

# Safeguard sensitive ICs - Increase battery life - Save space With NXP key products as recommended in this brochure

Interface / Function	Description	Product type	Package	Page
NFC antenna protection	18 / 24 V Bidirectional low capacitance ESD protection diode	PESD18VF1BL PESD24VF1BL PESD18VF1BSF PESD24VF1BSF	DFN1006 DFN1006 DSN0603 DSN0603	10
MIPI CSI / DSI protection	Common Mode Filter with integrated ESD protection	PCMF2DFN1 PCMF3DFN1	DFN2520 DFN4020	11
USB 3.0 / USB 2.0 High-Speed protection	Integrated or discrete solutions with very low line capacitance	IP4369CX4 / IP4303CX4 PRT85V0U2F IP4282CZ6 PUSB3F96 PESD5V0F1BSF	WLCSP DFN1006 DFN1010 DFN2510 DSN0603	13
USB 2.0 OTG protection and EMI filter	Common mode filter for USB2.0	IP3319CX6	WLCSP	12
USB On-The-Go (OTG) protection	Protection of micro-USB ports Vbus protection with $V_{RVM} = 5.5, 12, 15, \text{ or } 30 \text{ V}$	PUSBMxVX4-TL series	DFN1616	13
HDMI interface protection	Very good system protection for high-speed TMDS lines	PUSB3F96	DFN2510	12
SIM Card protection	ESD protection diodes with and without EMI Filtering	IP4064CX8 IP4364CX8 IP4365CX11 IP4366CX8 IP4264CZ8 PESD5V0V4Ux family PESD5V0F5UF PESD5V0F5UV	WLCSP WLCSP WLCSP WLCSP several small SMD and DFN packages	14
SD Card protection	Devices for protection and interface conditioning	IP4340CX15 IP4357CX17 IP4251CZ12 IP4252CZ12	WLCSP WLCSP DFN2514 DFN2514	15
Audio Interface protection (Headset, Speaker, Mic)	Bidirectional ESD protection diode with 12 V reverse standoff voltage	PESD12V1BL	DFN1006	12
Battery protection / Charger interface	Battery MOSFET / MOSFETs in the pass element	PMPB15XP PMDP58UPE PMDPB70XP	DFN2020 DFN2020 DFN2020	16
Surge protection / Charger interface	Transient Voltage Suppressor (TVS) Voltage regulator diode Zener diodes	PTVS12VS1UR PTVS26VS1UR BZX884-C5V6 TDZ5V6J	SOD123W SOD123W DFN1006 SOD323F	16

Interface / Function	Description	Product type	Package	Page
Generic ESD protection in smallest form factors	Various ESD protection diodes for generic and high-speed applications	PESDxSF series PESDxBL / PESDxUL PESDxBLD / PESDxULD	DSN0603 DFN1006 DFN1006 DFN1006D DFN1006D	4, 5
Boost converter for LED backlight	20, 40 V, up to 2 A, low $V_f$ , Schottky rectifiers	PMEGxEPK series	DFN1608D	8
Wireless charging	Very efficient low $R_{DS(on)}$ MOSFETs Very efficient low $V_f$ and $I_s$ Schottky diodes	PMPB12UN PMPB15XN PMDPB85UPE PMPB16XN PMPB40SNA PMPB33XP PMPB48EP PMEGxEPK series PMEGxBELD series	DFN2020 DFN2020 DFN2020 DFN2020 DFN2020 DFN2020 DFN2020 DFN1608D DFN1006D	17
Ultra-small MOSFETs for ▶ Load switches ▶ Battery / Charger switches ▶ DC-DC conversion	12-60 V DFN MOSFETs	PMXB40UNE PMXB65UPE PMDXB950UPE PMDXB900UNE PMXB900UE PMZ290UN PMZ250UN 2N7002BKMB NX3008NBKMB NX3008PBKMB PMZB350UPE PMPB15XP PMDPB70XP PMCB85XP PMDPB58UPE PMPB11EN PMPB20EN	DFN1010 DFN1010 DFN1010 DFN1010 DFN1010 DFN1006 DFN1006 DFN1006 DFN1006 DFN1006 DFN2020 DFN2020 DFN2020 DFN2020 DFN2020 DFN2020 DFN2020	6, 7
Bipolar transistor / MOSFET for ▶ Load switches ▶ Power management ▶ Charger circuits	PNP low $V_{CE(sat)}$ transistor / N-ch. Trench MOSFET combination	PBSM5240PF	DFN2020	9
Bipolar transistors for the Charger path	Low $V_{CE(sat)}$ Transistors	PBSS5330PA PBSS230QA PBSS5330X PBSS5320X PBSS301PD	DFN2020 DFN1010 SOT89 SOT89 SOT457	9



## Discretes for portable devices and mobile handsets

Setting the standard in performance, efficiency, and size

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# NXP: Your one-stop-shop discrete partner for mobile devices

## Looking for solutions to

- ▶ Safeguard sensitive ICs
- ▶ Increase battery life
- ▶ Save space

## Benefit from our experience and speed up time-to-market! We offer:

- ▶ 60 years experience in developing and producing diodes and transistors
- ▶ Long-standing partnerships with every major handset maker in the industry
- ▶ Commitment to highest quality standards and a reliable, efficient supply infrastructure, we are the no. 1 discrete supplier in units
- ▶ One of the most comprehensive discrete portfolio perfectly fitting the needs of mobile device makers with
  - Advanced protection and filtering solutions
  - Highly efficient Schottky diodes, small-signal MOSFETs, and bipolar transistors
  - Next generation package solutions

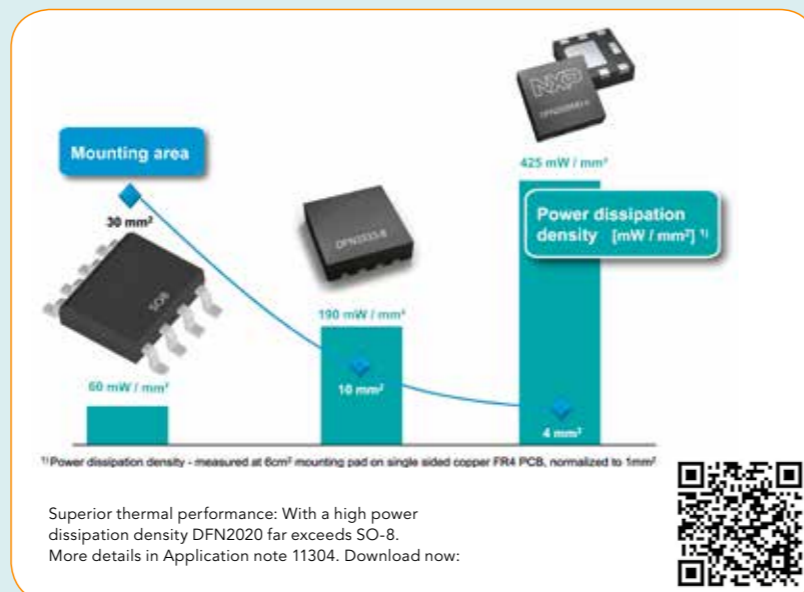
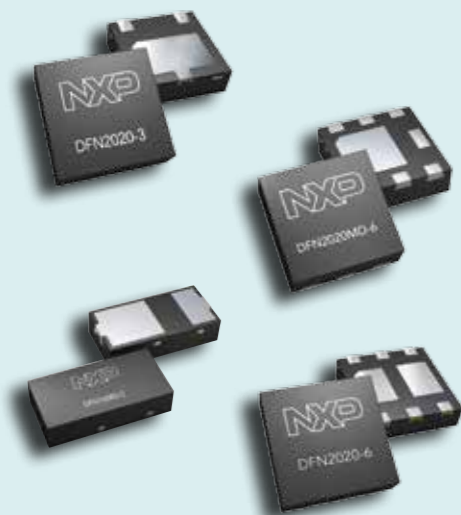
## Choose the solution you need from NXP's broad range of Discrete Flat No-leads (DFN) packages – one of the most extensive in industry

- ▶ More than 30 leadless package options, from 2 to 32 pins
- ▶ From ultra-small 0603 size (0201 inch) to medium power

## Package highlights include

### Packages with heat sink at die pad and dual die pad

- ▶ Thermal excellence, for high power on a small footprint, enabling smaller designs
- ▶ Multiple configurations possible



