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PRODUCT GUIDE

MOSFETs



Toshiba's MOSFET devices meet the needs of a wide range of ultra-high-density applications.

POWER-MOSFETS CONTENTS

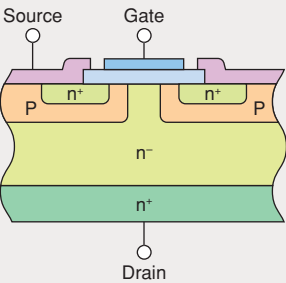
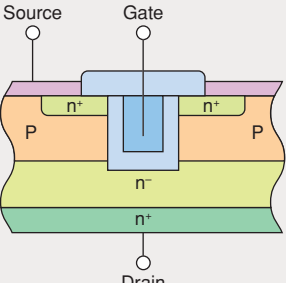
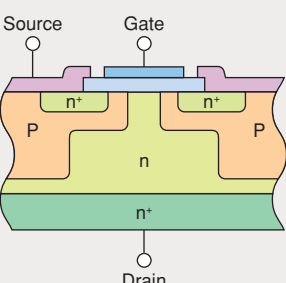
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• STP2 Series ... [Part Number: TPCT4xxx]	
• TSON Advance Series ... [Part Number: TPCC8xxx]	
• TSSOP Advance Series ... [Part Number: TPCM8xxx]	
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- 1) No carrier storage effect; superior frequency and switching characteristics
- 2) Rugged and no current concentration
- 3) Voltage-controlled device, hence low drive power
- 4) Easy parallel connection

■ Toshiba MOSFETs have the following additional features:

- 1) Guaranteed avalanche capability..... Allows an absorber circuit to be simplified
- 2) Improved functioning of built-in diodes Enhanced circuit design flexibility
- 3) High ruggedness Increased margin for circuit design
- 4) High-speed switching Higher speed in end-product's operation
- 5) Low $R_{(DS)ON}$ Reduced end-product's power consumption
- 6) Smaller packages Reduced end-product size
- 7) Low drive loss Reduced end product's power

■ Structures of Toshiba MOSFETs

<p>Double-Diffusion Structure</p> 	<p>● π-MOS</p> <p>Toshiba Power MOSFETs use a double-diffusion MOS (D-MOS) structure, which produces high-withstand voltage, to form channels. This structure is especially well suited to high-withstand voltage and high-current devices. A high level of integration yields a high-performance Power MOSFET with low ON-resistance and low power loss.</p>
<p>Trench Structure</p> 	<p>● U-MOS</p> <p>Higher channel density is achieved by connecting channels vertically to form a U-groove at the gate region, a structure that yields a lower ON-resistance than other MOSFET structures.</p>
<p>Super-Junction Structure</p> 	<p>● DTMOS</p> <p>The super-junction structure, which has P-type pillar layers as shown left, realizes high withstand voltage and ON-resistance lower than the conventional theoretical limit of silicon.</p>

2-1 MOSFET Product Lines

SSM Series ($V_{DS} = 12\text{ V to }60\text{ V}$)

Very compact and thin, the SSM Series is suitable for use in various electronic devices. The SSM Series is available in a wide range of packages and features low voltage drive.

- Applications
- Cell phones ● Notebook PCs
- Portable electronic devices ● Small-signal switching

VS and PS Series ($V_{DS} = 12\text{ V to }40\text{ V}$)

Very compact and thin, the VS and PS Series are suitable for use in various electronic devices.

- Applications
- Cell phones ● Notebook PCs
- Portable electronic devices

Chip LGA and STP Series ($V_{DS} = 20\text{ V to }30\text{ V}$)

The LGA and STP Series are housed in an ultra-small and thin package and are suitable for use in lithium-ion secondary battery protection circuits in various portable electronic devices.

- Applications
- Lithium-ion secondary battery protection circuits

SOP and TSON Series ($V_{DS} = 20\text{ V to }250\text{ V}$)

The SOP and TSON Series are compact and thin, and require only a small mounting area. They are suitable for lithium-ion secondary battery protection circuits and notebook PCs.

- Applications
- Lithium-ion secondary battery protection circuits
- Notebook PCs ● Portable electronic devices
- DC-DC converters

TO-220SM(W) Series ($V_{DS} = 40\text{ V to }150\text{ V}$)

The TO-220SM package, which uses Cu connectors and a wide source terminal, realizes low ON-resistance and a high current-carrying capability.

- Applications
- Motor drivers ● Switching power supplies

Low- V_{DS} , High- Q_g U-MOS Series ($V_{DS} = 40\text{ V to }100\text{ V}$)

High integration is achieved using a trench technology. Low-voltage drive ($V_{GS} = 4\text{ V}$) is possible due to ultra-low ON-resistance.

- Applications
- Motor drivers ● Solenoids and lamp drivers

U-MOS Series for Synchronous Rectification ($V_{DS} = 60\text{ V to }150\text{ V}$)

Fabricated using a trench technology, the U-MOS Series is ideal for synchronous rectification on the secondary side of power supply circuits.

- Applications
- Switching power supplies ● AC adapters
- Motor drivers

New π -MOSVII Series ($V_{DS} = 450\text{ V to }650\text{ V}$)

The latest addition to the π -MOS portfolio, the π -MOSVII Series offers reduced capacitances due to optimized chip design and is available with a greatly wider range of electrical characteristics.

- Applications
- Switching power supplies ● AC adapters

Super-Junction DTMOS Series ($V_{DS} = 600, 650\text{ V}$)

The super-junction DTMOS Series achieves low ON-resistance and low gate charge (Q_g) due to the use of the latest super-junction structure.

- Applications
- Switching power supplies ● AC adapters
- Motor drivers

High-Speed π -MOS Series ($V_{DS} = 450\text{ V to }600\text{ V}$)

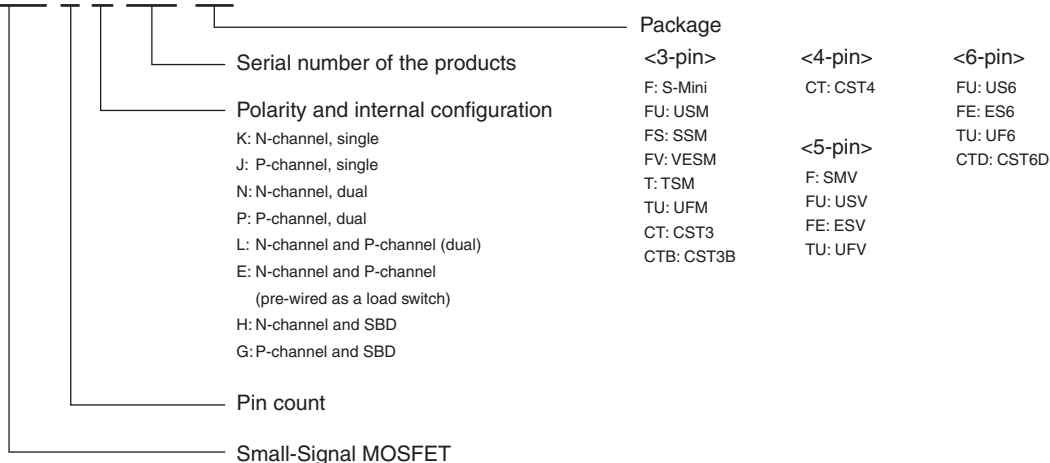
The new High-Speed π -MOS Series achieves higher switching speed than the well-proven π -MOS Series. Two series are available: high-speed switching series and high-speed diode series.

- Applications
- Inverters ● Switching power supplies
- Motor drivers ● AC adapters

2-2 Part Numbering Schemes

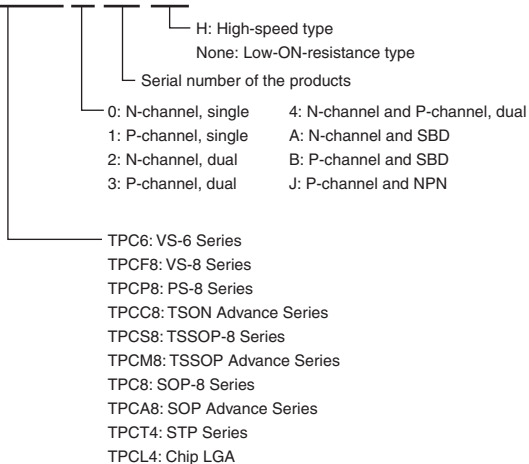
■ Small-Signal MOSFET (SSM) Series

SSM 3 K 101 TU



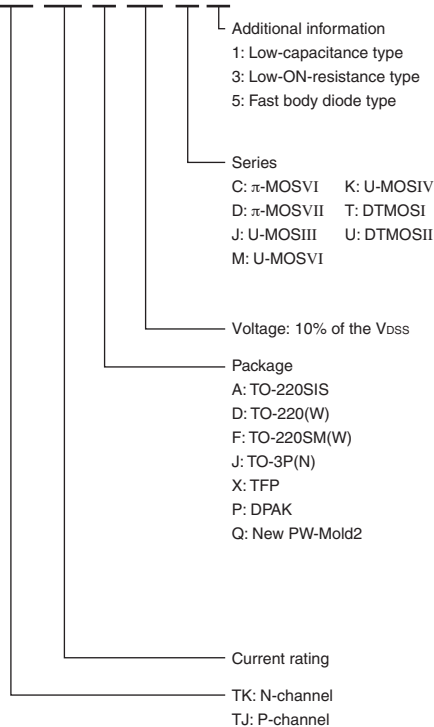
■ Multi-Pin Series

TPCM8 0 01 -H



■ New Series

TK 55 A 10 J 1



■ Conventional Series

2SK****

N-channel MOS

2SJ****

P-channel MOS

V _{DS} (V) I _D (A)	12	20	24	30	40	50	60	100	150	180	200	250	400	450	500	525	550	600	650	V _{DS} (V) I _D (A)		
0.05						*2SJ343(50)⑩ *2SJ344(50)⑩														0.05		
0.1		*SSM3K04FU(12)⑩ *SSM3K16FU(15)⑩ *SSM3J16FU(45)⑩ *SSM3K04FS(12)⑩ *SSM3K16FS(15)⑩ *SSM3J16FS(45)⑩ *SSM3J35FS(44)⑩ *SSM3K03FV(12)⑩ *SSM3K04FV(12)⑩ *SSM3K16FV(15)⑩ *SSM3J16FV(45)⑩ *SSM3J35MFV(44)⑩ *SSM3K16CT(15)⑩ *SSM3J16CT(45)⑩ *SSM3J35CT(44)⑩ *SSM6N04FU(12)⑩ *SSM6N16FU(15)⑩ *SSM6P16FU(45)⑩ *SSM6P35FU(44)⑩ *SSM6N03FE(12)⑩ *SSM6N16FE(15)⑩ *SSM6P16FE(45)⑩ *SSM6L16FE(15)⑩ *SSM6P35FE(45)⑩ *SSM5N16FU(15)⑩ *SSM5P16FU(45)⑩ *SSM5N03FE(12)⑩ *SSM5N16FE(15)⑩ *SSM5P16FE(45)⑩			*SSM3K15F(7)⑩ *SSM3J15F(32)⑩ *SSM3K15FU(7)⑩ *SSM3J15FU(32)⑩ *SSM3K15FS(7)⑩ *SSM3J15FS(32)⑩ *SSM3K15FV(7)⑩ *SSM3J15FV(32)⑩ *SSM3K15CT(7)⑩ *SSM3J15CT(32)⑩ *SSM6N15FU(7)⑩ *SSM6P15FU(32)⑩ *SSM5N15FU(7)⑩ *SSM5P15FU(32)⑩ *SSM6N15FE(7)⑩ *SSM6P15FE(32)⑩ *SSM5N15FE(7)⑩ *SSM5P15FE(32)⑩ *SSM3K44FS(7)⑩ *SSM3K44MFV(7)⑩ *SSM6N44FU(7)⑩ *SSM6N44FE(7)⑩			*SSM3K17FU(40)⑩ *SSM6N17FU(40)⑩													0.1	
0.18		*SSM3K35FS(20)⑩ *SSM3K35MFV(20)⑩ *SSM3K35CT(20)⑩ *SSM6N35FU(20)⑩ *SSM6L35FU(20)⑩ *SSM6N35FE(20)⑩ *SSM6L35FE(20)⑩																			0.18	
0.2		*SSM3J05FU(4)⑩ *SSM6P05FU(4)⑩ *SSM5P05FU(4)⑩		*2SJ305(4)⑩ *2SK2009(2)⑩ *SSM3J09FU(4.2)⑩ *SSM6P09FU(4.2)⑩			*SSM3K7002BF(3.3)⑩ *SSM6N7002BFU(3.3)⑩ *SSM3K7002BFS(3.3)⑩ *SSM6N7002BFS(3.3)⑩ *SSM3K7002AF(3.3)⑩ *SSM6N7002AFU(3.3)⑩ *SSM3K7002AF(3.3)⑩ *2SJ168(2)⑩ *SSM3K7002FU(3.3)⑩ *2SK1062(1)⑩ *SSM3K7002FU(3.3)⑩ *SSM6N7002BFE(3.3)⑩													0.2		
0.25		*SSM6N37CTD(5.6)⑩																			0.25	
0.33		*SSM3J36TU(3.6)⑩ *SSM3J36FS(3.6)⑩ *SSM3J36MFV(3.6)⑩ *SSM6P36TU(3.6)⑩ *SSM6P36FE(3.6)⑩																			0.33	
0.4		*SSM6L05FU(1.2)⑩ *SSM6N05FU(1.2)⑩ *SSM3K05FU(1.2)⑩ *SSM5N05FU(1.2)⑩		*SSM6L09FU(1.2)⑩ *SSM6N09FU(1.2)⑩ *SSM3K09FU(1.2)⑩																	0.4	
0.5		*SSM4K27CT(0.205)⑩ *SSM6L10TU(0.145)⑩ *SSM6L11TU(0.145)⑩ *SSM6L12TU(0.145)⑩ *SSM6N25TU(0.145)⑩ *SSM6N36TU(1.52)⑩ *SSM6P25TU(0.26)⑩ *SSM6P26TU(0.23)⑩ *SSM6J25FE(0.26)⑩ *SSM6J26FE(0.23)⑩ *SSM6K25FE(0.145)⑩ *SSM6L36TU(1.52)⑩ *SSM3K36FS(1.52)⑩ *SSM3K36MFV(1.52)⑩ *SSM3K36TU(1.52)⑩ *SSM6N36FE(1.52)⑩ *SSM6L36FE(1.52)⑩ *SSM6N43FU(1.52)⑩ *SSM3K43FS(1.52)⑩		*SSM6N24TU(0.145)⑩ *SSM6K24FE(0.145)⑩																	*2SK2998 (20)⑩ *2SK3302 (18)⑩ *2SK3471 (18)⑩	0.5
0.65		*SSM6J06FU(0.5)⑩																			0.65	
0.72		*SSM6P41FE(0.3)⑩																			0.72	
0.77		*SSM6N42FE(0.26)⑩																			0.77	
0.8		*SSM6L13TU(0.143)⑩ *SSM6N29TU(0.143)⑩ *SSM6P28TU(0.234)⑩ *SSM6J205FE(0.234)⑩		*SSM6J07FU(0.8)⑩																	0.8	

Legend **Product series** ①: π-MOSIII ②: π-MOSV ③: π-MOSVI ④: L²-π-MOSV ⑤: L²-π-MOSVI ⑥: U-MOS ⑦: π-MOSVII ⑧: π-MOSIV ⑨: DTMOSI ⑩: DTMOSII

Package ◊PW-Mini ◊VS-8 ♥VS-6 ♣PS-8 ◊STP ▲TO-92MOD ▼PW-Mold J New PW-Mold ⊙TSON Advance ◊New PW-Mold2 ▽DP ☆TPS ◊TSSOP Advance X TSSOP-8 ★SOP-8 ◊SOP-8 Lead Clamp ▶SOP Advance ◆TO-220NIS ⊗TO-220SIS ■TO-220AB ◻TO-220(W) ♣TFP ○TO-220FL/SM ◊TO-220SM(W) ◻TO-3P(N) ⊙TO-3P(N)IS ●TO-3P(L) ◻Chip LGA *S-Mini ◊TSM *USM △UFM ☆SSM ◊VESM ◊CST3 ◊CST3B ◊CST4 ◊SMV ◊US6 *UF6

Notes: () = R_{DS(on)} max () = R_{DS(on)} max * = 1.8-V drive P = P-ch P-ch + SBD NS = N-ch + SBD PD = P-ch + Driver (load switch) \$ = 10-V drive N = N-ch N = High-speed diode CN = Complementary N-ch PS = P-ch + SBD CP = Complementary P-ch [] = Under development

