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# Discrete semiconductors selection guide 2016

Bipolar transistors, diodes, ESD protection, TVS, filtering and signal conditioning, and MOSFETs



# Our extensive package range provides maximum flexibility

	Miniaturization										Medium Power					
2 Pins	 DSN0402 (SOD992) 0.4 x 0.2 x 0.12	 DSN0603-2 (SOD962) 0.6 x 0.3 x 0.3	 DSN1006-2 (SOD993) 1.0 x 0.6 x 0.3	 DSN1006U-2 (SOD995) 1.0 x 0.6 x 0.3	 DFN1006D-2 (SOD882D) 1.0 x 0.6 x 0.37	 DFN1006-2 (SOD882) 1.0 x 0.6 x 0.48	 SOD523 1.2 x 0.8 x 0.6	 DFN1608D-2 (SOD1608) 1.6 x 0.8 x 0.37	 DSN1608-2 (SOD963/SOD964) 1.6 x 0.8 x 0.25/0.29	 SOD323F 1.7 x 1.25 x 0.7	 SOD323 1.7 x 1.25 x 0.95	 SOD123F 2.6 x 1.6 x 1.1	 CFP3 (SOD123W) 2.6 x 1.7 x 1.0	 CFP5 (SOD128) 3.8 x 2.6 x 1.0	 CFP15 (SOT1289) 5.8 x 4.3 x 0.78	 D2PAK (SOT404) 11.0 x 10.0 x 4.3
3 Pins	 DFN1006B-3 (SOT883B) 1.0 x 0.6 x 0.37	 DFN1006-3 (SOT883) 1.0 x 0.6 x 0.48	 DFN1010D-3 (SOT1215) 1.1 x 1.0 x 0.37	 SOT663 1.6 x 1.2 x 0.55	 SOT323 2.0 x 1.25 x 0.95	 SOT23 2.9 x 1.3 x 1.0	 DFN2020-3 (SOT1061) 2.0 x 2.0 x 0.62	 DFN2020D-3 (SOT1061D) 2.0 x 2.0 x 0.62	 SOT89 4.5 x 2.5 x 1.5	 DPAK (SOT428) 6.6 x 6.1 x 2.3						
4/5 Pins	 WLCSP4* 0.8 x 0.8 x 0.35	 WLCSP5* 1.51 x 1.14 x 0.65	 SOT665 1.6 x 1.2 x 0.55	 SOT353 2.0 x 1.25 x 0.95	 SOT143B 2.9 x 1.3 x 1.0	 LFAK56 (SOT669) 5.0 x 6.0 x 1.0	 SOT223 6.5 x 3.5 x 1.65									
6 Pins	 DFN1010B-6 (SOT1216) 1.1 x 1.0 x 0.37	 DFN1010-6 (SOT891) 1.0 x 1.0 x 0.48	 DFN1410-6 (SOT886) 1.45 x 1.0 x 0.48	 WLCSP6 1.48 x 0.98 x 0.35	 SOT666 1.6 x 1.2 x 0.55	 SOT363 2.0 x 1.25 x 0.95	 DFN2020-6 (SOT1118) 2.0 x 2.0 x 0.62	 DFN2020D-6 (SOT1118D) 2.0 x 2.0 x 0.62	 DFN2020MD-6 (SOT1220) 2.0 x 2.0 x 0.62	 SOT457 2.9 x 1.5 x 1.0						
≥ 7 Pins	 DFN2110-9 (SOT1178) 2.1 x 1.0 x 0.48	 DFN2111-7 (SOT1358) 2.1 x 1.1 x 0.5	 DFN2510A-10 (SOT1176) 2.5 x 1.0 x 0.48	 DFN2520-9 (SOT1333) 2.5 x 2.0 x 0.48	 DFN2521-12 (SOT1156-1) 2.5 x 2.1 x 0.5	 LFAK33 (SOT1210) 3.3 x 3.3 x 0.85	 DFN4020-14 (SOT1334) 4.0 x 2.0 x 0.48	 DFN4040-32 (SOT1318-1) 4.0 x 4.0 x 0.5	 DFN5050-32 (SOT617-3) 5.0 x 5.0 x 0.85	 LFAK56D (SOT1205) 5.0 x 6.0 x 1.0						

\* The exact position of the balls and package dimensions vary.

Your global partner for discretes



# Discretes semiconductors selection guide 2016

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transistors**

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# Our commitment: quality and reliability

## AEC-Q101

- ▶ We qualify our products according to the automotive AEC-Q101 standard and even exceed it's requirements, for instance when doing extended lifetime testing.



- ▶ All our processes and manufacturing plants are subject to regular international and internal audits, including the following:
  - ▶ ISO9001
  - ▶ ISO/TS 16949 for automotive sites
  - ▶ ISO14001
  - ▶ OHSAS18001

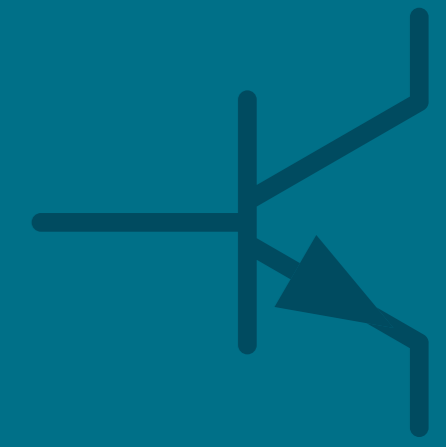


- ▶ NXP's Design for Excellence (DfX) program ensures that each new development builds on past learning and that best practices are always employed. The result is continual product improvement.



- ▶ Zero defect is our goal. To ensure continuous improvement failure analysis and the determination to find root causes is performed at all stages of development and production by adoption of quality-analysis tools and methods (e.g. Six-Sigma, Safe-Launch).

Rigorous attention to detail and commitment to quality have yielded a very low product failure rate of a single-digit part per billion (ppb).



## Bipolar transistors

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# Bipolar transistors portfolio

What you get when you choose NXP for bipolar transistors

## A comprehensive portfolio for all applications

Best in class performing transistors from general-purpose to low  $V_{CEsat}$  transistors

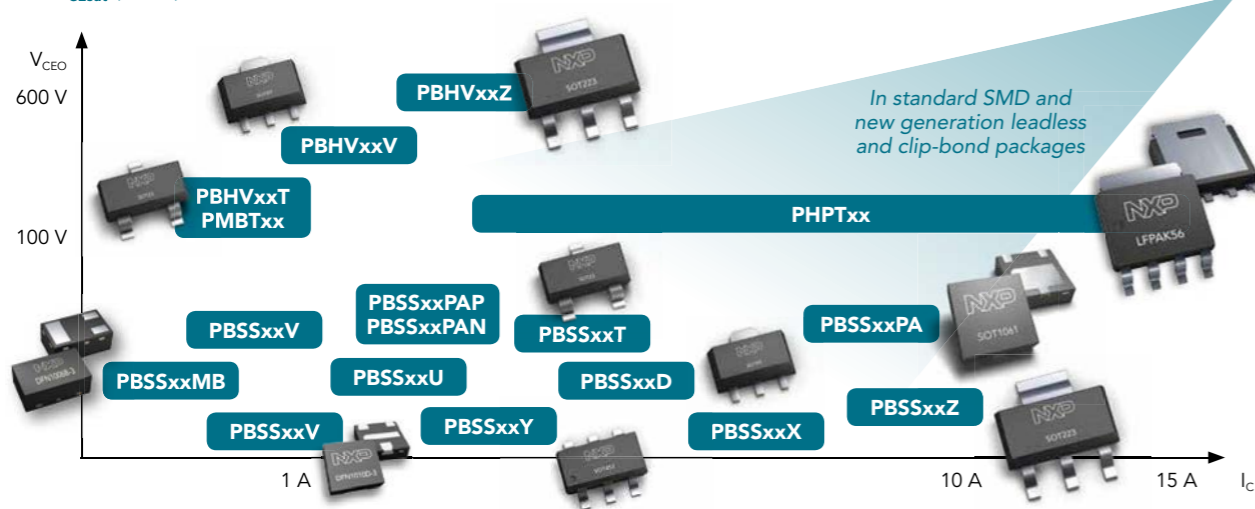
## A broad range of packages

Many options for leaded SMD, medium-power clip-bond and ultra-small leadless packages.

## A quality product from an experienced, high volume supplier

- ▶ NXP is strongly committed to automotive quality standards
- ▶ NXP has a track record of more than 60 years in developing and producing transistors
- ▶ NXP is the #1 in small-signal discretes with a high production capacity

### Low $V_{CEsat}$ (BISS) transistors



# Medium-power Bipolar transistors in LFPAK56



**LFPAK56 (SOT669)**  
Single package  
5 x 6 x 1.1 mm



**LFPAK56D (SOT1205)**  
Dual package  
5 x 6 x 1.1 mm

### Applications

- ▶ Power management
- ▶ Loadswitch
- ▶ Linear-mode voltage regulator
- ▶ Backlight units
- ▶ Motor drive
- ▶ LED lighting
- ▶ Relay replacement
- ▶ IGBT drive

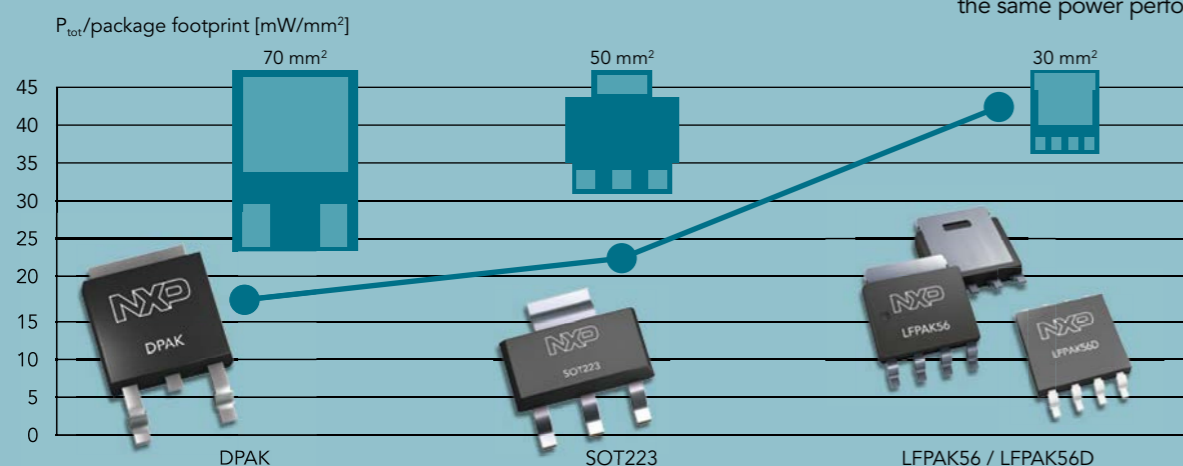
### In the spotlight

**Bipolar transistors in LFPAK56 and LFPAK56D power packages**

- High thermal power dissipation up to 3.7 W,  $V_{ce0}$  up to 100 V
- Most types AECQ-101 qualified ( $I_C = 3$  A up to 15 A)
- 2 types in LFPAK56D with current gain matching of 5% and 10%
- Reduced PCB area requirements compared to transistors in DPAK
- Suitable for high-temperature applications up to 175 °C

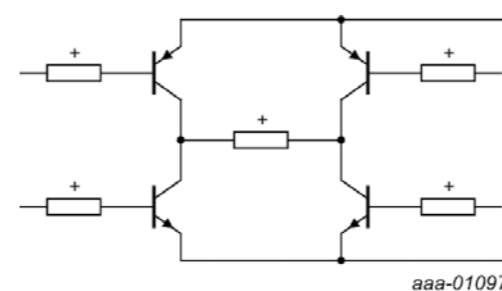
### LFPAK: Same power dissipation but half the size

55% package size reduction while retaining the same power performance



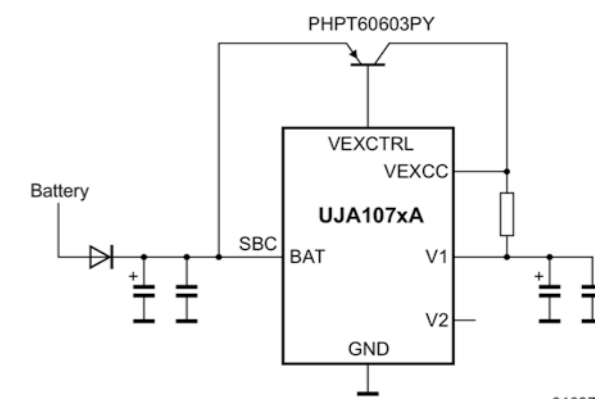
Reduced PCB area requirements comparison of DPAK, SOT223 and LFPAK

### Motor drive (2x PHPT60603NY/PY) or a double LFPAK56D (PHPT610030NK/PK)




aaa-010979

### IVN – System Basis Chip (PHPT60603PY) External pass transistor, linear regulator




aaa-010978


### High-power transistors (single)

Package												LFPAK56 (SOT669)
												
Size (mm)												5 × 6 × 1.1
V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	I <sub>CM</sub> (A)	h <sub>FE</sub> min/typ	@ I <sub>C</sub> (A)	@ V <sub>CE</sub> (V)	V <sub>CEsat</sub> typ (mV); I <sub>C</sub> = 0.5 A; I <sub>B</sub> = 0.05 A	V <sub>CEsat</sub> max (mV)	@ I <sub>C</sub> (A)	@ I <sub>B</sub> (A)	Polarity		
60	3	8	200 / 400	0.5	2	50	270	3	0.3	NPN	PHPT60603NY	
			200 / 400	0.5	2	70	360	3	0.3	PNP	PHPT60603PY	
100	3		150 / 250	0.5	10	50	330	3	0.3	NPN	PHPT61003NY	
			150 / 220	0.5	10	70	360	2	0.2	PNP	PHPT61003PY	
	2	6	150 / 250	0.5	10	50	300	2	0.2	NPN	PHPT61002NYC	
			150 / 220	0.5	10	70	400	2	0.2	PNP	PHPT61002PYC	

### High-current, high-power transistors

Package												LFPAK56 (SOT669)
												
Size (mm)												5 × 6 × 1.1
V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	h <sub>FE</sub> min/typ	@ I <sub>C</sub> (A)	@ V <sub>CE</sub> (V)	Polarity							
40	6	200/400	0.5	2	NPN	PHPT60406NY						
40	6	200/400	0.5	2	PNP	PHPT60406PY						
40	10	200/400	0.5	2	NPN	PHPT60410NY						
40	10	200/400	0.5	2	PNP	PHPT60410PY						
40	15	200/400	0.5	2	NPN	PHPT60415NY						
40	15	200/400	0.5	2	PNP	PHPT60415PY						
60	6	200/400	0.5	2	NPN	PHPT60606NY						
60	6	150/250	0.5	2	PNP	PHPT60606PY						
60	10	200/400	0.5	2	NPN	PHPT60610NY						
60	10	150/250	0.5	2	PNP	PHPT60610PY						
100	6	150/250	0.5	10	NPN	PHPT61006NY						
100	6	150/220	0.5	10	PNP	PHPT61006PY						
100	10	150/250	0.5	10	NPN	PHPT61010NY						
100	10	150/220	0.5	10	PNP	PHPT61010PY						

### High-power transistors (double)

Package												LFPAK56D (SOT1205)
												
Size (mm)												5 × 6 × 1.1
V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	I <sub>CM</sub> (A)	h <sub>FE</sub> typ	@ I <sub>C</sub> (A)	@ V <sub>CE</sub> (V)	V <sub>CEsat</sub> typ (mV); I <sub>C</sub> = 0.5 A; I <sub>B</sub> = 0.05 A	V <sub>CEsat</sub> max (mV)	@ I <sub>C</sub> (A)	@ I <sub>B</sub> (A)	Polarity	h <sub>FE1</sub> / h <sub>FE2</sub>	
100	3	6	150	0.5	10	50	300	3	0.2	2XNPN	-	
						70	400	3	0.2	2XPNP	-	
						50 / 70	300 / 400	3	0.2	NPN/PNP	-	
						50	300	3	0.2	2XNPN	0.95	
						70	400	3	0.2	2XPNP	0.9	

