RENESAS

Data Sheet

NP90N055MUK, NP90N055NUK

MOS FIELD EFFECT TRANSISTOR

R07DS0602EJ0100
Rev.1.00
Jan 11, 2012

Description

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

Features

- Super low on-state resistance
  $R_{DS(on)}$ = 3.8 mΩ MAX. (V_{GS} = 10 V, I_D = 45 A)
- Low C_{iss}: C_{iss} = 4900 pF TYP. (V_{DS} = 25 V)
- Designed for automotive application and AEC-Q101 qualified

Ordering Information

Part No.	Lead Plating	Packing	Package
NP90N055MUK-S18-AY *1	Pure Sn (Tin)	Tube 50 p/tube	TO-220 (MP-25K)
NP90N055NUK-S18-AY *1			TO-262 (MP-25SK)

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}	55	V
Gate to Source Voltage (V_{DS} = 0 V)	V_{GSS}	±20	V
Drain Current (DC) (T_C = 25°C)	$I_{D(DC)}$	±90	A
Drain Current (pulse) *1	$I_{D(pulse)}$	±360	A
Total Power Dissipation (T_C = 25°C)	P_{T1}	176	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
Repetitive Avalanche Current *2	I_{AR}	38	A
Repetitive Avalanche Energy *2	E_{AR}	144	mJ

Notes: *1 T_C = 25°C, $P_W \leq$ 10 μs, Duty Cycle $\leq$ 1%
*2 R_G = 25 Ω, V_{GS} = 20 → 0 V

Thermal Resistance

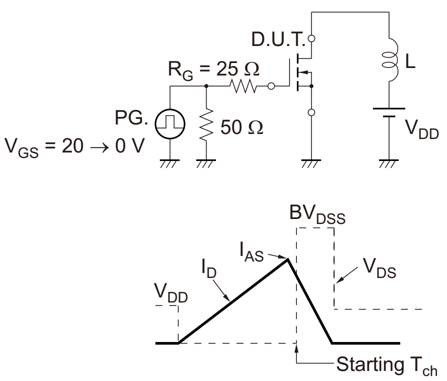
Channel to Case Thermal Resistance	$R_{th(ch-C)}$	0.85	°C/W
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	83.3	°C/W

Electrical Characteristics (T_A = 25°C)

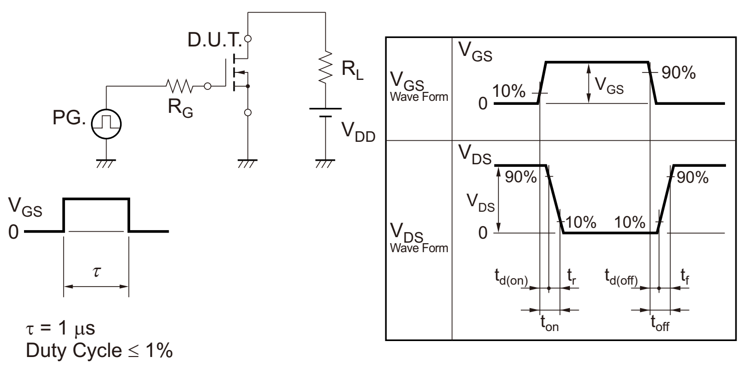
Item	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Zero Gate Voltage Drain Current	I_{DSS}	—	—	1	µA	V_{DS} = 55 V, V_{GS} = 0 V
Gate Leakage Current	I_{GSS}	—	—	±100	nA	V_{GS} = ±20 V, V_{DS} = 0 V
Gate to Source Threshold Voltage	$V_{GS(th)}$	2.0	3.0	4.0	V	V_{DS} = V_{GS}, I_D = 250 µA
Forward Transfer Admittance *1	$\lvert y_{fs} \rvert$	35	70	—	S	V_{DS} = 5 V, I_D = 45 A
Drain to Source On-state Resistance *1	$R_{DS(on)}$	—	3.15	3.80	mΩ	V_{GS} = 10 V, I_D = 45 A
Input Capacitance	C_{iss}	—	4900	7350	pF	V_{DS} = 25 V V_{GS} = 0 V f = 1 MHz
Output Capacitance	C_{oss}	—	500	750	pF	
Reverse Transfer Capacitance	C_{rss}	—	180	330	pF	
Turn-on Delay Time	$t_{d(on)}$	—	28	70	ns	V_{DD} = 28 V, I_D = 45 A V_{GS} = 10 V R_G = 0 Ω
Rise Time	t_r	—	12	30	ns	
Turn-off Delay Time	$t_{d(off)}$	—	70	140	ns	
Fall Time	t_f	—	7	20	ns	
Total Gate Charge	Q_G	—	80	120	nC	V_{DD} = 44 V V_{GS} = 10 V I_D = 90 A
Gate to Source Charge	Q_{GS}	—	21	—	nC	
Gate to Drain Charge	Q_{GD}	—	20	—	nC	
Body Diode Forward Voltage *1	$V_{F(S-D)}$	—	0.9	1.5	V	I_F = 90 A, V_{GS} = 0 V
Reverse Recovery Time	t_{rr}	—	52	—	ns	I_F = 90 A, V_{GS} = 0 V di/dt = 100 A/µs
Reverse Recovery Charge	Q_{rr}	—	95	—	nC	

