POWER MANAGEMENT SOLUTIONS FOR NXP PROCESSORS
Tested and Verified

QorIQ LS1088A Reference Design (LS1088A-RDB)

- www.linear.com/nxp
- Schematics
- Bill-of-Materials
- Power Circuit Simulation & Design Tools

Visit analog.com and linear.com
Introduction

Power management solutions presented here have been assembled and verified by NXP or third-party development board providers. For more information and technical documentation, visit [www.linear.com/nxp](http://www.linear.com/nxp).

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Development Boards in this Brochure Can Be Found at [www.linear.com/nxp](http://www.linear.com/nxp)

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<th>Product Name</th>
<th>Part Number for Core Rail</th>
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<td>QorIQ LS1088A</td>
<td>NXP</td>
<td>LS1088A-RDB</td>
<td>LTC®3882</td>
<td>3</td>
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<tr>
<td>QorIQ LS1043A</td>
<td>NXP</td>
<td>LS1043A-RDB</td>
<td>LTM®4649</td>
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<td>QorIQ T1023A</td>
<td>NXP</td>
<td>T1023RDB</td>
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<td>i.MX 7</td>
<td>Arrow</td>
<td>i.MX7.96Board</td>
<td>LTC3589-2</td>
<td>6</td>
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<tr>
<td>i.MX 6</td>
<td>Novtech</td>
<td>NOVPEK i.MX6Q/D</td>
<td>LTC3676-1</td>
<td>7</td>
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Contact board supplier to purchase the board

**NXP:** [www.nxp.com](http://www.nxp.com)

**Novtech:** [www.novtech.com](http://www.novtech.com)

**Arrow:** [www.arrow.com](http://www.arrow.com)
QorIQ LS1088A-RDB

The QorIQ LS1088A reference design board (LS1088A-RDB) is designed to exercise the capabilities of the LS1088A device. It has up to eight ARM® Cortex®-A53 cores with the advanced, high performance data-path and network peripheral interfaces required for wireless access points, networking infrastructure, intelligent edge access, including virtual customer premise equipment (vCPE) and high performance industrial applications.

<table>
<thead>
<tr>
<th>Rail/Function</th>
<th>Part Number</th>
<th>General Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0V: VDD</td>
<td>LTC3882</td>
<td>Dual Output PolyPhase® Step-Down DC/DC Voltage Mode Controller with Digital Power System Management. Using LTpowerPlay® for Design</td>
</tr>
<tr>
<td>1.2V: GVDD</td>
<td>LTM4649</td>
<td>10A Step-Down DC/DC μModule® Regulator</td>
</tr>
<tr>
<td>1.8V: OVD, EVDD</td>
<td>LTM4649</td>
<td>10A Step-Down DC/DC μModule® Regulator</td>
</tr>
<tr>
<td>3.3V: VPA</td>
<td>LT8612</td>
<td>42V, 6A Synchronous Step-Down Regulator with 3μA Quiescent Current</td>
</tr>
<tr>
<td>2.5V: DDR VPP</td>
<td>LTC3026</td>
<td>1.5A Low Input Voltage VLDO™ Linear Regulator</td>
</tr>
</tbody>
</table>

Start-Up Sequence
1. Green
2. Blue
3. Pink
4. Orange, Yellow
5. Purple

Summary Report
Total Pin = 181.54W
Total Pout = 159.45W
Total Ploss = 22.09W
Total Efficiency = 87.63%

Actual Screen Capture
Power Tree designed in LTpowerPlanner®
The QorIQ LS1043A-RDB is designed to exercise most capabilities of the LS1043A device, NXP’s first quad-core, 64-bit ARM-based processor for embedded networking and industrial infrastructure.

<table>
<thead>
<tr>
<th>Rail/Function</th>
<th>Part Number</th>
<th>General Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0V: VDD</td>
<td>LTM4649</td>
<td>10A Step-Down DC/DC µModule Regulator</td>
</tr>
<tr>
<td>3.3V: DVDD/EVDD, System Power</td>
<td>LTM4644</td>
<td>Quad DC/DC µModule Regulator with Configurable 4A Output Array</td>
</tr>
<tr>
<td>0.85V: PHY</td>
<td>LTC3668</td>
<td>1.8A, 4MHz, Synchronous Step-Down DC/DC Converter</td>
</tr>
<tr>
<td>2.1V: PHY</td>
<td>LT3085</td>
<td>Adjustable 500mA Single Resistor Low Dropout Regulator</td>
</tr>
<tr>
<td>1.2V: TVDD</td>
<td>LT3065</td>
<td>45V Vin, 500mA Low Noise, Linear Regulator with Programmable Current Limit and Power Good</td>
</tr>
</tbody>
</table>