V _{DS} (V) I _D (A)	12	20	24	30	40	50	60	100	150	180	200	250	400	450	500	525	550	600	800	900	1000	V _{DS} (V) I _D (A)		
1	PS *SSM5G02TU (0.16)Ⓞ PS *SSM5G04TU (0.24)Ⓞ PD *SSM6E01TU (0.16)Ⓞ	△SSM3J111TU (0.48)Ⓞ		PS *SSM5G01TU (0.8)Ⓞ			◇2SJ360 (0.73)Ⓞ ▲2SJ507 (0.7)Ⓞ	◇2SK2963 (0.7)Ⓞ ▲2SK2962 (0.7)Ⓞ ◇2SJ508 (1.9)Ⓞ ▲2SJ509 (1.9)Ⓞ	▲2SK3670 (1.7)	◆2SJ313 (5.0) ▼2SJ338 (5.0) ◆2SK2013 (5.0) ▼2SK2162 (5.0)	◇2SK2992 (3.5)Ⓞ	CP★TPC8404(2.55)Ⓞ CN★TPC8404(1.7)Ⓞ	▼2SK3498 (5.5)Ⓞ	Ⓜ2SK4023 (4.6)Ⓞ ☆2SK3374 (4.6)Ⓞ ▼2SK3472 (4.6)Ⓞ					Ⓜ2SK3371 (9)Ⓞ Ⓜ2SK4026 (9)Ⓞ	■2SK2733 (9.0)Ⓞ ▽2SK2845 (9)Ⓞ ▼2SK3301 (20)Ⓞ			1	
1.1		△SSM6K06FU (0.16)Ⓞ		△SSM3J112TU (0.79)Ⓞ																			1.1	
1.2	▲SSM6J23FE (0.16)Ⓞ	△SSM3K106TU (0.53)Ⓞ ●SSM6P54TU (0.228)Ⓞ NS *SSM5H07TU (0.54)Ⓞ ▲SSM6K31FE (0.54)Ⓞ ▲SSM6K30FE (0.42)Ⓞ																					1.2	
1.3		△SSM6J08FU (0.18)Ⓞ PS *TPC8BA1 (0.18)Ⓞ		▲SSM6J207FE (0.491)Ⓞ							ⓂTPCS8004-H (0.8)Ⓞ												1.3	
1.4	NS *SSM5H03TU (0.3)Ⓞ	▲SSM6K22FE (0.17)Ⓞ		△SSM3J118TU (0.48)Ⓞ ●SSM6P40TU (0.403)Ⓞ PS *SSM5G11TU (0.403)Ⓞ NS *SSM5H01TU (0.45)Ⓞ ▲SSM6K210FE (0.371)Ⓞ																			1.4	
1.5	PS *SSM5G09TU (0.13)Ⓞ	△SSM3K107TU (0.41)Ⓞ ●SSM6P39TU (0.213)Ⓞ NS *SSM5H05TU (0.16)Ⓞ NS *SSM5H08TU (0.16)Ⓞ		⊕SSM3J02T (0.5)Ⓞ △SSM3K128TU (0.36)Ⓞ PS *SSM5G10TU (0.213)Ⓞ △SSM6K07FU (0.22)Ⓞ																			1.5	
1.6		▲SSM6N42FE (0.252)Ⓞ NS *SSM5H10TU (0.119)Ⓞ NS *TPC8AA1 (0.105)Ⓞ ●SSM6L39TU (0.119)Ⓞ ●SSM6N39TU (0.119)Ⓞ △SSM6K08FU (0.105)Ⓞ		⊕SSM3J313T (0.268)Ⓞ NS *SSM5H11TU (0.182)Ⓞ ●SSM6L40TU (0.182)Ⓞ ●SSM6N40TU (0.182)Ⓞ																			1.6	
1.7		△SSM3J113TU (0.169)Ⓞ		⊕SSM3J01T (0.4)Ⓞ ⊕SSM3J305T (0.477)Ⓞ																			1.7	
1.8	PD *SSM6E03TU (0.144)Ⓞ	△SSM3J108TU (0.158)Ⓞ △SSM3J114TU (0.149)Ⓞ PD *SSM6E02TU (0.136)Ⓞ ▲SSM6J53FE (0.136)Ⓞ										★TPC8012-H (0.4)Ⓞ											1.8	
1.9				NS *SSM5H12TU (0.133)Ⓞ ▲SSM6K208FE (0.133)Ⓞ									NS *TPCS8007-H (0.45)Ⓞ										1.9	
2		△SSM3J109TU (0.13)Ⓞ △SSM3K122TU (0.123)Ⓞ ●SSM6K405TU (0.126)Ⓞ ▲SSM6J206FE (0.13)Ⓞ ▲SSM6K204FE (0.126)Ⓞ ⊕SSM3J46CTB (0.103)Ⓞ *SSM3J325F (0.155)Ⓞ		△SSM3J117TU (0.225)Ⓞ △SSM3K127TU (0.123)Ⓞ ●SSM6J402TU (0.225)Ⓞ				◇2SK2615 (0.3)Ⓞ ▲2SK2961 (0.3)Ⓞ ◇2SK3658 (0.3)Ⓞ ●SSM6K407TU (0.44)Ⓞ ●SSM6K32TU (0.44)Ⓞ						▼2SJ610 (2.55)Ⓞ	⊗2SK3757 (2.45)Ⓞ ⊗2SK3766 (2.45)Ⓞ	☆2SK2599 (3.2)Ⓞ Ⓜ2SK3373 (3.2)Ⓞ				☆2SK2846 (5.0)Ⓞ Ⓜ2SK2865 (5.0)Ⓞ ⊗2SK3767 (4.5)Ⓞ Ⓜ2SK4002 (5)Ⓞ ⓂTK2Q60D (4.3)Ⓞ			2	
2.1				△SSM3K116TU (0.1)Ⓞ					NS *TPCS8009-H (0.35)Ⓞ														2.1	
2.2		△SSM3J115TU (0.098)Ⓞ △SSM3K101TU (0.103)Ⓞ		△SSM3K105TU (0.2)Ⓞ				ⓂTPC8003-H (0.18)Ⓞ ★TPC8214-H (0.18)Ⓞ															2.2	
2.3	△SSM3J110TU (0.094)Ⓞ ⊕SSM3J304T (0.127)Ⓞ			▲SSM6K202FE (0.085)Ⓞ																			2.3	
2.4				⊕SSM3J306T (0.225)Ⓞ △SSM3K124TU (0.12)Ⓞ																			2.4	
2.5		●SSM6J50TU (0.064)Ⓞ		△SSM3K119TU (0.074)Ⓞ ⊕SSM3K02T (0.2)Ⓞ ●SSM6J401TU (0.145)Ⓞ			⊕SSM3K318T (0.145)Ⓞ						Ⓜ2SJ567 (2.0)Ⓞ Ⓜ2SJ680 (2.0)Ⓞ						⊗TK3A60DA (2.8)Ⓞ		⊗2SK3566 (6.4)Ⓞ		2.5	
2.6		△SSM3K102TU (0.071)Ⓞ																					2.6	
2.7	⊕SSM3J312T (0.091)Ⓞ	P# *TPC6105 (0.11)Ⓞ P# *TPCF8301 (0.11)Ⓞ PS *TPCF8B01 (0.11)Ⓞ P# *TPCF8103 (0.11)Ⓞ		⊕SSM3J14T (0.17)Ⓞ																			2.7	
2.8		▲SSM6K203FE (0.061)Ⓞ																					2.8	
2.9				⊕SSM3K303T (0.12)Ⓞ																			2.9	
3	⊕SSM3J13T (0.07)Ⓞ ●SSM6J21TU (0.05)Ⓞ	N# *TPCF8201 (0.049)Ⓞ NS *TPCF8A01 (0.049)Ⓞ P# *TPCF8302 (0.059)Ⓞ P# *TPCF8303 (0.058)Ⓞ △SSM3K104TU (0.056)Ⓞ ●SSM6K404TU (0.055)Ⓞ		⊕SSM3K12T (0.175)Ⓞ ●SSM6K34TU (0.077)Ⓞ NS *SSM5H14F (0.078)Ⓞ				☆2SK2200 (0.35)Ⓞ ☆2SK2201 (0.35)Ⓞ Ⓜ2SK4018 (0.35)Ⓞ					Ⓜ2SK3462 (1.7)Ⓞ Ⓜ2SK4022 (1.7)Ⓞ			◆2SK2862 (3.2)Ⓞ				Ⓜ2SK4003 (2.2)Ⓞ Ⓜ(Short lead) Ⓜ2SK3975 (2.2)Ⓞ	■2SK2603 (3.6)Ⓞ ○2SK2883 (3.6)Ⓞ	■2SK2608 (4.3)Ⓞ □2SK2719 (4.3)Ⓞ ⊗2SK3564 (4.3)Ⓞ		3
3.2		△SSM3K121TU (0.048)Ⓞ ▲SSM6K211FE (0.047)Ⓞ		CP *TPCF8402 (0.077)Ⓞ P *TPCF8304 (0.072)Ⓞ ⊕SSM3K01T (0.12)Ⓞ																			3.2	
3.3		▲SSM6J212FE (0.0434)Ⓞ																					3.3	
3.4				CP *TPCP8402 (0.072)Ⓞ	P *TPCP8403 (0.070)Ⓞ																		3.4	
3.5		⊕SSM3K301T (0.056)Ⓞ *SSM3J327F (0.095)Ⓞ		⊕SSM3J314T (0.1)Ⓞ															⊗TK4A55DA (2.45)Ⓞ	■2SK3085 (2.2)Ⓞ ⊗2SK3567 (2.2)Ⓞ ⊗TK4A60DA (2.2)Ⓞ			3.5	
3.6		⊕SSM3J317T (0.107)Ⓞ																					3.6	
3.8		P *TPCP8303 (0.04)Ⓞ					NS *TPC8218-H (0.057)Ⓞ																3.8	
3.9						NS *TPC6006-H (0.075)Ⓞ																	3.9	
4	●SSM6J51TU (0.054)Ⓞ	△SSM3J120TU (0.038)Ⓞ ●SSM6K18TU (0.04)Ⓞ		CN *TPCF8402 (0.05)Ⓞ CN *TPCP8404 (0.05)Ⓞ CP *TPCP8404 (0.05)Ⓞ ⊕SSM3K316T (0.065)Ⓞ ⊕SSM3K14T (0.067)Ⓞ									NS *TPCA8008-H (0.58)Ⓞ						⊗TK4A50D (2.0)Ⓞ	⊗TK4A55D (1.9)Ⓞ	⊗TK4A60D (1.7)Ⓞ	⊗2SK3798 (3.5)Ⓞ ○2SK1190 (3.8)	■2SK1119 (3.8)	4

Legend Product series ① : π-MOSIII ② : π-MOSV ③ : π-MOSVI ④ : L²-π-MOSV ⑤ : L²-π-MOSVI ⑥ : U-MOS ⑦ : π-MOSVII ⑧ : π-MOSIV ⑨ : DTMOI ⑩ : DTMOII Package ◇PW-Mini } VS-8 ♥ VS-6 ♣ PS-8 ⊕ STP ▲ TO-92MOD ▼ PW-Mold } New PW-Mold ⊙ TSON Advance Ⓜ New PW-Mold2 ▽ DP ☆ TPS ◀ TSSOP Advance Ⓜ TSSOP-8 ★ SOP-8 ⊕ SOP-8 Lead Clamp ▶ SOP Advance ◆ TO-220NIS ⊗ TO-220SIS ■ TO-220AB □ TO-220(W) ♣ TFP ○ TO-220FL/SM ⊕ TO-220SM(W) □ TO-3P(N) ⊙ TO-3P(N)IS ● TO-3P(L) ⊕ Chip LGA * S-Mini ⊕ TSM * USM △ UFM ☆ SSM ⊕ VESM ⊕ CST3 ◇ CST3B ⊕ CST4 ⊕ SMV ⊕ US6 * UF6 ⊕ ES6 * CST6D ⊕ USV * UFV ⊕ ESV

Notes: () = R_{DS(on) max} \$ = 10-V drive # = 2.5-V drive * = 1.8-V drive ♣ = High-speed diode N = N-ch P = P-ch CN = Complementary N-ch CP = Complementary P-ch NS = N-ch + SBD PS = P-ch + SBD PD = P-ch + Driver (load switch) [] = Under development

V _{DS} (V)	12	20	24	30	40	50	60	100	150	180	200	250	400	450	500	525	550	600	650	700	800	900	1000	V _{DS} (V)					
4.2		△SSM3K123TU (0.028)Ⓞ ●SSM6K403TU (0.028)Ⓞ		N▲TPCP8201 (0.05)Ⓞ CN▲TPCP8402 (0.077)Ⓞ +SSM3K320T (0.077)Ⓞ																					4.2				
4.4		△SSM3J130TU (0.0258)Ⓞ		●SSM6K406TU (0.0385)Ⓞ																					4.4				
4.5		P#TPCP6107 (0.055)Ⓞ		P#TPCP6108 (0.06)Ⓞ CP★TPCP8405 (0.033)Ⓞ								J 2SK3342 (1.0)Ⓞ J 2SK4021 (1.0)Ⓞ													4.5				
4.6		△SSM3J129TU (0.046)Ⓞ																							4.6				
4.7		+SSM3K309T (0.031)Ⓞ																							4.7				
4.8																									4.8				
5	△SSM3J132TU (0.0178)Ⓞ	★TPC8208 (0.05)Ⓞ X TPCS8209 (0.03)Ⓞ N# X TPCS8210 (0.03)Ⓞ P# X TPCS8303 (0.021)Ⓞ P X TPCS8302 (0.035)Ⓞ P ▲ TPC8301 (0.031)Ⓞ P ▲ TPC8302 (0.033)Ⓞ +SSM3J307T (0.031)Ⓞ +SSM3K310T (0.028)Ⓞ		X TPCS8209 (0.05)Ⓞ N▲ TPC8001 (0.032)Ⓞ P★ TPC8104-H (0.065)Ⓞ N# TPC6007-H (0.054)Ⓞ P X TPC6109-H (0.059)Ⓞ	▲2SK2989 (0.15)Ⓞ ▲2SJ537 (0.19)Ⓞ	J 2SJ668 (0.17)Ⓞ J 2SJ681 (0.17)Ⓞ ☆2SJ378 (0.19)Ⓞ ☆2SJ669 (0.17)Ⓞ ◆2SJ438 (0.19)Ⓞ ☆2SK2229 (0.16)Ⓞ J 2SK4017 (0.1)Ⓞ J 2SK4033 (0.1)Ⓞ ★TPC8213-H (0.05)Ⓞ	J 2SK2399 (0.23)Ⓞ ☆2SK2400 (0.23)Ⓞ J 2SK4019 (0.23)Ⓞ	▼2SK3205 (0.52)			◆2SJ407 (1.0)Ⓞ ◆2SK2381 (0.8)Ⓞ ☆2SK2835 (0.8)Ⓞ J 2SK2920 (0.8)Ⓞ J 2SK4020 (0.8)Ⓞ	◆2SJ512 (1.25)Ⓞ			○2SK2991 (1.5)Ⓞ ◆2SK3466 (1.5)Ⓞ ▽2SK3863 (1.5)Ⓞ J 2SK4103 (1.5)Ⓞ ¥○2SK3417 (1.8)Ⓞ ¥○2SK3868 (1.7)Ⓞ ○TK5A50D (1.5)Ⓞ		⊗TK5A55D (1.88)Ⓞ		⊗TK5A65D (1.45)Ⓞ	◆2SK2274 (1.7)	○2SK2884 (2.2)Ⓞ	⊗2SK3565 (2.5)Ⓞ □2SK3700 (2.5)Ⓞ ⊗2SK3742 (2.5)Ⓞ	□2SK1359 (3.8)		5				
5.2		+SSM3J321T (0.046)Ⓞ																							5.2				
5.5	PD▲TPC8401 (0.038)Ⓞ P#TPC6103 (0.035)Ⓞ	P#TPC6111 (0.04)Ⓞ		N★TPC8211 (0.036)Ⓞ N▲TPCP8202 (0.023)Ⓞ							N▶TPCA8010-H (0.45)Ⓞ	○2SK2838 (1.2)Ⓞ ◆2SK2679 (1.2)Ⓞ							⊗TK6A55DA (1.48)Ⓞ						5.5				
5.6		P#▲TPCP8101 (0.030)Ⓞ		+SSM3J326T (0.0457)Ⓞ																					5.6				
6	P#▶TPCF8101 (0.028)Ⓞ	N○TPCT4201 (0.031)Ⓞ N○TPCT4203 (0.031)Ⓞ N#▶TPC6004 (0.024)Ⓞ P#▶TPCF8102 (0.030)Ⓞ ★TPC8207 (0.02)Ⓞ X TPCS8211 (0.024)Ⓞ X TPCS8204 (0.017)Ⓞ P# X TPCS8102 (0.02)Ⓞ P# X TPCS8302 (0.035)Ⓞ N# X TPCS8212 (0.024)Ⓞ N# X TPCS8208 (0.017)Ⓞ N X TPCS8213 (0.013)Ⓞ N TPCL4201 (0.031)Ⓞ	N TPCL4203 (0.036)Ⓞ	N○TPCT4202 (0.038)Ⓞ N○TPCT4204 (0.038)Ⓞ N#▶TPC6011 (0.020)Ⓞ N#▶TPC6005 (0.028)Ⓞ PD▲TPCP801 (0.03)Ⓞ P#▶TPCF8104 (0.028)Ⓞ N X TPCS8214 (0.135)Ⓞ NS★TPC8A01 (0.025)Ⓞ ★TPC8212-H (0.021)Ⓞ CN★TPC8405 (0.026)Ⓞ +SSM3K315T (0.0415)Ⓞ N TPCL4202 (0.04)Ⓞ △SSM3K131TU (0.0415)Ⓞ								◆2SJ516 (0.8)Ⓞ			⊗TK6A50D (1.48)Ⓞ	⊗TK6A53D (1.3)Ⓞ ▽TK6P53D (1.3)Ⓞ			□2SK2602 (1.25)Ⓞ ○2SK2777 (1.25)Ⓞ ◆2SK3312 (1.25)Ⓞ ⊗TK6A60D (1.25)Ⓞ ¥⊗2SK3947 (1.4)Ⓞ	⊗TK6A65D (1.11)Ⓞ		⊗2SK4013 (1.7)Ⓞ	⊗2SK4014 (2.0)Ⓞ			6			
6.5				N★TPC8216-H (0.020)Ⓞ																		○2SK3879 (1.7)Ⓞ ○2SK3880 (1.7)Ⓞ			6.5				
7				N▶TPCF8001 (0.023)Ⓞ N▶TPCF8002 (0.023)Ⓞ	CN TPC8406-H (0.027)Ⓞ CP TPC8406-H (0.03)Ⓞ				N▶TPCA8009-H (0.35)Ⓞ													□2SK3633 (1.7)Ⓞ	□2SK4115 (2.0)Ⓞ	⊗2SK1365 (1.8)	7				
7.2		P#▶TPCP8102 (0.018)Ⓞ		N▶TPCF8001-H (0.018)Ⓞ																					7.2				
7.5				N▶TPCA8020-H (0.027)Ⓞ N★TPC8022-H (0.027)Ⓞ P★TPC8116-H (0.03)Ⓞ P▶TPCA8107-H (0.03)Ⓞ								◆2SK2417 (0.5)Ⓞ ■2SK2914 (0.5)Ⓞ								⊗TK6A55DA (1.07)Ⓞ	⊗TK6A60DA (1.0)Ⓞ					7.5			
8				N★TPC8210 (0.015)Ⓞ N★TPC8021-H (0.017)Ⓞ	P★TPC8110 (0.025)Ⓞ																			■2SK2542 (0.85)Ⓞ ○2SK2776 (0.85)Ⓞ ◆2SK3538 (0.85)Ⓞ ⊗TK6A50D (0.85)Ⓞ ¥⊗2SK4042 (0.97)Ⓞ	⊗TK6A65D (0.84)Ⓞ	⊗2SK2606 (1.2)Ⓞ	⊗2SK2847 (1.4)Ⓞ ⊗2SK3799 (1.3)Ⓞ	□2SK2613 (1.7)Ⓞ	8
8.3				N▶TPCP8004 (0.009)Ⓞ																					8.3				
8.5				NS★TPC8A01 (0.018)Ⓞ																⊗TK6A55DA (0.86)Ⓞ					⊗2SK3017 (1.25)Ⓞ	8.5			
9		N▲TPCP8006 (0.01)Ⓞ					N○TPC8053-H (0.0225)Ⓞ					◆2SK2350 (0.4)Ⓞ		◆2SK2952 (0.55)Ⓞ											□2SK2607 (1.2)Ⓞ	□2SK3473 (1.6)Ⓞ □2SK3878 (1.3)Ⓞ	9		
9.5		●SSM6J409TU (0.0221)Ⓞ																								9.5			
10		P★TPC8115 (0.01)Ⓞ		P★TPC8109 (0.02)Ⓞ P★TPC8119 (0.012)Ⓞ NS○TPC8A05-H (0.012)Ⓞ				J 2SK3669 (0.125)Ⓞ		□2SJ200 (0.83) □2SK1529 (0.83) □2SK3497 (0.15) □2SJ618 (0.37)			■2SK2841 (0.55)Ⓞ ○2SK2949 (0.55)Ⓞ	○2SK3309 (0.65)Ⓞ ◆2SK3310 (0.65)Ⓞ ⊗2SK3869 (0.68)Ⓞ	□2SK2601 (1.0)Ⓞ ⊗TK10A50D (0.72)Ⓞ										■2SK2866 (0.75)Ⓞ ○2SK2889 (0.75)Ⓞ ◆2SK3438 (1.0)Ⓞ ○2SK3437 (1.0)Ⓞ ○2SK3399 (0.75)Ⓞ ⊗TK10A60D (0.75)Ⓞ ¥⊗2SK4015 (0.86)Ⓞ	◆2SK3265 (1.0)Ⓞ ⊗2SK3453 (1.0)Ⓞ	□2SK2968 (1.25)Ⓞ	10	

