NP40N10YDF, NP40N10VDF, NP40N10PDF

100 V – 40 A – N-channel Power MOS FET
Application: Automotive

R07DS0361EJ0201
Rev.2.01
May 13, 2013

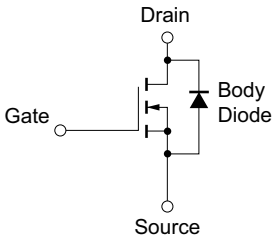
Description

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

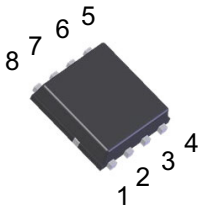
Features

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

Outline

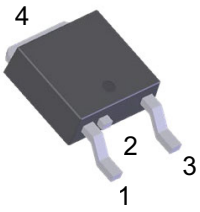


8-pin HSON



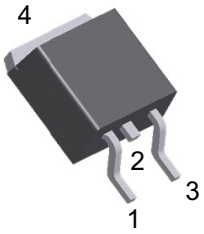
1, 2, 3 : Source
4 : Gate
5, 6, 7, 8: Drain

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°C)

Item	Symbol	Ratings	Unit
Drain to Source Voltage (V_{GS} = 0 V)	V_{DSS}	100	V
Gate to Source Voltage (V_{DS} = 0 V)	V_{GSS}	±20	V
Drain Current (DC) (T_C = 25°C)	$I_{D(DC)}$	±40	A
Drain Current (pulse) *1	$I_{D(pulse)}$	±80	A
Total Power Dissipation (T_C = 25°C)	P_{T1}	120	W
NP40N10YDF Total Power Dissipation (T_A = 25°C) *2	P_{T2}	1.0	W
NP40N10VDF Total Power Dissipation (T_A = 25°C) *2		1.2	
NP40N10PDF Total Power Dissipation (T_A = 25°C)		1.8	
Channel Temperature	T_{ch}	175	°C
Storage Temperature	T_{stg}	–55 to +175	°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	°C/W
Channel to Ambient Thermal Resistance *2	$R_{th(ch-A)}$	NP40N10YDF	150	°C/W
		NP40N10VDF	125	°C/W
		NP40N10PDF	83.3	°C/W

Notes: *1. T_C = 25°C, PW ≤ 10 μs, Duty Cycle ≤ 1%

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

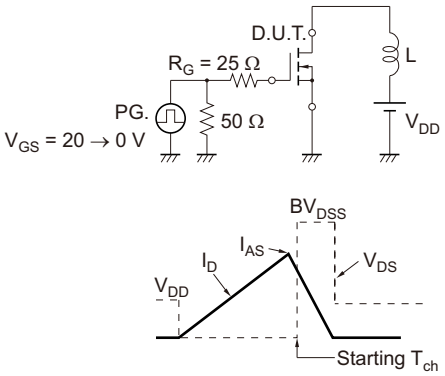
*3. $T_{ch(start)}$ = 25°C, V_{DD} = 50 V, R_G = 25 Ω, L = 100 μH, V_{GS} = 20 V → 0 V

Electrical Characteristics (T_A = 25°C)

