

Application Guide

Common Functional Block Circuits

Power ▪ Output ▪ Connectivity ▪ Sensing ▪ Processor

The core of all electronic devices are built using fundamental elements that contribute to the overall product function, feature and design.

KEY COMMON BLOCKS

Every electronic device contains one or more building blocks to successfully perform its designated function. This application guide outlines the 5 main functional systems, along with the applications, purpose and recommended Murata components for each block.

Power Electronics & Systems

AC-DC Converters & Inverters, DC-DC, Batteries, Energy Harvesting, PMIC, PoE, USB-PD, Wireless Charging

Manipulators

Motor / Actuator, Speaker (+Drivers)

Indicators

LED/LCD Displays, Gauges, Meters, Buzzers

Wired Data Transfer

Ethernet, USB, HDMI, MoCA/DOCSIS (+Controllers)

Wireless Data Transfer

RF Front End, BT, Wi-Fi®, Sub-GHz, RFID/NFC, LoRa, Zigbee, UWB, Sigfox, LTE

Environment / User Input Sensing

Temperature, Speed/Accel, Position, Distance, Sound, Light, Image, Gas, Air Flow, Vibration, Shock

Data Processing & Storage

CPU, APU, GPU Package, SoC, DSP + Memory

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KEY COMMON BLOCKS

Application block/product summary

Products used within each common functional block

	(Click on products to the right to view web page)	Capacitor	Timing	EMI/Inductors	RFID/New	Sensor	RF	Wireless Modules	Power	Battery
Power	Power Electronics & Systems: AC-DC Converters & Inverters, DC-DC, Energy Harvesting, PMIC, PoE, USB-PD, Wireless Charging	Used within common block		Used within common block	High probability to be used within common block	Used within common block	High probability to be used within common block		Used within common block	Used within common block
Output	Environment Manipulation: Motors/Actuators, Speakers (+Drivers)	Used within common block		Used within common block		Used within common block			Used within common block	
	Indicators: LED/LCD Displays, Gauges, Meters, Buzzers	Used within common block	High probability to be used within common block	Used within common block	High probability to be used within common block	High probability to be used within common block	High probability to be used within common block		Used within common block	
Connectivity	Wired Data Transfer: Ethernet, USB, HDMI, MoCA/DOCSIS (+Controllers)	Used within common block	Used within common block	Used within common block	High probability to be used within common block		Used within common block		Used within common block	
	Wireless Data Transfer: RF Front End, Bluetooth, Wi-Fi, Sub-Ghz, RFID/NFC, LoRa, Zigbee, UWB, Sigfox, LTE	Used within common block	Used within common block	Used within common block	Used within common block		Used within common block	Used within common block		
Sensor	Environment Sensing/User Input: Temp, Speed/Accel, Position, Distance, Sound, Light, Image, Gas, Airflow, Vibration, Shock	Used within common block		High probability to be used within common block	Used within common block	Used within common block				
Processor	Data Processing & Storage: CPU, APU, GPU Package, SoC, DSP + Memory	Used within common block	Used within common block	Used within common block	High probability to be used within common block	High probability to be used within common block	High probability to be used within common block		Used within common block	