Legend

Product series ① : π-MOSIII ② : π-MOSV ③ : π-MOSVI ④ : L²-π-MOSV ⑤ : L²-π-MOSVI ⑥ : U-MOS ⑦ : π-MOSVII ⑧ : π-MOSIV ⑨ : DTMOSI ⑩ : DTMOSII

Package ◇PW-Mini J VS-8 ♥ VS-6 ♣ PS-8 ⬢ STP ▲ TO-92MOD ▼ PW-Mold J New PW-Mold ○ TSSOP Advance J New PW-Mold2 ▽ DP ☆ TPS ◀ TSSOP Advance X TSSOP-8 ★ SOP-8
 ⚙ SOP-8 Lead Clamp ▶ SOP Advance ◆ TO-220NIS ⊗ TO-220SIS ■ TO-220AB ▣ TO-220(W) ⚡ TFP ○ TO-220FL/SM
 * S-Mini + TSM * USM △ UFM ☆ SSM +VESM + CST3 ◇ CST3B ⊕ CST4 +SMV /US6 *UF6
 +ES6 *CST6D \USV *UFV ☆ESV

Notes:
 () = Revision max * = 1.8-V drive P = P-ch NS = N-ch + SBD PD = P-ch + Driver
 \$ = 10-V drive ¥ = High-speed diode CN = Complementary N-ch PS = P-ch + SBD (load switch)
 # = 2.5-V drive N = N-ch CP = Complementary P-ch [] = Under development

V _{DSS} (V) I _D (A)	20	30	40	50	60	75	80	100	150	200	250	300	450	500	525	550	600	900/1000	V _{DSS} (V) I _D (A)		
11		N★TPC8025 (0.009)Ⓢ N★TPC8021-H (0.017)Ⓢ N★TPC8014 (0.014)Ⓢ P★TPC8111 (0.012)Ⓢ P★TPC8113 (0.01)Ⓢ P I TPC8105 (0.0135)Ⓢ P I TPC8104 (0.012)Ⓢ N★TPC8030 (0.0095) N★TPC8031-H (0.0133)Ⓢ N★TPC8005-H (0.0129)Ⓢ P★TPC8121 (0.012)Ⓢ P○TPC8123 (0.0090)Ⓢ				N○TPC8050-H (0.0145)Ⓢ					◆2SK2965 (0.26)Ⓢ							⊗TK11A55D (0.63)Ⓢ	⊗TK11A60D (0.65)Ⓢ		11
12		N○TPC8037-H (0.0114)Ⓢ N○TPC8038-H (0.0114)Ⓢ NS○TPC8A06-H (0.0101)Ⓢ	N○TPC8052-H (0.0115)Ⓢ					◆2SJ380 (0.21)Ⓢ		◆2SJ201 (0.625) ◆2SK1530 (0.625)				○2SK3068 (0.52)Ⓢ ◆2SK3398 (0.52)Ⓢ ⊗TK12A50D (0.52)Ⓢ ¥◆2SK3313 (0.62)Ⓢ	⊗TK12A53D (0.58)Ⓢ ◆TK12X53D (0.58)Ⓢ	□TK12J55D (0.57)Ⓢ	□2SK2699 (0.65)Ⓢ ⊗TK12A60U (0.4)Ⓢ ⊗TK12D60U (0.4)Ⓢ □TK12J60U (0.4)Ⓢ ⊗TK12A60D (0.55)Ⓢ	1000V: ◆2SK1489 (1.0)		12	
12.5														⊗TK13A50DA (0.47)Ⓢ						12.5	
13		N★TPC8041 (0.007)Ⓢ N★TPC8026 (0.0066)Ⓢ P★TPC8107 (0.007)Ⓢ P○TPC8112 (0.006)Ⓢ P○TPC8118 (0.007)Ⓢ N○TPC8003-H (0.0169)Ⓢ N○TPC8040-H (0.0097)Ⓢ				N○TPC8049-H (0.0107)Ⓢ		N○TPC8051-H (0.0097)Ⓢ			◆2SK2508 (0.25)Ⓢ ○2SK2598 (0.25)Ⓢ			◆2SK3743 (0.4)Ⓢ ○2SK3403 (0.4)Ⓢ ◆2SK3544 (0.4)Ⓢ ⊗TK13A45D (0.46)Ⓢ	⊗TK13A50D (0.4)Ⓢ			⊗TK13A60D (0.43)Ⓢ ¥⊗2SK4016 (0.5)Ⓢ	900V: □2SK4207 (0.95)		13
14					◆2SJ304 (0.12) 2SJ312 (0.12)									○2SK2916 (0.4)Ⓢ		⊗TK14A55D (0.37)Ⓢ	□2SK3903 (0.44)Ⓢ			14	
15		N○TPC8032-H (0.0065)Ⓢ P○TPC8102 (0.0189)Ⓢ			▶TPCA8053-H (0.0223)Ⓢ					◆2SK2382 (0.18)Ⓢ ○2SK2401 (0.18)Ⓢ				⊗TK15A50D (0.3)Ⓢ ¥□2SK3314 (0.49)Ⓢ □TK15J50D (0.4)Ⓢ			⊗2SK2953 (0.4)Ⓢ ⊗TK15A60U (0.3)Ⓢ ⊗TK15D60U (0.3)Ⓢ □TK15J60U (0.3)Ⓢ ⊗TK15A60D (0.37)Ⓢ			15	
16		NS★TPC8A02-H (0.0056)Ⓢ	N○TPC8047-H (0.0076)Ⓢ		N○TPC8048-H (0.0069)Ⓢ			○2SJ412 (0.21)Ⓢ ◆2SJ619 (0.21)Ⓢ									□TK16J55D (0.37)Ⓢ			16	
17		N○TPC8033-H (0.0053)Ⓢ NS○TPC8A03-H (0.0056)Ⓢ N○TPC8039-H (0.006)Ⓢ											⊗2SK3935 (0.25)Ⓢ	□2SK3905 (0.31)Ⓢ							17
18		P○TPC8114 (0.0045)Ⓢ N★TPC8027 (0.0027)Ⓢ N★TPC8028 (0.0043)Ⓢ N★TPC8029 (0.0038)Ⓢ N○TPC8034-H (0.0035)Ⓢ N★TPC8042 (0.0034)Ⓢ P○TPC8117 (0.0039)Ⓢ N○TPC8036-H (0.0045)Ⓢ NS○TPC8A04-H (0.0036)Ⓢ P○TPC8120 (0.0032)Ⓢ P○TPC8103 (0.012)Ⓢ N○TPC8035-H (0.0032)Ⓢ N○TPC8060-H (0.0037)Ⓢ	N○TPC8045-H (0.0039)Ⓢ N○TPC8046-H (0.0057)Ⓢ				◆2SJ464 (0.12)Ⓢ ◆2SJ620 (0.09)Ⓢ ▶TPCA8006-H (0.067)		◆2SK2882 (0.12)Ⓢ ◆2SK3387 (0.12)Ⓢ						○2SK2917 (0.27)Ⓢ ⊗TK18A50D (0.27)Ⓢ						18
19														□2SK3904 (0.26)Ⓢ						19	
20		NS★TPC8A05-H (0.0129)Ⓢ NS▶TPCA8A05-H (0.0129)Ⓢ N★TPCM8001-H (0.0095)Ⓢ	N▶TPCA8052-H (0.0115)Ⓢ	▽2SK2614 (0.046)Ⓢ	◆2SJ349 (0.045)Ⓢ ○2SJ401 (0.045)Ⓢ ▽2SK2782 (0.055)Ⓢ			◆2SK2391 (0.085)Ⓢ ⊗TJ20A10M3 (0.090)Ⓢ			○2SK2993 (0.105)Ⓢ ◆2SK3445 (0.105)Ⓢ ◆2SK3994 (0.105)Ⓢ				□TK20J50D (0.27)Ⓢ			□2SK3911 (0.32)Ⓢ ⊗TK20A60U (0.19)Ⓢ ⊗TK20D60U (0.19)Ⓢ □TK20J60U (0.19)Ⓢ ¥□2SK3906 (0.33)Ⓢ			20
21		N★TPCM8003-H (0.0129)Ⓢ NS○TPC8A01-H (0.0099)Ⓢ																			21
22		N○TPCC8001-H (0.0083)Ⓢ N○TPCC8002-H (0.0083)Ⓢ N○TPCC8006-H (0.008)Ⓢ						▶TPCA8022-H (0.026)Ⓢ													22
23		N▶TPCA8040-H (0.0094)Ⓢ																□2SK3907 (0.23)Ⓢ ¥□2SK3936 (0.25)Ⓢ			23

Legend **Product series** ①: π-MOSIII ②: π-MOSV ③: π-MOSVI ④: L²-π-MOSV ⑤: L²-π-MOSVI ⑥: U-MOS ⑦: π-MOSVII ⑧: π-MOSIV ⑨: DTMOI ⑩: DTMOII

Package ◊PW-Mini ↵VS-8 ♥VS-6 ♣PS-8 ⊕STP ▲TO-92MOD ▼PW-Mold ↵New PW-Mold ⊕TSON Advance ♪New PW-Mold2 ▽DP ☆TPS ◀TSSOP Advance ✕TSSOP-8 ★SOP-8
 ◊SOP-8 Lead Clamp ▶SOP Advance ◆TO-220NIS ⊗TO-220SIS ■TO-220AB ⊞TO-220(W) ◆TFP ○TO-220FL/SM
 * S-Mini †TSM *USM △UFM ☆SSM †VESM †CST3 ◊CST3B ⊗CST4 †SMV ∠US6 *UF6 †ES6 *CST6D ^USV *UFV ⊕ESV

Notes:
 () = R_{DS(on)} max * = 1.8-V drive P = P-ch NS = N-ch + SBD PD = P-ch + Driver
 \$ = 10-V drive † = High-speed diode CN = Complementary N-ch PS = P-ch + SBD (load switch)
 # = 2.5-V drive N = N-ch CP = Complementary P-ch [] = Under development

V _{DSS} (V) I _D (A)	20	30	40	50	60	75	80	100	150	200	250	300	450	500	525	550	600	900/1000	V _{DSS} (V) I _D (A)	
24		N ▶ TPC8004-H (0.011)Ⓢ N ▶ TPC8030-H (0.011)Ⓢ N ▶ TPC8031-H (0.011)Ⓢ			N ▶ TPC8050-H (0.014)Ⓢ														24	
25		P ◀ TPC8102 (0.0077)Ⓢ N ◀ TPC8006 (0.007)Ⓢ N ⊕ TPCC8008 (0.0068)Ⓢ		◆ 2SK2507 (0.046)Ⓢ	◆ 2SK2232 (0.046)Ⓢ ○ 2SK2311 (0.046)Ⓢ N ▶ TPC8016-H (0.021)Ⓢ				⊗ TK25A10K3 (0.040)Ⓢ	◆ 2SK3444 (0.082)Ⓢ ○ 2SK3625 (0.082)Ⓢ				● 2SK1544 (0.2)					25	
26		N ⊕ TPCC8005-H (0.0064)Ⓢ	◆ 2SK3846 (0.016)Ⓢ																26	
27	N ⊕ TPCC8007 (0.0046)Ⓢ																		27	
28					N ▶ TPC8049-H (0.0104)Ⓢ														28	
30		N ▶ TPC8018-H (0.0062)Ⓢ N ◀ TPC8002-H (0.0062)Ⓢ	N ▶ TPC8014-H (0.009)Ⓢ N ▶ TPC8027-H (0.010)Ⓢ		◆ 2SJ334 (0.038)Ⓢ ○ 2SJ402 (0.038)Ⓢ ⊗ TK30A06J3A (0.026)Ⓢ				◆ 2SK3443 (0.055)Ⓢ	□ 2SK3176 (0.052)Ⓢ	□ 2SK2967 (0.068)Ⓢ ⊗ 2SK2995 (0.068)Ⓢ								30	
32			○ 2SK3847 (0.016)Ⓢ N ▶ TPC8047-H (0.0073)Ⓢ												● 2SK1486 (0.095)				32	
34		NS ▶ TPC8A02-H (0.0053)Ⓢ N ▶ TPC8039-H (0.0057)Ⓢ																	34	
35		N ▶ TPC8024 (0.0043)Ⓢ	N ▶ TPC8015-H (0.0054)Ⓢ		◆ 2SK3662 (0.0125)Ⓢ N ▶ TPC8048-H (0.0066)Ⓢ														35	
36					◆ 2SK2385 (0.03)Ⓢ														36	
38		NS ▶ TPC8A08-H (0.0042)Ⓢ N ▶ TPC8036-H (0.0038)Ⓢ	N ▶ TPC8046-H (0.0054)Ⓢ																38	
40	N ▶ TPC8011-H (0.0035)Ⓢ	P ▶ TPC8102 (0.006)Ⓢ P ▶ TPC8103 (0.0042)Ⓢ P ▶ TPC8106 (0.0037)Ⓢ N ▶ TPC8012-H (0.0049)Ⓢ N ▶ TPC8025 (0.0036)Ⓢ N ▶ TK40P03M1 (0.0108)Ⓢ	P ▶ TPC8108 (0.0095)Ⓢ N ▶ TK40P04M1 (0.011)Ⓢ		P ▶ TPC8104 (0.016)Ⓢ	⊗ TK40A08K3 (0.009)Ⓢ			⊠ TK40D10J1 (0.015)Ⓢ ⊗ TK40A10J1 (0.015)Ⓢ ⊗ TK40A10K3 (0.015)Ⓢ ◆ TK40X10J1 (0.020)Ⓢ									□ TK40J60T (0.08)Ⓢ	40	
44		NS ▶ TPC8A04-H (0.0032)Ⓢ																	44	
45		□ 2SK3506 (0.02) N ▶ TPC8019-H (0.0031)Ⓢ N ▶ TPC8026 (0.0022)Ⓢ N ▶ TPC8042 (0.0033)Ⓢ N ▶ TPC8060-H (0.0034)Ⓢ		□ 2SK2550 (0.03)Ⓢ ◆ 2SK2886 (0.02)Ⓢ □ 2SK2744 (0.02)Ⓢ □ 2SK3051 (0.03)Ⓢ	□ 2SK2233 (0.03)Ⓢ ○ 2SK2266 (0.03)Ⓢ ○ 2SK2376 (0.017)Ⓢ □ 2SK2398 (0.03)Ⓢ ◆ 2SK3844 (0.0058)Ⓢ															45
46			N ▶ TPC8045-H (0.0036)Ⓢ																46	
50		N ▶ TPC8028-H (0.0028)Ⓢ N ▶ TK50P03M1 (0.0075)Ⓢ	N ▶ TK50P04M1 (0.0087)Ⓢ	□ 2SK2551 (0.011)Ⓢ □ 2SK2745 (0.0095)Ⓢ	□ 2SK2173 (0.017)Ⓢ □ 2SK2445 (0.018)Ⓢ				□ 2SK1381 (0.032)	◆ TK50X15J1 (0.03)Ⓢ ◆ TK50F15J1 (0.03)Ⓢ								● 2SK3132 (0.09)Ⓢ ◆ 2SK3131 (0.11)Ⓢ	50	
55																			55	
60					● 2SK2267 (0.011)Ⓢ □ 2SK2313 (0.011)Ⓢ	⊠ TK60D08J1 (0.0078)Ⓢ ⊗ TK60A08J1 (0.0078)Ⓢ			● 2SK1382 (0.020)										60	
70			□ TK70J04J3 (0.0038)Ⓢ ◆ TK70X04K3 (0.0056)Ⓢ ◆ TK70X04K3L (0.0056)Ⓢ		□ 2SK3845 (0.0058)Ⓢ ⊠ TK70D06J1 (0.0064)Ⓢ ⊗ TK70A06J1 (0.0064)Ⓢ ⊗ TJ70A06J3 (0.008)Ⓢ ◆ TK70X06K3 (0.008)Ⓢ														70	
75			◆ 2SK3843 (0.0035)Ⓢ		◆ 2SK4034 (0.0058)Ⓢ ◆ 2SK3842 (0.0058)Ⓢ														75	
80			◆ TK80X04K3 (0.0035)Ⓢ			⊗ TK80A08K3 (0.0045)Ⓢ ⊠ TK80D08K3 (0.0045)Ⓢ													80	
100			◆ TK100F04K3 (0.003)Ⓢ ◆ TK100F04K3L (0.003)Ⓢ		◆ TK100F06K3 (0.005)Ⓢ														100	
120					◆ TJ120F06J3 (0.008)Ⓢ														120	
130					◆ TK130F06K3 (0.0034)Ⓢ														130	
150			◆ TK150F04K3 (0.0021)Ⓢ ◆ TK150F04K3L (0.0021)Ⓢ																150	

