

# Automotive N-Channel MOSFETs

Green and robust



INFINEON TECHNOLOGIES consistently develops silicon technologies and assembly processes to better serve the automotive industry, setting the standard for quality and reliability.

AS A PART OF the Automotive Excellence™ program, our latest automotive MOSFETs are green and robust. “Green” enables solutions in compliance with RoHS/WEEE guidelines, and “robust” improves the reliability of both the component and the application.

THE ROBUST PACKAGE allows Automotive MOSFETs to sustain 260°C GREEN reflow processes at MSL1 and still pass automotive qualification. No special handling or dry-pack is needed. Real world performance confirms Infineon has extended the lead in MOSFET quality and reliability.

NEW OptiMOS™ -T AND OptiMOS™ -T2 trench technologies have been launched to address the latest automotive applications. These new trench products will exist alongside the current existing OptiMOS™ products.





OptiMOS™ – THE WELL-ESTABLISHED and continuously extended OptiMOS portfolio provides top quality, outstanding, robust and high-current capabilities. The OptiMOS devices are available in 30 V, 40 V, 55 V and 75 V in several packages.

THE 30 V OptiMOS™-T2 FAMILY includes a 2 mΩ 90 A DPAK which can be used for reverse battery protection and bridge topologies.

THE 40 V OptiMOS™-T FAMILY includes a sub-2 mΩ 180 A D<sup>2</sup>PAK and a 3.8 mΩ 90 A DPAK. The 40 V technology is well suited for electrical power steering, wipers, electric parking brake, fuel pump and any other PWM motor bridge topology.

THE 55 V OptiMOS™-T FAMILY includes a 3 mΩ 100 A D<sup>2</sup>PAK and a 5 mΩ 90 A DPAK. The 55 V technology adroitly handles valves, solenoids, lighting, single-ended motors and other general purpose automotive loads.

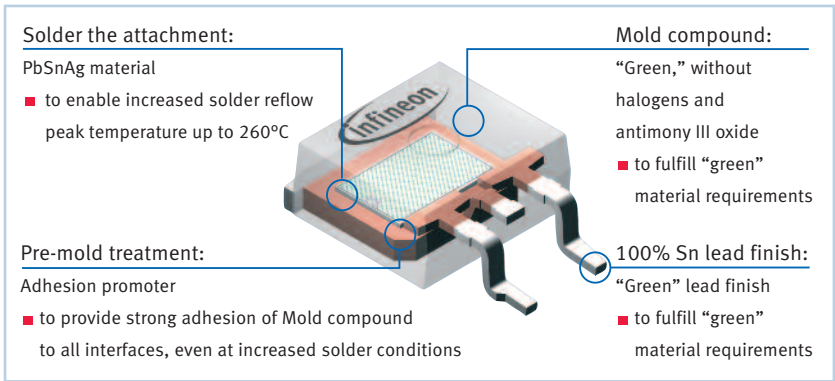
THE 100 V OptiMOS™-T FAMILY includes a 5 mΩ 120 A D<sup>2</sup>PAK to provide low  $R_{DS(on)}$  MOSFET for direct diesel injection, direct gasoline injection, camless engine, boosted systems and direct injection.

THE 30 V OptiMOS™-T and OptiMOS™-T2 P-CHANNEL PFET address the growing need for reverse battery protection without requiring a charge pump or ground path limitation. The PFET can be connected above the load to allow low-loss forward conduction and also prevent current flow in the event of reverse battery connection. The new OptiMOS™-T2 PFET provides 4 mΩ, 90 A in DPAK .

THE DUAL SUPER SO8 PACKAGE was recently launched to provide higher levels of integration and lower system costs. The initial products launched in OptiMOS™-T 55 V technology. These products are optimized for ABS, powertrain and body control and can significantly reduce PCB area.

THESE NEW MOSFET TECHNOLOGIES are optimized for low  $R_{DS(on)}$ , high current and robustness to provide the best possible balance of reliability, performance and price.

