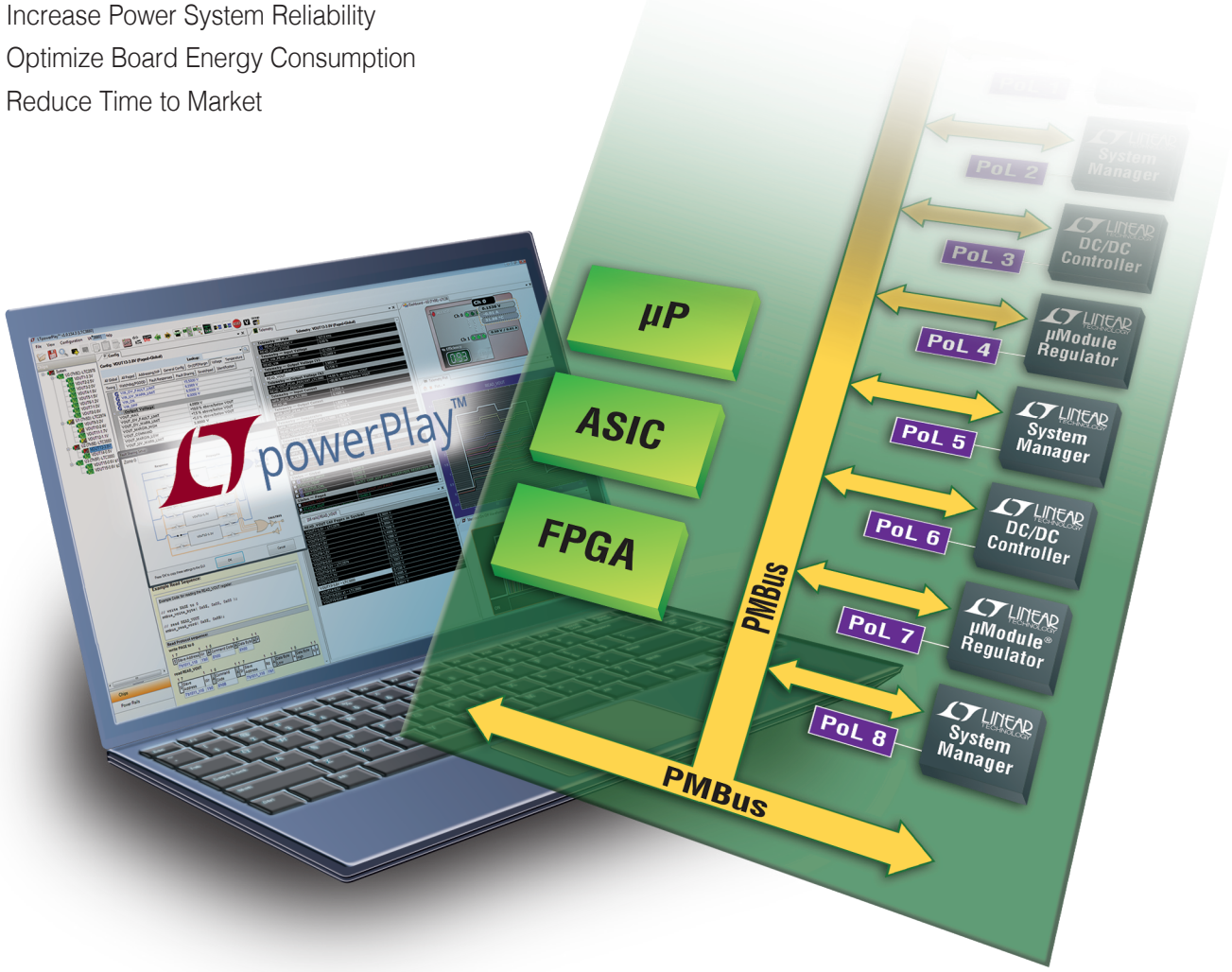
Digital Power System Management

µModule Regulators • DC/DC ICs • Manager ICs • Sequencers • Supervisors

- ✔ Digitally Manage Point-of-Load (POL) Power Supplies
  - – Trim, Margin, Sequence, Supervise, Log Faults
  - – Monitor Voltage, Current, Power, Energy and Temperature
- ✔ Increase Power System Reliability
- ✔ Optimize Board Energy Consumption
- ✔ Reduce Time to Market



