

White Goods Solutions Guide



White Goods Solutions

Design Considerations / Key System Block Diagrams

Design Considerations

Energy Efficiency

White goods motors are often oversized to account for the load torque changes and transients. Scalar techniques for control can result in inefficient systems and noisy operation. This, in turn, leads to a mediocre energy efficiency that hovers in the 40% to 50% range. By implementing the control system with TI's digital signal controllers, designers are able to implement smaller, quieter motors with energy efficiency as high as 85% to 90%.

Power Factor Correction (PFC)

PFC is a technique of counteracting the undesirable effects of electric loads that create a power factor that is less than one. In washing machines, PFC is needed because of the continuous transients and surge currents exhibited by the electric motor during the wash cycle, for example. With TI products, PFC can be performed externally with a separate integrated circuit or it can be done in software on a microcontroller eliminating the need for a separate external PFC controller.

IEC 60730 Compliance

White goods manufacturers continually introduce new design enhancements to their automatic electronic controls that ensure safe, reliable and efficient operation of the equipment. Among other things, the IEC 60730 specification discusses mechanical, electrical, electronic, EMC and abnormal operation of AC appliances. For microcontrollers, the specification details new test and diagnostic methods for the real-time embedded software to ensure the safe operation of embedded control hardware and software. Many TI microcontrollers offer software libraries to assist with IEC60730 class compliance. In 2009, IEC changed the definition of a low-power circuit from 100 W to 15 W. All user-accessible controls must be low-power circuits. For more information, please visit ti.com/safeti.

Power Management

Offline 12-V to 24-V power supply lines are typically available in most homes. TI offers buck controllers and linear regulators that convert this offline voltage to something the microcontroller on the thermostat or indoor controller unit can use – 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.

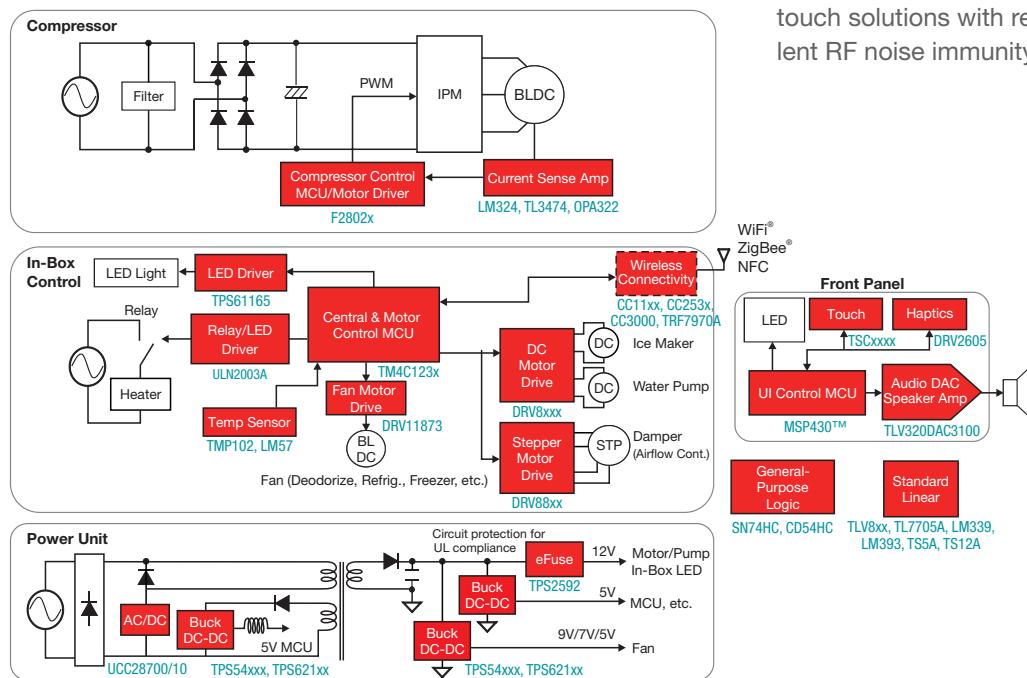
Smart Appliance

A home mesh network consists of home appliances connected wirelessly and controlled via a remote control. TI provides customers with ZigBee-compliant solutions, proprietary RF-ICs, Wi-Fi® and near field communication (NFC). TI has proven software and hardware solutions supporting each of these communication interfaces.

