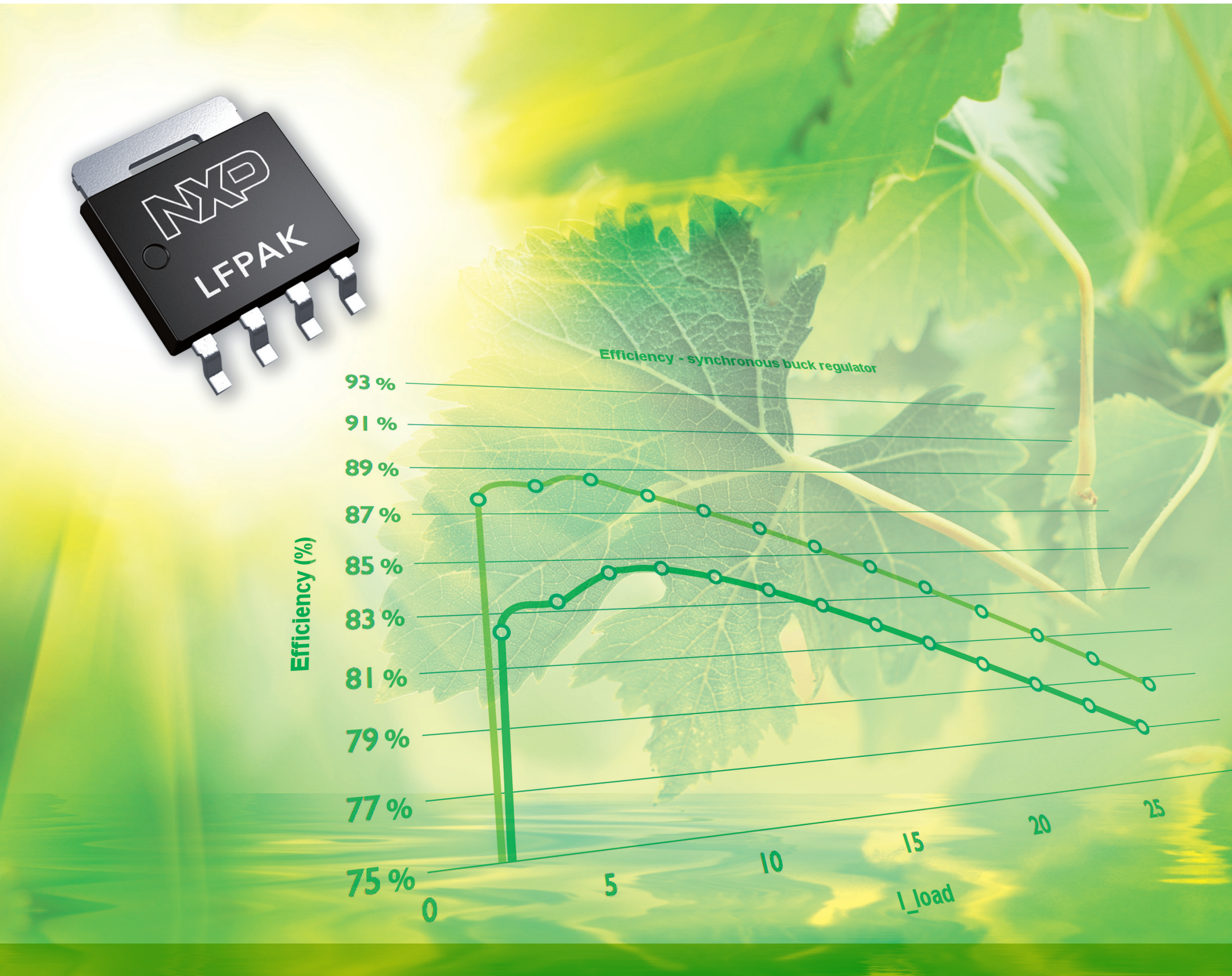


NextPower MOSFETs

Smaller, Faster, Cooler

NextPower 25 V & 30 V MOSFETs in LFPAK (Power-SO8)

NXP introduces a range of high performance N-channel, logic-level MOSFETs in LFPAK

As a power design engineer, compromise is never far from your mind. Do I choose a low $R_{DS(on)}$ device and accept the higher output capacitance? Do I demand the lowest gate charge characteristics to reduce switching losses but then find that the package options are no longer ideal in my application?

