ISL91302B AND ISL91301A/B

MULTI-PHASE BUCK PMIC AND MULTI-OUTPUT, MULTI-PHASE BUCK PMIC

BIG IDEAS
FOR EVERY SPACE

RENESAS

ADVANTAGES OF RENESAS R5 MULTIPHASE DC/DC PRODUCTS

Small PCB size and thin solution

- 7x10mm2 total solution size for 4 outputs/phases
- Small WLCSP package
- 4MHz frequency → supports less than 2x2x1mm case size inductors
- Fast transient performance → less output capacitors
- No external components for compensation, VOUT setting, etc.

High efficiency

- 91% peak efficiency 3.3V → 1.0V/4A

Easy to design in – no PCB level design needed

- Internal compensation – no need to design compensation
- Parts pre-programmed with required VOUTs, sequencing, etc.

Multiple package options

- WLCSP, 0.4mm pitch
- Upcoming BGA, 0.8mm pitch, samples available in early 2018 (ISL91302B)

Proven technology in mass production

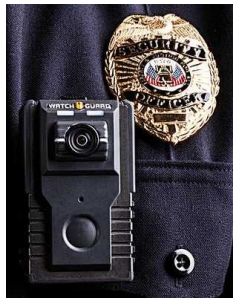
TARGET MARKETS AND APPLICATIONS

Industrial & Networking Markets

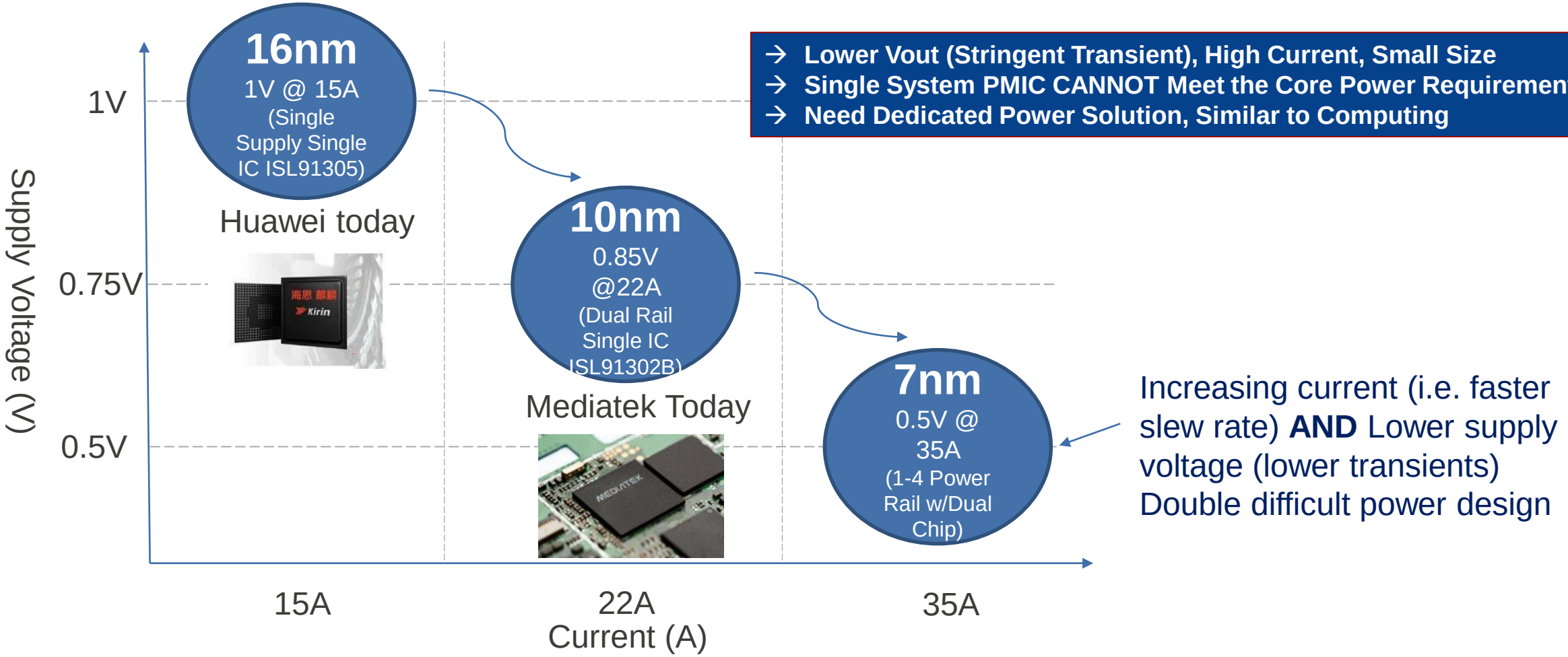
- Renesas MPU and ASICs
- Industrials and FPGAs
- Enterprise Networks, Switches, Routers, WIFI
- Security and Wearable Cameras
- Optical Transceiver Modules

Consumer Markets

- Smartphones and Tablets
- SSDs
- VR / AR Goggles and Glasses



AP PROCESS NODE TRANSITION DRIVES POWER DESIGN DEVELOPMENT



CORE POWER: SMARTPHONE/TABLET VS. LAPTOP

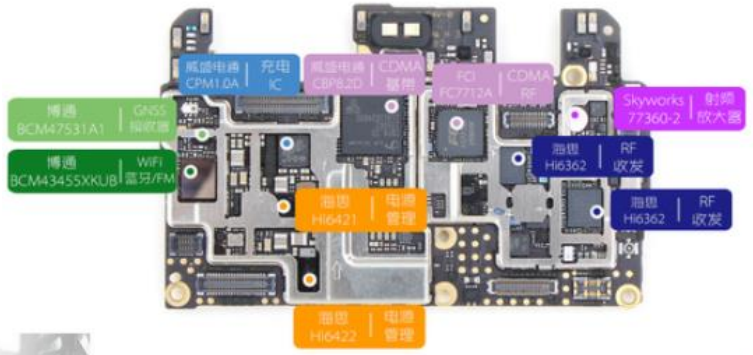
Typical Notebook MB with Intel Core I5

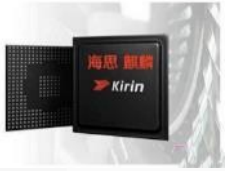
Quad-Core-CPU

Processor Number	Cache	Clock Speed	# of Cores/ # of Threads	Max TDP/ Power
Desktop				
Intel® Core™ i5-6402P Processor (6M Cache, up to 3.40 GHz)	6.0 MB	2.80 GHz	4/ 4	65

Power Solution: Renesas Multi-phase VR for Notebook

Huawei Latest P9 Smartphone MB





Octa-Core-AP

PLATFORM	OS	Android OS, v6.0 (Marshmallow)
	Chipset	HiSilicon Kirin 955
	CPU	Quad-core 2.5 GHz Cortex-A72 & quad-core 1.8 GHz Cortex-A53
	GPU	Mali-T880 MP4
MEMORY	Card slot	microSD, up to 256 GB (uses SIM 2 slot)
	Internal	32 GB, 3 GB RAM (EVA-L19/EVA-L09) 64 GB, 4 GB RAM (EVA-L29)

