PCF50633

Power supply and battery management controller

Rev. 02 — 20 February 2008 Product data sheet

1. General description

The PCF50633 is a highly integrated solution providing power supply generation and battery management for mobile devices such as portable media players. It contains linear and switching regulators, including an automatic up/down converter for hard disk supply. Other features include a complete USB-compliant battery charger, system control functions and a multi-purpose Analog-to-Digital Converter (ADC). The device can be controlled by a host controller via an I^2C-bus serial interface.

2. Features

2.1 System control

- I^2C-bus interface enabling extended control over all modules
- State machine ensuring optimal activity in each device state
- Programmable start-up and shutdown sequencer
- Real Time Clock including 32768 Hz oscillator and alarms
- Interrupt controller
- Wake-up possibilities at 7 pins allowing wake-up by push button, slide switch and adapter/USB insertion
- Three General Purpose I/Os (GPIO) and one high-current General Purpose Output (GPO)
- 8-byte general purpose memory
- Ambient light sensor
- Thermal protection.

2.2 Supplies

- Auto step-up/step-down converter (1.1 A, 1.7 MHz, internal switches) for a hard disk
- Step-down converter (500 mA, 1.7 MHz, internal switches) for a CPU
- Step-down converter (500 mA, 1.7 MHz, internal switches) for memory, plus parallel Low Dropout Regulator (LDO) for standby mode
- Backlight boost converter, incorporating intensity and on/off ramp control
- Seven linear regulators (4 x 50 mA, 2 x 150 mA, 1 x 200 mA with current limiting)
- Dynamic voltage management on both step-down converters
- Programmable inrush current on all switching regulators
- On/off and output voltage control by software (I^2C) and via control pins (GPIOs)
- Power failure detection on most outputs
- Outputs pulled down to ground when supplies are off (except LED converter)
- Linear regulators can be used as switches.

2.3 Battery management

- Battery charge and play system:
  - Supports single-cell Li-Ion batteries
  - Separate adapter and current-limited USB inputs
  - Application can operate from external source when battery is low or not connected
  - Battery remains fully charged after charging as long as an external power supply is connected
  - Programmable precharge and fast charge currents
  - Integrated power transistors
  - Thermal regulation loop controls charge rate at maximum device temperature.
- Undervoltage lockout detectors with programmable thresholds
- Backup battery input for RTC supply when main battery is empty
- Backup battery charger.

2.4 ADC

- 10-bit resolution
- 4 input pins
- Analog preprocessor offering input voltage division and subtraction
- Direct and ratiometric measurement modes.

3. Applications

- Hard disk-based portable media players
- Flash-based portable media players
- PDAs
- Smartphones.

4. Quick reference data

Table 1: Quick reference data

V_{SS} = REFGND = GND = 0 V; T_{amb} = −40 to +85 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{SYS}	system supply voltage	Active mode	2.8	-	5.3	V
V_{BAT}	battery supply voltage	Active mode	2.8	-	5	V
V_{BUBAT}	backup battery supply voltage		1.6	-	3	V
$V_{ADAPTSNS}$	voltage on pin **ADAPTSNS**		4	-	5.3	V
V_{USB}	USB supply voltage		4	-	5.3	V
V_{VISA}	voltage on pin **VISA**[1]		-	2.4	-	V
V_{VISC}	voltage on pin **VISC**[1]		-	2.4	-	V
V_{REFC}	voltage on pin **REFC**[1]		-	0.9	-	V
$V_{O(LED)}$	LED output voltage		5	-	18	V
$f_{sw(PWM)}$	PWM switching frequency	for DOWN1, DOWN2 and AUTO converters	-	1.7	-	MHz
$f_{sw(PFM)}$	PFM switching frequency	for LED boost converter	-	-	1	MHz
$T_{th(die)}$	die threshold temperature		-	125	-	°C
$V_{th(batok)}$	battery OK threshold voltage	range; programmable in 100 mV steps	2.8	-	3.4	V
$V_{th(sysok)}$	system OK threshold voltage	range; programmable in 100 mV steps	2.8	-	3.4	V
$V_{th(sysmin)}$	minimum system ON threshold voltage		-	2.5	-	V
$V_{th(syspres)}$	system voltage threshold for save state	no backup battery	1.7	2	2.3	V
$V_{th(bubpres)}$	backup battery threshold voltage for save state		1	1.3	1.6	V
$V_{th(adaptpres)}$	adapter presence threshold voltage		3.25	3.6	3.95	V
$V_{th(usbpres)}$	USB adapter presence threshold voltage		3.25	3.6	3.95	V
$I_{DD(tot)}$	total supply current	in Save state; V_{BAT} = 2.5 V; no USB or adapter present	-	-	50	µA
		in Standby state; all supplies disabled; V_{BAT} = 3.6 V; no USB or adapter present	-	-	60	µA
		in Active state; all supplies enabled (no load); V_{BAT} = 3.6 V; no USB or adapter present	-	-	1	mA

[1] Note that V_{VISA}, V_{VISC} and V_{REFC} are internal signals. Pins **VISA**, **VISC** and **REFC** are provided to allow external decoupling capacitors to be connected. Decoupling is necessary to ensure stable operation.

Table 2: Overview power supplies

V_{SS} = REFGND = GND = 0 V; T_{amb} = −40 to +85 °C; unless otherwise specified.

