

INDUSTRIAL POWER MANAGEMENT

Rugged, high-performance power solutions for demanding environments



PROVIDING SOLUTIONS FOR TODAY'S
COMPLEX POWER NEEDS

INDUSTRIAL POWER



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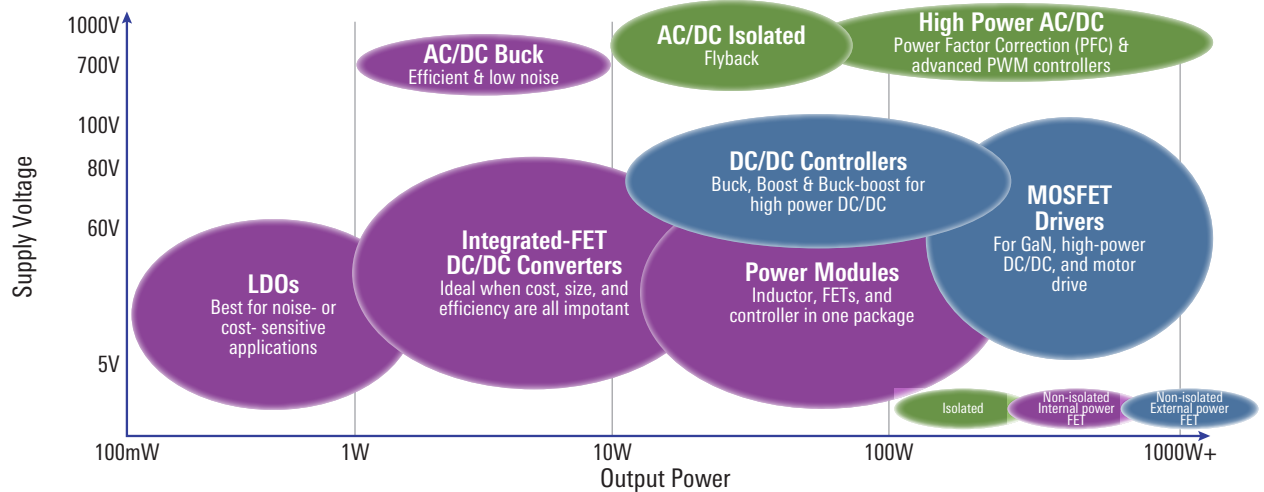
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Complete Power Solutions

Renesas offers a complete portfolio of high-performance power solutions for processor, controller, DSP, FPGA, CPLD, DDR memory, and other loads in your system. Whether you need standard linear regulators, highly flexible DC/DC converters, or fully integrated power modules, our products are tailored to meet your design challenges.

FROM MILLIWATTS TO KILOWATTS, WE CAN SUPPORT YOUR APPLICATION



AC/DC REGULATORS



MCU-based IoT and home automation



Small appliances



White goods

Part No.	V _{IN} Range (V)	V _{OUT} Range (V)	Package	Technical Highlights
RAA223011	20 to 305	3.3 to 54	SOICN, TSOT	700V AC/DC Regulator with Ultra-Low Standby Power and up to 4W Output Power
RAA223012	20 to 305	3.3 to 54	SOICN, TSOT	700V AC/DC Regulator with Ultra-Low Standby Power and up to 2.5W Output Power
RAA223021	20 to 305	3.3 to 54	SOICN	700V AC/DC Regulator with Ultra-Low Standby Power and up to 8W Output Power

Multi-Output Analog Controllers

Output	Part No.	Status	V _{IN} Range (V)	V _{OUT} Range (V)	Package	Technical Highlights
Dual	ISL81802	Released	4.5 to 80	0.8 to 76	32 Ld QFN 38 Ld HTSSOP	MOSFET controller
	ISL81806	Pre-release	4.5 to 80	0.8 to 76	32 Ld QFN 38 Ld HTSSOP	GaN controller
	ISL81805	Pre-release	4.5 to 80	4.5 to 80	32 Ld QFN 38 Ld HTSSOP	MOSFET controller
	ISL81807	Pre-release	4.5 to 80	4.5 to 80	32 Ld QFN 38 Ld HTSSOP	GaN controller
Triple	ISL9444	Released	4.5 to 28	0.6 to D _{max} *V _{IN}	40 Ld QFN	3 outputs, current mode, internal compensation

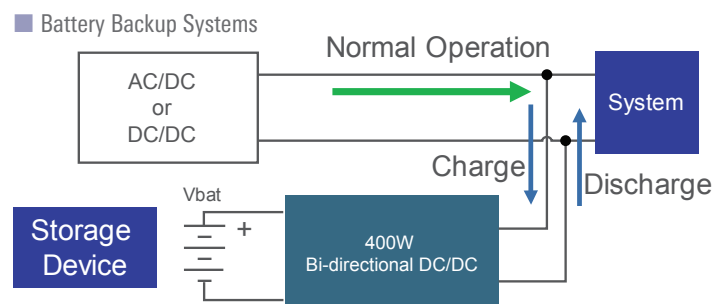
Multiphase Analog Controllers

Phase	Part No.	Status	V _{IN} Range (V)	V _{OUT} Range (V)	I _{OUT} (max) (A)	Package	Technical Highlights
Up to 12-phase	ISL8126	Released	3.0 to 26.5	0.6 to D _{max} *V _{IN}	60	32 Ld QFN	Current sharing up to 12 phase
2-phase, parallelable to 6 phases	ISL81802	Released	4.5 to 80	0.8 to 76	Current sharing	32 Ld QFN 38 Ld HTSSOP	MOSFET controller
	ISL81806	Pre-release	4.5 to 80	0.8 to 76	Current sharing	32 Ld QFN 38 Ld HTSSOP	GaN controller
	ISL81805	Pre-release	4.5 to 80	4.5 to 80	Current sharing	32 Ld QFN 38 Ld HTSSOP	MOSFET controller
	ISL81807	Pre-release	4.5 to 80	4.5 to 80	Current sharing	32 Ld QFN 38 Ld HTSSOP	GaN controller
4-phase	ISL6558		5 ±10%	0.8 to D _{max} *V _{IN}	120	20 Ld QFN, 16 Ld SOIC	4-phase controller, 5V _{IN} bias

ISL81801 80V BI-DIRECTIONAL BUCK-BOOST Controller

Industry's FIRST bi-directional 80V buck-boost controller

- CV/CC for both input and output
- Wide programmable frequency: 100KHz to 600KHz (SYNC to 2MHz)
- Current sharing for parallel operation
- Supports on-the-fly settings change including the current flow
- High reliability with OVP, OCP, OTP, UVLO protection
- Sense both positive and negative inductor peak current



Bidirectional Buck-Boost Controllers

Outputs	Part No.	V _{IN} Range (V)	V _{OUT} Range (V)	Output Current Max (A)	I _Q	POR	SYNCH Capability	External Bias	Control Type	Package Type
Single	ISL81401/A	4.5 to 40	0.8 to 40	Current sharing	3 μA	Yes	Yes	Yes	Current Mode	32pin-QFN
	ISL81601	4.5 to 60	0.8 to 60	Current sharing	3 μA	Yes	Yes	Yes	Current Mode	32pin-QFN, 38pin-TSSOP-EP
	ISL81801	4.5 to 80	0.8 to 80	Current sharing	2.7 μA	Yes	Yes	Yes	Current Mode	32pin-QFN, 38pin-TSSOP-EP

*Current sharing means current sharing with phase interleaving.

