DATA SHEET

RENESAS

MOS FIELD EFFECT TRANSISTOR
NP88N04NUG

SWITCHING
N-CHANNEL POWER MOSFET

DESCRIPTION

The NP88N04NUG is N-channel MOS Field Effect Transistor designed for high current switching applications.

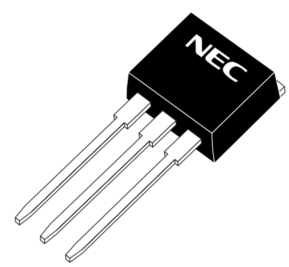
ORDERING INFORMATION

PART NUMBER	PACKAGE
NP88N04NUG	TO-262

FEATURES

- Channel temperature 175 degree rating
- Super low on-state resistance
  $R_{DS(on)}$ = 3.4 mΩ MAX. (V_{GS} = 10 V, I_D = 44 A)
- Low C_{iss}: C_{iss} = 9510 pF TYP. (V_{DS} = 25 V)

(TO-262)



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)	$I_{D(DC)}$	±88	A
Drain Current (pulse) Note1	$I_{D(pulse)}$	±352	A
Total Power Dissipation	P_{T1}	1.8	W
Total Power Dissipation (T_C = 25°C)	P_{T2}	200	W
Channel Temperature	T_{ch}	175	°C
Storage Temperature	T_{stg}	−55 to +175	°C
Repetitive Avalanche Current Note2	I_{AR}	56	A
Repetitive Avalanche Energy Note2	E_{AR}	314	mJ

Notes 1. PW ≤ 10 μs, Duty Cycle ≤ 1%

2. T_{ch} ≤ 150°C, V_{DD} = 20 V, R_G = 25 Ω, V_{GS} = 20 → 0 V

THERMAL RESISTANCE

Channel to Case Thermal Resistance	$R_{th(ch-C)}$	0.75	°C/W
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	83.3	°C/W

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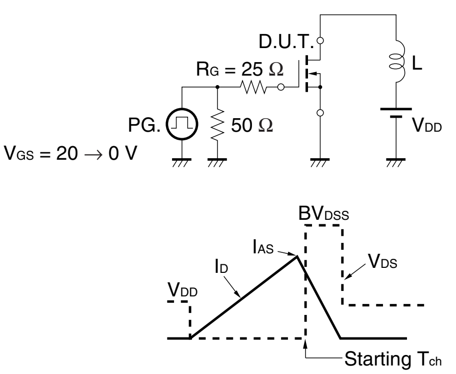
ELECTRICAL CHARACTERISTICS (T_A = 25°C)

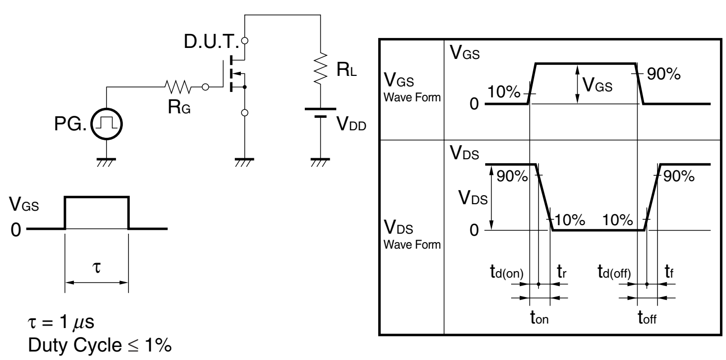
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 40 V, V_{GS} = 0 V			1	μA
Gate Leakage Current	I_{GSS}	V_{GS} = ±20 V, V_{DS} = 0 V			±100	nA
Gate to Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 μA	2.0	3.0	4.0	V
Forward Transfer Admittance Note	| y_{fs} |	V_{DS} = 10 V, I_D = 44 A	27	51		S
Drain to Source On-state Resistance Note	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 44 A		2.6	3.4	mΩ
Input Capacitance	C_{iss}	V_{DS} = 25 V		9510	15000	pF
Output Capacitance	C_{oss}	V_{GS} = 0 V		880	1370	pF
Reverse Transfer Capacitance	C_{rss}	f = 1 MHz		570	990	pF
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 20 V, I_D = 44 A		43	100	ns
Rise Time	t_r	V_{GS} = 10 V		104	260	ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 0 Ω		107	220	ns
Fall Time	t_f			22	60	ns
Total Gate Charge	Q_G	V_{DD} = 32 V		171	250	nC
Gate to Source Charge	Q_{GS}	V_{GS} = 10 V		38		nC
Gate to Drain Charge	Q_{GD}	I_D = 88 A		58		nC
Body Diode Forward Voltage Note	$V_{F(S-D)}$	I_F = 88 A, V_{GS} = 0 V		0.94	1.5	V
Reverse Recovery Time	t_{rr}	I_F = 88 A, V_{GS} = 0 V		51		ns
Reverse Recovery Charge	Q_{rr}	di/dt = 100 A/μs		67		nC