### Low V<sub>CEsat</sub> (BISS) transistors single NPN

types in **bold** represent new products

Package		SOT223 (SC-73)	SOT89 (SC-62)	SOT457 (SC-74)	DFN2020-3 (SOT1061)	DFN2020D-3 (SOT1061D)
Size (mm)		6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.5 x 1.0	2.0 x 2.0 x 0.62	2.0 x 2.0 x 0.62
P <sub>tot</sub> (mW)		1700	1650	750	1300	1300
V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	I <sub>CM</sub> (A)	h <sub>FE</sub> min/typ	@ I <sub>C</sub> (A)	@ V <sub>CE</sub> (V)	V <sub>CEsat</sub> typ (mV); I <sub>C</sub> = 0.5 A; I <sub>B</sub> = 0.05 A
12	5.3	10.6	300 / 530	0.5	2	18
	5.8	11.6	300 / 530	0.5	2	18
	6	7	280 / 440	0.5	2	20
20	3	5	220 / 390	0.5	2	40
	4	15	300 / 450	0.5	2	30
	5	10	300 / 450	0.5	2	35
	5.3	10.6	300 / 570	0.5	2	20
	5.8	10.2	300 / 570	0.5	2	20
	6	7	280 / 440	0.5	2	20
	7	15	300 / 550	0.5	2	12
	8	20	300 / 550	0.5	2	9
	3	5	300 / 490	0.5	2	45
	3	5	300 / 465	0.5	2	40
30	3.5	6	300 / 500	0.5	2	70
	4.7	10	300 / 500	0.5	2	57
	5.1	10.2	300 / 480	0.5	2	20
	5.4	10	300 / 500	0.5	2	57
	5.5	11	300 / 480	0.5	2	20
	6	7	280 / 450	0.5	2	21
	2.0	3.0	300 / -	0.5	5	140
40	4	15	300 / 520	0.5	2	35
	4	10	300 / 500	0.5	2	21
	5	10	300 / 500	0.5	2	25
50	2	5	300 / -	0.5	2	90 <sup>2)</sup>
	3.0	5.0	200 / 280	0.5	2	65
	3.0	5.0	300 / 460	0.5	2	50
	3.0	5.0	200 / 280	0.5	2	60 <sup>1)</sup>
60	3	6	200 / 360	0.5	5	45
	3	6	200 / -	0.5	5	45
	3	6	345 / 570	0.5	2	40
	4.7	9.4	300 / 520	0.5	2	25
	5.2	10.4	300 / 520	0.5	2	25
	6	7	280 / 440	0.5	2	22
	6.2	15	300 / 500	0.5	2	17
	7	15	300 / 500	0.5	2	13
	3	6	240 / 360	0.5	2	40
	4	10	250 / 400	0.5	2	25
80	4.6	9.2	300 / 470	0.5	2	25
	5.1	10.2	300 / 470	0.5	2	25
	5.6	7	270 / 425	0.5	2	25
100			150 / 290	0.25	10	75
			150 / 290	0.25	10	73
			150 / 290	0.25	10	73
	3	4	170 / 275	0.5	2	45
	4.5	9	200 / 330	0.5	2	27
5.1	10.2	200 / 330	0.5	2	27	
5.2	6	180 / 285	0.5	2	30	

<sup>1)</sup> I<sub>C</sub> / I<sub>B</sub> = 20 <sup>2)</sup> V<sub>CEsat</sub> (max) <sup>3)</sup> Optimized for high-speed switching



Low  $V_{CEsat}$  transistors up to 2000 mW

Low  $V_{CEsat}$  (BISS) transistors single PNP

types in **bold** represent new products

Package							SOT223 (SC-73)	SOT89 (SC-62)	SOT457 (SC-74)	DFN2020-3 (SOT1061)	DFN2020D-3 (SOT1061D)	
Size (mm)							6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.5 x 1.0	2.0 x 2.0 x 0.62	2.0 x 2.0 x 0.62	
$P_{tot}$ (mW)							1700	1650	750	1300	1300	
$V_{CEO}$ (V)	$I_C$ (A)	$I_{CM}$ (A)	$h_{FE}$ min/typ	@ $I_C$ (A)	@ $V_{CE}$ (V)	$V_{CEsat}$ typ (mV); $I_C = 0.5$ A; $I_B = 0.05$ A						
12	5.3	10.6	250 / 400	0.5	2	20		PBSS301PX				
	5.7	11.4	250 / 400	0.5	2	20		PBSS301PZ				
	6	7	220 / 335	0.5	2	20			PBSS5612PA			
20	3	5	200 / -	0.5	2	80 <sup>2)</sup>			PBSS5320D			
			220 / 450	0.5	2	50		PBSS5320X				
	4	15	250 / 400	0.5	2	35			PBSS301PD			
	5	10	300 / 430	0.5	2	45			PBSS5520X			
	5.1	10.2	250 / 370	0.5	2	25			PBSS302PX			
	5.5	11	250 / 370	0.5	2	25		PBSS302PZ				
	6	7	230 / 345	0.5	2	25				PBSS5620PA		
	6.2	15	250 / 400	0.5	2	18			PBSS4021PX			
30	6.6	20	250 / 400	0.5	2	16		PBSS4021PZ				
	2.7	5	200 / 350	0.5	2	87				PBSS4032PD <sup>3)</sup>		
	3	5	200 / 380	0.5	2	50			PBSS5330X			
			200 / 320	0.5	2	45			PBSS5330PA		PBSS5330PAS	
	4.2	10	200 / 350	0.5	2	70			PBSS4032PX <sup>3)</sup>			
	4.4	10	200 / 350	0.5	2	70		PBSS4032PZ <sup>3)</sup>				
	5.1	10.2	250 / 400	0.5	2	25			PBSS303PX			
	5.3	10.6	250 / 400	0.5	2	25		PBSS303PZ				
	6	7	200 / 335	0.5	2	25				PBSS5630PA		
	40	2.0	3.0	215 / -	0.5	5	170			PBSS5240X		
4		15	200 / 310	0.5	2	46				PBSS302PD		
		250 / 370	0.5	2	33				PBSS5540X			
5	10	250 / 350	0.5	2	40 <sup>1)</sup>			PBSS5540Z				
50	2.0	5	200 / -	0.5	2	90 <sup>2)</sup>			PBSS5250X			
	3.0	5.0	200 / 300	0.5	2	70				PBSS5350D		
			200 / 375	0.5	2	70				PBSS5350X		
			200 / 300	0.5	2	70			PBSS5350Z			
60	3	6	130 / 220	0.5	5	55					PBSS5360PAS	
			130 / -	0.5	5	55				<b>PBSS5360Z</b>		
	4.2	8.4	200 / 295	0.5	2	35				PBSS303PD		
	4.5	9	200 / 295	0.5	2	35			PBSS304PX			
	5	6	170 / 260	0.5	2	35					PBSS5560PA	
80	5	15	200 / 300	0.5	2	30				PBSS4041PX		
	5.7	15	200 / 300	0.5	2	22			PBSS4041PZ			
	3	5	155 / 225	0.5	2	55					PBSS304PD	
			180 / 265	0.5	2	40					PBSS5580PA	
			200 / 300	0.5	2	35				PBSS5480X		
	4.0	10	200 / 300	0.5	2	35				PBSS5480X		
	8	200 / 280	0.5	2	36				PBSS305PX			
4.5	9	200 / 280	0.5	2	36			PBSS305PZ				
100	1.0	3.0	150 / 350	0.5	5	100					PBSS9110D	
			150 / 350	0.5	5	90					PBSS9110X	
			150 / -	0.5	5	90				PBSS9110Z		
	2	3	175 / 275	0.5	2	65					PBSS305PD	
	2.7	4	180 / 295	0.5	2	45					PBSS9410PA	
4.1	8.2	200 / 300	0.5	5	45						PBSS306PX	
		200 / 300	0.5	5	45				PBSS306PZ			

<sup>1)</sup>  $I_C / I_B = 20$  <sup>2)</sup>  $V_{CEsat}$  (max) <sup>3)</sup> Optimized for high-speed switching

Low  $V_{CEsat}$  transistors up to 2000 mW

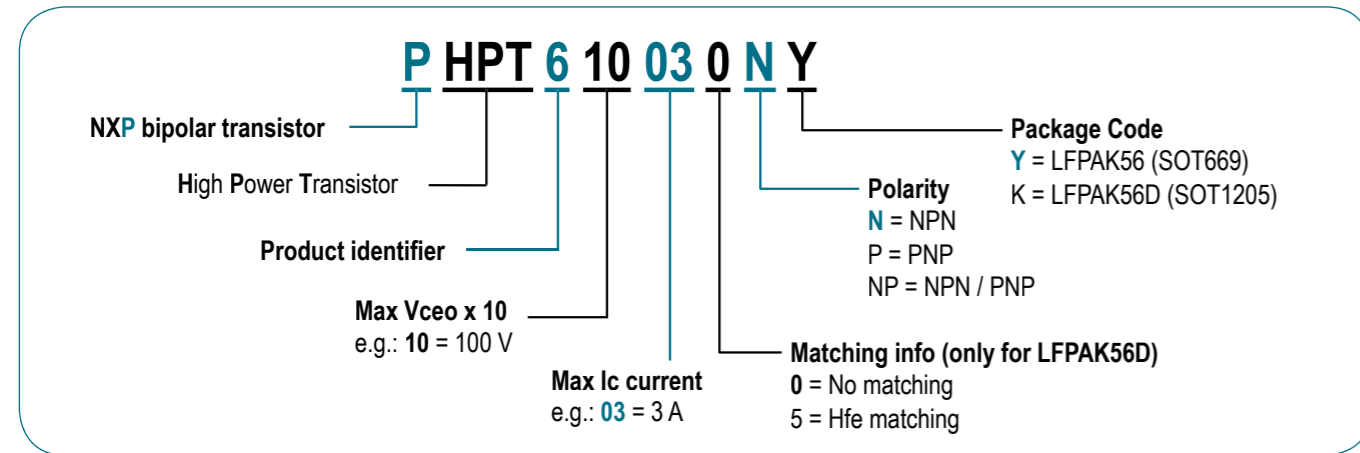
Low  $V_{CEsat}$  (BISS) double transistors

types in **bold** represent new products

Package										SOT96 (SO8)	SOT457 (SC-74)	SOT666	DFN2020-6 (SOT1118)	DFN2020D-6 (SOT1118D)
Size (mm)										4.9 x 3.9 x 1.75	2.9 x 1.5 x 1.0	1.6 x 1.2 x 0.55	2.0 x 2.0 x 0.62	2.0 x 2.0 x 0.62
$P_{tot}$ (mW)										2000 <sup>2)</sup>	750	500	1300	1300
$V_{CEO}$ (V)	$I_C$ (A)	Polarity	$h_{FE}$ min/typ	@ $I_C$ (A)	@ $V_{CE}$ (V)	$V_{CEsat}$ typ (mV); $I_C = 0.5$ A; $I_B = 0.05$ A	$V_{CEsat}$ max (mV)	@ $I_C$ (A)	@ $I_B$ (A)					
15	0.5	2 x NPN	200	0.01	2	170 <sup>1)</sup>	250	0.5	0.05				PBSS2515VS	
		2 x PNP	200	0.01	2	170 <sup>1)</sup>	250	0.5	0.05				PBSS3515VS	
		NPN / PNP	200	0.01	2	170 <sup>1)</sup>	250	0.5	0.05				PBSS2515VPN	
		NPN / PNP	200	0.01	2	170 <sup>1)</sup>	250	0.5	0.05					
20	7.5	NPN / NPN	300	0.5	2	15	150	4	0.2			PBSS4021SN		
	6.3	PNP / PNP	250	0.5	2	24	225	4	0.2			PBSS4021SP		
	7.5 / 6.3	NPN / PNP	300 / 250	0.5	2	15 / 24	150 / 225	4	0.2			PBSS4021SPN		
30	1	NPN / NPN	210	0.5	2	75	100	0.5	0.05					PBSS4130PAN
		PNP / PNP	170	0.5	2	85	140	0.5	0.05					PBSS5130PAP
		NPN / PNP	210 / 170	0.5	2	75 / 85	100 / 140	0.5	0.05					PBSS4130PANP
	2	NPN / NPN	230	0.5	2	60	80	0.5	0.05					PBSS4230PAN
		PNP / PNP	210	0.5	2	75	110	0.5	0.05					PBSS5230PAP
		NPN / PNP	230 / 210	0.5	2	60 / 75	80 / 100	0.5	0.05					PBSS4230PANP
	5.7	NPN / NPN	300	0.5	2	57	250	4	0.4			PBSS4032SN <sup>3)</sup>		
	4.8	PNP / PNP	200	0.5	2	70	390	4	0.4			PBSS4032SP <sup>3)</sup>		
	5.7 / 4.8	NPN / PNP	300 / 200	0.5	2	57 / 70	250 / 390	4	0.4			PBSS4032SPN <sup>3)</sup>		
	40	1.0	NPN / PNP	300 / 250	0.5	5	130 / 150	500	1	0.1				PBSS4140DPN
2.0		NPN / PNP	300 / 250	0.5	5	80 / 100	400 / 530	2	0.2				PBSS4240DPN	
50	2.7	2 x NPN	300	0.5	2	50	340	2.7	0.27					PBSS4350SS
		2 x PNP	200	0.5	2	60	370	2.7	0.27					PBSS5350SS
		NPN / PNP	300 / 200	0.5	2	50 / 60	340 / 370	2.7	0.27					PBSS4350SPN
60	1.0	2 x NPN	200	0.5	5	115	250	1	0.1					PBSS4160DS
		2 x PNP	150	0.5	5	120	330	1	0.1					PBSS5160DS
		NPN / PNP	200 / 150	0.5	5	115 / 120	250 / 330	1	0.1					PBSS4160DPN
	1	NPN / NPN	150	0.5	2	90	120	0.5	0.05					PBSS4160PAN
		PNP / PNP	120	0.5	2	125	180	0.5	0.05					PBSS5160PAP
		NPN / PNP	150 / 120	0.5	2	90 / 125	120 / 180	0.5	0.05					PBSS4160PANP
	2	NPN / NPN	210	0.5	2	70	90	0.5	0.05					PBSS4260PAN
		PNP / PNP	140	0.5	2	100	140	0.5	0.05					PBSS5260PAP
		NPN / PNP	210 / 140	0.5	2	70 / 100	90 / 140	0.5	0.05					PBSS4260PANP
	6.7	NPN / NPN	300	0.5	2	20	190	4	0.2					PBSS4041SN
	5.9	PNP / PNP	200	0.5	2	35	330	4	0.2					PBSS4041SP
	6.7 / 5.9	NPN / PNP	300 / 200	0.5	2	20 / 35	190 / 330	4	0.2					PBSS4041SPN
120	1	NPN / NPN	240	0.1	2	90	120	0.5	0.05					PBSS4112PAN
		PNP / PNP	190	0.1	2	150	220	0.5	0.05					PBSS5112PAP
		NPN / PNP	240 / 190	0.1	2	90 / 150	120 / 220	0.5	0.05					PBSS4112PANP

<sup>1)</sup>  $I_C / I_B = 20$  <sup>2)</sup> Device mounted on a ceramic PCB, Al2O3, standard footprint <sup>3)</sup> Optimized for high-speed switching

### Nomenclature for high-power transistors



### Low $V_{CEsat}$ (BISS) transistors single NPN

Package		SOT23	SOT323 (SC-70)	SOT363 (SC-88)	DFN1006-3 (SOT883)	DFN1006B-3 (SOT883B)	DFN1010D-3 (SOT1215)
Size (mm)		2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37	1.1 x 1.0 x 0.37
$P_{tot}$ (mW)		480	350	430	250	250	750
$V_{CE0}$ (V)	$I_c$ (A)	$I_{CM}$ (A)	$h_{FE}$ min/typ	@ $I_c$ (A)	@ $V_{CE}$ (V)	$V_{CEsat}$ typ (mV); $I_c = 0.5$ A; $I_B = 0.05$ A	
15	0.5	1	200 / 325	0.01	2	-	PBSS2515M PBSS2515MB
20	1	3	350 / 470	0.1	2	110 <sup>2)</sup>	PBSS4120T
	2	5	220 / 330	0.1	2	45	PBSS4320T
	4.3	8	300 / 550	0.5	2	21	PBSS4021NT
30	1	1.5	230 / 380	0.5	2	90	PBSS4130QA
		3	300 / 450	0.5	2	120 <sup>2)</sup>	PBSS4130T
	2	3	300 / 450	0.5	2	70	PBSS4230T
			230 / 380	0.5	2	75	PBSS4230QA
	2.6	5	300 / 500	0.5	2	80	PBSS4032NT <sup>3)</sup>
40	0.5	1	200 / 550	0.01	2	200 <sup>2)</sup>	PBSS2540M PBSS2540MB
			300 / 440	0.5	5	130	PBSS4140U
	2.0		300 / 510	0.5	5	120	PMMT491A
			300 / 420	0.5	5	130	PBSS4140T
	3.0		350 / 470	0.1	2	70	PBSS4240Y
			300 / 450	0.5	2	70	PBSS4240T
50	2	5	300 / 495	0.5	2	60	PBSS4350T
60	1.0	1.5	150 / 240	0.5	2	90	PBSS4160QA
			200 / 420	0.5	5	120	PBSS4160U
			200 / 350	0.5	5	110	PBSS4160T
	2	3	150 / 240	0.5	2	75	PBSS4260QA
	3.8	8	300 / 500	0.5	2	29	PBSS4041NT
100	1.0	3.0	150 / 400	0.25	10	80	PBSS8110Y
			150 / 300	0.25	10	70	PBSS8110T

<sup>1)</sup>  $I_c / I_B = 20$  <sup>2)</sup>  $V_{CEsat}$  (max) <sup>3)</sup> Optimized for high-speed switching

