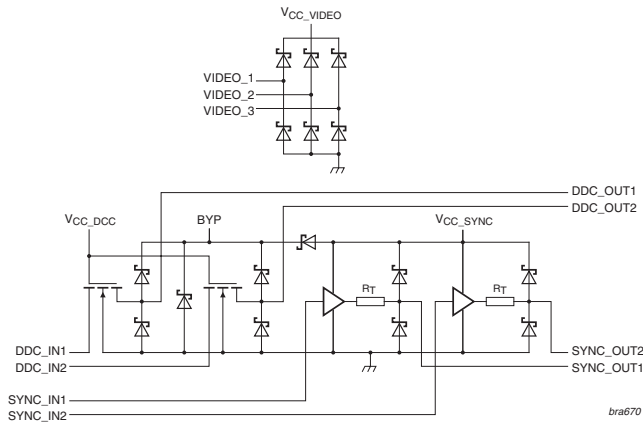


# Interface Protection Products Selection Guide

ESD protection

EMI filter

Level shifter and buffer



## Portfolio key features

- Level shifting, buffering, ESD protection, termination, pull-up resistors, EMI filtering
- Superior size / performance ratio
- Fully integrated passive and active components
- Lowest line capacitance for high-speed interfaces -  $C_{line} = 1.0 \text{ pF}$
- High level ESD protection in compliance with IEC 61000-4-2, level 4
- Lead-free products

## Product overview

Product group		Example	Application		
			Computing	Consumer	Mobile phone
ESD protection	Very low capacitance < 25 pF 1 to 16 lines		X	X	X
	Standard capacitance 1 to 18 lines		X	X	X
	Rail-to-Rail ESD protection Ultra low capacitance < 5 pF 2 to 8 lines		X	X	X
EMI filter with integrated ESD protection ESD protection diodes			X	X	X
Level shifter, buffer and EMI filter with integrated ESD protection ESD protection diodes			X	X	

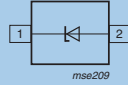
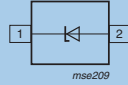
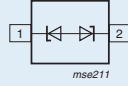
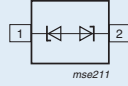
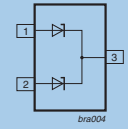
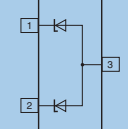
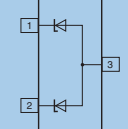
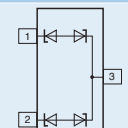
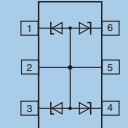
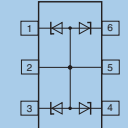
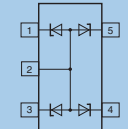
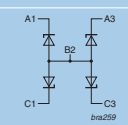
ESD protection – very low capacitance < 25 pF  
1 to 16 lines

Number of protected lines Uni- directional		$I_{RM}$ max. [ $\mu$ A]	@	$V_{RWM}$ [V]	$C_{line}$ typ. [pF]	$P_{PP}$ * max. [W]	ESD rating** max. [kV]	Configuration	Type	Package
1		2		3.3	0.6	80	30		PESD3V3U1UT	SOT23
		1		5	0.6	80	30		PESD5V0U1UT	
		0.05		12	0.6	200	30		PESD12VU1UT	
		0.05		15	0.6	200	30		PESD15VU1UT	
		0.05		24	0.6	200	23		PESD24VU1UT	
	1	0.05	15 (diode 1)	13	160	23		PESD1LIN	SOD323 (SC-76)	
	0.05	24 (diode 2)								
2	1	0.3		3.3	22	30	15		PESD3V3L2UM	SOT883 (SC-101)
		0.025		5	16	30	15		PESD5V0L2UM	
	2	0.05		24	11	200	23		PESD1CAN	SOT23
4	3	0.3		3.3	22	30	20		PESD3V3L4UG	SOT353 (SC-88A)
		0.025		5	16	30	20		PESD5V0L4UG	
		0.3		3.3	16	30	20		PESD3V3V4UG	
		0.025		5	12	16	10		PESD5V0V4UG	SOT665
		0.3		3.3	22	30	20		PESD3V3L4UJW	
		0.025		5	16	30	20		PESD5V0L4UJW	
		0.3	3.3	15	16	10	PESD3V3V4UJW			
		0.025	5	12	16	10	PESD5V0V4UJW			
	4	0.01		5	16		8		IP4043CX5/LF	5 ball CSP
5	4	0.3		3.3	22	25	20		PESD3V3L5UY	SOT363 (SC-88)
		0.25		5	16	25	20		PESD5V0L5UY	
		0.3		3.3	22	25	20		PESD3V3L5UV	SOT666
		0.025		5	16	25	20		PESD5V0L5UV	
6	5	0.025		5	16	35	20		PESD5V0L6US	SOT96-1 (SO8)
		0.025		5	16	35	20		PESD5V0L6UAS	SOT505-1 (TSSOP8)
	7	0.025		5	7	35	20		PESD5V0L7BS	SOT96-1 (SO8)
									PESD5V0L7BAS	SOT505-1 (TSSOP8)
16	15	0.01		3	15		15		IP4080CX20/LF	WL CSP