Phone AP/GPUs: Dedicated 'Sub' PMIC → Renesas Multi-phase Buck

SMARTPHONE/TABLET CORE POWER REQUIREMENT

- **Smartphone/Tablet Core Power Management - 'Old Socket' but now has new requirements:**
  - **High current demanding (~ 4A - 5A/phase) → 'Sub' PMIC**
  - Low profile solution (<=1mm)
  - Small footprint solution with minimum external components
  - Wide input voltage range
  - Low quiescent current
  - High efficiency
  - Tight transient spec
  - Dynamic output voltage change
  - Communications with AP/GPU
  - Protection

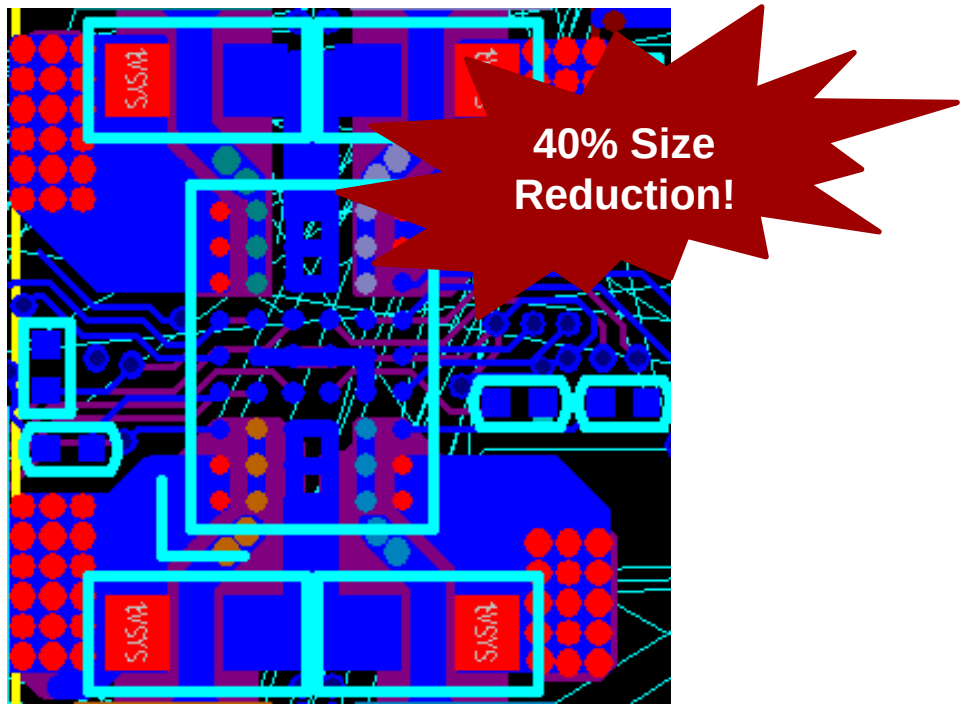
- **Renesas Multi-Phase Buck:**
  - Dedicated voltage regulator for AP/GPUs
  - It targets high performance and high current market segments

ISL91302B MULTI-PHASE BUCK PMIC

Designed to meet the stringent AP/GPU applications:

- Small solution size
- High output current capability
- Flexible configuration through internal one time programmable (OTP) registers
- Best efficiency performance
- Best transient response with proprietary R5 control technique
- Accurate system level telemetry ADC for VIN, Vout, IOUT, temperature, etc.
- Support I^2C and SPI communication protocol
- Full protection features, e.g., OV, UV, OT, OC

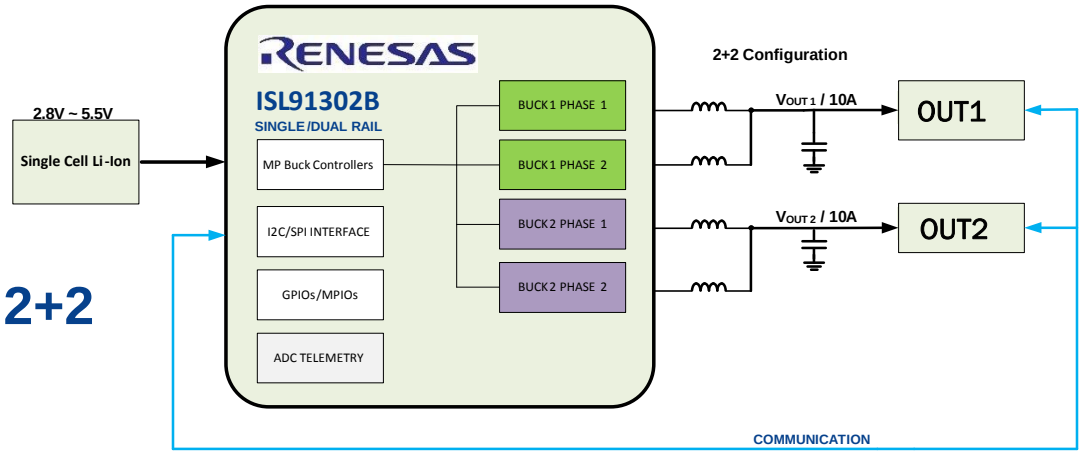
ISL91302B Solution Size: 70 mm^2



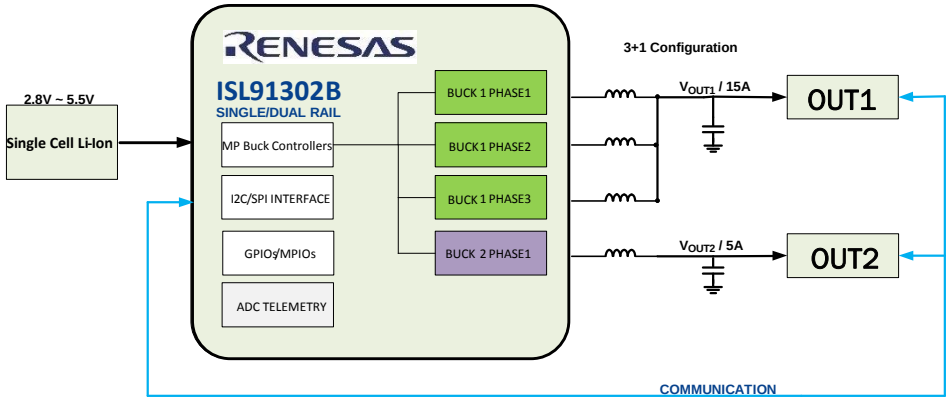
PRODUCT HIGHLIGHTS

ISL91302B AND ISL91301A/B

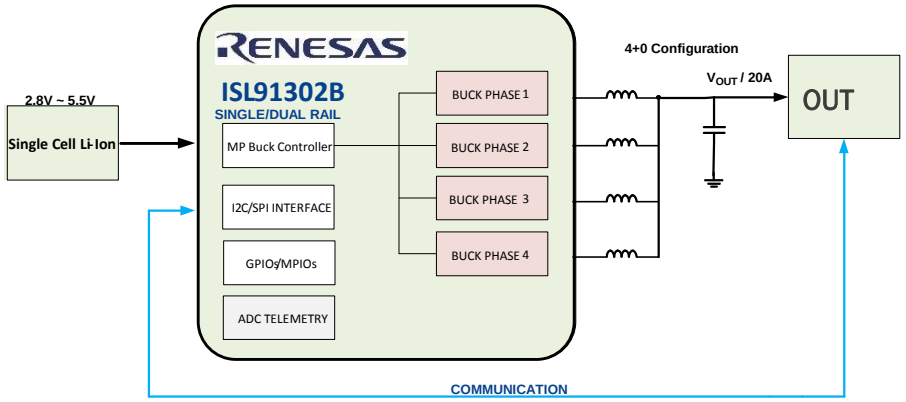
ISL91302B: MULTI-OUTPUT MULTI-PHASE BUCK PMIC



