

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
- $\pm 7.5\%$ 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 package.

APPLICATIONS

- USB Charger
- USB Wall Adapter
- Car Charger

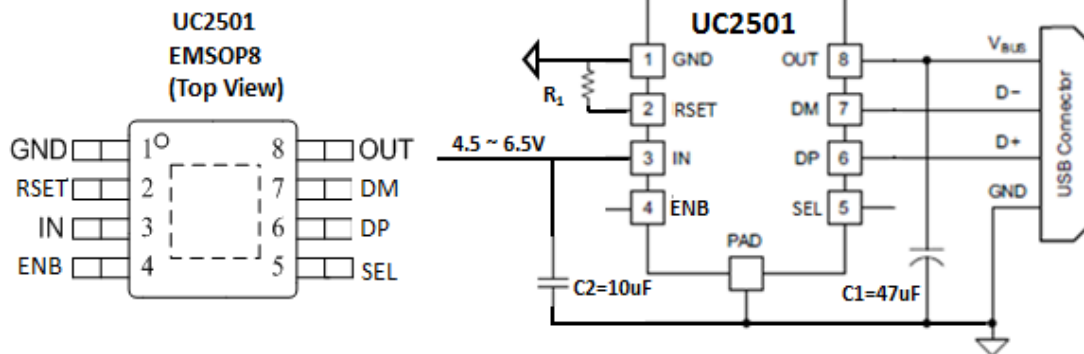
DESCRIPTION

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.

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;

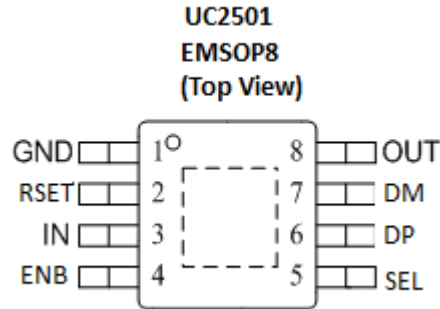
ENB is floating or pull down with 10k Resistor if not used

ORDING INFORMATION

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

USB Charger Emulator with Adjustable Power Switch

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 $13\text{ K}\Omega \leq R_{\text{SET}} \leq 100\text{ K}\Omega$;
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 data 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 22 μF or greater ceramic capacitor from OUT to GND as close to the IC as possible

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

USB Charger Emulator with Adjustable Power Switch

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

USB Charger Emulator with Adjustable Power Switch

ELECTRICAL CHARACTERISTICS

Conditions are $-40^{\circ}\text{C} \leq (T_J = T_A) \leq 125^{\circ}\text{C}$, $4.5\text{ V} \leq V_{\text{IN}} \leq 6.5\text{ V}$, $V_{\text{SEL}} = V_{\text{IN}}$ and $R_{\text{SET}} = 68.1\text{ k}\Omega$. 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						
$R_{\text{DS(on)}}$	Drain-source on-state resistance	$I_{\text{OUT}}=1\text{A}$		45	68	$\text{m}\Omega$
T_r	OUT voltage rise time	$C_L = 1\ \mu\text{F}$, $R_L = 100\ \Omega$,		1.73		ms
T_f	OUT voltage fall time			0.8		
T_{on}	OUT voltage turn-on time			2.48		
T_{off}	OUT voltage turn-off time			2.98		
Current Limit						
I_{os}	OUT current limited	$R_{\text{set}}=13.0\text{k}$	3.77	4.05	4.33	A
		$R_{\text{set}}=15.4\text{k}$	3.15	3.41	3.66	
		$R_{\text{set}}=19.1\text{k}$	2.50	2.74	3.00	
		$R_{\text{set}}=20.0\text{k}$	2.40	2.65	2.90	
		$R_{\text{set}}=21.5\text{k}$	2.20	2.43	2.60	
		$R_{\text{set}}=22.6\text{k}$	2.10	2.32	2.50	
Enable Pin (ENB)						
V_{ENB}	ENB threshold voltage, falling		0.8	1.33	2.3	V
$V_{\text{ENB_HYS}}$	Hysteresis			150		mV
R_{PD}	Pull Down Resistor		200	290	380	$\text{k}\Omega$
Hiccup Mode						
$V_{\text{OUT_SHORT}}$	OUT Threshold Voltage to enter Hiccup mode			2.85		V
$T_{\text{ON_HICCUP}}$	ON Time of Hiccup mode		70	130	190	ms
$T_{\text{OFF_HICCUP}}$	OFF Time of Hiccup mode		0.7	1.3	1.9	s
Thermal Shutdown						
	Temperature Rising Threshold			172		$^{\circ}\text{C}$
	Hysteresis			20		

