



Genesys Logic, Inc.

GL888E
USB Charging Port Controller
Datasheet

Revision 1.02
Aug. 06, 2013

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Revision History

Revision	Date	Description
0.10	07/11/2012	First preliminary release
0.20	10/15/2012	Add CH7 Electrical Characteristics
0.30	10/26/2012	Add CH8 Package Dimension Features updated, p. 7
0.40	10/31/2012	Add CH9 Ordering Information
0.41	11/15/2012	Modify Table 6.1 Charging Mode Comparison, p.12
1.00	04/23/2013	Update CH7 Electrical Characteristics
1.01	07/19/2013	Update CH7 Electrical Characteristics, p.13
1.02	08/06/2013	Update CH7 Electrical Characteristics, p.13

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CHAPTER 1 GENERAL DESCRIPTION

The GL888E is a USB fast-charging controller which complies with USB Battery Charging Specification (abbrev. as BC). Before the USB BC is released, most handheld devices have different charging mechanisms that are not compliant with each other. Generally speaking, old wall-chargers are useless when you have new handheld devices. Now with a USB enabled wall-charger, it provides unified charging mechanism by traditional USB current supply (0.5A) when charging devices through USB ports. With a USB enabled wall-charger which complies with USB BC, it provides unified charging mechanism by more USB current supply (up to 1.5A) when charging devices through USB ports, so called “fast-charging” mechanism. In another word, GL888E is a high performance solution for “fast-charging” mechanism and it saves at most 66% of charging time.

Desktop, notebooks, netbooks and LCD TVs/Monitors are commonly used to provide charging current to handheld devices through USB ports. They stand as the current source from host side like wall-charger, so GL888E can also be applied for “fast-charging” mechanism under these systems.

In addition, the GL888E will automatically detect and charge not only USB BC compliant devices, but also Apple/Samsung/RIM devices. This feature implies wide range of end product applications and provides design flexibility for system manufactures.

CHAPTER 2 FEATURES

- Supports Battery Charging Specification 1.2 charging port types of Charging Downstream Ports (CDP) and Dedicated Charging Ports (DCP)
- Supports Chinese Communications Industry Standard YD/T 1591-2009
- Auto detect and charge for Apple devices, BC compliant devices, Samsung Galaxy Tabs
- Auto renegotiation
- High bandwidth USB 2.0 data switch
- Support Smart CDP for legacy non-BC compliant devices
- Support low speed keyboard/mouse wake up from S3 mode
- Ultra low power consumption
- Ultra high ESD performance
- Target Application
 - Desktop
 - Notebook
 - Netbook
 - LCD monitors/TVs
 - Docking station
 - BD player/recorder
 - USB universal wall charger

CHAPTER 3 PIN ASSIGNMENT

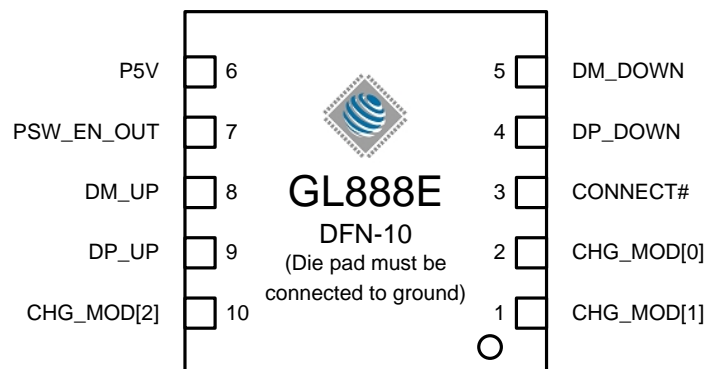


Figure 3.1 – GL888E Pinout

Table 3.1 – GL888E Pin Assignment

NO	PIN NAME	TYPE	DESCRIPTION
1 2 10	CHG_MOD[1] CHG_MOD[0] CHG_MOD[2]	I	Charging mode select, refer to Table 3.2
3	CONNECT#	O	Active-low, open-drain output 1 (floating): device disconnect 0: device connect
4	DP_DOWN	I/O	D+ data line to downstream USB connector
5	DM_DOWN	I/O	D- data line to downstream USB connector
6	P5V	P	5V input
7	PSW_EN_OUT	O	External power switch control 1: enable power switch (close) 0: disable power switch (open)
8	DM_UP	I/O	D- data line to upstream USB host
9	DP_UP	I/O	D+ data line to upstream USB host

Type Notation (in chip reset status)

I Input mode **P** Power / Ground
O Output mode

Table 3.2 - GL888E Charging Mode

CHG_MOD[2]	CHG_MOD[1]	CHG_MOD[0]	MODE
0	0	0	BC1.2 SDP mode
0	1	0	BC1.2 CDP mode with Smart CDP
0	1	1	BC1.2 DCP mode
1	0	0	Apple 1A mode
1	0	1	Apple 2A mode
1	1	0	Auto 1A mode with wake up function
1	1	1	Auto 2A mode with wake up function

CHAPTER 4 RECOMMENDED USAGE SCENARIO

According to different scenario, select an appropriate charge mode will provide better user experience. The suggestion of the GL888E charge mode selection on desktop and notebook application are described here.

