

# Connected Sensors Building Automation Systems Guide



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### Introduction

Monitoring devices or nodes in building control systems, fire safety systems, lighting control, and other building automation and Internet of Things (IoT) applications are becoming more prevalent in today's world.

The use of connected sensors has a wide range of uses in building automation applications, from monitoring human safety and security, controlling the environment and ambience specified by the comfort preferences of the end user, or either periodic or continuous data logging of environmental and system data to detect irregular system conditions.

Texas Instruments (TI) has a broad portfolio of products that cater to connected sensing in building automation applications. This portfolio ranges from innovative sensor analog front-end products to low-power wireless connectivity solutions.

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## Sensor Solutions

TI has a rich, five-decade history of sensing innovation and, combined with best-in-class sensing technologies, tools, and resources, we continue to deliver better solutions today and new possibilities for tomorrow.

Learn more about sensor solutions at: [www.ti.com/sensing](http://www.ti.com/sensing)

### Temperature Sensing

Part No.	Type	Supply Range (V)	Supply Current (Max) (µA)	Temp Range (°C)	Local Sensor Accuracy (Max) (±°C)	Infrared Sensor Accuracy (Max) (±°C)	Maximum Cable Length	Interface	Pin / Package	Approx. Price (US\$   1ku)
LMT70/70A	Analog	2.0 to 5.5	12	-55 to 150	0.36	–	–	Analog Out	4DSBGA	0.54 / 0.65
LMT84	Analog	1.5 to 5.5	8.1	-50 to 150	2.7	–	–	Analog Out	5SC70	0.18
TMP112	Digital	1.4 to 3.6	10	-40 to 125	1	–	–	2W, I2C, SMBus	6SOT563	0.90
TMP75	Digital	2.7 to 5.5	85	-40 to 125	2	–	–	2W, I2C, SMBus	8SOIC, 8VSSOP	0.45
LMT01	Digital	2.0 to 5.5	34	-50 to 150	0.5	–	2 Meters	Pulse Counter	2T092S	0.79
TMP107	Digital	1.7 to 5.5	35	-55 to 125	0.4	–	300 Meters	UART	8SOIC	1.40
TMP007	Contactless	2.2 to 5.5	270	0 to 60	1	3	–	I2C, SMBus	8DSBGA	1.90

### Humidity and Temperature Sensing

Part No.	Relative Humidity Accuracy (Typ) (%RH)	RH Operating Range (Typ) (%RH)	Temperature Accuracy (Typ) (°C)	Supply Range (V)	Average Supply Current (Typ) (µA)	Interface	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$   1ku)
<b>HDC1010</b>	±2	0 - 100	±0.2	3 to 5	1.2 @ 1 sps	I2C	-40 to 125	8DSBGA	1.20
<b>HDC1080</b>	±2	0 - 100	±0.2	3 to 5	1.2 @ 1 sps	I2C	-40 to 125	6DFN	1.38

\*Quantities of 1,000 begin at this suggested resale price in U.S. dollars.

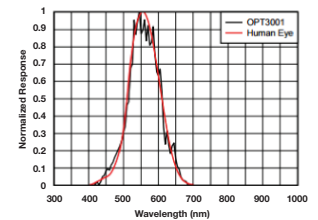
New products are listed in bold red.

# Sensor Solutions

## Ambient Light Sensor with Human Eye Visibility

The OPT3001 is a single-chip lux meter, measuring the intensity of light as visible by the human eye. The precision spectral response and strong IR rejection of the device enables the OPT3001 to accurately meter the intensity of light as seen by the human eye regardless of light source. The strong IR rejection also aids in maintaining high accuracy when industrial design calls for mounting the sensor under dark glass for aesthetics.

Spectral Response: The OPT3001 and Human Eye



## Ambient Light Sensing

Part No.	Supply Range (Nom) (V)	Iq (Max) (µA)	Measurement Range	Dark Response @ 0 Lux (Max)	Gain Selection	Interface	Benefits	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$ 1ku)
OPT3001	1.6 to 3.6	2	0.01 Lux to 83KLux	3 Code	12 Gains with Auto-ranging	I <sup>2</sup> C	Matches photopic response of the human eye Rejects > 99% (typ) of IR	-40 to 85	USON	0.99
OPT3002	1.6 to 3.6	2	1.2nW/cm <sup>2</sup> to 10mW/cm <sup>2</sup>	3 Code	12 Gains with Auto-ranging	I <sup>2</sup> C	Provides functionality of Optical Power Meter in one device with spectral bandwidth from 300nm to 1000nm Applicable for optical spectral systems that require detection of a variety of wavelength	-40 to 85	USON	0.99

## Inductance Sensing

Part No.	Key Applications	Special Features	Input Channels	L (Inductance) Resolution (Bits)	Supply Range	Active State Current (mA)	Interface	Sensor Frequency (Hz)	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$ 1ku)
LDC1312/4	<ul style="list-style-type: none"> <li>Position Sensing</li> <li>Angle/Rotation Sensing</li> </ul>	<ul style="list-style-type: none"> <li>Contactless sensing</li> <li>Ultralow cost sensors (coils, PCB coils)</li> <li>Immune to dust, dirt etc.</li> </ul>	2 / 4	12	2.7 to 3.6	2.1	I <sup>2</sup> C	1k to 10M	-40 to 125	WSON, WQFN	2.38 / 3.50
LDC1612/4			2 / 4	28	2.7 to 3.6	2.1	I <sup>2</sup> C	1k to 10M	-40 to 125	WSON, WQFN	3.25 / 4.75

## Capacitance Sensing

Part No.	Input Channels	Special Features	Shield Drive Channels	Special Features	Supply Range	Supply Current (mA)	Interface	Prog. Sampling Rate (Typ) (SPS)	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$ 1ku)
FDC1004	4	<ul style="list-style-type: none"> <li>Liquid level sensing (with interferers)</li> </ul>	2	Integrated Shield Drivers	3 to 3.6	0.75	I <sup>2</sup> C	100 / 200 / 400	-40 to 125	WSON	2.50
FDC2114/12	4 / 2	<ul style="list-style-type: none"> <li>Proximity Sensing</li> <li>Liquid Level Sensing</li> </ul>	—	EMI resistant core	2.7 to 3.6	2.1	I <sup>2</sup> C	40 to 4080	-40 to 125	WQFN	2.38 / 3.50
FDC2214/12	4 / 2	<ul style="list-style-type: none"> <li>Proximity Sensing</li> <li>Liquid Level Sensing</li> </ul>	—	EMI resistant core	2.7 to 3.6	2.1	I <sup>2</sup> C	40 to 13300	-40 to 125	WQFN	3.25 / 4.75

## Hall Effect Sensor

Part No.	Type	Type	Supply Range	Output	Output Bandwidth (Typ) (kHz)	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$ 1ku)
DRV5013/23/33	Digital	Latch / Switch / Omnipolar Switch	2.5 to 38	Open Drain	—	-40 to 125	SOT-23, T0-92	0.29
DRV5053	Analog	Analog Bipolar	2.5 to 38	0.2 to 1.8 V	10	-40 to 125	SOT-23, T0-92	0.31

\*Quantities of 1,000 begin at this suggested resale price in U.S. dollars.