The NextPower range of MOSFETs from NXP provides uniquely balanced characteristics across the six most important parameters essential for your latest high efficiency and high reliability designs. More performance, less compromise…

Many competitors focus only on optimising $R_{DS(on)}$ and Q_g. As Q_g gets lower then losses due to Q_{oss} and Q_{gd} become more significant. NextPower uses Superjunction technology to provide the optimum balance between low $R_{DS(on)}$, low Q_{oss}, low $Q_{g(tot)}$ and Q_{gd} to give optimum switching performance. NextPower delivers superior SOA performance, and low Q_{oss} reduces the losses between the output DRAIN & SOURCE terminals. NextPower also delivers the lowest $R_{DS(on)}$ with sub 1 mΩ types at both 25 V and 30 V.

LFPAK packaging provides rugged power switching on a compact 5 mm x 6 mm footprint compatible with other Power-SO8 vendors. The unique benefits of LFPAK make it the best package choice for demanding applications or where high-reliability is required. It also allows for visual inspection, reducing the need for costly X-ray equipment to detect solder defects as is common with QFN style Power-SO8 packages.

Key benefits

- High efficiency in power switching applications
- Industry's lowest $R_{DS(on)}$ Power-SO8 - Less than 1 mΩ at 25 V and 30 V
- Low Q_{oss} for reduced output losses between DRAIN & SOURCE
- Low Q_{gd} for reduced switching losses and high frequency switching
- 20 V rated GATE provides better tolerance to voltage transients than lateral MOSFET types
- Superior 'Safe Operating Area' performance compared to other Trench MOSFET vendors
- Optimised for 4.5 V gate drive voltage
- Optimum switching performance under light & heavy load conditions
- LFPAK package for compatibility with other vendor Power-SO8 types
- Eliminates costly X-ray inspection – LFPAK solder joints can be optically inspected

Key applications

- Synchronous buck regulators
- DC-DC conversion
- Voltage regulator modules (VRM)
- Power OR-ing

