

# NP50P03YDG

## MOS FIELD EFFECT TRANSISTOR

R07DS0019EJ0200

Rev.2.00

Mar 16, 2011

### Description

The NP50P03YDG is P-channel MOS Field Effect Transistor designed for high current switching applications.

### Features

- Low on-state resistance  
—  $R_{DS(on)} = 8.4 \text{ m}\Omega \text{ MAX.}$  ( $V_{GS} = -10 \text{ V}$ ,  $I_D = -25 \text{ A}$ )
- Low  $C_{iss}$ :  $C_{iss} = 2300 \text{ pF TYP.}$  ( $V_{DS} = -25 \text{ V}$ ,  $V_{GS} = 0 \text{ V}$ )
- Designed for automotive application and AEC-Q101 qualified
- Small size package 8-pin HSON

### Ordering Information

Part No.	LEAD PLATING	PACKING	Package
NP50P03YDG -E1-AY *1	Pure Sn (Tin)	Tape 2500 p/reel	8-pin HSON, Taping (E1 type)
NP50P03YDG -E2-AY *1			8-pin HSON, Taping (E2 type)

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

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

Item	Symbol	Ratings	Unit
Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	-30	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20$	V
Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 50$	A
Drain Current (pulse) *1	$I_{D(pulse)}$	$\pm 200$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T1}$	102	W
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ ) *2	$P_{T2}$	1.0	W
Channel Temperature	$T_{ch}$	175	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +175	$^\circ\text{C}$
Single Avalanche Current *3	$I_{AS}$	24	A
Single Avalanche Energy *3	$E_{AS}$	58	mJ

### Thermal Resistance

Channel to Case Thermal Resistance  $R_{th(ch-C)} = 1.47 \text{ }^\circ\text{C/W}$

Channel to Ambient Thermal Resistance \*2  $R_{th(ch-A)} = 150 \text{ }^\circ\text{C/W}$

Notes: \*1.  $T_C = 25^\circ\text{C}$ ,  $PW \leq 10 \text{ }\mu\text{s}$ , Duty Cycle  $\leq 1\%$

\*2. Mounted on glass epoxy substrate of 40 mm x 40 mm x 0.8 mm

\*3. Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = -15 \text{ V}$ ,  $R_G = 25 \text{ }\Omega$ ,  $L = 100 \text{ }\mu\text{H}$ ,  $V_{GS} = -20 \rightarrow 0 \text{ V}$

The mark <R> shows major revised points.

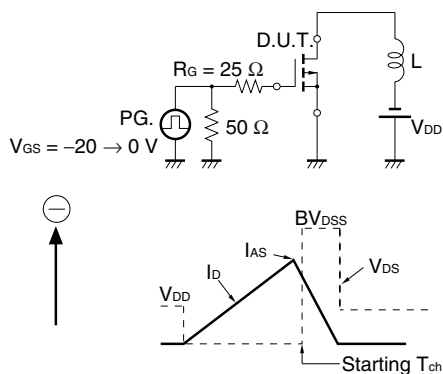
The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

Electrical Characteristics ( $T_A = 25^\circ\text{C}$ )

