Power Management Solutions

- Battery Power Control Flash MCU
- Battery Charger Management Flash MCU
- Power Bank Flash MCU
- Fast Charger Discrimination IC

Discrete Power IC

- TinyPower™ 30V LDO
- AC to DC Converter IC
- Step-Down DC to DC Converter
Battery Power Control
Flash MCU

HT45F3420
HT45F3430
Why use a Battery Power Control MCU?

Huge present and expanding market area

► For Li-ion or Ni-MH battery powered products
► Protects and extends battery life
► Provides constant voltage control
► Provides constant current control

High Power LED Flashlight

Electronic Cigarette
Product Range

Flash

2K

HT45F3420
1K×16 ROM
64×8 RAM
32×8 EEPROM
H.R. PWM

1K

16/24

128×8 RAM
64×8 EEPROM
H.R. PWM
LCD

New Products

H.R. PWM : High Resolution PWM

2015 Holtek New Product Presentation >> Power Management Solutions >> Battery Power Control Flash MCU
Block Diagram

HT45F3420/30

Analog
- A/D 12-bit x 8
- Internal Reference (VBG)
- OVP
- OCP

HOLTEK 8-Bit MCU Core
- 1/2KW Flash Memory
- 64/128 Bytes SRAM
- 32/64 Bytes EEPROM
- \( f_{\text{SYS~OSC.}} : \text{HIRC} \)
- \( f_{\text{SUB~OSC.}} : \text{LIRC} \)
- LVR
- Timer Module
- Time Base
- INT

Driver
- H.R. PWM (DLL)

Peripheral
- R-type LCD (HT45F3430 only)

H.R. PWM : High Resolution PWM
DLL : Delay Lock Loop

2015 Holtek New Product Presentation >> Power Management Solutions >> Battery Power Control Flash MCU
LED Flashlight Application

- Switch
- VBAT Sense
- Key
- DC-DC Buck & LED
- Current Sense
- Indicator

MCU HT45F3420

Power Management Solutions >> Battery Power Control Flash MCU
Product Highlights

High Power LED Flashlight

OVP
Internal 8-bit D/A for voltage comparison

H.R. PWM
High resolution PWM
up to 500kHz with 8-bit resolution

Protection Features
OCP, H/W protection PGA 1x~51x,
high current detection

Inter. Ref. Voltage
Provides A/D stable power

High Level Functional Integration
Minimal external components for direct driving NMOS
Applications

Flashlights
- Extends battery life
- Battery protection
- Directly drives external MOSFETS

Personal Care Appliances
- Different battery types
- DC motor control
- Low battery indicator

Electric Cigarette
- Heater power control
- Li-ion Battery charger control
- Over current protection

Other Battery Management
- Suitable for higher power control applications which require constant power control
Battery Charger Management Flash MCU

HT45F5R
Why use a Battery Charge Management Flash MCU?

- Electronic power products are increasingly using rechargeable batteries, such as garden tools, power tools, e-bikes etc.
- Provides fast charge and supports **Quick Charge 2.0 – QC 2.0**
- Flexible protection functions such as OTP, OVP, OCP, etc.

**OTP** : Over Temperature Protection  
**OVP** : Over Voltage Protection  
**OCP** : Over Current Protection
Product Range

Flash

4K

2K

HT45F5Q
2K×14 ROM
64×8 RAM
32×8 EEPROM

24/28

HT45F5R
4K×16 ROM
128×8 RAM
64×8 EEPROM
LCD/LED
QC 2.0

New Product
Existing

2015 Holtek New Product Presentation >> Power Management Solutions >> Battery Charger Management Flash MCU
Block Diagram

HT45F5R

Battery Charger Module
- CC/CV control
- D/A 12-bit
- OVP(H/W)
- OCP(H/W)
- Power Good Detection (H/W)

HOLTEK
8-Bit MCU Core
- 4 KW Flash Memory
- 128 Bytes SRAM
- 64 Bytes EEPROM
- $f_{SYS}$ OSC. : HIRC
- $f_{SUB}$ OSC. : LIRC
- LVD / LVR
- Timer Module
- Time Base
- INT

Analog
- A/D 12-bit

Peripheral
- QC 2.0
- R-type LCD
- LED driver

Charge Voltage

Charge Current

2015 Holtek New Product Presentation >> Power Management Solutions >> Battery Charger Management Flash MCU
Product Highlights