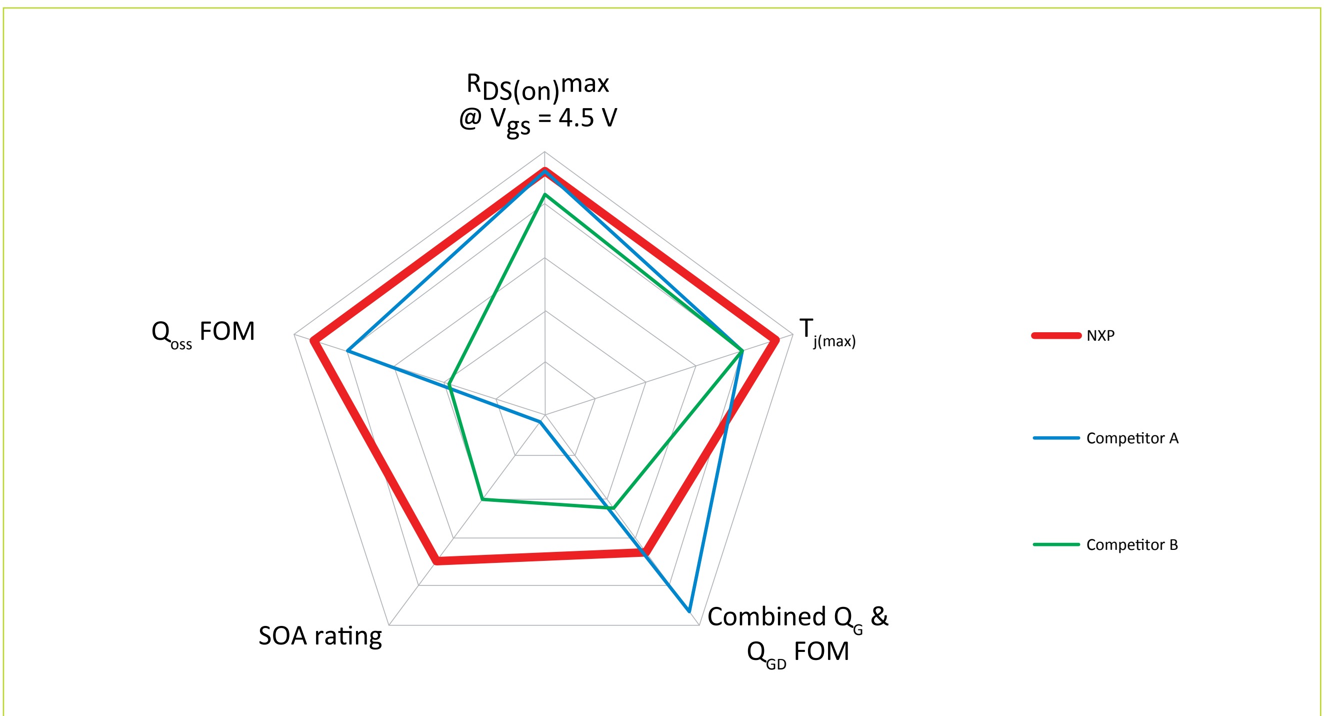
Benefits of Superjunction technology

Many suppliers focus on two favourable indicators when defining MOSFET performance, but this only tells part of the story.

The spider chart below shows the relative performance of NextPower versus the leading MOSFET vendors, comparing the six most important MOSFET parameters required for high-performance & high reliability switching applications. The outside edge of the graph represents the 'best-in-class' performance, whilst scoring towards the centre of the graph represents a weakness.

- Low $R_{DS(on)}$ gives low I^2R losses and superior performance when used in a SYNC FET or power OR-ing application
- Low Q_{oss} gives reduced losses between the drain & source terminals since the energy stored in the output capacitance (C_{oss}) is wasted whenever the voltage changes across the output terminals
- SOA performance provides tolerance to overload & fault conditions. The graph shows the maximum allowable current for a 1 mS pulse at V_{DS}=10 V
- Low Miller charge (Q_{GD}) gives reduced switching losses between the MOSFET's drain & source terminals when the MOSFET turns ON or turns OFF
- Low gate charge (Q_G) gives reduced losses in the gate drive circuit since less energy is required to turn the MOSFET ON & OFF
- Superior junction temperature rating, $T_{j(max)}$, is proof that LFPAK is the most rugged Power-SO8 package available. LFPAK is the best choice for demanding environments and where high reliability is required

Comparison of NextPower technology with key competitor types

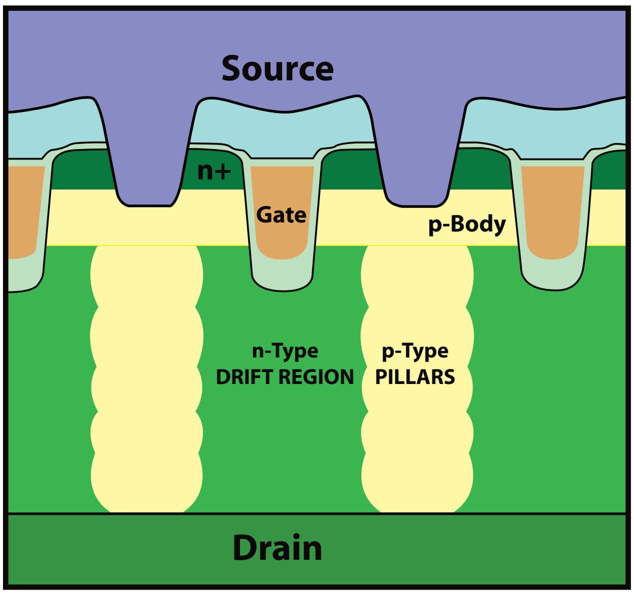


Superjunction technology

NextPower MOSFETs use 'Superjunction' silicon technology to deliver the optimum balance between low R_{DS}, low $Q_{G(tot)}$, low Q_{GD}, high SOA performance and low C_{oss} at 25 V and 30 V.

Superjunction technology combines the benefits of a lateral MOSFET, (low $Q_{g(tot)}$ and low Q_{GD}) with the benefits of a Trench-MOSFET (low $R_{DS(on)}$ and 20 V rugged GATE rating) resulting in a uniquely balanced specification.

NextPower uses an optimized balance of the different resistance elements in the MOSFET to achieve a lower on-resistance for every cell. The low cell resistance means that NextPower types typically require fewer cells than competitor devices to achieve the same $R_{DS(on)}$, and a lower cell count provides lower $Q_{G(tot)}$, low Q_{GD}, low C_{oss} and superior 'Safe operating area' ruggedness.