## An NXP discrete solution for every interface

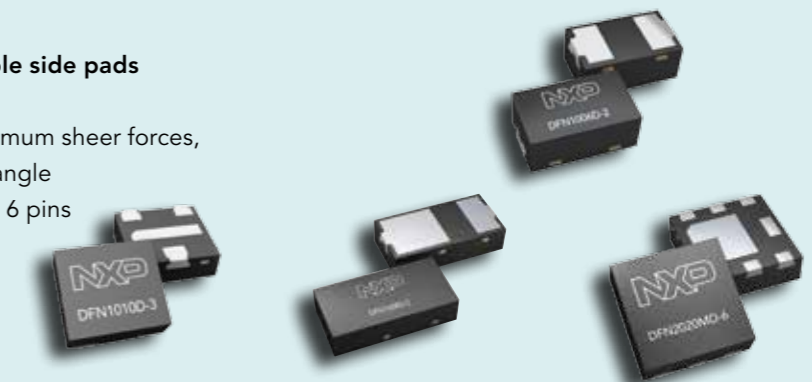


- **NFC Antenna protection**  
Page 10
- **USB2.0, USB3.0, USB OTG with Vbus protection**  
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Page 16
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- **LED backlight boost converter**  
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- **Ultra-small MOS and bipolar transistors for**
  - ▶ Load switches
  - ▶ Charger / battery switches
  - ▶ DC-DC conversion  
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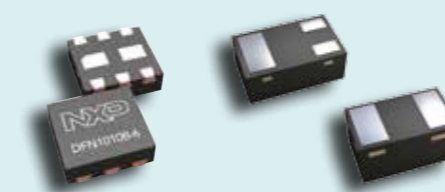
## Package highlights include

### Packages with tin-plated and 100% solderable side pads

- ▶ Enabling visual inspection of solder joints
- ▶ For enhanced robustness, optimized for maximum sheer forces, board bending and reduced package tilting angle
- ▶ Four package options available with 2, 3, and 6 pins



### Largest discrete portfolio in 1 x 1 mm and 1 x 0.6 mm packages, only 0.37 mm high



### Ultra-small DSN0603 package 0.6 x 0.3 mm only 0.3 mm high



Download DFN Package poster



# Best protection in smallest packages – NXP ESD protection solutions in 1006- and 0603- size

## Industry's broadest portfolio of protection diodes in DFN1006(D)-2

As devices are getting smaller and data rates faster, today's electronic circuits are increasingly sensitive to ESD. NXP offers a large portfolio of ESD protection diodes in the leadless ultra-small plastic package DFN1006(D)-2 with the industry standard outline 0603 (0402 inch).

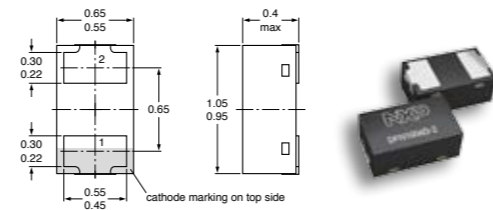
### Key features and benefits:

- ▶ Ultra-small package size of 1 x 0.6 mm and a height of 0.37 mm / 0.5 mm
- ▶ Up to 30 kV ESD robustness according to IEC61000-4-2
- ▶ Up to 15 A peak pulse current for an 8/20  $\mu$ s pulse
- ▶ Ultra low leakage current of 1 nA typical – ideal for battery powered devices
- ▶ Package version with tin-plated, solderable side pads available (DFN1006D-2) (fully compatible to standard leadless 1006, 2-pin packages)

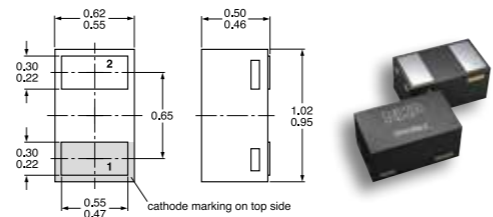
### Portfolio:

- ▶ General purpose devices with high surge rating and ESD robustness and better clamping performance
- ▶ Uni-directional ESD protection diodes for a wide range of max. reverse operating voltages  $V_{RWM}$
- ▶ Bi-directional configuration to cover many applications where AC signals need to be handled or lowest capacitance values are indispensable

DFN1006D-2 Outline



DFN1006-2 Outline



## DSN0603-2 – the smallest available package for protection diodes

NXP continuously extends its protection portfolio in DSN0603-2 (0201 inch) – the ideal fit for protection solutions like data-, speaker- and microphone-line protection or keypad protection in smart phones or tablets, but also for high-speed interface protection.

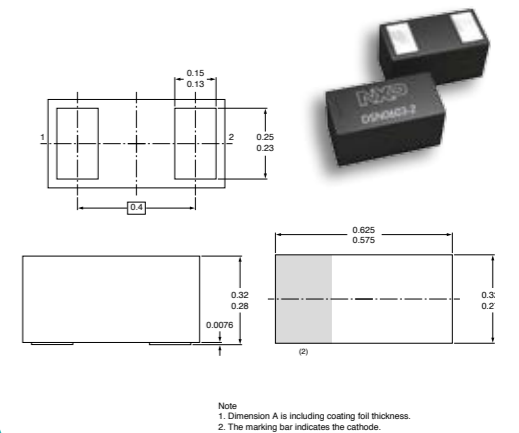
### Key features and benefits:

- ▶ Ultra small package size of 0.6 x 0.3 mm and ultra low package height of only 0.3 mm save PCB space
- ▶ Up to 30 kV ESD robustness according to IEC61000-4-2
- ▶ Up to 8 A peak pulse current for an 8/20  $\mu$ s pulse
- ▶ Ultra low leakage current of 1 nA typical and 0.1  $\mu$ A max. – ideal for battery powered devices
- ▶ Line capacitances down to 0.25 pF

### Highlight product: PESD5V0F1BSF

- ▶ Ultra low line capacitance of 0.25 pF
- ▶ Minimized capacitance variation over voltage
- ▶ High ESD robustness = 10 kV

DSN0603-2 Outline



## Key products:

Bi-directional diodes in DFN1006-2 (SOD882)			
	$C_d$ (typ.) in pF	$V_{RWM}$ in V	$V_{ESD}$ in kV (IEC61000-4-2)
PESD3V3X1BL	1.3	3.3	9
PESD5V0X1BCAL	0.85	5	15
PESD5V0X1BL	0.9	5	9
PESD5V0V1BL	11	5	30
PESD5V0F1BL	0.4	5.5	10
PESD5V0X1BCL	0.49	5.5	8
PESD12VV1BL	17	12	30
PESD18VF1BL	0.4	18	10

Bi-directional diodes in DFN1006D-2 (SOD882D)			
	$C_d$ (typ.) in pF	$V_{RWM}$ in V	$V_{ESD}$ in kV (IEC61000-4-2)
PESD5V0U1BLD	2.9	5	10
PESD5V0V1BLD	11	5	30
PESD5V0S1BLD	35	5	30
PESD5V0F1BLD	0.4	5.5	10

Uni-directional diodes in DFN1006-2 (SOD882)			
	$C_d$ (typ.) in pF	$V_{RWM}$ in V	$V_{ESD}$ in kV (IEC61000-4-2)
PESD3V3U1UL	2.6	3.3	9
PESD3V3L1UL	34	3.3	30
PESD3V3S1UL	207	3.3	30
PESD5V0U1UL	2	5	9
PESD5V0L1UL	25	5	26
PESD9X5.0L	68	5	30
PESD5V0S1UL	152	5	30
PESD9X7.0L	62	7	30
PESD12VS1UL	38	12	30
PESD15VS1UL	32	15	30
PESD16VX1UL	0.83	16	8
PESD24VS1UL	23	24	23
PESD36VS1UL	18	36	30

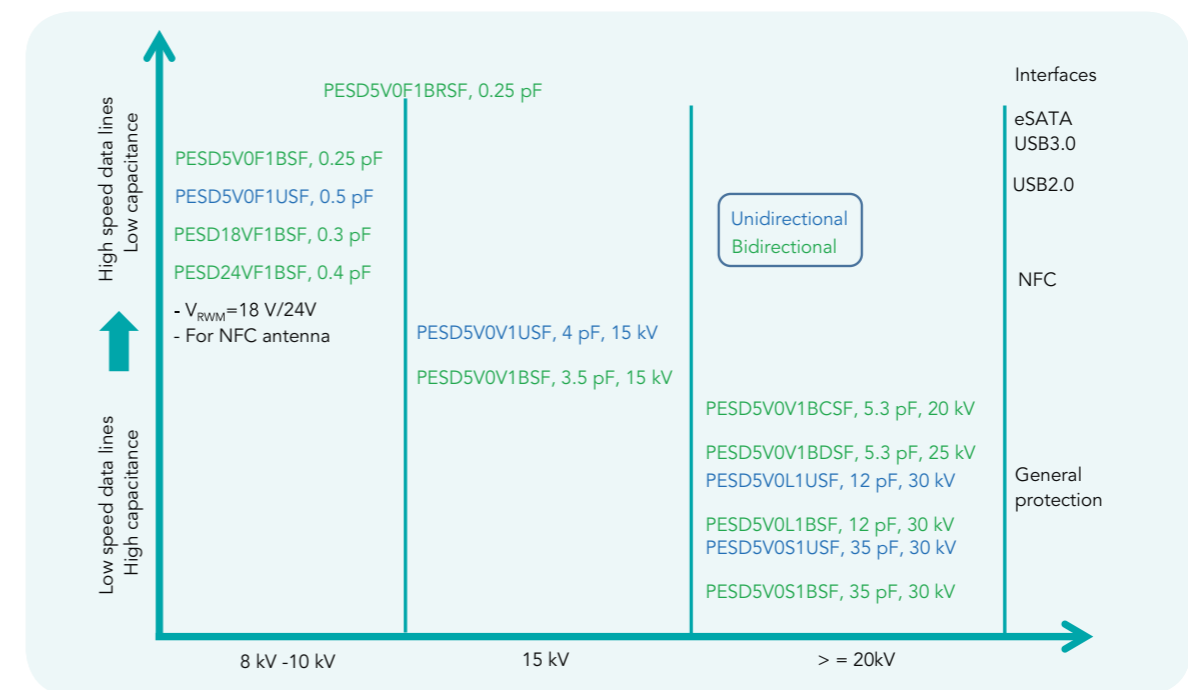
Uni-directional diodes in DFN1006D-2 (SOD882D)			
	$C_d$ (typ.) in pF	$V_{RWM}$ in V	$V_{ESD}$ in kV (IEC61000-4-2)
PESD5V0L1ULD	25	5	26
PESD5V0S1ULD	152	5	30
PESD5V0X1ULD	0.95	5.5	8
PESD5V0X1UALD	1.55	5.5	15
PESD12VS1ULD	38	12	30
PESD15VS1ULD	32	15	30
PESD24VS1ULD	23	24	23