SWITCHING REGULATORS

Wide V_{IN} Coverage

Benefits and Key Features

Robust & Reliable Performance

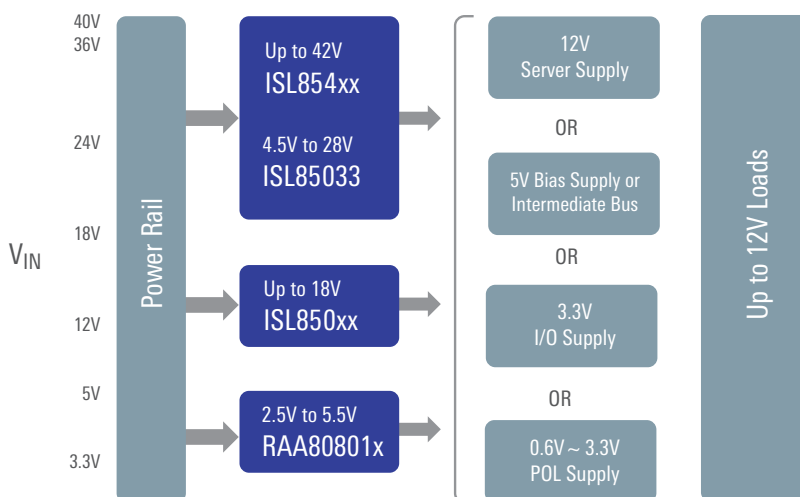
- PGOOD, Enable, adjustable soft-start
- Extensive protection (OCP, OVP, OTP, SCP)
- External frequency synchronization

High Integration

- Integrated HS/LS FETs
- Internal compensation

Target Applications

- Servers and infrastructure POLs
- Industrial PCs, factory automation, PLCs
- General purpose POLs
- Telecom and networking systems



ISL854xx 40V Sync Buck Regulator Family – Wide V_{IN} Range with Rich Feature Set

Adjustable Output Voltage

- 0.6V to 95% of input voltage
- Wide conversion range

Fully Integrated

- Internal compensation
- Integrated HS/LS FETs and bootstrap diode

Selectable PWM or PFM Mode

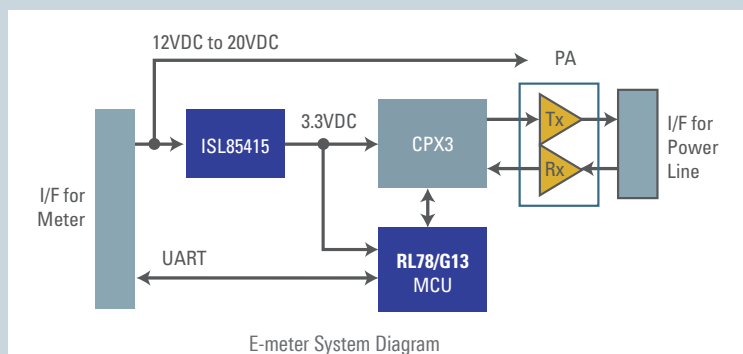
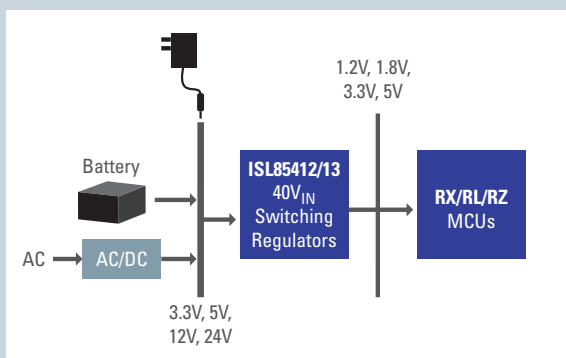
- PFM for high efficiency at light loads

Full Protection

- OC (Pos and Neg), OV, UV, OT protections and UVLO

Part No.	V_{IN} Range	I_{OUT}	Package
ISL85412	3.5V to 40V	150 mA	3x3 TDFN
ISL85413	3.5V to 40V	300 mA	3x3 TDFN
ISL85415	3V to 36V	500 mA	4x3 DFN
ISL85418	3V to 40V	800 mA	4x3 DFN
ISL85410	3V to 40V	1 A	4x3 DFN
ISL854102	3V to 40V	1.2 A	4x3 DFN

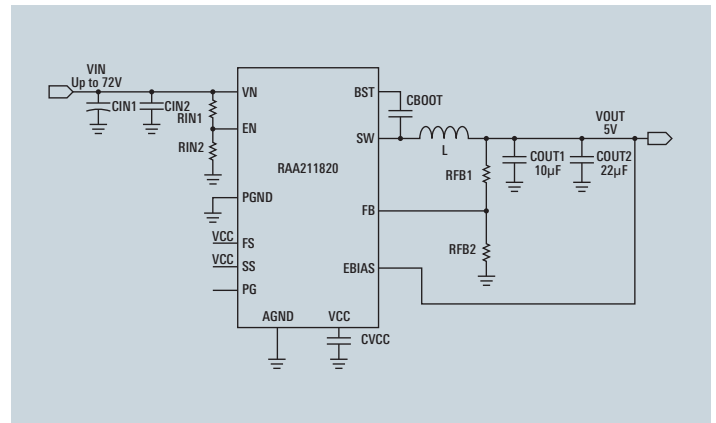
Using 40V Sync Buck Regulator Family to Power MCUs



RAA211820 80V, 2A Synchronous Buck Regulator

Key Features

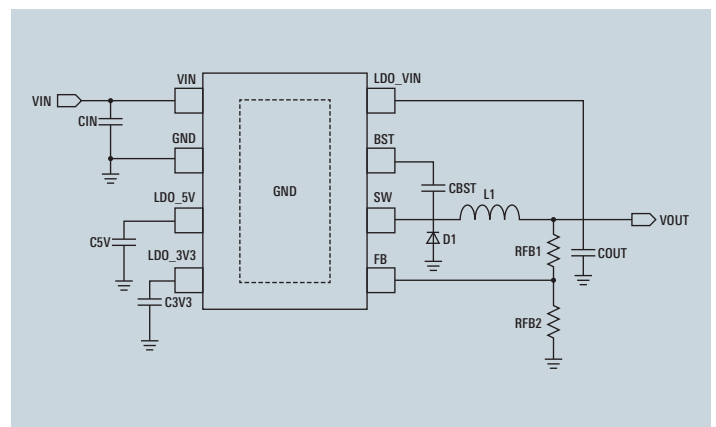
- Up to 2A Continuous Output Current
- Integrated 200m / 100mOhm MOSFETs
- Programmable frequency 200k-800kHz
- PFM and DEM at light load for best efficiency
- Integrated E-BIAS for improved efficiency



RAA212831 80V/0.5A Regulator with Two Integrated LDO

Key Features

- Wide Vin range: 8V to 80V
- 350kHz fixed frequency, PWM/PFM
- Integrated 5V/100mA and 3.3V/50mA LDO to power MCU and sensors
- Adjustable output from 1.25V to 24V
- Standby feature for 832: when activated, Vout drops to 6V to lower system standby power



2.5V-6V Synchronous Buck Regulators

Part No.	Status	# of Outputs	V _{IN} Range (V)	I _{OUT} (max) (A)	V _{OUT} Range (V)	PFM	Adj SS/TRK	Ext Comp	Sync	Adj Freq	Adj OCP	Package
ISL8088	Released	Dual	2.75 to 5.5	0.8	0.6 to V _{IN}	Y	N/N	N	Y	N	N	10 Ld 3x3 DFN
RAA808015	Pre-release	Single	2.7 to 5.5	5	0.6 to V _{IN}	N	N/N	N	N	N	N	8 Ld QFN 2x2.5
ISL80019/A	Released	Single	2.7 to 5.5	1.5	0.6 to V _{IN}	Y	N/N	Y	N	N	N	8 Ld 2x2 TDFN
ISL80015/A	Released	Single	2.7 to 5.5	1.5	0.6 to V _{IN}	N	N/N	N	N	N	N	8 Ld 2x2 TDFN
ISL8022	Released	Dual	2.7 to 5.5	2/1.7	0.6 to V _{IN}	Y	N/N	N	Y	N	N	12 Ld 4x3 DFN
ISL8002/A	Released	Single	2.8 to 5.5	2	0.6 to V _{IN}	Y	N/N	Y	N	N	N	8 Ld 2x2 TDFN
ISL8002B	Released	Single	2.7 to 5.5	2	0.6 to 4	Y	Y/Y	N	N	N	N	8 Ld 2x2 TDFN
ISL80020/A	Released	Single	2.7 to 5.5	2	0.6 to V _{IN}	N	N/N	N	N	N	N	8 Ld 2x2 TDFN
ISL8033/A	Released	Dual	2.85 to 6	3/3	0.8 to V _{IN}	N	N/N	N	Y	N	Y	24 Ld 4x4 QFN
ISL8036/A	Released	Dual	2.85 to 6	3/3	0.8 to V _{IN}	N	Y/N	N	Y	N	N	24 Ld 4x4 QFN
ISL80030/A	Released	Single	2.7 to 5.5	3	0.6 to V _{IN}	N	N/N	N	N	N	N	8 Ld 2x2 DFN
ISL80031/A	Released	Single	2.7 to 5.5	3	0.6 to V _{IN}	Y	N/N	N	N	N	N	8 Ld 2x2 DFN
ISL8023/A	Released	Single	2.7 to 5.5	3	0.6 to V _{IN}	Y	Y/N	Y	Y	Y	N	16 Ld 3x3 TQFN
ISL8024/A	Released	Single	2.7 to 5.5	4	0.6 to V _{IN}	Y	Y/N	Y	Y	Y	N	16 Ld 3x3 TQFN
ISL8025/A	Released	Single	2.7 to 5.5	5	0.6 to V _{IN}	Y	Y/N	Y	Y	Y	N	16 Ld 3x3 TQFN
ISL8026/A	Released	Single	2.5 to 5.5	6	0.6 to V _{IN}	Y	Y/N	Y	Y	Y	N	16 Ld 3x3 TQFN
ISL8016	Released	Single	2.7 to 5.5	6	0.6 to V _{IN}	Y	Y/N	Y	Y	Y	Y	20 Ld 3x4 QFN
ISL8018	Released	Single	2.7 to 5.5	8	0.6 to V _{IN}	Y	Y/N	Y	Y	Y	Y	20 Ld 3x4 QFN