NextPower technology uses p-Type pillars to improve the breakdown voltage in the OFF state, and a heavily doped n-Type drift region to achieve exceptionally low ON resistance.

Since fewer cells are required to achieve a given R_{DS} rating, then gate charge (Q_G), Miller charge (Q_{GD}), output capacitance (C_{oss}) are all reduced and optimum ruggedness (denoted by the safe operating area characteristics) is achieved.

NextPower types – parametric data

The 25 V and 30 V types shown below are recommended for synchronous buck regulators, the low $R_{DS(on)}$ types are also highly recommended for Power OR-ing applications and low voltage isolated power supply topologies.

25 V NextPower types

Type	Voltage (V)	$R_{DS(on)}$typ V_{GS} = 4.5 V (mΩ)	Q_G(typ) V_{GS} = 4.5 V (nC)	Q_{GD}(typ) V_{GS} = 4.5 V (nC)	C_{OSS} (pF)
PSMN0R9-25YLC	25	0.95	51	14	1437
PSMN1R1-25YLC	25	1.2	39	11	1121
PSMN1R2-25YLC	25	1.35	31	8.3	994
PSMN1R7-25YLC	25	2	28	7.8	880
PSMN1R9-25YLC	25	2.2	27	7.4	761
PSMN2R2-25YLC	25	2.6	18	5.2	617
PSMN2R9-25YLC	25	3.45	16	4.4	501
PSMN3R2-25YLC	25	3.7	14	4	462
PSMN3R7-25YLC	25	4.25	10.1	3	370
PSMN4R0-25YLC	25	4.5	10.9	3.5	354
PSMN6R0-25YLB	25	6.7	9	2.6	337
PSMN6R5-25YLC	25	7.3	8.4	2.8	282
PSMN7R5-25YLC	25	8.4	7	2.2	255
PSMN9R0-25YLC	25	10.5	5.6	1.8	205
PSMN010-25YLC	25	11.9	5	1.5	166
PSMN012-25YLC	25	14.1	3.8	1.22	145

30 V NextPower types

Type	Voltage (V)	$R_{DS(on)}$typ V_{GS} = 4.5 V (mΩ)	Q_G(typ) V_{GS} = 4.5 V (nC)	Q_{GD}(typ) V_{GS} = 4.5 V (nC)	C_{OSS} (pF)
PSMN1R0-30YLC	30	1.1	50	14.6	1210
PSMN1R2-30YLC	30	1.35	38	11.6	977
PSMN1R5-30YLC	30	1.65	30	8.6	860
PSMN2R2-30YLC	30	2.3	26	8	651
PSMN2R6-30YLC	30	3.1	18	5.5	549
PSMN3R2-30YLC	30	3.75	14.2	4.1	432
PSMN3R7-30YLC	30	4.25	14	4.2	380
PSMN4R1-30YLC	30	4.75	11	3.5	316
PSMN4R5-30YLC	30	5.1	9.6	2.85	288
PSMN6R0-30YLB	30	6.9	9	2.6	278
PSMN7R0-30YLC	30	7.6	7.9	2.5	235
PSMN8R0-30YLC	30	8.5	7	2.3	207
PSMN9R5-30YLC	30	10.3	5	1.6	169
PSMN011-30YLC	30	12.3	4.9	1.4	151
PSMN013-30YLC	30	14.4	4	1.2	128

