# USB Charger Emulator with Adjustable Power Switch and Load Detection

## FEATURES

- 45 mΩ High-Side MOSFET
- 0.5~4.0 A (typ.) Adjustable Current Limit
- Ultra-Low Load Detection
- 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

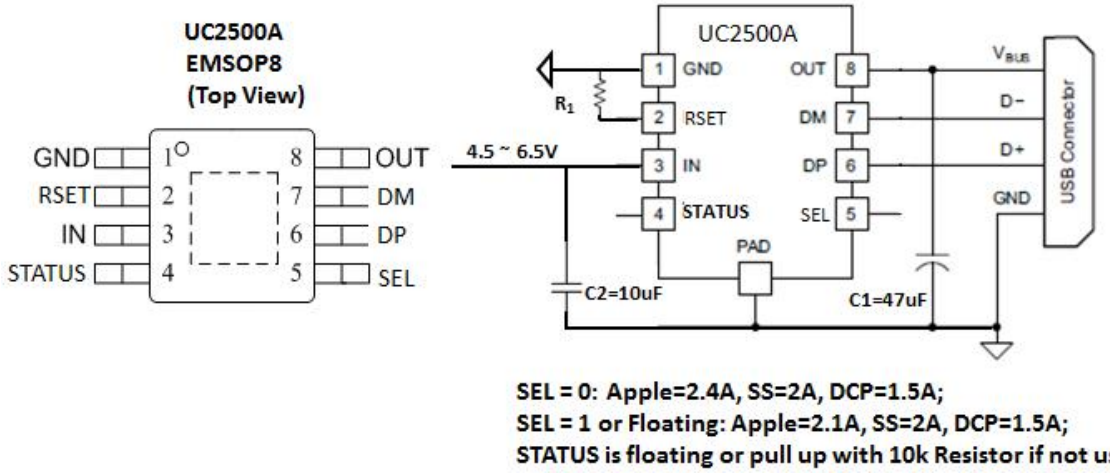
## DESCRIPTION

The UC2500A 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 UC2500A 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 enter OTSD.

The UC2500A provides a STATUS pin for ultra-low load detection or USB cable resistance compensation 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;**
**STATUS is floating or pull up with 10k Resistor if not used**

## ORDING INFORMATION

| Part Number | Package Type | Package Qty | Op Temp(°C) | Mark |
|---|---|---|---|---|
| UC2500A | EMSOP8 | 3000 | -40~85 | UC2500A XXX |

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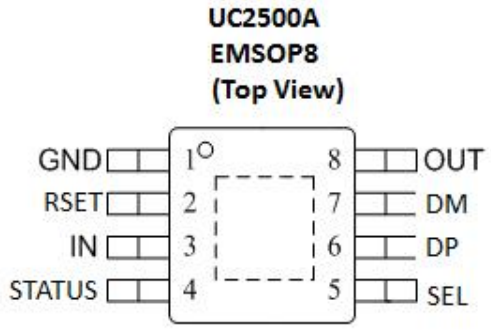
# PINOUT

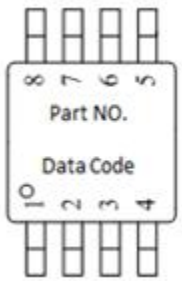



# PIN FUNCTIONS

| NO. | NAME | TYPE(1) | DESCRIPTION |
|---|---|---|---|
| 1 | GND | G | Ground connection |
| 2 | RSET | I | External resistor used to set current-limit threshold; |
| 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 | STATUS | O | Active-low open-drain output, asserted when the load exceeds the load-detection threshold |
| 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

# MARK INFORMATION



# 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 | | 4 | kV |
| | DP, DM | | 4 | |
| 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（EMSOP8） | | | UNIT |
|---|---|---|---|
| $\theta_{JA}$ | Junction-to-ambient thermal resistanc | 65 | °C/W |
| $\theta_{JCtop}$ | Junction-to-case (top) thermal resistance | 53 | |
| $\theta_{JCbot}$ | Junction-to-case (bottom) thermal resistance | 13.5 | |
| $\Theta_{JB}$ | Junction-to-board thermal resistance | 37 | |

(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 | 500 | 4000 | mA |
| $T_J$ | Operating Junction Temperature | -40 | 125 | °C |

