

The background features a dark gray field with several white geometric shapes. On the left, there is a large white shape resembling a stylized 'X' or a pair of opposing triangles meeting at a point. To its right, a white chevron shape points towards the center. In the bottom right corner, there is a white semi-circle.

**MOSFETs**

# P-channel MOSFETs in LFPAK



This program includes a series of P-channel MOSFETs in the popular LFPAK56 package

## Design benefit

- For high side drive no charge pump required
- Simple interface drive circuit
- Proven package technology LFPAK56 (SOT669)
- 100% footprint compatible to Power-SO8
- Superior reliability and quality

## Key technical features & portfolio

- Suitable for high temperature application - 175 °C T<sub>j</sub> max
- Automotive quality grade (AEC-Q101) available
- Low R<sub>DSon</sub> version available
- Portfolio expansion planned

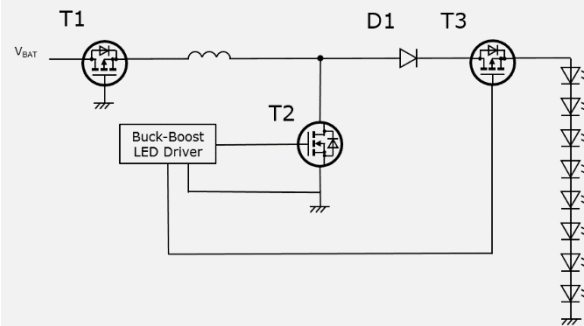
Automotive	Industrial	V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	R <sub>DSon</sub> max (mΩ) @ V <sub>GS</sub>	
				10 V	4.5 V
BUK4YxRx-20P	-	20	12		~6.5
BUK4Yxx-20P	-	20	12		~11
BUK6Y12-30P	PSMP012-30YE	30	20	12	
BUK6Y20-30P	PSMP020-30YE	30	20	20	
BUK6Y15-40P	PSMP015-40YE	40	20	15	
BUK6Y25-40P	PSMP025-40YE	40	20	25	
BUK6Y32-60P	PSMP032-60YE	60	20	32	
BUK6Y57-60P	PSMP057-60YE	60	20	57	

## Functions & applications

- Reverse battery protection
- Load switch: high-side switch in low frequency, EMC sensitive applications
- Buck converter for low power non-isolated point of loads

## Application diagram

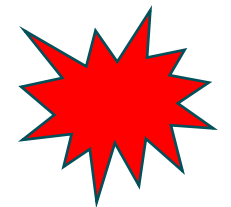
- Reverse battery protection
- Power switch



## Available packages (W x L x H in mm)



MOSFETs



# Small signal low $R_{DSon}$ MOSFETs



This program includes a comprehensive portfolio of automotive small signal low  $R_{DSon}$  MOSFETs (<1 Ohm)

## Design benefit

- Largest portfolio of automotive small signal low  $R_{DSon}$  MOSFETs on the market
- Full automotive compliance (AEC-Q101)
- growing portfolio in leaded and DFN packages
- Products available with 175 °C  $T_j$  max

## Key technical features & portfolio

- Most parts with ESD robustness of 2kV
- $R_{DSon}$  down to 15 m $\Omega$  and up to 6 A max drain current
- Available  $V_{DS}$  voltages of 20, 30, 40, 60, 70, 80 Volt

part number	package	polarity
PMNxxx(x)EN(E)A	SOT457	N
PMNxxxP(E)A	SOT457	P
PMVxx(x)xN(E)A	SOT23	N
PMVxx(x)xP(E)A	SOT23	P
PMPBxxxN(E)A	SOT1220	N
PMPBxxxP(E)A	SOT1220	P
BUKxDxx-x0E	SOT1220	N
BUK6Dxx(x)-x0P	SOT1220	P
PMTxxxENEA	SOT223	N

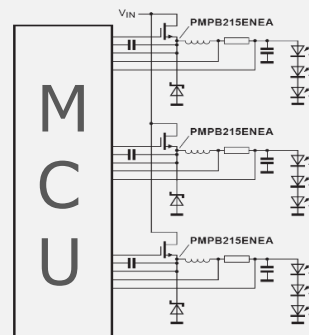
## Functions & applications

Load switches in power management functions of:

- Body control units like doors, window lift, seat control ...
- Entertainment systems
- Safety and control systems like air bag, LED lighting ...

