

DATA SHEET



MOS FIELD EFFECT TRANSISTOR NP36P04KDG

SWITCHING P-CHANNEL POWER MOSFET

DESCRIPTION

The NP36P04KDG is P-channel MOS Field Effect Transistor designed for high current switching applications.

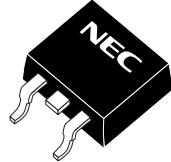
<R> ORDERING INFORMATION

PART NUMBER	LEAD PLATING	PACKING	PACKAGE
NP36P04KDG-E1-AY ^{Note}	Pure Sn (Tin)	Tape 800 p/reel	TO-263 (MP-25ZK)
NP36P04KDG-E2-AY ^{Note}			

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

FEATURES

- Super low on-state resistance (TO-263)
- R_{DS(on)1} = 17.0 mΩ MAX. (V_{GS} = -10 V, I_D = -18 A)
- R_{DS(on)2} = 23.5 mΩ MAX. (V_{GS} = -4.5 V, I_D = -18 A)
- Low input capacitance
- C_{iss} = 2800 pF TYP.



ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Drain to Source Voltage (V _{GS} = 0 V)	V _{DSS}	-40	V
Gate to Source Voltage (V _{DS} = 0 V)	V _{GSS}	±20	V
Drain Current (DC) (T _c = 25°C)	I _{D(DC)}	±36	A
Drain Current (pulse) ^{Note1}	I _{D(pulse)}	±108	A
Total Power Dissipation (T _c = 25°C)	P _{T1}	56	W
Total Power Dissipation (T _A = 25°C)	P _{T2}	1.8	W
Channel Temperature	T _{ch}	175	°C
Storage Temperature	T _{stg}	-55 to +175	°C
Single Avalanche Current ^{Note2}	I _{AS}	26	A
Single Avalanche Energy ^{Note2}	E _{AS}	72	mJ

Notes 1. PW ≤ 10 μs, Duty Cycle ≤ 1%

2. Starting T_{ch} = 25°C, V_{DD} = -30 V, R_G = 25 Ω, V_{GS} = -20 → 0 V

THERMAL RESISTANCE

Channel to Case Thermal Resistance	R _{th(ch-C)}	2.68	°C/W
Channel to Ambient Thermal Resistance	R _{th(ch-A)}	83.3	°C/W

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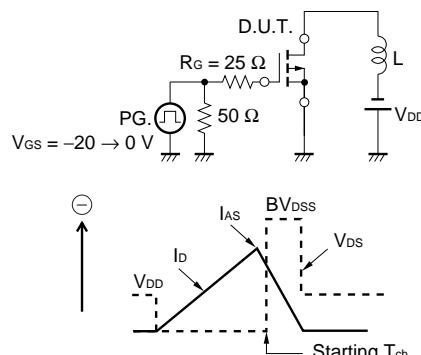
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ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

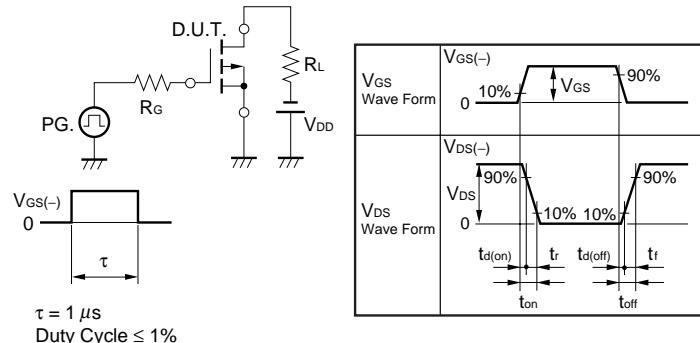
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -40\text{ V}$, $V_{GS} = 0\text{ V}$			-10	μA
Gate Leakage Current	I_{GSS}	$V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0\text{ V}$			± 100	nA
Gate to Source Threshold Voltage	$V_{GS(\text{th})}$	$V_{DS} = -10\text{ V}$, $I_D = -1\text{ mA}$	-1.0	-1.6	-2.5	V
Forward Transfer Admittance ^{Note}	$ y_{fs} $	$V_{DS} = -10\text{ V}$, $I_D = -18\text{ A}$	12	22		S
Drain to Source On-state Resistance ^{Note}	$R_{DS(\text{on})1}$	$V_{GS} = -10\text{ V}$, $I_D = -18\text{ A}$		12.8	17.0	$\text{m}\Omega$
	$R_{DS(\text{on})2}$	$V_{GS} = -4.5\text{ V}$, $I_D = -18\text{ A}$		16.6	23.5	$\text{m}\Omega$
Input Capacitance	C_{iss}	$V_{DS} = -10\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$		2800		pF
Output Capacitance	C_{oss}			450		pF
Reverse Transfer Capacitance	C_{rss}			280		pF
Turn-on Delay Time	$t_{d(\text{on})}$	$V_{DD} = -20\text{ V}$, $I_D = -18\text{ A}$, $V_{GS} = -10\text{ V}$, $R_G = 0\Omega$		8		ns
Rise Time	t_r			10		ns
Turn-off Delay Time	$t_{d(\text{off})}$			250		ns
Fall Time	t_f			140		ns
Total Gate Charge	Q_G	$V_{DD} = -32\text{ V}$, $V_{GS} = -10\text{ V}$, $I_D = -36\text{ A}$		55		nC
Gate to Source Charge	Q_{GS}			7		nC
Gate to Drain Charge	Q_{GD}			15		nC
Body Diode Forward Voltage ^{Note}	$V_{F(S-D)}$	$I_F = -36\text{ A}$, $V_{GS} = 0\text{ V}$		0.95	1.5	V
Reverse Recovery Time	t_{rr}	$I_F = -36\text{ A}$, $V_{GS} = 0\text{ V}$, $di/dt = -100\text{ A}/\mu\text{s}$		44		ns
Reverse Recovery Charge	Q_{rr}			51		nC