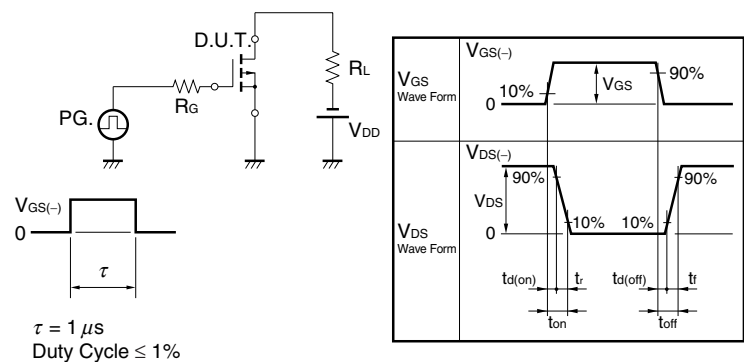
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Zero Gate Voltage Drain Current	$I_{DSS}$			-1	$\mu\text{A}$	$V_{DS} = -30\text{ V}$ , $V_{GS} = 0\text{ V}$
Gate Leakage Current	$I_{GSS}$			$\mp 100$	nA	$V_{GS} = \mp 20\text{ V}$ , $V_{DS} = 0\text{ V}$
Gate to Source Threshold Voltage	$V_{GS(th)}$	-1.0	-1.6	-2.5	V	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$
Forward Transfer Admittance <sup>*1</sup>	$ y_{fs} $	23	46		S	$V_{DS} = -5\text{ V}$ , $I_D = -25\text{ A}$
Drain to Source On-state Resistance <sup>*1</sup>	$R_{DS(on)1}$		6.7	8.4	m $\Omega$	$V_{GS} = -10\text{ V}$ , $I_D = -25\text{ A}$
	$R_{DS(on)2}$		8.5	13	m $\Omega$	$V_{GS} = -5\text{ V}$ , $I_D = -25\text{ A}$
Input Capacitance	$C_{iss}$		2300	3500	pF	$V_{DS} = -25\text{ V}$ , $V_{GS} = 0\text{ V}$ ,
Output Capacitance	$C_{oss}$		440	660	pF	$f = 1\text{ MHz}$
Reverse Transfer Capacitance	$C_{rss}$		320	580	pF	
Turn-on Delay Time	$t_{d(on)}$		9	19	ns	$V_{DD} = -15\text{ V}$ , $I_D = -25\text{ A}$ , $V_{GS} = -10\text{ V}$ , $R_G = 0\text{ }\Omega$
Rise Time	$t_r$		7	16	ns	
Turn-off Delay Time	$t_{d(off)}$		230	470	ns	
Fall Time	$t_f$		180	440	ns	
Total Gate Charge	$Q_G$		64	96	nC	$V_{DD} = -24\text{ V}$ , $V_{GS} = -10\text{ V}$ , $I_D = -50\text{ A}$
Gate to Source Charge	$Q_{GS}$		9		nC	
Gate to Drain Charge	$Q_{GD}$		21		nC	
Body Diode Forward Voltage <sup>*1</sup>	$V_{F(S-D)}$		1.0	1.5	V	$I_F = -50\text{ A}$ , $V_{GS} = 0\text{ V}$
Reverse Recovery Time	$t_{rr}$		49		ns	$I_F = -50\text{ A}$ , $V_{GS} = 0\text{ V}$ , $di/dt = 100\text{ A}/\mu\text{s}$
Reverse Recovery Charge	$Q_{rr}$		44		nC	

