Power Management Selection Guide 2006

PHILIPS

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20 V - 60 V N-CHANNEL MOSFETS

types in **bold red** represent new products

V_{DS} (V)	MAX $R_{DS(ON)}$ @10V (mΩ)	MAX $R_{DS(ON)}$ @5V (mΩ)	MAX $R_{DS(ON)}$ @4.5V (mΩ)	MAX $R_{DS(ON)}$ @2.5V (mΩ)	I_D (max) @ 25C (A)	D^2PAK (SOT404)		D-PAK (SOT428)	SO8 (SOT96)	LFPAK (SOT669)	I-pak (SOT533)	TO220AB (SOT78)	TO247 (SOT429)
20			2.5	3.2	121					PH2520U			
20	2.65		3.7		100					PH3120L			
20			5	5.7	32				PSMN006-20K				
20		16		30	38	PHB38N02LT		PHD38N02LT					
25	2.6	2.9			75	PSMN002-25B						PSMN002-25P	
25			2.9	3.7	113					PH2925U			
25	2.8		4.1		100					**PH2625L**			
25	3.2	3.5	4		100								PSMN003-25W
25	4	5			75	PHB152NQ03LTA						PHP152NQ03LTA	
25	4.6	6.2			75			PHD110NQ03LT					
25	4.95	7.5			75	PHB96NQ03LT		PHD96NQ03LT				PHP96NQ03LT	
25	5.8	7.5			75			PSMN005-25D					
25	5.9	7.3			75	PHB98N03LT		PHD98N03LT					
25	6	7.5			75	PHB108NQ03LT		PHD108NQ03LT			PHU108NQ03LT		
25	6.3		9.5		78					**PH6325L**			
25	9	12			75							PHP83N03LT	
25	9	13.5			75	PHB78NQ03LT		PHD78NQ03LT			PHU78NQ03LT	PHP78NQ03LT	
25	10.5	13.6			66	PHB66NQ03LT		PHD66NQ03LT			PHU66NQ03LT	PHP66NQ03LT	
25	14	18			55	PHB55N03LTA		PHD55N03LTA				PHP55N03LTA	
25	21	24			45	PHB45N03LTA		PHD45N03LTA				PHP45N03LTA	
30	2.8	4			75	PSMN003-30B						PSMN003-30P	
30	3.2		6.5		107					PH3230S			
30	3.3		4.6		100					**PH3330L**			
30	3.8	4.9			98					PH3830L			
30	4.6		5.9		31				**PHK31NQ03LT**				
30	5.5	7			75			PHD101NQ03LT			PHU101NQ03LT	PHP101NQ03LT	
30	5.5		8		20				PSMN005-30K				
30	5.7	7.2			80					PH4530L			
30	5.7		8.5		80					PH5330E			
30	5.9		9.7		70					**PH8030L**			
30	6.5		7.7		28				PHK28NQ03LT				
30	7.9	10	11		68					PH7030L			
30	8	10			75			PHD82NQ03LT					
30	8.2		13.2		67					PH8230E			
30	8.7		12.8		12.5				**PHK18NQ03LT**				
30	10	15.2			71			PHD71NQ03LT				PHP71NQ03LT	
30	10.5		14		12				PHK12NQ03LT				
30	13	17.7			63			PHD63NQ03LT				PHP63NQ03LT	
30	16.9		23.5		47					PH16030L			
30	20		26		13			PHD36N03LT	PHK13N03LT				
30	67		100		16			PHD16N03LT					
30	100				16			PHD16N03T					
36	4	5	5.4		75	PSMN004-36B							
40	2.8	3.2	3.5		75	PHB222NQ04LT						PHP222NQ04LT	
40	3.1				75	PHB225NQ04T						PHP225NQ04T	
40	4	4.4	4.8		75	PHB174NQ04LT						PHP174NQ04LT	
40	4.1				94					PH4840S			
40	4.3				75	PHB176NQ04T						PHP176NQ04T	
40	5	6.4	7.1		75	PHB129NQ04LT						PHP129NQ04LT	
40	5.2				75	PHB143NQ04T						PHP143NQ04T	
40	7	9	10		75	PHB95NQ04LT							
40	7.7		9.2		24				PHK24NQ04LT				
40	8				75	PHB101NQ04T						PHP101NQ04T	
55	3.7	4.2	4.4		75	PHB191NQ06LT						PHP191NQ06LT	
55	4				75	PHB193NQ06T						PHP193NQ06T	
55	4.2	4.5	5		100								PSMN004-55W
55	5.4	6	6.4		75	PHB146NQ06LT							

20 V - 60 V N-CHANNEL MOSFETS

V_{DS} (V)	MAX $R_{DS(ON)}$ @10V (mΩ)	MAX $R_{DS(ON)}$ @5V (mΩ)	MAX $R_{DS(ON)}$ @4.5V (mΩ)	MAX $R_{DS(ON)}$ @2.5V (mΩ)	I_D (max) @ 25C (A)	D^2PAK (SOT404)		D-PAK (SOT428)	SO8 (SOT96)	LFPAK (SOT669)	I-pak (SOT533)	TO220AB (SOT78)	TO247 (SOT429)
55	5.8	6.3	6.7		75	PSMN005-55B						PSMN005-55P	
55	6				75	PHB145NQ06T							
55	7	8.4	9.3		75	PHB110NQ06LT						PHP110NQ06LT	
55	7.1				75	PHB119NQ06T						PHP119NQ06T	
55	8				75	PHB112N06T						PHP112N06T	
55	8.3		9.9		85					PH955L			
55	10.5	12	13		75			PSMN010-55D					
55	16	19	21		60					PH1955L			
55	20				54							PHP54N06T	
55	32	35			37			PHD37N06LT					
55	36	40	45		40					PH3855L			
55	70	75			19	PHB21N06LT		PHD21N06LT				PHP21N06LT	
55	75				20	PHB20N06T						PHP20N06T	
55	77				18			PHD20N06T					
55	130	150			10.3	PHB11N06LT							
60	3.6				75	PSMN004-60B						PSMN004-60P	
60	14				73	PHB73N06T						PHP73N06T	
60	22				52							PHP52N06T	
60	37	40	43		32	PHB32N06LT						PHP32N06LT	
60	150				10.3			PHD3055E				PHP3055E	

These products have been designed and qualified for use in computing, communications, consumer and industrial applications

For application examples please see:

LFPAK for DC/DC converters on page 49
PDA Backlight Supply on page 50
Active load circuit in DC/DC conversion on page 50
Buck conversion for high-end graphics cards (VGA) on page 51
Power switching in CCFL resonant inverters on page 51
Low voltage DC motor control on page 52

75 V - 200 V N-CHANNEL MOSFETS

types in **bold red** represent new products

V_{DS} (V)	MAX $R_{DS(ON)}$ @10V (mΩ)	MAX $R_{DS(ON)}$ @5V (mΩ)	MAX $R_{DS(ON)}$ @4.5V (mΩ)	Q_{GD} (typ) (nC)	I_D (max) @ 25C (A)	D^2PAK (SOT404)		DPAK (SOT428)	SO8 (SOT96)	LFPAK (SOT669)	I PAK (SOT533)	TO220AB (SOT78)	SOT186A (isol TO220AB)	TO247 (SOT429)
75	5			50	75	PSMN005-75B						PSMN005-75P		
75	5.5	6.1	6.6	37	75	PHB153NQ08LT						PHP153NQ08LT		
75	5.6			28	75	PHB160NQ08T						PHP160NQ08T		
75	8.5	9	9.95	54.5	75	PHB110NQ08LT						PHP110NQ08LT		
75	8.5			50	75	PSMN008-75B						PSMN008-75P		
75	9			48.2	75	PHB110NQ08T						PHP110NQ08T		
75	13			15	75							PHP75NQ08T		
75	16	16.4	18	14	73							**PHP79NQ08LT**		
75	16.5	18	20	15.3	46					**PH1875L**				
75	28	30	34	9	30					PH3075L				
75	34.5			16	25					**PH3475S**				
75	51			9	27	PHB29N08T						PHP29N08T		
100	8.8			44	75	PSMN009-100B						PSMN009-100P		
100	9			91	100									PSMN009-100W
100	15			50	75	PSMN015-100B						PSMN015-100P		
100	15			50	80									PHW80NQ10T
100	23			9	34					PH20100S				
100	25			25	47	PHB45NQ10T		PSMN025-100D				PHP45NQ10T		
100	25			25	47							**PHP45NQ10TA**		
100	28			25	47	PHB47NQ10T						PHP47NQ10T		
100	28			9	12				PHK12NQ10T					
100	38			14	5.2				PSMN038-100K					
100	40			18	34			PHD34NQ10T						
100	50			12	28	PHB27NQ10T								
100	70			10	23			PHD23NQ10T					PHX23NQ10T	
100	70			10	4				PHK4NQ10T					
100	70			10	23	PHB23NQ10LT								
100	90			8	18	PHB18NQ10T		PHD18NQ10T				PHP18NQ10T		
100	180			5	11						PHU11NQ10T			
105	25			25	47							PHP45NQ11T		
110	15			50	75							PSMN015-110P		
110	25			25	30.4								PHX45NQ11T	
110	40			18	35							PHP34NQ11T		
110	40			18	24.8								PHX34NQ11T	
110	50			12	28							PHP27NQ11T		
110	50			12	20.8								PHX27NQ11T	
110	70			10	23							PHP23NQ11T		
110	70			10	16								PHX23NQ11T	
110	90			8	18							PHP18NQ11T		
110	90				12.5								PHX18NQ11T	
110	180			5.3	7.5								PHX8NQ11T	
150	25			91	73									PSMN020-150W
150	30			38	55.5	PSMN030-150B						PSMN030-150P		
150	35			33	50	PSMN035-150B						PSMN035-150P		
150	42			10.3	33	PHB45NQ15T						PHP45NQ15T		
150	63			20	29			PSMN063-150D				PHP30NQ15T		
150	65			7.7	28							**PHP28NQ15T**		
150	75	80		12	5.5				PHK5NQ15T					
150	85			14	3.5				PSMN085-150K					
150	200			8	12.5							PHP12NQ15T		
200	40			73	50									PSMN040-200W
200	57			37	39	PSMN057-200B						PSMN057-200P		
200	70			28	35	PSMN070-200B						PSMN070-200P		
200	77			9.6	25	PHB33NQ20T						PHP33NQ20T		
200	120			8.9	22			PHD22NQ20T						
200	130			22	20	PHB20NQ20T		PSMN130-200D				PHP20NQ20T		
200	130			8.7	4				PHK4NQ20T					

75 V - 200 V N-CHANNEL MOSFETS

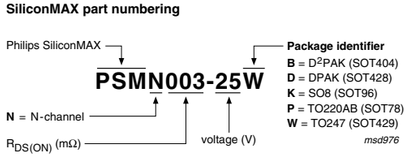
V_{DS} (V)	MAX $R_{DS(ON)}$ @10V (mΩ)	MAX $R_{DS(ON)}$ @5V (mΩ)	MAX $R_{DS(ON)}$ @4.5V (mΩ)	Q_{GD} (typ) (nC)	I_D (max) @ 25C (A)	D^2PAK (SOT404)		DPAK (SOT428)	SO8 (SOT96)	LFPAK (SOT669)	I PAK (SOT533)	TO220AB (SOT78)	SOT186A (isol TO220AB)	TO247 (SOT429)
200	165			14	2.5				PSMN165-200K					
200	180			22	8.2								PHX18NQ20T	
200	230			13.3	14			PHD14NQ20T				PHP14NQ20T		
200	230			13.3	7.6								PHX14NQ20T	
200	400			12	9			PHD9NQ20T				PHP9NQ20T		
200	400			12	5.2								PHX9NQ20T	

These products have been designed and qualified for use in computing, communications, consumer and industrial applications

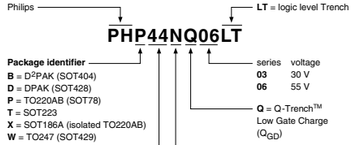
For application examples please see:

Active clamp in AC/DC conversion on page 52
UHP lamp driver on page 53

Philips Part Numbering System



Philips Part Numbering System



µTRENCHMOS

types in ***bold red italic underlined*** represent products in development

V_{DS} (V)	MAX $R_{DS(ON)}$ @10V (mΩ)	MAX $R_{DS(ON)}$ @4.5V (mΩ)	MAX $R_{DS(ON)}$ @2.5V (mΩ)	MAX $R_{DS(ON)}$ @1.8V (mΩ)	I_D (max) @ 25C (A)	SOT223	TSOP6 (SOT457)		SOT23	SOT89	SOT363	SOT323	SOT416	SOT883 (MCD)	SOT54	SOT874 (nanoPAK 3333-8)
12		34	40	56	5.7		PMN28UN									
20		28	34.4	52	5.7		PMN23UN									
20		34	40	56	5.7		PMN27UN									
20		36	43	63	6				PMV30UN							
20		37	53		5.9				PMV31XN							
20	34	40			5.7		PMN34LN									
20	65	82			4.1		PMN55LN									
20		85	115		2.5				PMV56XN							
20		85	115		2.5				SI2302DS							
20		200	250	300	1.05				BSH105							
20		280	380	600										***PMZ250UN***		
20		340	550											***PMZ270XN***		
20		340	430	660	1.02							PMF280UN	PMR280UN			
20		350	550		1							PMF290XN	PMR290XN			
30	38	45			5.4		PMN40LN									
30	38	46			5.4		PMN38EN									
30		46	54	77	4.9		PMN34UN									
30		47	53	73	4.9				PMV40UN							
30	30	50			11	BSP030										
30	40	50			5.2		PMN45EN									
30	42	54			5.4				PMV45EN							
30	55	72			4.7				PMV60EN							
30	120	140			1.9				BSH108							
30	117	190			1.7				PMV117EN							
30	117	190			1.7				SI2304DS							
30	100	200			6	BSP100										
30		400	500	600	0.85				BSH103							
30		410	610											***PMZ350XN***		
30		440	650		0.87						PMG370XN	PMF370XN	PMR370XN			
30		460	730											***PMZ390UN***		
30		480	580	830	0.83							PMF400UN	PMR400UN			
50	15000	20000	30000		0.17				BSN20							
55		80			7.5	PHT8N06LT										
55		150			5.5	PHT6N06LT										
55		4000	5000	8000	0.3				BSH111			BSH121				
55	150				5.5	PHT6N06T										
60	900	1200												***PMZ760SN***		
60	920	1400			0.57							PMF780SN	PMR780SN			
60	2000	4000			0.475				2N7002F							
60	3000	4000			0.385				2N7002E							
60	3900	5300			0.3				2N7002K							
60	4500	5300			0.3							PMF3800SN				
60	5000	5300			0.3				PMBF170							
60	5000	5300			0.3				2N7002							
60	5000	5300							***2N7002T***							
60	5000	5300			0.3				BSH112							
60	5000	5300			0.3										2N7000	
100		250			3.5	PHT4NQ10LT										
100		10000			0.52	BSP110										
100		10000			0.19				BST82						BST72A	
100	90				6	PHT6NQ10T										
100	250				3.5	PHT4NQ10T										
100	250				1.9				PMV213SN							
100	430				2	PHT2NQ10T										
100	500				0.85				BSH114							
100	6000				0.15				BSS123							
200	260	320														***PML260SN***

µTRENCHMOS

types in ***bold red italic underlined*** represent products in development

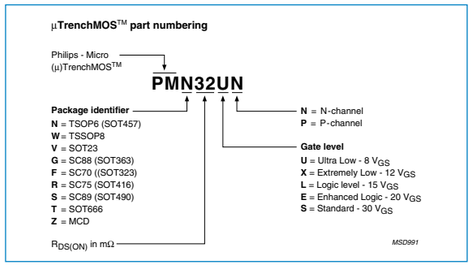
V_{DS} (V)	MAX $R_{DS(ON)}$ @10V (mΩ)	MAX $R_{DS(ON)}$ @4.5V (mΩ)	MAX $R_{DS(ON)}$ @2.5V (mΩ)	MAX $R_{DS(ON)}$ @1.8V (mΩ)	I_D (max) @ 25C (A)	SOT223	TSOP6 (SOT457)		SOT23	SOT89	SOT363	SOT323	SOT416	SOT883 (MCD)	SOT54	SOT874 (nanoPAK 3333-8)
200	2500				0.55	BSP122										
200	3000				0.4					BSS87						
200				5000	0.25										BS108	
220	367															***PML340SN***
240	5000	7500			0.35	BSP89										
250	5000				0.35	BSP126										
250	5000		7500		0.3										BSN254	
300	6000		10000		0.25										BSN304	
300	8000				0.3	BSP130										