Used within common block

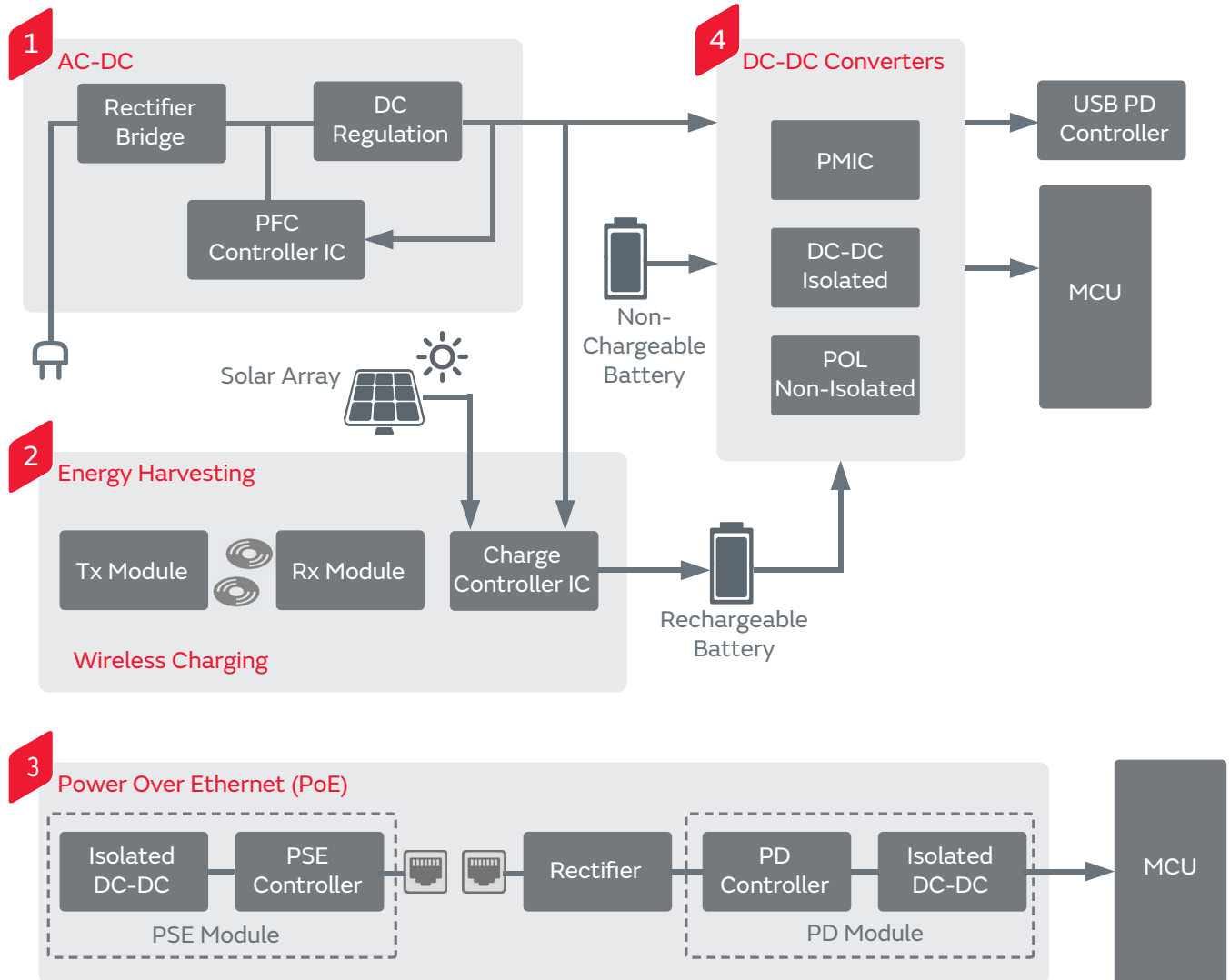
High probability to be used within common block

KEY COMMON BLOCK: Power



Power electronics and systems

AC-DC converters & inverters, DC-DC, batteries, energy harvesting, PMIC, PoE, USB-PD, wireless charging



KEY COMMON BLOCK: Power

(Click on products below to view web page)

1	Product	Function	Series
AC-DC	X/Y Safety Cap	AC Line Filter	DE1, DE2, DK1, GA3
	High Voltage MLCC	Snubber / Smoothing	GRM, KRM
	General Purpose MLCC	Filtering / Bypass / Decoupling	GRM, GRJ
	Polymer Capacitors	DC Output Decoupling	ECAS
	Power Magnetics	Choke, High Power Transformer	LQM, LQH, DFE, HPHF

2	Product	Function	Series
Energy Harvesting/ Wireless Charging	General Purpose MLCC	Filtering / Bypass / Decoupling	GRM, GRJ
	Polymer Capacitors	Bypass / Decoupling	ECAS
	Battery	External Power Source	Micro Battery, Li-ion
	Thermistor	Temp Sense / In-Rush Current	NCP, NCU
	Power Inductors	Choke	LQM, DFE, LQH
	Ferrite Beads	Signal Line Noise Filtering	BLM-P/G/H/E
	EMI Filters	Noise Suppression	NFM, BNX, DLW/ PLT
	Multiline Connector	Board-to-Board Signal Connection	MLF