Legend **Product series** ① : π-MOSIII ② : π-MOSV ③ : π-MOSVI ④ : L²-π-MOSV ⑤ : L²-π-MOSVI ⑥ : U-MOS ⑦ : π-MOSVII ⑧ : π-MOSIV ⑨ : DTMOSI ⑩ : DTMOSII

Package ◊ PW-Mini ↗ VS-8 ♥ VS-6 ♣ PS-8 ⊕ STP ▲ TO-92MOD ▼ PW-Mold ↘ New PW-Mold ○ TSON Advance ⊞ SOP-8 Lead Clamp ▶ SOP Advance ◆ TO-220NIS ⊗ TO-220SIS ■ TO-220AB ⊞ TO-220(W) ◆ TFP ○ TO-220FL/SM * S-Mini + TSM * USM △ UFM ☆ SSM + VESM + CST3 ◊ CST3B ◊ CST4 + SMV / US6 * UF6

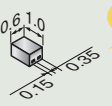
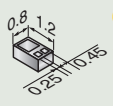
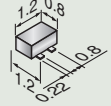
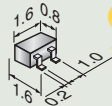
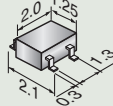
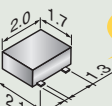
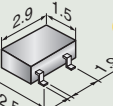
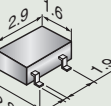
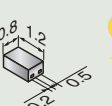
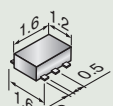
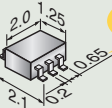
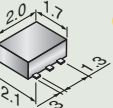
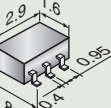
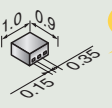
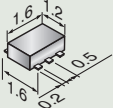
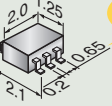
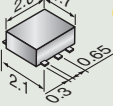
⊞ New PW-Mold2 ▽ DP ☆ TPS ◀ TSSOP Advance ✕ TSSOP-8 ★ SOP-8 ⊞ TO-220SM(W) □ TO-3P(N) ○ TO-3P(N)IS ● TO-3P(L) ⊞ Chip LGA + ES6 * CST6D △ USV * UFV ☆ ESV ▷ DPAK

Notes:
 () = R_{DS(on)} max * = 1.8-V drive P = P-ch NS = N-ch + SBD PD = P-ch + Driver
 \$ = 10-V drive Y = High-speed diode CN = Complementary N-ch PS = P-ch + SBD (load switch)
 # = 2.5-V drive N = N-ch CP = Complementary P-ch [] = Under development

4-1 Packaging Options

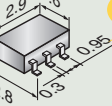
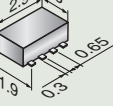
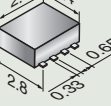
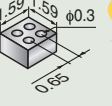
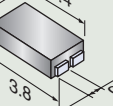
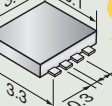
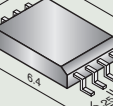
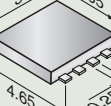
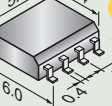
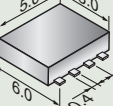
SSM Series

The SSM Series comes in small, thin packages suitable for portable devices. Chip-scale packages (1006 size) help reduce system size.

CST3 Chip-Scale Package, Transfer Molded, 3-Pin Typical product: SSM3K35CT  Thickness: 0.38 typ. Unit: mm	CST3B Chip-Scale Package, Transfer Molded, 3-Pin, B-Type Typical product: SSM3J46CTB  Thickness: 0.48 typ. Unit: mm	VESM (SOT-723) Very Extreme Super-Mini Typical product: SSM3K35MFV  Thickness: 0.5 typ. Unit: mm	SSM (SOT-416)(SC-75) Small Super-Mini Typical product: SSM3K35FS  Thickness: 0.7 typ. Unit: mm	USM (SOT-323)(SC-70) Ultra-Super-Mini Typical product: SSM3K15FU  Thickness: 0.9 typ. Unit: mm
UFM Ultra-super-Mini Flat lead Typical product: SSM3J130TU  Thickness: 0.7 typ. Unit: mm	S-Mini (SOT-346)(SC-59) Super-Mini Typical product: SSM3K15F  Thickness: 1.1 typ. Unit: mm	TSM Thin Super-Mini Typical product: SSM3J304T  Thickness: 0.7 typ. Unit: mm	CST4 Chip-Scale Package, Transfer Molded, 4-Pin Typical product: SSM4K27CT  Thickness: 0.38 typ. Unit: mm	ESV (SOT-553) Extreme Super-mini, 5-pin Typical product: SSM5N15FE  Thickness: 0.55 typ. Unit: mm
USV (SOT-353)(SC-88A) Ultra-Super-mini, 5-pin Typical product: SSM5N15FU  Thickness: 0.9 typ. Unit: mm	UFV Ultra-super-mini, Flat lead, 5-pin Typical product: SSM5H12TU  Thickness: 0.7 typ. Unit: mm	SMV (SOT-25)(SC-74A) Super-Mini, 5-pin Typical product: SSM5H14F  Thickness: 1.1 typ. Unit: mm	CST6D Chip-Scale Package, Transfer Molded, 6-Pin, D-Type Typical product: SSM6N37CTD  Thickness: 0.38 typ. Unit: mm	ES6 (SOT-563) Extreme Super-mini, 6-pin Typical product: SSM6N36FE  Thickness: 0.55 typ. Unit: mm
US6 (SOT-353)(SC-88A) Ultra-Super-mini, 6-pin Typical product: SSM6N15FU  Thickness: 0.9 typ. Unit: mm	UF6 Ultra Super mini Flat lead 6-pin Typical product: SSM6J409TU  Thickness: 0.7 typ. Unit: mm			

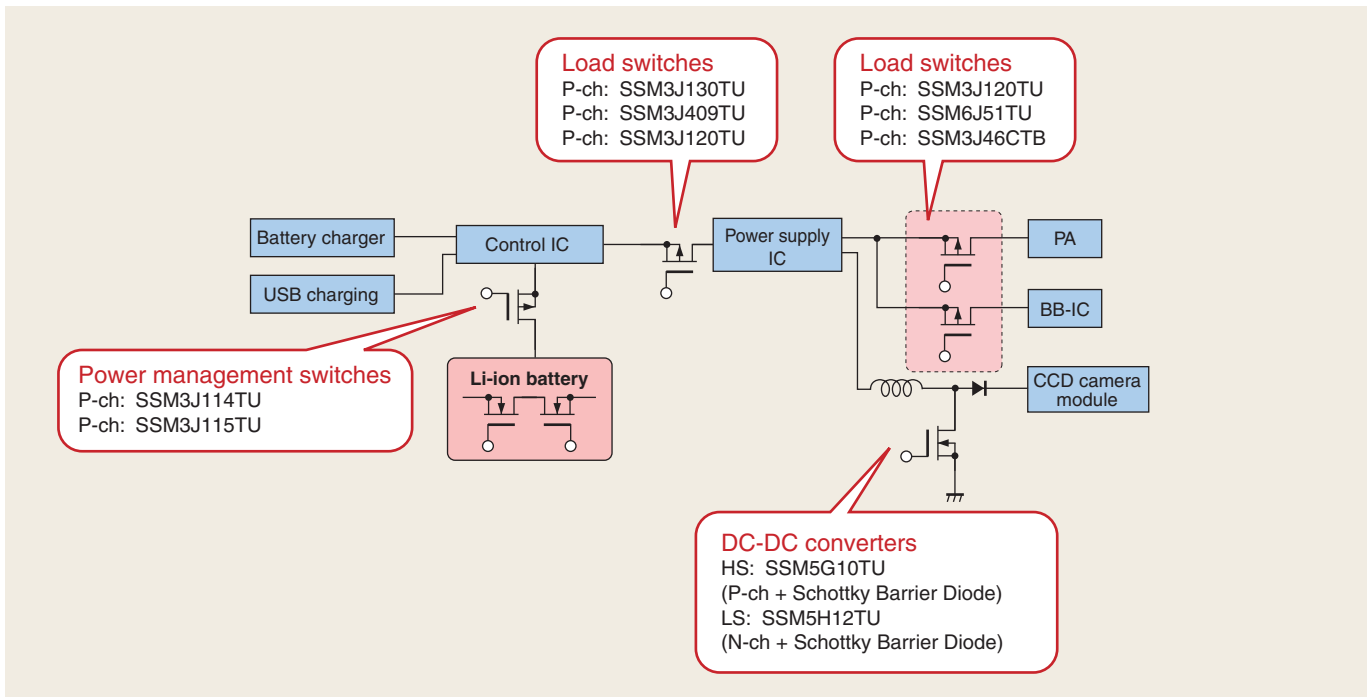
TPC Series

The TPC Series comes in small, thin packages suitable for portable devices. The latest TSON Advance package allows the maximum permissible power dissipation equivalent to SOP-8, but occupies 64% less board space.

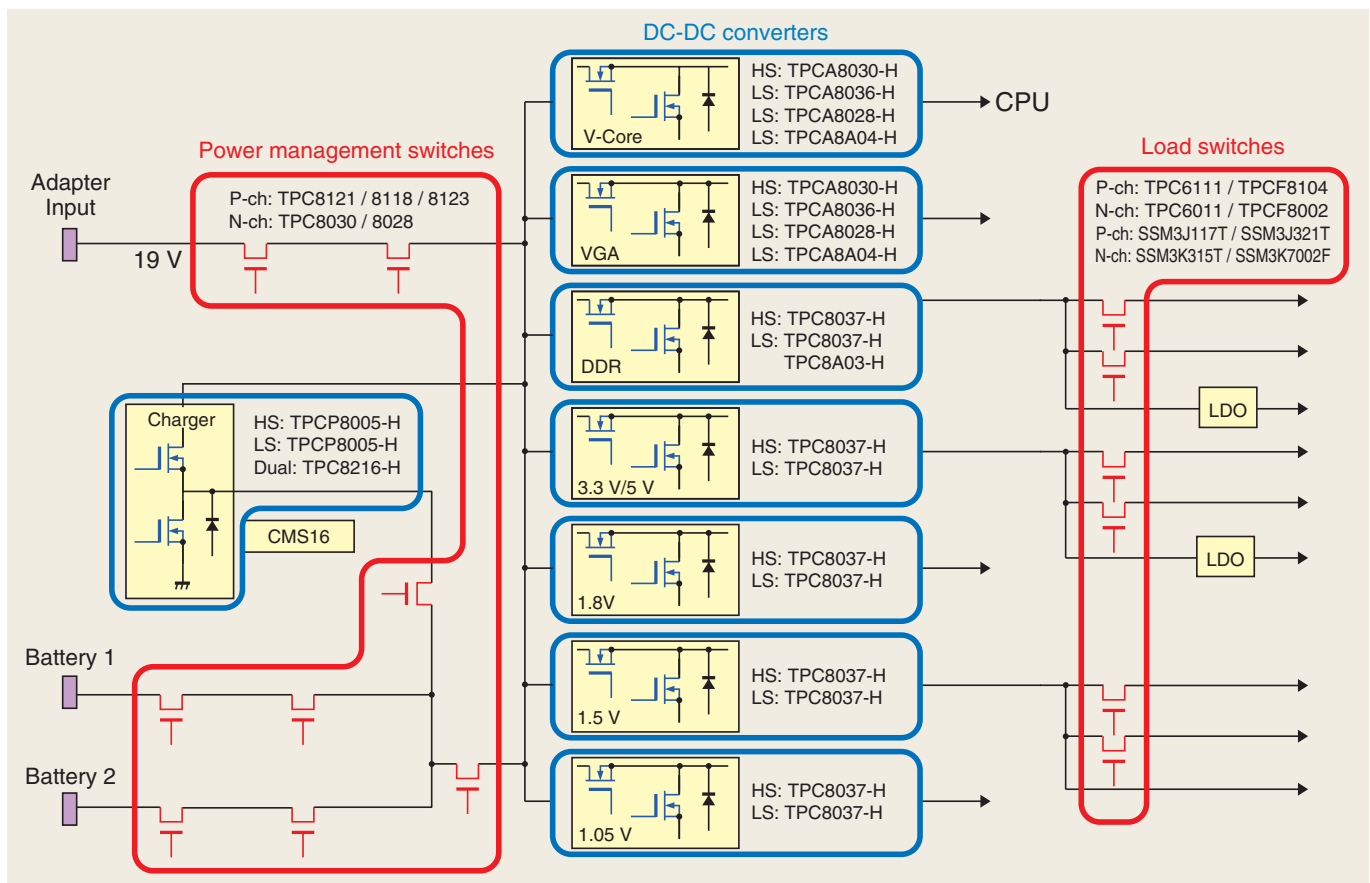
VS-6 Very Thin & Small, 6-pin Typical product: TPC6003  Thickness: 0.75 typ. Unit: mm	VS-8 Very Thin & Small, 8-pin Typical product: TPCF8101  Thickness: 0.8 typ. Unit: mm	PS-8 Progressive & Small 8-pin Series Typical product: TPCP8402  Thickness: 0.8 typ. Unit: mm	Chip LGA Land Grid Array Typical product: TPCL4201  Thickness: 0.25 typ. Unit: mm	STP2 Small Thin Package Typical product: TPCT4204  Thickness: 0.65 typ. Unit: mm
TSON Advance Typical product: TPCC8005-H  Thickness: 0.85 typ. Unit: mm	TSSOP-8 Typical product: TPCS8208  Thickness: 0.9 typ. Unit: mm	TSSOP Advance Typical product: TPCM8001-H  Thickness: 0.75 typ. Unit: mm	SOP-8 Typical product: TPC8035-H  Thickness: 1.6 typ. Unit: mm	SOP Advance Typical product: TPCA8028-H  Thickness: 0.95 typ. Unit: mm

4-2 Application Examples and Block Diagrams

Cell Phone (Power Supply Circuit)