Supply Name	Maximum output current	Minimum output voltage	Maximum output voltage	Step size	Switching frequency	Quiescent current	PSRR[1]	Output capacitor[2]	Inductor
Programmable power supplies									
DOWN1	500 mA	0.625 V	3.00 V	25 mV	1.7 MHz	-	-	22 µF	4.7 µH
DOWN2	500 mA	0.625 V	3.00 V	25 mV	1.7 MHz	-	-	22 µF	4.7 µH
AUTO	500 mA[3]	1.80 V	3.80 V	25 mV	1.7 MHz	-	-	22 µF	4.7 µH
	1100 mA	1.80 V	3.80 V	25 mV	1.7 MHz	-	-	47 µF	2.2 µH
LED	25 mA	5.0 V	18.0 V	1 mA	< 1 MHz	-	-	10 µF	2.2 µH
LDO1: LDO3	50 mA	0.90 V	3.60 V	100 mV	-	25 µA + 2 % of load	60 dB	470 nF	-
LDO4	150 mA	0.90 V	3.60 V	100 mV	-	70 µA + 2 % of load	60 dB	470 nF	-
LDO5	150 mA	0.90 V	3.60 V	100 mV	-		60 dB	470 nF	-
LDO6	50 mA	0.90 V	3.60 V	100 mV	-	25 µA + 2 % of load	60 dB	470 nF	-
HCLDO	200 mA[4]	0.90 V	3.60 V	100 mV	-	70 µA + 2 % of load	60 dB	470 nF	-
MEMLDO	1 mA	0.90 V	3.60 V	100 mV	-	5 µA	60 dB	[5]	-

[1] Typical values assuming 100 Hz < f < 1000 Hz.

[2] Typical values assuming X7R type ceramic capacitor.

[3] Smaller external components can be used in the 500 mA configuration; the **AUTOLXA2** and **AUTOLXB1** pins must remain unconnected in this configuration.

[4] Current limited: output limited to 175 % of the max current (or 350 mA).

[5] Output available at the **DOWN2FB** pin.

5. Ordering information

Table 3: Ordering information

Type number	Package		
	Name	Description	Version
PCF50633HN/xx/N3[1]	HVQFN68	plastic, thermal enhanced, very thin quad flat package; no leads, Pb free, 68 terminals; body 8 x 8 x 0.85 mm	SOT852-2

[1] 'xx' indicates the IC variant.

