

# Small-signal MOSFET Selection Guide

## Broad selection of small-signal MOSFETs for a wide range of applications

Our advanced MOSFET solutions deliver the flexibility and performance that today's market demands. Choose from a wide range of general-purpose MOSFET solutions, available in a variety of packages, from the larger SOT223 to the ultra small DFN1006B-3, the ultimate in miniaturization.

### Key features

- ▶ Voltage range: 12 to 300 V
- ▶ Package sizes: 1 x 0.6 to 5 x 6 mm
- ▶  $R_{DS(on)}$  as low as 10 m $\Omega$
- ▶ Leadless packages with 100% solderable side pads
- ▶ ESD-protected devices up to 3 kV HBM

### Key applications

- ▶ Power management
- ▶ Charging circuits
- ▶ Power switches (motors, fans, etc.)
- ▶ LED drivers
- ▶ LCD backlighting

### Key benefits

- ▶ New AEC-Q101 qualified types
- ▶ New ultra-small leadless package DFN1006B-3
- ▶ New 2 x 2 mm leadless package with high  $P_{tot}$  capability to replace significantly larger packages like SO8

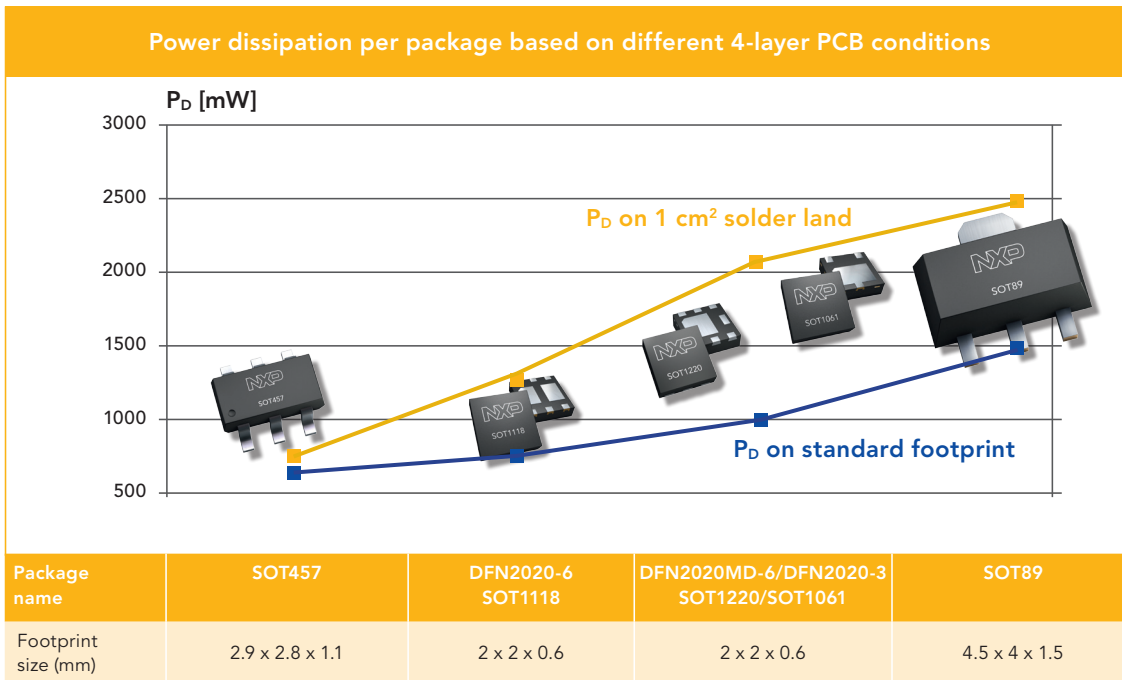
### New leadless package innovation – DFN2020MD-6

NXP has developed a new 2 x 2 mm leadless package with the unique feature of 100% tin-plated, solderable side pads. The concept is based on galvanic plating. These solderable side pads enable visual inspection of solder joints, and allow for tighter contact onto the PCB. The package saves cost in production by eliminating the need for x-ray solder inspection.