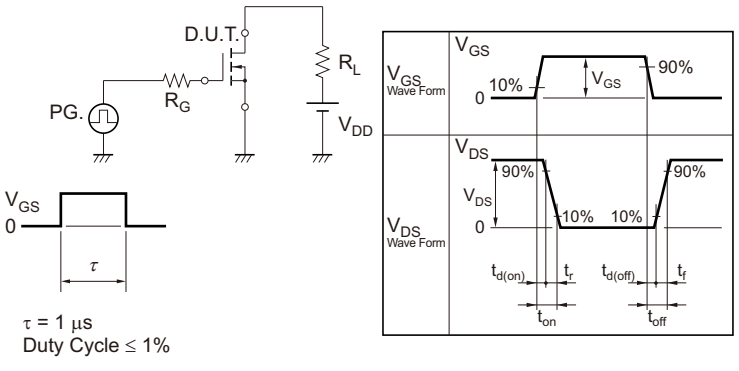
Item		Symbol	Min	Typ	Max	Unit	Test Conditions
Zero Gate Voltage Drain Current		I_{DSS}			1	μA	V_{DS} = 100 V, V_{GS} = 0 V
Gate Leakage Current		I_{GSS}			±100	nA	V_{GS} = ±20 V, V_{DS} = 0 V
Gate to Source Threshold Voltage		$V_{GS(th)}$	1.5	2.0	2.5	V	V_{DS} = V_{GS}, I_D = 250 μA
Forward Transfer Admittance *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,
Output Capacitance		C_{oss}		200	300	pF	V_{GS} = 0 V,
Reverse Transfer Capacitance		C_{rss}		80	144	pF	f = 1 MHz
Turn-on Delay Time		$t_{d(on)}$		15	33	ns	V_{DD} = 50 V, I_D = 20 A,
Rise Time		t_r		16	40	ns	V_{GS} = 10 V,
Turn-off Delay Time		$t_{d(off)}$		60	120	ns	R_G = 0 Ω
Fall Time		t_f		5	13	ns	
Total Gate Charge		Q_G		47	71	nC	V_{DD} = 80 V,
Gate to Source Charge		Q_{GS}		8		nC	V_{GS} = 10 V,
Gate to Drain Charge		Q_{GD}		12		nC	I_D = 40 A
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,
Reverse Recovery Charge		Q_{rr}		162		nC	di/dt = 100 A/μs

Note: *1. Pulsed test

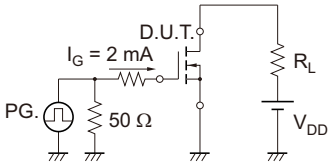
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

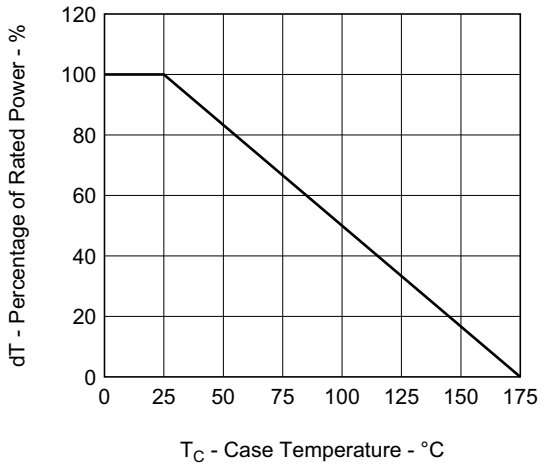


TEST CIRCUIT 3 GATE CHARGE

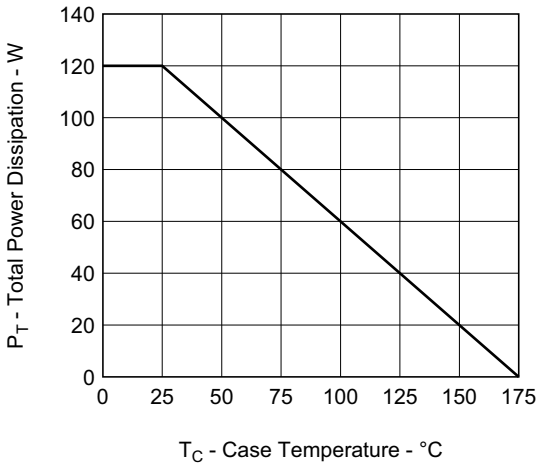


Typical Characteristics (T_A = 25°C)

