



Semtech TVS for USB Type-C May, 2018

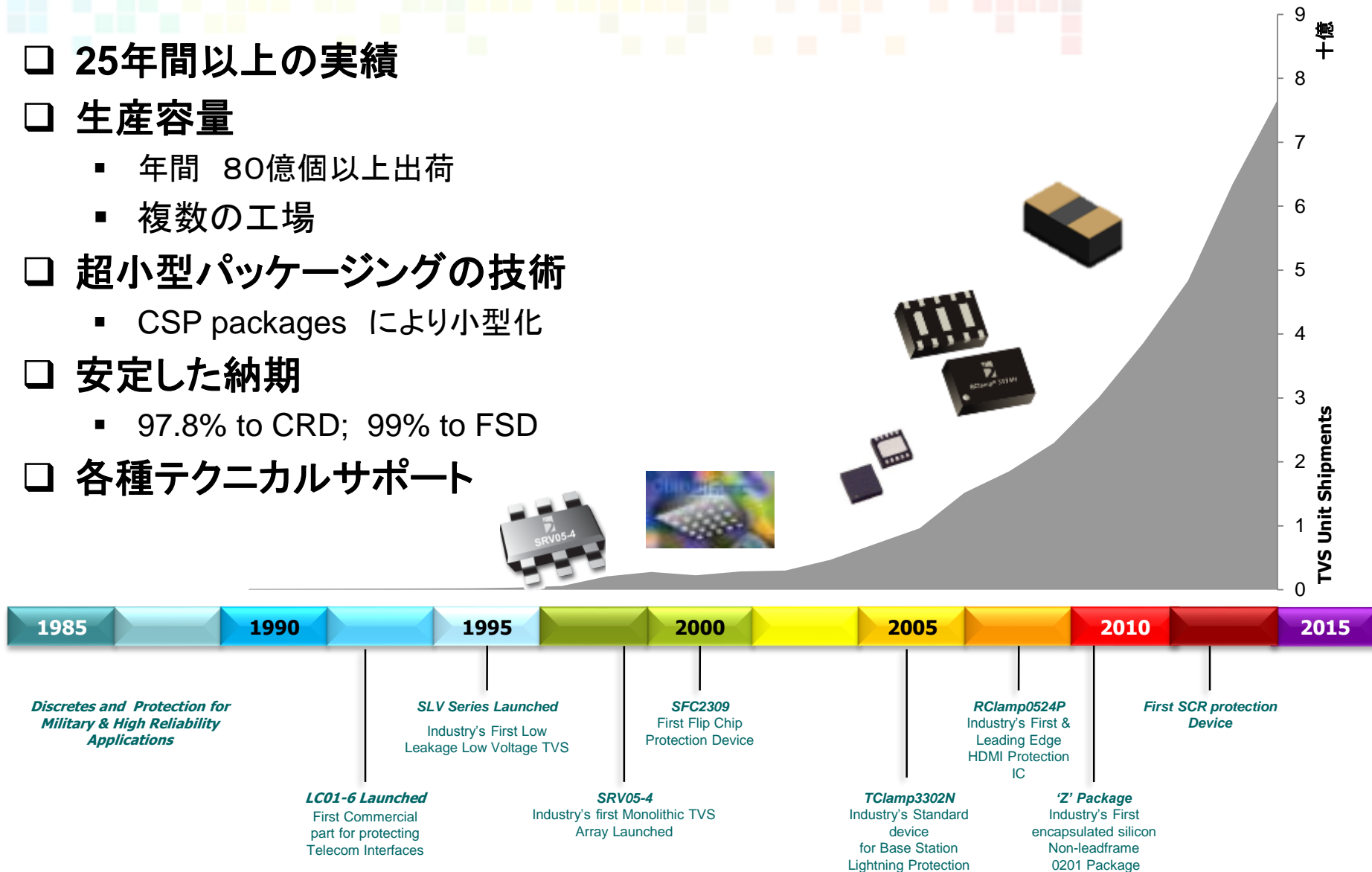
本資料及び製品に関する問い合わせ先：
菱洋エレクトロ株式会社 半導体デバイス事業本部
第2ビジネスユニット 技術グループ

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Semtech is a Proven Leader

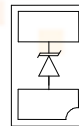
- 25年間以上の実績
- 生産容量
 - 年間 80億個以上出荷
 - 複数の工場
- 超小型パッケージングの技術
 - CSP packages により小型化
- 安定した納期
 - 97.8% to CRD; 99% to FSD
- 各種テクニカルサポート



TVS製品シリーズ

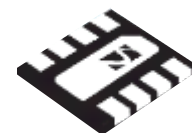
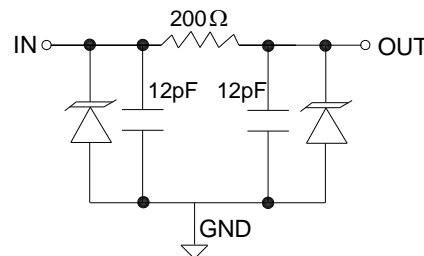
■ μ Clamp[®] = *MicroClamp*

- 寄生容量が大きいが安価なシリーズ



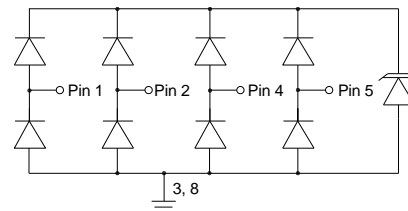
■ EClamp[®] = *EMIClamp*

- EMIフィルターも持っている複合タイプ



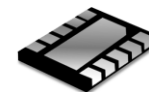
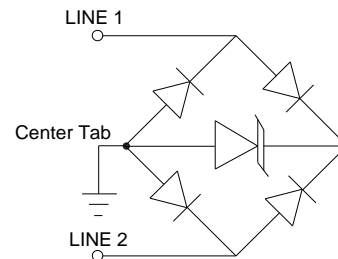
■ RClamp[®] = *RailClamp*

- 低容量タイプ。高速ライン向け。



■ TClamp[®] = *TransClamp*

- 大きな雷サージエネルギーを保護するタイプ



Trademarked Name Convention

xClampXXXXYQ

xClamp = Family (Trademarked)

1) **XXXX** = 前半2桁:電圧 / 3桁目:Version / 4桁目:ライン数

例) **3324** : 3.3V・4ライン品 / **0544** : 5V・4ライン用

例外) **7538** : 5V・8ライン用

2) **Y** = Package (A – Z)