NXP package 100% solderable side pads	Packages from other suppliers
<p><b>100% solder wetting solution</b> with new 2 x 2 mm leadless package DFN2020MD-6</p> <ul style="list-style-type: none"> <li>▶ Optimal visual solder inspection</li> <li>▶ High-quality solder connections</li> </ul>	<ul style="list-style-type: none"> <li>▶ No complete wetting on side pad</li> <li>▶ Quality of solder connection difficult to determine</li> <li>▶ Very limited options for optical solder inspection</li> </ul>



# Thermal capability comparison



For more information please visit our website:

<http://www.nxp.com/campaigns/ultra-small-mosfets>

<http://www.nxp.com/news/news-archive/2012/DFN2020-with-solderable-side-pads.html>

## Small-signal MOSFETs in new DFN2020MD-6 (SOT1220) single package

Package											DFN2020MD-6 (SOT1220)			
Size (mm)											2.0 x 2.0 x 0.65			
P <sub>tot</sub> (mW)											>1500			
Polarity	V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>D</sub> (A)	V <sub>GS(th) min</sub> (V)	V <sub>GS(th) max</sub> (V)	t <sub>on typ</sub> (ns)	t <sub>off typ</sub> (ns)	Q <sub>G typ</sub> (nC)	ESD protection (kV)	R <sub>DS(on) typ</sub> (mΩ) @ V <sub>GS</sub> =				
										10 V	4.5 V	2.5 V	1.8 V	
Nch	20	8							-		12			PMPB12UN*
Nch	20	8							-		20			PMPB20UN*
Nch	20	12							2		10			PMPB10XNE*
Nch	20	12							-		15			PMPB15XN*
Nch	20	12							2		23			PMPB23XNE*
Nch	30	12							-		16			PMPB16XN*
Nch	30	12							2		13			PMPB13XNE*
Nch	30	12							2		29			PMPB29XNE*
Nch	30	12							-		33			PMPB33XN*
Nch	30	20							-		11			PMPB11EN*
Nch	30	20	8.5	1.1	2.2	24	11	7.2	-	16	20			PMPB20EN*
Nch	60	16							-		40			PMPB40SNA*
Pch	12	12							-		15			PMPB15XP*
Pch	20	12							-		19			PMPB19XP*
Pch	20	12							-		33			PMPB33XP*
Pch	20	12							2		20			PMPB20XPE*
Pch	20	12							2		29			PMPB29XPE*
Pch	20	12							2		43			PMPB43XPE*
Pch	30	12							-		47			PMPB47XP*
Pch	30	20							-		27			PMPB27XP*
Pch	30	20							-		48			PMPB48EP*

## Small-signal MOSFET – Schottky combination

Package														DFN2020-6 (SOT1118)			
Size (mm)														2.0 x 2.0 x 0.65			
P <sub>tot</sub> (mW)														>500			
Configuration	V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>D</sub> (A)	V <sub>GS(th) min</sub> (V)	V <sub>GS(th) max</sub> (V)	t <sub>on</sub> typ (ns)	t <sub>off</sub> typ (ns)	Q <sub>G</sub> typ (nC)	ESD protection (kV)	I <sub>F</sub> (A)	V <sub>R</sub> (V)	V <sub>F</sub> typ. (mA)	R <sub>DSon</sub> typ (mΩ) @ V <sub>GS</sub> =				
													4.5 V	2.5 V	1.8 V		
Single + Schottky	20	8	3.3	0.5	1.5	15	92	4.5	1	2	30	455	58	72	100	PMFPB6545UP	
			3.3	0.5	1.5	15	92	4.5	1	2.2	30	325	58	72	100	PMFPB6532UP	
			3							1	2.2	30	325	80			PMFPB8045XP*
			3							1	2.2	30	325	80			PMFPB8032XP*