These products have been designed and qualified for use in computing, communications, consumer and industrial applications

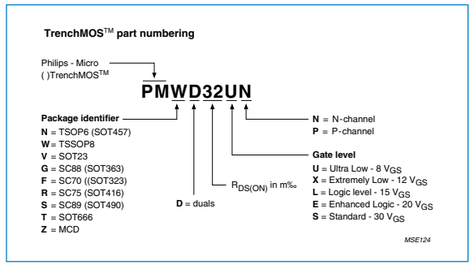
For application examples please see:

P-channel MOSFETs for 'floating gate' load switching on page 47
Bi-directional level shifters in I²C-bus interfaces on page 47
Battery powered motor control on page 48
Battery protection in Li-ion powered applications on page 48
MOSFET gate driver stage in DC/DC converters using TSOP6 on page 49

Philips Part Numbering System



Philips Part Numbering System



20 V - 300 V MULTI-CHIP MOSFETS (N-CHANNEL/P-CHANNEL/COMPLEMENTARY)

types in **bold red** represent new products
types in ***bold red italic underlined*** represent new products in development

V_{DS} (V)	MAX $R_{DS(ON)}$ @10V (mΩ)	MAX $R_{DS(ON)}$ @4.5V (mΩ)	MAX $R_{DS(ON)}$ @2.5V (mΩ)	MAX $R_{DS(ON)}$ @1.8V (mΩ)	I_{DS} (A)	Configuration		SO24 (SOT137)	SO8 (SOT96)	TSSOP8 (SOT530)	SOT363	SOT666	SOT874 (nanoPAK 3333-8)
20		18.5	20.5	28.5	5	Dual common drain				PMWD15UN			
20		19	22	30	5	Dual common drain				PMWD16UN			
20		20	35		2 x 6	Dual N-channel			PHKD6N02LT				
20		20/-60	30/-100		9.1/5.3	Complementary Pair			**PMKD23XC**				
20	22	24	34		6.6	Dual common drain				PMWD20XN			
20	24	26	35		9.2	Dual common drain				PMWD22XN			
20		30	35	40	5	Dual common drain				PMWD26UN			
20		340	430	660	1.02	Dual N-channel					PMGD280UN		
20		340	430	660	1.04	Dual Isolated drain						***PMTD280UN***	
20		350	550		1.03	Dual Isolated drain						***PMTD290XN***	
20		350	550		1	Dual N-channel					PMGD290XN		
25	6 x 35 (MOS) 6 x 5A (Schottky)				5.5	N-channel + Schottky array		PHN603S					
30		21.5	23.5	35	5	Dual common drain				PMWD18UN			
30		23	26	35	5	Dual N-channel				PMWD19UN			
30	20	26			2 x 7	Dual N-channel			PHKD13N03LT				
30		33	36	40	5	Dual N-channel				PMWD30UN			
30	40	50				Dual N-Channel							***PMLD45EN***
30	30	55			2 x 6.3	Dual N-channel			PHN203				
30	100	200			2 x 3.4	Dual N-channel			PHN210T				
30	100 / -250				3.5 (N) / 2.3 (P)	Complementary Pair			PHC21025				
30	-250	-400			2 x 2.3	Dual P-channel			PHP225				
30		440	650		0.87	Dual N-channel					PMGD370XN		
30		440	650		0.89	Dual Isolated drain						***PMTD370XN***	
30		480	580	830	0.83	Dual N-channel					PMGD400UN		
30		480	580	830	0.85	Dual Isolated drain						***PMTD400UN***	
30		8000	13000		0.125	Dual N-channel					PMGD8000LN		
60	920	1400			0.49	Dual N-channel					PMGD780SN		
60	920	1400			0.59	Dual Isolated drain						***PMTD780SN***	
100	90				2 x 3	Dual N-channel			PHKD3NQ10T				
300	6,000 / -17,000				0.3 (N) / 0.2 (P)	Complementary Pair			PHC2300				

These products have been designed and qualified for use in computing, communications, consumer and industrial applications

12 V - 300 V P-CHANNEL MOSFETS

types in **bold red** represent new products
types in ***bold red italic underlined*** represent products in development

V_{DS} (V)	MAX $R_{DS(ON)}$ @10V (mΩ)	MAX $R_{DS(ON)}$ @4.5V (mΩ)	MAX $R_{DS(ON)}$ @2.5V (mΩ)	MAX $R_{DS(ON)}$ @1.8V (mΩ)	I_{DS} (A)	SOT223	SOT96 (SO8)	TSOP6 (SOT457)	SOT23	SOT89	TO92 (SOT54)
12		120	150	180	2			BSH207			
16		120	150	180	2		PHK04P02T				
20		43	71		7.3		***PMK35XP***				
20		60	85		4.3			**PMN50XP**			
20		76	120		3.8				PMV65XP		
30	250	400			3	BSP250					
30		900	1100	1200	0.57				BSH203		
50	10000				0.13				BSS84		
200	12000				0.225	BSP220					
240	12000				0.2					BSS192	
250	15000				0.225	BSP225					BSP254A
300	17000				0.21	BSP230					

These products have been designed and qualified for use in computing, communications, consumer and industrial applications

GENERAL PURPOSE AUTOMOTIVE (GPA) TRENCHMOS

V_{DS} (V)	$R_{DS(ON)}$ (mΩ)	@V_{GS} (V)	I_D (max) @ 25°C (A)	SC73 (SOT223)	D^2PAK (SOT404)	DPAK (SOT428)	TO220 (SOT78)	SOT226 I^2PAK
30	5	10	75		BUK7605-30A		BUK7505-30A	
30	5	5	75		BUK9605-30A		BUK9505-30A	
30	13	10	55			BUK6213-30A		
30	13	5	55			BUK9213-30A		
30	14	10	55			BUK9214-30A		
40	4	10	75		BUK7604-40A		BUK7504-40A	BUK7E04-40A
40	4	5	75		BUK9604-40A		BUK9504-40A	BUK9E04-40A
40	13	10	55			BUK7213-40A		
55	6	10	75		BUK7606-55A		BUK7506-55A	
55	6	5	75		BUK9606-55A		BUK9506-55A	BUK9E06-55A
55	8	10	75		BUK7608-55A		BUK7508-55A	
55	8	5	75		BUK9608-55A		BUK9508-55A	
55	9	10	75		BUK7609-55A		BUK7509-55A	
55	9	5	75		BUK9609-55A		BUK9509-55A	
55	10	5	75		BUK9610-55A		BUK9510-55A	
55	11	10	75		BUK7611-55A		BUK7511-55A	
55	11	5	75		BUK9611-55A		BUK9511-55A	
55	14	10	73		BUK7614-55A		BUK7514-55A	
55	14	5	73		BUK9614-55A		BUK9514-55A	
55	15	10	55			BUK7215-55A		
55	15	5	55			BUK9215-55A		
55	16	10	66		BUK7616-55A		BUK7516-55A	
55	16	5	66		BUK9616-55A		BUK9516-55A	
55	18	5	58		BUK9618-55A		BUK9518-55A	
55	19	5	55			BUK9219-55A		
55	20	10	54		BUK7620-55A		BUK7520-55A	
55	20	10	29					
55	22	10	48			BUK7222-55A		
55	22	5	48			BUK9222-55A		
55	24	10	47		BUK7624-55A		BUK7524-55A	
55	24	5	47		BUK9624-55A		BUK9524-55A	
55	25	10	39			BUK7225-55A		
55	25	5	39			BUK9225-55A		
55	28	10	42		BUK7628-55A		BUK7528-55A	
55	28	5	42		BUK9628-55A		BUK9528-55A	
55	30	10	38			BUK7230-55A		
55	30	5	38			BUK9230-55A		
55	32	5	12	BUK9832-55A				
55	35	10	35		BUK7635-55A		BUK7535-55A	
55	35	10	20					
55	35	5	35		BUK9635-55A		BUK9535-55A	
55	37	10	32			BUK7237-55A		
55	37	5	32			BUK9237-55A		
55	45	5	28			BUK9245-55A		
55	75	10	20		BUK7675-55A		BUK7575-55A	
55	75	5	20		BUK9675-55A		BUK9575-55A	
55	77	10	18			BUK7277-55A		
55	77	5	18			BUK9277-55A		
55	80	5	7	BUK9880-55A				
55	150	10	11	BUK78150-55A	BUK76150-55A	BUK72150-55A	BUK75150-55A	
55	150	5	5	BUK98150-55A				
55	150	5	11		BUK96150-55A	BUK92150-55A	BUK95150-55A	
75	9	10	75		BUK7609-75A		BUK7509-75A	
75	9	5	75		BUK9609-75A		BUK9509-75A	
75	23	10	53		BUK7623-75A		BUK7523-75A	
75	23	5	53		BUK9623-75A		BUK9523-75A	
75	26	10	46			BUK7226-75A		
75	26	5	46			BUK9226-75A		
100	15	10	75		BUK7615-100A		BUK7515-100A	
100	15	5	75		BUK9615-100A		BUK9515-100A	
100	20	10	63		BUK7620-100A		BUK7520-100A	
100	20	5	63		BUK9620-100A		BUK9520-100A	
100	28	10	49		BUK7628-100A		BUK7528-100A	
100	28	5	49		BUK9628-100A		BUK9528-100A	
100	35	10	41		BUK7635-100A		BUK7535-100A	
100	35	5	41		BUK9635-100A		BUK9535-100A	
100	40	10	37		BUK7640-100A		BUK7540-100A	
100	40	10	34			BUK7240-100A		
100	40	5	37		BUK9640-100A		BUK9540-100A	
100	40	5	34			BUK9240-100A		
100	60	10	26		BUK7660-100A		BUK7560-100A	
100	60	5	26		BUK9660-100A		BUK9560-100A	
100	75	10	23		BUK7675-100A	BUK7275-100A	BUK7575-100A	
100	75	5	7	BUK9875-100A				
100	75	5	23		BUK9675-100A	BUK9275-100A	BUK9575-100A	
100	180	5	5	BUK98180-100A				
100	180	5	11		BUK96180-100A		BUK95180-100A	

These products have been designed and qualified to the appropriate AEC standard for use in automotive applications

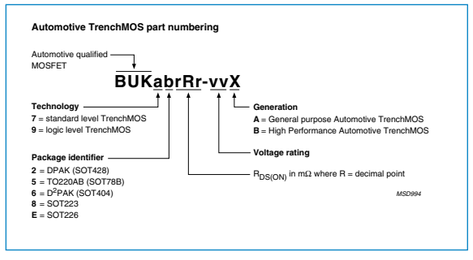
HIGH PERFORMANCE AUTOMOTIVE (HPA) TRENCHMOS

types in **bold red** represent new products

V_{DS} (V)	$R_{DS(ON)}$ (mΩ)	@V_{GS} (V)	I_D (max) @ 25°C (A)	D^2PAK (SOT404)	DPAK (SOT428)	LFPAK (SOT669)	TO220 (SOT78B)	SOT226 I^2PAK
30	2.7	10	75	BUK762R7-30B			BUK752R7-30B	BUK7E2R7-30B
30	2.8	5	75	BUK962R8-30B			BUK952R8-30B	
30	4	5	75					BUK9E04-30B
30	7	10	75	BUK7607-30B	BUK7207-30B		BUK7507-30B	
30	7	5	75	BUK9607-30B	BUK9207-30B		BUK9507-30B	
40	3.1	10	75	BUK763R1-40B			BUK753R1-40B	
40	3.2	5	75	BUK963R2-40B			BUK953R2-40B	BUK9E3R2-40B
40	4.3	10	75	BUK764R3-40B			BUK754R3-40B	
40	4.4	5	75	BUK964R4-40B			BUK954R4-40B	BUK9E4R4-40B
40	5.2	10	75	BUK765R2-40B			BUK755R2-40B	
40	6	5	75	BUK9606-40B			BUK9506-40B	
40	8	10	75	BUK7608-40B	BUK7208-40B		BUK7508-40B	
40	9	5	75	BUK9609-40B	BUK9209-40B		BUK9509-40B	
55	4	10	75	BUK764R0-55B			BUK754R0-55B	
55	4.2	5	75	BUK964R2-55B			BUK954R2-55B	
55	6	10	75	BUK7606-55B			BUK7506-55B	
55	6	10	75	BUK9606-55B			BUK9506-55B	BUK9E06-55B
55	7	10	75	BUK7607-55B			BUK7507-55B	
55	8	5	75	BUK9608-55B			BUK9508-55B	**BUK9E08-55B**
55	11	10	75	BUK7611-55B			BUK7511-55B	BUK7E11-55B
55	12	10	55		BUK7212-55B			
55	12	5	75	BUK9612-55B	BUK9212-55B		BUK9512-55B	
55	19	5	40			BUK9Y19-55B		
55	40	5	20			BUK9Y40-55B		
75	6	10	75	BUK7606-75B			BUK7506-75B	
75	6	5	75	BUK9606-75B			BUK9506-75B	
75	13	10	60	BUK7613-75B			BUK7513-75B	
75	14	10	55		BUK7214-75B			
75	16	5	60	BUK9616-75B			BUK9516-75B	
75	17	5	55		BUK9217-75B			
75	30	5	30			BUK9Y30-75B		
100	10	10	75	BUK7610-100B			BUK7510-100B	
100	10	5	75	BUK9610-100B			BUK9510-100B	
100	26	10	49	BUK7626-100B			BUK7526-100B	
100	27	10	48		BUK7227-100B			
100	29	5	46	BUK9629-100B			BUK9529-100B	
100	30	5	47		BUK9230-100B			

These products have been designed and qualified to the appropriate AEC standard for use in automotive applications

Philips Part Numbering System

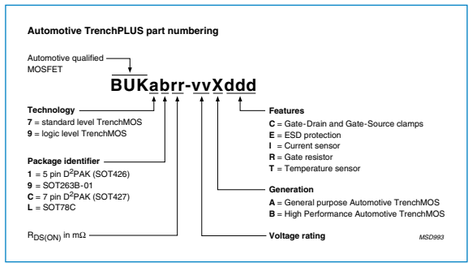


TRENCHPLUS - AUTOMOTIVE MOSFETS WITH PROTECTION FEATURES

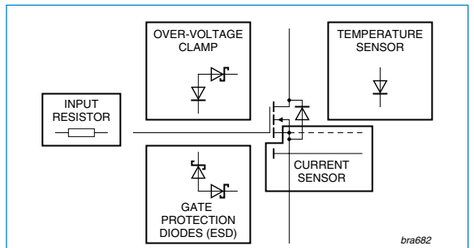
V_{DS} (V)	$R_{DS(ON)}$ (mohm)	@V_{GS}(V)	I_D (max)	Temp Sense	Gate Source Clamps	Gate Drain Clamps		Current Sensing	Gate Resistor	D^2PAK 7-pin (SOT427)	D^2PAK 5-pin (SOT426)	TO220 (SOT78C)	SOT263B-01 (5-pin TO220)
34	6	10	75			♦			♦			BUK7L06-34ARC	
34	11	10	75			♦			♦			BUK7L11-34ARC	
40	4.1	10	75	♦							BUK714R1-40BT		BUK794R1-40BT
40	5	10	75		♦			♦			BUK7105-40AIE		BUK7905-40AIE
40	5	10	75	♦	♦						BUK7105-40ATE		BUK7905-40ATE
40	5	10	75					♦					BUK7905-40AI
40	6	10	75	♦	♦			♦		BUK7C06-40AITE			
40	7	5	75	♦	♦	♦					BUK9107-40ATC		
40	7	10	75	♦	♦	♦					BUK7107-40ATC		BUK7907-40ATC
40	7	5	75	♦	♦	♦							BUK9907-40ATC
40	8	10	75		♦			♦			BUK7108-40AIE		BUK7908-40AIE
48	20	5	52	♦	♦	♦					BUK9120-48TC		
55	7	10	75		♦			♦			BUK7107-55AIE		BUK7907-55AIE
55	7	10	75	♦	♦						BUK7107-55ATE		BUK7907-55ATE
55	7	5	75	♦	♦						BUK9107-55ATE		BUK9907-55ATE
55	8	10	75	♦				♦		BUK7C08-55AITE			
75	9	10	75	♦	♦						BUK7109-75ATE		BUK7909-75ATE
75	9	10	75		♦			♦			BUK7109-75AIE		BUK7909-75AIE
75	10	10	75	♦	♦			♦		BUK7C10-75AITE			