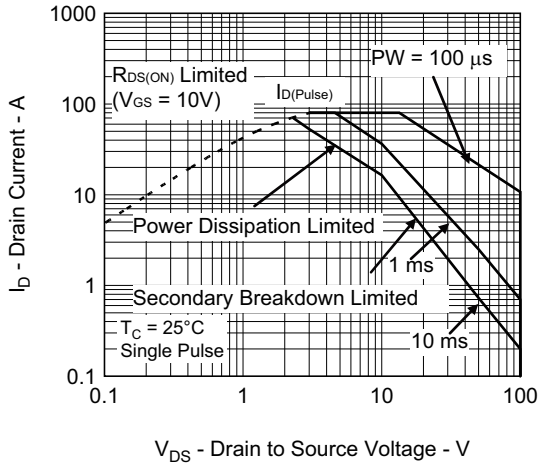
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



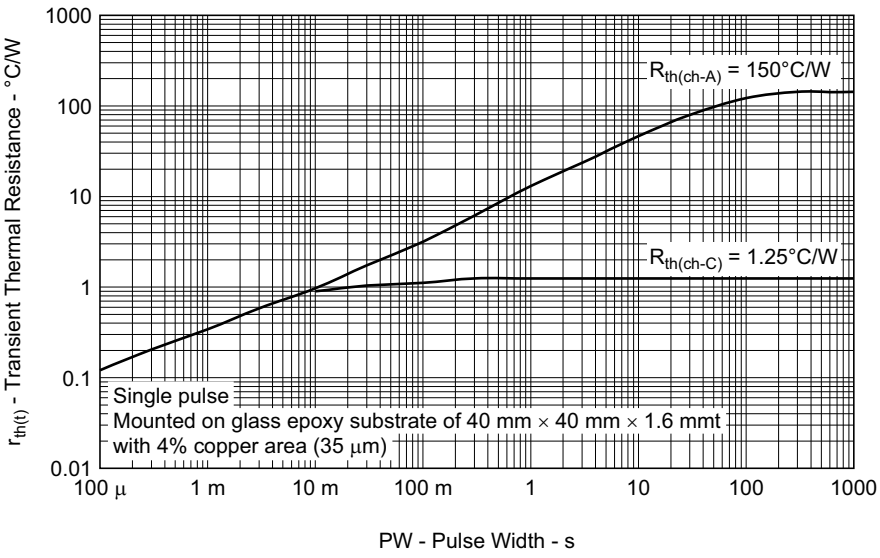
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