Up to 18V Synchronous Buck Regulators

Part No.	Status	# of Outputs	V _{IN} Range	I _{OUT} (max)	V _{OUT} Range	I _Q (typ)	Package
ISL85003/A	Released	Single	4.5V to 18V	3A	0.8V to D _{max} *V _{IN}	3.2 mA	12 Ld 3x4 DFN
ISL85005/A	Released	Single	4.5V to 18V	5A	0.8V to D _{max} *V _{IN}	3.2 mA	12 Ld 4x3 DFN

Up to 30V Synchronous Buck Regulators

Part No.	Status	# of Outputs	V _{IN} Range	I _{OUT} (max)	V _{OUT} Range	I _Q (typ)	Package
RAA211230	Pre-release	Single	4.5V to 24V	3A	0.8V to D _{max} *V _{IN}	500 μA	TSOT23-6
RAA211250	Pre-release	Single	4.5V to 30V	5A	0.8V to 90%*V _{IN}	200 μA	20Ld QFN 16Ld HTSSOP
ISL85033	Released	Dual	4.5V to 28V	3A	0.8V to D _{max} *V _{IN}	1.2 mA	28 Ld 4x4 TQFN

Up to 40V Synchronous Buck Regulators

Part No.	Status	# of Outputs	V _{IN} Range	I _{OUT} (max)	V _{OUT} Range	I _Q (typ)	Package
ISL85412	Released	Single	3.5V to 40V	150 mA	0.6V to D _{max} *V _{IN}	50 μA	8 Ld 3x3 TDFN
ISL85413	Released	Single	3.5V to 40V	300 mA	0.6V to D _{max} *V _{IN}	50 μA	8 Ld 3x3 DFN
ISL85415	Released	Single	3V to 36V	500 mA	0.6V to D _{max} *V _{IN}	80 μA	12 Ld 4x3 DFN
ISL85418	Released	Single	3V to 40V	800 mA	0.6V to D _{max} *V _{IN}	80 μA	12 Ld 4x3 DFN
ISL85410	Released	Single	3V to 40V	1A	0.6V to D _{max} *V _{IN}	80 μA	12 Ld 4x3 DFN
ISL854102	Released	Single	3V to 40V	1.2A	0.6V to D _{max} *V _{IN}	80 μA	12 Ld 4x3 DFN
ISL85403 (Buck or Buck-Boost)	Released	Single	3V to 40V	2.5A	0.8V to D _{max} *V _{IN}	300 μA	20 Ld 4x4 QFN
RAA211450	Pre-release	Single	4.5V to 40V	5A	0.8V to 90%*V _{IN}	200 μA	20Ld QFN 16Ld HTSSOP

Up to 80V Synchronous Buck Regulators

Part No.	Status	# of Outputs	V _{IN} Range	I _{OUT} (max)	V _{OUT} Range	I _Q (typ)	Package
RAA211630	Pre-release	Single	4.5V to 60V	3A	0.8V to 90%*V _{IN}	200 μA	20Ld QFN 16Ld HTSSOP
RAA211650	Released	Single	4.5V to 60V	5A	0.8V to 90%*V _{IN}	15 μA	28 Ld QFN
RAA211651	Released	Single	4.5V to 60V	5A	0.8V to 90%*V _{IN}	15 μA	28 Ld QFN
RAA211820	Pre-release	Single	4.5V to 80V	2A	0.8V to 90%*V _{IN}	200 μA	20Ld QFN 16Ld HTSSOP

Up to 80V Non-Synchronous Buck Regulators

Part No.	Status	# of Outputs	V _{IN} Range	I _{OUT} (max)	V _{OUT} Range	I _Q (typ)	Package
RAA211605	Pre-release	Single	4.5V to 56V	500 mA	0.6V to D _{max} *V _{IN}	230 μA	TSOT23-6
RAA212831	Pre-release	Three	4.5V to 72V	500mA	1.25V to 24V	TBD	SOIC-8
RAA212832	Pre-release	Three	4.5V to 72V	500mA	1.25V to 24V	TBD	SOIC-8

SIMPLE DC/DC POWER ICs

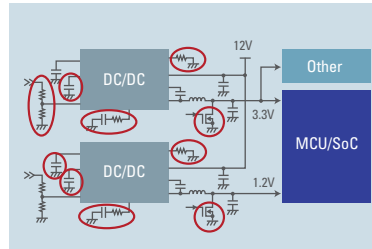
ICs for Microcontroller Power Supply Systems

Benefits and Key Features

Compact Design

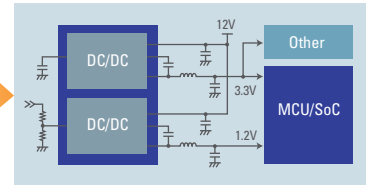
The main power supply circuit elements are integrated. This reduces the number of components and mounting area of the power supply block.

Conventional Product



Components
-50%
Mounting Area
-30%

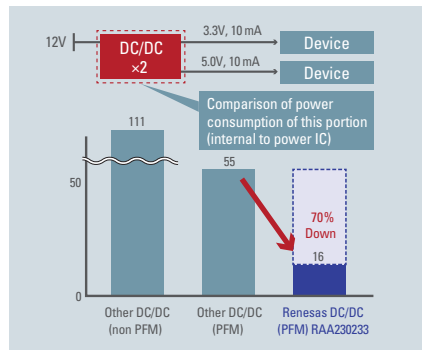
Simple DC/DC Power IC



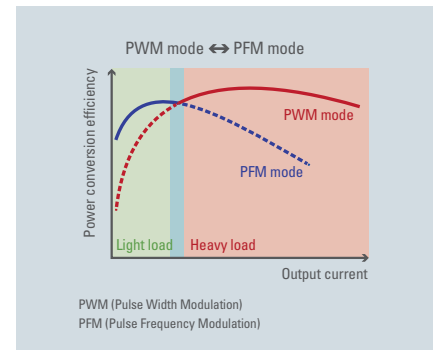
Reduced System Power Consumption

Integrated Auto Pulse Frequency Modulation (PFM) mode. Matches the system's operating current, making it easy to reduce the overall power consumption.

Power Consumption Comparison with 16V 2-Ch Devices



Auto PFM Mode – Automatic Switching to High-efficiency Operation Mode



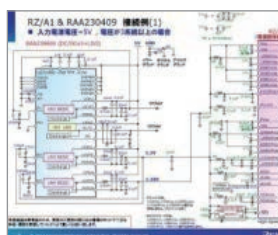
Easy Power Supply Design for Renesas RZ Family MPUs and R-IN Series Multi-Protocol LSI Products



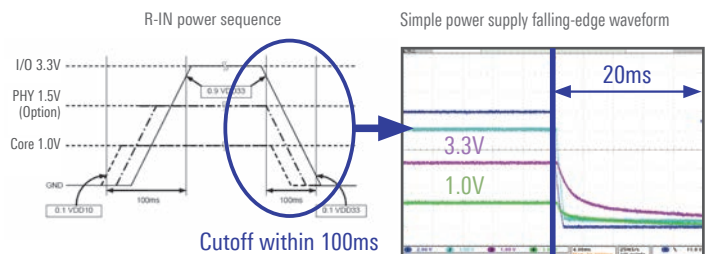
- RZ and R-IN reference boards populated with Simple DC/DC devices are available. Simplify the design process and reduce development turnaround time by utilizing the provided circuit diagrams and recommended parts.



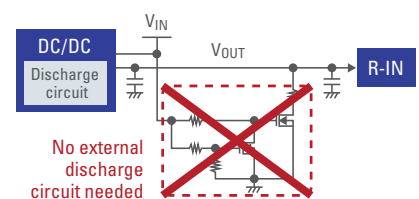
- Board schematics with Renesas MCU, SoC, and other suggested devices are available.