These products have been designed and qualified to the appropriate AEC standard for use in automotive applications

Philips Part Numbering System



Circuit Diagram



TOPFET - HIGH SIDE DEVICES

V_{DS} (V)	$R_{DS(ON)}$ (mΩ)	$I_{(ISO)}$ (max) (A)	Type	Over-temperature Protection	Low Current Detect*	Short Circuit Detect	I_{lim} (A)	SOT263B-01 (5-pin TO220)	D^2PAK 5-pin (SOT426)
50	14	10	High Side 5 Pin	•		■	10 - 21	BUK2914-50SYTS	BUK2114-50SYTS
50	14	25	High Side 5 Pin	•	•	✦	47 - 100	BUK212-50Y	BUK217-50Y
50	14	25	High Side 5 Pin	•	•	✦	47 - 100	BUK212-50YT	
50	20	18	High Side 5 Pin	•	•	✦	42 - 88	BUK211-50Y	BUK216-50Y
50	20	18	High Side 5 Pin	•	•	✦	42 - 88	BUK211-50YT	
50	30	12	High Side 5 Pin	•	•	✦	38 - 72	BUK223-50Y	BUK224-50Y
50	38	9	High Side 5 Pin	•	•	✦	20 - 40	BUK210-50Y	
50	38	9	High Side 5 Pin	•	•	✦	20 - 40	BUK210-50YT	
50	38	9	High Side 5 Pin	•	•	✦	34 - 64		BUK215-50Y
50	38	9	High Side 5 Pin	•	•	✦	34 - 64		BUK2138-50SYAA
50	43	9	High Side 5 Pin	•	•	✦	34 - 64	BUK2938-50TYAA	BUK2138-50TYAA
50	60	6	High Side 5 Pin	•	•	✦	34 - 64	BUK209-50Y	
50	60	6	High Side 5 Pin	•	•	✦	20 - 40		BUK214-50Y
50	100	3.6	High Side 5 Pin	•	•	✦	12 - 24	BUK208-50Y	BUK213-50Y
50	180	2	High Side 5 Pin	•	•	✦	6 - 12	BUK219-50Y	BUK220-50Y

These products have been designed and qualified to the appropriate AEC standard for use in automotive applications

Note: * indicated on status pin
The following notes are for the short circuit detect column only:
Note: ✦ indicates short circuit on status and latches off (by voltage detection)
Note: ■ indicates short circuit on status and latches off (by power detection)

TOPFET - LOW SIDE DEVICES

V_{DS} (V)	$R_{DS(ON)}$ (mΩ)	$I_{(ISO)}$ (max) (A)	Type	Status Reporting	SOT78B (TO220AB)	SOT263B-01 (5-pin TO220)	SC73 (SOT223)	D^2PAK (SOT404)	SOT226 I^2PAK	D^2PAK 5-pin (SOT426)	D-PAK (SOT428)
50	20	16	Low Side 5 Pin	•		BUK125-50L				BUK136-50L	
50	28	12	Low Side 3 Pin		BUK119-50DL			BUK130-50DL	BUK150-50DL		
50	28	12	Low Side 5 Pin	•		BUK124-50L				BUK135-50L	
50	50	7	Low Side 3 Pin		BUK118-50DL			BUK129-50DL	BUK149-50DL		BUK139-50DL
50	100	3.5	Low Side 3 Pin		BUK117-50DL			BUK128-50DL	BUK148-50DL		BUK138-50DL
50	200	0.7^	Low Side 3 Pin				BUK127-50DL				
50	200	0.7^	Low Side 3 Pin				BUK127-50GT*				

These products have been designed and qualified to the appropriate AEC standard for use in automotive applications

Note: • indicates status feature is available
Note: * indicates this device has current trip and low input resistance
Note: ^ indicates current capability set by Ilim parameter

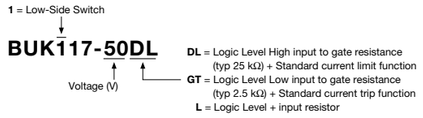
TOPFET - MULTIPLE CHANNEL DEVICES

V_{DS} (V)	Single Channel $R_{DS(ON)}$ (mΩ)	$I_{(ISO)}$ (max) (A)	Type	Over-temperature Protection	Low Current Detect*	Short Circuit Detect	I_{lim} (A)	Open load Detection in Off State	SOT427 (D^2PAK 7-pin)	SO20 (SOT163-1)
50	40 (dual)	8	High Side Dual 7 Pin	•	•	■	18 - 42	•	BUK218-50DY	
50	40 (dual)	8	High Side Dual 7 Pin	•			18 - 42	•	BUK218-50DC	
50	80 (dual)	3.2	High Side Dual 7 Pin	•	•	✦	8 - 16		BUK221-50DY	
50	200 (quad)	0.7^	Low Side Quad 20 Pin	•						BUK1M200-50SGTD
50	200 (quad)	0.7^	Low Side Quad 20 Pin	•						BUK1M200-50SDLD

Note: ^ indicates current capability set by Ilim parameter
Note: * indicated on status pin
The following notes are for the short circuit detect column only:
Note: ✦ indicates short circuit on status and latches off (by voltage detection)
Note: ■ indicates short circuit on status and latches off (by power detection)

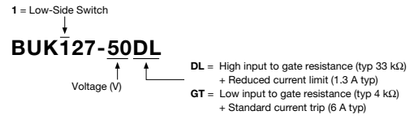
Philips Part Numbering System

Low Side Switch part numbering (types BUK117 - BUK150 only)



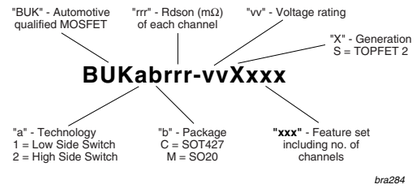
Philips Part Numbering System

Topfet BUK127 (exception) part numbering

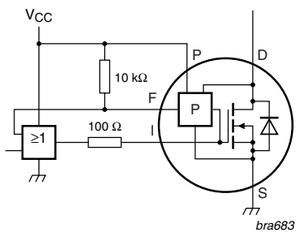


Philips Part Numbering System

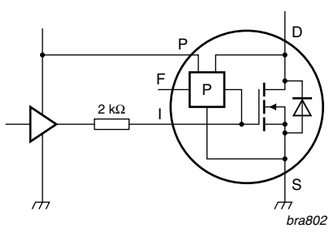
TOPFET Multiple Channel part numbering



Fast driver for 5-pin TOPFET



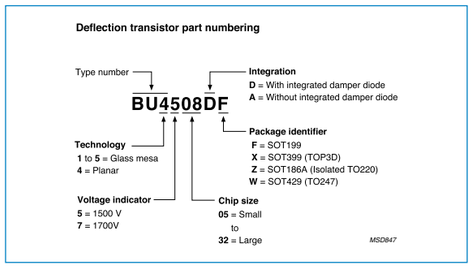
Self protection driver circuit



DEFLECTION

V_{CESM} (V)	$I_{C[SAT]}$ (A)	tf[max] (ms)	SOT186A (isolated TO220AB)	SOT199	SOT399 (TOP3D)	TO247 (SOT429)
1000	3	0.3	BUT11APX			
1200	2	0.3	BUT11APX-1200			
1500	3	0.4	BU4506DZ			
1500	3	0.45		BU4506AF	BU4506AX	
1500	3	0.5	BU1506DX	BU2506DF	BU2506DX	
1500	4	0.4	BU1507DX		BU4507DX	
1500	4	0.45			BU4507AX	
1500	4	0.5	BU1507AX		BU2507AX	
1500	4	0.5			BU2507DX	
1500	4.5	0.6	BU1508AX	BU2508AF	BU2508AX	
1500	4.5	0.6	BU1508DX	BU2508DF	BU2508DX	
1500	4.5	1		BU508AF		BU508AW
1500	4.5	1		BU508DF		BU508DW
1500	5	0.4	BU4508DZ	BU4508DF	BU4508DX	
1500	5	0.48			BU4508AX	
1500	6	0.5		BU4515AF	BU4515AX	
1500	6	0.25		BU2522AF	BU2522AX	
1500	6	0.5		BU2520AF	BU2520AX	
1500	6	0.5		BU2520DF	BU2520DX	
1500	7	0.4		BU4522AF	BU4522AX	
1500	8	0.35		BU2525AF	BU2525AX	BU2525AW
1500	8	0.35			BU2525DX	
1500	6	0.2		BU2527AF	BU2527AX	
1500	6	0.2			BU2527DX	
1500	9	0.55			BU4525AX	
1500	7	0.1				BU2532AW
1500	9	0.25				BU2530AW
1500	10	0.4				BU4530AW
1700	5.5	0.9			BU2720DX	
1700	7	0.8			BU2725DX	

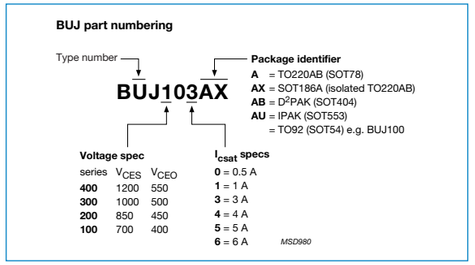
Philips Part Numbering System



INDUSTRIAL

V_{CESM} (V)	$I_{C[DC]}$ (A)	$I_{C[SAT]}$ (A)	tf[max] (ms)	SOT82	TO220AB (SOT78)	SOT186A (isolated TO220AB)	TO92 (SOT54)	D^2-PAK (SOT404)	D-PAK (SOT428)
700	1	0.5	0.05				BUJ100		
700	1	0.5	0.05				BUJ100B		
700	4	3	0.033		BUJ103A	BUJ103AX			BUJ103AD
700	4	2	0.16		PHE13005				
700	8	4	0.045		BUJ105A			BUJ105AB	BUJ105AD
700	8	5	0.04		PHE13007				
700	10	6	0.05		BUJ106A				
700	12	6	0.15		PHE13009				
800	0.5		0.28	BUX86P					
1000	0.5		0.28	BUX87P					
1000	2	1	0.4		BUX85				
1000	5	2.5	0.8		BUT11A	BUT11AX			
1000	5	2.5	0.8		BUT11AI				
1000	5	3	0.145		BUJ303A				
1000	6	4	0.8		BUT18A				
1000	8	5	0.8			BUT12AX			
1000	8	5	0.8		BUT12AI				
1050	5	3	0.45		BUJ303B				
1200	6	2	0.17		BUJ403A				

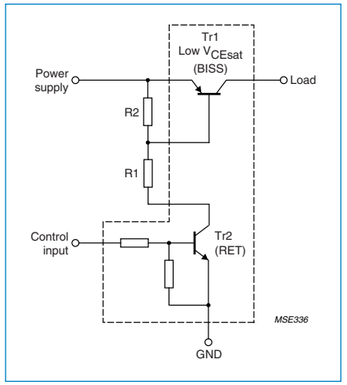
Philips Part Numbering System



BISS LOADSWITCHES

(I_C) = mA P_{tot} max.	(V_{CEO}) = V	(V_{CEsat}) = mV @ I_C = 0.5 A	R (kΩ)	SOT457 (SC-74) 600 mW	SOT363 (SC-88) 300 mW	SOT666 300 mW
500	15	< 250	2.2		PBLS1501Y	PBLS1501V
500	15	< 250	4.7		PBLS1502Y	PBLS1502V
500	15	< 250	10		PBLS1503Y	PBLS1503V
500	15	< 250	22		PBLS1504Y	PBLS1504V
500	40	< 350	2.2		PBLS4001Y	PBLS4001V
500	40	< 350	4.7		PBLS4002Y	PBLS4002V
500	40	< 350	10		PBLS4003Y	PBLS4003V
500	40	< 350	22		PBLS4004Y	PBLS4004V
500	40	< 350	47		PBLS4005Y	PBLS4005V
1000	20	< 150	2.2	PBLS2001D		
1000	20	< 150	4.7	PBLS2002D		
1000	20	< 150	10	PBLS2003D		
1000	20	< 150	22	PBLS2004D		
1000	40	< 170	2.2	PBLS4001D		
1000	40	< 170	4.7	PBLS4002D		
1000	40	< 170	10	PBLS4003D		
1000	40	< 170	22	PBLS4004D		
1000	40	< 170	47	PBLS4005D		
1000	60	< 180	2.2	PBLS6001D		
1000	60	< 180	4.7	PBLS6002D		
1000	60	< 180	10	PBLS6003D		
1000	60	< 180	22	PBLS6004D		
1000	60	< 180	47	PBLS6005D		

BISS Loadswitch



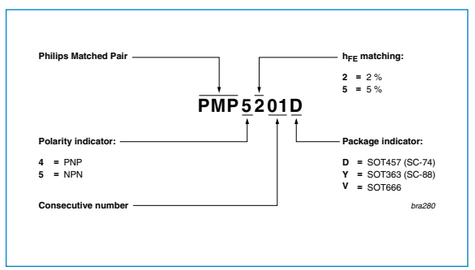
MATCHED PAIR TRANSISTORS

types in ***bold red italic underlined*** represent products in development

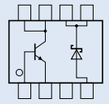
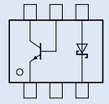
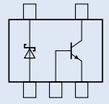
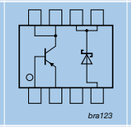
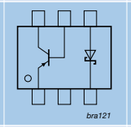
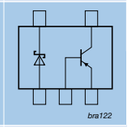
Polarity P_{tot} max.	(I_C) = mA	(V_{CEO}) = V	h_{FE} min.	h_{FE} max.	h_{FE1}/h_{FE2} %	V_{BE1} - V_{BE2} (mV)	SOT143B 250 mW	SOT457 (SC-74) 380 mW	SOT363 (SC-88) 300 mW	SOT353 (SC-88A) 300 mW	SOT666 300 mW
NPN	100	30	110	800	30*	30*	BCV61/A/B/C				
NPN	100	45	200	450	10*	2	***BCM61B***	BCM847DS	BCM847BS		***BCM847BV***
NPN	100	45	200	450	5	2			PMP4501Y	PMP4501G	***PMP4501V***
NPN	100	45	200	450	2	2			PMP4201Y	PMP4201G	***PMP4201V***
PNP	100	30	110	800	30*	30*	BCV62/A/B/C				
PNP	100	45	200	450	10*	2	***BCV62B***	BCM857DS	BCM857BS		***BCM857BV***
PNP	100	45	200	450	5	2			PMP5501Y	PMP5501G	***PMP5501V***
PNP	100	45	200	450	2	2			PMP5201Y	PMP5201G	***PMP5201V***

* I_{C1}/I_{E2}

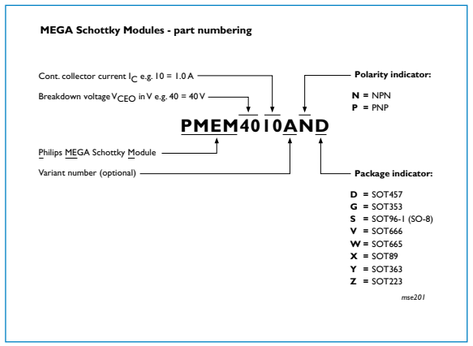
Philips Part Numbering System



MEGA SCHOTTKY DIODES/BISS TRANSISTOR MODULES

Package / Size / Configuration						SOT96 (SO8) 4.9 x 3.9 x 1.75 NPN	SOT457 (SC-74) 2.9 x 1.5 x 1.0 NPN	SOT353 (SC-88A) 2.1 x 1.25 x 0.95 NPN
Transistor	Transistor	Transistor	Schottky rectifier	Schottky rectifier	Schottky rectifier			
						 bra120	 bra118	 bra119
I_C max. (A)	V_{CEO} max. (V)	V_{CEsat} max. (mV)	I_F max. (A)	V_R max. (V)	V_F max. (mV)			
0.5	15	250	0.5	20	390			PMEM1505NG
1.0	40	210	1	20	550		PMEM4010ND	
2.0	40	400	1	20	550		PMEM4020ND	
2.0	40	400	1	40	640		PMEM4020AND	
3.0	40	370	1	40	500	PMEM4030NS		
Configuration						PNP	PNP	PNP
.						 bra123	 bra121	 bra122
0.5	15	250	0.5	20	390			PMEM1505PG
1.0	40	410	1	20	550		PMEM4010PD	
2.0	40	530	1	20	550		PMEM4020PD	
2.0	40	530	1	40	640		PMEM4020APD	
3.0	40	390	1	40	500	PMEM4030PS		