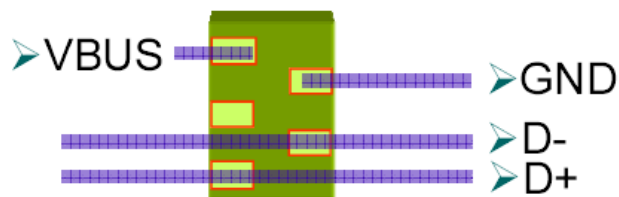
例) **RClamp0504F**

→ **RailClamp Family** 5V, 4 Lines **SC-70**

3) **Q** = AEC-Q100

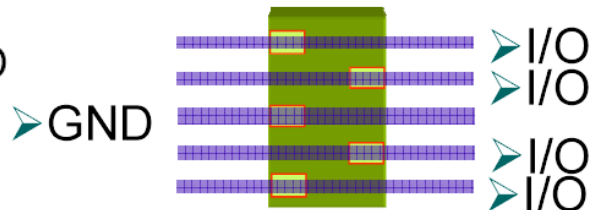
SMTC Flow through package

- デバイスの下に配線を引けるようなパッケージ
- 基板面積を最小化、かつ表層のみでの配線が可能
- 仮にデバイスを外しても信号通信が可能
 - 現状保護素子を使っていないケースでは基板にパッドさえ用意いただければ、後から追加・削除が可能なパッケージです



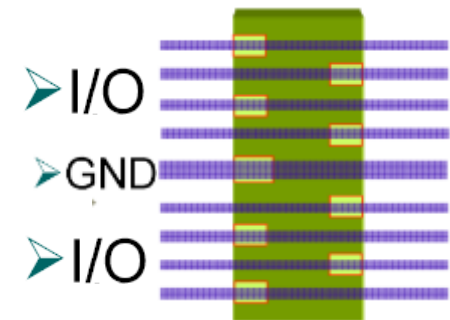
➢ RClamp7522T

➢ (1mm x 0.7mm)



➢ RClamp7524T

➢ (1.3mm x 0.8mm)

