

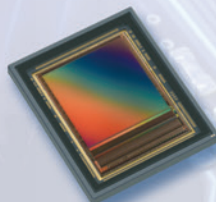


Industrial Solutions

Communications, control, sensing, interface, power management, and protection solutions for industrial applications from ON Semiconductor.

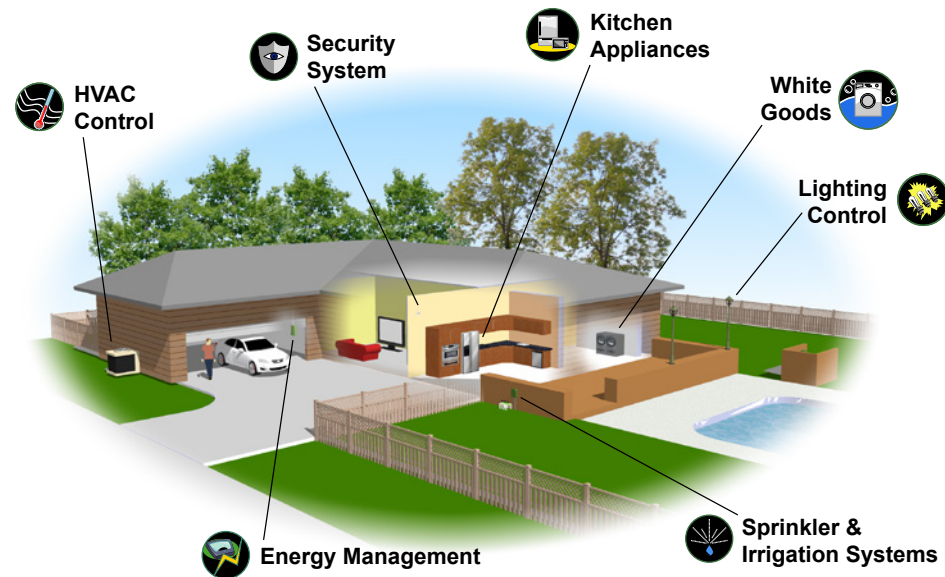
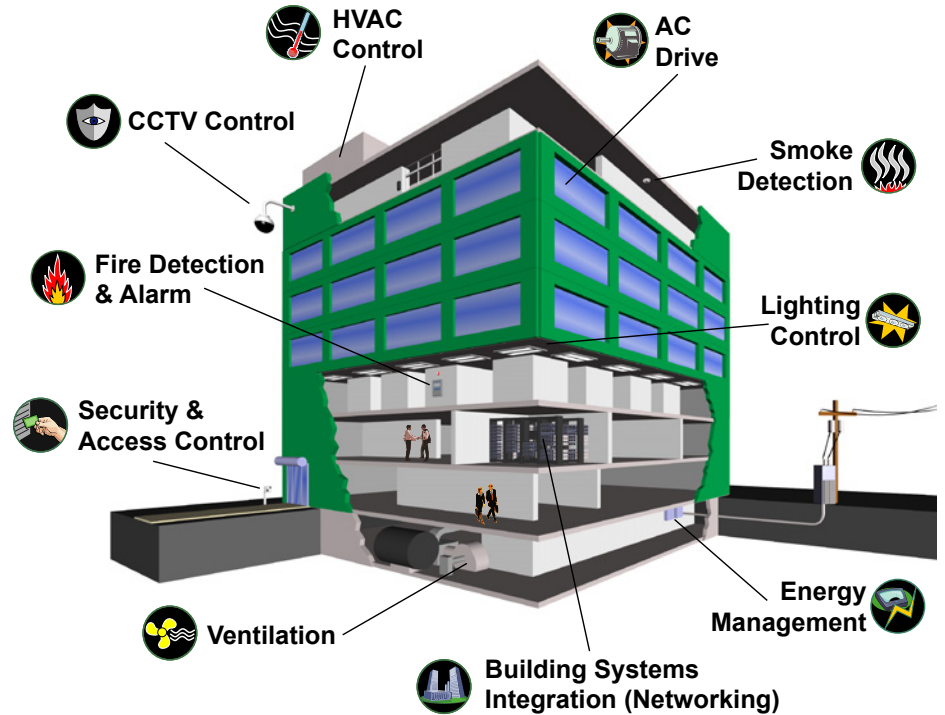


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ON Semiconductor has a complete portfolio of rugged, reliable products that meet the needs of industrial grade applications.

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



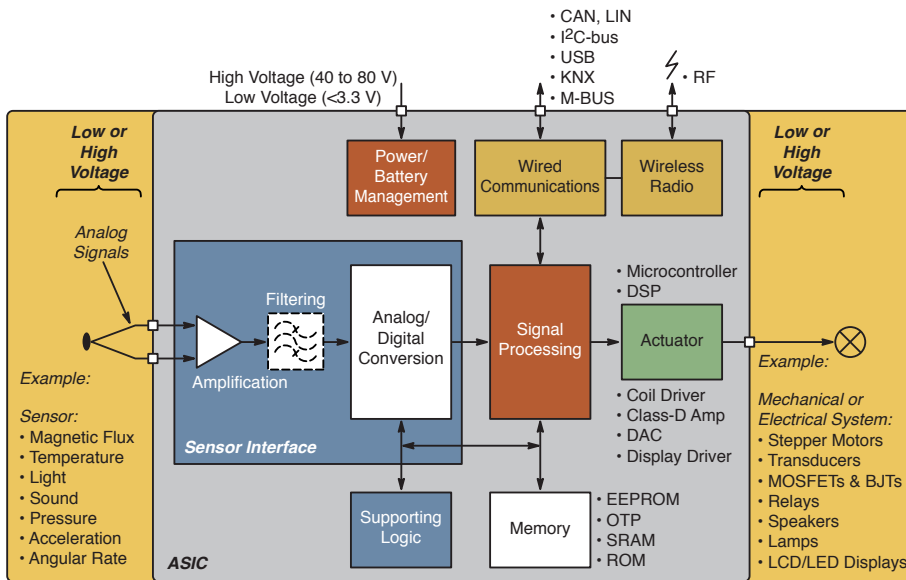
Mixed-Signal ASIC Development Services

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

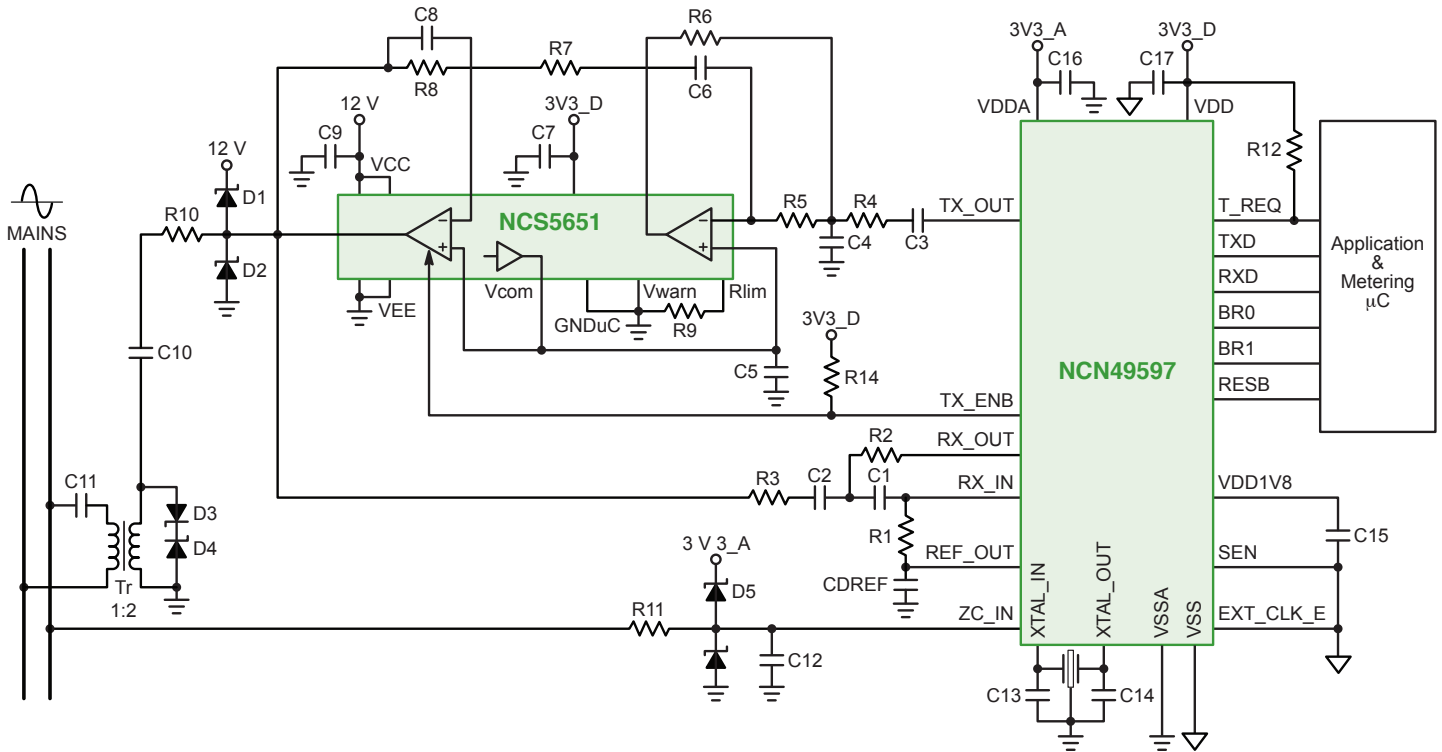


IP & Fab Processes

- ≥ 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 – $\leq 200^\circ\text{C}$ (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

PLC Modems/Power Line Driver



	Device	Function	Features	Package(s)	
Smart Grid Modem	NCN49599	PLC S-FSK Modem; A - D Band	<ul style="list-style-type: none"> ARM Cortex M0 Baud rate: 4800 Bauds S-FSK modulation 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> ARM Cortex M0 Baud rate: 4800 Bauds 	<ul style="list-style-type: none"> S-FSK modulation Hardware embedded MAC + PHY 	QFN-52
Smart Metering Modem	AMIS49587	PLC S-FSK Modem; A & B Band	<ul style="list-style-type: none"> ARM7TDMI, 24 MHz core Baud rate: 2400 Bauds 	<ul style="list-style-type: none"> S-FSK modulation Hardware embedded MAC + PHY 	QFN-52
Power Amplifier	NCS5651	Power Line Driver; Class AB	<ul style="list-style-type: none"> Low distortion power line driver with optimized interface for PLC modems Capability to drive 2.0 A peak into reactive loads 	<ul style="list-style-type: none"> Current shutdown minimizes power consumption during power down state Rail-to-Rail Drop of Only ± 1 V with $I_{out} = 1.5$ A 	QFN-20 EP

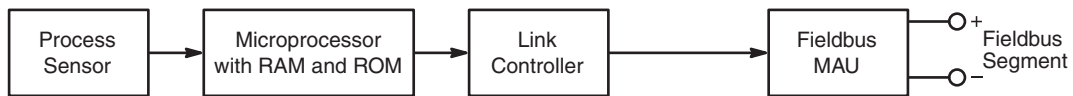


Modems



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

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

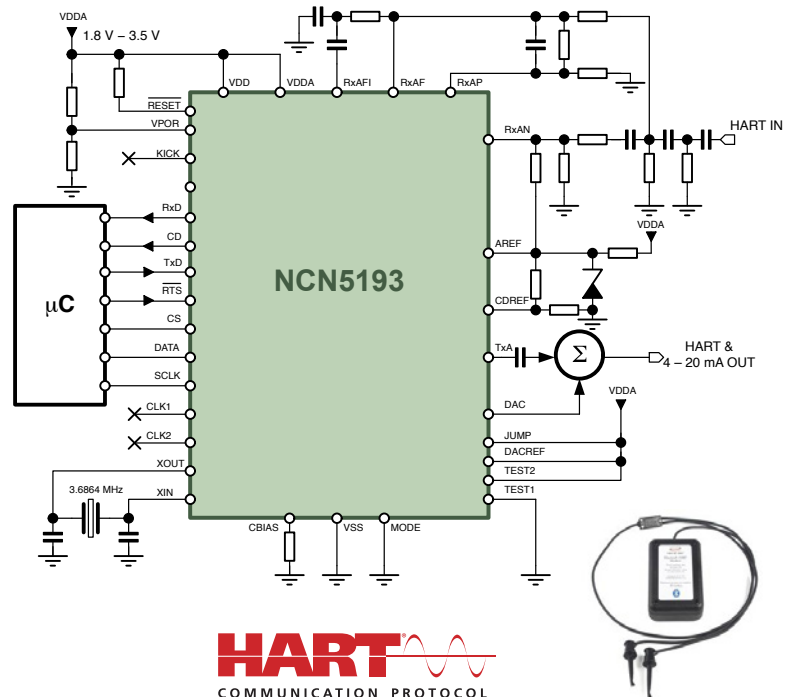


Industrial HART Protocol Modems

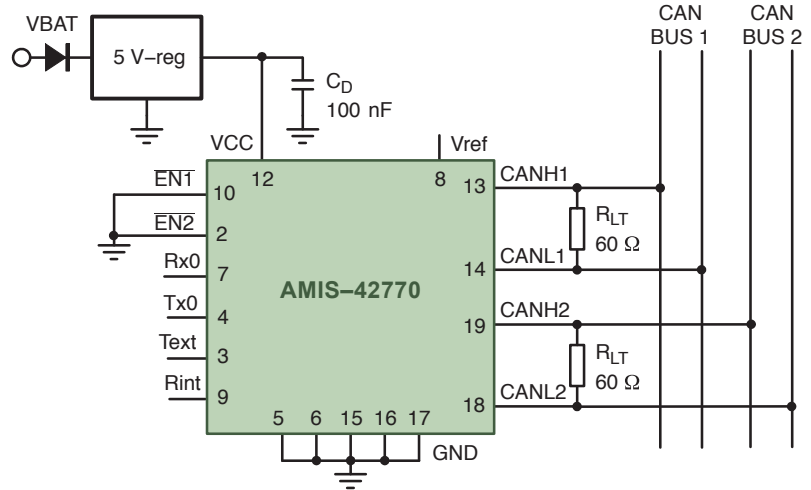
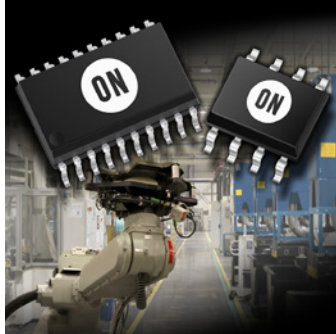
- Single-chip, half-duplex 1200 bps FSK modem
- Bell 202 shift frequencies of 1200 Hz and 2200 Hz
- Transmit-signal wave shaping
- Receive band-pass filter

HART Modems

Device	Input Frequency	DAC	Temp Range (°C)	Package
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



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
AMIS42671	Single	High-Speed CAN Transceiver for Long Networks	SOIC-8
AMIS42673	Single	High-Speed CAN Transceiver for Long Networks	SOIC-8
AMIS42675	Single	High-Speed CAN Transceiver for Long Networks	SOIC-8

KNX Transceiver

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 to the 9600 Baud KNX twisted pair (TP) bus inside a building
- TP bus provides data communication and power supply

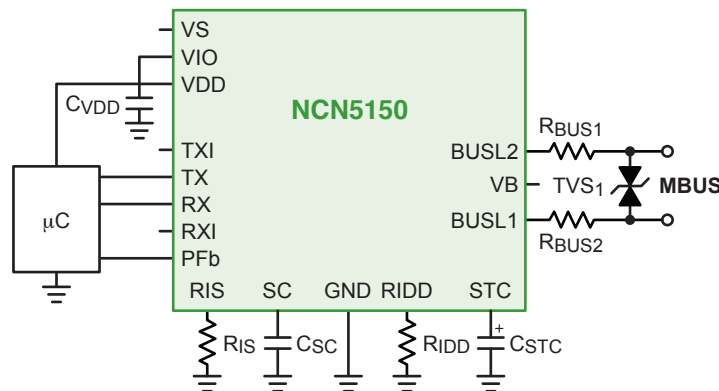
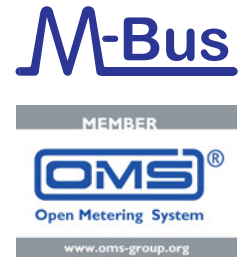
Device	DC=DC Converters		20 V Regulator	Embedded MAC + LLC ¹	KNX Host Interface		Package
	Fixed 3.3 V	Adj 3.3 to 21 V			Digital SPI/UART	Analog UART	
NCN5120	✓	✓	✓	✓	✓	✓	QFN-40

Note 1: LLC = Logical Link Control layer of the OSI-based communications network.