Note: \*1. Pulsed

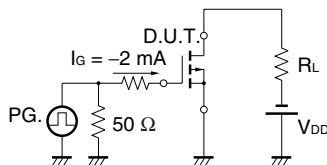
## TEST CIRCUIT 1 AVALANCHE CAPABILITY



## TEST CIRCUIT 2 SWITCHING TIME

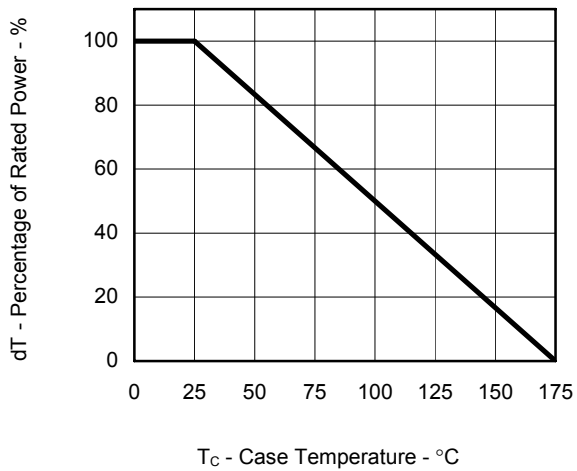


## TEST CIRCUIT 3 GATE CHARGE

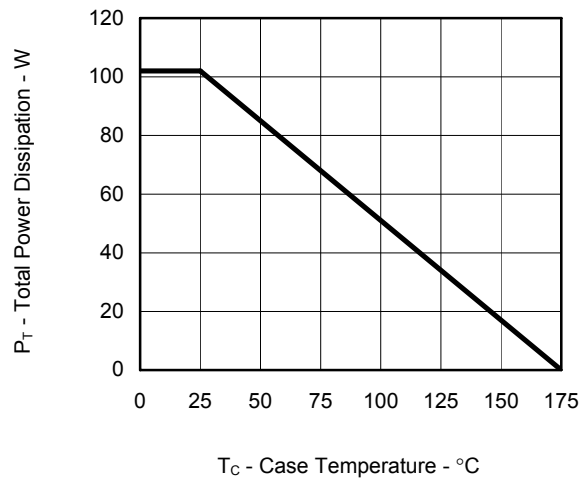


## Typical Characteristics ( $T_A = 25^\circ\text{C}$ )

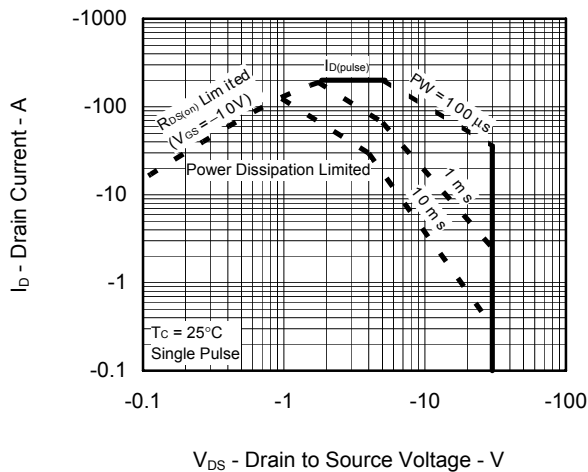
DERATING FACTOR OF FORWARD BIAS SAFE  
OPERATING AREA



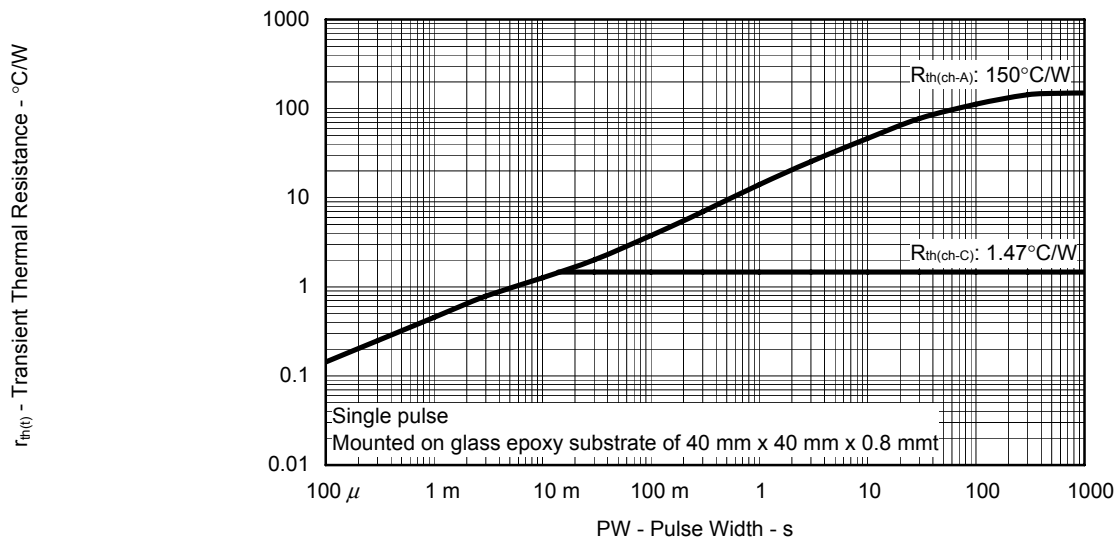
TOTAL POWER DISSIPATION vs.  
CASE TEMPERATURE