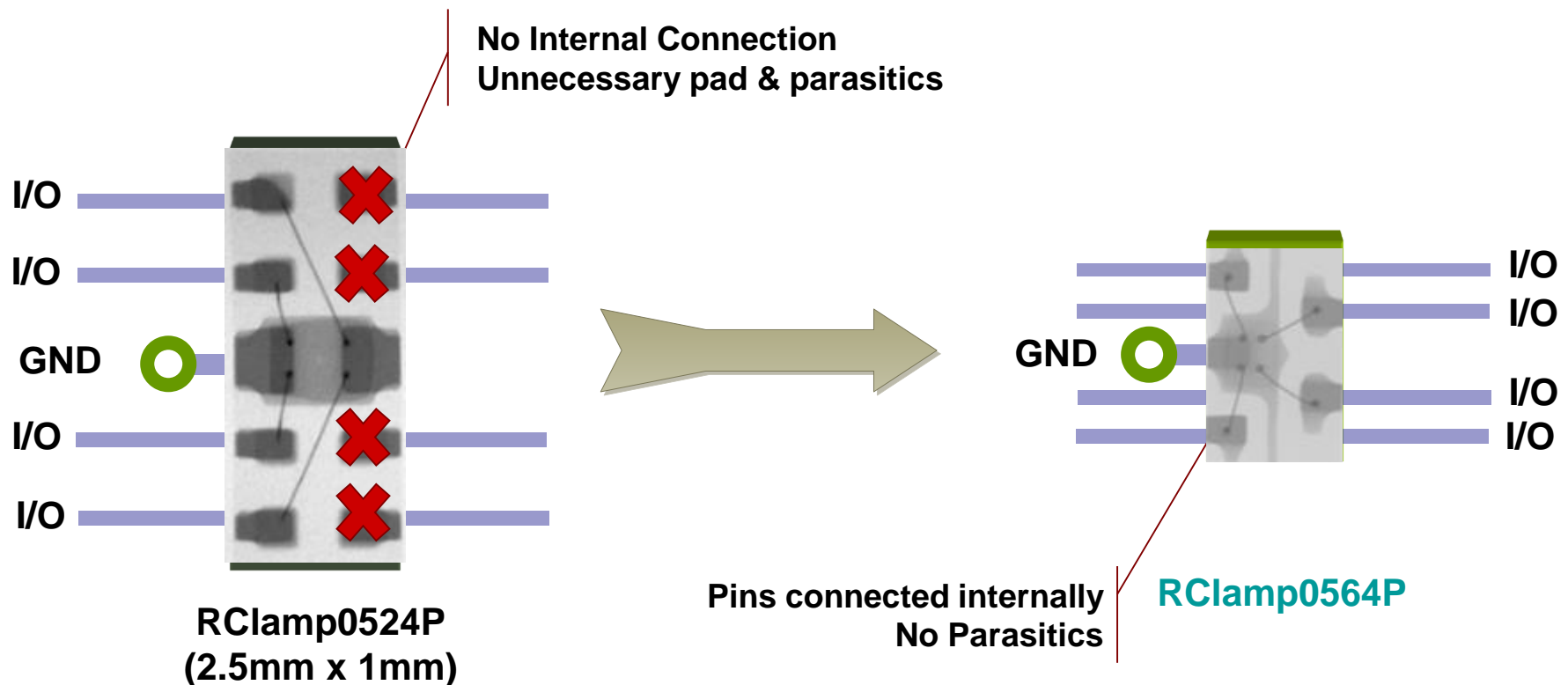


RClamp7528T

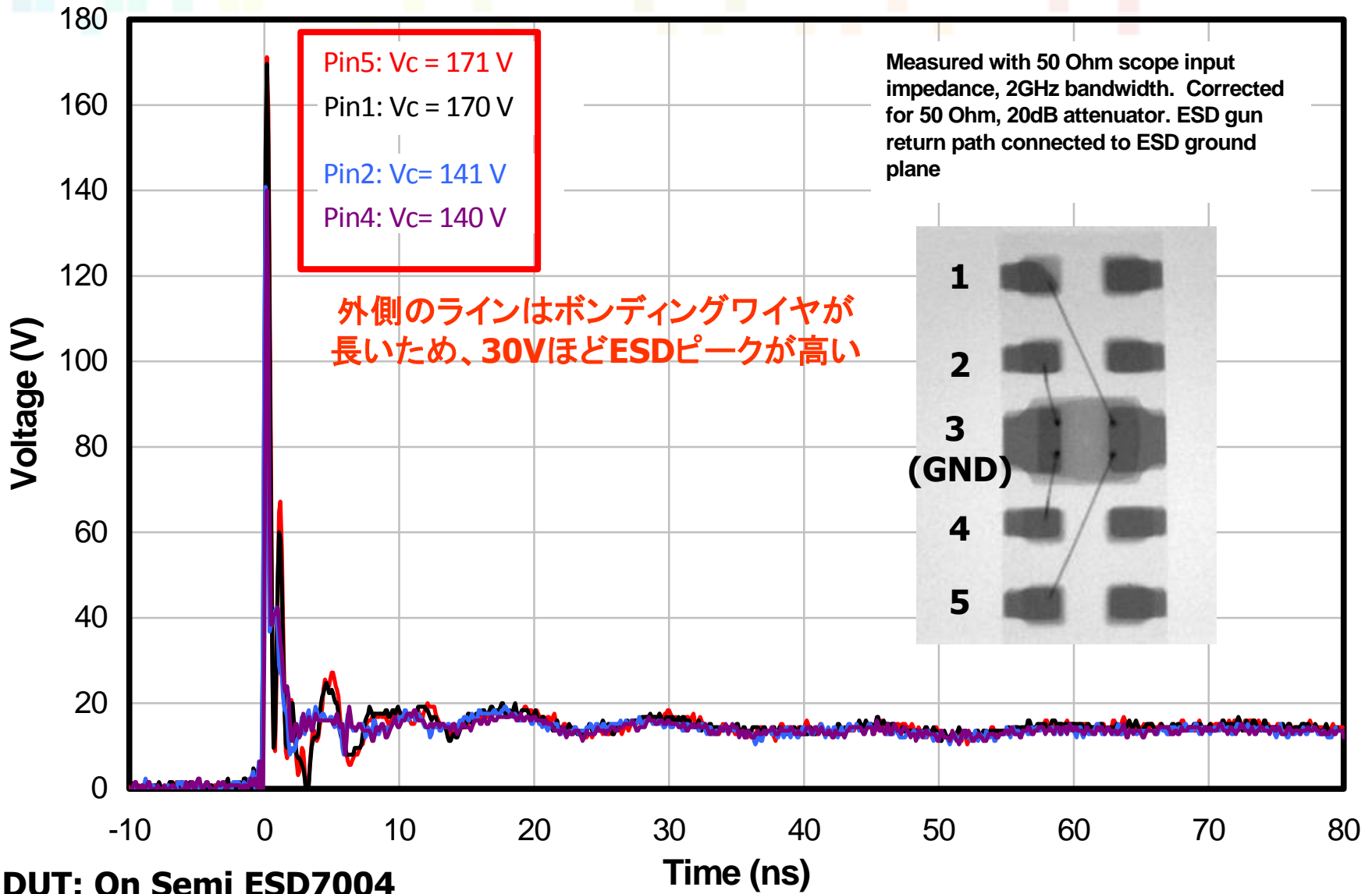
(2.6mm x 1.1mm)

SMTC Flow through package

- 外部pinを互い違いに置くことにより下記のメリットがあります
 - パッケージの小型化
 - ESDピーク電圧の低減
 - 半田フィレットが向かい合わないため、より低容量化



SMTC Flow through package





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USB 3.1 Protection

USB 3.1 Protection



RClamp3331ZA

Gen 1

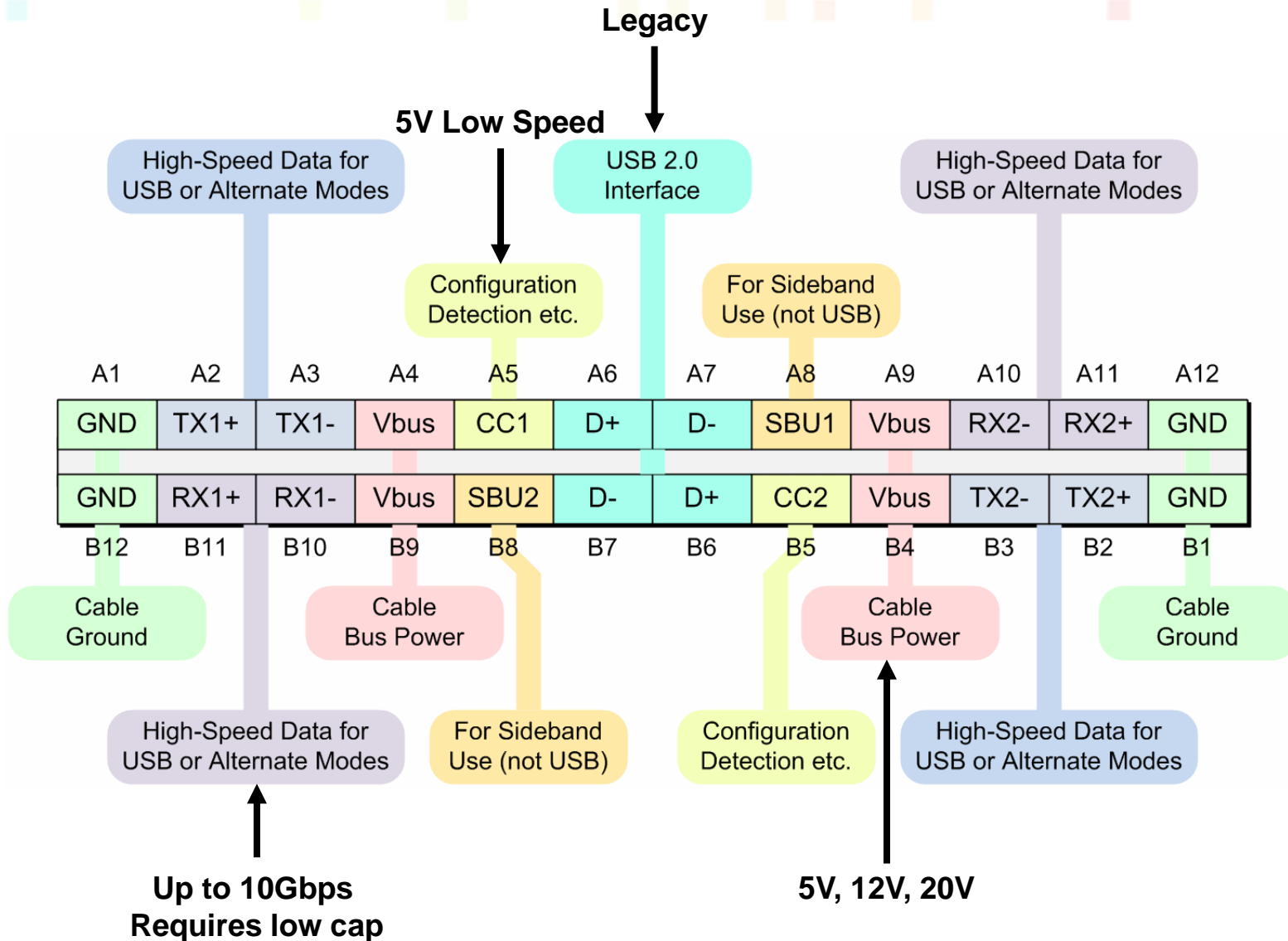
- ❑ Operating Voltage of 3.3V
- ❑ ESD Withstand +/-18kV/+18kV (Contact/Air)
- ❑ Low Capacitance of 0.45pF(MAX)
- ❑ Low Dynamic Resistance 0.20 Ohms
- ❑ ESD Clamping 7V(Typ) @ IPP=16A