6. Functional diagram

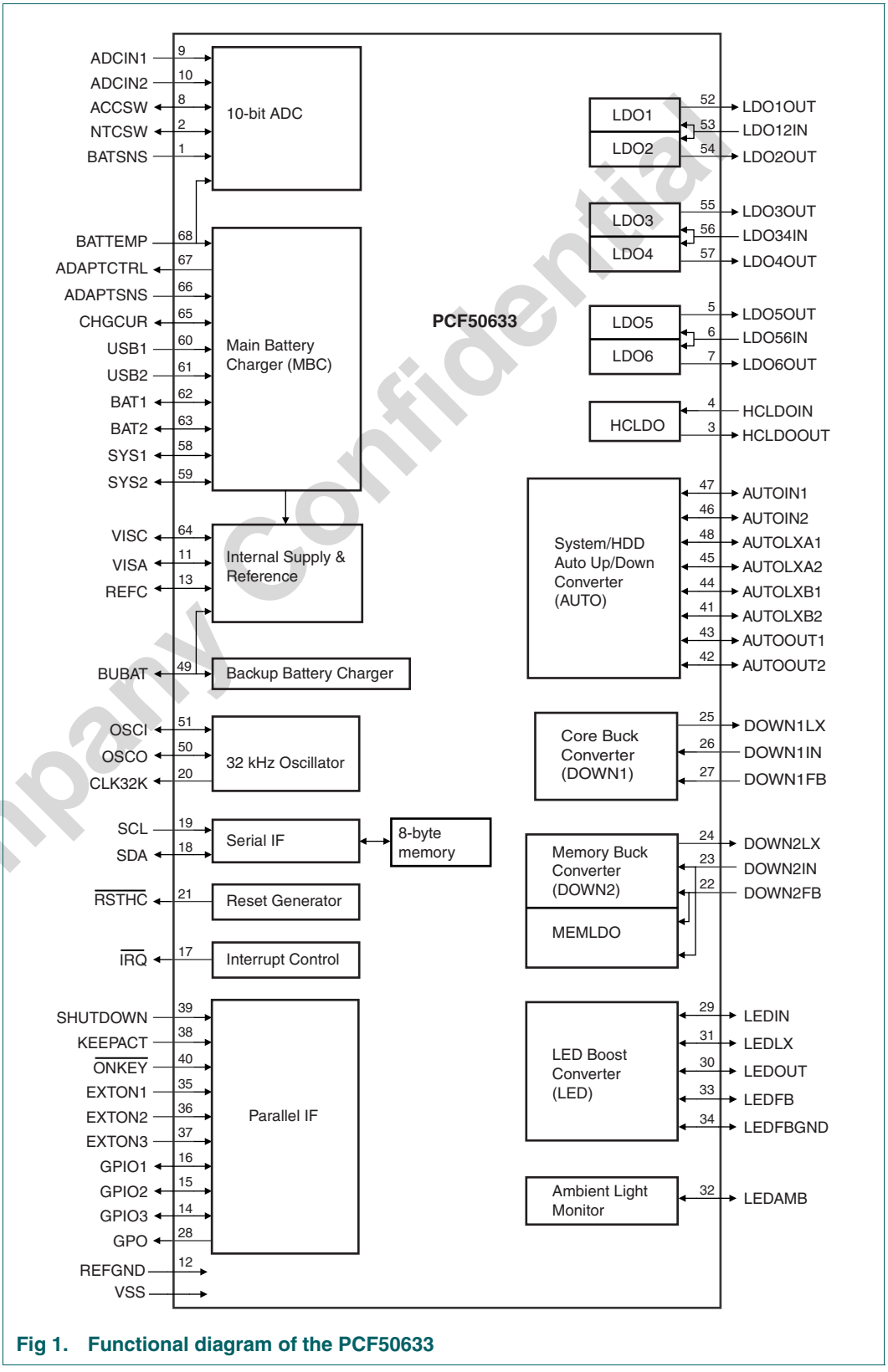


Fig 1. Functional diagram of the PCF50633

7. Pinning information

7.1 Pinning

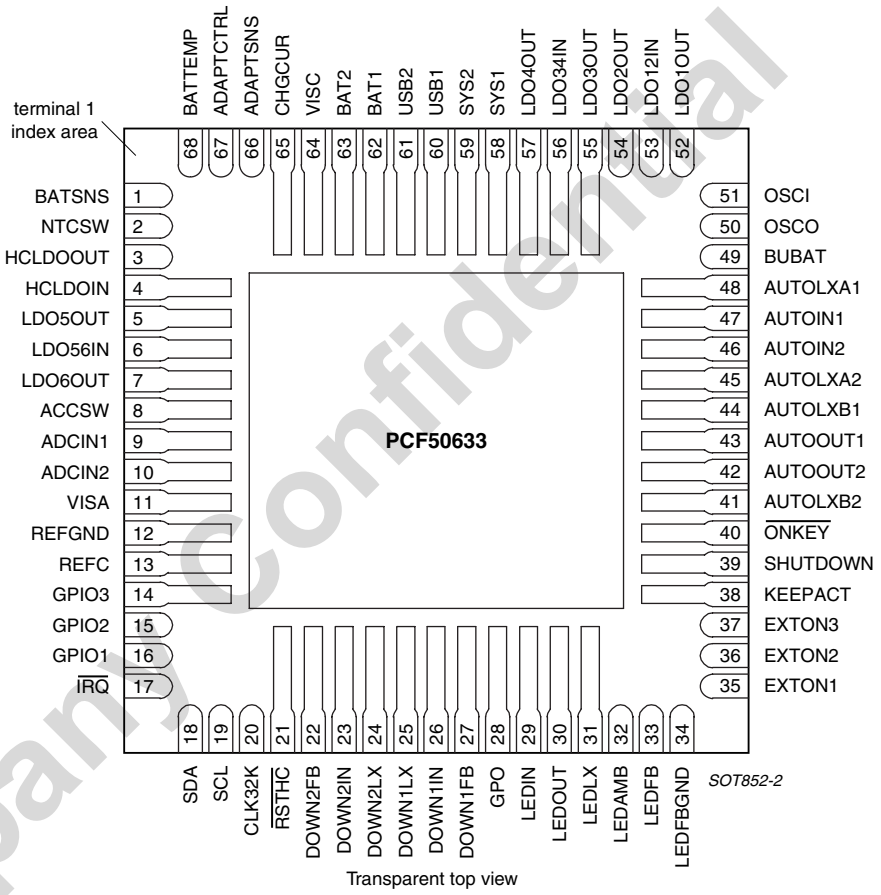


Fig 2. Pin configuration for HVQFN68 package

7.2 Pin description

Table 4: Pin description

Name	Pin	Description
Control interfaces		
$\overline{\text{ONKEY}}$	40	active-LOW ‘on’ key input with internal pull-up resistor
EXTON1	35	external activation (wake-up) input
EXTON2	36	external activation (wake-up) input
EXTON3	37	external activation (wake-up) input
$\overline{\text{RSTHC}}$	21	active-LOW reset output for host controller; open-drain output
CLK32K	20	32.768 kHz digital clock output; open-drain output
GPIO1	16	input mode: control signal inputs with programmable impact on activity of regulators. output mode: general purpose open-drain outputs
GPIO2	15	
GPIO3	14	