## Application diagram

- Automotive LED lighting with PMPB215ENEA in DFN2020MD-6 (NXP\_reference design)



## Available packages (W x L x H in mm)

Package	SOT223 (SC-73)	SOT457 (SC-74)	SOT323 (SC-70)	DFN2020MD-6 (SOT1220)
Size (mm)	6.5 x 3.5 x 1.65	2.9 x 1.5 x 1.0	2.0 x 1.25 x 0.95	2.0 x 2.0 x 0.65
$P_{tot}$ (mW)	1700	600	200	1250

# MOSFETs in DFN0606

Smallest package with 0.35 mm pitch

## Design benefit

- Same performance as larger package on smallest footprint.
- Ideal for mobile and space-constraint application
- Broad portfolio in N-channel and P-channel
- 2N7002 functionality in DFN0606

## Key technical features & portfolio

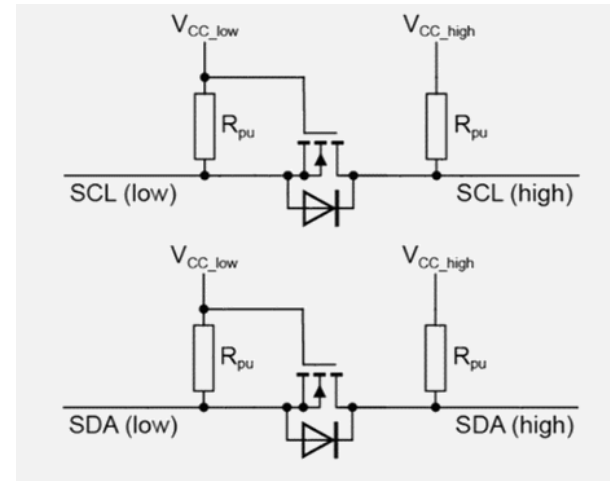
- Leadless ultra small package DFN0606-3
- Lowest  $R_{DSon}$  in the market (in development) down to 170m $\Omega$
- Low voltage drive ( $V_{GS(th)} = 0.7$  V typ)
- Voltage range of 20 V to 60 V

part number	pol	$R_{DSon}$ typ (m $\Omega$ ) @ $V_{GS} = 4.5$ V	$V_{DS}$ (V)	$V_{GS}$ (V)	$V_{GSth}$ min (V)	$V_{GSth}$ max (V)	ESD robustness (kV)
PMH600UNE	N	470	20	8	0.45	0.95	1
PMH550UNE		550	30	8	0.45	0.95	2
NX7002BKH		2500	60	20	1.10	1.20	2
PMH950UPE	P	1020	20	8	0.45	0.95	1
PMH1200UPE		1200	30	10	0.45	0.95	2

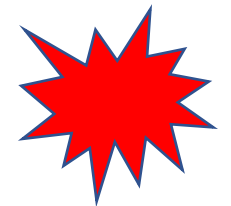
## Functions & applications

- Mobile phone
- Wearable, portable devices
- Cell phone accessories
- E-cigarette

## Application diagram



## Available packages (W x L x H in mm)



# MOSFETs in WLCSP

Optimal  $R_{DSon}$  to space ratio

## Design benefit

- Ultra small package, PCB space saving
- Highest efficiency by electrical performance
- Higher performance compared to leadless DFN packages

## Key technical features & portfolio

- N-channel and P-channel version available
- Lowest  $R_{DSon}$  per  $mm^2$
- WLCSP 4 balls with low  $R_{DSon}$  and smallest footprint
- WLCSP 6 balls with lowest  $R_{DSon}$  and small footprint
- ESD protection above 2kV HBM

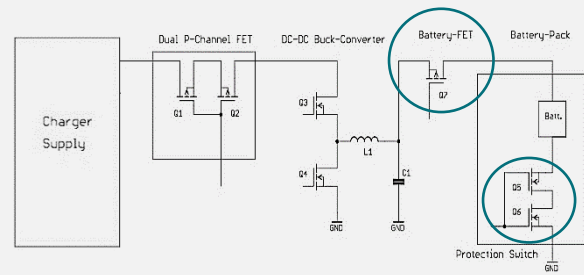
Portfolio	Package	PoI
PMCM440xxxE	WLCSP4	N-channel and P-channel
PMCM6501xxE	WLCSP6	N-channel and P-channel

## Functions & applications



- Load switching for mobile devices
- Battery switch
- LED driver
- High-speed line driver