Touch Control

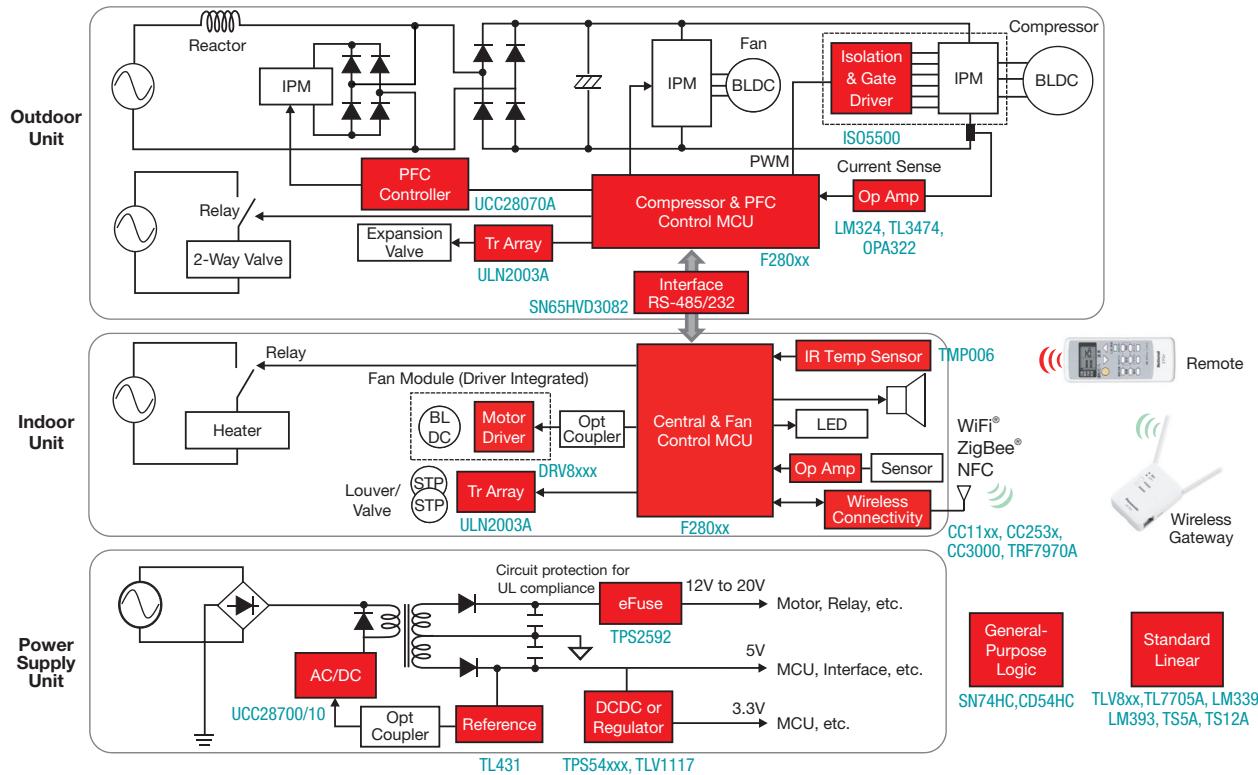
The use of touch control has moved beyond the high-end market to a wide range of applications. Touch controls typically take the form of a button or a slider, but touch controls on the electronic display are increasing. Haptic feedback can provide touch interfaces with the tactile response that users are accustomed to from mechanical controls. TI provides a wide range of touch solutions with reliable and excellent RF noise immunity.