Wired M-BUS Transceiver

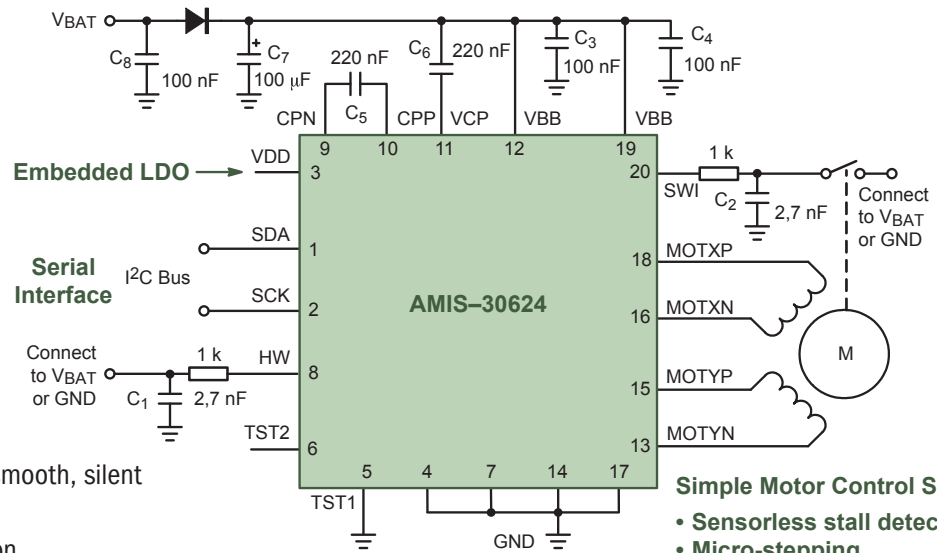
Features

- 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

Stepper Motor Drivers for Motion Control



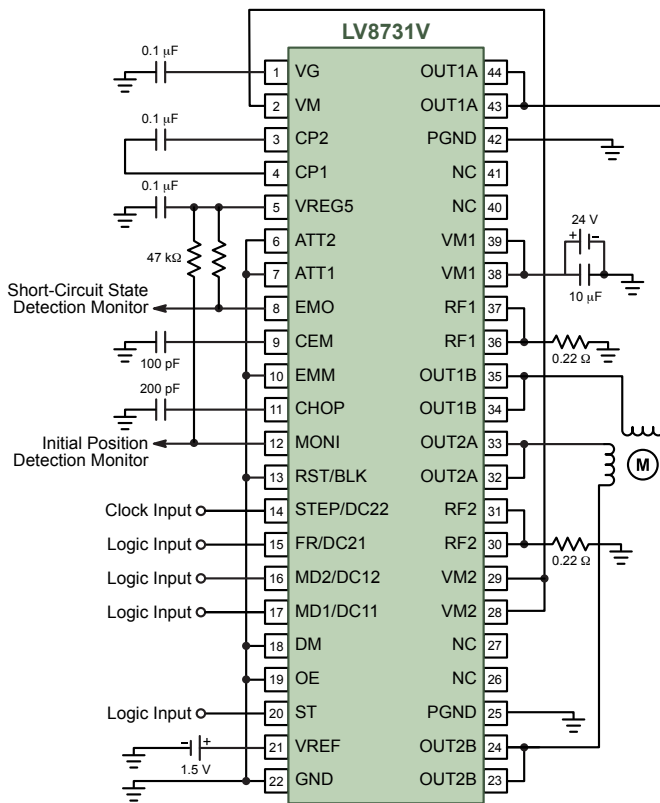
AMIS-30624 Application Diagram

Simple Motor Control System

- Sensorless stall detection
- Micro-stepping
- Position controller
- Programmable velocity and acceleration

Features

- High resolution micro-stepping for smooth, silent movement
- Integrated sensor-less stall detection
- Single chip control and drivers for mechatronics
- Dynamic control of speed, torque, and position for continuous motion



LV8731V Application Diagram

Features

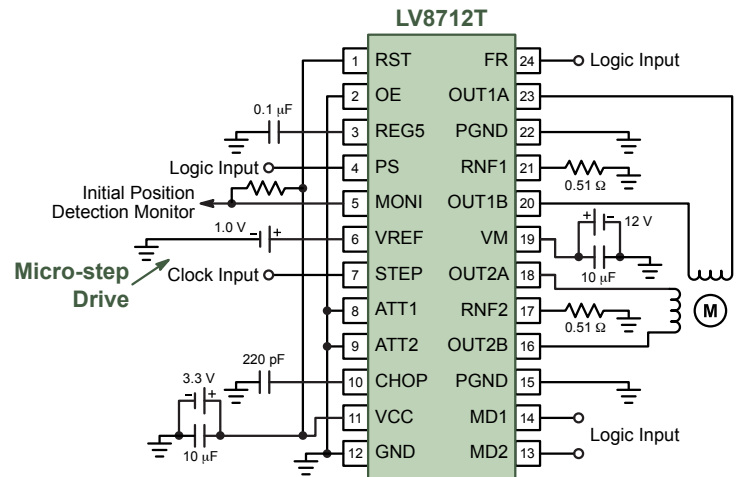
- Integrated protection functions (OCP, TSD, warning output)
- Additional compatible devices available

Type	Channels	~1 A Output	~1.5 A Output	~2 A Output
Stepper Motor Driver	1	LV8735V LV8736V	LV8734V	LV8731V LV8732V
Brush Motor Driver	2	LV8735V LV8736V	LV8734V	LV8731V LV8732V

Stepper Motor Drivers for Motion Control

Features

- Single channel PWM constant current control
- Excitation mode: LV8712T - full step, half step, 1/4 step, 1/8 step;
LV8713T - full step, half step, 1/16 step, 1/32 step
- Integrated thermal shutdown and low-voltage detection



LV8712T, LV8713T: 5-12 V Application Diagram

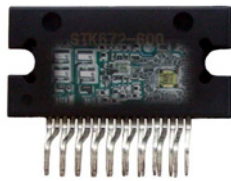
Device	Type	V _M Max (V)	V _{CC} Max (V)	I _O Max (A)	I _O Peak Max (A)	Step Resolution	Control Type	Current Sense	Regulator Output	Flyback Protection	Package
AMIS-30422	Stepper	30	40	Note 1	Note 1	1/128	Clock	Fully Integrated	Yes	Integrated Active	NQFP-48
AMIS-30512	Stepper	30	40	0.4	0.8	1/32	Clock	Fully Integrated	Yes	Integrated Active	SOIC-24
AMIS-30522	Stepper	30	40	0.8	1.6	1/32	Clock	Fully Integrated	Yes	Integrated Active	NQFP-32
AMIS-30543	Stepper	30	40	3.2	6	1/128	Clock	Fully Integrated	Yes	Integrated Active	NQFP-32
AMIS-30623	Stepper	30	40	0.8	0.8	1/16	LIN	Fully Integrated	Yes	Integrated Active	NQFP-32, SOIC-20W
AMIS-30624	Stepper	30	40	0.8	0.8	1/16	I2C	Fully Integrated	Yes	Integrated Active	NQFP-32, SOIC-20W
LV8075LP	Brush DC	6.0	6.0	0.5	-	-	Parallel	None	No	Integrated Active	VCT-16
LV8080LP	Stepper/Brush DC	6.5	-	0.4	-	1/2	Parallel	External Resistor	No	Integrated Active	VCT-16
LV8400V	Brush DC	16	6.0	1.2	3.8	-	Parallel	None	No	Integrated Active	SSOP-16
LV8402GP	Stepper/Brush DC	16	6.0	1.4	2.5	1/2	Parallel	None	No	Integrated Active	VCT-24
LV8411GR	Stepper/Brush DC	6.0	6.0	0.4	0.6	1/2	Parallel	None	No	Integrated Active	VCT-24
LV8413GP	Stepper/Brush DC	6.0	6.0	0.4	0.6	1/2	Parallel	None	No	Integrated Active	VCT-16
LV8548MC	Stepper/Brush DC	20	-	1.0	-	1/2	Parallel	None	No	Integrated Active	SOIC-10
LV8549MC	Stepper	20	-	1.0	-	1	Parallel	None	No	Integrated Active	SOIC-10
LV8711T	Stepper/Brush DC	18	6.0	0.8	1	1/2	Parallel	External Resistor	Yes	Integrated Active	TSSOP-24
LV8712T	Stepper	18	6.0	0.8	1	1/8	Clock	External Resistor	Yes	Integrated Active	TSSOP-24
LV8713T	Stepper	18	6.0	0.8	1	1/32	Clock	External Resistor	Yes	Integrated Active	TSSOP-24
LV8731V	Stepper/Brush DC	36	-	2	2.5	1/16	Clock; Parallel	External Resistor	Yes	Integrated Active	SSOP-44K
LV8732V	Stepper/Brush DC	36	-	2	2.5	1/8	Clock; Parallel	External Resistor	Yes	Integrated Active	SSOP-44K
LV8734V	Stepper/Brush DC	36	-	1.5	1.75	1/8	Clock; Parallel	External Resistor	Yes	Integrated Active	SSOP-44K
LV8735V	Stepper/Brush DC	36	-	1	1.5	1/16	Clock; Parallel	External Resistor	Yes	Integrated Active	SSOP-44K
LV8736V	Stepper/Brush DC	36	-	1	1.5	1/8	Clock; Parallel	External Resistor	Yes	Integrated Active	SSOP-44K
LV8740V	Stepper/Brush DC	38	-	2.5	3	1/4	Clock; Parallel	External Resistor	Yes	Integrated Active	SSOP-44J
LV8741V	Stepper/Brush DC	38	6.0	1.5	1.75	1/4	Clock; Parallel	External Resistor	Yes	Integrated Active	SSOP-44K
LV8746V	Stepper	38	-	1	1.2	1/4	Clock; Parallel	External Resistor	Yes	Integrated Active	SSOP-44K
LV8760T	Brush DC	38	6.0	3	4	-	Parallel	External Resistor	Yes	Integrated Active	TSSOP-20J
LV8761V	Brush DC	38	6.0	3	4	-	Parallel	External Resistor	Yes	Integrated Active	SSOP-36J
LV8762T	Brush DC	36	-	1	1.5	-	Parallel	External Resistor	Yes	Integrated Active	TSSOP-24
LV8773	Stepper/Brush DC	36	-	2	2.5	1/2	Parallel	External Resistor	Yes	Integrated Active	DIP-28HC
LV8414CS	Stepper	6	6.0	0.4	0.6	1/64	Clock; IC2	External Resistor	No	Integrated Active	WLP-32J
LV8727	Stepper	50	-	4	4.6	1/128	Clock	External Resistor	No	Integrated Active	HZIP-25
LV8729V	Stepper	36	-	1.8	-	1/128	Clock	External Resistor	Yes	Integrated Active	SSOP-44K
LV8716QA	Stepper/Brush DC	12.6	-	1	1.5	1/2	Parallel	RF Resistorless	No	Integrated Active	QFN-16

NOTE 1: Function of external MOSFETs

Stepper Motor Drivers for Motion Control

Key Features

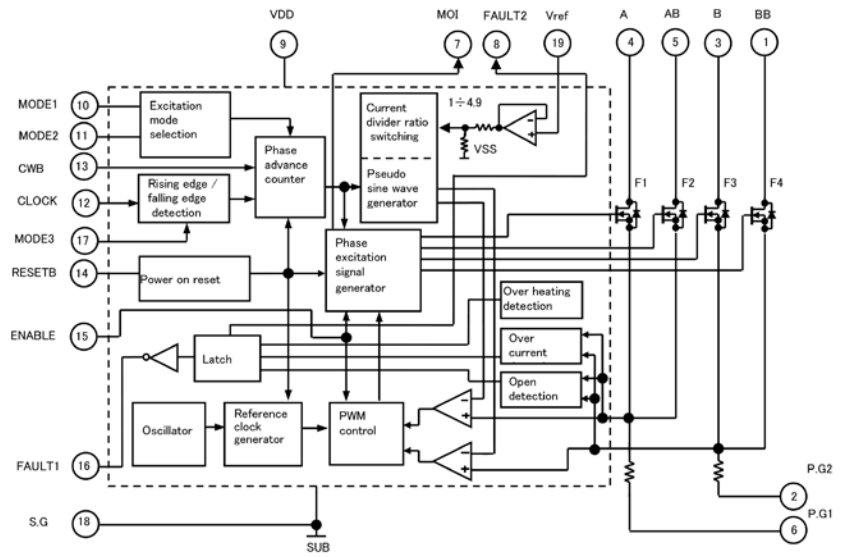
- For Unipolar Stepper Motor Drive by IPM (Intelligent Power Module)
- Current Sense, Fault Detections are Fully integrated
- Pin-compatible line up



SIP-19



SIP-19S



Block Diagram for STK672-440BN-E

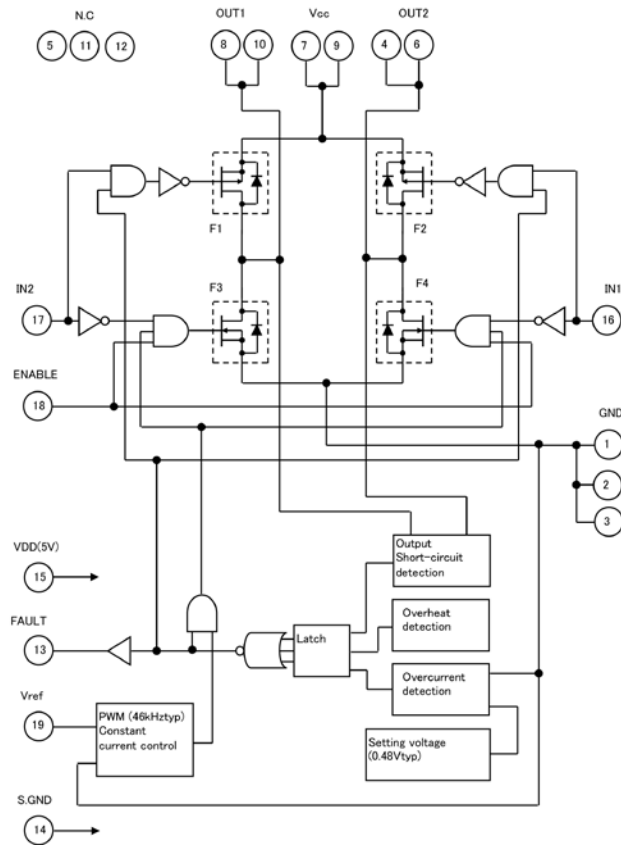
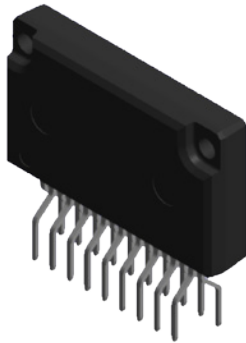
Device	Type	V _M Max (V)	V _{CC} Max (V)	I _O Max (A)	I _O Peak Max (A)	Step Resolution	Control Type	Current Sense	Fault Detection			Package
									Overcurrent	Thermal	UVLO	
STK672-430AN-E*	Stepper	52	5.25	2.5	10	1/16	Clock	Fully Integrated	Yes	Yes	Yes	SIP-19
STK672-432AN-E*	Stepper	52	5.25	2.5	10	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

* Pending 3Q14

Brush DC Motor Control

Key Features

- No need for dead time design
- Built-in Sensing resistor
STK681-300/-310/-320/-360
- Built-in Protective Functions
STK681-332/-352
- PWM operation
STK681-332/-352/-360



Block Diagram for STK681-332-E

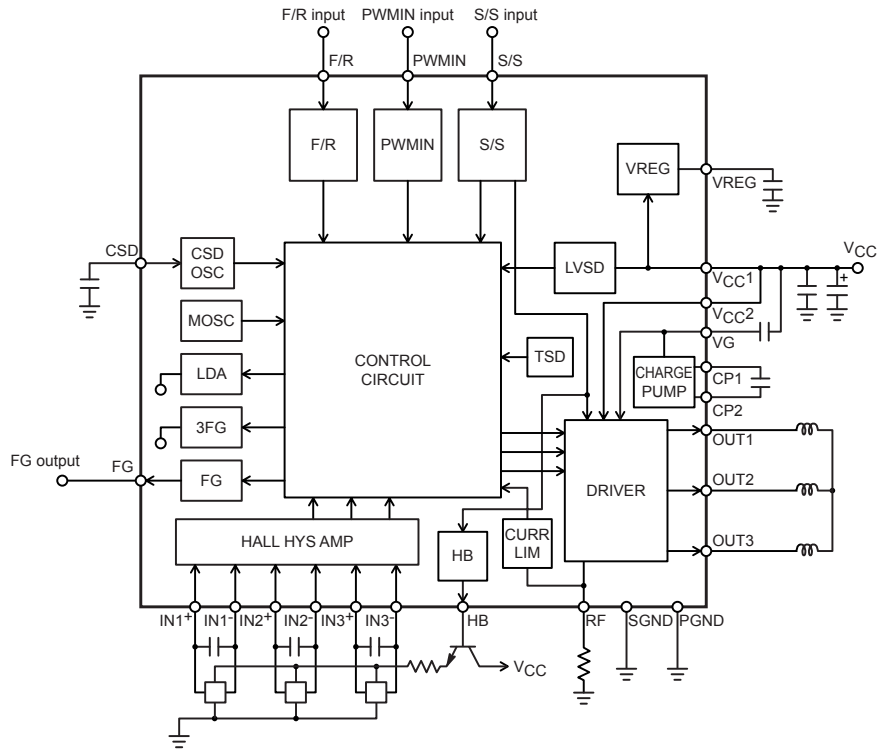
Device	Type	V _M Max (V)	V _{CC} Max (V)	I _O Max (A)	I _O Peak Max (A)	Control Type	Current Sense	Fault Detection			Package
								Overcurrent	Thermal	UVLO	
STK681-300	Brush DC	52	5.25	2.9	5	Parallel	Fully Integrated	Yes	Yes	No	SIP-19
STK681-310	Brush DC	52	5.25	4.2	8	Parallel	Fully Integrated	Yes	Yes	No	SIP-19
STK681-320	Brush DC	52	5.25	5.2	8	Parallel	Fully Integrated	Yes	Yes	No	SIP-19
STK681-332-E	Brush DC	52	5.25	8.5	12	Parallel PWM	External Resistor	Yes	Yes	Yes	SIP-19S
STK681-352-E	Brush DC	38	—	6.4	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

* It is not necessary V_{CC} input for STK681-352-E

Brushless DC Motor Control

LV8827LFQA Features

- VCC max = 36 V, IO max = 1.5 A (built-in output transistor)
- Speed control and synchronous rectification using direct PWM input
- 1-Hall FG output
- Latch type constraint protection circuit (the latch is released by S/S and F/R)
- Forward/reverse switching circuit, Hall bias pin
- Power save circuit (power save in stop mode)
- Integrated current limit, low-voltage protection, thermal shutdown circuit
- Charge pump circuit; 5 V regulator output
- Start/stop circuit (short brake when motor is to be stopped)



LV8827LFQA 3-Phase Brushless DC Motor Driver

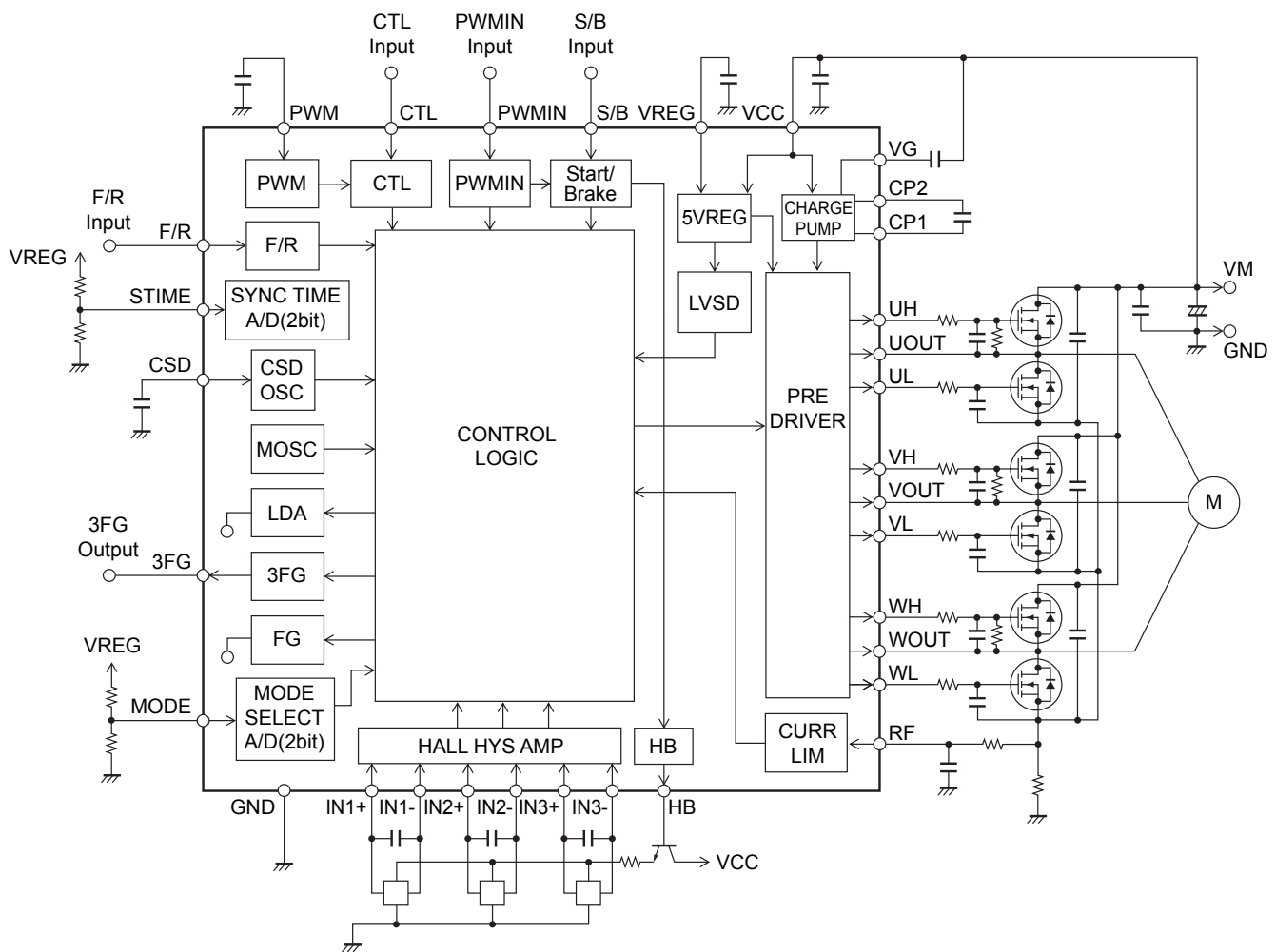
Device	Description	Vcc Min (V)	Vcc Max (V)	Po Max (W)	Io Max (mA)	Package
LV8121V	Brushless DC 3-Phase Motor Controller	8	36	1.7	3500	SSOP-44K
LV8824QA	Brushless DC 3-Phase Motor Pre-Driver	7	34	1.45	50	VQFN-32U
LB11696V	Brushless DC 3-Phase Motor Controller	4.5	18	1.05	30	SSOP-30
LV8827LFQA	Brushless DC 3-Phase Motor Driver	8	36	1.35	1500	VQFN-24N
LV8127T	Brushless DC 3-Phase Motor Controller	12 ¹	23 ²	1.1	50	TSSOP-36
MC33033	Brushless DC 3-Phase Motor Controller	10	30	0.619 - 0.867*	100	SOIC-20, PDIP-20
MC33035	Brushless DC 3-Phase Motor Controller	10	30	0.650 - 0.867*	100	SOIC-24, PDIP-24
MC33039	Closed-Loop Brushless Motor Adapter	5.5	9	0.650 - 0.867*	20	SOIC-8, PDIP-8

* Dependent upon package. 1. VM Min = 18 V. 2. VM Max = 190 V.