Rail/Function Part Number General Description
1.0V: VDD LTM4649 10A Step-Down DC/DC µModule Regulator
3.3V: DVDD/EVDD, System Power LTM4644 Quad DC/DC µModule Regulator with Configurable 4A Output Array
0.85V: PHY LTC3668 1.8A, 4MHz, Synchronous Step-Down DC/DC Converter
2.1V: PHY LT3085 Adjustable 500mA Single Resistor Low Dropout Regulator
1.2V: TVDD LT3065 45V Vin, 500mA Low Noise, Linear Regulator with Programmable Current Limit and Power Good

Power Tree designed in LTpowerPlanner
The QorIQ T1023 Reference Design Board (T1023RDB) is a high performance evaluation, development and test platform supporting the QorIQ T1023 communications processor. The board will support the evaluation and development of the dual core T1023 and the single core T1013 communications processors built on Power Architecture® technology.

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### Rail/Function Part Number General Description

<table>
<thead>
<tr>
<th>Rail/Function</th>
<th>Part Number</th>
<th>General Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0V: VDD</td>
<td>LT8612</td>
<td>42V, 6A Synchronous Step-Down Regulator with 3µA Quiescent Current</td>
</tr>
<tr>
<td>3.3V: System Power, PHY, PCIe</td>
<td>LT3021</td>
<td>500mA, Low Voltage, Very Low Dropout Linear Regulator</td>
</tr>
<tr>
<td>1.0V: S1VDD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2V: TVDD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1V: PHY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.85V: PHY</td>
<td>LTC3605A</td>
<td>20V, 5A Synchronous Step-Down Regulator</td>
</tr>
<tr>
<td>5V: USB</td>
<td>LTC3600</td>
<td>15V, 1.5A Synchronous Rail-to-Rail Single Resistor Step-Down Regulator</td>
</tr>
</tbody>
</table>

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**Start-Up Sequence**
1. Green
2. Orange and Blue
3. Pink

**Summary Report**
- Total Pin = 61.77W
- Total Pout = 52.95W
- Total Ploss = 8.82W
- Total Efficiency = 85.72%

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*Power Tree designed in LTpowerPlanner*
i.MX7 96Board

The i.MX 7 series-based, open-source board provided by Arrow enables secure, power-efficient systems with drastically reduced time to market. The i.MX 7 series is a highly integrated multi-market applications processor designed to enable secure and portable applications within the Internet of Things. The i.MX 7 series utilizes both the ARM Cortex-A7 and Cortex-M4 cores for general purpose programmable processing.

<table>
<thead>
<tr>
<th>Rail/Function</th>
<th>Part Number</th>
<th>General Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0V: VDD_SoC</td>
<td>LTC3589-2</td>
<td>8-Output Regulator with Sequencing and I2C for ARM and ARM Based Processors</td>
</tr>
<tr>
<td>1.1V: VDD_ARM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.35V: DRAM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.8V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.8V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5V: System Power</td>
<td>LT8609</td>
<td>42V, 2A/3A Peak Synchronous Step-Down Regulator with 2.5μA Quiescent Current</td>
</tr>
</tbody>
</table>

Power Management Solutions for NXP Processors

Visit analog.com
The NOVPEK i.MX 6 Platform Evaluation Kit provided by Novtech™ was developed to give OEMs a flexible platform to evaluate i.MX 6 processors by giving access to all the available I/Os on the device and a robust power supply system using the LTC3676-1 PMIC from Analog Devices.

The i.MX 6 series of applications processors is a scalable multicore platform that includes single-, dual- and quad-core families based on the ARM Cortex architecture, including Cortex-A9, combined Cortex-A9 + Cortex-M4 and Cortex-A7 based solutions.

<table>
<thead>
<tr>
<th>Rail/Function</th>
<th>Part Number</th>
<th>General Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8V: DDR_VTT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1V: VDD_SOC, VDD_ARM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5V: DDR</td>
<td>LTC3676-1</td>
<td>8-Output Power Management Solution with I²C Interface for Application Processors</td>
</tr>
<tr>
<td>3.3V: VDD_SNVS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.8V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Summary Report**
- Total Pin = 16.02W
- Total Pout = 11.05W
- Total Power Loss = 4.97W
- Total Efficiency = 69%

**Start up sequence:**
1) Green & Orange
2) Yellow
3) Blue

Actual Screen Capture
Power Tree designed in LTpowerPlanner
New PMIC for Advanced Application Processors

The LTC3676 and LTC3676-1 are complete power management solutions for NXP i.MX 6 series, ARM Cortex and other advanced portable application processor systems. The LTC3676/LTC3676-1 feature eight independent resistor-programmable voltage rails, with dynamic voltage scaling and sequencing, in compact QFN and thermally enhanced QFP packages. These rails supply power to the processor core, SDRAM, I/O, system memory, PC cards, always-on real-time clock (RTC) and a variety of other functions.

