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1. Description

With Smartphone and Tab become the mainstream portable mobile devices, the demand for a “universal charging (fast charging)” to various mobile devices increase dramatically.

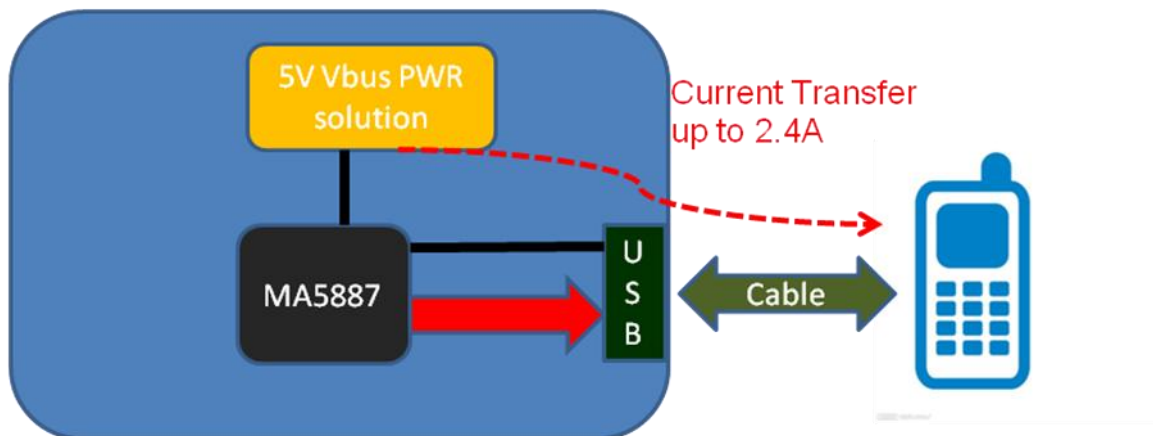
The MA5887 is a USB fast-charging controller which complies with USB Battery Charging Specification (BC) version 1.2, which allows charging device to draw a current similar to using the original wall-charger. Normally, a USB wall-charger provides unified charging mechanism by traditional USB current 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, MA5887 is a high performance solution for “fast-charging” mechanism and speed up charging time much.

MA5887 embedded automatic charger detection circuit which complies with USB Battery Charging Specification (BC) version 1.2, and Apple/Samsung Tab resistor mode. This feature implies MA5887 supports wide range of Smartphone/Tabs for fast charging and provides design flexibility for system manufactures.

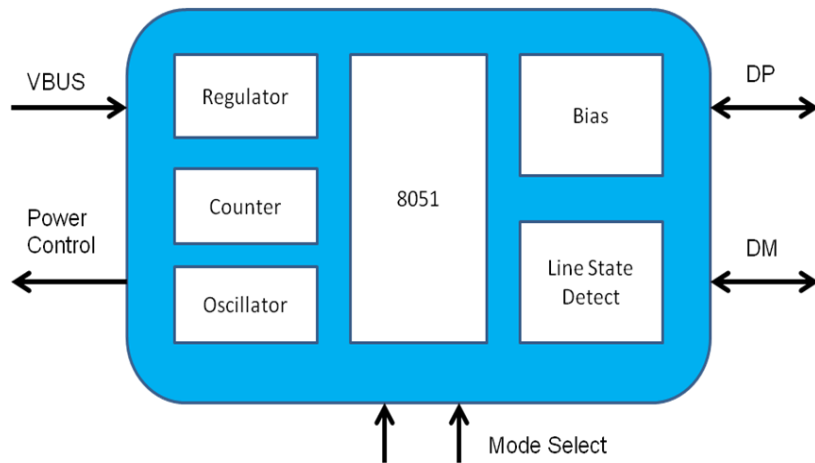
The MA5887 is designed for all charger products with USB interface, which provides the package of SOT23-5 for single USB port support.

2. Features

- Support USB Battery Charging Specification 1.2 (BC1.2 Charging Spec)
- Support Apple® Devices fast charging. (Selectable Apple® 1A / 2.4A mode)
- Support Samsung Galaxy Tab Devices Charging (2.1A mode)
- Support Chinese Telecommunications Industry Standard YD/T 1591-2009
- Automatic charging detection circuit for Apple, Samsung, and BC compliant devices
- Ultra low power consumption
- MCU base design for fast technical support
- Available in SOT23-5 package for MA5887 (single USB port)
- Available in SOT23-6 package for MA5889 (dual USB port)
- Target application:
 - ✓ USB universal wall-charger
 - ✓ USB universal car-charger
 - ✓ Travel adapter
 - ✓ Power bank supply