Philips Part Numbering System

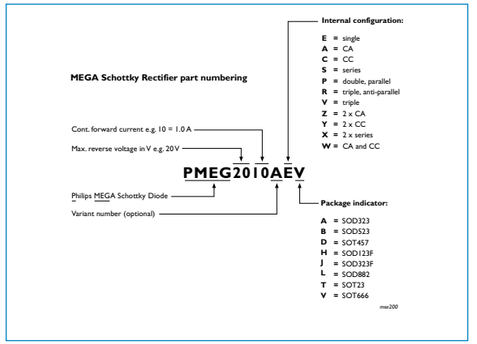


LOW V_F (MEGA) SCHOTTKY RECTIFIERS

types in ***bold red italic underlined*** represent products in development

I_F max. (A)	V_R max. (V)	V_F max. (mV)	SOT457 (SC-74) 2.9 x 1.5 x 1.0	SOT23 2.9 x 1.3 x 1.0	SOD123F 2.6 x 1.6 x 1.1	SOD323 (SC-76) 1.7 x 1.25 x 0.95	SOD323F (SC-90) 1.7 x 1.25 x 0.7	SOT666 1.6 x 1.2 x 0.6	SOD523 (SC-79) 1.2 x 0.8 x 0.6	SOD882 1.0 x 0.6 x 0.5
0.2	30	480							PMEG3002AEB	PMEG3002AEL
0.2	40	600							PMEG4002EB	PMEG4002EL
0.5	20	390		PMEG2005ET	PMEG2005EH	PMEG2005AEA	PMEG2005EJ	PMEG2005AEV		
0.5	20	440								PMEG2005AEL
0.5	20	480							PMEG2005EB	
0.5	20	500								PMEG2005EL
0.5	30	430		PMEG3005ET	PMEG3005EH	PMEG3005AEA	PMEG3005EJ	PMEG3005AEV		
0.5	40	470		PMEG3005ET	PMEG4005EH	PMEG4005AEA	PMEG4005EJ	PMEG4005AEV		
1.0	20	430			PMEG2010AEH					
1.0	20	500			PMEG2010EH	PMEG2010BEA	PMEG2010EJ	PMEG2010BEV		
1.0	20	550				PMEG2010EA	PMEG2010AEJ	PMEG2010EV		
1.0	20	620							PMEG2010AEB	
1.0	30	540			***PMEG3010CEH***		***PMEG3010CEJ***			
1.0	30	560			PMEG3010EH	PMEG3010BEA	PMEG3010EJ	PMEG3010BEV		
1.0	40	600			***PMEG4010CEH***		***PMEG4010CEJ***			
1.0	40	640			PMEG4010EH	PMEG4010BEA	PMEG4010EJ	PMEG4010BEV		
1.0	60	650	PMEG6010AED							
1.0	60	710			***PMEG6010CEH***		***PMEG6010CEJ***			
1.5	20	660			PMEG2015EH	PMEG2015EA	PMEG2015EJ	PMEG2015EV		
1.5	30	500			PMEG3015EH		PMEG3015EJ	PMEG3015EV		
2.0	10	460			PMEG1020EH	PMEG1020EA	PMEG1020EJ	PMEG1020EV		
2.0	20	525			PMEG2020EH	PMEG2020AEA	PMEG2020EJ			
2.0	30	620					PMEG3020EJ			
3.0	10	530					PMEG1030EJ			

Philips Part Numbering System



LOW V_{CESAT} (BISS) TRANSISTORS-SINGLE BISS TRANSISTORS < 3 A

Polarity P_{tot} max.	(I_C) = A	(V_{CEO}) = V	SOT223 (SC-73) 2.000 mW	SOT89 (SC-62) 1.300 mW	SOT457 (SC-74) 750 mW	SOT23 480 mW	SOT346 (SC-59) 250 mW	SOT323 (SC-70) 350 mW		SOT363 (SC-88) 430 mW	SOT416 (SC-75) 150 mW	SOT666 300 mW	SOT883 (SC-101) 250 mW	SOT54 (TO-92) 830 mW	(R_{CEsat}) = mΩ	(V_{CEsat}) = mV I_C/I_B = 10 I_C = 500 mA	(V_{CEsat}) = mV I_C/I_B = 10 max. I_C
NPN	0.5	15									PBSS2515E		PBSS2515M		< 500	< 250	
NPN	0.5	40									PBSS2540E		PBSS2540M		< 500	< 250	
NPN	1.0	20				PBSS4120T									< 200	< 110	< 250
NPN	1.0	30				PBSS4130T									< 220	< 120	< 270
NPN	1.0	40										PBSS4140V			< 190	< 110	< 190
NPN	1.0	40				PMMT491A									< 500	< 300	< 500
NPN	1.0	40				PBSS4140T		PBSS4140U				PBSS4160V		PBSS4140S	< 500	< 250	< 500
NPN	1.0	60				PBSS4160T	PBSS4160K	PBSS4160U				PBSS4160V			< 250	< 140	< 250
NPN	1.0	100	PBSS8110Z	PBSS8110X	PBSS8110D	PBSS8110T				PBSS8110Y				PBSS8110S/AS	< 200	< 120	< 200
NPN	2.0	20				PBSS4320T									< 105	< 70	< 310
NPN	2.0	30				PBSS4230T									< 200	< 100	< 320
NPN	2.0	40										PBSS4240V			< 190	< 100	< 400
NPN	2.0	40				PBSS4240T				PBSS4240Y					< 200	< 100	< 320
NPN	2.0	50		PBSS4250X											< 160	< 90	< 320
NPN	2.0	50				PBSS4350T									< 130	< 80	< 370
NPN	3.0	20		PBSS4320X		PBSS4320T									< 105	< 70	< 310
NPN	3.0	30		PBSS4330X											< 100	< 60	< 300
NPN	3.0	50		PBSS4350X											< 130	< 80	< 370
NPN	3.0	50	PBSS4350Z		PBSS4350D									PBSS4350S/SA	< 145	< 90	< 290
PNP	0.5	15									PBSS3515E		PBSS3515M		< 500	< 250	
PNP	0.5	40									PBSS3540E		PBSS3540M		< 700	< 350	
PNP	1.0	20				PBSS5120T									< 250	< 125	< 250
PNP	1.0	30				PBSS5130T									< 220	< 110	< 225
PNP	1.0	40										PBSS5140V			< 340	< 170	< 310
PNP	1.0	40				PMMT591A									< 500	< 350	< 500
PNP	1.0	40				PBSS5140T		PBSS5140U						PBSS5140S	< 500	< 250	< 500
PNP	1.0	60				PBSS5160T	PBSS5160K	PBSS5160U				PBSS5160V			< 330	< 175	< 330
PNP	1.0	100	PBSS9110Z	PBSS9110X	PBSS9110D	PBSS9110T				PBSS9110Y				PBSS9110S/AS	< 320	< 180	< 320
PNP	2.0	20				PBSS5220T						PBSS5220V			< 113	< 80	< 225
PNP	2.0	20				PBSS5320T									< 105	< 70	< 300
PNP	2.0	30				PBSS5230T									< 220	< 110	< 350
PNP	2.0	40										PBSS5240V			< 250	< 145	< 530
PNP	2.0	40				PBSS5240T				PBSS5240Y					< 220	< 110	< 350
PNP	2.0	50				PBSS5250T									< 150	< 90	< 300
PNP	2.0	50				PBSS5350T									< 135	< 90	< 390
PNP	2.0	50		PBSS5250X											< 160	< 90	< 320
PNP	3.0	20		PBSS5320X											< 105	< 70	< 300
PNP	3.0	20			PBSS5320D										< 133	< 80	< 400
PNP	3.0	30		PBSS5330X											< 107	< 70	< 320
PNP	3.0	50		PBSS5350X											< 135	< 90	< 390
PNP	3.0	50	PBSS5350Z		PBSS5350D									PBSS5350S/SA	< 150	< 100	< 300

LOW V_{CESAT} (BISS) TRANSISTORS-SINGLE BISS TRANSISTORS > 3 A

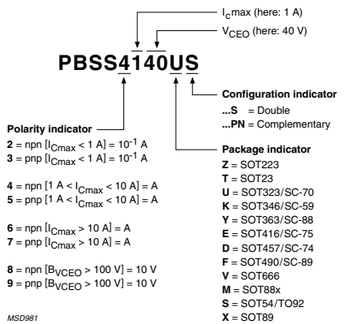
Polarity P_{tot} max.	(I_C) = A	(V_{CEO}) = V	SOT223 (SC-73) 2.000 mW	SOT89 (SC-62) 1.300 mW	SOT457 (SC-74) 750 mW	(R_{CEsat}) = mΩ	(V_{CEsat}) = mV I_C/I_B = 10 I_C = 500 mA	(V_{CEsat}) = mV I_C/I_B = 10 max. I_C
NPN	4.0	20			PBSS301ND	< 70	< 50	< 280
NPN	4.0	40			PBSS302ND	< 75	< 60	< 300
NPN	4.0	40				< 71	< 90	< 290
NPN	4.0	80		PBSS4480X		< 54	< 40	< 216
NPN	5.0	20		PBSS4520X		< 44	< 50	< 220
NPN	5.0	40	PBSS4540Z	PBSS4540X		< 71	< 90	< 355
PNP	4.0	20			PBSS301PD	< 70	< 50	< 280
PNP	4.0	40			PBSS302PD	< 75	< 60	< 300
PNP	4.0	80		PBSS5480X		< 75	< 55	< 300
PNP	5.0	20		PBSS5520X		< 44	< 50	< 220
PNP	5.0	40	PBSS5540Z	PBSS5540X		< 80	< 80	< 375

LOW V_{CESAT} (BISS) TRANSISTORS-DOUBLE BISS TRANSISTORS

Polarity P_{tot} max.	(I_C) = A	(V_{CEO}) = V	SOT457 (SC-74) 750 mW	SOT363 (SC-88) 430 mW	SOT666 300 mW	(R_{CEsat}) = mΩ	(V_{CEsat}) = mV I_C/I_B = 10 I_C = 500 mA	(V_{CEsat}) = mV I_C/I_B = 10 max. I_C
NPN	0.5	15			PBSS2515VS	< 500	< 250	< 250
NPN	1.0	60	PBSS4160DS			< 250	< 140	< 250
PNP	0.5	15			PBSS3515VS	< 500	< 250	< 250
PNP	1.0	60	PBSS5160DS			< 330	< 175	< 330
NPN/PNP	0.5	15		PBSS2515YPN	PBSS2515VPN	< 500	< 250	< 250
NPN/PNP	1.0	40	PBSS4140DPN			< 500	< 250	< 500
NPN/PNP	1.0	60	PBSS4160DPN			< 250/330	< 120/175	< 220/330
NPN/PNP	2.0	40	PBSS4240DPN			< 200/260	< 100/145	< 400/530

Philips Part Numbering System

Breakthrough In Small Signal (BISS) part numbering

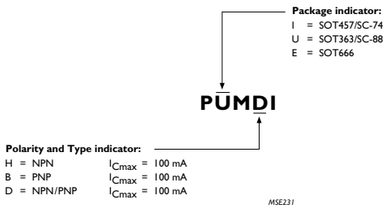


RESISTOR-EQUIPPED TRANSISTORS (RETS)-NPN/PNP DOUBLE RETS 100 MA

Polarity P_{tot} max.	(I_C) = mA	(V_{CEO}) = V		R1 (kΩ)	R2 (kΩ)	SOT457 (SC-74) 600 mW	SOT363 (SC-88) 300 mW	SOT666 300 mW
NPN/PNP	100	50	R1 = R2	2.2	2.2		PUMD20	PEMD20
NPN/PNP	100	50	R1 = R2	4.7	4.7		PUMD15	PEMD15
NPN/PNP	100	50	R1 = R2	10	10	PIMD3	PUMD3	PEMD3
NPN/PNP	100	50	R1 = R2	22	22	PIMD2	PUMD2	PEMD2
NPN/PNP	100	50	R1 = R2	47	47		PUMD12	PEMD12
NPN/PNP	100	50	R1 = R2	100	100		PUMD24	PEMD24
NPN/PNP	100	50	R1 <> R2	2.2	47		PUMD10	PEMD10
NPN/PNP	100	50	R1 <> R2	4.7	10		PUMD18	PEMD18
NPN/PNP	100	50	R1 <> R2	4.7	47		PUMD13	PEMD13
NPN/PNP	100	50	R1 <> R2	10	47		PUMD9	PEMD9
NPN/PNP	100	50	R1 <> R2	22	47		PUMD16	PEMD16
NPN/PNP	100	50	R1 <> R2	47	22		PUMD17	PEMD17
NPN/PNP	100	50	R1 <> R2	47/2.2	47/2.2		PUMD48	PEMD48
NPN/PNP	100	50	Only R1	4.7	-		PUMD6	PEMD6
NPN/PNP	100	50	Only R1	10	-		PUMD4	PEMD4
NPN/PNP	100	50	Only R1	22	-		PUMD19	PEMD19
NPN/PNP	100	50	Only R1	47	-		PUMD14	PEMD14

Philips Part Numbering System

Double Resistor-Equipped Transistors part numbering



THREE-QUADRANT TRIACS

types in **bold red** represent new products
types in ***bold red italic underlined*** represent products in development

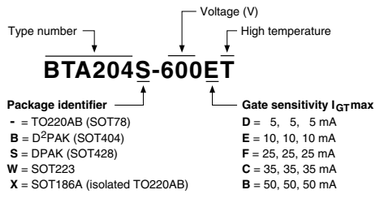
$I_{T(RMS)}$ (A)	VOLTAGE (V)	I_{GT}(max) (mA)	SOT223	SOT428 DPAK	SOT404 D²PAK	SOT54 TO92	SOT186A (isolated TO220AB)	SOT78 TO220AB
1	600 / 800	B/E/ER				BTA201		
1	600 / 800	E	**BTA201W**					
1	600	B/C/D/E/F	BTA204W					
1	800	C/E	BTA204W					
4	600	B/C/D/E/F		BTA204S			BTA204X	BTA204
4	800	B/C/E		BTA204S			BTA204X	BTA204
8	600	B/D/E/F		BTA208S			BTA208X	BTA208
8	800	B/E		BTA208S			BTA208X	BTA208
8	1000	C			**BTA208B**		**BTA208X**	
12	600	B/D/E/F			BTA212B		BTA212X	BTA212
12	600	B/C/D/E			***BTA312B***		***BTA312X***	***BTA312***
12	800	B/E			***BTA312B***		***BTA312X***	***BTA312***
12	800	C			***BTA312B***			***BTA312***
12	800	B/E			BTA212B		BTA212X	BTA212
16	600	B/D/E/F			BTA216B		BTA216X	BTA216
16	600	B/C/E			***BTA316B***		***BTA316X***	***BTA316***
16	600	D						***BTA316***
16	600	F			***BTA316B***			
16	800	B			BTA216B		BTA216X	BTA216
16	800	B/C/E			***BTA316B***		***BTA316X***	***BTA316***
25	600 / 800	B			BTA225B			BTA225
16	600	BT						BTA216-600BT
25	600	BT						BTA225-600BT

For application examples please see:

Triac commutation monitoring without sensing resistor on page 53
Inductive DC load on AC mains on page 54
Speed controller for power tools on page 54
Lamp dimmer on page 55
Universal Motor Speed Controller on page 55
Reversible induction motor on page 56
Improved speed control of small universal motors on page 56