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

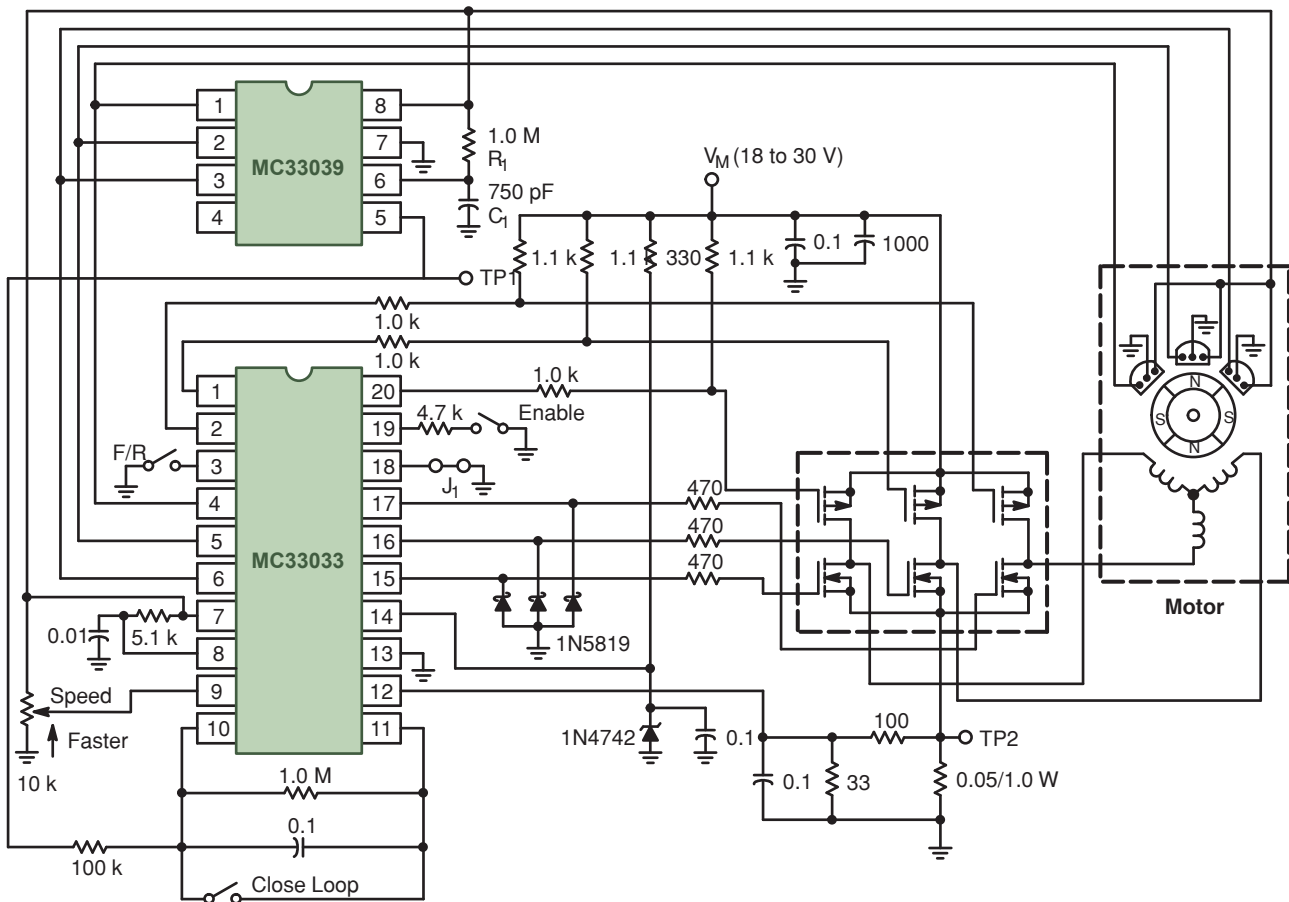
Brushless DC Motor Control

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

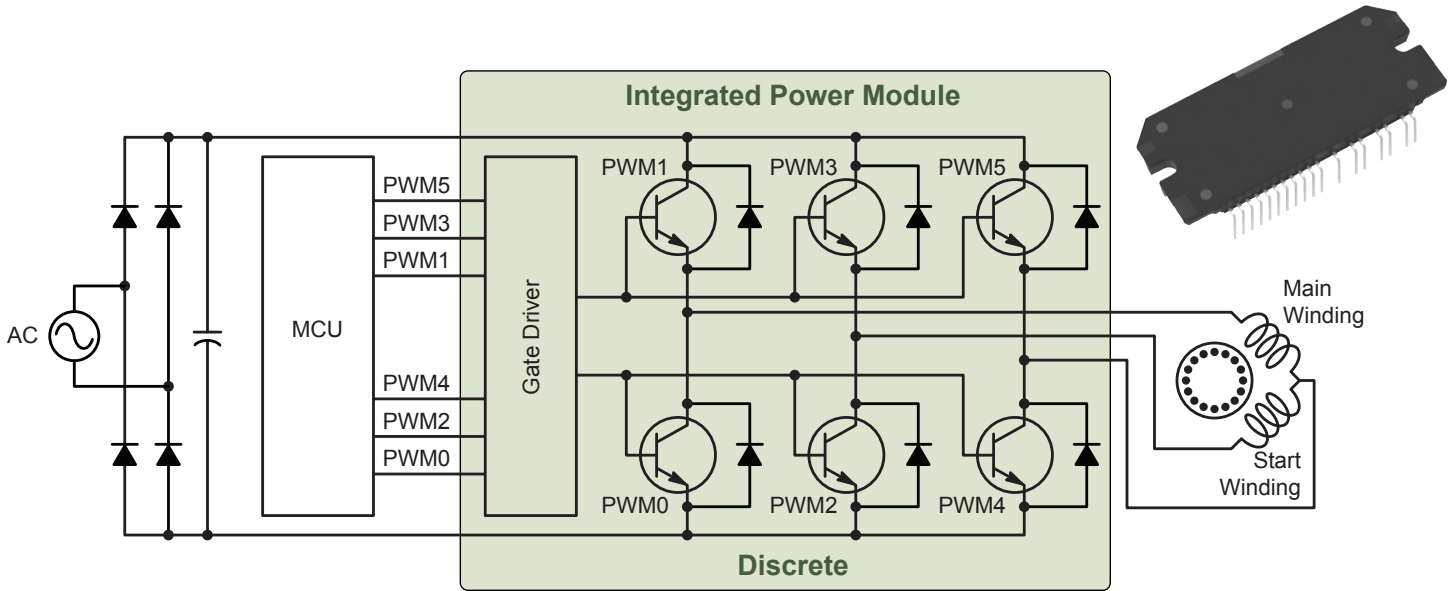
MC33039 Features

- 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

Inverter Drive - Discrete and Module Designs

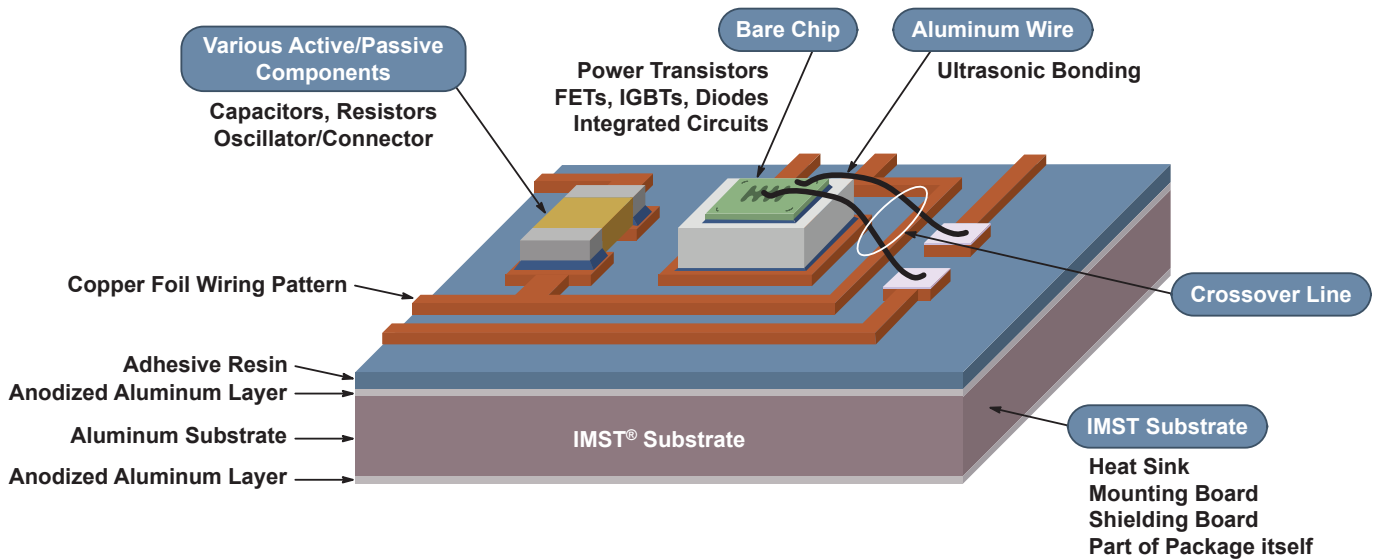


CONTROL & DRIVE

Intelligent Power Modules (IPM) for Inverter Designs

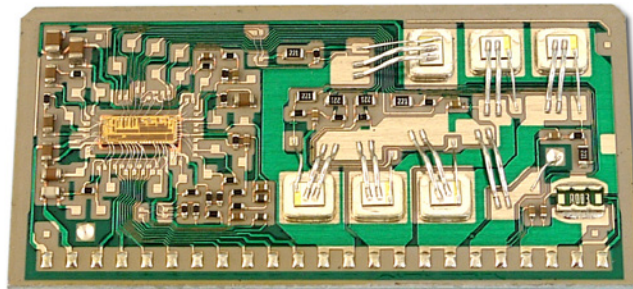
Insulated Metal Substrate Technology (IMST®) forms electronic circuits on plates of aluminum (metal substrates). IMST-based hybrid devices use the high thermal conductivity plates of aluminum for their base substrates.

Hybrid devices from ON Semiconductor enable power output circuits, control circuits, and peripheral circuits to be mounted on the same substrate. IMST succeeds in turning bare chip mounting into an element technology, and will continue to evolve as an outstanding mounting technology capable of delivery high density, high performance, and high reliability.



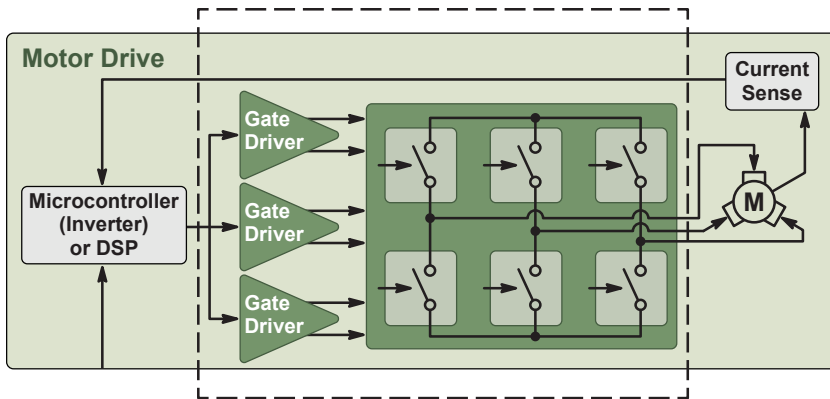
Insulated Metal Substrate Technology

IMST enables assembly of discrete passive components (resistors, capacitors); discrete active components (diodes, transistors); and more complex devices (gate drivers, DSPs, logic) into highly integrated modules.

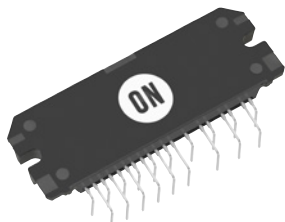


Typical Integrated Module

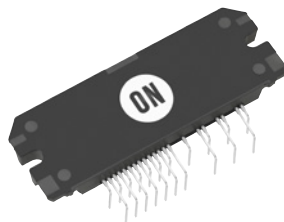
Intelligent Power Modules (IPM) for Inverter Designs



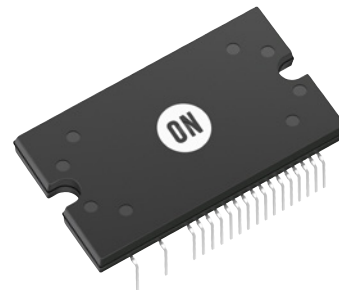
- Intelligent power module (IPM) is a 3-phase inverter with gate drivers, UVLO, thermal and current sense
- Optimized layout for EMI & thermal performance
- Insulated Metal Substrate Technology (IMST)
- Available with integrated PFC



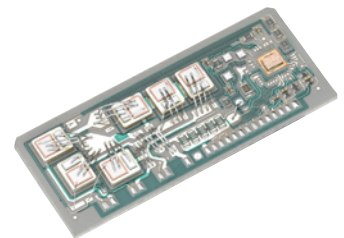
SIP1 Package



SIP1A Package



DIP4 Package



SPL Interpol Board

CONTROL & DRIVE

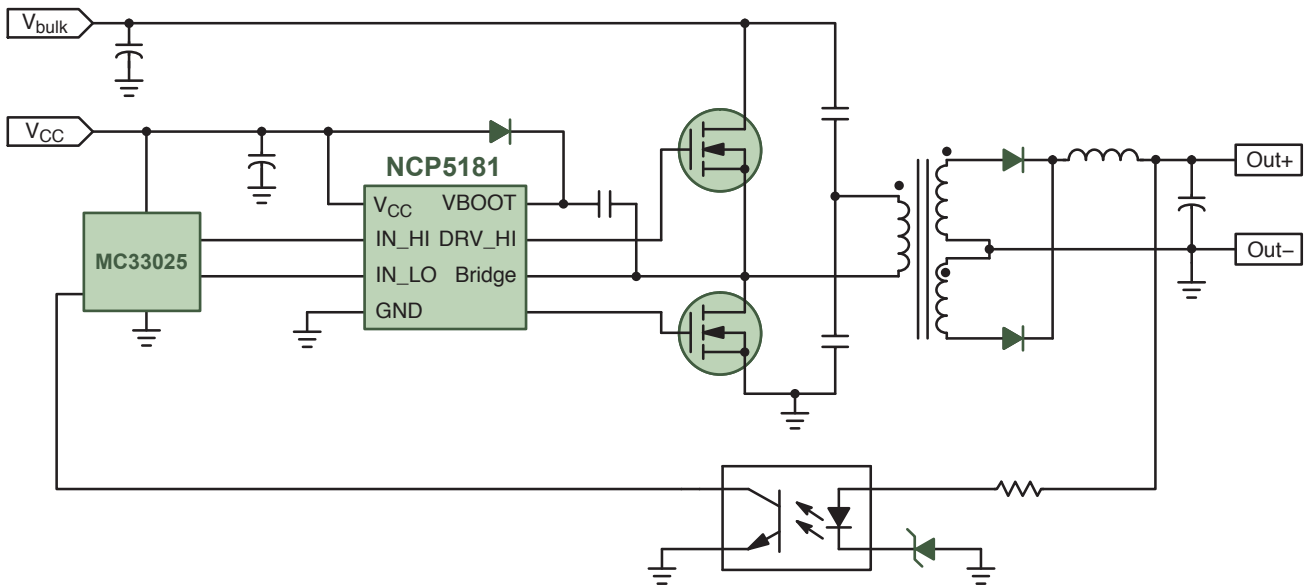
Power Modules

Device	Type	V _{DS} Max (V)	I _{op} Peak Current (A)	Package
STK551U362A-E	Module 1 Shunt resistor	600	10	SIP1A
STK554U362A-E	Module 3 Shunt resistor	600	10	SIP1A
STK554U362C-E	Module 3 Shunt resistor	600	10	SIP1A
STK544UC62K-E	Module 3 Shunt resistor	600	10	SIP1
STK551U392A-E	Module 1 Shunt resistor	600	15	SIP1A
STK554U392A-E	Module 3 Shunt resistor	600	15	SIP1A
STK551U3A2A-E	Module 1 Shunt resistor	600	20	SIP1A
STK5F1U3C2D-E	Module 1 Shunt resistor	600	30	DIP4
STK5F4U3C2D-E	Module 3 Shunt resistor	600	30	DIP4
STK5F1U3E2D-E	Module 1 Shunt resistor	600	50	DIP4
STK5F4U3E2D-E	Module 3 Shunt resistor	600	50	DIP4