# Robust package



Green and robust package

## Automotive MOSFET green and robust package

IN ORDER TO cope with the new RoHS (Restriction of the use of Hazardous Substances Directive) and WEEE (Waste Electrical and Electronic Equipment) regulations, the electronics industry is moving from lead-based (Pb) to lead-free (Pb-free) Printed Circuit Board (PCB) solder. The Pb-free solders require higher solder reflow temperatures. Infineon Green and Robust MOSFETs can sustain up to 260°C peak reflow temperatures and still pass full AEC-Q101 qualification. The consequence of this increased temperature stress with a standard package is delamination of the Mold compound (MC), which creates an air void between the MC and metallic interfaces (chip, lead-frame or pins). Depending on the severity, this can result in reduced lifetime or total failure. Infineon’s robust package was developed to fulfill the increased Pb-free solder reflow temperatures with increased reliability. Furthermore, Infineon’s Green and Robust package is fully compatible with existing Pb-based solder processes without any process modification.

# OptiMOS™-T 55 V in Dual Super SO8



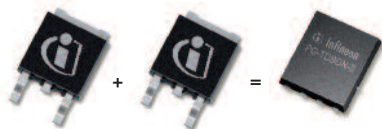
## OptiMOS™-T 55V in Dual Super SO8 complete product portfolio:

OptiMOS™-T 55 V	max $R_{DS(on)}$ (mOhm)	ID(A)	max $R_{th(j)}$ (K/W)	Package*
IPG 20N06S3L-23	2 X 23	20	3.3	⑧
IPG 20N06S3L-35	2 X 35	20	5.0	⑧
IPG 15N06S3L-45	2 X 45	15	7.0	⑧

\* See packages on page 15

## About the package:

- One Dual Super SO8 package is 5.515 mm<sup>2</sup> x 6.15 mm<sup>2</sup> or ~32 mm<sup>2</sup>
- Single DPAK has a footprint of 6.5 mm<sup>2</sup> x 10 mm<sup>2</sup> or 65 mm<sup>2</sup>
- One Dual Super SO8 can replace 2 DPAKs so area will be reduced from 130 mm<sup>2</sup> to 32 mm<sup>2</sup>
- 4x reduction in PCB area and 2x reduction in part count
- Dual Super SO8 can replace two existing OptiMOS™ DPAK products for system level cost reduction (significant PCB area savings):

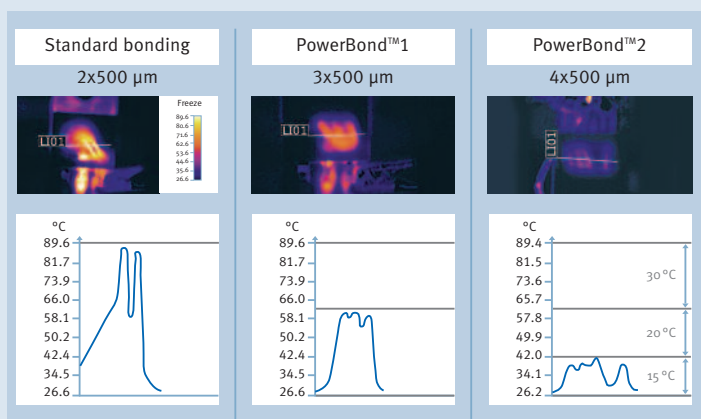


- 2 Types S/IPD 15N06S2L-64 in DPAK to 1 type IPG 15N06S3L-45 in TDSO8
- 2 Types S/IPD 26N06S2L-35 in DPAK to 1 type IPG 20N06S3L-35 in TDSO8
- 2 Types S/IPD 26N06S2L23 in DPAK to 1 type IPG 20N06S3L-23 in TDSO8

# PowerBond™

POWERBOND™ is Infineon's high-current wirebond technology. It addresses the bondwire limitation in a MOSFET's current rating.