### Low $V_{CEsat}$ (BISS) transistors single PNP

Package		SOT23	SOT323 (SC-70)	SOT363 (SC-88)	DFN1006-3 (SOT883)	DFN1006B-3 (SOT883B)	DFN1010D-3 (SOT1215)
Size (mm)		2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37	1.1 x 1.0 x 0.37
$P_{tot}$ (mW)		480	350	430	250	250	750
$V_{CE0}$ (V)	$I_c$ (A)	$I_{CM}$ (A)	$h_{FE}$ min/typ	@ $I_c$ (A)	@ $V_{CE}$ (V)	$V_{CEsat}$ typ (mV); $I_c = 0.5$ A; $I_B = 0.05$ A	
15	0.5	1	200 / 260	0.01	2	150	PBSS3515M PBSS3515MB
20	1	2	300 / 450	0.1	2	125 <sup>2)</sup>	PBSS5120T
		3	225 / -	0.5	2	80 <sup>2)</sup>	PBSS5220T
		5	220 / 420	0.5	2	50	PBSS5320T
	3.5	8	250 / 400	0.5	2	35	PBSS4021PT
30	1	1.5	180 / 295	0.5	2	85	PBSS5130QA
			260 / 350	0.5	2	110	PBSS5130T
	2	3	300 / 450	0.1	2	70	PBSS5230T
			180 / 295	0.5	2	70	PBSS5230QA
	2.4	5	200 / 320	0.5	2	95	PBSS4032PT <sup>3)</sup>
40	0.5	1	200 / 380	0.01	2	220	PBSS3540M PBSS3540MB
			300 / 520	0.1	5	130	PBSS5140U
	1.0	2.0	300 / 800	0.1	5	130	PMMT591A
			300 / 510	0.1	5	130	PBSS5140T
			300 / -	0.1	2	110 <sup>2)</sup>	PBSS5240Y
			300 / 450	0.1	2	70	PBSS5240T
50	2.0	3	200 / -	0.5	2	90 <sup>2)</sup>	PBSS5250T
			200 / 360	0.5	2	55	PBSS5350T
60	1.0	1.5	120 / 185	0.5	2	125	PBSS5160QA
			150 / 250	0.5	5	135	PBSS5160U
			150 / 250	0.5	5	120	PBSS5160T
	1.7	2.5	120 / 185	0.5	2	105	PBSS5260QA
	2.7	8	200 / 300	0.5	2	49	PBSS4041PT
100	1.0	3.0	150 / -	0.25	5	93	PBSS9110Y
			150 / 350	0.5	5	95	PBSS9110T

<sup>1)</sup>  $I_c / I_B = 20$  <sup>2)</sup>  $V_{CEsat}$  (max) <sup>3)</sup> Optimized for high-speed switching

#### In the spotlight

##### Low $V_{CEsat}$ transistors in DFN1010D-3: 2 A on 1.1 mm<sup>2</sup> footprint

High  $I_c$  performance on ultra-small footprint

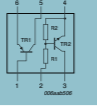
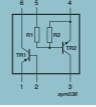
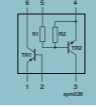
$V_{CE}$  30 V and 60 V

Leadless DFN1010D-3 (SOT1215) SMD package with solderable sidepads (1.1 x 1.0 x 0.37)

AEC-Q101 qualified



## Low $V_{CEsat}$ (BISS) load switches

Package				SOT457 (SC-74)	SOT363 (SC-88)	
Size (mm)				2.9 x 1.5 x 1.0		
$P_{tot}$ (mW)				750 <sup>1)</sup>	600 <sup>1)</sup>	
$V_{CEO}$ (V)	$I_C$ (A)	$V_{CEsat}$ max (mV); $I_C = 0.5$ A; $I_B = 0.05$ A	R1, R2 (k $\Omega$ )	  		
15	0.5	250	2.2	PBL1501Y		
			4.7	PBL1502Y		
			10	PBL1503Y		
			22	PBL1504Y		
20	1	150	2.2	PBL2001D		
			4.7	PBL2002D		
			10	PBL2003D		
			22	PBL2004D		
	1.8	70	2.2	PBL2021D		
			4.7	PBL2022D		
			10	PBL2023D		
			22	PBL2024D		
40	0.5	350	2.2	PBL4001Y		
			4.7	PBL4002Y		
			10	PBL4003Y		
			22	PBL4004Y		
	47			47	PBL4005Y	
				2.2	PBL4001D	
				4.7	PBL4002D	
				10	PBL4003D	
	60	1	170	22	PBL4004D	
				47	PBL4005D	
				2.2	PBL6001D	
				4.7	PBL6002D	
1.5		100	10	PBL6003D		
			22	PBL6004D		
			47	PBL6005D		
			2.2	PBL6021D		
			4.7	PBL6022D		
			10	PBL6023D		
			22	PBL6024D		

<sup>1)</sup> Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint

<sup>2)</sup> Device mounted on an FR4 PCB, single-sided copper, tin-plated, and standard footprint

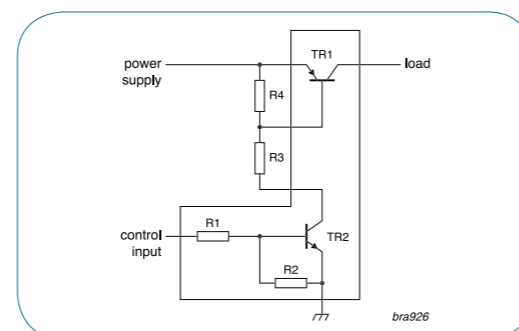
### Key features and benefits

- ▶ Very small input current drives high load current
- ▶ High efficiency and low-voltage drop due to low  $V_{CEsat}$  (BISS) pass transistor
- ▶ Replaces expensive P-MOSFETs
- ▶ Inherent reverse-current blocking
- ▶ Automotive qualified according to AEC-Q101

### Key applications

- ▶ Fan driver
- ▶ Battery-charge switch
- ▶ Supply-line switch
- ▶ High-side load

### Low $V_{CEsat}$ (BISS) load switch – the optimal choice for supply-line and high-side switches

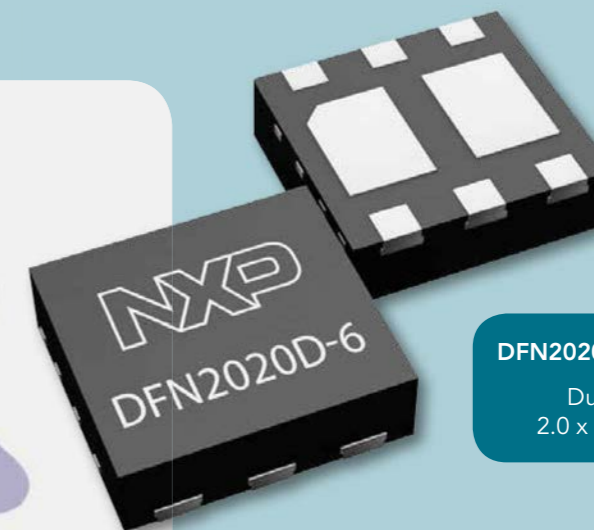
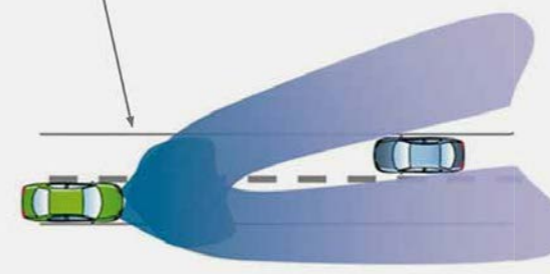


## DFN2020D-6 with solderable sidepads

Application example: LED lighting in automotive

### Matrix light sketch

LEDs can be selectively controlled to shape the front beam



DFN2020D-6 (SOT1118D)

Dual package  
2.0 x 2.0 x 0.62 mm

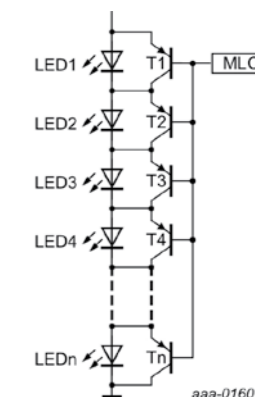
### PBSS5160PAPS in DFN2020D-6

- ▶ Industry's first low  $V_{CEsat}$  transistor in DFN2020 with 100% solderable sidepads, AOI suitable
- ▶ Enables individual dimming in the LED front light matrix solution
- ▶ Saves PCB space by replacing two DFN2020D-3 or two SOT89 packages
- ▶ Ideal solution for multilayer PCB designs

### Key package benefits

- ▶ AEC-Q101 qualified
- ▶ Suitable for AOI of solder joints
- ▶ Exposed heat sink for excellent thermal and electrical conductivity
- ▶ Package size of only 2 x 2 mm and a height of only 0.62 mm
- ▶ Single version available in DFN2020D-3
- ▶ DFN2020 is an approved and widely available package platform

### Dimming transistor application



### Low $V_{CEsat}$ double transistors portfolio on DFN2020D-6

types in **bold** represent new products

$V_{CEO}$ (V)	$I_C$ (A)	Polarity	$h_{FE}$ min	@ $I_C$ (A)	@ $V_{CE}$ (V)	$V_{CEsat}$ typ (mV); $I_C = 0.5$ A; $I_B = 0.05$ A	Product
20	2	NPN / NPN	230	0.5	2	60	PBSS4220PANS
		PNP / PNP	210	0.5	2	70	<b>PBSS5220PAPS</b>
60	1	NPN / NPN	150	0.5	2	90	PBSS4160PANS
		PNP / PNP	120	0.5	2	125	PBSS5160PAPS
60	2	NPN / PNP	150 / 120	0.5	2	90 / 125	PBSS4160PANPS
		NPN / NPN	210	0.5	2	70	<b>PBSS4260PANS</b>
60	2	PNP / PNP	140	0.5	2	100	<b>PBSS5260PAPS</b>
		NPN / PNP	210 / 140	0.5	2	70 / 100	<b>PBSS4260PANPS</b>

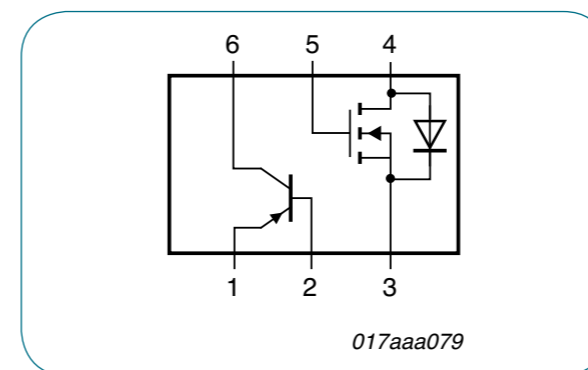
### High-voltage low $V_{CEsat}$ (BISS) transistors

types in **bold** represent new products

Package			SOT223 (SC-73)	SOT89 (SC-62)	SOT1215	SOT23
Size (mm)			6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	1.1 x 1.0 x 0.37	2.9 x 1.3 x 1.0
P <sub>tot</sub> (mW)			1700	1300	750	250
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (A)				
NPN	150	0.5			<b>PBHV8115QA</b>	
		1	PBHV8115Z	PBHV8115X		PBHV8115T
		2	PBHV8215Z			
	180	1				PBHV8118T
		400	0.5	PBHV8540Z	PBHV8540X	
	500	1	PBHV8140Z			
PNP	140	0.5			<b>PBHV9115QA</b>	
		1	PBHV9115Z	PBHV9115X		PBHV9115T
	150	2	PBHV9215Z			
		0.5	PBHV9560Z			
	600	0.1	PBHV3160Z			
		0.25	PBHV9040Z	PBHV9040X		PBHV9040T
	400	0.5	PBHV9540Z			
		0.15	PBHV3160Z			PBHV9050T
	500	0.25	PBHV9050Z			

### Low $V_{CEsat}$ (BISS) transistor PNP – N-channel MOSFET combination

Package											DFN2020-6 (SOT1118)
Size (mm)											2.0 x 2.0 x 0.62
P <sub>tot</sub> (mW)											1300
V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	h <sub>FE min</sub>	h <sub>FE max</sub>	@ I <sub>C</sub> (mA)	@ V <sub>CE</sub> (V)	R <sub>CEsat</sub> typ (mΩ)	V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>D</sub> (A)	R <sub>Dson</sub> typ (mΩ)	
40	2	300	800	100	5	240	30	0.7	0.66	390	PBSM5240PF
		100	-	100	5	240	30	0.7	0.66	390	PBSM5240PFH



Combination of low  $V_{CEsat}$  transistor with N-channel MOSFET in the very small and ultrathin leadless package DFN2020-6 (SOT1118)

In the spotlight

#### High-voltage low $V_{CEsat}$ (BISS) transistors in SOT223, SOT23 & SOT89

- Voltage  $V_{CEO}$  up to 600 V
- Current  $I_C$  up to 4 A (continuous), 10 A (peak)
- $V_{CEsat}$  down to 33 mV
- AEC-Q101 qualified
- New high-voltage low  $V_{CEsat}$  (BISS) in DFN1010D-3



### Low $V_{CEsat}$ (BISS) RETs

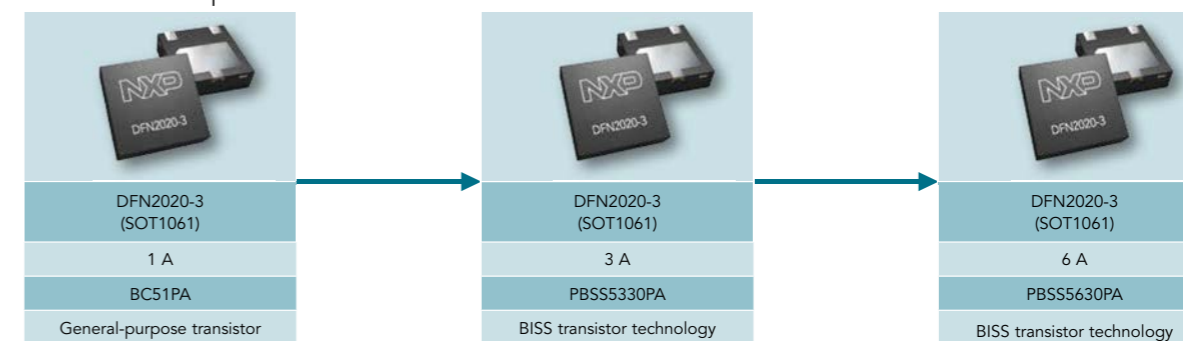
Package						SOT23	
Size (mm)						2.9 x 1.3 x 1.0	
P <sub>tot</sub> (mW)						250	
V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	R1 = R2	R1 (kΩ)	R2 (kΩ)	NPN	PNP	
40	600	R1 = R2	1	1	PBRN113ET	PBRP113ET	
			2.2	2.2	PBRN123ET	PBRP123ET	
		R1 ≠ R2	1	10	PBRN113ZT	PBRP113ZT	
			2.2	10	PBRN123YT	PBRP123YT	

### Advantages of low $V_{CEsat}$ (BISS) technology

Our BISS (Breakthrough In Small-Signal) transistors show lowest  $V_{CEsat}$  values due to an innovative mesh-emitter technology and further technology improvement. They also reduce board space due to improved collector-current capabilities as shown below.

#### Improved collector-current capabilities

▶ 17.87 mm<sup>2</sup> footprint



### RETs 100 mA single - Part 1

Package					SOT23		SOT323 (SC-70)							
Size (mm)					2.9 x 1.3 x 1.0		2.0 x 1.25 x 0.95							
P <sub>tot</sub> (mW)					250		200							
V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	Configuration	R1 (kΩ)	R2 (kΩ)	NPN		PNP							
50	100		1	1					PDTA113ET			PDTA113EU		
			2.2	2.2	PDTC123ET						PDTA123ET		PDTC123EU	PDTA123EU
			4.7	4.7	PDTC143ET						PDTA143ET		PDTC143EU	PDTA143EU
			10	10	PDTC114ET						PDTA114ET		PDTC114EU	PDTA114EU
			22	22	PDTC124ET						PDTA124ET		PDTC124EU	PDTA124EU
			47	47	PDTC144ET						PDTA144ET		PDTC144EU	PDTA144EU
			100	100	PDTC115ET						PDTA115ET		PDTC115EU	PDTA115EU
			1	10							PDTA113ZT			PDTA113ZU
			2.2	10	PDTC123YT						PDTA123YT		PDTC123YU	PDTA123YU
			2.2	47	PDTC123JT						PDTA123JT		PDTC123JU	PDTA123JU
			4.7	10	PDTC143XT						PDTA143XT		PDTC143XU	PDTA143XU
			4.7	47	PDTC143ZT						PDTA143ZT		PDTC143ZU	PDTA143ZU
			10	47	PDTC114YT						PDTA114YT		PDTC114YU	PDTA114YU
			22	47	PDTC124XT						PDTA124XT		PDTC124XU	PDTA124XU
		47	10	PDTC144VT						PDTA144VT		PDTC144VU	PDTA144VU	
		47	22	PDTC144WT						PDTA144WT		PDTC144WU	PDTA144WU	
		2.2	-	PDTC123TT						PDTA123TT		PDTC123TU	PDTA123TU	
		4.7	-	PDTC143TT						PDTA143TT		PDTC143TU	PDTA143TU	
		10	-	PDTC114TT						PDTA114TT		PDTC114TU	PDTA114TU	
		22	-	PDTC124TT						PDTA124TT		PDTC124TU	PDTA124TU	
		47	-	PDTC144TT						PDTA144TT		PDTC144TU	PDTA144TU	
		100	-	PDTC115TT						PDTA115TT		PDTC115TU	PDTA115TU	