Table 4: Pin description *…continued*

Name	Pin	Description
GPO	28	general purpose push-pull output
SHUTDOWN	39	shuts down the PCF50633 when a LOW-to-HIGH transition is detected
$\overline{IRQ}$	17	interrupt request to host controller; this active-LOW signal has an open-drain output
KEEPACT	38	Active state continuation input
SCL	19	I^2C-bus interface clock
SDA	18	I^2C-bus interface data
Linear and switching regulators		
AUTOIN1[1]	47	DC-to-DC auto up/down converter input 1
AUTOIN2[1]	46	DC-to-DC auto up/down converter input 2
AUTOLXA1[2]	48	inductor connection 1 to buck part of DC-to-DC auto up/down converter
AUTOLXA2[2]	45	inductor connection 2 to buck part of DC-to-DC auto up/down converter
AUTOLXB1[2]	44	inductor connection 1 to boost part of DC-to-DC auto up/down converter
AUTOLXB2[2]	41	inductor connection 2 to boost part of DC-to-DC auto up/down converter
AUTOOUT1[1]	43	DC-to-DC auto up/down converter output 1
AUTOOUT2[1]	42	DC-to-DC auto up/down converter output 2
DOWN1IN	26	DC-to-DC step-down converter 1 input
DOWN1FB	27	DC-to-DC step-down converter 1 feedback input
DOWN1LX	25	inductor connection to DC-to-DC step-down converter 1
DOWN2IN	23	DC-to-DC step-down converter 2 input
DOWN2FB	22	DC-to-DC step-down converter 2 feedback input and MEMLDO output
DOWN2LX	24	inductor connection to DC-to-DC step-down converter 2
LEDIN	29	LED boost converter input
LEDLX	31	inductor connection to LED boost converter
LEDOUT	30	current-controlled output of LED boost converter
LEDFB	33	feedback for current loop of LED boost converter
LEDFBGND	34	feedback ground sense input to LED boost converter
LEDAMB	32	ambient light sensor input
LDO12IN	53	shared input for LDO1 and LDO2 linear regulators
LDO1OUT	52	LDO1 linear regulator output
LDO2OUT	54	LDO2 linear regulator output
LDO34IN	56	shared input for LDO3 and LDO4 linear regulators
LDO3OUT	55	LDO3 linear regulator output
LDO4OUT	57	LDO4 linear regulator output
LDO56IN	6	shared input for LDO5 and LDO6 linear regulators
LDO5OUT	5	LDO5 linear regulator output
LDO6OUT	7	LDO6 linear regulator output

Table 4: Pin description *…continued*

Name	Pin	Description
HCLDOIN	4	high-current linear regulator input
HCLDOOUT	3	high-current linear regulator output
32.768 kHz oscillator		
OSCI	51	32.768 kHz oscillator input
OSCO	50	32.768 kHz oscillator output
Internal supply		
REFC	13	reference voltage; bypass capacitor connection
VISA	11	internal analog supply voltage decoupling node
VISC	64	internal analog supply voltage decoupling node
Battery charger		
USB1[1]	60	USB power input 1
USB2[1]	61	USB power input 2
BAT1[1]	62	battery terminal 1
BAT2[1]	63	battery terminal 2
BATSNS	1	battery voltage sense input
SYS1[1]	58	system and adapter connection terminal 1
SYS2[1]	59	system and adapter connection terminal 2
ADAPTSNS	66	adapter sense input
ADAPTCTRL	67	adapter switch gate drive output
BATTEMP	68	battery temperature sense input
CHGCUR	65	charger current reference resistor connection
BUBAT	49	backup battery connection
ADC		
ADCIN1	9	ADC channel 1 input
ADCIN2	10	ADC channel 2 input
NTCSW	2	battery temperature resistor bridge connection
ACCSW	8	accessory resistor bridge connection
Ground		
REFGND	12	reference ground
VSS	backplane	power ground connection

[1] The following pin pairs must be connected on the PCB:
AUTOIN1 to AUTOIN2
AUTOOUT1 to AUTOOUT2
USB1 to USB2
BAT1 to BAT2
SYS1 to SYS2
These pins are all power pins. They must be connected via a low-ohmic connection.

[2] For the AUTO converter, in the 1.1 A configuration, the following pin pairs must be connected on the PCB:
AUTOLXA1 to AUTOLXA2
AUTOLXB1 to AUTOLXB2
The AUTOLXA2 and AUTOLXB1 pins must remain unconnected in the 500 mA configuration. These pins are all power pins. They must be connected via a low-ohmic connection.

8. Limiting values

Table 5: Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).In accordance with the Absolute Maximum Rating System (IEC 60134)

Symbol	Parameter	Conditions		Min.	Max	Unit
V_{BAT}	battery supply voltage			–0.5	+5.5	V
V_{BUBAT}	backup battery supply voltage			–0.5	+5.5	V
V_{SYS}	system supply voltage			–0.5	+5.5	V
V_{USB}	USB supply voltage			–0.5	+5.5	V
V_I	input voltage	on any pin with respect to **REFGND**		–0.5	+5.5	V
I_I	input current	DC; at any control input		–10	+10	mA
I_O	output current	DC; at any control output		–10	+10	mA
P_{tot}	total power dissipation			–	2000	mW
T_{amb}	ambient temperature			–40	+85	°C
T_{stg}	storage temperature			–55	+150	°C
V_{esd}	electrostatic discharge voltage	HBM[1]	[2]	-	±1000	V
			[3]	-	±2000	V
		MM[4]	[2]		±100	V
			[3]		±200	V
		CDM[5]			±500	V

[1] Human Body Model: equivalent to discharging a 100 pF capacitor via a 1.5 kΩ resistor.

[2] Pins **AUTOIN1**, **AUTOIN2**, **AUTOLXA1**, **AUTOLXA2**, **AUTOLXB1**, **AUTOLXB2**, **AUTOOUT1**, **AUTOOUT2**, **DOWN1IN**, **DOWN2IN**, **DOWN1LX**, **DOWN2LX**, **LEDIN**, **LEDLX** and **LEDOUT**.

[3] Pins other than those listed in Table note 2 above.

[4] Machine Model: equivalent to discharging a 200 pF capacitor via a 0 Ω resistor.

[5] Charge Device Model.