## Find the Perfect Sensor Reference Design to Get Started

	Description	Key Features	TI Devices
	<b>Humidity &amp; temperature sensor node for 2.4-GHz Star networks enabling 10+ year coin cell battery life</b> Reference Design – TIDA-00374	<ul style="list-style-type: none"> <li>Use of nano-power system timer results in 10+ years of battery life on a coin cell battery</li> <li>±2% relative humidity accuracy, ±0.2°C temperature accuracy</li> </ul>	CC2650 HDC1010 TPL5110 TS5A3160
	<b>Energy harvesting ambient light and environment sensor node for Sub-1 GHz networks</b> Reference Design – TIDA-00488	<ul style="list-style-type: none"> <li>Runs entirely from solar energy when LUX level is sufficient</li> <li>Precision optical filtering to match human eye (± 0.01 LUX light accuracy)</li> </ul>	CC1310 OPT3001 BQ25505 HDC1010
	<b>Interrupt-based ambient light and environment sensor node for Sub-1 GHz networks</b> Reference Design – TIDA-00758	<ul style="list-style-type: none"> <li>Precision optical filtering to match human eye (± 0.01 LUX light accuracy)</li> <li>±2% relative humidity accuracy, ±0.2°C temperature accuracy</li> </ul>	CC1310 OPT3001 HDC1010
	<b>Backlight &amp; smart lighting control by ambient light and noise-immune proximity sensor</b> Reference Design – TIDA-00754	<ul style="list-style-type: none"> <li>Dynamically adjusts backlight brightness on a logarithmic scale based on how the human eye perceives brightness</li> <li>Excellent human eye spectral response matching with a strong IR rejection (&lt;1%)</li> </ul>	CC1310 OPT3001 BQ25505 HDC1010
	<b>People counting for demand controlled ventilation using 3D Time-of-Flight (ToF) reference design</b> Reference Design – TIDA-00750	<ul style="list-style-type: none"> <li>Accuracy: &gt;90%</li> <li>Configurable response time, occupancy data available in real-time or periodically</li> <li>Being independent of ambient light, 3D ToF camera can even see in the dark</li> </ul>	AM4379 OPT8241 OPT9221

# Amplifier and Comparator Solutions

Texas Instruments delivers a broad portfolio of amplifier and linear solutions including precision and high speed op amps, instrumentation and differential amplifiers along with comparators. TI has an amplifier suited for any application.

Learn more about Amplifier solutions at: [www.ti.com/amplifier](http://www.ti.com/amplifier)

## Low Power Amplifiers

Part No.	Supply Range (V)	Channels	Iq per ch. (Max) (mA)	GBW (Typ) (MHz)	Slew Rate (Typ) (V/μs)	CMRR (Typ) (dB)	Offset Voltage @ 25°C (Max) (mV)	Offset Drift (Typ) (μV/°C)	Rail-Rail	Operating Temp. (°C)	Approx. Price (US\$   1ku)
LMV611/2/4	1.8 to 5.5	1 / 2 / 4	0.21	1.5	0.42	60	4	5.5	RRIO	-40 to 125	0.22 / 0.25 / 0.30
OPA369	1.8 to 5.5	1	0.0012	0.012	0.005	100	0.75	0.4	RRIO	-40 to 85	0.65
OPA349	1.8 to 5.5	1	0.002	0.065	0.02	52	10	15	RRIO	0 to 70	0.45
TLV521	1.7 to 5.5	1	0.0005	0.006	2.9	–	3	1.5	RRIO	-40 to 125	0.14
TLV522	1.7 to 5.5	2	0.0008	0.008	3.7	–	4	1.5	RRIO	-40 to 125	0.16
LPV542	1.6 to 5.5	2	0.0008	0.0058	0.0037	101	3	1	RRIO	-40 to 125	0.60

## General Purpose Amplifiers

Part No.	Supply Range (V)	Channels	Iq per ch. (Max) (mA)	GBW (Typ) (MHz)	Slew Rate (Typ) (V/μs)	CMRR (Typ) (dB)	Offset Voltage @ 25°C (Max) (mV)	Offset Drift (Typ) (μV/°C)	Operating Temp. (°C)	Approx. Price (US\$   1ku)
TLC271/2/4	3 to 16	1, 2, 4	1.6	1.7	3.6	65	10	1.8	–	0.31 / 0.41 / 0.60
OPAx313	1.8 to 5.5	1, 2, 4	0.06	1	0.5	70	2.5	2	-40 to 125	0.26, 0.38, 0.55
OPAx314	1.8 to 5.5	1, 2, 4	0.21	3	1.5	75	2.5	1	-40 to 125	0.30, 0.45, 0.65
OPAx316	1.8 to 5.5	1, 2, 4	0.5	10	6	76	2.5	2	-40 to 125	0.48, 0.72, 1.08
TLV316	1.8 to 5.5	1	1.2	10	6	90	3	2	-40 to 125	0.24
TLV6001	1.8 to 5.5	1	0.1	1	0.5	76	4.5	2	-40 to 125	0.17
TLV379	1.8 to 5.5	1	0.012	0.09	0.03	100	2.5	0.8	-40 to 125	0.20
OPA320	1.8 to 5.5	1	1.75	20	10	114	0.15	1.5	-40 to 125	0.80

## Comparators

Part No.	Output Type	Supply Range (V)	Channels	tRESP Low-to-High (μs)	Iq per ch. (Max) (mA)	Input Bias Current (±) (Max) (nA)	VICR (V)	Offset Voltage @ 25°C (Max) (mV)	Operating Temp. (°C)	Approx. Price (US\$   1ku)
TLV3691	Push-Pull	0.9 to 6.5	1	24	0.00015	0.1	-0.1 to 6.6	15	-40 to 85	0.40
TLV3012	Push-Pull	1.8 to 5.5	1	6	0.005	0.01	-0.2 to 5.7	12	-40 to 85	0.75
TLC3702	Push-Pull	3 to 16	2	1.1	0.02	0.03	0 to 15	5	-40 to 85	0.36
TLV1701/2/4	Open Collector	2.2 to 36	1, 2, 4	0.56	0.075	15	2.2 to 36	2.5	-40 to 125	0.38, 0.61, 0.97
<b>LMV7219</b>	Push-Pull	2.5 to 5.5	1	0.007	1.8	950	-0.2 to 4.3	6	-40 to 105	0.98

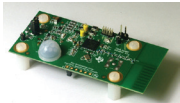
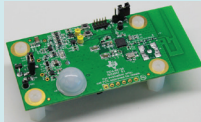

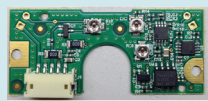
*New products are listed in bold red.*

## Analog-to-Digital Converters

Part No.	Type	Resolution (bits)	Sample Rate (SPS)	Input Channels	Interface	Input Range (V)	Features	Operating Temp. (°C)	Approx. Price (US\$   1ku)
<b>SAR</b>									
ADS7040/1/2/3/4	SAR	8 to 12	1000	1	SPI	1.65 to 3.6	Nanowatt Power Consumption	-40 to 125	0.53 / 1.60 / 2.10
ADS7868/7/6	SAR	8 to 12	280, 240, 200	1	SPI	0 to 3.6	AVDD Input Range Down to 1.2V	-40 to 85	0.55 / 0.95 / 1.25
ADS7924	SAR	12	100	4	I2C	0 to 5.5	Programmable Alarm Thresholds	-40 to 85	1.25
ADS8861/81	SAR	16, 18	1000	1	SPI	-5 to 5	Differential Input Range	-40 to 85	11.00, 19.95
<b>ΔΣ</b>									
ADS1115	ΔΣ	16	0.86	4	I2C	2 to 5.5	Ultra-Small: 0.75mm <sup>2</sup> / channel	-40 to 125	2.30
ADS1018	ΔΣ	12	3.3	4	SPI	2 to 5.5	Temp. Sensor (0.5°C accurate)	-40 to 125	1.15
ADS1120/1220	ΔΣ	16, 24	2	4	SPI	2.3 to 5.5	Single cycle setting, IDACs	-40 to 125	3.15 / 3.95