Note Pulsed test $PW \leq 350\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$

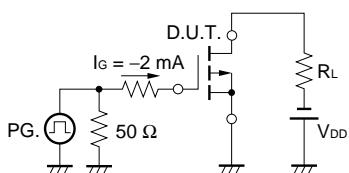
TEST CIRCUIT 1 AVALANCHE CAPABILITY

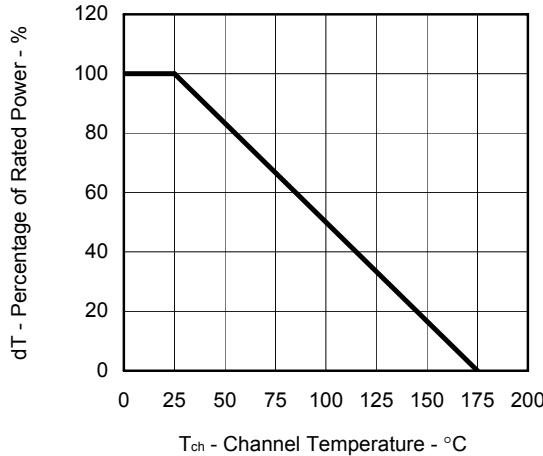
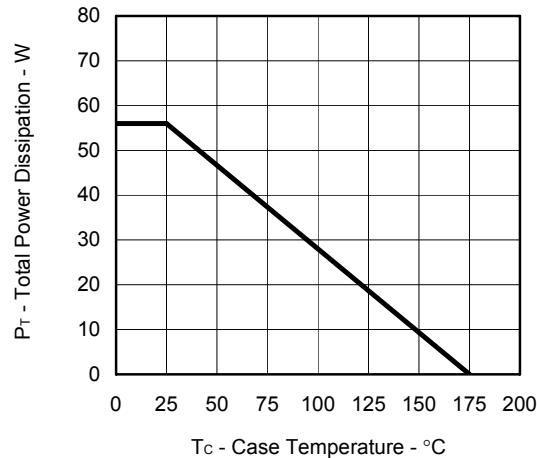