\* Products to be released in 2012

## Small-signal MOSFET – NPN transistor combination

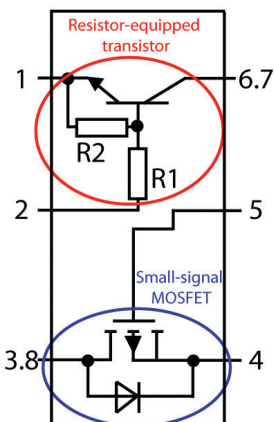
Type number	Package	Channel type	V <sub>DS</sub> max (V)	V <sub>GS</sub> max (V)	I <sub>D</sub> max (A)	V <sub>GS(th) min</sub> (V)	V <sub>GS(th) max</sub> (V)	R <sub>DSon</sub> max @ V <sub>GS</sub> = 4.5 V (mΩ)	R <sub>DSon</sub> max @ V <sub>GS</sub> = 2.5 V (mΩ)
PMC85XP	DFN2020-6 (SOT1118)	P-ch MOSFET	30	12	3.4	0.45	1	110	140
		Channel type NPN RET	V <sub>CEO</sub> max (V) 50	V <sub>EB0</sub> max (V) 10	I <sub>o</sub> max (A) 0.1	V <sub>I</sub> (off) typ (V) 0.6	V <sub>I</sub> (on) typ (V) 0.9	h <sub>FE</sub> typ 100	V <sub>CE(sat)</sub> max (V) 0.1

### Features and benefits

- ▶ Trench MOSFET technology
- ▶ NPN transistor built-in bias resistors
- ▶ Small and leadless ultra thin SMD plastic package: 2 x 2 x 0.65 mm
- ▶ Exposed drain pad for excellent thermal conduction

### Applications

- ▶ Charging switch for portable devices
- ▶ High-side load switch
- ▶ USB port overvoltage protection
- ▶ Power management in battery-driven portables
- ▶ Hard disk and computing power management




A p-channel MOSFET as main switch combined with a driver bipolar transistor including resistors, in one package for use in e.g. VBUS protection switches.



Scalable and flexible discrete solutions built on NXP's broad packaging and technology portfolio.










# Single N-channel MOSFETs

Package name and dimensions (mm)	Type number	V <sub>GS</sub> max (V)	V <sub>GS</sub> max (V)	ESD HBM (kV)	I <sub>b</sub> max (A)	V <sub>GSth</sub> min (V)	V <sub>GSth</sub> max (V)	R <sub>DSon</sub> max @ V <sub>GS</sub> = 10 V (mΩ)	R <sub>DSon</sub> max @ V <sub>GS</sub> = 5 V (mΩ)	R <sub>DSon</sub> max @ V <sub>GS</sub> = 4.5 V (mΩ)	R <sub>DSon</sub> max @ V <sub>GS</sub> = 2.5 V (mΩ)	R <sub>DSon</sub> max @ V <sub>GS</sub> = 1.8 V (mΩ)	Q <sub>G(on)</sub> typ (nC)	C <sub>iss</sub> typ (pF)	Automotive qualified	
 SOT223 6.5 x 3.5 x 1.65	PMT21EN	30	20	-	7.4	1.00	2.5	21		26			12.5	588	N	
	PMT29EN	30	20	-	6	1.00	2.5	29		36			9.6	492	N	
	BSP030	30	20	-	10	1.00	2.8	30	50				24	770	N	
	BSP100	30	20	-	6	1.00	2.8	100		200			6	250	N	
	PHT6N06LT	55	13	yes	5.5	1.00	2		150				4.5	250	N	
	PHT6N06T	55	13	2	5.5	2.00	4	150					6	190	N	
	PHT8N06LT	55	13	yes	7.5	1.00	2		80				11.2	500	N	
	PHT4NQ10LT	100	16	-	3.5	1.00	2		250				6.8	374	N	
	PMT200EN*	100	20	-	1.8	1.30	2.7	235			270			7.4	314	N
	PMT760EN*	100	20	-	0.9	1.30	2.7	950			1000			2.4	108	N
	BSP110	100	20	-	0.52	1.00	-		10000					-	25	N
	PHT4NQ10T	100	20	-	3.5	2.00	4	250						7.4	300	N
	PHT6NQ10T	100	20	-	6.5	2.00	4	90						21	633	N
	BSP122	200	20	-	0.55	0.40	2	2500						-	100	N
	BSP89	240	20	-	0.375	0.80	2	5000			7500			-	100	N
	BSP126	250	20	-	0.375	0.80	2	5000				7500		-	100	N
	BSP130	300	20	-	0.35	0.80	2	6000				10000		-	100	N








