STPMIC1
Power Management IC
STPMIC1 Overview

Highly integrated PMIC for microprocessor units

High level of integration – 14 power rails
- 4 Buck DC/DC converters
- 1 Boost DC/DC converter
- 6 LDOs
- 1 voltage reference
- 2 power switches
- Provides power to the microprocessor unit as well as to external peripherals such as USB, DDR, Flash memories and other external components

Application flexibility
- Large input voltage range: from 2.8 to 5.5 V.
- Compatible with 5 V wall adaptor, USB as well as Li-Ion/Li-Po batteries
- Full programmability via I2C

Package
- QFN 44L [5 x 6 x 0.8 mm]

KEY APPLICATIONS
- Industrial [e.g. Controls, POS, M2M interfaces, predictive maintenance]
- Home Automation
- Networking
- Medical Monitoring
STPMIC1 Block Diagram

Control
- STATE MACHINE & RESET
- Dig IOs & Inter
- I2C and registers

Start-up
- NVM prototyping and programming
- Power seq
- Prot, auto turn-on, I2C add, lock

Reference & Monitoring
- DDR V_REF
- POR, OCP, Short CP, TP, Watchdog

BUCK 1 [VDD – CORE]
- 0.725 to 1.5 V [1.5 A]

BUCK 2 [VDD – DDR]
- 1.0 to 1.5 V [1 A]

BUCK 3 [VDD]
- 1.0 to 3.4 V [0.5 A]

BUCK 4 [Gen Purp]
- 0.6 to 3.9 V [2 A]

BOOST [VBUS]
- 5.2 V [1.1 A]

LDO1 [Gen Purp]
- 1.7 to 3.3 V / 350 mA

LDO2 [SD / Gen Purp]
- 1.7 to 3.3 V / 350 mA

LDO3 [Gen Purp / DDR-VTT]
- 1.7 to 3.3 V / 100 mA – normal mode
- ±120 mA – Sink/Source
- 50 mA – bypass mode

LDO4 [USB-PHY]
- 3.3 V [50 mA]

LDO5 [Gen Purp/Flash mem]
- 1.7 to 3.9 V / 350 mA

LDO6 [Gen Purp/VDDA]
- 0.9 to 3.3 V / 150 mA

VBUSOTG_SW
- [0.5 A]

PWR_SW
- [1.0 A]
## STPMIC1 | Buck Converters
### Main Electrical Characteristics

<table>
<thead>
<tr>
<th></th>
<th>BUCK 1</th>
<th>BUCK 2</th>
<th>BUCK 3</th>
<th>BUCK 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output Voltage</strong></td>
<td>0.725 to 1.5 V</td>
<td>1 to 1.5 V</td>
<td>1 to 3.4 V</td>
<td>0.6 to 3.9 V</td>
</tr>
<tr>
<td><strong>Output Voltage Steps</strong></td>
<td>25 mV</td>
<td>50 mV</td>
<td>100 mV</td>
<td>25 mV [V_{OUT} from 0.6 to 1.3V]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 mV [V_{OUT} from 1.3 to 1.5V]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100 mV [V_{OUT} from 1.5 to 3.9V]</td>
</tr>
<tr>
<td><strong>I_{OUT}</strong></td>
<td>1.5 A</td>
<td>1 A</td>
<td>0.5 A</td>
<td>2 A</td>
</tr>
<tr>
<td><strong>100% DC</strong></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Control Method</strong></td>
<td>Adaptive Constant ON-Time [in HP mode] → 2 MHz in steady state, FSW during transient allowing excellent response, high accuracy [2 %]</td>
<td></td>
<td></td>
<td>Hysteretic [in LP mode]: low I_q [5 - 20 uA], good transient response but lower accuracy [4 %]</td>
</tr>
</tbody>
</table>
## Boost Converter for USB-VBUS

### Main Electrical Characteristics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>O/P Voltage</td>
<td>5.2 V</td>
</tr>
<tr>
<td>V(_{OUT\ acc})</td>
<td>± 3.5 %</td>
</tr>
<tr>
<td>Rated I(_{OUT})</td>
<td>1.1 A</td>
</tr>
<tr>
<td>Bypass</td>
<td>Y</td>
</tr>
<tr>
<td>Disch V(_{OUT})</td>
<td>Y</td>
</tr>
<tr>
<td>OCP</td>
<td>Y</td>
</tr>
<tr>
<td>OVP</td>
<td>Y</td>
</tr>
</tbody>
</table>

![Boost Converter Diagram](image1)

### Boost Efficiency

![Efficiency Graph](image2)
LDOs / \( V_{\text{REF}} \)