Refrigerator

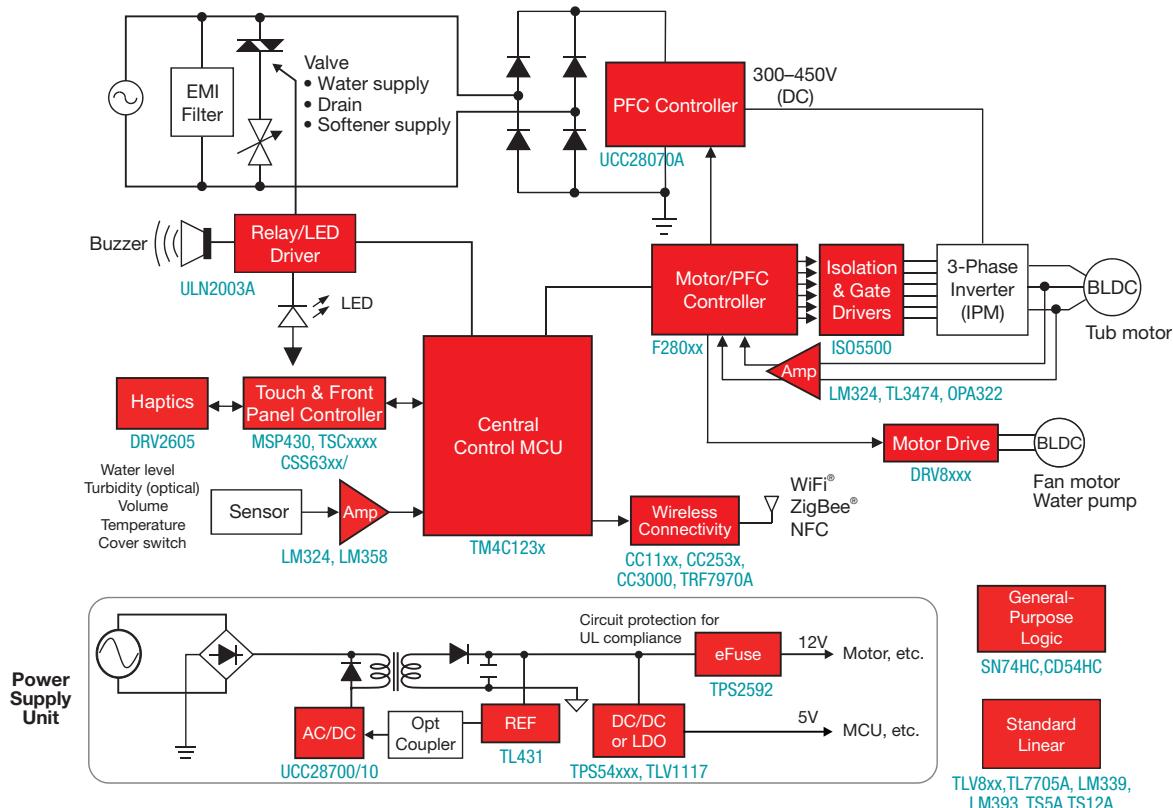


Key System Block Diagrams

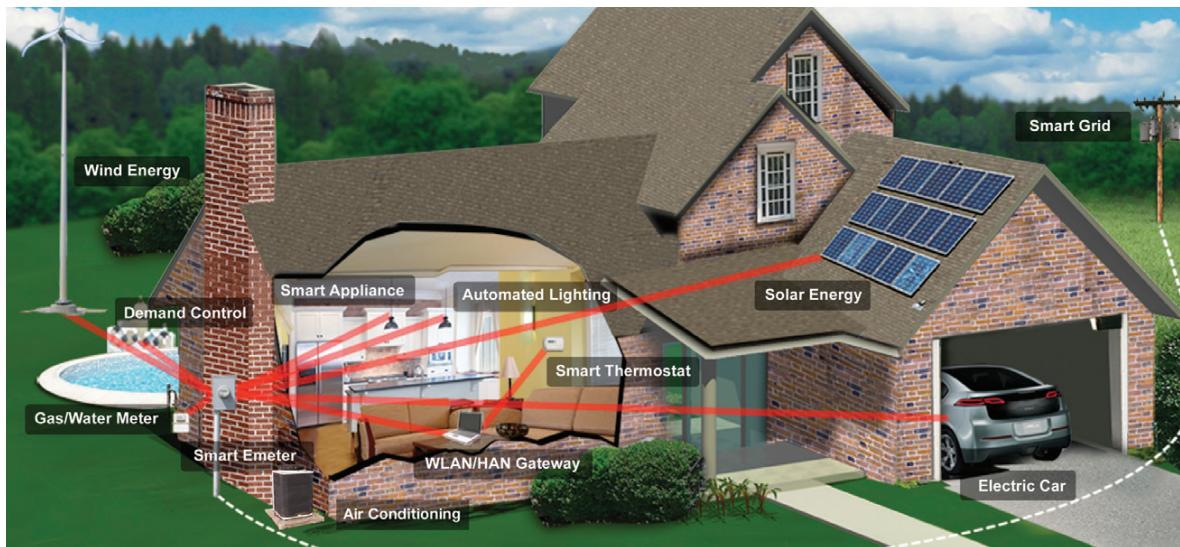
Air Conditioner



Washing Machine



Smart Home and Building (HAN) Solutions



The home area network (HAN) refers to the ecosystem of devices within the home that are connected to the smart grid through a smart meter, a home energy gateway, or directly in some cases. Some examples of these devices are in-home displays (IHDs) for power-consumption monitoring (see block diagram), smart appliances that respond to time-of-use pricing signals, smart thermostats that cycle the air conditioning in response to peak-load-reduction signaling from the utilities, or smart plugs that can monitor power consumption and control appliances.

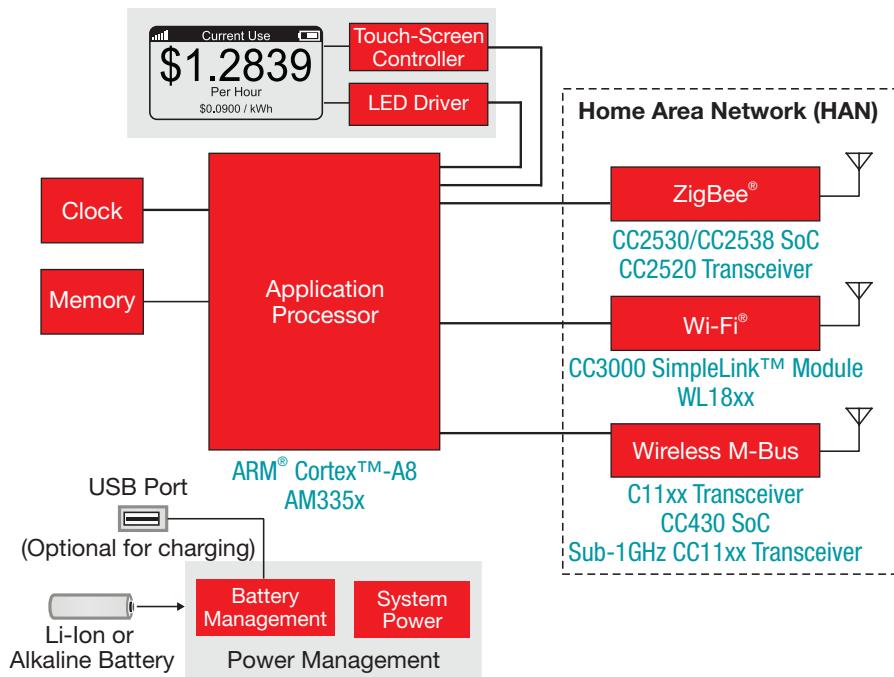
Activities in the HAN can be broadly split into three categories: Measurement, communication and control. TI has comprehensive solutions to address each of these three categories.