- The integrated discharge circuit simplifies R-IN cutoff sequence design.



- There is no need for an external discharge circuit, reducing the total number of parts.



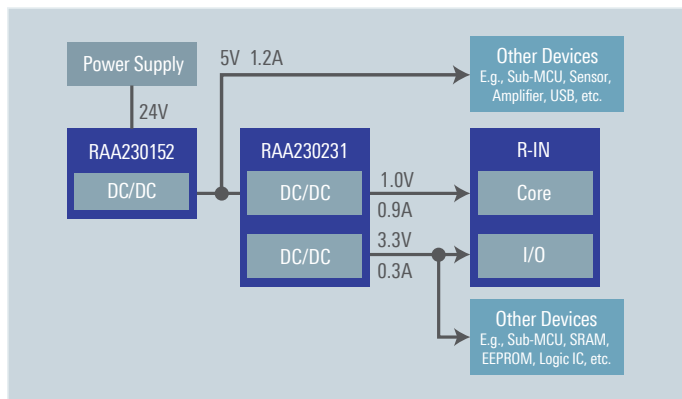
Simple DC/DC Products

Part No.	Ch	Circuit	V _{IN} (V)	V _{OUT} (V)	I _{OUT} MAX (A)	Package	Sequence	Auto PFM
RAA230231	2	DC/DC x2 (Step-down)	4.5 to 16	ch 1 = 3.3V ch 2 = Adj.* ¹ Adj: 0.8V to 6.0V	3A	20-pin HTSSOP	Controlled by P-Good	✓
RAA230152	1	DC/DC (Step-down)	7.0 to 28	5.0V	3A	8-pin HLSOP	-	✓
RAA230153				Adj:.* ¹ 0.8V to 6.0V				

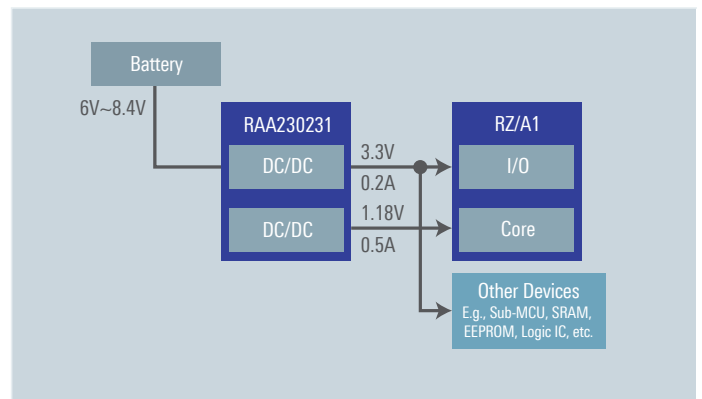
* 1: Adjustable: Voltage can be set using an external resistor.

Simple DC/DC Applications

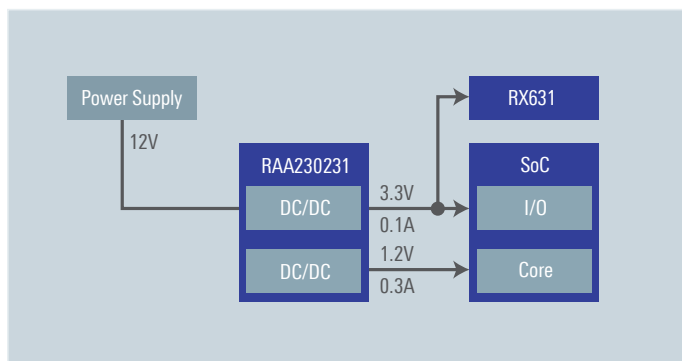
Industrial Equipment (PLCs, etc.)



Handheld Terminals



Smart Grid



LOW DROPOUT REGULATORS (LDO)

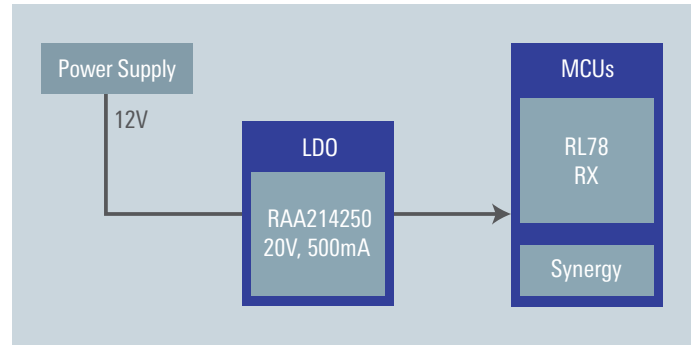
High Performance LDOs

RAA214250 20V Wide Input Voltage Range, 500mA Linear Regulator

The RAA214250 is a Cost-effective power for Renesas RA, RL78, Synergy, and RX MCUs

Key Features

- Efficient
- Low 50µA supply current for high light-load efficiency
- ENABLE pin shuts down output to save power
- Reliable
- Approved for use with all modern Renesas MCUs
- Stable with no load, so it can power an MCU in HALT or SLEEP mode

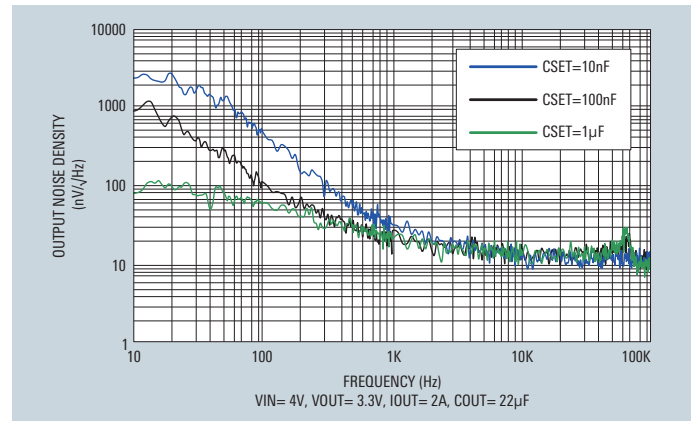


RAA214020 LOW NOISE LDO FOR SENSITIVE CIRCUITRY

New ultra-low noise LDOs minimize phase noise & jitter in high-performance applications

Excellent Noise Performance

- Low Spot Noise Spectral Density: 82nV/Sqrt Hz @ 10Hz
- Low Integrated Noise: 4.54µV RMS from 10Hz-100kHz
- Very high PSRR @ 2A load current: Freq=10kHz=80dB
- $V_{in} = 2.7V$ to 5.5V, $V_{out}=0.9V$ to V_{in} -dropout
- Low dropout of 500mV max @ 2A, over temperature



High-Performance LDOs

Part No.	Status	V _{IN} (V)	V _{OUT} (V)	I _{OUT} max (A)	PSRR @1 kHz (dB)	Fixed V _{OUT} Option	Dropout (mV)	Acc. (%)	I _Q (typ)	Package
ISL80410	Released	6 to 40	2.5 to 12	0.15	66	No	295 @ 150mA	±1.0	18 µA	8 Ld EPSON
RAA214401	Released	5.4 to 40	3.3	0.15	47	Yes	1550 @ 150mA	±1.0	<3 µA	SOT23
RAA214220	Released	2.5 to 20	1.23 to 18	0.15	>63	No	145 @ 100mA	±2.0	6 µA	SOT23
RAA214250	Pre-release	2.5 to 20	1.23 to 18	0.5	>63	No	350 @ 500mA	±2.0	NA	8Ld DFN3x3/ SOIC
ISL80136	Released	6 to 40	2.5 to 12	0.05	45	No	120 @ 50mA	1.0	18 µA	8 Ld EPSON
ISL80138	Released	6 to 40	2.5 to 12	0.15	47	No	295	1.0	18 µA	14 Ld HTSSOP
RAA214020	Released	2.7 to 5.5	0.9 to 5.5 - dropout	2	>80	No	500	±2.0	100 µA	10 Ld DFN
RAA214023	Pre-release	2.7 to 5.5	0.9 to 5.5 - dropout	2	>80	No	500	±2.0	100 µA	5mm x 5mm 20 Ld QFN 3.5mm x 3.5mm 20 Ld QFN
ISL80505	Released	1.8 to 6	0.8 to 5.5	0.5	50	No	45 @ 500mA	1.8	2.2 mA	8 Ld 3x3 DFN
ISL80510	Released	2.2 to 6	0.8 to 5.5	1	48	No	130 @ 1A	1.8	2.2 mA	8 Ld 3x3 DFN
ISL80101A	Released	2.2 to 6	0.8 to 5	1	48	Yes	90 @ 1A	1.8	3.0 mA	10 Ld 3x3 DFN
ISL80101-Adj.	Released	2.2 to 6	0.8 to 5	1	58	Yes	130 @ 1A	1.8	3.0 mA	10 Ld 3x3 DFN
ISL80102	Released	2.2 to 6	0.8 to 5	2	55	Yes	81 (@2A, Vout=2.5V)	1.8	7.5 mA	10 Ld 3x3 DFN
ISL80103	Released	2.2 to 6	0.8 to 5	3	55	Yes	120 (@3A, Vout=2.5V)	1.8	7.5 mA	10 Ld 3x3 DFN
ISL80111	Released	1 to 3.6	0.8 to 3.3	1	80	No	27 @ 1A	1.6	3.5 mA	10 Ld 3x3 DFN
ISL80112	Released	1 to 3.6	0.8 to 3.3	2	80	No	53 @ 2A	1.6	3.5 mA	10 Ld 3x3 DFN
ISL80113	Released	1 to 3.6	0.8 to 3.3	3	80	No	75 @ 3A	1.6	3.5 mA	10 Ld 3x3 DFN