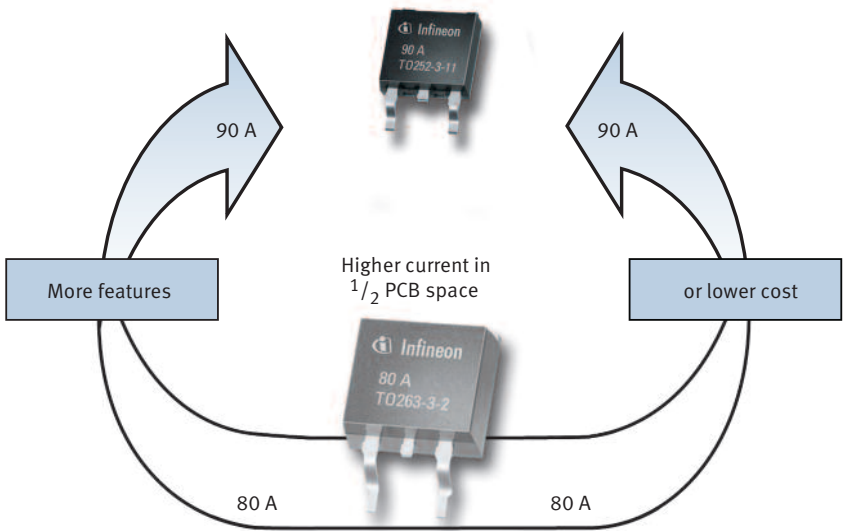
POWERBOND™ reduces the  $R_{DS(on)}$  drop of the bondwires and increases the current capability. This also improves the reliability by keeping the wirebonds cooler, even with high currents.



Infrared picture of the source bondwires after a current pulse of 120 A for 1 second

POWERBOND™ ALLOWS up to four double-stitch 500  $\mu\text{m}$  wirebonds in a single MOSFET which permits a 180 A current rating in a TO263 7-lead package. This technology is especially suitable for high-current applications like electrical power steering, starter alternators, variable engine valves or electrical turbochargers.

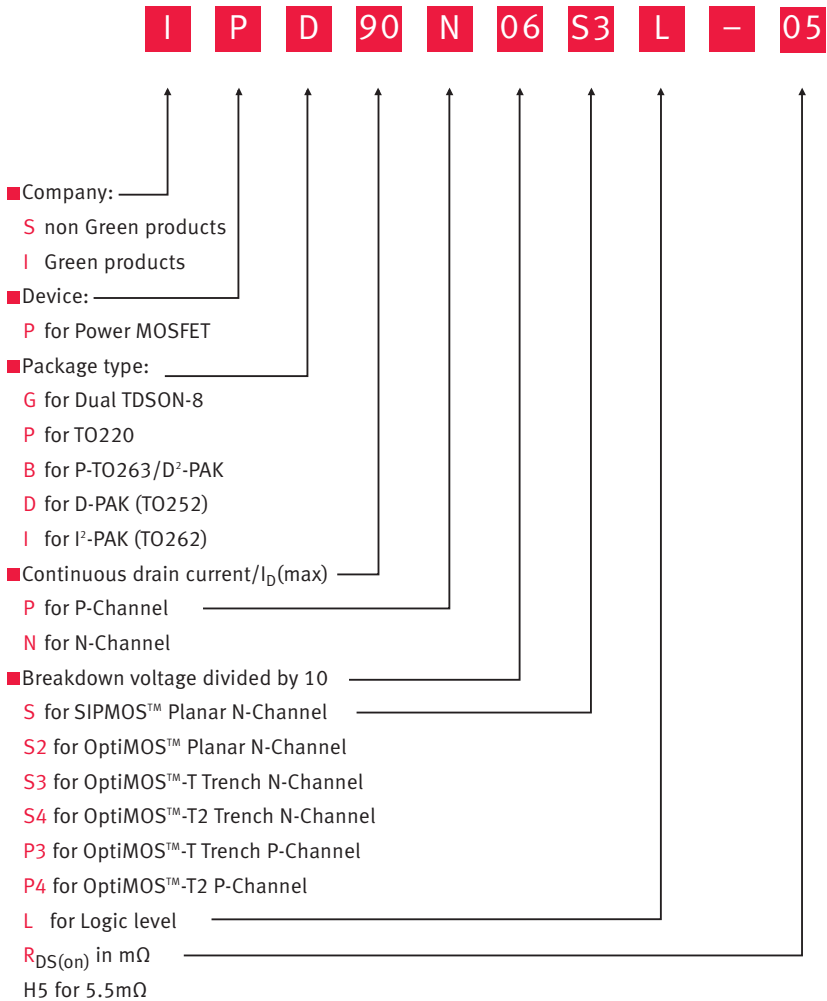
## DPAK replaces D<sup>2</sup>PAK



H-BRIDGE AND 3-PHASE MOTORS use 4 or 6 MOSFETs in the output stage. These motors require inrush currents 6-10 times higher than run current. A 10 A DC brush motor with an 80 A inrush current would then use 4 D<sup>2</sup>PAK MOSFETs. Changing the D<sup>2</sup>PAKs to DPAKs would reduce the required PCB area by 50 % and save significant costs.

