US061
Soundbar with
Bluetooth Streaming

December 2019

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Soundbar with Bluetooth Streaming

▪ Overview

 A soundbar, also called a speaker bar, is a special speaker with multiple drivers and is usually put above a computer monitor or under a television or home theater screen. It can significantly improve the sound experience without the complexity of surround sound speakers, wiring, etc.
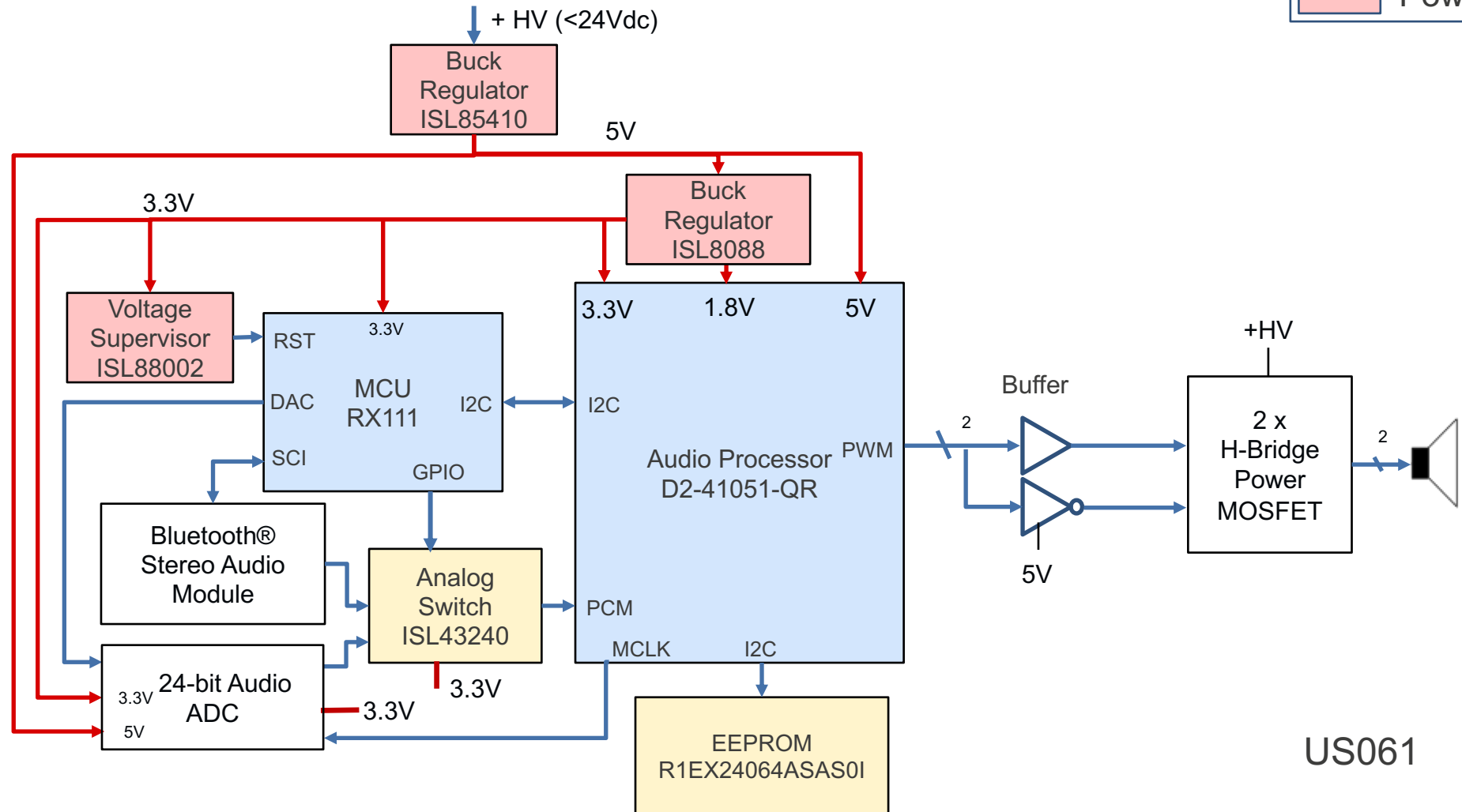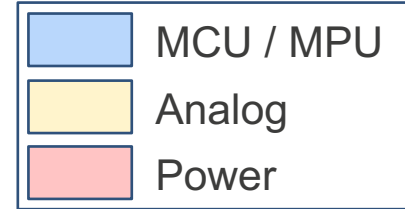
The design is meant to be compact, generate premium sound, and can be cost effective. The D2-4 family of devices are complete System-on-Chip (SoC) audio processor and Class-D amplifier controllers that offer a powerful, yet very cost effective audio solution.