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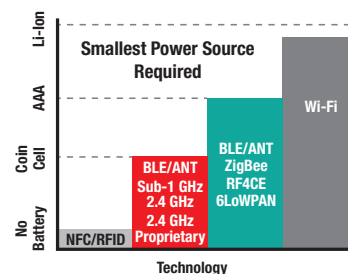
# Amplifier and Comparator Solutions

Find the Perfect Sensor Reference Design to Get Started			
	Description	Key Features	TI Devices
	<b>Low power wireless PIR motion detector reference design enabling 10 year coin cell battery life</b> Reference Design – TIDA-00489	<ul style="list-style-type: none"> <li>Low standby current of 1.65 <math>\mu</math>A (PIR sensor remains active in standby)</li> <li>Low active state current due to low active processor and Tx currents (1.12 mA for 104.1 ms)</li> <li>Motion Sensitivity up to 30-ft</li> </ul>	LPV521 LPV542 TLV3691 CC1310
	<b>Low-power PIR motion detector with Bluetooth Smart and 10 year coin cell battery life reference design</b> Reference Design – TIDA-00759	<ul style="list-style-type: none"> <li>Low standby current of 1.63 <math>\mu</math>A (PIR sensor remains active in standby)</li> <li>Low active state current due to low active processor and Tx currents (1.57 mA for 57 ms)</li> <li>Motion Sensitivity up to 30-ft</li> </ul>	LPV521 LPV542 TLV3691 CC2650
	<b>Low-Power carbon monoxide (CO) detector with BLE and 10-year coin cell battery life reference design</b> Reference Design – TIDA-00756	<ul style="list-style-type: none"> <li>Low Standby Current of 1.07 <math>\mu</math>A (Gas Sensing Remains Active in Standby)</li> <li>Carbon Monoxide Gas Detection Range of 0 to 1000 ppm With <math>\pm</math>15% Accuracy</li> </ul>	LPV521 TLV3691 CC2650 TMP103 TPL5111
	<b>PM2.5 and PM10 particle sensor analog front-end for air quality monitoring reference design</b> Reference Design – TIDA-00378	<ul style="list-style-type: none"> <li>Tested against Arizona dust, mulberry pollen, and cigarette smoke using adapted ANSI/AHAM AC-1-2013 test standard</li> <li>Instrumentation amplifier topology to reject external noise sources</li> <li>Low noise, low input bias current, low offset op-amps with rail-to-rail output to maintain high SNR and increase output dynamic range</li> </ul>	INA132 OPA2320 OPA320

## Wireless Connectivity

With the industry's broadest wireless connectivity portfolio TI offers cost-effective, low-power solutions for short-range, long-range, mesh, and IP networks

Learn more about Wireless Connectivity solutions at:  
[www.ti.com/wireless](http://www.ti.com/wireless)



### Wi-Fi

Part No.	Benefits	TI Designs and Development Tools
CC3200	SimpleLink Wi-Fi Wireless MCU with ARM Cortex®-M4, Integrated Wi-Fi Connectivity, security, low power, ease of use: Certified Wi-Fi modules available	CC3200MODLAUNCHXL, TIDC-CC3200SMARTPLUG, TIDC-CC3200CAMBOOST
CC3100	SimpleLink Wi-Fi Wireless Network Processor: provides easy Wi-Fi connectivity for building automation applications. Fully integrated 802.11 b/b/n radio, baseband, and MAC. Connect serially interface to any 8, 16, or 32-bit micro-controllers. Certified Wi-Fi modules available	CC3100MODBOOST
WL1837MOD	High performance, low power, certified combo modules integrating Wi-Fi + Bluetooth + Bluetooth Low Energy. Connects to any Linux Processor with SDIO interface, available up to 85°C, 2.4GHz and 5GHz	WL1837MODCOM8I

### Sub-1GHz

Part No.	Benefits	TI Designs and Development Tools
CC1200	High performance, long distance, low power radio transceiver: optimized for wide band applications	CC1200DK, CC1200EMK-868-930, TIDC-CHN
CC1120	High performance, long distance, low power radio transceiver: optimized for Narrowband	CC1120DK, CC1120EMK-169, CC1120EMK-420-470, CC1120EMK-868-915, TIDC-MULTIBAND-WMBUS
CC1101	Ultra-low power radio transceiver	CC1101DK433, CC1101DK868-915, TIDM-SUB1GHZ-MESH-NETWORK
CC1310	SimpleLink Ultra-low power ARM® Cortex®-M Based Wireless MCU	TIDA-00484

\*Quantities of 1,000 begin at this suggested resale price in U.S. dollars.

# Wireless Connectivity

## Bluetooth®

Part No.	Benefits	TI Designs and Development Tools
<b>CC2650</b>	SimpleLink Wi-Fi Ultra-Low power ARM® Cortex®-M Based Wireless MCU: multi-standard supported Bluetooth Low-Energy, 6LoWPAN and ZigBee. Ideal for end point and sensors	CC2650DK, CC2650STK TIDA-00374,
<b>CC2640</b>	SimpleLink Wi-Fi Ultra-Low power ARM® Cortex®-M Based Wireless MCU supporting Bluetooth Low-Energy: ultra-low power, small size and ease of use. Ideal for end point and sensors	CC2650DK, CC2650STK TIDA-00374
<b>CC2540T</b>	Extreme temperature Bluetooth Low Energy (up to 125 degree C) wireless MCU combined with low power and ease of use	CC2541DK-MINI TIDC-BLUETOOTH-LOW-ENERGY-LONG-RANGE TIDC-BLUETOOTH-SMART-TO-RS-485-GATEWAY
<b>CC2564MODA</b>	Dual Mode Bluetooth (Bluetooth Low energy + Bluetooth Classic) transceivers module with antenna integrated: low-power, stable and robust SW stack	CC256XQFNEM CC2564MODAEM (RTM September)
<b>CC2650MODA</b>	SimpleLink Bluetooth low energy certified module: easiest way to add Bluetooth low energy functionality to an existing product	MSP-EXP432P401R

## ZigBee®

Part No.	Benefits	TI Designs and Development Tools
<b>CC2630</b>	SimpleLink Wi-Fi Ultra-Low power ARM® Cortex®-M Based Wireless MCU : ideal for end point sensors	CC2650DK, CC2650STK, TIDA-00374
<b>CC2530</b>	ZigBee Wireless MCU: enables robust network nodes to be built with very low total bill-of-material costs	CC2530DK, CC2530EMK, CC2531EM-IOT-HOME-GATEWAY-RD, CC2530-CC2592EM-RD
<b>CC2538</b>	512kB ARM® Cortex®-M Based Wireless MCU: handle complex network stacks with security, demanding applications, and over-the-air download	CC2538DK, CC2538EMK, TIDC-ZNP-HOST-SW3





## NFC

Part No.	Benefits	TI Designs and Development Tools
<b>RF430FRL152H</b>	13.56-MHz transponder chip with a programmable 16-bit MSP430 low-power microcontroller. Optimized for operation in fully passive (battery-less) or single-cell battery-powered (semi-active) mode.	TIDM-RF430-TEMPSENSE, TIDM-RF430FRLSENSE
<b>RF430CL330H</b>	NFC Tag Type 4 device which combines a wireless NFC interface and a wired SPI/I2C interface to connect the device to a host	TIDA-00217
<b>RF430CL331H</b>	Dynamic NFC/RFID Interface Transponder that combines wireless and wired I2C interface. Support of read caching, prefetching and write automatic acknowledgment features allows greater data throughput and enables data streaming.	TIDA-00524

\*Quantities of 1,000 begin at this suggested resale price in U.S. dollars.

New products are listed in **bold red**.