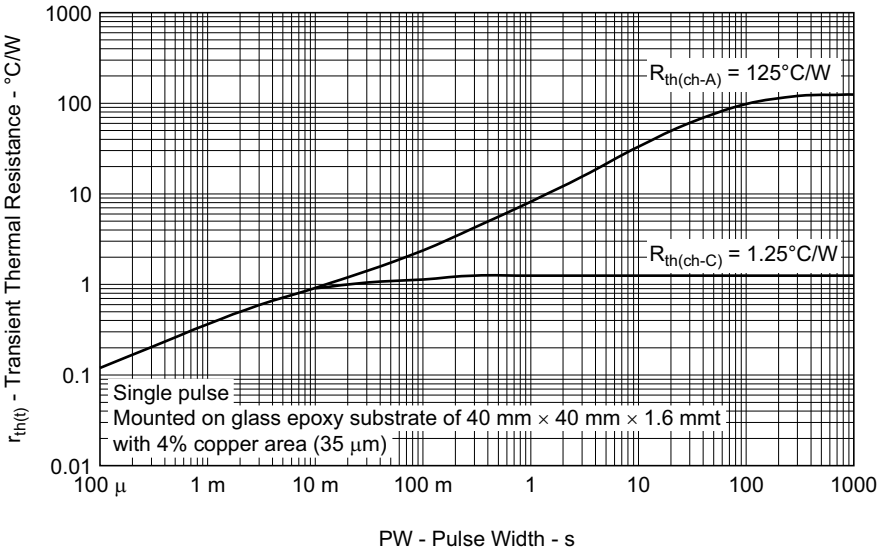
FORWARD BIAS SAFE OPERATING AREA



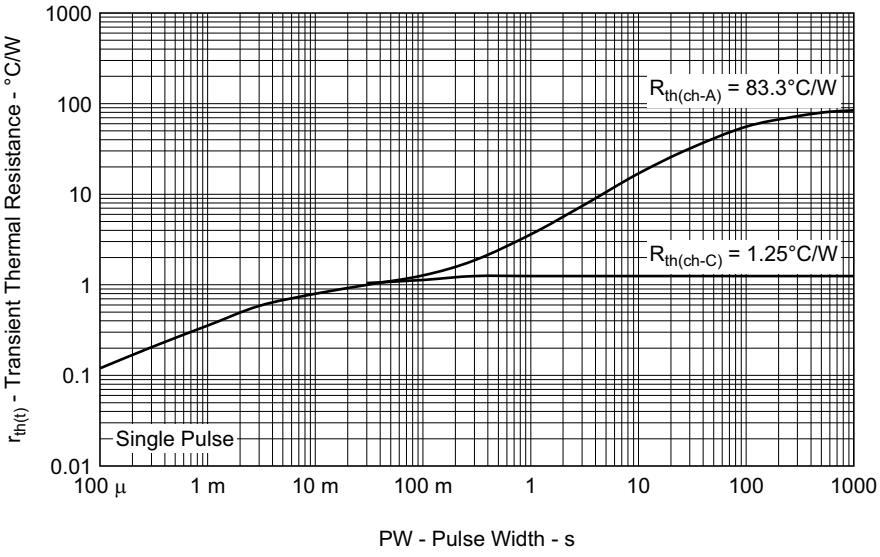
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH (NP40N10YDF)



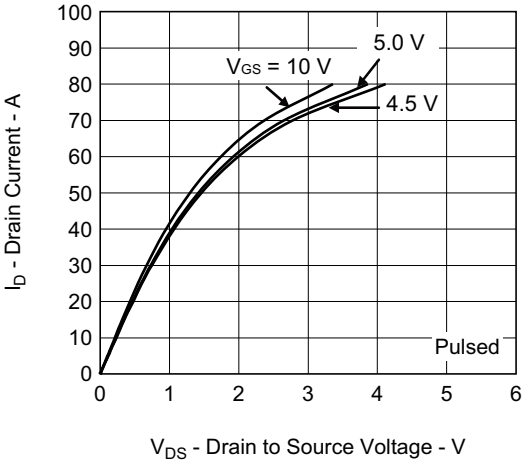
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH (NP40N10VDF)



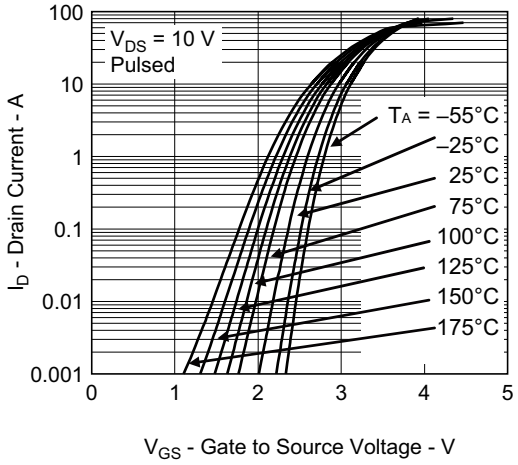
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH (NP40N10PDF)



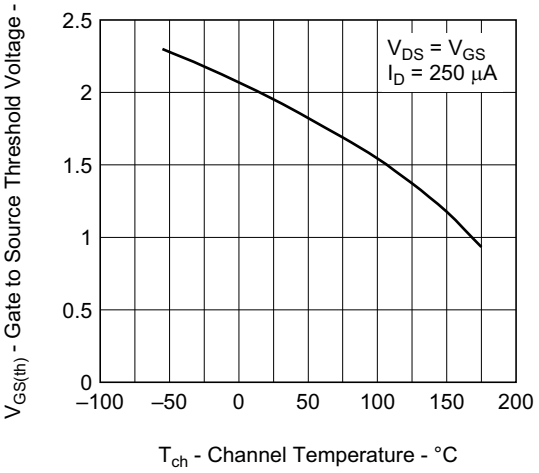
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