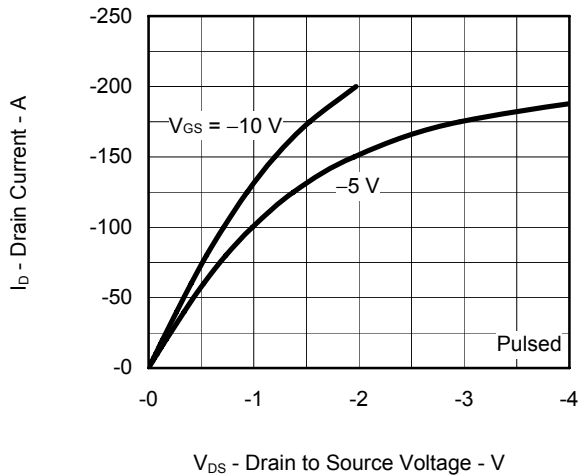


FORWARD BIAS SAFE OPERATING AREA

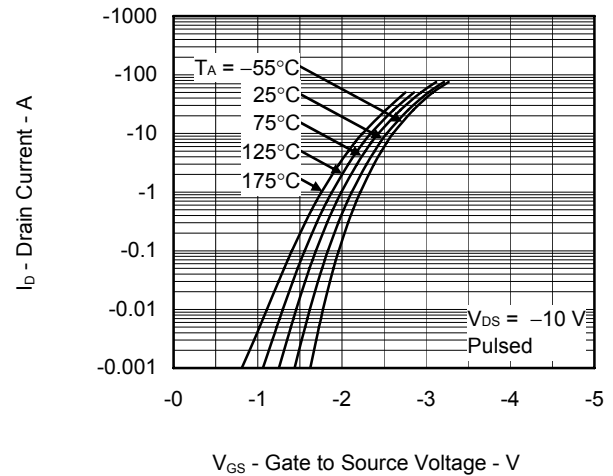
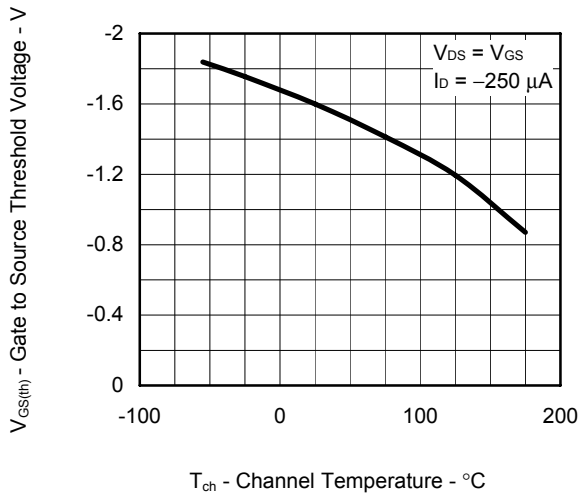
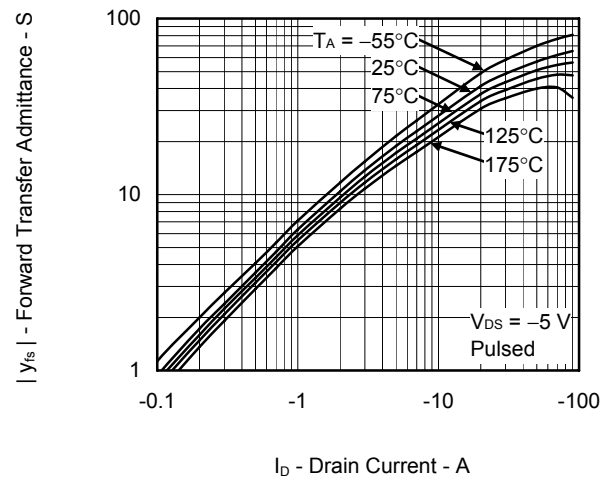
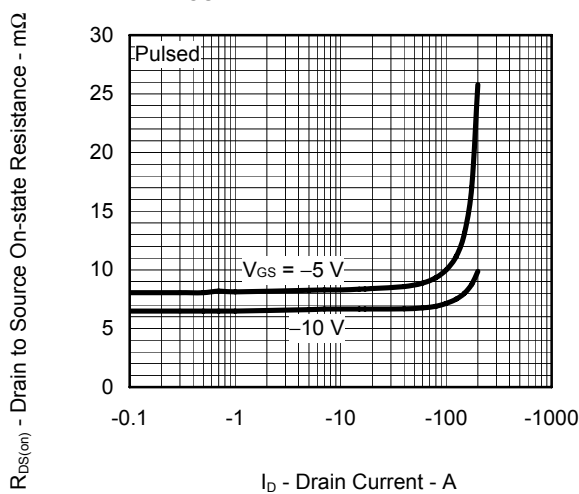
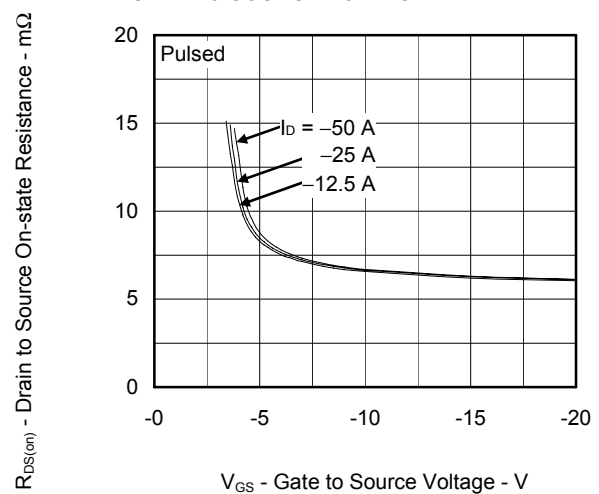