View complete ESD protection portfolio



[www.nxp.com/products/esd\\_emi\\_and\\_signal\\_conditioning/](http://www.nxp.com/products/esd_emi_and_signal_conditioning/)

## More key products:



Visit the DSN0603-2 ESD product information page

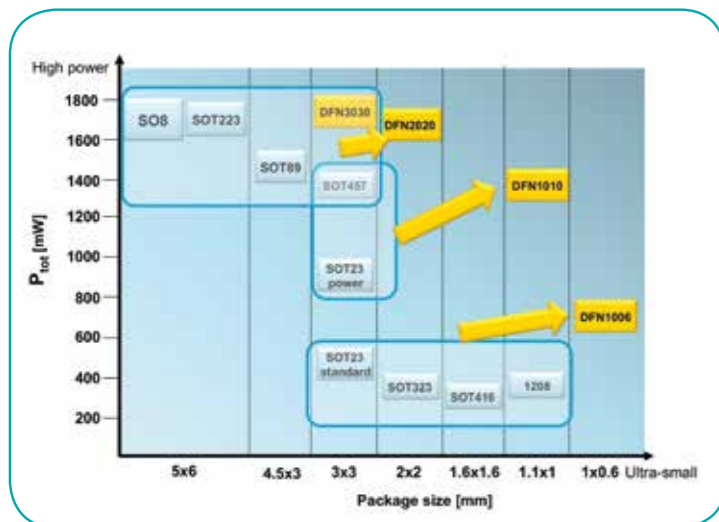


[www.nxp.com/group/11064](http://www.nxp.com/group/11064)



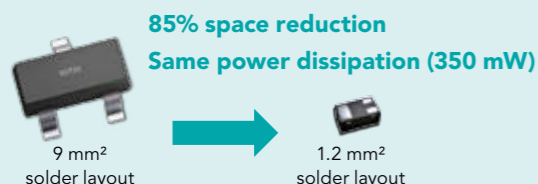
# High performance MOSFETs in small packages – for switching and power conversion

Discover NXP's extensive range of high-performance, low  $R_{DS(on)}$  MOSFETs in small form factors  
 – DFN packages save >50% space at same electrical performance of larger gullwing packages –



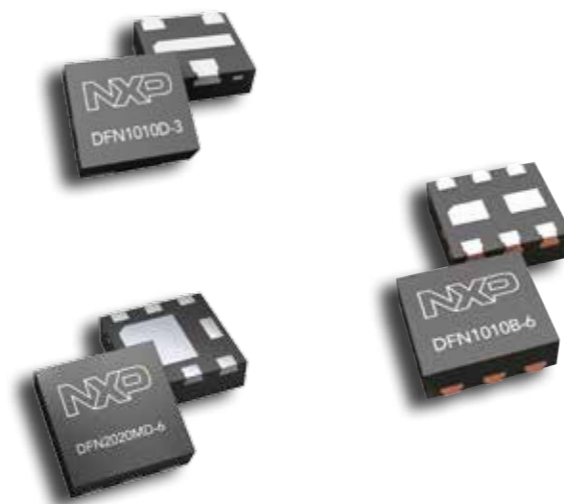
- ▶ **DFN2020MD-6** with 1.7 W power capability replaces larger gullwing packages like SO8, SOT223, SOT89, and SOT457
- ▶ **DFN1010D-3** with 1 W power capability replaces SOT457 and SOT23 low  $R_{DS(on)}$  types on a 85% reduced footprint size
- ▶ **DFN1006** with 0.7 W power capability replaces a large range of standard packages like SOT23, SOT323, SOT416, and “1208-size” (VEMT3, SOT723 ...)

## The Ultimate in Miniaturization: DFN1006(B)-3



### DFN1006(B)-3:

- ▶ 1.0 mm x 0.6 mm, height 0.37 mm (DFN1006(B)-3), 0.5 mm (DFN1006-3)
- ▶ Very low  $R_{ds(on)}$  values of less than 0.65mΩ at 2.5 V
- ▶ Single N- and P-channel MOSFETs
- ▶ ESD-protected devices



### DFN1010D-3 and DFN1010B-6:

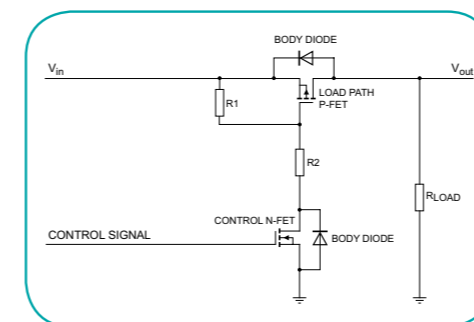
- ▶ 1.1 x 1.0 x 0.37 mm
- ▶ Single die, with heatsink and dual die, with two heatsinks
- ▶ Tin-plated solderable side pads for single package
- ▶ Power dissipation: 1 W (single) and 350 mW (dual)
- ▶  $R_{DS(on)}$  range down to 50 mΩ and ID up to 3A

### DFN2020MD-6 / DFN2020-6:

- ▶ 2.0 x 2.0 x 0.65 mm
- ▶ Single/dual die, with heatsinks
- ▶ Tin-plated solderable side pads for single version
- ▶ Power dissipation: 1.7 W (single) and 1.2 W (dual)
- ▶  $R_{DS(on)}$  range down to 10 mΩ and ID up to 13 A

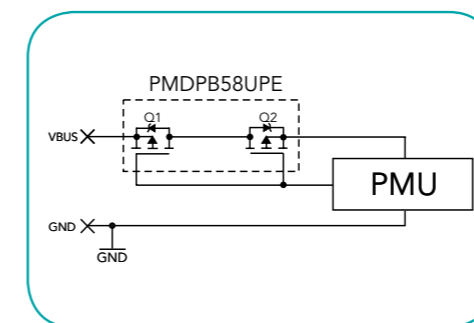
Solutions for very small low-power actuators and low-ohmic switches  
 – DFN MOSFETs in portable applications –

### Key products for load switches in power management units



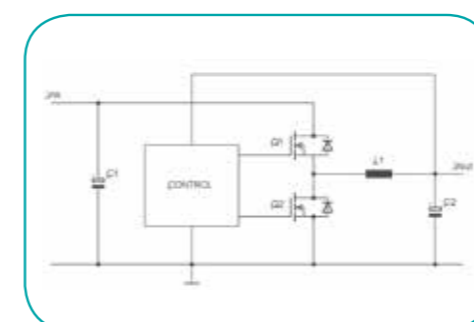
	Polarity	$V_{DS}$ (V)	$R_{DS(on)}$ typ (mΩ)	Package
PMXB40UNE	N	12	40	DFN1010
PMXB65UPE	P	12	65	DFN1010
PMDXB950UPE	Dual P	20	950	DFN1010
PMDXB900UNE	Dual N	20	900	DFN1010
PMXB900UE	Compl.	20	900/950	DFN1010
PMZB290UN	N	20	290	DFN1006
PMZ250UN	N	20	250	DFN1006
2N7002BKMB	N	60	1300	DFN1006
NX3008NBKMB	N	30	1000	DFN1006
NX3008PBKMB	P	30	2800	DFN1006
PMZB350UPE	P	20	330	DFN1006

### Key products for battery switches / charger switches



	Polarity	$V_{DS}$ (V)	$R_{DS(on)}$ typ (mΩ)	Package
PMPB15XP	P	12	15	DFN2020
PMDPB70XP	Dual P	30	70	DFN2020
PMCB5XP	P + RET driver	30	85	DFN2020
PMDPB58UPE	Dual P	20	58	DFN2020

### Key products for DC-DC conversion in Notebooks and Tablets



	Polarity	$V_{DS}$ (V)	$R_{DS(on)}$ typ (mΩ)	Package
PMPB11EN	N	30	12	DFN2020
PMPB20EN	N	30	16.5	DFN2020

More about NXP ultra-small MOSFETs



[www.nxp.com/ultra-small-mosfets](http://www.nxp.com/ultra-small-mosfets)

# Highest efficiency in smallest packages – NXP low loss Schottky diodes and transistors in leadless DFN

## Low $V_F$ Schottky rectifiers in small and flat leadless packages

– Extremely low  $V_F$  with low  $I_R$ , covering a current range of 0.2 – 2 A –

DFN1608D-2 is the smallest package on the market capable of carrying a current of 2 A.

