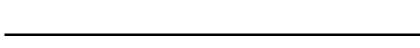
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April 1<sup>st</sup>, 2010 Renesas Electronics Corporation

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# MOS FIELD EFFECT TRANSISTOR NP20P06SLG

# SWITCHING P-CHANNEL POWER MOSFET

#### **DESCRIPTION**

The NP20P06SLG is P-channel MOS Field Effect Transistor designed for high current switching applications.

#### **ORDERING INFORMATION**

PART NUMBER	LEAD PLATING	PACKING	PACKAGE	
NP20P06SLG-E1-AY Note	D O. (Tin)	T 0500 -/l	TO 050 (MD 0710)	
NP20P06SLG-E2-AY Note	P06SLG-E2-AY Note Pure Sn (Tin)	Tape 2500 p/reel	TO-252 (MP-3ZK)	

Note Pb-free (This product does not contain Pb in external electrode.)

#### **FEATURES**

• Super low on-state resistance

 $R_{DS(on)1} = 48 \text{ m}\Omega \text{ MAX.} (V_{GS} = -10 \text{ V}, I_{D} = -10 \text{ A})$ 

 $R_{DS(on)2}$  = 64 m $\Omega$  MAX. (Vgs = -4.5 V, ID = -10 A)

• Low input capacitance

Ciss = 1650 pF TYP.

• Built-in gate protection diode

#### ABSOLUTE MAXIMUM RATINGS (TA = 25°C)

Drain to Source Voltage (V <sub>GS</sub> = 0 V)	VDSS	-60	٧
Gate to Source Voltage (VDS = 0 V)	Vgss	∓20	٧
Drain Current (DC) (Tc = 25°C)	I <sub>D(DC)</sub>	∓20	Α
Drain Current (pulse) Note1	D(pulse)	∓60	Α
Total Power Dissipation (Tc = 25°C)	P <sub>T1</sub>	38	W
Total Power Dissipation (T <sub>A</sub> = 25°C)	P <sub>T2</sub>	1.2	W
Channel Temperature	Tch	175	°C
Storage Temperature	T <sub>stg</sub>	-55 to +175	°C
Single Avalanche Current Note2	las	17	Α
Single Avalanche Energy Note2	Eas	28	mJ

**Notes 1.** PW  $\leq$  10  $\mu$ s, Duty Cycle  $\leq$  1%

2. Starting T<sub>ch</sub> = 25°C, V<sub>DD</sub> = -30 V, R<sub>G</sub> = 25  $\Omega$ , V<sub>GS</sub> =  $-20 \rightarrow 0$  V

#### THERMAL RESISTANCE

Channel to Case Thermal Resistance	Rth(ch-C)	3.9	°C/W
Channel to Amhient Thermal Resistance	Rth(ch A)	125	°C/W

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(TO-252)



#### **ELECTRICAL CHARACTERISTICS (TA = 25°C)**

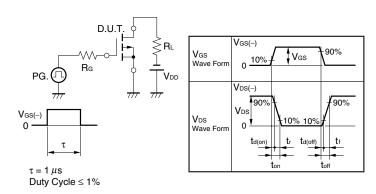
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	IDSS	V <sub>DS</sub> = -60 V, V <sub>GS</sub> = 0 V			-10	μΑ
Gate Leakage Current	Igss	V <sub>GS</sub> = ∓20 V, V <sub>DS</sub> = 0 V			∓10	μΑ
Gate to Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}, I_{D} = -250 \mu\text{A}$	-1.0	-1.6	-2.5	V
Forward Transfer Admittance Note	<b>y</b> fs	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -10 A	7	14		S
Drain to Source On-state Resistance Note	R <sub>DS(on)1</sub>	V <sub>GS</sub> = -10 V, I <sub>D</sub> = -10 A		36	48	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = −4.5 V, I <sub>D</sub> = −10 A		42	64	mΩ
Input Capacitance	Ciss	V <sub>DS</sub> = -10 V,		1650		pF
Output Capacitance	Coss	V <sub>GS</sub> = 0 V,		200		pF
Reverse Transfer Capacitance	Crss	f = 1 MHz		130		pF
Turn-on Delay Time	t <sub>d(on)</sub>	$V_{DD} = -30 \text{ V}, I_{D} = -10 \text{ A},$		8		ns
Rise Time	<b>t</b> r	V <sub>GS</sub> = -10 V,		8		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 0 Ω		160		ns
Fall Time	<b>t</b> f			80		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = -48 V,		34		nC
Gate to Source Charge	Qgs	V <sub>GS</sub> = -10 V,		4		nC
Gate to Drain Charge	Q <sub>GD</sub>	l <sub>D</sub> = -20 A		9		nC
Body Diode Forward Voltage Note	V <sub>F(S-D)</sub>	I <sub>F</sub> = -20 A, V <sub>GS</sub> = 0 V		0.95	1.5	V
Reverse Recovery Time	trr	I <sub>F</sub> = -20 A, V <sub>GS</sub> = 0 V,		38		ns
Reverse Recovery Charge	Qrr	di/dt = -100 A/μs		51		nC

**Note** Pulsed test PW  $\leq$  350  $\mu$ s, Duty Cycle  $\leq$  2%

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

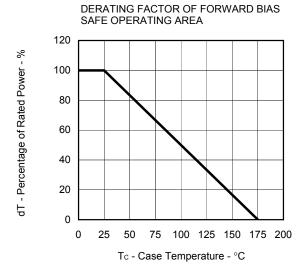
# $V_{GS} = -20 \rightarrow 0 \text{ V}$ $V_{DD}$ $V_{DD}$