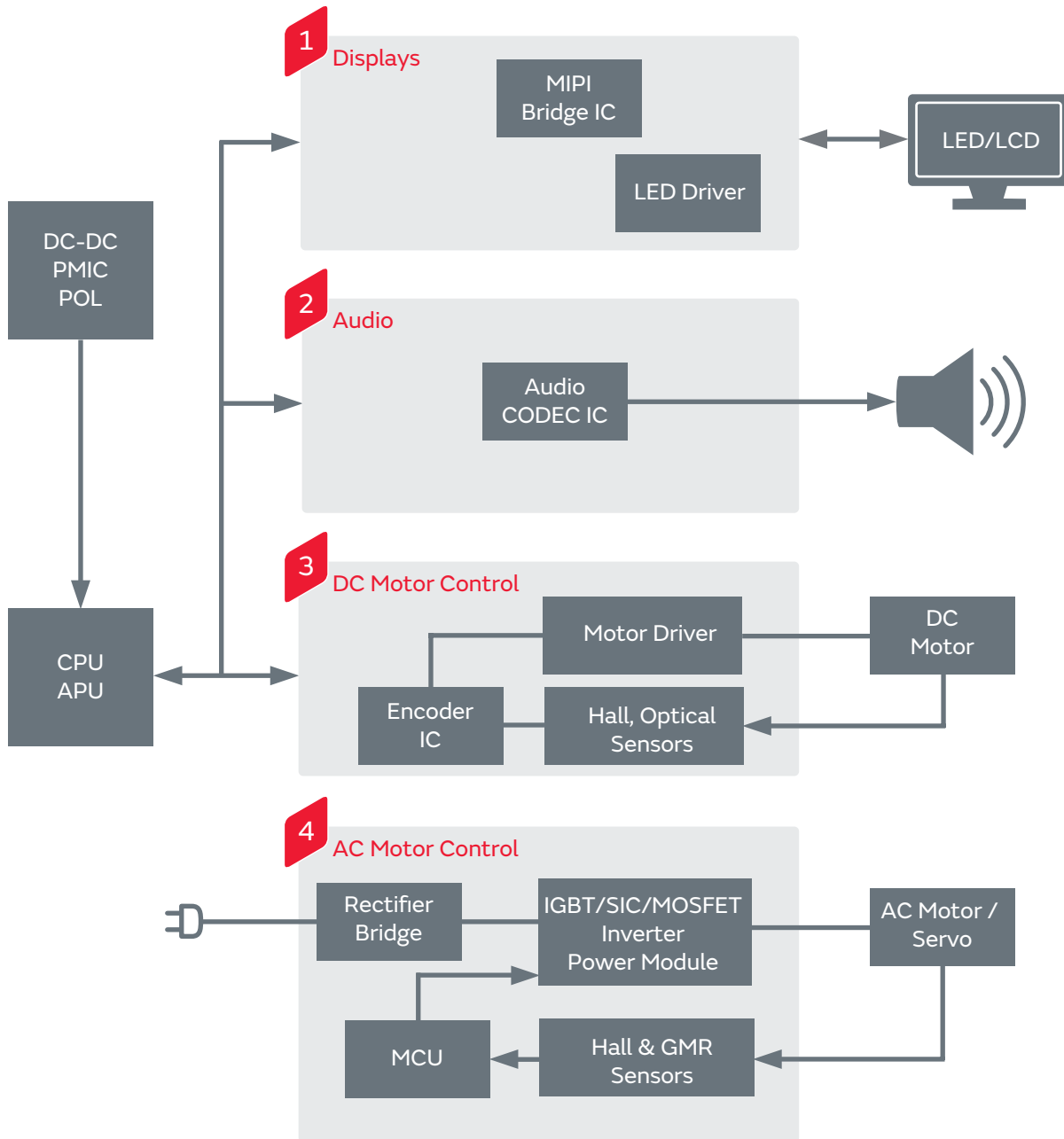
3	Product	Function	Series
Power Over Ethernet	General Purpose MLCC	Filtering / Bypass / Decoupling	GRM, GRJ
	High Voltage MLCC	Primary - Secondary Coupling	GR4
	Polymer Capacitors	Bypass / Decoupling	ECAS
	Isolated DC-DC	Voltage Conversion for PSE	MYBSS, SPC, PQC
	Power Module	Power Conversion/Controller for PD side	MYBSP
	Thermistor	Temp Sense / In-Rush Current	NCP, NCU
	Power Inductors	Choke	LQM, DFE, LQH
	Ferrite Beads	Signal Line Noise Filtering	BLM-P
	EMI Filters	Noise Suppression	NFM, BNX, DLW/ PLT
Multiline Connector	Board-toBoard Signal Connection	MLF	

4	Product	Function	Series
DC-DC Converters	General Purpose MLCC	Filtering / Bypass / Decoupling	GRM, GRJ, KRM
	Polymer Capacitors	Bypass / Decoupling	ECAS
	Silicon Capacitors	Power Integrity, Supply Decoupling	LPSC, EMSC, HTSC, XTSC, ETSC, EXSC
	Non-Isolated DC-DC	Voltage Conversion	MYM, MYS, MYR, MYT, MYC, MYW
	Isolated DC-DC	Voltage Conversion	NXJ, MGJ, UEI, UWS, UWE, DAE, DAQ
	Thermistor	Temp Sense / In-Rush Current	NCP, NCU
	Power Inductors	Choke	LQM, DFE, LQH
	Ferrite Beads	Signal Line Noise Filtering	BLM-P/G/H/E
	EMI Filters	Noise Suppression	NFM, BNX, DLW/ PLT
	Battery	External Power Source	Micro Battery, Li-ion
	Multiline Connector	Board-to-Board Signal Connection	MLF

KEY COMMON BLOCK: Output

Manipulators & indicators

Motors/actuators, speakers (+drivers), LED/LCD displays, gauges, meter and buzzers



KEY COMMON BLOCK: Output

(Click on products below to view web page)

