

NP40N10YDF, NP40N10VDF, NP40N10PDF

100 V – 40 A – N-channel Power MOS FET

Application: Automotive

R07DS0361EJ0201

Rev.2.01

May 13, 2013

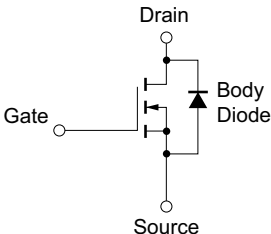
Description

These products are N-channel MOS Field Effect Transistors designed for high current switching applications.

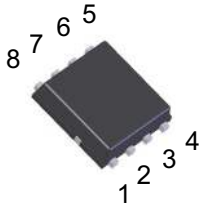
Features

- Low on-state resistance
 - $R_{DS(on)} = 25 \text{ m}\Omega$ MAX. ($V_{GS} = 10 \text{ V}$, $I_D = 20 \text{ A}$) (NP40N10YDF)
 - $R_{DS(on)} = 26 \text{ m}\Omega$ MAX. ($V_{GS} = 10 \text{ V}$, $I_D = 20 \text{ A}$) (NP40N10VDF)
 - $R_{DS(on)} = 27 \text{ m}\Omega$ MAX. ($V_{GS} = 10 \text{ V}$, $I_D = 20 \text{ A}$) (NP40N10PDF)
- Low C_{iss} : $C_{iss} = 2100 \text{ pF}$ TYP. ($V_{DS} = 25 \text{ V}$, $V_{GS} = 0 \text{ V}$)
- Logic level drive type
- Designed for automotive application and AEC-Q101 qualified

Outline

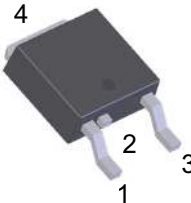


8-pin HSON



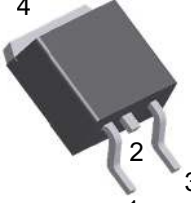
1, 2, 3 : Source
4 : Gate
5, 6, 7, 8: Drain

TO-252



1. Gate
2. Drain
3. Source
4. Fin (Drain)

TO-263



1. Gate
2. Drain
3. Source
4. Fin (Drain)

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	Packing		Package
NP40N10YDF-E1-AY *1	Pure Sn (Tin)	Tape 2500 p/reel	Taping (E1 type)	8-pin HSON
NP40N10YDF-E2-AY *1			Taping (E2 type)	
NP40N10VDF-E1-AY *1	Pure Sn (Tin)	Tape 2500 p/reel	Taping (E1 type)	TO-252 (MP-3ZP)
NP40N10VDF-E2-AY *1			Taping (E2 type)	
NP40N10PDF-E1-AY *1	Pure Sn (Tin)	Tape 800 p/reel	Taping (E1 type)	TO-263 (MP-25ZP)
NP40N10PDF-E2-AY *1			Taping (E2 type)	

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

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

Item	Symbol	Ratings	Unit
Drain to Source Voltage ($V_{GS} = 0\text{ V}$)	V_{DSS}	100	V
Gate to Source Voltage ($V_{DS} = 0\text{ V}$)	V_{GSS}	± 20	V
Drain Current (DC) ($T_C = 25^\circ\text{C}$)	$I_{D(DC)}$	± 40	A
Drain Current (pulse) *1	$I_{D(pulse)}$	± 80	A
Total Power Dissipation ($T_C = 25^\circ\text{C}$)	P_{T1}	120	W
NP40N10YDF Total Power Dissipation ($T_A = 25^\circ\text{C}$) *2	P_{T2}	1.0	W
NP40N10VDF Total Power Dissipation ($T_A = 25^\circ\text{C}$) *2		1.2	
NP40N10PDF Total Power Dissipation ($T_A = 25^\circ\text{C}$)		1.8	
Channel Temperature	T_{ch}	175	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 to +175	$^\circ\text{C}$
Single Avalanche Current *3	I_{AS}	25	A
Single Avalanche Energy *3	E_{AS}	61	mJ

