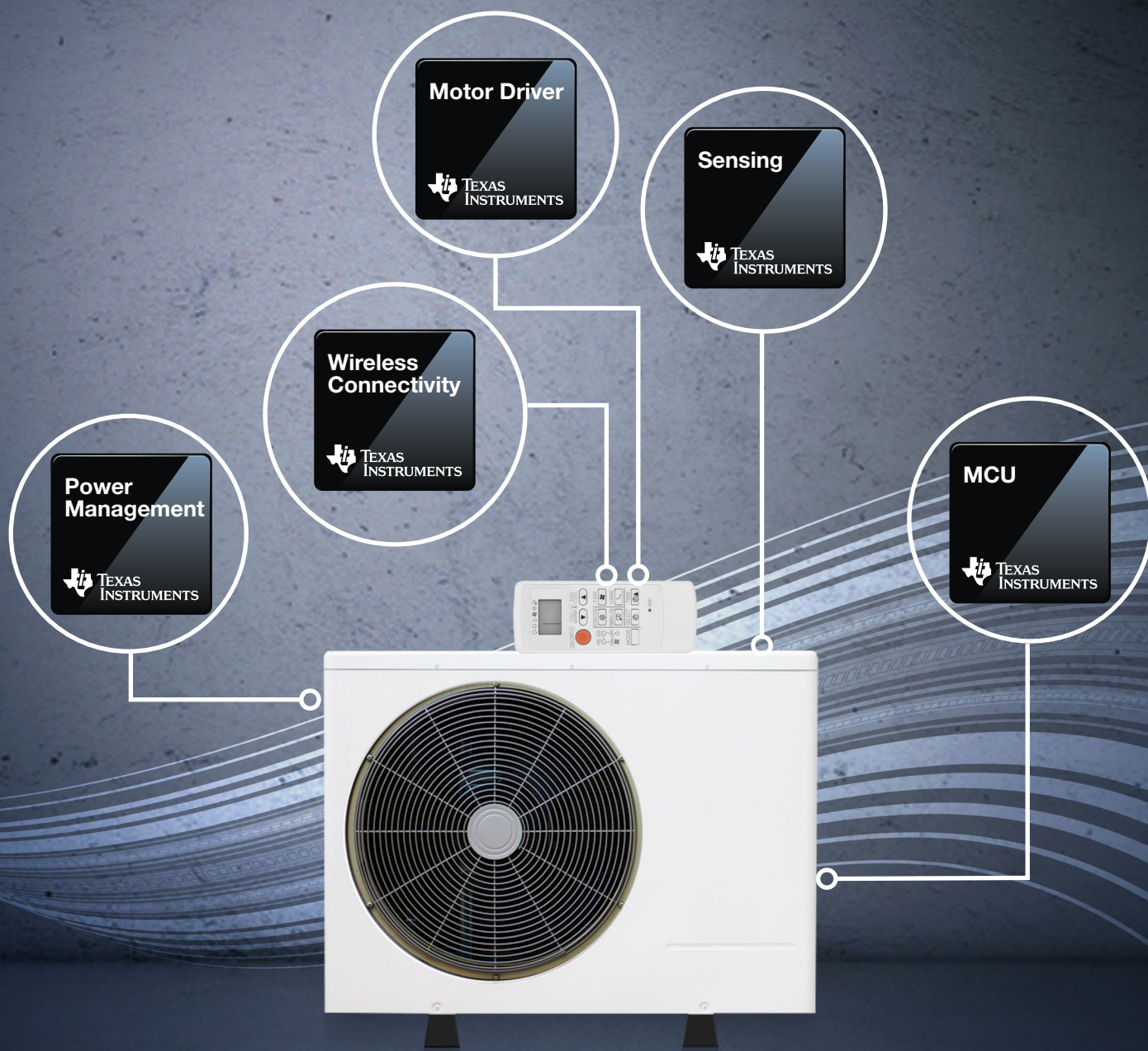


Air Conditioner Solutions Guide



TI's diverse expertise helps designers deliver the next generation of appliances while conserving power, increasing intelligence and cutting costs.



Air conditioner solutions

Design considerations

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Energy efficiency

Motors in air conditioners (compressors and fans) are often driven asynchronously with fixed-operating-speed direct supply. This can result in inefficient systems and noisy operation. This, in turn, lead to mediocre energy efficiency that hovers in the 40 to 50 percent range. By implementing the control system with TI's digital signal controllers, designers can implement smaller, quieter compressors and fans by adopting variable-frequency driving technology with energy efficiency as high as 85 to 90 percent.

Power factor correction (PFC)

PFC is a technique for counteracting the undesirable effects of electric loads that create a power factor less than one. In air conditioners, PFC is necessary because of the continuous transients and surge currents exhibited by the electric motor during the operation cycle.

With TI products, PFC can occur externally within a separate integrated circuit or in software on a microcontroller, eliminating the need for a separate external PFC controller.

Power management

TI offers AC/DC converters, DC/DC converters and linear regulators that convert power from the line power to various DC power supplies required by indoor and outdoor units as well as remote controllers and such as 15 V, 12 V, 5 V, 3.3 V or 1.8 V typically.

High-voltage isolation

For larger, higher-performance products where reliability and motor-control accuracy are key concerns, TI offers isolation products that block high voltage, isolate grounds, and prevent noise currents from entering the local ground.

Smart air conditioners

A home mesh network may consists of smart sensors connected wirelessly, reporting to a concentrator. TI provides customers with ZigBee-compliant solutions, proprietary radio-frequency (RF) integrated circuits (ICs), up-to-date *Bluetooth*[®] solutions, Wi-Fi and near-field communication (NFC). TI has proven software and hardware solutions supporting each of these communication interfaces.

Touch control

The use of touch control has moved beyond the high-end market to a wide range of applications, such as the control panel of the cabinet indoor unit and the remote controller. Touch controls typically take the form of a button or a slider. Haptic feedback can provide touch interfaces with the tactile response that users are accustomed to from mechanical controls. TI provides a wide range of touch solutions with reliable and excellent RF noise immunity.

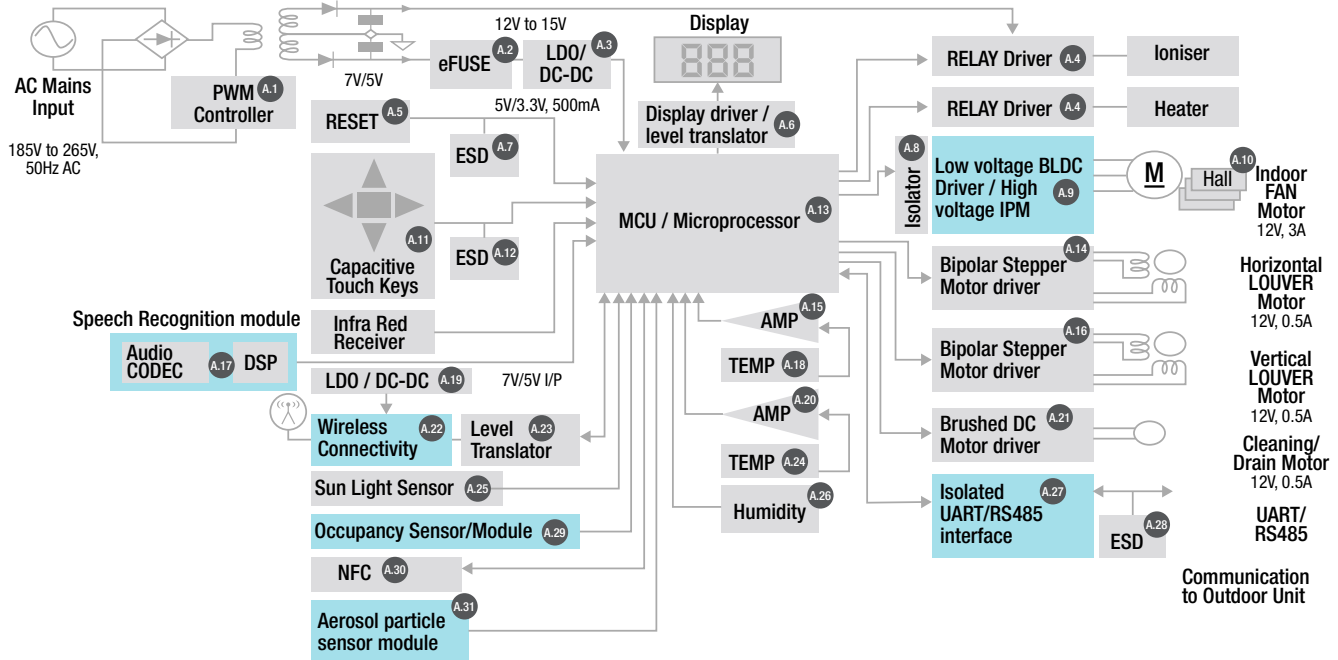
Advanced sensing

TI provides IC products and solutions that cover accurate temperature sensing, humidity sensing, proximity detection using capacitive sensing, inductive sensing-based touch on metal and ultrasonic sensing for various purposes.