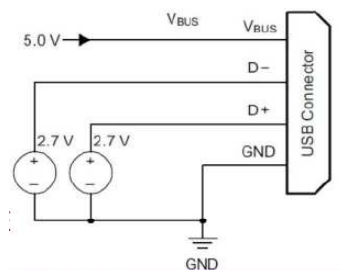
3. Block Diagram and Charging Mode



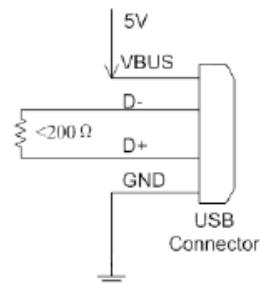
Block Diagram of MA5887

3.1 Detail Function Description

- Smartphone/Tab will monitor Timing/voltage/Current of D+/D- signal to determine which kind of charging port it connected to.
- The impedances presented on D+ and D- of “dedicated chargers” is different depending on the “specific standard” the dedicated charger is designed to. Standards such as BS1.2, Divider mode and Quick Charge 2.0.
 - ✓ BC1.2 and the Chinese Telecommunications Industry Standard YD/T 1591-2009 define that the D+ and D- data lines should be shorted together with a maximum series impedance of 200 Ω .
 - ✓ Apple divider mode, 2 V and 2.7 V are presented on D+ and on D-.



Apple 2.4A divider mode



BC1.2 DCP mode

- Apple divider mode, Samsung Galaxy mode and BC1.2 define the protocol necessary to allow “portable devices” to recognize what kind of port it is connected to, so that it can start its maximum allowable current draw.

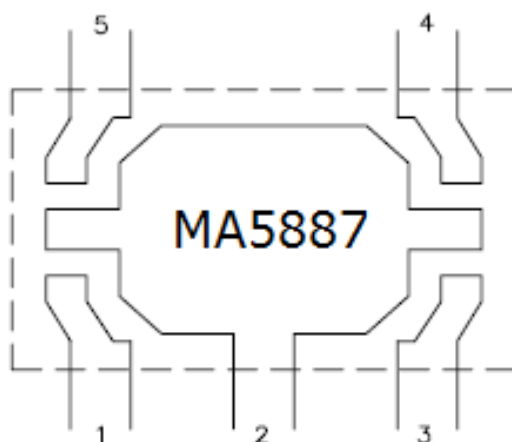
Product Data Sheet

MA5887 (USB Fast Charging Controller)



- Current dedicated charger limitation :
 - ✓ Apple iPad USB charger cannot charge Galaxy Tab
 - ✓ Samsung Galaxy Tab USB charger cannot charge iPhone/iPad
 - ✓ Traditional USB wall adaptor (BC1.2, DCP, with DP/DM short) cannot charge iPhone/iPad/Galaxy tab
- If using MA5887 in an USB charger, after protocol handshaking between MA5887 and the charging device (Smartphone/Tab) through DP/DM signals, MA5887 will auto-configure the dedicated DP/DM voltage bios for the connecting charging devices.

4. MA5887 Pin Assignment



Pin #	Pin Name	I/O	Description
1	SEL	I	Mode selection
2	GND	P	Ground
3	VDD5	P	Power
4	DP	B	D+ to USB connector
5	DM	B	D- to USB connector

I/O Type Definition

O : Output

B : Bi-directional

I : Input

P : Power

4.1 MA5887 Charging Modes:

Charging Mode	Max charging current	Support Device Type
BC1.2 (DCP only)	1.5A	BC 1.2 device
Apple Resistor	1A (SEL pull low)	iPhone, iPad
Apple Resistor	2.4A (SEL NC, Default)	iPad Series (up to iPad Air)
Samsung Divider	2.1A	Galaxy Tab

5. Electrical Characteristics

5.1 Absolute Maximum Rating

Parameter Description	Min	Typ	Max	Unit
Junction Temperature Range	-10		85	°C
Storage Temperature Range	-40		125	°C
ESD MM (Machine Mode)		±650		V
ESD HBM (Human Body Mode)		±8		kV

5.2 General Characteristics

Parameter	Description	Min	Typ	Max	Unit
Vcc	Supply Input Voltage Range	4.5	5	5.5	V
Vih	Input High Voltage	4		5.5	V
Vil	Input Low Voltage	0		1	V
SEL	SEL Pin Floating Voltage (MA5887)		3.1		V
Ivcc	Current Consumption		250		uA