Up to 600 V MOSFET/IGBT Gate Drivers

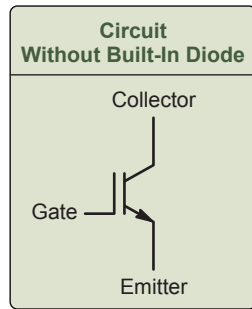
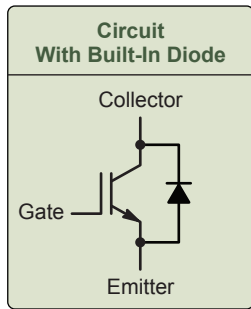
Device	Description	Number of Drivers	V _{CC} Max (V)	Drive Source/Sink Typ (mA)	Rise Time (ns)	Fall Time (ns)	t _p Max (ns)	Package
NCP5104	Single Input High and Low Side Power MOSFET Driver	2	20	250 / 500	85	35	170	SOIC-8; PDIP-8
NCP5106	Dual Input High Voltage High and Low Side MOSFET or IGBT Drivers	2	23	250 / 500	85	35	170	SOIC-8; PDIP-8
NCP5304	Dual Input High Voltage High and Low Side MOSFET or IGBT Drivers	2	23	250 / 500	85	35	170	SOIC-8; PDIP-8
NCP5111	Single Input Half-Bridge Power MOSFET or IGBT Driver	2	23	250 / 500	85	35	170	SOIC-8; PDIP-8
NCP5181	Dual Input High Voltage High and Low-Side MOSFET or IGBT Drivers	2	20	1400 / 2200	20; 40	20; 40	170	SOIC-8; PDIP-8

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NCP5181 Application Diagram

IGBTs for Inverters, UPS, Solar, and Welding



IGBT Features

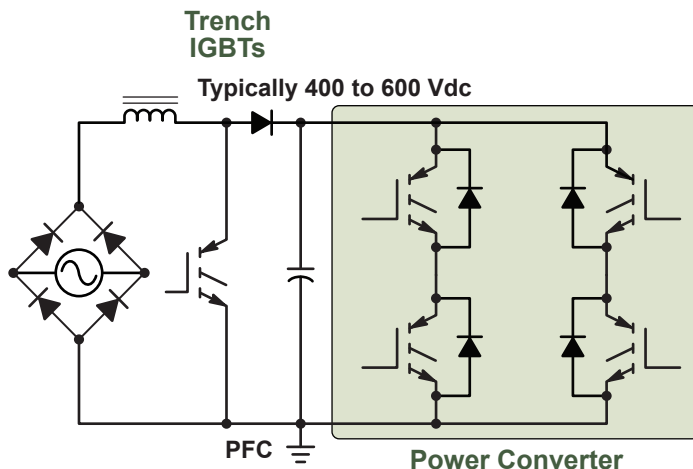
- Low saturation voltage using trench technology
- Low switching loss
- Rugged short circuit withstand capability
- Soft Fast Reverse Recovery Diode

IGBTs

Device	Voltage (V)	Current @ 100°C (A)	VCE(sat) (V)	E _{off} (mJ)	T _{sc} (μs)	Co-Packaged Diode	Package
NGTB15N120L	1200	15	1.8	0.56	5	Yes	TO-247
NGTB20N120L	1200	20	1.8	0.7	5	Yes	TO-247
NGTB25N120L	1200	25	1.85	0.8	5	Yes	TO-247
NGTB30N120L	1200	30	1.75	1.1	5	Yes	TO-247
NGTB30N120L2	1200	30	1.65	1.3	5	Yes	TO-247
NGTB40N120L	1200	40	1.9	1.6	5	Yes	TO-247
NGTB10N60FG	600	10	1.5	–	5	Yes	TO-220F-3FS
NGTB30N60L2WG	600	15	1.4	1.14	5	Yes	TO-247
NGTB15N60	600	15	1.7	0.3	10	Yes	TO-220
NGTB15N60S1	600	15	1.5	0.35	5	Yes	TO-220
NGTGB15N60S1	600	15	1.5	0.35	5	No	TO-220

CONTROL & DRIVE

Motor Drive Power Factor Correction



Trench IGBTs

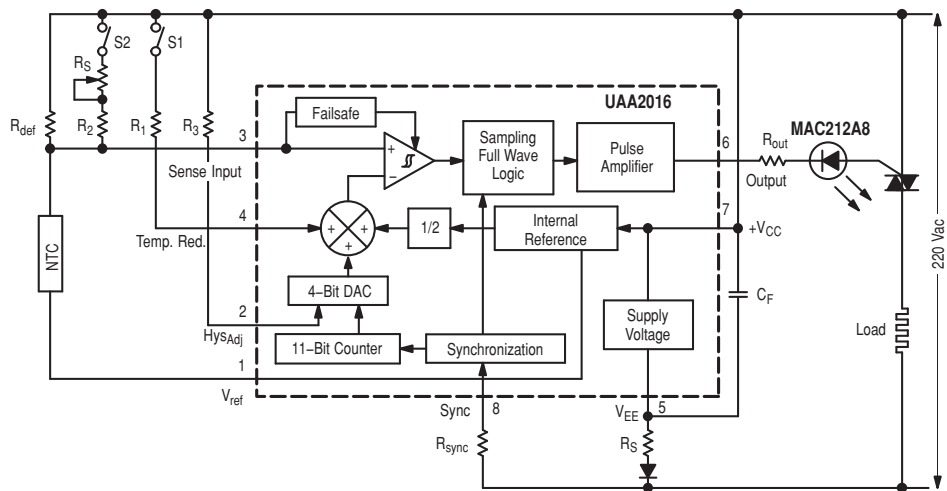
Device	Voltage (V)	Current (A)	Package
NGTG50N60F	600	50	TO-247
NGTG30N60F	600	30	TO-247

UAA2016 for Precision Regulation of Electrical Heating Systems

The UAA2016 is designed to drive TRIACs with the Zero Voltage technique which allows RFI-free power regulation of resistive loads.

Features

- Direct AC line operation
- Proportional regulation of temperature over a 1°C band
- Programmable temperature reduction
- Adjustable hysteresis

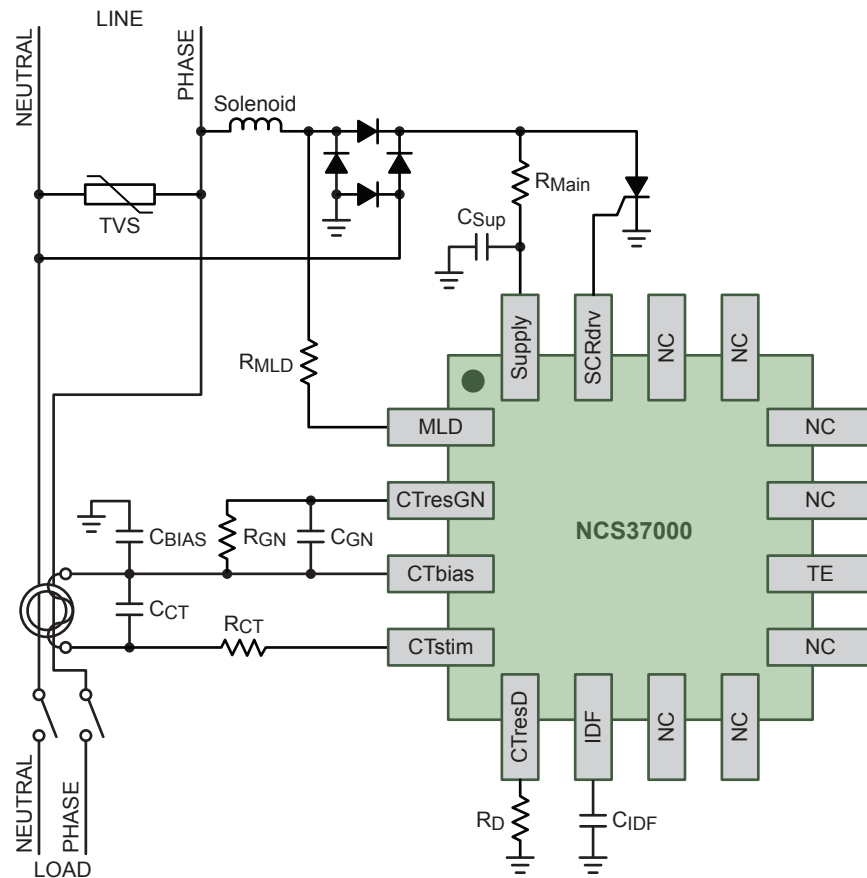


CONTROL & DRIVE

UL943 Compliant GFCI Controllers

Features

- Detect all required fault types with 1 single current transformer (v. industry standard 2)
- Proprietary impedance measurement circuitry
- Fault current density weighted response time provides superior noise immunity
- Best in class power consumption
- Trip indicator/load monitoring
- LED and buzzer options for external indicator
- Optimized solenoid deployment
- Synchronized to AC for higher reliability load separation from the mains
- Highly integrated solution (including self-test) reduces BOM
- Smart power control works with virtually all supply topologies



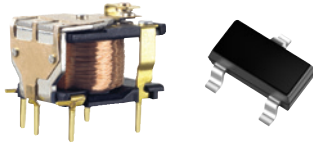
NCS37000 Application Diagram

Device	Differential Fault	Grounded-Neutral Fault	Mechanical Lockout	Electronic Lockout	LED Status Indication	External Differential Self Test	Trip Circuit Self Test	V _{CC} Min (V)	V _{CC} Max (V)	I _T Max (mA)	V _I Typ (V)	T _A Min (°C)	T _A Max (°C)	Package
NCS37000*	✓	✓						6	12	1.5	1.8	-40	125	QFN-16
NCS37005	✓							6	18			-40	85	QFN-16, TSSOP-16
NCS37010	✓	✓		✓	✓	✓	✓	6	12	2.2	1.8	-40	85	QFN-16, TSSOP-20
NCS37012	✓	✓	✓		✓	✓		6	12	1	12	-40	85	QFN-16, TSSOP-20

* Pending 2H14

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

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



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

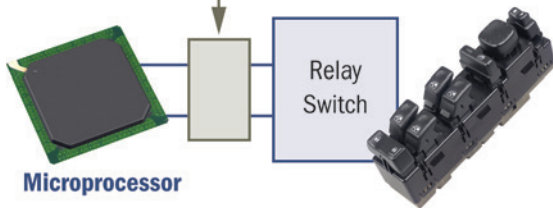
Relay Drivers

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.

24 V Relay Driver Socket

MOSFET Relay Driver Socket - NUD3124



CONTROL & DRIVE

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

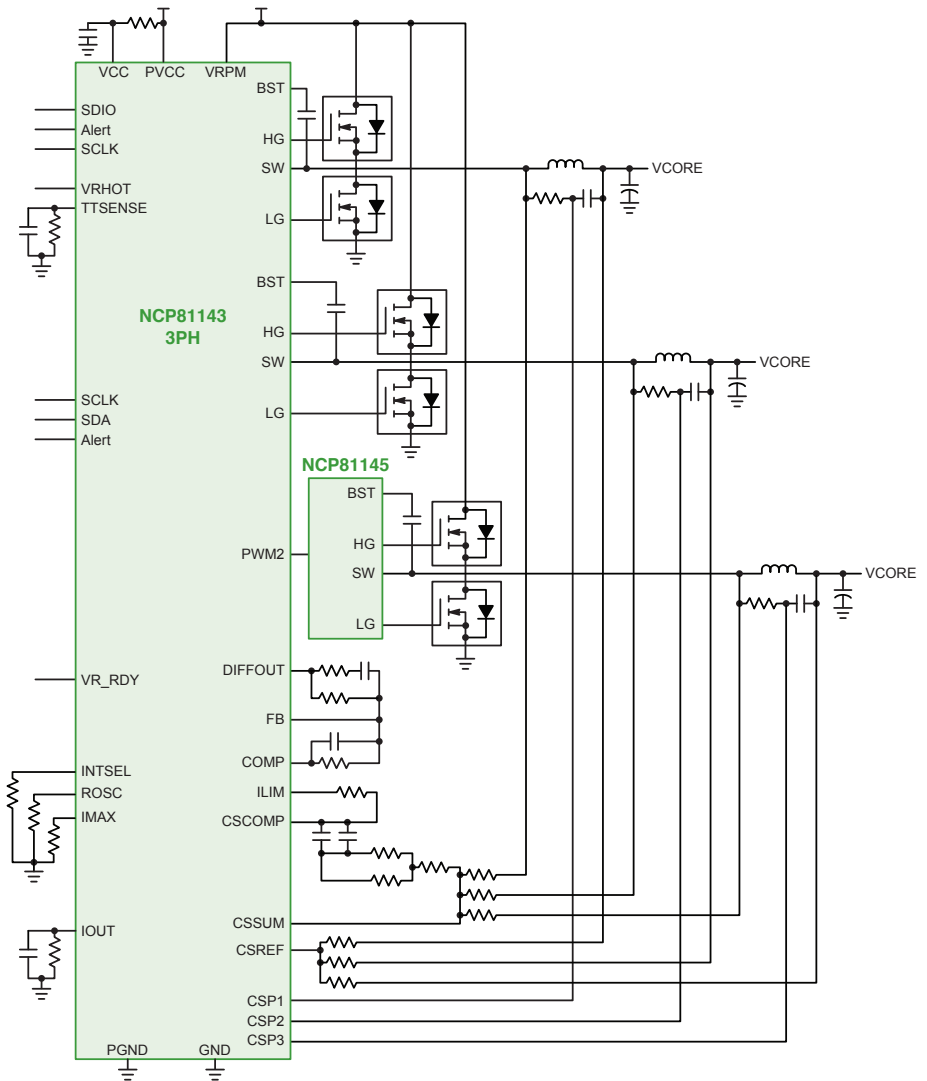
Low Noise Operational Amplifiers

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

VR12.5/6 Multiphase Controllers for Embedded Applications

Features

- Dual-edge pulse width modulation
- 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



POWER

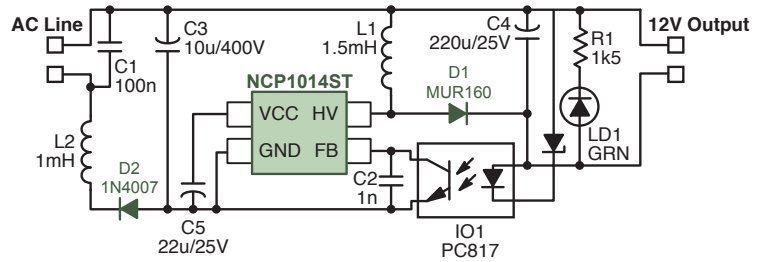
Device	Description	Driver / MOSFETs	Package
NCP81140	4-Phase Controller	—	QFN-32
NCP81141	1-Phase VR12.6 Controller	Integrated 5 V Driver	QFN-28
NCP81142	4-Phase VR12.5 Controller	—	QFN-32
NCP81143	3-Phase VR12.5 Controller	2x Integrated 5 V Drivers	QFN-36
NCP81145	5 V Driver	—	DFN-8
NCP81146	12 V Driver	—	DFN-8
NCP81147*	1-Phase Buck 0.8 V / 3.3 V	—	QFN-16
NCP81148	Dual Buck with LDOs	—	QFN-28
NCP81149*	1-Phase VR12.6 Controller	Integrated MOSFETs	—

* Pending 2H14

Compact Power Delivery with Switching Regulators

Features

- Highly integrated solution
 - Reduces system size and cost
- Thermistor input can be configured as
 - Second remote diode temp; two analog inputs
- Dynamic Self Supply (DSS) capability
 - No need for an auxiliary transformer winding
- On-chip 700 V power switch circuit
 - Compact and easy system design
- Frequency jittering
 - Reduces EMI signature
- Skip-cycle operation
 - No acoustic noise
- Low power consumption
 - Allows energy ECO regulations compliance
- Output overload and open loop protection
 - Protects your application
- Over-power and brown-out protection
- Ramp Compensation



NCP1014 - 12 V, 200 mA Buck Application

Switching Regulators

Device	Max Output Power ¹ (W)	Mode	Power Switch Voltage (V)	Peak Current Limit (mA)	Typ ² RDS(on) (Ω)	Min HV Startup	Frequency Options (kHz)	Dynamic Self Supply	Freq Jittering	Latch	Brownout	Soft-Start	Enable	Over Power Compensation	Package(s)
NCP1050	10	Gated Osc	700	100	22	20	44, 100, 136	✓	✓				✓		PDIP-7, SOT-223
NCP1051	10	Gated Osc	700	200	22	20	44, 100, 136	✓	✓				✓		PDIP-7, SOT-223
NCP1052	10	Gated Osc	700	300	22	20	44, 100, 136	✓	✓				✓		PDIP-7, SOT-223
NCP1053	20	Gated Osc	700	400	10	20	44, 100, 136	✓	✓				✓		PDIP-7, SOT-223
NCP1054	20	Gated Osc	700	530	10	20	44, 100, 136	✓	✓				✓		PDIP-7, SOT-223
NCP1055	20	Gated Osc	700	680	10	20	44, 100, 136	✓	✓				✓		PDIP-7, SOT-223
NCP1010	4	Current	700	100	22	30	65, 100, 130	✓	✓				✓	✓	PDIP-7, SOT-223
NCP1011	4	Current	700	250	22	30	65, 100, 130	✓	✓				✓	✓	PDIP-7, SOT-223
NCP1070	4	Current	700	250	22	30	65, 100, 130	✓	✓				✓	✓	P-DIP7, SOT-223
NCP1071	5	Current	700	350	22	30	65, 100, 130	✓	✓				✓	✓	P-DIP7, SOT-223
NCP1012	11	Current	700	250	11	30	65, 100, 130	✓	✓				✓	✓	PDIP-7, SOT-223
NCP1072	11	Current	700	250	11	30	65, 100	✓	✓				✓	✓	PDIP-7, SOT-223
NCP1013	15	Current	700	350	11	30	65, 100, 130	✓	✓				✓	✓	PDIP-7, SOT-223
NCP1075	15	Current	700	450	11	30	65, 100	✓	✓				✓	✓	PDIP-7, SOT-223
NCP1014/15 ³	17	Current	700	450	11	30	65, 100	✓	✓				✓	✓	PDIP-7, SOT-223
NCP1027/28 ³	20	Current	700	800	5.6	30	65, 100		✓	✓	✓	✓	✓	✓	PDIP-7
NCP1076	20	Current	700	650	4.7	30	65, 100, 130	✓	✓				✓	✓	P-DIP7, SOT-223
NCP1077	20	Current	700	800	4.7	30	65, 100, 130	✓	✓				✓	✓	P-DIP7, SOT-223

1. Maximum Power Output with DSS 2. Typical at 25°C 3. NCP1015 & NCP1028 have no OVP on V_{CC}

Rugged Linear Voltage Regulators

Linear Voltage Regulators

Device	I _o Typ	Dropout Typ (V)	V _{in} Max (V)	V _{out} (V)	Package
LM317M	500 mA	2.2	40	Adj.	TO-220, DPAK, SOT-223
MC78Mxx/A	500 mA	2.0	40	5, 6, 8, 9, 12, 15, 18, 20, 24	TO-220, DPAK
MC79Mxx/A	500 mA	1.1	-35	-5, -8, -12, -15	TO-220, DPAK
NCP78xx	1.0 A	2.0	35	5, 12, 15	TO-220
MC78xx/A/AE	1.0 A	2.0	40	5, 6, 8, 9, 12, 15, 18, 24	TO-220, DPAK, D2PAK
MC79xx/A	1.0 A	1.3	-40	-5, -5.2, -6, -8, -12, -15, -18, -24	TO-220, D2PAK
LM317	1.5 A	2.25	40	Adj.	TO-220, D2PAK
LM337	1.5 A	2.4	-40	Adj.	TO-220, D2PAK

* Visit www.onsemi.com for additional linear voltage regulators at lower output currents and voltages.