Air conditioner solutions

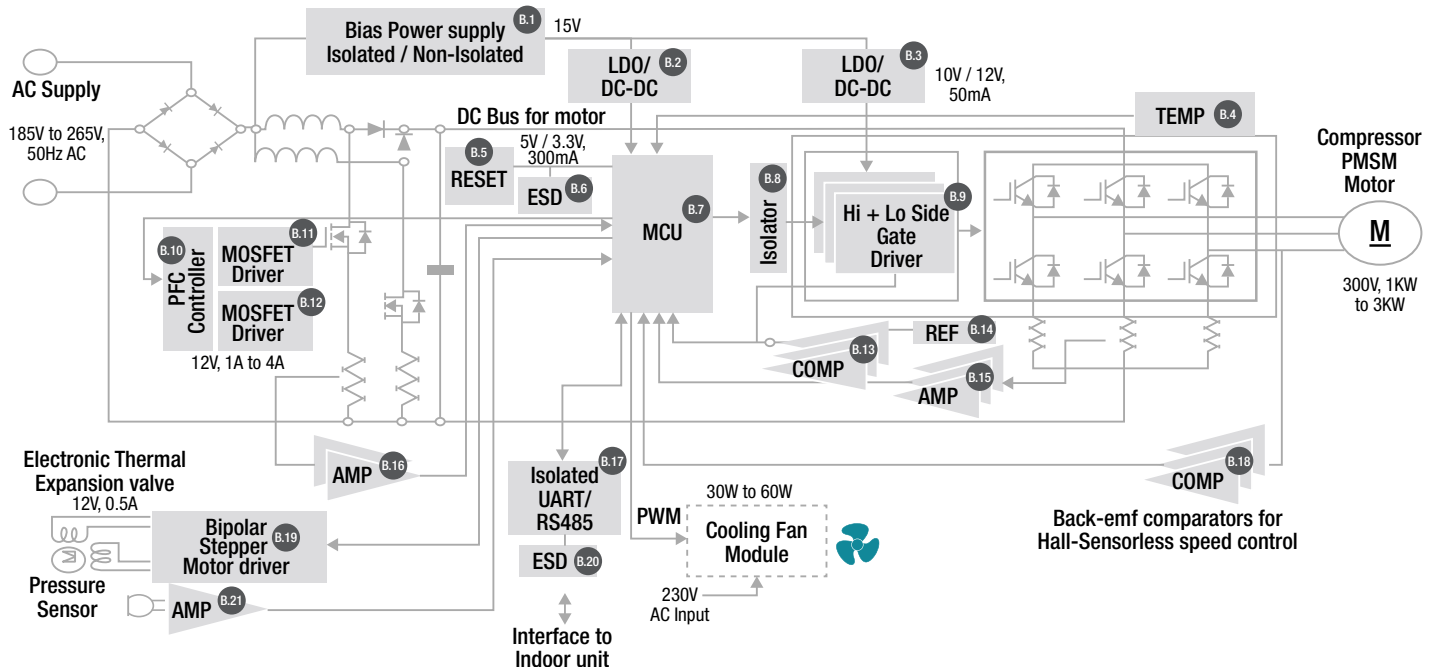
System block diagrams

Air conditioner indoor unit controller



■ Represents a module or multiple parts / options.

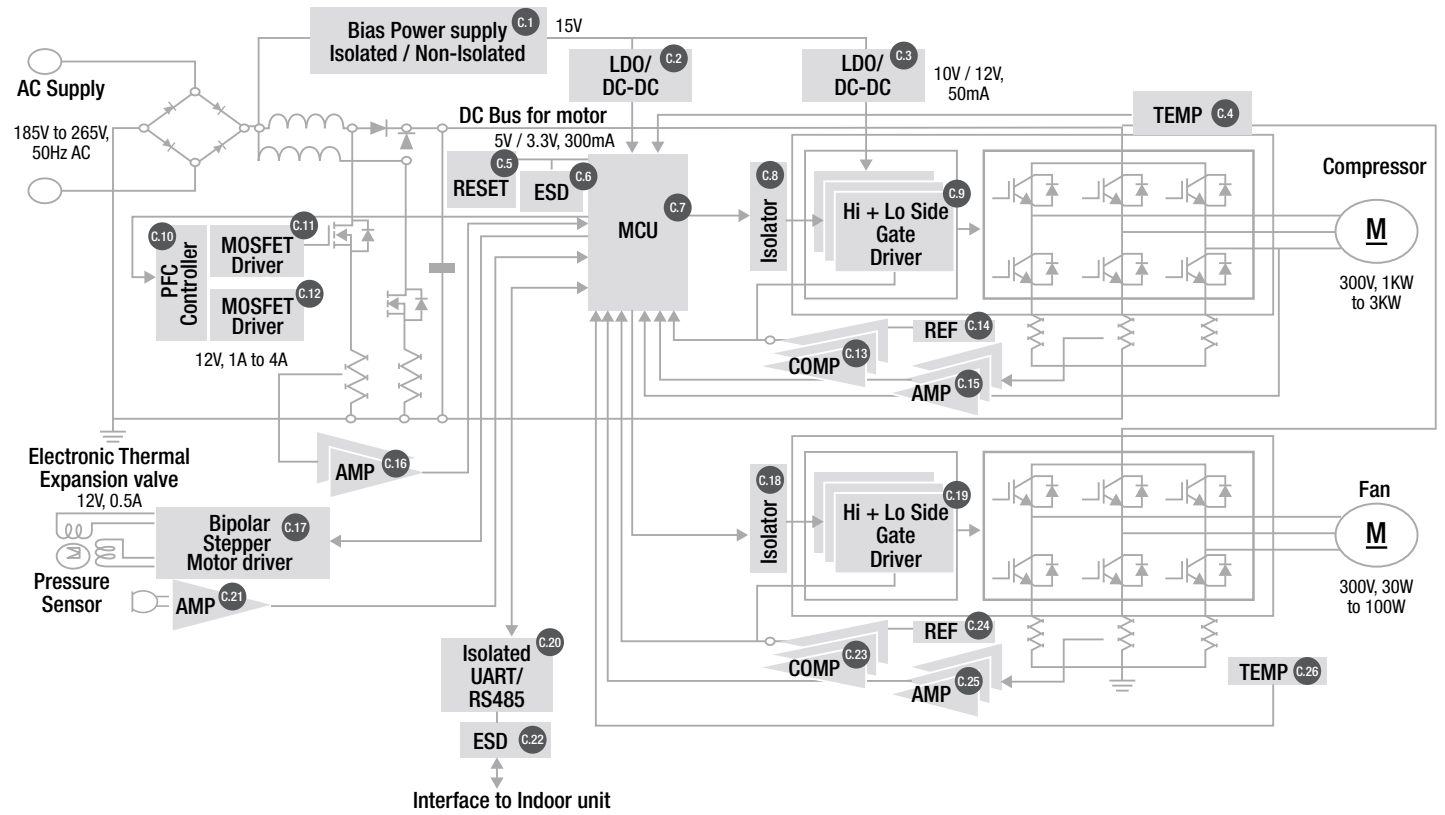
Air conditioner outdoor unit - compressor drive with PFC



Air conditioner solutions

System block diagrams

Air conditioner outdoor unit - compressor and fan drives with PFC



Components selection

Operational amplifiers / current shunt monitor

Operational amplifiers

Item	Part Number	# of Channels	Supply Voltage (Min) (V)	Supply Voltage (Max) (V)	GBW (Typ) (MHz)	Slew Rate (Typ) (V/μs)	CMRR (Min) (dB)	Vn at 1 kHz (Typ) (nV/rtHz)	Vio (25°C) (Max) (mV)	IIB (Max) (pA)	Iq per Channel (Max) (mA)	Price* (US\$)
A.15, A.20, B.15, B.16, C.15, C.16, C.25	LM324	4	3	32	1.2	0.5	80	35	7	250000	0.175	0.07
A.15, A.20, B.15, B.16, C.15, C.16, C.25	LM2904	2	3	26	0.7	0.3	80	40	2	250000	0.35	0.07
A.15, A.20, B.13, B.15, B.16, B.21, C.13, C.15, C.16, C.21, C.23, C.25	TLC2274A	4	4.4	16	2.2	3.6	75	9	0.95	60	1.1	0.8
A.15, A.20, B.13, B.15, B.16, B.21, C.13, C.15, C.16, C.21, C.23, C.25	TLV2772	2	2.5	6	5.1	10.5	96	17	2.5	60	1	1.18
B.13, B.15, B.21, C.13, C.15, C.16, C.21, C.23, C.25	LM6142	2	1.8	24	17	25	107	16	1	280000	0.65	1.58
B.13, B.15, B.21, C.13, C.15, C.16, C.21, C.23, C.25	LM6144	4	1.8	24	17	25	107	16	1	280000	0.65	2.93
A.15, A.20	OPA316	1	1.8	5.5	10.0	6.0	76	11	2.5	15	0.5	0.48
A.15, A.20	OPA314	1	1.8	5.5	3.0	1.5	75		3	10	0.2	0.30
B.15, B.16	OPA847	1	10	12	3900	950	110	0.85	0.5	39000	18.9	2.27
B.15	OPA835	1	2.5	5.5	56	160	113	9.3	0.5	400	0.25	0.85
B.15	OPA836	1	2.5	5.5	205	560	116	4.6	0.4	1000	1	0.90
C.15, C.16, C.25	OPA4374	4	2.3	5.5	6.5	5	90	15	5	10	0.585	1.06
C.15, C.16, C.25	OPA4314	4	1.8	5.5	3	1.5	80	14	2.5	10	0.15	0.65
C.15, C.16, C.25	OPA4322	4	1.8	5.5	20	10	100	8.5	2	10	1.4	1.25
C.15, C.16, C.25	OPA322	1	1.8	5.5	20	10	100	8.5	2	10	1.4	0.55
B.15	THS4531A	1 (Fully Differential)	2.5	5.5	27	220	116	10	0.4	250	0.25	1.10
B.15	THS4521	1 (Fully Differential)	2.5	5.5	95	490	102	4.6	2	900	1.1	\$1.21
B.21, C.13, C.15, C.16, C.21, C.23, C.25	OPA2348	1	2.2	5.5	1.0	0.5	70	35	5	10	0.7	0.35
B.21, C.13, C.15, C.16, C.21, C.23, C.25	LMV852	1	2.7	5.5	8.0	4.5	77	11	1	500	0.5	0.90
A.31, B.21	OPA2320	2	1.8	5.5	20	10	100	8.5	0.15	0.9	1.75	1.25

Current shunt monitor

Item	Part Number	Input Offset (+/-) (Max) (μV)	Input Offset Drift (+/-) (Typ) (μV/Degrees Celsius)	Iq (Max) (mA)	Gain (V/V)	Small-Signal Bandwidth (Typ) (MHz)	CMRR (Min) (dB)	Vs (Min) (V)	Vs (Max) (V)	Common Mode Range (Min)	Common Mode Range (Max)	Special Features	Package Group	Price* (US\$)
B.15, B.16, C.15, C.16, C.25	INA216	100	0.1	0.0	25/50/100/200	0.0	90	2	5.5	2	5.5	Analog Output	DSBGA UQFN	0.35
A.31	INA133	450	5.0	1.0	1.0	1500.0	80	5	36.0	-27	27.0	-	8SOIC	1.15
B.15, B.16, C.15, C.16, C.25	INA210	35	0.1	0.1	200.0	0.0	105	3	26.0	-0.3	26.0	Bi-directional Low-side Capable Analog Output	SC70 UQFN	0.75
B.15, B.16, C.15, C.16, C.25	INA211	35	0.1	0.1	500.0	0.0	105	3	26	-0.3	26.0	Bi-directional Low-side Capable Analog Output	SC70	0.75
B.15, B.16, C.15, C.16, C.25	INA212	35	0.1	0.1	1000.0	0.0	105	3	26.0	-0.3	26.0	Bi-directional Low-side Capable Analog Output	SC70	0.75
B.15, B.16, C.15, C.16, C.25	INA213	100	0.1	0.1	50.0	0.1	100	3	26	-0.3	26.0	Bi-directional Low-side Capable Analog Output	SC70 UQFN	0.75
B.15, B.16, C.15, C.16, C.25	INA214	60	0.1	0.1	100.0	0.0	105	3	26.0	-0.3	26.0	Bi-directional Low-side Capable Analog Output	SC70 UQFN	0.75
B.15, B.16, C.15, C.16, C.25	INA215	60	0.1	0.1	75.0	0.0	105	3	26	-0.3	26.0	Bi-directional Low-side Capable Analog Output	SC70	0.75
B.15, B.16, C.15, C.16, C.25	INA199	150	0.1	0.1	50/100/200	0.1	100	3	26	-0.3	26.0	Analog Output Bi-directional Low-side Capable	SC70 UQFN	0.50