SHUNT REGULATORS

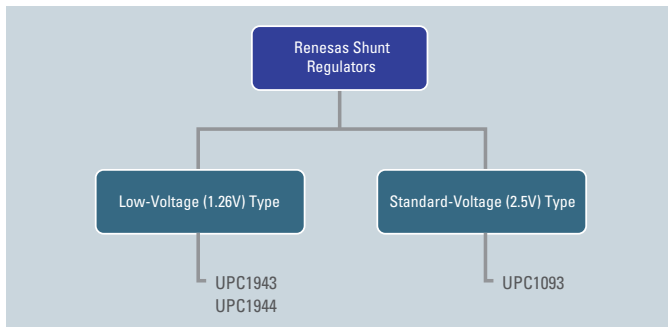
Reference Power Supply ICs

Benefits and Key Features

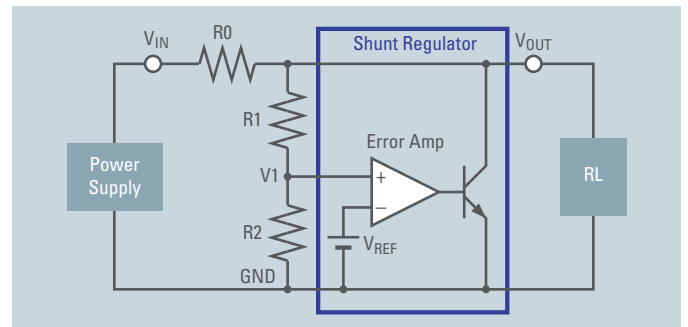
Shunt regulators are the standard reference voltage source widely used by the feedback circuits of switching power supplies and so on. Compared to the Zener diode, which is a discrete product, a shunt regulator has much better voltage precision because voltage control is carried out as an IC.

In addition to its use as a reference power source for amplifier circuits, A/D converters, etc., it is also widely used for feedback circuits of switching regulators.

Shunt Regulators Lineup



Shunt Regulator Application



Shunt Regulators

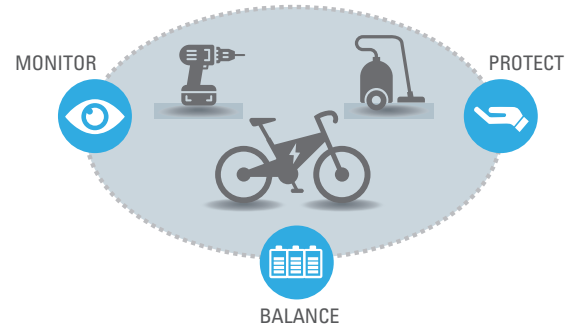
Item		Low-Voltage (1.26V) Type		Standard-Voltage (2.5V) Type		
		UPC1943T	UPC1944T	UPC1093TA	UPC1093T	UPC1093G
Reference voltage	VREF (V)	1.23 (min.) to 1.26 (typ.) to 1.29 (max.)		2.440 (min.) to 2.495 (typ.) to 2.550 (max.)		
Cathode voltage	VKA (V)	24 (max.)		36 (max.)		
Cathode current	IK (mA)	30 (max.)		100 (max.)		
Operating temperature range	TA (°C)	-30 to +85		-20 to +85		
Package	5-pin mini mold(SC-74A)					
	3-pin power mini mold(SC-62)					
	8-pin SOP					

BATTERY MANAGEMENT

Management and Protection of Lithium-ion Batteries

Protect, Monitor & Balance Rechargeable Battery Packs

Renesas' Li-ion battery pack monitoring, protection, and balancing ICs are specifically designed to meet the stringent safety, reliability, and performance requirements of portable and battery powered applications such as consumer, industrial, and medical products.



Battery Front End (BFE), Battery Management ICs

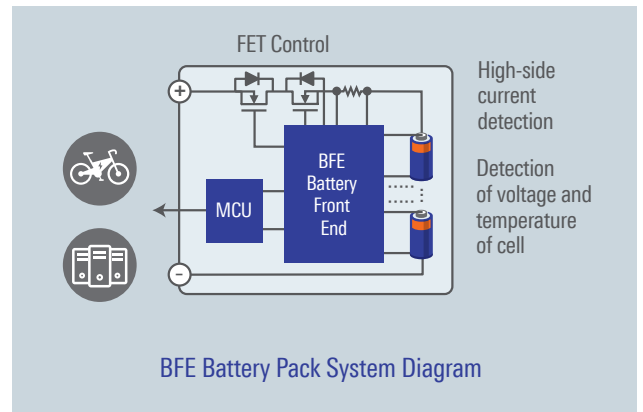
Benefits and Key Features

Protection and Cell Balancing

- Hot plug tolerant
- Over/under voltage
- Charge/discharge current
- FET control when error detected
- Open-wire detection
- Auto-cell balancing

Host Controlled Features

- Current measurement
- Cell voltage measurement
- Pack voltage measurement
- Temperature measurement
- LED indication by GPIO
- Power supply for MCU



RAA489206 Industrial Battery Front End Protects, Monitors, and Balances High Voltage Battery Packs

- Up to 16 cell inputs
- Highly integrated, includes charge pump, high side FET drivers, current measurement, LDO, wake-up logic, internal and external balancing circuits, and LED drivers
- Hot plug tested and proven via random connection trials
- Reference circuit, sample code, and high degree of integration accelerates battery pack design, test and verification

Battery Front End, Multi-Cell Li-Ion Battery Management ICs

Cells	Pack Voltage	Part Number	Cell Balance	Current Sense	Charge/Discharge FET	Internal ADC	Features	Package
4 to 16	12 to 60V (60V available Q4'2021)	RAA489206	Both Internal and External	Low Side	N-channel, High side and Low side	Yes	LDO, LED Drivers	64QFN
4 to 6	4 to 26.4	ISL94208	Both Internal and External	Low Side	N-channel, Low Side	No	Simplicity, internal cell balancing	32QFN
6 to 14 (and Daisy Chain)	10 to 65	RAA489204	Both Internal and External	No	N/A	Yes	Daisy chain	64TQFP
3 to 8	4 to 36	ISL94202	External	High Side	N-channel, High Side	Yes	High-side current sense, standalone capable	48TQFN

Battery Fuel Gauge ICs (FGIC)

Dedicated one-package solution with MCU and AFE provides an intelligent, programmable system for battery management that constantly monitors and protects the battery.