Take Control of Your Power Supplies

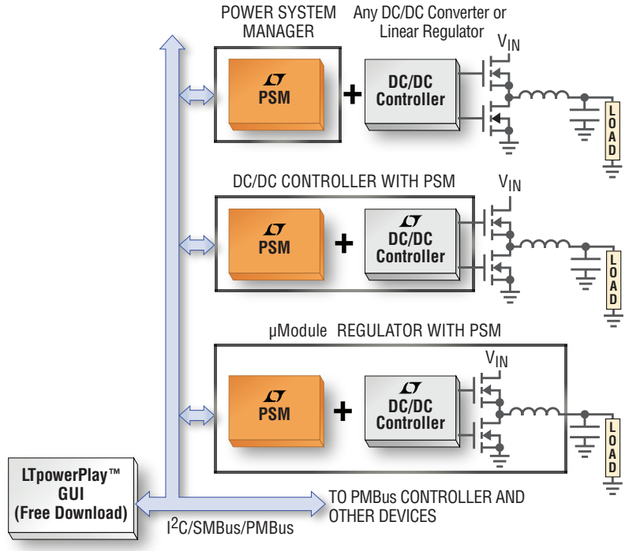
Accelerate characterization and optimization during prototyping and field operation with Linear Technology's digital power system management (PSM) products, configured and monitored via a PMBus/SMBus/I^2C digital interface.

LINEAR TECHNOLOGY

Linear Technology Digital Power System Management

Benefits

- ±0.25% Voltage Accuracy
- Products
  - Power System Managers
  - DC/DC Controllers with PSM
  - Fully Integrated µModule® Regulators
- LTpowerPlay™ GUI: Engineering-Level Development Environment
- PMBus Compliant Commands Over I²C/SMBus Digital Interface
- EEPROM for Configuration and Black Box Fault Logging
- Autonomous Operation—No Software Coding Required
- Coordinate Sequencing and Fault Management Across PSM Devices
- Reduced BOM Cost and Validation Effort



µModule Regulators, DC/DC Controllers and Monolithic Regulators with Power System Management

- Fast Analog Feedback Loop with Digital Telemetry and Control
- Program V_{OUT}, I_{LIM}, OV/UV Level, Frequency, Ramp Rate, Sequencing Time Delays, Margining
- Read Back V_{IN}, I_{IN}, V_{OUT}, I_{OUT}, P_{OUT}, Duty Cycle, Temperature, Faults