▪ System Benefits

- Complete audio processor and Class-D amplifier controller in one package
- Cost effective, small-capacity ROM and low pin count 32-bit MCU
- High performance power includes voltage supervisors, dual buck regulators and a wide Vin 1A buck regulator

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Soundbar with Bluetooth Streaming

Legend:
- MCU / MPU (blue)
- Analog (yellow)
- Power (pink)

+ HV (<24Vdc)

Buck Regulator ISL85410

5V

3.3V

Buck Regulator ISL8088

Voltage Supervisor ISL88002

MCU RX111
- RST
- 3.3V
- DAC
- SCI
- I2C
- GPIO

Audio Processor D2-41051-QR
- 3.3V
- 1.8V
- 5V
- I2C
- PWM
- PCM
- MCLK
- I2C

Bluetooth® Stereo Audio Module

Analog Switch ISL43240
- 3.3V

24-bit Audio ADC
- 3.3V
- 5V
- 3.3V

EEPROM R1EX24064ASAS0I

Buffer

5V

2

2 x H-Bridge Power MOSFET

+HV

2

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Device Category	P/N	32Bit
MCU	RX111	32-bit MCU with comprehensive small-capacity ROM/low pin count lineup and built-in USB 2.0
SoC	D2-41051-QR	Intelligent digital amplifier PWM controller and audio processor
Power	ISL88002	Ultra low power 3 Ld voltage supervisors
	ISL85410	Wide VIN 1A synchronous buck regulator
	ISL8088	Dual 800mA low quiescent current 2.25MHz high efficiency synchronous buck regulator
Analog	R1EX24064ASAS0I	64KB industry grade I^{2}C EEPROM
	ISL43240	Low-voltage, single and dual supply, Quad SPDT, analog switch

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RX/111 – 32-bit MCU Small-capacity ROM/Low Pin Count
Cost Optimized RX with USB 2.0 for Battery Charging (BC 2.0)

Cost Optimized and High Performance

- Max. operating frequency: 32MHz
- Accumulator support DSP instructions
- Up to 512 Kbytes code flash and 64 Kbytes SRAM, no wait states
- Incorporating external components into MCU like POR/LVD, RTC, E2 data flash

Rich Peripheral Functions and Low Power Design

- 3 low power consumption modes
- Low power timer(LPT) that operates during the software standby states
- Supply current: high-speed operating mode: 96 µA/MHz   software standby mode: 0.37 µA
- Up to 6 communication functions
- USB 2.0 Host/Function/OTG and Battery Charger
- Up to 8 extended-function timers,12-bit ADC, 8-bit DAC, comparator, remote control signal reception

Part #	ROM (Kbytes)	RAM (Kbytes)	E2 DataFlash (Kbytes)	Package
R5F5111xAxLM#3A	16~64	8~10	8	36 WFLGA 4 x 4mm 0.5mm pitch
R5F5111xAxNF#3A	16~64	8~10	8	40 HWQFN 6 x 6mm 0.5mm pitch
R5F5111xAxNE#3A	16~512	8~64	8	48 LQFP 7 x 7mm 0.5mm pitch
R5F5111xAxFL#3A	16~512	8~64	8	48 HWQFN 7 x 7mm 0.5mm pitch
R5F5111xAxFK#3A	16~512	8~64	8	64 LQFP 14 x14mm 0.8mm pitch
R5F5111xAxFM#3A	16~512	8~64	8	64 LFQFP 10 x 10mm 0.5mm pitch
R5F5111xAxLF#3A	16~512	8~64	8	64 WFLGA 5 x 5mm 0.5mm pitch