WITH INFINEON'S POWERBOND TECHNOLOGY, the DPAK can provide 90 A of current without bondwire or package limitation. This will allow an 80 A D<sup>2</sup>PAK to be replaced with a 90 A DPAK and achieve a 12 % increase in output current.

# Naming system



All automotive MOSFETs beginning with the letter “I” are robust and green with full RoHS compliance



# Automotive N-Channel MOSFET

## OptiMOS™ 30 V (Planar)

Type	Green	max. $R_{DS(on)}$ [mΩ]	$I_D$ [A]	max. $R_{thJC}$ [K/W]	Package*
IPD 50N03S2L-06	✓	6.4	50	1.1	③
IPD 30N03S2L-07	✓	6.7	30	1.1	③
IPD 50N03S2-07	✓	7.3	50	1.1	③
IPD 30N03S2L-10	✓	10.0	30	1.5	③
IPD 30N03S2L-20	✓	20.0	30	2.5	③

\* See packages on page 15

## OptiMOS™-T2 30 V (Trench)

Type	Green	max. $R_{DS(on)}$ [mΩ]	$I_D$ [A]	max. $R_{thJC}$ [K/W]	Package*
IPD 90N03S4L-02	✓	2.2	90	1.1	③
IPD 90N03S4L-03	✓	3.0	90	1.6	③
IPD 70N03S4L-04	✓	4.3	70	2.2	③
IPD 50N03S4L-06	✓	6.0	50	2.7	③
IPD 30N03S4L-09	✓	9.0	30	3.6	③
IPD 30N03S4L-14	✓	13.6	30	4.9	③
IPP/I 80N03S4L-03	✓	2.6	80	1.1	①, ②
IPP/I 80N03S4L-04	✓	3.7	80	1.6	①, ②
IPP/I 22N03S4L-15	✓	14.9	22	4.9	①, ②
IPB 80N03S4L-02	✓	2.3	80	1.1	④
IPB 80N03S4L-03	✓	3.4	80	1.6	④
IPB 22N03S4L-15	✓	14.6	22	4.9	④

\* See packages on page 15

## OptiMOS™ 55 V (Planar)

Type	Green	max. $R_{DS(on)}$ [mΩ]	$I_D$ [A]	max. $R_{thJC}$ [K/W]	Package*
IPD 30N06S2L-13	✓	12.7	30	1.1	③
IPD 50N06S2L-13	✓	13.0	50	1.1	③
IPD 50N06S2-14	✓	14.4	50	1.1	③
IPD 30N06S2-15	✓	14.7	30	1.1	③
IPD 30N06S2L-23	✓	23.0	30	1.5	③
IPD 30N06S2-23	✓	23.0	30	1.5	③
IPD 26N06S2L-35	✓	35.0	26	2.2	③
IPD 25N06S2-40	✓	40.0	25	2.2	③
IPD 15N06S2L-64	✓	64.0	15	3.2	③
IPD 14N06S2-80	✓	80.0	14	3.2	③
IPP 100N06S2L-05	✓	4.7	100	0.5	①
IPP/I 80N06S2L-05	✓	4.8	80	0.5	①, ②
IPP 100N06S2-05	✓	5	100	0.5	①
IPP 80N06S2-05	✓	5.1	80	0.5	①
IPP 80N06S2L-H5	✓	5.3	80	0.5	①
IPP 80N06S2-H5	✓	5.5	80	0.5	①
IPP 80N06S2L-06	✓	6.3	80	0.6	①
IPP/I 80N06S2-07	✓	6.6	80	0.6	①, ②
IPP 80N06S2L-07	✓	7	80	0.7	①
IPP/I 80N06S2-08	✓	8	80	0.7	①, ②
IPP 80N06S2L-09	✓	8.5	80	0.8	①
IPP 80N06S2-09	✓	9.1	80	0.8	①
IPP 80N06S2L-11	✓	11	80	0.95	①
IPP 77N06S2-12	✓	12	77	0.95	①
IPB 100N06S2L-05	✓	4.4	100	0.5	④
IPB 80N06S2L-05	✓	4.5	80	0.5	④
IPB 100N06S2-05	✓	4.7	100	0.5	④
IPB 80N06S2-05	✓	4.8	80	0.5	④
IPB 80N06S2L-H5	✓	5	80	0.5	④
IPB 80N06S2-H5	✓	5.5	80	0.5	④
IPB 80N06S2L-06	✓	6.3	80	0.6	④
IPB 80N06S2-07	✓	6.6	80	0.6	④
IPB 80N06S2L-07	✓	7	80	0.7	④
IPB 80N06S2-08	✓	8	80	0.7	④
IPB 80N06S2L-09	✓	8.5	80	0.8	④
IPB 80N06S2-09	✓	9.1	80	0.8	④
IPB 80N06S2L-11	✓	11	80	0.95	④
IPB 77N06S2-12	✓	12	77	0.95	④
BSP 603S2L	✓	33.0	5.2	16	⑥
BSP 615S2L	✓	90.0	2.8	18	⑥
BSO 604NS2	✓	35.0 x 2	5.0	5.0	⑦