Measurement refers to the metrology or power and energy measurement piece that is addressed by a suite of our solutions based on the MSP430™ microcontroller. Communications between the smart meter and devices can be via a wireless standard such as ZigBee®. Devices in the HAN might communicate with each other via power line communications (PLC), ZigBee or other wireless standards such as Wi-Fi®. Powering and connecting more advanced systems requiring

higher performance or a graphical user interface, TI offers the Sitara™ processor. TI has proven software and hardware solutions supporting each of these communication interfaces. The last piece of the HAN is controlling the components based on the measurement and communication. This can be done by using IHDs or via a web portal. It can also be done by sending signals directly to load controllers or smart plugs.

Part Number	Description
AM335x	<ul style="list-style-type: none"> Up to 1-GHz Cortex™-A8 32-bit RISC microprocessor Extensive peripheral set (2× Gbit-Ethernet, CAN, USB, 8× UARTs extended from PRU, ...) Flexible communication protocols Linux™ community, Android™, Windows® Embedded CE, DSP/BIOS™ and RTOS ecosystem of development partner.
WL18xx	WiLink™ connectivity for AM335x
TPS650250	Low-cost power management IC for the AM335x processor

In-Home Display



Selection Guide for White Goods

Microcontroller, Wireless and Motor Driver Selection

Central / Motor Control MCU

Part Number	MHz	Flash (kB)	RAM (kB)	VREG (POR/BOR)	Analog Comp.	12-Bit ADC # of Chan.	ADC Sampling (MSPS)	PWM (HRPWM) Outputs	Capture Inputs	Communication Ports	Price (U.S.\$)*
C2000™ Family											
F280200	40	16	6	Yes	1/2	7/13	2	9 (0)	0	SPI, SCI, I ² C	1.85–2.01
F28020	40	32	6	Yes	1/2	7/13	2	9 (0)	1	SPI, SCI, I ² C	1.99–2.23
F28021	40	64	10	Yes	1/2	7/13	2	9 (0)	1	SPI, SCI, I ² C	2.20–2.45
F28022	50	32	12	Yes	1/2	7/13	3.8	9 (4)	1	SPI, SCI, I ² C	2.25–2.76
F28023	50	64	12	Yes	1/2	7/13	3.8	9 (4)	1	SPI, SCI, I ² C	2.45–3.00
F28026	60	32	12	Yes	1/2	7/13	4.6	9 (4)	1	SPI, SCI, I ² C	2.65–3.24
F28027	60	64	12	Yes	1/2	7/13	4.6	9 (4)	1	SPI, SCI, I ² C	2.85–3.47

Part Number	Core	MHz	Flash (kB)	SRAM (kB)	USB	CAN	PWM Units	QEI	Price (U.S.\$)*
Cortex™-M Family									
TM4C123F/G	Cortex-M4F	80	128–256	32	H/D/OTG	2	16	2	4.52–5.25
TM4C123B/A	Cortex-M4F	80	128–256	32	—	2	16	2	3.40–3.90
TM4C1236/7	Cortex-M4F	80	32–256	12–32	H/D/OTG	2	—	—	4.41–5.11
TM4C1232/3	Cortex-M4F	80	32–256	12–32	D	2	—	—	4.35–4.99
TM4C1230/1	Cortex-M4F	80	32–256	12–32	—	2	—	—	3.27–3.80

Cap Touch / Remote Control MCU

Part Number	Flash (kB)	RAM	Capacitive Touch I/O	Touch Buttons Supported	ADC	USCI (UART, I ² C, 2× SPI)	Additional Features	Price (U.S.\$)*
MSP430™ Family								
MSP430G2x02	1–8	256 B	✓	≤ 16	—	—	—	Call
MSP430G2x32	1–8	256 B	✓	≤ 16	10 bit	—	—	Call
MSP430G2x03	2–16	512 B	✓	≤ 24	—	✓	—	Call
MSP430G2x33	2–16	512 B	✓	≤ 24	10 bit	✓	—	Call
MSP430F51x1	8–32	1–2 kB	—	≤ 29	—	✓	High-res. timer D	Call
MSP430F51x2	8–32	1–2 kB	—	≤ 29	10 bit	✓	High-res. timer D	Call

Wireless Connectivity

Part Number	Function	Category	Key Feature	Pin/Package	Price (U.S.\$)*
CC1120	Sub-1 GHz	Proprietary RF	High performance, narrowband, –123-dBm sensitivity	32 QFN	2.20
CC110L	Sub-1 GHz	Proprietary RF	Cost-optimized, –116-dBm sensitivity	20 QFN	1.45
CC2520	2.4 GHz	ZigBee®/IEEE 802.15.4	8051 MCU (up to 256KB Flash), –98-dBm sensitivity	28 VQFN	1.80
CC2530	2.4 GHz	ZigBee/IEEE 802.15.4	Soc; 8051 MCU (up to 256KB Flash), –97-dBm sensitivity	40VQFN	2.75–3.63
CC2538	2.4 GHz	ZigBee/IEEE 802.15.4	Soc; Cortex™-M3 MCU (up to 512K Flash, 32K RAM)	56 QFN	4.20
CC3000	Wi-Fi®	802.11 b/g	Simple APIs, SmartConfig™ Technology, Service Discovery	Module	9.99
CC430F6147	Sub-1 GHz	MCU + FR SoC	Sub-1-GHz SoC, LCD; CC1101 transceiver, MSP430™ MCU	64V QFN	3.20
TRF7970A	NFC	NFCIP-1, NFCIP-2	RFID/NFC transceiver, fully integrated protocol handling	32 QFN	3.10