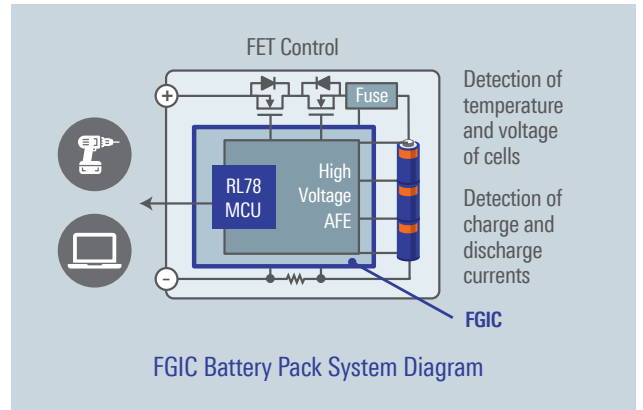
Benefits and Key Features

Safety and Protection Control

- Over/under voltage
- Charge/discharge current
- FET control when error detected
- Chemical fuse control
- Cell balancing

Remaining Capacity Management

- Current/voltage detection
- Precise coulomb counter
- Deterioration detection
- Calculation and learning of battery capacity
- Current/voltage calibration
- Fault detection/history management



FGIC Block Diagram

Voltage and Current Measurement by Independent A/D Converters

- Current detection: 153 $\mu\text{A}/\text{LSB}$ resolution (18-bit $\Delta\Sigma$ 5 m Ω shunt resistor) support for simultaneous measurement with virtually no temperature drift
- Voltage/temperature measurement: 15-bit $\Delta\Sigma$ ADC

High Reliability & High Integration

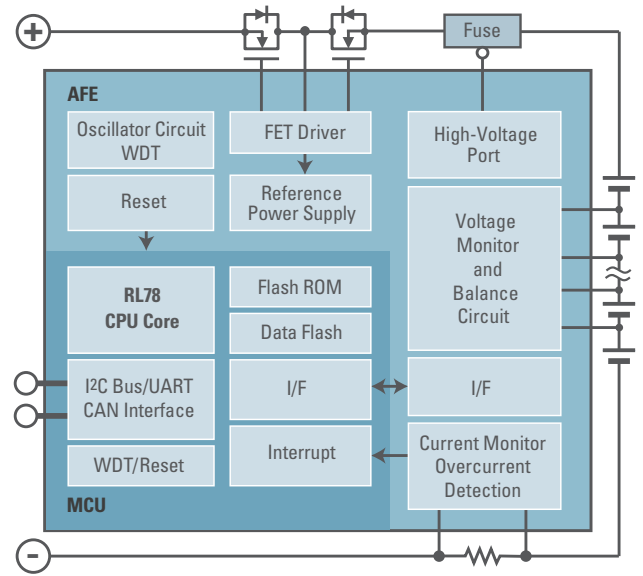
- Built-in FET protection for overcurrent or short circuit conditions
- Redundant fault detection by both MCU and AFE
- Ability to set lifecycle related limits and maintain battery parameter and operation history using data flash guaranteed for 100,000 erase/write cycles
- Integrated CAN interface and RTC (Real Time Clock) circuit for industrial apps; ICs can manage date and time in a single device (RAJ240090 and RAJ240100)

Few Parts, Low System Cost

- Supports large-current discharge with N-channel FET drivers
- Integrated pull-up resistors for thermistor

Extended Battery Life

- Low power mode with consumption of 25 μA or less and cell balance circuit to maximize battery capacity (RAJ240090 and RAJ240100)



Battery Fuel Gauge ICs

Cells	Pack Voltage (V)	Part No.	Flash ROM	RAM	Charge/Discharge FET Control	Serial I/F	I/O	Features	Package
2 to 4	4 to 25	RAJ240045	64 KB	4.0 KB	High side	I ² C, UART	12	Compact package (4mm x 4mm)	32QFN
		RAJ240047	128 KB	5.5 KB					
2 to 5	4 to 25	RAJ240071	32 KB	1.5 KB	High side	I ² C, UART	11	Compact package (4mm x 4mm) 5 cell support	32QFN
		RAJ240075	64 KB	4.0 KB					
2 to 5	4 to 28	RAJ240080	64 KB	5.5 KB	High side	I ² C, UART	22	GPIO: I/O x 18, input x 2, NOD x 2	48LQFP
3 to 8	4 to 50	RAJ240090	128 KB	7 KB	High / Low side	I ² C, UART, CAN	31	High voltage tolerance, on-chip CAN, low power consumption (25 μA)	64LQFP
3 to 10	4 to 50	RAJ240100	128 KB	7 KB	High / Low side	I ² C, UART, CAN	31	High voltage tolerance, on-chip CAN, low power consumption (25 μA)	64LQFP
NEW 3 to 10	4 to 50	RAJ240310	64KB	4.0KB	Low side	I ² C, UART	15	Compact package (5mm x 5mm) 10 cell support	40QFN

* Specifications are subject to change without notice.

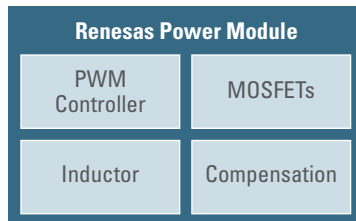
POWER MODULES

Complete Power System in an Encapsulated Module

Benefits and Key Features

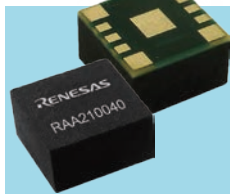
Easy to Use

- Full integration means less complexity and easier design



Featured Product

- RAA210040 5V, 4A Step-Down DC/DC Mini Module with Integrated Inductor



5V, 4A Low-profile Mini Module

for industrial, telecom and medical applications

Highest Power Density

- Power output up to 100W POL in a single package

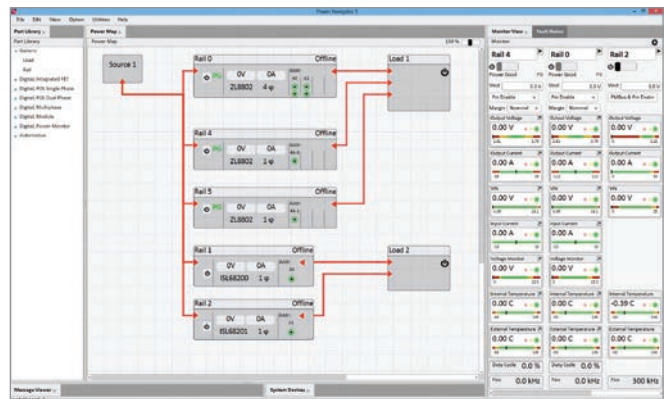
Thermally Enhanced Package Technology

- Thermal molding compound allows for even heat distribution
- Large copper pads transfer heat efficiently
- Operates at full load across wide temperature range
- Leaded package allows pin access

Real-Time Telemetry — Dynamic Configuration (Available in Digital Power Modules)



Allows simple configuration and monitoring of multiple Digital-DC devices using a PC with a USB interface.



Analog Modules

A simple, effective DC/DC power supply solution that integrates necessary power elements in a single package.