### Find the Perfect Connectivity Reference Design to Get Started

	Description	Key Features	TI Devices
	<b>SimpleLink™ Bluetooth low energy SensorTag™ kit</b> Reference Design – <b>CC2650STK-RD</b>	<ul style="list-style-type: none"> <li>• More Sensors! 10 Sensors including light, humidity, pressure, magnetic, accelerometer, gyroscope, and others</li> <li>• Flexibility for IoT applications; Enable ZigBee or 6LoWPAN through a firmware upgrade</li> </ul>	CC2650 TMP007 OPT3001
	<b>Battery-less NFC/RFID temperature sensing patch</b> Reference Design – <b>TIDM-RF430-TEMPSENSE</b>	<ul style="list-style-type: none"> <li>• No batteries required</li> <li>• “Over the air” configuration of ADC</li> <li>• Different antenna configurations allow many form factors</li> </ul>	RF430FRL152H
	<b>Dynamic field powered NFC reference design for data logging and security applications</b> Reference Design – <b>TIDA-00217</b>	<ul style="list-style-type: none"> <li>• User can receive updated information from a field unit</li> <li>• Battery-less sensor interface; NFC reader provides</li> </ul>	TMP103 RF430CL330H MSP430FR5969
	<b>Ultralow power multi-sensor data logger with NFC interface</b> Reference Design – <b>TIDA-00524</b>	<ul style="list-style-type: none"> <li>• &gt;5 year battery life on a CR2032 coin cell</li> <li>• RF430 NFC dynamic tag type 4B compliant communication</li> <li>• NFC configuration and data read back</li> <li>• Multiple sensor options</li> <li>• Up to 64KB of non-volatile FRAM memory</li> <li>• Data is date/time stamped using RTC</li> </ul>	RF430CL331H TMP112 OPT3001 MSP430FR5969 TPD1E10B06

# Embedded Processing Solutions

Microcontrollers and processors from Texas Instruments offer a broad range of performance and power consumption options. From MSP430 MCU with ultra-low power consumption to the Sitara™ AM335x family with integrated multi-protocol industrial communications support to connect various kinds of sensors in real-time for better automation; TI is tailored to meet your design challenges.

Learn more about Microcontroller solutions at: [www.ti.com/msp430](http://www.ti.com/msp430) and [www.ti.com/msp432](http://www.ti.com/msp432).

Learn more about processor solutions at: [www.ti.com/processors](http://www.ti.com/processors).

## MSP430 Ultra-Low-Power FRAM MCUs




Part No.	Frequency (MHz)	Non-volatile Memory (KB)	SRAM (KB)	GPIO	I2C	SPI	UART	DMA	ADC	Comparator (Channels)	Timers 16-Bit	Multipliers	AES	Additional Features	Operating Temp. (°C)	Package	Approx. Price (US\$ 11ku)
MSP430FR2311	16	3.75	1	16	1	2	1	0	ADC10-10ch	2	2	N/A	N/A	OpAmp, Transimpedance amplifier, Real-Time Clock, Watchdog, Temp Sensor, Brown Out Reset	-40 to 85	VQFN, TSSOP	0.60
MSP430FR4133	16	15.5	2	60	1	2	1	0	ADC10-10ch	0	2	N/A	N/A	LCD, RTC, BOR, Temp Sensor	-40 to 85	LQFP, TSSOP	1.55
MSP430FR5969	16	64	2	40	1	3	2	3	ADC12-16ch	16	5	32x32	AES256	RTC, BOR, IrDA, Temp Sensor	-40 to 85	VQFN	2.35
MSP430FR6972	16	64	2	51	2	4	2	3	ADC12-8ch	8	5	32x32	AES256	LCD, RTC, BOR, IrDA, Temp Sensor	-40 to 85	LQFP	2.55
MSP430FR6989	16	128	2	83	2	4	2	3	ADC12-16ch	16	5	32x32	AES256	LCD, RTC, Scan I/F, BOR, IrDA, Temp Sensor	-40 to 85	LQFP	4.50
MSP430FR5994	16	256	8	68	4	8	4	6	ADC12-20ch	16	6	32x32	AES256	LEA, RTC, BOR, IrDA, Temp Sensor	-40 to 85	VQFN, LQFP, BGA	2.55

## MSP430 Ultra-Low-Power MCUs

Part No.	Frequency (MHz)	Non-volatile Memory (KB)	SRAM (KB)	GPIO	I2C	SPI	UART	ADC	Comparator (Channels)	Timers 16-Bit	Multipliers	Additional Features	Operating Temp. (°C)	Package	Approx. Price (US\$ 11ku)
MSP430G2553	16	16	0.5	24	1	1	1	ADC10-8ch	8	2	N/A	Temp Sensor, BOR, IrDA	-40 to 85	TSSOP, VQFN	0.90
MSP430G2955	16	56	4	32	1	2	1	ADC10-12ch	8	3	N/A	Temp Sensor, BOR, IrDA	-40 to 105	TSSOP, VQFN	1.30
MSP430F2274	16	32	1	32	1	1	1	ADC10-12ch	0	2	N/A	Temp Sensor, BOR, OpAmp	-40 to 105 -40 to 85	DSBGA, TSSOP, VQFN	1.80
MSP430I2041	16	32	2	16	1	2	1	SigmaDelta 24-4ch	0	2	16 x16	Temp Sensor, BOR, IrDA	-40 to 105	TSSOP, VQFN	1.75

\*Quantities of 1,000 begin at this suggested resale price in U.S. dollars.

### Find the Perfect MCU Design to Get Started

	Description	Key Features	TI Devices
	<b>Thermostat implementation with FRAM microcontroller</b> Reference Design – TIDM-FRAM-THERMOSTAT	<ul style="list-style-type: none"> <li>0°C to 35°C Temperature Measurement with 0.1°C Resolution</li> <li>3.4 inch LCD Display</li> <li>Ultra-Low Power: 1.8 µA Standby Current</li> </ul>	MSP430FR4133 SN65HVD75 TPS782
	<b>MSP430FR4133 microcontroller air quality sensor reference design</b> Reference Design – TIDM-AIRQUALITYSENSOR	<ul style="list-style-type: none"> <li>Calculates PM2.5 concentration levels and air quality index levels (AQI)</li> <li>Calculates temperature and humidity levels</li> <li>Offers an 8-character, 14-segment LCD to display calculation results</li> </ul>	MSP430FR4133 HDC1010 TPS63060 TPS715
	<b>Single-Chip, portable carbon monoxide (CO) monitor reference design with MSP430 MCUs</b> Reference Design – TIDM-1CHP-DTECT-CO	<ul style="list-style-type: none"> <li>Demonstrates three different approaches towards constructing a CO potentiostat circuit</li> <li>Low power design with LCD readout</li> </ul>	MSP430FG6626

# Embedded Processing Solutions




## MSP430 Capacitive Touch MCUs featuring CapTivate™ technology

Part No.	Non-volatile Memory (KB)	SRAM (KB)	# of Self Capacitance Buttons	# of Mutual Capacitance Buttons	Key Features	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$ 1ku)
MSP430FR2532/2632	8.5	1 / 2	8	8 / 16	Ultra-low-power, Noise Immunity, Moisture rejection, Flexible Configuration	-40 to 85	QFN	0.96 / 1.44
MSP430FR2533/2633	15.5	2 / 4	16	16 / 64	Ultra-low-power, Noise Immunity, Moisture rejection, Flexible Configuration	-40 to 85	QFN, TSSOP	1.89 / 2.16

## Digital Signal Processor (DSP) for Speech Recognition

Part No.	DSP MHz (Max.)	Other Hardware Acceleration	USB	SPI	I2C	UART (SCI)	Operating Temp. (°C)	Operating Systems	Approx. Price (US\$ 1ku)
TMS320C5535	50 100	FFT Coprocessor	1	1	1	1	-10 to 70 -40 to 85	DSP/BIOS VLX	2.79
TMS320C5545	60 100	FFT Coprocessor	1	1	1	1	-10 to 70	DSP/BIOS VLX	3.45