Motor Driver

Part Number	Motor Type	Special Features	Vs (Min) (V)	Vs (Max) (V)	Peak Output Current (A)	RMS Output Current (A)	Control I/F	Price (U.S.\$)*
DRV8800/1	Brushed DC	Current sense (8801)	8	36	2.8	2	PH/EN, PWM	1.25
DRV8802	Brushed DC	Dual, inrush protection	8	45	1.6	1.1	PH/EN	1.65
DRV8412	Brushed DC, Stepper	1× brushed @ 12A	0	52.5	6	3	PWM	3.85
DRV8814	Brushed DC, Stepper	4-level current regulation	8	45	2.5	1.7	PH/EN	2.25
DRV8812	Brushed DC, Stepper	4-level current regulation	8.2	45	1.6	1.1	PH/EN	1.65
DRV8823	Brushed DC, Stepper	SPI control interface	8	32	1.5	1	Serial	2.00
DRV8835	Brushed DC, Stepper	2-V operation, dual supplies	2	11	1.5	1.5	PWM or PH/EN	0.70
DRV8824	Stepper driver	On-chip 1/32 microstepping indexer (Step/Dir Ctrl)	8.2	45	1.6	1.1	Indexer	1.62
DRV8301/2	3-Phase brushless	Pre-driver, 1.5-A step-down regulator, dual current-sense amp (SPI control: 8301, HW control: 8302)	8	60	Ext FETs	Ext FETs	PWM	2.50
DRV8313	3-Phase brushless	On-chip comparator	8	60	2.5	1.75	PWM	2.25
DRV11873	3-Phase brushless	5-V LDO output, sensorless BEMF control	5	16	1.5	1.5	PWM	0.79

Relay/Valve Drivers

Part Number	Special Feature	# of Drivers	Switching Voltage (Max) (V)	Peak Output Current (mA)	Delay Time (Typ)(ns)	Output Voltage (Max) (V)	Pin/Package	Price (U.S.\$)*
ULN2003V12	Low power	7	16	1000	80	16	16 SOIC, 16 TSSOP	0.16
TPL9201	5V LDO, zero-volt detection	8	16.5	150	10, 80	16.5	20 HTSSOP, 20 PDIP	0.65
ULN2003A	2.7-kΩ series base resistor	7	50	500	250	50	16 PDIP, 16 SO, 16 SOIC, 16 TSSOP	0.21
ULN2004A	10.5-kΩ series base resistor	7	50	500	250	50	16 PDIP, 16 SO, 16 SOIC	0.22
ULN2803A	2.7-kΩ series base resistor	8	50	500	130	50	18 PDIP, 18 SOIC	0.45
DRV120	Current loop regulation	1	26	250	—	26	14 TSSOP, 8 TSSOP	1.00
DRV8806	Serial interface to control output	4	40	1000	50	40	16HTSSOP	1.25

*Suggested resale price in U.S. dollars in quantities of 1,000.

New products are listed in bold red. Preview products are listed in bold teal.

Selection Guide for White Goods

Analog IC Selection

Isolation / Gate Driver

Part Number	Description	# of Channels	V _{CC} (Min) (V)	V _{CC} (Max) (V)	V _{peak} Isolation (kV)	V _{rms} Isolation (kV)	Transient Immunity (kV/μs) (typ)	Pin/Package	Price (U.S. \$)*
ISO7241C	Quad channel, 3/1, 25 Mbps, digital isolator	4	2.8	5.5	4	2.5	50	16 SOIC	1.80
ISO7421	Dual channel, 1/1, 1 Mbps digital isolator	2	3.15	5.25	4	2.5	50	8 SOIC	1.06
ISO1541	Bidirectional I ² C data, unidirectional clock isolators	2	3	5.5	4	2.5	50	8 SOIC	1.80
ISO1540	Bidirectional I ² C isolators	2	3	5.5	4	2.5	50	8 SOIC	1.80
ISO5500	2.5-A isolated IGBT, MOSFET gate driver	1	3 15	5.5 30	6	—	50	16 SOIC	3.00

Operational Amplifier

Part Number	Description	# of Channels	Supply Voltage (Min) (V)	Supply Voltage (Max) (V)	GBW (Typ) (MHz)	Slew Rate (Typ) (V/μs)	CMRR (Min) (dB)	V _n at 1 kHz (Typ) (nV/rtHz)	V _{io} (25°C) (Max) (mV)	IIB (Max) (pA)	I _q per Channel (Max) (mA)	Price (U.S. \$)*
LM324	Quad general-purpose op amp	4	3	32	1.2	0.5	65	35	7	250000	0.3	0.10
LM358	Dual general-purpose op amp	2	3	32	0.7	0.3	65	40	7	250000	0.6	0.10
TL3472/4	High-slew-rate op amp	2/4	4	36	5	13	65	49	10	500000	4.5	0.31–0.67
OPAxx322	High-slew-rate op amp	1/2/4	1.8	5.5	20	10	90	8.5	2	10	1.9	0.50–0.95
OPAxx348	General-purpose op amp	1/2/4	2.1	5.5	1	0.5	70	35	2	10	0.065	0.20–0.60