2+2



3+1

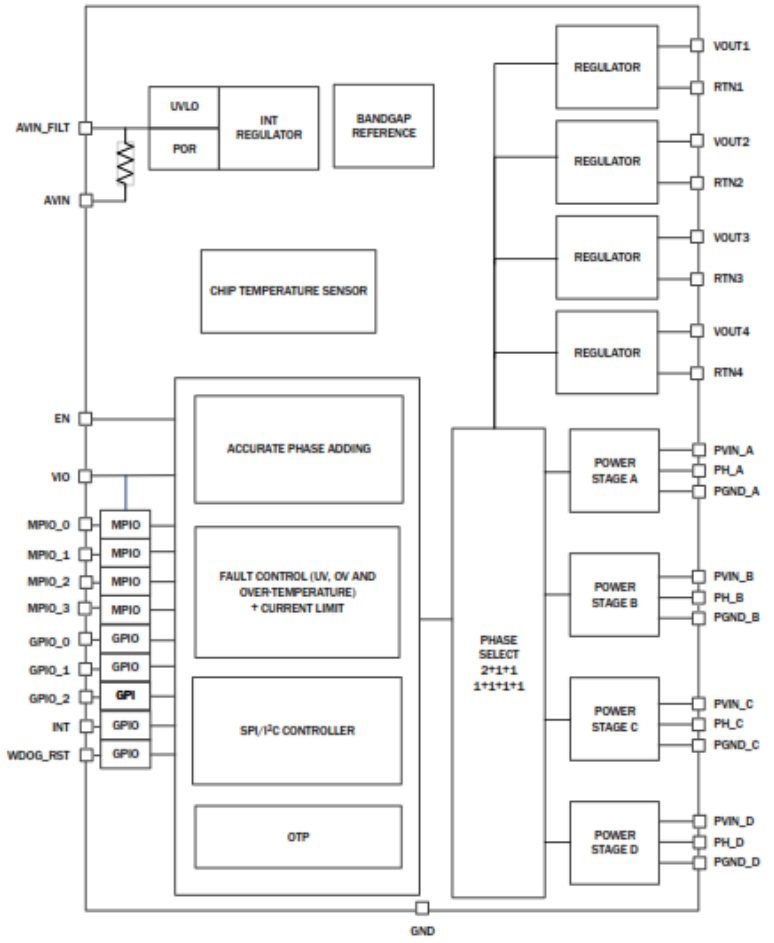


4+0

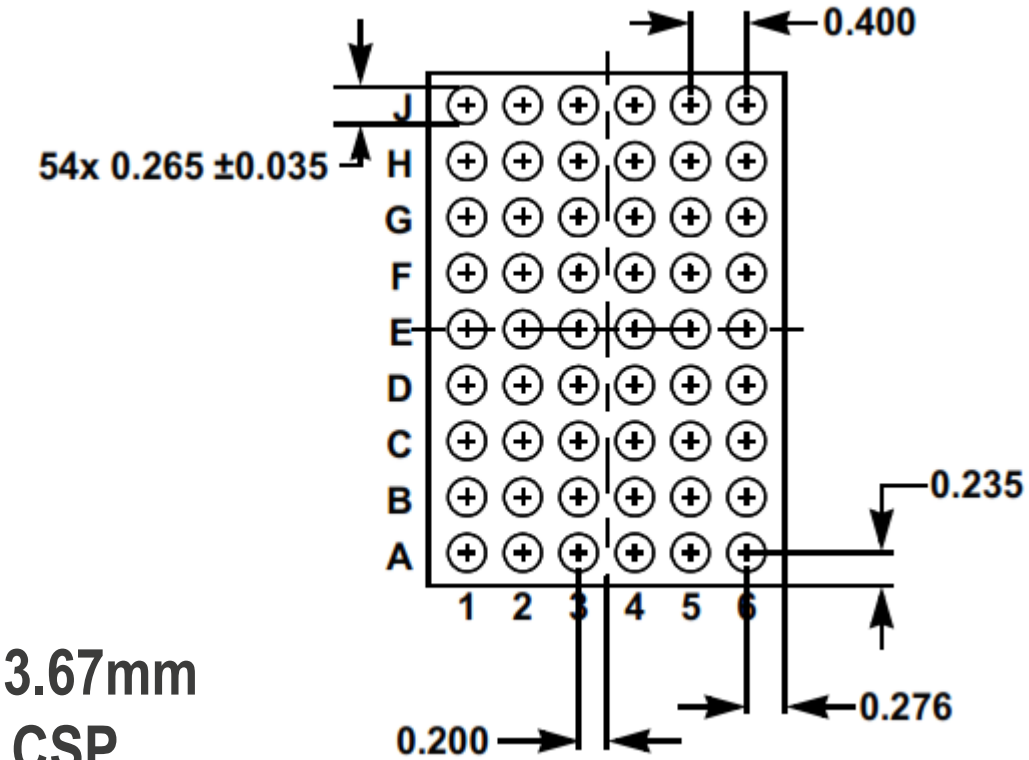
ISL91302B: MULTI-OUTPUT MULTI-PHASE BUCK PMIC

ISL91302B

- Supported output configurations
  - Dual phase: 2+2; Max output: 10A+10A
  - Triple phase: 3+1, Max output: 15A + 5A
  - Quad phase: 4+0, Max output: 20A
- 2.5V to 5.5V supply voltage
- Programmable output from 0.3V to 2.0V
- Low Iq: 75uA in DCM mode
- 94% peak efficiency
- Output voltage remote sensing
- ±0.5% system accuracy
- I²C and SPI protocol
- Independent dynamic voltage scaling (DVS) for each output
- Programmable frequency from 2MHz to 6MHz
- Full protection features: OVP, UVP, OCP, OTP
- 2.55mm x 3.67mm 54-ball WLCSP with 0.4mm ball pitch