Note Pulsed

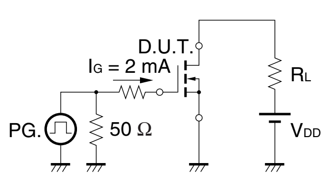
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

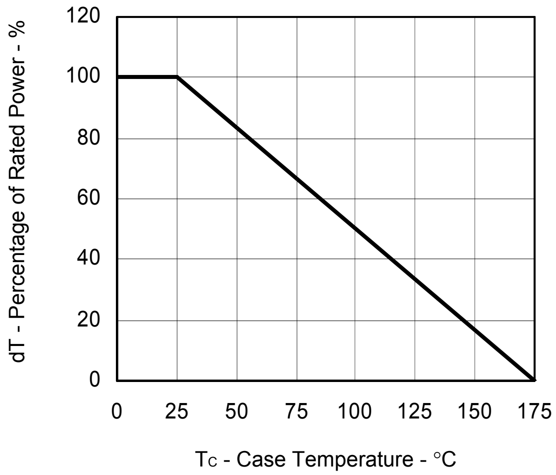


TEST CIRCUIT 3 GATE CHARGE

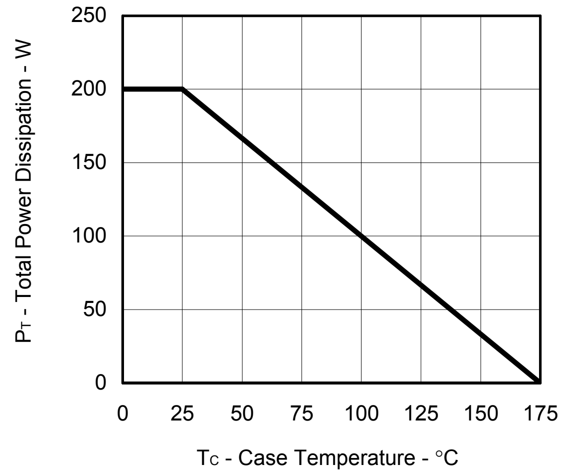


TYPICAL CHARACTERISTICS (T_A = 25°C)

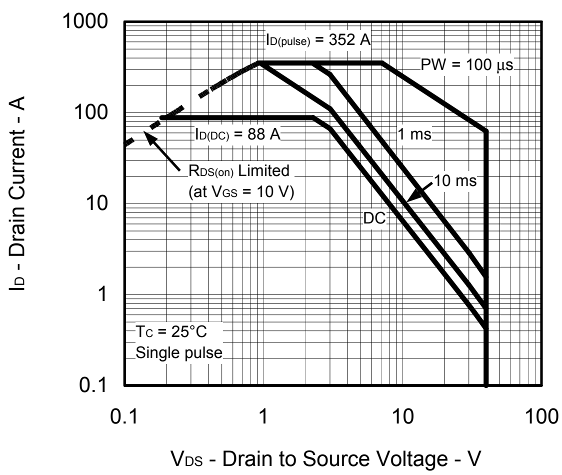
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



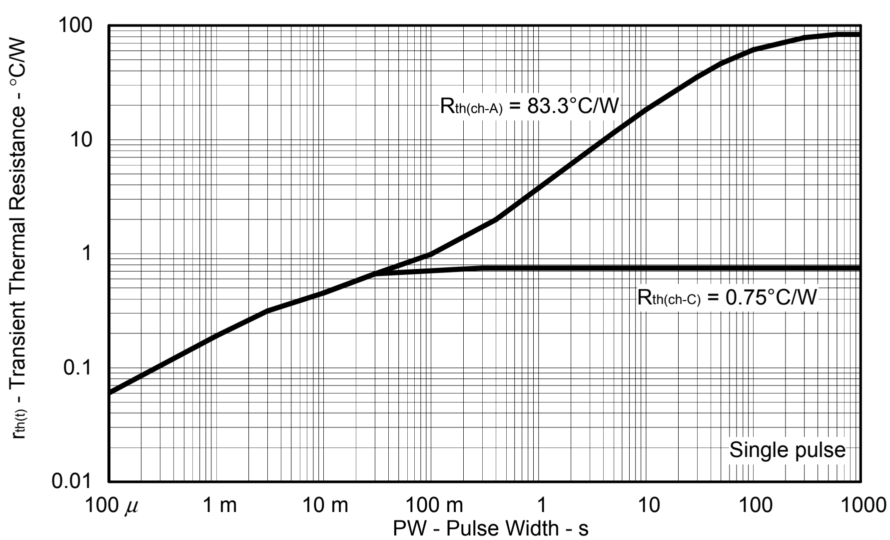
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