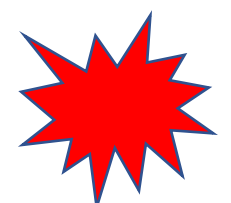
## Application diagram

- Control FET
- Battery MOSFET: very low  $R_{DSon}$  required in DFN or WLCSP packages ( $R_{DSon} < 20\text{ m}\Omega$ )
- protection: 20..30V common drain CSP MOSFETs, very low  $R_{DSon}$  (2-5  $m\Omega$   $R_{SSon}$ )



## Available packages (W x L x H in mm)

WLCSP4	WLCSP6
	
0.78 x 0.78 x 0.345	1.48 x 0.98 x 0.345



# Trench 9 Automotive MOSFETs in LFPAK



High performance Automotive grade MOSFETS in clip bonded packages

## Design benefit

- Beyond automotive AEC-Q101 qualified to 175°C
- Combining the clip bond LFPAK package and the low  $R_{DSon}$  Trench 9 technology to enable improved power density
- Trench 9 superjunction technology for improved avalanche robustness to enable easier designs and improved reliability.
- Improved  $V_{GS(th)}$  for better paralleling of MOSFETs in increased power requirement applications.

## Key technical features & portfolio

- New portfolio of 40V Trench 9 MOSFETS
- Low  $R_{DSon}$  from 0.7 – 6.0 mΩ in various LFPAK packages
- SOT1023 (LFPAK56E), SOT669 (LFPAK56), SOT1235 (LFPAK88) and SOT1210 (LFPAK33)

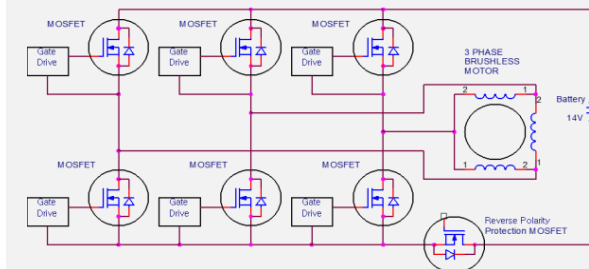
Portfolio	Voltage	$R_{DSon}$ mΩ	Package
BUK7J1R0-40H	40 V	1.0 mΩ	LFPAK56E
BUK7Y1R4-40H	40 V	1.4 mΩ	LFPAK56
BUK9Y1R6-40H	40 V	1.6 mΩ	LFPAK56
BUK7S1R0-40H	40 V	1.0 mΩ	LFPAK88
BUK7S0R9-40H	40 V	0.9 mΩ	LFPAK88
BUK7S0R7-40H	40 V	0.7 mΩ	LFPAK88
BUK7M3R3-40H	40 V	3.3 mΩ	LFPAK33
BUK7M6R0-40H	40 V	6.0 mΩ	LFPAK33

## Functions & applications


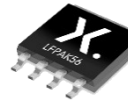


- Motor control (BLDC, braking, steering)
- DCDC
- Reverse battery protection
- Engine fans and pumps
- Engine management

## Application diagram

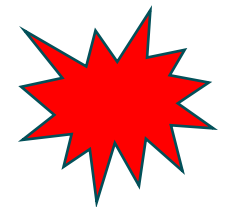
e.g. BLDC Motor



## Available packages (W x L x H in mm)

LFPAK56E (SOT1023)	LFPAK56 (SOT669)	LFPAK88 (SOT1235)
		
5.0 x 6.0 x 1.0	5.0 x 6.0 x 1.0	8.0 x 8.0 x 1.6
LFPAK33 (SOT1210)		
		
3.3 x 3.3 x 0.85		

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# Trench 6 Automotive MOSFETs in LFPAK33

High performance copper clip MOSFETs for engine control systems

## Design benefit

- Fully automotive AEC-Q101 qualified to 175°C
- Combination of Trench 6 silicon technology in clip bonded LFPAK33 package
- Products offers low switching losses and low R<sub>th</sub> performance
- Benchmark R<sub>th</sub> for thermally demanding applications
- Strong fault condition tolerance due to technology features

## Key technical features & portfolio

- Broad portfolio offering 30V – 100V Trench 6 MOSFETS
- Logic Level and Standard Level gate
- Strong focus at 60V 9.9 – 85mΩ
- Clip bond LFPAK33 Package