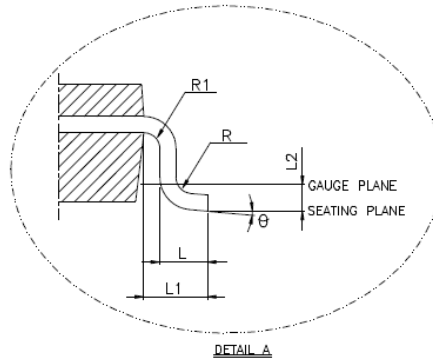
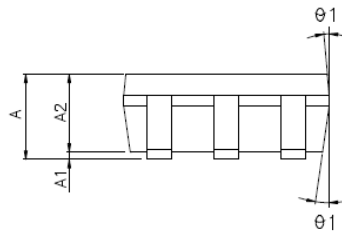
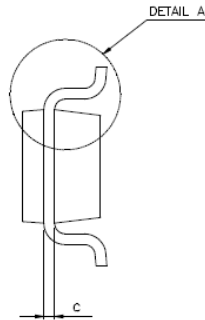
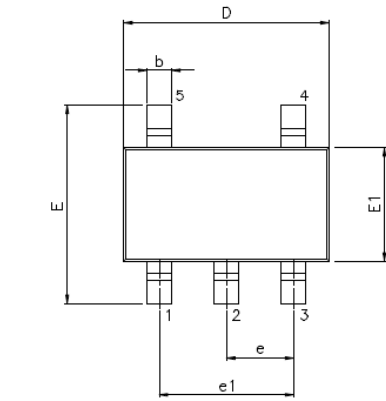
Note: the Vcc voltage stress test is able to reach 6.5V under conditions. The range above are the recommended operating characteristics.

5.3 Electrical Characteristics

Parameter	Description	Min	Typ	Max	Unit
Rbc	DP/DM Short Resistance in DCP Mode		80		Ω
Vdp_a1	DP Voltage in Apple 1A Mode		2.0		V
Vdm_a1	DM Voltage in Apple 1A Mode		2.7		V
Vdp_a24	DP Voltage in Apple 2.4A Mode		2.7		V
Vdm_a24	DM Voltage in Apple 2.4A Mode		2.7		V
Vs_g	DP/DM Voltage in Samsung Galaxy Mode		1.2		V

6. Package

6.1 SOT23-5



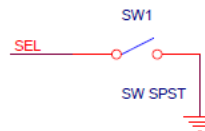
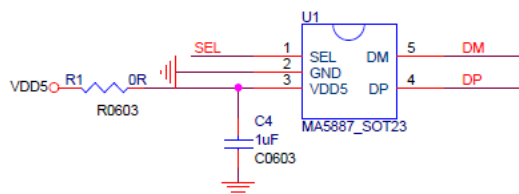
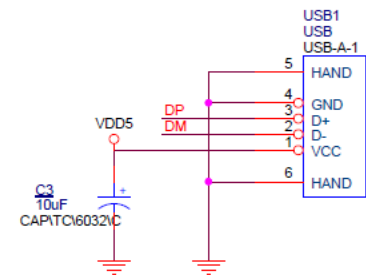
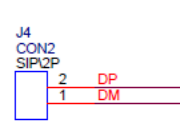
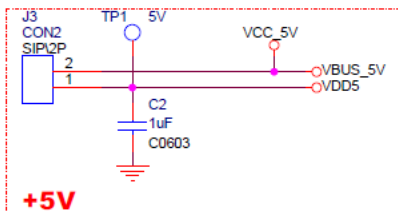
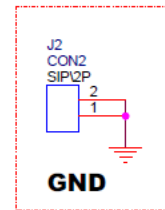
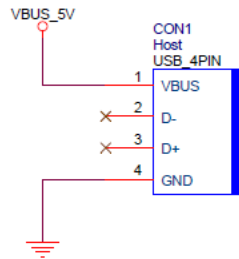
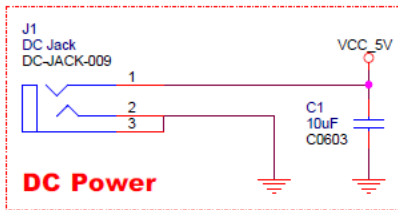
VARIATION(ALL DIMENSIONS SHOWN IN MM)

SYMBOL	MIN.	NOM.	MAX.
A	—	—	1.45
A1	0.00	—	0.15
A2	0.90	1.15	1.30
b	0.30	—	0.50
c	0.08	—	0.22
D	2.90 BSC.		
E	2.80 BSC.		
E1	1.60 BSC.		
e	0.95 BSC.		
e1	1.90 BSC.		
L	0.30	0.45	0.60
L1	0.60 REF.		
L2	0.25 BSC.		
R	0.10	—	—
R1	0.10	—	0.25
θ	0°	4°	8°
$\theta 1$	5°	10°	15°

NOTE :

1. JEDEC OUTLINE : MO-178 AA.

7. Schematic



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