4.1 Desktop and System with AC Power

Table 4.1 – Suggested Usage Scenario on Desktop

System Mode	Operation (S0)	Sleep/Power-off (S3/S4/S5)
Charging Mode Selection	CDP mode	Auto-mode
Description	For S0, the USB host controller is active and the system is responsible for sourcing at least 1.5A when CDP mode is selected. If the connected device is non-BC compliant, there is no BC handshake between host and device. So the connected device will only draw current under 500mA.	For S3/S4/S5, only device charging function is necessary. Auto-mode will switch to appropriate charge mechanism depends on the connected device.

4.2 Notebook/Netbook with AC Power or Battery

Table 4.2 – Suggested Usage Scenario on Notebook/Netbook

System Mode	Operation (S0)	Sleep/Power-off (S3/S4/S5)
Power from AC adapter		
Charging Mode Selection	CDP mode	Auto-mode
Description	For S0, the USB host controller is active and the system is responsible for sourcing at least 1.5A when CDP mode is selected. If the connected device is non-BC compliant, there is no BC handshake between host and device. So the connected device will only draw current under 500mA.	For S3/S4/S5, only device charging function is necessary. Auto-mode will switch to appropriate charge mechanism depends on the connected device.
Power from Battery		
Charging Mode Selection	CDP mode	Option
Description	For S0, the USB host controller is active and the system is responsible for sourcing at least 1.5A when CDP mode is selected. If the connected device is non-BC compliant, there is no BC handshake between host and device. So the connected device will only draw current under 500mA.	NB battery could selectively support device charging depends on system design. Auto-mode is suggested if NB battery mode must support device charging.

Figure 5.1 – Block Diagram

Figure 5.1 shows the architecture of GL888E, which supports different kinds of charger mechanism, including USB BC 1.2 SDP/CDP/DCP, Apple 1A/2A wall charger, and Samsung Galaxy Tab wall charger. In auto mode, it can automatically detect the type of connected device, and switch to appropriate charging mode. When user changes the charging mode, GL888E will control the external power switch via PSW_EN_OUT pin to renegotiate with the device. The high bandwidth data switch between UP port and DOWN port reduces the side effect of USB signal integrity as much as possible.

GL888E is designed for low standby power application. For the system with AC power, the ultra low power consumption of GL888E doesn't increase the system suspend current. And for the system with battery power, GL888E doesn't impact the system standby time as well.

CHAPTER 6 CHARGING MODES

GL888E supports several kinds of particular charging modes, and two auto modes. The most significant differences between those charging modes are listed in Table 6.1.

Table 6.1 – Charging Mode Comparison

Charging Mode	Data Transfer	Max Charging Current	Support Device
SDP	O	0.5A/0.9A	Legacy device ⁽¹⁾
CDP	O	1.5A	BC 1.1/1.2 device
DCP	X	1.5A	BC 1.1/1.2 device Legacy device
Apple 1A	X	1A	Apple device ⁽²⁾
Apple 2A	X	2A	Apple device ⁽²⁾
Samsung Tablet ⁽³⁾	X	2A	Samsung Galaxy Tab
Auto 1A	X	2A	Legacy device BC 1.1/1.2 device Apple device (max 1A) Samsung Galaxy Tab
Auto 2A	X	2A	Legacy device BC 1.1/1.2 device Apple device (max 2A) Samsung Galaxy Tab

- (1) After configuration with host
- (2) Refer Apple website for detail support list
- (3) Support by GL888E Auto mode

Battery Charging Specification defines three charging ports: SDP, CDP and DCP. The SDP is a standard USB port which can transfer data and provide maximum 500mA (for USB2.0) or 900mA (for USB3.0) current. The purpose of CDP is to replace SDP, so it can charge device with higher current (up to 1.5A) even during USB data transfer. The DCP is only a dedicated charging port which supports high current without data transfer. The BC 1.1/1.2 compliant device is able to be charged whether it connects to CDP or DCP.

The CDP mode has Smart CDP feature that GL888E will internally switch to SDP mode when the connected device is not completely compatible with CDP. The CDP mode also provides USB low speed keyboard/mouse wake up feature to wake up the system from S3 via the port with GL888E.