Application example – Lead Acid Battery Charger

**LED Driver**
Programmable LED current control

**Charge Management**
Both constant current and constant voltage control

**Key Inputs**
Logic input/outputs and interrupt

**Protection Features**
Over voltage, over current and over temperature protection

**Analog to Digital Converter**
12-bit resolution A/D for voltage and current sensing
Charger Application

Flyback Circuit

HT45F5R

Current Sense

Battery

Key & Indicators

-- Diagram with various components and connections labeled with different voltages and terminals such as VDD, VSS, PWM, IS, GND, etc. --
Applications

Power Tools Charger, e-Bike Charger
Battery protection
Integrated constant current and constant voltage circuits

Other Battery Chargers
Supply any battery type applications
► Lead Acid battery
► Li-ion battery
Power Bank Flash MCU

HT45F5N
Power Bank Basic Theory

- Uses the USB port to charge the Battery in the Power bank

- Discharges the battery in the power bank via the USB output port

5V USB Input

Buck Circuit

3.7V Li-Battery

5V USB Output

Boost Circuit

3.7V Li-Battery
Product Range

New Product

HT45F5N
HT45FH5N
4K×16 ROM
256×8 RAM
64×8 EEPROM
LCD/7-Segment
QC 2.0
PE+
Apple Mode
500kHz @ 8-bit Step

Existing

HT45F4N
HT45FH4N
4K×16 ROM
192×8 RAM
64×8 EEPROM
LCD/7-Segment
QC 2.0
PE+
Apple Mode
300kHz @ 7-bit Step

Flash

4K

2K

16/20

28

32

Pins

HT45F4MA
HT45FH4MA-1
2K×16 ROM
128×8 RAM
64×8 EEPROM
300kHz@7-bit Step
HT45FH4N Pass QC 2.0 Certification
Power Bank Proposed Design

- 5V USB Input
- 5V USB Output
- 3.7V Li-Battery
- Boost Circuit
- HT45F5N
- Current Sense
- Indicator

2015 Holtek New Product Presentation >> Power Management Solutions >> Power Bank Flash MCU
Block Diagram

**HT45F5N**

**Analog**
- A/D 12-bit x 14
- OCP x 2
- OUVP x 2
- V-Ref. 2.4V ±1%

**HOLTEK 8-Bit MCU Core**
- 4 KW Flash Memory
- 256 Bytes SRAM
- 64 Bytes EEPROM
- f_{SYS} OSC. : HIRC
- f_{SUB} OSC. : LIRC
- LVR
- Timer Module
- Time Base
- INT

**Driver**
- Auto-Adjust H.R.
- PWM with slew rate control x 2

**Peripheral**
- 4-SCOM LCD Driver
- SPI + I²C
- QC 2.0
- PE+
- Apple Mode
Product Highlights

Power Bank with 7-segment Power Display

Key Inputs
Logic inputs/outputs and interrupt

High Conversion Efficiency
Reduced power losses

LED Driver
Programmable LED current control

Charge/Discharge Management
Both constant current and constant voltage control

PWM Output
Up to 500kHz PWM with 8-bit resolution stand alone 2-ports Max. 4A Output

Protection Features
Over voltage, over current and over temperature protection

Analog to Digital Converter
12-bit resolution A/D for voltage and current sensing
Power Bank Application

- Buck/Boost
- OUVP
- H.R.PWM
- Vref. 2.4V

Boost

Charger: Buck
Discharger: Boost (HT45F5N)

3.7V

2015 Holtek New Product Presentation >> Power Management Solutions >> Power Bank Flash MCU
Applications

**Single Cell Power Banks**
Charge with buck circuit and CC/CV control
Discharge with boost circuit and CC/CV control
OCP/OUVP

**Dual Cell Power Banks**
Charge with boost circuit and CC/CV control
Discharge with bulk circuit and CC/CV control
OCP/OUVP

**Power Banks with Displays**
7-segment LCD
Fast Charger Discrimination IC

HT45B0010-1
What is Fast Charging

- Without Fast Charge: 15% charge
- With Fast Charge: 60% charge

USB 3.0: 5V/0.9A~1.5A

Fast Charge Adaptor:
- 20V/2A
- 12V/2A
- 9V/2A
- 7V/2A
- 5V/2.4A

Communication between the Fast Charge Adaptor and the device.
Product Highlights

- **Qualcomm Quick Charge 2.0**
  - 20V/2A
  - 12V/2A
  - 9V/2A
  - 5V/2A
  - 5V/1.5A

- **USB BC 1.2**

- **PumpExpress+ by MediaTek**
  - 12V/2A
  - 9V/2A
  - 7V/2A
  - 5V/2A

- **5V/2.4A**

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2015 Holtek New Product Presentation >> Power Management Solutions >> Fast Charger Discrimination IC
Fast Charge Adapter
Proposed Design

