USB Charger Emulator with Adjustable Power Switch

FEATURES

- 45 mΩ High-Side MOSFET
- 3.1A continuous current capability in EMSOP8
- 1.0~4.0 A (typ.) Adjustable Current Limit
- ±7.5% Current Limited Accurate at 3.1A
- Meet Apple® Current Requirements
- Low Average Current in OUT shorted GND
- Support Apple® Devices fast charging (Apple® 2.1A / 2.4A mode)
- Support Samsung Galaxy Tab Devices fast Charging
- Support BC1.2 & YD/T 1591-2009 Charging Spec
- Built-in Soft-Start
- Support single layer PCB layout.
- 4.5 ~ 6.5V Single Supply Operation.
- Available EMSOP8, ESOP8 package.

DESCRIPTION

The UC2501 integrated USB charger emulators with automatic host charger identification circuitry and high performance adjustable current limiting power switch. An automatic USB charger identification circuit allows mobile power supply can automatically provides the correct modes on the data lines to charger compliant devices among the Apple, Samsung and BC1.2 modes.

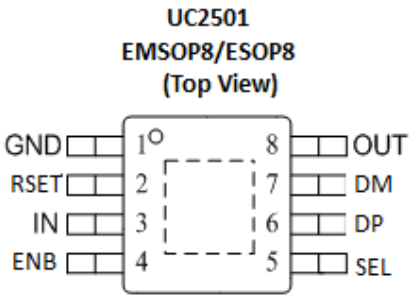
The UC2501 is a 45mΩ power switch intended for applications where heavy capacitive loads and short-circuits are likely to be encountered. This also provides hiccup mode when OUT voltage is less than 2.85V or OTSD.

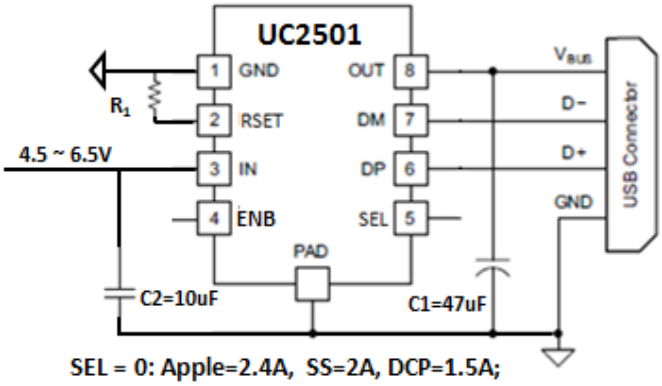
The UC2501 provides an ENB pin to turn on or turn off UC2501 and an SEL pin to select 10W or 12W mode in application.

APPLICATIONS

- USB Charger
- USB Wall Adapter
- Car Charger

PACKAGE AND APPLICATION





SEL = 0: Apple=2.4A, SS=2A, DCP=1.5A;
SEL = 1 or Floating: Apple=2.1A, SS=2A, DCP=1.5A;
ENB is floating or pull down with 10k Resistor if not used

ORDING INFORMATION

Part Number	Package Type	Package Qty	Op Temp(°C)	Mark
UC2501	EMSOP8	3000	-40~85	UC2501
UC2501	ESOP8	3000	-40~85	UC2501

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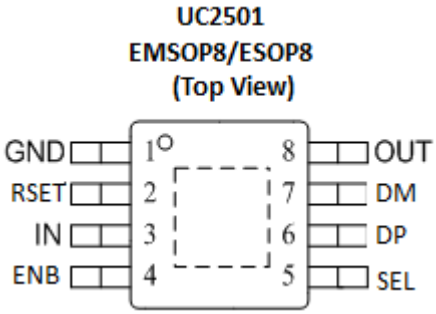
PINOUT