### Key features and benefits:

- ▶ Space saving ultra-small package size with low height (1.6 x 0.8 x 0.37 mm)
- ▶ Low values for  $V_F$  and  $I_R$  – ideal for battery powered devices
- ▶  $I_F$  up to 2 A
- ▶ With tin-plated, solderable side pads
- ▶ AEC-Q101 qualified
- ▶ The best possible protection of the NFC system – made by the global leader for ESD protection and NFC solutions

### Key products in DFN1608D-2:

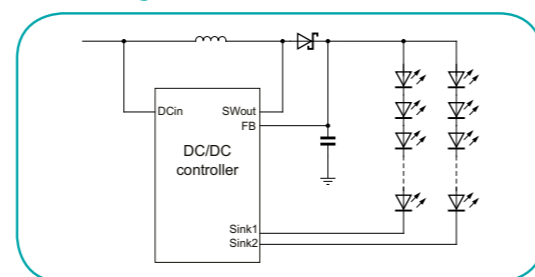
Type number	Optimization	$I_F$ max (A)	$V_F$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_R$ max (mA) @ $V_R$ max
PMEG2005EPK	low $V_F$	0.5	20	410	0.3
PMEG2010EPK	low $V_F$	1	20	415	0.6
PMEG2015EPK	low $V_F$	1.5	20	420	0.9
PMEG2020EPK	low $V_F$	2	20	450	0.9
PMEG4005EPK	low $I_R$	0.5	40	590	0.01
PMEG4010EPK	low $I_R$	1	40	600	0.02
PMEG4015EPK	low $I_R$	1.5	40	610	0.03
PMEG4020EPK	low $I_R$	2	40	660	0.03



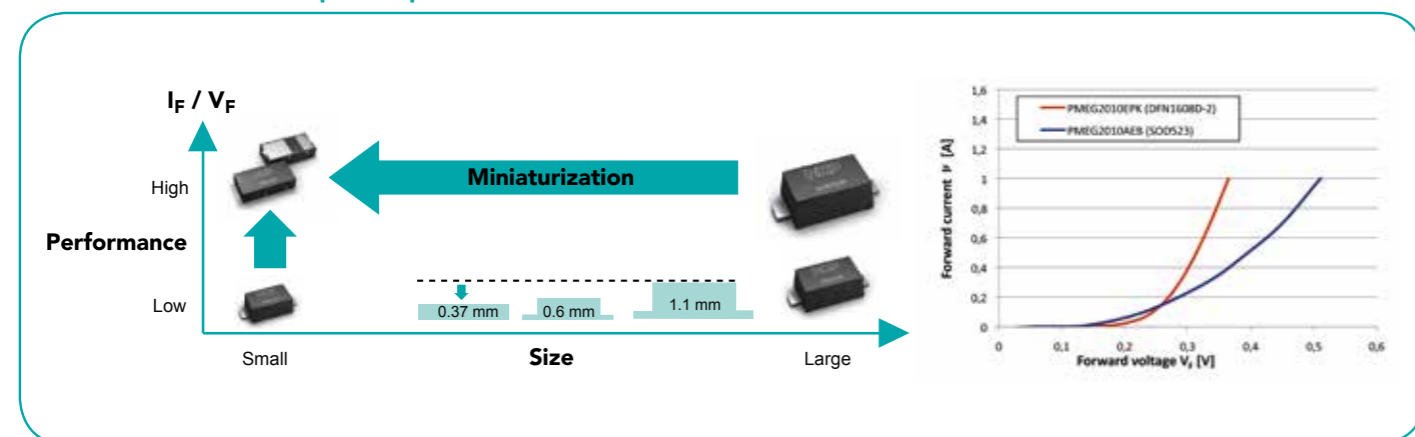
### Application areas:

- ▶ Boost converter for LED backlight and 5 V USB-OTG supply (DC-DC up-conversion)
- ▶ Wireless charging (passive rectification, efficiency enhancement)
- ▶ Logic (low-cost OR gate, AND gate)
- ▶ Power (OR-ring of multiple supply voltage)

### LED backlight boost converter



### DFN1608D-2 combines improved performance with reduced size



### Many more Schottky rectifiers available in ultra-small DFN1006(D)-2 and DSN0603-2



View complete portfolio Low  $V_F$  rectifiers



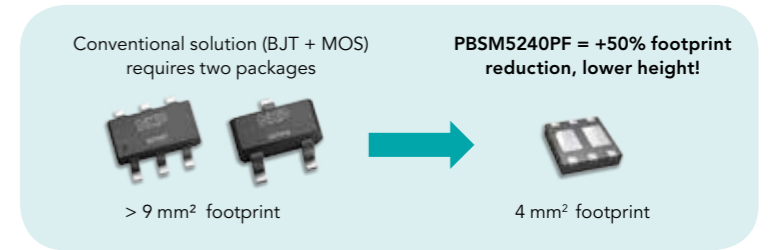
[www.nxp.com/products/diodes/medium\\_power\\_schottky\\_diodes\\_200\\_ma](http://www.nxp.com/products/diodes/medium_power_schottky_diodes_200_ma)

## Low $V_{CEsat}$ Transistors - Keeping power consumption and heat dissipation to a minimum -

### Key product PB5M5240PF: PNP low $V_{CEsat}$ transistor / N-ch. Trench MOSFET combination in DFN2020-6

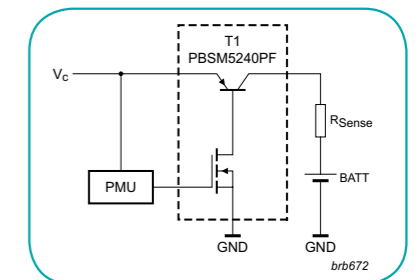
For slim designs and best-in-class thermal performance to support higher currents and longer lifetimes.

- ▶ 25% better thermal performance due to heat sink in DFN2020-6 leading to higher currents and longer lifetimes.
- ▶ Very low collector-emitter saturation voltage  $V_{CEsat}$
- ▶ High collector current capability  $I_C$  and  $I_{CM}$
- ▶ High collector current gain ( $h_{FE}$ ) at high  $I_C$
- ▶ Low-voltage MOSFET driver stage



### Applications

- ▶ Load switches
- ▶ Power management
- ▶ Charging circuits



### Key product BC847QAPN: 45 V, 100 mA general purpose double NPN/PNP in a 1 x 1 mm package

The first double bipolar transistors in DFN1010B-6 offering tremendous package size reduction while keeping the same power density compared to SOT363 or SOT666.



Further single transistors are available in a leadless, ultra small DFN1010D-3 package, the fourth NXP DFN package with visible and solderable sidepads.

### Key products as typically used in the charger path of feature phones and entry level smart phones:

Type number	Package	transistor polarity	$P_{tot}$ [max](mW)	$V_{CE0}$ [max](V)	$I_C$ [max](A)	$V_{CEsat}$ [max](mV)	$R_{CEsat}@I_C$ [max]; $I_C/I_B = 10$ [typ] (mΩ)	$h_{FE}$ [min]	$f_t$ [typ](MHz)
PB5S5330PA	DFN2020-3	PNP	1250	-30	-3	-320	75	280	165
PB5S230QA	DFN1010D-3	PNP	750	-30	-2	-440	170	200	170
PB5S5330X	SOT89	PNP	1600	-30	-3	-320	80	200	100
PB5S5320X	SOT89	PNP	1600	-20	-3	-300	90	220	100
PB5S301PD	SOT457	PNP	2500	-20	-4	-420	50	250	80

View complete portfolio Low  $V_{CEsat}$  transistors



[www.nxp.com/products/bipolar\\_transistors/low\\_vcesat\\_biss\\_transistors](http://www.nxp.com/products/bipolar_transistors/low_vcesat_biss_transistors)

# Protection of Near-Field Communication antenna circuits

## New high-performance, small form factor devices to protect the NFC antenna terminal

Near-Field Communication (NFC) is the breakthrough technology that allows tags in posters, check-in signs, and contactless payment terminals to interact with your mobile phone. The antenna for NFC is integrated into the battery cover or the battery itself in many cases and is connected to the NFC ICs via small contacts on the phone. These contacts are an entry point for ESD strikes which are potentially hazardous to the NFC IC.