1	Product	Function	Series
Displays	General Purpose MLCC	Decoupling	GRM
	Polymer Capacitors	Filtering, Bypassing, Decoupling	ECAS
	Power Inductors	Choke	LQM, DFE, LQH
	Ferrite Beads	Signal Line Noise Filtering	BLM-P/G/H/E
	EMI Filters	Noise Suppression	NFM, BNX
	Common Mode Choke Coil	Noise Suppression	DLW, PLT
	Resonator / X-Tal	Reference Clock for IC	XRCGB, CSTN
	Multiline Connector	Board-to-Board Signal Connection	MLF
	Digital Panel Meter	For Voltmeter, Ammeters, etc.	DMR, ACA

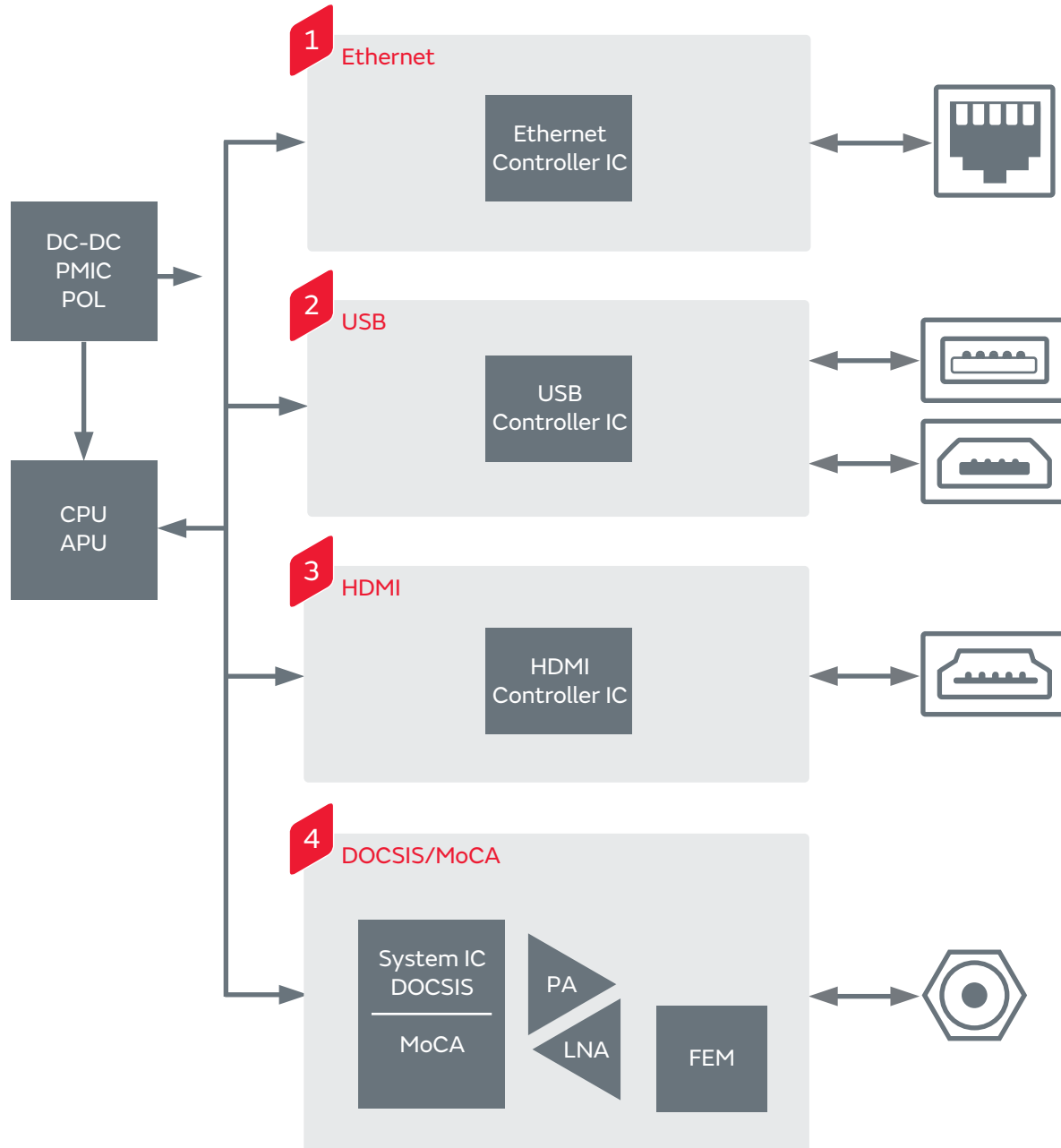
2	Product	Function	Series
Audio	General Purpose MLCC	Filter, Frequency tuning, coupling	GRM, GJM
	Anti-Acoustic MLCC	Reduced Acoustic Noise	ZRA, ZRB, KRM
	Power Inductors	Choke	LQM, DFE, LQH
	Ferrite Beads	Signal Line Noise Filtering	NFZ, BLM-P/G/H/E
	EMI Filters	Noise Suppression	NFM, BNX,
	Resonator / X-Tal	Reference Clock for IC	XRCGB, CSTN
	Buzzers	For Sounder	PKM, PKL
	Multiline Connector	Board-to-Board Signal Connection	MLF