PSM Switcher Selection Guide

	µModule Regulators			DC/DC Controllers											Monolithic Regulators
Features	**LTM®4676**	**LTM4676A**	**LTM4675**	**LTC®3880**	**LTC3880-1**	**LTC3882**	**LTC3882-1**	**LTC3883**	**LTC3883-1**	**LTC3884**	**LTC3884-1**	**LTC3886**	**LTC3887**	**LTC3887-1**	**LTC3815**
PSM	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Lite
Number of Outputs	2	2	2	2	2	2	2	1	1	2	2	2	2	2	1
PWM Control Mode	Current	Current	Current	Current	Current	Voltage	Voltage	Current	Current	Current	Current	Current	Current	Current	Current
Start-Up Time (Typ)	153 (170 Max)	60 (70 Max)	60 (70 Max)	145	145	70	70	145	145	65	65	65	70	70	<10
Input Current Sense	Calibrated	Calibrated	Calibrated	Inferred	Inferred	No	No	Yes	Yes	Yes	Yes	Yes	Inferred	Inferred	Yes
V_{OUT} Range (V)	0.5 to 4.0, ch0 0.5 to 5.4, ch1	0.5 to 5.5	0.5 to 5.5	0.5 to 4.0, ch0 0.5 to 5.4, ch1	0.5 to 4.0, ch0 0.5 to 5.4, ch1	0.5 to 5.3	0.5 to 5.3	0.5 to 5.4	0.5 to 5.4	0.5 to 5.4	0.5 to 5.4	0.5 to 13.2	0.5 to 5.5	0.5 to 5.5	0.4 – 0.72 • V_{IN}
V_{IN} Range (V)	4.5 to 26.5	4.5 to 17	4.5 to 17	4.5 to 24	4.5 to 24	3.0 to 38	3.0 to 38	4.5 to 24	4.5 to 24	4.5 to 38	4.5 to 38	4.5 to 60	4.5 to 24	4.5 to 24	2.2 to 5.5
V_{OUT} Accuracy (%)	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1
I_{OUT} (A) Max	Dual 13 or Single 26	Dual 13 or Single 26	Dual 9 or Single 18	30/Phase*	30/Phase*	40A/Phase*	40A/Phase*	30/Phase*	30/Phase*	30/Phase*	30/Phase*	30/Phase*	30/Phase*	30/Phase*	6A
Temperature Sensing	ΔV_{BE}	ΔV_{BE}	ΔV_{BE}	ΔV_{BE}	ΔV_{BE}	ΔV_{BE} and Direct	ΔV_{BE} and Direct	ΔV_{BE}	ΔV_{BE}	ΔV_{BE} and Direct	ΔV_{BE} and Direct	ΔV_{BE} and Direct	ΔV_{BE}	ΔV_{BE}	Internal
DCR Sensing	NA	NA	NA	Low	Low	Ultralow	Ultralow	Low	Low	Very Low	Very Low	Low	Low	Low	NA
Dedicated PGOOD Pins	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Gate Drivers	NA	NA	NA	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	No	NA
Three-State PWM Control	NA	NA	NA	No	No	Yes	Yes	No	No	No	Yes	No	No	Yes	NA
Digitally Adjustable Loop Compensation	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	No	No
On-Chip LDO from V_{IN}	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Fast ADC Mode	No	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	NA
Corresponding Slaves	NA	NA	NA	LTC3870	LTC3870	NA	NA	LTC3870	LTC3870	LTC3874	LTC3874	LTC3870	LTC3870	LTC3870	NA
Package (mm x mm)	16 x 16 x 5.01 BGA	16 x 16 x 5.01 BGA	11.9 x 16 x 3.51 BGA	6 x 6 QFN-40	6 x 6 QFN-40	6 x 6 QFN-40	6 x 6 QFN-40	5 x 5 QFN-32	5 x 5 QFN-32	7 x 7 QFN-48	7 x 7 QFN-48	7 x 8 QFN-46	6 x 6 QFN-40	6 x 6 QFN-40	4 x 6 QFN-38

* Depends on choice of external components

Power System Managers

- Manage Any Adjustable Point-of-Load Power Supply
- Trim, Margin, Sequence, Supervise, Manage Faults, Monitor Telemetry, Record Fault Logs
- Read Back Voltage, Current, Power, Temperature and Faults

Device	Voltage Supply Channels Managed[1]	Number of Current Sensed Loads	Input Energy	Temp Sense		Digital Interface			EEPROM	Includes Res/Cap	Trim/Margin/ Monitor Accuracy (%)	Sequencing			Bias Supply			Package (mm × mm)	Demo Board
				Internal	External	PMBus	SMBus	I²C				Time	Cascade	Tracking	3.3V	5V	12V		
LTC2970[2]	2	2		•			•	•			±0.50					•	•	4 x 5 QFN-24	DC1262
LTC2974	4	4		•	4	•	•	•	•		±0.25	•	•	•	•	•	•	9 x 9 QFN-64	DC1978
LTC2975	4	5	•	•	4	•	•	•	•		±0.25	•	•	•	•	•	•	9 x 9 QFN-64	DC2022
LTC2977	8			•		•	•	•	•		±0.25	•		•	•	•	•	9 x 9 QFN-64	DC2028
LTC2980	16			•		•	•	•	•		±0.25	•		•	•	•	•	12 x12 BGA	DC2198
LTM2987	16			•		•	•	•	•	•	±0.25	•		•	•	•	•	15 x15 BGA	DC2023

