QC3.0 & NT6008 Introduction

2015/10/06
QC3.0 vs. QC2.0

- QC3.0 defines continuous mode as $D^+ = 0.6$, $D^- = 3.3V$
- Output voltage increases/decreases 200mV upon each $D^+/D^-$ toggle
- Output voltage range: $3.6V \sim 20V$ (12V for class A)
Output Voltage Increment/Decrement

- D+ > 2.0V pulse increases output voltage by 200mV
- D- < 2.0V pulse decreases output voltage by 200mV
- Pulses < 150us will be skipped
- Once entering QC3.0, stay at QC3.0 unless D+ or D - < 0.4V
Application Circuit

- OUT pin sinks/sources current to adjust output voltage of HVDCP according to QC2.0/3.0 protocol
- MSOP-10L easy to co-layout with other QC2.0 parts

![Application Circuit Diagram]
Features

- 3.3V ~ 13.5V Single Supply Operation
- Smart USB Charger Identification Circuit
  - Compliant with QC2.0/3.0 Class A
  - Selectable Apple iPad 2.4A/2.1A Applications
  - Support Samsung Galaxy Note 2.0A Applications
  - Support BC1.2 & YD/T 1591 Battery Charging Specifications
- 8kV High ESD
- Smooth Voltage Transition
- OVP Protection
- Discharge Function
- -40°C ~ +125°C Operating Ambient Temperature
- TSOT23-8L or MSOP-10L Package
- RoHS Compliant and Halogen-Free
Operation Mode I – Apple Mode

- Enter mode 2 if data line detection, primary detection
  - $V_{DP} > 2.875V$ for 2ms
  - $V_{DM} < 2.0V$ (1.5V if Apple 2.1A selected) for 10ms
  - $V_{DP} < 2.0V$ for 10ms
Operation Mode II – Samsung Mode

- Enter mode 3 if $0.4 < V_{DP} < 1.05\text{V}$ for one second
- Otherwise enters mode 1 when the 3-second counter expires
Operation Mode III – BC1.2 Mode

- Enters mode 4 (QC2.0 mode) if $0.4V < V_{DP} < 1.05V$ for 0.2s.
- Otherwise enters mode 1 when the 3-second counter expires.
Operation Mode IV – QC Mode

- Leaves mode 4 and enter mode 1 if $V_{DP} < 0.4V$ for 2ms or $V_{CC}$ overvoltage protection is triggered
- QC2.0 is confirmed if $V_{DM} < 0.4V$ for 2ms
- NT6008 adjusts output voltage according to QC2.0/3.0 protocol
Output Voltage Adjustment

- \( I_{REF} = \frac{V_{REF}}{R_{REF}} = 1V/R_{REF} \)
- \( \Delta V_{BUS} = \Delta K \times I_{REF} \times R_{REF} = \Delta K \text{ (V)} \)
- \( K = 0 \) for 5V; \( K = 4 \) for 9V; \( K = 7 \) for 12V
- 0.1\( I_{REF} \), 50us per step to ensure smooth voltage transition
- When voltage decreasing, discharges with 10mA/500ms

\[
\begin{align*}
I_{OUT} & \quad \text{50us} \\
0.1 \times I_{REF} & \\
\end{align*}
\]
- $V_{IN} = 20V$ to ensure 12V output
NT6008 vs. QC2.0 Supporting Phone

- Smooth voltage transition w/o overshoot
NT6008 vs. QC3.0 Supporting Phone

QC3.0 Identification

Single Increment

Group Increment

Group Decrement