### The NXP solution offers:

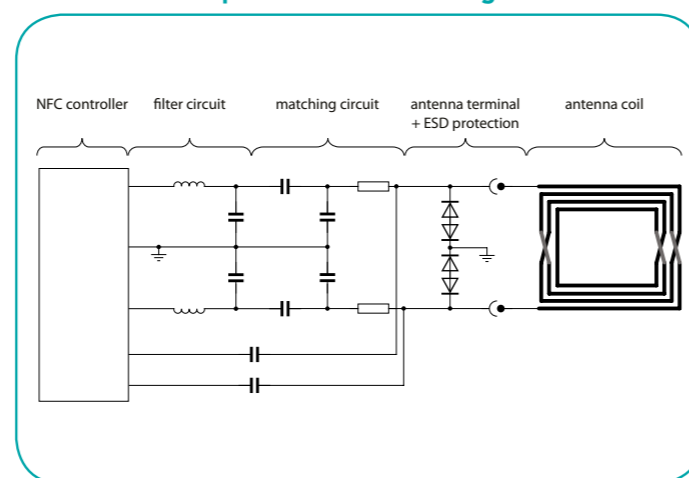
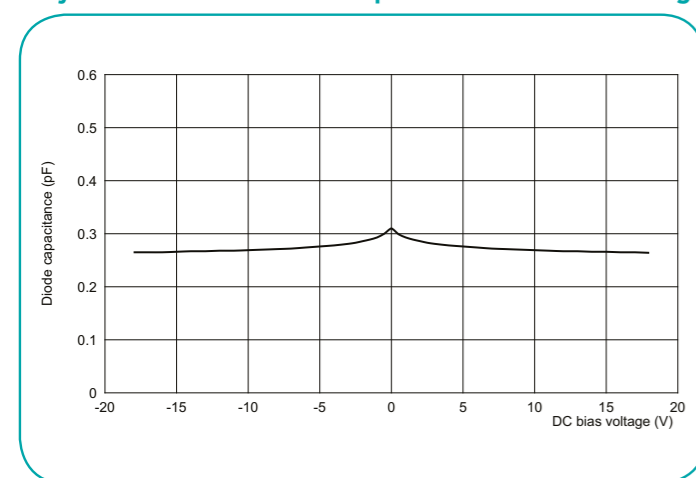
- ▶ Bi-directional configuration, allowing operating voltages up to 18 / 24 V
- ▶ Low capacitance enabling easy design of the antenna matching circuit
- ▶ Very small voltage dependency of the diode capacitance avoiding intermodulation distortion
- ▶ Small form factor packages down to the 0603 (0201 inch) size
- ▶ The best possible protection of NFC systems - from the global leader in ESD protection and NFC

### Key products:

Type number	No. of protected lines	V <sub>RWM</sub> (V)	C <sub>int</sub> typ (pF)	C <sub>int</sub> max (pF)	ESD rating max (kV)	Configuration	Package	Size (mm)
PESD18VF1BL	1	18	0.35	0.50	10	Bi-directional	DFN1006-2	1 x 0.6 x 0.47
PESD18VF1BSF			0.30	0.45			DSN0603-2	0.6 x 0.3 x 0.3
PESD24VF1BL*	1	24	0.4	0.55	10	Bi-directional	DFN1006-2	1 x 0.6 x 0.47
PESD24VF1BSF*							DSN0603-2	0.6 x 0.3 x 0.3

\* In development

## Very small variation of diode capacitance versus bias voltage NFC antenna ESD protection – Circuit diagram



More information about NXP antenna protection



[www.nxp.com/products/esd\\_emi\\_and\\_signal\\_conditioning/application\\_specific\\_esd\\_and\\_esd\\_emi\\_solutions/nfc\\_antenna\\_protection/](http://www.nxp.com/products/esd_emi_and_signal_conditioning/application_specific_esd_and_esd_emi_solutions/nfc_antenna_protection/)

# Common Mode Filter with integrated ESD protection for MIPI CSI, DSI

## New Common Mode Filters:

### Minimizing EMI disturbances, offering strong system protection, outperforming all other solutions

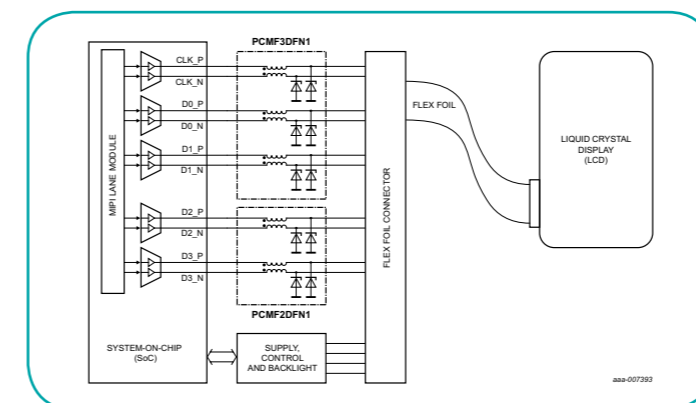
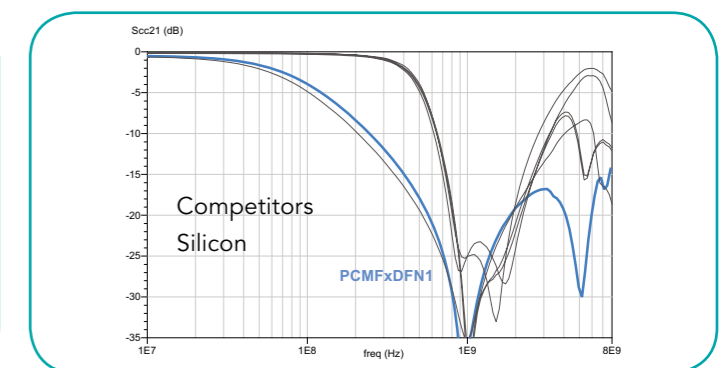
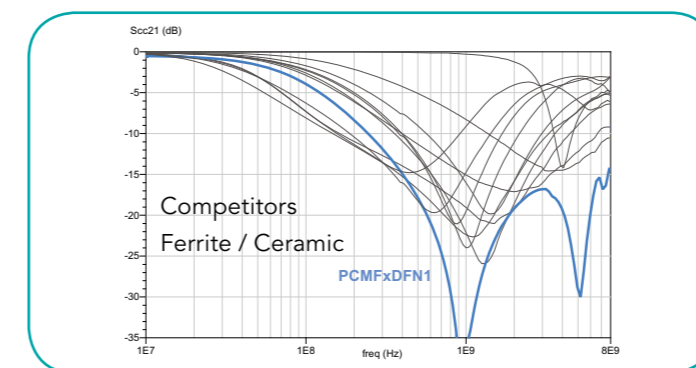
In the world of high-speed differential data lines (e.g. USB, MIPI, HDMI, LVDS), the spectrum of wired data signals overlaps with the frequencies used in wireless transceiver modules like GSM, WIFI, LTE, and Bluetooth. Electromagnetic interference (EMI) is therefore almost unavoidable. Careful system design and additional components can help minimize disturbances caused by EMI. Common mode filters are designed to transmit the desired wire-bound signal without degradation while suppressing the unwanted EMI noise.

### Key products:

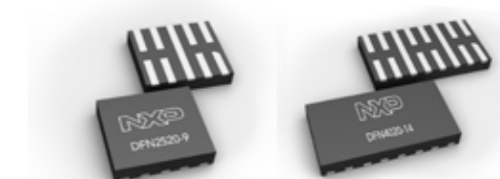
Type name	Number of protected line pairs (uni-directional)	Number of protected line pairs (bi-directional)	Differential Mode 3 dB frequency (typ.)	Common Mode insertion loss 800 MHz - 2.4 GHz (typ.)	C <sub>d</sub> typical	V <sub>RWM</sub>	input ESD rating IEC 61004-2	Channel series resistance	Package / Size (mm)
PCMF2DFN1	2	0	3 GHz	< -24 dB	0.8 pF	5.5 V	15 kV	8 Ohm	DFN2520-9 / 2.5 x 2.0 x 0.5
PCMF3DFN1	3	0							DFN4020-14 / 4.0 x 2.0 x 0.5

- ▶ Industry-leading bandwidth of Common-Mode suppression for minimized EMI-emission and susceptibility saves time-consuming searches for EMI sources
- ▶ High system-level ESD protection due to deep snapback and low dynamic resistance
- ▶ Very thin package: 0.5 mm max. and industry standard footprint
- ▶ Shorter time-to-market due to minimized impact on signal integrity and simplified "out-of-the-box" design