Components selection

Comparator / isolated amplifier / isolated delta-sigma modulator / sensor

Comparator

Item	Part Number	# of Channels	Supply Voltage (Min) (V)	Supply Voltage (Max) (V)	tRESP Low - to - High (us)	Input Bias Current (+/-) (Max) (nA)	Rail-to-Rail	VICR (Max) (V)	VICR (Min) (V)	Vos (25°C) (Max) (mV)	Output Type	Iq per Channel (Max) (mA)	Price* (US\$)
B.13, C.13, C.23	LM2903	2	2	30	1.3	50	Out	28.5	0	7	Open Collector, Open Drain	0.5	0.07
B.13, C.13, C.23	LM393	2	2	36	0.3	50	Out	34.5	0	5	Open Collector, Open Drain	0.5	0.07
B.13, C.13, C.23	TLV3202	2	2.7	5.5	0.047	0.05	–	5.2	-0.2	5	Push-Pull	0.05	0.5
B.13, B.18, C.13, C.23	TLV1702	2	2.2	36.0	0.560	15	In	36	2.2	–	Open Collector	0.07500	0.61
B.13, C.13, C.23	TLV3491	1	1.8	5.5	6.000	0.01	In	5.7	-0.2	15	Push-pull	0.00120	0.35
B.13, B.18, C.13, C.23	TLV3691	1	0.9	6.5	24.000	0.1	In	6.6	-0.1	–	Push-pull	0.00015	0.40
B.13, C.13, C.23	LMV331	1	2.7	5.5	0.200	250	Out	4.2	0	7.0	Open Collector, Open Drain	0.12000	0.20

Isolated amplifier

Item	Part Number	Isolation Mode Rejection 60Hz (Typ) (dB) CMRR (Typ.) (dB)	Isolation Voltage Cont Peak (DC) (V)	Isolation Voltage Pulse/ Test Peak (V)	Small Signal Bandwidth (Typ) (kHz)	Working Voltage Peak (V)	Gain Non-Linearity (+/-) (Max) (%)	CMTI (Min) (kV/μs)	Operating Temperature Range °C	Gain Error % (Max)	Shunt Input Range (mV)	Price* (US\$)
B.15, B.16, C.15, C.16, C.25	AMC1100	108	4250	5100	100	1200	0.015	2.5	-40 to 105	1%	±250	2.0
B.15, B.16, C.15, C.16, C.25	AMC1200B	108	4250	5100	100	1200	0.015	10	-40 to 105	1%	±250	–
B.15, B.16, C.15, C.16, C.25	AMC1200	108	4000	4800	100	1200	0.015	10	-40 to 105	1%	±250	–
B.15, B.16, C.15, C.16, C.25	AMC1204	108	4250	5100	–	1200	–	15	-40 to 125	2%	±250	–

Isolated delta-sigma modulator

Item	Part Number	Resolution (Bits)	Sample Rate (max) (SPS)	# Input Channels	Input Range	Interface	Isolation (kV peak)	CMTI (Min) (kV/μs)	INL (Max) (+/- LSB)	SNR (dB)	THD (Max) (dB)	Power Consumption (Typ) (mW)	Architecture	Analog Voltage AV/DD (Min) (V)	Analog Voltage AV/DD (Max) (V)	Digital Supply (Min) (V)	Digital Supply (Max) (V)	Operating Temperature Range (°C)	Pin/ Package	Price* (US\$)
B.15, B.16, C.15, C.16, C.25	AMC1204	16	78KSPS	1	±250mV	Serial	4.25	15	9	84%	-80	88.0	Delta-Sigma	4.5	5.5	3	5.5	-40 to 125	8/16SOIC	3.45
B.15, B.16, C.15, C.16, C.25	AMC1304L05	16	20MSPS	1	±50mV	LVDS	7	15	4	77	-80	58	Delta-Sigma	4	18	3	5.5	-40 to 125	16SOIC	3.8
B.15, B.16, C.15, C.16, C.25	AMC1304L25	16	20MSPS	1	±250mV	LVDS	7	15	4	85	-80	58.9	Delta-Sigma	4	18	3	5.5	-40 to 125	16SOIC	3.8
B.15, B.16, C.15, C.16, C.25	AMC1304M05	16	20MSPS	1	±50mV	Serial CMOS	7	15	4	77	-80	58	Delta-Sigma	4	18	3	5.5	-40 to 125	16SOIC	3.8
B.15, B.16, C.15, C.16, C.25	AMC1304M25	16	20MSPS	1	±250mV	Serial CMOS	7	15	4	85	-80	58.9	Delta-Sigma	4	18	3	5.5	-40 to 125	16SOIC	3.8
B.15, B.16, C.15, C.16, C.25	AMC1305L25	16	20MSPS	1	±250mV	LVDS	7	15	4	85	-83	49.3	Delta-Sigma	4.5	5.5	3	5.5	-40 to 125	16SOIC	3.5
B.15, B.16, C.15, C.16, C.25	AMC1305M05	16	20MSPS	1	±50mV	Serial CMOS	7	15	4	76	-83	38.4	Delta-Sigma	4.5	5.5	3	5.5	-40 to 125	16SOIC	3.8
B.15, B.16, C.15, C.16, C.25	AMC1305M25	16	20MSPS	1	±250mV	Serial CMOS	7	15	4	85	-83	36.1	Delta-Sigma	4.5	5.5	3	5.5	-40 to 125	16SOIC	3.5

Sensor

Item	Part Number	Sensor type	Supply Voltage (Max)	Supply Voltage (Min)	Resolution (Bits)	Special Features	Interface	Operating Temperature Range (°C)	Feature	Price* (US\$)
A.26	HDC1080	Humidity Sensor	5.5	2.7	14	Reliable/Water resistant	I2C	Temp Sensor: -40 to 125 Humidity sensor: -20 to 70	Embedded temperature sensor 14 bit resolution 0.2degC accuracy	2.5
A.11, A.29	LDC 1314/1614	Inductive	3.6	2.7	28	EMI-resistant	I2C	-40 to 125	4ksps	3.5 /4.75
A.10, A.29	LDC0851	Inductive	3.3	1.8		Differential Inductive Switch	Push/Pull	-40 to 125	4ksps	0.5
A.29	FDC2214	Capacitive	3.6	2.7	28	-5.5mV/C	I2C	-40 to 125	4ksps	4.75
A.18, A.24, B.4, C.4, C.26	LMT84	Temp	5.5	1.5	N/A	-8.2mV/C	I2C	-50C to 150C	2.7C Accuracy over entire temp range	0.18
A.18, A.24, B.4, C.4, C.26	LMT85	Temp	5.5	1.8	N/A	-10.9mV/C	I2C	-50C to 150C	2.7C Accuracy over entire temp range	0.18
A.18, A.24, B.4, C.4, C.26	LMT86	Temp	5.5	2.2	N/A	-13.6mV/C	SPI	-50C to 150C	2.7C Accuracy over entire temp range	0.18
A.18, A.24, B.4, C.4, C.26	LMT87	Temp	5.5	2.7	N/A	2-Pin Digital Temp Sensor	SPI	-50C to 150C	2.7C Accuracy over entire temp range	0.18
A.18, A.24, B.4, C.4, C.26	LMT01	Temp	5.5	2	N/A	Programmable Alert, Fault Queue, One-Shot Conversion, Shutdown Power Mode	Voltage Output	-50C to 150C	0.7C Accuracy over entire temp range	0.79

Components selection

Sensor / AC/DC power supply / PFC controller / power management unit

Sensor (continued)

Item	Part Number	Sensor type	Supply Voltage (Max)	Supply Voltage (Min)	Resolution (Bits)	Special Features	Interface	Operating Temperature Range (°C)	Feature	Price* (US\$)
A.18, A.24, B.4	TMP102	Temp	3.6	1.4	12	Programmable Alert, Fault Queue, One-Shot Conversion, Shutdown Power Mode	Voltage Output	-40 to 125	–	0.5
A.18, A.24, B.4, C.4, C.26	TMP75B	Temp	3.6	1.4	12	Programmable Alert, Fault Queue, One-Shot Conversion, Shutdown	Voltage Output	-55 to 125	–	0.47
C.4, C.26	TMP112	Temp	3.6	1.4	12	Configurable Resolution, Programmable Alert, Fault Queue, One-Shot Conversion, Shutdown	Pulse Count Output	-40 to 125	–	0.9
C.4, C.26	TMP275	Temp	5.5	2.7	12	Protected digital switch Hall effect sensor	I2C / SMBUS	-40 to 125	–	0.99
A.10	DRV5023	Hall Sensor	38	2.5	–	Digital Ambient Light Sensor (ALS) with High Precision Human Eye Response	I2C / SMBUS	–	–	0.26
A.25	OPT3001	light	3.6	1.6	23	Protected digital switch Hall effect sensor	Open Drain	-40 to 85	–	0.99

AC/DC power supply

Item	Part Number	No-Load Power (mW)	Output Regulation (Max) (%)	Constant Current (%)	Frequency (Max) (kHz)	Green (Mode)	Soft Start	700-V Start-up	Cable Compensation	Price* (US\$)
A.1, B.1, C.1	LM5023	10mW	1%	5%	130-KHz	Yes	Yes	–	–	0.38
A.1, B.1, C.1	UCC28700	30mW	5%	5%	132-KHz	Yes	Yes	–	Yes	0.35
A.1, B.1, C.1	UCC28710	10mW	5%	5%	100-KHz	Yes	Yes	Yes	Yes	0.42
A.1, B.1, C.1	UCC28740	30mW	3%	5%	100-KHz	Yes	Yes	Yes	–	0.42
A.1, B.1, C.1	UCC28630	30mW	5%	10%	120-KHz	Yes	Yes	Yes	–	0.60
A.1, B.1, C.1	UCC28730	Zero/5mW	5%	5%	83-KHz	Yes	Yes	Yes	Yes	0.42
A.1, B.1, C.1	UCC28911	30mW	5%	5%	115-KHz	Yes	Yes	Yes	–	0.82