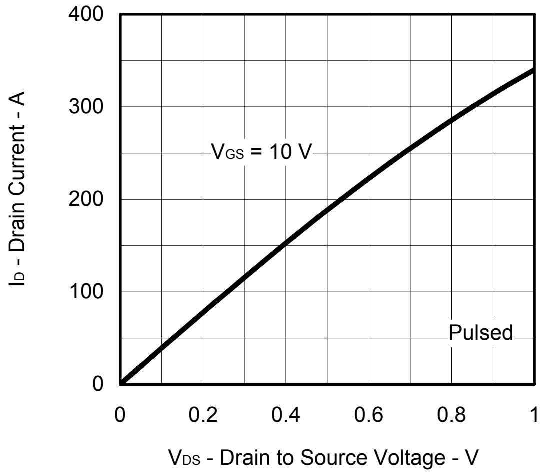
FORWARD BIAS SAFE OPERATING AREA



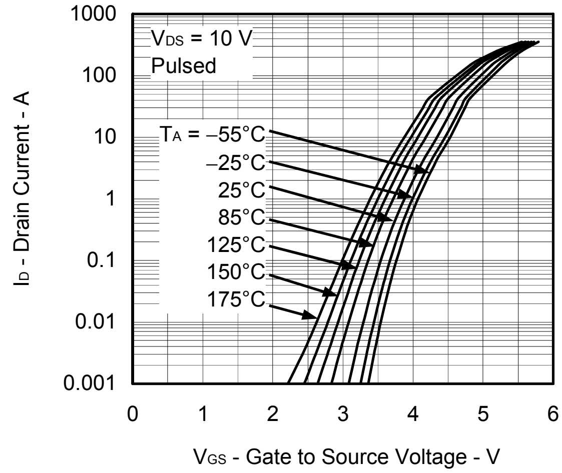
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



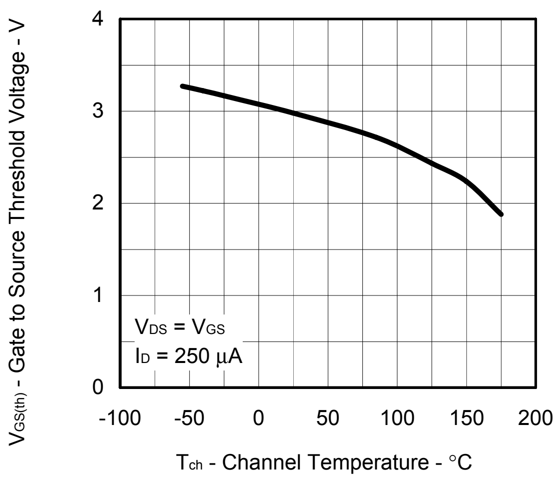
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