## Common mode suppression : NXP CMF outperform all Ferrite / Ceramic / Silicon solutions



## Using PCMFDFN1 in a MIPI DSI display interface



More information about NXP Common Mode Filters



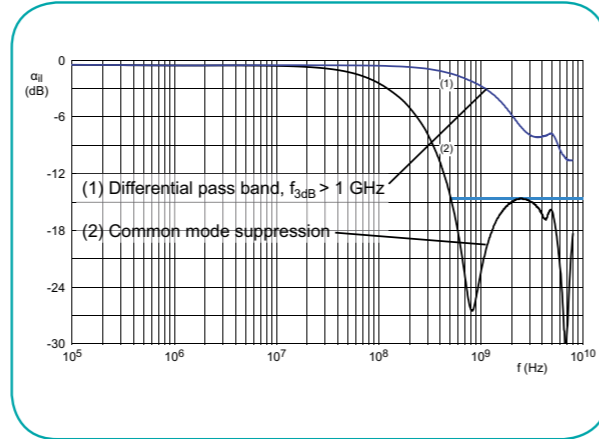
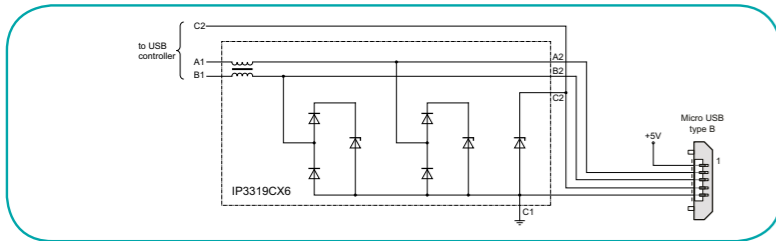
[www.nxp.com/group/11629](http://www.nxp.com/group/11629)



# USB 2.0 OTG protection and EMI filter

## Key product: IP3319CX6

- ▶ Very good Common Mode suppression in the GSM/3G/LTE bands
- ▶ Very good differential mode pass band
- ▶ Excellent SoC protection against ESD pulses
- ▶ Package details: WLCSP, 1.34 x 0.95 x 0.57 mm<sup>3</sup>



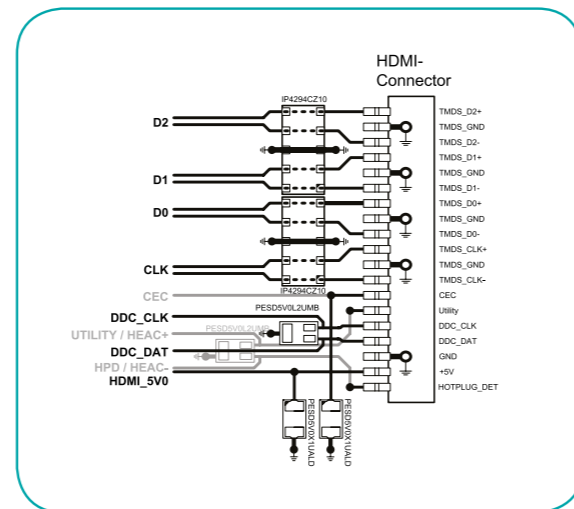
# HDMI interface protection

## Key product: PUSB3F96

This device offers best protection for the various signals of the HDMI interface and allows a very flexible layout. For the high-speed TMDS lines PUSB3F96 offers superior system protection with very small capacitance on each signal line. The lower-speed communication interface can be protected by dedicated single and dual protection devices that match the electrical requirements.

### Features

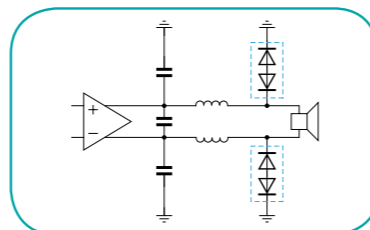
- ▶ ESD protection of ±10 kV according to IEC 61000-4-2, level 4 for all TMDS lines
- ▶ TMDS lines with ≤ 0.05 pF matching capacitance between TMDS pairs
- ▶ Line capacitance of only 0.5 pF for each differential channel



# Audio interface protection (Speaker, Mic, Headset)

## Key product: PESD12VV1BL in ultra-small DFN1006-2

- ▶ Bi-directional ESD protection diode with 12 V reverse standoff voltage
- ▶ Low capacitance of 17 pF (typ.)
- ▶ Ideal for protecting speaker lines in portable devices, particularly active boost drivers with high output voltages



# High-Speed USB protection

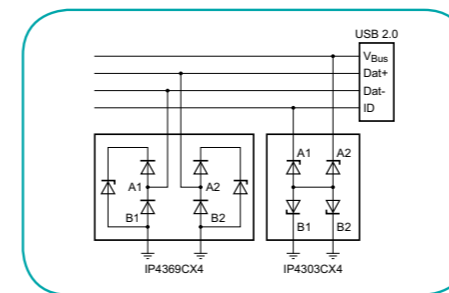
## USB 3.0 and USB 2.0 High-Speed (HS) devices: Choose from integrated or discrete solutions

ESD protection devices supporting this standard require very low line capacitance and allows no series resistors in the data lines. Available in CSP, leadless or plastic packages, NXP offers highly integrated solutions deliver high robustness against ESD pulses and are easy to route as well as discrete, very flexible and ultra-small solutions.

### Key products:

#### IP4369CX4 / IP4303CX4

- ▶ Superior ESD and RF performance
- ▶ Very small footprint (WLCSP)
- ▶ 0.8 pF line capacitance

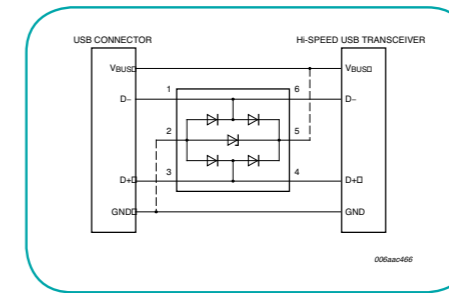


#### PUSB3F96

- ▶ Industry's best overall protection for USB 3.0 system chips
- ▶ Extremely low channel capacitance: 0.5 pF (typ)
- ▶ Very low dynamic resistance (less than 0.4 Ω) for both polarities
- ▶ RF-optimized DFN2510A-10 (SOT1176) package (1 x 2.5 x 0.5 mm)

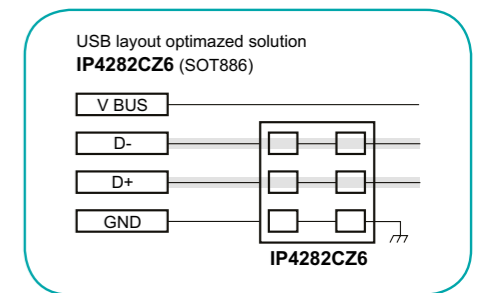
#### PRTR5V0U2F

- ▶ Small plastic package DFN1006-3
- ▶ Simple "pass-thru" routing
- ▶ AEC-Q101 qualified
- ▶ 1.0 pF line capacitance



#### IP4282CZ6

- ▶ Small plastic package
- ▶ Simple "pass-thru" routing
- ▶ 0.7 pF line capacitance



#### PESD5V0F1BSF

- ▶ Flexible layout options
- ▶ Extremely low diode capacitance: 0.25 pF (typ)
- ▶ Ultra-small DSN0603-2 package (0.6 x 0.3 x 0.3 mm)



# USB On-The-Go (OTG) protection

## Key product: PUSBMxVX4-TL series - ideally suited for the protection of micro-USB ports

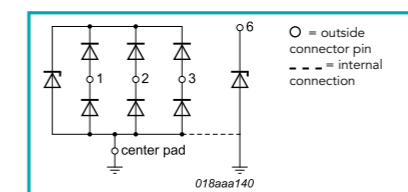
- ▶ Vbus protection with V<sub>RWM</sub> = 5.5, 12, 15 or 30 V, suitable for a range of charging applications
- ▶ 1.6 x 1.6 mm leadless DFN1616-6 package, space saving, industry-standard footprint, easy to place
- ▶ 1.1 pF low capacitance ESD protection structure for USB D+, D- and ID
- ▶ Ultra-low-clamping ESD protection
- ▶ Complies with the YT/D 1591-2006 / 2009 standard (China) and GSMA / OMTP Universal Charging Solution (UCS)



### V<sub>bus</sub> working voltages of the PUSBM series

PUSBM5VX4-TL	↔	V <sub>RWM</sub> of 5.5 V for V <sub>bus</sub>
PUSBM12VX4-TL	↔	V <sub>RWM</sub> of 12 V for V <sub>bus</sub>
PUSBM15VX4-TL	↔	V <sub>RWM</sub> of 15 V for V <sub>bus</sub>
PUSBM30VX4-TL	↔	V <sub>RWM</sub> of 30 V for V <sub>bus</sub>

### Equivalent circuit of the complete PUSBM device



Read more about NXP Circuit protection



www.nxp.com/circuit-protection

# SIM card interface – ESD protection and EMI filter

Choose one of the many devices that offer three digital lines and an additional protection for the supply rail