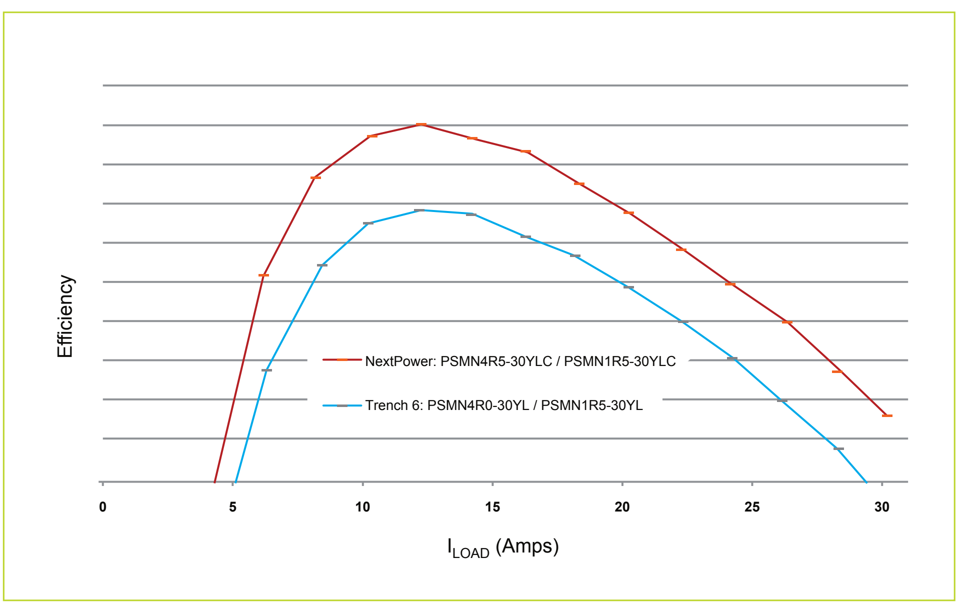
Benchmarking

Comparing NXP NextPower with NXP Trench 6 technology

Benchmark testing for NextPower types shows a 1% efficiency gain compared to equivalent Trench 6 types:

30 V NextPower types

Type	Voltage (V)	$R_{DS(on)}$typ V_{GS} = 4.5 V (mΩ)	Q_G(typ) V_{GS} = 4.5 V (nC)	Q_{GD}(typ) V_{GS} = 4.5 V (nC)	C_{OSS} (pF)
PSMN1R5-30YL	30	1.8	36	8.7	1082
PSMN1R5-30YLC	30	1.65	30	8.6	860
PSMN4R0-30YL	30	3.7	18	4.3	469
PSMN4R5-30YLC	30	5.1	9.6	2.85	288

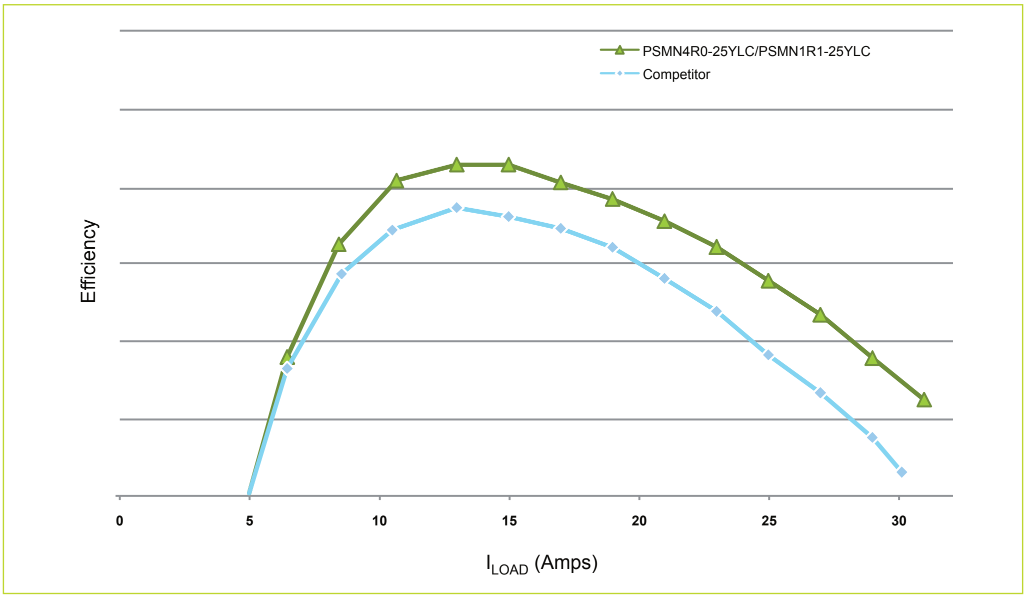


Test conditions

- Input Voltage: 12 V
- Output Voltage: 1.2 V
- 1 phase
- Frequency: 500 KHz
- Air flow: 200 LFM