Two Apple wall charging modes for Apple devices: “Apple 1A” is for lower battery capacity device, such as iPhone, iPod, and “Apple 2A” is for higher battery capacity device, such as iPad series. Most up-to-date Apple devices comply with both types of charging modes, so “Apple 2A” mode is recommended. Please be noted that the charging current is controlled by device itself, so connecting iPhone to a host under “Apple 2A” charging mode may not cause iPhone draw higher charging current than under “Apple 1A” charging mode.

Samsung Galaxy Tab has a dedicated charging behavior. To support this series of tablet, GL888E also provides “Samsung Tablet” mode. However, in order to be backward compatible with previous GL888, this mode is only supported within Auto mode instead of a dedicated charging mode that can be selected externally.

When setting “Auto 1A” mode, GL888E will automatically detect the connected device and switch between DCP, “Apple 1A”, and “Samsung Tablet” mode to charge, whereas “Auto 2A” mode will switch between DCP, “Apple 2A”, and “Samsung Tablet” mode. To support most up-to-date devices, “Auto 2A” mode is strongly recommended.

CHAPTER 7 ELECTRICAL CHARACTERISTICS

Table 7.1 – Temperature Conditions

Parameter	Min	Typ	Max	Unit
Operating temperature	0		70	°C
Storage temperature	-65		150	°C

Test conditions: $V_{P5V}=5V$, $T_A=25^{\circ}C$ (for Table 7.2~7.4)

Table 7.2 – General Characteristics

Parameter	Description	Min	Typ	Max	Unit
V_{P5V}	P5V input voltage	4.5	5	5.5	V
V_{IH}	Input high voltage	4		5.5	V
V_{IL}	Input low voltage	-0.3		1	V
V_{OH}	Output high voltage	4			V
V_{OL}	Output low voltage			0.4	V
V_{ESD_HBM}	ESD (Human Body Mode)			± 8000	V
V_{ESD_MM}	ESD (Machine Mode)			± 300	V

Table 7.3 – Charger Characteristics

Parameter	Description	Min	Typ	Max	Unit
$R_{DATA(ON)}$	DP/DM data switch on resistance		3		Ω
BW	DP/DM data switch bandwidth (-3dB)		1.4		GHz
R_{DCP}	DP/DM short resistance in DCP mode		80	200	Ω
I_{DP_SINK}	DP sink current in CDP mode	25	60	175	μA
V_{DM_SRC}	DM source voltage in CDP mode	0.5	0.6	0.7	V
V_{DAT_REF}	Data detect voltage in CDP mode	0.25	0.3	0.4	V
T_{VBT}	VBUS toggle time		2		S
V_{DP_APP1A}	DP voltage in Apple 1A mode	1.9	2.0	2.17	V
V_{DM_APP1A}	DM voltage in Apple 1A mode	2.53	2.7	2.9	V
V_{DP_APP2A}	DP voltage in Apple 2A mode	2.53	2.7	2.9	V
V_{DM_APP2A}	DM voltage in Apple 2A mode	1.9	2.0	2.17	V
V_{Galaxy}	DP/DM voltage in Galaxy mode		1.2		V

Table 7.4 – Power Consumption

CHG_MOD[2]	CHG_MOD[1]	CHG_MOD[0]	Mode	Min	Typ	Max	Unit
0	0	0	SDP		140	250	μA
0	1	0	CDP		100	250	μA
0	1	1	DCP		90	250	μA
1	0	0	Apple 1A		120	250	μA
1	0	1	Apple 2A		120	250	μA
1	1	0	Auto 1A		120	250	μA
1	1	1	Auto 2A		120	250	μA