PIN FUNCTIONS

NO.	NAME	TYPE(1)	DESCRIPTION
1	GND	G	Ground connection
2	RSET	I	External resistor used to set current-limit threshold; recommended 13 KΩ≤R_{SET} ≤100 KΩ;
3	IN	P/I	Power supply/Input voltage connected to Power Switch; connect a 1 μF or greater ceramic capacitor from IN to GND as close to the IC as possible
4	ENB	I	Enable input, logic low turns on UC2501
5	SEL	I	Logic-level control input; When it is high or floating, DP/DM operate in 2.1A mode , when it is Low, DP/DM operate in 2.4A mode;
6	DP	O/I	DP date line to connector, output for hand-shake voltage to portable equipment, high impedance while disabled
7	DM	O/I	DM data line to connector, input for hand-shake voltage from portable equipment high impedance while disabled
8	OUT	O	Power-switch output, connected to VBUS of USB; connect a 22μF or greater ceramic capacitor from OUT to GND as close to the IC as possible

(1) G = Ground, I = Input, O = Output, P = Power

ABSOLUTE MAXIMUM RATINGS (1)

Over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		MIN	MAX	UNIT
Supply Voltage Range	IN	-0.3	7.0	V
Input voltage range	DP,DM	-0.3	5.8	
Continuous output sink current	DP input current, DM input current		35	mA
Continuous output source current	DP output current, DM output current		35	
ESD rating, Human Body Model (HBM)	IN		2	kV
	DP, DM		2	
ESD rating, Charging Device Model (CDM)			500	V
Operating Junction Temperature	T_J	-40	125	°C
Storage Temperature Range	T_{stg}	-65	150	

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

THERMAL CHARACTERISTICS

over operating free-air temperature range (unless otherwise noted)

THERMAL METRIC			UNIT
θ_{JA}	EMSOP8 Package thermal impedance(1)	65	°C/W

(1) The package thermal impedance is calculated in accordance with JESD 51-7.

RECOMMENDED OPERATING CONDITIONS

PARAMETER		MIN	MAX	UNIT
V_{IN}	Input voltage of IN	4.5	6.5	V
$V_{DP/DM}$	DP data line input voltage		5.5	
$I_{DP/DM}$	Continuous sink/source current		±10	mA
R_{SET}	Resistance of R_{SET}	13	100	kΩ
I_{OUT}	Continuous sink/source current	1000	4000	mA
T_J	Operating Junction Temperature	-40	125	°C

ELECTRICAL CHARACTERISTICS

Conditions are –40°C ≤ (TJ = TA) ≤ 125°C, 4.5 V ≤ VIN ≤ 6.5 V, VSEL = VIN and RSET = 68.1 kΩ. Positive current are into pins. Typical values are at 25°C. All voltages are with respect to GND (unless otherwise noted).

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Switch						
R_{DSON}	EMSOP8 Package	I_{OUT}=1A		45	68	mΩ
	ESOP8 Package			55	83	
Tr	OUT voltage rise time	C_L = 1 μ F, R_L = 100 Ω,		1.73		ms
Tf	OUT voltage fall time			0.8		
Ton	OUT voltage turn-on time			2.48		
Toff	OUT voltage turn-off time			2.98		
Current Limit						
I_{OS}	OUT current limited	Rset=13.0k	3.77	4.05	4.33	A
		Rset=15.4k	3.15	3.41	3.66	
		Rset=19.1k	2.50	2.74	3.00	
		Rset=20.0k	2.40	2.65	2.90	
		Rset=21.5k	2.20	2.43	2.60	
		Rset=22.6k	2.10	2.32	2.50	
Enable Pin (ENB)						
V_{ENB}	ENB threshold voltage, falling		0.8	1.33	2.3	V
V_{ENB_HYS}	Hysteresis			150		mV
R_{PD}	Pull Down Resistor		200	290	380	kΩ
Hiccup Mode						
V_{OUT_SHORT}	OUT Threshold Voltage to enter Hiccup mode			2.85		V
T_{ON_HICCUP}	ON Time of Hiccup mode		70	130	190	ms
T_{OFF_HICCUP}	OFF Time of Hiccup mode		0.7	1.3	1.9	s
Thermal Shutdown						
	Temperature Rising Threshold			172		°C
	Hysteresis			20		