PFC controller

Item	Part Number	Recommended Power Range (W)	# of Phase	Frequency Range (kHz)	Operating Supply Voltage (Max) (V)	Vref Tolerance (%)	Duty Cycle (Max) (%)	Practical Operating Frequency (Max) (MHz)	UVLO Thresholds On/Off (V)	Price* (US\$)
B.10, C.10	UCC28070A	> 800	Dual	10 to 300	21	3	99	0.3	10.2/9.2	1.95
B.10, C.10	UCC28019A	200 to 800	Single	57 to 71	21	2	–	–	10.5/9.5	0.75
B.10, C.10	UCC2818A	200 to 800	Single	6 to 220	18	1.5	–	100	10.5/10	1.25
B.10, C.10	UCC28180	–	Single	18 to 250	18	1.5	–	98	11.5/9.5	0.85
B.10, C.10	UCC28063	> 750W	Dual	–	21	3.0	100	–	12.6/10.35	1.10

Power management unit

Item	Part Number	MCU/processor attached	Vin (V)	No. of Regulator Outputs	DC/DC Step-down Converter	DC/DC Step-Down Controller	DC/DC Step-Up Converter	DC/DC Buck-Boost Converter	LDO	Communication Interface	Description	Package(s)	Price* (US\$)
A.3, A.19, B.2, C.2	TPS65217	AM335x	2.7 to 6.5V	7.00	3	–	–	–	4	I2C	Power Management IC (PMIC) w/ 3 DC/DCs, 4 LDOs, Linear Battery Charger & White LED Driver	QFN-48	3.45
A.3, A.19, B.2, B.3, C.2, C.3	TPS65910x	AM335x	2.7 to 5.5V	13.0	3	–	1	–	9	2 x I2C	Integrated Power Management IC (PMIC) w/ 4 DC/DCs, 8 LDOs and RTC	QFN-48	3.30
A.3, A.19, B.2, C.2	TPS650250	AM335x	2.5 to 6V	6.00	3	–	–	–	3	I2C	Integrated Power Management IC (PMIC) w/ 3 DC/DCs, 3 LDOs	QFN-32	2.20
A.3, A.19, B.2, B.3, C.2, C.3	TPS65218	AM335x, AM437x	2.7 to 5.5V	7.00	5	–	–	1	1	I2C	Power Management IC (PMIC) w/ 6 DC/DC, 1 LDO, Load Switches	QFN & QFP	3.45
A.3, A.19, B.2, C.2	TPS65320-Q1	General Purpose	3.6 to 40V	2.00	1	–	–	–	1	–	Integrated Power Management IC (PMIC) w/ 1 DC/DC and 1 LDO	14HTSSOP	\$1.45
A.3, A.19, B.2, C.2	TPS650061	C2000, General Purpose	2.3 to 6V	3.0	1	–	–	–	2	–	Power Management IC (PMIC) w/ 1 DC/DC, 2 LDOs, Supply Voltage Supervisor	QFN-20	1.40
A.3, A.19, B.2, C.2	TPS65023	AM335x, General Purpose	1.5 to 6.5V	6.00	3	–	–	–	3	I2C	6-channel Power Management IC (PMIC) with 3DC/DCs, 3 LDOs, I2C Interface and DVS	QFN-40	2.95
A.3, A.19, B.2, C.2	TPS65053	General Purpose	1.5 to 6.5V	5.0	2	–	–	–	2	–	5-Channel Power Management IC (PMIC) with two step down converters and 3 low-input voltage LDOs	QFN-20	1.65

Components selection

DC/DC switching regulator / linear regulator

DC/DC switching regulator

Item	Part Number	Topology	Vin (Min) (V)	Vin (Max) (V)	Vout (Min) (V)	Vout (Max) (V)	Iout (Max) (A)	Switch Current Limit (Typ)(A)	Synchronous	High Light-Load Efficiency	Duty Cycle (Max) (%)	Price* (US\$)
A.19	LM2770/71	Switched Capacitors	2.7	5.5	1.2	1.575	0.25	–	–	–	–	0.30
A.3, A.19, B.2, C.2	TPS562200/9	Buck	4.5	17	0.76	7	2	3.2	y	y(2200)	80	0.47/0.47
A.3, A.19, B.2, B.3, C.2, C.3	TPS54231/331	Buck	3.5	28	0.8	25	2 / 3	3.5 / 5.8	–	y	90	0.70/0.75
A.3, A.19, B.2, C.2	TPS563200/9	Buck	4.5	17	0.76	7	3	4.2	y	y (3200)	80	0.52/0.52
A.3, A.19, B.2, C.2	TPS56628	Buck	4.5	18	0.76	5.5	6	7.3	y	y	85	1.45
A.3, A.19, B.2, B.3, C.2, C.3	TPS54335A/336A	Buck	4.5	28	0.8	25	3	5	y	y	90	0.9
A.3, A.19, B.2, B.3, C.2, C.3	LM25007/10/11	Buck	9	42	2.5	37	0.5 / 1 / 2	0.7 / 1.2	–	–	90	1.05/1.15/1.30
A.3, A.19, B.2, B.3, C.2, C.3	LM25011	Buck	6	42	2.51	40	2	3.5	–	–	99	0.95
A.3, A.19, B.2, B.3, C.2, C.3	LM25017/LM5017	Buck	7.5	48/100	1.23	40/90	0.65	1.02	y	–	90	1.25/1.57
A.3, A.19, B.2, B.3, C.2, C.3	LMR12010	Buck	3	20	0.8	16	1	1.7	–	–	92	0.79
A.3, A.19, B.2, B.3, C.2, C.3	LMR14203/06	Buck	4.5	42	0.8	34	0.3 / 0.6	0.5 / 1.15	–	–	87	0.90/1.01
A.3, A.19, B.2, B.3, C.2, C.3	LMR24210/20	Buck	4.5	42	0.8	24	1 / 2	1.8 / 2.8	y	–	85	1.50/2.00
A.3, A.19, B.2, C.2	TLV62565	Buck	2.7	5.5	0.6	5.2	1.5	–	–	y	95	0.56
A.3, A.19, B.2, C.2	TLV62080/4/5	Buck	2.5	5.5	0.5	4	1 / 2 / 3	4 / 4 / 5.5	–	y	100	0.46 / 0.59 / 0.67
A.3, A.19, B.2, C.2	TLV62130/50	Buck	4	17	0.9	5	3 / 1	4.2 / 1.7	y	y	100	0.75/0.90
A.3, A.19, B.2, C.2	TLV62160	Buck	3	17	0.9	6	1	1.8	y	y	100	0.8
A.3, A.19, B.2, C.2	TPS54227/8	Buck	4.5	18	0.76	7.00	2.00	3.3	y	– / y	90	0.61/0.63
A.3, A.19, B.2, C.2	TPS54327/8	Buck	4.5	18	0.76	7.00	3.00	4.2	y	– / y	90	0.73/0.75
A.3, A.19, B.2, C.2	TPS54627/8	Buck	4.5	18	0.76	5.50	6.00	7.3	y	– / y	85	1.50/1.55
A.3, A.19, B.2, B.3	LM5017	Buck	7.5	100.00	1.25	90	0.65	1.30	y	–	90.00	1.57
A.3, A.19, B.2, C.2, C.3	LMZ10501	Buck	2.7V	5.5V	0.6	3.6	1	–	y	–	–	1.55
A.3, A.19, B.2, B.3, C.2, C.3	LMR14020	Buck	4V	40V	1	36	2	3.2	–	y	98	1.46
A.3, A.19, B.2, B.3, C.2, C.3	LMR14030	Buck	4V	40V	1	36	3.5	5.5	–	y	98	1.68
A.3, A.19, B.2, B.3, C.2, C.3	LM46000	Buck	3V	60V	1	28	0.5	1.35	y	y	99	1.65
A.3, A.19, B.2, B.3, C.2, C.3	LMR16006	Buck	4V	60V	0.8	55	0.6	1.2	–	y	97	1.2
A.3, A.19, B.2, B.3, C.2, C.3	LMR62014	Boost	2.7V	14V	3	20	–	2	–	–	93	0.55
A.3, A.19, B.2, C.2	TLV62565	Buck	2.7	5.5	0.6	5.2	1.5	1.5	y	y	95	0.6
A.3, A.19, B.2, B.3, C.2, C.3	TPS57040-Q1	Buck	1.8	6	1.8	28	0.5	0.94	–	y	100	1.19

Linear regulator

Item	Part Number	Output Options	Vin (Min) (V)	Vin (Max) (V)	Vout (Min) (V)	Vout (Max) (V)	Iout (Max) (A)	Fixed Output Options (V)	Comments	Price* (US\$)
A.18	LP5907	Fixed	2.2	5.5	–	–	0.25	1.2, 1.5, 1.8, 1.9, 2.2, 2.5, 2.7, 2.75, 2.8, 2.85, 2.9, 3, 3.1, 3.2, 3.3, 3.7, 4, 4.5	Enable; Output Discharge; Overcurrent Protection	0.14
A.18, B.2, B.3	TLV1117	Adjustable	2.7	15	1.25	13.7	0.8	–	Overcurrent Protection, Thermal Shutdown	0.18
A.18, B.2	UA7805	Fixed	7	25	–	–	1.5	5	Overcurrent Protection, Thermal Shutdown	0.18
A.18	TPS735	Fixed, Adjustable	2.7	6.5	1.2	6.0	0.5	1.2, 1.5, 2.5, 2.85, 3.3	–	0.49
B.2	LM2936	Fixed	5.5	60	–	–	0.05	3, 3.3, 5	Enable, Overcurrent Protection, Thermal Shutdown	0.62
A.18, B.2, B.3	LP2951-N	Fixed, Adjustable	1.3	30	1.24	29	0.1	3, 3.3, 5	Enable, Overcurrent Protection, Thermal Shutdown, Power Good	0.25
B.2	LP2985-N	Fixed	2.2	16	–	–	0.15	1.8, 2.5, 2.6, 2.7, 2.8, 2.9, 3, 3.1, 3.2, 3.3, 3.5, 3.6, 3.8, 4, 4.5, 5, 6.1	Enable, Overcurrent Protection, Thermal Shutdown	0.24
A.18, B.2, B.3	TPS7B67xx-Q1	Adjustable	4	40	1.5	18	0.45	–	Enable, Overcurrent Protection, Thermal Shutdown, Power Good	0.8
B.2	TPS7B69xx-Q1	Fixed	4	40	–	–	0.15	2.5, 3.3, 5	Overcurrent Protection, Thermal Shutdown	0.45
B.2	LP2989	Fixed	2.1	16	–	–	0.5	2.5, 2.8, 3, 3.3, 3.8, 5	Enable, Overcurrent Protection, Thermal Shutdown, Power Good	0.89
A.3, A.19, B.2, B.3, C.2, C.3	LP2950/51	Fixed	3.4	30	–	–	0.1	3.0/3.3/5	Overcurrent Protection, Thermal Shutdown	0.12
A.3, A.19, B.2, B.3, C.2, C.3	LM317	Adjustable	4.2	40	1.2	37	1.5	–	Overcurrent Protection, Thermal Shutdown	0.29
A.3, A.19, B.2, B.3, C.2, C.3	LM1084	Fixed, Adjustable	2.6	29	1.25	27.5	5	3.3, 5	Overcurrent Protection, Thermal Shutdown	1
A.3, A.19, B.2, B.3, C.2, C.3	LM78L05	Fixed	6.7	35	–	–	0.1	5	Overcurrent Protection, Thermal Shutdown	0.2