Philips Part Numbering System

Three-quadrant triacs
Philips part numbering system



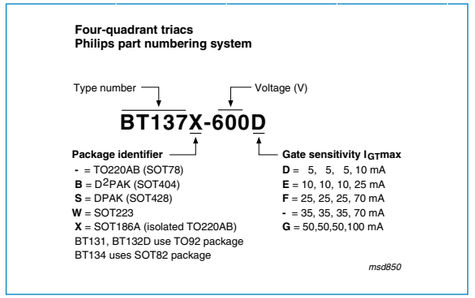
FOUR-QUADRANT TRIACS

types in **bold red** represent new products

$I_{T(RMS)}$ (A)	VOLTAGE (V)	I_{GT}(max) (mA)	SOT223	SOT428 DPAK	SOT404 D²PAK	SOT54 TO92	SOT82	SOT186A (isolated TO220AB)	SOT78 TO220AB
0,6	400	5/5/5/7				MAC97A6			
0,6	600	5/5/5/7				MAC97A8			
0,6	400 / 600	5/5/5/7				BT1306-D			
0,8	400 / 600	5/5/5/7	**BT1308W-D**			BT1308-D			
1	600 / 800	3/3/3/5	Z0103MN/NN			Z0103MA/NA			
1	600 / 800	5/5/5/7	Z0107MN/NN			Z0107MA/NA			
1	600 / 800	10/10/10/10	Z0109MN/NN			Z0109MA/NA			
1	600 / 800	3/3/3/7				BT131			
1	600 / 800	5/5/5/7				BT131-D			
1	600 / 800	10				BT131-E			
1	600	5/5/5/10				BT132-D			
1	600		BT131W						
1	600 / 800		BT134W						
1	600	D/E	BT134W						
4	600	D/G					BT134		
4	600 / 800	E					BT134		
4	600	F						BT136X	
4	600	D						BT136X	BT136
4	600 / 800	E		BT136S	BT136B			BT136X	BT136
4	600	D		BT136S					
4	600 / 800	F		BT136S					
6	600 / 800							**BT236X**	
6	600 / 800	G						**BT236X**	
6	600	F						**BT236X**	
8	600 / 800	E							BT137
8	600	D/G							BT137
8	600 / 800	E/F			BT137B				
8	800	G			BT137B				
8	600 / 800	E						BT137X	
8	600	D/F/G						BT137X	
8	600 / 800	D		BT137S					
8	600 / 800	E/F/G		BT137S					
12	600 / 800	E/G							BT138
12	600	F/G			BT138B				
12	600 / 800	E			BT138B				
12	600 / 800	E/F						BT138X	
16	600 / 800	E			BT139B				BT139
16	800	G							BT139
16	600 / 800	F/G			BT139B				
16	600	E/F/G						BT139X	
16	800							BT139X	
25	400								MAC223A6
25	600							MAC223A8X	
25	600 / 800								BTA140

Philips Part Numbering System

Four-quadrant triacs
Philips part numbering system



SILICON CONTROLLED RECTIFIERS

$I_{T(RMS)}$ (A)	VOLTAGE (V)	$I_{GT(max)}$ (mA)	SOT223	SOT428 DPAK	SOT404 D^2PAK	SOT54 TO92	SOT533 IPAK	SOT82	SOT186A (isolated TO220AB)	SOT78 TO220AB
0.8	400	12uA				EC103D1				
0.8	200 / 400 / 600	200uA				BT169				
0.8	200 / 400 / 600	200uA				BT149				
0.8	500 / 600	200uA (min 20uA)	BT168W			BT168				
0.8	200	200uA	MCR08BT1							
1	600	200uA	BT148W							
4	400 / 500 / 600	200uA						BT148		
4	600	200uA		BT150S						
4	500	200uA								BT150
8	500 / 600 / 800	200uA							BT258X	BT258
8	800	200uA		BT258S						
8	600	15mA		BT300S						
12	500 / 650 / 800	15mA		BT151S					BT151X	BT151
12	650	15mA		BTH151S-xxxR						
12	500 / 650 / 800	15mA					BT151U-xxxC		BT151X-xxxC	BT151-xxxC
20	400 / 600 / 800	32mA			BT152B				BT152X	BT152
25	800	35mA								BT145

Philips Part Numbering System

SCRs
Philips part numbering system

Type number — Voltage (V)

BT151X-650R

Package identifier
- **-** = TO220AB (SOT78)
- **B** = D^2PAK (SOT404)
- **S** = DPAK (SOT428)
- **U** = IPAK (SOT533/TO251)
- **W** = SOT223
- **X** = SOT186A (isolated TO220AB)

BT149, BT168 & BT169 use TO92 package
BT148 uses SOT82 package

MSD848

DIACS

I_{FRM} (A)	$V_{(BO)}$ (V)	$I_{(BO)}max$ (uA)	SOD27
2	28 -36	50	BR100/03

GENERAL PURPOSE RECTIFIERS

V_{RRM} <(V)	$I_{O(AV)}$ / $I_{F(AV)}$ (A)	V_F (V)	@IF (A)	SINGLE/ DUAL	SOD59 (TO220AC)
600	7	1.6	20	SINGLE	BY249-600

DAMPER AND MODULATOR DIODES

V_{RRM} (V)	$I_{F(av)}$ (A)	$V_{F(max)}$ (V)	$V_{fr(typ)}$ (V)	$t_{fr(typ)}$ (ns)	$t_{rr(max)}$ (ns)	Single / Dual	SOD113 (2-pin SOT186A)	SOD59 (TO220AC)	SOT186A 2-pin	SOT399 (TOP3D)
1500	20	1.3	8	170	350	Single	BY459X-1500	BY459-1500		
1500	20	1.35	11	200	220	Single	BY459X-1500S			
1500 / 600	60 / 70	1.45 / 1.25	27 / 3.2	200 / 35	300 / 60	Dual			BYM357X	BYM357DX
1500 / 600	60 / 70	1.6 / 1.3	29 / 5.0	130 / 35	170 / 60	Dual			BYM358X	
1500 / 800	60 / 70	1.45 / 1.55	27 / 18.0	200 / 125	300 / 145	Dual			BYM359X	BYM359DX

FAST SOFT-RECOVERY DIODES

V_{RRM} (V)	$I_{O(AV)}$/$I_{F(AV)}$ (A)	t_{rr} (ns)	TO220AC (SOD59)	SOD113	TO220AB (SOT78)
200	8	135		BY229X-200	
400	8	60			BYV29-400
500	9	60			BYV29-500
600	8	135	BY229-600	BY229X-600	
800	8	135		BY229X-800	
1000	8	135	BY329-1000		
1200	8	135	BY329-1200	BY329X-1200	
1500	7	230		BY329X-1500	
1500	7	160		BY329X-1500S	
1500	10	600	BY359-1500	BY359X-1500	
1500	10	350		BY359X-1500S	

ULTRAFAST & HYPERFAST DIODES FOR PFC

types in ***bold red italic underlined*** represent products in development

V_{RRM} (V)	$I_{F(av)}$ (A)	$t_{fr(typ)}$ @25C(ns)	$V_{fr(typ)}$ @150C(ns)	TO220AC (SOD59)	D^2PAK (SOT404)	TO220AB (SOT78)	SOD113 (2-pin SOT186A)	SOD186A (isolated TO220)
Continuous Current Mode								
600	5	19	1,4	BYC5-600	BY5B-600			
600	8	19	1,4	BYC8-600	BYC8B-600		***BYC8X-600***	
600	10	19	1,4	BYC10-600	BYC10B-600		***BYC10X-600***	
600	2 X 5	19	1,4			BYC10-600CT		
Discontinuous or Critical Current Mode								
600	9	55	1	***BYV29-600***	BYV29B-600		BYV29X-600	
600	15	55	1,05	***BYT79-600***			***BYT79X-600***	
600	2 X 10	55	1,12			***BYV34-600***		***BYV34X-600***

ULTRAFAST RECOVERY DIODES

types in ***bold red italic underlined*** represent products in development

V_{RRM} (V)	$I_{O(AV)}$ / $I_{F(AV)}$ (A)	V_F (V)	@I_F (A)	t_{rr} (ns)	SINGLE/ DUAL	DPAK (SOT428)		D^2PAK (SOT404)	SOD113 (2-pin SOT186A)	SOD59 (TO220AC)	SOT186A (isolated TO220AB)	TO220AB (SOT78)	TO247 (SOT429)	SOT223
100	20	0.95	8	25	DUAL (2 x 10A)							BYV32E-100		
100	8	0.895	8	25	SINGLE					BYW29E-100				
150	8	0.895	8	25	SINGLE					BYW29E-150				
150	20	0.85	8	25	DUAL (2 x 10A)							BYV32E-150		
150	30	0.85	15	28	DUAL (2 x 15A)							BYV42E-150		
150	1.5	0.7	0.5	25	DUAL (2 x 1.5A)									BYV40E-150
200	8	0.895	8	25	SINGLE	BYW29ED-200				BYW29E-200	BYW29EX-200			
200	10	0.895	5	25	DUAL (2 x 5A)	BYQ28ED-200			BYQ28X-200			BYQ28E-200		
200	14	0.9	14	30	SINGLE					BYV79E-200				
200	16	0.95	8	25	DUAL (2 x 8A)							BYQ30E-200		
200	20	0.85	8	25	DUAL (2 x 10A)			BYV32EB-200				BYV32E-200		
200	30	0.82	15	28	DUAL (2 x 15A)								BYV72EW-200	
200	30	0.85	15	28	DUAL (2 x 15A)			BYV42EB-200				BYV42E-200		
300	10	1.05	5	60	DUAL (2 x 5A)							BYT28-300		
400	9	1.03	8	60	SINGLE					BYV29-400				
400	20	1.05	10	60	DUAL (2 x 10A)							BYV34-400		
400	30	1.12	15	60	DUAL (2 x 15A)								BYV74W-400	
500	9	1.03	8	60	SINGLE			BYV29B-500	BYV29X-500	BYV29-500				
500	10	1.05	5	60	DUAL (2 x 5A)							BYT28-500		
500	14	1.05	15	60	SINGLE					BYT79-500				
500	20	1.05	10	60	DUAL (2 x 10A)							BYV34-500		
500	30	1.12	15	60	DUAL (2 x 15A)							BYV44-500		
600	8	1.5	8	75	SINGLE				BYR29X-600	BYR29-600				
600	9	1	5	55	SINGLE			BYV29B-600	BYV29X-600	***BYV29-600***				
600	14	1.05	15	55	SINGLE				***BYT79X-600***	***BYT79-600***				
600	20	1.05	10	55	DUAL (2 x 10A)						***BYV34X-600***	***BYV34-600***		
800	8	1.5	8	75	SINGLE					BYR29-800				

For application examples please see:

Ultrafast diodes for high frequency applications on page 57
High frequency diode bridge on page 57
Ultrafast and Hyperfast diodes for Power Factor Correction on page 58

DDR BUS TERMINATION REGULATORS

type	package	description	remarks	intended applications	operating temperature in °C
NE57810	SOT756 (SPAK-5)	Advanced DDR memory termination power with external reference in	Optional external voltage reference in for flexible applications	Desktop computers, note-books, workstations, servers, routers, game machines, set top boxes, digital VCR, embedded systems, computer graphics display	0 to 70
NE57811	SOT756 (SPAK-5)	Advanced DDR memory termination power with shutdown	Reduced power mode	Workstations, servers, routers, embedded systems	0 to 70
NE57814	SOT786BB2 (HSO8)	DDR memory termination regulator with standby mode and enhanced efficiency	Very low power standby mode	Desktop computers, note-books, workstations, servers, routers, game machines, set top boxes, digital VCR, embedded systems, computer graphics display	0 to 70

LOW DROPOUT REGULATORS

type	package	description	intended applications	output voltage
TDA3661	SOT96-1 (SO8)	Very low dropout voltage/quiescent current adjustable voltage regulator	Radio, Audio and CD/DVD Systems	1
TDA3663	SOT223-1 (SO4) SOT96-1 (SO8)	Very low dropout voltage/quiescent current 3.3 V voltage regulator	Radio, Audio and CD/DVD Systems	5
TDA3664	SOT223-1 (SO4) SOT96-1 (SO8)	Very low dropout voltage/quiescent current 5 V voltage regulator	Radio, Audio and CD/DVD Systems	4.75~5.25

LIGHTING ICS

types in **bold red** represent new products

type	description	package	type of light	operating temperature in °C	supply voltage	intended applications
UBA2014	600 V driver IC for HF fluorescent lamps	SOT109 (SO16) SOT38 (DIP16)	HFTL	-25 to 150	600	Dimmable CFL
UBA2021	630 V driver IC for CFL and TL lamps	SOT27-1 (DIP14) SOT108-1 (SO14)	CFL / HFTL	-40 to 150	630	CFL and fixed output TL
UBA2024P	Half- bridge power IC for CFL lamps	SOT 97-1 (DIP8)	CFL	-40 to 150	550	CFL
UBA2032	Full bridge driver IC	SOT137-1 (SO24) SOT341-1 (SSOP28)	HID	-40 to 150	550	Projectors
UBA2033	HF full bridge driver IC	SOT341 (SSOP28)	HID	-40 to 150	550	Projectors
UBA2070	600 V CCFL ballast driver IC	SOT38-1 (DIP16) SOT109-1 (SO16)	CCFL	-40 to 150	600	LCD Backlighting
UBA2072	Full bridge control IC for CCFL backlighting	SOT136-1 (SO28) SOT341 (SSOP28)	CCFL / EEFL	-25 to 150	30 and 550	LCD Backlighting, including LCD TV and LCD Monitor applications

AC-DC CONVERTERS-SMPS ICS FOR LOW POWER SYSTEMS

type	package	description	Indicated output power global mains	Rds (on)	intended applications
TEA1520	SOT97-1 (DIP8) SOT108-1 (SO14)	Switched Mode Power Supply Control IC	2-5 W	48	TV monitor standby power supplies and chargers
TEA1521	SOT97-1 (DIP8) SOT108-1 (SO14)	Switched Mode Power Supply Control IC	3-7 W	24	TV monitor and DVD players standby power supplies and chargers
TEA1522	SOT97-1 (DIP8) SOT108-1 (SO14)	Switched Mode Power Supply Control IC	7-9 W	12	White goods and personal care and DVD players standy power supplies
TEA1523	SOT97-1 (DIP8) SOT108-1 (SO14)	Switched Mode Power Supply Control IC	9-12 W	6,5	Audio video and PC peripherals
TEA1620	SOT97-1 (DIP8)	Switched Mode Power Supply Control IC 2nd generation	2-5 W	48	TV monitor standby power supplies and chargers
TEA1622	SOT97-1 (DIP8)	Switched Mode Power Supply Control IC 2nd generation	7-9 W	12	White goods and personal care
TEA1623	SOT97-1 (DIP8) SOT38-1 (DIP16)	Switched Mode Power Supply Control IC 2nd generation	9-12 W 12-30W	6,5	Audio video and PC peripherals

For application examples please see:

AC/DC converters: SMPS ICs for low power consumer systems on page 58

AC-DC CONVERTERS-SMPS ICS FOR HIGH POWER SYSTEMS

type	package	description	intended applications	Max supply voltage	high voltage start up source	0% duty cycle / cycle skipping
TEA1506	SOT97-1 (DIP8)	TV Flyback Switched Mode Power Supply IC	CRT TV monitor	20	no	yes
TEA1507	SOT97-1 (DIP8)	TV Flyback Switched Mode Power Supply IC	CRT TV monitor	20	yes	no
TEA1532	SOT96-1 (SO8)	Consumer Switched Mode Power Supply IC	Consumer equipment eg printer, fax, set top box LCD TV , monitor	20	yes	yes
TEA1533	SOT97-1 (DIP8) SO108-1 (SO14)	Consumer Switched Mode Power Supply IC	Consumer equipment eg printer, fax, set top box LCD TV , monitor	20	yes	yes
TEA1552	SO108-1 (SO14)	Laptop & Notebook adapter Switched Mode Power Supply IC	(Notebook) adapter	20	yes	yes
TEA1610	SOT38-1 (DIP16) SOT109 (SO16)	Resonant Switched Mode Power Supply IC	LCD TV	14	yes	yes

For application examples please see:

AC/DC converters: SMPS ICs for high power consumer systems on page 59

PIP2XX (PHILIPS INTELLIGENT POWER, AN INTEGRATED SOLUTION)

types in ***bold red italic underlined*** represent products in development

V_{in} (V)	V_{out} (V)	$f_{in\ (typical)}$ (kHz)	$I_{O(avg)}$ (A)	System Efficiency @15A (%)	10x10 MLF	Package Name	Package Name
12	1.5	500	20	82	PIP201-12M-3	HVQFN68	10X10 MLF
12	1.5	500	25	86	PIP202-12M-2	HVQFN68	10X10 MLF
5 - 12	1.3	500	35	90	***PIP212-12M***	HVQFN56	8X8 MLF

PIP3XX (PHILIPS INTELLIGENT POWER)