### RETs 100 mA single - Part 2

types in **bold** represent new products

Package					DFN1006-3 (SOT883)		DFN1006B-3 (SOT883B)		SOT1215						
Size (mm)					1.0 x 0.6 x 0.48		1.0 x 0.6 x 0.37		1.1 x 1.0 x 0.37						
P <sub>tot</sub> (mW)					250		250		750						
V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	Configuration	R1 (kΩ)	R2 (kΩ)	NPN		PNP		NPN						
50	100		1	1											
			2.2	2.2	PDTC123EM								PDTA113EM	PDTA113EMB	
			4.7	4.7	PDTC143EM								PDTA123EM	PDTA123EMB	
			10	10	PDTC114EM								PDTC123EMB	PDTA143EMB	
			22	22	PDTC124EM								PDTA114EMB	<b>PDTC143EQA</b>	<b>PDTA143EQA</b>
			47	47	PDTC144EM								PDTA124EMB	<b>PDTC114EQA</b>	<b>PDTA114EQA</b>
			100	100	PDTC115EM								PDTA144EMB	<b>PDTC124EQA</b>	<b>PDTA124EQA</b>
			1	10									PDTA115EMB	<b>PDTC144EQA</b>	<b>PDTA144EQA</b>
			2.2	10	PDTC123YM								PDTA113ZM		
			2.2	47	PDTC123JM								PDTA123YM		
			4.7	10	PDTC143XM								PDTA143ZM		
			4.7	47	PDTC143ZM								PDTA114YMB	<b>PDTC123YQA</b>	<b>PDTA123YQA</b>
			10	47	PDTC114YM								PDTA143ZMB	<b>PDTC143XQA</b>	<b>PDTA143XQA</b>
			22	47	PDTC124XM								PDTA114YQA	<b>PDTC143ZQA</b>	<b>PDTA143ZQA</b>
		47	10	PDTC144VM								PDTA124XMB	<b>PDTC114YQA</b>	<b>PDTA114YQA</b>	
		47	22	PDTC144WM								PDTA124XMB			
		2.2	-	PDTC123TM								PDTA144VMB			
		4.7	-	PDTC143TM								PDTA144WMB			
		10	-	PDTC114TM								PDTA123TMB			
		22	-	PDTC124TM								PDTA143TMB			
		47	-	PDTC144TM								PDTA114TMB			
		100	-	PDTC115TM								PDTA124TMB			

### RETs 100 mA double

types in **bold** represent new products

Package					DFN1010B-6 (SOT1216)			SOT363 (SC-88)			SOT666								
Size (mm)					1.1 x 1.0 x 0.37			2.0 x 1.25 x 0.95			1.6 x 1.2 x 0.55								
P <sub>tot</sub> (mW)					350			300			300								
V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	Configuration	R1 (kΩ)	R2 (kΩ)	NPN / NPN		NPN / PNP		PNP / PNP		NPN / NPN		NPN / PNP						
50	100	R1 = R2	2.2	2.2								PUMH20	PUMD20	PUMB20	PEMH20	PEMD20	PEMB20		
			4.7	4.7									PUMH15	PUMD15	PUMB15	PEMH15	PEMD15	PEMB15	
			10	10	<b>PQMH11</b>	<b>PQMD3</b>	<b>PQMB11</b>							PUMH11	PUMD3	PUMB11	PEMH11	PEMD3	PEMB11
			22	22			<b>PQMD2</b>							PUMH1	PUMD2	PUMB1	PEMH1	PEMD2	PEMB1
			47	47	<b>PQMH2</b>	<b>PQMD12</b>								PUMH2	PUMD12	PUMB2	PEMH2	PEMD12	PEMB2
			100	100										PUMH24	PUMD24	PUMB24	PEMH24	PEMD24	PEMB24
			2.2	47	<b>PQMH10</b>	<b>PQMD10</b>								PUMH10	PUMD10	PUMB10	PEMH10	PEMD10	PEMB10
			4.7	10										PUMH18	PUMD18	PUMB18	PEMH18	PEMD18	PEMB18
			4.7	47	<b>PQMH13</b>	<b>PQMD13</b>								PUMH13	PUMD13	PUMB13	PEMH13	PEMD13	PEMB13
			10	47	<b>PQMH9</b>									PUMH9	PUMD9	PUMB9	PEMH9	PEMD9	PEMB9
			22	47		<b>PQMD16</b>								PUMH16	PUMD16	PUMB16	PEMH16	PEMD16	PEMB16
			47	22										PUMH17	PUMD17	PUMB17	PEMH17	PEMD17	PEMB17
			47 / 2.2	47 / 47										PUMD48				PEMD48	
			2.2	-										PUMH30	PUMD30	PUMB30	PEMH30	PEMD30	PEMB30
		4.7	-										PUMH7	PUMD6	PUMB3	PEMH7	PEMD6	PEMB3	
		10	-										PUMH4	PUMD4	PUMB4	PEMH4	PEMD4	PEMB4	
		22	-										PUMH19	PUMD19	PUMB19	PEMH19	PEMD19	PEMB19	
		47	-										PUMH14	PUMD14	PUMB14	PEMH14	PEMD14	PEMB14	

### RETs 500 mA

types in **bold** represent new products

Package					SOT457 (SC-74)		SOT23		SOT323 (SC-70)		SOT1215							
Size (mm)					2.9 x 1.5 x 1.0		2.9 x 1.3 x 1.0		2.0 x 1.25 x 0.95		1.1 x 1.0 x 0.37							
P <sub>tot</sub> (mW)					750		250		200		750							
V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	Configuration	R1 (kΩ)	R2 (kΩ)	NPN / NPN		NPN / PNP		NPN		PNP							
50	500	R1 = R2	1	1							PDTD113ET	PDTB113ET	PDTD113EU	PDTB113EU	<b>PDTD113EQA</b>	<b>PDTB113EQA</b>		
			2.2	2.2								PDTD123ET	PDTB123ET	PDTD123EU	PDTB123EU	<b>PDTD123EQA</b>	<b>PDTB123EQA</b>	
			4.7	4.7									PDTD143ET	PDTB143ET	PDTD143EU	PDTB143EU	<b>PDTD143EQA</b>	<b>PDTB143EQA</b>
			10	10									PDTD114ET	PDTB114ET	PDTD114EU	PDTB114EU	<b>PDTD114EQA</b>	<b>PDTB114EQA</b>
		R1 ≠ R2	1	10	PIMN31	PIMC31							PDTD113ZT	PDTB113ZT	PDTD113ZU	PDTB113ZU	<b>PDTD113ZQA</b>	<b>PDTB113ZQA</b>
			2.2	10									PDTD123YT	PDTB123YT	PDTD123YU	PDTB123YU	<b>PDTD123YQA</b>	<b>PDTB123YQA</b>
			4.7	10									PDTD143XT	PDTB143XT	PDTD143XU	PDTB143XU	<b>PDTD143XQA</b>	<b>PDTB143XQA</b>
		Only R1		2.2	-								PDTD123TT	PDTB123TT				

Single transistors NPN

types in **bold** represent new products

Package						SOT23	SOT323 (SC-70)	DFN1010D-3 (SOT1215)	DFN1006-3 (SOT883)	DFN1006B-3 (SOT883B)
Size (mm)						2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	1.1 x 1.0 x 0.37	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37
P <sub>tot</sub> (mW)						250	200	750	250	250
V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min/typ	h <sub>FE</sub> max	f <sub>r</sub> min (MHz)						
25	100	450	1200	100						PMST5089
30	100	110 - 200	450 - 800	100		BC848B				BC848W
		350	900	100						PMST5088
32	100	110 - 420	220 - 800	100		BCW31 / 32 / 33				
		180 - 380	310 - 630	250		BCW60B / C / D				
45	100	110 - 420	220 - 800	100		BC847 / A / B / C	BC847W / AW / BW / CW	BC847AQA / BQA / CQA	BC847AM / BM / CM	BC847AMB / BMB / CMB
		120 - 380	220 - 630	100		BCX70G / H / J / K				
		110 - 200	220 - 450	100		BCW71 / 72				
50	100	210 - 290	340 - 460	100 - 150			2PD601ARW / SW			
		250	650	100						PMST6429
		210 - 290	340 - 460	100 - 150						2PD601ART 2PD601ARL 2PD601ASL PMBT6428 PMST6428
60	100	110 - 200	220 - 450	100		BCV71 / 72				
65	100	110 - 200	220 - 450	100		BC846 / A / B	BC846W / AW / BW			<b>BC846BM</b>
80	100	20	80	60		BSS64				BC846BMB
50	150	120 - 200	240 - 400	80		NXP3875Y / G				
		120 - 270	270 - 560	100			2PC4081Q / R / S		2PC4617QM / RM	2PC4617QMB / RMB
		210	340	100			2PD601BRL			2PD601BSL
45	500	100 - 250	250 - 600	100		BC817 / -16 / -25 / -40	BC817W / -16W / -25W / -40W	BC817 / -25QA / -40QA		
		100	600	100		BCX19				
50	500	85 - 170	170 - 340	140 - 180		2PD602AQL 2PD602ARL 2PD602ASL	2PD1820AR / S			
60	500	50	-	100						PMSTA05
80	500	100	-	50						PMSTA06

Single transistors PNP

types in **bold** represent new products

Package						SOT23	SOT323 (SC-70)	DFN1010D-3 (SOT1215)	DFN1006-3 (SOT883)	DFN1006B-3 (SOT883B)
Size (mm)						2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	1.1 x 1.0 x 0.37	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37
P <sub>tot</sub> (mW)						250	200	750	250	250
V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min/typ	h <sub>FE</sub> max	f <sub>r</sub> min (MHz)						
30	100	125 - 220	500 - 800	100		BC858B	BC858W			
32	100	120 - 215	260 - 500	100		BCW29 / 30				
		180 - 380	310 - 630	100		BCW61B / C / D				
45	100	210 - 290	340 - 460	70 - 80			2PB709ARW / SW			
		180 - 380	310 - 630	100		BCX71H / J / K				
		120 - 215	260 - 500	100		BCW69 / 70				
60	100	125 - 420	250 - 800	100		BC857 / A / B / C	BC857W / AW / BW / CW	BC857AQA / BQA / CQA	BC857AM / BM / CM	BC857AMB / BMB / CMB
		120	260	150		BCW89				
65	100	125 - 200	250 - 475	100		BC856 / A / B	BC856W / AW / BW			<b>BC856BM</b>
100	100	30	-	50		BSS63				<b>BC856BMB</b>
50	150	120 - 270	270 - 560	100			2PA1756Q / R / S		2PA1774QM / RM / SM	2PA1774QMB / RMB / SMB
		210	340	100			2PB709BRL			
25	500	290	460	100			2PB709BSL			
		100	600	80			BCX18			
45	500	100 - 250	250 - 600	80		BC807 / -16 / -25 / -40	BC807W / -16W / -25W / -40W	BC807 / -25QA / -40QA		
		100	600	80		BCX17				
50	500	85 - 170	170 - 340	100 - 140		2PB710ARL 2PB710ASL	2PB1219AQ / R / S			
60	500	100	-	50						PMSTA55
80	500	100	-	50						PMSTA56

Double transistors

Package						SOT457 (SC-74)	SOT363 (SC-88)	SOT666	DFN1010B-6 (SOT1216)	
Size (mm)						2.9 x 1.5 x 1.0	2.0 x 1.25 x 0.95	1.6 x 1.2 x 0.55	1.0 x 1.0 x 0.37	
P <sub>tot</sub> (mW)						750	300	300	350	
Polarity	V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>r</sub> min (MHz)					
NPN	40	100	120	450	100			PUMX1	PEMX1	
	45	100	200	450	100	BC847DS	BC847BS	BC847BV	BC847QAS	
	65	100	110	-	100			BC846S		
			200	450	100	BC846DS	BC846BS			
	50	150	120	560	100			PUMX2		
45	500	160	400	80		BC817DS				
PNP	40	100	120	450	100	PIMT1	PUMT1	PEMT1		
	45	100	200	450	100		BC857BS	BC857BV	BC857QAS	
	65	100	110	-	100			BC856S		
			200	450	100		BC856BS			
45	500	160	400	80	BC807DS					
NPN / PNP	40	100	120	450	100			PUMZ1	PEMZ1	
	45	100	200	450	100			BC847BPN	BC847BVN	
	50	100	120	560	100	PIMZ2	PUMZ2		BC847QAPN	
	65	100	200	450	100			BC846BPN		
	12	500	200	-	250 / 100				PEMZ7	
45	500	160	160	100 / 800		BC817DPN				

Single and double switching transistors

types in **bold** represent new products

Package							SOT223 (SC-73)	SOT89 (SC-62)	SOT23	SOT323 (SC-70)	SOT363 (SC-88)	SOT666	DFN1006-3 (SOT883)	DFN1006B-3 (SOT883B)	
Size (mm)							6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.6 x 1.2 x 0.55	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37	
P <sub>tot</sub> (mW)							1700	1300	250	200	300	300	250	250	
Configuration							single	single	single	single	double	double	single	single	
Polarity	V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>r</sub> min (MHz)	t <sub>off</sub> (ns)									
NPN	12	100	40	120	400	20			BSV52						
	40	200	100	300	180	1200			PMB3904	PMSS3904					
					300	250									
	15	600	40	120	500	20			PMBT2369	PMST2369					
	40	200	100	300	300	250			MMBT3904						
	30	600	100	300	250	250				PMBT3904	PMST3904	PMBT3904YS	PMBT3904VS	PMBT3904M	PMBT3904MB
										PMBT2222	PMST2222				
	40	600	100	300	300	250	250	PZT4401	PXT4401	PMBT4401	PMST4401	<b>PMBT4401YS</b>			
MMBT2222A															
40	800	100	300	300	250	250	PZT2222A	PXT2222A	PMBT2222A	PMST2222A	<b>PMBT2222AYS</b>				
									BSR14						
PNP	40	100	100	300	150	700			PMB3906	PMSS3906					
	40	200	100	300	250	300			MMBT3906						
									PMBT3906	PMST3906	PMBT3906YS	PMBT3906VS	PMBT3906M	PMBT3906MB	
	40	600	100	300	200	350	300	PZT4403	PXT4403	PMBT4403	PMST4403	<b>PMBT4403YS</b>			
										PMBT2907					
60	600	100	300	200	365			BSR16	PMST2907A						
NPN / PNP	40	200	100	300	300 / 250	250 / 300	PZT2907A	PXT2907A	PMBT2907A		<b>PMBT2907AYS</b>				
											PMBT3946YPN	PMBT3946VFN			

### Medium-power general-purpose transistors

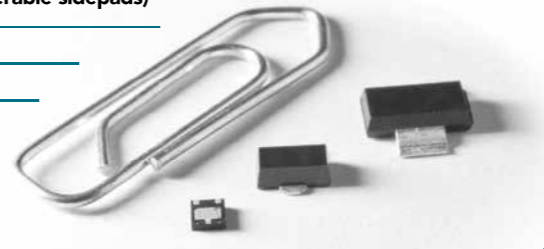
Package						SOT223 (SC-73)	SOT89 (SC-62)	DFN2020-3 (SOT1061)	DFN2020D-3 (SOT1061D)
Size (mm)						6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.0 x 2.0 x 0.62	2.0 x 2.0 x 0.62
P <sub>tot</sub> (mW)						1700	1300	1300	1300
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)				
NPN	20	2	85 - 160	375	40	BCP68 / -25	BC868 / -25	BC68PA / BC68-25PA	BC68PAS / BC68-25PAS
	45	1	63 - 100	160 - 250	100	BCP54 / -10 / -16	BCX54 / -10 / -16	BC54PA / BC54-10PA / BC54-16PA	BC54PAS / BC54-10PAS / BC54-16PAS
	60	1	63 - 100	160 - 250	100	BCP55 / -10 / -16	BCX55 / -10 / -16	BC55PA / BC55-10PA / BC55-16PA	BC55PAS / BC55-10PAS / BC55-16PAS
	80	1	63 - 100	160 - 250	100	BSP41	BSR41		
PNP	20	2	85 - 160	250 - 375	40	BCP69 / -16 / -25	BC869 / -16 / -25	BC69PA / BC69-16PA / BC69-25PA	BC69PAS / BC569-16PAS / BC69-25PAS
	45	1	63 - 100	160 - 250	115 <sup>1)</sup> - 145 <sup>1)</sup>	BCP51 / -10 / -16	BCX51 / -10 / -16	BC51PA / BC51-10PA / BC51-16PA	BC51PAS / BC51-10PAS / BC51-16PAS
	60	1	63 - 100	160 - 250	100	BCP52 / -10 / -16	BCX52 / -10 / -16	BC52PA / BC52-10PA / BC52-16PA	BC52PAS / BC52-10PAS / BC52-16PAS
	80	1	63 - 100	160 - 250	115 <sup>1)</sup> - 145 <sup>1)</sup>	BCP53 / -10 / -16	BCX53 / -10 / -16	BC53PA / BC53-10PA / BC53-16PA	BC53PAS / BC53-10PAS / BC53-16PAS

<sup>1)</sup> Typical value

In the spotlight

#### Medium-power transistors in DFN2020-3 and DFN2020D-3 (with solderable sidepads)

- Excellent electrical performance on a small 2 x 2 mm footprint
- 80% board space reduction (DFN2020 vs. SOT89)
- 100% solderable sidepads (DFN2020D-3)
- V<sub>CEO</sub> ranging from 20 V to 80 V
- High collector-current capability I<sub>C</sub> up to 2 A
- AEC-Q101 qualified



### High-voltage transistors

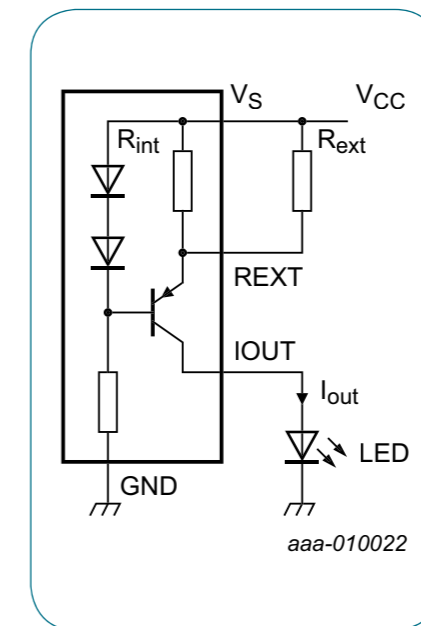
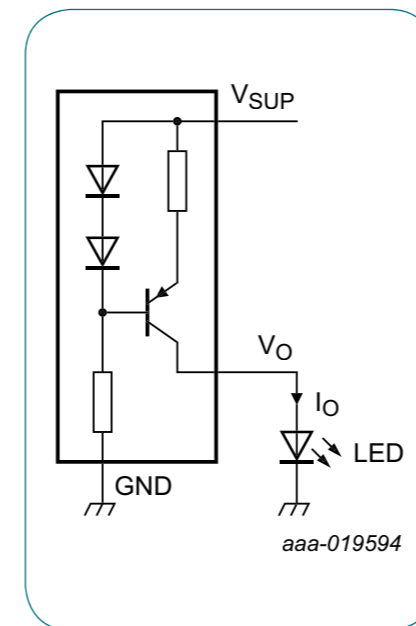
Package						SOT223 (SC-73)	SOT89 (SC-62)	SOT457 (SC-74)	SOT23	SOT323 (SC-70)
Size (mm)						6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.5 x 1.0	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95
P <sub>tot</sub> (mW)						1700	1300	750	250	200
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)					
NPN	80	100	20	-	60				BSS64	
	140	300	60	250	100				PMBT5550	PMST5550
	160	300	80	250	100				PMBT5551 / BSR19A	PMST5551
	250	100	50	-	60	BF722	BF622		BF822	
	300	100	50	-	60	BF720	BF620		BF820	BF820W
	350	100	40	-	70	PZTA42	PXTA42		PMBTA42	PMSTA42
PNP	400	300	50	200	20	BSP19	BST39			
	100	100	30	-	50	PZTA44			PMBTA44	
	250	100	50	-	60	BF723			BSS63	
	300	100	50	-	60		BF623		BF823	
2 x NPN	40	100	40	-	50				BF821	
						PZTA92	PXTA92		PMBTA92	PMSTA92
								PMBTA42DS		

For high-voltage transistors with increased performance please refer to our high-voltage low V<sub>CEsat</sub> (BISS) transistor portfolio on page 18.