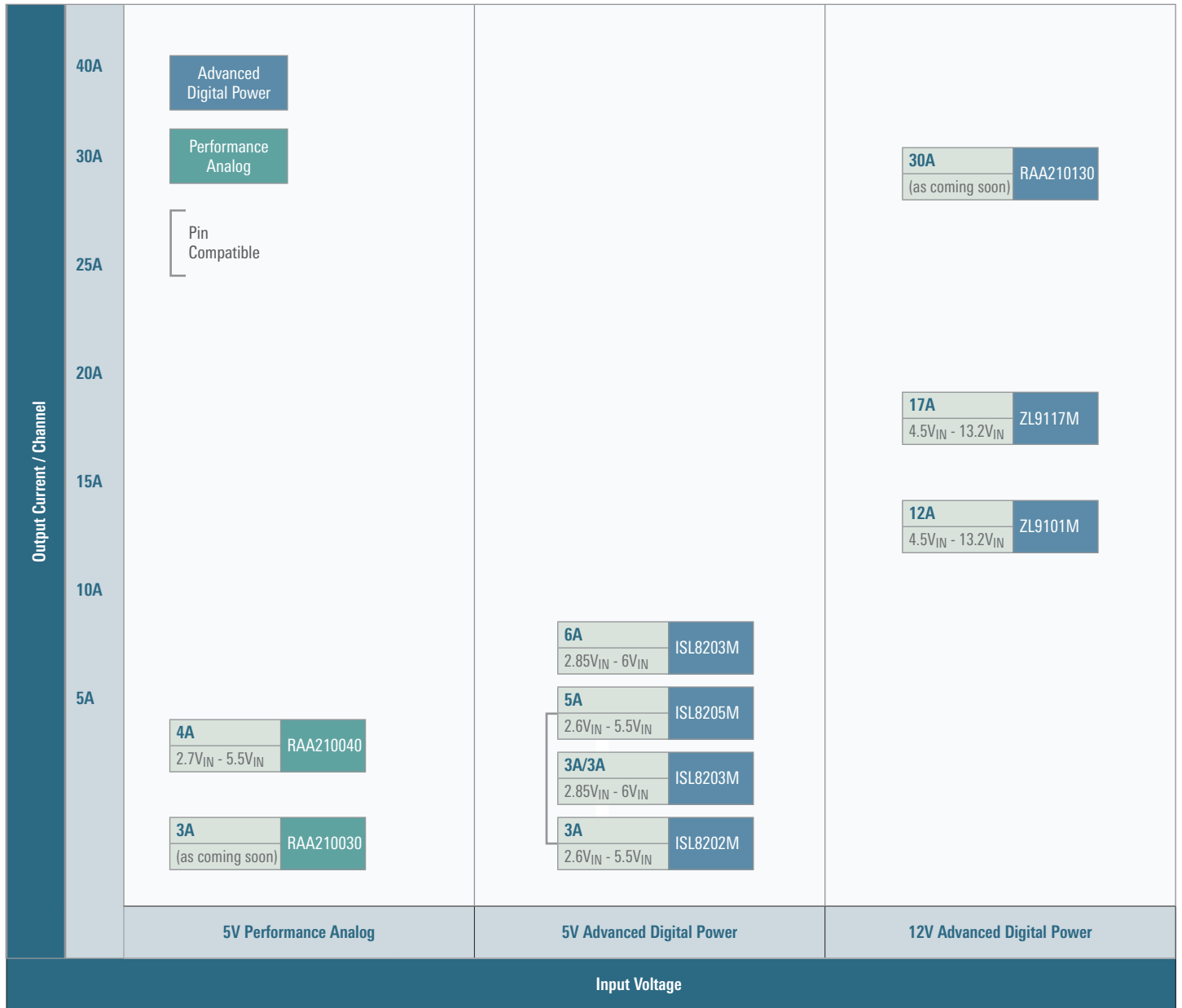


Digital Modules

A high-performance DC/DC power supply solution that integrates all power elements in a single package and supports digital communication and configurability for advanced power management techniques. Digitally design with PowerNavigator™ GUI software.



Featured Analog & Digital Power Modules



More power modules are available. To see a complete product list, visit: www.renesas.com.



SIMPLE DC/DC POWER MODULES

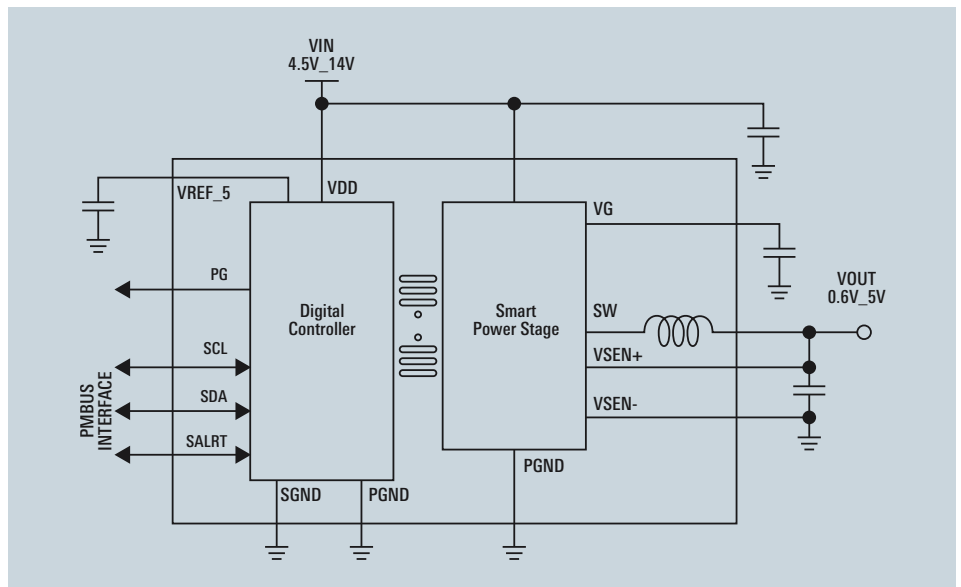
RAA210130 Pre-release PMBUS-enabled 12V, 30A Module



High power density supports demanding loads in BGA-POP module

Key Features

- PMBus™ Compliant Controller + Smart Power Stage
- Vin range: 4.5V to 14V, Vout range: 0.6V to 3.3V
- 0.5% Output Voltage Accuracy over Temperature
- Pin-selectable pre-programmed output voltage options
- "Black box" fault capture & recording
- User-accessible one-time-programmable memory slots



Simple DC/DC Power modules integrated inductor

Part No.	Ch	Circuit	V _{IN} (V)	V _{OUT} (V)	I _{OUT} MAX (A)	Package	PMBus	Molded
RAA210130	1	DC/DC (Step-down)	4.5 to 18	0.45 to 3.3	30A	10mm x 13mm x 7.8mm BGA package	Yes	NO
RAA210040	1	DC/DC (Step-down)	2.7 to 5.5	0.6 to 5	4A	3mm x 3mm x 1.7mm dual flat embedded laminate package	No	YES

MOSFET DRIVERS

Industry-Leading Bridge Drivers

HIP2103/04 Family of 60V Bridge Drivers for BLDC and Similar Loads

Optimized for Battery Powered Applications from 5V to 36V

- 60V max rating is suitable for 36V battery applications
- 4.5 UVLO allows operation as low as 5V
- Proprietary sleep mode activation eliminates the need for additional I/O control pins
- Very low I_Q ($<10 \mu A$) eliminates the need for a disconnect switch to maintain idle battery life

Integrated Linear Regulators (HIP2104) for External Loads

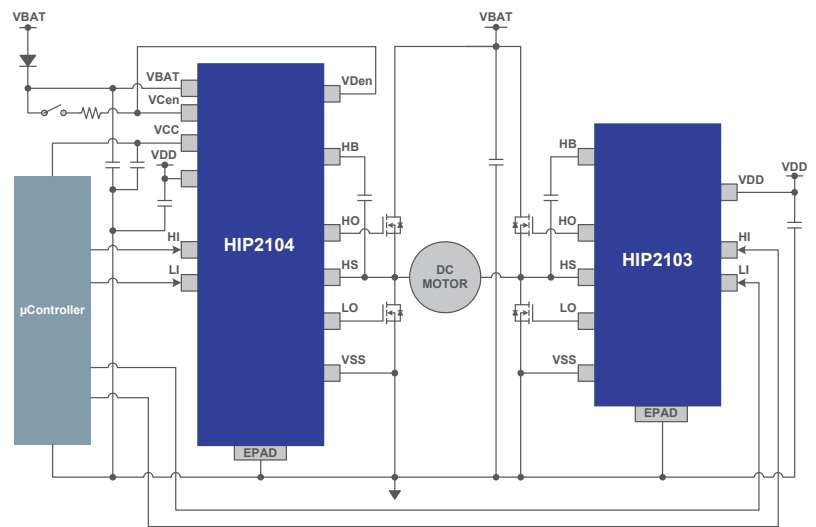
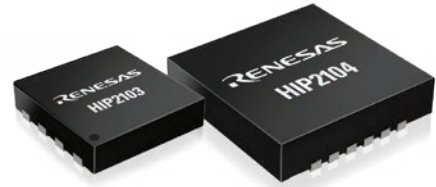
- Reduces external components for lower BOM cost and smaller solution footprint
- 12V output provides gate drive bias
- 3.3V output provides digital controller bias

1A Sourcing, 2A Sinking MOSFET Drivers

- Enough drive strength for high speed switching applications
- Enough drive strength for very high MOSFET gate charge

Easy to Configure Half-Bridge, Full-Bridge, and 3-phase

- Small packages allow drivers to be placed next to the bridge FETs



Typical Full-Bridge Application

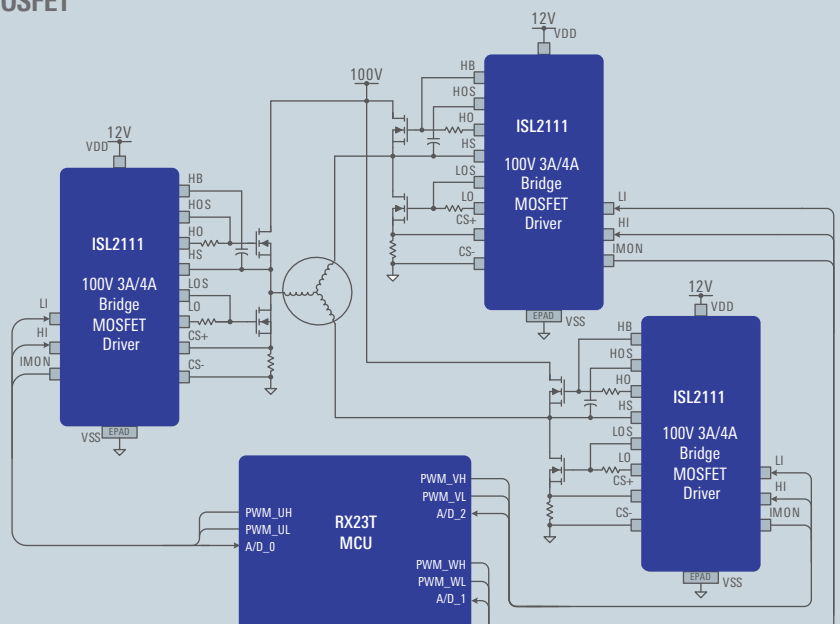
100V BLDC Motor Control — Using High Voltage MOSFET Drivers with Renesas MCUs