RClamp3371ZC

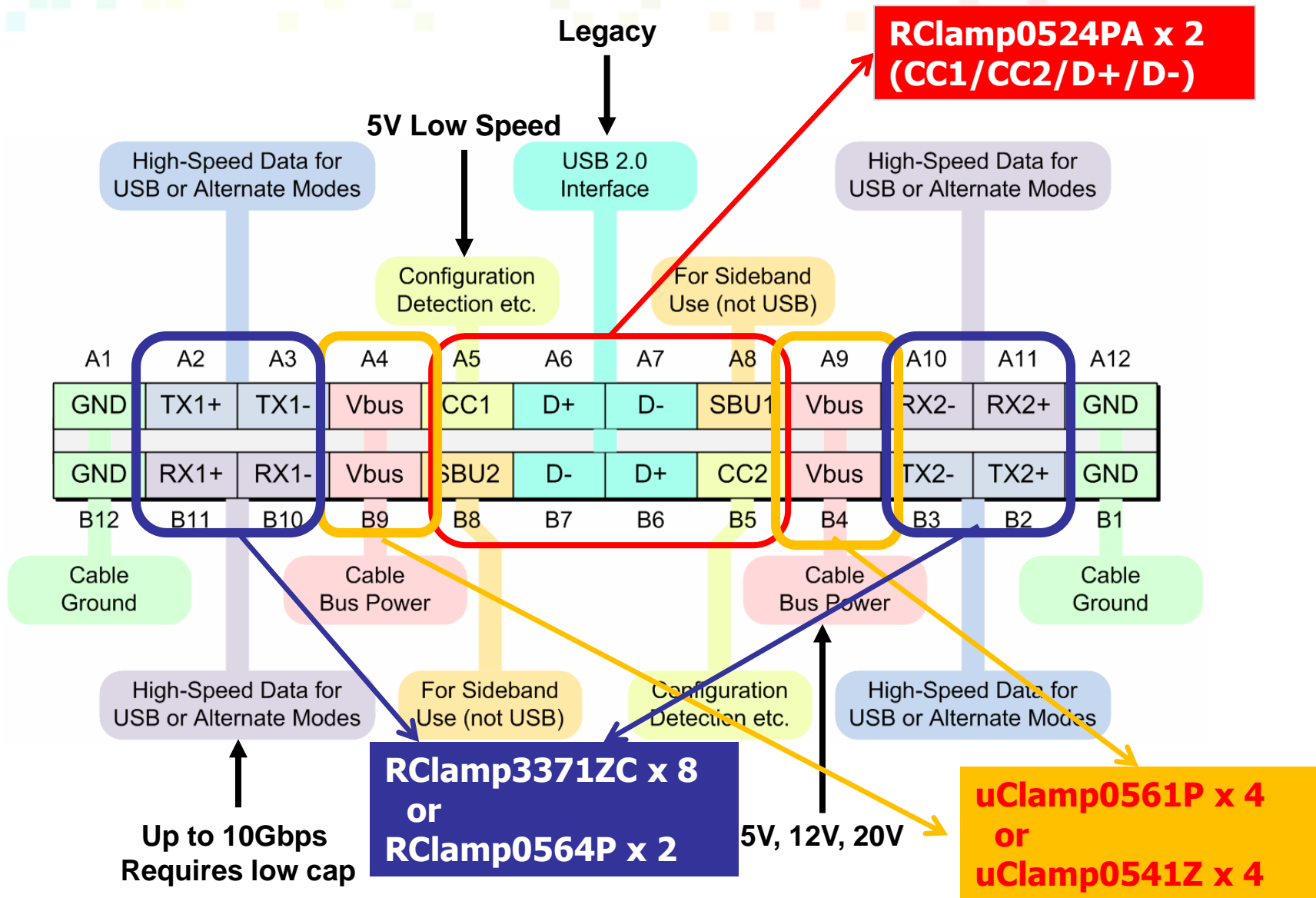
Gen 2

- ❑ Operating Voltage of 3.3V
- ❑ ESD Withstand +/-10KV/+17kV (Contact/Air)
- ❑ Low Capacitance of 0.25 pF(MAX)
- ❑ Low Dynamic Resistance 0.14 Ohms
- ❑ ESD Clamping 4.6V Typ @ IPP=16A

Reversible Type-C Connector Pin out



Reversible Type-C Connector Pin out with Analogix reference design



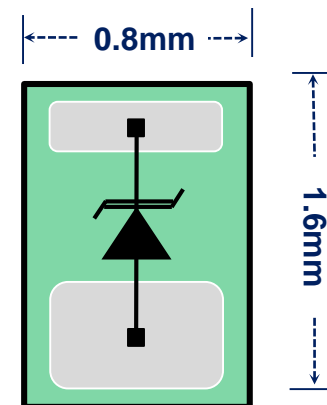


uClampxx61P Family

Vbus保護用 TVS

Features

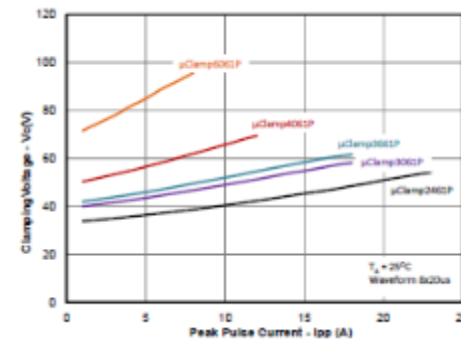
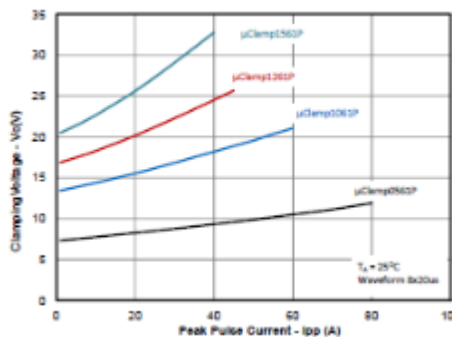
- 電圧別ラインナップ 5V, 10V, 12V, 15V, 24V
30V, 36V, 40V, 60V family
- 非常に高いサージ電流容量 (up to 80A)
- 低いESDピーク電圧 (<50V on 8KV test)
- ピーク電力 1200 – 1600 Watts
- +/- 30KV contact/air per IEC 61000-4-2 保証