### Find the Perfect MCU Reference Design to Get Started

	Description	Key Features	TI Devices
	<b>16-button inductive keypad reference design</b> Reference Design – TIDA-00509	<ul style="list-style-type: none"> <li>Contactless buttons with superior reliability over electrical/mechanical contact solutions</li> <li>Support simultaneous button presses</li> </ul>	LDC1314 LP2985-N MSP430F5528
	<b>Capacitive touch thermostat UI with MSP MCUs featuring CapTivate technology reference design</b> Reference Design – TIDM-CAPTIVATE-THERMOSTAT-UI	<ul style="list-style-type: none"> <li>Less than 50 uA average current in battery powered mode</li> <li>Conducted noise immunity at the commercial product level (IEC 61000-4-6 Class A @ 3 Vrms) in line powered mode</li> </ul>	MSP430FR2633
	<b>Touch on metal buttons with integrated haptic feedback</b> Reference Design – TIDA-00314	<ul style="list-style-type: none"> <li>Replaces mechanical buttons with inductive-sensing based touch on metal detection</li> <li>Customizable haptic feedback and waveforms provide high quality user experience</li> <li>Programmable button sensitivity (from light touch to hard press)</li> </ul>	LDC1614 DRV2667 DRV2605L MSP430F5528 TS5A12301

## FRAM Technology

Ferroelectric Random Access Memory (FRAM) is a memory technology that combines the best of Flash and SRAM. It is non-volatile like Flash, but offers fast and low power writes, write endurance of  $10^{15}$  cycles, code and data security that is less vulnerable to attackers than Flash/EEPROM, resistance to radiation and electromagnetic fields, and unmatched flexibility. This memory technology has been around for decades, but is now being integrated in MSP430 ultra-low-power microcontrollers (MCUs) to bring its unique advantages to real-world applications such as energy harvesting, data security, remote sensing or data logging, and many others.

All-in-one: FRAM MCU delivers max benefits				
Specifications	FRAM	SRAM	EEPROM	Flash
<b>Non-volatile</b> Retains data w/o power	Yes	No	Yes	Yes
<b>Write speed</b> (13 KB)	10ms	<10ms	2 secs	1 sec
<b>Average active Power</b> [µA/MHz] 16 bit word access by the CPU	100	<60	50,000+	230
<b>Write endurance</b>	$10^{15}$	Unlimited	100,000	10,000
<b>Soft Errors</b>	Below Measurable Limits	Yes	Yes	Yes
<b>Bit-wise programmable</b>	Yes	Yes	No	No
<b>Unified Memory</b> Flexible code and data partitioning	Yes	No	No	No

# Power Management

Texas Instruments offers complete power solutions with a full line of high-performance products. These products, which range from standard linear regulators to highly efficient DC/DC converters and battery management, are tailored to meet your design challenges.

Learn more about Power Management solutions at: [www.ti.com/power](http://www.ti.com/power) and [www.ti.com/powerlab](http://www.ti.com/powerlab)

## DC/DC Switching Regulators Vin<24V

Part No.	Topology	Supply Range (V)	Output Voltage (V)	Output Current (Max) (A)	Switching Frequency (Max) (kHz)	Duty Cycle (Max) (%)	Iq (Typ) (mA)	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$   1ku)
<b>Vin &lt; 24V</b>										
TPS82740A	Buck Module	2.2 to 5.5	1.8 to 2.5	0.2	2000	100	0.00036	-40 to 85	9uSIP	1.50
LMZ21700/1	Buck Module	3 to 17	0.9 to 6	0.65 / 1	2500	–	–	-40 to 125	8uSIP	1.55 / 1.75
LMZ10500/1	Buck Module	2.7 to 5.5	0.6 to 3.6	0.65 / 1	2250	–	–	-40 to 125	8uSIP	1.30 / 1.55
TPS82084	Buck Module	2.5 to 6	0.8 to 6	2	2400	100	0.017	-40 to 125	8uSIP	1.65
TPS62730	Buck	1.9 to 3.9	1.9, 2.1, 2.3	0.1	3000	100	0.025	-40 to 85	6SON	0.55
TPS62097	Buck	2.5 to 6	0.8 to 6	2	Adjustable	100	0.04	-40 to 125	11QFN	0.81
TPS62160	Buck	3 to 17	0.9 to 6	1	2500	100	0.017	-40 to 85	8VSSOP, 8WSON	0.80
TPS62745	Buck	3.3 to 10	1.3 to 3.3	0.3	2500	100	0.0004	-40 to 125	12WSON	1.04
TPS61021	Boost	0.5 to 4.4	1.8 to 4.4	1.5	2000	90	0.017	-40 to 125	8WSON	0.60
TPS61291	Boost	0.9 to 5.0	2.5, 3.0, 3.3	0.2	–	–	0.005	-40 to 85	6SON	0.68
TPS61098	Boost	0.7 to 4.5	2.2 to 4.3	0.1	–	–	0.0003	-40 to 85	6WSON	0.72
TPS61220	Boost	0.7 to 5.5	1.8 to 5.5	0.1	2000	90	0.005	-40 to 85	6SC70	0.43

## Linear Regulators

Part No.	Supply Range (V)	Output Voltage (V)	Output Current (Max) (A)	Iq (Typ) (mA)	Output Options	Accuracy (Max) (%)	PSRR @ 100kHz (dB)	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$   1ku)
<b>Vin &lt; 24V</b>										
TLV733P	1.4 to 5.5	1 to 3.3	0.3	0.034	Fixed	1.4	28	-40 to 125	5SOT-23, 4X2SON	0.17
TLV1117	2.7 to 15	1.25 to 13.7	0.8	0.08	Adjustable Fixed	1.6	28	-40 to 125	3TO, 4SOT, 8SON	0.18
LM1117	2.6 to 15	1.25 to 13.8	0.8	5	Adjustable Fixed	1.6	47	-40 to 125	3TO, 4SOT, 8SON	0.38
TPS706	2.7 to 6.5	1.2 to 3.3	0.15	0.001	Fixed	2	–	-40 to 125	5SOT-23, 6SON	0.23
TPS7A37	2.2 to 5.5	1.2 to 5.3	1	0.4	Adjustable Fixed	1	32	-40 to 125	6SON	0.56
LP5907	2.2 to 5.5	1.2 to 4.5	0.25	0.012	Fixed	2	60	-40 to 125	4DSBGA, 4X2SON, 5SOT-2	0.14
<b>Wide Vin (Vin ≥ 24V)</b>										
TPS709	2.7 to 30	1.2 to 6	0.15	0.001	Fixed	2	26	-40 to 125	5SOT-23, 6SON	0.39
TPS715	2.5 to 24	1.2 to 15	0.05	0.003	Fixed Adjustable	4	60	-40 to 125	5SC70	0.30
TPS7A4101	7 to 50	1.2 to 48	0.05	0.02	Adjustable	2.5	38	-40 to 125	8MSOP	0.35
LM2936	5.5 to 60	3 to 5	0.05	0.015	Fixed	3	35	-40 to 125	3TO-92, 4SOT-223, 8SOIC, 8VSSOP, 3TO-252	0.62

## Voltage Reference

Part No.	Supply Range (V)	Output Voltage (V)	Iout/Iz (Max) (mA)	Iq (Typ) (µA)	Initial Accuracy (%)	0.1-10Hz Noise (µVpp)	Temp. Coeff (Typ) (ppm/°C)	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$   1ku)
REF3325	2.7 to 5.5	2.5	5	3.9	0.15	70	9	-40 to 125	3SC70, 3SOT-23, 8UQFN	0.85
REF3012	1.8 to 5.5	1.25	25	42	0.2	14	35	-40 to 125	3SOT-23	0.60
REF2025	2.52 to 5.5	1.25 and 2.50	20	360	0.05	12	3	-40 to 125	5SOT-23	1.40
ATL431	2.5 to 36	2.5 to 36	100	20	0.5 / 1	–	–	-40 to 125 / -40 to 85	3SOT-23	0.19