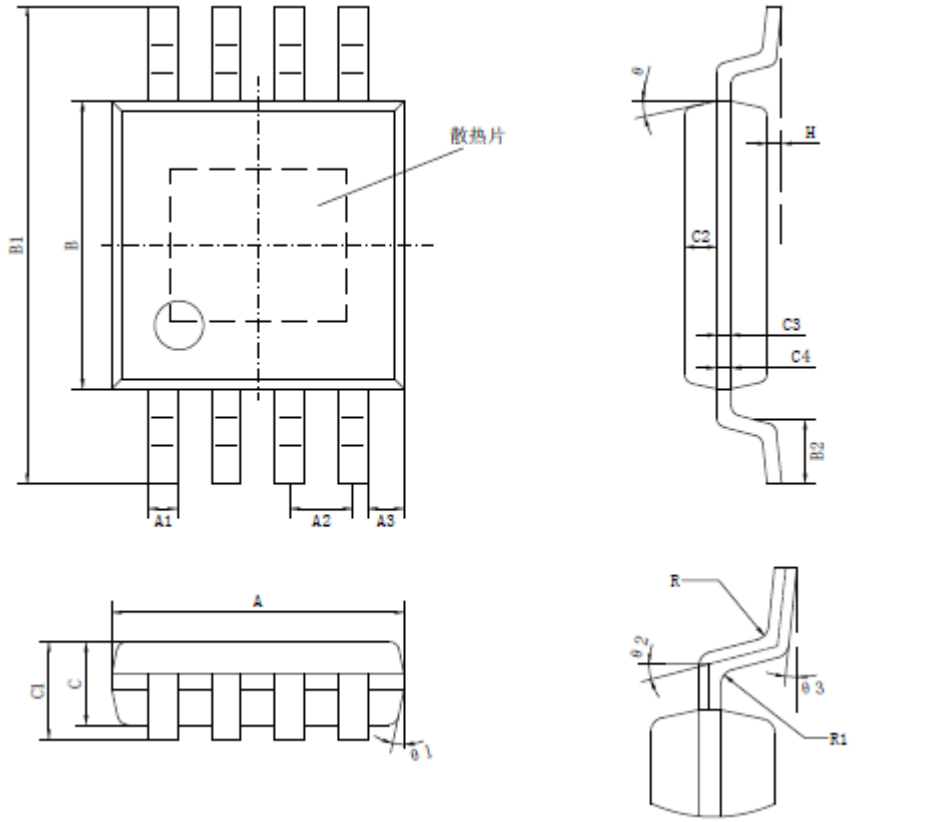
ELECTRICAL CHARACTERISTICS

Conditions are –40°C ≤ (TJ = TA) ≤ 125°C, 4.5 V ≤ VIN ≤ 6.5 V, VSEL = VIN and RSET = 68.1 kΩ. Positive current are into pins. Typical values are at 25°C. All voltages are with respect to GND (unless otherwise noted).