μClampxx61P

Applications

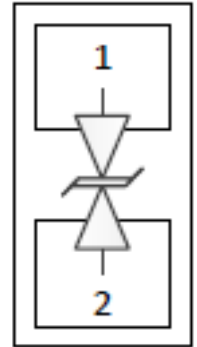
- **USB VBUS**
- Battery Line protection
- General VBUS protection
- Automotive Applications



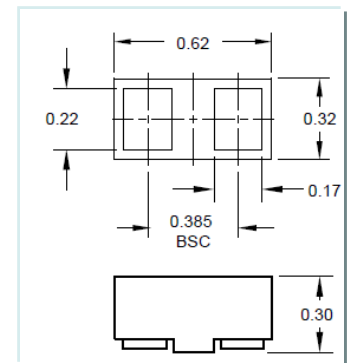
RClamp3371ZC- USB 3.1 Gen 2 Protection

RClamp3361ZのVersion up

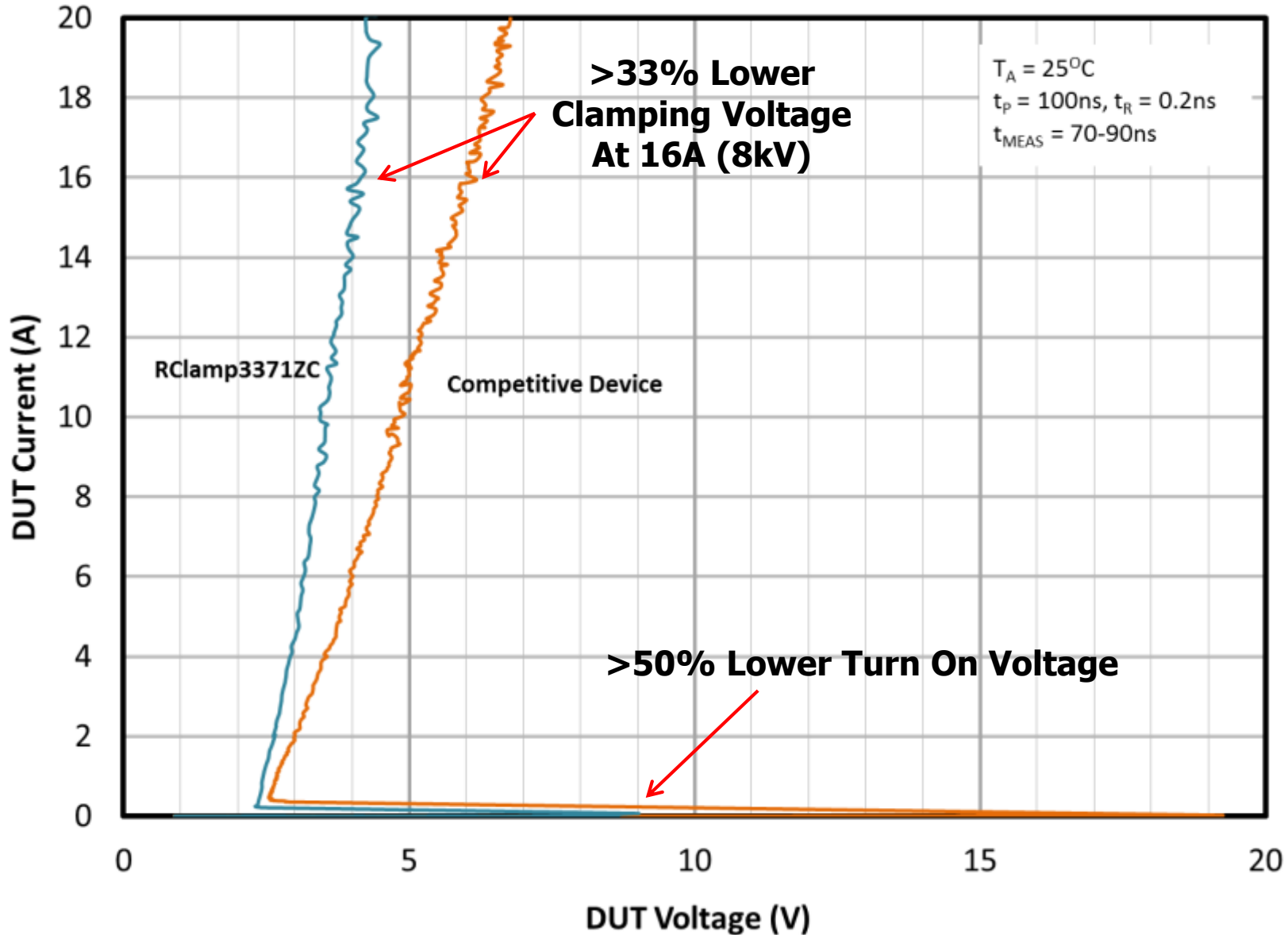
- Protects USB 3.1 - 10 Gbps data lines
- ESD保証値 $\pm 10\text{kV}$ Contact $\pm 17\text{kV}$ Air
- 超低容量 : 0.23 pF (Typ)
- Designed for USB 3.1, HDMI 2.0, DisplayPort 1.4
- 3.3V working voltage
- ターンON抵抗値 : 0.14 ohm