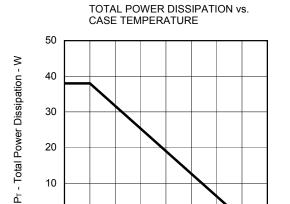
#### TEST CIRCUIT 2 SWITCHING TIME



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

#### TYPICAL CHARACTERISTICS (TA = 25°C)





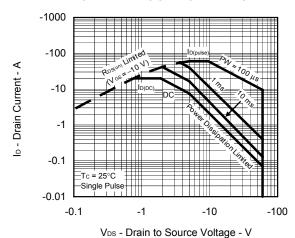
75 100 125 150 175 200

Tc - Case Temperature - °C

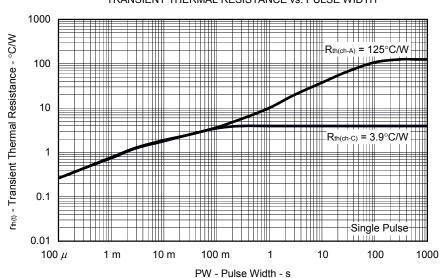
0

0 25 50

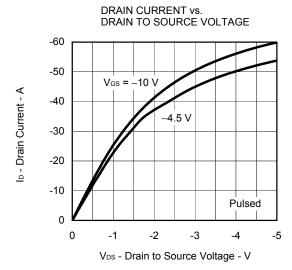
#### FORWARD BIAS SAFE OPERATING AREA



#### TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

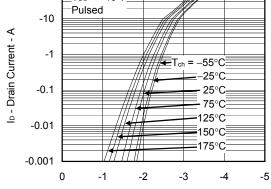


3



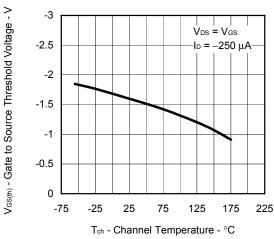


FORWARD TRANSFER CHARACTERISTICS

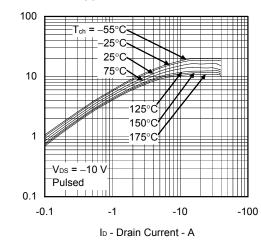


V<sub>GS</sub> - Gate to Source Voltage - V

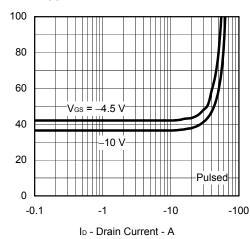
GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



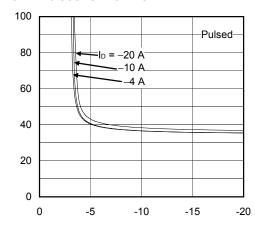
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



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



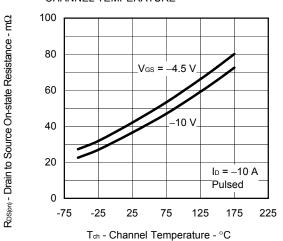
V<sub>GS</sub> - Gate to Source Voltage - V

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

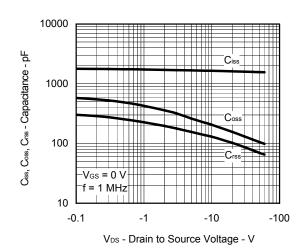
R<sub>DS(m)</sub> - Drain to Source On-state Resistance - mΩ

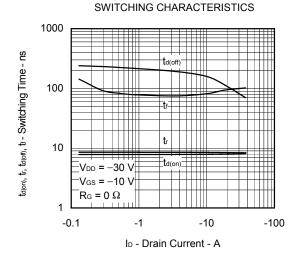
l yfs | - Forward Transfer Admittance - S

### DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE

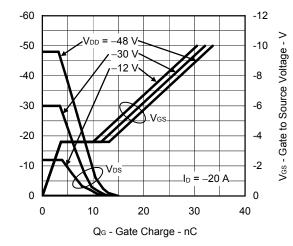


#### CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE

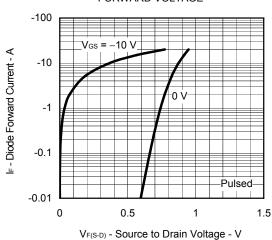




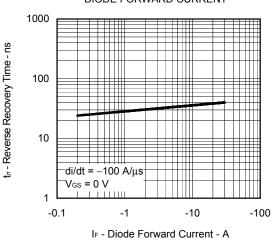
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



# SOURCE TO DRAIN DIODE FORWARD VOLTAGE

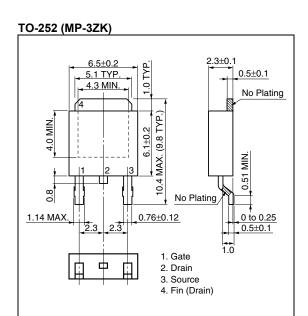


REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

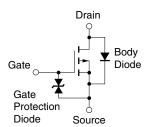


Vps - Drain to Source Voltage - V

#### PACKAGE DRAWING (Unit: mm)



#### **EQUIVALENT CIRCUIT**



**Remark** The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

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