Thermal Resistance

Channel to Case Thermal Resistance	$R_{th(ch-C)}$		1.25	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance *2	$R_{th(ch-A)}$	NP40N10YDF	150	$^\circ\text{C/W}$
		NP40N10VDF	125	$^\circ\text{C/W}$
		NP40N10PDF	83.3	$^\circ\text{C/W}$

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

*2. Mounted on glass epoxy substrate of 40 mm \times 40 mm \times 1.6 mm with 4% copper area (35 μm)

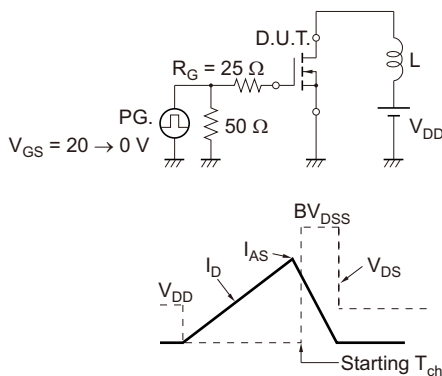
*3. $T_{ch(start)} = 25^\circ\text{C}$, $V_{DD} = 50\text{ V}$, $R_G = 25\ \Omega$, $L = 100\ \mu\text{H}$, $V_{GS} = 20\text{ V} \rightarrow 0\text{ V}$

Electrical Characteristics (T_A = 25°C)

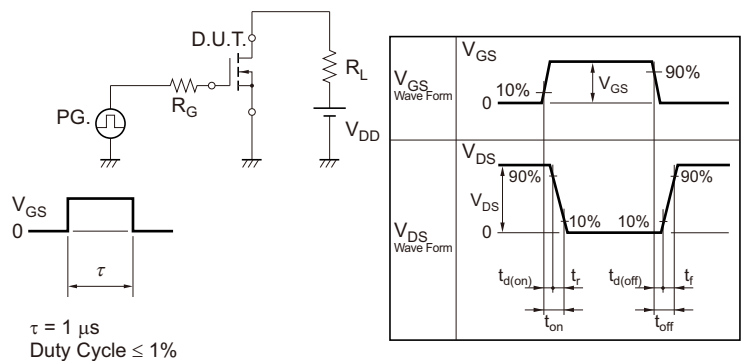
Item	Symbol	Min	Typ	Max	Unit	Test Conditions	
Zero Gate Voltage Drain Current	I _{DSS}			1	μA	V _{DS} = 100 V, V _{GS} = 0 V	
Gate Leakage Current	I _{GSS}			±100	nA	V _{GS} = ±20 V, V _{DS} = 0 V	
Gate to Source Threshold Voltage	V _{GS(th)}	1.5	2.0	2.5	V	V _{DS} = V _{GS} , I _D = 250 μA	
Forward Transfer Admittance *1	y _{fs}	20	40		S	V _{DS} = 5.0 V, I _D = 20 A	
Drain to Source On-state Resistance *1	NP40N10YDF	R _{DS(on)1}		21	25	mΩ	V _{GS} = 10 V, I _D = 20 A
		R _{DS(on)2}		23	30	mΩ	V _{GS} = 5.0 V, I _D = 20 A
		R _{DS(on)3}		24	36	mΩ	V _{GS} = 4.5 V, I _D = 20 A
	NP40N10VDF	R _{DS(on)1}		21	26	mΩ	V _{GS} = 10 V, I _D = 20 A
		R _{DS(on)2}		23	31	mΩ	V _{GS} = 5.0 V, I _D = 20 A
		R _{DS(on)3}		24	37	mΩ	V _{GS} = 4.5 V, I _D = 20 A
	NP40N10PDF	R _{DS(on)1}		21	27	mΩ	V _{GS} = 10 V, I _D = 20 A
		R _{DS(on)2}		23	32	mΩ	V _{GS} = 5.0 V, I _D = 20 A
		R _{DS(on)3}		24	38	mΩ	V _{GS} = 4.5 V, I _D = 20 A
Input Capacitance	C _{iss}		2100	3150	pF	V _{DS} = 25 V, V _{GS} = 0 V, f = 1 MHz	
Output Capacitance	C _{oss}		200	300	pF		
Reverse Transfer Capacitance	C _{rss}		80	144	pF		
Turn-on Delay Time	t _{d(on)}		15	33	ns	V _{DD} = 50 V, I _D = 20 A, V _{GS} = 10 V, R _G = 0 Ω	
Rise Time	t _r		16	40	ns		
Turn-off Delay Time	t _{d(off)}		60	120	ns		
Fall Time	t _f		5	13	ns		
Total Gate Charge	Q _G		47	71	nC	V _{DD} = 80 V, V _{GS} = 10 V, I _D = 40 A	
Gate to Source Charge	Q _{GS}		8		nC		
Gate to Drain Charge	Q _{GD}		12		nC		
Body Diode Forward Voltage *1	V _{F(S-D)}		0.9	1.5	V	I _F = 40 A, V _{GS} = 0 V	
Reverse Recovery Time	t _{rr}		67		ns	I _F = 40 A, V _{GS} = 0 V, di/dt = 100 A/μs	
Reverse Recovery Charge	Q _{rr}		162		nC		