USB Charger Emulator with Adjustable Power Switch

ELECTRICAL CHARACTERISTICS

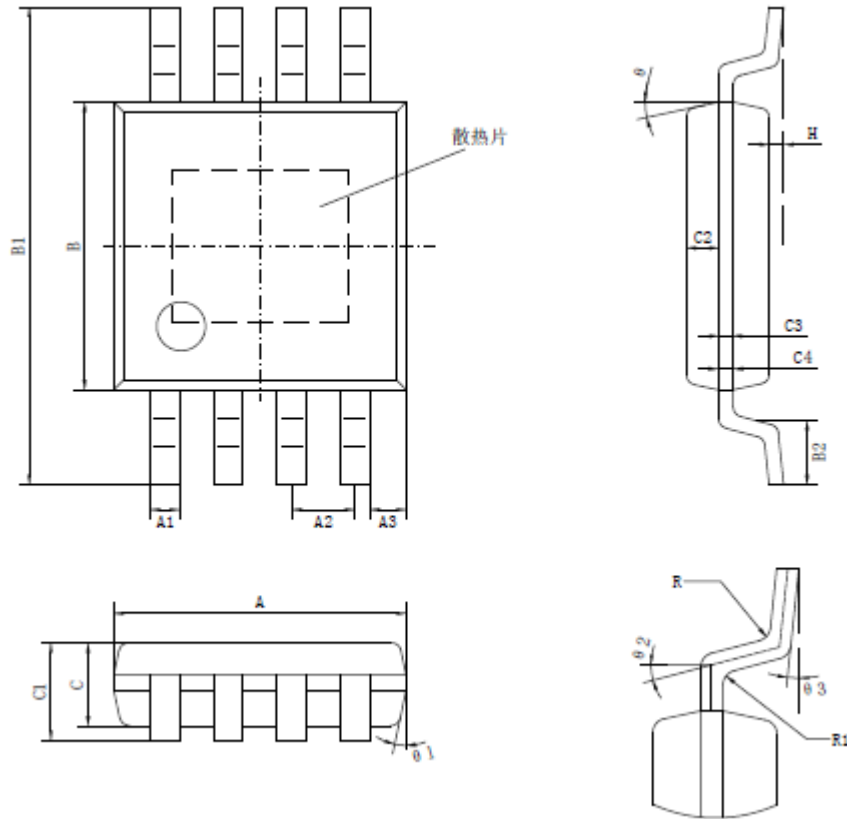
Conditions are $-40^{\circ}\text{C} \leq (T_J = T_A) \leq 125^{\circ}\text{C}$, $4.5\text{ V} \leq V_{\text{IN}} \leq 6.5\text{ V}$, $V_{\text{SEL}} = V_{\text{IN}}$ and $R_{\text{SET}} = 68.1\text{ k}\Omega$. Positive current are into pins. Typical values are at 25°C . All voltages are with respect 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)						
$R_{\text{DPM_SHORT}}$	DP / DM shorting resistance		125	200	Ω	
$R_{\text{DCHG_SHORT}}$	Resistors connected DP /DM to GND after hand-shaking		200	400	k Ω	
$V_{\text{DPL_TH_DETACH}}$	DP low threshold while detaching BC1.2 devices	310	330	350	mV	
$V_{\text{DPL_TH_DETACH_HYS}}$	hysteresis		50		mV	
IPAD MODE 2.1A Mode (SEL=1 or Floating)						
$V_{\text{DP_IPAD}}$	DP output voltage	2.5	2.7	2.9	V	
$V_{\text{DM_IPAD}}$	DM output voltage	1.85	2.0	2.15	V	
$R_{\text{DP_IPAD}}$	DP output impedance	$I_{\text{DP}} = -5\mu\text{A}$	20	30	40	k Ω
$R_{\text{DM_IPAD}}$	DM output impedance	$I_{\text{DM}} = -5\mu\text{A}$	20	30	40	k Ω
IPAD MODE 2.4A Mode (SEL=0)						
$V_{\text{DP_IPAD}}$	DP output voltage	2.5	2.7	2.9	V	
$V_{\text{DM_IPAD}}$	DM output voltage	2.5	2.7	2.9	V	
$R_{\text{DP_IPAD}}$	DP output impedance	$I_{\text{DP}} = -5\mu\text{A}$	20	30	40	k Ω
$R_{\text{DM_IPAD}}$	DM output impedance	$I_{\text{DM}} = -5\mu\text{A}$	20	30	40	k Ω
Galaxy Tab MODE						
$V_{\text{DP_GAL}}$	DP output voltage	1.1	1.2	1.3	V	
$V_{\text{DM_GAL}}$	DM output voltage	1.1	1.2	1.3		
$R_{\text{DP_GAL}}$	DP output impedance	$I_{\text{DP}} = -5\mu\text{A}$	70	105	140	k Ω
$R_{\text{DM_GAL}}$	DM output impedance	$I_{\text{DM}} = -5\mu\text{A}$	70	105	140	

USB Charger Emulator with Adjustable Power Switch

PACKAGE INFORMATION

EMSOP8



标注	尺寸	最小(mm)	最大(mm)	标注	尺寸	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° IYP	
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1.80X1.80，散热片尺寸为1.80X1.55（单位：mm）