Comparing NextPower with a leading competitor

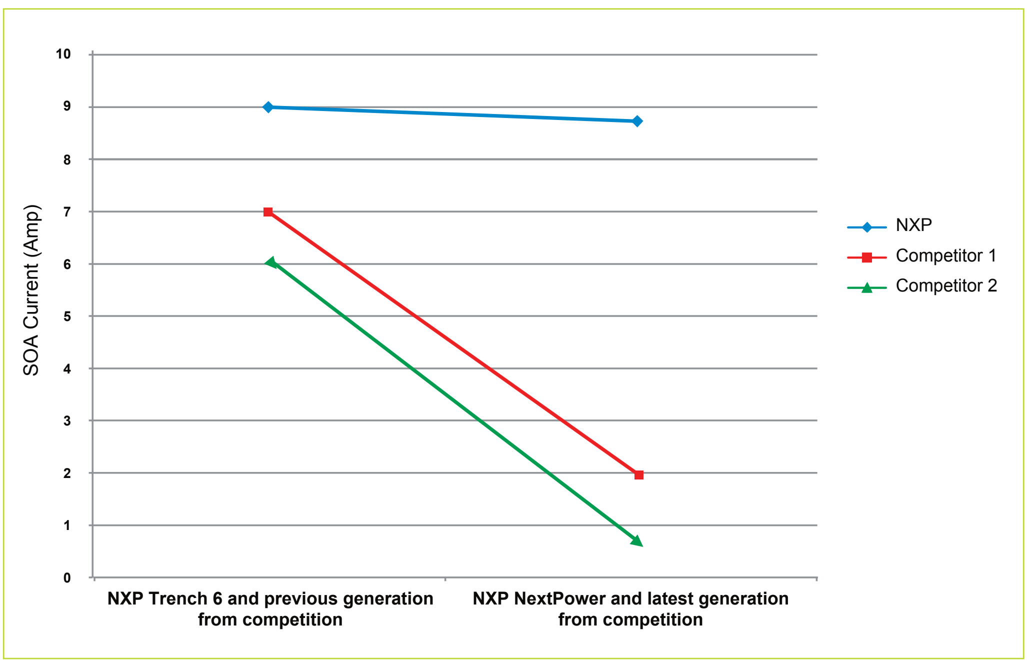
Benchmarking tests show that NextPower types deliver 1% efficiency gains compared to the nearest competitor types:



Test conditions

- Input Voltage: 12 V
- Output Voltage: 1.2 V
- 1 phase
- Frequency: 500 KHz
- Air flow: 200 LFM

Safe Operating Area comparison



Condition: SOA Drain current (Amp) @ V_{ds}=10 V, 10 ms pulse for a 5 mΩ (@ 10 V) in Power SO8

Why Choose LFPAK?

- Reduced electrical resistance and inductance
- Outstanding thermal performance
- Rugged design, qualified to AEC-Q101 (stringent automotive standard)
- Easy to handle, solder and inspect
- Power-SO8 footprint compatible

Part numbering for NXP MOSFETs

MOSFET BRAND NAME			MOSFET type N-ch or P-ch	MOSFET on-resistance $R_{DS(on)}$			-	MOSFET voltage BV_{DS}	Package type	Gate threshold voltage	NextPower special features
P	**S**	**M**	**N**	**1**	**R**	**7**	**-**	**25**	**Y**	**L**	**C**
Power Silicon Max			N = N-ch	R95 = 0.95 mΩ			-	25 = 25 V	B = D²PAK SOT404	L = Logic-level	C = Optimised for $Q_{g(fom)}$
			P = P-ch	1R7 = 1.7 mΩ			-	30 = 30 V	D = DPAK SOT428	S = Standard-level	B = integrated snubber
			X = Dual N-ch	014 = 14 mΩ			-	40 = 40 V	E = I²PAK SOT226		
			Y = Dual P-ch	125 = 125 mΩ			-	60 = 60 V	K = SO8 SOT96		
			Z = N-ch + P-ch				-	80 = 80 V	L = QFN3333 SOT873		
							-	100 = 100 V	P = TO220 SOT78		
							-	110 = 110 V	Y = LFPAK SOT669 & SOT1023		
							-	120 = 120 V	X = TO220F (FULLPACK) SOT186A		

www.nxp.com

Date of release: October 2011
Document order number: 9397 750 17191
Printed in the Netherlands