

# NP29N06QDK

60 V – 30 A – Dual N-channel Power MOS FET Application: Automotive

R07DS1330EJ0100 Rev.1.00 Mar 28, 2016

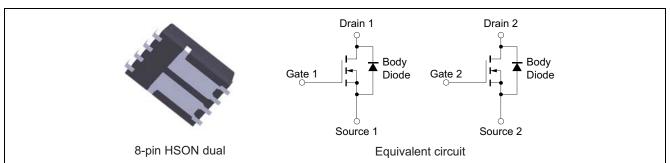
#### **Description**

NP29N06QDK is a dual N-channel MOS Field Effect Transistor designed for high current switching applications.

#### **Features**

- Super low on-state resistance
  - ---  $R_{DS(on)1}$  = 20 mΩ MAX. ( $V_{GS}$  = 10 V,  $I_D$  = 15 A)
  - $R_{DS(on)2} = 30$  mΩ MAX. ( $V_{GS} = 4.5$  V,  $I_D = 7.5$  A)
- Low  $C_{iss}$ :  $C_{iss} = 1000 \text{ pF TYP.} (V_{DS} = 25 \text{ V})$
- Designed for automotive application and AEC-Q101 qualified
- Small size package 8-pin HSON dual

#### **Outline**



Remark: Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.

#### **Ordering Information**

Part No.	Lead Plating	Pac	Package	
NP29N06QDK-E1-AY *1	Pure Sn (Tin)	Tape 2500 p/reel	Taping (E1 type)	8-pin HSON dual
NP29N06QDK-E2-AY *1			Taping (E2 type)	

Note: \*1. Pb-free (This product does not contain Pb in the external electrode)

## **Absolute Maximum Ratings** $(T_A = 25^{\circ}C)$

Item	Symbol	Ratings	Unit
Drain to Source Voltage (V <sub>GS</sub> = 0 V)	V <sub>DSS</sub>	60	V
Gate to Source Voltage (V <sub>DS</sub> = 0 V)	V <sub>GSS</sub>	±20	V
Drain Current (DC) (T <sub>C</sub> = 25°C) *4	I <sub>D(DC)</sub>	±30	Α
Drain Current (pulse) *1,4	I <sub>D(pulse)</sub>	±60	Α
Total Power Dissipation (T <sub>C</sub> = 25°C) *4	P <sub>T1</sub>	44	W
Total Power Dissipation (T <sub>A</sub> = 25°C) *2,4	P <sub>T2</sub>	1.0	W
Channel Temperature	T <sub>ch</sub>	175	°C
Storage Temperature	T <sub>stg</sub>	−55 to +175	°C
Repetitive Avalanche Current *3	I <sub>AR</sub>	12	Α
Repetitive Avalanche Energy *3	E <sub>AR</sub>	15	mJ

#### **Thermal Resistance**

Notes: \*1.  $T_C$  = 25°C, PW  $\leq$  10  $\mu$ s, Duty Cycle  $\leq$  1%

\*2. Mounted on glass epoxy substrate of 40 mm  $\times$  40 mm  $\times$  1.6 mmt with 4% copper area (35  $\mu\text{m})$ 

<sup>\*3.</sup>  $R_G$  = 25  $\Omega,\,V_{GS}$  = 20 V  $\rightarrow$  0 V

<sup>\*4.</sup> One channel operation

## **Electrical Characteristics** (T<sub>A</sub> = 25°C)

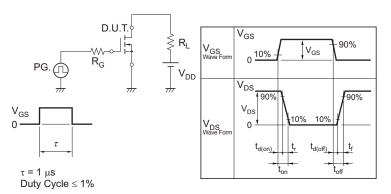
Item	Symbol	Min	Тур	Max	Unit	Test Conditions
Zero Gate Voltage Drain Current	I <sub>DSS</sub>			1	μА	$V_{DS} = 60 \text{ V}, V_{GS} = 0 \text{ V}$
Gate Leakage Current	I <sub>GSS</sub>			±100	nA	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$
Gate to Source Threshold Voltage	$V_{GS(th)}$	1.5	2.1	2.5	V	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$
Forward Transfer Admittance *1	y <sub>fs</sub>	10	22		S	$V_{DS} = 5 \text{ V}, I_{D} = 15 \text{ A}$
Drain to Source On-state	R <sub>DS(on)1</sub>		13.8	20	mΩ	$V_{GS} = 10 \text{ V}, I_D = 15 \text{ A}$
Resistance *1	R <sub>DS(on)2</sub>		16.5	30	mΩ	$V_{GS} = 4.5 \text{ V}, I_D = 7.5 \text{ A}$
Input Capacitance	C <sub>iss</sub>		1000	1500	pF	V <sub>DS</sub> = 25 V,
Output Capacitance	Coss		110	170	pF	$V_{GS} = 0 V$ ,
Reverse Transfer Capacitance	C <sub>rss</sub>		50	90	pF	f = 1 MHz
Turn-on Delay Time	t <sub>d(on)</sub>		15	30	ns	$V_{DD} = 30 \text{ V}, I_D = 15 \text{ A},$
Rise Time	t <sub>r</sub>		5	12	ns	V <sub>GS</sub> = 10 V,
Turn-off Delay Time	$t_{d(off)}$		40	80	ns	$R_G = 0 \Omega$
Fall Time	t <sub>f</sub>		2	5	ns	
Total Gate Charge	$Q_G$		16	24	nC	V <sub>DD</sub> = 48 V,
Gate to Source Charge	Q <sub>GS</sub>		4		nC	V <sub>GS</sub> = 10 V,
Gate to Drain Charge	$Q_{GD}$		3		nC	I <sub>D</sub> = 30 A
Body Diode Forward Voltage *1	$V_{F(S-D)}$		0.9	1.5	V	I <sub>F</sub> = 30 A, V <sub>GS</sub> = 0 V
Reverse Recovery Time	t <sub>rr</sub>		25		ns	I <sub>F</sub> = 30 A, V <sub>GS</sub> = 0 V,
Reverse Recovery Charge	Q <sub>rr</sub>		22		nC	di/dt = 100 A/μs