Note: *1. Pulsed test

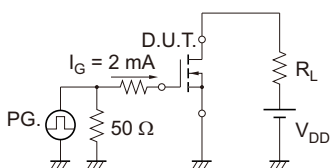
TEST CIRCUIT 1 AVALANCHE CAPABILITY



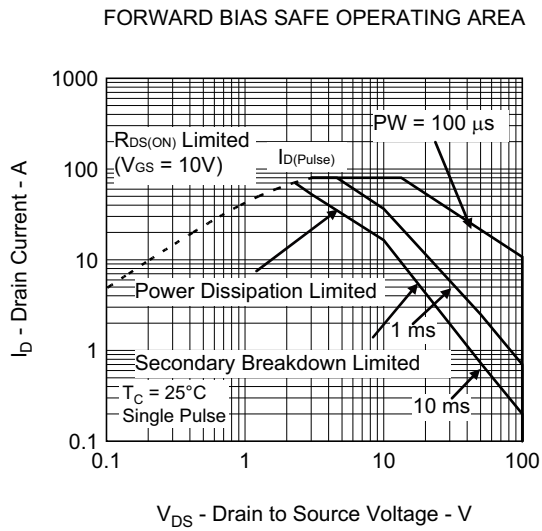
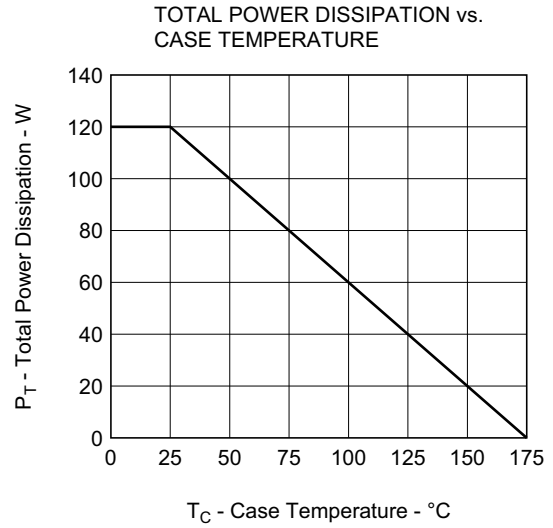
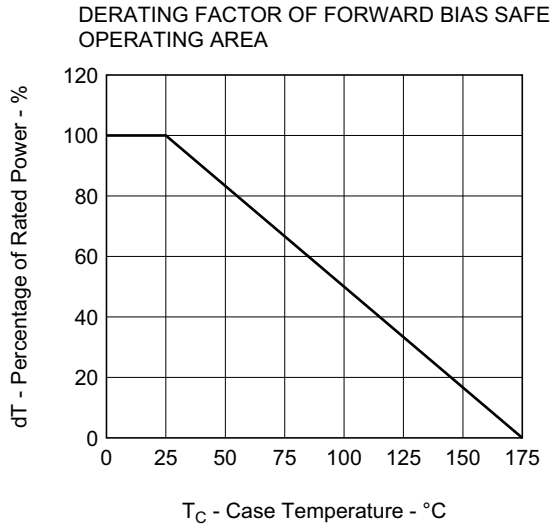
TEST CIRCUIT 2 SWITCHING TIME



