

# Application Brief



SEMTECH PROTECTION PRODUCTS

## ESD/CDE Protection For DisplayPort



### Semtech's RClamp<sup>®</sup>0524P Protects DisplayPort Interfaces from ESD/CDE and Latchup without Loss of Signal Integrity

DisplayPort is an emerging high speed digital video interface standard. It provides interconnect between a Source (such as PC) and Sink (such as monitor). As such, the DisplayPort plug is frequently exposed to electrostatic discharge (ESD) directly from the user or a cable discharge (CDE) event.

The DisplayPort Compliance Test Specification (CTS) requires immunity to ESD set forth in IEC 61000-4-2. These stringent requirements can not be met by on-chip ESD protection; therefore, external off chip ESD protection circuitry is necessary. DisplayPort supports two link rates of 2.7Gbps and 1.62Gbps. At such high data rates, proper selection of a protection device is not trivial. The chosen device needs to provide adequate protection, as well as meet signal integrity and impedance requirements.

Semtech's RClamp0524P is designed specifically to provide ESD protection in excess of IEC 61000-4-2 Level 4 (  $\pm 15\text{kV}$  air,  $\pm 8\text{kV}$  contact). It exhibits superior low clamping voltage characteristic. In event an ESD strike, it limits the over-voltage stress across the protected DisplayPort IC to a level well below the destructive threshold, which increases the system reliability.

***Semtech's RClamp0524P is a unique offering for high speed interface protection. It is designed specifically to provide ESD protection in excess of IEC 61000-4-2 Level 4 (  $\pm 15\text{kV}$  air,  $\pm 8\text{kV}$  contact). With its industry leading low capacitance of 0.3pF between I/Os, the RClamp0524P can be used in circuits operating in excess of 3GHz without PCB trace compensation.***

## RClamp<sup>®</sup>0524P for DisplayPort

The RClamp0524P has a typical capacitance value of 0.3pF between I/O pins. This minimizes its impact on the high speed signal lines and enables it to be used in circuits operating in excess of 3GHz without board compensation. It has a flow through design which allows the traces to run straight through the device, thus reducing discontinuities as well as easing the PCB layout design. To further facilitate the high speed design, RClamp0524P is housed in a small leadless package with a size of 2.5x1.0x0.58mm and a 0.5mm pitch. Traces within a differential pair of the DisplayPort connector can be routed tightly coupled at 0.5mm pitch for good common mode rejection. Separate differential pairs can be routed loosely coupled at 1.0mm pitch between the pairs to reduce crosstalk. Figure 1 shows the application diagram of RClamp0524P for DisplayPort.

## Test Results and Recommendations

The low capacitance, clamping voltage, and operating voltage of Semtech's RClamp0524P, coupled with its innovative package design, make it a superior protection device for DisplayPort applications.

Semtech has produced 4-layer DisplayPort evaluation boards, which can be used to evaluate RClamp0524P's ESD characteristics as well as TDR and Eye Pattern performance. Figure 2 shows the TDR result on 4-layer DisplayPort evaluation board. It has met, and is well within, the DisplayPort CTS requirements (100 Ohm  $\pm$ 15% per differential pair). Figure 3 and Figure 4 show the Eye Mask Testing results of a DisplayPort protected by RClamp0524P at 1.62Gbps and 2.7Gbps, respectively. In both cases, there is sufficient margin between the eye diagram and the eye mask.