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
UNDERVOLTAGE LOCKOUT						
V_{UVLO}	IN rising UVLO threshold voltage		3.75	3.95	4.15	V
	Hysteresis			100		mV
SUPPLY CURRENT						
I_{IN}	IN supply current			160	280	μA
BC 1.2 DCP MODE (SHORT)						
R_{DPM_SHORT}	DP / DM shorting resistance			125	200	Ω
R_{DCHG_SHORT}	Resistors connected DP /DM to GND after hand-shaking			200	400	kΩ
$V_{DPL\_TH\_DETACH}$	DP low threshold while detaching BC1.2 devices		310	330	350	mV
$V_{DPL\_TH\_DETACH\_HYS}$	hysteresis			50		mV
IPAD MODE 2.1A Mode (SEL=1 or Floating)						
V_{DP_IPAD}	DP output voltage		2.5	2.7	2.9	V
V_{DM_IPAD}	DM output voltage		1.85	2.0	2.15	V
R_{DP_IPAD}	DP output impedance	I_{DP} = -5uA	20	30	40	kΩ
R_{DM_IPAD}	DM output impedance	I_{DM} = -5uA	20	30	40	kΩ
IPAD MODE 2.4A Mode (SEL=0)						
V_{DP_IPAD}	DP output voltage		2.5	2.7	2.9	V
V_{DM_IPAD}	DM output voltage		2.5	2.7	2.9	V
R_{DP_IPAD}	DP output impedance	I_{DP} = -5uA	20	30	40	kΩ
R_{DM_IPAD}	DM output impedance	I_{DM} = -5uA	20	30	40	kΩ
Galaxy Tab MODE						
V_{DP_GAL}	DP output voltage		1.1	1.2	1.3	V
V_{DM_GAL}	DM output voltage		1.1	1.2	1.3	
R_{DP_GAL}	DP output impedance	I_{DP} = -5uA	70	105	140	kΩ
R_{DM_GAL}	DM output impedance	I_{DM} = -5uA	70	105	140	

PACKAGE INFORMATION

EMSOP8



尺寸 / 标注	最小(mm)	最大(mm)	尺寸 / 标注	最小(mm)	最大(mm)
A	2.90	3.10	C3	0.152	
A1	0.28	0.35	C4	0.15	0.23
A2	0.65TYP		H	0.02	0.15
A3	0.375TYP		θ	12° TYP4	
B	2.90	3.10	θ1	12° TYP4	
B1	4.70	5.10	θ2	14° TYP	
B2	0.45	0.75	θ3	0° ～ 6°	
C	0.75	0.95	R	0.15TYP	
C1	--	1.10	R1	0.15TYP	
C2	0.328TYP				
* 注：EMSOP8产品框架基岛尺寸为1.60X1.60，散热片尺寸为1.60X1.55（单位：mm）					

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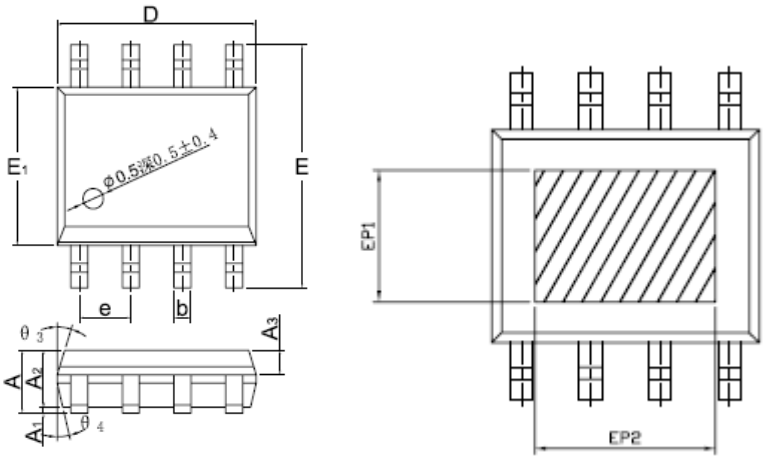
ESOP8



DIMENSIONS IN MUILLIMETERS

SYMBOL	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.00	——	0.10
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.39	——	0.49
b1	0.28	——	0.48
c	0.10	——	0.25
c1	0.10	——	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
L	0.45	——	1.00
L1	1.04REF		
L2	0.25BSC		
R	0.07	——	——
R1	0.07	——	——
h	0.3	0.4	0.5
	0°	——	8°
θ1	11°	17°	19°
θ2	11°	13°	15°
θ3	15°	17°	19°
θ4	11°	13°	15°
EP1	2.40	——	——
EP2	3.30	——	——