PART NUMBER	TYPE	PACKAGE	$R_{DS(ON)}$ (mΩ)	V_{DS} (V)
PIP3101-A	Low Side 5 Pin	SOT263-01	28	50
PIP3102-R	Low Side 5 Pin	SOT426 (D^2-PAK)	28	50
PIP3103-T	Low Side 3 Pin	SOT223	200	50
PIP3104-P	Low Side 3 Pin	SOT78 (TO220AB)	100	50
PIP3105-P	Low Side 3 Pin	SOT78 (TO220AB)	50	50
PIP3106-D	Low Side 3 Pin	SOT428 (D-PAK)	100	50
PIP3107-D	Low Side 3 Pin	SOT428 (D-PAK)	50	50
PIP3115-B	Low Side 3 Pin	SOT404 (D^2-PAK)	100	50
PIP3117-B	Low Side 3 Pin	SOT404 (D^2-PAK)	50	50
PIP3118-B	Low Side 3 Pin	SOT404 (D^2-PAK)	28	50
PIP3119-P	Low Side 3 Pin	SOT78 (TO220AB)	28	50
PIP3121-A	Low Side 5 Pin	SOT263-01	20	50
PIP3122-R	Low Side 5 Pin	SOT426 (5 pin (D^2-PAK)	20	50
PIP3201-A	High Side 5 Pin	SOT263-01	38	50
PIP3202-DC	High Side Dual 7 Pin	SOT427 (D^2-PAK)	40	50
PIP3203-A	High Side 5 Pin	SOT263-01	100	50
PIP3205-A	High Side 5 Pin	SOT263-01	14	50
PIP3206-R	High Side 5 Pin	SOT426 (D^2-PAK)	14	50
PIP3207-DC	High Side Dual 7 Pin, soft latch	SOT427 (D^2-PAK)	40	50
PIP3208-A	High Side 5 Pin	SOT263-01	180	50
PIP3209-R	High Side 5 Pin	SOT426 (D^2-PAK)	180	50
PIP3210-R	High Side 5 Pin	SOT426 (D^2-PAK)	38	50
PIP3211-R	High Side 5 Pin	SOT426 (D^2-PAK)	38	50
PIP3212-A	High Side 5 Pin	SOT263-01	20	50
PIP3213-R	High Side 5 Pin	SOT426 (D^2-PAK)	20	50
PIP3218-R	High Side 5 Pin	SOT426 (D^2-PAK)	14	50
PIP3221-DC	High Side Dual 7 Pin, soft latch	SOT427 (D^2-PAK)	80	50
PIP3224-DC	High Side Dual 7 Pin	SOT427 (D^2-PAK)	80	50

PIP4XX (ORIS OR-ING INTELLIGENT SWITCH)

V_{in}/V_{out} (V) min	V_{in}/V_{out} (V) max	I_O (A) DC max	I_{OM} (A) t<10us	V_{in}/V_{out} (mV) @25A	t_{off} (ns)	Device	Package Name
1.3	12	75	400	60	400	PIP401	SOT427

Applying Power Semiconductors

In today's increasingly complex system solutions, Philips MultiMarket Semiconductors portfolio, and specifically our discrete semiconductor offering, plays a vital role. To give just a brief overview of some of the many benefits our broad power MOSFET, Integrated Power and Bipolar products bring to individual functions and applications, we have gathered together a number of brief application notes. For ease of use we have sectioned the applications for the various key MOSFET, Integrated Power or Bipolar technologies, covering a number of power management and control functions. The twenty-six notes highlight the benefits and focus products from our portfolio as well as illustrating just how simple some of these solutions are.

µTrenchMOS™
- P-channel MOSFETs for 'floating gate' load switching
- Bi-directional level shifters in I²C-bus interfaces
- Battery powered motor control
- Battery protection in Li-ion powered applications
- MOSFET gate driver stage in DC/DC converters using TSOP6

<30 V MOSFETs
- LFPAK for DC/DC converters
- Active load circuit in DC/DC conversion
- PDA backlight supply
- Buck conversion for high-end graphics cards (VGA)
- Power switching in CCFL resonant inverters

40–100 V MOSFETs
- Low voltage DC motor control

>100 V MOSFETs
- Active clamp in AC/DC conversion
- UHP lamp driver

Triacs and SCRs
- Triac commutation monitoring without sensing resistor
- Speed controller for power tools
- Inductive DC load on AC mains
- Lamp dimmer
- Universal motor speed controller
- Improved speed control of small universal motors
- Reversible induction motor

Rectifiers & Zeners
- Ultrafast diodes for high frequency applications
- High frequency diode bridge
- Ultrafast and Hyperfast diodes for Power Factor Correction

Integrated Power
- AC/DC converters: SMPS ICs for low power consumer systems
- AC/DC converters: SMPS ICs for high power consumer systems
- One-chip motor drive IC

µTrenchMOS

P-channel MOSFETs for 'floating gate' load switching

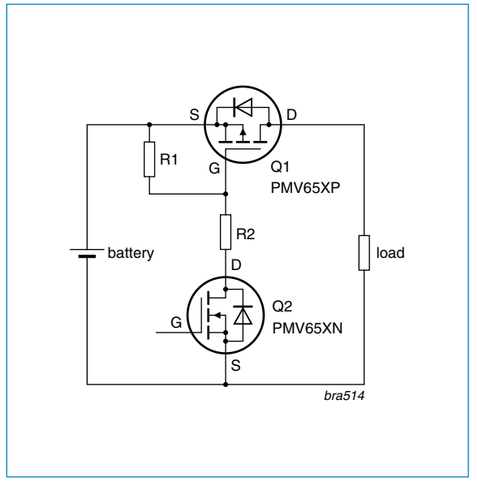
Description
Modern power management systems are often required to switch one or more power supply lines according to the specific requirements of the system at any given time. The power switches employed in such systems must be capable of 'floating' operation, in which neither of the main current carrying terminals is connected to 0 V.

The drive circuit arrangement shown in the diagram allows Q1 to operate as a switch in applications in which none of the device terminals are connected to 0 V.

Benefits
- Low threshold voltage enables operation in battery powered applications such as mobile phones and PDAs
- Very low $R_{DS(on)}$ minimizes on-state losses, allowing the device to conduct relatively large currents without excessive power dissipation
- P-channel operation removes the need for charge pump gate drive circuits
- Small industry standard, surface mount footprint, SOT23

Suitable Products
- PMV65XP

Circuit Diagram



µTrenchMOS

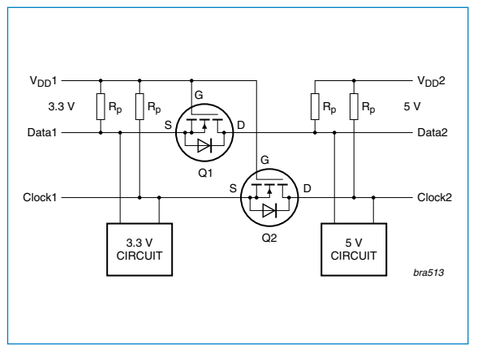
Bi-directional level shifters in I²C-bus interfaces

Description
The bi-directional level shifter connects two sections of an I²C-bus or similar system. Each section has a different supply voltage and different logic levels. In the bus system shown, pull-up resistors and devices in the left section are connected to a 3.3 V supply, while the right section operates from a 5 V supply.
The I/O ports of the circuits have logic input levels related to the supply voltages and an open drain output configuration.
For correct operation of the circuit, it is essential that MOSFETs Q1 and Q2 are capable of fully turning on at gate-source voltages of less than 2 V.

Benefits
- Surface mount package
- Low on-state resistance
- Low threshold voltage
- Fast switching

Suitable Products
- PMR280UN
- PMN27UN
- PMV30UN
- PMF280UN
- PMGD280UN
- PMR400UN
- PMN34UN
- PMV40UN
- PMF400UN
- PMGD400UN

Circuit Diagram



µTrenchMOS

Battery powered motor control

Description

Philips' µTrenchMOS family in the very small TSOP6 can be used to control small motors in range a of common applications such as shavers and electric toothbrushes, as well as a variety of industrial applications. The speed of these small motors must remain constant whatever the motor load, and hence the current through the MOSFET varies during usage. R2 is used to sense the current through the motor and MOSFET, and by monitoring the voltage developed across R2 the controller is able to maintain the motor at a constant speed, irrespective of load. In the circuit below the MOSFET gate current can be limited and any spikes generated by the motor are suppressed.

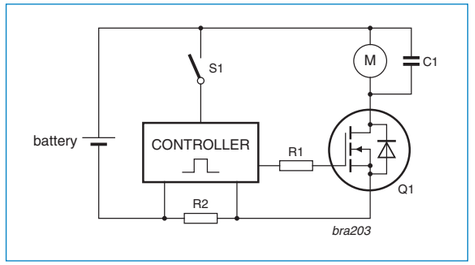
Benefits

- Appropriate for driving motors in the 3-5 W power range
- Low $V_{GS(th)}$ MOSFETs are capable of functioning at low battery voltages (even single cell powering), and are in extremely small packages
- No MOSFET snubber circuit required as the devices are capable of handling high peak currents and voltages
- Efficient, very low $R_{DS(on)}$ specifications means no change in motor speed due to voltage drops across the MOSFET

Suitable Products

- PMN34UN
- PMN27UN
- PMN40LN
- PMN55LN
- PMN34LN
- PMN28UN
- PMN45EN
- PMN23UN

Circuit Diagram



µTrenchMOS

Battery protection in Li-ion powered applications

Description

The use of Li-ion batteries in modern hand-held equipment is now very common, with applications typically using between one and four cells depending on individual power requirements. Protection of the cell(s) is always necessary in order to prevent cell damage during instances of over- or under-charging or short-circuit conditions, and the protection scheme employed must be able to isolate the battery from the rest of the circuit. The circuit diagram below carries out the protection and isolation function with the safety IC constantly monitoring the (dis)charge current and the voltage across the cell. When the cell is being (dis)charged correctly, conduction will take place via both MOSFETs (turned ON and with very low $R_{DS(on)}$). When a fault condition occurs, the MOSFET will be turned off disconnecting the Li-ion cell from the rest of the circuit.

Benefits

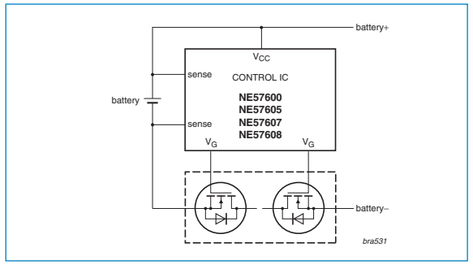
- Very low on-state resistance, hence very low power loss in the switches
- Good switching performance
- Very small PCB footprint and low package height
- Low threshold voltage enables MOSFET drive directly from the battery voltage without the use charge pumps

Suitable Products

- PMWD26UN
- PMWD16UN
- PMWD15UN
- PMWD30UN
- PMWD19UN
- PMWD18UN

	Typical $R_{DS(on)}$ mΩ			R @ 1.8 V	Max	Configuration
	V_{DS} (V)	V_{GS}=4.5 V	V_{GS}=2.5 V	Typ (mΩ)	V_{GS} (V)	
PMWD26UN	20	26.0	29.0	34	10	Isolated drain
PMWD16UN	20	16.0	18.0	22	10	Isolated drain
PMWD15UN	20	15.3	17.0	20	12	Common drain
PMWD30UN	30	30.0	33.0	36	10	Isolated drain
PMWD19UN	30	19.0	21.0	25	10	Isolated drain
PMWD18UN	30	18.0	20.0	24	12	Common drain

Circuit Diagram



µTrenchMOS

MOSFET gate driver stage in DC/DC converters using TSOP6

Description

In high-power DC/DC converters, synchronous rectification is often used on the converter secondary side in order to improve efficiency and minimise converter power loss. To facilitate fast and efficient switching of the synchronous rectifier MOSFETs, MOSFET gate driver stages are often used. Each driver stage consists of one N-channel and one P-channel MOSFET in a totem-pole configuration (Q3/Q4 for the upper power MOSFET Q1 and Q5/Q6 for the lower power MOSFET Q2), the gate driver circuits are in turn driven by a PWM controller situated on either the primary or secondary side of the converter.

Benefits

- The V_{GS} waveforms of the synchronous rectifier MOSFETs show less ringing and under / overshoot
- Better V_{GS} waveform stability compared with standard driver stages (at low and high current demands)
- Synchronous rectifier I_G waveforms are also more stable with a MOSFET driver stage
- No effect on the behaviour of the power switching circuit (compared with traditionally used driver components)

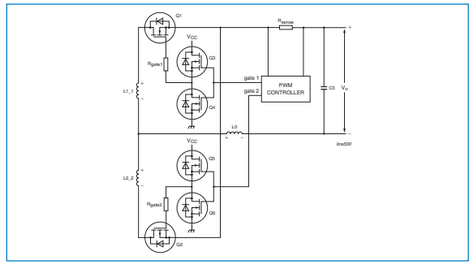
Suitable Products

- PMN34UN
- PMN34LN
- PMN27UN
- PMN28UN
- PMN40LN
- PMN45EN
- PMN55LN
- PMN23UN

SiliconMAX and NQ series Power MOSFETs are suitable for use in the Q1 and Q2 MOSFET positions. The PMN series are suitable for use in Q3 and Q5 MOSFET positions

	Max.	Typical $R_{DS(on)}$ mΩ				V_{GS}	I_D
	V_{DS} (V)	V_{GS}=10 V	V_{GS}=4.5 V	V_{GS}=2.5 V	V_{GS}=1.8 V		max.
PMN34UN	30	-	38	45	54	8	4.9
PMN27UN	20	-	27	32	39	8	5.7
PMN40LN	30	32	40	-	-	15	5.4
PMN55LN	20	55	70	-	-	15	4.1
PMN34LN	20	28	34	-	-	15	5.7
PMN28UN	12	-	28	32	39	8	5.7
PMN45EN	30	32	42	-	-	20	5.2
PMN23UN	20	-	23	28	36.4	8	6.4

Circuit Diagram



<30 V MOSFETs

LFPAK for DC/DC converters

Description

With the increasing importance of power density in DC/DC converters, Philips' solutions in LFPAK offer greater power density than both SO8 and DPAK products. Our devices offer leading performance in applications such as Point of Load (POL) and VRMs, whether in the low-side or high-side position, where minimum switching losses are vital.

There is also a requirement for high component density, thus a minimum number of small footprint MOSFETs must be used. In higher current applications, an LFPAK device can meet the thermal requirements that one SO8 cannot, and in these cases either two SO8 devices or a DPAK would be needed.

Benefits

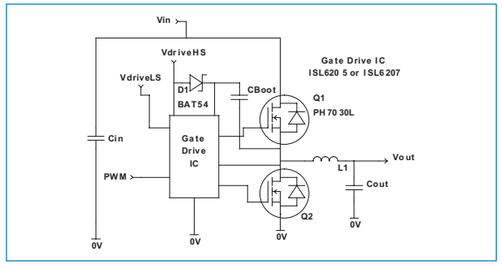
- Suitable for 5 V or 12 V gate drive
- Greater power density than SO8 or DPAK
- Same footprint area as SO8

Suitable Products

- PH3830L
- PH5330E
- PH7030L
- PH4530L
- PH3120L

	V_{DS} (V)	Max $R_{DS(on)}$ (mΩ)		Q_{GD} (nC)	Q_{Gtotal} (nC)
		V_{GS} 10 V	V_{GS} 4.5 V		
PH3830L	30	3.8	4.9	11.0	33.0
PH5330E	30	5.7	8.5	6.0	21.0
PH7030L	30	7.9	10.0	3.2	12.0
PH4530L	30	6.3	9.0	4.1	21.0
PH3120L	30	2.4	3.4	12.8	48.5

Circuit Diagram



<30 V MOSFETs

Active load circuit in DC/DC conversion

Description

This circuit provides a simple and cost effective alternative to 'off-the-shelf' electronic load circuits and is ideal for carrying out efficiency testing of low- to medium-power DC/DC converters. A single 1A load section is formed around SW1a, R2a, R3a, C3a, C4a, IC2a and Q1a and multiple 1A load sections may be connected in parallel to achieve a complete circuit capable of sinking in excess of 10A. Switchable in steps of 1A via SW1, the overall current may also be fine tuned by adjusting VR1.