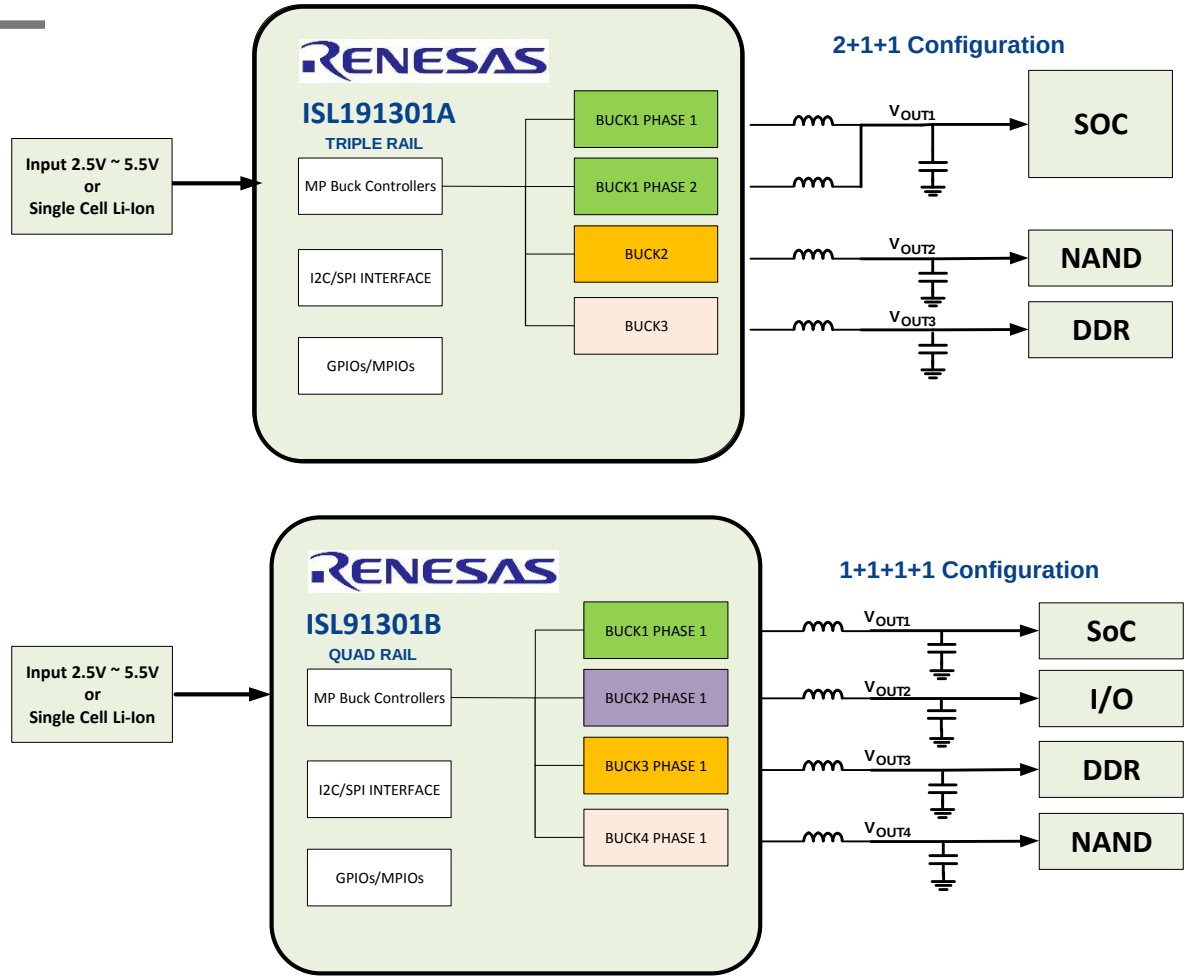


ISL91302B PACKAGE INFORMATION



- 2.55mm x 3.67mm
- 54-ball WLCSP
- 0.4mm pitch

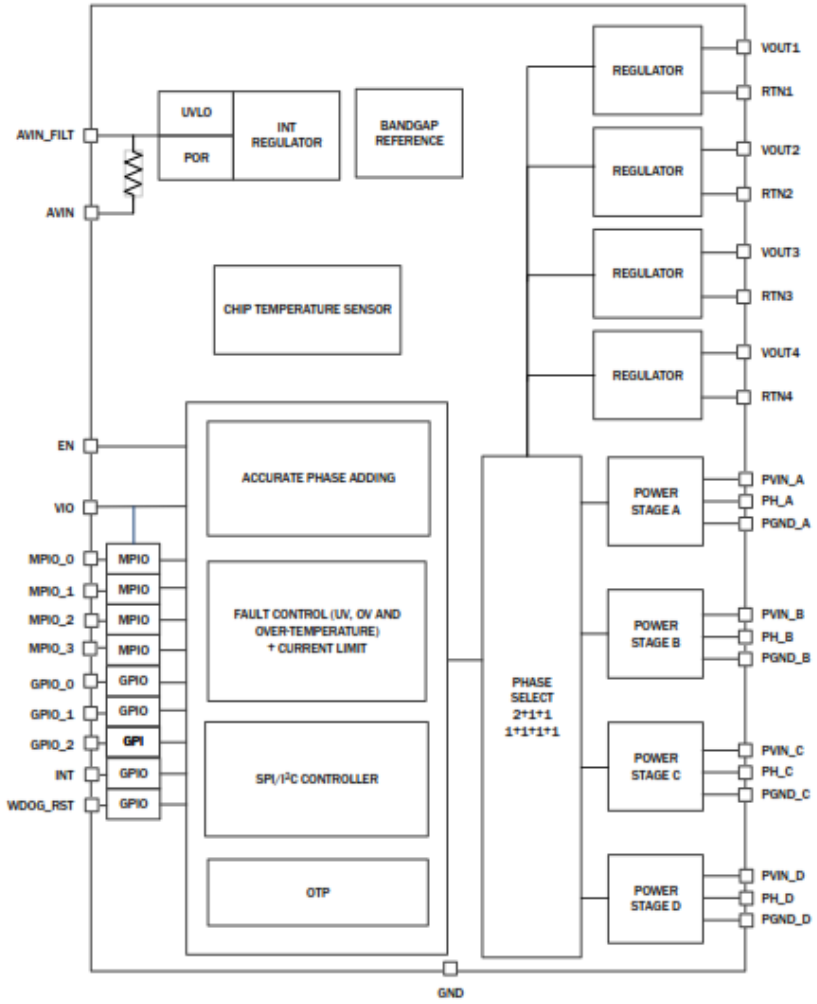
ISL91301A/B: MULTI-OUTPUT MULTI-PHASE BUCK PMIC



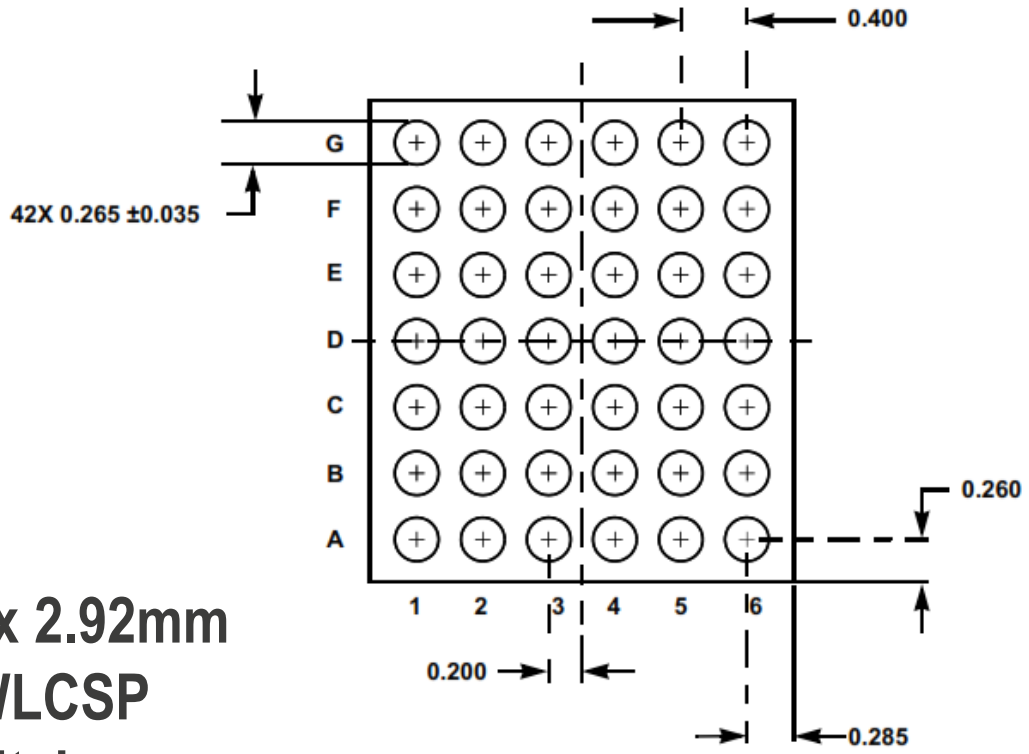
ISL91301A/B: MULTI-OUTPUT MULTI-PHASE BUCK PMIC