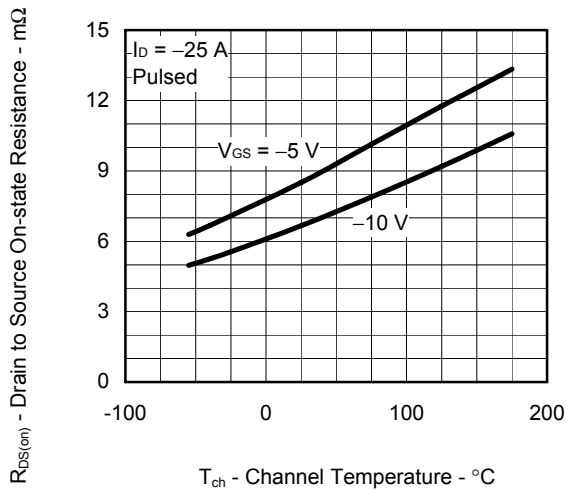
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



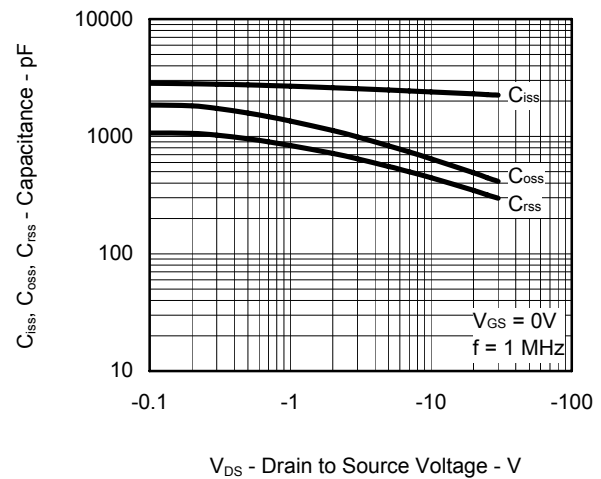
DRAIN CURRENT vs.  
DRAIN TO SOURCE VOLTAGE