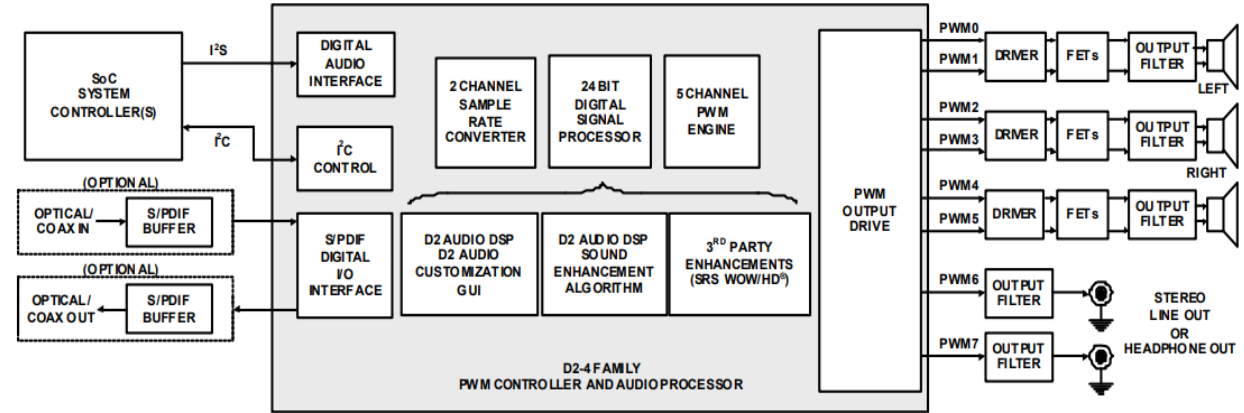**Smart Design Tools**

Evaluation Kits

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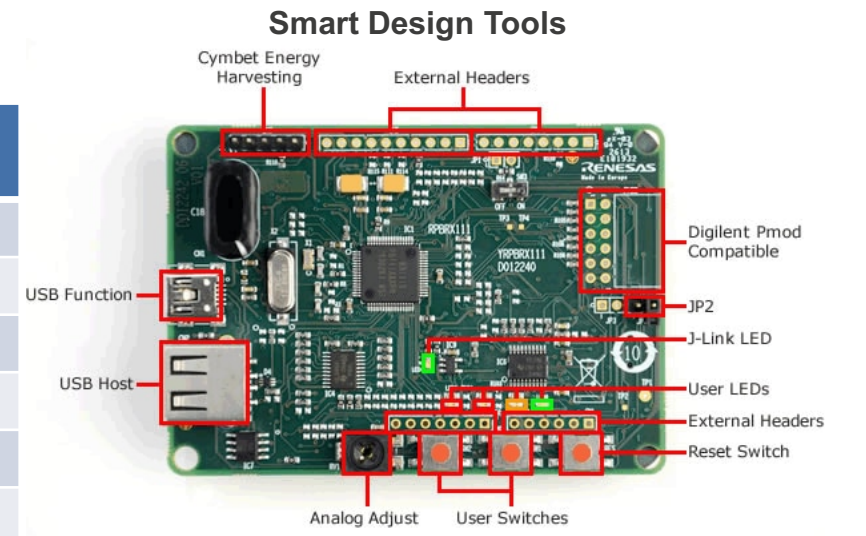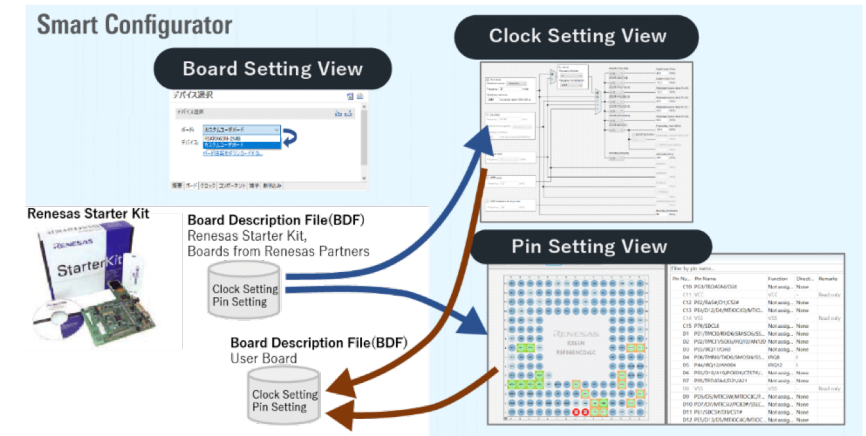
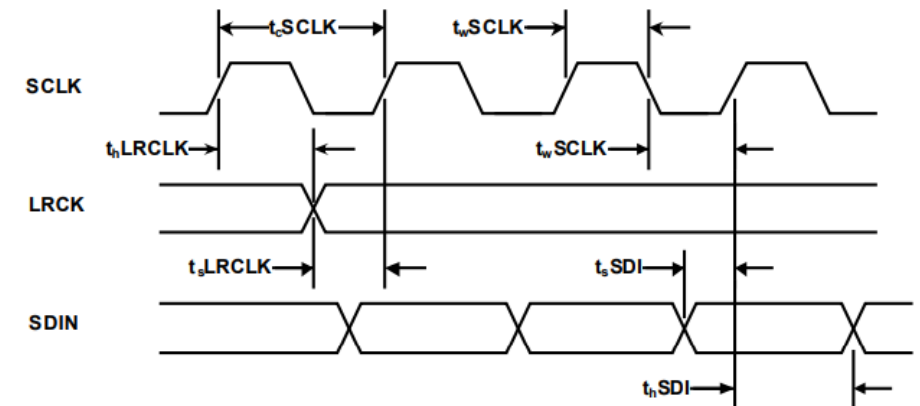# D2-41x51 – PWM Controller and Audio Processor
Self-contained 5-channel Digital Signal Processing SoC