Main Electrical Characteristics

- **Input voltage:** 2.8 V* to 5.5 V

- **Output voltage / rated output current / default output voltage / usage:**
  
  - LDO1: 1.7 to 3.3 V | 350 mA | OFF | General Purpose
  
  - LDO2: 1.7 to 3.3 V | 350 mA | OFF** or 2.9 V** | General Purpose [e.g. SD-card]
  
  - LDO3: 1.7 to 3.3 V | 120 mA | OFF | DDR3 VTT or lpDDR2’s VDD1 or General Purpose
  
  - LDO4: 3.3 V | 50 mA | 3.3 V | Dedicated for MPU USB PHY
  
  - LDO5: 1.7 to 3.9 V | 350 mA | 2.9 V | General Purpose [e.g. Flash memory / SD-CARD]
  
  - LDO6: 0.9 to 3.3 V | 150 mA | OFF | General Purpose
  
  - \( V_{\text{REF}}: V_{\text{OUT}}/2 \) | 5 mA | OFF | Dedicated for DDR reference voltage

- **I^2C programming step:** 100 mV

- **Output voltage accuracy:** +/- 2%

- **Programmable passive discharge resistor:** inactive / active

- **OCP fault flag**

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* LDO3 \( V_{\text{IN}} \) min= 1.8V depending of operating mode

** STPMIC1A: OFF / STPMIC1B: 2.9 V
STM32MP1 General Purpose MPU
Accelerating IoT and Smart Industry Innovation

- Multicore Microprocessor running RTOS & Linux in parallel
- Suitable for industrial applications with 10-year longevity commitment
- Heterogeneous architecture [2 x Cortex-A7 + Cortex-M4 + GPU Cores]
- STM32Cube full ecosystem reuse on Arm Cortex-M4 core
- Dual Cortex-A7 with free Linux Distribution: OpenSTLinux

Target markets
- Industrial
- Home
- Consumer
- Medical
STPMIC1 and STM32MP1

The All-In-One power management solution for STM32MP1 microprocessors

- Optimized power consumption
- BOM saving
- Smaller PCB footprint than discrete solution
STPMIC1 and STM32MP1

- **LDO3**: 1.7 - 3.3 V / VTT / ByPass @ 120 mA
- **BUCK2**: 1~1.5 V @ 1 A
- **LDO4**: 3.3 V @ 50 mA
- **LPDDR2/3 DDR3/DDR3L**: VTT[0.75 V / 0.625 V]
- **REFDDR**: Vbuck2 / 2 @ 5 mA
- **BUCK1**: 0.725~1.5 V @ 1.5 A
- **BUCK3**: 1~3.4 V @ 0.5 A
- **LDO5**: 1.7-3.9V@350mA
- **LDO1**: 1.7-3.3V@350mA
- **LDO2**: 1.7-3.3V@350mA
- **LDO6**: 0.9-3.3V@150mA
- **PMIC_CTRL**: • I2C4 • IRQ/WKUP1 • PWR_ON • NRST

STPMIC1

- **BOOST**: 5.2V@1A
- **PWR SW1**: VBUSOTG @0.5A
- **PWR SW2**: SWOUT @1A
- **BUCK4**: 0.6~3.9V @2A
- **LDO5**: 1.7-3.9V@350mA
- **LDO2**: 1.7-3.3V@350mA
- **LDO1**: 1.7-3.3V@350mA
- **LDO6**: 0.9-3.3V@150mA
- **GP LDO**: [user app.]
- **GP DC/DC**: [Peripherals]
- **GP LDO**: [SD card]
- **GP LDO**: [user app.]
- **GP LDO**: [LCD analog]

VDDQ_DDR [1.2 / 1.35 / 1.5 V]
VDDCORE [1.2 V]
VDD [1.8 / 3.3 V]
VDD3V3_USB [3.3 V]
<table>
<thead>
<tr>
<th>Feature</th>
<th>STPMIC1</th>
<th>Discrete solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor all power rails and provide OCP, OVP, OTP features</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Power-up / Power-down sequence</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Voltage accuracy / settling time needed by STM32MP1 series</td>
<td>✔</td>
<td>Need an accurate component selection</td>
</tr>
<tr>
<td>Overall solution footprint (*)</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>BOM</td>
<td>✔</td>
<td>✗</td>
</tr>
</tbody>
</table>

* STPMIC1 PCB footprint ~ **300mm^2**
Discrete solution ~ **750mm^2** | 5*DC/DC~**600mm^2** | 6*LDO~**150mm^2**
End-Markets

Home Automation
Industrial Control
POS Terminals
Networking
Medical Monitoring
STPMIC1

- Highly Integrated Power Management IC
- State-of-the-art IP performance

Companion chip of the STM32MP1 series

- Optimized solution both from a performance and PCB footprint perspective VS a power rail design with stand-alone components.
Thank You