\*8/20 $\mu$ s surge pulse acc. to IEC61000-4-5

\*\*acc. to IEC61000-4-2 (contact discharge)

ESD protection – standard capacitance  
1 to 18 lines

Number of protected lines Uni- directional		$I_{RM}$ max. [ $\mu$ A]	@ [V]	$V_{RWM}$ [V]	$C_{line}$ typ. [pF]	$P_{PP}$ * max. [W]	ESD rating** max. [kV]	Configuration	Type	Package		
1	Uni-directional	2	3.3	200	150	150	30		PESD3V3S1UL	SOD882		
		1	5	150	150	150	30		PESD5V0S1UL			
		0.05	12	38	150	150	30		PESD12VS1UL			
		0.05	15	32	150	150	30		PESD15VS1UL			
		0.05	24	23	150	150	23		PESD24VS1UL			
		2	3.3	207	330	330	30				PESD3V3S1UB	SOD523 (SC-79)
		1	5	152	260	260	30				PESD5V0S1UB	
		0.05	12	38	180	180	30				PESD12VS1UB	
		0.05	15	32	160	160	30				PESD15VS1UB	
		0.05	24	23	160	160	23				PESD24VS1UB	
	0.05	24	23	160	160	23	PESD24VS1UB					
	Bi-directional	0.1	5	35	120	120	30		PESD5V0S1BA	SOD323 (SC-76)		
									PESD5V0S1BB	SOD523 (SC-79)		
									PESD5V0S1BL	SOD882		
2		3.3	101	500	30		PESD3V3L1BA		SOD323 (SC-76)			
1		5	75	500	30		PESD5V0L1BA					
0.05		12	19	200	30		PESD12VL1BA					
0.05	15	16	200	30	PESD15VL1BA							
0.05	24	11	200	23	PESD24VL1BA							
2	Uni-directional	2	3.3	207	330	330	30		PESD3V3S2UAT	SOT23		
		1	5	152	260	260	30		PESD5V0S2UAT			
		0.05	12	38	180	180	30		PESD12VS2UAT			
		0.05	15	32	160	160	30		PESD15VS2UAT			
		0.05	24	23	160	160	23		PESD24VS2UAT			
		3	3.3	200	150	150	30				PESD3V3S2UQ	SOT663
		0.3	5	150	150	30	PESD5V0S2UQ					
		0.03	12	38	150	30	PESD12VS2UQ					
		0.05	15	32	150	30	PESD15VS2UQ					
		0.05	24	23	150	23	PESD24VS2UQ					
		0.05	24	23	150	23	PESD24VS2UQ					
		Bi-directional	2	3.3	207	330	330		30			PESD3V3S2UT
	1		5.3	152	260	260	30	PESD5V2S2UT				
	1		12	38	180	180	30	PESD12VS2UT				
	1		15	32	160	160	30	PESD15VS2UT				
	1		24	23	160	160	23	PESD24VS2UT				
	1		24	23	160	160	23	PESD24VS2UT				
	Bi-directional	0.1	5	35	120	120	30		PESD5V0S2BT	SOT23		
		2	3.3	101	350	30	PESD3V3L2BT					
		1	5	75	350	30	PESD5V0L2BT					
		0.05	12	19	200	30	PESD12VL2BT					
		0.05	15	16	200	30	PESD15VL2BT					
		0.05	24	11	200	23	PESD24VL2BT					
	4	Uni-directional	2	3	200			8		BZA456A	SOT457 (SC-74)	
0.7			4	165			8	BZA462A				
0.075			14	37			8	BZA418A				
0.1			15	37			8	BZA420A				
2.2			3.3	215	200	200	30	PESD3V3S4UD***				
0.15			5	158	200	200	30	PESD5V0S4UD***				
0.01			12	73	200	200	30	PESD12VS4UD***				
0.01			15	61	200	200	30	PESD15VS4UD***				
0.01			24	45	200	200	23	PESD24VS4UD***				
2			3	200			8			BZA856A		SOT353 (SC-88A)
0.7			4	165			8			BZA862A		
0.2			4.3	145			8			BZA868A		
0.01		15	37			8	BZA820A					
1		3	107			8	BZA856AL					
0.5		4	90			8	BZA862AL					
0.01		4.3	78			8	BZA868AL					
Bi-directional		1	3	107			8		BZA956A	SOT665		
		0.5	4	90			8		BZA962A			
		0.01	4.3	78			8		BZA968A			
		0.01	3.3	30			15				IP4042CX5/LF	5 ball CSP