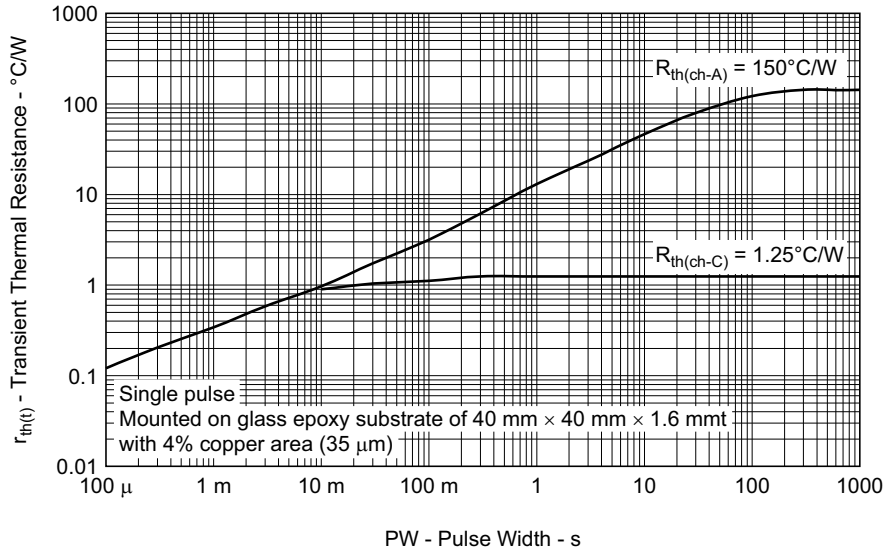
TEST CIRCUIT 3 GATE CHARGE



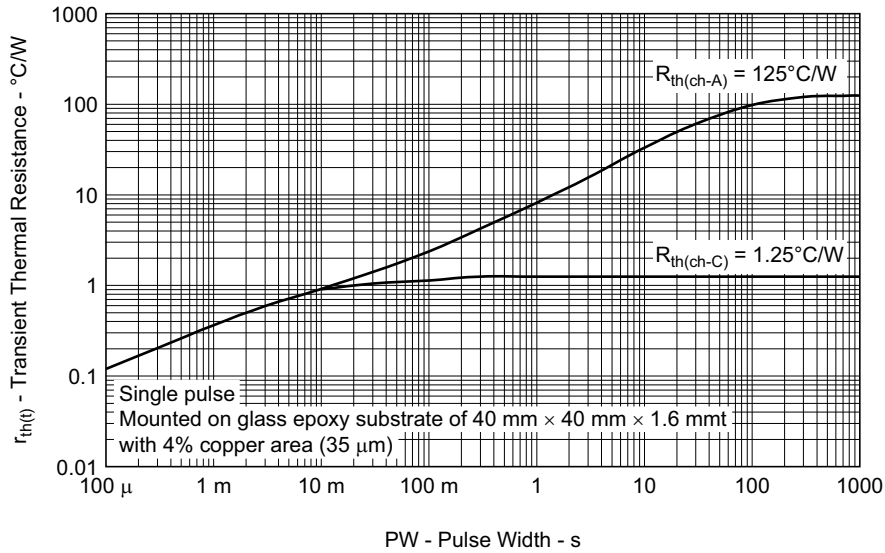
Typical Characteristics ($T_A = 25^\circ\text{C}$)