3 / 4	Product	Function	Series
AC-DC Motor Control	X/Y Safety Cap	AC Line Filter	DE1, DE2, GA3
	High Voltage Snubber Cap	Snubber / Smoothing	GRM, KRM
	General Purpose MLCC	Decoupling	GRM, GRJ
	Leaded Capacitors	Decoupling, Filtering	RDE
	Polymer Capacitors	Filtering, Bypassing, Decoupling	ECAS
	PTC Thermistor	For Overcurrent Protection	PRG
	Motor/Gate driver	Gate Drive for IGBT/SiC/mosFET	MGJ
	Power Inductors	Choke	LQM, DFE, LQH
	Ferrite Beads	Signal Line Noise Filtering	BLM-P/G/H/E
	EMI Filters	Noise Suppression	NFM, BNX
	Multiline Connector	Board-to-Board Signal Connection	MLF

KEY COMMON BLOCK: Connectivity

Wired data transfer

Ethernet, USB, HDMI, DOCSIS/MoCa (+controllers)



KEY COMMON BLOCK: Connectivity

(Click on products below to view web page)

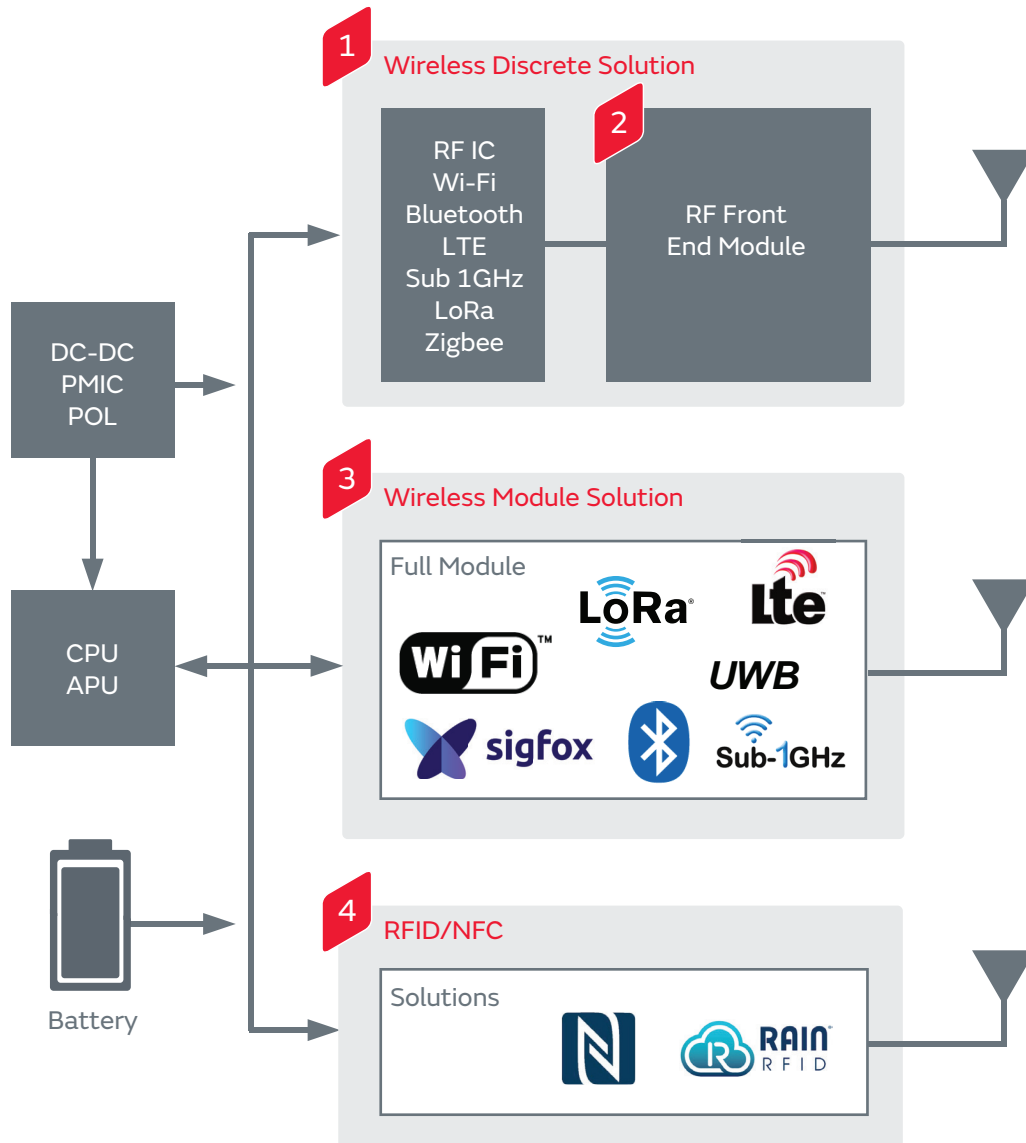
1/2/3	Product	Function	Series
Ethernet/USB/HDMI	Hi Q MLCC	Impedance Matching, Tuning	GJM
	High Capacitance MLCC	Filtering, Bypassing, Decoupling	GRM, GRJ
	High Voltage MLCC	Primary - Secondary Coupling	GR4
	Polymer Capacitors	Filtering, Bypassing, Decoupling	ECAS
	Power Inductors	Choke	LQM, DFE, LQH
	Ferrite Beads	Signal & Power Line Filtering	BLM-P/G/H/E
	Common Mode Choke Coil	Noise Suppression	DLP, NFP, DLM, DLW
	RF Inductors	Impedance Matching, Tuning	LQW, LQP
	Resonator / X-Tal	Reference Clock for IC	XRCGB
	NTC Thermistor	Temperature Detection	NCU, NCP
	PTC Thermistor	Data Line Capping	PRG
	Multiline Connector	Board-to-Board Signal Connection	MLF