Features

- Quad I2C Adjustable High Efficiency Step-Down DC/DC Converters: 2.5A, 2.5A, 1.5A, 1.5A
- Triple 300mA LDO Regulators (2 Adjustable)
- DDR Power Solution with VTT and VTTR Reference (LTC3676-1 Version)
- Pushbutton On/Off Control with System Reset
- Independent Enable Pin-Strap or I2C Sequencing
- Programmable Autonomous Power-Down Control
- Power Good and Reset Functions
- Dynamic Voltage Scaling
- Selectable 2.25MHz or 1.12MHz Switching Frequency
- Always Alive 25mA LDO Regulator
- 12μA Standby Current
- 40-Pin 6mm × 6mm × 0.75mm QFN Package
- 48-Pin 7mm × 7mm LQFP Package

Applications

- Supports NXP i.MX 6, Altera ARM-Based SoC FPGAs, ARM Cortex and other Application Processors
- Handheld Instruments and Scanners
- Portable Industrial and Medical Devices
- Automotive Infotainment
- High End Consumer Devices
- Multirail Systems

4 High Current High Efficiency Bucks + 4 LDOs + DDR Solution with VTTR + I2C Control + Sequencing + Dynamic Voltage Scaling = Complete Power Management Solution for Advanced Application Processor-Based Systems
A PMIC for Modern Application Processors

The LTC®3589/-1/-2 is a complete power management solution for portable processors such as NXP i.MX, PXA, ARM, OMAP and other advanced portable microprocessor systems. The device features eight independent rails, with dynamic control and sequencing, in a compact QFN package. These rails supply power to the processor core, SDRAM, system memory, PC cards, always-on real-time clock (RTC) and a variety of other functions.

Features

- Triple I²C Adjustable High Efficiency Step-Down DC/DC Converters: 1.6A, 1A, 1A (1.6A, 1.2A, 1.2A on LTC3589-1/-2)
- High Efficiency 1.2A Buck-Boost DC/DC Converter
- Triple 250mA LDO Regulators
- Pushbutton On/Off Control with System Reset
- Flexible Pin-Strap Sequencing Operation
- I²C and Independent Enable Control Pins
- Power Good and Power-On Reset Outputs
- Dynamic Voltage Scaling and Slew Rate Control
- Selectable 2.25MHz or 1.12MHz Switching Frequency
- Always Alive 25mA LDO Regulator
- 8µA Standby Current
- 40-Pin 6mm × 6mm × 0.75mm QFN Package

Applications

- Supports NXP i.MX, Marvell PXA and Other Application Processors
- Handheld Instruments and Scanners
- Portable Industrial and Medical Devices
- Automotive Infotainment
- High End Consumer Devices
- Multirail Systems

3 Bucks + Buck-Boost + 4 LDOs + I²C Control + Sequencing + Dynamic Voltage Scaling = A Complete Power Management Solution for Advanced Application Processor-Based Systems
Design Support

Analog Devices provides design support tools that help you select, design and simulate Analog Devices’s products. These tools shorten your design time and optimize your power supply solution before you build your prototype board.

LTpowerCAD

LTpowerCAD® is a free download and easy-to-use power supply design tool with a user-friendly graphical user interface (GUI) and powerful design features. It helps power supply designers select a solution for given supply specifications, design power stage components, estimate regulator efficiency and power loss, and optimize supply loop stability and load transient performance. It is a fast off-line tool that runs on Windows PCs, and includes a sync-release feature to ensure your program and its solution libraries are up-to-date. Once a circuit design is completed, it is easily exported to the LTspice® simulation platform. Inside the LTpowerCAD toolbox, there is also an LTpowerPlanner system architecture tool for system-level power management design and optimization.
LTspice

LTspice is a free, simple and powerful circuit simulation tool with a library containing Analog Devices products, as well as commonly used discrete passive and transistor components.

LTpowerPlay

LTpowerPlay® is a powerful and intuitive Windows-based development environment used to configure and interrogate power system management (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.