\* in development, release Q3/2012

# Single P-channel MOSFETs

Package name and dimensions (mm)	Type number	V <sub>GS</sub> max (V)	V <sub>GS</sub> max (V)	ESD HBM (kV)	I <sub>b</sub> max (A)	V <sub>GSth</sub> min (V)	V <sub>GSth</sub> max (V)	R <sub>DSon</sub> max @ V <sub>GS</sub> = 10 V (mΩ)	R <sub>DSon</sub> max @ V <sub>GS</sub> = 5 V (mΩ)	R <sub>DSon</sub> max @ V <sub>GS</sub> = 4.5 V (mΩ)	R <sub>DSon</sub> max @ V <sub>GS</sub> = 2.5 V (mΩ)	R <sub>DSon</sub> max @ V <sub>GS</sub> = 1.8 V (mΩ)	Q <sub>G(on)</sub> typ (nC)	C <sub>iss</sub> typ (pF)	Automotive qualified	
 DFN1006B-3 1.0 x 0.6 x 0.37	PMZB350UPE	20	8	2	1	0.45	0.95						1.3	127	N	
	PMZB670UPE	20	8	2	0.68	0.50	1.3			447	645	940	0.76	58	N	
	NX3008PBKMB	30	8	2	0.3	0.60	1.1			4100	6500		0.55	31	N	
	BSS84AKMB	50	20	1	0.23	1.10	2.1	7500	8500				0.26	24	N	
 DFN1006-3 1.0 x 0.6 x 0.5	BSS84AKM	50	20	1	0.23	1.10	2.1	7500	8500				0.26	24	Y	
	PMR670UPE	20	8	2	0.48	0.50	1.3			850	1500	2800	0.76	58	Y	
 SOT416 1.6 x 0.8 x 0.77	NX3008PBKBT	30	8	2	0.2	0.60	1.1			4100	6500		0.55	31	Y	
	BSS84AKT	50	20	1	0.15	1.10	2.1	7500	8500				0.26	24	Y	
	PMF170XP	20	12	-	1	0.65	1.15			200	300		2.6	280	N	
 SOT323 2.0 x 1.25 x 0.95	NX3008PBKW	30	8	2	0.2	0.60	1.1			4100	6500		0.55	31	Y	
	BSS84AKW	50	20	1	0.15	1.10	2.1	7500	8500				0.26	24	Y	
	PMG85XP	20	12	-	2	0.65	1.15			115	160		4.8	560	N	
 SOT23 2.9 x 1.3 x 1.0	BSH205	12	8	-	0.75	0.40	-				500		3.8	200	N	
	PMV33UPE	20	8	2	5.3	0.45	0.95			36	47	65	14.7	1820	N	
	PMV160UP	20	8	-	1.2	0.45	0.95			210	270	380	3.3	365	N	
	NX2301P	20	8	-	2	0.50	1.1			120	190	270	4.5	380	Y	
	PMV32UP	20	8	-	4	0.45	0.95			36	46	73	15.5	1890	N	
	PMV75UP*	20	12	-	2.2	0.47	0.9			87	118	145	6.7	560	N	
	PMV48XP	20	12	-	3.5	0.75	1.25			55	81		8.5	1000	N	
	PMV65XP	20	12	-	3.9	0.55	0.95			76	112		7.6	725	N	
	NX3008PBK	30	8	2	0.23	0.60	1.1			4100	6500		0.55	31	Y	
	BSH203	30	8	-	0.47	0.40	-			900	1100		2.2	110	N	
	BSH202	30	20	-	0.52	1.00	-	900					2.9	80	N	
	BSS84AK	50	20	1	0.18	1.10	2.1	7500	8500				0.26	24	Y	
	BSH201	60	20	-	0.3	1.00	-	2500					3	70	N	
	BSH207	12	8	-	1.52	0.40	-					150		8.8	500	N
	 SOT457 2.9 x 1.5 x 1.0	PMN40UPE*	20	8	4	6	0.45	0.95			43	55	72	15.6	1820	N
PMN27UP		20	8	-	5.7	0.45	0.95			32	41	66	21	2340	N	
PMN34UP		20	8	-	5	0.45	0.95			40	48	66	15.5	1950	N	
PMN27XPE*		20	12	2	5.7	0.75	1.25			30	44		15	1770	N	
PMN42XPE*		20	12	2	4.5	0.75	1.25			46	64		11.5	1410	N	
PMN70XPE*		20	12	2	4.1	0.75	1.25			85	129		5.2	602	N	
PMN80XP		20	12	-	3.2	0.45	1			102	125	156	5	550	N	
PMN48XP		20	12	-	4.1	0.75	1.25			55	82		8.7	1000	N	
BSS192			240	20	-	0.2	0.80	2.8	12000					-	55	N
 SOT223 6.5 x 3.5 x 1.65	BSP250	30	20	-	3	1.00	2.8	250		400			-	250	N	
	BSP220	200	20	-	0.225	0.80	2.8	12000					-	65	N	
	BSP225	250	20	-	0.225	0.80	2.8	15000					-	65	N	
	BSP230	300	20	-	0.21	1.95	2.8	17000					-	60	N	