4	Product	Function	Series
DOCSIS/MoCA	Hi Q MLCC	Impedance Matching, Tuning	GJM
	High Capacitance MLCC	Filtering, Bypassing, Decoupling	GRM, GRJ
	Polymer Capacitors	Filtering, Bypassing, Decoupling	ECAS
	Power Inductors	Choke	LQM, DFE, LQH
	Ferrite Beads	Signal & Power Line Filtering	BLM-P/G/H/E
	Common Mode Choke Coil	Noise Suppression	DLP, NFP, DLM, DLW
	Diplexer	Split MOCA and DOCSIS Signals	LFD
	Bandpass Filter	Signal Conditioning / Isolation / Rejection	LFB
	Low Pass Filter	Signal Conditioning / Isolation / Rejection	LFL
	Isolated AC-DC, DC-DC	Voltage Conversion for PoE PSE	MYBSS, SPC
	Power Module	Power Controller for PoE PD side	MYBSP

KEY COMMON BLOCK: Connectivity

Wireless data transfer

RF front-end, Bluetooth®, Wi-Fi®, sub-GHz, RFID/NFC. LoRa, Zigbee, UWB, Sigfox and LTE



KEY COMMON BLOCK: Connectivity

(Click on products below to view web page)

1	Product	Function	Series
Components	Hi Q MLCC	Impedance Matching, Tuning	GJM, GQM
	High Capacitance MLCC	Filtering, Decoupling	GRM, GRJ
	Power Inductors	Choke	LQM, DFE, LQH
	Ferrite Beads	Signal & Power Line Filtering	BLM-P/G/H/E
	RF Inductors	Impedance Matching, Tuning	LQW, LQP
	Battery	External Power Source	Micro-battery, Li-ion

2	Product	Function	Series
Discrete RF Solution	X-Tal	Reference Clock for IC	XRCGB
	MEMS Resonator	32.768kHz (sleep clock)	WMRA
	RF Switch Connector	RF Test Point	MM
	Multiline Connector	Board-to-Board Signal Connection	MLF
	RF SAW Filter	Signal Conditioning/Isolation/Rejection	SAFF, SAW, SAD
	RF SAW Duplexer	Tx - Rx Separation/Isolation	SAY
	RF LTCC Filter	Signal Conditioning/Isolation/Rejection	LFB, LFL, LFH
	RF LTCC Diplexer/Triplexer	Combine RF Band-to-Antenna	LFD
	RF Coupler	Signal Monitoring/Control	LDJ, LDB
	RF Switch	Signal Routing	XM
	LF Antenna	Low Frequency (125kHz) 3D Antenna	SA3D, SA-X
	FEM Module	Partial Module Solution (PA + LNA + Switch)	LMFE
RFFE Module	Partial Module Solution (FEM + Diplexer + Coupler)	MDFE	

3	Product	Function	Series
Full Module Solution	Bluetooth® / BLE	Bluetooth Module Solution	LBCA
	WiFi® / Combo	WiFi / Combo Module Solution	LBEE, LBWA, LBEH, CMWC
	UWB	Ultra-Wide Band	LBUA
	LoRa	LoRa Module Solution	CMWX
	LTE	LTE Module Solution	LBAD