Components selection

Voltage supervisors / gate driver / motor driver / isolated gate driver / relay and LED

Voltage supervisors

Item	Part Number	Output Options	Vin (Min) (V)	Vin (Max) (V)	Threshold Voltage 1 (Typ)(V)	Fixed Output Options (V)	Output Driver Type / Reset Output	Time Delay (ms)	Price* (US\$)
A.5, B.5, C.5	TLV803	Fixed	1.1	6.0	–	2.25, 2.64, 2.93, 4.38	Active-low,Open-drain	200	0.18
A.5, B.5, C.5	TPS3831	Fixed	0.6	6.5	–	0.9, 1.12, 1.52, 1.67, 2.63, 2.93, 3.08, 4.38	Active-low, Push-pull	200	0.30
A.5, B.5, C.5	TL7759	Adjustable	1	7	4.55	–	Active-high, Active-low,Open-drain	Programmable	0.24
A.5, B.5, C.5	TL7700	Adjustable	1.8	40	0.5	–	Active-low,Open-drain	Programmable	1.47

Gate driver

Item	Part Number	Drive configuration	Drive current (A)	VCC (Min) (V)	VCC (Max) (V)	Rise time (ns)	Fall time (ns)	Propagation delay (ns)	Special features	Other features	Operating Temperature Range	Packages	Price* (US\$)
B.11, B.12, C.11, C.12	UCC27531	Non-Inverting Single	5	10	35	15	7	17	Negative voltage handling (-5V) at input pins	UVLO, Enable pin	-40 to 140C	6SOT-23, 8SOIC	0.75
B.11, B.12, C.11, C.12	UCC27532	Non-Inverting Single	5	10	35	15	7	17	Negative voltage handling (-5V) at input pins	UVLO, Enable pin	-40 to 140C	6SOT-23	0.75
B.11, B.12, C.11, C.12	UCC27533	Single Inverting Non-Inverting	5	10	35	15	8	15	Negative voltage handling (-5V) at input pins	UVLO, Enable pin	-40 to 140C	5SOT-23	0.75
B.11, B.12, C.11, C.12	UCC27517A	Single Inverting Non-Inverting	8	4.5	18	9	7	13	Negative voltage handling (-5V) at input pins	UVLO, Enable pin	-40 to 140C	5SOT-23	0.49
B.11, B.12, C.11, C.12	UCC27511	Single Inverting Non-Inverting	8	4.5	18	9	7	13	TTL Threshold	UVLO, Enable pin	-40 to 140C	6SOT-23	0.49
B.9, C.9, C.19	UCC27714	600V Non-Inverting High side low side	4	8	18	15	15	90	Negative voltage handling at HS pin	UVLO, Enable pin	-40 to 125C	SOIC14	1.75
B.11, B.12, C.11, C.12	UCC27524A	Dual non inverting	5	4.5	18	7	7	14	Negative voltage handling (-5V) at input pins	UVLO, Enable pin	-40 to 140C	8MSOP-PowerPAD, 8SOIC	0.75

Motor driver

Item	Part Number	Motor Type	Special Features	Vs (Min) (V)	Vs (Max) (V)	Peak Output Current (A)	RMS Output	Control I/F	Price* (US\$)
A.9	DRV10983	3-phase BLDC	100mA Step Down Buck; Rotor Lock Protection	8	28	3	2	PWM, Analog, or I2C	1.95
A.9	DRV8313	Brushless DC	2.5A 3-Phase BLDC motor driver	8	60	3 A	1.75 A	PWM	2.25
A.9	DRV8812	Bipolar Stepper	1.6A Bipolar Stepper Motor Driver with 4-Level Current Regulation	8.2	45	1.6	1.1	PH/EN	1.45
A.14, A.16, B.19, C.17	DRV8860	Unipolar / Bipolar Stepper	8-Channel protected low side driver with integrated catch diodes	8	38	620 mA / Channel	330mA / Channel	Serial	1.5
A.14, A.16, A.21, B.19, C.17	DRV8848	Bipolar Stepper	2A Dual H-Bridge motor driver with inrush current protection	4	18	2A / Channel	1A / Channel	PWM	1.3
A.21	DRV8871	Brushed DC	2A Dual H-Bridge motor driver with inrush current protection	6.5	45	3.5 A	2.5 A	PWM	1.41

Isolated gate driver

Item	Part Number	Description	# of Channels	Split Output	VCC (Min) (V)	VCC (Max) (V)	Vpeak Isolation (kV)	Vrms Isolation (kV)	Transient Immunity (kV/μs) (typ)	Pin/Package	Price* (US\$)
A.9, B.9, C.9, C.19	ISO5451	Gate driver, basic isolaton	1	No	15.00	30.00	6	4.25	100	16 SOIC	2.15
A.9, B.9, C.9, C.19	ISO5452	Gate driver, basic isolaton	1	yes	15.00	30.00	6	5.7	100	16 SOIC	2.15

Relay and LED drivers

Item	Part Number	Vs (V) (Min / Max)	Switching Voltage (Max) (V)	Peak Output Current (mA)	Iout/ch (Max) (mA)	Drivers Per Package	Operating Temperature Range (°C)	Vol@Lowest Spec Current (Typ)(mV)	Delay Time (Typ)(ns)	Price* (US\$)
A.4, A.14, A.16, B.11, B.12, B.19, C.11, C.12, C.17	ULN2003B	–	50	500	500	7	-40 to 105	900	250	0.14
A.4, A.14, A.16, B.11, B.12, B.19, C.11, C.12, C.17	TPL7407L	–	40	500	500	7	-40 to 125	200	350	0.2

Components selection

Shunt reference / voltage reference / eFuse / isolator

Shunt reference

Item	Part Number	Description	VO Adj (Min) (V)	VO Adj (Max) (V)	Initial Accuracy @ 25°C (%)	Initial Accuracy (Max) (%)	Min Iz for Regulation (µA)	Iout/Iz (Max) (mA)	Temp Coeff (Typ) (ppm/°C)	Temp Coeff (Max) (ppm/°C)	Price* (US\$)
B.14, C.14, C.24	TLV431	Low-voltage adjustable shunt reference	1.24	6	1.5	1.5	55	15	39	129	0.23
B.14, C.14, C.24	LMV431	Low-voltage adjustable shunt reference	1.24	30	0.5/1.0/1.5	0.5/1.0/1.5	55	15	39	129	0.23
B.14, C.14, C.24	TL431	Adjustable shunt reference	2.495	36	1	1	400	100	34	92	0.11
B.14, C.14, C.24	LM431	Adjustable shunt reference	2.495	36	0.4/1.0/2.2	0.4/1.0/2.2	400	100	17	50	0.11

Voltage reference

Item	Part Number	Description	Supply Voltage (Min) (V)	Supply Voltage (Max) (V)	Output Voltage (V)	Iout/Iz (max) (mA)	Iq (Typ) (µA)	Operating Temperature Range (°C)	Temp Coeff (Max) (ppm/ degree C)	Price* (US\$)
B.14, C.14, C.24	REF5025A-Q1	Low Noise, Very Low Drift, Precision Voltage Reference	2.7	18	2.5	10	800	-40 to 125	8	1.6
B.14, C.14, C.24	REF3318	30ppm voltage reference	2.000	5.5	1.800	0.15	3.9	-40 to 125	30.0	0.85
B.14, C.14, C.24	REF3312	30ppm, 3.9µA voltage reference	1.800	5.5	1.250	5	3.9	-40 to 125	30	0.85
B.14, C.14, C.24	REF3120	20ppm, 100µA Voltage Reference	2.098	5.5	2.048	10	100.0	-40 to 125	20	0.99
B.14, C.14, C.24	REF3112	20ppm, 100µA Voltage Reference	1.800	5.5	1.250	10	100.0	-40 to 125	20	0.99

eFuse

Item	Part Number	Vin (Min) (V)	Vin (Max) (V)	Abs. Max (Cont) (V)	Current Limit Threshold (Typ) (A)	Current Limit Accuracy	Over Voltage Protection	Internal FET RON (mOhm)	Special Features	Fault Response	Package	Price* (US\$)
A.2	TPS25921	4.5	18	20	0.4 to 1.6	+/-2% (1A @ 25C)	+/-3% Adjustable	90	No RSENSE Required	Auto Retry (A) or Latch Off (L)	SOIC-8 (4mm x 5mm)	0.50
A.2	TPS25924	4.5	13.8	20	2 to 5	+/-15%	15V VOUT Clamp	28	No RSENSE Required BLK FET Driver	Auto Retry (A) or Latch Off (L)	VSON-10 (3mm x 3mm)	0.55
A.2	TPS25925	4.5	5.5	20	2 to 5	+/-15%	6.1V VOUT Clamp	30	No RSENSE Required	Auto Retry (A) or Latch Off (L)	VSON-10 (3mm x 3mm)	0.55
A.2	TPS25927	4.5	18	20	2 to 5	+/-15%	None	28	No RSENSE Required BLK FET Driver	Auto Retry (A) or Latch Off (L)	VSON-10 (3mm x 3mm)	0.55