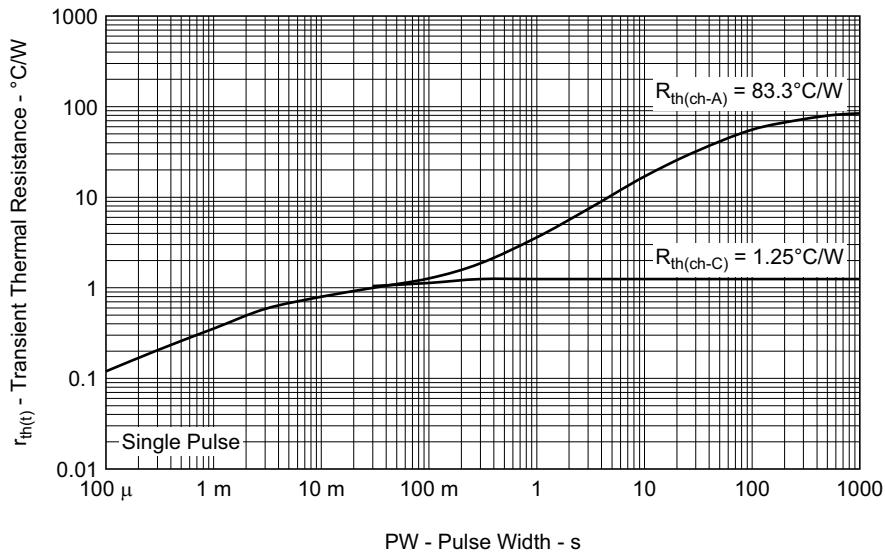
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH (NP40N10YDF)

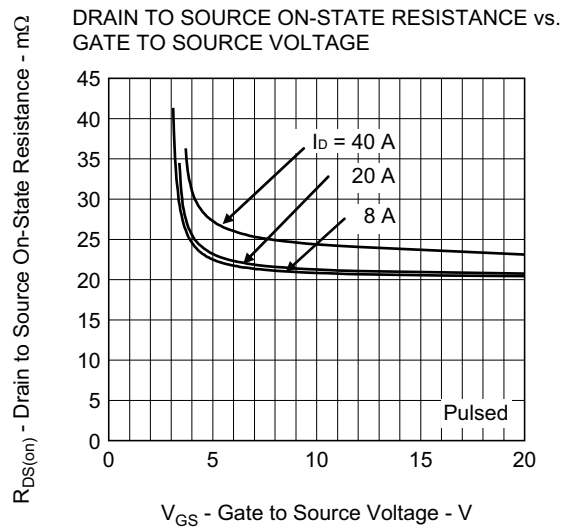
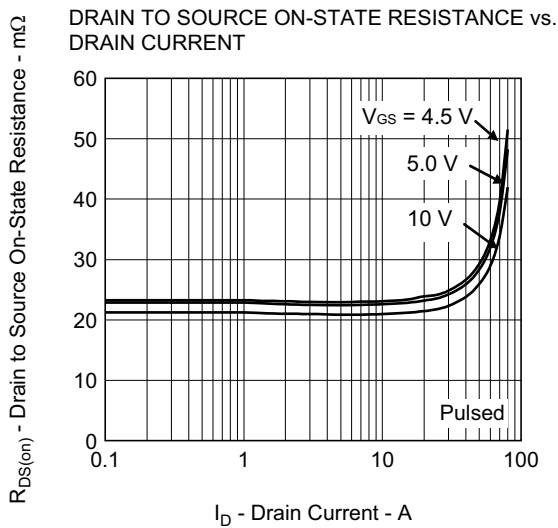
