

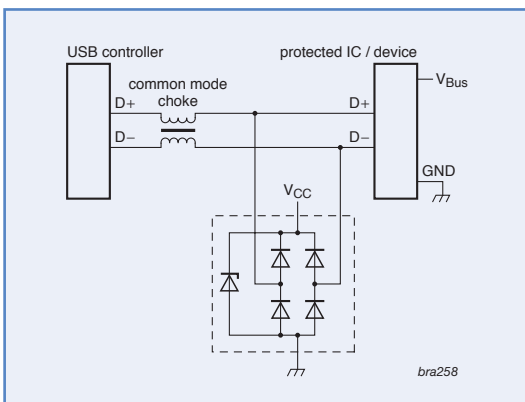


ESD protection  
EMI filter  
Level shifter and buffer

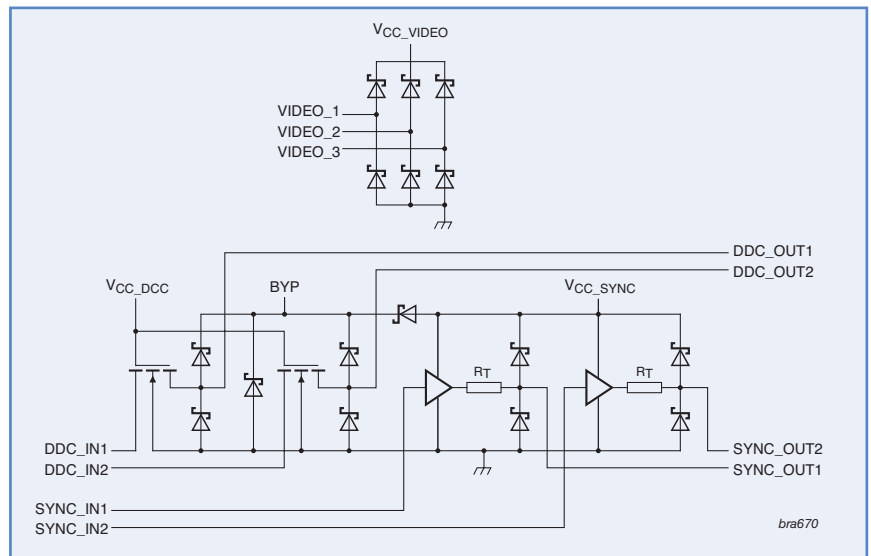
# Interface protection products selection guide

## 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



USB2.0 port ESD protection with PRTR5V0U2X



Fully integrated VGA interface supporting highest UXGA resolutions up to 2560 x 1920 pixel at 85 Hz with IP4770/71/72CZ16

# 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	1	0.1		5	2.9	25	10		PESD5V0U1BA***	SOD323 (SC-76)
		0.1		5	2.9	25	10		PESD5V0U1BB***	SOD523 (SC-79)
		0.1		5	2.9	25	10		PESD5V0U1BL***	SOD882
1	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	2	0.1		5	2.9	25	10		PESD5V0U2BT***	SOT23
		0.05		24	11	200	23		PESD1CAN	SOT23
		0.01		24	25	230	30	PESD2CAN		
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		PESD3V3L4UW	
		0.025		5	16	30	20		PESD5V0L4UW	
4	4	0.01		5	16		8		IP4043CX5/LF	5 ball CSP
		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
0.025	5		16		35		20	PESD5V0L6UAS	SOT505-1 (TSSOP8)	
7	7	0.025		5	7	35	20		PESD5V0L7BS	SOT96-1 (SO8)
									PESD5V0L7BAS	SOT505-1 (TSSOP8)
16	15	0.01		3	15		15		IP4080CX20/LF	WLCSP

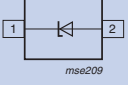
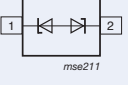
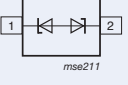
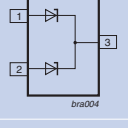
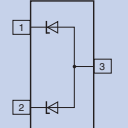
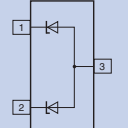
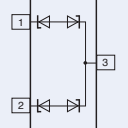
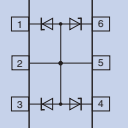
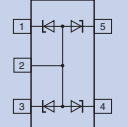
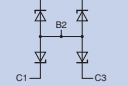
\*8/20 $\mu$ s surge pulse acc. to IEC61000-4-5