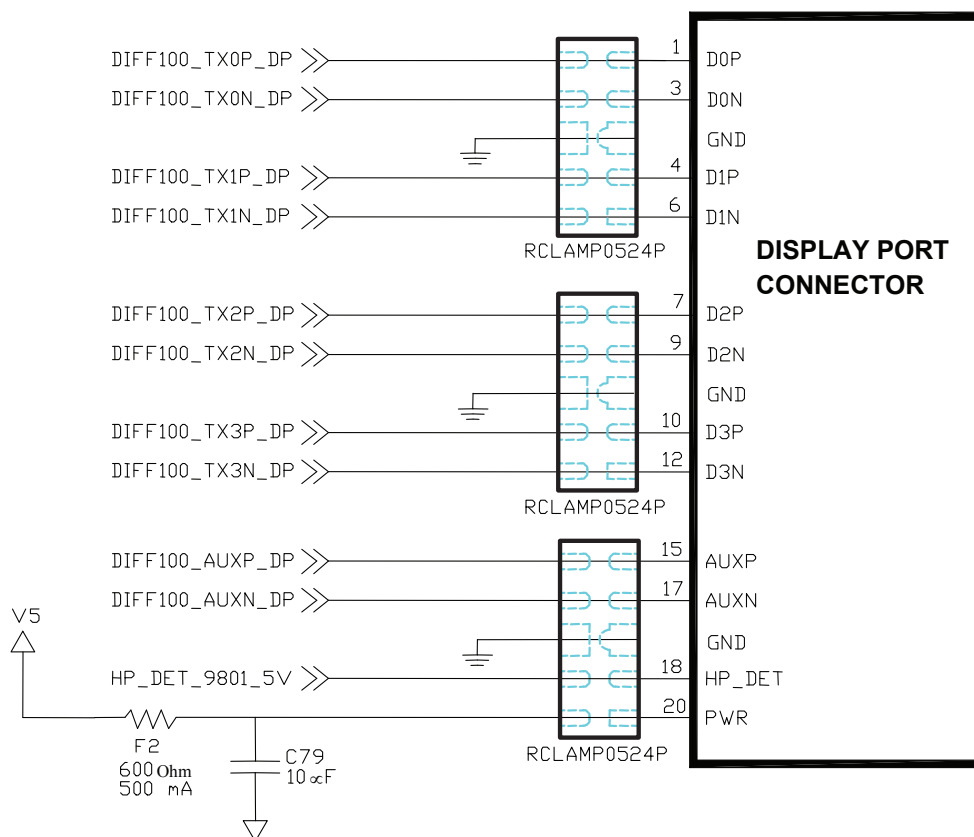
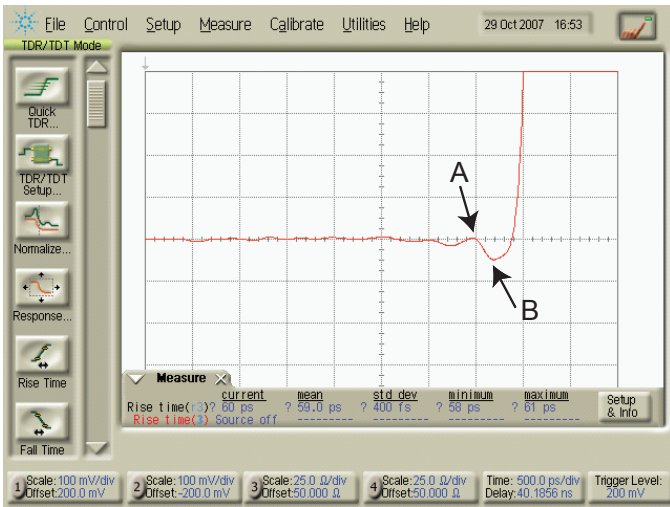


Figure 1: Flow-through layout of Semtech RClamp0524P for DisplayPort Applications

# RClamp<sup>®</sup>0524P for DisplayPort



	A	B	
X-axis	0.875	1.085	(nsec)
Y-axis	101	88	(Ohm)

Figure 2: RClamp0524P DisplayPort TDR Result

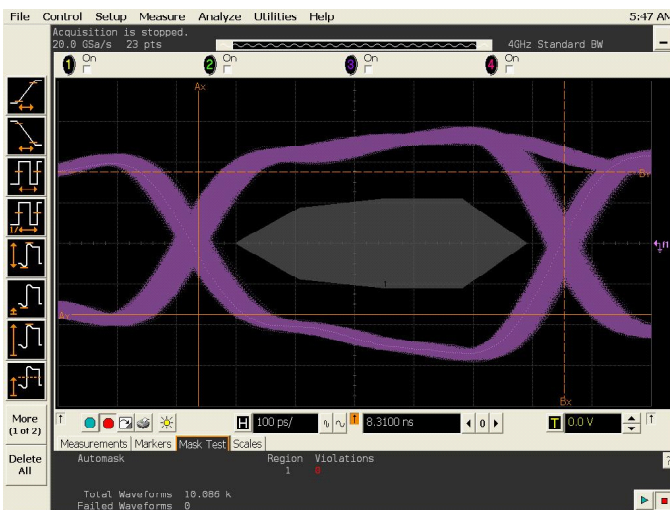


Figure 3: RClamp0524P DisplayPort Eye Mask Testing Result (1.62Gbps)

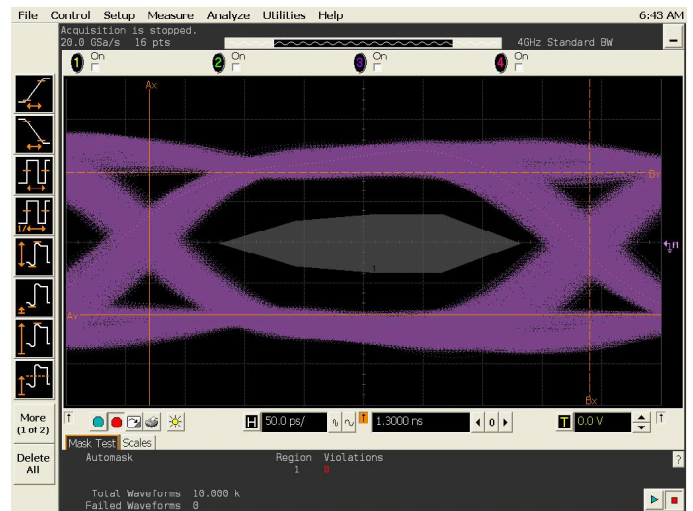


Figure 4: RClamp0524P DisplayPort Eye Mask Testing Result (2.7Gbps)

## Conclusion

DisplayPort system designers are faced with the challenging task of providing reliable ESD protection while maintaining signal integrity per DisplayPort CTS. Proper selection of off-chip protection devices is crucial. The chosen device must exhibit very low capacitance while keeping low clamping voltage to maintain quality and reliability of the protected IC. This will ensure that the DisplayPort IC will not experience catastrophic or latent failure during a transient threat.