9. Thermal characteristics

Table 6: Thermal characteristics

Symbol	Parameter	Package	Typ	Unit
$R_{th\ j\text{-}a,inf}$	thermal resistance from junction to ambient in free air, mounted on infinite heatsink	HVQFN68	10	K/W
$R_{th\ j\text{-}a,pcb}$	thermal resistance from junction to ambient, typical PCB situation		40	K/W

10. Characteristics

Table 7. Characteristics

V_{SS} = REFGND = GND = 0 V; T_{amb} = –40 to +85 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
OOC						
V_{SYS}	system supply voltage	Active mode	2.8	-	5.3	V
$T_{th(die)}$	die threshold temperature		-	125	-	°C

Table 7. Characteristics *...continued*

V_{SS} = REFGND = GND = 0 V; T_{amb} = −40 to +85 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{th(sysmin)}$	minimum system ON threshold voltage[1]		-	2.5	-	V
$V_{th(syspres)}$	system threshold voltage for save state[2]	no backup battery	1.7	2	2.3	V
$V_{th(bubpres)}$	backup battery threshold voltage for save state[3]		1	1.3	1.6	V
V_{VISA}	voltage on pin **VISA**[4]		-	2.4	-	V
V_{REFC}	voltage on pin **REFC**[4]		-	0.9	-	V
$I_{DD(tot)}$	total supply current	in Save state; V_{BAT} = 2.5 V; no USB or adapter present	-	-	50	µA
		in Standby state; all supplies disabled; V_{BAT} = 3.6 V; no USB or adapter present	-	-	60	µA
		in Active state; all supplies enabled (no load)	-	-	1	mA
GPIO						
I_{sink}	sink current	active low; ON mode (switch closed)	0	-	100	mA
SVM						
$V_{th(sysok)}$	system OK threshold voltage	range; programmable in 100 mV steps	2.8	-	3.4	V
BVM						
$V_{th(batok)}$	battery OK threshold voltage[5]	range; programmable in 100 mV steps	2.8	-	3.4	V
AUTO						
I_O	output current	1.1 A configuration	-	-	1100	mA
		500 mA configuration	-	-	500[6]	mA
V_I	input voltage		2.7	-	5.3	V
$V_{O(prog)}$	programmable output voltage		1.8	-	3.8	V
$V_{O(step)}$	output voltage step size		-	25	-	mV
V_O	output voltage		$V_{O(prog)}$ − 5 %	$V_{O(prog)}$	$V_{O(prog)}$ + 3 %	V
$f_{sw(PWM)}$	PWM switching frequency		-	1.7	-	MHz
DOWN1/DOWN2						
I_O	output current		-	-	500	mA
V_I	input voltage range		2.7	-	5.3	V
$V_{O(prog)}$	programmable output voltage		0.625	-	3.0	V
$V_{O(step)}$	output voltage step size		-	25	-	mV
V_O	output voltage		$V_{O(prog)}$ − 3 %	$V_{O(prog)}$	$V_{O(prog)}$ + 3 %	V
$f_{sw(PWM)}$	PWM switching frequency		-	1.7	-	MHz
MEMLDO						

Table 7. Characteristics *…continued*

V_{SS} = REFGND = GND = 0 V; T_{amb} = −40 to +85 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_O	output current		-	-	1	mA
V_I	input voltage range	LDO operated as regulator	2.7	-	5.5	V
		LDO operated as low ohmic switch	1.8	-	5.5	V
$V_{O(prog)}$	programmable output voltage		0.9	-	3.6	V
$V_{O(step)}$	output voltage step size		-	100	-	mV
V_O	output voltage		$V_{O(prog)}$ − 3 %	$V_{O(prog)}$	$V_{O(prog)}$ + 3 %	V
LED						
$V_{O(LED)}$	LED output voltage		5	-	18	V
$I_{O(LED)}$	LED output current	V_O = 18 V	-	-	25	mA
		V_O = 5 V[7]	-	-	100	mA
V_{LEDFB}	voltage on pin **LEDFB**		1/512 × 1.25	-	1.25	V
$V_{th(ovp)}$	over-voltage protection threshold voltage		18	19	20	V
$f_{sw(PFM)}$	PFM switching frequency		-	-	1	MHz
LDO1, LDO2, LDO3 and LDO6						
I_O	output current		-	-	50	mA
V_I	input voltage	LDO operated as regulator	2.7	-	5.5	V
		LDO operated as low ohmic switch	1.8	-	5.5	V
$V_{O(prog)}$	programmable output voltage		0.9	-	3.6	V
$V_{O(step)}$	output voltage step size		-	100	-	mV
V_O	output voltage		$V_{O(prog)}$ − 2.5 %	$V_{O(prog)}$	$V_{O(prog)}$ + 2.5 %	V
LDO4 and LDO5						
I_O	output current				150	mA
V_I	input voltage range	LDO operated as regulator	2.7	-	5.5	V
		LDO operated as low ohmic switch	1.8	-	5.5	V
$V_{O(prog)}$	programmable output voltage		0.9	-	3.6	V
$V_{O(step)}$	output voltage step size			100		mV
V_O	output voltage		$V_{O(prog)}$ − 2.5 %	$V_{O(prog)}$	$V_{O(prog)}$ + 2.5 %	V
HCLDO						
I_O	output current		-		200	mA
V_I	input voltage range	LDO operated as regulator	2.7	-	5.5	V
		LDO operated as low ohmic switch	1.8	-	5.5	V