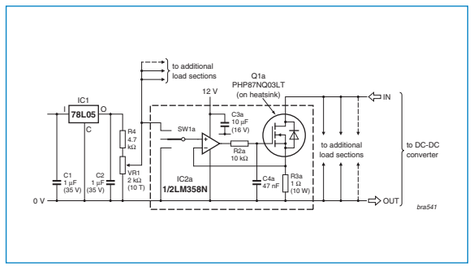
Benefits

- Simple design and extremely cost effective
- Little drift over time compared to ordinary resistive loads
- Low power consumption - can be battery powered thereby providing a true 'floating' load

Suitable Products

- PHP78NQ03LT (Q1a)
- LM358N (IC2)

Circuit Diagram



<30 V MOSFETs

PDA Backlight Supply

Description

The following circuit is ideal for providing a white LED backlighting supply in, for example, cellular phones and PDAs that are powered from a single battery cell. Q1, Q2 and associated components form a simple oscillator running at approximately 25 kHz. Due to the very low threshold characteristics of Q1 and Q2, this oscillator will function with a supply voltage of 1.2 V or less. Q3, L1 and the LED(s) are configured as a non-isolated flyback converter. The 'flyback' action of L1 provides sufficient voltage to drive the LED(s), whose forward voltage is typically 3 to 4 V per device. The circuit may also be configured to run at increased supply voltages e.g. for a 3 V supply and 3 LEDs, change R2 to 560 Ω and L1 to 560 µH.

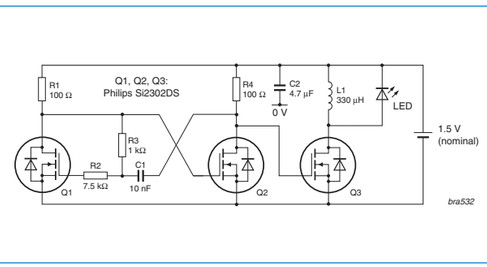
Benefits

- Will power a single, dual or triple LED in series with the circuit values shown
- Operation with supply voltage ≤ 1.2 V – which can be extended to higher voltages
- Uses readily available components

Suitable Products

- Philips Si2302DS (Q1, 2, 3)

Circuit Diagram



<30 V MOSFETs

Buck conversion for high-end graphics cards (VGA)

Description

Modern high-end graphics cards typically incorporate their own fast, dedicated graphics processor (GPU) and a large amount of memory. The power consumption of such graphics cards is now similar to that of complete motherboards from two to three years ago, with the GPU alone requiring up to 10A at an approximate voltage of 1.7 V. The GPU supply is usually derived from a higher voltage (3.3 V in this case) via a synchronous buck DC/DC converter. Correct choice of power MOSFETs in the DC/DC converter is essential if the converter is to run with acceptable temperature and efficiency. The Philips PHK12NQ03LT and PHK28NQ03LT MOSFETs are ideal for this application, and are available in the industry standard SO8 package, prevalent in this application.

Benefits

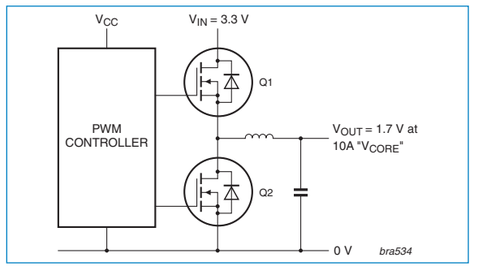
- Efficiency equal to leading industry requirements
- Very low $R_{DS(on)}$ specification and fast switching enables lower working temperatures
- Lower profile to simplify compact design

Suitable Products

- PHK12NQ03LT
- PHK28NQ03LT

	$R_{DS(on)}$ mΩ	@V_{GS} V
PHK12NQ03LT	14	4.5
	10.5	10
PHK28NQ03LT	7.5	4.5
	7.1	10

Circuit Diagram



<30 V MOSFETs

Power switching in CCFL resonant inverters

Description

Dual N-channel MOSFETs can be used as power switches inside resonant inverters for the high voltage power supply of Cold Cathode Fluorescent Lamps (CCFL) in LCD backlighting applications. In the application circuit below a full bridge converts the low DC voltage (typically 3 V to 28 V) to an AC voltage. The IC controls the four N-channel MOSFETs to produce a low AC voltage that is transformed to a higher AC voltage, which in turn powers the CCFL tubes.

The drain-source voltage of the MOSFET must be selected to withstand the maximum voltage that can occur on the DC input. The MOSFETs recommended in the table below are suitable for lamp powers ranging from 1 W to about 5 W. For half or full bridge configurations either single or dual MOSFETs can be used. Note that the total power capability of two single TSOP6 packages is equal to one SO8 package or twice the power capability of a TSSOP8 package.

Benefits

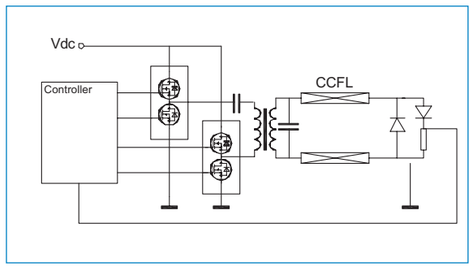
- Lower $R_{DS(on)}$ than P-channel MOSFETs
- Latest Trench technology helps improve system efficiency
  - lower on-state resistance
  - increased inverter efficiency
- High integration, reduced component count

Suitable Products

Power MOSFETs
- PHKD6NO2LT
- PHN203
- PHKD13NO13LT
- PHKD3NQ10T
- PMWD16UN
- PMWD19UN
- PMWD30UN
- PMGD370XN
- PMN45EN
- PMN40LN
- PMN23UN

Driver IC
- UBA2070

Circuit Diagram



40–100 V MOSFETs

Low voltage DC motor control

Description

In controlling the speed and direction of low voltage brushed and brushless DC motors, power MOSFETs provide robust and easy-to-use solutions and have largely replaced their bipolar counterparts. This is because they offer several features which make them uniquely suitable for operation in DC motor control circuits.

MOSFETs are extremely easy to turn on or off, simply requiring that the gate capacitance is charged to the necessary voltage level. Once turned on or off, the MOSFET gate draws no further current from the drive circuit. Modern MOSFET technology enables devices with $R_{DS(on)}$ figures of less than 10 mΩ, ensuring that even at high current levels, on-state losses are extremely low. In bridge configurations, the MOSFETs built-in body diode may be used to conduct freewheeling currents, eliminating the need for external parallel diodes.

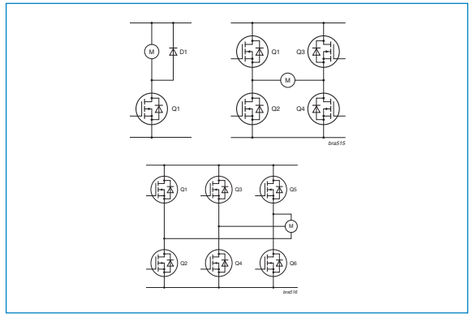
Benefits

- Very low $R_{DS(on)}$ ensures low on-state loss
- Fast switching
- Low loss operation reduces heatsinking and increases battery life
- Robust, handles large current spikes without damage

Suitable Products

- PHP222NQ04LT
- PHB222NQ04LT
- PHP193NQ06T
- PHB193NQ06T
- PHP73N06T
- PHB73N06T
- PHP110NQ08T
- PHB110NQ08T

Circuit Diagram



>100 V MOSFETs

Active clamp in AC/DC conversion

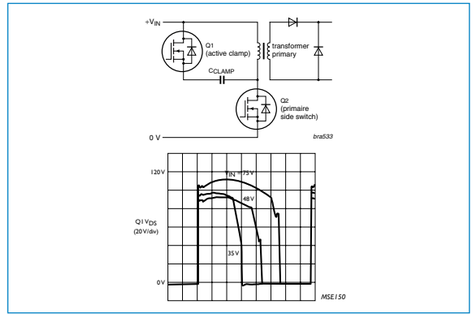
Description

The active clamp topology allows for a more efficient method of transformer core reset in isolated flyback and forward converters. For example in a forward converter, core reset is traditionally achieved by the use of an 'RCD' clamp, resulting in a loss of core magnetising energy as it dissipates in the resistive part of the clamp. An active clamp circuit allows the core magnetising energy to be recovered and returned to the supply, improving overall converter efficiency. This is achieved by the circuit comprised of the transformer, CCLAMP and MOSFET Q1 – a lower current N-channel MOSFET with a voltage rating of 150V or 200 V. A second benefit offered by the active clamp topology is that the voltage appearing across the primary side switch MOSFET (Q2) is reduced, compared to other core reset methods. This also has less variation with the input voltage allowing a lower voltage rated device to be used in the Q2 position.

Suitable Products for Q1 and Q2

- PML260SN (200V, 294 mΩ)
- PSMN063-150D (150V, 63 mΩ, DPAK)
- PHK5NQ15T (150V, 75 mΩ, SO8)
- PHD22NQ20T (200V, 120 mΩ, DPAK)
- PHK4NQ20T (200V, 130 mΩ, SO8)
- PHD14NQ20T (200V, 230 mΩ, DPAK)

Circuit Diagram



>100 V MOSFETs

UHP lamp driver

Description

Ultra high pressure (UHP) lamps in projectors are often driven by a full bridge resonant inverter, with N-channel MOSFETs as power switches involved in converting the DC input voltage to an AC voltage.

In the circuit below, a full bridge converts the DC rail to a low frequency square AC voltage that supplies the lamp. The DC voltage is typically regulated by a step-down converter, which is normally connected to an AC mains PFC pre-conditioner with nearly constant voltage (e.g. 380 V) and provides a voltage within the 50 V to 175 V range. The MOSFETs drain-source voltage must be selected to withstand the maximum voltage that can occur on the DC supply. The products listed below are ideal for lamp powers ranging from 40 W to about 200 W.

A driver IC, such as the Philips UBA2033, provides the drive for all the N-channel MOSFETs in the full bridge configuration.

Benefits

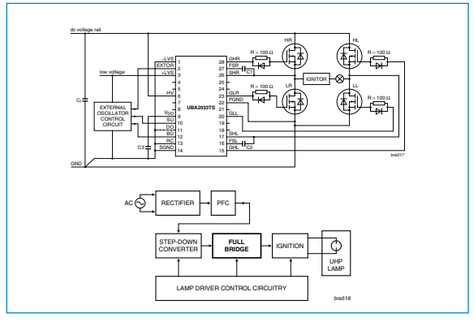
- Low on-state losses increase inverter efficiency
- Easy gate driving due to low input capacitance
- Flexible choice of packages, V_{DS} and $R_{DS(on)}$

Suitable Products

Power MOSFETs
- PHP33NQ20T
- PHB33NQ20T
- PHD22NQ20T
- PHP45NQ15T
- PHB45NQ15T

Driver IC
- UBA2033

Circuit Diagram



Triacs and SCRs

Triac commutation monitoring without sensing resistor

Description

Intelligent, microcontroller-based triac management allows continuous conduction or phase control of any unspecified load without the need for a current sense resistor. The closed-loop system adjusts automatically to apply sufficient current to guarantee triggering, while minimizing current drawn from the driver supply.

Combining Philips' Hi-Com triacs and low-cost LPC (Low Pin Count) microcontrollers, together with the necessary software code, can achieve any triac control function simply, cheaply and reliably. Once the system has been designed, its closed-loop functionality ensures success for any load in a wide range of applications including solid-state relays, domestic appliances and personal care products, as well as leisure and industrial equipment.

Benefits

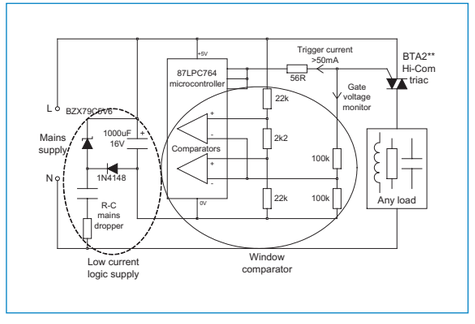
- Predicts imminent triac commutation
- No current sense resistor required
- Microcontroller applies gate current only when needed
- Self adjusts for any load
- Enables simple, reliable, one-for-all design-and-forget triac control systems

Suitable Products

Triac
- BTA2xx

Microcontroller
- 87LPC764

Circuit Diagram



Triacs and SCRs

Speed controller for power tools

Description

Most handheld power tools such as drills, routers, jigsaws and sanders incorporate a speed controller in their trigger switch. The popular solution is a half-wave phase controller incorporating a Silicon Controlled Rectifier (thyristor) with a high ITRM (repetitive surge) capability. This simple, compact and efficient circuit offers variable speed control with the best speed stability under a widely varying motor load. It also withstands the high, repetitive inrush currents experienced during multiple start/stop sequences and motor stall. Another demand placed on components by this application is high ambient temperatures, often combined with limited space and little provision for heatsinking. Our portfolio includes compact and rugged devices such as the BTH151S-650R SCR, specifically designed to satisfy all these conditions.

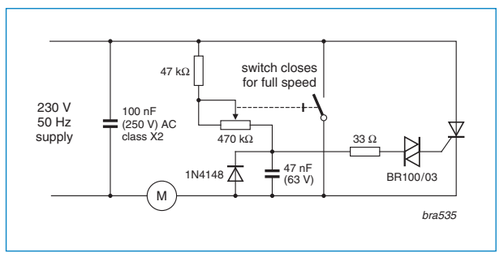
Benefits

- Compact surface mount package (DPAK)
- Load current $I_{T(RMS)}$ = 12 A
- High repetitive surge guarantee
- I_{TRM} = 60 A @ 10 ms, 100 kilocycles
- High surge capability (I_{TSM} = 110 A @ 10 ms)

Suitable Products

- SCR
  - 12 A BTH151S-650R (DPAK) – leaded option (TO220) available on request
- Diac
  - BR100/03 (SOD27)

Circuit Diagram



Triacs and SCRs

Inductive DC load on AC mains

Description

Occasions arise where a DC load must be powered from AC mains via a bridge rectifier. Examples include DC permanent magnet motors as used in small hand-held tools & kitchen appliances, DC solenoid valves as used in home and industry, etc. The motors will most likely be speed-controlled by means of a triac phase control circuit. The solenoids also are often triac-controlled, with the triac used as a solid-state switch to apply full power only. In both cases, the load current is extremely non-linear and can more closely resemble a square wave than a sine wave. This produces very high commutating current (dI_{COM}/dt) for the triac. Most triacs will fail to commutate under such conditions and will experience uncontrolled conduction of one or more half cycles after removal of the gate drive. The problem gets rapidly worse with increasing temperature. Such commutation failure can be avoided by using Hi-Com (three quadrant) triacs exclusively. If the least sensitive options are chosen (B series with IGT = 50 mA), guaranteed reliable operation is possible without the need for commutation aids like snubbers or series dI_{COM}/dt limiting inductors.

Benefits

- Hi-Com (three quadrant) triacs require no commutation aids such as snubbers and dI_{COM}/dt-limiting inductors
- Simplest possible circuits
- Best reliability
- Most reliable operation at high temperatures

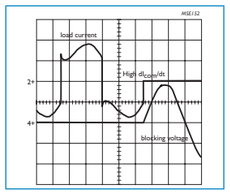
Suitable Products

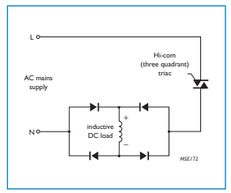
- Three quadrant triacs

- 1A	BTA201 range	- 12A	BTA212 range
- 4A	BTA204 range	- 16A	BTA216 range
- 8A	BTA208 range	- 25A	BTA225 range

- Diodes
  - Any low frequency diode from Philips' General Purpose Rectifier range.

Circuit Diagram





Triacs and SCRs

Lamp dimmer

Description

Lamp dimmers must be very compact and generate little waste heat as they are usually housed in the extremely restricted space of a wall switch box. A triac phase control circuit can meet these requirements. Lamp brightness is varied by varying the amount of time in each mains half cycle that the lamp is connected to the supply. This conduction time is governed by how fast the 47 nF capacitor charges up, which in turn is controlled by the setting of the 1 MΩ potentiometer. Because the load is resistive, it offers no smoothing or filtering of the current waveform, so harmonic distortion remains high. Therefore it is necessary to include the 2.5 mH inductor to attenuate the harmonic currents, in addition to the 47 nF RFI filter capacitor.