# Automotive N-Channel MOSFET

## OptiMOS™-T 55 V (Trench)

Type	Green	max. $R_{DS(on)}$ [mΩ]	$I_D$ [A]	max. $R_{thJC}$ [K/W]	Package*
IPD 90N06S3L-05	✓	5.0	90	1.1	③
IPD 90N06S3-06	✓	6.0	90	1.1	③
IPD 50N06S3L-06	✓	6.0	50	1.1	③
IPD 50N06S3-07	✓	6.9	50	1.1	③
IPD 90N06S3L-07	✓	7.1	90	1.4	③
IPD 50N06S3L-08	✓	7.8	50	1.4	③
IPD 80N06S3-09	✓	8.4	80	1.4	③
IPD 50N06S3-09	✓	9.0	50	1.4	③
IPD 50N06S3L-13	✓	12.6	50	2.3	③
IPD 50N06S3-15	✓	15.0	50	2.3	③
IPD 30N06S3L-20	✓	20.0	30	3.3	③
IPD 30N06S3-24	✓	24.0	30	3.3	③
IPP/I 100N06S3L-03	✓	3.0	100	0.5	①, ②
IPP/I 100N06S3-03	✓	3.3	100	0.5	①, ②
IPP/I 100N06S3L-04	✓	3.8	100	0.7	①, ②
IPP/I 100N06S3-04	✓	4.4	100	0.7	①, ②
IPP/I 80N06S3L-05	✓	4.8	80	0.9	①, ②
IPP/I 80N06S3-05	✓	5.4	80	0.9	①, ②
IPP/I 80N06S3L-06	✓	5.9	80	1.1	①, ②
IPP/I 80N06S3-07	✓	6.8	80	1.1	①, ②
IPP/I 80N06S3L-08	✓	7.9	80	1.4	①, ②
IPP/I 77N06S3-09	✓	9.1	77	1.4	①, ②
IPP/I 45N06S3L-13	✓	13.4	45	2.3	①, ②
IPP/I 45N06S3-16	✓	15.7	45	2.3	①, ②
IPP/I 25N06S3L-22	✓	21.6	25	3.3	①, ②
IPP/I 25N06S3-25	✓	25.1	25	3.3	①, ②
IPB 100N06S3L-03	✓	2.7	100	0.5	④
IPB 100N06S3-03	✓	3.0	100	0.5	④
IPB 100N06S3L-04	✓	3.5	100	0.7	④
IPB 100N06S3-04	✓	4.1	100	0.7	④
IPB 80N06S3L-05	✓	4.5	80	0.9	④
IPB 80N06S3-05	✓	5.1	80	0.9	④
IPB 80N06S3L-06	✓	5.6	80	1.1	④
IPB 80N06S3-07	✓	6.5	80	1.1	④
IPB 80N06S3L-08	✓	7.6	80	1.4	④
IPB 77N06S3-09	✓	8.8	77	1.4	④
IPB 45N06S3L-13	✓	13.1	45	2.3	④
IPB 45N06S3-16	✓	15.4	45	2.3	④
IPB 25N06S3L-22	✓	21.3	25	3.3	④
IPB 25N06S3-25	✓	24.8	25	3.3	④
IPG 15N06S3L-45	✓	45 x 2	15	7.0	⑧
IPG 20N06S3L-35	✓	35 x 2	20	5.0	⑧
IPG 20N06S3L-23	✓	23 x 2	20	3.3	⑧