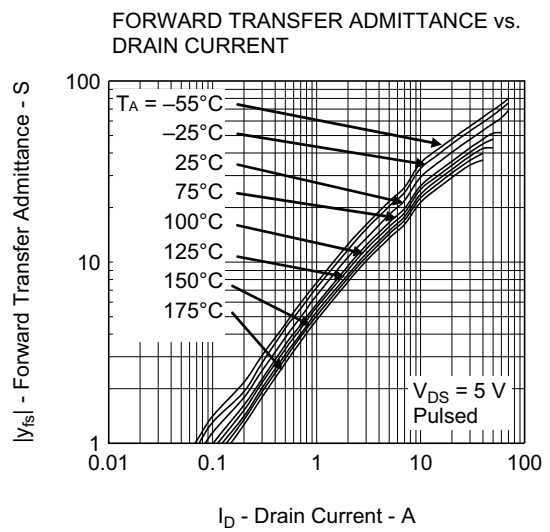
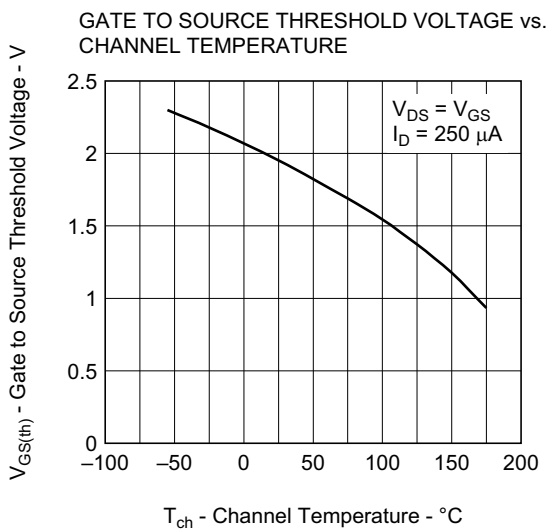
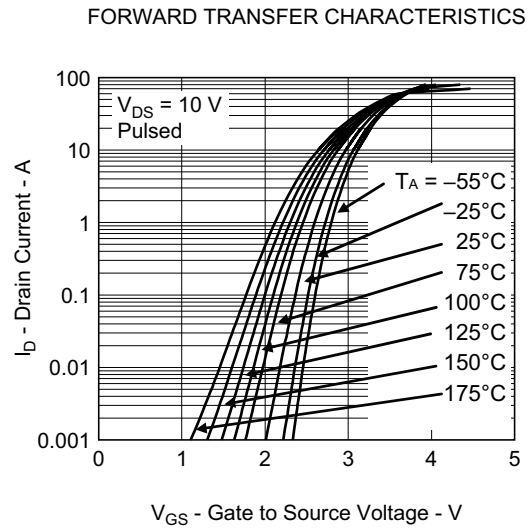
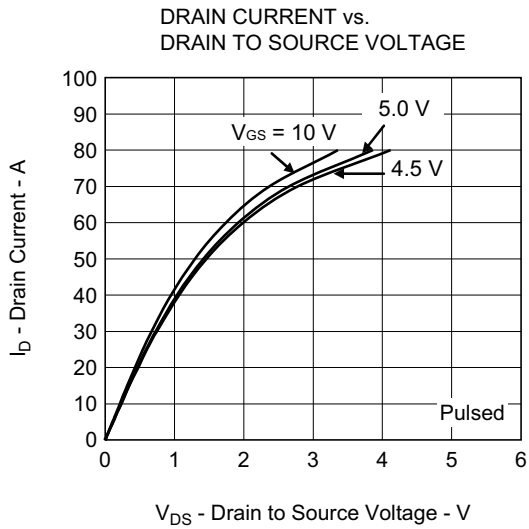


TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH (NP40N10VDF)

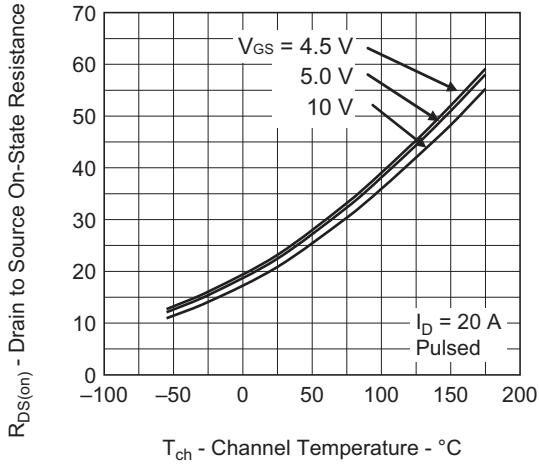


TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH (NP40N10PDF)

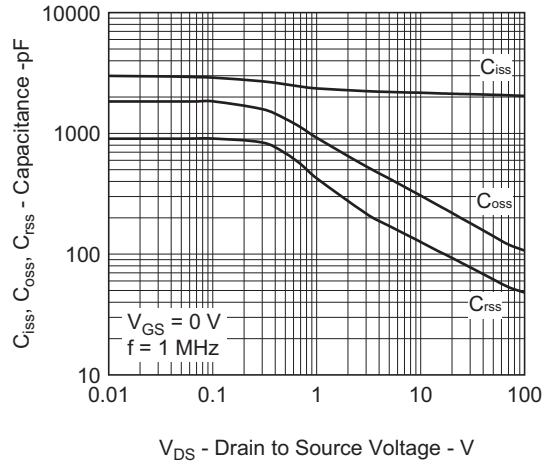




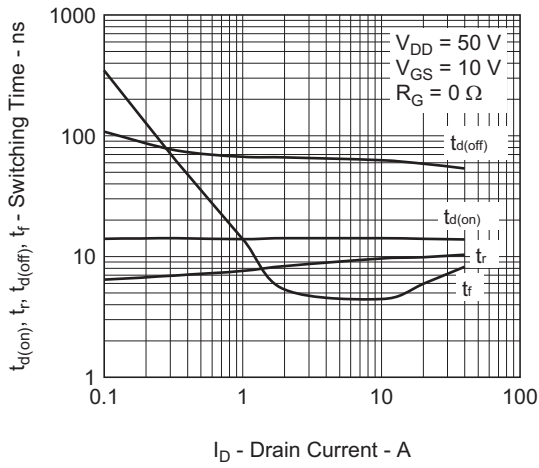
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



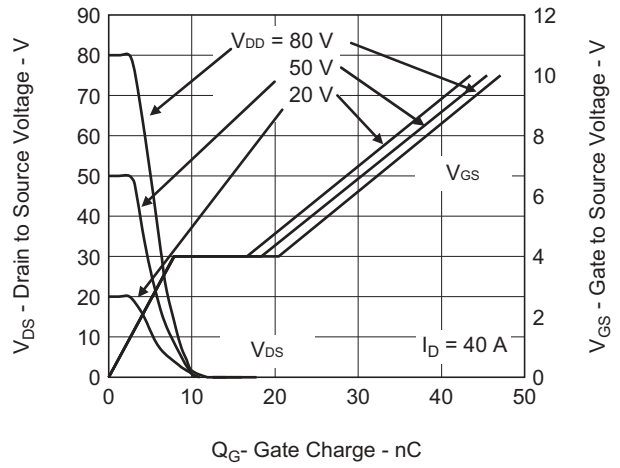
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



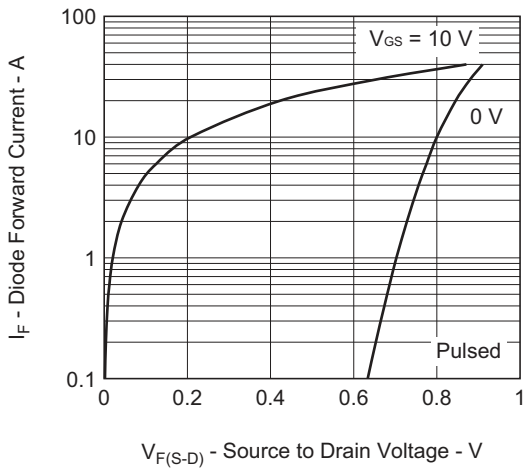
SWITCHING CHARACTERISTICS



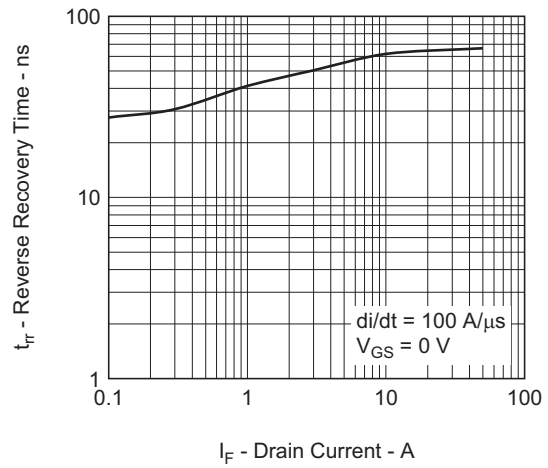
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