Table 7. Characteristics *…continued*

V_{SS} = REFGND = GND = 0 V; T_{amb} = −40 to +85 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{O(prog)}$	programmable output voltage		0.9	-	3.6	V
$V_{O(step)}$	output voltage step size		-	100	-	mV
V_O	output voltage		$V_{O(prog)}$ − 2.5 %	$V_{O(prog)}$	$V_{O(prog)}$ + 2.5 %	V
MBC						
V_{USB}	USB supply voltage		4.0	-	5.3	V
$V_{th(usbpres)}$	USB adapter presence threshold voltage	rising edge	3.25	3.6	3.95	V
		falling edge	3.15	3.5	3.85	
$I_{lim(USBx)}$	current limit on pin **USBx**	limit set to 1000 mA	800	900	1000	mA
		limit set to 500 mA	400	450	500	mA
		limit set to 100 mA	80	90	100	mA
$V_{th(adaptpres)}$	adapter presence threshold voltage	rising edge	3.25	3.6	3.95	V
		falling edge	3.15	3.5	3.85	
$V_{ADAPTSNS}$	voltage on pin **ADAPTSNS**		4.0	-	5.3	V
$I_{lim(BAT-SYS)}$	BAT-to-SYS path current limit	through ideal diode; ideal diode conducting	-	-	2.2	A
V_{BAT}	battery supply voltage	Active mode	2.8	-	5	V
$V_{batcond}$	battery conditioning voltage	programmable in 150 mV steps	2.7	-	3.15	V
V_{VISC}	voltage on pin **VISC**[8]		-	2.4	-	V
$V_{bat(float)prog}$	programmable battery float voltage	programmable in 20 mV steps	4.0	-	4.3	V
$V_{bat(float)}$	battery float voltage	single cell Li-Ion / Li-Pol	$V_{bat(float)prog}$ − 1%	$V_{bat(float)prog}$	$V_{bat(float)prog}$ + 1%	V
$I_{ch(ref)}$	charger reference current[9]	defined as 12500/$R_{ext(CHGCUR)}$	0	-	1000	mA
		excluding tolerance of external resistor	0.95 × $I_{ch(ref)}$ − 3	$I_{ch(ref)}$	1.05 × $I_{ch(ref)}$ + 3	mA
$R_{ext(CHGCUR)}$	external resistance on pin **CHGCUR**[9]	connected between pin **CHGCUR** and ground	12.5	-	-	kΩ
$I_{ch(BATx)}$[10]	charge current on pin **BATx**	precharge phase; programmable in 256 steps	0	-	255/255 × $I_{ch(ref)}$	mA
		adapter fast charge phase; programmable in 256 steps	0	-	255/255 × $I_{ch(ref)}$	mA
		USB fast charge phase; programmable in 256 steps	0	-	255/255 × $I_{ch(ref)}$	mA
BBC						
V_{BUBAT}	backup battery supply voltage		1.6	-	3	V
$I_{ch(BUBAT)}$	charge current on pin **BUBAT**	programmable	35	-	550	µA
$V_{lim(BUBAT)}$	limiting voltage on pin **BUBAT**	programmable	2.37	-	3.09	V
ADC						

Table 7. Characteristics *…continued*

V_{SS} = REFGND = GND = 0 V; T_{amb} = −40 to +85 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{I(ADCIN1)}$	input voltage on pin **ADCIN1**		0	-	2.0	V
$V_{I(BATTEMP)}$	input voltage on pin **BATTEMP**		0	-	2.0	V
$V_{I(ADCIN2)}$	input voltage on pin **ADCIN2**	full scale mode, divide by 2	0	-	4.0	V
		full scale mode, divide by 3	0	-	5.5	V
		subtraction mode	2.25	-	4.25	V
$V_{I(BATSNS)}$	input voltage on pin **BATSNS**	full scale mode, divide by 2	0	-	4.0	V
		full scale mode, divide by 3	0	-	5.5	V
		subtraction mode	2.25	-	4.25	V
DNL	differential non-linearity	**ADCIN1** and **BATTEMP** inputs	−0.7	-	+0.7	LSB
		high voltage **ADCIN2** and **BATSNS** inputs; full scale mode, divide by 2 or 3	−0.8	-	+0.8	LSB
		high voltage **ADCIN2** and **BATSNS** inputs; subtraction mode	−1.0	-	+1.0	LSB
INL	integral non-linearity	**ADCIN1** and **BATTEMP** inputs	−4.0	-	+4.0	LSB
		high voltage **ADCIN2** and **BATSNS** inputs; full scale mode, divide by 2	−4.0	-	+4.0	LSB
		high voltage **ADCIN2** and **BATSNS** inputs; full scale mode, divide by 3	−4.0	-	+4.0	LSB
		high voltage **ADCIN2** and **BATSNS** inputs; subtraction mode	−12.0	-	+12.0	LSB

[1] If the system voltage drops below $V_{th(sysmin)}$, an emergency shutdown is initiated and the system transitions to the Save state.

[2] If the system voltage drops below $V_{th(syspres)}$, and no backup battery is present, the system will be reset and will enter the NoPower state. If a backup battery is connected ($V_{BUBAT} > V_{th(BUBPRES)}$), the PCF50633 will continue in Save mode, powered by the backup battery.