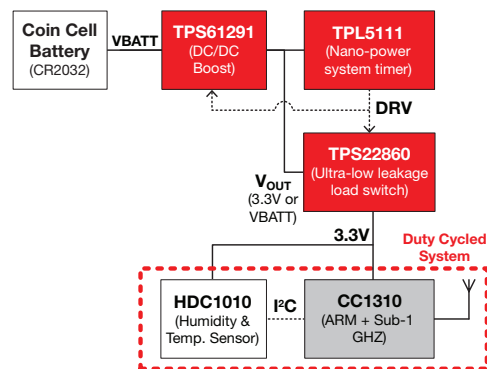
## Ultra-Low Power Harvesting Charger

Part No.	Description	Benefits	TI Designs
BQ25570	Power management IC which efficiently extracts microwatts (uW) to milliwatts (mW) of power generated from high output impedance DC Sources like photo voltaic (solar) or thermal electric generators (TEG).	Integrates nanopower buck converter and high efficient boost charger	TIDA-00242
BQ25505		A high efficiency nano-boost charger that charges a rechargeable energy reservoir, and also provides battery back-up though a nonrechargeable battery to extend run-time.	TIDA-00100 TIDA-00488

# Power Management

## Duty-Cycled Power Design Theory for Star Networks

One method to achieve extremely long battery life is through the use of a nano-power system timer. This type of device is intended to replace the internal timer of any standard microcontroller with a discrete analog system timer that consumes much less power than the MCUs internal timer. The nano-power timer can also bring an MCU out of sleep mode by means of a pin interrupt, or to completely shut off power to the system, in whole, or in part. This reduces the system off-state current draw to the tens or hundreds of nanoamps.



TIDA-00484 Block Diagram which Demonstrates a Duty-Cycled Sensor Node

## System Timer

Part No.	Supply Current (Typ) (µA)	Supply Range	Prog. Delay Range	Manual Reset	Additional Notes	Programmable Timer Interval (s)	Timekeeping Accuracy (Typ) (%)	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$   1ku)
<b>TPL5100</b>	0.030	1.8 to 5	Yes	No	MOS-Driver	0.1 to 7200	1	-40 to 105	6SOT	0.40
<b>TPL5110</b>	0.035	1.8 to 5	Yes	Yes	MOS-Driver	0.1 to 7200	1	-40 to 105	6SOT	0.40
<b>TPL5111</b>	0.035	1.8 to 5	Yes	Yes	Active Low MOS-Driver, Active High LDO Enable	0.1 to 7200	1	-40 to 105	6SOT	-





\*Quantities of 1,000 begin at this suggested resale price in U.S. dollars.

New products are listed in bold red.

## Load Switches

Part No.	Vin (Max) (V)	I <sub>max</sub> (A)	R <sub>on</sub> @ 3.6V (Typ) (mΩ)	Leakage Current (µA) (Typ)	Channels	Special Features	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$   1ku)
<b>Single Channel Devices</b>									
<b>TPS22860</b>	1.65 to 5.5	0.1	1300	0.02	1	-	-40 to 85	6SC70, 6SOT-23	0.25
<b>TPS22907</b>	1.1 to 3.6	1	44	0.5	1	-	-40 to 85	4CSP (0.5 pitch)	0.22
<b>TPS22918</b>	1.05 to 5.5	2	46	2	1	-	-40 to 85	6SOT-23	-
<b>TPS22954</b>	0.7 to 5.5	5	14	5	1	Voltage Monitor (PG Pin)	-40 to 105	10SON	0.36
<b>Multi-channel Devices</b>									
<b>TPS22960</b>	1.62 to 5.5	0.5/ch	435	0.47	2	-	-40 to 85	8SOT-23, 8µQFN	0.36

## Find the Perfect Power Management Reference Design to Get Started

	Description	Key Features	TI Devices
	<b>Smart Lock Reference Design Enabling 5+ Years of Life on 4x AA Batteries</b> Reference Design – TIDA-00757	<ul style="list-style-type: none"> <li>Over 5 years battery life using 4x AA batteries in series</li> <li>BLE tested using third party BLE iOS application</li> <li>6 RGB LEDs display event notifications</li> </ul>	TPS62745 DRV8833 CC2640 LP55231 CSD25310Q2
	<b>Humidity &amp; Temp Sensor Node for Sub 1-GHz Star Networks Enabling 10+ Year Coin Cell Battery Life</b> Reference Design – TIDA-00484	<ul style="list-style-type: none"> <li>Use of nano-power system timer results in 10+ years of battery life on a coin cell battery</li> <li>±2% relative humidity accuracy, ±0.2°C temperature accuracy</li> </ul>	HDC1010 TPL5111 TPS22860 TPS61291 CC1310
	<b>Energy buffering for long-life battery applications</b> Reference Design – PMP9753	<ul style="list-style-type: none"> <li>Efficient super capacitor charging</li> <li>Peak power assistance</li> <li>Long battery runtime</li> </ul>	CSD23381F4 TPS62740
	<b>110-VAC to 5-VDC @ 30-mA non-isolated power supply reference design</b> Reference Design – TIDA-00379	<ul style="list-style-type: none"> <li>Solution does not require a custom transformer</li> <li>Optimized, low-cost BOM</li> <li>Output ripple of less than 10-mV</li> </ul>	UCC28880 LP2985-50

# Haptic

Texas Instruments offers a complete line of haptic devices which have the ability to drive eccentric rotating mass (ERM), linear resonant actuator (LRA), and piezoelectric actuators. With TI's haptic drivers you can add that extra sensory element that is missing in modern day touch interfaces. Learn more about Haptic Feedback solutions at: [www.ti.com/haptics](http://www.ti.com/haptics)

## Piezo Driver

Part No.	Maximum Differential Output Voltage (Vpp)	Maximum Single-Ended Output Voltage (Vp)	Supply Voltage (V)	Small-signal Bandwidth (kHz)	Gain-Bandwidth (kHz)	Load Capacitance (μF)	Slew Rate (V/μs)	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$ 11ku)
DRV2700	±100	1000	3 to 5.5	20	550	4.7	0.6	-40 to 85	QFN	4.95

## Haptic Driver

Part No.	Haptic Actuator Type	Input Signal	Supply Voltage (V)	Startup Time (ms)	Vout (Max) (V)	Iq (Typ) (mA)	Shutdown Current (Typ) (μA)	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$ 11ku)
DRV2605L	ERM, LRA	PWM, Analog, I <sup>2</sup> C	2 to 5.2	0.7	5.5	0.5	4	-40 to 85	10VSSOP, 9DSBGA	1.65
DRV2667	Piezo	PWM, Analog, I <sup>2</sup> C	3 to 5.5	2	200	0.13	-	-40 to 85	20QFN	2.95
<b>DRV2625</b>	ERM/LRA	PWM, Analog, I <sup>2</sup> C	2.7 to 5.5	1	11	3.5	0.01	-40 to 85	9DSBGA	2.13