Benefits

- Smaller solution size
- Better system efficiency through higher driver current and lower I_Q
- Adaptive dead time eliminates the need for leading-edge delays for shoot-thru prevention, reducing the programming complexity for the controller
- BOM cost saving with integrated current monitor

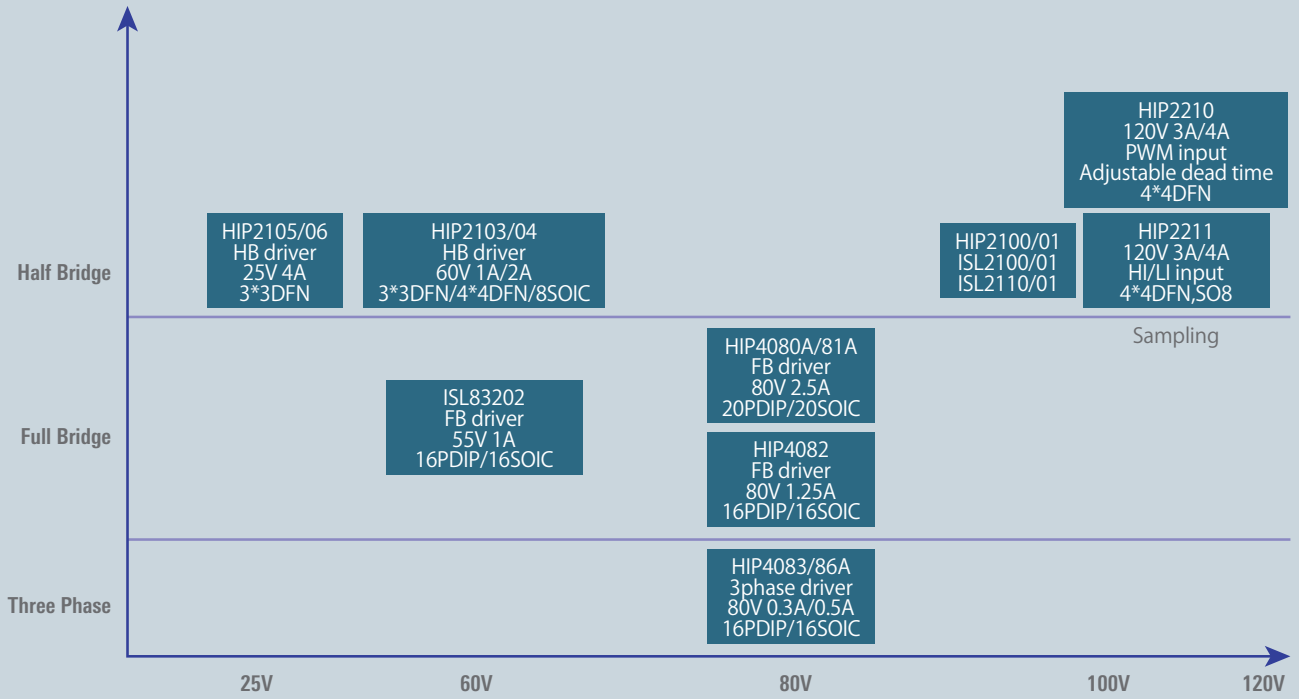
Applications

- Telecom bricks and power supplies
- High power motor control
- Robotics



Full Menu of MOSFET Gate Drivers

BRIDGE FET DRIVERS



POWERCOMPASS™ TOOL

Simplify Your Power Design with the PowerCompass Multi-load Configurator.

The PowerCompass™ tool makes product selection easy — quickly find Renesas parts that match your requirements, set up multiple rails if needed, perform high-level system analysis, and generate reference design files.

- Upfront design time reduced by 92%
- Multiple solution options highlight design tradeoffs for BOM count, design size, and price
- Pre-loaded design templates for popular FPGAs and microprocessors



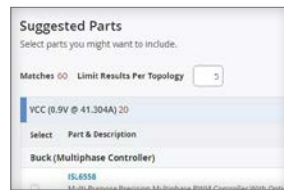
Start Your Project Now.

www.renesas.com/powercompass

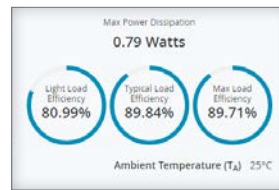
1 Define Your Power Requirements.



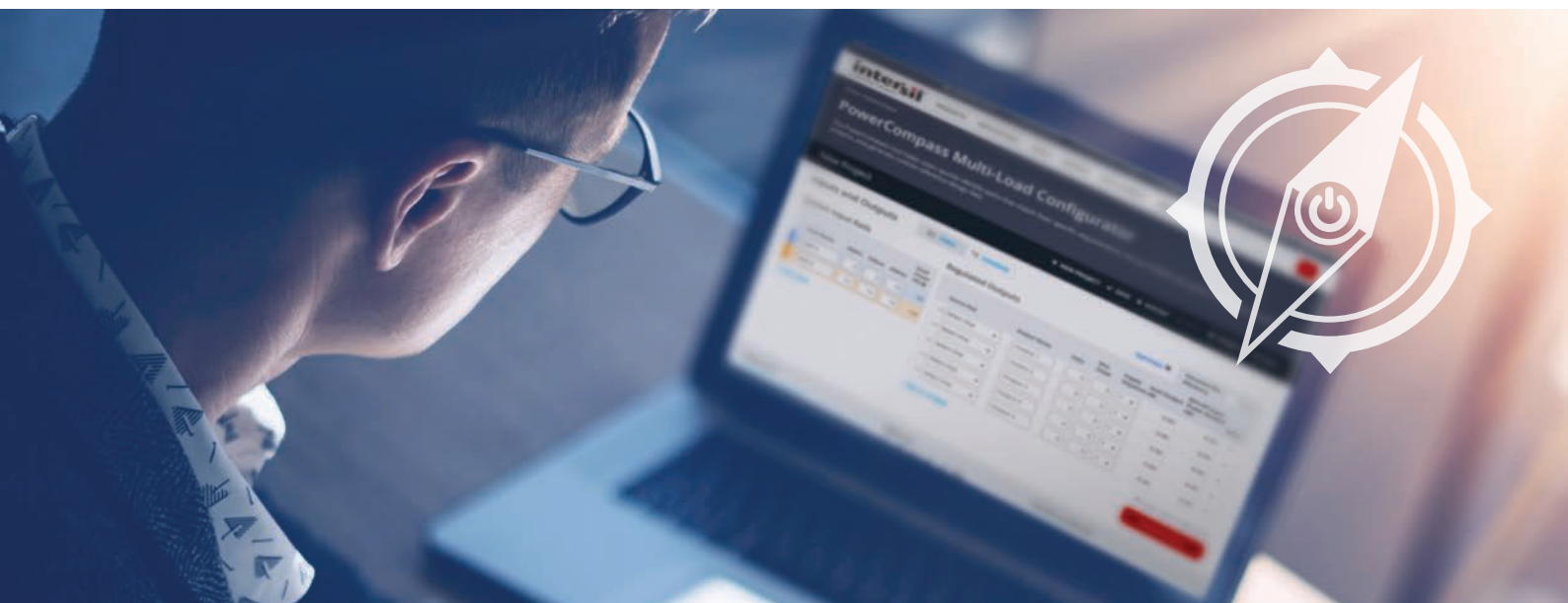
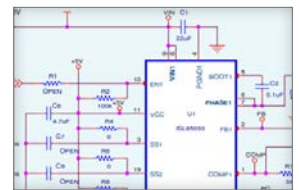
2 Select Parts.



3 Summary Analysis



4 Generate Reference Designs.



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