Comparator

Part Number	Description	# of Channels	V _s (Min) (V)	V _s (Max) (V)	t _{RESP} Low-to-High (μs)	V _{io} (25°C) (Max) (mV)	I _q per Channel (Max) (mA)	Output Type	Input Bias Current (+/-) (Max) (nA)	Price (U.S. \$)*
LM339/393	Differential comparator	2/4	2	36	0.3	5	0.5	Open drain	50	0.10

Temperature Sensor and Switch

Part Number	Interface	Special Features	Local Sensor Accuracy (Max) (± °C)	Supply Voltage (Min)(V)	Supply Voltage (Max)(V)	Monitor Temperature Range (°C)	I _q (Typ) (μA)	Pin/Package	Price (U.S. \$)*
LM57	Analog output	Programmable trip point switch	0.7	2.4	5.5	-50 to 150	24	8 WSON	0.65
LM94022	Analog output	Selectable gain setting	1.5	1.5	5.5	-50 to 150	5.4	5 SC70	0.37
TMP102	I ² C, SMBus	Programmable alert	2	1.4	3.6	-50 to 150	10	6 SOT	0.75
TMP006	I ² C, SMBus	Contactless IR thermopile sensor	1	2.2	3.6	-50 to 150	240	8 DSBGA	1.50

Cap Touch Switch and Resistive Multi-Touch Controller

Part Number	Description	Resistive Multi-Touch Gesture Capable	# of Capacitive Switch	Sink Current for LED Drive (typ) (mA)	Control Interface	MCU Core	Pin/Package	Price (U.S. \$)*
CSS6308	8-ch capacitive switch and multi-touch resistive touch-screen controller	Zoom in, Zoom out, Swipe, Rotation	8	25	I ² C, SPI	32-bit Cortex™-M0	36 QFN	Call

Capacitive Touch-Screen Controller

Part Number	Description	Screen Size	Max Nodes	Proximity Detection	Water Rejection	Grip Suppression	Control Interface	Architecture	Price (U.S. \$)*
TSC3060	16-ch capacitive touch-screen AFE	< 3.2"	60	Yes	Yes	No	I ² C	AFE + Digital state machine	Call
TSC4270	33-ch capacitive touch-screen controller	< 7"	270	Yes	Yes	Yes	I ² C	AFE + ARM Cortex-M0 + DSP filter	Call

Resistive Touch-Screen Controller

Part Number	Touch Panel	Supply Voltage (Min) (V)	Supply Voltage (Max) (V)	Control Interface	ESD Contact Discharge	Pin/Package	Price (U.S. \$)*
TSC2046E	Resistive 4-wire	2.2	5.25	SPI	15 kV	16 TSSOP, 16 VQFN	0.80
TSC2007	Resistive 4-wire	1.2	3.6	I ² C	15 kV	12 DSBGA, 16 TSSOP	1.75

Haptics Driver

Part Number	Description	Haptic Actuator Type	Input Signal	Boost Converter	Output V _{pp} (Max) (V)	Internal Waveform Memory	Supply Voltage (Min) (V)	Supply Voltage (Max) (V)	Pin/Package	Price (U.S. \$)*
DRV8662	Piezo haptic driver	Piezo	PWM, Analog	105 V	200	—	3	5.5	20 QFN	1.75
DRV2667	Piezo haptic driver with digital front end	Piezo	I ² C, PWM, Analog	105 V	200	RAM	3	5.5	20 QFN	2.95
DRV2605	ERM/LRA haptic driver with smart loop architecture	ERM, LRA	PWM, Analog, I ² C	—	10	ROM	2.5	5.5	9 DSBGA	1.60

ESD Protection

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 (U.S. \$)*
TPD2E009	ESD protection array for high-speed interfaces	2	8	8	0.7	9	10	0.15
TPD2S017	Ultra-low clamp voltage ESD protection	2	11	—	1	11	10	0.14
TPD4E1U06	High-speed ESD protection device	4	15	15	0.7	6.5	—	0.08

*Suggested resale price in U.S. dollars in quantities of 1,000.

New products are listed in bold red. Preview products are listed in bold teal

Selection Guide for White Goods

Power IC Selection

AC/DC (Quasi-Resonant Current Mode PWM Controller)

Part Number	Power (Max) (W)	No-Load Power (mW)	Output Regulation (Max) (%)	Constant Current (%)	Frequency (Max) (kHz)	Green Mode	Soft Start	700-V Start-up	Cable Compensation	Price (U.S.\$)*
LM5023	70	< 10 mV	1	±5	130	Yes	Yes	—	—	Call
UCC28700	20	< 30 mV	±5	±5	132	Yes	Yes	—	Yes	0.35
UCC28710	25	< 10 mV	±5	±5	100	Yes	Yes	Yes	Yes	0.42

PFC Controller (Continuous Conduction Mode)