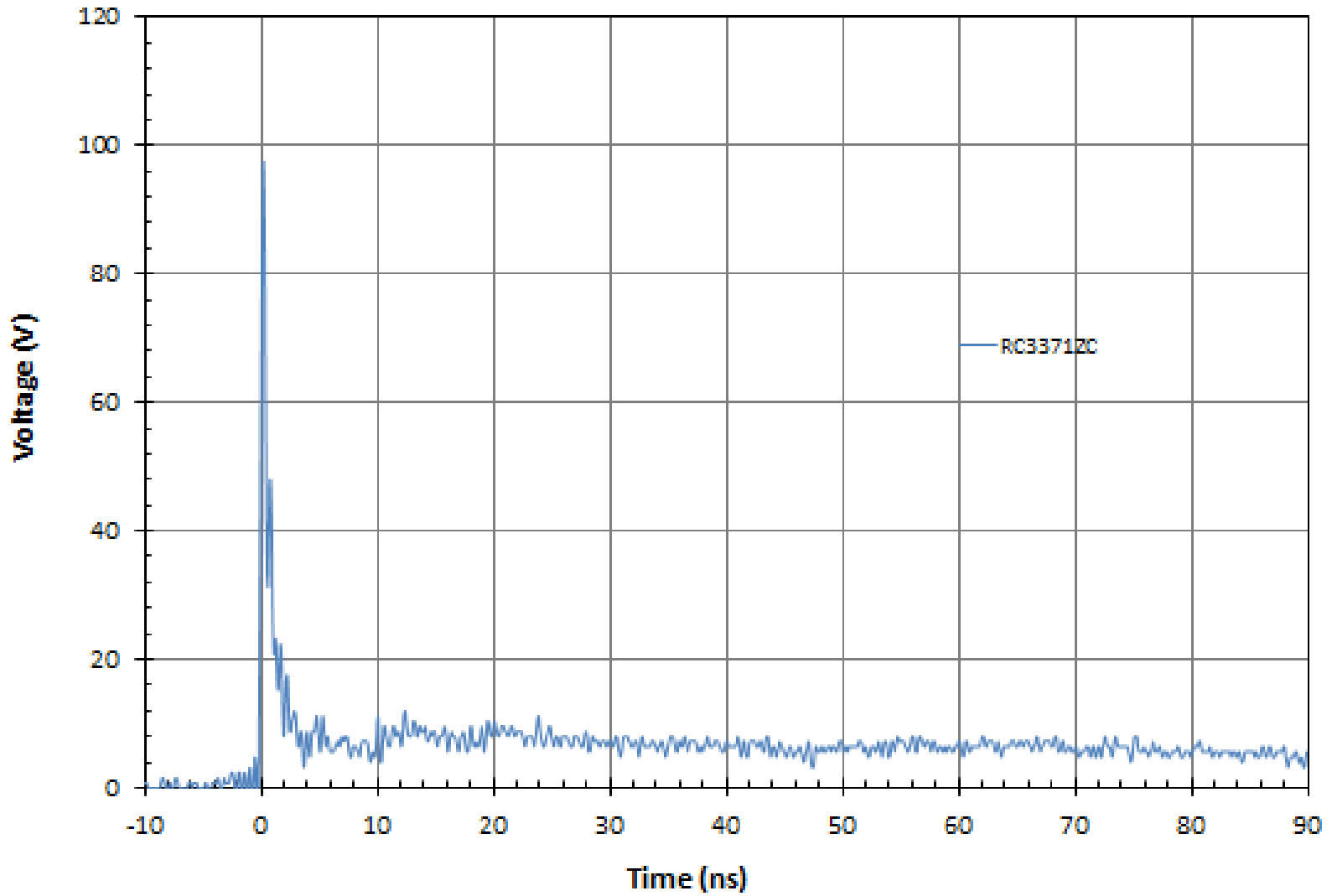
RClamp3371ZC (Bottom View)



RClamp3371ZC vs Competition



RClamp3371ZC Clamping by 8KV



USB Type C Protection

Layout using RClamp3361Z (series device)

Figure 1 - USB Type-C Top Layer Protection Example

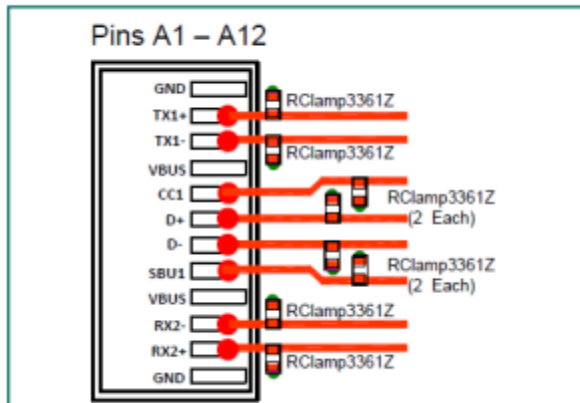
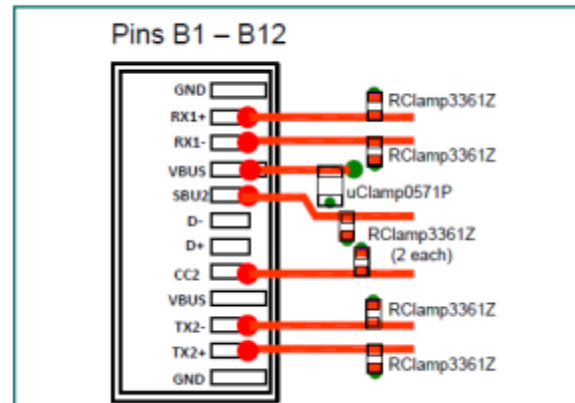
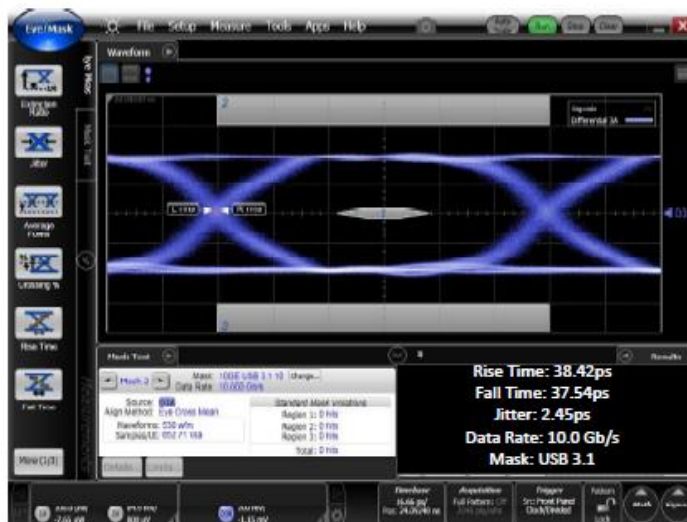