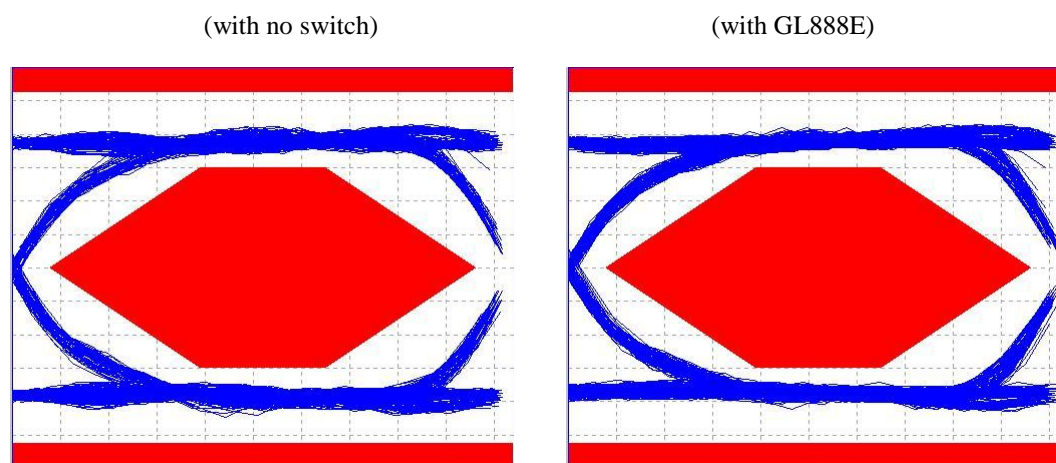


Figure 7.1 – USB Eye Diagram

CHAPTER 8 PACKAGE DIMENSION

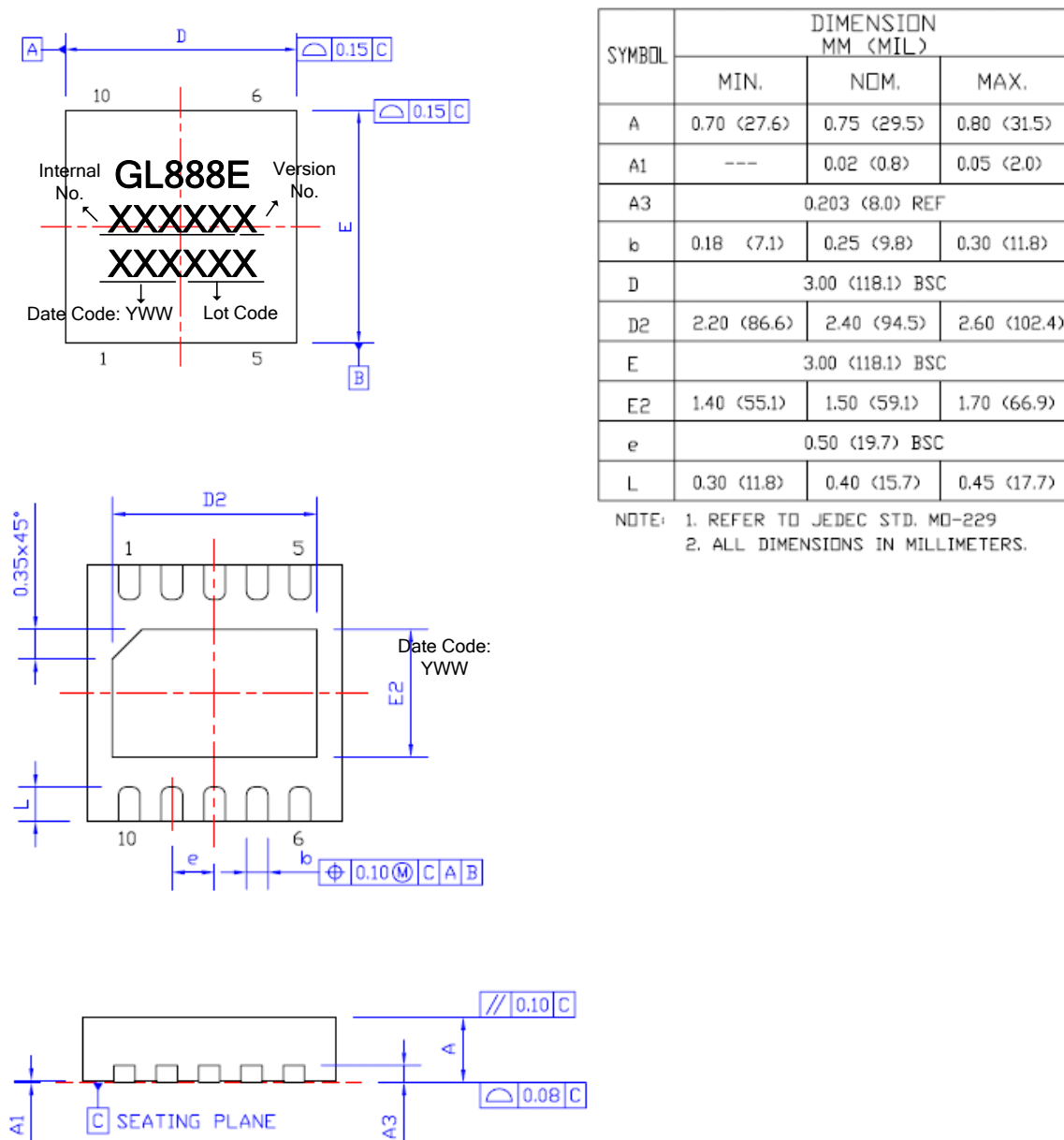


Figure 8.1 – GL888E 10 pin DFN Package

CHAPTER 9 ORDERING INFORMATION

Table 9.1 – Ordering Information

Part Number	Package	Green/Wire Material	Version	Status
GL888E-BWG*X	DFN 10	Green Package + Au Wire	X	Available

*The marking of "BWG" will not be shown on the IC due to DFN10 package size limitation.