Benefits

- Simple circuit
- Very compact
- Efficient - low heat generation
- Cost effective for cost-critical applications
- Applicable to any lamp power - e.g. 40 to 1000 W - simply select the appropriate triac current rating*

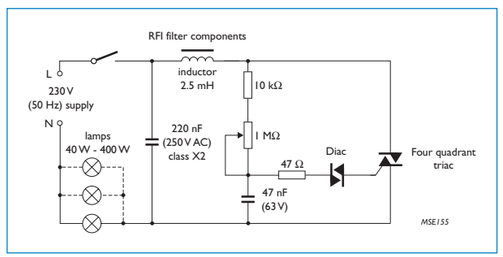
* Severe current de-rating is routinely applied due to the extremely limited heatsinking and the very high potential inrush current of cold filaments or failing lamps

Suitable Products

• Four quadrant triacs		Max load
- 4A	BT136 series	200 W
- 8A	BT137 series	400 W
- 12A	BT138 series	600 W
- 16A	BT139 series	800 W
- 25A	BTA140 series	1250 W

- Diac
  - BR100/03

Circuit Diagram



Triacs and SCRs

Universal Motor Speed Controller

Description

Universal motors are commonly used in industrial and commercial applications, as well as many appliances found in the home, where high-speed, low-cost and ease of speed control are a requirement. Typical applications include mixers, washers, power tools, laboratory equipment, sewing machines and vacuum cleaners. Motor speed is easily controlled by varying the average voltage applied to it. This can be achieved very simply by use of the phase control circuit. A Phase Controller varies the amount of time in each mains half-cycle that voltage is applied to the load, according to the setting of the 1 MΩ potentiometer. The inductance of the motor provides some smoothing and filtering of the load current, while the 220 nF capacitor provides additional filtering of RF interference.

Benefits

- Simple circuit
- Three quadrant triac requires no Snubber
- Cost effective
- Efficient - low heat generation
- Applicable to any motor power - e.g. 100 W mixer or 2.2 kW heavy duty vacuum cleaner - simply select the appropriate triac current rating*

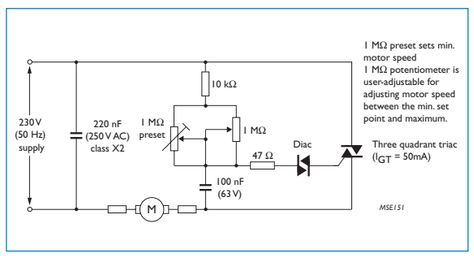
* Half current derating has been applied to allow for inrush and overload currents and to allow for non-ideal heatsinking in hot environments.

Suitable Products

• Three quadrant triacs		Max load
- 4A	BTA204-B series	550 W
- 8A	BTA208-B series	1100 W
- 12A	BTA212-B series	1600 W
- 16A	BTA216-B series	2200 W
- 25A	BTA225-B series	3400 W

- Diac
  - BR100/03

Circuit Diagram



Triacs and SCRs

Improved speed control of small universal motors

Description

A universal motor's speed drops off rapidly when it is loaded. This effect is emphasized further if the motor is undersized or subject to intermittent overload, typical in mixers, sewing machines and power tools. A half wave phase control circuit - one that uses a Silicon Controlled Rectifier (SCR) instead of a triac - enables improved compensation by the motor for changes in load and therefore helps maintain a more constant speed for a given power setting. In some applications a bypass switch is included to connect the motor directly to the mains supply for full speed. However, the difference in motor speed between 180° (half wave) conduction and 360° (full wave) conduction is often not great. A degree of RFI filtering is provided by the motor inductance and the 100 nF capacitor. An SCR capable of withstanding high repetitive surge current will be required for arduous applications such as professional, heavy duty power tools.

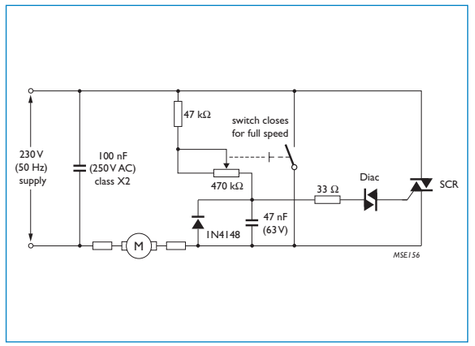
Benefits

- Simple, compact circuit
- Cost effective
- Efficient - low heat generation
- Better speed maintenance as load varies

Suitable Products

- SCRs
  - 8A BT300 series
  - 12A BT151series
  - 20A BT152 series
- Diac
  - BR100/03

Circuit Diagram



Triacs and SCRs

Reversible induction motor

Description

Industrial applications such as roller shutter doors and conveyors, and domestic appliances including tumble dryers and top-loading washing machines often employ reversible induction motors. Many controllers for these motors use two triacs to connect two motor terminals alternately to the supply. To avoid uncontrolled discharge of the motor capacitor through both triacs it is essential that their operation is mutually exclusive.
This requires high quality Hi-Com (High Commutation) triacs with excellent immunity to false triggering. In addition, due to the voltage boosting that occurs across the undriven motor winding (voltage step-up by 'autotransformer effect'), high voltage triacs must be specified. Using the recommended triacs in the circuit shown below ensures reliable operation without the need for snubbers or gate capacitors.

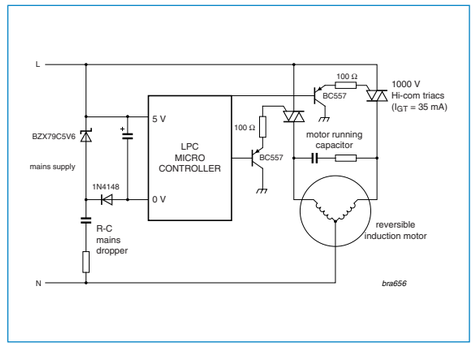
Benefits

- Three Quadrant triacs require ***no*** snubbers
- Increased reliability from simpler circuit
- Microcontroller / triac combination does not require driver IC
- Best reliability due to high voltage triacs

Suitable Products

- Triacs (8 A, 1000 V)
  - BTA208B-1000C
  - BTA208X-1000C
- Microcontroller: 87LPC764
- Transistor: BC557
- Diode: 1N4148

Circuit Diagram



Rectifiers and Zeners

Ultrafast diodes for high frequency applications

Description

In fast switching applications where low conduction losses are important, Philips BYV29 (9 A / 600 V) ultrafast diodes gave the lowest total power loss in a component test which measured several parameters. In the first circuit the diodes were used as a boost diode in a 600 W PFC circuit with a ZVS (zero voltage switching) circuit to limit power loss in the PFC switch. The second test involved a full diode bridge in a 1500 W isolation stage. Additionally forward voltage was measured at two different temperatures and the reverse recovery time at two different switch conditions.

Compared against four other ultrafast diodes, the tests showed that the BYV29 has the lowest body temperature, the lowest forward voltage and an intermediate reverse recovery time.
For higher power converters the 20 A BYV34 and 30 A BYV44 diodes are recommended.

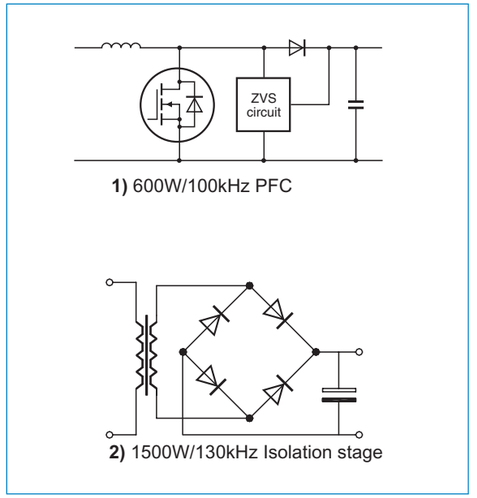
Benefits

- Highly efficient solution
- Extra reliability from low operating temperature
- Up to 150 kHz switching
- Surface mount and leaded packages

Suitable Products

- BYV29-500
- BYV29-600

Circuit Diagram



Rectifiers and Zeners

High frequency diode bridge

Description

Taking a 400 V / 1600 W isolation stage used in a solar energy inverter, the high frequency diode bridge in this application consists of four ultrafast recovery diodes (BYV29B-500/600).
A full-bridge inverter consisting of four 600 V MOSFETs converts the DC input voltage to AC, with a frequency as high as 150 kHz to reduce the size of the 1:1 transformer.

With a full diode bridge, the secondary AC voltage is rectified to 400 V DC. The high frequency needs ultrafast recovery diodes and, as conduction losses play a major role, the forward voltage must be as low as possible. As the maximum reverse voltage is equal to the maximum DC voltage, for safe operation this application requires 500 V or 600 V diodes. Philips ultrafast recovery diodes with optimized forward voltages are available from 500 V to 800 V.

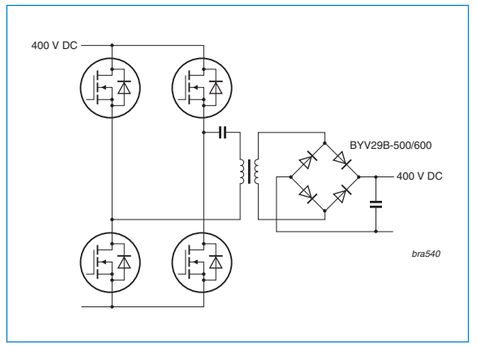
Benefits

- Ultrafast switching up to 150 kHz in given application
- Optimized to reduce conduction losses
- High temperature operation at maximum rated reverse voltage
- Soft recovery characteristics reduce EMI
- Surface mount and leaded packages

Suitable Products

- BYV29
- BYV29X
- BYV29B
- BYT79
- BYR29
- BYR29X

Circuit Diagram



Rectifiers and Zeners

Ultrafast and Hyperfast diodes for Power Factor Correction

Description

Active Power Factor Correction (PFC) is necessary to reduce disturbance on the AC distribution net. Regulations such as IEC1000-3-2/EN61000-3-2 impose restrictions on Power Factor (PF) and Total Harmonic Distortion (THD) of high power applications like off-line power supplies for PCs, Telecommunications and lower power applications such as lighting ballasts. A boost converter placed after the bridge rectifier transforms a crest or inductive load into a resistive load with a power factor equal to 1 and a very low harmonic distortion (THD). Important for the efficiency of the PFC is the choice of the PFC diode. Usually a high switching frequency is chosen to enable the use of small sized inductor.
For high power applications the boost converter usually operates in the 'continuous conduction mode'. For this mode, diode reverse recovery losses are the most significant, so Philips recommends ultrafast or hyperfast diodes with the shortest reverse recovery time t_{rr}.
For lower power applications the boost converter usually operates in the 'critical conduction' or 'discontinuous conduction mode'. In this case, on-state losses become more significant, so Philips recommends ultrafast diodes with a low forward voltage drop V_F.

Benefits

- World's fastest reverse recovery is best for continuous conduction mode in high power AC-DC SMPS and allows a high PFC frequency (up to 200kHz)
- Low forward recovery voltage minimises MOSFET losses at turn-on
- Minimised V_F to keep conduction losses as low as possible for critical conduction and discontinuous modes in lighting ballasts
- Excellent soft recovery characteristics minimise powerconsuming oscillations
- High maximum junction temperature makes diodes suitable for high temperature operation
- Useful range of surface mount and through-hole packages

Suitable Products

Diode	V_{RRM} (V)	$I_{F(AV)}$ (A)	t_{rr} (ns) @ 25C	V_F @ 150C	Package	Key
BYV29-600	600	9	50 typ 60 max	< 1.03V @ 8A	TO220AC	D, CC
BYV29B-600	600	9	50 typ 60 max	< 1.03V @ 8A	D2PAK	D, CC
BYV29X-600	600	9	50 typ 60 max	< 1.03V @ 8A	SOD113	D, CC
BYT79-600	600	14	50 typ 60 max	< 1.03V @ 14A	TO220AC	D, CC
BYT79X-600	600	14	50 typ 60 max	< 1.03V @ 14A	SOD113	D, CC
BYV34-600	600	2 X 10	50 typ 60 max	< 1.03V @ 10A	TO220AB	D, CC
BYV34X-600	600	2 X 10	50 typ 60 max	< 1.03V @ 10A	SOT186A	D, CC
BYC5-600	600	5	19 typ	< 1.75V @ 5A	TO220AC	C
BYC5B-600	600	5	19 typ	< 1.75V @ 5A	D2PAK	C
BYC8-600	600	8	19 typ	< 1.85V @ 8A	TO220AC	C
BYC8B-600	600	8	19 typ	< 1.85V @ 8A	D2PAK	C
BYC8X-600	600	8	19 typ	< 1.85V @ 8A	SOD113	C
BYC10-600	600	10	19 typ	< 1.80V @ 10A	TO220AC	C
BYC10B-600	600	10	19 typ	< 1.80V @ 10A	D2PAK	C
BYC10X-600	600	10	19 typ	< 1.80V @ 10A	SOD113	C

Key: D - discontinuous mode; CC - critical conduction; C - continuous mode

Integrated Power

AC/DC converters: SMPS ICs for low power consumer systems

Description

The TEA162x devices belong to Philips' highly efficient STARplug range of controller ICs for low-power SMPSs are ideal in a plethora of consumer applications including chargers, adapters, TV and monitor standby supplies, PC peripherals and set-top boxes. Like all STARplug products, they operate directly from rectified universal mains supplies from 80 V to 276 V. Essentially turnkey solutions, they dramatically cut design-in time for new power supplies and enable low-power, low-cost and extremely compact solutions for power plugs and small supplies.

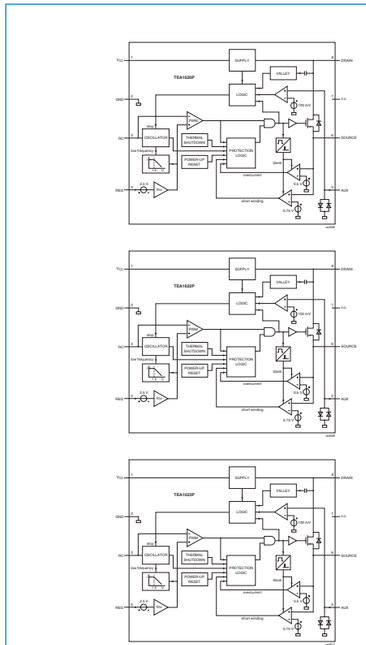
Benefits

- Adjustable frequency for flexible design
- RC oscillator for load insensitive regulation loop constant
- Valley switching for minimum switch-on loss
- Safe restart mode for system fault conditions
- Simple application with both primary and secondary (opto) feedback
- Available in 8-pin and 16-pin DIP package

Suitable Products

- TEA1620
- TEA1622
- TEA1623

Circuit Diagram



Integrated Power

AC/DC converters: SMPS ICs for high power consumer systems

Description

Used for power ranges up to 250 W, Philips' TEA1532 offers all of the advantages of the rest of the GreenChip family and is ideal for applications such as printers and other adapters, LCD monitors, set-top boxes and DVD recordable drives.

Among the many on-chip features are over-temperature and over-voltage protection for safety, demagnetization detection, reduced power frequency during standby (less than 3 W) and universal mains supply operation (from 70 to 276 V AC). The TEA1532 also offers 63 kHz maximum switching frequency and cycle skipping for low standby power levels. One additional feature is the built-in high voltage start-up current source, providing current when needed and is switched off during normal operation. With this function, the current level is independent to the input voltage.

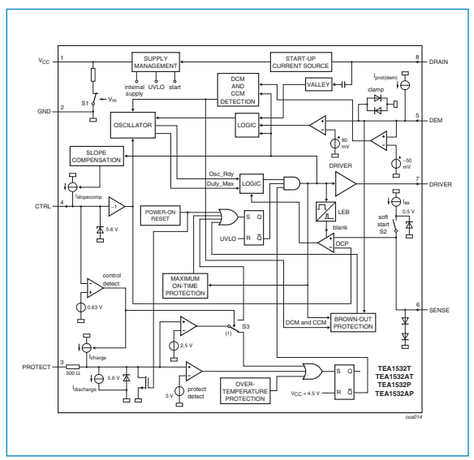
Benefits

- Universal mains supply operation (70 V to 276 V AC)
- High level of integration, resulting in a very low external component count
- Optimized efficiency at all power levels
- Enables highly efficient and reliable supplies to be designed easily

Suitable Products

- TEA1532

Circuit Diagram



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