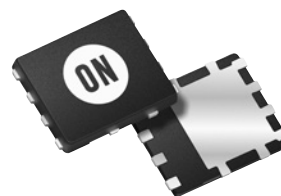
Low Dropout Regulators

Device	I _o Typ	Dropout (mV)	V _{in} Max (V)	V _{out} (V)	Package
NCP4641	150 mA	700 (typ)	50	2.0 - 12.0	SOT-89-5
NCP705	500 mA	250 (typ)	6	0.8, 1.8, 2.8, 3.0, 3.3	SOT-223-6, WDFN-6
NCP3335A	500 mA	340 (max)	16	Adj, 1.5, 1.8, 2.5, 2.8, 2.85, 3.0, 3.3, 5.0	Micro8, DFN-10
NCP3337	500 mA	340 (max)	16	Adj, 1.8, 2.5, 3.3, 5.0	DFN-10
NCP59748	1.5 A	165 (max)	6	Adj	QFN-20, DFN-10
NCP59150/1/2	1.5 A	175 (typ)	18	1.8, 2.5, 2.8, 3.0, 3.3, 5.0	D2PAK-5, DFN-8
NCP59744	3.0 A	195 (max)	5.5	Adj	QFN-20
NCP59749	3.0 A	280 (max)	6	Adj	QFN-20
NCP59300/1/2	3.0 A	300 (typ)	18	1.8, 2.5, 2.8, 3.0, 3.3, 5.0	D2PAK-5
NCP4632	3.0 A	510 (typ)	6	0.8, 1.5, 2.8, 3.3	DPAK-5

Power MOSFETs for Motor Control

Features

- Low $R_{DS(on)}$ to minimize conduction losses
- Low capacitance to minimize driver losses
- Low gate charge to minimize switching losses
- High avalanche resistance
- High current capability



SO-8 Flat Lead Package



ATPAK

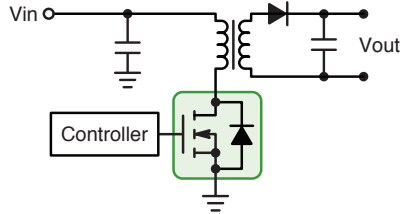
Power MOSFETs

Device	Channel	V _{DS} (V)	I _D (A)	R _{DS(on)} (mΩ)	Q _{G(TOT)} (nC)	Package
BMS3004	P	-75	-68	8.5	300	TO-220F-3SG (SC-67)
BMS3003	P	-60	-78	6.5	285	TO-220F-3SG (SC-67)
NTTFS5116PL	P	-60	-20	52	25	u8FL
BXL4004*	N	40	100	3.9	140	TO-220-3L (SC-46)
NTD5802N	N	40	101	4.4	75	DPAK, IPAK
NTD5805N	N	40	51	9.5	33	DPAK, IPAK
NTP5404N	N	40	167	4.5	125	D2PAK, TO-220
NTMFS5C404NL*	N	40	352	0.75	81	SO-8FL (DFN-5)
NTMFS5C410NL*	N	40	315	0.9	66	SO-8FL (DFN-5)
NTMFS5C442NL*	N	40	126	2.8	22	SO-8FL (DFN-5)
NTMFS5830NL	N	40	172	2.3	113	SO-8FL (DFN-5)
NTMFS5832NL	N	40	111	4.2	51	SO-8FL (DFN-5)
NTMFS5834NL	N	40	74	9.3	24	SO-8FL (DFN-5)
NTTFS5811NL	N	40	53	6.7	31	u8FL
2SK3703	N	60	30	26	40	TO-220F-3SG (SC-67)
2SK3816	N	60	40	26	40	TO-262-3L (I2PAK)
2SK4066	N	60	100	4.7	220	TO-262-3L (I2PAK)
2SK4094	N	60	100	5	220	TO-220-3L (SC-46)
ATP401	N	60	100	3.7	300	ATPAK
ATP404	N	60	95	7.2	120	ATPAK
BBL4001	N	60	74	6.1	135	TO-220F-3SG (SC-67)
NTMFS5C604NL*	N	60	40	1.2	52	SO-8FL (DFN-5)
NTMFS5C612NL*	N	60	36	1.5	41	SO-8FL (DFN-5)
NTMFS5C646NL*	N	60	20	4.7	15.7	SO-8FL (DFN-5)
NTMFS5844NL	N	60	60	12	30	SO-8FL (DFN-5)
NTP5864N	N	60	63	12.4	31	TO-220
NTTFS5820NL	N	60	37	11.5	28	u8FL
NTTFS5826NL	N	60	20	24	8.4	u8FL
BMS4007*	N	75	60	7.8	160	TO-220F-3SG (SC-67)
2SK3707	N	100	20	60	44	TO-220F-3SG (SC-67)
ATP405	N	100	40	33	68	ATPAK
NTD6416ANL	N	100	19	80	25	DPAK, IPAK
ATP613	N	500	5.5	2	14	ATPAK
WPB4001	N	500	26	0.26	87	TO-220-3L (SC-46)
BFL4007	N	600	14	0.68	46	TO-220F-3SG (SC-67)
WPB4002	N	600	23	0.36	84	TO-220-3L (SC-46)

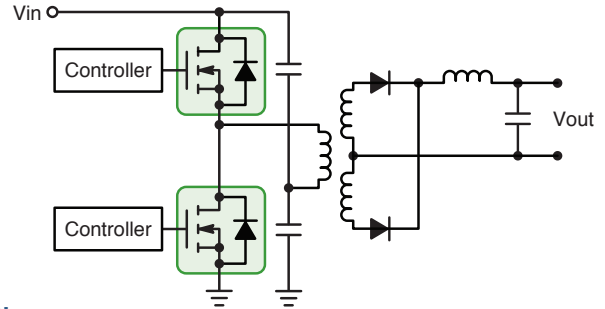
* Pending 2H14

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	BFL4004	800	6.5	1.9	2.5	710	36	—	TO-220F
	BFL4026	900	5	2.8	3.6	650	33	—	TO-220F
	BFL4001	900	6.5	2.1	2.7	850	44	—	TO-220F
380 to 480 Vac	2SK3745LS	1500	2	10	13	380	37.5	Built in	TO-220F
	2SK4177	1500	2	10	13	380	—	Built in	TO-263(D2PAK)
	2SK3746	1500	2	10	13	380	—	Built in	TO-3P
	2SK3747	1500	2	10	13	380	—	Built in	TO-3PF
	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
590 to 690 Vac	WPH4003	1700	3	8.2	10.5	850	48	—	TO-3PF

Energy Efficient TRIACs for High & Low Power Switching & AC Control

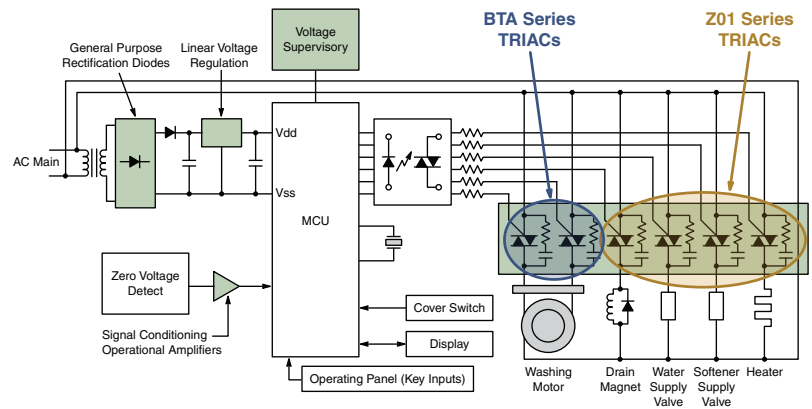
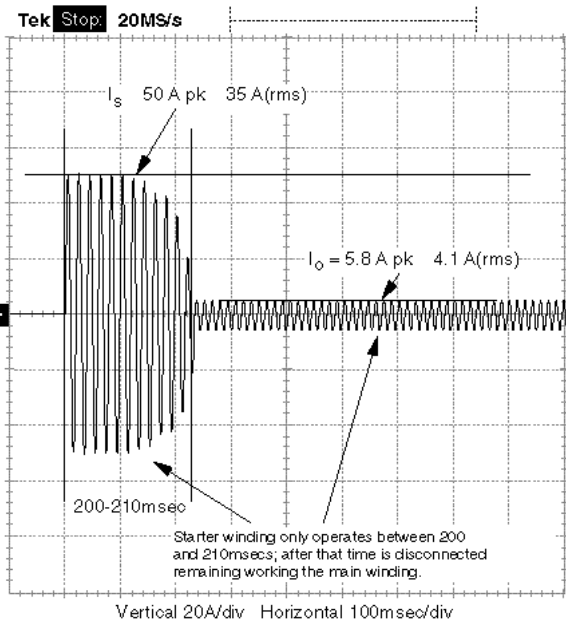
TRIACs – High Current

Device	$I_T(\text{rms})$ (A)	V_{drm} (V)	I_{gt} (mA)	dV/dt (V/ μs)	Package
BTB Series, Standard	8 - 16	600 - 800	25 - 50	25 - 400	TO-220 AB
BTB Series, Logic Level	8 - 16	600 - 800	5 - 10	15 - 50	TO-220 AB
BTB Series, Snubberless	8 - 30	600 - 800	35 - 50	500 - 2000	TO-220 AB
BTB Series, High Tj	8 - 16	600	35 - 50	1000	TO-220 AB
BTA Series, Standard	8 - 16	600 - 800	25 - 50	25 - 400	TO-220 II ¹
BTA Series, Logic Level	8 - 16	600 - 800	5 - 10	15 - 50	TO-220 II ¹
BTA Series, Snubberless	8 - 30	600 - 800	35 - 50	500 - 2000	TO-220 II ¹
BTA Series, High Tj	8 - 16	600	35 - 50	1000	TO-220 II ¹
MAC Series	8 - 16	200 - 800	5 - 50	25 - 750	TO-220 AB
MAC15 Series	15	400 - 800	50	5 - 250	TO-220 AB
2N63 Series	8 - 12	600 - 800	50	5 - 250	TO-220 AB

1. Internally Isolated TO-220

BTA/BTB Series Key Features

- Blocking voltage to 800 V
- On-state current ratings to 30 A RMS @ 25°C
- Greater noise immunity achieved with higher dV/dt up to 2,000 V/ μs minimum @ 125°C
- Standard and snubberless
- Logic level
- Uniform gate trigger current in 3 & 4 quadrants
- Highest industry standard isolation voltage of 2,500 V_{rms}
- Internal ceramic pad provides voltage insulated tab



Typical Application Using High and Low Current TRIACs

TRIACs – Low Current

Device	$I_T(\text{rms})$ (A)	V_{drm} (V)	I_{gt} (mA)	dV/dt (V/ μs)	Package
Z01 Series	0.8 - 1	600 - 800	3 - 10	25 - 400	TO-92, SOT-223
MAC97 Series	0.6 - 0.8	600 - 800	5	25	TO-92
MAC997 Series	0.8	600 - 800	3 - 5	20 - 60	TO-92
MAC08 Series	0.8	600 - 800	10	10	SOT-223
MAC4D Series	4	600 - 800	3 - 35	10	DPAK

Current during compressor startup (<200 ms) is too high; >200 ms, current drops to nominal value. Thyristor must be selected to sustain startup current without overheating. See AND8007/D for details.

High & Low Current SCRs for Half-Wave AC

Z01 & NYC Series Key Features

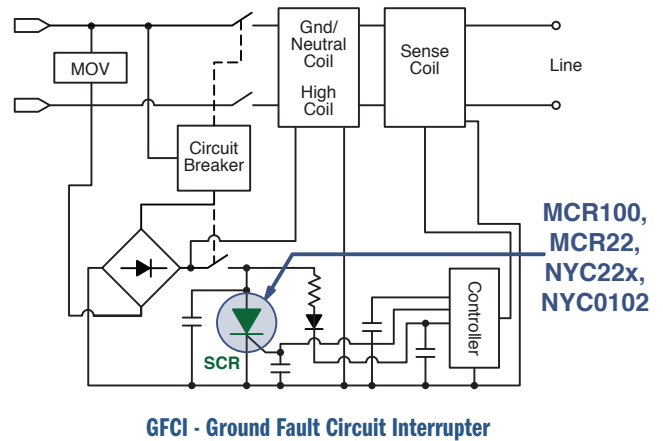
- $I_{T(rms)}$ = 1.5 A, 1.0 A and 0.25 A
- I_{gt} = 200 μ A to 10 mA
- Off-state voltage of 600 V
- dV/dt up to 200 V/ μ s minimum, depending on I_{gt} level
- Sensitive gate triggering in four trigger modes; low I_{gt} levels in quadrants 1, 2 & 3 for good interface with MPU
- Improved noise immunity
- Peak non-repetitive surge current up to 15 A

SCRs - Low Current

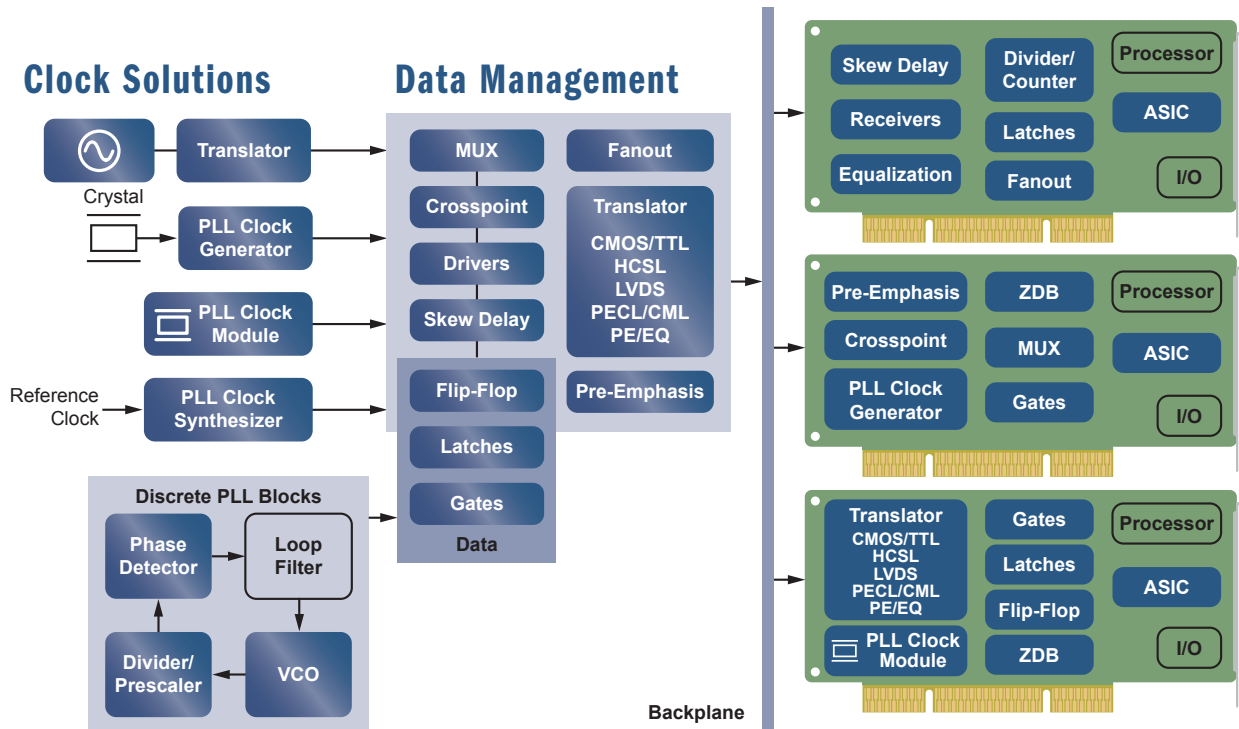
Device	$I_{T(rms)}$ (A)	V_{drm} (V)	I_{gt} (mA)	dV/dt (V/ μ s)	Package
NYC0102	0.25	200	0.2	200	SOT-23
2N5060	0.8	30 - 200	0.2	30	TO-92
MCR100	0.8	100 - 600	0.2	35	TO-92
MCR08	0.8	200 - 600	0.2	10	SOT-223
NYC222	1	50 - 600	0.2	25	SOT-223
MCR22	1.5	400 - 600	0.2	25	TO-92
MCR703	4	100 - 600	0.1	10	DDPAK
MCR718	4	400 - 600	0.1	10	DDPAK

SCRs - High Current

Device	$I_{T(rms)}$ (A)	V_{drm} (V)	I_{gt} (mA)	dV/dt (V/ μ s)	Package
MCR8D Series	8	600 - 800	0.2 - 15	10 - 200	DDPAK
MCR8 Series	8	400 - 800	0.2 - 15	15 - 250	TO-220 AB
MCR72 Series	8	100 - 600	0.2	10	TO-220 AB
MCR218 Series	8	50 - 400	25	100	TO-220 AB
MCR12D Series	12	600 - 800	0.2 - 20	10 - 50	DDPAK
MCR12 Series	12	400 - 800	8 - 20	100 - 250	TO-220 AB
2N6394 Series	12	50 - 800	30	50	TO-220 AB
MCR16 Series	16	800	20	300	TO-220 AB
2N6400 Series	16	50 - 800	30	50	TO-220 AB
MCR25 Series	25	400 - 800	30	250	TO-220 AB
2N6504 Series	25	50 - 800	30	50	TO-220 AB
MCR69 Series	25	50 - 100	30	10	TO-220 AB



Timing and Data Distribution Subsystem

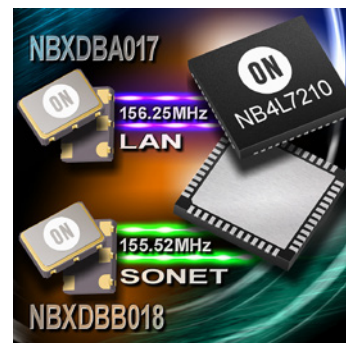


ON Semiconductor provides a complete portfolio of timing and data management solutions for all aspects of the clock tree. System designers can optimize their clock circuits with industry leading clock distribution devices, demonstrating the industry's lowest jitter and skew. A broad product portfolio, 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, HCSSL, LVTTTL/LVCMOS outputs for flexible interfacing
- Maximum clock rates >10 GHz
- Maximum data rates >12 Gbps
- Typical jitter as low as 30 fs
- Integrated termination resistors for simplified circuit design
- Edge rates as low as 28 ps
- Low phase noise floor ≤ -174 dBc/Hz
- Low skew