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

\*\*\*now sampling

# ESD protection – standard capacitance

## 1 to 18 lines

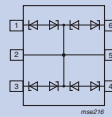
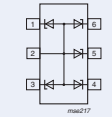
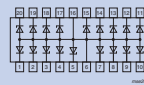
Number of protected lines		I <sub>RM</sub> max. [μA]	V <sub>RWM</sub> [V]	C <sub>line</sub> typ. [pF]	P <sub>PP</sub> * max. [W]	ESD rating** max. [kV]	Configuration	Type	Package						
Uni-directional	Bi-directional														
1		2	3.3	200	150	30		PESD3V3S1UL	SOD882						
		1	5	150	150	30		PESD5V0S1UL							
		0.05	12	38	150	30		PESD12VS1UL							
		0.05	15	32	150	30		PESD15VS1UL							
		0.05	24	23	150	23		PESD24VS1UL							
		2	3.3	207	330	30				PESD3V3S1UB	SOD523 (SC-79)				
		1	5	152	260	30				PESD5V0S1UB					
		0.05	12	38	180	30				PESD12VS1UB					
		0.05	15	32	160	30				PESD15VS1UB					
		0.05	24	23	160	23				PESD24VS1UB					
		1		0.1	5	35				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	1			2	3.3	207	330		30			PESD3V3S2UAT		SOT23	
				1	5	152	260	30	PESD5V0S2UAT						
		0.05	12	38	180	30	PESD12VS2UAT								
		0.05	15	32	160	30	PESD15VS2UAT								
		0.05	24	23	160	23	PESD24VS2UAT								
		3	3.3	200	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							
		2	3.3	207	330	30					PESD3V3S2UT	SOT23			
		1	5.3	152	260	30					PESD5V2S2UT				
		1	12	38	180	30			PESD12VS2UT						
		1	15	32	160	30			PESD15VS2UT						
1	24	23	160	23	PESD24VS2UT										
2		0.1	5	35	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	3	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	30		PESD3V3S4UD							
		0.15	5	158	200	30		PESD5V0S4UD							
		0.01	12	73	200	30		PESD12VS4UD							
		0.01	15	61	200	30		PESD15VS4UD							
		0.01	24	45	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									
	1	3	107		8	BZA956A									
	0.5	4	90		8	BZA962A									
	0.01	4.3	78		8	BZA968A									
	4		0.01	3.3	30		15			IP4042CX5/LF		5 ball CSP			

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

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

# ESD protection – standard capacitance (cont'd)

## 1 to 18 lines

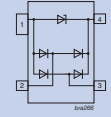
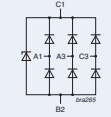
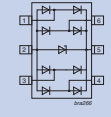
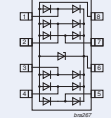
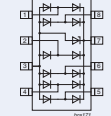
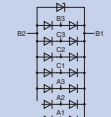
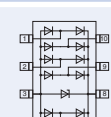
Number of protected lines Uni- directional	Bi- directional	$I_{RM}$ max. [ $\mu$ A]	@	$V_{RWM}$ [V]	$C_{line}$ typ. [pF]	$P_{pp}$ * max. [W]	ESD rating** max. [kV]	Configuration	Type	Package
	4	0.01		5	48		15		BZA408B	SOT457 (SC-74)
5	4	2.2 0.15 0.01 0.01 0.01		3.3 5 12 15 24	215 158 73 61 45	200 200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

\*8/20 $\mu$ s 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. [ $\mu$ A]	@	$V_{RWM}$ [V]	$C_{line}$ typ. [pF]	ESD rating** max. [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	-	overvoltage 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 NXP ISP110x, ISP130x, ISP136x	IP4058CX8/LF	8 ball CSP
	2	33 $\Omega$	35 pF	~5.5 MHz	fully integrated USB 1.0 low / full-speed interface with EMI filter, ESD protection and impedance matching on NXP ISP1110	IP4078CX6/LF	6 ball CSP
	2	-	1.4 pF	~1 GHz	USB2.0 high-speed ESD protection on NXP ISP1504/01 HS transceiver	IP4359CX4/LF	4 ball CSP
	3	-	3 pF	~240 MHz	USB2.0 high-speed ESD protection on NXP 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	4	100 $\Omega$	30 pF	~30 MHz	EMI filter, ESD protection	IP4253CZ12-6	12 pin QFN
	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	(mini) SD/trans flash-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
	9	40 $\Omega$ / 50 k $\Omega$ / 15 k $\Omega$	20 pF	> 52 MHz	(mini) SD-card/trans flash ESD protection, EMI filter, pull-up resistor	IP4352CX24/LF	24 ball CSP
	9	-	-	> 52 MHz	(mini) SD/SDIO memory cardlevel shifter, can be combined with IP4352CX24/LF	IP4852CX24/LF	25 ball CSP
LCD display	4	100 $\Omega$	30 pF	~30 MHz	EMI filter, ESD protection	IP4253CZ8-4	8 pin QFN
	8	100 $\Omega$	30 pF	~30 MHz	EMI filter, ESD protection	IP4253CZ16-8	16 pin QFN
	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
Rail-to-Rail protection	4	-	1pF	~1.5 GHz	ESD protection	PRTR5V0U4Y	SOT363 (SC-88)

\*now sampling

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

## Computing and consumer applications

Interface	Number of lines	Buffer	Level shifter	C <sub>line</sub>	Resistor	Remark	Type	Package
VGA	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	-	-	3 pF	-	> 15 kV contact ESD protection with pi-filter	IP4225CZ10	SOT457 (SC-74)
HDMI	4	-	-	1 pF	-	ESD protection	PRTR5V0U4D	SOT457 (SC-74)
	4	-	-	0.7 pF	-	ESD protection	IP4280CZ10	TSSOP10
	8	-	-	1 pF	-	ESD protection	PRTR5V0U8S	TSSOP10
	8	Yes	Yes	0.7 pF	-	level shifter, ESD protection	IP4776CZ38	TSSOP38
	8	Yes	Yes	0.7 pF	-	I <sup>2</sup> C buffer, level shifter, ESD protection, back drive protection, CEC buffer	IP4778CZ38*	TSSOP38

\* now sampling