AC to DC Topology
DC/DC Topology
Feedback Circuit

HT45B0010-1

USB PORT
USB PORT

With Fast Charge

Power Management Solutions >> Fast Charger Discrimination IC
Fast Car Charger Proposed Design

Automotive Power

Step-Down Converter HT7466

Feedback Circuit

USB PORT

HT45B0010-1

USB PORT

With Fast Charge

Power Management Solutions >> Fast Charger Discrimination IC
Fast Car Charger Application

12V~24V Buck Converter

HT45B0010-1

- QC 2.0
- PE+
- USB DCP
- Apple Mode

VIN COMP VSS SW BS EN FB

PA0 PA1 PA2 D- D+ OCP

VDD VSS
TinyPower™ 30V LDO
HT73xx-1/-2/-3
Product Range

<table>
<thead>
<tr>
<th>Output Current</th>
<th>New Products</th>
<th>Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>±3%</td>
<td>HT75xx-1</td>
<td>HT71xx-1</td>
</tr>
<tr>
<td></td>
<td>30V, $I_Q$: 2.5µA</td>
<td>30V, $I_Q$: 2.5µA</td>
</tr>
<tr>
<td>±2%</td>
<td>HT75xx-3</td>
<td>HT71xx-3</td>
</tr>
<tr>
<td></td>
<td>30V, $I_Q$: 1.0µA</td>
<td>30V, $I_Q$: 1.0µA</td>
</tr>
<tr>
<td>±1%</td>
<td>HT75xx-2</td>
<td>HT71xx-2</td>
</tr>
<tr>
<td></td>
<td>30V, $I_Q$: 2.5µA</td>
<td>30V, $I_Q$: 2.5µA</td>
</tr>
</tbody>
</table>

HT73xx-1
30V, $I_Q$: 2.5µA

HT73xx-3
30V, $I_Q$: 1.0µA

HT73xx-2
30V, $I_Q$: 2.5µA

HT71xx-1
30V, $I_Q$: 2.5µA

HT71xx-3
30V, $I_Q$: 1.0µA

HT71xx-2
30V, $I_Q$: 2.5µA

HT73xx-1
30V, $I_Q$: 2.5µA

HT73xx-2
30V, $I_Q$: 2.5µA

HT73xx-3
30V, $I_Q$: 1.0µA

HT75xx-1
30V, $I_Q$: 2.5µA

HT75xx-2
30V, $I_Q$: 2.5µA

HT75xx-3
30V, $I_Q$: 1.0µA

HT73xx-2
30V, $I_Q$: 2.5µA

HT73xx-3
30V, $I_Q$: 1.0µA

HT73xx-2
30V, $I_Q$: 2.5µA

HT73xx-3
30V, $I_Q$: 1.0µA
Block Diagram

HT73xx -1/-2/-3

Analog
Low Power Voltage Reference
Soft Start Function

Analog
Low Power OP Amp
Precise Voltage Divider

Analog
High Power P-type MOSFET

AC-DC Adaptor
Battery Packs

18650
18650
18650
18650

Holtek MCU
Product Highlights
TinyPower™ LDO

**Soft Start**
When power on

**Input Voltage**
$V_{\text{OUT}} + 2V \sim 30V$

**Output Current Capability**
250mA

**Output Accuracy**
$\pm 1\%/\pm 2\%/\pm 3\%$

**Power Dissipation**
1.0µA/2.5µA

**Output Voltage**
2.1V/2.3V/2.5V/2.7V/3.0V
3.3V/3.6V/4.0V/4.4V/5.0V

**LED Display**

12V/24V Adaptor

**LED Matrix**

$V_{\text{REF}}$

**Generator**

OPA

**Resistor Divider**

**Power Element**
Applications

**Smart Meters**
Electronic meters, water meters, gas meters and thermo meters such as Meter Data Management (MDM)

**Load Cells**
Applications such as body weight scales, shop scales, body fat scales, and other load measurement products

**Machine Tools**
Household and health products such as medical thermometers, weather stations etc
AC to DC Converter IC

HT7A6322
Product Range

HT7A6312
730V MOS
R_{DS(ON)} : 19\Omega
Up to 8W
HV-startup

HT7A6322
730V MOS
R_{DS(ON)} : 12\Omega
Up to 12W
HV-startup

HT7A6312
730V MOS
R_{DS(ON)} : 19\Omega
Up to 13W
HV-startup

HT7A6322
730V MOS
R_{DS(ON)} : 12\Omega
Up to 20W
HV-startup

New Products
Existing

85~265 V_{AC}

195~265 V_{AC}
Block Diagram

HT7A6322

Analog
- Universal AC Input Voltage
- Buck, Buck-Boost & Isolation
- Flyback Topology
- PWM Controller