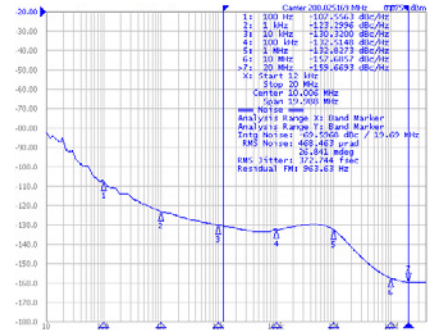


PLL Clock Synthesizers/Generators



Features

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

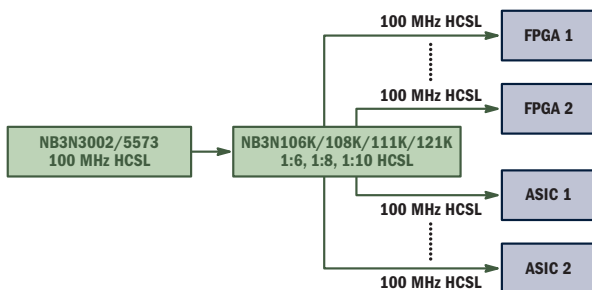


NB3N5573 Typical Phase Noise at Fc = 200 MHz

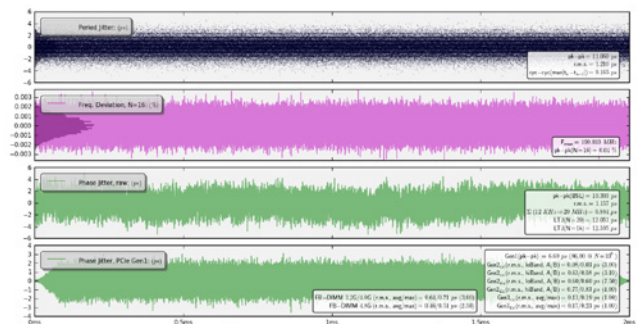
Device	Input (MHz)	Output (MHz)	Application	Input Level					Output Level	Vcc Typ (V)	Package(s)
				XTAL	CML	CMOS	LVPECL	TTL			
NB3N3002	25	25/125/200	CPU/DIMM, PCIe Gen 1,2,3	✓		✓		✓	HCSL	3.3	TSSOP-16
NB3N5573	25	25/100/125/200	CPU/DIMM, PCIe Gen 1,2,3	✓		✓		✓	HCSL	3.3	TSSOP-16
NB3N3020	5 to 27	5 to 210	Network GigE	✓	✓	✓	✓		ECL, LVTTTL	3.3	TSSOP-16
NB3N501	2 to 50	13 to 160	Networking, Consumer, STB	✓					CMOS	3.3, 5	SOIC-8
NB3N502	2 to 50	14 to 120	Networking, Consumer, STB	✓		✓			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 1:6, 1:8, 1:10, and 1:21 fanouts
- Solutions for one, two, six, eight, ten, and twenty-one channel applications available
- Ultra low skew
- Small propagation delay variation (up to 21 output)
- Jitter compliant with PCIe Gen 1,2, 3 specification
- Direct device interface eliminates external termination components and simplifies BOM



PCIe Gen 1, 2, 3 Clock Generation and Distribution



Jitter Results After Fanout

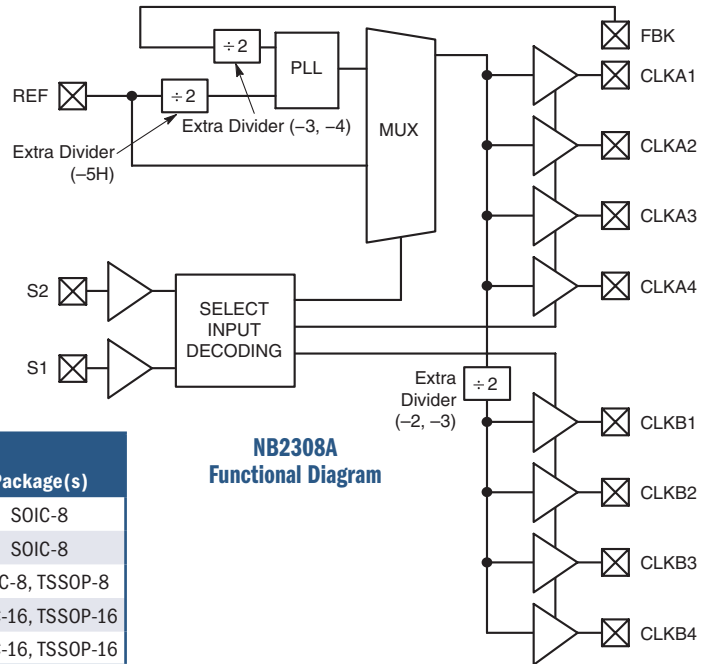
Zero Delay Buffers



Features

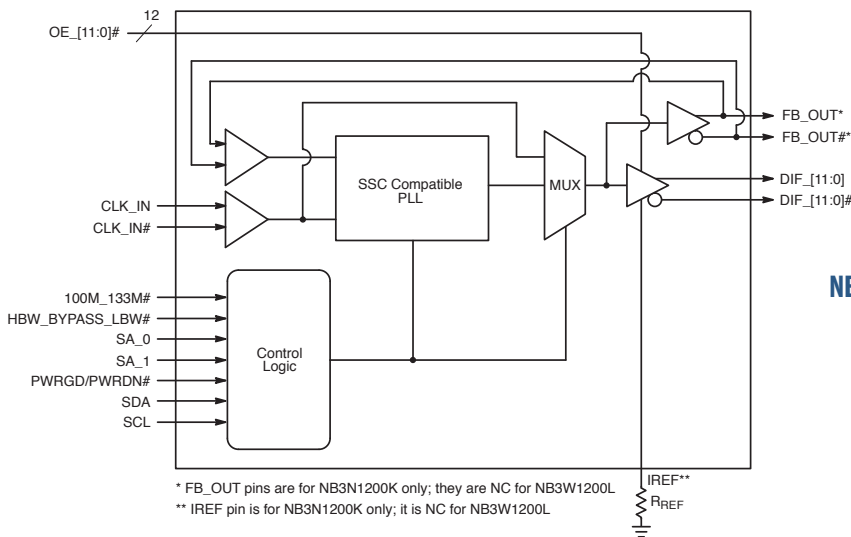
- Industry standard functions and pin-outs
- Zero input-output propagation delay, adjustable by capacitive load
- Multiple configurations available for maximum flexibility
- Operating frequency to 133 MHz for CPU and PCI compatibility

Device	Input Level	Output Level	VCC Typ (V)	f _{Max} Typ (MHz)	Channels	tSkew 0-0 Max (ps)	Package(s)
NB3N2302	CMOS	CMOS	3.3, 5	133	2	250	SOIC-8
NB2304A	CMOS	CMOS	3.3	133.3	4	200	SOIC-8
NB2305A	CMOS	CMOS	3.3	133.3	5	250	SOIC-8, TSSOP-8
NB2308A	CMOS	CMOS	3.3	133.3	8	200	SOIC-16, TSSOP-16
NB2309A	CMOS	CMOS	3.3	133.3	9	250	SOIC-16, TSSOP-16



PCIe Zero Delay Buffers

12 HCSL/NMOS Push Pull Outputs



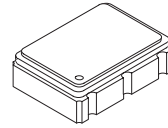
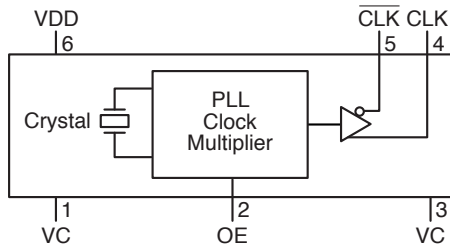
* FB_OUT pins are for NB3N1200K only; they are NC for NB3W1200L
 ** IREF pin is for NB3N1200K only; it is NC for NB3W1200L

Simplified Block Diagram

NB3N1200K & NB3W1200L Features

- DIF SRC clock support
- Optimized for 100/133 MHz to meet PCIe Gen 2/3 and Intel QPI phase jitter specifications
- Spread spectrum compatible for low EMI
- Pseudo-external fixed-feedback for <100 ps input-to-output delay variation
- Individual OE control pin for each of 12 outputs
- 50 ps output-to-output skew
- 50 ps cycle-to-cycle jitter (PLL mode)
- QFN-64 package

PureEdge™ Clock Oscillator Modules

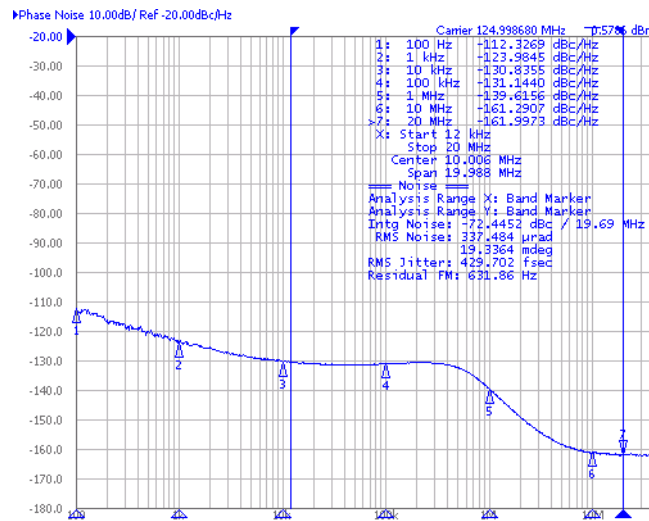


6 PIN CLCC



Features

- Broad portfolio of Crystal Oscillators XO and Voltage-Controlled Crystal Oscillators (VCXO)
- Fully integrated crystal reference and PLL synthesizer in the ceramic module
- Industry standard 5 mm x 7 mm x 1.9 mm ceramic module
- Footprint compatible replacement to 3rd overtone, and SAW based XO/VCXO modules
- XOs offer up to two user selectable frequencies
- Lower cost and shorter lead time
- LVPECL, LVDS and CML outputs
- Output Enable (OE) available
- Total frequency stability of ± 20 PPM or ± 50 PPM
- Industrial temperature range -40°C to $+85^{\circ}\text{C}$
- Low phase noise floor ≤ -160 dBc/Hz
- Integrated phase RMS jitter (12 kHz – 20 MHz) 0.5 ps (Typ)
- Spurious noise less than -70 dBc
- VCXOs have positive tuning slope
- VCXOs have 10% linearity for specified tuning range
- VCXOs have ± 100 PPM pulling range guaranteed
- All standard frequencies available (50 MHz to 700 MHz)
 - NBXzzaA0xx – XO with total frequency stability of ± 50 PPM
 - NBXzzB0xxx – XO with total frequency stability of ± 20 PPM
 - NBVSBaA0xx – VCXO with LVPECL output
 - NBVSPA0xx – VCXO with LVDS output



Typical Phase Noise/Jitter Plot @ 125 MHz

CLOCK DISTRIBUTION

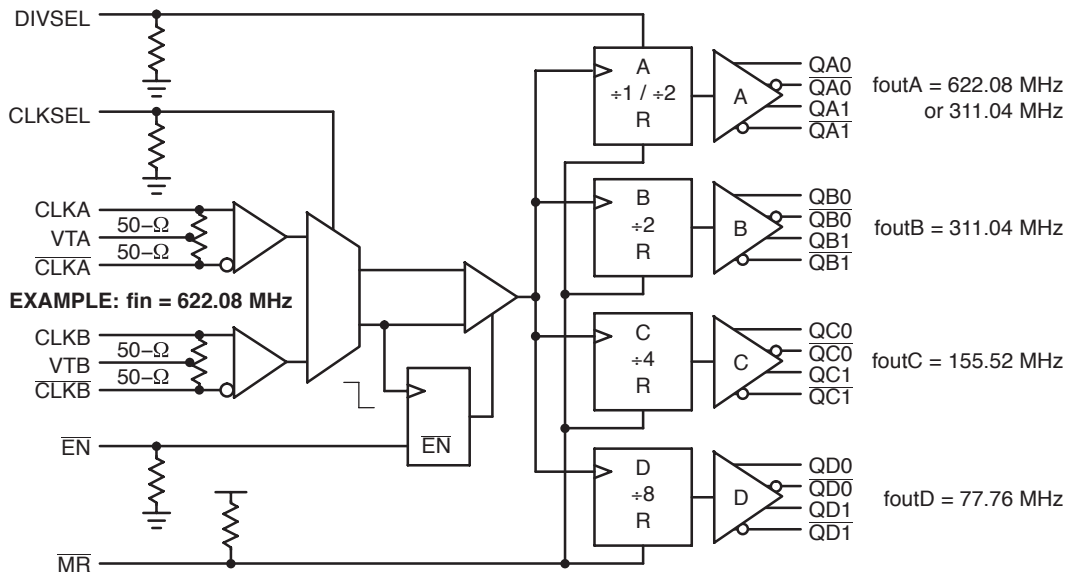
Dividers and Counters



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

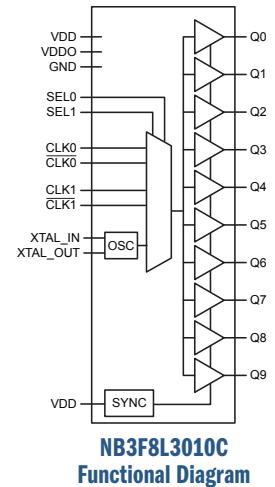


NB4L339 Functional Diagram

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, HCSSL, LVCMOS/LVTTL
- Power supply 1.5 V, 1.8 V, 2.5 V, 3.3 V, 5.0 V



Device	Outputs per Channel	Output Level	Input Level								V _{cc} Typ (V)	t _{skew} 0-0 (ps)	f _{Max} Typ (GHz)	Package(s)
			CML	CMOS	LVPECL	HCSSL	HSTL	LVDS	XTAL	TTL				
NB3N121K	21	HCSSL		✓	✓	✓	✓	✓	✓	3.3	100	0.4	QFN-52	
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	HCSSL, CMOS, LVDS, ECL			✓	✓		✓		2.5, 3.3	50	1.4	QFN-48	
NB3N111K	10	HCSSL		✓	✓	✓	✓	✓	✓	3.3	100	0.4	QFN-32	
NB7L111M	10	CML	✓	✓	✓			✓	✓	2.5, 3.3	20	5.5	QFN-52	
NB3N108K	8	HCSSL		✓	✓	✓	✓	✓	✓	3.3	100	0.4	QFN-32	
NB7L1008	8	ECL	✓		✓			✓		2.5, 3.3	20	7	QFN-32	
NB7L1008M	8	CML	✓		✓			✓		2.5, 3.3	25	8	QFN-32	
NB3N106K	6	HCSSL		✓	✓	✓	✓	✓	✓	3.3	100	0.4	QFN-24	
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	
NB3M8304C	4	CMOS, TTL		✓					✓	2.5, 3.3	45	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	4	ECL	✓	✓	✓			✓	✓	2.5, 3.3	20	3	QFN-16	
NB6L14M	4	CML	✓	✓	✓			✓	✓	2.5, 3.3	20	3	QFN-16	
NB6L14S	4	LVDS	✓	✓	✓		✓	✓	✓	2.5	20	2	QFN-16	
NB6N14S	4	LVDS	✓	✓	✓		✓	✓	✓	3.3	20	2	QFN-16	
NB7HQ14M	4	CML	✓		✓			✓		2.5	15	7	QFN-16	
NB7L14	4	ECL	✓	✓	✓			✓	✓	2.5, 3.3	15	7	QFN-16	
NB7L14M	4	CML	✓	✓	✓			✓	✓	2.5, 3.3	15	8	QFN-16	
NB3M8302C	2	CMOS, TTL		✓					✓	2.5, 3.3	85	0.2	SOIC-8	
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	
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	

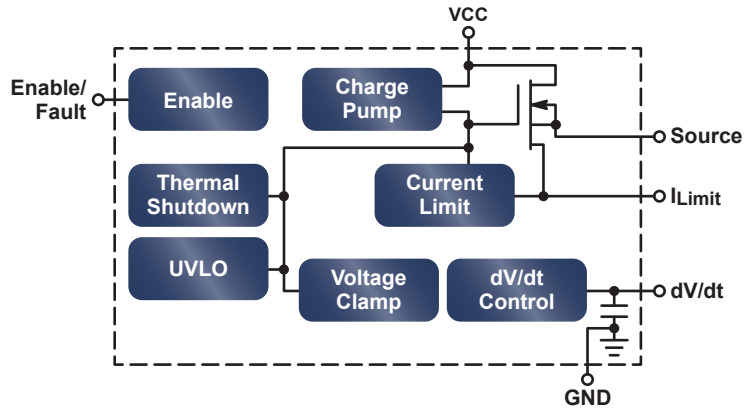
CLOCK DISTRIBUTION

Electronic Fuses for Inrush Current Limiting on Power Buses

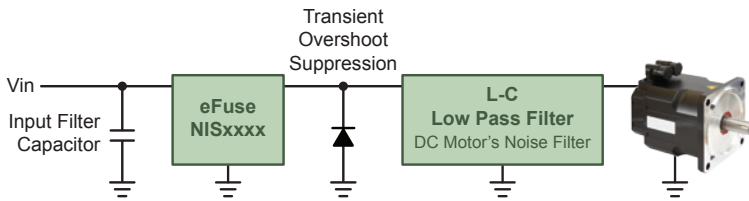
5 V and 12 V Power Bus Protection

Features

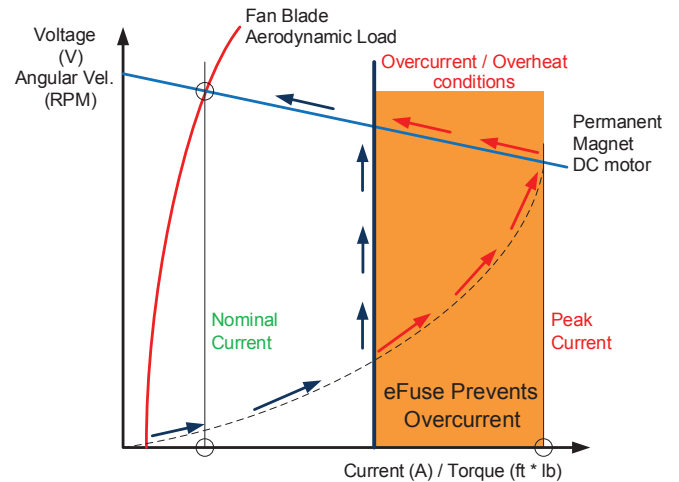
- Low $R_{DS(ON)}$, high operating and trip currents (I_{OP} , I_{TRIP})
- Overvoltage protection
- Precise I_{TRIP} control
- Slew rate control
- Thermal shut-down
- EN pin for synchronizing multiple eFuses
- Outperforms poly-fuses:
 - Tighter spec tolerances
 - Lower resistance
 - Lower trip-time
 - Superior repeatability



Typical Feature Set for eFuse



Typical Application Block Diagram



DC Motor I/V Characteristics

Device	Input Voltage (V)	Output Clamping Voltage (V)	I_{TRIP} Trip Current (A)	$R_{DS(ON)}$ ($m\Omega$)	Auto Recovery Option	Latching Option	Package
NIS5112	-0.6 to 18	15	2.5 (adjustable)	28	Yes	Yes	SOIC-8
NIS5132	-0.6 to 18	15	3.5 (adjustable)	44	Yes	Yes	DFN-10
NIS5232	-0.6 to 18	15	4 (adjustable)	44	No	Yes	DFN-10
NIS5135	-0.6 to 18	6.65	3.5 (adjustable)	68	Yes	Yes	DFN-10

ESD and Surge Protection for Industrial Networks

Transient Voltage Suppressors (TVS)

Device	P _{pk} * (W)	V _{rwm} (V)	Direction	Package
SMF Series	200	5 - 36	Unidirectional	SOD-123FL
1SMA Series	400	5 - 78	Uni-, Bidirectional	SMA
1SMB Series	600	5 - 170	Uni-, Bidirectional	SMB
P6SMB Series	600	5.8 - 171	Uni-, Bidirectional	SMB
1SMC Series	1500	5 - 78	Unidirectional	SMC
1.5SMC Series	1500	5.8 - 77.8	Unidirectional	SMC

* Peak surge power under 10/1000 μs.