Note: \*1. Pulsed test

#### **TEST CIRCUIT 1 AVALANCHE CAPABILITY**

# $V_{GS} = 20 \rightarrow 0 \text{ V}$ $V_{DD}$ $V_{DD}$ $V_{DS}$ $V_{DS}$ $V_{DS}$ $V_{DS}$ $V_{DS}$ $V_{DS}$ $V_{DS}$

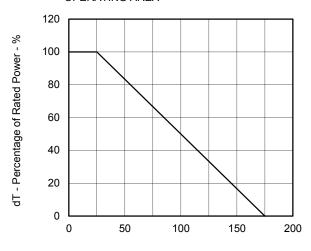
#### **TEST CIRCUIT 2 SWITCHING TIME**



#### **TEST CIRCUIT 3 GATE CHARGE**

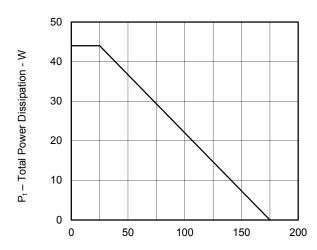
## **Typical Characteristics** $(T_A = 25^{\circ}C)$

# DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



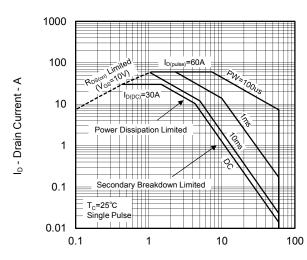
T<sub>C</sub> - Case Temperature - °C

## TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



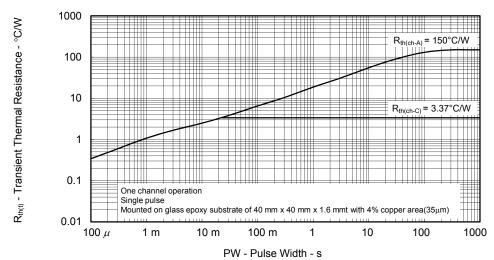
T<sub>C</sub> - Case Temperature - °C

#### FORWARD BIAS SAFE OPERATING AREA



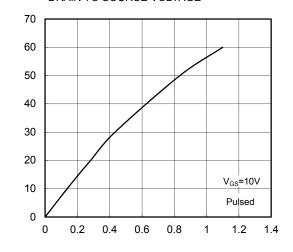
 $V_{\text{DS}}$  - Drain to Source Voltage – V

#### TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



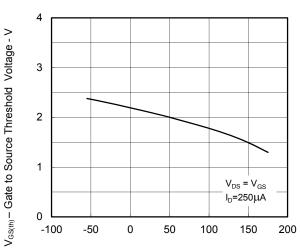
Ip - Drain Current - A

#### DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



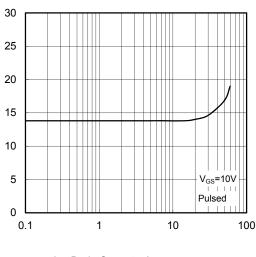
 $V_{\text{DS}}$  - Drain to Source Voltage - V

#### GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



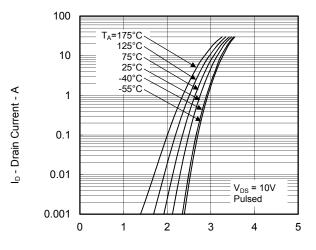
 $T_{\text{ch}}$  - Channel Temperature -  $^{\circ}C$ 

#### DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



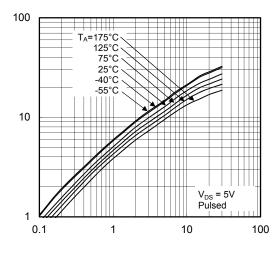
## I<sub>D</sub> - Drain Current - A

#### FORWARD TRANSFER CHARACTERISTICS



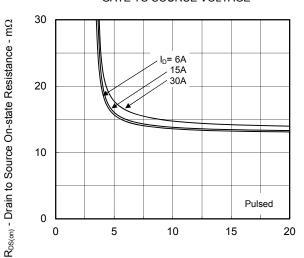
V<sub>GS</sub> - Gate to Source Voltage - V

#### FORWARD TRANSFER ADMITTANCE vs. DRAIN **CURRENT**



ID - Drain Current - A

#### DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



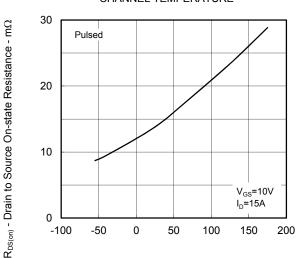
 $V_{\text{GS}}$  - Gate to Source Voltage - V

 $\mathsf{R}_{\mathsf{DS}(\mathsf{on})}$  - Drain to Source On-state Resistance -  $m\Omega$ 

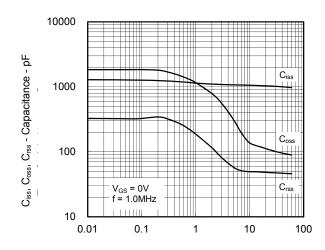
 $\mid y_{fs} \mid$  - Forward Transfer Admittance - S

td(on),tr,td(off),tr - Switching Time - ns

IF - Diode Forward Current - A

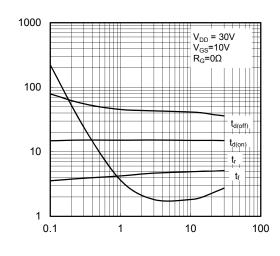


T<sub>ch</sub> - Channel Temperature - °C



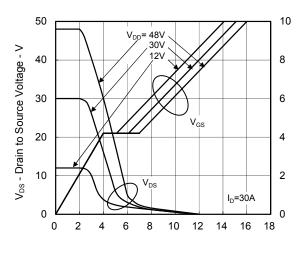
V<sub>DS</sub> - Drain to Source Voltage - V

#### SWITCHING CHARACTERISTICS



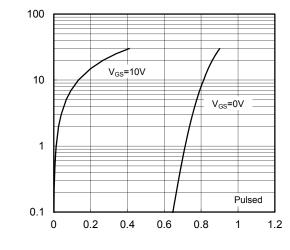
I<sub>D</sub> - Drain Current - A

#### DYNAMIC INPUT CHARACTERISTICS



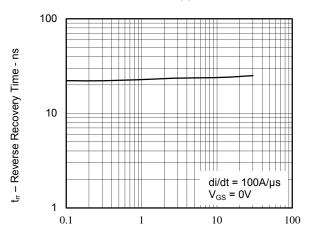
Q<sub>G</sub> - Gate Charge - nC

#### SOURCE TO DRAIN DIODE FORWARD VOLTAGE



 $V_{F(S-D)}$  - Source to Drain Voltage - V

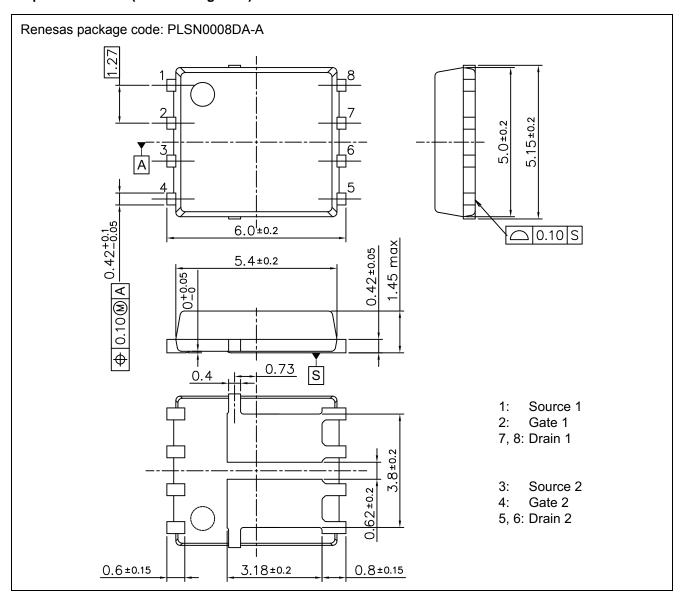
# REVERSE RECOVERY TIME vs. DRAIN CURRENT



I<sub>F</sub> - Drain Current - A

## Package Drawings (Unit: mm)

#### 8-pin HSON Dual (Mass: 0.12 g TYP.)



**Revision History** 

## NP29N06QDK Data Sheet

		Description		
Rev.	Date	Page	Summary	
1.00	Mar 28, 2016	_	First Edition Issued	

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