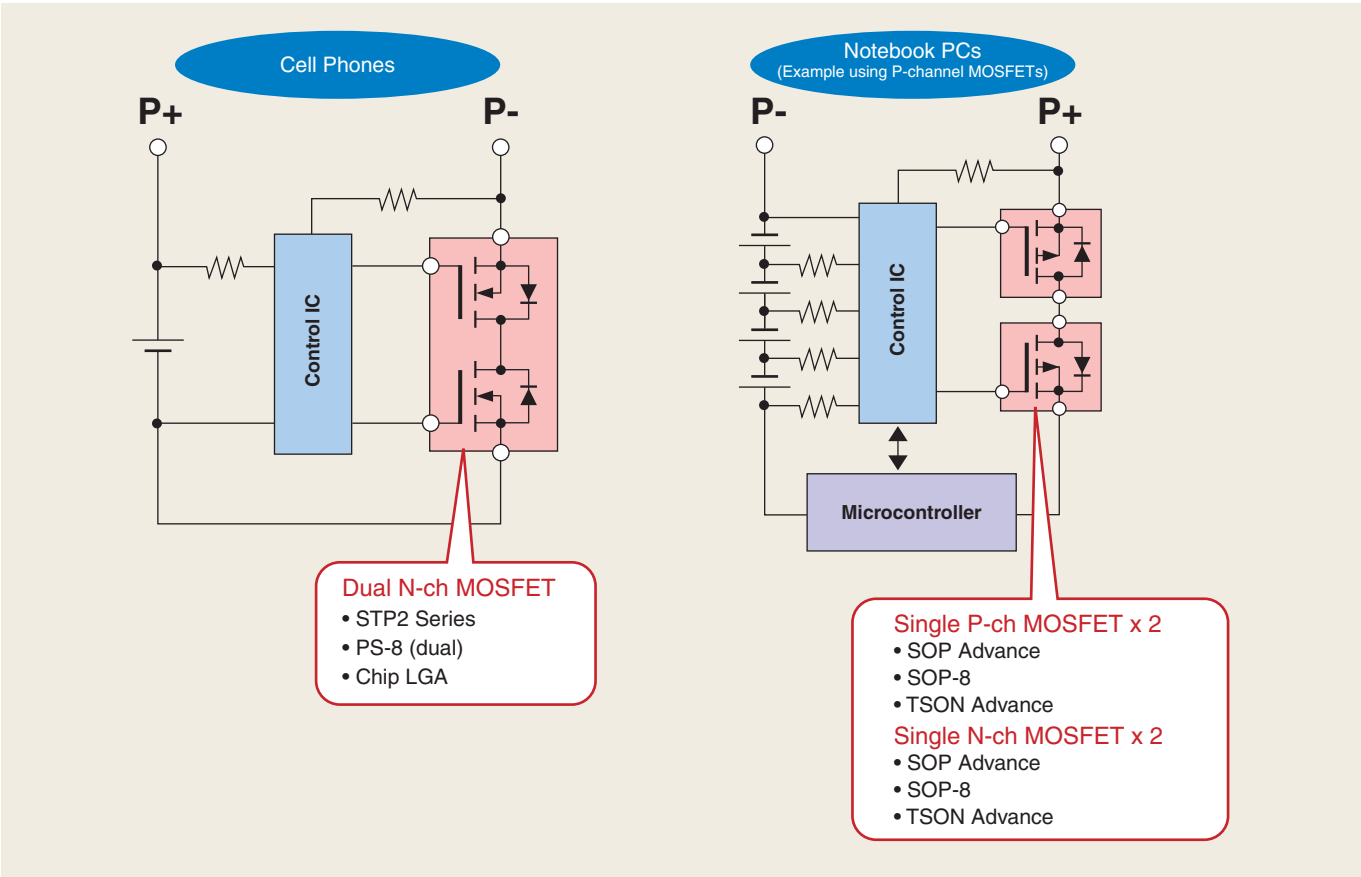


Notebook PC (Power Supply Circuit)

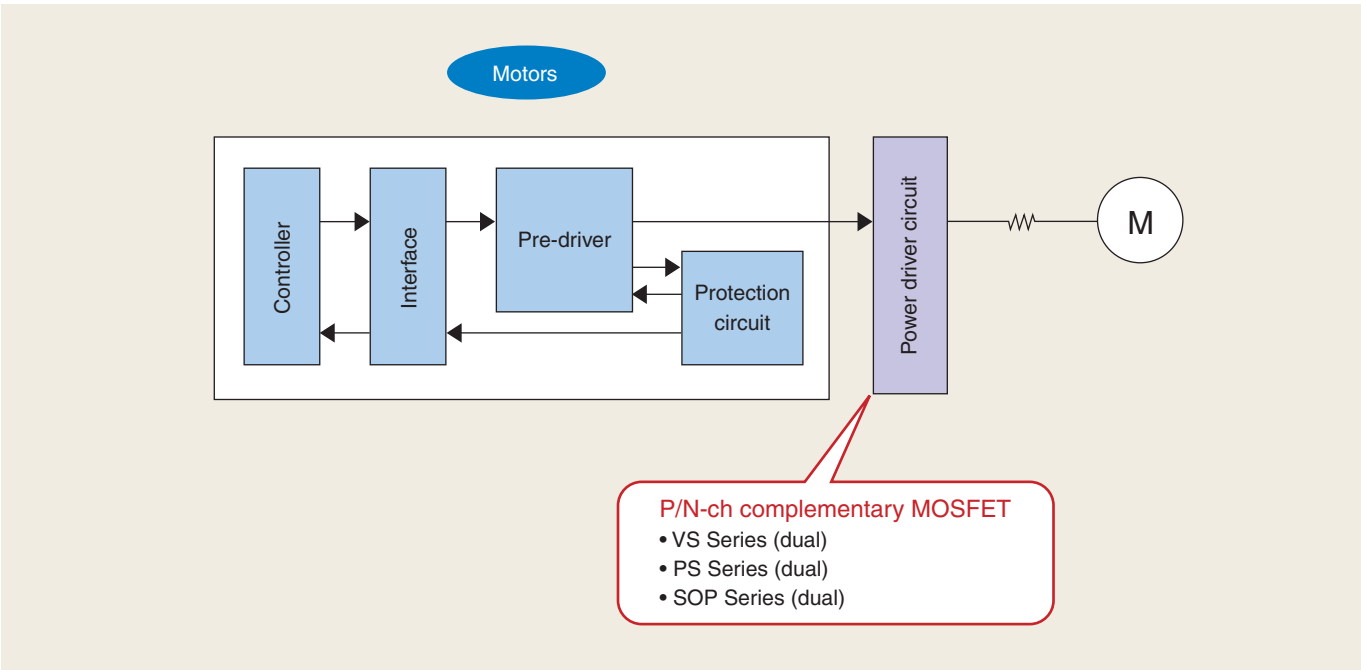


4-2 Application Examples and Block Diagrams

Lithium-Ion Secondary Battery (Battery Protection Circuits)



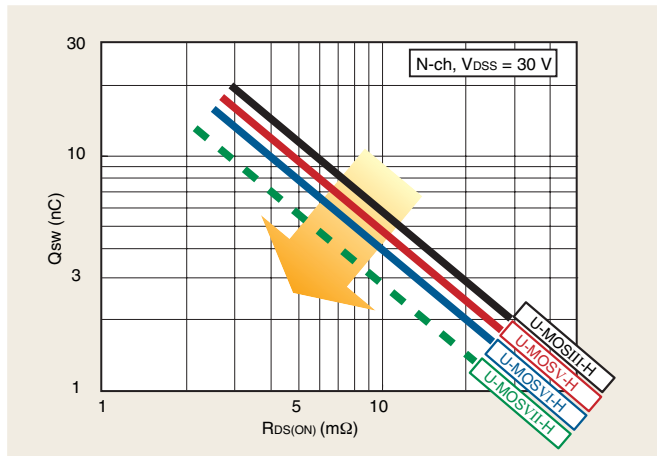
Motor Driver (Power Driver Circuit)



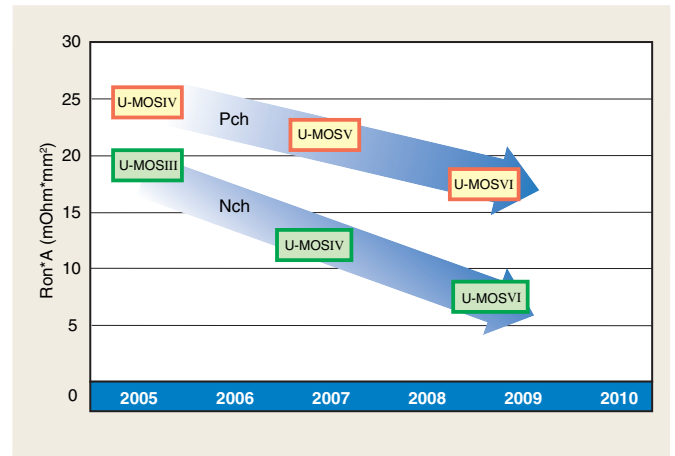
4-3 Low- V_{DSS} MOSFET Roadmaps

Roadmap for Trench MOSFETs

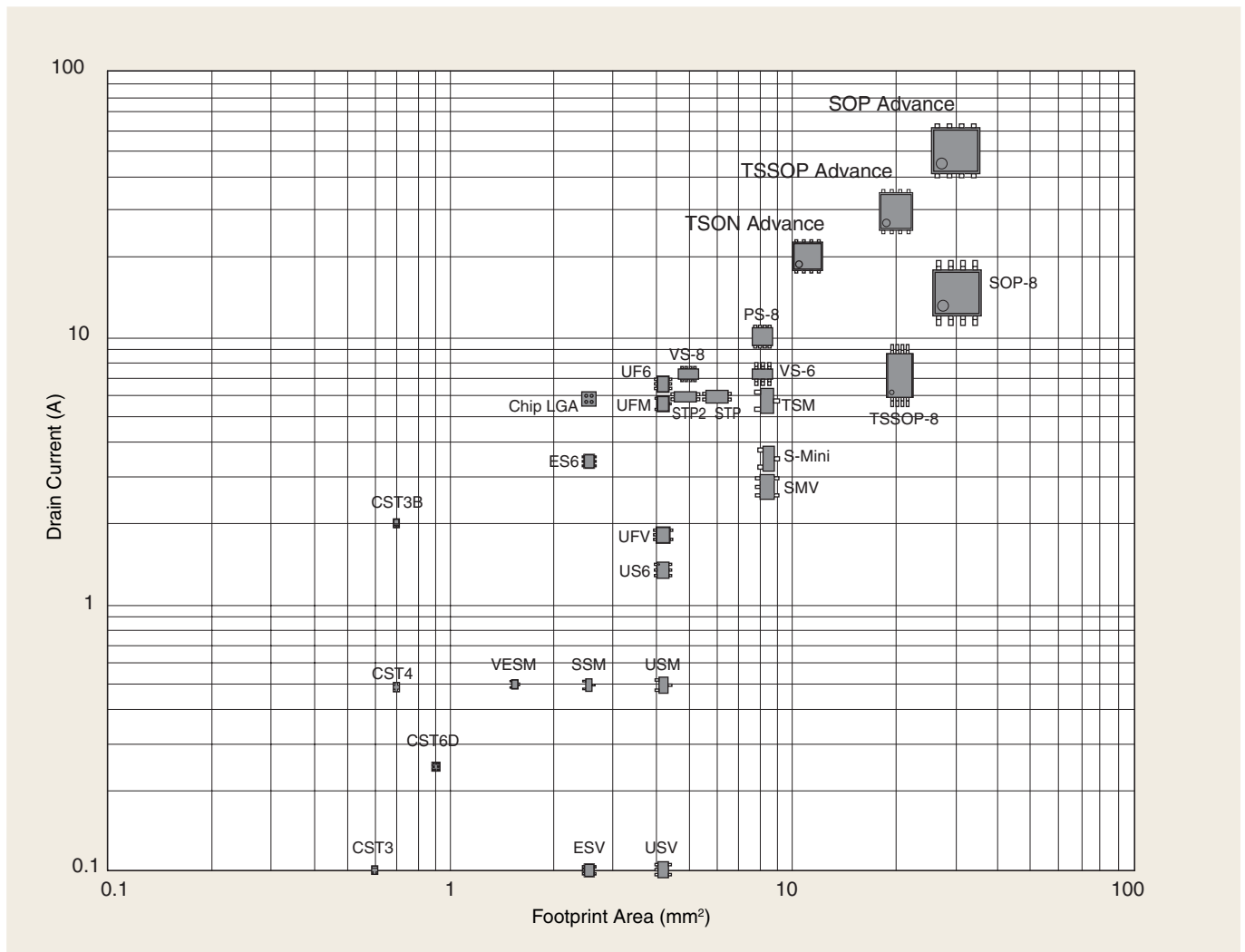
■ High-Speed, Low- V_{DSS} U-MOS



■ Low-Ron Trench MOSFETs



Package Options



4

Low- V_{DSS} MOSFETs (in Small SMD Packages)

Ultra-Small Packages

	S-Mini	USM	SSM	VESM	CST3	US6	USV	ESV	CST6D
Footprint Area	7.3 mm ²	4.2 mm ²	2.6 mm ²	1.4 mm ²	0.6 mm ²	4.2 mm ²	4.2 mm ²	2.6 mm ²	0.9 mm ²
Permissible Power Dissipation (Note)	0.2 W	0.2 W	0.1 W	0.15 W	0.1 W	0.2 W	0.2 W	0.15 W	0.14 W
Height (MAX)	1.4 mm	1.1 mm	0.9 mm	0.55 mm	0.4 mm	1.1 mm	1.1 mm	0.6 mm	0.4 mm

Note: Mounted on FR4 Board (25.4 x 25.4 mm)

Thermally-Enhanced Compact Packages

	TSM	UF6	SMV	UFV	UFM	ES6	CST3B	CST4
Footprint Area	8.1 mm ²	4.2 mm ²	8.1 mm ²	4.2 mm ²	4.2 mm ²	2.6 mm ²	1.0 mm ²	1.0 mm ²
Permissible Power Dissipation (Note)	0.7 W	0.5 W	0.75 W	0.5 W	0.5 W	0.5 W	1.0 W	0.4 W
Height (MAX)	0.85 mm	0.75 mm	1.4 mm	0.75 mm	0.75 mm	0.6 mm	0.5 mm	0.4 mm

Note: Mounted on FR4 Board (25.4 x 25.4 mm)

Thermally Enhanced Packages

	SOP Adv.	SOP-8	TSSOP Adv.	TSON Adv.
Footprint Area	30 mm ²	30 mm ²	16.3 mm ² (-46%)	10.9 mm ² (-64%)
Permissible Power Dissipation	2.8 W (+47%)	1.9 W	2.3 W (+21%)	1.9 W
Height	1.0 mm (-47%)	1.9 mm	0.8 mm (-58%)	0.9 mm (-53%)

(Percentage relative to SOP-8)

Compact Packages

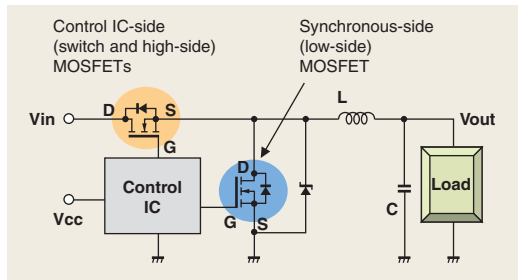
	VS-8	VS-6	PS-8	Chip LGA
Footprint Area	5.5 mm ² (-32%)	8.1 mm ²	8.1 mm ²	2.56 mm ² (-68%)
Permissible Power Dissipation	2.5 W (+14%)	2.2 W	1.68 W (-24%)	—
Height	0.85 mm	0.85 mm	0.85 mm	0.25 mm (-71%)

(Percentage relative to VS-6)

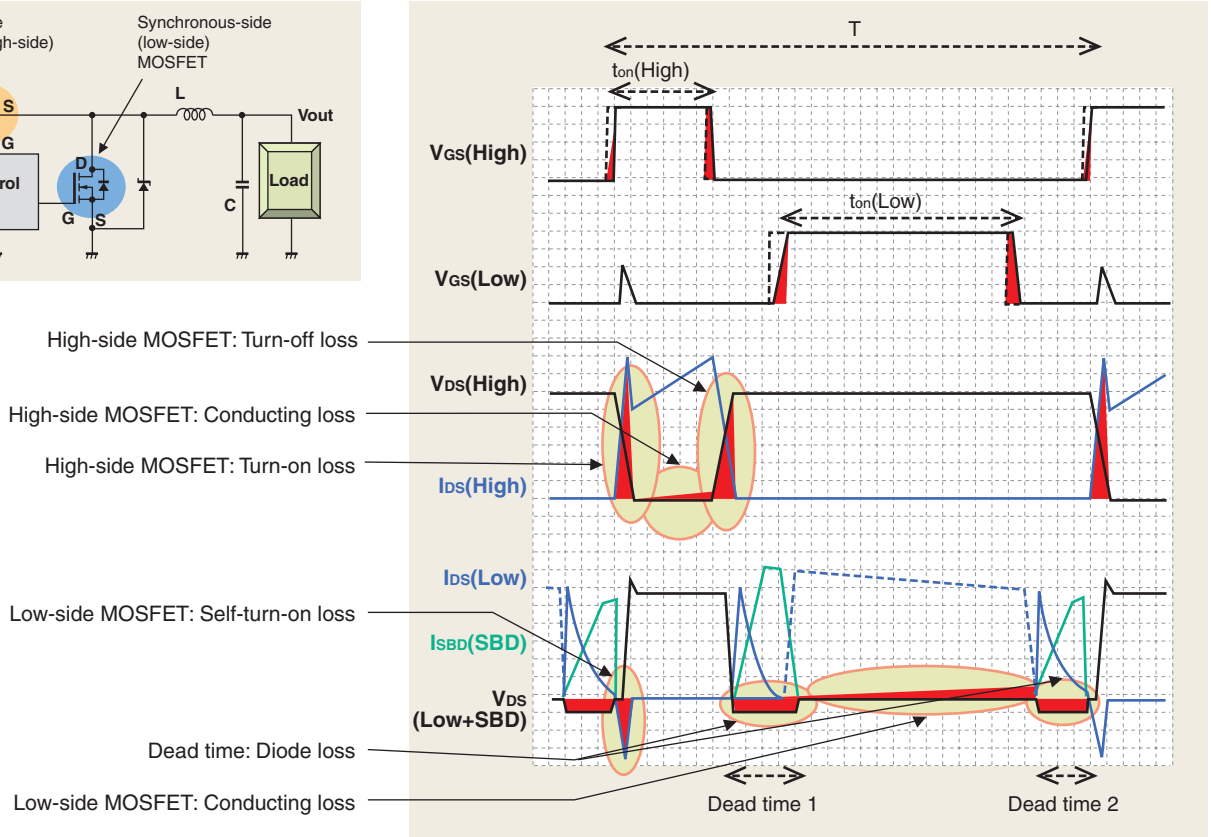
4-4 Low- V_{DS} , High-Speed MOSFETs

Synchronous Rectification DC-DC Converters – Block Diagram, Timing Chart and Power Loss Factors

