ESD Protection Design in Portable Device

Gary Yang
Union Semiconductor Inc.
Design Challenges in Portable Design

ESD
EMI
Low Power Consumption
Space constraint

Union will help you!!
ESD is Everywhere in Portable World
Where is ESD Protection Needed in Handset?

- Memory Card
- Display
- IO Connector
- USB Interface
- Keypad
- Battery Interface
- Speaker
High Performance Analog Solutions for Digital World

ESD Protection Options

I/O

V_{DD}

ESD Circuit

GND

MINIUSB
External ESD Protection Devices?

- Integrating simple protection on complex ICs is expensive and it is low level
- IC gate oxides are thinner and are more sensitive to ESD events
- Protector are most effective when placed farther from the major ICs
- Designing in ESD/EMI protection up front is cost effective.....
  - Avoid re-designs after a failure during certification tests
  - Avoid cost of returned product from end customers
UESD64B Performance - IEC 61000-4-2 Pulse

Input: 8KV ESD Pulse, IEC 61000-4-2

Output: UESD64B TVS
Good PCB Layout: Place TVS close to connector
Layout Improve ESD Performance

Minimize \( \frac{dI}{dt} \) effects Layout

Device Being Protected

**ISTRIKE**

\[ I_{\text{strike}} \]

\[ \frac{dI}{dt} \]

\[ \sim V_z \]

\[ V \]
High Performance Analog Solutions for Digital World

Union’s ESD Protection Product Offer

Data Port Protection

UESD6V85CT36 [SC-88 Package]
UESD56B [SOT563 Package]
ESD + EMI for Audio Port in Portable Application

- To Audio Circuit
- Internal Speaker
- UM1002
  - UM1003
  - UM4684
  - Microphone
  - To Audio Circuit

Cell Phone Headset Audio Port Protection
High Performance Analog Solutions for Digital World

LCD/ Touch Screen Interface

- **Processor**
  - CLK
  - Vsync
  - Hsync

- **LCD**

- **UM8401**
  - 8 channel filter [100 Ω]
  - C line= 36pF@ 0 Volt
  - 1.6X4.0 mm

- **UM6401**
  - 6 channel filter [100 Ω]
  - C line= 36pF@ 0 Volt
  - 1.6X4.0 mm

- **UM4401**
  - 4 channel filter [100 Ω]
  - C line= 36pF@ 0 Volt
  - 1.6X4.0 mm
High Performance Analog Solutions for Digital World

Mega Pixel Camera Interface

- **UM8401**: 8 channel filter [100 Ω]
  - C line: 36pF @ 0 Volt
  - Size: 1.6x4.0 mm

- **UM6401**: 6 channel filter [100 Ω]
  - C line: 36pF @ 0 Volt
  - Size: 1.6x4.0 mm

- **UM4401**: 4 channel filter [100 Ω]
  - C line: 36pF @ 0 Volt
  - Size: 1.6x4.0 mm
 Protected Interface

Vcc
D+ (USB)
D-(USB)
D1

UM4717

D8

Bottom Connector

UM8401
8 channel filter [100 Ω]
C line= 36pF@ 0 Volt
1.6X4.0 mm

UM6401
6 channel filter [100 Ω]
C line= 36pF@ 0 Volt
1.6X4.0 mm

UM4401
4 channel filter [100 Ω]
C line= 36pF@ 0 Volt
1.6X4.0 mm
Integrated Solution has Less parasitic inductance

DFN package is designed to provide BEST IN CLASS Parasitic inductance enabling better filter performances.

Integrated EMI+ESD Solution helps you design circuit much easily

Equivalent circuit of discrete capacitor

\[ \begin{align*}
C &= 30 \text{ pF} \\
R_s &= 0.5 \text{ } \Omega 
\end{align*} \]
EMI Filtering Performance Comparison

Capacitor Array with NO ESD protection

- Narrow filtering capability at High RF Band
- Marginal filtering at higher Frequency
- No ESD protection or rating
- Parasitic Parameter associated

Integrated C-R-C EMI-Filter in DFN

- Wider RF filtering Band from 800 MHz to 6 GHz.
- EXCELLENT LOW PASS filter characteristic.
- ESD protection: >15KVolt contact (IEC61000-4-2)