Isolator

Item	Part Number	Description	# of Channels	Forward/Reverse Channels	VCC (Min) (V)	VCC (Max) (V)	Vpeak Isolation (kV)	Vrms Isolation (kV)	Transient Immunity (kV/µs) (typ)	Pin/Package	Price* (US\$)
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7131CC	Quad channel, 3/1, 25 Mbps, digital isolator	3	2/1	3.00	5.50	4242	2.5	50	16 QSOP	1.60
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7140CC	50Mbps Quad and Triple Digital Isolators	4	4/0	3.00	5.50	4242	2.5	50	16 QSOP	1.90
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7141CC	50Mbps Quad and Triple Digital Isolators	4	3/1	3.00	5.50	4242	2.5	50	16 QSOP	1.90
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7142CC	50Mbps Quad and Triple Digital Isolators	4	2/2	3.00	5.50	4242	2.5	50	16 QSOP	1.90
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7310C	25Mbps Quad and Triple Digital Isolators	1	1/0	3.00	5.50	4.242	3.0	70	16 SOIC	0.90
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7310FC	25Mbps Quad and Triple Digital Isolators	1	1/0	3.00	5.50	4.242	3.0	70	16 SOIC	0.90
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7320C	25Mbps Quad and Triple Digital Isolators	2	2/0	3.00	5.50	4.242	3.0	70	16 SOIC	1.05
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7320FC	25Mbps Quad and Triple Digital Isolators	2	2/0	3.00	5.50	4.242	3.0	70	16 SOIC	1.05
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7321C	25Mbps Quad and Triple Digital Isolators	2	1/1	3.00	5.50	4.242	3.0	70	16 SOIC	1.05
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7321FC	25Mbps Quad and Triple Digital Isolators	2	1/1	3.00	5.50	4.242	3.0	70	16 SOIC	1.05
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7330C	25Mbps Quad and Triple Digital Isolators	3	3/0	3.00	5.50	4.242	3.0	70	16 SOIC	1.40
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7330FC	25Mbps Quad and Triple Digital Isolators	3	3/0	3.00	5.50	4.242	3.0	70	16 SOIC	1.40
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7331C	25Mbps Quad and Triple Digital Isolators	3	2/1	3.00	5.50	4.242	3.0	70	16 SOIC	1.40
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7331FC	25Mbps Quad and Triple Digital Isolators	3	2/1	3.00	5.50	4.242	3.0	70	16 SOIC	1.40
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7340C	25Mbps Quad and Triple Digital Isolators	4	4/0	3.00	5.50	4.242	3.0	70	16 SOIC	1.80
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7340FC	25Mbps Quad and Triple Digital Isolators	4	4/0	3.00	5.50	4.242	3.0	70	16 SOIC	1.80
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7341C	25Mbps Quad and Triple Digital Isolators	4	3/1	3.00	5.50	4.242	3.0	70	16 SOIC	1.80
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7341FC	25Mbps Quad and Triple Digital Isolators	4	3/1	3.00	5.50	4.242	3.0	70	16 SOIC	1.80
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7342C	25Mbps Quad and Triple Digital Isolators	4	2/2	3.00	5.50	4.242	3.0	70	16 SOIC	1.80
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7342FC	25Mbps Quad and Triple Digital Isolators	4	2/2	3.00	5.50	4.242	3.0	70	16 SOIC	1.80
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7810	100Mbps Quad and Triple Digital Isolators	1	1/0	2.25	5.50	8	5.7	100	16 SOIC	-
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7810F	100Mbps Quad and Triple Digital Isolators	1	1/0	2.25	5.50	8	5.7	100	16 SOIC	-
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7820	100Mbps Quad and Triple Digital Isolators	2	2/0	2.25	5.50	8	5.7	100	16 SOIC	2.10
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7820F	100Mbps Quad and Triple Digital Isolators	2	2/0	2.25	5.50	8	5.7	100	16 SOIC	2.10
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7821	100Mbps Quad and Triple Digital Isolators	2	1/1	2.25	5.50	8	5.7	100	16 SOIC	2.10
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7821F	100Mbps Quad and Triple Digital Isolators	2	1/1	2.25	5.50	8	5.7	100	16 SOIC	2.10
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7830	100Mbps Quad and Triple Digital Isolators	3	3/0	2.25	5.50	8	5.7	100	16 SOIC	-

Components selection

Isolator / ESD protection / level translator / LED driver/ comm. interface / processor/MCU

Isolator (continued)

Item	Part Number	Description	# of Channels	Forward/Reverse Channels	VCC (Min) (V)	VCC (Max) (V)	Vpeak Isolation (kV)	Vrms Isolation (kV)	Transient Immunity (kV/μs) (typ)	Pin/Package	Price* (US\$)
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7830F	Quad channel, 3/1, 25 Mbps, digital isolator	3	3/0	2.25	5.50	8	5.7	100	16 SOIC	–
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7831	100Mbps Quad and Triple Digital Isolators	3	2/1	2.25	5.50	8	5.7	100	16 SOIC	–
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7831F	100Mbps Quad and Triple Digital Isolators	3	2/1	2.25	5.50	8	5.7	100	16 SOIC	–
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7841	100Mbps Quad and Triple Digital Isolators	4	3/1	2.25	5.50	8	5.7	100	16 SOIC	3.49
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7841F	100Mbps Quad and Triple Digital Isolators	4	3/1	2.25	5.50	8	5.7	100	16 SOIC	3.49
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7842	100Mbps Quad and Triple Digital Isolators	4	2/2	2.25	5.50	8	5.7	100	16 SOIC	3.49
A.8, A.27, B.8, B.17, C.8, C.18, C.20	ISO7842F	100Mbps Quad and Triple Digital Isolators	4	2/2	2.25	5.50	8	5.7	100	16 SOIC	3.49

ESD protection

Item	Part Number	Description	# of Channels	IEC 61000-4-2 Contact (± kV)	IEC 61000-4-2 Air-Gap (± kV)	IO Capacitance (Typ) (pF)	Breakdown Voltage (Min) (V)	IO Leakage Current (nA)	Price* (US\$)
A.7, B.6, C.6	TPD1E10B06	Single Channel ESD in 0402 package with 10pF Capacitance and 6V Breakdown	1	30	30	12	6	100	0.05
A.12	TPD1E05U06	1 Channel Ultra Low Capacitance IEC ESD Protection Diode	1	12	15	0.4	6.5	10	0.05
A.28, B.20, C.22	TPD2E007	2-Channel ESD Protection Array for AC Signal Data Interface	2	8	15	15	14	50	0.20

Level translator

Item	Part Number	Bits(#)	VCCA (Max) (V)	VCCA (Min) (V)	VCCB (Max) (V)	VCCB (Min) (V)	Max Drive (mA)	Operating Temperature Range	Price (U.S. \$)*
A.6, A.23, A.27, B.17, C.20	SN74LVC8T245	8	5.5	1.65	5.5	1.65	32	-40 to 85	0.45
A.6, A.23, A.27, B.17, C.20	SN74LVC1T45	1	5.5	1.65	5.5	1.65	32	-40 to 85	0.17
A.6, A.23, A.27, B.17, C.20	LSF0108	8	4.5	1	5.5	1.8	64	-40 to 125	0.73
A.6, A.23, A.27, B.17, C.20	LSF0204	4	4.5	1	5.5	1.8	64	-40 to 125	0.45
A.6, A.23, A.27, B.17, C.20	TXS0108E	8	3.6	1.2	5.5	1.65	50	-40 to 85	0.77
A.6, A.23, A.27, B.17, C.20	TXS0104E	4	3.6	1.65	5.5	2.3	24	-40 to 85	0.47
A.6, A.23, A.27, B.17, C.20	TXS0102	2	3.6	1.65	5.5	2.3	–	-40 to 85	0.23

LED driver

Item	Part Number	Output Channels	Supply Voltage (Min) (V)	Supply Voltage (Max) (V)	LED Voltage (Max) (V)	Data Input	Data Transfer Rate (Typ) (MHz)	Per Ch Drive (mA)	Price* (US\$)
A.6	TLC6C598-Q1	8	3	5.5	40	Serial	–	50	0.34
A.6	TLC6C5912-Q1	12	3	5.5	40	Serial	–	50	0.5

Communication interface

Item	Part Number	Supply Voltage(s) (Nom) (V)	Drivers per package	Receivers per package	Common Mode Range	Duplex	Isolated	Operating Temperature Range (°C)	Special Features	Price (U.S. \$)*
A.27, B.17, C.20	SN75176B	5	1	1	-7 to 12	–	No	0 to 70	Differential Bus Transceiver	0.24
A.27, B.17, C.20	Max3232E	3.3 to 5V	2	2	-7 to 12	–	No	-40 to 85	Multichannel RS-232 Line Driver/Receiver With +/-15kV IEC ESD Protection	0.71
A.27, B.17, C.20	DS75176BT	5	1	1	-7 to 12	Half	No	-40 to 85	Multipoint RS-485/RS-422 Transceivers	0.52
A.27, B.17, C.20	DS485	5	1	1	-7 to 12	Half	No	-40 to 85	Low-Power RS-485/RS-422 Multipoint Transceiver	0.87
A.27, B.17, C.20	PC16552D	5	2	2	–	–	No	0 to 70	Dual Universal Asynchronous Receiver/Transmitter with FIFOs	4.31
A.27, B.17, C.20	NS16C2552	3.3, 5	2	2	–	–	No	-40 to 85	Dual UART with 16-byte FIFO and up to 5 Mbit/s Data Rate	4.69
A.27, B.17, C.20	NS16C2752	3.3, 5	2	2	–	–	No	-40 to 85	Dual UART with 64-byte FIFO and up to 5 Mbit/s Data Rate	4.94
A.27, B.17, C.20	SN65HVD1786	5	1	1	-20 to 25	Half	No	-40 to 105	70-V Fault-Protected RS-485 with -20 to +25 common mode	0.85
A.27, B.17, C.20	SN65HVD888	5	1	1	-7 to 12	Half	No	-40 to 85	Bus-Polarity Correcting RS-485 Transceiver with IEC-ESD Protection	1.1
A.27, B.17, C.20	ISO3082	5	1	1	–	Half	4kV	-40 to 85	Isolated 5-V Half-Duplex RS-485 Transceivers	2.6

Processor/MCU

Item	Part Number	MHz	Non-volatile Flash/FRAM (KB)	RAM	Capacitive Touch I/O	ADC	Serial Communications	Additional Features	Price* (US\$)
A.13	MSP430FR4133	16	16	2	Yes	10-bit SAR	SPI, I2C, UART	LCD, IR Logic, FRAM	1.55
A.13	MSP430FR6972	16	64	2	Yes	12-bit SAR	SPI, I2C, UART	LCD, AES, FRAM	2.55
A.13	MSP430G2553	16	16	0.5	Yes	10-bit SAR	SPI, I2C, UART	N/A	0.9