ISL91301A/B

- Supported output configurations
  - Dual phase (ISL91301A): 2+1+1, Max output: 8A+4A+4A
  - Single phase (ISL91301B): 1+1+1+1, Max output: 4A+4A+4A+4A
- 2.5V to 5.5V supply voltage
- Programmable output from 0.3V to 2.0V
- Low Iq: 62uA in low power mode
- 94% peak efficiency
- Output voltage remote sensing
- ±0.7% system accuracy
- I²C and SPI protocol
- Independent dynamic voltage scaling (DVS) for each output
- Programmable frequency from 2MHz to 6MHz
- Full protection features: OVP, UVP, OCP, OTP
- 2.57mm x 2.92mm 42-ball WLCSP with 0.4mm ball pitch



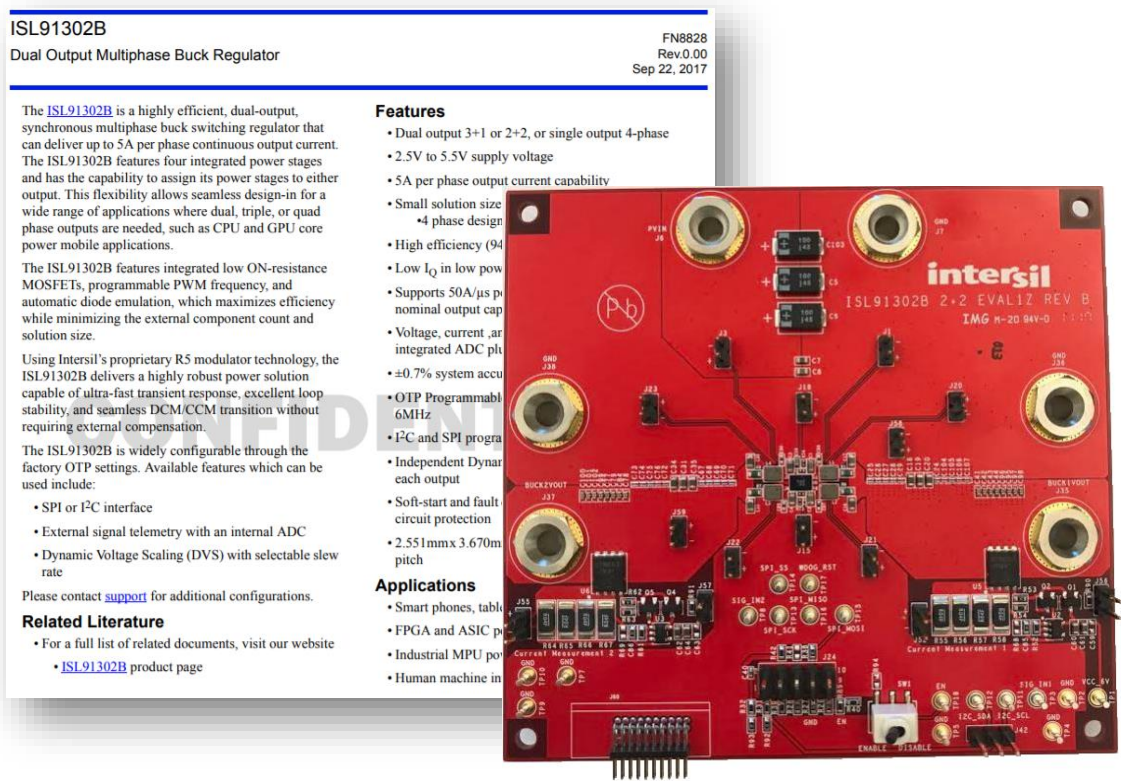
ISL91301A/B PACKAGE INFORMATION



- 2.57mm x 2.92mm
- 42-ball WLCSP
- 0.4mm pitch

DESIGN IN SUPPORT TOOLS

ISL91302B COLLATERAL


ISL91302B
Dual Output Multiphase Buck Regulator
FN8828
Rev.0.00
Sep 22, 2017

The ISL91302B is a highly efficient, dual-output, synchronous multiphase buck switching regulator that can deliver up to 5A per phase continuous output current. The ISL91302B features four integrated power stages and has the capability to assign its power stages to either output. This flexibility allows seamless design-in for a wide range of applications where dual, triple, or quad phase outputs are needed, such as CPU and GPU core power mobile applications.

The ISL91302B features integrated low ON-resistance MOSFETs, programmable PWM frequency, and automatic diode emulation, which maximizes efficiency while minimizing the external component count and solution size.

Using Intersil's proprietary R5 modulator technology, the ISL91302B delivers a highly robust power solution capable of ultra-fast transient response, excellent loop stability, and seamless DCM/CCM transition without requiring external compensation.

The ISL91302B is widely configurable through the factory OTP settings. Available features which can be used include:

- SPI or I²C interface
- External signal telemetry with an internal ADC
- Dynamic Voltage Scaling (DVS) with selectable slew rate

Please contact support for additional configurations.

Related Literature

- For a full list of related documents, visit our website
  - ISL91302B product page

Features

- Dual output 3+1 or 2+2, or single output 4-phase
- 2.5V to 5.5V supply voltage
- 5A per phase output current capability
- Small solution size
  - 4 phase design
- High efficiency (94
- Low I_Q in low pow
- Supports 50A/µs p
  nominal output cap
- Voltage, current ,ar
  integrated ADC plu
- ±0.7% system accu
- OTP Programmabl
  6MHz
- I²C and SPI progra
- Independent Dynar
  each output
- Soft-start and fault
  circuit protection
- 2.551mm x 3.670m
  pitch

Applications

- Smart phones, tabl
- FPGA and ASIC p
- Industrial MPU po
- Human machine in

Documentation

- ISL91302B datasheet
- EVB User's Guide

Evaluation Board

- ISL91302B22-EVZ (for 2+2 configuration)
- ISL91302B31-EVZ (for 3+1 configuration)
- ISL91302B40-EVZ (for 4+0 configuration)