[3] If the system voltage is below $V_{th(syspres)}$, the system will continue to operate in the Save state as long as $V_{BUBAT} > V_{th(BUBPRES)}$. If $V_{BUBAT} < V_{th(BUBPRES}$, the system will be reset and will enter the NoPower state.

[4] Note that V_{VISA} and V_{REFC} are internal signals. Pins **VISA** and **REFC** are provided to allow external decoupling capacitors to be connected. Decoupling is necessary to ensure stable operation.

[5] If a USB supply is connected, a transition from Save to Standby will occur if $V_{BAT} > V_{th(batok)}$ and $V_{SYS} > V_{th(sysok)}$. A transition from Standby to Save will occur if $V_{BAT} < V_{th(batok)}$ or $V_{SYS} < V_{th(sysok)}$.

[6] Smaller external components can be used in the 500 mA configuration. The **AUTOLXA2** and **AUTOLXB1** pins must be left floating in this configuration.

[7] A 5 V/100 mA USB supply source can be generated by configuring the LED supply module as a boost converter.

[8] Note that V_{VISC} is an internal signal. Pin **VISC** is provided to allow an external decoupling capacitor to be connected. Decoupling is necessary to ensure stable operation.

[9] $I_{ch(ref)}$ is defined as $12500/R_{ext(CHGCUR)}$, where $R_{ext(CHGCUR)}$ is the value of an external resistor connected between pin **CHGCUR** and ground.

[10] To select the maximum charge current of 1 A, a 12500 Ω resistor should be connected between **CHGCUR** and ground and the programmed value set to 265.