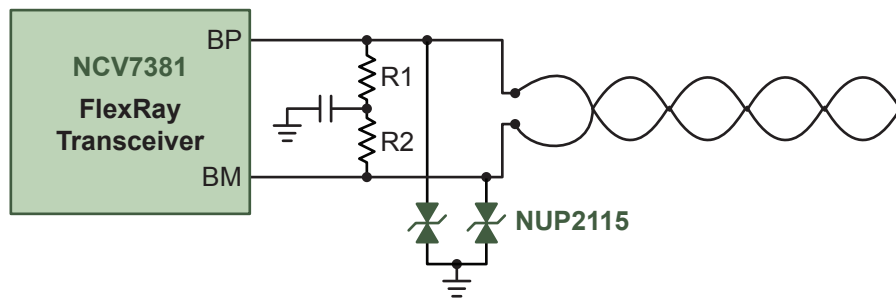
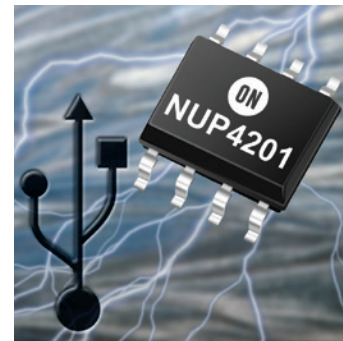
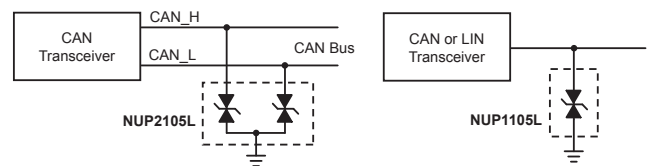
Zener Voltage Regulators

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
NUP2115L	FlexRay	24	5	3	SOT-23
NUP2105L	HS CAN	24	15	8	SOT-23
NUP1105L	LIN, LS CAN	24	30	8	SOT-23
SM12T	RS-232	12	48	12	SOT-23
NUP4201	USB2.0 FS	5	2.5	25	S0-8
NUP4114	USB2.0 HS	5	0.5	12*	TSOP-6
ESD1014	10/100/1000BASE-T Ethernet, Gb Ethernet	3.3	1.5	25	UDFN-10

* on VP pin (pin 5).



Ethernet Protection

Four Pairs, Low Capacitance Surge and ESD Protection

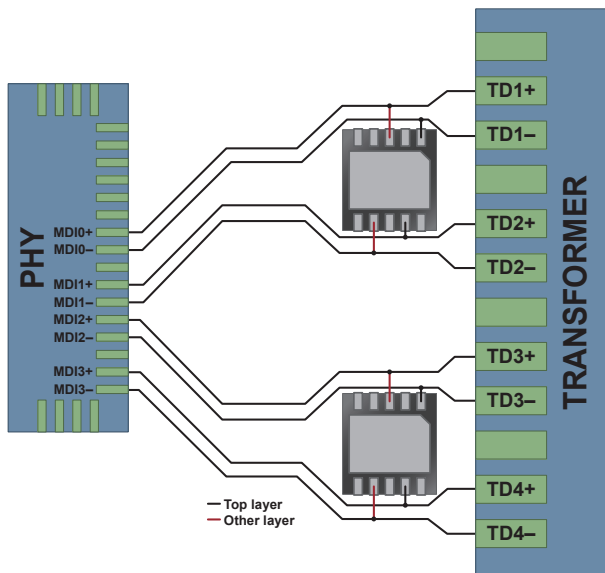
The 1000BASE-T or Gigabit Ethernet interface operating at higher bitrates is susceptible to ESD strikes, cable-discharge events and lightning-induced transients. Our products help meet IEC 61000-4-5, GR-1089-CORE and other Standards.

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

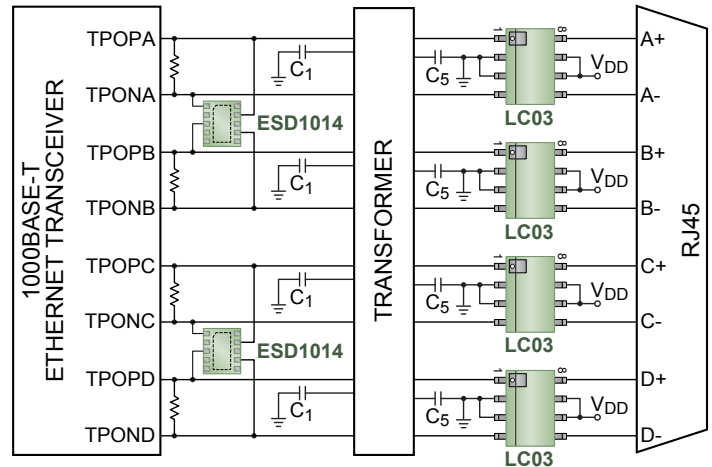


Transient Voltage Suppressors

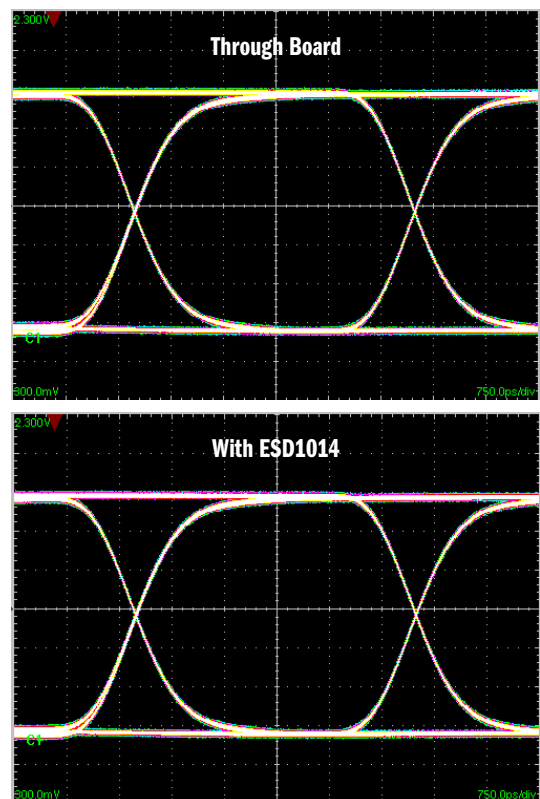
Device	V_{DC} Max (V)	Line Transient Max (V)	Surge I_{pp} , 8/20 μ s (A)	Typical Line-Line Capacitance (pF)	ESD Contact Rating (kV)	Package
NUP4114H	5.0	5.0	12*	0.4	\pm 13	TSOP-6
SRDA3.3	3.3	5.0	25	4.0	\pm 8	SOIC-8
SRDA05	5.0	7.0	23	5.0	\pm 8	SOIC-8
ESD1014	3.3	5.0	25	1.5	\pm 30	UDFN-10
LC03-6R2	6.7	7.0	100	8.0	\pm 30	SOIC-8

* On Pin 5

Typical Application



Line Side : LC03-6R2 (optional)
Transformer Side: ESD1014
Protection against metallic (transverse) strikes



Signal Integrity for Gigabit Ethernet

USB 2.0 Protection

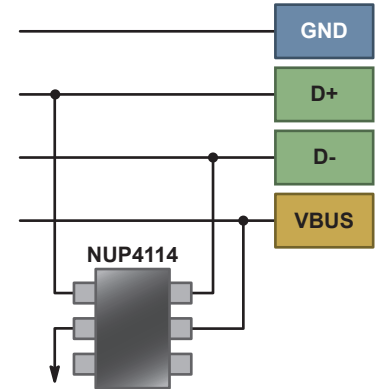
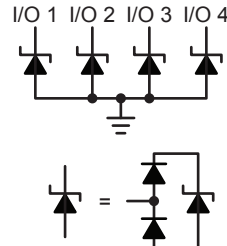
One High Speed Pair, V_{CC}, Low Capacitance ESD Protection

Key Requirement

- Cap < 1.5 pF

Features

- 0.5 - 0.8 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
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

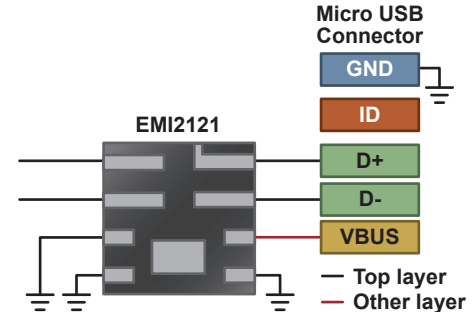
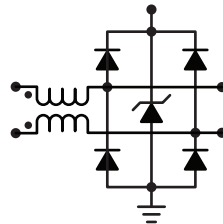
One High Speed Pair, V_{CC}, Common Mode Filter + ESD Protection

Key Requirement

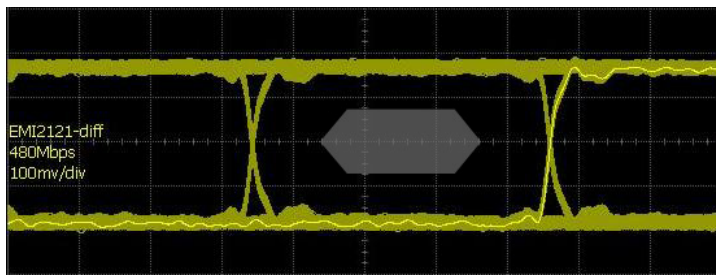
- Cap < 1.5 pF
- Common Mode Filtering

Features

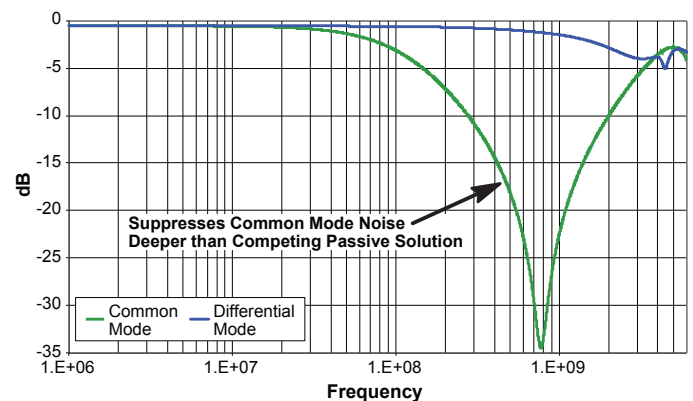
- 0.5 - 0.8 pF
- Integrated EMI suppression with ESD protection
- Industry leading low clamping voltage



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

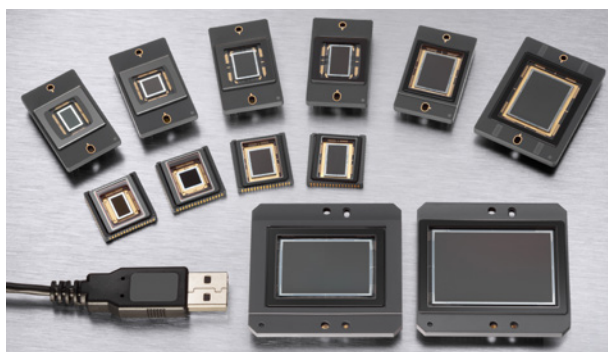


Interline Transfer CCD Image Sensors

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. All 5.5 μm and most 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	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"	C/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-2001	1.9	1600 x 1200	7.4	14.8	1"	C/M	30	✓
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-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	✓

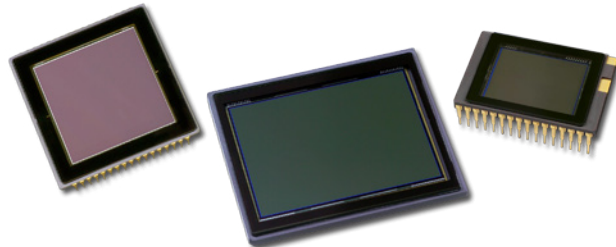
1. CFA Options - Bayer Color (C), Monochrome (M), and TRUESENSE Sparse CFA (S). 2. Pin and Electrically Compatible

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

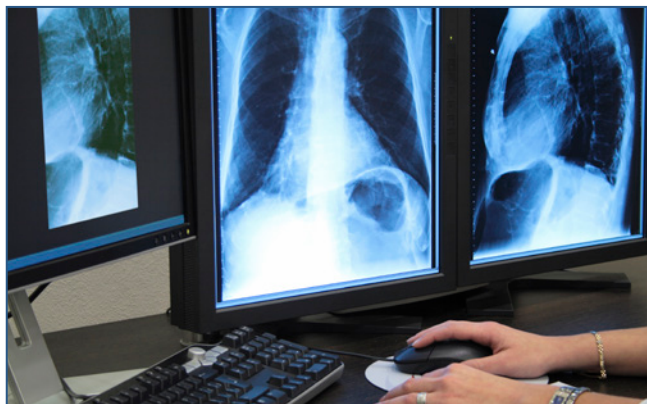
- High resolution
- Support for large sensor formats
- Simple, two-phase clocking
- Very low dark current for long exposures
- Vertical and horizontal binning



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	14.5	1"	M	15	✓
KAF-0402	WVGA	768 x 512	9	8.3	1/2"	M	20	✓
KAF-1001	1	1024 x 1024	24	34.8	APS-H	M	3	✓
KAF-1603	1.6	1536 x 1024	9	16.6	1"	M	2.2	✓
KAF-3200	3.3	2184 x 1510	6.8	18	4/3"	M	2.5	✓
KAF-4320	4.3	2084 x 2084	24	70.7	645	M	2	✓
KAF-6303	6.3	3088 x 2056	9	33.4	APS-H	M	0.6	✓
KAF-8300	8.3	3326 x 2504	5.4	22.5	4/3"	C/M	2.9	✓
KAF-09000	9.3	3056 x 3056	12	51.9	645 1.3x	M	0.4	
KAF-16801	16.8	4096 x 4096	9	52.1	645 1.3x	M	0.4	✓
KAF-16803	16.8	4096 x 4096	9	52.1	645 1.3x	M	0.2	
KAF-40000	40	7304 x 5478	6	54.8	645 1.3x	C	1.3	
KAF-50100	50.1	8176 x 6132	6	61.3	645 1.1x	C/M	1	

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



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-2104	4196 x 1, 2098 x 3	7.0, 14.0	29.4	Luma+C	
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).

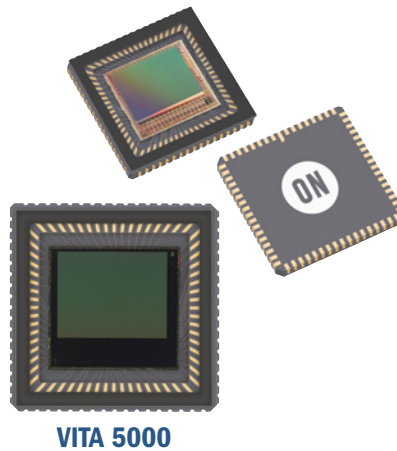


Versatile CMOS Image Sensors

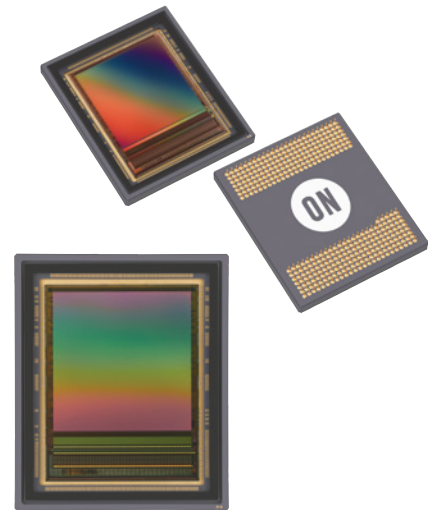
ON Semiconductor provides a broad portfolio of cost-effective, high performing global shutter CMOS image sensors. These sensors combine flexibility in configuration and resolution with high speed and high sensitivity, addressing a wide range of customer requirements. The flexible read-out architecture provided by CMOS image sensors is 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 25 Megapixels
- Pipelined and triggered global shutter with dual readout
- Rolling shutter with CDS
- High frame rates
- Multiple regions of interest



VITA 5000



VITA 25K

IMAGE SENSORS

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	4096 x 3072	4.5	23	4/3"	C/M	160	✓
VITA 16K	16	4096 x 4096	4.5	26.1	35 mm	C/M	125	✓
VITA 25K	26.2	5120 x 5120	4.5	32.6	35 mm	C/M	80	✓

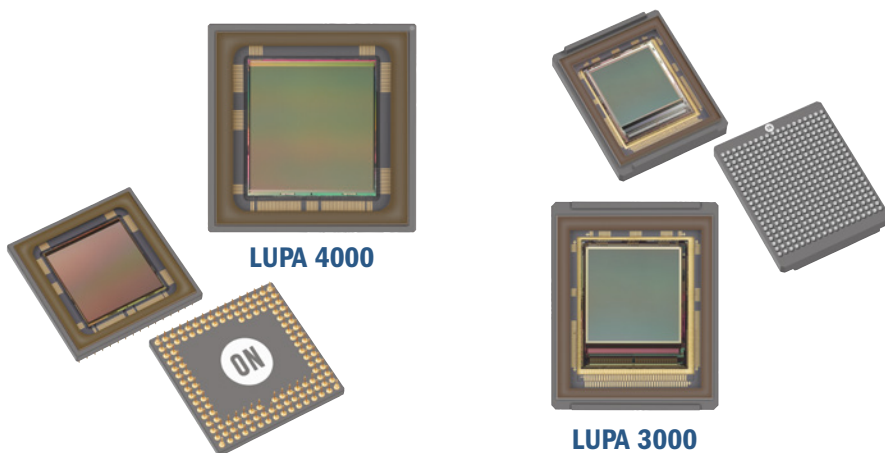
1. CFA Options - Bayer Color (C), Monochrome (M).

High Speed CMOS Image Sensors

LUPA devices offer resolution as high as 2048 x 2048 and frame rates up to 500 fps. These features, combined with a power consumption as low as 150 mW with absolutely no blooming or lag, create a perfect foundation for highly reliable, high sensitivity image sensors.

Features

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



LUPA 4000

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	✓
LUPA 4000	4	2048 x 2048	12	34.8	35 mm	C/M	15	✓

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

High Sensitivity CMOS Image Sensors

With resolutions of 300 K, 500 K and 1.3 Megapixels (MPix) respectively, the PYTHON 300, 500 and 1300 are designed to address the needs of general purpose industrial image sensing applications such as machine vision, inspection and motion monitoring, as well as security and surveillance applications including intelligent transportation systems (ITS).