# ELECTRICAL CHARACTERISTICS

Conditions are: TA = 25°C, VIN = 5.0 V, VSEL = VIN and RSET = 33.0kΩ. Positive current are into pins. 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 |
| **Current Limit** | | | | | | |
| $I_{OUT}$ | | Rset=33.0k | 2.50 | 2.84 | 3.15 | A |
| **Hiccup Mode** | | | | | | |
| $T_{ON\_HICCUP}$ | ON Time of Hiccup mode | | | 130 | | ms |
| $T_{OFF\_HICCUP}$ | OFF Time of Hiccup mode | | | 1.3 | | s |
| **Load Detection** | | | | | | |
| $I_{LD\_RISING}$ | $I_{OUT}$ Rising Load Detection Thresold | Rset=33.0k | 135 | 195 | 255 | mA |
| $I_{LD\_FALLING}$ | $I_{OUT}$ Falling Load Detection Thresold | | 90 | 145 | 200 | |
| $T_{LD\_SET}$ | Load Detection Set time | | | 128 | | ms |
| $T_{LD\_RESET}$ | Load Detection Reset time | | | 128 | | |
| **Thermal Shutdown** | | | | | | |
| | Temperature Rising Threshold | | | 172 | | ºC |
| | Hysteresis | | | 20 | | |

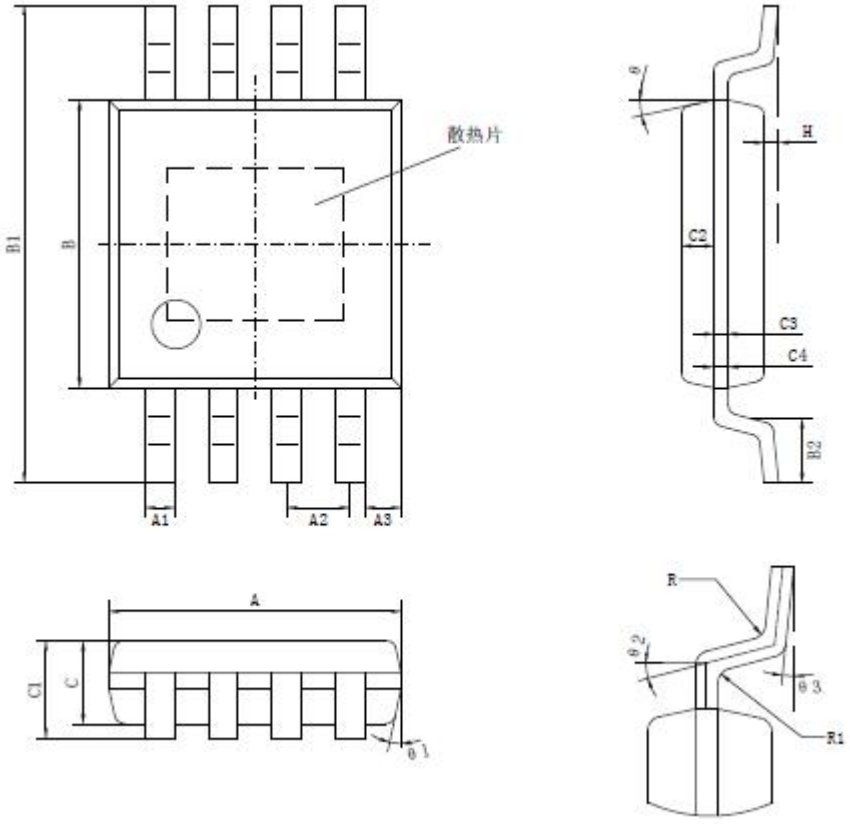
# ELECTRICAL CHARACTERISTICS

Conditions are: TA = 25°C, VIN = 5.0 V, VSEL = VIN and RSET = 33.0 kΩ. Positive current are into pins. 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 | 350 | μA |
| **BC 1.2 DCP MODE (SHORT)** | | | | | | |
| $R_{DPM\_SHORT}$ | DP / DM shorting resistance | | | 125 | 200 | Ω |
| **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 |
| **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 |
| **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 | |

# 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° 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1.80X1.80，散热片尺寸为1.80X1.55（单位：mm） | | | | | |