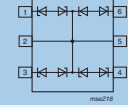
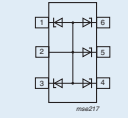
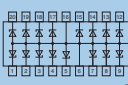
\*8/20 $\mu$ s surge pulse acc. to IEC61000-4-5

\*\*acc. to IEC61000-4-2 (contact discharge)

\*\*\* under development

## ESD protection – standard capacitance (cont'd)

1 to 18 lines

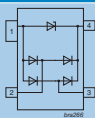
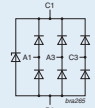
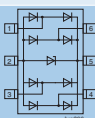
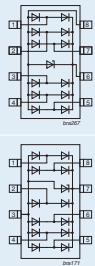
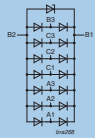
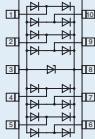
Number of protected lines		$I_{RM}$ max. [μA]	@	$V_{RWM}$ [V]	$C_{line}$ typ. [pF]	$P_{PP}$ max. [W]	ESD rating** [kV]	Configuration	Type	Package
Uni-directional	Bi-directional									
	4	0.01		5	48		15		BZA408B	SOT457 (SC-74)
5	4	2.2		3.3	215	200	30		PESD3V3S5UD	SOT457 (SC-74)
		0.15		5	158	200	30		PESD5V0S5UD	
		0.01		12	73	200	30		PESD12VS5UD	
		0.01		15	61	200	30		PESD15VS5UD	
		0.01		24	45	200	23		PESD24VS5UD	
18	17	1		5.2	100	100	8		BZA100	SOT163 (SO20)
								PESD5V2S18U	SOT339-1 (SSOP20)	

\*8/20μs surge pulse acc. to IEC61000-4-5

\*\*acc. to IEC61000-4-2 (contact discharge)

## Rail-to-Rail ESD protection – ultra low capacitance < 5 pF

2 to 8 lines

Number of protected lines	$I_{RM}$ max. [μA]	@	$V_{RWM}$ [V]	$C_{line}$ typ. [pF]	ESD rating** [kV]	Configuration	Type	Package
2	0.1		3	1	8		PRTR5V0U2X	SOT143
	0.1		3	1.8	12		PRTR5V0U2AX	
3	0.1		3	4	8		IP4059CX5/LF	5 ball CSP
4	0.1		3	1	8		PRTR5V0U4D	SOT457 (SC-74)
6	0.1		3	1	8		PRTR5V0U6S	SOT96-1 (SO8)
	0.1		3	1	8		PRTR5V0U6AS	
7	0.1		3	4	8		IP4067CX9/LF	9 ball CSP
8	0.1		3	1	8		PRTR5V0U8S	SOT552-1 (TSSOP10)

\*\*acc. to IEC61000-4-2 (contact discharge)