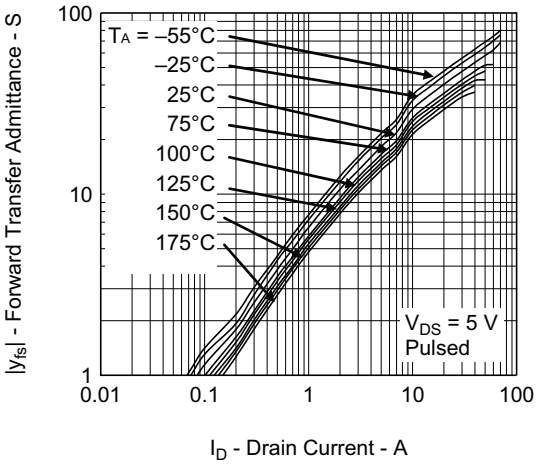
FORWARD TRANSFER CHARACTERISTICS



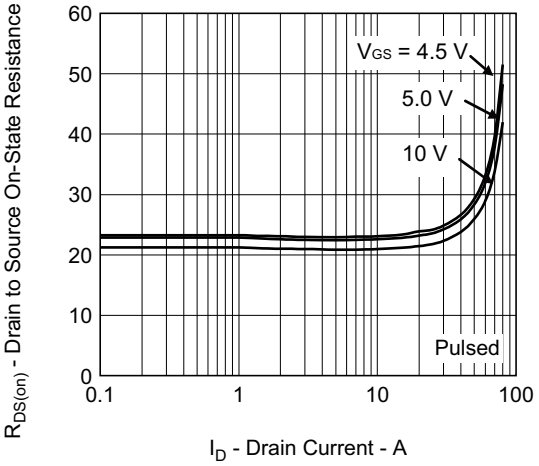
GATE TO SOURCE THRESHOLD VOLTAGE vs.
CHANNEL TEMPERATURE



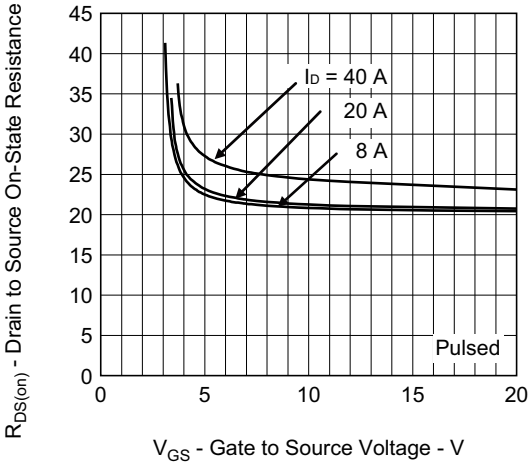
FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



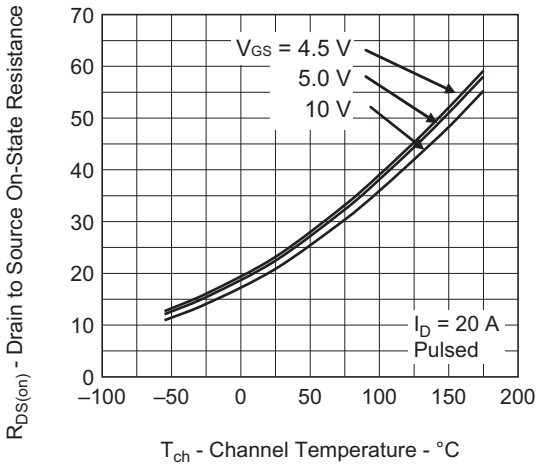
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT



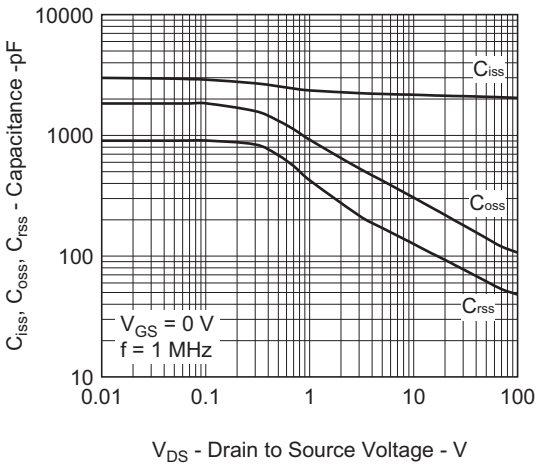
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



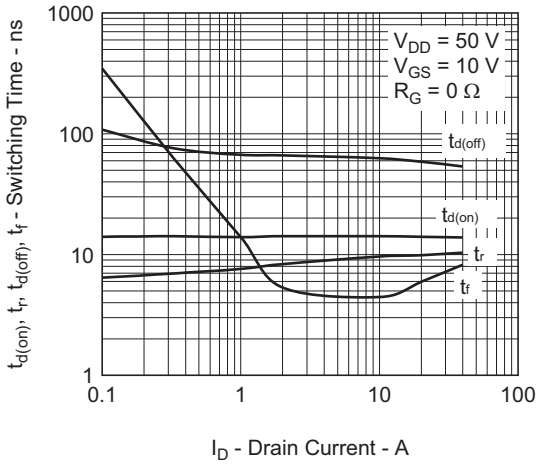
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



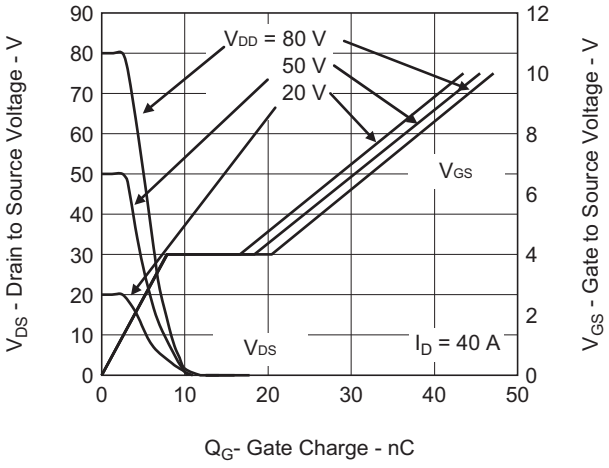
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



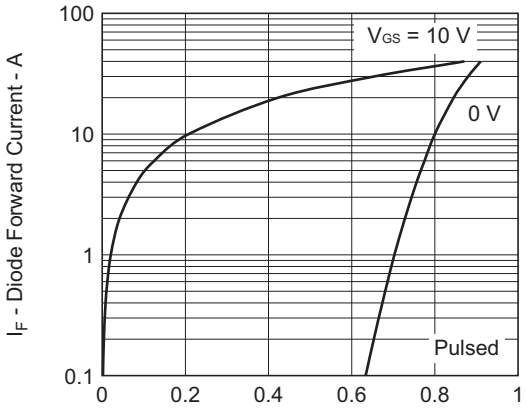
SWITCHING CHARACTERISTICS



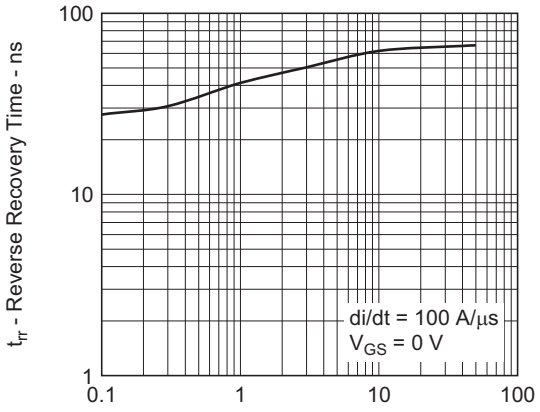
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