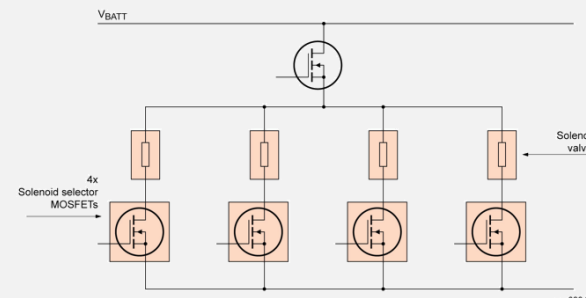
Portfolio	Voltage	R <sub>DSon</sub> mΩ	Package
BUK9M12-60E	60V	12 mΩ	LFPAK33
BUK9M15-60E	60V	15 mΩ	LFPAK33
BUK9M19-60E	60V	16 mΩ	LFPAK33
BUK9M24-60E	60V	24 mΩ	LFPAK33
BUK9M42-60E	60V	42 mΩ	LFPAK33
BUK9M53-60E	60V	53 mΩ	LFPAK33
BUK9M85-60E	60V	73 mΩ	LFPAK33

## Functions & applications

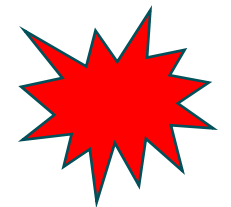
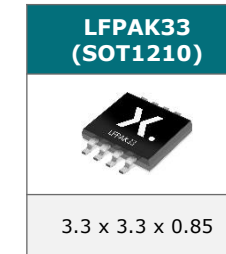
- Engine control systems
- Solenoid Control
- Reverse battery protection
- Engine fans and pumps
- Auxiliary loads & motor control

## Application diagram

e.g. Engine Management



## Available packages (W x L x H in mm)



# NextPowerS3 low $R_{DSon}$ 25V & 30V

Market leading  $R_{DSon}$  performance

## Design benefit

- Optimized for low  $R_{DSon}$
- Max current up to 380A
- Best-in-class Safe Operating Area (SOA)
- Copper-clip for excellent thermal performance
- High reliability LPAK package, qualified to 175 °C
- Wave solderable; exposed leads for optimal solder coverage and visual solder inspection

## Key technical features & portfolio

- Available in 25V and 30V
- Three package variants; LPAK33 (SOT1210), LPAK56 (SOT669) and LPAK56E (SOT1023)

Portfolio	Voltage	$R_{DSon}$ (max) @ $V_{GS} = 10\text{ V}$	Package
PSMN1R5-25MLH	25 V	1.55 mΩ*	LPAK33
PSMNR60-25YLH	25 V	0.64 mΩ*	LPAK56
PSMNR51-25YLH	25 V	0.61 mΩ*	LPAK56E
PSMN1R6-30MLH	30 V	1.9 mΩ	LPAK33
PSMNR70-30YLH	30 V	0.82 mΩ	LPAK56
PSMNR58-30YLH	30 V	0.67 mΩ*	LPAK56E

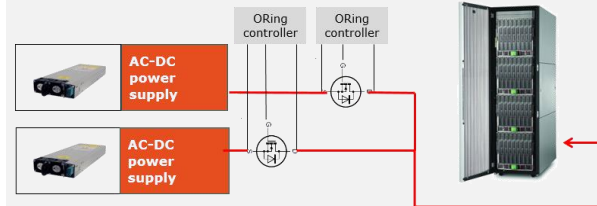
\* Preliminary data

## Functions & applications

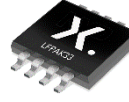

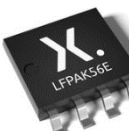
- Power OR-ing
- Battery protection
- Hot-swap
- e-Fuse
- DC switch / Load switch
- Brushed and brushless motor control
- Synchronous rectification in AC-DC and DC-DC applications

## Application diagram

e.g. Power OR-ing allows redundant power supplies to be coupled in high reliability applications



## Available packages (W x L x H in mm)

LPAK33 (SOD1210)	LPAK56 (SOD669)	LPAK56E (SOT1023)
		
3.3 x 3.3 x 0.9	5.0 x 6.0 x 1.0	5.0 x 6.0 x 1.0

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# NextPower 100V

Market leading  $Q_{rr}$  performance

## Design benefit

- Low  $Q_{rr}$  for higher efficiency and lower spiking
- Low  $Q_G \times R_{DSon}$  FOM for high efficiency switching applications
- Strong avalanche energy rating (Eas)
- Avalanche rated and 100% tested
- Ha-free and RoHS compliant LFPAK56 package
- Wave-solderable LFPAK56 package

## Key technical features & portfolio

- New 100V portfolio
- packages: LFPAK56 (SOT669) and LFPAK56E (SOT1023)