ON Semiconductor's new global shutter image sensors combine flexibility in configuration and resolution with high speed and high sensitivity for the industrial imaging market. The pixel in these PYTHON sensors allows the capture of fast moving scenes without distortion by combining a read noise of less than 9 e-, with 7.7 V/lux sensitivity and frame rates as high as 850 fps.

Features

- CDS global shutter technology with single digit noise performance
- True HW scalable family concept
- High configurability and fast adaptability
- High frame rates
- Multiple regions of interest
- High dynamic range
- High NIR sensitivity



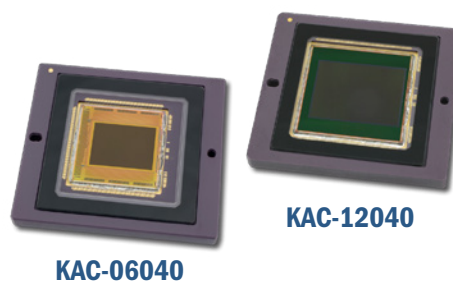
Device	Resolution (MPix)	Pixel Count (H x V)	Pixel (μm)	Diagonal (mm)	Lens	CFA ¹	FPS Max	Evaluation Kit
PYTHON 300	0.3	640 x 480	4.8	3.8	¼"	C/M	840	✓
PYTHON 500	0.5	800 x 600	4.8	4.8	1/3.6"	C/M	560	✓
PYTHON 1300	1.3	1280 x 1024	4.8	7.9	½"	C/M	210	✓
PYTHON 2000*	2	1920 x 1200	4.8	10.9	2/3"	C/M	245	✓
PYTHON 5000*	5	2592 x 2048	4.8	15.9	1"	C/M	105	✓

1. CFA Options – Bayer Color (C), Monochrome (M). * Pending 4Q14.

The KAC-12040 and KAC-06040 CMOS 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. This feature enables the use of multiple regions of interest that can simultaneously monitor both wide areas and local regions. These devices are 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



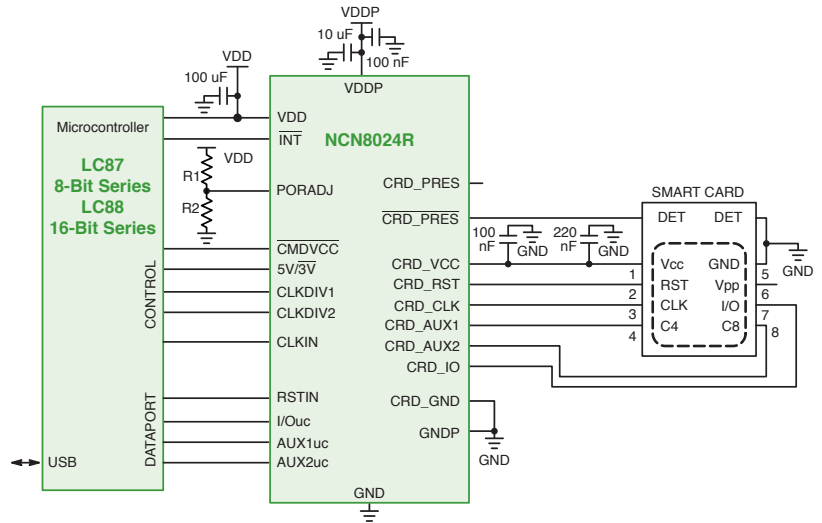
Device	Resolution (MPix)	Pixel Count (H x V)	Pixel (μm)	Diagonal (mm)	Lens	CFA ¹	FPS Max	Evaluation Kit
KAC-06040	6	2832 x 2128	4.7	16.7	1"	C/M	160	✓
KAC-12040	12	4000 x 3000	4.7	23.5	4/3"	C/M	70	✓

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

MCUs and Interfaces for Smart Card Control

Smart Card Interface Features

- ISO and EMV compliance
- ESD protection on card pins up to +8 kV (Human Body Model)



Smart Card Interfaces

	Device	Ports	Control Interface	Card Type	VDD μ C Interface (V)	Power Supply	Sequencer	Card Detect	Clock Divider	Standards	Package(s)
Smart Card	NCN6001	1	SPI	A, B, C	2.7 - 5.5	Inductive DC-DC	Yes	Yes	Yes	ISO7816; EMV4.3	TSSOP-20, TLLGA-20
	NCN6804	2	SPI	A, B, C	2.7 - 5.5	Inductive DC-DC	Yes	Yes	Yes	ISO7816; EMV4.3	QFN-32
	NCN8024R	1	Parallel	A, B	2.7 - 5.5	LDO	Yes	Yes	Yes	ISO7816; EMV4.3	SOIC-28W
	NCN8025/A (SAM/SIM)	1/3	Parallel	A, B, C	2.7 - 5.5	LDO	Yes	Yes	Yes	ISO7816; EMV4.3; UICC	QFN-16, QFN-24
	NCN8026A (SAM/SIM)	1	Parallel	A, B, C	1.6 - 5.5	LDO	Yes	Yes	Yes	ISO7816; EMV4.3; UICC; SIM	QFN-24

Microcontrollers

Device	Type	VDD (V)	ROM (kB)	RAM (bit)	12-Bit ADC	Features	Packages
LC87FBG08A	8-bit	1.8 - 5.5	8	256 x 9	9-channel	PWM; internal OSC \pm 2%, POR, LVD	SSOP-24, VCT-24
LC87FBK08A	8-bit	2.7 - 5.5	8	256 x 9	8-channel	PWM; internal OSC \pm 2%, POR, LVD	SSOP-24
LC87FBH08A	8-bit	1.8 - 5.5	8	256 x 9	9-channel	PWM; internal OSC \pm 2%, POR, LVD	QFP-36
LC87FBL08A	8-bit	2.7 - 5.5	8	256 x 9	9-channel	PWM; internal OSC \pm 2%, POR, LVD	QFP-36
LC87F2J32A	8-bit	1.8 - 5.5	32	1024 x 9	14-channel	PWM (12-bit x 2-channel), RTC, POR, LVD	QIP-48E, SQFP-48
LC87F2W48A	8-bit	2.7 - 5.5	50	1536 x 9	14-channel	PWM (12-bit x 2-channel), remote control receiver	SQFP-48
LC87FC096A	8-bit	2.5 - 3.6	96	4096 x 9	11-channel	PWM (12-bit x 4-channel), SMIIC	QIP-64E
LC87F5M64A	8-bit	2.2 - 5.5	64	2048 x 9	11-channel (8-bit)	PWM (12-bit x 2-channel), remote control receiver	QIP-64E
LC87F5R96B	8-bit	2.5 - 5.5	96	4096 x 9	11-channel (8-bit)	PWM (12-bit x 2-channel), remote control receiver	QIP-64E
LC87F2C64A	8-bit	2.4 - 5.5	64	2048 x 9	16-channel	PWM (12-bit x 4-channel), RTC, POR, LVD	QFP-80
LC87F5WC8A	8-bit	2.2 - 5.5	128	4096 x 9	15-channel	PWM (12-bit x 4-channel)	QIP-100E
LC87F5VP6A	8-bit	2.5 - 5.5	256	10K x 9	15-channel (8-bit)	PWM (12-bit x 4-channel)	QIP-100E, TQFP-100
LC88F58B0A	16-bit	2.2 - 5.5	128	6144 x 8	11-channel	PWM; 3 x SIO; 2 x UART	SQFP-64
LC88F52H0A	16-bit	2.5 - 5.5	512	24K x 8	16-channel	PWM, DAC, SMIIC x 2, SLIIC, RTC, remote control receiver	TQFP-100
LC87F1A32A	8-bit	2.7 - 5.5	32	2048 x 9	12-channel	PWM; USB 2.0 controller interface; remote control receiver	SQFP-48
LC87F1M16A	8-bit	2.7 - 5.5	16	1024 x 9	20-channel	PWM; USB 2.0 controller interface; UART	SQFP-48
LC87F1D64A	8-bit	2.7 - 5.5	64	4096 x 9	12-channel	USB 2.0 controller interface, UART	SQFP-48

OTHER

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

PoE Controllers

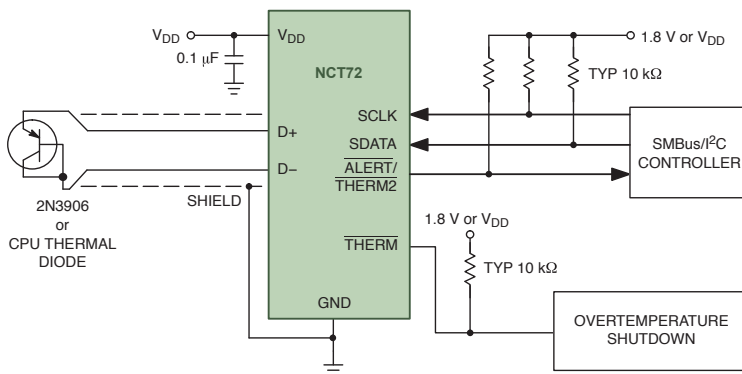
Device	Power (W)	Standard	Interface	Controller	Power Device	Package
NCP1080	13	IEEE 802.3af	✓	✓	✓	TSSOP-20 EP
NCP1082	13	IEEE 802.3af + Auxiliary	✓	✓	✓	TSSOP-20 EP
NCP1081	40	IEEE 802.3at	✓	✓	✓	TSSOP-20 EP
NCP1083	40	IEEE 802.3at + Auxiliary	✓	✓	✓	TSSOP-20 EP
NCP1090	13	IEEE 802.3af	✓		✓	TSSOP-8, SOIC-8
NCP1091	13	IEEE 802.3af	✓		✓	TSSOP-8, SOIC-8
NCP1092	13	IEEE 802.3af	✓		✓	TSSOP-8, SOIC-8
NCP1093	25	IEEE 802.3af	✓		✓	DFN-10
NCP1094	25	IEEE 802.3af	✓		✓	DFN-10
NCP1030	6	IEEE 802.3af		✓	✓	SOIC-8, DFN-8
NCP1031	3	IEEE 802.3af		✓	✓	Micro8™
NCP1034	Up to 40	IEEE 802.3at (Non-Isolated)		✓		SOIC-16
CS51221	Up to 40	IEEE 802.3at (Isolated)		✓		SOIC-16

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

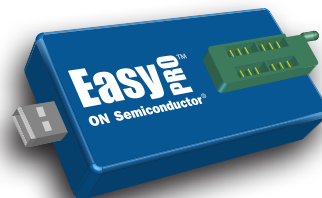
Device	Supply Range (V)	Interface	Number of Addresses	Temperature Sensors	Temperature Sensor Accuracy (°C)	Temperature Range (°C)	Package
NCT75	3.0 - 5.5	I2C/SMBus	8	1 Local	±1	-55 to +125	Micro8, SOIC-8, DFN-8
NCT72	2.8 - 3.6	I2C/SMBus	2	1 Local; 1 Remote	±1	-40 to +125	WDFN-8, DFN-8

Serial EEPROMs

Features

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

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



EEPROMs

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

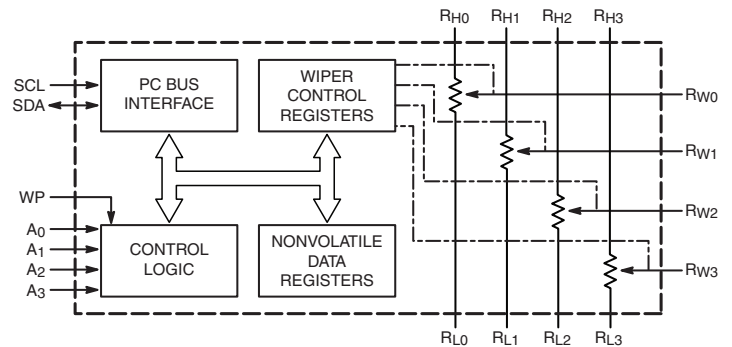
* Organization for Microwire devices is selectable.

OTHER

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



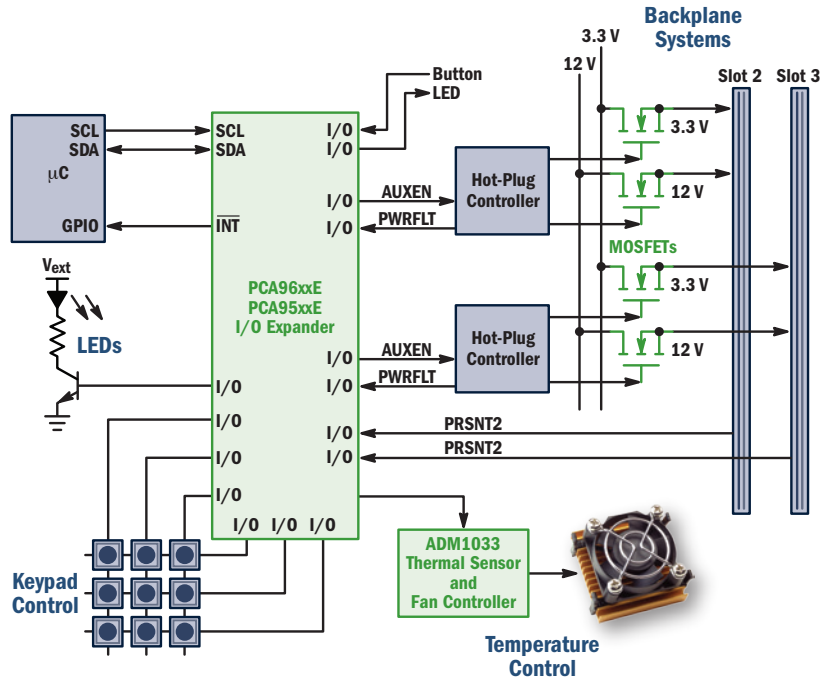
Device	Number of Pots	Number of Taps	Resistance (kΩ)	Buffered Wiper	Interface	Packages
CAT5120/1/2	1	16	10; 50	No	Up/Down	SC-70; SOT-23
CAT5110	1	32	10; 50; 100	No	Up/Down	SC-70; SOT-23
CAT5112	1	32	10; 50; 100	Yes	Up/Down	MSOP-8; PDIP-8; SOIC-8; TSSOP-8
CAT5114	1	32	10; 50; 100	Yes	Up/Down	MSOP-8; PDIP-8; SOIC-8; TDFN-8; TSSOP-8
CAT5115	1	32	10; 50; 100	No	Up/Down	MSOP-8; PDIP-8; SOIC-8; TSSOP-8
CAT5118/9	1	32	10; 50; 100	No	Up/Down	SC-70; SOT-23
CAT5123	1	32	10	No	Up/Down	SOT-23
CAT5124	1	32	50	No	Up/Down	SOT-23
CAT5125	1	32	10	No	Up/Down	SOT-23
CAT5126	1	32	10	OTP	Up/Down	MSOP-8; TDFN-8
CAT5127	1	32	10	Yes	Up/Down	MSOP-8
CAT5128	1	32	10; 50	No	Up/Down	SOT-23-8
CAT5111	1	100	10; 50; 100	Yes	Up/Down	MSOP-8; PDIP-8; SOIC-8; TSSOP-8
CAT5113	1	100	1; 10; 50; 100	Yes	Up/Down	MSOP-8; PDIP-8; SOIC-8; TSSOP-8
CAT5116	1	100	32	Yes	Up/Down	MSOP-8; PDIP-8; SOIC-8; TSSOP-8
CAT5132	1	128	10; 50; 100	Yes	I2C	MSOP-10
CAT5133	1	128	10	Yes	Up/Down	MSOP-10
CAT5136/7	1	128	50	No	I2C	SC-70
CAT5138	1	128	10	No	I2C	SC-70
CAT5140	1	256	50; 100	Yes	I2C	MSOP-8
CAT5171	1	256	50; 100	No	I2C	SOT-23-8
CAT5172	1	256	50	No	SPI	SOT-23-8
CAT5221	2	64	2.5; 10; 50; 100	Yes	I2C	SOIC-20W; TSSOP-20
CAT5411	2	64	2.5; 10; 50; 100	Yes	SPI	SOIC-24W; TSSOP-24
CAT5419	2	64	2.5; 10; 50; 100	Yes	I2C	SOIC-24W; TSSOP-24
CAT5261	2	256	50; 100	Yes	SPI	SOIC-24W; TSSOP-24
CAT5269	2	256	50; 100	Yes	I2C	SOIC-24W; TSSOP-24
CAT5271	2	256	50; 100	No	I2C	MSOP-10
CAT5273	2	256	50	No	I2C	MSOP-10
CAT5241	4	64	2.5; 10; 50; 100	Yes	I2C	SOIC-20W; TSSOP-20
CAT5401	4	64	2.5; 10; 50; 100	Yes	SPI	SOIC-24W; TSSOP-24
CAT5409	4	64	2.5; 10; 50; 100	Yes	I2C	SOIC-24W; TSSOP-24
CAT5251	4	256	50; 100	Yes	SPI	SOIC-24W; TSSOP-24
CAT5259	4	256	50; 100	Yes	I2C	SOIC-24W; TSSOP-24

OTHER

Cascadable I/O Expanders

Features

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



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

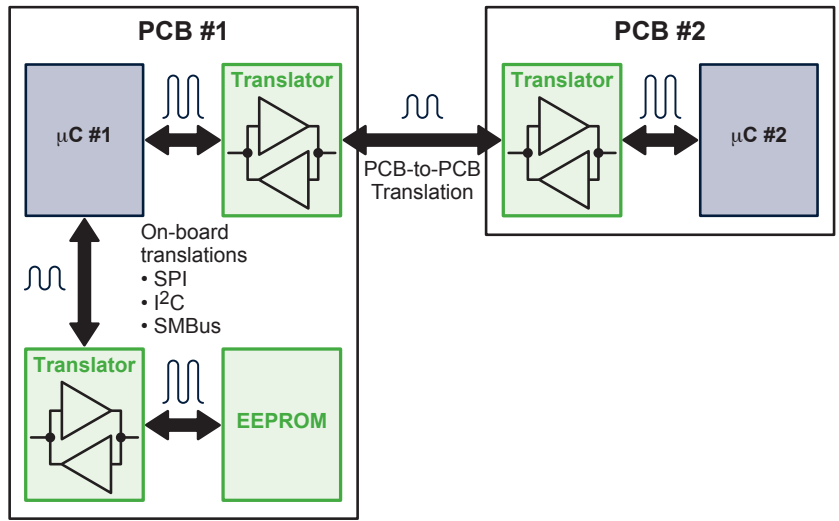
OTHER

Logic Translators

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

Key Features

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



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

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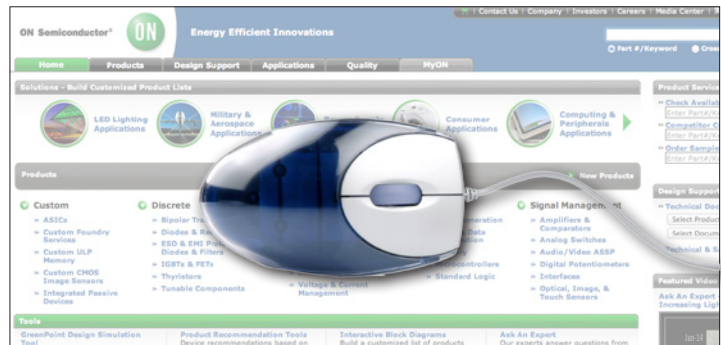
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