Audio Processing Features

- All digital class-D amplifier controller with integrated Digital Signal Processing (DSP)
- Fully programmable audio signal path parameters
- Up to 5 channels of Digital Signal Processing (DSP)
- Includes equalizers, filters, mixers, and other common audio processing blocks
- Audio enhancement algorithms included
- I^2S and S/PDIF™ digital audio stereo inputs
- I^2C host control port
- Asynchronous sample rate converters, sample rates from 32kHz up to 192kHz
- Supports 2.0, 2.1, or bi-amp amplifier outputs with discrete or integrated power stages

Part #	MOQ	Temp.(℃)	Package
D2-41051-QR	1040	-10 to 85	48 Ld QFN
D2-41051-QR-TK	1000	-10 to 85	48 Ld QFN
D2-41151-QR	1040	-10 to 85	48 Ld QFN
D2-41151-QR-TK	1000	-10 to 85	48 Ld QFN

Typical Application

Serial Audio Interface Port Timing

ISL88001/2/3 – Ultra Low Power 3Ld Voltage Supervisors
Ultra Small Package for Confined Spaces

Single Voltage Monitoring Supervisor

- Fixed-Voltage Options Allow Precise Monitoring of +1.8V, +2.5V, +3.0V, +3.3V and +5.0V Power Supplies
- Ultra Low 160nA Supply Current
- ±1.2% Voltage Threshold Accuracy

Popular Voltage Trip Points

- Trip points are available for standard power supplies from 1.8V to 5.0V
- 190ms Power-On Reset Timeout
- Reset Signal Valid Down to VDD = 1V

Simple Board Design

- No external components necessary

Part #	Nominal V_{THVDD} (V)	Temp.	Package
ISL88001IH46Z-T7A	4.62	-40/+85	3Ld 2.92x 1.3mm SOT-23
ISL88001IH44Z-T7A	4.38	-40/+85	3Ld 2.92x 1.3mm SOT-23
ISL88001IE46Z-T7A	4.62	-40/+85	3Ld 2 x 1.24mm SC70
ISL88001IE31Z-T7A	3.07	-40/+85	3Ld 2 x 1.24mm SC70