Portfolio	Voltage	$R_{DSon}$ (max) @ $V_{GS} = 10\text{ V}$	Package
PSMN3R9-100YSF	100 V	4.3 m $\Omega$ *	LFPAK56E
PSMN5R6-100YSF	100 V	5.6 m $\Omega$ *	LFPAK56E
PSMN6R9-100YSF	100 V	7 m $\Omega$	LFPAK56
PSMN8R7-100YSF	100 V	9 m $\Omega$	LFPAK56
PSMN011-100YSF	100 V	10.9 m $\Omega$ *	LFPAK56

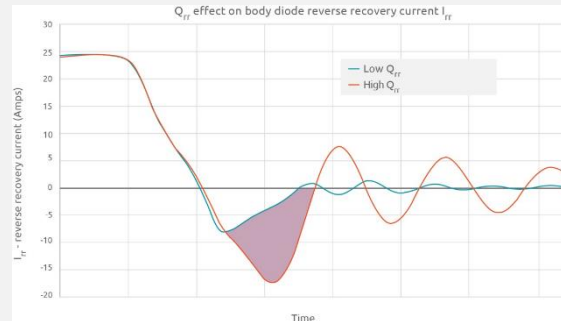
\* Preliminary data

## Functions & applications


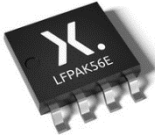
- Synchronous rectifier in AC:DC & DC:DC
- Primary side switch – 48 V DC:DC
- BLDC motor control
- USB-PD adapters
- Full-bridge and half-bridge applications
- Flyback and resonant topologies

## Application performance

Simulations show that choosing a MOSFET with 2x  $Q_{rr}$  increases voltage spiking by 8% and reduces efficiency by 5%



## Available packages (W x L x H in mm)

LFPAK56 (SOD669)	LFPAK56E (SOT1023)
	
5.0 x 6.0 x 1.0	5.0 x 6.0 x 1.0

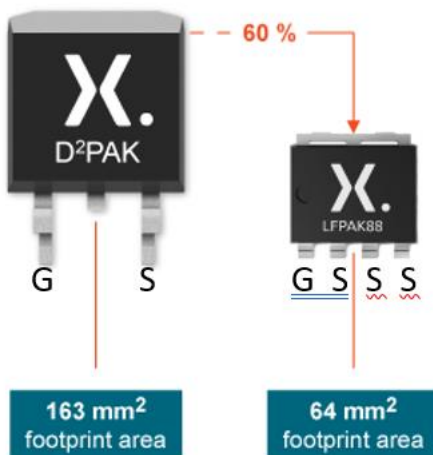
## Additional information

- [Benefits of Low  \$Q\_{rr}\$  MOSFETs in switching applications \(Quick Learning video\)](#)
- [Benefits of low  \$Q\_{rr}\$  MOSFETs in motor control applications \(Quick Learning video\)](#)
- [\$Q\_{rr}\$ : overlooked and underappreciated in efficiency battle \(Blog post\)](#)

# NextPowerS3 40V LFPAK88

Driving power-density to the next level

## Space saving footprint - D2PAK Vs LFPAK88



- 60% footprint reduction
- 65% height reduction
- 86% space reduction
- Gate-compatible with D2PAK

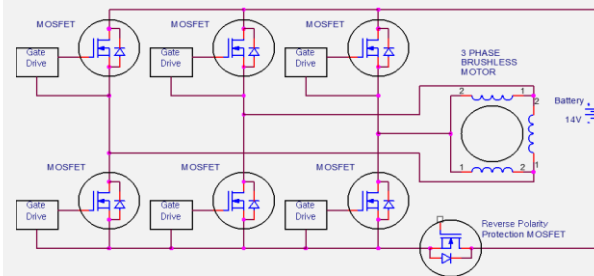
Portfolio	Voltage	$R_{DSon} \text{ (max)}$ @ $V_{GS} = 10 \text{ V}$	Package
PSMNR70-40SSH	40 V	0.7 m $\Omega$	LFPAK88
PSMNR90-40SSH	40 V	0.9 m $\Omega$	LFPAK88
PSMN1R0-40SSH	40 V	1.0 m $\Omega$	LFPAK88

## Functions & applications

- BLDC motor control
- Battery protection
- e-Fuse
- Power OR-ing
- Synchronous rectification

## Application diagram

e.g. BLDC Motor



## Package details (W x L x H in mm)



MOSFETS



EFFICIENCY WINS.