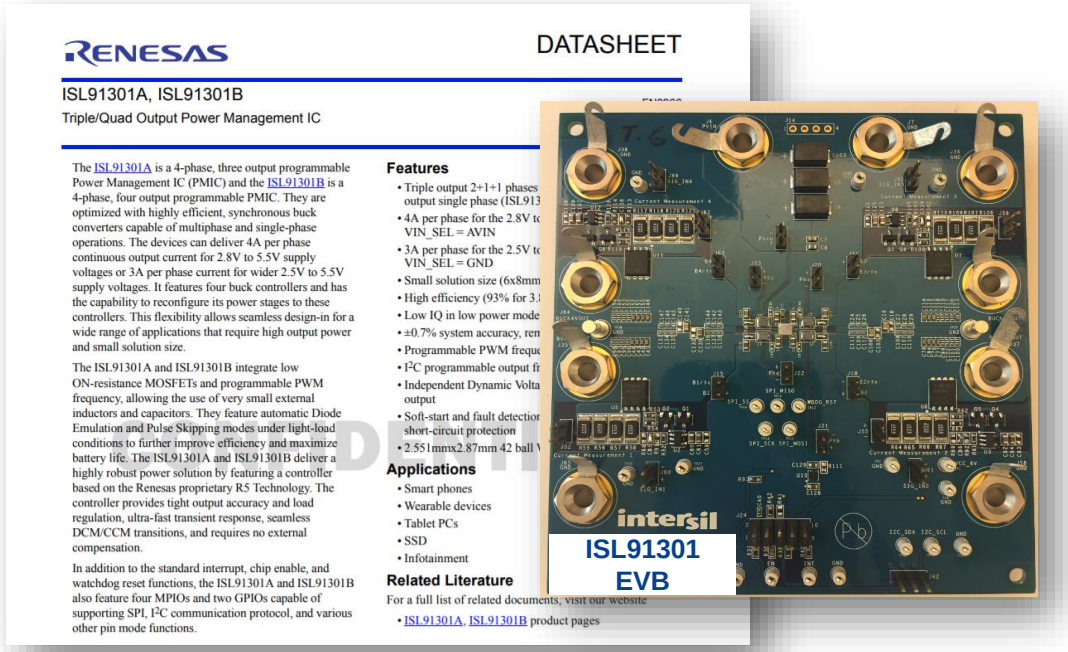
Online Support Portal

- Online FAQs database
- https://www.intersil.com/en/products/power-management/pmic/integrated-fet-regulators/ISL91302B.html#resources

Ordering Information

- Samples available
- P/N: ISL91302BIIZ-T Reel 3000 Piece/Reel 1K Price: $3.90

ISL91301A AND ISL91301B COLLATERAL



Documentation

- ISL91301A/B datasheet

Evaluation Board

- ISL91301AII-H-EV1Z (for 2+1+1 4A/phase configuration)
- ISL91301AII-L-EV1Z (for 2+1+1 3A/phase configuration)
- ISL91301BII-H-EV1Z (for 1+1+1+1 4A/phase configuration)
- ISL91301BII-L-EV1Z (for 1+1+1+1 3A/phase configuration)

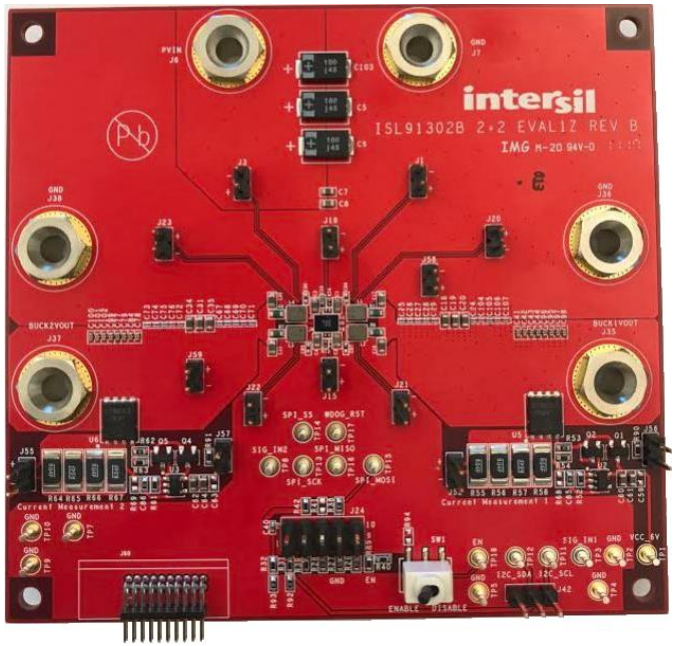
Online Support Portal

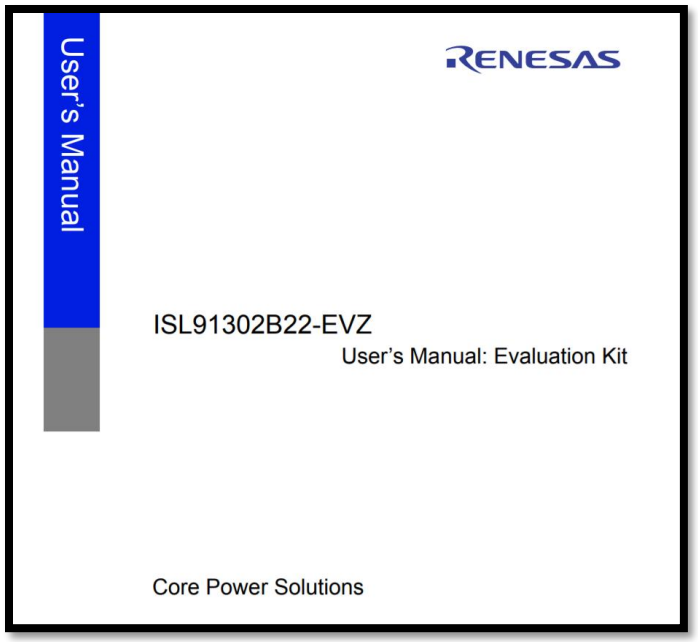
- Online FAQs database
- https://www.intersil.com/en/products/power-management/pmic/integrated-fet-regulators/ISL91301.html#resources

Ordering Information

- Samples available
- P/N: ISL91301AIIZ-T Reel 3000 Piece/Reel 1K Price: $3.12
- P/N: ISL91301BIIZ-T Reel 3000 Piece/Reel 1K Price: $3.12

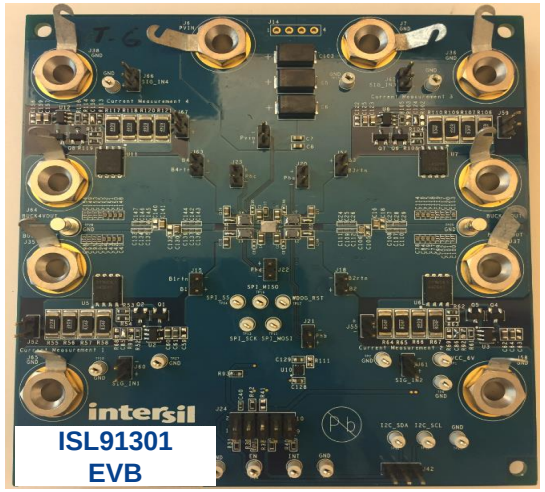
ISL91302B DEMO KIT EVALUATION BOARD



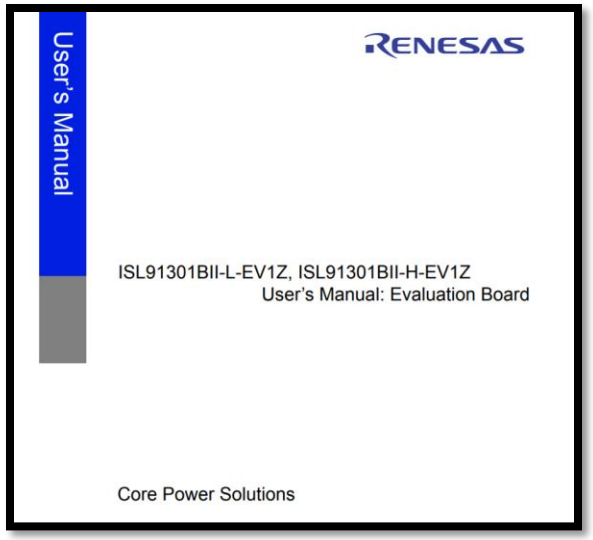


EVB Part Number	Description
ISL91302B22-EVZ	ISL91302B EVB : 2+2, Max Output Current: 10A + 10A
ISL91302B31-EVZ	ISL91302B EVB : 3+1, Max Output Current: 15A + 5A
ISL91302B40-EVZ	ISL91302B EVB : 4+0, Max Output Current: 20A