Figure 2 - USB Type-C Bottom Layer Protection Example



USB 3.1 Eye Pattern

10Gb/s (USB 3.1) Eye Diagram with RClamp3361ZA



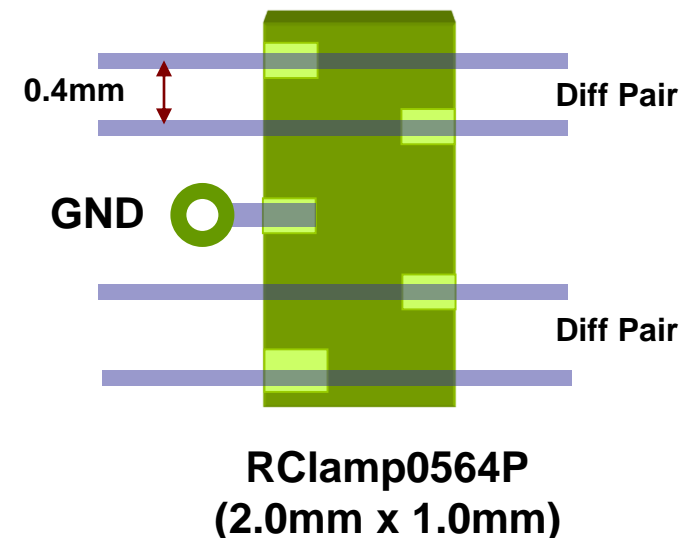
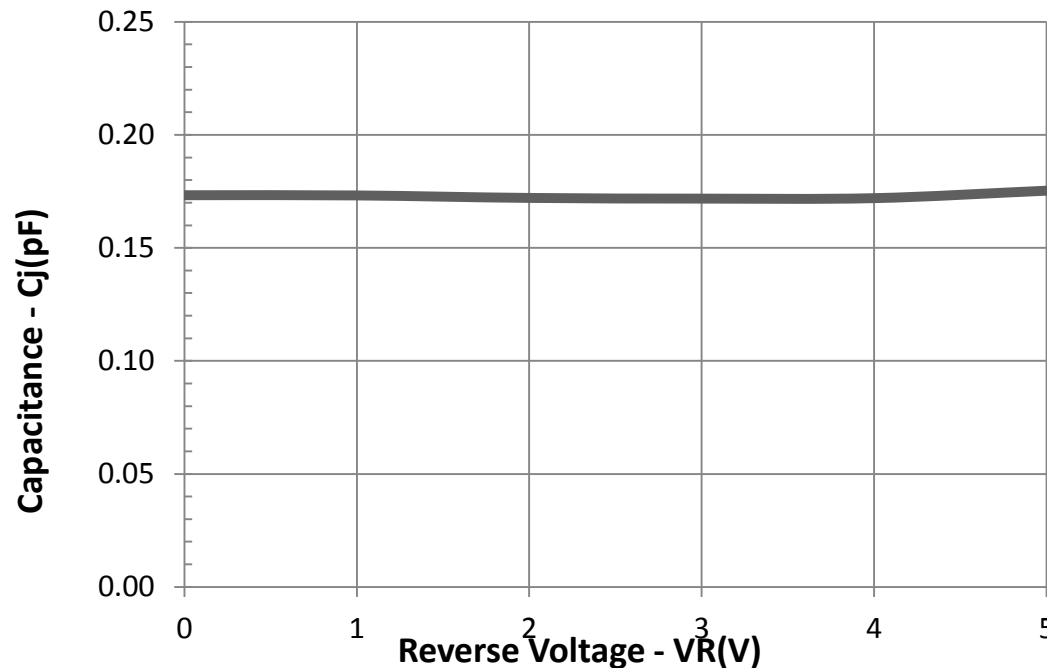
10Gb/s (USB 3.1) Eye Diagram without RClamp3361ZA



RClamp0564P – 4 Line HDMI 2.0 Solution

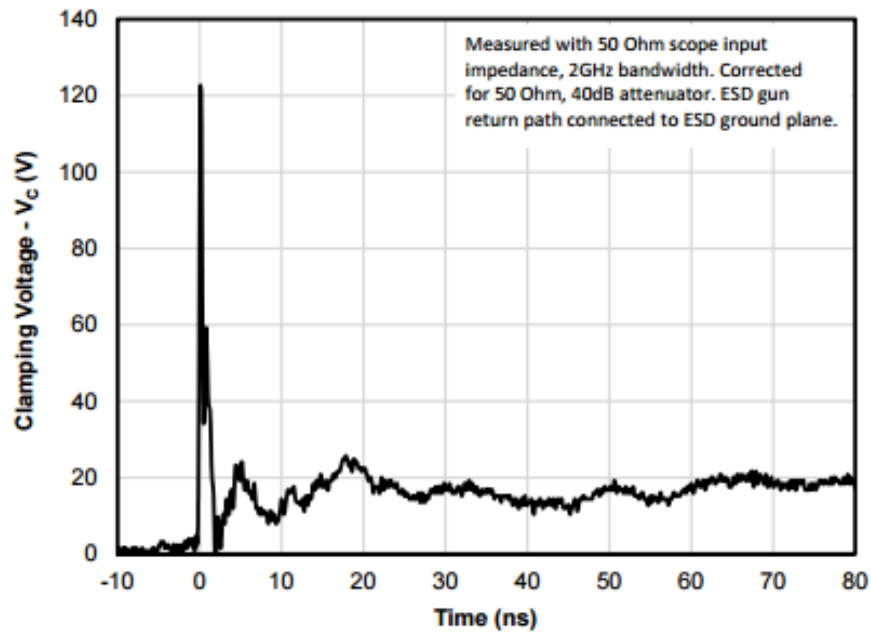
Benefits

- 5V 4 ライン保護用
- 超低Cap (**0.20pF I/O-GND max**)
- Flow through packageによる容易なレイアウト
- ESD保証値 $\pm 10\text{kV}$ Contact $\pm 15\text{kV}$ Air