11. Application information

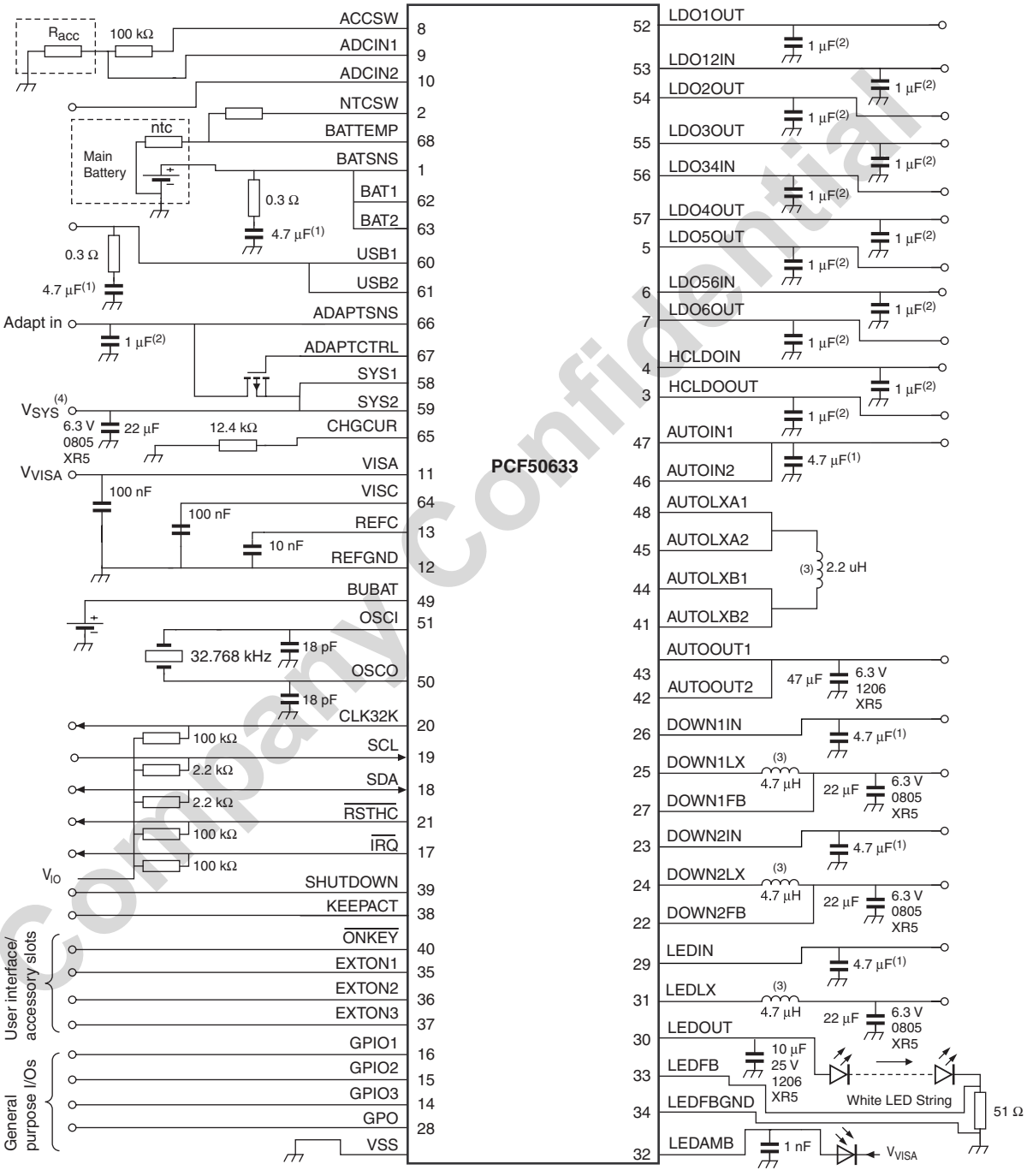
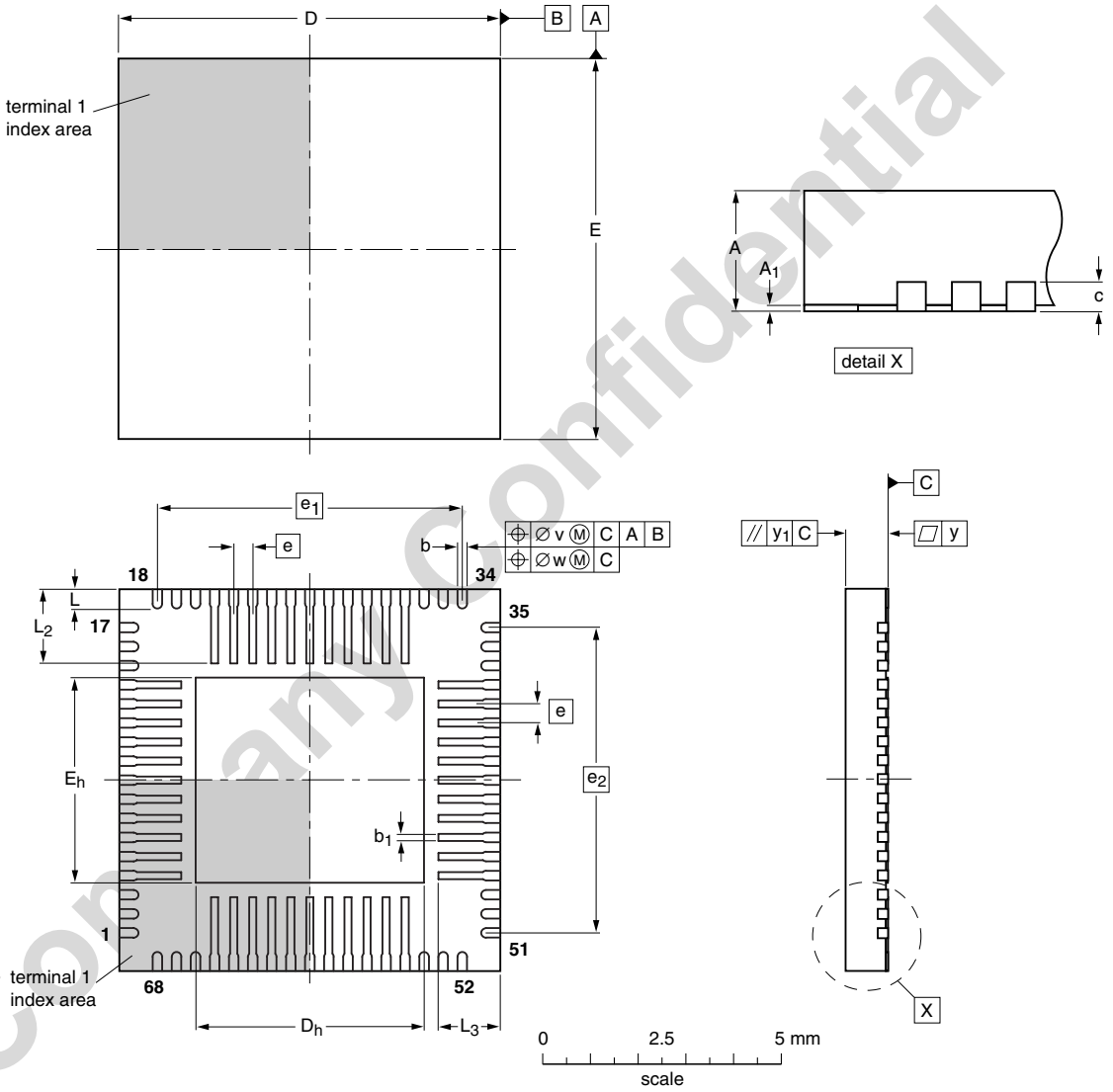


Fig 3. Typical application

12. Package outline

HVQFN68: plastic thermal enhanced very thin quad flat package; no leads; 68 terminals; body 8 × 8 × 0.85 mm **SOT852-2**



DIMENSIONS (mm are the original dimensions)

UNIT	$A^{(1)}$ max	A_1	b	b_1	c	$D^{(1)}$	D_h	$E^{(1)}$	E_h	e	e_1	e_2	L	L_2	L_3	v	w	y	y_1
mm	1	0.05 0.00	0.25 0.15	0.2 0.1	0.2	8.1 7.9	4.95 4.65	8.1 7.9	4.45 4.15	0.4	6.4	6.4	0.5 0.3	1.65 1.45	1.4 1.2	0.1	0.05	0.05	0.1

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT852-2	- - -	- - -	- - -			~~05-04-21~~ 05-05-23

Fig 4. HVQFN68 package outline. Note that the diepad is NOT square.

13. Revision history

Table 8: Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PCF50633_2	20080220	Product data sheet	-	PCF50633_1
Modifications • Application diagram revised (Figure 3) • Minor updates and corrections.				
PCF50633_1	20061101	Preliminary data sheet	Initial release	-

14. Legal information

14.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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16. Contents

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