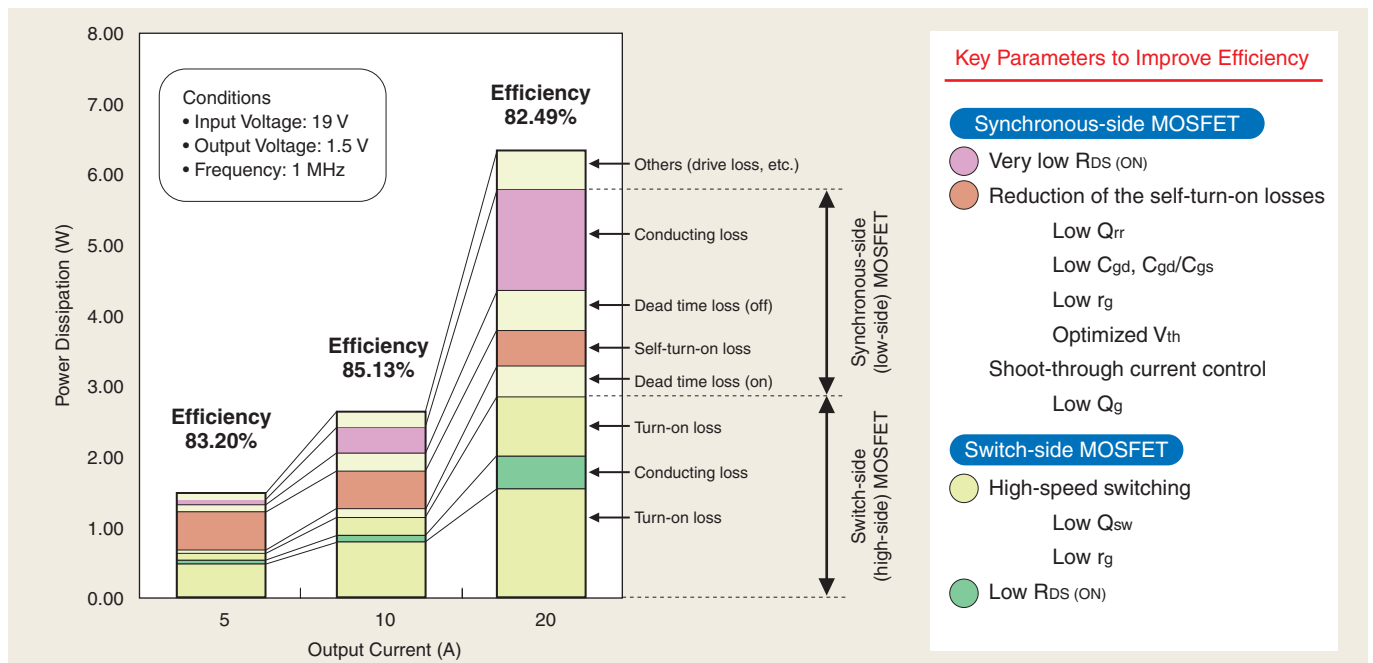
Block Diagram



Timing Chart



Synchronous Rectification DC-DC Converters – Summary Results of Power Loss Simulation and Key Parameters for MOSFETs

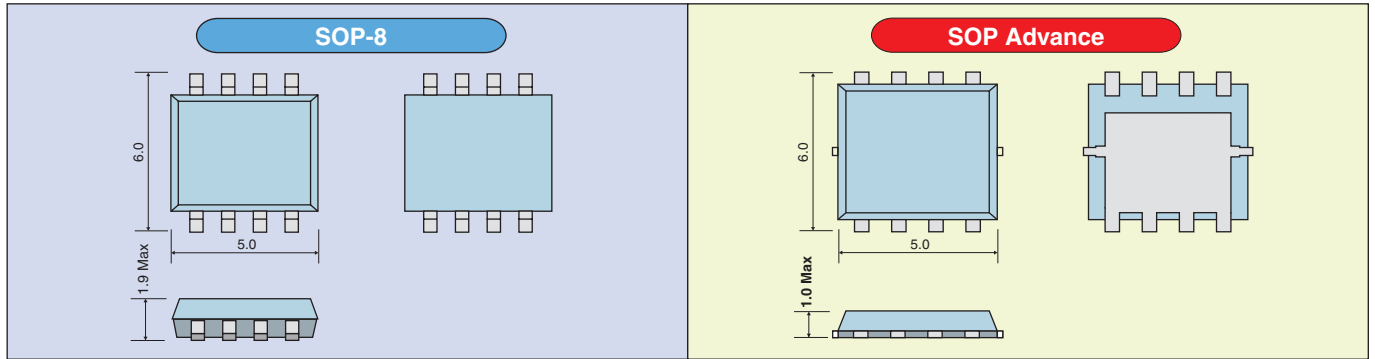


Synchronous Rectification DC-DC Converters – Efficiency Improvement by Thermally Enhanced Package and New Process Technology

Thermally Enhanced Package

Toshiba has developed the SOP Advance package with the same footprint area as the standard SOP-8 package. With an external heatsink on the bottom, the SOP Advance package offers enhanced thermal characteristics, realizing a high power dissipation and thus high-current capability.

Unit: mm



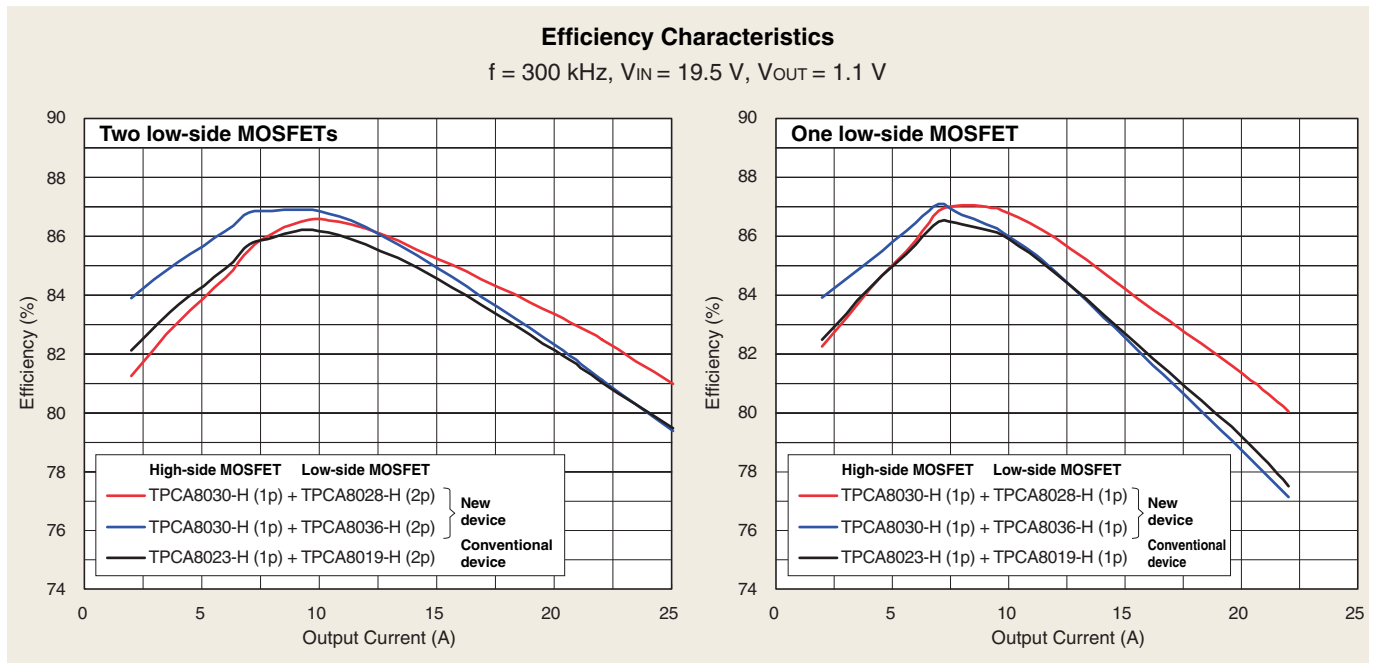
		SOP-8	SOP Advance	Features of the SOP Advance
Footprint Area	(mm ²)	30	30	Same footprint area as the SOP-8
Total height (max)	(mm)	1.9	1.0	Low profile, Thinner by 0.9 mm
R _{th(ch-a)} (t = 10 s) ^(Note 1)	(°C / W)	65.8	44.6	High power dissipation
Current rating	(A)	18	40	High current-carrying capacity
Package resistance ^(Note 2)	(mΩ)	1.6	0.5	Low package resistance

Note 1: When mounted on a glass-epoxy board (25.4 mm x 25.4 mm x 0.8 mm) Note 2: Without chip resistance

New Process Technology

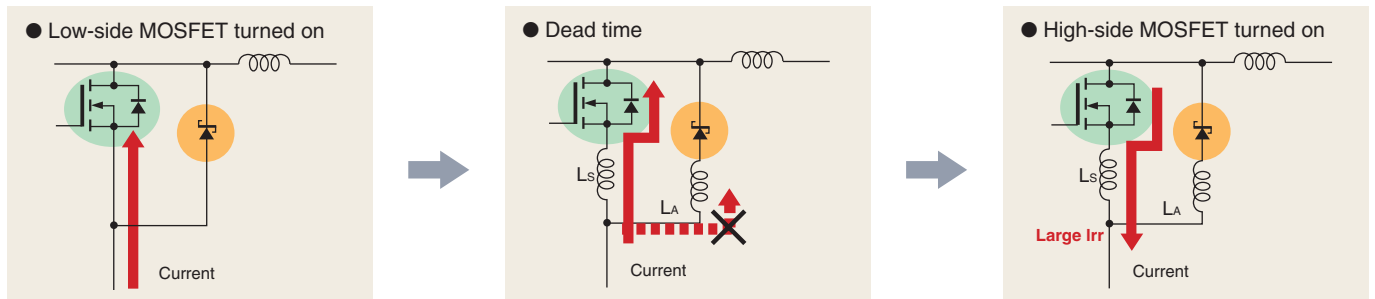
Toshiba has developed a new process technology to further reduce an internal gate resistance (r_g) and gate capacitance ratio (C_{gd}/C_{gs}) for minimizing the self-turn-on loss while maintaining both the low ON-resistance and low gate charge characteristics.

	R _{DS(ON)} Typ. @4.5 V (mΩ)	r_g Typ. (Ω)	C _{gd} /C _{gs} Typ. (%)
TPCA8028-H (New generation)	2.3	1.0	6.8
TPCA8019-H (One gen. ago)	3.1	1.0	6.6
TPCA8004-H (Two gen. ago)	4.8	2.4	12.7



Synchronous Rectification DC-DC Converters – MOSBD (MOSFET with SBD)

External SBD



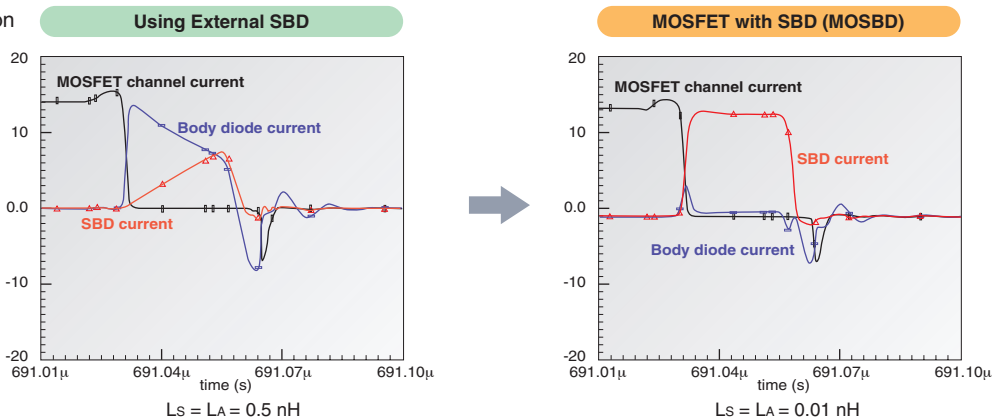
When an SBD is added externally, the SBD can't function fully due to the influence of wire inductances (L_s and L_A); thus a body diode current during the dead time becomes larger and causes the following penalties.

- 1: Increase in the conducting loss of the body diode.
- 2: Increase in the reverse recovery loss due to high di/dt .
- 3: Induces a self-turn-on phenomenon.

MOSFET with SBD (MOSBD)

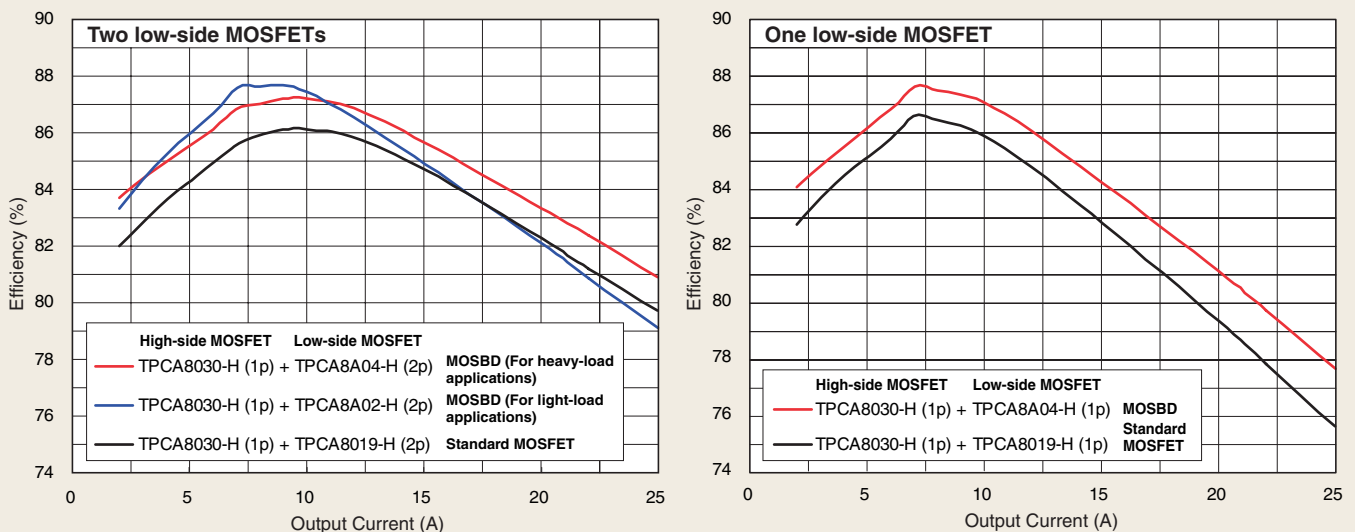
A MOSFET with SBD using a monolithic structure reduces a wire inductance (L_A) and a parasitic inductance (L_s). This structure makes it possible for the SBD to function fully and to reduce losses.

Current Waveform Simulation



Efficiency Characteristics

$f = 300 \text{ kHz}$, $V_{IN} = 19.5 \text{ V}$, $V_{OUT} = 1.1 \text{ V}$



● High-Speed MOSFET Offerings

Part Number	Absolute Maximum Ratings			Circuit Configuration	Package	$R_{DS(ON)}$ Max (m Ω)			Qsw Typ.(nC) @ $V_{DS} = V_{DSS} \times 0.8$	Series	
	V_{DSS} (V)	V_{GS} (V)	I_D (A)			2.5 V	4.5 V	10 V			
TPCA8011-H	20	± 12	40	N-ch Single	SOP Advance	7.5	3.5	—	16	U-MOSIII-H	
TPC6007-H	30		5		VS-6	—	79	54	1.8	U-MOSIII-H	
TPC6109-H	-30		-5	P-ch Single		—	83	59	4.8	U-MOSIII-H	
TPC8216-H ☆			6.4	N-ch Dual	SOP-8	—	23.0	20	3.4	U-MOSVI-H	
TPCP8005-H ☆			11	N-ch Single	PS-8	—	15.7	12.9	5.0	U-MOSV-H	
TPCC8003-H ☆			13		TSON Advance	—	19.3	16.9	4.2	U-MOSVI-H	
TPCC8001-H ☆			22			—	10.6	8.3	7.1	U-MOSV-H	
TPCC8002-H ☆			22			—	10.6	8.3	7.1	U-MOSV-H	
TPCC8006-H ☆			22			—	9.3	8.0	7.4	U-MOSVI-H	
TPCC8005-H ☆			26			—	7.4	6.4	9.1	U-MOSVI-H	
TPCM8003-H ☆			21			TSSOP Advance	—	15.7	12.9	5.0	U-MOSV-H
TPCM8004-H ☆			24		—		13.4	11	5	U-MOSV-H	
TPCM8002-H ☆			30		—		8.2	6.2	9.3	U-MOSV-H	
TPC8021-H			11		SOP-8		—	25	17	3.6	U-MOSIII-H
TPC8031-H ☆			11			—	16.1	13.3	5.0	U-MOSV-H	
TPC8037-H ☆			12			—	13.9	11.4	5	U-MOSV-H	
TPC8038-H ☆			12			—	13.9	11.4	5	U-MOSV-H	
TPC8040-H ☆			13			—	11.1	9.7	5.1	U-MOSVI-H	
TPC8032-H ☆	30		15	—		8.6	6.5	8.4	U-MOSV-H		
TPC8033-H ☆			17	—		7.2	5.3	9.6	U-MOSV-H		
TPC8039-H ☆			17	—		6.9	6.0	8.5	U-MOSVI-H		
TPC8034-H ☆			18	—		4.5	3.5	16	U-MOSV-H		
TPC8036-H ☆			18	—		5.1	4.5	13	U-MOSVI-H		
TPC8035-H ☆			18	—		3.6	3.2	17	U-MOSVI-H		
TPCA8023-H ☆		± 20	21	N-ch Single		—	15.7	12.9	5.0	U-MOSV-H	
TPCA8040-H ☆			23			—	10.8	9.4	5.7	U-MOSVI-H	
TPCA8030-H ☆			24			—	13.4	11.0	5	U-MOSV-H	
TPCA8031-H ☆			24			—	13.4	11.0	5	U-MOSV-H	
TPCA8018-H ☆			30			SOP Advance	—	8.2	6.2	9.3	U-MOSV-H
TPCA8039-H ☆			34				—	6.6	5.7	8.6	U-MOSVI-H
TPCA8036-H ☆			38				—	4.8	4.2	13	U-MOSVI-H
TPCA8012-H ☆			40		—		6.8	4.9	11.0	U-MOSV-H	
TPCA8060-H ☆			45		—		3.9	3.4	17	U-MOSVI-H	
TPCA8019-H ☆			45		—		4.1	3.1	15.5	U-MOSV-H	
TPCA8028-H ☆			50		—	3.2	2.8	20	U-MOSVI-H		
TPC6006-H			3.9			VS-6	—	100	75	1.3	U-MOSIII-H
TPC8022-H			7.5	N-ch Single	SOP-8	—	35	27	3.5	U-MOSIII-H	
TPC8052-H ☆			12			—	13.3	11.5	6.6	U-MOSVI-H	
TPC8047-H ☆			16			—	8.8	7.6	11	U-MOSVI-H	
TPC8046-H ☆			18		—	6.6	5.7	15	U-MOSVI-H		
TPC8045-H ☆			18		—	4.4	3.9	23	U-MOSVI-H		
TPCA8020-H			7.5		SOP Advance	—	35	27	3.5	U-MOSIII-H	
TPCA8052-H ☆	40		20	—		13.1	11.3	6.6	U-MOSVI-H		
TPCA8014-H			30	—		14	9	7.4	U-MOSIII-H		
TPCA8027-H			30	—		—	10	8.1	U-MOSIII-H		
TPCA8047-H ☆			32	—		8.5	7.3	13	U-MOSVI-H		
TPCA8015-H			35	—		7.9	5.4	13	U-MOSIII-H		
TPCA8046-H ☆			38	—		6.3	5.4	15	U-MOSVI-H		
TPCA8045-H ☆			46	—		4.1	3.6	23	U-MOSVI-H		