Part Number	Recommended Power Range (W)	# of Phase	Frequency Range (kHz)	Operating Supply Voltage (Max) (V)	V _{ref} Tolerance (%)	Duty Cycle (Max) (%)	Practical Operating Frequency (Max) (MHz)	UVLO Thresholds On/Off (V)	Price (U.S.\$)*
UCC28070A	> 800	Dual	10 to 300	21	3	99	0.3	10.2/9.2	1.95
UCC28019A	200 to 800	Single	57 to 71	21	2	—	—	10.5/9.5	0.75
UCC2818A	200 to 800	Single	6 to 220	18	1.5	100	0.25	10.5/10	1.25

DCDC Switching Regulator

Part Number	V _{in} (Min) (V)	V _{in} (Max) (V)	V _{out} (Min) (V)	V _{out} (Max) (V)	I _{out} (Max) (A)	Switch Current Limit (Typ)(A)	Synchronous	High Light-Load Efficiency	Duty Cycle (Max) (%)	Price (U.S.\$)*
TPS54227/8	4.5	18	0.76	7	2	3.3	✓	✓ (228)	90	0.80/0.82
TPS54231/331	3.5	28	0.8	25	2 / 3	3.5 / 5.8	—	✓	90	0.70/0.75
TPS54327/8	4.5	18	0.76	7	3	4.2	✓	✓ (328)	90	1.20/1.25
TPS54627/8	4.5	18	0.76	5.5	6	7.3	✓	✓ (628)	85	Call
TPS54335/336	4.5	28	0.8	25	3	5	—	✓	90	1.05
TLV62130/50	4	17	0.9	5	1 / 3	1.7 / 4.2	✓	✓	100	0.75/0.90
LM25007/10/11	9	42	2.5	37	0.5 / 1 / 2	0.7 / 1.2	—	—	90	1.05/1.15/1.30
LM34919	6	40	2.5	30	0.6	0.64	—	—	90	1.20
LM25017	9	48	1.23	40	0.65	1.02	✓	—	90	1.25
LMR12010	3	20	0.8	16	1	1.7	—	—	92	0.79
LMR14203/06	4.5	42	0.8	34	0.3 / 0.6	0.5 / 1.15	—	—	87	0.90/1.01
LMR24210/20	4.5	42	0.8	24	1 / 2	1.8 / 2.8	✓	—	85	1.50/2.00

Linear Regulator

Part Number	Output Options	LDO	V _{in} (Min) (V)	V _{in} (Max) (V)	V _{out} (Min) (V)	V _{out} (Max) (V)	I _{out} (Max) (A)	Fixed Output Options (V)	Price (U.S.\$)*
UA7805/08/10/12/15/24	Fixed	—	7	38	—	—	1.5	5/8/10/12/15/24	0.29
LM317	Adjustable	—	4.2	40	1.2	37	1.5	—	0.29
TLV1117-xx	Adjustable, Fixed	✓	2.7	15	1.25	13.7	0.8	1.5/1.8/2.5/3.3/5	0.28
LP2950/51	Adjustable, Fixed	✓	5.4	30	1.235	30	0.1	3.0/3.3/5	0.13

Shunt Reference

Part Number	Description	V ₀ Adj (Min) (V)	V ₀ Adj (Max) (V)	Initial Accuracy @ 25°C (%)	Initial Accuracy (Max) (%)	Min I _z for Regulation (µA)	I _{out} /I _z (Max) (mA)	Temp Coeff (Typ) (ppm/°C)	Temp Coeff (Max) (ppm/°C)	Price (U.S.\$)*
TLV431	Low-voltage adjustable shunt reference	1.24	6	1.5	1.5	55	15	39	129	0.23
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
TL431	Adjustable shunt reference	2.495	36	1	1	400	100	34	92	0.11
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

Supervisor and Reset IC

Part Number	# of Supplies Monitored	Threshold Voltage (Typ) (V)	V _{CC} (Min) (V)	V _{CC} (Max) (V)	I _q (Typ) (µA)	Output Driver Type / Reset Output	Reset Threshold Accuracy (%)	Time Delay (ms)	Pin / Package	Price (U.S.\$)*
TLV803M	1	4.38	1.1	6	9	Active low, open drain	2	200	3 SOT-23	0.20
TLV810S	1	2.93	1.1	6	9	Active high, push-pull	2	200	3 SOT-23	0.20

eFuse

Part Number	Description	V _{in} (Min) (V)	V _{in} (Max) (V)	V _{absmax} _cont (V)	Current Limit (Typ) (A)	Current Limit Accuracy	Fault Response	R _{ds(ON)} FET (Typ) (mOhms)	Pin/ Package	Price (U.S.\$)*
TPS2592	12-V eFuse with integrated blocking FET driver	4.5	15	22	2 to 5	±15% @ 2A	Auto retry	28	10 SON	Call

LED Backlight / In-Box Lighting

Part Number	Description	V _{in} (Min) (V)	V _{in} (Max) (V)	V _{out} (Min) (V)	V _{out} (Max) (V)	Switching Frequency (Max) (kHz)	Switch Current Limit (Typ) (A)	Dimming Method	Price (U.S.\$)*
TPS61040	Switch boost converter for white LED	1.8	6	1.8	28	1000	0.4	PWM	0.70
LM3410	High-brightness white LED driver	2.5	5.5	3	24	1600	2.8	PWM	1.11
TPS61165	High-brightness white LED driver	3	18	3	38	1200	1.2	PWM	1.10
LM3406	Constant current buck regulator for driving LEDs	4.5	30	0.45	27	1000	0.35	PWM	1.41