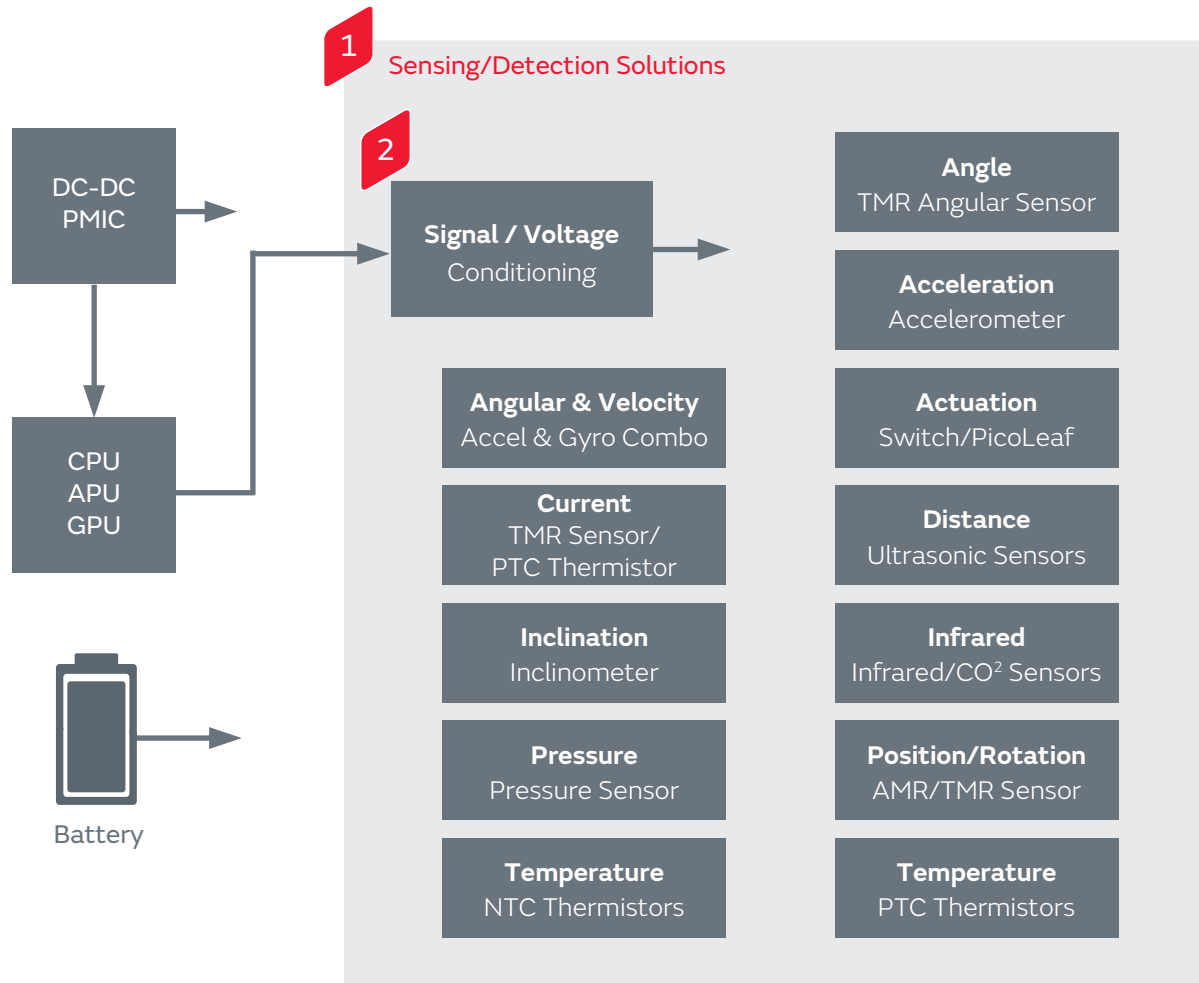
4	Product	Function	Series
RFID/ NFC	RFID / NFC	Item Identification, Tracking	LXMS, LXTB

KEY COMMON BLOCK: Sensor



Environment/user input sensing

Temperature, speed/acceleration, position, distance, sound, light, image, gas, airflow, vibration, and shock