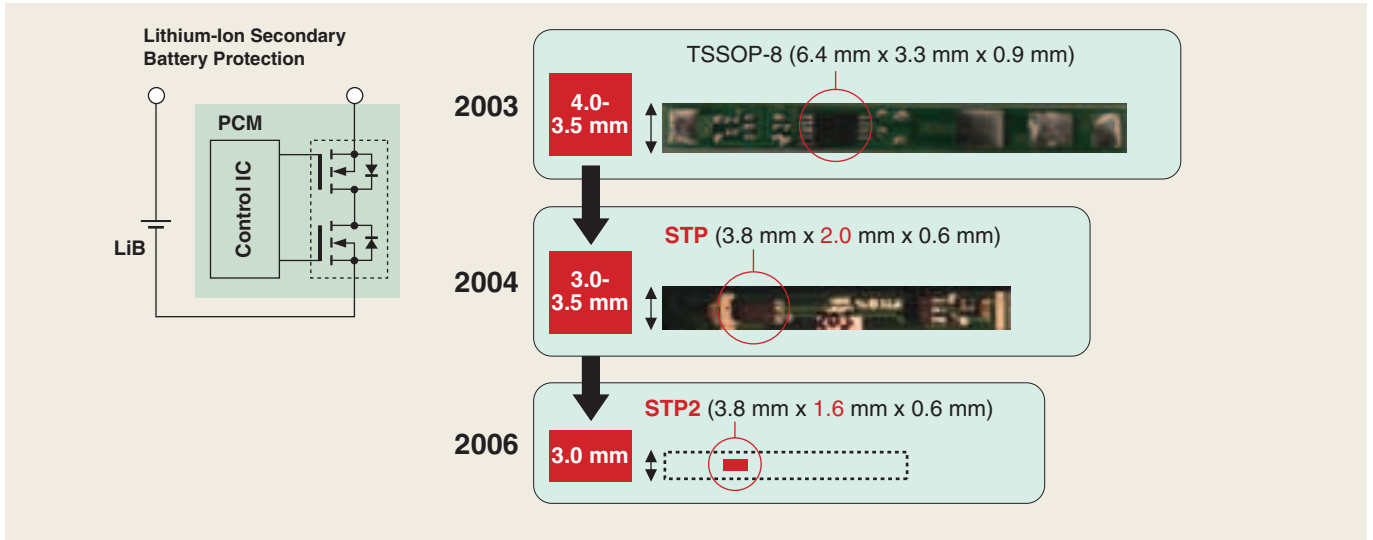
☆: No protection Zener diode between gate and source

Part Number	Absolute Maximum Ratings			Circuit Configuration	Package	R _{DS(ON)} Max (mΩ)		Q _{sw} Typ.(nC) @ V _{DS} = V _{DS} x 0.8	Series	
	V _{DSS} (V)	V _{GSS} (V)	I _D (A)			4.5 V	10 V			
TPC8218-H ☆	60	±20	3.8	N-ch Dual	SOP-8	64	57	2.6	U-MOSVI-H	
TPC8213-H			5			56	50	2.9	U-MOSIII-H	
TPC8053-H ☆			9	N-ch Single		SOP Advance	24.2	22.5	6.7	U-MOSVI-H
TPC8050-H ☆			11				15.6	14.5	9.2	U-MOSVI-H
TPC8049-H ☆			13				11.5	10.7	13	U-MOSVI-H
TPC8048-H ☆			16				7.4	6.9	17	U-MOSVI-H
TPCA8053-H ☆			15		24		22.3	6.9	U-MOSVI-H	
TPCA8050-H ☆			24		15.3		14.2	10	U-MOSVI-H	
TPCA8016-H			25		26		21	6.6	U-MOSIII-H	
TPCA8049-H ☆			28		11.2		10.4	13	U-MOSVI-H	
TPCA8048-H ☆			35	7.1	6.6	19	U-MOSVI-H			
TPC8051-H ☆			80	13	SOP-8	10.1	9.7	16	U-MOSVI-H	
TPCA8051-H ☆				28	SOP Advance	9.8	9.4	18	U-MOSVI-H	
TPCP8003-H			100	2.2	PS-8	190	180	2.0	U-MOSIII-H	
TPC8214-H	2.2	N-ch Dual		SOP-8	190	180	2.0	U-MOSIII-H		
TPCA8022-H	150	22	N-ch Single	SOP Advance	—	26	14	U-MOSIII-H		
TPCA8009-H		7		SOP Advance	—	350	3.7	π-MOSV		
TPCA8010-H		200		5.5	SOP Advance	—	450	3.7	π-MOSV	
TPCA8008-H		250		4	SOP Advance	—	580	3.7	π-MOSV	
TPCP8A05-H ☆		30		8	MOSBD	PS-8	21.9	17.5	2.7	U-MOSV-H
TPCC8A01-H ☆				21		TSON Advance	12.6	9.9	4.1	U-MOSV-H
TPCM8A05-H ☆	20		TSSOP Advance	17.2		12.9	3.7	U-MOSV-H		
TPC8A05-H ☆	10		SOP-8	17.6		13.3	3.7	U-MOSV-H		
TPC8A06-H ☆	12			12.9		10.1	4.5	U-MOSV-H		
TPC8A03-H ☆	17			7.0		5.6	8.4	U-MOSV-H		
TPC8A04-H ☆	18			4.5		3.6	13.4	U-MOSV-H		
TPCA8A05-H ☆	20		SOP Advance	17.2		12.9	3.7	U-MOSV-H		
TPCA8A02-H ☆	34			6.7		5.3	8.6	U-MOSV-H		
TPCA8A08-H ☆	38			5.1		3.9	11	U-MOSV-H		
TPCA8A04-H ☆	44	4.1		3.2	13.4	U-MOSV-H				
TPCP8103-H	-40	-4.8	P-ch Single	PS-8	54	40	6.5	U-MOSIII-H		
TPC8116-H		-7.5		SOP-8	37	30	9.7	U-MOSIII-H		
TPCA8107-H		-7.5		SOP Advance	37	30	9.7	U-MOSIII-H		
TPC8406-H		40	6.5	N-ch/P-ch Dual	SOP-8	35	27	3.5	U-MOSIII-H	
	-40	-6.5	37			30	9.7	U-MOSIII-H		

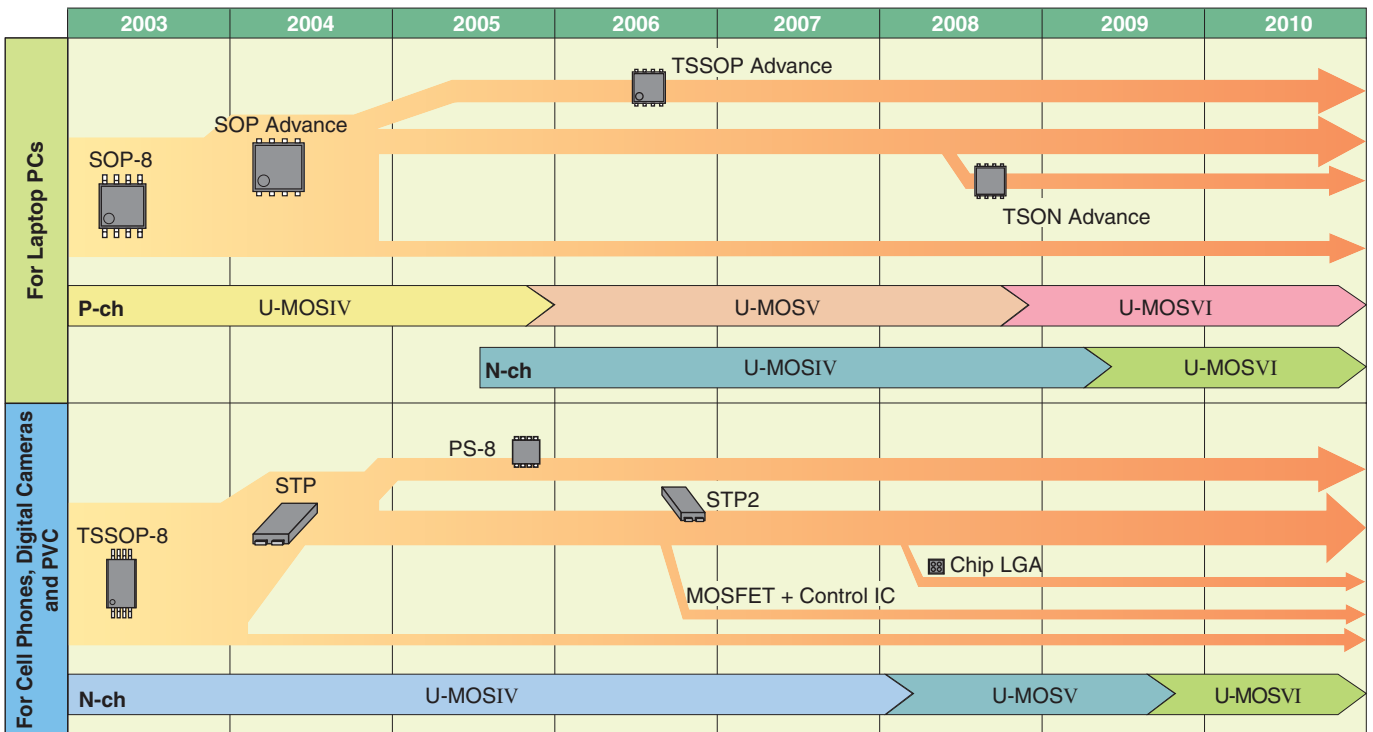
☆: No protection Zener diode between gate and source

4-5 Low- V_{DSS} , Low- $R_{DS(ON)}$ MOSFETs (for Lithium-Ion Battery Protection)

Lithium-Ion Battery Protection Circuit Trend



MOSFET Roadmap



● Low-ON-resistance N-Channel Power MOSFETs

Part Number	Absolute Maximum Ratings			Circuit Configuration	Package	R _{DS(ON)} Max (mΩ)				Series
	V _{bss} (V)	V _{gss} (V)	I _d (A)			2.5 V	4 V	4.5 V	10 V	
TPCT4203 ☆	20	±12	6	STP2	N-ch Dual	49	32	—	—	U-MOSIV
TPCT4204 ☆	30	±12	6			52	39	—	—	U-MOSIV
TPCL4201 ☆	20	±12	6	Chip LGA		52	—	31	—	U-MOSV
TPCL4203 ☆*	24	±12	6			55	—	36	—	U-MOSV
TPCL4202 ☆*	30	±12	6	PS-8	N-ch Single	64	—	40	—	U-MOSV
TPCP8006 ☆	20	±12	9.1			13.7	—	10	—	U-MOSIV
TPCP8004 ☆	30	±20	8.3	PS-8	N-ch Dual	—	—	14	8.5	U-MOSIV
TPCP8202	30	±12	5.5			39	24	23	—	U-MOSIV
TPCC8007 ☆*	20	±12	27	TSON Advance	N-ch Single	(8.7)	—	(4.6)	—	U-MOSIV
TPCC8008 ☆	30	±25	25			—	—	12.8	6.8	U-MOSIV
TPC8025 ☆	30	±20	11	SOP-8		—	—	14.5	9	U-MOSIV
TPC8030 ☆	30	±25	11			—	—	17	9	U-MOSIV
TPC8041 ☆	30	±20	13		—	—	13.5	7	U-MOSIV	
TPC8026 ☆	30	±20	13		—	—	10	6.6	U-MOSIV	
TPC8028 ☆	30	±20	18		—	—	8	4.3	U-MOSIV	
TPC8029 ☆	30	±20	18		—	—	7	3.8	U-MOSIV	
TPC8042 ☆	30	±20	18		—	—	6.5	3.4	U-MOSIV	
TPC8027 ☆	30	±20	18		—	—	5.5	2.7	U-MOSIV	
TPC8208	20	±12	5		N-ch Dual	70	50	—	—	U-MOSIII
TPC8207	20	±12	6			30	20	—	—	U-MOSIII
TPC8211	30	±20	5.5	—		—	44	36	U-MOSIII	
TPC8210	30	±20	8	—		—	20	15	U-MOSIII	
TPCA8024 ☆	30	±20	35	SOP Advance	N-ch Single	—	—	7.8	4.3	U-MOSIV
TPCA8025 ☆	30	±20	40			—	—	6.0	3.5	U-MOSIV
TPCA8042 ☆	30	±20	45			—	—	5.7	3.3	U-MOSIV
TPCA8026 ☆	30	±20	45			—	—	4.5	2.2	U-MOSIV

☆: No protection Zener diode between gate and source * : Under development

● Low-ON-resistance P-Channel Power MOSFETs

Part Number	Absolute Maximum Ratings			Circuit Configuration	Package	R _{DS(ON)} Max (mΩ)				Series
	V _{bss} (V)	V _{gss} (V)	I _d (A)			2.5 V	4 V	4.5 V	10 V	
TPCC8102 ☆	-30	±20	-15	TSON Advance	P-ch Single	—	33.2	—	18.9	U-MOSV
TPCC8103 ☆	-30	±20	-18			—	22	—	12	U-MOSV
TPC8115	-20	±8	-10	SOP-8		14	—	10	—	U-MOSIV
TPC8119 ☆	-30	±20	-10			—	28	—	13	U-MOSV
TPC8121 ☆	-30	±20	-11			—	24	—	12	U-MOSV
TPC8111	-30	±20	-11			—	18	—	12	U-MOSIV
TPC8113	-30	±20	-11			—	18	—	10	U-MOSIV
TPC8123 ☆	-30	-25/+20	-11			—	—	12.5	9	U-MOSVI
TPC8122 ☆	-30	±20	-12			—	16.5	—	8	U-MOSV
TPC8118 ☆	-30	±20	-13			—	15	—	7	U-MOSV
TPC8114	-30	±20	-18			—	6.8	—	4.5	U-MOSIV
TPC8117 ☆	-30	±20	-18			—	7.9	—	3.9	U-MOSV
TPC8120 ☆	-30	-25/+20	-18	—		—	4.2	3.2	U-MOSVI	
TPC8405	30	±20	6	N-ch/P-ch Dual		—	—	33	26	U-MOSIII
	-30	±20	-4.5			—	—	42	33	U-MOSIV
TPCM8102 ☆	-30	±20	-25	TSSOP Advance		P-ch Single	—	16	—	7.7
TPCA8105	-12	±8	-6	SOP Advance	51		33	—	—	U-MOSIV
TPCA8103	-30	±20	-40		—		6.8	—	4.2	U-MOSIV
TPCA8106 ☆	-30	±20	-40		—		7.8	—	3.7	U-MOSV