Note: Many other output voltage and package options. See website.
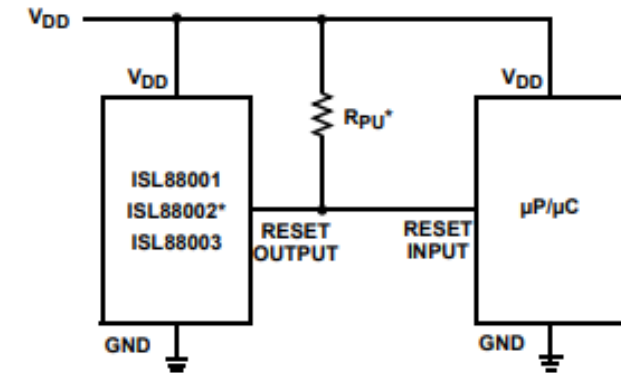
Typical Operating Circuits
(*necessary for ISL88002)
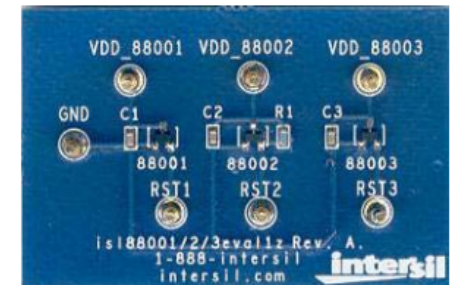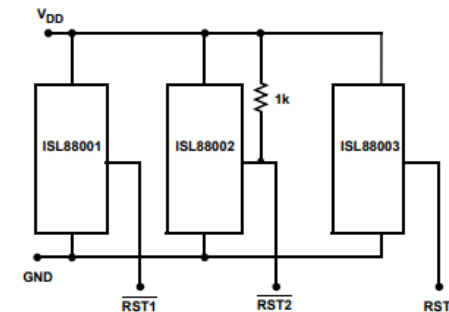
ISL88001/2/3EVAL1Z Evaluation Board

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# ISL85410 – 1A Synchronous Buck with Integrated FETs
Supports 3V-40V Input Voltage Range for Buck Output

## Wide Working Range and Space-Limited Applications

- Power input voltage range from 3V to 40V
- Up to 1A load over full temperature range
- 4mm x 3mm DFN package
- Minimal external components required

High Efficiency and Performance

- Synchronous operation for high efficiency
- No compensation required
- Integrated High-side and Low-side NMOS devices
- Selectable PFM or forced PWM mode at light loads
- Internal fixed (500kHz) or adjustable switching frequency 300kHz to 2MHz

INTERNAL DEFAULT PARAMETER SELECTION
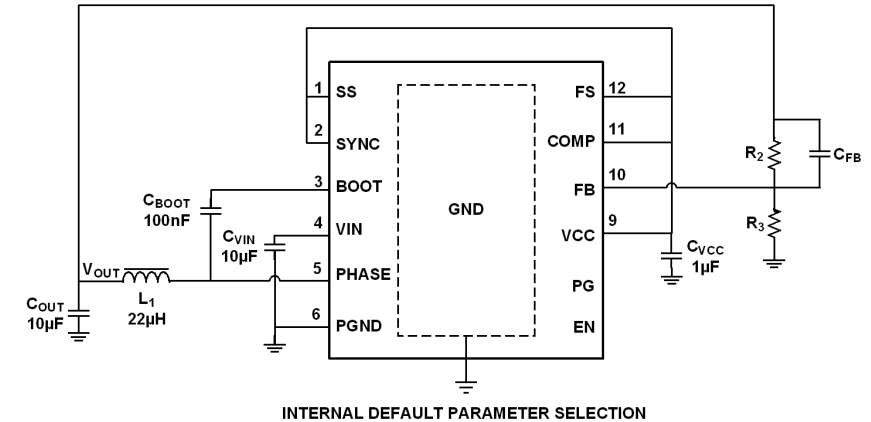
Typical Application Circuit
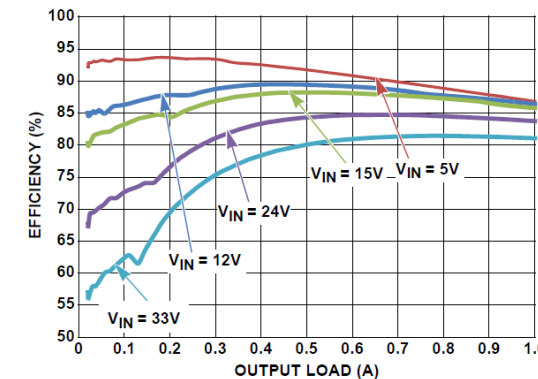
Efficiency vs Load, PFM, V_{OUT} = 3.3V