*New products are listed in bold red.*



## Audio Amplifiers

Part No.	Speaker Amp Type	Speaker Channels	Output Power (W)	Supply Min (Volt)	Supply Max (Volt)	PSRR (dB)	Input Type	Rating	Operating Temp. (°C)	Approx. Price (US\$ 11ku)
TPA2008D2	Class-D	Stereo	3	4.5	5.5	70	Analog Input	Catalog	-40 to 85	1.89
TAS2555	Class-D Boosted	Mono	5.7	2.95	5.5	110	Digital Input	Catalog	-40 to 85	2.50
TPA6211A1	Class-AB	Mono	3.1	2.5	5.5	85	Analog Input	Catalog	-40 to 85	0.42
TPA2013D1	Class-D Boosted	Mono	2.7	1.8	5.5	95	Analog Input	Catalog	-40 to 85	0.80

## Audio Codec

Part No.	DACs (#)	# Inputs / # Outputs	Resolution (Bits)	Digital Audio Interface	# of Digital Audio Interfaces	Additional Features	Pin / Package	Rating	Operating Temp. (°C)	Approx. Price (US\$ 11ku)
TLV320AIC3204	2	6 / 4	32	L, R, I <sup>2</sup> S, TDM, DSP	1	PowerTune™, Processing blocks for digital audio effects, LP Bypass, PLL, Digital Mic Support, LDO	32VQFN	Catalog	-40 to 85	2.05

## Find the Perfect Haptic Reference Design to Get Started

	Description	Key Features	TI Devices
	<b>Piezo speaker strobe notification reference design</b> Reference Design – TIDA-00376	<ul style="list-style-type: none"> <li>• 86.5 dBA @ 3m (520 Hz Square Wave)</li> <li>• 80.5 dBA @ 3m (2.84 kHz Sine Wave)</li> <li>• 77.5 dBA @ 3m (Pre-Recorded Speech)</li> <li>• 300 candela @ 3m (Flash Mode)</li> </ul>	<b>TI Devices</b> DRV2700 LMV344 LM3550 MSP430FR5969
	<b>Speech recognition reference design on the C5535 eZdsp™</b> Reference Design – TIDEP0066	<ul style="list-style-type: none"> <li>• Efficient active power for always listening applications</li> <li>• Customizable trigger words</li> <li>• Enables addition of voice control to any application</li> </ul>	TMS320C5535 TLV320AIC3204

## ARM Based MCUs and MPUs

Part No.	ARM CPU	Benefits	TI Designs and Dev. Tools
MSP432P401R	ARM Cortex-M4F	MSP432P4x microcontrollers are the ideal combination of TI's MSP430 low-power DNA, advanced mixed-signal features, and the high-performance processing capabilities of ARM®'s 32-bit Cortex®-M4F RISC engine.	MSP-EXP432P401R
AM3352	ARM Cortex-A8	Sitara™ AM335x ARM Cortex-A8 Processors deliver the right balance of performance (300 MHz to 1 GHz of processing power), Interfaces (DDR3, LCD, Touch Screen Controller), and Connectivity (UART and Industrial Protocols)	BeaglebK, TMDXEVM3358

## Peripheral Drivers

Part No.	Type	Peak Output Current (mA)	Output Voltage (Max) (V)	Delay Time (Typ) (ns)	Input Compatibility	Drives per Package	Gate	Output Clamp Diodes	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$   1ku)
TPL7407L	NMOS Array	600	40	250	CMOS, TTL	7	INVERT	Yes	-40 to 125	16SOIC, 16TSSOP	0.20
ULN2003A	Darlington Transistor Array	500	50	250	CMOS, TTL	7	INVERT	Yes	-20 to 70	16SO, 16SOIC, 16TSSOP	0.14

## Ethernet

Part No.	Datarate (Mbps)	Interface	Cable Length (m)	WoL	Cable Diagnostics	ESD (kV)	FX Support	IEEE1588 Support	Package	Temp Range (°C)
DP83822I	10/100	MII, RMII, RGMII	200	✓	✓	16	-	Start of Frame Detect	QFN-32	-40 to 125
DP83822IF	10/100	MII, RMII, RGMII	200	✓	✓	16	✓	Start of Frame Detect	QFN-32	-40 to 85
DP83867CS	10/100/1000	SGMII, RGMII	130	✓	✓	8	-	Start of Frame Detect	QFN-48	0 to 70
DP83867CR	10/100/1000	RGMII	130	✓	✓	8	-	Start of Frame Detect	QFN-48	0 to 70
DP83867IRRGZ	10/100/1000	RGMII	130	✓	✓	8	-	Start of Frame Detect	QFN-48	-40 to 85

## RS-485

Part No.	TX/RX	Duplex	Supply Voltage (V)	Features	Signaling Rate (Mbps)	HBM ESD (kV)	Receiver Fail-Safe	Nodes	Pin / Package	Approx. Price (US\$   1ku)
SN65HVD72	1/1	Half	3.3	High Hysteresis, ±12kV IEC 61000-4-2 ESD, ±4kV EFT	0.25	15	Short, Open, Idle	256	8SOIC, 8SON, *VSSOP	0.70
SN65HVD82	1/1	Half	5	Low Power, ±12kV IEC 61000-4-2 ESD, ±4kV EFT	0.25	16	Short, Open, Idle	256	8SOIC	1.00
SN65HVD3082E/5E/8E	1/1	Half	5	Ultra-Low Power, Optimized for Low, Medium, & High Speeds	0.2, 1, 20	15	Short, Open, Idle	256	8SOIC, 8MSOP, 8PDIP	0.90, 1.00, 1.10

## Isolator

Part No.	Description	Isolation Voltage (Single) (Vrms)	Transient Overvoltage Rating (Vpk)	Surge Voltage Rating (Vpk)	Working Voltage (Vpk)	Forward/Reverse Channels	Default Output	Speed (Max) (Mbps)	VCC (Min) (V)	VCC (Max) (V)	Propagation Delay (Typ) (ns)	Number of Channels (#)	Operating Temp. (°C)	Package	Approx. Price (US\$   1ku)
ISO7310C	Robust EMC, Low Power, Single-Channel 1/0 Digital Isolator, Fail-Safe High	3000	4242	6000	566	1/0	High	25	3.3	5	31	1	-40 to 125	8SOIC	0.90
ISO7321C	Robust EMC, Low Power, Dual-Channel 1/1 Digital Isolator, Fail-safe High	3000	4242	6000	566	1/1	High	25	3.3	5	31	2	-40 to 125	8SOIC	1.05

\*Quantities of 1,000 begin at this suggested resale price in U.S. dollars.

# Gateway

## Isolated RS-485

Part No.	Description	Isolation Voltage (Single) (Vrms)	Transient Overvoltage Rating (Vpk)	Surge Voltage Rating (Vpk)	Working Voltage (Vpk)	Integrated Transformer Driver	Duplex	VCC1 (Min) (V)	VCC1 (Max) (V)	VCC2 (Min) (V)	VCC2 (Max) (V)	Datarate (Mbps)	Number of Nodes	ESD (kV)	Fail Safe	Operating Temp. (°C)	Package	Approx. Price (US\$   1ku)
ISO3080	Isolated 5-V Full-Duplex RS-485 Transceivers	2500	4000	4000	560	No	Full	3.15	5.5	4.5	5.5	0.2	256	16	Idle, Open, Short	-40 to 85	16SOIC	2.60
ISO3082	Isolated 5-V Half-Duplex RS-485 Transceivers	2500	4000	4000	560	No	Half	3.15	5.5	4.5	5.5	0.2	256	16	Idle, Open, Short	-40 to 85	16SOIC	2.60

## Transformer Drivers for Isolated Power

Part No.	Description	Vin (Min) (V)	Vin (Max) (V)	Vout (Min) (V)	Vout (Max) (V)	Iout (A)	Soft Start	Switching Frequency (Min) (kHz)	Switching Frequency (Max) (kHz)	Operating Temp. (°C)	Package	Approx. Price (US\$   1ku)
SN6505A	Low-Noise 1-A Transformer Driver for Isolated Power Supplies, Internal Clock-160kHz	2.25	5.5	0	16	1	Fixed	100	600	-55 to 125	SOT-23	1.95
SN6501	Transformer Driver for Isolated Power Supplies	3	5.5	0	11	0.25	None	410	620	-40 to 125	SOT-23	0.80