☆: No protection Zener diode between gate and source

4-6 Semi-Power MOSFET Offerings

Semi-Power P-Channel Single MOSFETs

Unit: mm

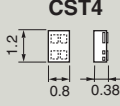
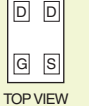
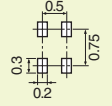
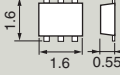
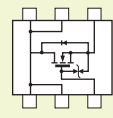
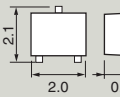
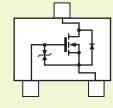
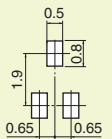
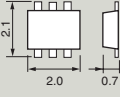
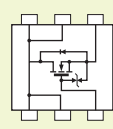
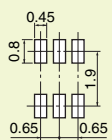
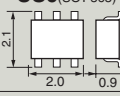
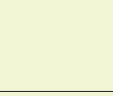
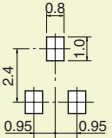
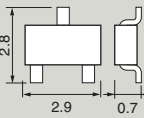
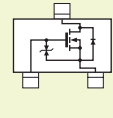
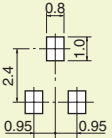
Package	Part Number	V_{DSS} (V)	V_{GSS} (V)	I_D (A)	$R_{DS(ON)}$ Max (m Ω)				C_{iss} (pF)	Series	*Internal Connections	Land Pattern Example
					$V_{GS} = 1.5$ V	$V_{GS} = 1.8$ V	$V_{GS} = 2.5$ V	$V_{GS} = 4.0$ V				
CST3B 	SSM3J46CTB	-20	± 8	-2.0	250	178	133	103 (@4.5 V)	290	U-MOSVI		
ES6 (SOT-563) 	SSM6J212FE*	-20	± 8	-3.3	108	73.7	45.6	43.4(@4.5V)	834	U-MOSVI		
	SSM6J53FE	-20	± 8	-1.8	364	204	136	—	568	U-MOSIV		
	SSM6J206FE	-20	± 8	-2.0	—	320	186	130	335	U-MOSIII		
	SSM6J205FE	-20	± 8	-0.8	—	460	306	234	250	U-MOSIII		
	SSM6J26FE	-20	± 8	-0.5	—	980	330	230	250	U-MOSIII		
	SSM6J23FE	-12	± 8	-1.2	—	—	210	160	420	U-MOSIII		
	SSM6J25FE	-20	± 12	-0.5	—	—	430	260	218	U-MOSIII		
SSM6J207FE	-30	± 20	-1.4	—	—	—	491	137	U-MOSII			
UFM 	SSM3J132TU*	-12	± 5	-5.0	40.4	28.3	21.7	17.8(@4.5V)	2700	U-MOSVI		
	SSM3J130TU	-20	± 8	-4.4	63.2	41.1	31	25.8(@4.5V)	1800	U-MOSVI		
	SSM3J120TU	-20	± 8	-4.0	140	78	49	38	1484	U-MOSIV		
	SSM3J129TU	-20	± 8	-4.6	137	88	62	46(@4.5V)	640	U-MOSV		
	SSM3J115TU	-20	± 8	-2.2	353	193	125	98	568	U-MOSIV		
	SSM3J110TU	-12	± 8	-2.3	—	240	145	94	550	U-MOSIII		
	SSM3J109TU	-20	± 8	-2.0	—	300	172	130	335	U-MOSIII		
	SSM3J114TU	-20	± 8	-1.8	526	321	199	149	331	U-MOSIV		
	SSM3J108TU	-20	± 8	-1.8	—	363	230	158	250	U-MOSIII		
	SSM3J113TU	-20	± 12	-1.7	—	—	249	169	370	U-MOSIII		
	SSM3J111TU	-20	± 12	-1.0	—	—	680	480	160	U-MOSIII		
	SSM3J117TU	-30	± 20	-2.0	—	—	—	225	280	U-MOSII		
	SSM3J118TU	-30	± 20	-1.4	—	—	—	480	137	U-MOSII		
SSM3J112TU	-30	± 20	-1.1	—	—	—	790	86	U-MOSII			
UF6 	SSM6J409TU	-20	± 8	-9.5	72.3	46.3	30.2	22.1(@4.5V)	1100	U-MOSV		
	SSM6J51TU	-12	± 8	-4.0	150	85	54	—	1700	U-MOSIV		
	SSM6J50TU	-20	± 10	-2.5	—	205(@2.0V)	100	64(@4.5V)	800	U-MOSIV		
	SSM6J21TU	-12	± 12	-3.0	—	—	88	50	1300	U-MOSIII		
	SSM6J401TU	-30	± 20	-2.5	—	—	—	145	730	U-MOSIII		
SSM6J402TU	-30	± 20	-2.0	—	—	—	225	280	U-MOSIII			
US6(SOT-363) 	SSM6J08FU	-20	± 12	-1.3	—	460(@2.0V)	260	180	370	U-MOSII		
	SSM6J06FU	-20	± 12	-0.65	—	—	700	500	160	π -MOSVI		
	SSM6J07FU	-30	± 20	-0.8	—	—	—	800	130	π -MOSVI		
TSM 	SSM3J307T	-20	± 8	-5.0	83	56	40	31(@4.5V)	1170	U-MOSV		
	SSM3J321T	-20	± 8	-5.2	137	88	62	46(@4.5V)	640	U-MOSV		
	SSM3J326T*	-30	± 12	-5.6	—	115	62.5	45.7(@4.5V)	640	U-MOSVI		
	SSM3J13T	-12	± 8	-3.0	—	180(@2.0V)	95	70	890	U-MOSIII		
	SSM3J312T	-12	± 8	-2.7	—	237	142	91	550	U-MOSIII		
	SSM3J304T	-20	± 8	-2.3	—	297	169	127	335	U-MOSIII		
	SSM3J317T	-20	± 8	-3.6	—	306	144	107(@4.5V)	390	U-MOSIII		
	SSM3J313T	-20	± 8	-1.6	—	640	396	268	170	U-MOSIII		
	SSM3J01T	-30	± 10	-1.7	—	—	600	400	240	π -MOSVI		
	SSM3J02T	-30	± 10	-1.5	—	—	700	500	150	π -MOSVI		
	SSM3J314T	-30	± 20	-3.5	—	—	—	100	505	U-MOSIII-H		
	SSM3J14T	-30	± 20	-2.7	—	—	—	170	413	U-MOSII		
	SSM3J306T	-30	± 20	-2.4	—	—	—	225	280	U-MOSII		
SSM3J305T	-30	± 20	-1.7	—	—	—	477	137	U-MOSII			
S-Mini 	SSM3J327F*	-20	± 8	-3.5	242	170	125	95(@4.5V)	290	U-MOSVI		
	SSM3J325F*	-20	± 8	-2.0	362	252	191	155(@4.5V)	226	U-MOSVI		

*: Under development

* The internal connection diagrams only show the general configurations of the circuits.

Semi-Power N-Channel Single MOSFETs

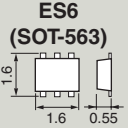
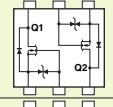
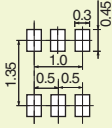
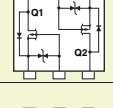
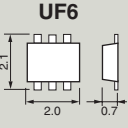
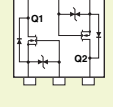
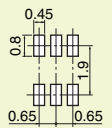
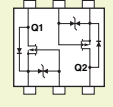
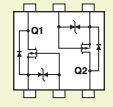
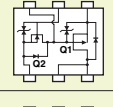
Unit: mm

Package	Part Number	V _{DSS} (V)	V _{GSS} (V)	I _b (A)	R _{DS(ON)} Max (mΩ)				C _{iss} (pF)	Series	*Internal Connections	Land Pattern Example
					V _{GS} = 1.5 V	V _{GS} = 1.8 V	V _{GS} = 2.5 V	V _{GS} = 4.0 V				
CST4 	SSM4K27CT	20	±12	0.5	—	390	260	205	174	U-MOSIII	 TOP VIEW	
	ES6 (SOT-563) 	SSM6K211FE	20	±10	3.2	118	82	59	47(@4.5 V)	510	U-MOSIII	
SSM6K203FE		20	±10	2.8	153	106	76	61	400	U-MOSIII		
SSM6K202FE		30	±12	2.3	—	145	101	85	270	U-MOSIII		
SSM6K204FE		20	±10	2.0	307	214	164	126	195	U-MOSIII		
SSM6K208FE		30	±12	1.9	—	296	177	133	123	U-MOSIII		
SSM6K25FE		20	±12	0.5	—	395	190	145	268	U-MOSIII		
SSM6K24FE		30	±12	0.5	—	—	180	145	245	U-MOSIII		
SSM6K22FE		20	±12	1.4	—	—	230	170	125	U-MOSIII		
SSM6K210FE		30	±20	1.4	—	—	—	371	57	U-MOSIII		
SSM6K30FE		20	±20	1.2	—	—	—	420	60	π-MOSVII		
SSM6K31FE		20	±20	1.2	—	—	—	540	36	π-MOSVII		
UFM 	SSM3K123TU	20	±10	4.2	66	43	32	28	1010	U-MOSIII		
	SSM3K121TU	20	±10	3.2	140	93	63	48	400	U-MOSIII		
	SSM3K104TU	20	±12	3.0	—	110	74	56	320	U-MOSIII		
	SSM3K119TU	30	±12	2.5	—	134	90	74	270	U-MOSIII		
	SSM3K102TU	20	±12	2.6	—	154	99	71	268	U-MOSIII		
	SSM3K122TU	20	±10	2.0	304	211	161	123	195	U-MOSIII		
	SSM3K101TU	20	±12	2.2	—	230	138	103	125	U-MOSIII		
	SSM3K127TU	30	±12	2.0	—	286	167	123	123	U-MOSIII		
	SSM3K116TU	30	±12	2.2	—	—	135	100	245	U-MOSIII		
	SSM3K131TU	30	±20	6.0	—	—	—	41.5(@4.5 V)	450	U-MOSIV		
	SSM3K124TU	30	±20	2.4	—	—	—	120	180	π-MOSVII		
	SSM3K105TU	30	±20	2.1	—	—	—	200	102	π-MOSVI		
	SSM3K128TU	30	±20	1.5	—	—	—	360	57	U-MOSIII		
	SSM3K107TU	20	±20	1.5	—	—	—	410	60	π-MOSVII		
	SSM3K106TU	20	±20	1.2	—	—	—	530	36	π-MOSVII		
UF6 	SSM6K403TU	20	±10	4.2	66	43	32	28	1050	U-MOSIII		
	SSM6K404TU	20	±10	3.0	147	100	70	55	400	U-MOSIII		
	SSM6K405TU	20	±10	2.0	307	214	164	126	195	U-MOSIII		
	SSM6K18TU	20	±12	4.0	—	—	54	40	1100	U-MOSIII		
	SSM6K406TU	30	±20	4.4	—	—	—	38.5(@4.5 V)	490	U-MOSIV		
	SSM6K34TU	30	±20	3.0	—	—	—	77(@4.5 V)	470	U-MOSIII		
	SSM6K407TU	60	±20	2.0	—	—	—	440	150	π-MOSV		
SSM6K32TU	60	±20	2.0	—	—	—	440	140	π-MOSV			
US6 (SOT-363) 	SSM6K08FU	20	±12	1.6	—	210(@2.0 V)	140	105	306	U-MOSII		
	SSM6K06FU	20	±12	1.1	—	—	210	160	125	π-MOSVI		
	SSM6K07FU	30	±20	1.5	—	—	—	220	102	π-MOSVI		
TSM 	SSM3K310T	20	±10	5.0	66	43	32	28	1120	U-MOSIII		
	SSM3K309T	20	±12	4.7	—	47	35	31	1020	U-MOSIII		
	SSM3K301T	20	±12	3.5	—	110	74	56	320	U-MOSIII		
	SSM3K316T	30	±12	4.0	—	131	87	65(@4.5 V)	270	U-MOSIII		
	SSM3K01T	30	±10	3.2	—	—	150	120	152	π-MOSVI		
	SSM3K02T	30	±10	2.5	—	—	250	200	115	π-MOSVI		
	SSM3K315T	30	±20	6.0	—	—	—	41.5(@4.5 V)	450	U-MOSIV		
	SSM3K14T	30	±20	4.0	—	—	—	67	460	U-MOSII		
	SSM3K320T	30	±20	4.2	—	—	—	77(@4.5 V)	190	U-MOSIV		
	SSM3K303T	30	±20	2.9	—	—	—	120	180	π-MOSVII		
	SSM3K12T	30	±20	3.0	—	—	—	175	120	π-MOSVII		
SSM3K318T	60	±20	2.5	—	—	—	145(@4.5 V)	235	U-MOSIV			

* The internal connection diagrams only show the general configurations of the circuits.

Semi-Power Dual MOSFETs

Unit: mm

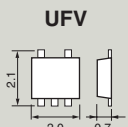
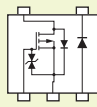
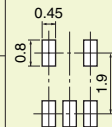
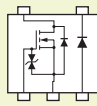
Package	Polarity	Part Number	V_{DSS} (V)	V_{GS} (V)	I_D (A)	$R_{DS(ON)}$ Max (m Ω)				C_{iss} (pF)	Series	*Internal Connections	Land Pattern Example
						$V_{GS} = 1.5V $	$V_{GS} = 1.8V $	$V_{GS} = 2.5V $	$V_{GS} = 4.0V $				
 ES6 (SOT-563)	N-ch x 2	SSM6N42FE*	20	± 10	0.77	630	460	340	260 (@4.5V)	95	U-MOSIII		
	P-ch x 2	SSM6P41FE	-20	± 8	-0.72	1040	670	440	300 (@4.5V)	110	U-MOSV		
 UF6	N-ch x 2	SSM6N39TU	20	± 10	1.6	247	190	139	119	260	U-MOSIII		
		SSM6N29TU	20	± 12	0.8	—	235	178	143	268	U-MOSIII		
		SSM6N25TU	20	± 12	0.5	—	395	190	145	268	U-MOSIII		
		SSM6N24TU	30	± 12	0.5	—	—	180	145	245	U-MOSIII		
		SSM6N40TU	30	± 20	1.6	—	—	—	182	180	U-MOSIII		
	P-ch x 2	SSM6P54TU	-20	± 8	-1.2	555	350	228	—	331	U-MOSIV		
		SSM6P39TU	-20	± 8	-1.5	—	430	294	213	250	U-MOSIII		
		SSM6P28TU	-20	± 8	-0.8	—	460	306	234	250	U-MOSIII		
		SSM6P26TU	-20	± 8	-0.5	—	980	330	230	250	U-MOSIII		
		SSM6P25TU	-20	± 12	-0.5	—	—	430	260	218	U-MOSIII		
	N-ch + P-ch	SSM6L39TU	20	± 10	1.6	247	190	139	119	260	U-MOSIII		
			-20	± 8	-1.5	—	430	294	213	250	U-MOSIII		
		SSM6L13TU	20	± 12	0.8	—	235	178	143	268	U-MOSIII		
		SSM6L10TU	20	± 12	0.5	—	395	190	145	268	U-MOSIII		
			-20	± 8	-0.5	—	980	330	230	250	U-MOSIII		
		SSM6L11TU	20	± 12	0.5	—	395	190	145	268	U-MOSIII		
			-20	± 12	-0.5	—	—	430	260	218	U-MOSIII		
	SSM6L12TU	30	± 12	0.5	—	—	180	145	245	U-MOSIII			
		-20	± 12	-0.5	—	—	430	260	218	U-MOSIII			
		30	± 20	1.6	—	—	—	182	180	U-MOSIII			
P-ch + N-ch (Load Switch)	SSM6E01TU	-12	± 12	-1.0	—	—	240	160	310	U-MOSIII			
		20	10	0.05	—	—	10 Ω	—	11	π -MOSVI			
	SSM6E02TU	-20	± 8	-1.8	364	204	136	—	568	U-MOSIV			
		20	± 10	0.1	15 Ω	—	4 Ω	3 Ω	9.3	π -MOSVI			
SSM6E03TU	-20	± 8	-1.8	—	335	180	144	335	U-MOSIII				
	20	± 10	0.1	15 Ω	—	4 Ω	3 Ω	9.3	π -MOSVI				

*: Under development

* The internal connection diagrams only show the general configurations of the circuits.

MOSFET with a Schottky Barrier Diode

Unit: mm

Package	Polarity	Part Number	MOSFET								SBD			*Internal Connections	Land Pattern Example		
			V_{DSS} (V)	V_{GS} (V)	I_D (A)	$R_{DS(ON)}$ Max (m Ω)				C_{iss} (pF)	Series	V_R (V)	I_o (A)			V_F Max (V) @ I_F (A)	
						$V_{GS} = 1.5V $	$V_{GS} = 1.8V $	$V_{GS} = 2.5V $	$V_{GS} = 4.0V $								
 UFV	P-ch+ SBD	SSM5G09TU	-12	± 8	-1.5	—	200	130	550	U-MOSII	12	0.5	0.43	0.5			
		SSM5G02TU	-12	± 12	-1.0	—	240	160	310	U-MOSII	12	0.5	0.43	0.5			
		SSM5G10TU	-20	± 8	-1.5	—	430	294	213	250	U-MOSIII	20	0.7	0.39			0.5
		SSM5G04TU	-12	± 12	-1.0	—	—	420	240	170	U-MOSII	12	0.5	0.43			0.5
		SSM5G11TU	-30	± 20	-1.4	—	—	—	403	120	U-MOSIII-H	30	0.7	0.41			0.5
		SSM5G01TU	-30	± 20	-1.0	—	—	—	800	86	U-MOSII	20	0.5	0.45			0.3
	N-ch+ SBD	SSM5H10TU	20	± 10	1.6	247	190	139	119	260	U-MOSIII	20	0.7	0.39	0.5		
		SSM5H12TU	30	± 12	1.9	—	296	177	133	123	U-MOSIII	30	0.7	0.41	0.5		
		SSM5H05TU	20	± 12	1.5	—	—	220	160	125	U-MOSIII	12	0.5	0.43	0.5		
		SSM5H08TU	20	± 12	1.5	—	—	220	160	125	U-MOSIII	20	0.5	0.45	0.3		
		SSM5H03TU	12	± 12	1.4	—	—	—	300	125	U-MOSII	12	0.5	0.43	0.5		
		SSM5H11TU	30	± 20	1.6	—	—	—	182	180	U-MOSIII	30	0.7	0.41	0.5		
		SSM5H01TU	30	± 20	1.4	—	—	—	450	106	U-MOSII	20	0.5	0.45	0.3		
SSM5H07TU	20	± 20	1.2	—	—	—	540	36	π -MOSVII	12	0.5	0.43	0.5				

* The internal connection diagrams only show the general configurations of the circuits.