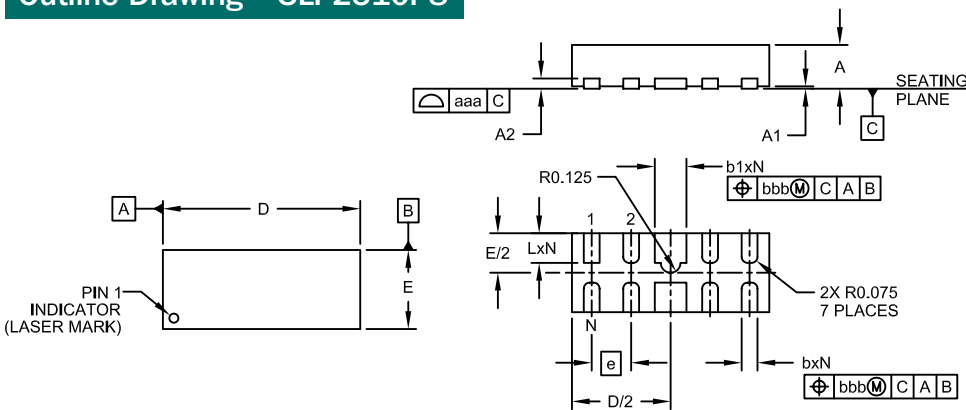
Semtech's RClamp0524P offers ultra low capacitance and superior ESD and signal integrity performance. It will ensure the compliance of a DisplayPort application to DisplayPort CTS without the need for any further board compensation.

# Application Brief

## Electrical Characteristics (T=25°)

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
Reverse Stand-Off Voltage	$V_{RWM}$	Any I/O pin to ground			5	V
Reverse Breakdown Voltage	$V_{BR}$	$I_t = 1mA$ Any I/O pin to ground	6			V
Reverse Leakage Current	$I_R$	$V_{RWM} = 5V, T = 25^\circ C$ Any I/O pin to ground			1	$\mu A$
Clamping Voltage	$V_c$	$I_{pp} = 1A, t_p = 8/20\mu s$ Any I/O pin to ground			15	V
Junction Capacitance	$C_j$	$V_R = 0V, f = 1MHz$ Between I/O pins		0.30	0.4	pF
Junction Capacitance	$C_j$	$V_R = 0V, f = 1MHz$ Any I/O pin to ground			0.8	pF

## Outline Drawing – SLP2510P8

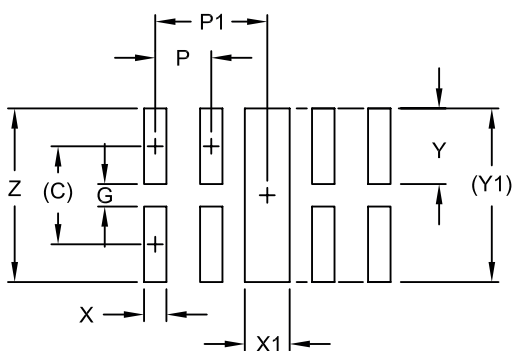


DIM	INCHES			MILLIMETERS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	.020	.023	.026	.050	0.58	0.65
A1	0.00	.001	.002	0.00	0.03	0.05
A2		(.005)			(0.13)	
b	.006	.008	.010	0.15	0.20	0.25
b1	.014	.016	.018	0.35	0.40	0.45
D	.094	.098	.102	2.40	2.50	2.60
E	.035	.039	.043	0.90	1.00	1.10
e	.020 BSC			0.50 BSC		
L	.012	.015	.017	0.30	0.38	0.425
N	8			8		
aaa	.003			0.08		
bbb	.004			0.10		

Notes:

- Controlling dimensions are in millimeters (Angles in degrees).

## Land Pattern – SLP2510P8



DIM	DIMENSIONS	
	INCHES	MILLIMETERS
C	(.034)	(0.875)
G	.008	0.20
P	0.20	0.50
P1	.039	1.00
X	.008	0.20
X1	.016	0.40
Y	.027	0.675
Y1	(.061)	(1.55)
Z	.061	1.55

Notes:

- Controlling dimensions are in millimeters (Angles in degrees).
- This land pattern is for reference purposes only.
- Consult your manufacturing group to ensure your company's manufacturing guidelines are met.

Visit our website to locate the most current product specifications, datasheets and contact information for your local Semtech Field Applications Engineer.