## DC/DC Switching Regulators Vin ≥ 24V

Part No.	Topology	Supply Range (V)	Output Voltage (V)	Output Current (Max) (A)	Switching Frequency (Max) (kHz)	Duty Cycle (Max) (%)	Iq (Typ) (mA)	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$   1ku)
Wide Vin (Vin ≥ 24V)										
MC33063A	Buck/Boost	3 to 40	1.25 to 40	1.5	100	80	4	-40 to 85	8PDIP, 8SOIC, 8SON	0.18
LM5160	Buck	4.5 to 65	2 to 60	1.5	1000	92	2.3	-40 to 125	12WSON	1.80
LM5165	Buck	3 to 65	1.23 to 65	0.15	600	100	0.01	-40 to 150	10VSON	1.35
LM46000/1/2	Buck	3.5 to 60	1 to 28	0.5 / 1 / 2	2200	99	0.024	-40 to 125	16HTSSOP	1.65 / 1.75 / 1.85
LMR16010/20/30	Buck	4.3 to 60	1 to 50	1 / 2 / 3	2500	98	0.04	-40 to 125	8SO PowerPAD	1.50 / 1.82 / 1.95
TPS62175	Buck	4.7 to 28	1 to 6	0.5	1000	100	0.0048	-40 to 85	10WSON	0.70
TPS54160A	Buck	3.5 to 60	0.8 to 58	1.5	2500	98	0.138	-40 to 125	10MSOP/10SON	1.58

## PMIC

Part No.	Topology	Supply Range (V)	Output Voltage (V)	Output Current (Max) (A)	Switching Frequency (Max) (kHz)	Duty Cycle (Max) (%)	Iq (Typ) (mA)	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$   1ku)
TPS65720/ TPS65721	1xBuck + 1xLDO + 300mA Charger	2.3 to 5.6	0.6 to 5.6	0.4	2250	100	0.035	-40 to 85	25WCSP, 32QFN	0.89
TPS65000/ TPS65001	1xBuck + 2xLDOs	2.3 to 6.0	0.6 to 6.0	0.6	2250	100	0.023	-40 to 85	16QFN	1.40

## Voltage Monitor, Supervisors

Part No.	Supply Range (V)	Supply Current (Typ) (µA)	Threshold Voltages (V)	Operating Temp. (°C)	Pin / Package	Approx. Price (US\$   1ku)
LMS33460	1 to 7	1	3	-40 to 85	SC-70	0.17
LM8364/65	1 to 6	0.65	2.0, 2.7, 4.5	-40 to 85	SOT23-5	0.24 / 0.25
TPS3831/39	0.9 to 6.5	0.15	0.9 to 4.38	-40 to 85	X2SON, 3SOT-23	0.30 / 0.21
TPS3808	1.7 to 6	2.4	0.4 to 4.65	-40 to 125	SON-6 SOT23-6	0.68
TPS3890	1.5 to 5.5	2.1	1.15 to 3.17	-40 to 125	SON-6	0.55

\*Quantities of 1,000 begin at this suggested resale price in U.S. dollars.

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## Current Sensing

Part No.	Output Type	Common-mode Voltage Range (V)	Input Offset (Max) (+/- $\mu$ V)	Input Offset Drift (Typ) ( $\pm\mu$ V/ $^{\circ}$ C)	Gain Error % (Typ)	Gain Error % (Typ)	Operating Temp. ( $^{\circ}$ C)	Pin / Package	Approx. Price (US\$   1ku)
INA199	Analog Voltage Output	-0.3 to 26	150	0.1	50, 100, 200	0.03	-40 to 125	10UQFN, 6SC70	0.30
INA216	Analog Voltage Output	1.8 to 5.5	100	0.06	25, 50, 100, 200	0.01	-40 to 125	10UQFN, 4DSBGA	0.35

## eFuses

Part No.	Supply Range (V)	Vabsmax cont (V)	Current Limit Threshold (A)	Current Limit Accuracy	Internal FET RON (mOhm)	Fault Response	On Off Control Input(s)	Special Features	Pin / Package	Approx. Price (US\$   1ku)
TPS25921A	4.5 to 18	20	0.4 to 1.6	$\pm 2\%$ @ 1A	90	Auto Retry	ENUV, OV	No Rsense Required	8SOIC	0.50
TPS25926	4.5 to 13.8	20	2 to 5	$\pm 8\%$ @ 3.7A	30	Auto Retry	ENUV	BLK FET Driver, Output Clamp, No Rsense Required	10VSON	0.55
TPS25927	4.5 to 18	20	1 to 5	$\pm 15\%$ @ 2.1A	30	Auto Retry	ENUV	BLK FET Driver, No Rsense Required	10VSON	0.55

## Integrated ESD Protection

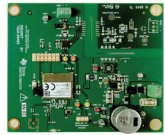


Part No.	Interface	Channels	IO Capacitance (Typ) (pF)	Breakdown Voltage (Min) (V)	IEC 61000-4-2 Contact (+/- kV)	IEC 61000-4-2 Air-Gap (+/- kV)	Special Features	Current Limit Rating (Min) (mA)	Operating Temperature Range( $^{\circ}$ C)	Pin / Package	Approx. Price (US\$   1ku)
TPD4F003	LCD Display, Memory / SIM Card	4	17	6	12	20	EMI Filter	-	-40 to 85	WSON	0.18

## High Performance TVS Diodes

Part No.	Interface	Channels	IO Capacitance (Typ) (pF)	Breakdown Voltage (Min) (V)	IEC 61000-4-2 Contact (+/- kV)	IEC 61000-4-2 Air-Gap (+/- kV)	Bi-/ Uni-Directional	Operating Temp. ( $^{\circ}$ C)	Pin / Package	Approx. Price (US\$   1ku)
TPD1E04U04	HDMI 1.4/1.3, HDMI 2.0, USB 2.0, USB 3.0, USB Type-C	1	0.5	5	16	16	Uni-Directional	-40 to 125	X1SON	0.07
TPD4E05U06	Ethernet, HDMI 1.4/1.3, HDMI 2.0, LVDS, SATA/PCIe, USB 3.0, USB Type-C	4	0.5	6.5	12	15	Uni-Directional	-40 to 125	USON	0.19
TPD2E2U06	General Purpose, LVDS, USB 2.0	2	1.5	6.5	25	30	Uni-Directional	-40 to 125	SOT	0.14

\*Quantities of 1,000 begin at this suggested resale price in U.S. dollars.

## Find the Perfect Gateway Reference Design to Get Started

Description	Key Features	TI Devices
 <p><b>Non-isolated RS-485 to Wi-Fi bridge with 24 VAC power</b> Reference Design – TIDA-00485</p>	<ul style="list-style-type: none"> <li>• Add Wi-Fi® Connectivity to an existing wired network</li> <li>• Wide input voltage range of 18- to 30-VAC, 12- to 48-VDC</li> <li>• Galvanically isolated or non-isolated variations</li> </ul>	CC3200MOD TPD1E10B06 LM5160 SN65HVD72 TLV713P ISO15
 <p><b>Isolated RS-485 to Wi-Fi bridge with 24 VAC power</b> Reference Design – TIDA-00486</p>		CC3200MOD TPD1E10B06 LM5160 SN65HVD72 TLV713P ISO15 SN65HVD72
 <p><b>UART to Wi-Fi bridge with 24 VAC power</b> Reference Design – TIDA-00375</p>		CC3200MOD TPD1E10B06 SN74LV1T34 LMR16006



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