ISL91301A/B DEMO KIT EVALUATION BOARDS



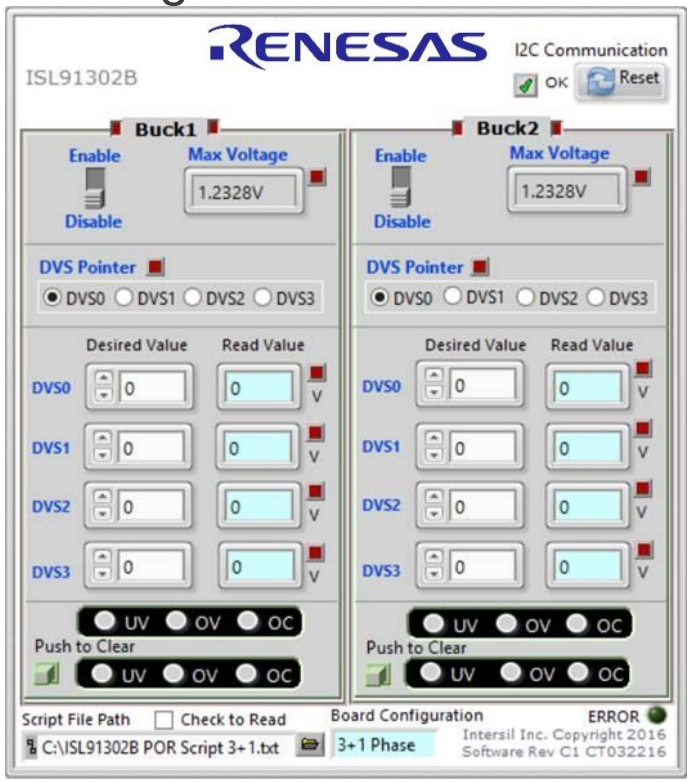
ISL91301
EVB

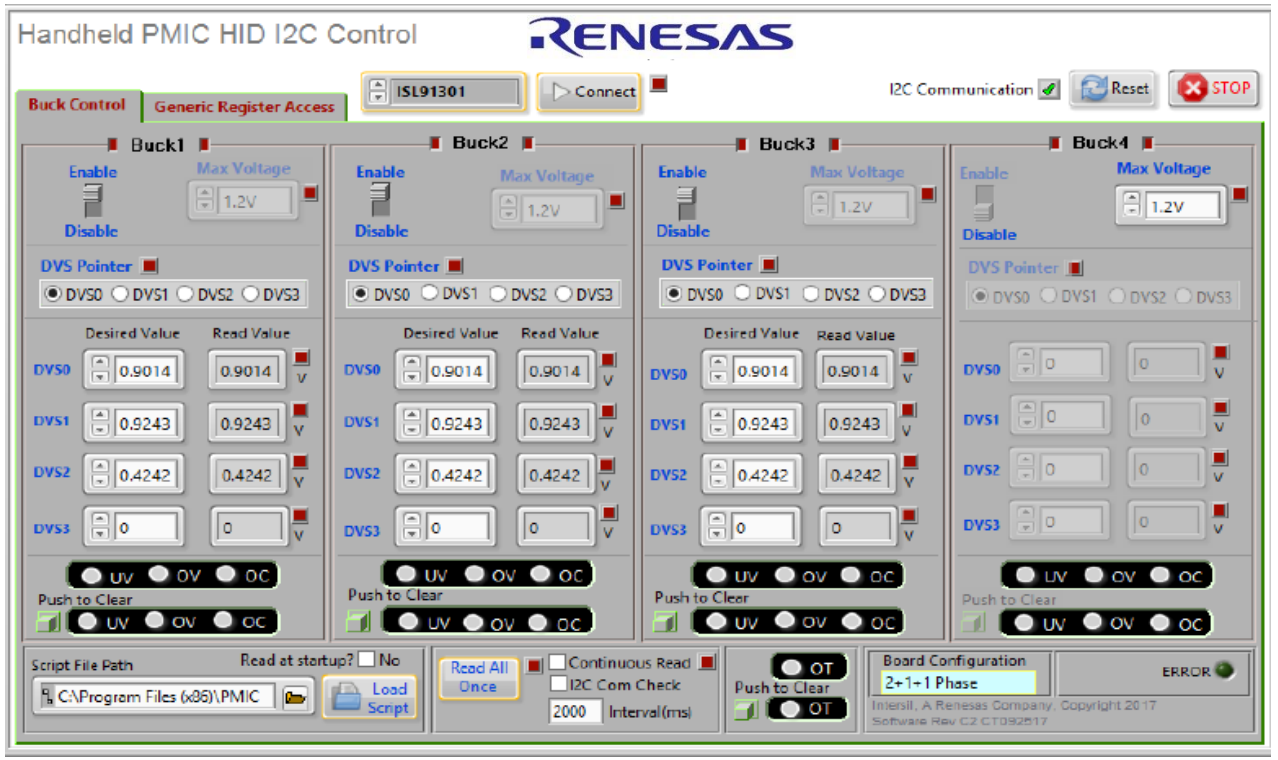


EVB Part Number	Description
ISL91301AII-H-EV1Z	ISL91301A 4A/Phase EVB : 2+1+1, Max Output Current: 8A+4A+4A
ISL91301AII-L-EV1Z	ISL91301A 3A/Phase EVB : 2+1+1, Max Output Current: 6A+3A+3A
ISL91301BII-H-EV1Z	ISL91301B 4A/Phase EVB : 1+1+1+1, Max Output Current: 4A+4A+4A+4A
ISL91301BII-L-EV1Z	ISL91301B 3A/Phase EVB : 1+1+1+1, Max Output Current: 3A+3A+3A+3A

MULTI-PHASE BUCK PMIC DEMO KITS

- Complete demo kit for multi-phase buck, including EVBs, customer GUI and dongle





