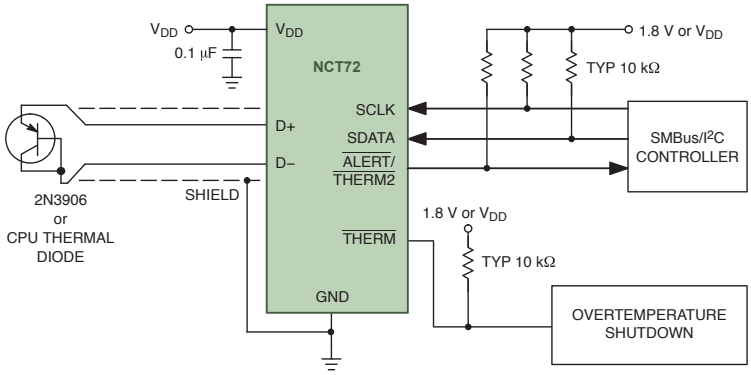
PoE Controllers

Device	Power (W)	Standard	Interface	Controller	Package
NCP1080	13	IEEE 802.3af	✓	✓	TSSOP-20 EP
NCP1082	13	IEEE 802.3af + Auxiliary	✓	✓	TSSOP-20 EP
NCP1081	40	IEEE 802.3at	✓	✓	TSSOP-20 EP
NCP1083	40	IEEE 802.3at + Auxiliary	✓	✓	TSSOP-20 EP
NCP1090	13	IEEE 802.3af	✓		TSSOP-8, SOIC-8
NCP1091	13	IEEE 802.3af	✓		TSSOP-8, SOIC-8
NCP1092	13	IEEE 802.3af	✓		TSSOP-8, SOIC-8
NCP1093	25	IEEE 802.3at	✓		DFN-10
NCP1094	25	IEEE 802.3at	✓		DFN-10
NCP1030	6	IEEE 802.3af		✓	SOIC-8, DFN-8
NCP1031	3	IEEE 802.3af		✓	Micro8™

Features

- 3.0 kV cable ESD robustness
- 8.0-15 kV system ESD robustness
- IEC61000-4-5 surge compliant without external protection

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
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

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