KEY COMMON BLOCK: Sensor



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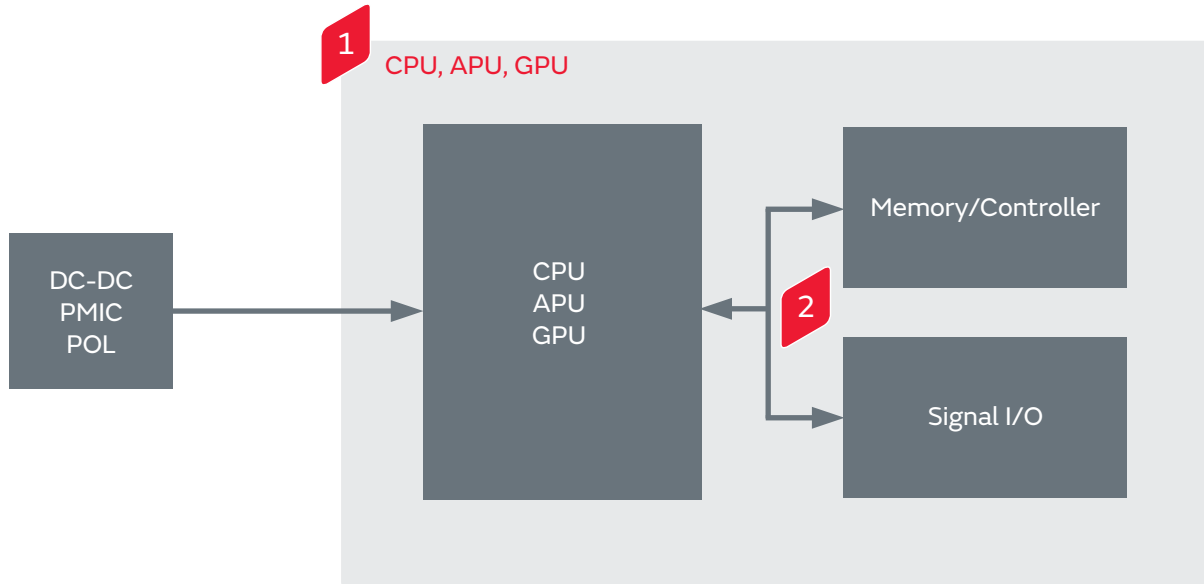
1	Product	Function	Series
Sensing	TMR Sensor	1D Linear Sensor, 2D Angular Sensor	CT100, CT310
		Isolated Analog Current Sensor	CT110
	AMR Sensor	Open/Close/Rotation	MRMS
	CO2 Sensor	CO2 Amount in PPM	IMG-CB
	Infrared (PIR) Sensor	Human Motion	IRA
	Ultrasonic Sensor	Distance	MA40
	Accelerometer	Directional Force	SCA
	Accel & Gyro	Accel + Angular Velocity	SCC
	Inclinometer	Tilt/Incline	SCL
	Temperature Sensor	Board Level Temp	NCU, NCP
		Environment / Point Temp	NXF
		Overheat, Overcurrent	PRF, PRG
	Actuation	Switch Function (PicoLeaf)	FM
	Pressure Sensor	Pressure Detection (PicoLeaf)	FML
Barometric Sensor	Pressure Detection	ZPA	
	Pressure Element	SCB	

2	Product	Function	Series
Signal Filtering/ Voltage Conditioning	Silicon Capacitors	Signal Integrity & Conditioning	LPSC, EMSC, HTSC, XTSC, ETSC, EXSC, ATSC, WASC, MGSC, CUSTOM Si-IPD
	General Purpose MLCC	Decoupling, Signal Filtering	GRM, GRJ
	Polymer Aluminum Capacitance	Decoupling	ECAS
	RF Inductors	Impedance Matching, Tuning	LQW, LQP
	Power Inductors	Choke	LQM, DFE, LQH
	Ferrite Beads	Signal Line Noise Filtering	BLM-P/G/H/E
	EMI Filters	Noise Suppression	NFM, BNX
	Battery	External Power Source	CR, LR, SR

KEY COMMON BLOCK: Processor

Data processing and storage

CPU, APU, GPU package, SoC, DSP + memory



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1/2	Product	Function	Series
CPU/APU/GPU	High Capacitance MLCC	Power Line Decoupling	GRM
	Low ESL MLCC	High Speed Decoupling	NFM, LL
	Polymer Aluminum Capacitance	Power Line Decoupling	ECAS
	Silicon Capacitors	Power & Signal Integrity, Supply Decoupling, Signal DC Block / AC Coupling	LPSC, EMSC, XBSC, UBSC, BBSC, ULSC, UBDC, custom Si-IPD
	Power Inductors	Choke	LQM, DFE, LQH
	Ferrite Beads	Signal and Power Line Noise Filtering	BLM-P/G/H/E
	EMI Filters	Noise Suppression	NFM, BNX, DLW / PLT
	NTC Thermistor	Temperature Monitoring	NCP, NCU
	Non-Isolated DC/DC	Voltage Conversion	MYM, MYR, MYC, MYT
	Resonator / X-tal	Crystal Unit (HCR)	XRCGB
		MEMS Resonator	WMRA
		Ceramic Resonator	CSTN
Multiline Connector	Board-to-Board Signal Connection	MLF	

Global locations

For details please visit www.murata.com



Note

1 Export Control

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- ① Aircraft equipment
- ② Undersea equipment
- ③ Medical equipment
- ④ Traffic signal equipment
- ⑤ Data-processing equipment
- ⑥ Aerospace equipment
- ⑦ Power plant equipment
- ⑧ Transportation equipment (vehicles, trains, ships, etc.)
- ⑨ Disaster prevention / crime prevention equipment
- ⑩ Application of similar complexity and/or reliability requirements to the applications listed above

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