### LED driver

Package		SOT457	SOT23
Size (mm)		2.9 x 1.5 x 1.0	2.9 x 1.3 x 1.0
P <sub>tot</sub> (mW)		750	480
V <sub>s</sub> supply voltage [V]		LED drive current [mA] @ V <sub>s</sub> =10V	
18		10	NCR401T
		20	NCR402T
40		10	NCR401U
		20	NCR402U
		50	NCR405U

#### Voltage reference for SOT457



#### Key features and benefits

- ▶ Single-chip constant-current source with reduced component count
- ▶ Very small footprint for smaller designs

#### Key applications

- ▶ Constant-current LED driver
- ▶ Generic constant-current source
- ▶ Active bias control for audio amplifiers

### Constant-current source

Package		SOT353 (SC-88A)				
Size (mm)		2.0 x 1.25 x 0.95				
P <sub>tot</sub> (mW)		335				
Type		PSS12021SAY				
Description	maximum supply voltage	maximum supply current	typical stabilized output current	minimum stabilized output current	maximum stabilized output current	
Parameter	V <sub>s</sub> max (V)	I <sub>s</sub> max (mA)	I <sub>out</sub> typ (µA)	I <sub>out</sub> min (mA)	I <sub>out</sub> max (mA)	
Value	75	2.2	15	0.015	50	

## Darlington transistors

Package					SOT223 (SC-73)	SOT89 (SC-62)	SOT23	
Size (mm)					6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.3 x 1.0	
P <sub>tot</sub> (mW)					1700	1300	250	
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	f <sub>T</sub> min (MHz)				
NPN	30	500	10000	125			PMBTA13	
			20000		PZTA14	PXTA14	PMBTA14	
	45	1000	2000	200			BCV29	BCV27
			10000			BSP50	BST50	
	60	500	10000	220			BCV49	BCV47
			2000			BSP51	BST51	
80	1000	2000	200			BSP52	BST52	
PNP	30	500	20000	125			PMBTA64	
			220				BCV28	BCV26
	45	1000	2000	200				
			10000			BSP60	BST60	
	60	500	10000	220				
			2000			BSP61	BST61	
80	1000	2000	200			BSP62	BST62	

## Schmitt triggers

Package							SOT143B
Size (mm)							2.9 x 1.3 x 1.0
P <sub>tot</sub> (mW)							250
Polarity	V <sub>CEO</sub> (V) TR1	V <sub>CEO</sub> (V) TR2	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	V <sub>CEsat</sub> typ (mV)	
NPN	30	6	100	110	800	250	BCV63 / B
PNP	30	6	100	220	475	250	BCV64B

## Low-noise transistors

Package							SOT23	SOT323 (SC-70)
Size (mm)							2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95
P <sub>tot</sub> (mW)							250	200
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	Noise figure max (dB)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)		
NPN	30	100	4	200	450	100	BC849B	BC849BW
				420	800	100	BC849C	BC849CW
	45	100	4	200	450	100	BC850B	BC850BW
				420	800	100	BC850C	BC850CW
PNP	30	100	4	220	475	100	BC859B	BC859BW
				420	800	100	BC859C	BC859CW
	45	100	4	220	475	100	BC860B	BC860BW
				420	800	100	BC860C	BC860CW

## Matched-pair transistors

types in **bold** represent new products

Package								SOT143B	SOT457 (SC-74)	SOT353 (SC-88A)	SOT363 (SC-88)	SOT666	LFPK56D (SOT1205)
Size (mm)								2.9 x 1.3 x 1.0	2.9 x 1.5 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.6 x 1.2 x 0.55	5 x 6 x 1.1
P <sub>tot</sub> (mW)								250	750	300	300	300	1250
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	h <sub>FE1</sub> /h <sub>FE2</sub>	V <sub>BE1</sub> - V <sub>BE2</sub> (mV)							
NPN	30	100	110	800	0.7 <sup>1)</sup>	n.a.	BCV61/A/B/C <sup>1)</sup>						
						n.a.	BCM61B <sup>1)</sup>						
	45	100	200	450	0.9 <sup>1)</sup>	2		BCM847DS		BCM847BS		BCM847BV	
						0.95	2			PMP4501G		PMP4501Y	PMP4501V
	65	100	200	450	0.9	2				PMP4201G		PMP4201Y	PMP4201V
						0.98	2				BCM846BS		
100	3000	150	400	0.95	n.a.							PHPT610035NK	
Configuration													
PNP	30	100	100	800	0.7 <sup>1)</sup>	n.a.	BCV62/A/B/C <sup>1)</sup>						
						n.a.	BCM62B <sup>1)</sup>						
	45	100	200	450	0.9 <sup>1)</sup>	2		BCM857DS		BCM857BS		BCM857BV	
						0.95	2			PMP5501G		PMP5501Y	PMP5501V
	65	100	200	450	0.9	2				PMP5201G		PMP5201Y	PMP5201V
						0.98	2				BCM856DS		BCM856BS
100	3000	150	220	0.9	n.a.							PHPT610035PK	
Configuration													

<sup>1)</sup> I<sub>C1</sub> / I<sub>E2</sub>

### New transistors in LFPK56D (SOT1205) power package

- High thermal power dissipation up to 3 W
- V<sub>ceo</sub> up to 100 V
- All types AECQ-101 qualified
- 2 types with current gain matching of 5% and 10%
- Reduced PCB size requirements
- High-temperature applications up to 175 °C
- For LED lighting, motor drive, linear regulators, backlight units, PowerMOS, and IGBT drive



### Key features

- Current gain matching to 2, 5, or 10%
- Base-emitter voltage matching to 2 mV
- Choice of standard double transistor pinout or application-optimized pinout
- Common-emitter configuration for 5-pin type
- Range of small, very small, and ultra-small packages

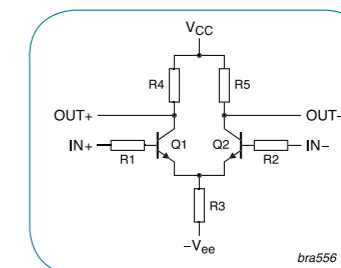
### Key benefits

- Improved performance of current mirror and differential amplifier circuits
- Drop-in replacement for standard double transistors (BCM series)
- Simplified board layout (PMP series)
- Eliminates the need for costly additional trimming

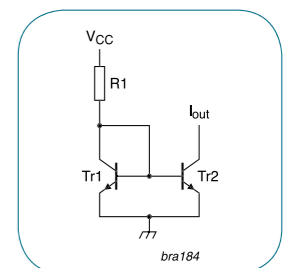
### Key applications

- Current mirrors
- Differential and instrumentation amplifiers
- Logarithmic amplifiers
- Comparators

#### Differential amplifier


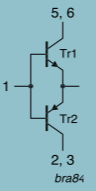



#### Current mirror





## MOSFET driver

$V_{CE0}$ (V)	$I_C$ (A)	$I_{cm}$ [A]	Type	Package	Remark	Configuration
30	0.1	0.2	BCV65	SOT143B 	General-purpose transistors	
40	0.6	1	PMD2001D	SOT457 	Switching transistors with reduced storage time	
	1	2	PMD3001D		Low $V_{CEsat}$	

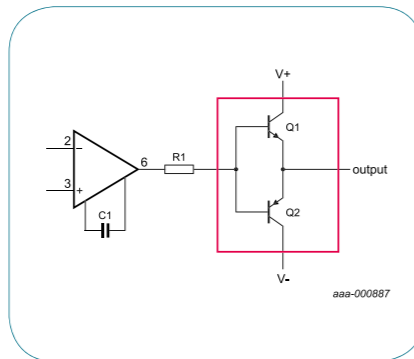
### Key features and benefits

- ▶ Three different configurations
- ▶ Types available with standard, switching, and low  $V_{CEsat}$  (BISS) transistors
- ▶ Small footprint

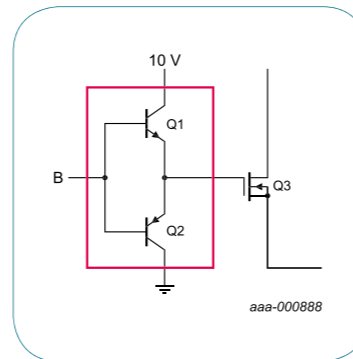
### Key applications

- ▶ Power management
  - (Half) bridge push-pull driver
  - Isolated DC/DC converters
  - Secondary synchronous rectification
- ▶ Peripheral driver
  - (Half) bridge push-pull driver
  - Motor driver
  - Brushless DC motor driver
  - Op-amp output current booster



Op-amp booster



MOSFET driver for faster switching, lower losses



## Medium-frequency transistors

						SOT23	SOT323 (SC-70)
Package							
Size (mm)						2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95
$P_{tot}$ (mW)						250	200
Polarity	$V_{CE0}$ (V)	$I_C$ (mA)	$h_{FE}$ min	$h_{FE}$ max	$f_T$ typ (MHz)		
NPN	15	100	40	-	500	BF570	
	20	25		85	>275	BFS20	BFS20W
		30	65	225	260	BFS19	
	40	25	67	220	380	BF840	
PNP	30	25	25	50	250	BF824	BF824W
	40		50	-	>325	BF550	



## Diodes

### Schottky barrier diodes and rectifiers

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- Medium-power low VF Schottky rectifiers single  $\geq 1$  A - Flatpower packages 33
- Medium-power low VF Schottky rectifiers single  $\geq 200$  mA - DSN packages 34
- Medium-power low VF Schottky rectifiers single  $\geq 200$  mA - leadless (DFN) packages 35
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- General-purpose Schottky diodes  $\leq 250$  mA 38
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### Zener diodes

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### Switching diodes

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- General-purpose, high-speed switching diodes < 90 V 42
- General-purpose, high-speed switching diodes 100 V 42
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- PN-rectifier 43
- Controlled-avalanche switching diodes 44
- Low-leakage current-switching diodes 44

# What you get when you choose NXP for diodes and rectifiers

## A comprehensive portfolio for all kind of applications

NXP is continually innovating parts by reducing power consumption and size while boosting performance and reliability

## A broad range of packages

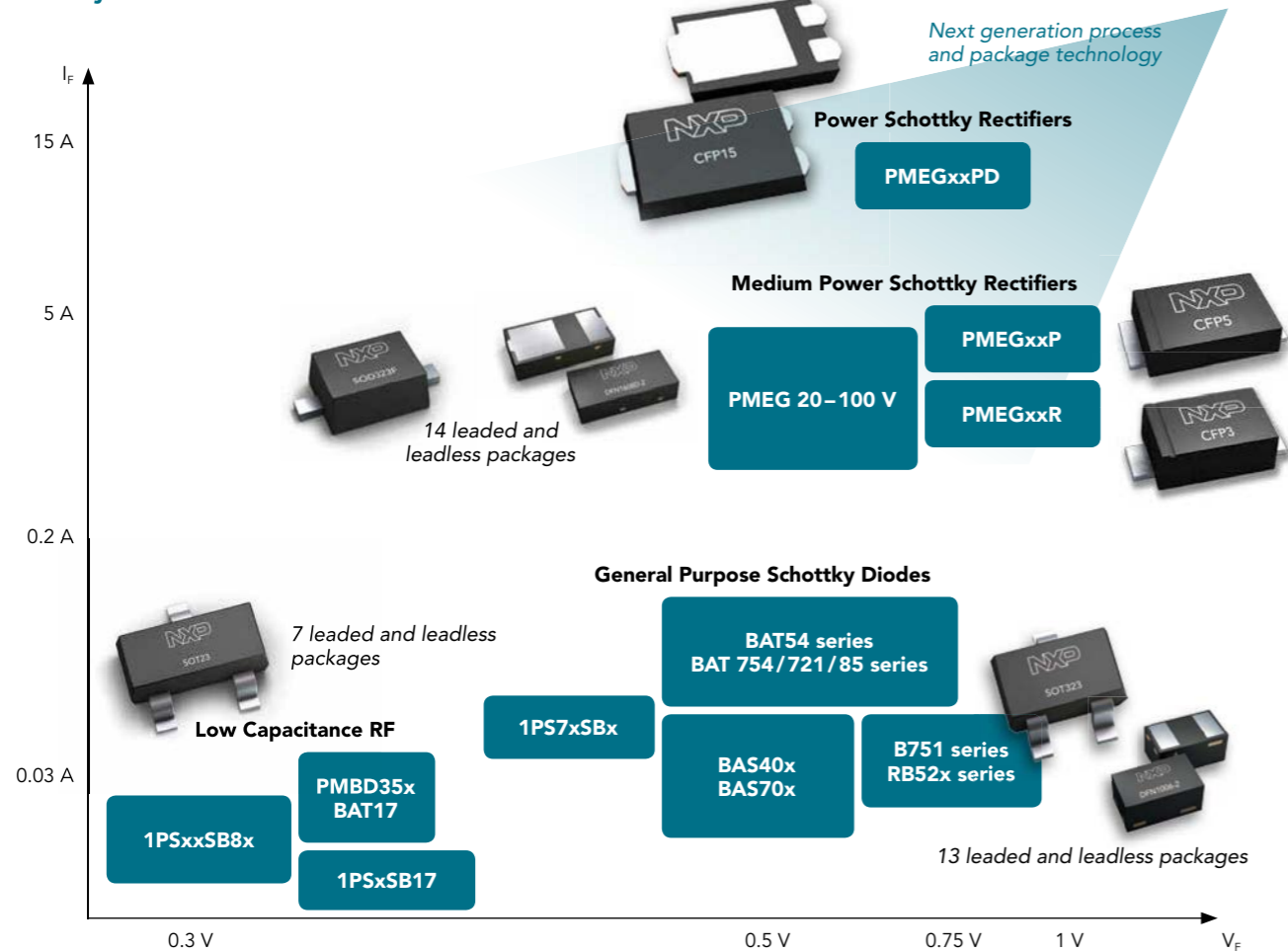
Including standard leaded SMD, medium-power clip-bond and ultra-small leadless packages with dimensions down to 0.6 x 0.3 x 0.3 mm