FORWARD TRANSFER CHARACTERISTICS

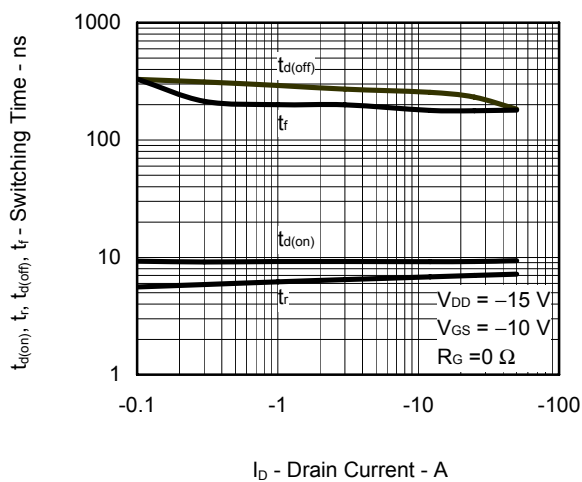
GATE TO SOURCE THRESHOLD VOLTAGE  
vs. CHANNEL TEMPERATUREFORWARD TRANSFER ADMITTANCE vs. DRAIN  
CURRENTDRAIN TO SOURCE ON-STATE RESISTANCE vs.  
DRAIN CURRENTDRAIN TO SOURCE ON-STATE RESISTANCE vs.  
GATE TO SOURCE VOLTAGE

DRAIN TO SOURCE ON-STATE RESISTANCE vs.  
CHANNEL TEMPERATURE

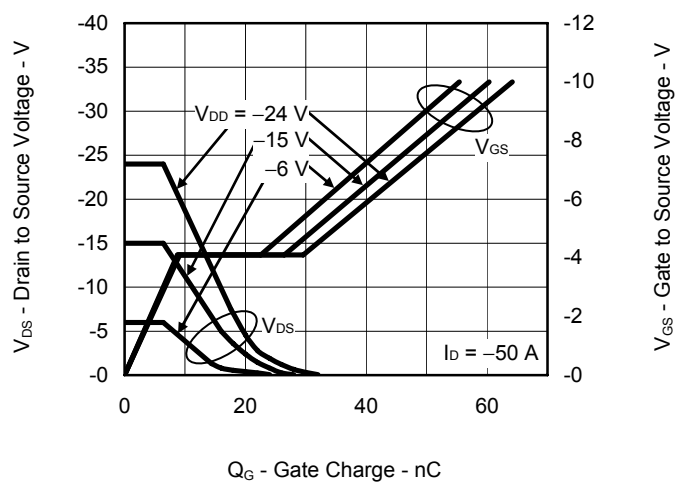
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



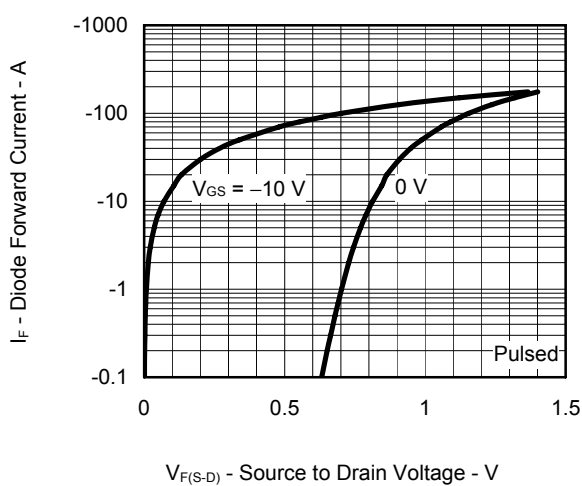
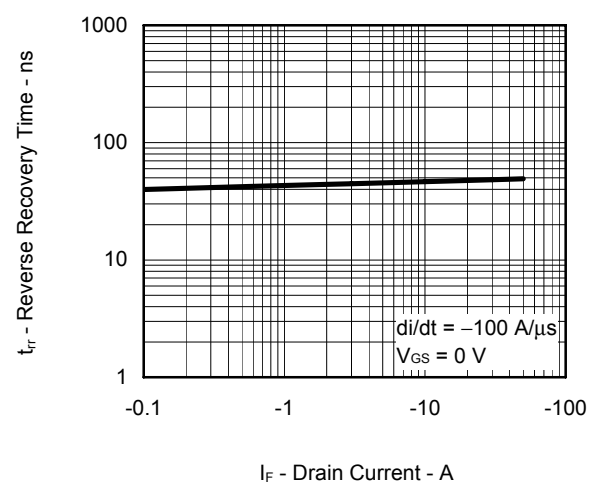
SWITCHING CHARACTERISTICS