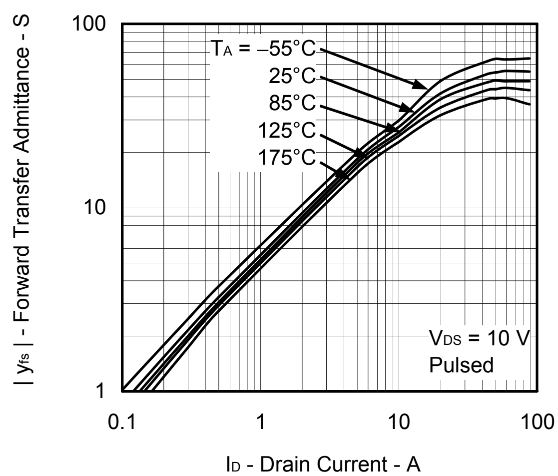
FORWARD TRANSFER CHARACTERISTICS



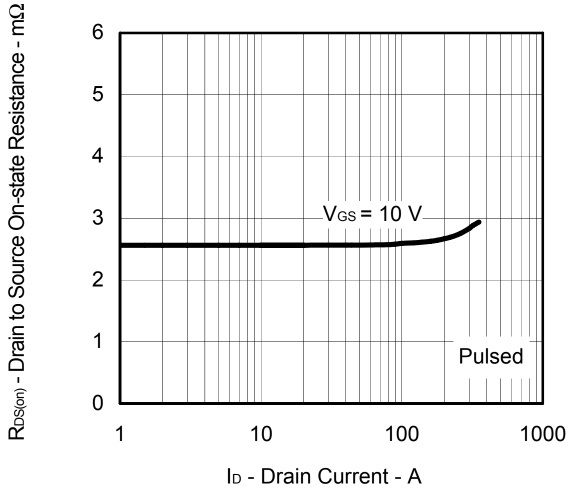
GATE TO SOURCE THRESHOLD VOLTAGE vs.
CHANNEL TEMPERATURE



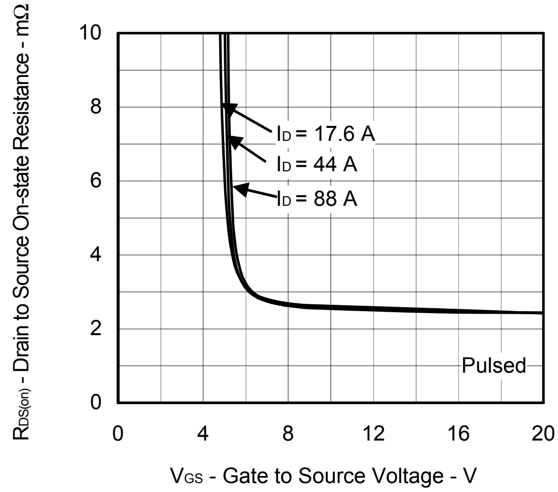
FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



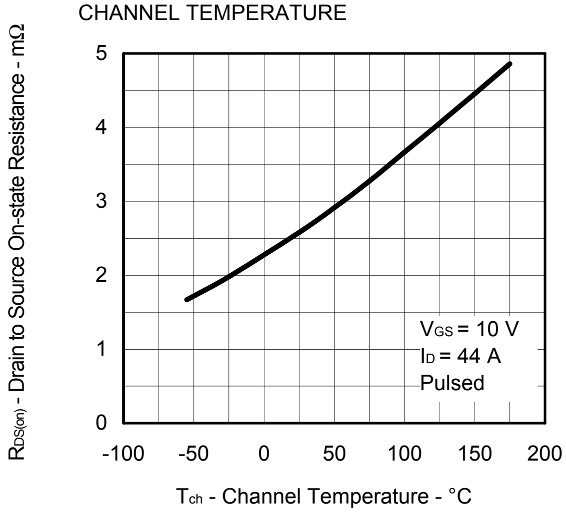
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT



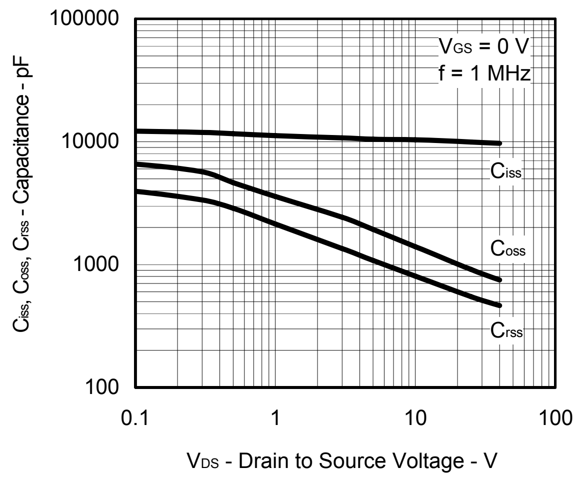
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



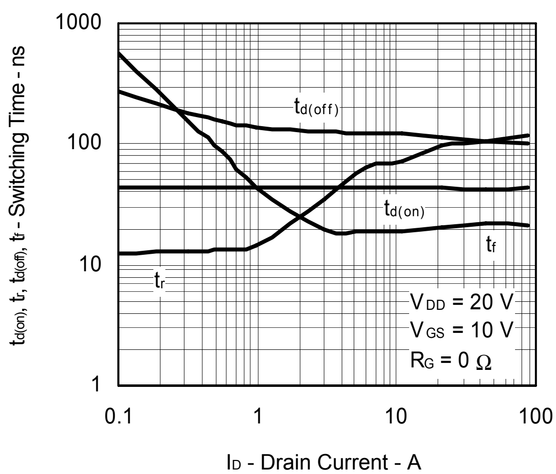
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