1 A channel refers to the collection of functions that trims, supervises and monitors a given power supply rail.

2 LTC2970 is not supported by LTpowerPlay. See LTC2970-1 for sequencing.

Programmable 6-Channel Sequencer and Supervisors with EEPROM

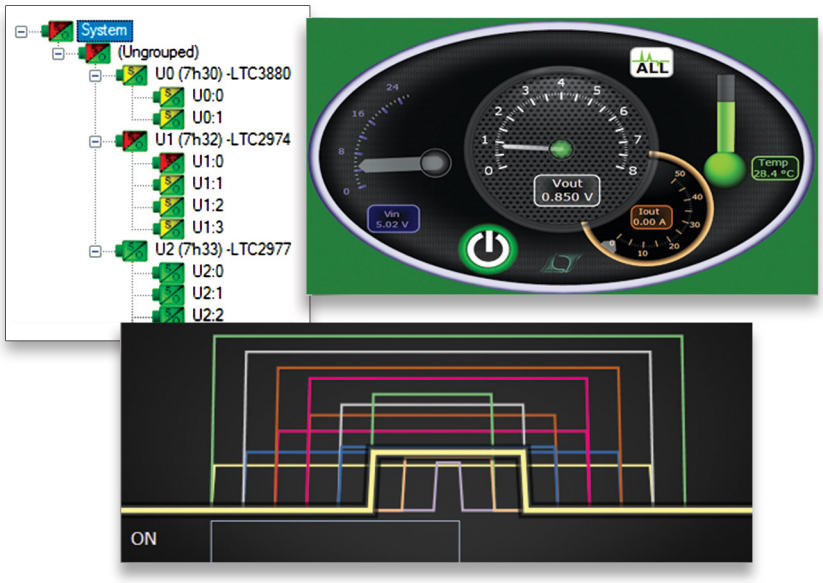
Device	Sequencer/ Supervisor	Comparator Outputs	Threshold Range (V)	Threshold Accuracy (%)	Power Supply (V)	Package (mm × mm)	Demo Board
LTC2933	Supervisor	No	1 to 13.9 (1×) 0.2 to 5.8 (5×)	±1	3.4 to 13.9	5×4 DFN-16, SSOP-16	DC1633
LTC2936	Supervisor	Yes	0.2 to 5.8 (6×)	±1	3.13 to 13.9	4×5 QFN-24, SSOP-24	DC1605
LTC2937	Sequencer	No	0.2 to 6 (6×)	±0.75	2.9 to 16.5	5×6 QFN-28	DC2313

Hardware Support

A DC1613 USB-to-I²C/SMBus/PMBus controller (adapter) is used to interface any PSM demo board to a computer. Every PSM device comes with at least one specific demo board. Some PSM demo boards can be cascaded together for evaluating multiple rails.

Software Support

LTpowerPlay is a powerful and intuitive Windows-based development environment used to configure and interrogate PSM devices. It can also be used in an offline mode (with no hardware present) in order to build a multichip configuration file that can be saved and reloaded at a later time. It is available as a free download at: **www.linear.com/LTpowerPlay**



Device Programming

PSM devices ship from Linear Technology with a default register configuration loaded in EEPROM. The options to ship with a customized, application-specific configuration developed during the prototyping phase are as follows:

- **Linear Technology NVM Programming Service:** This involves submitting the configuration file, then receiving a few custom programmed samples (First Articles) for verification and approval. Please visit: **www.linear.com/program**
- **In-Circuit Programming:** Use LTpowerPlay on a computer with a DC1613 USB-to-PMBus controller (adapter) to program PSM devices on circuit boards with pin headers accessing the PSM device.
- **JTAG Programming:** Use third-party programmers from Asset Intertech or JTAG Technologies to program PSM devices on circuit boards connected to JTAG scan chains without needing additional programmers or pin headers.

Getting Started

Scan to watch video:
http://ltpowerplay.com/ps1full

1. **Obtain the PSM Starter Kit, DC1962C-KIT**
2. **Download LTpowerPlay**
3. **Watch the Video**