\* See packages on page 15



## OptiMOS™ 40 V (Planar)

Type	Green	max. $R_{DS(on)}$ [mΩ]	$I_D$ [A]	max. $R_{thJC}$ [K/W]	Package*
IPP 100N04S2L-03	✓	3.3	100	0.5	(1)
IPP 80N04S2L-03	✓	3.4	80	0.5	(1)
IPP 100N04S2-04	✓	3.6	100	0.5	(1)
IPP/I 80N04S2-04	✓	3.7	80	0.5	(1),(2)
IPP/I 80N04S2-H4	✓	4	80	0.5	(1),(2)
IPB 160N04S2L-03	✓	2.7	160	0.5	(5)
IPB 160N04S2-03	✓	2.9	160	0.5	(5)
IPB 100N04S2L-03	✓	3.0	100	0.5	(4)
IPB 80N04S2L-03	✓	3.1	80	0.5	(4)
IPB 100N04S2-04	✓	3.3	100	0.5	(4)
IPB 80N04S2-04	✓	3.4	80	0.5	(4)
IPB 80N04S2-H4	✓	4	80	0.5	(4)

## OptiMOS™-T 40 V (Trench)

Type	Green	max. $R_{DS(on)}$ [mΩ]	$I_D$ [A]	max. $R_{thJC}$ [K/W]	Package*
IPD 90N04S3-04	✓	3.6	90	1.1	(3)
IPD 90N04S3-H4	✓	4.3	90	1.2	(3)
IPD 80N04S3-06	✓	5.2	90	1.5	(3)
IPD 70N04S3-07	✓	6.0	82	1.9	(3)
IPD 50N04S3-08	✓	7.5	50	2.2	(3)
IPD 50N04S3-09	✓	9.0	50	2.3	(3)
IPP/I 120N04S3-02	✓	2.3	120	0.5	(1),(2)
IPP/I 100N04S3-03	✓	2.8	100	0.7	(1),(2)
IPP/I 80N04S3-03	✓	3.5	80	0.8	(1),(2)
IPP/I 80N04S3-04	✓	4.1	80	1.1	(1),(2)
IPP/I 80N04S3-H4	✓	4.8	80	1.2	(1),(2)
IPP/I 80N04S3-06	✓	5.7	80	1.5	(1),(2)
IPP/I 70N04S3-07	✓	6.5	80	1.9	(1),(2)
IPB 180N04S3-02	✓	1.5	180	0.5	(5)
IPB 120N04S3-02	✓	2.0	120	0.5	(4)
IPB 160N04S3-H2	✓	2.1	160	0.7	(5)
IPB 100N04S3-03	✓	2.5	100	0.7	(4)
IPB 80N04S3-03	✓	3.2	80	0.8	(4)
IPB 80N04S3-04	✓	3.8	80	1.1	(4)
IPB 80N04S3-H4	✓	4.5	80	1.2	(4)

\* See packages on page 15



## OptiMOS™-T 40 V (Trench)

Type	Green	max. $R_{DS(on)}$ [mΩ]	$I_D$ [A]	max. $R_{thJC}$ [K/W]	Package*
IPB 80N04S3-06	✓	5.4	80	1.5	④
IPB 70N04S3-07	✓	6.2	80	1.9	④