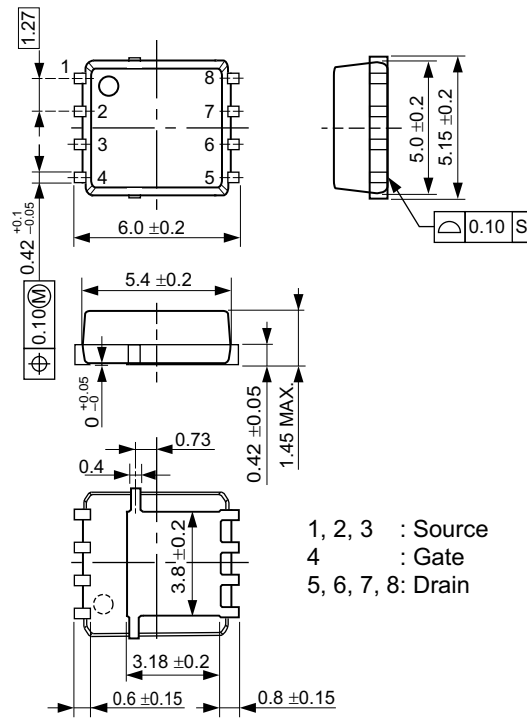
REVERSE RECOVERY TIME vs. DRAIN CURRENT



Package Drawings (Unit: mm)

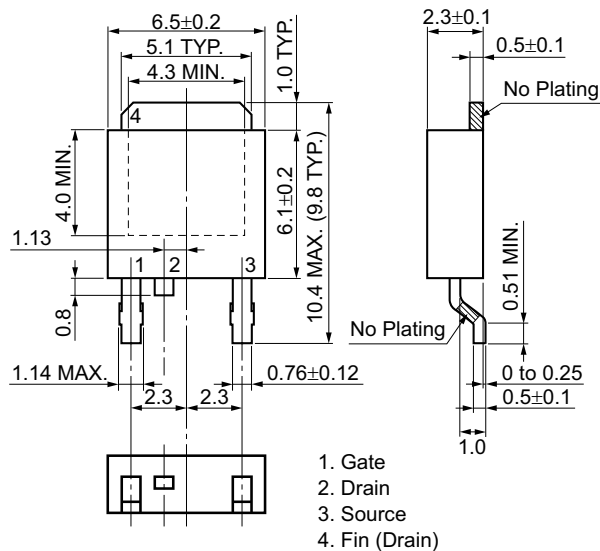
8-pin HSON (Mass: 0.13 g TYP.)

Renesas package code: PLSN0008KA-A



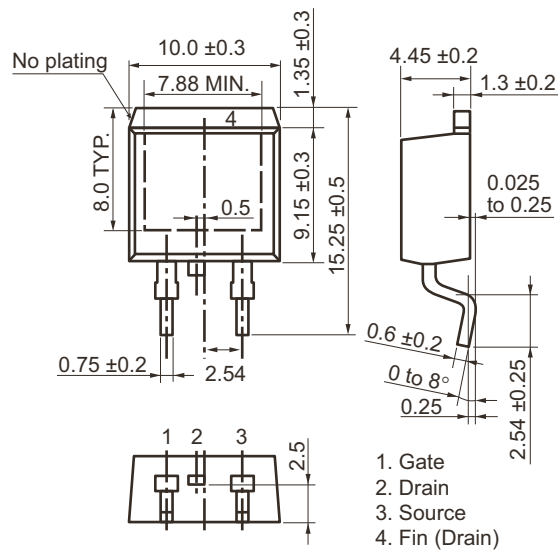
TO-252 (MP-3ZP) (Mass: 0.27 g TYP.)

Renesas package code: PRSS0004ZP-A



TO-263 (MP-25ZP) (Mass: 1.48 g TYP.)

Renesas package code: PRSS0004AL-A



Revision History**NP40N10YDF, NP40N10VDF, NP40N10PDF Data Sheet**

Rev.	Date	Description	
		Page	Summary
1.00	Feb 21, 2013	—	First Edition Issued
2.00	Mar 11, 2013	1	"Outline" added
		7	Modification of "CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE"
2.01	May 13, 2013	1	Modification of "Outline"
		8	Modification of "Package Drawings 8-pinHSON"

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