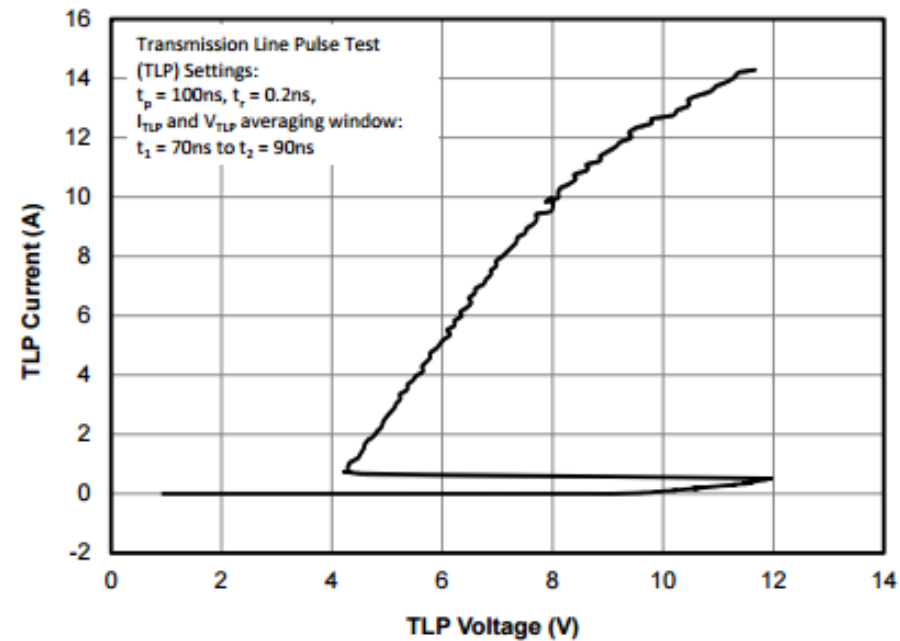


Clamping Performance

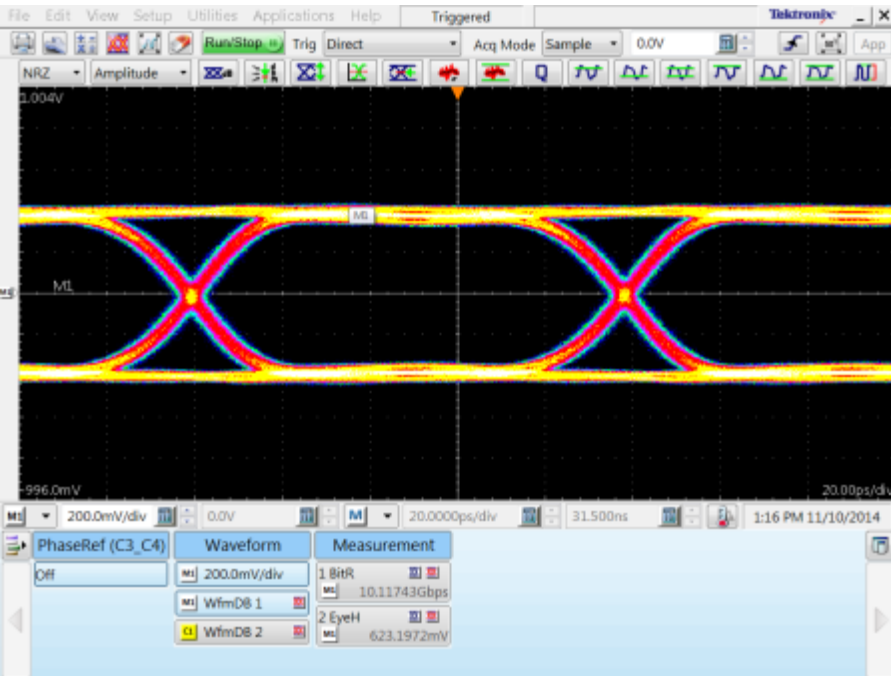
ESD Clamping (+8kV Contact per IEC 61000-4-2)



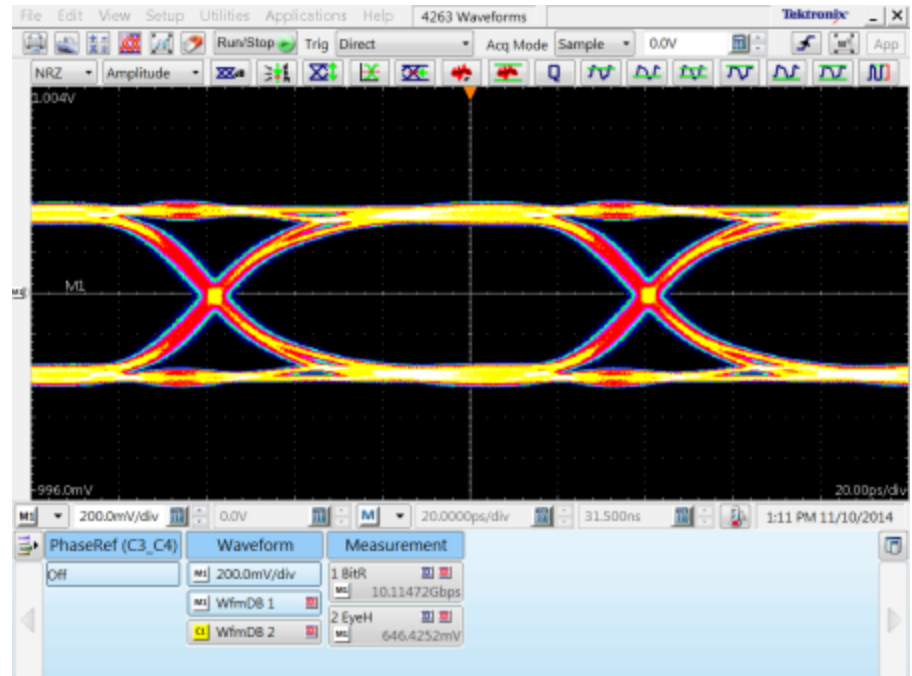
TLP IV Curve - Positive Pulse



10Gbps Eye Diagram with RClamp0564P



10Gbps without TVS



10Gbps with RClamp0564P

Differential measurement with PRBS-31 Pattern



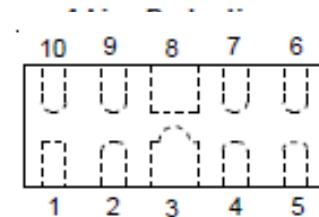
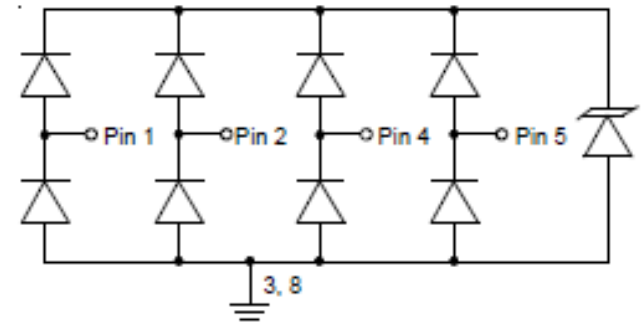
Rclamp0524PA - Low cost 4 line

□ RClamp0524PA Features:

- 5V 4 Line protection
- 超低容量 : 0.3 pF typ
- ESD保証値 : ±17kV/±12kV Air/Contact
- 非常に一般的な 2.5 x 1.0パッケージ

□ Key Applications:

- 高速ライン向け
- HDMI1.4
- USB3.0
- GbE



Pin	Identification
1, 2, 4, 5	Input Lines
6, 7, 9, 10	Output Lines (No Internal Connection)
3, 8	Ground

SLP2510P8 Pin Configuration (Top View)



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