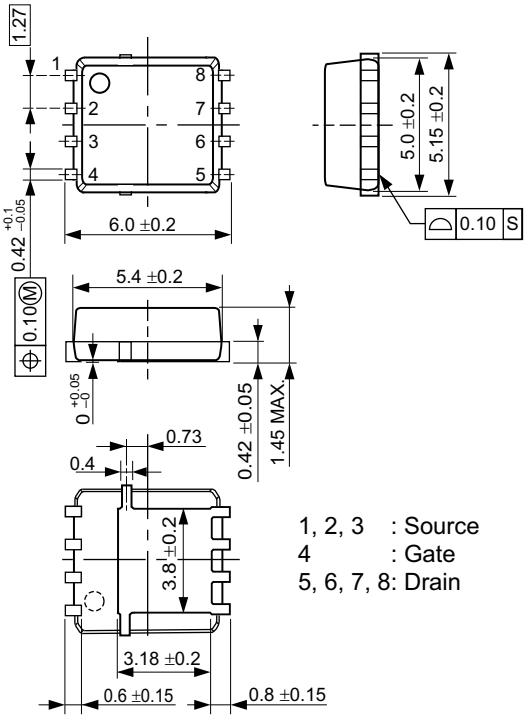
REVERSE RECOVERY TIME vs. DRAIN CURRENT



Package Drawings (Unit: mm)

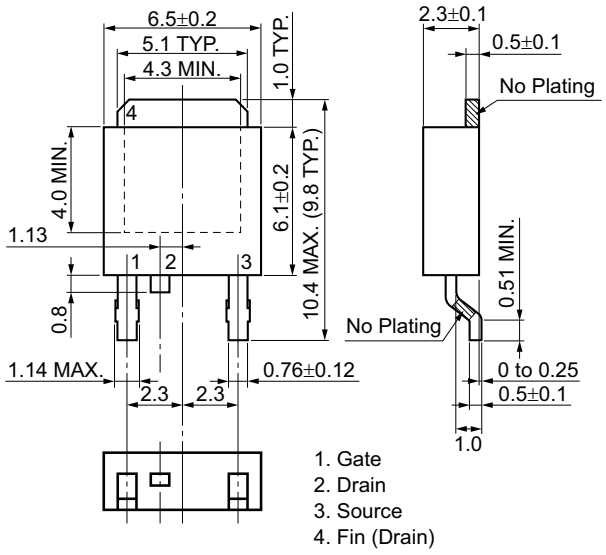
8-pin HSON (Mass: 0.13 g TYP.)

Renesas package code: PLSN0008KA-A



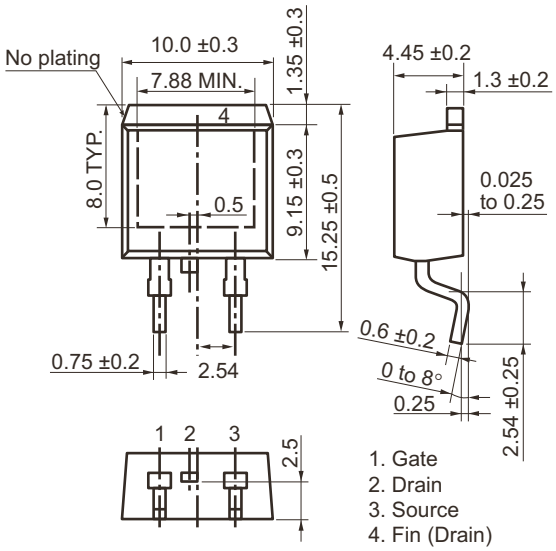
TO-252 (MP-3ZP) (Mass: 0.27 g TYP.)

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 7	"Outline" added Modification of "CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE"
2.01	May 13, 2013	1 8	Modification of "Outline" Modification of "Package Drawings 8-pinHSON"

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Renesas Electronics America Inc.
2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-651-700, Fax: +44-1628-651-804

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898

Renesas Electronics Hong Kong Limited
Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics Korea Co., Ltd.
11F., Samik Lavied' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

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