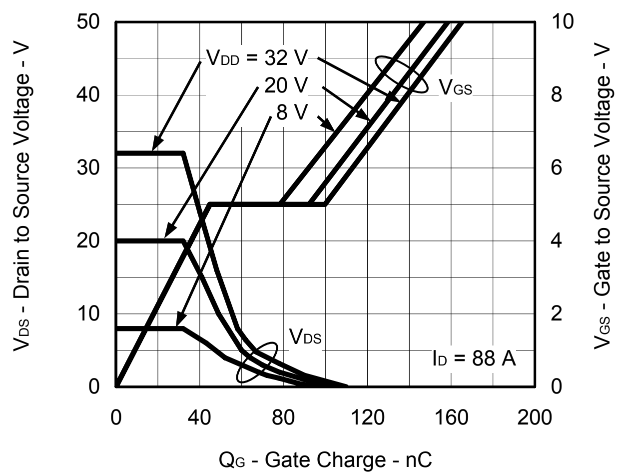
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



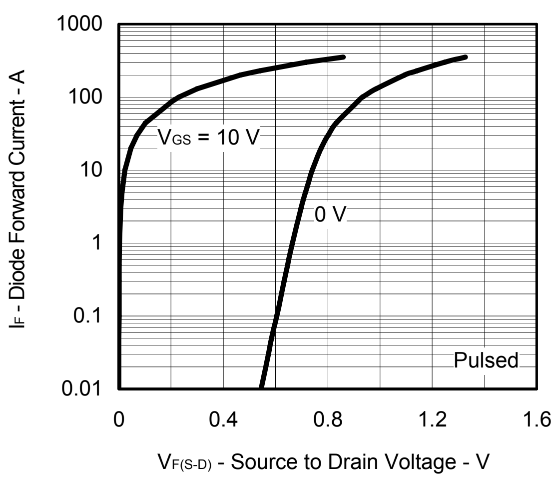
SWITCHING CHARACTERISTICS



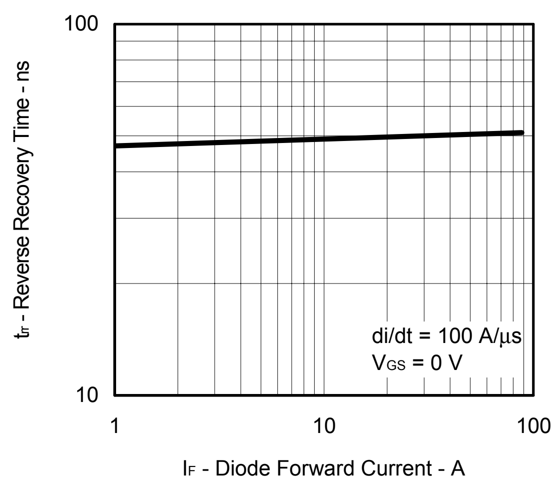
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

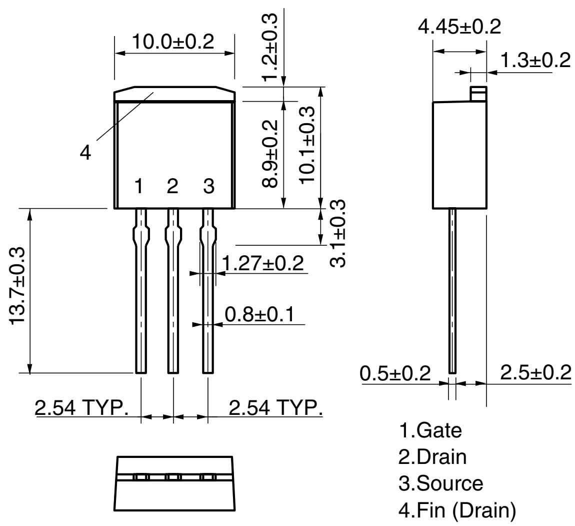


REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

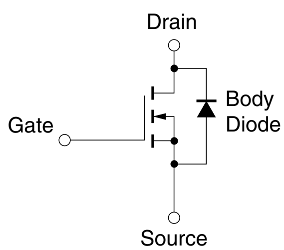


PACKAGE DRAWING (Unit: mm)

TO-262 (Revised)



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.