# EMI filter and ESD protection

## Mobile phone applications

Baseband interface	Number of lines	Line small-signal equivalents		Digital interface clock speed	Remark	Type	Package
		$R_{line}$	$C_{line}$				
Reverse battery	1	-	240 pF	-	Overtoltage and reverse battery protection	IP4085CX5/LF	5 ball CSP
Audio	2	0.9 $\Omega$	290 pF	-	low ohmic speaker (< ~8 $\Omega$ )	IP4047CX6/LF	6 ball CSP
	2	10 $\Omega$	200 pF	-	high ohmic speaker (> ~8 $\Omega$ )	IP4048CX5/LF	5 ball CSP
	2	68 $\Omega$	110 pF	-	differential microphone	IP4049CX5/LF	5 ball CSP
	2	470 $\Omega$	35 pF	-	differential microphone	IP4055CX5/LF	5 ball CSP
USB	2	33 $\Omega$ / 1.5 k $\Omega$	35 pF	~5.5 MHz	Fully integrated USB2.0 low / full-speed interface with EMI filter, ESD protection, pull-up resistors and impedance matching on Philips ISP110x, ISP130x, ISP136x	IP4058CX8/LF	8 ball CSP
	2	33 $\Omega$	35 pF	~5.5 MHz	Fully integrated USB2.0 low / full-speed interface with EMI filter, ESD protection and impedance matching on Philips ISP1110	IP4078CX6/LF	6 ball CSP
	3	-	3 pF	~240 MHz	USB2.0 high-speed ESD protection on Philips ISP176x and ISP1504	IP4059CX5/LF	5 ball CSP
Sim card	3	47 $\Omega$ / 100 $\Omega$	35 pF	~12 MHz	EMI filter, ESD protection	IP4044CX8/LF	8 ball CSP
	3	47 $\Omega$ / 100 $\Omega$	< 20 pF	~20 MHz	EMI filter, ESD protection	IP4064CX8/LF	8 ball CSP
Bottom connector	6	100 $\Omega$	60 pF	~20 MHz	EMI filter, ESD protection	IP4053CX15/LF	15 ball CSP
	6	100 $\Omega$	30 pF	~40 MHz	EMI filter and ESD protection + 4 single protection diodes	IP4153CX15/LF	15 ball CSP
Memory cards	4	47 $\Omega$ / 13 k $\Omega$ / 56 k $\Omega$	25 pF	-	MMC ESD protection, pull-up resistors	IP4051CX11/LF	11 ball CSP
	4	50 $\Omega$ / 75 k $\Omega$ / 7 k $\Omega$	18 pF	~25 MHz	High-speed MMC ESD protection, pull-up resistors	IP4060CX16/LF	16 ball CSP
	7	40 $\Omega$ / 50 k $\Omega$ / 25 k $\Omega$	18 pF	~20 MHz	SD-Card ESD protection, EMI filter, pull-up resistors	IP4052CX20/LF	20 ball CSP
	7	-	5 pF	~24 MHz	Memory stick PRO ESD protection	IP4067CX9/LF	9 ball CSP
LCD display	8	100 $\Omega$	50 pF	~25 MHz	EMI filter, ESD protection	IP4088CX20/LF*	20 ball CSP
	10	80 $\Omega$	40 pF	~30 MHz	EMI filter, ESD protection	IP4033CX25/LF	25 ball CSP
	10	84 $\Omega$	14 pF	~40 MHz	EMI filter, ESD protection	IP4040CX25/LF	25 ball CSP
	10	200 $\Omega$	50 pF	~20 MHz	EMI filter, ESD protection	IP4041CX25/LF	25 ball CSP
Keypad	10	1 $\Omega$	50 pF	< 1 MHz	EMI filter, ESD protection	IP4035CX24/LF	24 ball CSP

\* under development

# Level shifter, buffer and EMI filter with integrated ESD protection

Computing and consumer applications

Interface	Number of lines	Sync buffer	Level shifter	C <sub>line</sub>	Resistor	Remark	Type	Package
VGA	7	-	-	5 pF	75 Ω 2.2 KΩ 33 Ω	75 Ω termination, EMI filter	IP4271CZ20*	TSSOP20 (MO-153)
	7	-	-	5 pF	75 Ω	75 Ω termination, EMI filter	IP4272CZ20*	TSSOP20 (MO-153)
	7	-	-	5 pF	75 Ω 2.2 KΩ 33 Ω	75 Ω termination, EMI filter	IP4273CZ16*	SO16 (MS-012)
	7	-	-	5 pF	75 Ω	75 Ω termination, EMI filter	IP4274CZ16*	SO16 (MS-012)
	7	Yes	Yes	5 pF	55 Ω	Sync buffer, DDC level shifter	IP4770CZ16	SSOP16
	7	Yes	Yes	5 pF	65 Ω	Sync buffer, DDC level shifter	IP4771CZ16	SSOP16
	7	Yes	Yes	5 pF	10 Ω	Sync buffer, DDC level shifter	IP4772CZ16	SSOP16
IEEE1394	4	-	-	5 pF	55 Ω	Common mode filter	IP4224CZ6	SOT457 (SC-74)
LVDS	10	-	-	5 pF	100 Ω	100 Ω termination	IP4263CZ14*	SO14 (MS-012)
USB2.0	2	-	-	1 pF	-	ESD protection	PRTR5V0U2X	SOT143
	4	-	-	1 pF	-	ESD protection	IP4220CZ6	SOT457 (SC-74)
	4	-	-	4 pF	-	EMI filter, ESD protection	IP4225CZ10	SOT457 (SC-74)
HDMI	4	-	-	1 pF	-	ESD protection	PRTR5V0U4D	SOT457 (SC-74)
	8	-	-	1 pF	-	ESD protection	PRTR5V0U8S	TSSOP10
	8	-	Yes	0.7 pF	-	Level shifter, ESD protection	IP4776CZ38	TSSOP38

\* under development

## Philips Semiconductors

Philips Semiconductors is one of the world's top semiconductor suppliers, with 20 manufacturing and assembly sites and a sales organization that delivers in 60 countries. For a complete up-to-date list of our sales offices please visit our website <http://www.semiconductors.philips.com/sales>

## ©2006 Koninklijke Philips Electronics N.V.

All rights reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Document order number: 9397 750 15386

Date of release: July 2006

Published in the Netherlands