DYNAMIC INPUT/OUTPUT CHARACTERISTICS

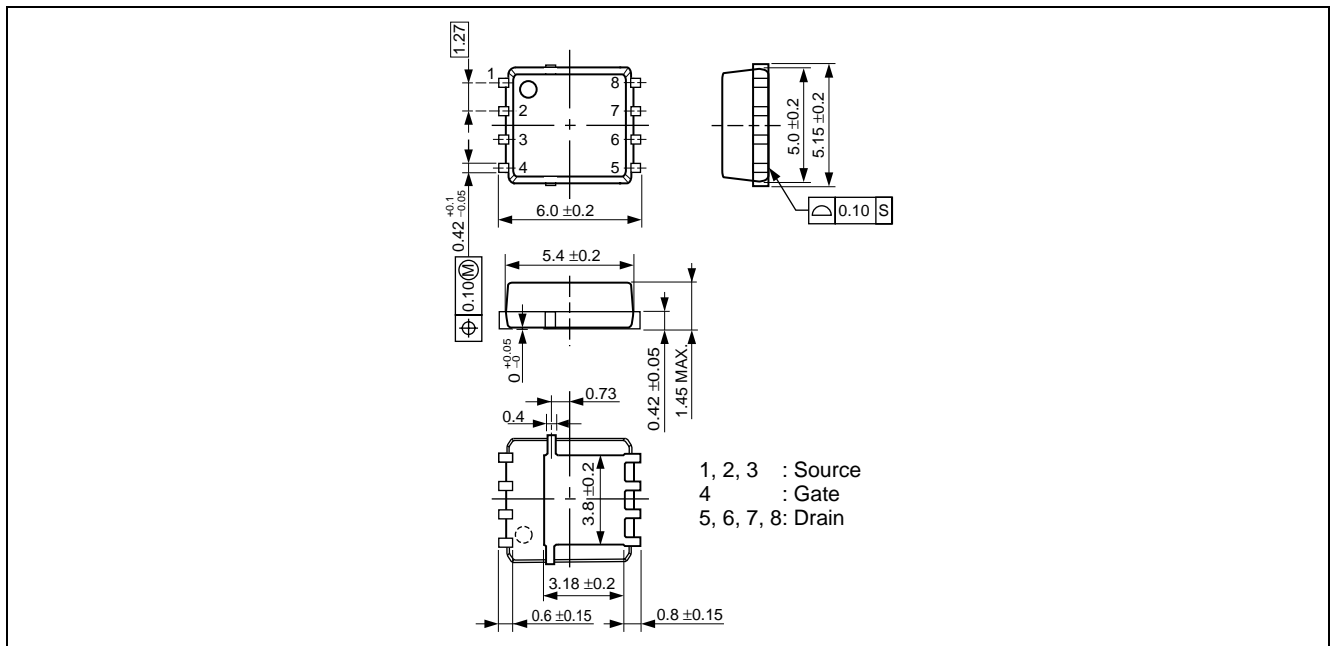


SOURCE TO DRAIN DIODE FORWARD VOLTAGE

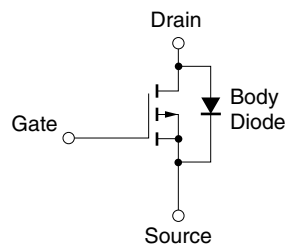
REVERSE RECOVERY TIME vs.  
DRAIN CURRENT

## Package Drawings (Unit: mm)

8-pin HSON (Mass: 0.13 g TYP.)



## 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.

<b>Revision History</b>	<b>NP50P03YDG Data Sheet</b>
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Rev.	Date	Description	
		Page	Summary
1.00	Jul 01, 2010	–	First Edition Issued
2.00	Mar 16, 2011	p.1	Repetitive Avalanche Current -> Single Avalanche Current Repetitive Avalanche Energy -> Single Avalanche Energy Modification of Note *3

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