**Key products: IP4064CX8/LF, IP4364CX8/LF, IP4264CX8-20, IP4264CZ8-40**

- ▶ 3-channel SIM card interface integrated RC-filter array
- ▶ Integrated 100 Ω/100 Ω/47 Ω series channel resistors
- ▶ Suppression of all 2G and 3G mobile phone frequencies
- ▶ Downstream ESD protection up to ±15 kV (contact), exceeding IEC 61000-4-2, level 4 for ultra-robust ESD protection with low clamping voltage
- ▶ Available in leadless and wafer-level chip-scale packages with 0.5 or 0.4 mm pitch, simplifying design and saving space

**Key product for SIM card protection with USB connection pins: IP4365CX11**

- ▶ Offering exceptional EMI filtering and ESD protection while adding additional connector pins for use with USB
- ▶ 3-channel SIM card interface integrated RC-filter array
- ▶ Additional protection diodes for internal USB connection protection
- ▶ Integrated 100 Ω/100 Ω/47 Ω series channel resistors integrated
- ▶ Downstream ESD protection up to ±15 kV (contact), exceeding IEC 61000-4-2, level 4
- ▶ Wafer-level chip-scale package with 0.4 mm pitch to simplify design and save space

## Product details

Type number	C <sub>line</sub> (pF)	Pitch (mm)	Package	Size (mm)
IP4064CX8	<20 pF	0.5 mm	CSP	1.41 x 1.41 mm
IP4364CX8	<20 pF	0.4 mm	CSP	1.16 x 1.16 mm
IP4365CX11	<10 pF	0.4 mm	CSP	1.16 x 1.56 mm
IP4366CX8	<10 pF	0.4 mm	CSP	1.16 x 1.16 mm
IP4264CZ8	10 pF / 40 pF	0.4 mm	Plastic	1.35 x 1.75 mm

## Key products for alternative ESD protection without EMI Filtering

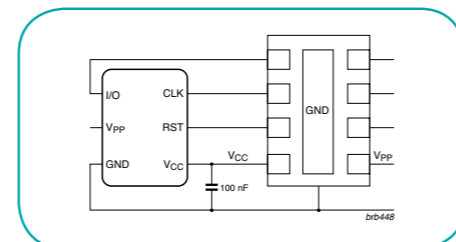
### PESD5V0V4Ux product family

- ▶ Unidirectional quadruple ESD protection diode arrays
- ▶ Small SMD plastic packages and DFN plastic packages
- ▶ Line capacitance of 12 pF / 15 pF (typ.)

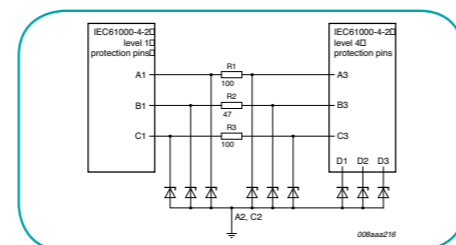
### PESD5V0F5UF and PESD5V0F5UV

- ▶ Unidirectional fivefold ESD protection array
- ▶ Small DFN1006-3, DFN1410-6 and SOT666 plastic packages
- ▶ Femtofarad line capacitance of 0.55 pF (typ.)
- ▶ AEC-Q101 qualified

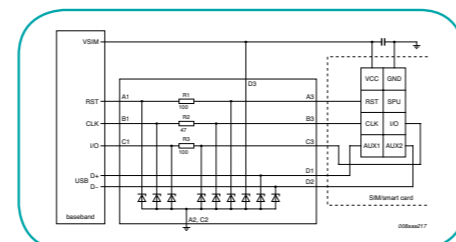
### IP4264CZ8 – SIM Application



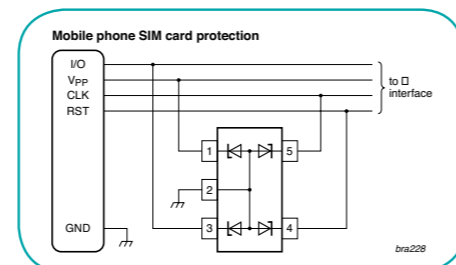
### IP4365CX11 – SIM Application



### IP4264CZ8 – USIM Application



### PESD5V0V4Ux – SIM Application



More details about NXP SIM and SD card solutions



# SD card interface – ESD protection and EMI filter

Integrated, small-sized solutions to protect SD- and micro SD-cards

SD-memory card communication is based on an 8-/9-pin interface (clock, command, 1- or 4-bit data and 2/3 power/GND lines).

Strict EMI regulations and system requirements – as specified for mobile phones – demand filters that reduce the radiated and/or conducted EMI, but which still comply with the electrical requirements of the interface specification. The continuing trend in miniaturization of portable appliances implies that interface devices offering ESD protection and EMI filtering should also, where possible, integrate biasing circuits or resistors into a single, small-sized package.

**NXP's SD-memory card interface conditioning devices fully support this continuing trend and offer interface conditioning functions such as:**

- ▶ High-level ESD protection according the IEC61000-4-2 standard, often exceeding the highest level 4 specification
- ▶ EMI filtering, suppressing unwanted RF, in combination with SD interface compliant physical signaling
- ▶ Integrated biasing resistor networks to reduce component count and to free up additional space on the PCB

## Key product:

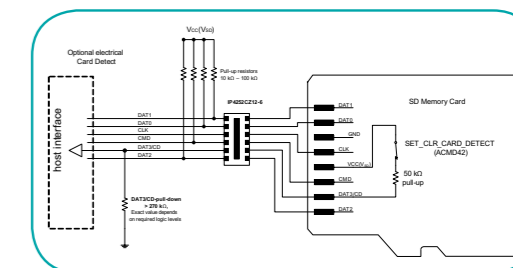
### IP4340CX15

- ▶ Provides EMI filtering and ESD protection for six channels of an SD card interface
- ▶ Pull-up resistors for the data lines already integrated to reduce the PCB area and application size
- ▶ 1.56 x 1.56 mm wafer-level chip-scale package (WLCSF), fabricated using monolithic silicon semiconductor technology
- ▶ At the connector side terminals, the ESD protection exceeds 15 kV acc. to IEC 61000-4-2 test condition

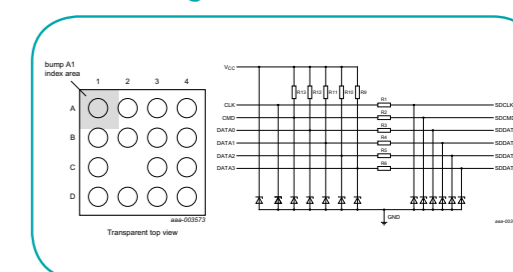
## Further products:

Type number	Application	Feature	3 dB frequency (MHz)	Package	Size (mm)
IP4340CX15	SD3.0 and 2.0	Small SD3.0 solution	~ 450	WLCSF15	1.56 x 1.56 x 0.5 mm
IP4357CX17	SD 2.0	High attenuation at 800 MHz	~ 190	WLCSF17	1.1 x 2.4 x 0.61 mm
IP4251CZ12-6-TTL	SD 2.0	High attenuation at 800 MHz	~ 300	DFN2514-12 (SOT1167)	2.5 x 1.35 x 0.53 mm
IP4252CZ12-6-TTL	SD 2.0	Low pass band insertion loss	~ 300	DFN2514-12 (SOT1167)	2.5 x 1.35 x 0.53 mm

### IP4252CZ16 – Application diagram



### IP4340CX15 – Pin configuration and schematic diagram



Download Application Note on SD(HD)-memory card and MMC interface cond.





# Charger interfaces

## Low $R_{DSon}$ is key

In the conventional charger circuit, a 'battery MOSFET' is used to disconnect the battery, e.g. in case of temperature violation, excessive (dis-)charge currents or over-/under-voltage conditions. A low  $R_{DSon}$  value is important in this MOSFET to minimize losses.

### Key product: PMPB15XP – 12 V single P-ch MOSFET

- ▶ Very low  $R_{DSon}$  of 15 mΩ at VGS = 4.5 V
- ▶ Housed in a 0.65 mm flat, small 2 x 2 mm DFN2020MD-6 package with tin-plated solderable side pads

MOSFETs are also used in the pass element of chargers, which isolates the USB Vbus line from the internal supply ("USB OTG Vbus protection"). Here, a double MOSFET in back-to-back configuration can be used.