LED Illumination / Signage

Part Number	Description	Output Channels	Data Input	Data Transfer Rate (Typ) (MHz)	Per Ch Drive (mA)	LED Voltage (Max) (V)	Price (U.S.\$)*
TLC5916	8-bit constant-current LED sink driver	8	Serial	30	120	17	0.47
TLC59213	8-bit source driver with latch	8	Serial	1	500	13.2	0.70
TLC5973	12-bit PWM constant current LED driver with auto repeat	3	Single-Wire	3	50	21	0.45
TLC59731	8-bit PWM current sink LED driver with auto repeat	3	Single-Wire	0.6	50	21	0.28

*Suggested resale price in U.S. dollars in quantities of 1,000.

New products are listed in bold red. Preview products are listed in bold teal.

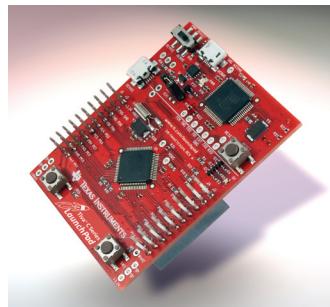
Getting Started with TI Motor Control Products

Evaluation Boards and Reference Design

Motor Control Solutions

EK-TM4C123GXL Tiva™ C Series LaunchPad

The Tiva C Series TM4C123G LaunchPad Evaluation Kit is a low-cost evaluation platform for ARM® Cortex™-M4F based microcontrollers. The Tiva C Series LaunchPad design highlights the TM4C123GH6 microcontroller's USB 2.0 device interface, Hibernation module, Motion Control PWMs and overall cost effectiveness. The Tiva C Series LaunchPad also features programmable user buttons and an RGB LED for custom applications.



DRV8412-C2-KIT

The DRV8412 evaluation kit (DRV8412-C2-KIT) includes everything needed to spin two brushed DC or a single stepper motor out of the box: the DRV8412 motor driver, a C2000 Piccolo F28035 MCU controlCARD, getting started GUI, software, code development environment, and motors. This highly integrated, robust motor-control and driver solution speeds development time for brushed and stepper motors running up to 6-A continuous / 12-A peak at 50 V. Typical applications include medical pumps, gate openers, stage lighting, textile manufacturing tools and industrial or consumer robotics.



Touch Control Solution

MSP430™ Capacitive Touch Hardware Development Kits

The Capacitive Touch BoosterPack (430BOOST-CAPTOUCH1) is a plug-in board for the MSP430 Value Line LaunchPad development kit (MSP-EXP430G2 – sold separately). The Capacitive Touch BoosterPack (U.S. \$10) features several capacitive touch elements including a scroll wheel, button and proximity sensor. Also, on-board are nine LEDs that provide instant feedback as users interact with the capacitive touch elements. In addition, a timer-based UART enables communication to a PC for feedback via GUI or hyperterminal. This BoosterPack also includes a pre-programmed MSP430G2452IN20 Value Line device.



DRV8312-69M-KIT

The DRV8312-69M-KIT is an InstaSPIN™-FOC and InstaSPIN-MOTION technology-based sensorless FOC motor control evaluation kit for spinning three-phase BLDC and brushless AC (BLAC) or PMSM motors. It allows developers to quickly identify, automatically tune and control a three phase motor, providing an "instantly" stable and functional motor control system.



TMDSHVMTRINSPIN

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.



LAUNCHXL-F28027 – C2000™ Piccolo™ LaunchPad

The Piccolo LaunchPad is an easy-to-use development tool that enables anyone to create digital control applications on a microcontroller (MCU). It features a 32-bit MCU and includes all the hardware and software needed to develop real-time control applications like motor control and digital power conversion.



DRV2605EVM-CT ERM/LRA Haptic Driver

The DRV2605 is a haptic driver designed for Linear Resonant Actuators (LRA) and Eccentric Rotating Mass (ERM) motors. The kit includes a microcontroller, linear actuator, eccentric rotating mass motor, sample waveforms and capacitive touch buttons which can be used to completely demonstrate and evaluate the DRV2605. You also have access to Immersion's royalty-free effect library.



TI's portfolio of high-performance analog products – from amplifiers and data converters to power-management and interface solutions – can meet your performance requirements. www.ti.com/analog

For various motor types; AC Induction (ACIM), Brushed DC, Brushless DC (BLDC), Permanent Magnet Synchronous and Stepper find the right devices, software and support to precisely control the position, velocity and torque.

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TI's solutions for touch-enabled applications include ultra-low power MSP430™ microcontrollers, capacitive and resistive touch-screen controllers as well as inertial and piezo haptic actuator drivers. www.ti.com/touch, www.ti.com/haptics

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Tiva™ C Series ARM® Cortex™-M4 microcontrollers offer embedded MCU designers the option of obtaining 32-bit performance for the same price as their current 8- and 16-bit microcontroller designs. Designers who migrate to Tiva C Series benefit from great tools, small code footprint, and outstanding performance. www.ti.com/tm4c

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