ISL8541xDEMO1Z Evaluation Board

Part #	V_{IN} Range(V)	Temp.(°C)	Package
ISL85410FRZ	3 to 40	-40 to 125	12 Ld DFN 4x3

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ISL8088 Dual 800mA Low IQ Synchronous Buck Regulator
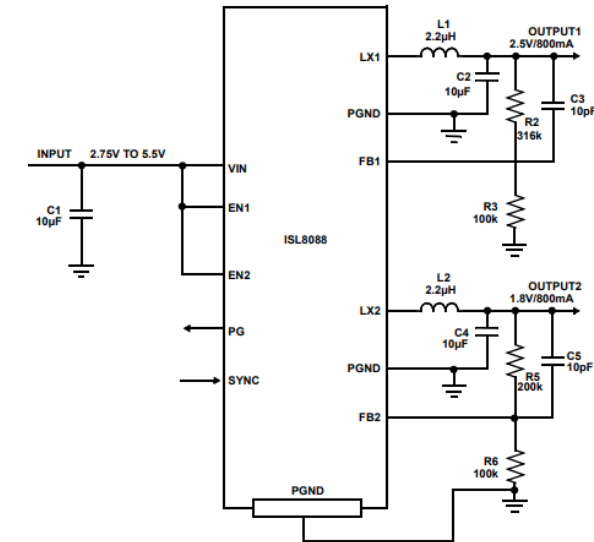## Test & Measurement, Li-Ion Battery power devices, µC/µP, FPGA and DSP Power

High Performance

- Dual 800mA output
- Internal Current Mode Compensation
- 100% Maximum Duty Cycle for Lowest Dropout
- Selectable Forced PWM Mode and PFM Mode
- Supply voltage range of 2.75 to 5.5V

High Efficiency in a Small Package

- High Efficiency Synchronous Buck Regulator with up to 97% Efficiency
- In PFM mode of operation, both channels draw a total quiescent current of only 30µA in order to maximize battery life
- Small DFN package

Part #	T&R count	Package
ISL8088IRZ-T7A	250	10Ld 3 x 3mm DFN
ISL8088IRZ	1000	10Ld 3 x 3mm DFN

Typical Application Circuit

ISL8088EVALxZ Eval Board

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R1EX24064ASAS0I – 64KB Industry-Grade EEPROM
I²C Interface Series EEPROM for Industrial Segment

High Speed Memory

- Clock frequency: 400 kHz (1.8 V to 5.5 V)
- Automatic page write: 32-byte/page
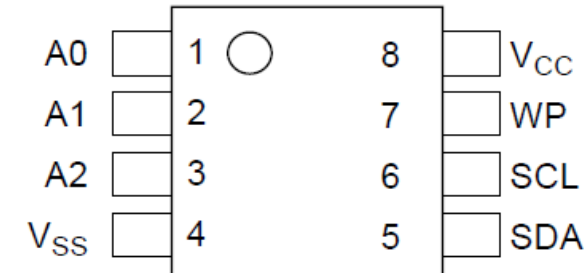- Write cycle time: 5 ms

Robust Industry Grade

- Endurance: 1,000k or more Cycles
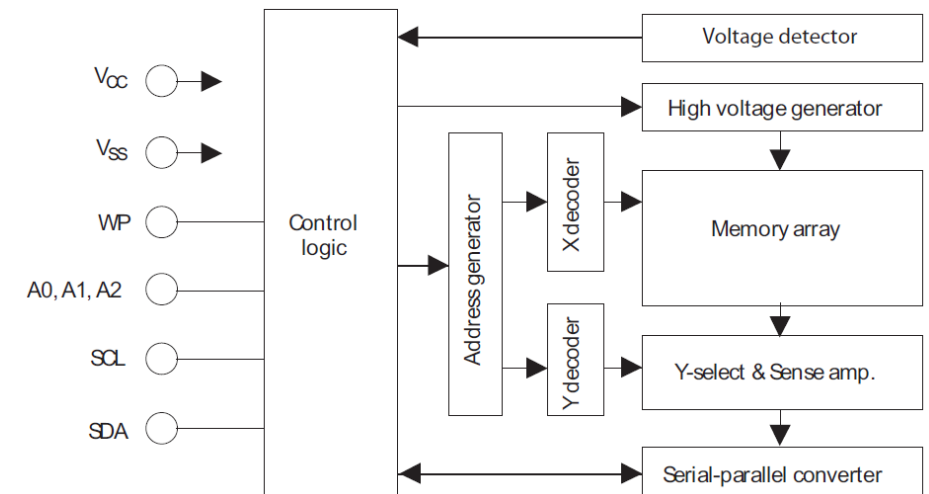- Data retention: 100 or more Years