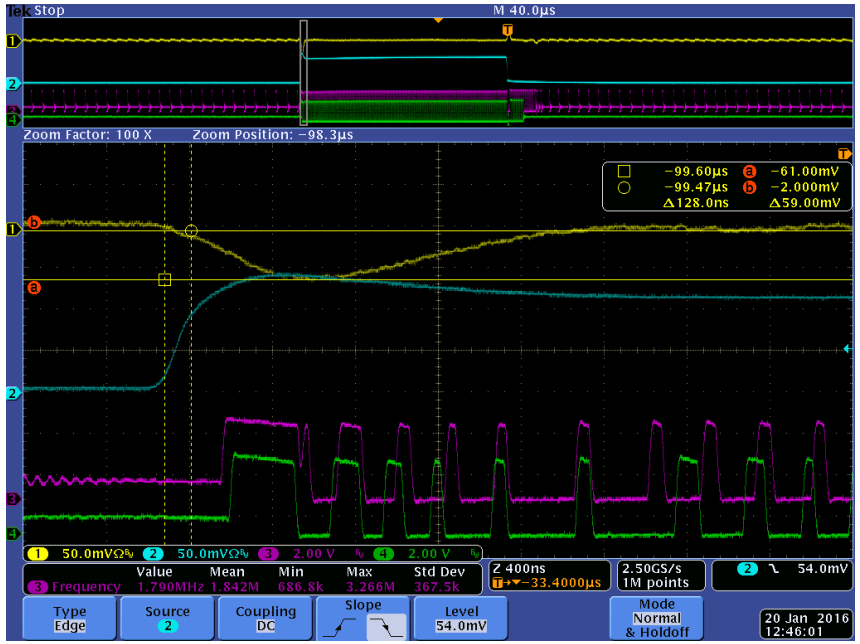
ISL91302B & ISL91301A/B Customer GUIs

DESIGN IN SUPPORT: OPTIMIZED TUNING FOR THE BEST PERFORMANCE

- Multi-phase buck products have more than 700 registers
- To ensure each design is getting best performance:
  - Part has been loaded with default register values → starting point
  - Registers can be tuned for the best efficiency/transient performance for various L/Cout combinations
  - System-level simulation model is provided for performance verification

Register Address Map

ADDRESS	REGISTER	ADDRESS	REGISTER	ADDRESS	REGISTER
0x01	IO_CHIPNAME	0x30	ADC_AUX0MSB	0x80	BUCK1_EN_DLY
0x02	IO_CHIPVERSION	0x31	ADC_AUX0LSB	0x81	BUCK1_SHUTDN_DLY
0x0A	IO_DIEID3	0x32	ADC_AUX1MSB	0x85	BUCK2_DCM
0x0B	IO_DIEID2	0x33	ADC_AUX1LSB	0x89	BUCK2_CFG0
0x0C	IO_DIEID1	0x42	IO_I2CCFG	0x8A	BUCK2_PROTCFG
0x0D	IO_DIEID0	0043	IO_SPICFG	0x8E	BUCK2_DVS0CFG1
0x0E	OTP_VERSION	0x44	IO_MODECTRL	0x8F	BUCK2_DVS0CFG0
0x0F	IO_SOFTRESET	0x45	IO_RSTDVS	0x90	BUCK2_DVS1CFG1
0x10	CHIPSTATE	0x46	IO_PINMODE	0x91	BUCK2_DVS1CFG0
0x11	CHIPSTATE_DCMPGOOD	0x58	FLT_TEMPWARN	0x92	BUCK2_DVS2CFG1
0x13	FLT_RECORDTEMP	0x59	FLT_TEMPSHUTDN	0x93	BUCK2_DVS2CFG0
0x14	FLT_RECORDBUCK1	0x5A	FLT_TEMPHYS	0x94	BUCK2_DVS3CFG1
0x15	FLT_RECORDBUCK2	0x5B	FLT_BUCK1_ISENSEWARN	0x95	BUCK2_DVS3CFG0
0x16	ADC_SAMPLE0MSB	0x5C	FLT_BUCK2_ISENSEWARN	0x96	BUCK2_VOUTMAXMSB
0x17	ADC_SAMPLE0LSB	0x5D	FLT_BUCK1_ISENSESHUTDN	0x97	BUCK2_VOUTMAXLSB
0x18	ADC_SAMPLE1PH1MSB	0x5E	FLT_BUCK2_ISENSESHUTDN	0x98	BUCK2_DVSCFG
0x19	ADC_SAMPLE1PH1LSB	0x60	FLT_MASKTEMP	0x99	BUCK2_DVSSEL
0x1A	ADC_SAMPLE1PH2MSB	0x61	FLT_MASKBUCK1	0x9A	BUCK2_RSPCFG1
0x1B	ADC_SAMPLE1PH2LSB	0x62	FLT_MASKBUCK2	0x9B	BUCK2_RSPCFG0
0x1C	ADC_SAMPLE1PH3MSB	0x63	FLT_OT_CTRL	0x9C	BUCK2_EN_DLY
0x1D	ADC_SAMPLE1PH3LSB	0x64	FLT_BUCK1_CTRL	0x9D	BUCK2_SHUTDN_DLY
0x1E	ADC_SAMPLE1PH4MSB	0x65	FLT_BUCK2_CTRL		
0x1F	ADC_SAMPLE1PH4LSB	0x69	BUCK1_DCM		
0x20	ADC_SAMPLE1TMSB	0x6D	BUCK1_CFG0		
0x21	ADC_SAMPLE1TLSB	0x6E	BUCK1_PROTCFG		
0x22	ADC_SAMPLE2MSB	0x72	BUCK1_DVS0CFG1		
0x23	ADC_SAMPLE2LSB	0x73	BUCK1_DVS0CFG0		
0x24	ADC_SAMPLE3MSB	0x74	BUCK1_DVS1CFG1		
0x25	ADC_SAMPLE3LSB	0x75	BUCK1_DVS1CFG0		
0x26	ADC_SAMPLE4PH1MSB	0x76	BUCK1_DVS2CFG1		



R5 MODULATION TECHNOLOGY INFORMATION

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Home > All Products > Power Management > R5™ Technology

R5 Modulation Technology

Rapid Robust Ripple Regulator

Reduce board footprint and BOM costs with Intersil's R5™ Technology.

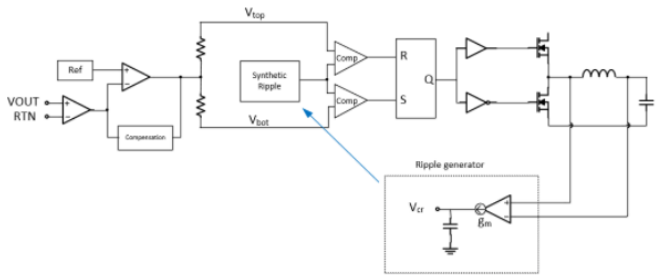
Intersil's R5 Controller Technology is a proprietary modulation technique that offers the fastest response to changing output load conditions. R5 is the next evolution of our unique current-mode hysteretic controller with improved bandwidth and lower Iq than previous implementations.

Using R5 results in much smaller output voltage overshoot and undershoot, resulting in a lower output capacitance. As a result, the board footprint and BOM cost can be reduced significantly.

Key Features:

- Best-in-class transient performance
- Stable operating frequency in steady-state with variable duty cycle and frequency in response to load transient
- Automatic Phase Adding/Shedding with efficiency optimization algorithm
- Seamless, natural transition between PWM and PFM
- Low-Iq in PFM

Simplified R5 diagram



https://www.intersil.com/en/products/power-management/r5-technology.html

BIG IDEAS FOR EVERY SPACE

Renesas.com