Components selection

Processor/MCU / wireless connectivity / NFC transceiver / I2C/IO expander

Processor/MCU (continued)

Item	Part Number	Description
A.13	AM335x	Up to 1GHz Cortex-A8 32-bit RISC microprocessor; LCD Display option; 3D Graphics acceleration; Extensive peripheral set (2x Gbit-Ethernet, CAN, USB, 8x UARTs extended from PRU, ...); Flexible communication protocols
A.13	AM437x	Up to 1GHz POWERVR SGX Graphics Accelerator subsystem for 3D graphics acceleration to support display and gaming effects Single-cycle vector floating point (VFP) Dual camera and display processing subsystem Cryptographic acceleration and secure boot PRU-ICSS enables simultaneous industrial Ethernet protocols and motor feedback protocols Support for 32 bit LPDDR2/DDR3/DDR3L Low power: ~5mW deep sleep and < 0.1mW RTC-only Simplified power sequence for flexible power designs

Item	Part Number	Core	MHz	Flash (kB)	SRAM (kB)	USB	CAN	PWM Units (# of Output)	QEP	# of 12-Bit ADC	# of ADC channel	ADC Sampling (MSPS)	Other Communication Ports	Battery Backed Hibernation	LCD Controller	Price* (US\$)
A.13, B.7, C.7	TM4C123AE6	M4F	80	128	32	-	2	2 (16)	2	2	12 -22	1	SPI, SCI, I2C	-	-	3.63
A.13, B.7, C.7	TM4C123BE6	M4F	80	128	32	-	2	2 (16)	2	2	12 -22	1	SPI, SCI, I2C	Y	-	3.63 - 3.91
A.13, B.7, C.7	TM4C123FE6	M4F	80	128	32	OTG	2	2 (16)	2	2	12 -22	1	SPI, SCI, I2C	-	-	4.79
A.13, B.7, C.7	TM4C123GE6	M4F	80	128	32	OTG	2	2 (16)	2	2	12 -22	1	SPI, SCI, I2C	Y	-	4.8 - 4.28
A.13, B.7, C.7	TM4C123AH6	M4F	80	256	32	-	2	2 (16)	2	2	12 -24	1	SPI, SCI, I2C	-	-	4.23
A.13, B.7, C.7	TM4C123BH6	M4F	80	256	32	-	2	2 (16)	2	2	12 -24	1	SPI, SCI, I2C	Y	-	4.23 - 4.72
A.13, B.7, C.7	TM4C123FH6	M4F	80	256	32	OTG	2	2 (16)	2	2	12 -24	1	SPI, SCI, I2C	-	-	5.43
A.13, B.7, C.7	TM4C123GH6	M4F	80	256	32	OTG	2	2 (16)	2	2	12 -24	1	SPI, SCI, I2C	Y	-	5.44 - 5.26
A.13, B.7, C.7	TM4C1299KC	M4F	120	512	256	OTG	2	1 (8)	1	2	24	2	SPI, SCI, I2C	-	Y	8.36
A.13, B.7, C.7	TM4C129XKC	M4F	120	512	256	OTG	2	1 (8)	1	2	24	2	SPI, SCI, I2C	-	Y	9.32
A.13, B.7, C.7	TM4C1297NC	M4F	120	1024	256	OTG	2	1 (8)	1	2	24	2	SPI, SCI, I2C	-	Y	8.07
A.13, B.7, C.7	TM4C1299NC	M4F	120	1024	256	OTG	2	1 (8)	1	2	24	2	SPI, SCI, I2C	-	Y	9.61
A.13, B.7, C.7	TM4C129LNC	M4F	120	1024	256	OTG	2	1 (8)	1	2	24	2	SPI, SCI, I2C	-	Y	10.27
A.13, B.7, C.7	TM4C129XNC	M4F	120	1024	256	OTG	2	1 (8)	1	2	24	2	SPI, SCI, I2C	-	Y	10.57
B.7	RM41L232	R4	80	128	32	-	2	1 (16)	1	1	16	1	SPI, SCI	-	-	4.74
B.7	RM42L432	R4	100	384	32	-	2	1 (16)	1	1	16	1	SPI, SCI	-	-	5.81
C.7	TMS320F28027F	C28x	60	64	12	-	-	4 (8)	-	2	13	4.6	SPI, SCI, I2C	-	-	4.66

Wireless connectivity

Item	Part Number	Function	Category	Key Feature	Pin/Package	Price* (US\$)
A.22	LMX9838	Bluetooth 2.0 Integrated MCU	Wireless MCU and Smart RF Transceiver Module	-	-	14.97
A.22	LMX9830	Bluetooth 2.0 Integrated MCU	Wireless MCU and Smart RF Transceiver Module	-	-	6.8
A.22	CC3200MOD	Wi-Fi wireless microcontroller	Wireless MCU	Low power, Cortex M4 integrated with Wi-Fi wireless network processor, easy to use. Wi-Fi certified module	-	12.99
A.22	CC3100MOD	Wi-Fi Network Processor	Network Processor	Connect easily Wi-Fi to any 8-bit, 16-bit, 32-bit MCU with a simple serial interface. Wi-Fi certified Module	-	9.99
A.22	CC2640	SimpleLink Bluetooth Low Energy ultra-low power Wireless microcontroller	Wireless MCU	Ultra-low Power, Cortex M MCU, sensor-controller, small 4mmx4mm QFN package, robust and easy to use	-	2.5
A.22	CC2650	SimpleLink Multi-protocol ultra-low power Wireless microcontroller	Wireless MCU	Ultra-low Power, supports BLE, 6LoWPAN or ZigBee by a software change Cortex M MCU, sensor-controller, small 4mmx4mm QFN package, robust and easy to use	0.5	3
A.22	CC2533	A True System-on-Chip Solution for 2.4-GHz IEEE 802.15.4 and ZigBee Applications	Wireless MCU	support 2.4GHz protocol including RF4CE ideal for remote control	3.2	2.55

NFC transceiver

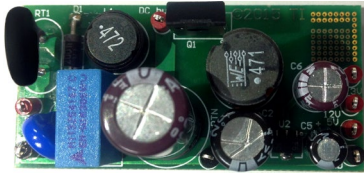
Item	Part Number	Description	Frequency	Standard	Output Power (mW)	Supply voltage (Vdc)	Operating Temperature Range (C)	Package Size (mm)	Package Type	Price* (US\$)
A.30	TRF7970	-	13.56 MHz	ISO 14443A,ISO 14443B, JIS X 6319-4,ISO 15693,ISO 18000-3,ISO 18092	100,200	2.7 to 5.5	-40 to 110	5 x 5	32QFN	3.1

I2C/IO Expander

Part Number	Voltage Nodes (V)	Max Frequency (kHz)	# of I/Os	Special Features	Operating Temperature Range (C)	Approx. Price (US\$)
TCA9535	1.8, 2.7, 3.3, 3.6, 5	400	16	5V Tolerant I/O, Configuration Registers, Interrupt Driven, Interrupt Output, Low Power, Low Voltage, Push-Pull I/O Type	-40 to 85	0.85
TCA6408A	1.8, 2.7, 3.3, 3.6, 5	400	8	5V Tolerant I/O, Configuration Registers, Interrupt Driven, Interrupt Output, Low Power, Low Voltage, Push-Pull I/O Type, Reset Input	-40 to 85	0.59
PCA9306	-	400	2	Enable Pin, Open-Drain I/O Type, 5V Tolerant I/O	-40 to 85	0.24
TCA9517	-	400	2	Bus Repeater, Enable Pin, Low Voltage, Open-Drain I/O Type	-40 to 85	0.58



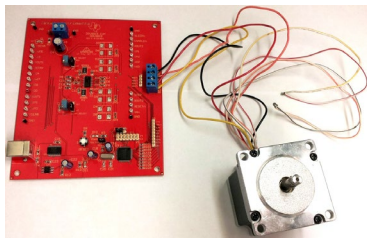
Simple and Robust Bias Power Supply with Low Standby for Home Appliances



This reference design is a multiple output (12 V, 3.3 V/5 V), 2.4 W bias power supply for home appliances using a low-cost quasi-resonant pulse-width modulation (PWM) controller. The design supports the conversion of wide-range direct current (DC) inputs ranging from 90V DC to 425V DC or AC input ranging from 85 VAC to 300 VAC to standard power rails of 12 V and 3.3 V/5V. TIDA-00434 is able to achieve reduced switching losses using a buck power stage operating in discontinuous mode with valley switching. The design offers high efficiency (>70 percent) and low stand-by power of <100 mW when the system is in idle mode. The design uses a low-cost external 800V BJT as a switch, providing higher operating voltage margins. The PWM controller has an integrated safety feature that turns off the external switch in case of a loss of feedback, which helps prevent high-output voltages. Reconfiguring the design for different output-voltage and standby power-consumption levels is easier with simple resistor-value changes. Overall, the design offers a simple and rugged bias power supply with low standby power.

<http://www.ti.com/tool/TIDA-00434>

Stepper Motor System with Medium Torque Drive



This bipolar stepper motor system implements an MSP430, a DRV8818, and a NEMA 23 motor. It's suitable for applications requiring up to 140 oz-in of torque, and up to 800 RPM. Motor voltage support is 8V to 35V, and max current is 2.5A. A multitude of configuration options allow fine tuning of the current waveform, including the regulated current level, the microstepping applied, H-bridge FET states during current decay, the time interval of current decay, and current deglitch time. The motor drive stage has integrated protection from short-circuit, shoot-through, under-voltage, and over-temperature.

<http://www.ti.com/tool/TIDA-00111>

Low Voltage Brushed Motor System



This brushed motor system implements an MSP430™ microcontroller, a DRV8837 brushed DC motor driver, and a 12 V brushed motor. It is suitable for applications requiring up to 10300 RPM under no load condition. The system is 19 mm by 33 mm excluding the motor, making it ideal for applications that require a small footprint. Motor power supply-voltage support is 1.8 V to 11 V, and max current is 1.8 A. Several configuration options allow for easy control over the speed of the motor's rotation, changing the direction of rotation and sending the system into a low-power state when not in operation to reduce power consumption. The motor-drive stage has integrated protection from short-circuit, shoot through, under voltage, and over temperature.