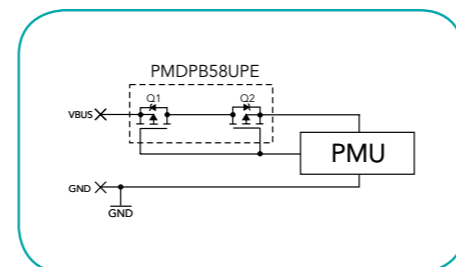
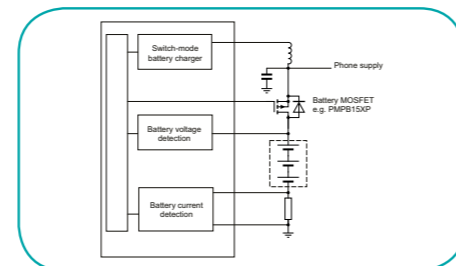
### Key products in DFN2020-6 (SOT1118) a 0.65 mm flat, 2 x 2 mm leadless package

- ▶ Offering best-in-class thermal performance due to extra heat sink

### PMDP58UPE – Dual P-ch ESD protected MOSFET

- ▶ ESD protected MOSFET of > 2 kV HBM
- ▶ Very low  $R_{DSon}$  of <58 mΩ at VGS = 4.5 V
- ▶ 1.8 V  $R_{DSon}$  rating for operation at low voltage gate drive levels

## Battery MOSFET in smart phones



### PMDPB70XP – 30 V Dual P-ch MOSFET

- ▶ Very low  $R_{DSon}$  of 70 mΩ at VGS = 4.5 V

# Surge protection in Charger interfaces

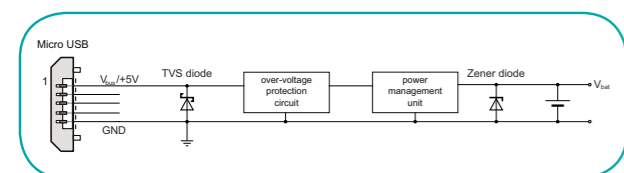
## Protect the battery with strong TVS and Zener diodes

Smart phones with large displays usually come with high capacitance batteries to provide sufficient operating time for the user. For a reasonable charging time, these phones typically use dedicated charger ICs in combination with over-voltage protection circuits. While these circuits can disconnect the battery in case of a permanent over-voltage condition, they can be sensitive to surge events. To protect against this, a TVS diode is placed at the Vbus line of the USB connector. In addition, a Zener or ESD protection diode can be placed in parallel to the battery to protect it against short duration over-voltage spikes.



### Key products:

- ▶ PTVS12VS1UR, 12 V, 400 W unidirectional Transient Voltage Suppressor (TVS) in a SOD123W FlatPower package (2.6 x 1.7 x 1 mm)
- ▶ PTVS26VS1UR, 16 V, 400 W unidirectional Transient Voltage Suppressor (TVS) in a SOD123W FlatPower package (2.6 x 1.7 x 1 mm)
- ▶ BZX884-C5V6, 16 V, Low-power voltage regulator diode in an ultra small DFN1006-2 plastic package
- ▶ TDZ5V6J: 5.6 V General-purpose Zener diode in a SOD323F very small and flat lead plastic package



Download application note about how to protect a mobile device charger



[www.nxp.com/documents/application\\_note/AN10910.pdf](http://www.nxp.com/documents/application_note/AN10910.pdf)

# Wireless charging

## Free the phone from the cable, allow simpler charging

### – With highly efficient small-sized MOSFETs and Schottky rectifiers –

Today's smart phones tend to provide limited operating time. Wireless charging is highly convenient and straightforward: just place the phone on a charger pad integrated into a desk or work surface (e.g. in the office, at home, or in a coffee shop).

In the charger pad MOSFETs drive a current through the windings of a copper coil to transmit inductive energy to the phone. In the phone itself either dedicated integrated circuits or MOSFETs are used for synchronous rectification behind the receiver coil. Additional Schottky diodes can enhance the efficiency of the rectifier.

## Multi-Standard wireless charging pad



### Key products:

#### Very efficient low $R_{DSon}$ MOSFETs in a 2 x 2 mm DFN2020 package with tin-plated solderable side pads

Type number	Polarity and configuration	$V_{DS}$ (V)	$R_{DSon}$ typ (mΩ) @ $V_{GS} = 4.5$ V	Package
PMPB12UN	N-ch, single	20	12	DFN2020MD-6
PMPB15XN	N-ch, single	20	15	DFN2020MD-6
PMDPB85UPE	N-ch, dual, ESD protected	20	85	DFN2020-6
PMPB16XN	N-ch, single	30	16	DFN2020MD-6
PMPB40SNA	N-ch, single	60	40	DFN2020MD-6
PMPB33XP	P-ch, single	20	33	DFN2020MD-6
PMPB48EP	P-ch, single	30	43	DFN2020MD-6

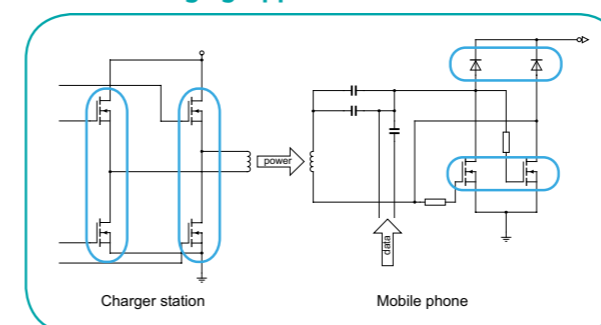


#### Very efficient low $V_F$ and $I_R$ Schottky diodes in ultra small packages with tin-plated solderable side pads

Type number	$I_F$ max (A)	$V_R$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_R$ max (mA) @ $V_R$ max	Optimization	Package
PMEG2005EPK	0.5	20	410	0.3	low $V_F$	DFN1608D-2
PMEG2010EPK	1	20	415	0.6	low $V_F$	DFN1608D-2
PMEG2015EPK	1.5	20	420	0.9	low $V_F$	DFN1608D-2
PMEG2020EPK	2	20	450	0.9	low $V_F$	DFN1608D-2
PMEG4005EPK	0.5	40	590	0.01	low $I_R$	DFN1608D-2
PMEG4010EPK	1	40	600	0.02	low $I_R$	DFN1608D-2
PMEG4015EPK	1.5	40	610	0.03	low $I_R$	DFN1608D-2
PMEG4020EPK	2	40	660	0.03	low $I_R$	DFN1608D-2
PMEG2010BELD	1	20	490	0.2	low $V_F$	DFN1006D-2
PMEG3005BELD	0.5	30	500	0.5	low $V_F$	DFN1006D-2



## Wireless Charging Application



Read more about Wireless Charging of Mobile Devices



[www.nxp.com/news/whats-cooking-in-rd/wireless-charging.html](http://www.nxp.com/news/whats-cooking-in-rd/wireless-charging.html)



# Our extensive Discrete Flat No-leads portfolio

Ultra small

Medium power



DSN0603-2\*  
(SOD962)  
0.6 x 0.3 x 0.3



DFN1006D-2  
(SOD882D)  
1.0 x 0.6 x 0.37



DFN1006B-3  
(SOT883B)  
1.0 x 0.6 x 0.37



DFN1006-3  
(SOT883)  
1.0 x 0.6 x 0.48



DFN1006-2  
(SOD882)  
1.0 x 0.6 x 0.48



DFN1010D-3  
(SOT1215)  
1.1 x 1.0 x 0.37



DFN1608D-2  
(SOT1608)  
1.6 x 0.8 x 0.37



DFN2020-3  
(SOT1061)  
2.0 x 2.0 x 0.62

2 - 3 Pins



DFN1010E-6  
(SOT1202)  
1.0 x 1.0 x 0.33



DFN1010B-6  
(SOT1216)  
1.0 x 1.0 x 0.37



DFN1010-6  
(SOT891)  
1.0 x 1.0 x 0.48



DFN1010C-4  
(SOT1194)  
1.0 x 1.0 x 0.52



DFN1410-6  
(SOT886)  
1.45 x 1.0 x 0.48



DFN1616-6  
(SOT1189)  
1.6 x 1.6 x 0.48



DFN2020-6  
(SOT1118)  
2.0 x 2.0 x 0.62



DFN2020MD-6  
(SOT1220)  
2.0 x 2.0 x 0.62

4 - 6 Pins



DFN1712-8  
(SOT1157)  
1.7 x 1.2 x 0.48



DFN1714U-8  
(SOT983)  
1.7 x 1.35 x 0.48



DFN1714-8  
(SOT1166)  
1.7 x 1.35 x 0.52



DFN2110-9  
(SOT1178)  
2.1 x 1.0 x 0.48



DFN2510A-10  
(SOT1176)  
2.5 x 1.0 x 0.48



DFN2520-9  
(SOT1333)  
2.5 x 2.0 x 0.48



DFN2626-10  
(SOT1197)  
2.6 x 2.6 x 0.48



DFN3333-8  
(SOT823-1)  
3.3 x 3.3 x 1.0

8 - 10 Pins



DFN2512-12  
(SOT1158)  
2.5 x 1.2 x 0.48



DFN2514U-12  
(SOT984)  
2.5 x 1.35 x 0.48



DFN2514-12  
(SOT1167)  
2.5 x 1.35 x 0.53



DFN3312-16  
(SOT1159)  
3.3 x 1.2 x 0.48



DFN3314U-16  
(SOT985)  
3.3 x 1.35 x 0.48



DFN3314-16  
(SOT1168)  
3.3 x 1.35 x 0.53



DFN5050-32  
(SOT617)  
5.0 x 5.0 x 1.0

12 - 32 Pins

## The largest supplier of discrete leadless packages



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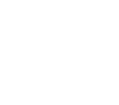
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