## A quality product from an experienced, high volume supplier

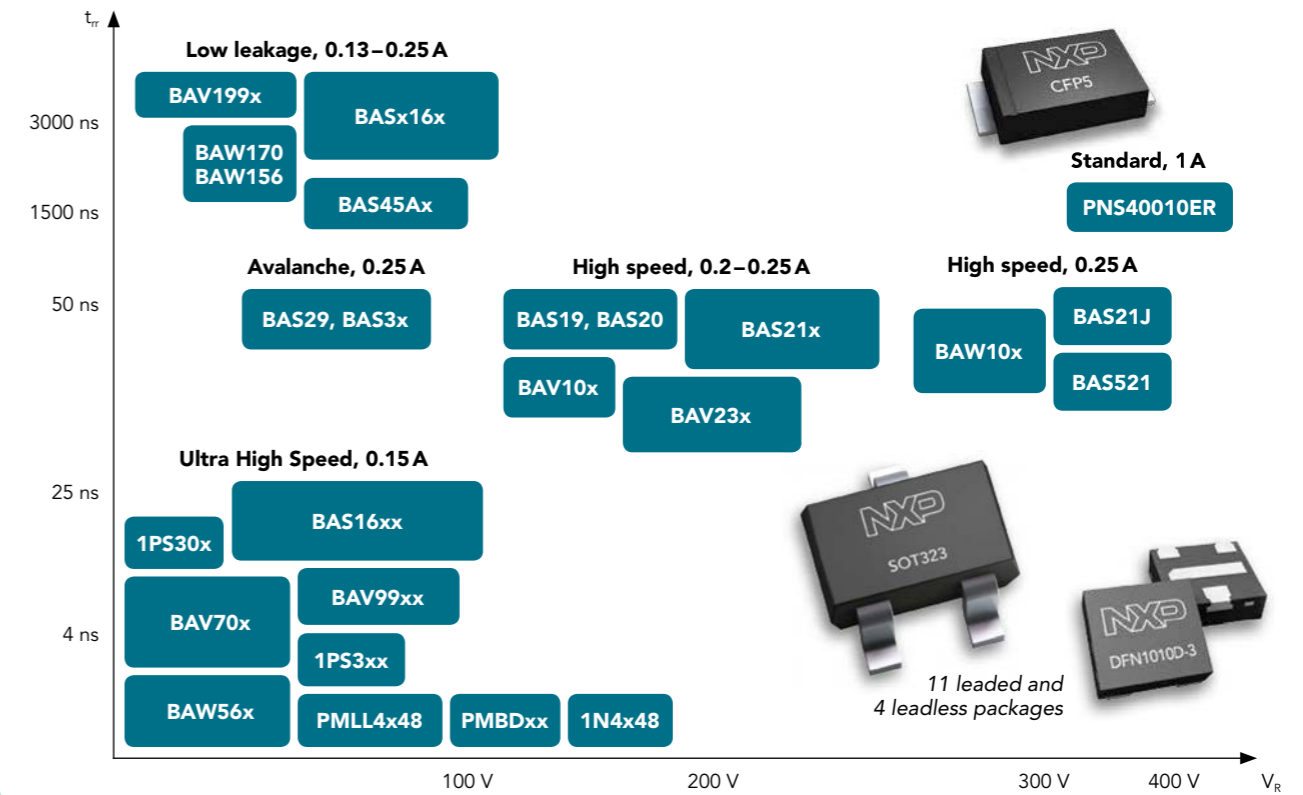
- ▶ NXP is strongly committed to automotive quality standards
- ▶ NXP has a track record of more than 60 years in developing and producing diodes
- ▶ NXP is the #1 in small-signal discretes with a high production capacity

## Portfolio Overview Diodes

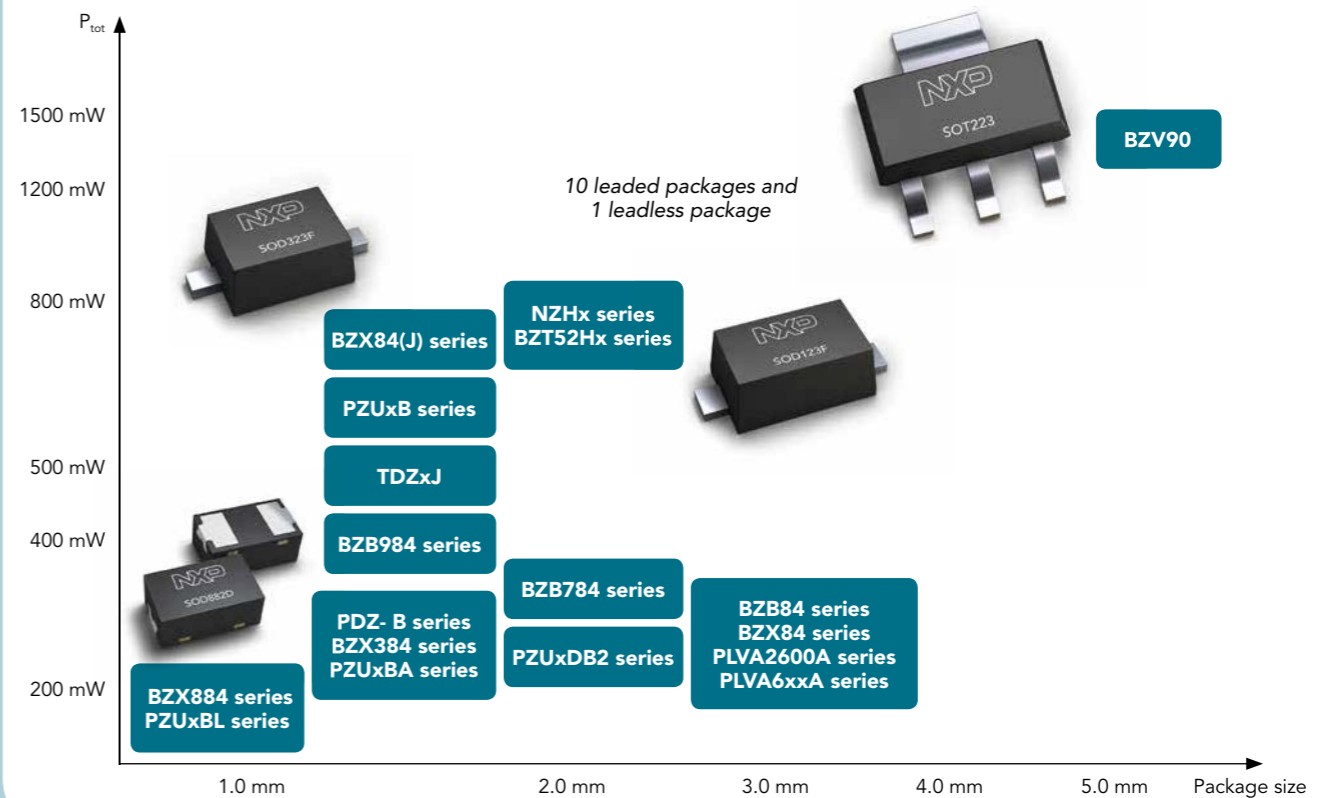
### Schottky Diodes



### Switching Diodes



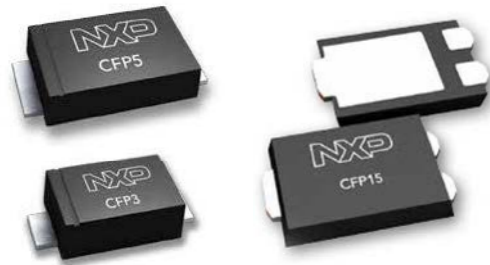
### Zener Diodes



# NXP's FlatPower packages CFP3, CFP5, and CFP15

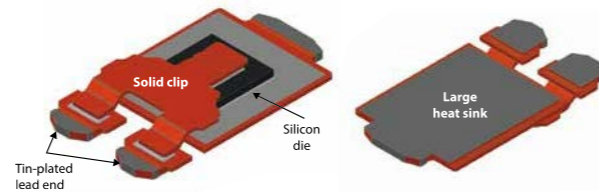
The medium-power solution for shrinking designs

## Small SMD FlatPower packages in three different versions



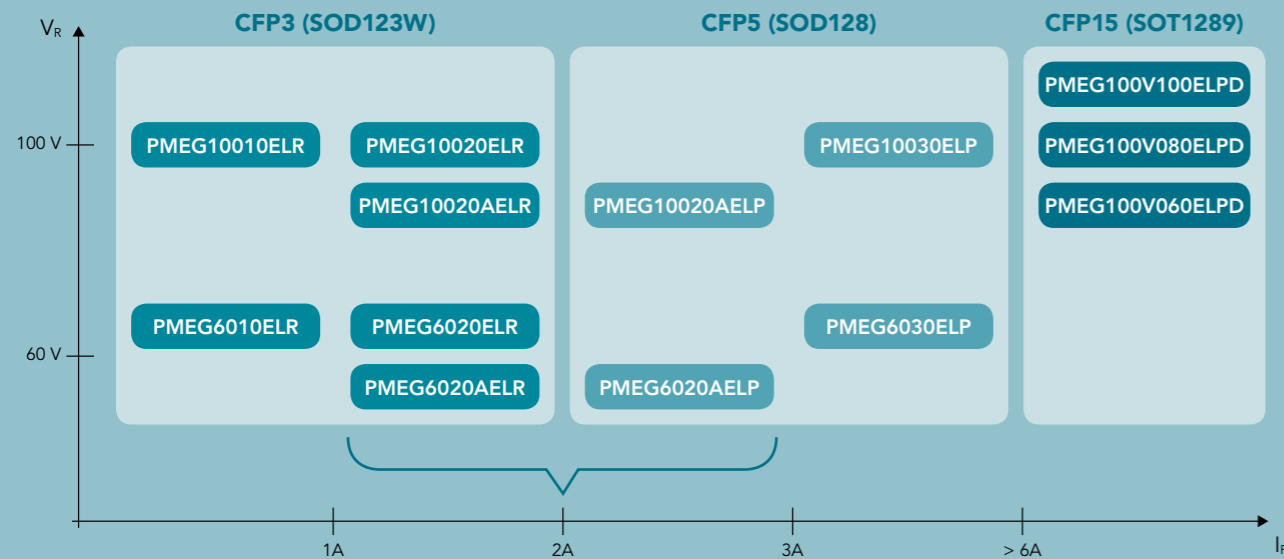
- ▶ Flat geometry, of down to 0.78 mm height
- ▶ Halogen-free mold compound
- ▶ AEC-Q101 qualified

## Robust design



- ▶ High-power capability due to wire-free clip-bond technology and heatsink
- ▶ Automatic optical inspection of solder joint due to tin-plated lead ends
- ▶ Benchmark flat design of only 0.7 mm height

## Low $I_R$ Schottky Portfolio, AEC-Q101



NXP offers more than 200 products in FlatPower packages, to support a wide range of applications for medium-power rectification and surge protection.

Schottky barrier diodes and rectifiers

## Medium-power low $V_F$ Schottky rectifiers single $\geq 1$ A - FlatPower packages

types in **bold** represent new products

$I_F$ max (A)	$V_R$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_R$ max (mA) @ $V_R$ max	Package	CFP15 (SOT1289)	CFP5 (SOD128)	CFP3 (SOD123W)
				Size (mm)	5.8 x 4.3 x 0.78	3.8 x 2.5 x 1.0	2.6 x 1.7 x 1.0
				$P_{tot}$ (mW) @ 1 cm <sup>2</sup>	2150	1050	950
Optimization							
1	20	340	1	Low $V_F$			PMEG2010ER
		450	0.05	Low $I_R$			PMEG2010BER
	30	360	1.5	Low $V_F$		PMEG3010EP	PMEG3010ER
		450		Low $I_R$		PMEG3010BEP	PMEG3010BER
	40	490	0.05	Low $V_F$		PMEG4010EP	PMEG4010ER
				Low $V_F$		PMEG4010ETP	PMEG4010ETR
	60	530	0.06	Low $V_F$		PMEG6010EP	PMEG6010ER
		530		Low $V_F$			PMEG6010ETR
	100	660	0.0003	Low $I_R$			PMEG6010ELR
		770		0.00015	Low $I_R$		
2	30	360	3	Low $V_F$		PMEG3020EP	
		420	1.5	Low $V_F$		PMEG3020CEP	PMEG3020ER
		450	0.1	Low $I_R$		PMEG3020BEP	
		520	0.05	Low $I_R$		PMEG3020DEP	PMEG3020BER
	40	490	0.1	Low $V_F$		PMEG4020EP	PMEG4020ER
				Low $V_F$		PMEG4020ETP	PMEG4020ETR
	60	530	0.2	Low $V_F$		PMEG6020EP	PMEG6020ER
		530		Low $V_F$		PMEG6020ETP	PMEG6020ETR
		680	0.0007	Low $I_R$		PMEG6020AELP	PMEG6020AELR
		760		Low $I_R$			PMEG6020ELR
100	770	0.0003	Low $I_R$			PMEG10020AELR	
	830		0.00015	Low $I_R$		PMEG10020AELP	PMEG10020ELR
3	30	360	5	Low $V_F$		PMEG3030EP	
		450	0.15	Low $I_R$		PMEG3030BEP	
	40	490	0.2	Low $V_F$		PMEG4030EP	
				Low $V_F$		PMEG4030ETP	
	60	540	0.1	Low $I_R$			PMEG4030ER
		530		0.2	Low $V_F$		PMEG6030EP
		475	0.4	Low $V_F$		PMEG6030EVP	
		530	0.2	Low $V_F$		PMEG6030ETP	
	100	690	0.001	Low $I_R$		PMEG6030ELP	
		770		0.00045	Low $I_R$		PMEG10030ELP
4.5	60	530	0.4	Low $V_F$		PMEG6045ETP	
		360	8	Low $V_F$		PMEG3050EP	
5	30	450	0.25	Low $I_R$		PMEG3050BEP	
		490	0.3	Low $V_F$		PMEG4050EP	
	45	Low $V_F$			PMEG045V050EPD		
6	60	560	0.4	Low $V_F$		PMEG060V050EPD	
		100	850	0.001	Low $I_R$		PMEG100V060ELPD
8	100	850	0.001	Low $I_R$		PMEG100V080ELPD	
		490	0.6	Low $V_F$		PMEG045V100EPD	
10	45	540	0.5	Low $I_R$		PMEG45U10EPD	
		560	0.7	Low $V_F$		PMEG45A10EPD	
	60	560	0.7	Low $V_F$		PMEG060V100EPD	
		850		0.001	Low $I_R$		PMEG100V100ELPD
15	45	550	0.1	Low $I_R$		PMEG045T150EPD	
		580		Low $I_R$		PMEG045T15EPD	
	50	490	1	Low $V_F$		PMEG045V150EPD	
		550	0.1	Low $I_R$		PMEG050T150EPD	
500	1	Low $V_F$		PMEG050V150EPD			

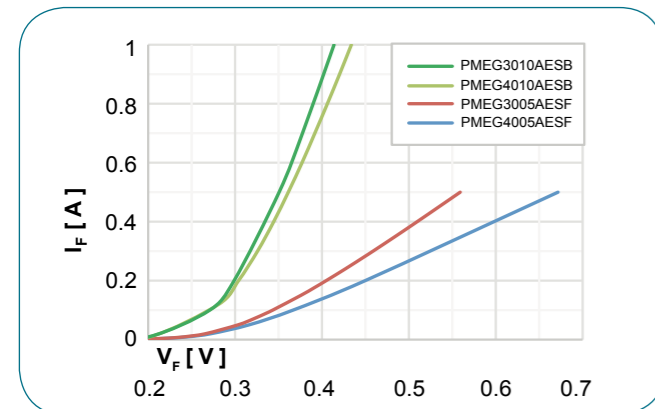
Medium-power low  $V_F$  Schottky rectifiers single  $\geq 200$  mA - Leadless DSN packages types in bold represent new products

$I_F$ max (A)	$V_F$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_R$ max (mA) @ $V_F$ max	Package	DSN0603-2 (SOD962)	DSN1006-2 (SOD993)	DSN1006U-2 (SOD995)
				Size (mm)	0.6 x 0.3 x 0.3	1.0 x 0.6 x 0.28	1.0 x 0.6 x 0.28
				$P_{tot}$ (mW) @ 1 cm <sup>2</sup>	525	1.000	1.190
Optimization							
0.2	20	420	0.045	Low $V_F$	<b>PMEG2002AESF</b>		
		490	0.0035	Low $I_R$	PMEG2002ESF		
	30	470	0.08	Low $V_F$	<b>PMEG3002AESF</b>		
		535	0.009	Low $I_R$	PMEG3002ESF		
40	525	0.08	Low $V_F$	<b>PMEG4002AESF</b>			
	600	0.0065	Low $I_R$	PMEG4002ESF			
0.5	20	550	0.045	Low $V_F$	<b>PMEG2005AESF</b>		
		620	0.0035	Low $I_R$	PMEG2005ESF		
	30	630	0.08	Low $V_F$	<b>PMEG3005AESF</b>		
		720	0.009	Low $I_R$	PMEG3005ESF		
40	820	0.08	Low $V_F$	<b>PMEG4005AESF</b>			
	880	0.0065	Low $I_R$	PMEG4005ESF			
1	30	480	1.25	Low $V_F$		<b>PMEG3010AESB</b>	<b>PMEG3010AESA</b>
		565	0.045	Low $I_R$		PMEG3010ESF	
	40	505	0.115	Low $V_F$		<b>PMEG4010AESB</b>	
		610	0.04	Low $I_R$		PMEG4010ESB	
	60	625	0.65	Low $V_F$		<b>PMEG6010AESB</b>	
		730	0.03	Low $I_R$		PMEG6010ESB	

Forward characteristic survey of Schottkys in DSN1006-2

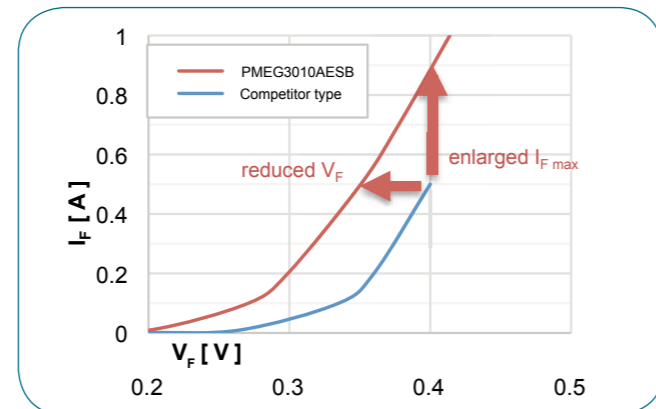
$V_R$ : 30V,  $I_F$ :  $I_A$  (typical data)

Selected DSN Schottky rectifier



This diagram shows the broad variety of the DSN portfolio

PMEG3010AESB versus competitor type



NXP type has higher forward current specified and has benchmark low  $V_F$

In the spotlight

**PMEG3010AESB, PMEG6010ESB, low  $V_F$  Schottky Rectifier**

30 / 40 / 60 V, 1A Schottky rectifier in DSN1006-2 (SOD993) package

Low forward voltage,  $V_F$  max = 480 mV @ 1 A (PMEG3010AESB)