\* in development, release Q3/2012

# Dual MOSFETs

Package name	Type number	channel type	V <sub>DS</sub> max (V)	V <sub>GS</sub> max (V)	ESD HBM (kV)	I <sub>b</sub> max (A)	V <sub>GStH</sub> min (V)	V <sub>GStH</sub> max (V)	R <sub>DS(on)</sub> max @ V <sub>GS</sub> = 10 V (mΩ)	R <sub>DS(on)</sub> max @ V <sub>GS</sub> = 5 V (mΩ)	R <sub>DS(on)</sub> max @ V <sub>GS</sub> = 4.5 V (mΩ)	R <sub>DS(on)</sub> max @ V <sub>GS</sub> = 2.5 V (mΩ)	R <sub>DS(on)</sub> max @ V <sub>GS</sub> = 1.8 V (mΩ)	Q <sub>g(100)</sub> typ (nC)	C <sub>iss</sub> typ (pF)	Automotive qualified	
N	 DFN2020-6 2.0 x 2.0 x 0.65	PMDPB28UN	20	8	-	5.8	0.40	1			37	51	83	3.1	265	N	
		PMDPB42UN	20	8	-	5.1	0.40	1			50	70	123	2	185	N	
		PMDPB38UNE*	20	8	1.6	4.5	0.40	1			46	61	90	2.9	268	N	
		PMDPB30XN*	20	12	-	5.3	0.40	0.9			40	53	75	14.4	660	N	
		PMDPB56XN	30	12	-	4	0.50	1.5			73	124		1.9	170	N	
		PMDPB95XNE*	30	12	1.6	2.7	0.50	1.5			120	165				N	
	 SOT363 2.0 x 1.25 x 0.95	PMDPB70EN	30	20	-	4.5	1.00	2.5	57		88				3	130	N
		PMGD130UN	20	8	-	1.3	0.40	1			145	204	318	0.88	83	N	
		PMGD290XN	20	12	-	0.86	0.50	1.5			350	550		0.72	34	N	
		PMGD400UN	30	8	-	0.71	0.45	1			480	580		0.89	43	N	
		NX3008NBKS	30	8	2	0.35	0.60	1.1			1400	2100	2800	0.52	34	Y	
		PMGD175XN	30	12	-	1	0.50	1.5			225	340		0.7	75	N	
		PMGD370XN	30	12	-	0.74	0.50	1.5			440	650		0.65	37	N	
		NX3020NAKS*	30	20	yes	0.18	0.80	1.5	4500		5200				0.33	11	N
		BSS138PS	60	20	-	0.32	0.90	1.5	1600	2000					0.72	38	Y
		BSS138BKS	60	20	1.5	0.32	0.48	1.6	1600		2200	6500			0.6	42	Y
		2N7002BKS	60	20	2	0.3	1.00	2.5	1600	2000					0.5	33	Y
		2N7002PS	60	20	-	0.32	1.00	2.5	1600	2000					0.6	30	Y
		NX7002AKS	60	20	yes	0.17	1.10	2.1	4500	5200					0.33	11	N
		 SOT666 1.6 x 1.2 x 0.55	PMDT290UNE	20	8	2	0.8	0.50	0.95			380	620	1100	0.45	55	Y
NX3008NBKV	30		8	2	0.4	0.60	1.1			1400	2100	2800	0.52	34	Y		
2N7002BKV	60		20	2	0.34	1.00	2.5	1600	2000					0.5	33	Y	
2N7002PV	60		20	-	0.35	1.00	2.5	1600	2000					0.6	30	Y	
PMDPB58UPE	20		8	2	4.5	0.45	0.95			67	95	137	6.3	804	N		
PMDPB65UP	20		8	0.8	3.5	0.50	1.5			70	90	150	4.5	380	N		
P	 DFN2020-6 2.0 x 2.0 x 0.65	PMDPB85UPE	20	8	2	3.7	0.45	0.95			103	146	210	5.4	514	N	
		PMDPB55XP	20	12	-	4.5	0.47	0.9			70	90	135	16.5	785	N	
		PMDPB70XPE	20	12	2	4.2	0.75	1.25			97	123		5	600	N	
		PMDPB80XP	20	12	-	3.7	0.40	1			102	125	156	5.7	550	N	
		PMDPB70XP	30	12	-	3.8	0.45	1			87	110		5.2	680	N	
		PMC85XP	30	12	-	3.4	0.45	1			110	140		5.2	680	N	
	 SOT363 2.0 x 1.25 x 0.95	NX3008PBKS	30	8	2	0.2	0.60	1.1			4100	6500		0.55	31	Y	
		BSS84AKS	50	20	1	0.16	1.10	2.1	7500	8500					0.26	24	Y
		 SOT666 1.6 x 1.2 x 0.55	PMDT670UPE	20	8	2	0.55	0.50	1.3			850	1500	2800	0.76	58	Y
			NX3008PBKV	30	8	2	0.22	0.60	1.1			4100	6500		0.55	31	Y
 SOT666 1.6 x 1.2 x 0.55	BSS84AKV	50	20	1	0.17	1.10	2.1	7500	8500					0.26	24	Y	