<http://www.ti.com/tool/TIDA-00115>

Humidity & Temp Sensor Node for Sub-1GHz Star Networks Enabling 10+ Year Coin Cell Battery Life



This TI Designs reference design uses Texas Instruments' nano-power system timer, boost converter, SimpleLink™ ultra-low power sub-1-GHz wireless microcontroller unit (MCU) platform, and humidity sensing technologies to demonstrate an ultra-low power method to duty-cycle sensor end nodes leading to extremely long battery life. The reference design includes techniques for system design, detailed test results, and information to get the design up and running quickly.

<http://www.ti.com/tool/TIDA-00484>

Air conditioner solutions

TI Designs



Humidity & Temp Sensor Node for Star Networks Enabling 10+ Year Coin Cell Battery Life Ref Design



This TI Designs reference design uses a Texas Instruments, nanopower system timer, SimpleLink™ ultra-low power wireless MCU platform, and humidity-sensing technologies to demonstrate an ultra-low power method to duty-cycle sensor end nodes. These technologies lead to an extremely long battery life: over 10 years with a standard CR2032 lithium-ion coin-cell battery. This reference design uses the HDC1000.

<http://www.ti.com/tool/TIDA-00374>

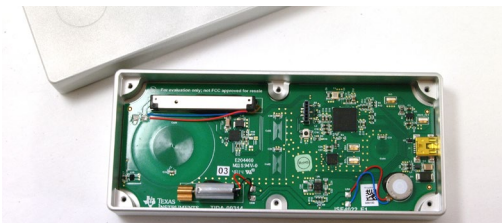
16-Button Inductive Keypad Reference Design Using the LDC1314 Inductance-to-Digital Converter



The LDC1314's unique inductive-sensing capability is used to implement a contactless, 16-button, multi-function keypad. It uses standard PCB technology and easily manufactured components to implement a low-cost solution. This reference design uses the LDC1314 but can also be used with the LDC1312, LDC1612 and LDC1614.

<http://www.ti.com/tool/TIDA-00509>

Touch on Metal Buttons with Integrated Haptic Feedback Reference Design

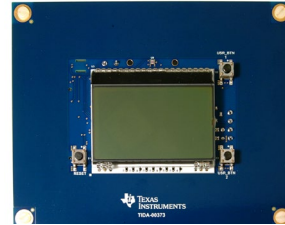


This TI Designs reference design uses Texas Instruments' inductance-to-digital converter technology to provide a

high-precision method to sense button presses on a metal surface, while TI's haptic drivers provide high-quality haptics feedback to the user. This reference design demonstrates techniques for system design, environmental compensation and electromagnetic interference protection.

<http://www.ti.com/tool/TIDA-00314>

Backlight and Smart Lighting Control by Ambient Light and Proximity Sensor Reference Design



This system conserves power and extends backlight life by dynamically adjusting the backlight brightness relative to the environment's ambient light. A capacitive proximity sensor wakes up the system when the user is close, to save even more power. This reference design uses the HDC1000 but can also be used with the HDC1008.

<http://www.ti.com/tool/TIDA-00373>

Remote Controller of Air Conditioner Using Low Power Microcontroller



This TI Designs reference design demonstrates an ultra-low power general-purpose infrared remote-controller solution. An ferroelectric random access memory (FRAM) based MSP430FR4133-supports necessary features like a real-time clock (RTC), button scan, infrared code sending, light-emitting diode (LED) backlight and liquid crystal display (LCD).

Features:

- Ultra-low power system with long battery life: as low as 3 μ A standby current with the LCD and RTC on.
- Highly integrated ultra-low power FRAM MCU enables minimum external components.
- Full functional demonstration includes battery detection, key scan, RTC and infrared signal transmitting for the remote controller.
- Software-optimized for real remote controlling of air conditioner applications.
- Easy evaluation, ready to use.

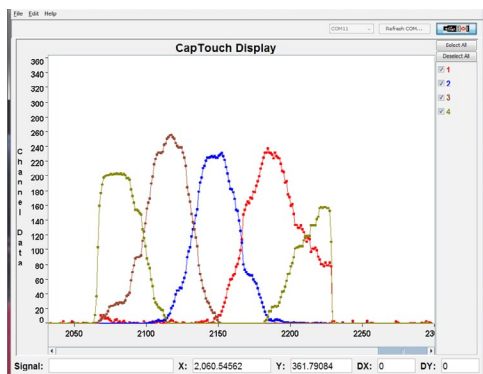
<http://www.ti.com/tool/TIDM-REMOTE-CONTROLLER-FOR-AC>

Air conditioner solutions

TI Designs

TI Designs

MSP430 Touch Pro GUI



The MSP430™ Touch Pro tool is a PC-based tool that can be used to verify capacitive-touch-button, slider and wheel designs. The tool receives and visualizes capacitive-touch sensor data to help the user quickly and easily evaluate, diagnose, and tune button, slider, and wheel designs.

Features:

- Receive real-time data from a target board, including up to 10 signals.
- Points connected or bar-chart display styles for viewing real-time data waveforms
- User-configurable automatic ranging or manual ranging of the y-axis.
- Data recording and recall.
- Print waveforms.
- User-selectable individual-signal or multiple-signal waveform display.

<http://www.ti.com/tool/msptouchprogui>

High-Voltage Motor Control Kit with InstaSPIN-FOC and InstaSPIN-MOTION Enabled Piccolo MCU



The InstaSPIN-FOC™ and InstaSPIN-MOTION™ technology-based high-voltage motor control kit provides an easy way to evaluate the Piccolo microcontroller and TI analog in a

high-voltage environment for spinning three-phase induction, brushless DC (BLDC) and brushless AC

(BLAC), or permanent magnet synchronous (PMSM) motors. The motor-driver stage can be driven from either an onboard AC/DC rectifier or separate DC power and accepts up to 400 V and outputs up to 1.5 kW of power.

<http://www.ti.com/tool/TMDSHVMTRINSPIN>

Piccolo F2805x High Voltage Motor Control Developer's Kit



The Piccolo™ F2805x high-voltage motor control developer's kit provides a high-voltage development platform for Piccolo microcontroller unit (MCU) based digital control of high voltage motors. The kit has a universal alternating current (AC) input (110-240 VAC) and supports a rated output of 750 W, regulated by closed-loop control. All three common types of three-phase motors can be spun: AC induction (ACI), BLDC, PMSM. The Piccolo F2805x MCU controls (sensored or sensorlessly) each type of motor using closed loop control (trapezoidal, variable frequency, or field oriented control).

Software, support, example projects, libraries, and documentation for this kit are provided completely free through the C2000™ controlSUITE™ software platform. Motor-control libraries providing modular code blocks can greatly simplify the development process.

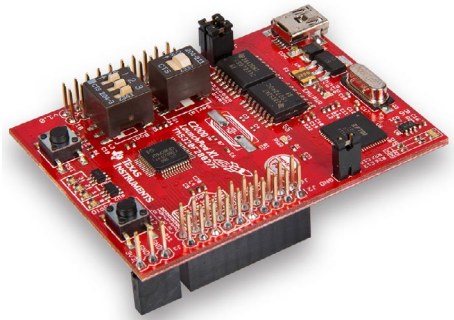
<http://www.ti.com/tool/TMDXHVMTRKIT5X>

Air conditioner solutions

TI Designs



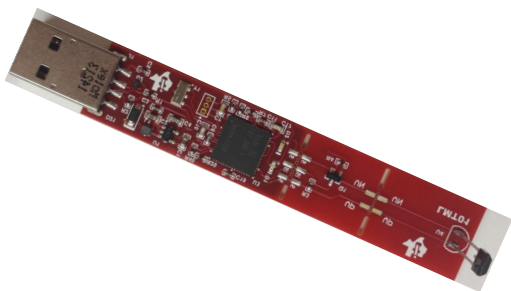
InstaSPIN™-FOC Enabled C2000 Piccolo LaunchPad



The C2000™ Piccolo™ LaunchPad is an inexpensive, modular, and fun evaluation platform, enabling you to dive into real-time, closed-loop control development with Texas Instruments' C2000™ 32-bit microcontroller family. This platform provides a great starting point for development of many common-power electronics applications, including motor control, digital power supplies, solar inverters, digital light-emitting diode (LED) lighting, precision sensing and more.

<http://www.ti.com/tool/launchxl-f28027f>

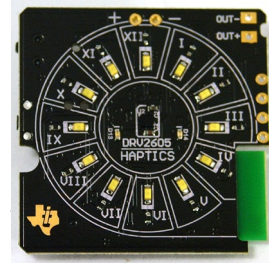
LMT01 Evaluation Module



The LMT01 evaluation module (EVM) allows users to evaluate the performance of the LMT01 two-pin digital-temperature sensor. The EVM comes in a USB stick form-factor package with an onboard MSP430F5528 microcontroller that interfaces with the host computer's USB port and the LMT01 device. The EVM features perforated breakout slots that the user can break apart to separate the EVM and LMT01 device for remote measurements with long wires.

<http://www.ti.com/tool/LMT01EVM>

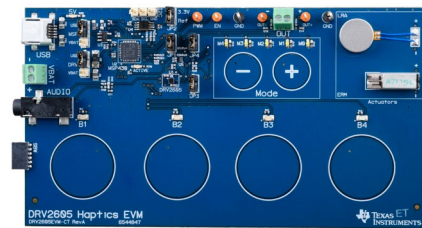
Haptic Bluetooth® Kit



The haptic *Bluetooth*® kit is a complete evaluation and design kit for prototyping haptic feedback in any application. The board features the DRV2605 eccentric rotating mass motor (ERM) and linear resonant actuator (LRA) haptic driver with an integrated effect library licensed from Immersion. The board also includes an LRA, alkaline battery support, and can be programmed and controlled by the included iOS app via the SimpleLink *Bluetooth*® Low Energy CC2541 wireless MCU.

<http://www.ti.com/tool/DRV2605EVM-BT>

DRV2605EVM-CT ERM/LRA Haptic Driver Evaluation



The DRV2605 is a haptic driver designed for LRA and ERM motors. The kit includes a microcontroller, linear actuator, ERM motor, sample waveforms and capacitive touch buttons that you can use to completely demonstrate and evaluate the DRV2605. You also have access to Immersion's royalty-free effect library.

<http://www.ti.com/tool/DRV2605EVM-CT>

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Korea	080-551-2804
Malaysia	1-800-80-3973
New Zealand	0800-446-934
Philippines	1-800-765-7404
Singapore	800-886-1028
Taiwan	0800-006800
Thailand	001-800-886-0010
International	+86-21-23073444
Fax	+86-21-23073686
Email	tiasia@ti.com or ti-china@ti.com
Internet	support.ti.com/sc/pic/asia.htm

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