Low Power Mode

- Power dissipation:
  - Standby: 2.0 µA (max)
  - Active (Read): 1.0 mA (max)
  - Active (Write): 3.0 mA (max)

Part #	Reel	Lead Free	Halogen Free	Package
R1EX24064ATAS0I	3,000	#U0, #S0	#S0	8 Ld TSSOP
R1EX24064ASAS0I	2,500	#U0, #S0	#S0	8 Ld SOP

8-pin SOP/8-pin TSSOP

(Top view)
Pin assignment

Block Diagram

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ISL43240 – High Performance Analog Switch
## Low-Voltage, Single and Dual Supply, Quad SPDT for Portable Equipment

High Performance

- Fully specified for 10% tolerances at VS = ±5V and V+ = 12V, 5V and 3.3V
- Four separately controlled SPDT switches
- ON-resistance (r_{ON}): 18Ω r_{ON} matching between channels <1Ω
- Fast switching action: t_{ON} 52ns t_{OFF} 40ns
- Guaranteed break-before-make
- Low charge injection: 5pC (Max)
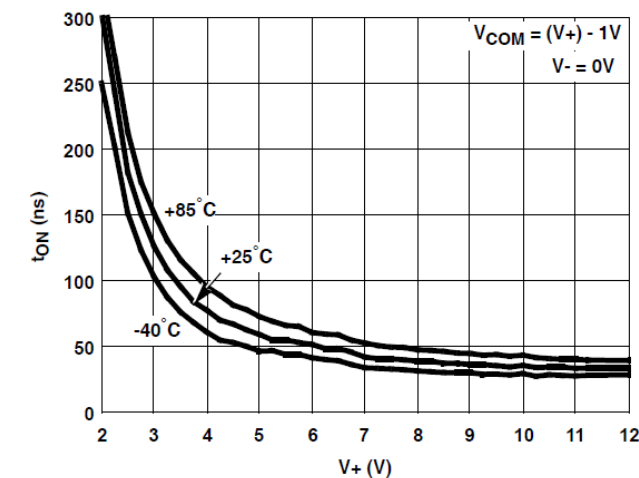- Minimum 2kV ESD protection per Method 3015.7

Low Power Design

- Low power consumption (P_D): <5µW
- Low off leakage current (max at +85°C): 2.5nA

Part #	Single Supply(V)	Dual Supply(V)	Package
ISL43240IAZ	+2V to +12V	±2V to ±6V	20 Ld SSOP
ISL43240IRZ	+2V to +12V	±2V to ±6V	20 Ld QFN
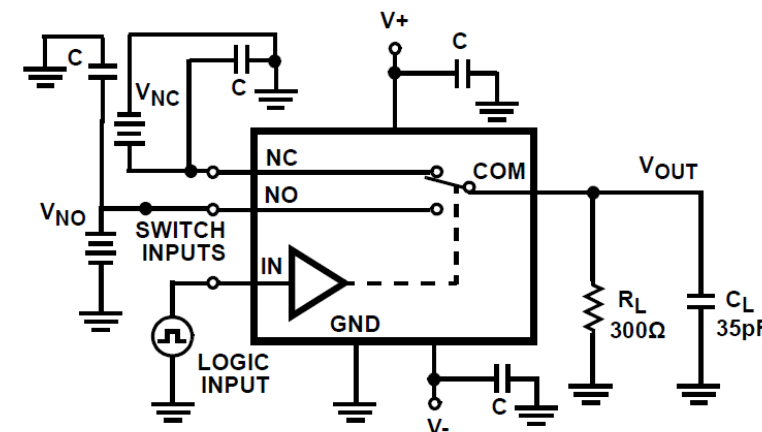
Typical Test Circuit

Turn on Time vs Positive Supply Voltage

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