## OptiMOS™ 75 V (Planar)

Type	Green	max. $R_{DS(on)}$ [mΩ]	$I_D$ [A]	max. $R_{thJC}$ [K/W]	Package*
IPD 30N08S2L-21	✓	20.5	30	1.1	③
IPD 30N08S2-22	✓	21.5	30	1.1	③
IPD 22N08S2L-50	✓	50.0	22	2.0	③
IPP 100N08S2L-07	✓	6.8	100	0.5	①
IPP 100N08S2-07	✓	7.1	100	0.5	①
IPP 80N08S2L-07	✓	7.1	80	0.5	①
IPP 80N08S2-07	✓	7.4	80	0.5	①
IPB 100N08S2L-07	✓	6.5	100	0.5	④
IPB 100N08S2-07	✓	6.8	100	0.5	④
IPB 80N08S2L-07	✓	6.8	80	0.5	④
IPB 80N08S2-07	✓	7.1	80	0.5	④

## OptiMOS™-T 100 V

Type	Green	max. $R_{DS(on)}$ [mΩ]	$I_D$ [A]	max. $R_{thJC}$ [K/W]	Package*
IPD 70N10S3-12	✓	11.1	70	1.2	③
IPD 70N10S3L-12	✓	11.5	70	1.2	③
IPD 50N10S3L-16	✓	15	50	1.5	③
IPD 35N10S3L-26	✓	24	35	2.1	③
IPD 30N10S3L-34	✓	31	30	2.6	③
IPP/I 100N10S3-05	✓	5.1	100	0.5	①, ②
IPP/I 70N10S3-12	✓	11.6	70	1.2	①, ②
IPP/I 70N10S3L-12	✓	12.1	70	1.2	①, ②
IPP/I 50N10S3L-16	✓	15.7	50	1.5	①, ②
IPB 100N10S3-05	✓	4.8	100	0.5	④
IPB 70N10S3-12	✓	11.3	70	1.2	④
IPB 70N10S3L-12	✓	11.8	70	1.2	④
IPB 50N10S3L-16	✓	15.4	50	1.5	④

\* See packages on page 15

# P-Channel 30 V MOSFET

## OptiMOS™-T PFET 30 V

Type	Green	max. $R_{DS(on)}$ [mΩ]	$I_D$ [A]	max. $R_{thJC}$ [K/W]	Package*
IPB 100P03P3L-04	✓	4.0	100	0.65	④
IPP/I 100P03P3L-04	✓	4.3	100	0.65	①,②

## OptiMOS™-T2 PFET 30 V

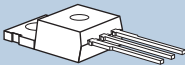
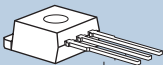


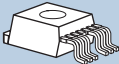



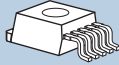
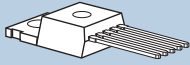
Type	Green	max. $R_{DS(on)}$ [mΩ]	$I_D$ [A]	max. $R_{thJC}$ [K/W]	Package*
IPD 90P03P4L-04	✓	4.1	90	1.1	③
IPD 80P03P4L-07	✓	6.8	80	1.7	③
IPD 50P03P4L-11	✓	10.5	50	2.6	③
IPP/I 80P03P4L-04	✓	4.5	80	1.1	①,②
IPP/I 80P03P4L-07	✓	7.2	80	1.7	①,②
IPP/I 45P03P4L-11	✓	11.1	45	2.6	①,②
IPB 80P03P4L-04	✓	4.2	80	1.1	④
IPB 80P03P4L-07	✓	6.9	80	1.7	④
IPB 45P03P4L-11	✓	10.8	45	2.6	④

## OptiMOS™-T PFET 30 V + NFET 55 V

Type	Green	max. $R_{DS(on)}$ [mΩ]	$I_D$ [A]	max. $R_{thJC}$ [K/W]	Package*
BTS 7904B	✓	12.7	40	1.3, 1.8	⑨
BTS 7904S	✓	11.7	40	1.3, 1.8	⑩

\* See packages on page 15

## Packages

1	PG-TO220-3	2	PG-TO262-3
			
3	PG-TO252-3 (D-PAK)	4	PG-TO263-3 (D <sup>2</sup> -PAK)
			
5	PG-TO263-7 (P-TO220-7 (SMD))	6	PG-SOT-223
			
7	PG-DSO-8	8	PG-TDSON-8
			
9	PG-TO263-5 (TO220-5 (SMD))	10	PG-TO220-5
			

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Product Information, September 2008,  
 Published by Infineon Technologies AG

[www.infineon.com]

Order No.  
 B112-H8486-G3-X-7600  
 Printed in Germany  
 WS 08081.