TEST CIRCUIT 2 SWITCHING TIME

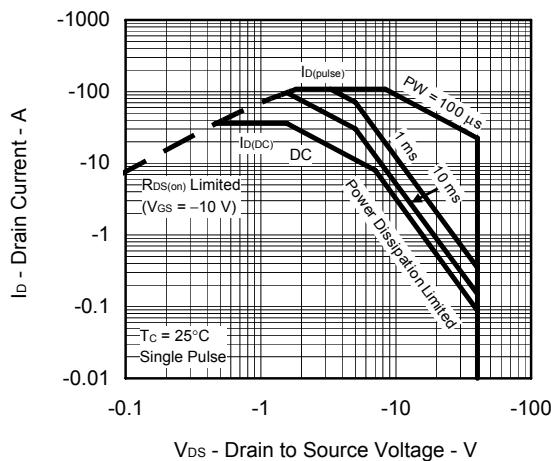


TEST CIRCUIT 3 GATE CHARGE

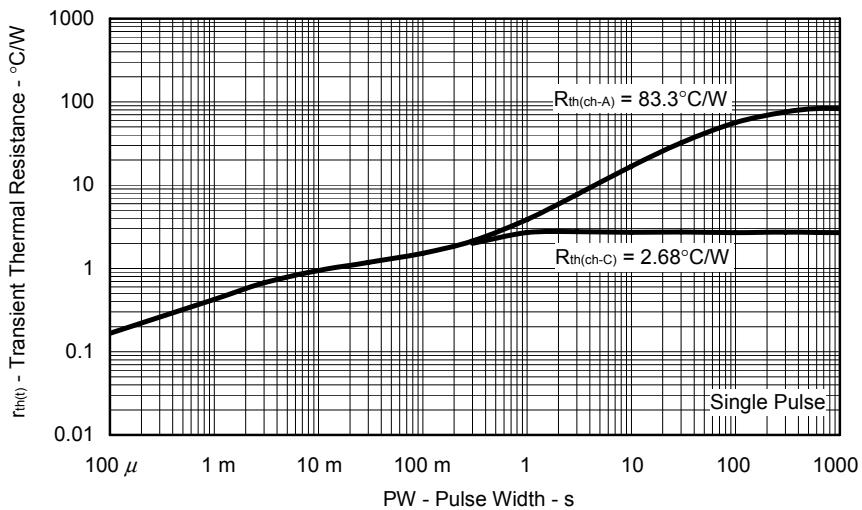


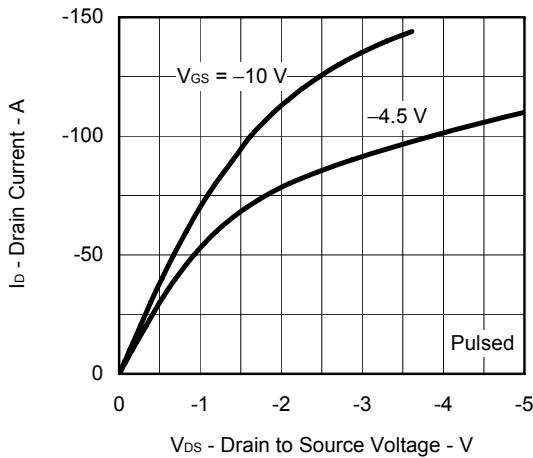
TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)DERATING FACTOR OF FORWARD BIAS
SAFE OPERATING AREATOTAL POWER DISSIPATION vs.
CASE TEMPERATURE