Low leakage current,  $I_R$  max = 30  $\mu$ A @ 60 V (PMEG6010ESB)

High surge capability up to  $I_{FSM}$  = 10 A

Ideal for LED backlighting in mobile applications



Medium-power low  $V_F$  Schottky rectifiers single  $\geq 200$  mA - Leadless DFN packages types in bold represent new products

$I_F$ max (A)	$V_F$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_R$ max (mA) @ $V_F$ max	Package	DFN2020-3 (SOT1061)	DFN2020D-3 (SOT1061D)	DFN1608D-2 (SOD1608)	DFN1006-2 (SOD882)	DFN1006D-2 (SOD882D)
				Size (mm)	2.0 x 2.0 x 0.62	2.0 x 2.0 x 0.62	1.6 x 0.8 x 0.37	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.37
				$P_{tot}$ (mW) @ 1 cm <sup>2</sup>	960	960	780	565	660
Optimization									
0.2	30	480	0.05	low $V_F$				PMEG3002AEL	PMEG3002AELD
	40	600	0.01	low $I_R$				PMEG4002EL	PMEG4002ELD
	60	600	0.1	low $V_F$					PMEG6002ELD
0.5	20	390	0.2	low $V_F$					PMEG2005BELD
		410	0.3	low $V_F$			PMEG2005EPK		
		440	1.5	low $V_F$				PMEG2005AEL	PMEG2005AELD
	500	0.03	low $I_R$				PMEG2005EL	PMEG2005ELD	
	30	500	0.5	low $V_F$				PMEG3005EL	PMEG3005ELD
1	20	375	1.9	low $V_F$	PMEG2010EPA	<b>PMEG2010EPAS</b>			
		415	0.6	low $V_F$			PMEG2010EPK		
	490	0.2	low $V_F$					PMEG2010BELD	
	40	600	0.02	low $I_R$			PMEG4010EPK		
1.5	20	420	0.9	low $V_F$			PMEG2015EPK		
	40	610	0.03	low $I_R$			PMEG4015EPK		
2	20	420	1.9	low $V_F$	PMEG2020EPA	<b>PMEG2020EPAS</b>			
		450	0.9	low $V_F$			PMEG2020EPK		
	30	470	2.5	low $V_F$	PMEG3020EPA	<b>PMEG3020EPAS</b>			
	40	535	0.1	low $V_F$	PMEG4020EPA	<b>PMEG4020EPAS</b>			
	530	0.2	low $V_F$			PMEG4020EPK			
	60	575	0.25	low $V_F$	PMEG6020EPA	<b>PMEG6020EPAS</b>			

**Features and benefits**

- ▶ 33% lower  $V_F$  on same footprint
- ▶ Low profile of 0.37 mm
- ▶ Solderable side pads
- ▶ Visual solder inspection

**Applications**

- ▶ Handheld equipment
- ▶ Smartphone backlight units
- ▶ Battery chargers
- ▶ Shrunk PCB designs

Differentiated portfolio

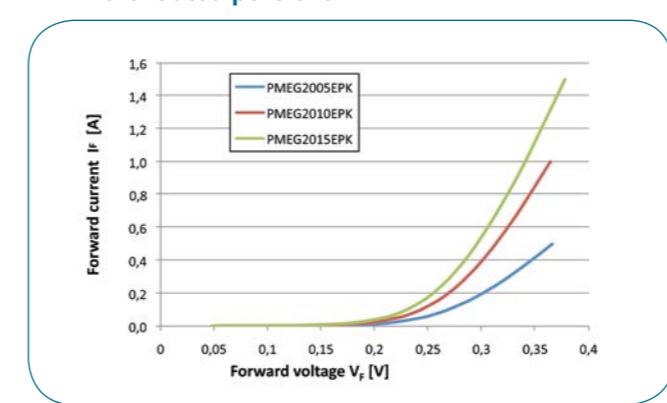
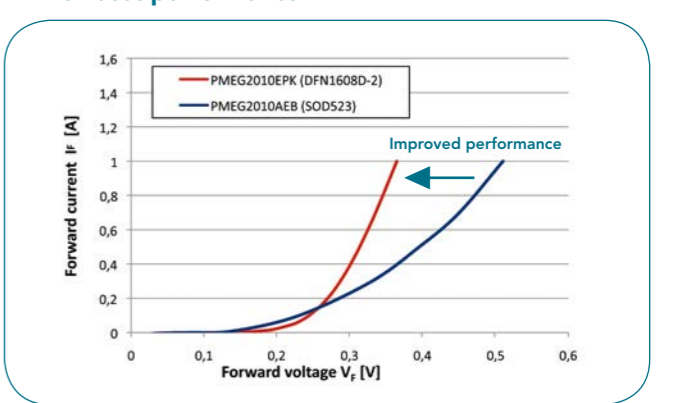


Diagram shows the variety of characteristics in DFN1608D-2 (SOD1608)

with best performance



PMEG2010EPK shows significant  $V_F$  improvement compared to the SOD523 device



### Medium-power low $V_F$ Schottky rectifiers single $\geq 200$ mA - Leaded packages

$I_F$ max (A)	$V_F$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_R$ max (mA) @ $V_R$ max	Package	SOT457 (SC-74)	SOT23	SOD123F	SOT323 (SC-70)	SOD323F (SC-90)	SOD323 (SC-76)	SOT666	SOD523 (SC-79)	
					Size (mm)	2.9 x 1.5 x 1.0	2.9 x 1.3 x 1.0	2.6 x 1.6 x 1.1	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.7	1.7 x 1.25 x 0.95	1.6 x 1.2 x 0.55	1.2 x 0.8 x 0.6
					540	420	830	400	830	570	570	500	
				Optimization									
0.2	30	480	0.05	low $V_F$					PMEG3002EJ			PMEG3002AEB	
	40	600	0.01	low $I_R$					PMEG4002EJ			PMEG4002EB	
	60	600	0.1	low $V_F$					PMEG6002EJ			PMEG6002EB	
0.5	20	390	0.2	low $V_F$		PMEG2005ET	PMEG2005EH		PMEG2005EJ	PMEG2005AEA	PMEG2005AEV		
		480	0.03	low $I_R$								PMEG2005EB	
	30	430	0.15	low $V_F$		PMEG3005ET	PMEG3005EH		PMEG3005EJ	PMEG3005AEA	PMEG3005AEV		
		500	0.5	low $V_F$								PMEG3005EB	
		470	0.1	low $V_F$		PMEG4005ET	PMEG4005EH		PMEG4005EJ	PMEG4005AEA	PMEG4005AEV		
40	550	1.1	low $V_F$		BAT720		1PS70SB20						
1	20	430	0.2	low $V_F$		PMEG2010AET	PMEG2010AEH						
		500	0.2	low $V_F$		PMEG2010ET	PMEG2010EH		PMEG2010EJ	PMEG2010BEA	PMEG2010BEV		
		550	0.07	low $I_R$					PMEG2010AEJ	PMEG2010EA BAT760	PMEG2010EV BAT960		
		620	1.5	low $V_F$								PMEG2010AEB	
	30	450	1	low $V_F$	1PS74SB23								
		520	0.1	low $I_R$			PMEG3010CEH		PMEG3010CEJ				
		560	0.15	low $V_F$			PMEG3010ET	PMEG3010EH		PMEG3010EJ	PMEG3010BEA	PMEG3010BEV	
		680	0.5	low $V_F$								PMEG3010EB	
		570	0.05	low $I_R$					PMEG4010CEH		PMEG4010CEJ		
		600	0.02	low $I_R$									
40	640	0.05	low $V_F$			PMEG4010ET	PMEG4010EH		PMEG4010EJ	PMEG4010BEA	PMEG4010BEV		
	650	0.35	low $V_F$	PMEG6010AED									
60	660	0.05	low $I_R$					PMEG6010CEH		PMEG6010CEJ			
1.5	20	660	0.2	low $I_R$				PMEG2015EH		PMEG2015EJ	PMEG2015EA	PMEG2015EV	
	30	500	1	low $V_F$				PMEG3015EH		PMEG3015EJ		PMEG3015EV	
2	10	460	3	low $V_F$				PMEG1020EH		PMEG1020EJ	PMEG1020EA	PMEG1020EV	
	20	525	0.2	low $V_F$				PMEG2020EH		PMEG2020EJ	PMEG2020AEA		
	30	620	1	low $V_F$				PMEG3020EH		PMEG3020EJ			
3	10	530	3	low $V_F$				PMEG1030EH		PMEG1030EJ			

In the spotlight

#### Schottky Rectifier in SOD123F and SOD323F

Broad portfolio base of 36 types, 20 / 60 V, 0.2 - 3 A

Optimized either for low  $V_F$  or low  $I_R$

High surge capability up to 10 A

High thermal capability due to flat-lead design

AEC-Q101 qualified

Ideal for DC/DC conversion, free-wheeling, reverse polarity protection

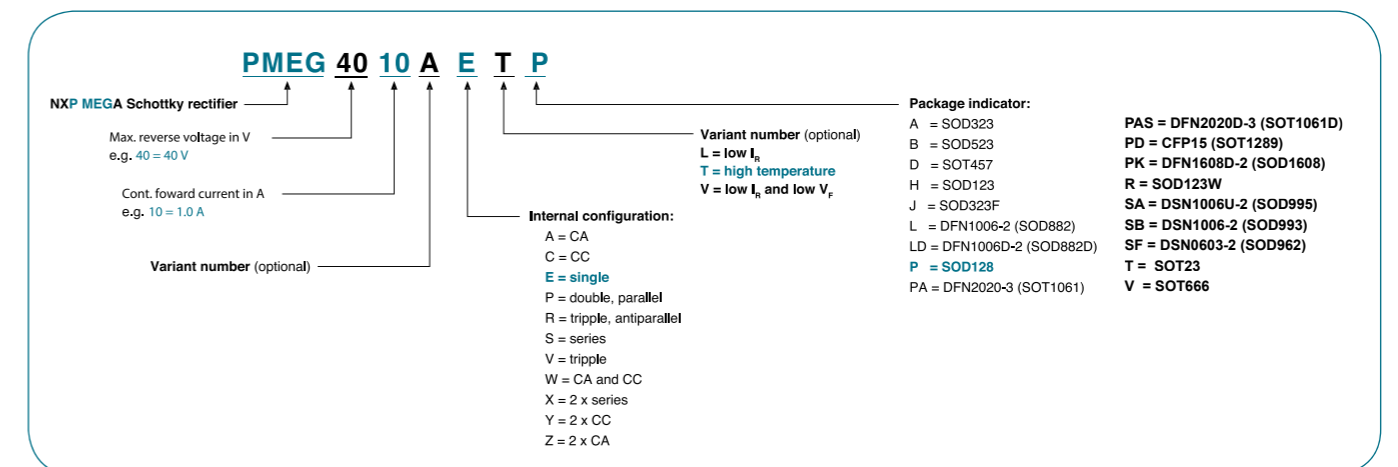


### Medium-power low $V_F$ Schottky rectifiers dual $\geq 200$ mA

types in **bold** represent new products

$I_F$ max (A)	$V_F$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_R$ max (mA) @ $V_R$ max	Optimization	Package	SOT223 (SC-73)	SOT23	DFN2020-3 (SOT1061)	DFN2020D-3 (SOT1061D)	SOT666
						Size (mm)	6.5 x 3.5 x 1.65	2.9 x 1.3 x 1.0	2.0 x 2.0 x 0.62	2.0 x 2.0 x 0.63
						1500	250	1000	1000	300
					$P_{tot}$ (mW) @ 1 cm <sup>2</sup>					
0.2	30	480	0.03	low $V_F$						PMEG3002TV
	60	600	0.1	low $V_F$						PMEG6002TV
0.5	20	390	0.2	low $V_F$						PMEG2005CT
	30	430	0.15	low $V_F$						PMEG3005CT
	40	470	0.1	low $V_F$						PMEG4005CT
1.0	25	450	1.0	low $V_F$		BAT120S				
				low $V_F$		BAT120C				
				low $V_F$		BAT120A				
	40	500	0.05	low $V_F$				PMEG4010CPA	<b>PMEG4010CPAS</b>	
				low $V_F$				PMEG6010CPA	<b>PMEG6010CPAS</b>	
				low $V_F$		BAT160S				
60	650	0.35	low $V_F$		BAT160C					
			low $V_F$		BAT160A					
2.0	20	420	1.0	low $V_F$				PMEG2020CPA	<b>PMEG2020CPAS</b>	
	30	440	2.0	low $V_F$				PMEG3020CPA	<b>PMEG3020CPAS</b>	

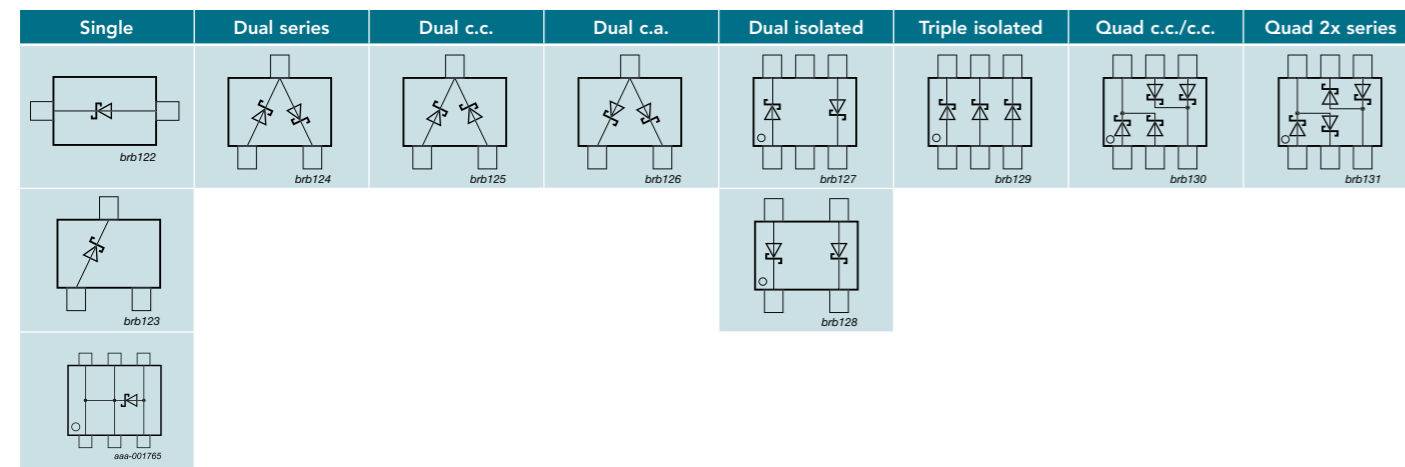
### Low $V_F$ (MEGA) Schottky rectifier nomenclature



General-purpose Schottky diodes ≤ 250 mA

I <sub>F</sub> max (mA)	V <sub>R</sub> max (V)	V <sub>F</sub> max (mV)	@ I <sub>F</sub> (mA)	I <sub>F</sub> max (μA)	@ V <sub>R</sub> (V)	Package	SOD80C (MiniMelf)	SOD68 (DO-34)	SOT23	SOT143B	SOD123F	SOT323 (SC-70)	SOT363 (SC-88)	SOD323F (SC-90)	SOD323 (SC-76)	SOT666	SOD523 (SC-79)	DFN1006-2 (SOD882)/DFN1006-3 (SOT883)				
						Size (mm)	3.5 x 1.5 x 1.5	3.04 x 1.6 x 0.55	2.9 x 1.3 x 1.0	2.9 x 1.3 x 1.0	2.6 x 1.6 x 1.1	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.7	1.7 x 1.25 x 0.95	1.6 x 1.2 x 0.55	1.2 x 0.8 x 0.6	1.0 x 0.6 x 0.48				
						P <sub>tot</sub> (mW)	300	500	250	250	830	250	300	550	400	300	500	250				
70	70	750	10	0.1	50	single			BAS70		BAS70H	BAS70W			1PS76SB70		1PS79SB70	BAS70L				
						dual series			BAS70-04			BAS70-04W										
						dual c.c.			BAS70-05			BAS70-05W										
						dual c.a.			BAS70-06			BAS70-06W										
						dual isolated				BAS70-07					BAS70-07S				BAS70-07V			
						triple isolated													BAS70VV			
120	40	500	10	1	30	single			BAS40		BAS40H	BAS40W			1PS76SB40		RB751S40	RB751CS40				
						dual series			BAS40-04			BAS40-04W										
						dual c.c.			BAS40-05			BAS40-05W										
						dual c.a.			BAS40-06			BAS40-06W										
						dual isolated				BAS40-07									BAS40-07V			
						quad c.c./c.c.											1PS88SB48		BAS40-05V			
200	30	300	10	30	10	single												1PS79SB31				
						single			BAT754													
						dual series			BAT754S													
						dual c.c.			BAT754C													
						dual c.a.			BAT754A													
						triple isolated									BAT754L							
	40	400	10	2	25	25	single	BAS85	BAT85	BAT54		BAT54H	BAT54W		BAT54J	1PS76SB10		1PS79SB10	BAT54L			
							dual series			BAT54S			BAT54SW									
							dual c.c.			BAT54C			BAT54CW									BAT54CM
							dual c.a.			BAT54A			BAT54AW									
							dual isolated				BAT74				BAT74S					BAT74V		
							triple isolated													BAT54VV		
	50	450	10	5	40	75	single	BAS86	BAT86													
							single															
							single			BAT721										1PS76SB21		
							dual series			BAT721S												
							dual c.c.			BAT721C												
							dual c.a.			BAT721A												
100	850	250	250	4	75	single																
						single																
						single																
						single																
						dual series																
						dual c.c.																
250	100	850	250	4	75	single					BAT46WH				BAT46WJ							
						single																
						single																
						single																
						dual series																
						dual c.c.																