\* in development, release Q3/2012

## Complementary types

Package name	Type number	channel type	V <sub>DS</sub> max (V)	V <sub>GS</sub> max (V)	ESD HBM (kV)	I <sub>b</sub> max (A)	V <sub>GStH</sub> min (V)	V <sub>GStH</sub> max (V)	R <sub>DS(on)</sub> max @ V <sub>GS</sub> = 10 V (mΩ)	R <sub>DS(on)</sub> max @ V <sub>GS</sub> = 5 V (mΩ)	R <sub>DS(on)</sub> max @ V <sub>GS</sub> = 4.5 V (mΩ)	R <sub>DS(on)</sub> max @ V <sub>GS</sub> = 2.5 V (mΩ)	R <sub>DS(on)</sub> max @ V <sub>GS</sub> = 1.8 V (mΩ)	Q <sub>g(100)</sub> typ (nC)	C <sub>iss</sub> typ (pF)	Automotive qualified
 SOT666 1.6 x 1.2 x 0.55	NX1029X	N	60	20	2	0.33	1.1	2.1	1600	2000				0.5	33	Y
		P	50	20	1	0.17	1.1	2.1	7500	8500					0.26	24
	NX3008CBKV	N	30	8	2	0.4	0.6	1.1			1400	2100	2800	0.52	34	Y
		P	30	8	2	0.22	0.6	1.1			4100	6500		0.55	31	Y
		PMDT290UCE	N	20	8	2	0.8	0.5	0.95			380	620	1100	0.45	55
 TSSOP6 2.0 x 1.25 x 0.95	NX3008CBKS	N	30	8	2	0.35	0.6	1.1			1400	2100	2800	0.52	34	Y
		P	30	8	2	0.2	0.6	1.1			4100	6500		0.55	31	Y
 DFN2020-6 2.0 x 2.0 x 0.65	PMCPB5530X*	N	20	12	-	5.3	0.4	0.9			40	53	75	14.4	660	N
		P	20	12	-	4.5	0.47	0.9			70	90	135	16.5	785	N

\* in development, release Q3/2012

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Date of release: June 2012

Document order number: 9397 750 17288

Printed in the Netherlands