FORWARD BIAS SAFE OPERATING AREA

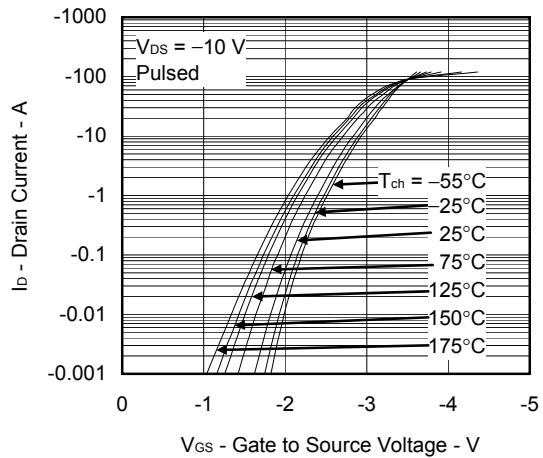
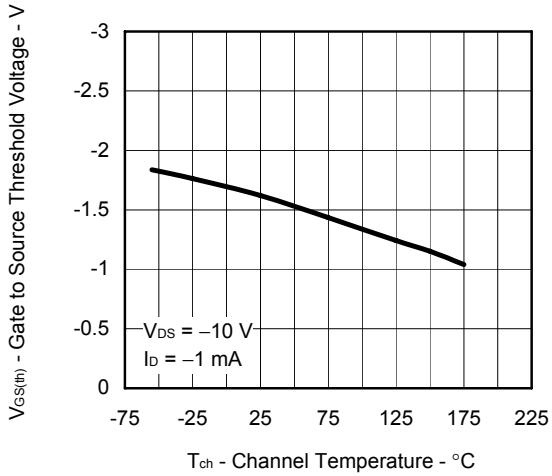
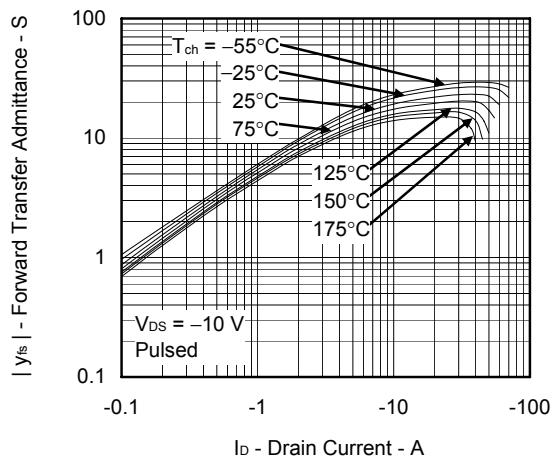
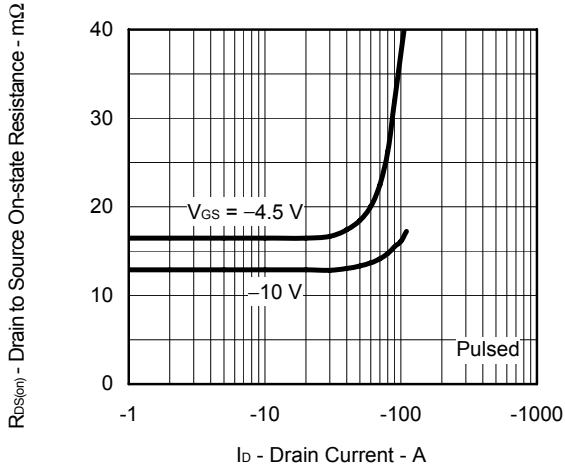
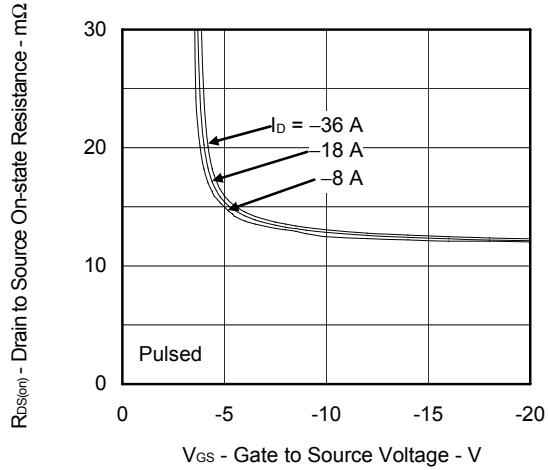


TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

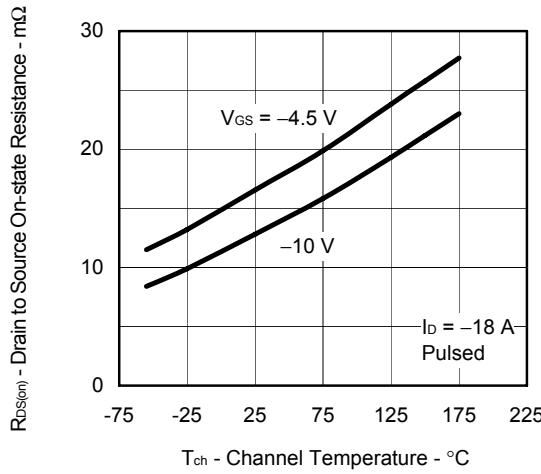


DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE

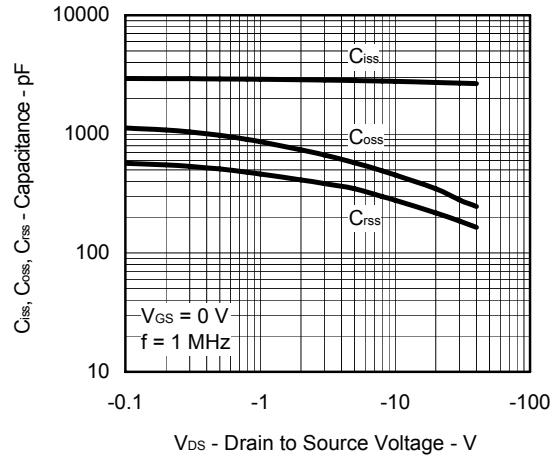
FORWARD TRANSFER CHARACTERISTICS

GATE TO SOURCE THRESHOLD VOLTAGE vs.
CHANNEL TEMPERATUREFORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENTDRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENTDRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE

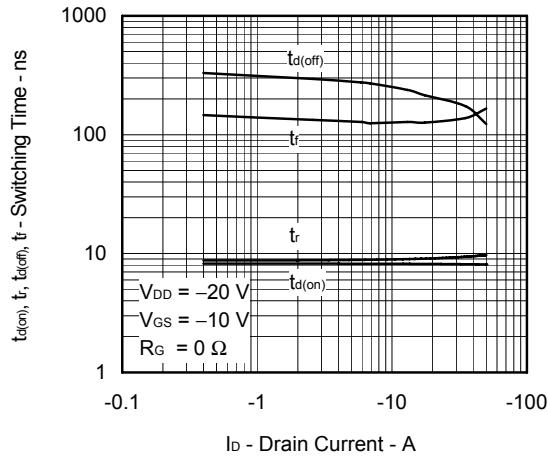
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