Diodes



Low-capacitance Schottky diodes

I <sub>F</sub> max (mA)	V <sub>R</sub> max (V)	V <sub>F</sub> max (mV)	@ I <sub>F</sub> (mA)	C <sub>d</sub> max (pF)	@ V <sub>R</sub> = 0 V	Package	SOT23	SOT323 (SC-70)	SOT363 (SC-88)	SOD323 (SC-76)	SOT666	SOD523 (SC-79)	DFN1006-2 (SOD882)
						Size (mm)	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.95	1.6 x 1.2 x 0.55	1.2 x 0.8 x 0.6	1.0 x 0.6 x 0.48
						P <sub>tot</sub> (mW)	250	250	300	400	300	500	250
30	4	450	1	1	1	single	BAT17			1PS76SB17		1PS79SB17	
						triple isolated				1PS66SB17			
						dual series	PMBD353 PMBD354 <sup>1)</sup>						
						single		1PS70SB82				1PS10SB82	
						triple isolated			1PS88SB82	1PS66SB82			
						dual series		1PS70SB84					
15	340	1	1	1	1	dual c.c.		1PS70SB85					
						dual c.a.		1PS70SB86					

<sup>1)</sup> Diodes have matched capacitance



### General-purpose high-speed switching diodes < 90V

types in **bold** represent new products

V <sub>R</sub> max (V)	V <sub>F</sub> max (V)	@ I <sub>F</sub> (mA)	I <sub>R</sub> max (nA)	@ V <sub>R</sub> (V)	t <sub>tr</sub> max (ns)	Package	SOD80C (MiniMelf)	SOT23	SOT143B	SOT323 (SC-70)	SOT363 (SC-88)	DFN1010D-3 (SOT1215)	DFN1006-3 (SOT883)	
							Size (mm)	3.5 x 1.5 x 1.5	2.9 x 1.3 x 1.0	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.1 x 1.0 x 0.37	1.0 x 0.6 x 0.48
P <sub>tot</sub> (mW)	500	250	250	200	300	540	250							
50	1	50	100	50	4			BAL74						
								BAV74						
70	1	50	1000	70	4			BAL99						
75	1	50	1000	75	4				BAS28					
		100	5000	75	4		BAS32L							
80	1	50	500	80	4					1PS300				
										1PS301				
										1PS302				
90	1	50	500	80	4			BAW56		BAW56W		<b>BAW56QA</b>	BAW56M	
											BAW56S			
											BAW756S			

### General-purpose, high-speed switching diodes 100V

types in **bold** represent new products

V <sub>R</sub> max (V)	V <sub>F</sub> max (V)	@ I <sub>F</sub> (mA)	I <sub>R</sub> max (nA)	@ V <sub>R</sub> (V)	t <sub>tr</sub> max (ns)	Package	SOT23	SOD123F	SOT323 (SC-70)	SOT363 (SC-88)	SOD323 (SC-76)	SOD323F (SC-90)	SOT666	SOD523 (SC-79)	DFN1010D-3 (SOT1215)	DFN1006-2 (SOD882)	DFN1006-3 (SOT883)	DFN1006D-2 (SOD882D)
							Size (mm)	2.9 x 1.3 x 1.0	2.6 x 1.6 x 1.1	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.95	1.7 x 1.25 x 0.7	1.6 x 1.2 x 0.55	1.2 x 0.8 x 0.6	1.1 x 1.0 x 0.37	1.0 x 0.6 x 0.48	1.0 x 0.6 x 0.48
P <sub>tot</sub> (mW)	250	830	200	300	400	550	180	500	540	250	250	250						
100	1	50	500	80	4			BAS16H			BAS316	BAS16J		BAS516		BAS16L		BAS16LD
							BAS16		BAS16W				<b>BAS16QA</b>					
									BAS16VY			BAS16VV						
							BAV70		BAV70W					<b>BAV70QA</b>		BAV70M		
										BAV70S								
							BAV99		BAV99W					<b>BAV99QA</b>				
										BAV99S								

### General-purpose switching diodes ≥ 100V

types in **bold** represent new products

V <sub>R</sub> max (V)	V <sub>F</sub> max (V)	@ I <sub>F</sub> (mA)	I <sub>R</sub> max (nA)	@ V <sub>R</sub> (V)	t <sub>tr</sub> max (ns)	Package	SOD80C (MiniMelf)	SOT457 (SC-74)	SOT23	SOT143B	SOD123F	SOT323 (SC-70)	SOT353 (SC-88A)	SOT363 (SC-88)	SOD323 (SC-76)	SOD323F (SC-90)	SOD523 (SC-79)
							Size (mm)	3.5 x 1.5 x 1.5	2.9 x 1.5 x 1.0	2.9 x 1.3 x 1.0	2.9 x 1.3 x 1.0	2.6 x 1.6 x 1.1	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.95	1.7 x 1.25 x 0.7
P <sub>tot</sub> (mW)	300	500	250	250	830	350		300	400	550	500						
100	1	100	100	100	50				BAS19								
150	1	100	100	150	50		BAV102										
									BAS20								
≥200	1	100	100	200	50		BAV103				BAS21H				BAS321		
									BAS21		BAS21W						
										BAV23							
												<b>BAS21PG</b>					
									BAV23A			BAS21AW					
									BAV23C								
									BAV23S			BAS21SW					
									BAS21AVD								
									BAS21VD								
														BAS21J	BAS521		
300	1.1	100	150	250	50				BAS101								
									BAS101S								
										BAW101							
													BAS101S				

### PN-rectifier

V <sub>R</sub> max (V)	V <sub>F</sub> max (V)	@ I <sub>F</sub> (A)	I <sub>R</sub> max (μA)	@ V <sub>R</sub> (V)	t <sub>tr</sub> max (ns)	Package	CFP3 SOD123W
							Size (mm)
P <sub>tot</sub> (mW)	950						
400	1.1	1	1	400	1800		PNS40010ER

**In the spotlight**

**Dual high-speed switching diode BAS21PG in SOT353 (SC-88A)**

V<sub>R</sub> max = 250 V, I<sub>F</sub> max = 225 mA, dual isolated configuration

Low leakage current: I<sub>R</sub> max = 100 nA







High-speed switching: t<sub>tr</sub> max = 50 ns

Low capacitance: C<sub>d</sub> max = 2 pF

AEC-Q101 qualified



Controlled-avalanche switching diodes

















V <sub>R</sub> max (V)	V <sub>F</sub> max (V)	I <sub>F</sub> (mA)	I <sub>R</sub> max (nA) @ V <sub>R</sub> max	I <sub>FSM</sub> max (A)	I <sub>FRM</sub> max (mA)	C <sub>d</sub> max (pF)	t <sub>r</sub> max (ns)	Package	SOT23	SOT143B
										
									Size (mm)	2.9 x 1.3 x 1.0
P <sub>tot</sub> (mW)	250	250								
60	1	200	100	9	600	2.5	6			BAS56
90	1	200	100	10	600	35	50		BAS29	
									BAS31	
									BAS35	



# ESD protection, TVS, filtering and signal conditioning

Low-leakage current-switching diodes

types in **bold** represent new products

V <sub>R</sub> max (V)	V <sub>F</sub> max (V)	I <sub>F</sub> (mA)	I <sub>R</sub> max (nA) @ V <sub>R</sub> max	t <sub>r</sub> max (μs)	Package	SOD80C (MiniMelf)	SOD68 (DO-34)	SOT23	SOD123F	SOT323 (SC-70)	SOD323 (SC-76)	SOD523 (SC-79)	DFN1010D-3 (SOT1215)	DFN1006-3 (SOT883)	DFN1006-2 (SOD882)
															
						Size (mm)	3.5 x 1.5 x 1.5	3.04 x 1.6 x 0.55	2.9 x 1.3 x 1.0	2.6 x 1.6 x 1.1	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.95	1.2 x 0.8 x 0.6	1.1 x 1.0 x 0.37	1.0 x 0.6 x 0.48
P <sub>tot</sub> (mW)	300	500	250	830	250	400	500	540	250	250					
75	1	10	5	3					BAS116H		BAS416	BAS716			<b>BAS116L</b>
								BAS116					<b>BAS116QA</b>		
								BAV199		BAV199W					
								BAW156							
								BAV170				<b>BAV170QA</b>	<b>BAV170M</b>		
125	1	100	1	1.5 typ		BAS45AL	BAS45A								

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# ESD protection, TVS devices, and EMI filtering

## What you get when you choose NXP

### Solutions for wide application fields

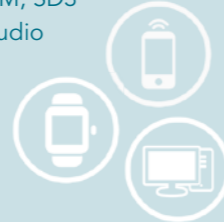
- ▶ High-speed data lines
- ▶ General interfaces
- ▶ Automotive protection
- ▶ Supply lines

### A broad range of packages that simplify PCB design

### A quality product from an experienced, high volume supplier

- ▶ NXP is strongly committed to automotive quality standards
- ▶ NXP has a track record of more than 12 years in developing and producing ESD / TVS devices
- ▶ NXP is the #1 in ESD protection with a high production capacity

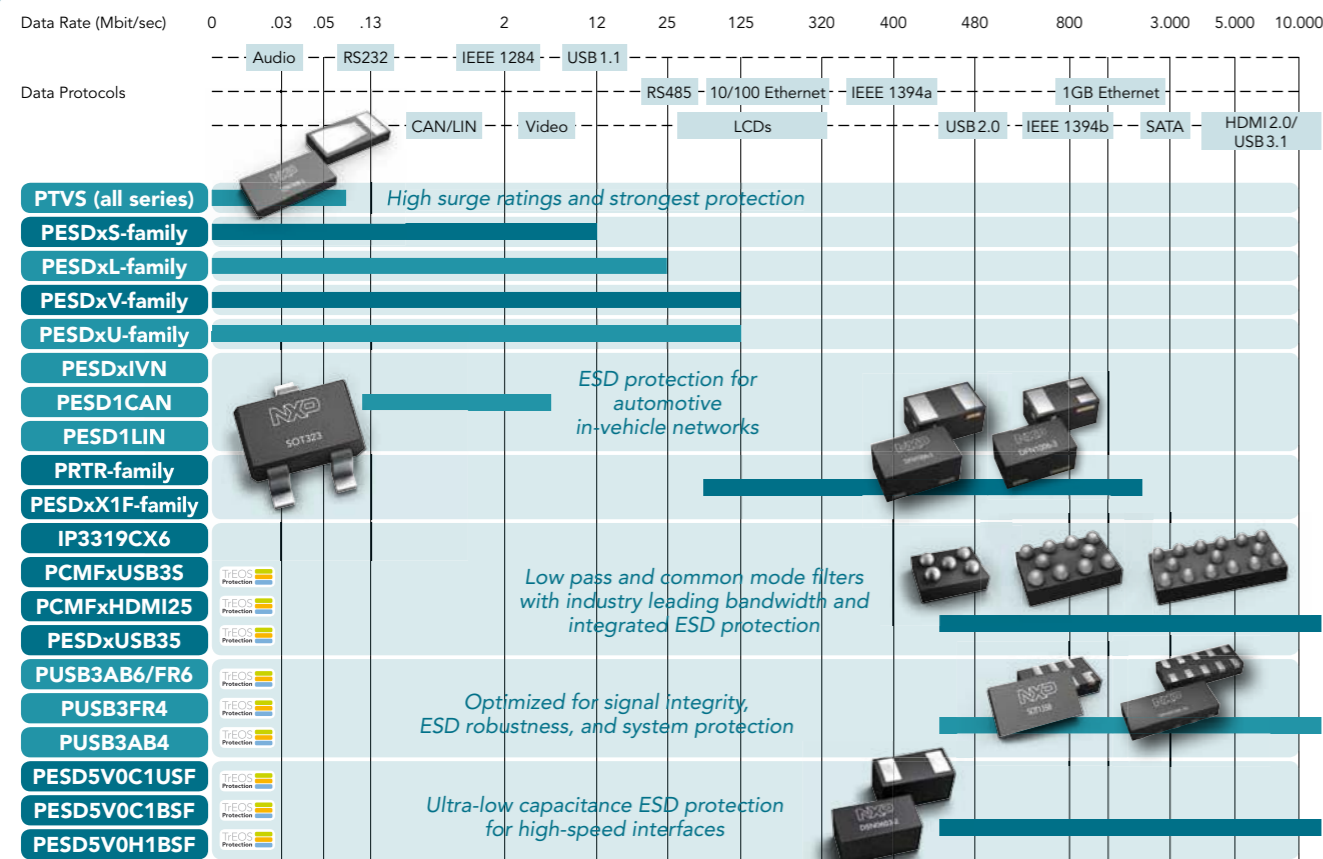
USB3 / Type C  
 USB2 / Type C  
 USB Vbus / charger port / Type C  
 NFC antenna  
 Wireless charging  
 Audio speaker  
 Battery contact, Vbat  
 Keys / buttons  
 SIM, SD3  
 Audio



CAN, LIN  
 FlexRay  
 BroadR-Reach  
 SENT  
 LVDS



### Portfolio Overview Diodes



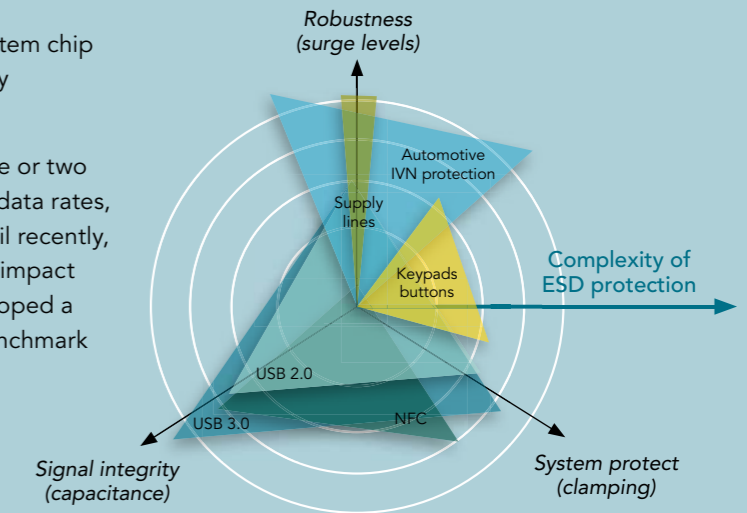
## The best system-chip protection for high-speed data lines (USB 3.1, Type-C connector)

### ESD protection characteristics that count

There are three key parameters for a perfect ESD protection device:

- ▶ High robustness against ESD pulses
- ▶ Low clamping / dynamic resistance – to protect the system chip
- ▶ Low capacitance – to maintain excellent signal integrity in high-speed interfaces

Some applications require good performance in only one or two of these areas. For the latest interfaces with the highest data rates, optimum performance in all three parameters is key. Until recently, improving one of these key parameters had a negative impact on the others. Addressing this challenge, NXP has developed a new ESD technology (TrEOS Protection) that delivers benchmark performance in all three key parameters.



**Extremely low clamping voltage**  
 Absorbing highest ESD pulses THE key for reliable system protection



▶ Low capacitance down to 0.1 pF  
 ▶ High robustness up to 9A, 8/20 μs  
 ▶ Packages optimized for communications interfaces

### TrEOS Protection devices

Type	device	VRWM (V)	Uni- or bidirectional	Cd typ (pF)	ESD rating max (kV) (Ω)	Rdyn TLP (Ω)	Number of protected lines	Package	Size (mm)
PUSB3FR4	ESD protection	3.3	uni	0.29	15	0.27	4	DFN2510A-10	2.5 x 1.0 x 0.48
PUSB3FR6	ESD protection	3.3	uni	0.35	15	0.29	6	DFN2111-7	2.1 x 1.1 x 0.48
PUSB3AB4	ESD protection	3.3	bi	0.17	15	0.4	4	DFN2510A-10	2.5 x 1.0 x 0.48
PUSB3AB6	ESD protection	3.3	bi	0.15	15	0.4	6	DFN2111-7	2.1 x 1.1 x 0.48
PCMF1USB3S	Common Mode Filter with ESD protection	5	uni	0.3	15	0.14	2	WLCSP5	0.8 x 1.2 x 0.5
PCMF2USB3S	Common Mode Filter with ESD protection	5	uni	0.3	15	0.14	4	WLCSP10	1.6 x 1.2 x 0.5
PCMF3USB3S	Common Mode Filter with ESD protection	5	uni	0.3	15	0.14	6	WLCSP15	2.4 x 1.2 x 0.5
PESD3V3C1BSF	ESD protection	3.3	bi	0.2	20	0.23	1	DSN0603-2	0.6 x 0.3 x 0.3
PESD5V0R1BSF	ESD protection	5	bi	0.1	10	0.45	1	DSN0603-2	0.6 x 0.3 x 0.3
PESD5V0H1BSF	ESD protection	5	bi	0.15	15	0.25	1	DSN0603-2	0.6 x 0.3 x 0.3
PESD5V0C1BSF	ESD protection	5	bi	0.2	20	0.23	1	DSN0603-2	0.6 x 0.3 x 0.3
PESD5V0C1USF	ESD protection	5	uni	0.45	20	0.1	1	DSN0603-2	0.6 x 0.3 x 0.3

ESD protection, TVS, filtering and signal conditioning