Analog
- High Voltage Start-up
- $12 \Omega$ $R_{DS(ON)}$
- 730V Power MOSFET
- 0.7mA Operating Current

Analog
- DC Output Voltage
- Auto Recovery
- OCP, OVP & OTP/UVLO Protections

AC Source

Holtek MCU

DC Source

Holtek LDO
Product Highlights

AC to DC IC

Input Voltage
Universal input range 85Vac ~ 265Vac

Fully Integrated System
High voltage start-up, 730V 12Ω \( R_{\text{DS(ON)}} \) power MOSFET, PWM controller

Several Topology Types
Buck, Buck-Boost, Isolation Flyback

Protection Features
Auto recovery OCP, OVP, OTP and UVLO

Low Operating Current
Typical 0.7mA operating current and low standby power
**Home Appliances**

Most home appliances include electronic circuits such as microcontrollers and LCD displays, which need an AC/DC power supply to provide clean and regulated DC power.

**Adapters**

A small power supply that changes AC voltage to low voltage DC suitable for consumer electronics.

**Battery Chargers**

AC-powered battery chargers work by supplying a constant DC or pulsed DC power source to a battery being charged.
Step-Down DC to DC Converter

HT7463A/HT7463B
Why use Step-Down DC to DC Converters?

High Power, High Efficiency and Longer Battery Life

- Smart Meters
- Electric Vehicles
- Security Surveillance Systems
- DC-DC LED Lighting
Product Range

**Output Current**

- **24V**
  - **HT7466**
    - Async. Buck
    - $f_{SW} : 380$kHz
    - $I_Q : 1.1$mA
    - SOP8(EP)
  - **HT7465**
    - Async. Buck
    - $f_{SW} : 380$kHz
    - $I_Q : 1.0$mA
    - SOP8(EP)
  - **HT7463A/B**
    - Async. Buck
    - $f_{SW} : 1.25/0.55$MHz
    - $I_Q : 0.7$mA
    - SOT23-6

**Input Voltage**

- **52V**
- **2A**
- **3A**
- **0.6A**

New Product

Existing

2015 Holtek New Product Presentation >> Power Management Solutions >> Step-Down DC to DC Converter
Block Diagram

HT7463A/HT7463B

Analog
- Accurate Voltage Reference
- 0.55/1.25MHz Oscillator
- Internal 5V Regulator

Analog
- Asynchronous PWM Buck Controller
- UVLO/OSP Protections
- Soft Start Function

Analog
- 0.9Ω $R_{DS(ON)}$ N-type MOSFET
- OCP/OTP Protections

AC-AC Transformer
18650 Battery Packs
0.55/1.25MHz Oscillator
Internal 5V Regulator
Asynchronous PWM Buck Controller
UVLO/OSP Protections
Soft Start Function
0.9Ω $R_{DS(ON)}$ N-type MOSFET
OCP/OTP Protections

Holtek MCU
PLC Module
2015 Holtek New Product Presentation >> Power Management Solutions >> Step-Down DC to DC Converter
**Product Highlights**

**Step-Down DC to DC Converter**

**Input Voltage**
Wide range input voltage 4.5V ~ 52V

**Output Accuracy**
Excellent output voltage accuracy ±2%

**Protection Function**
UVLO, OSP, OCP, OTP protection

**Output Ripple**
Satisfies 1‰ criteria

**Soft Start**
Improved power on performance

**High Switching Frequency**
Higher frequencies result in higher efficiencies 550kHz/1.25MHz

**High Voltage Input**

**Internal 5V Regulator**

**PWM Controller**

**Low Ron Power Element**

**Fully Protections**

**VREF Generator**

**VREF Generator**

**PLC Module**

**VREF Generator**

**Internal 5V Regulator**

**PWM Controller**

**Low Ron Power Element**

**Fully Protections**

**Soft Start**
Improved power on performance

**High Switching Frequency**
Higher frequencies result in higher efficiencies 550kHz/1.25MHz

**Output Ripple**
Satisfies 1‰ criteria
Applications

Smart Meters
Powering PLC module for electronic meter in smart grid which require ultra low voltage ripple to guarantee communication integrity

Electric Vehicles
Converts high voltage from serial-battery to a low supply voltage for MCUs, sensors and actuators with high transfer efficiency

Security Surveillance Systems
For adaptor/PoE -powering systems, supplying voltage for motors, MCUs and CIS/CCDs