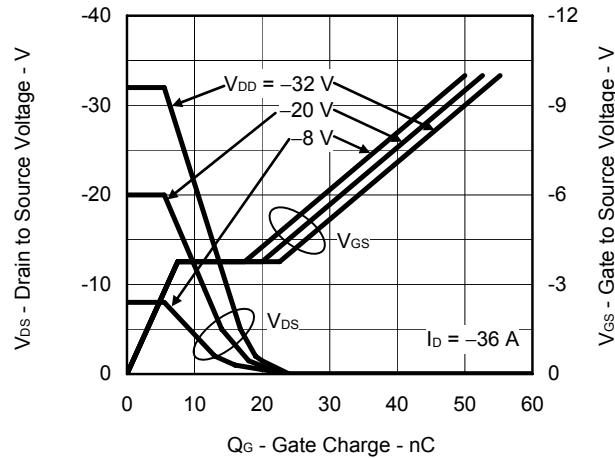
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



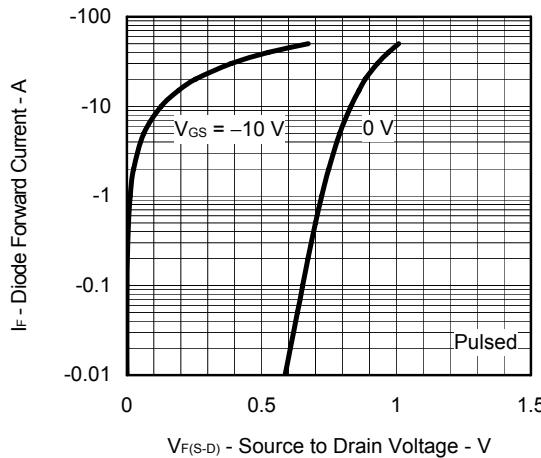
SWITCHING CHARACTERISTICS



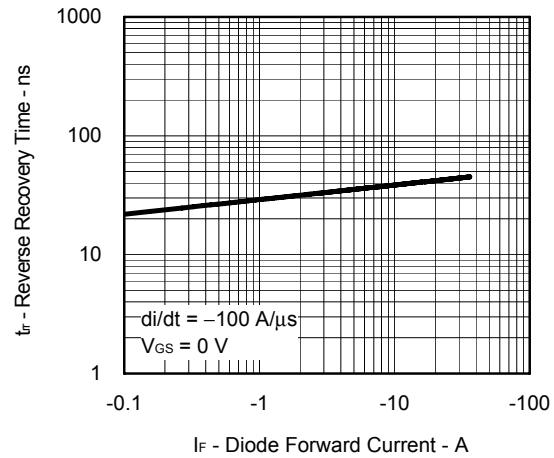
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

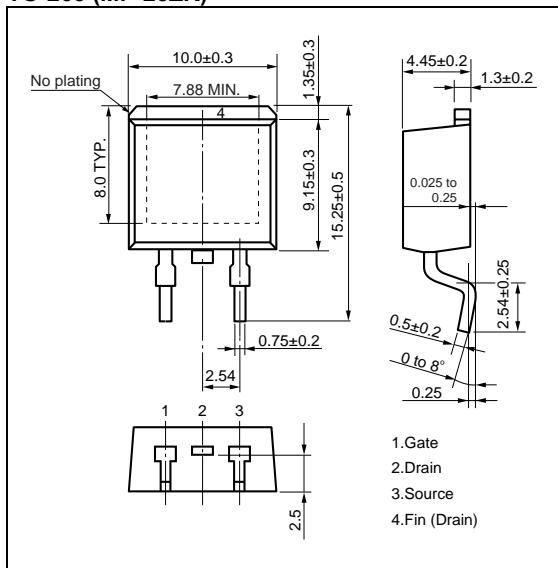


REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

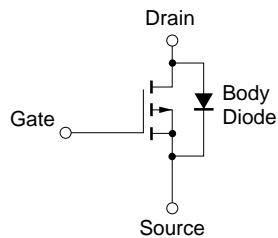


PACKAGE DRAWING (Unit: mm)

TO-263 (MP-25ZK)



EQUIVALENT CIRCUIT



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.

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