Note: *1 Pulsed test

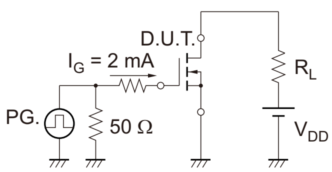
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

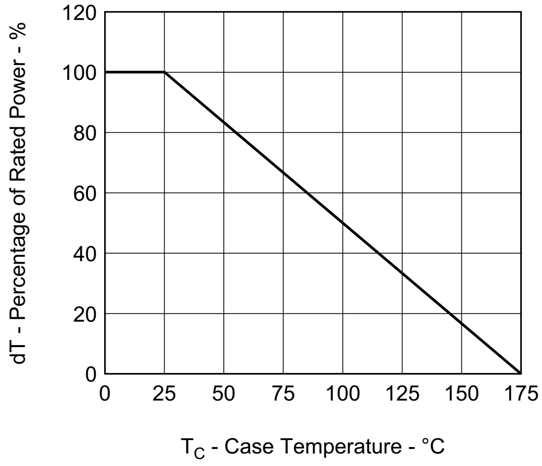


TEST CIRCUIT 3 GATE CHARGE

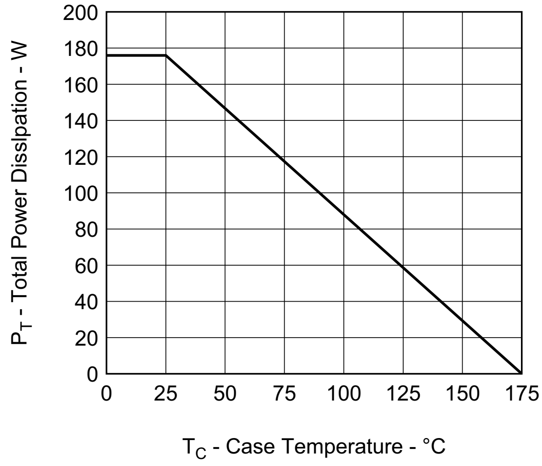


Typical Characteristics (T_A = 25°C)

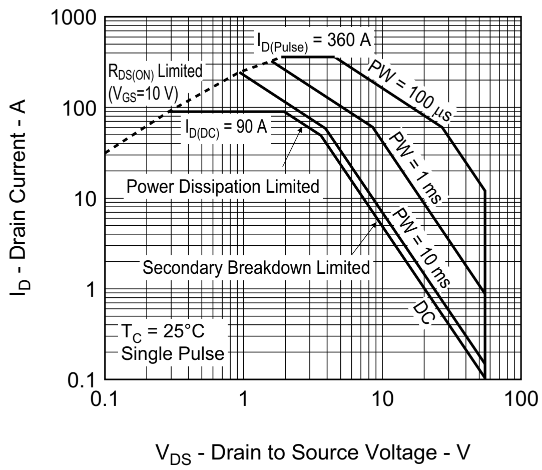
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



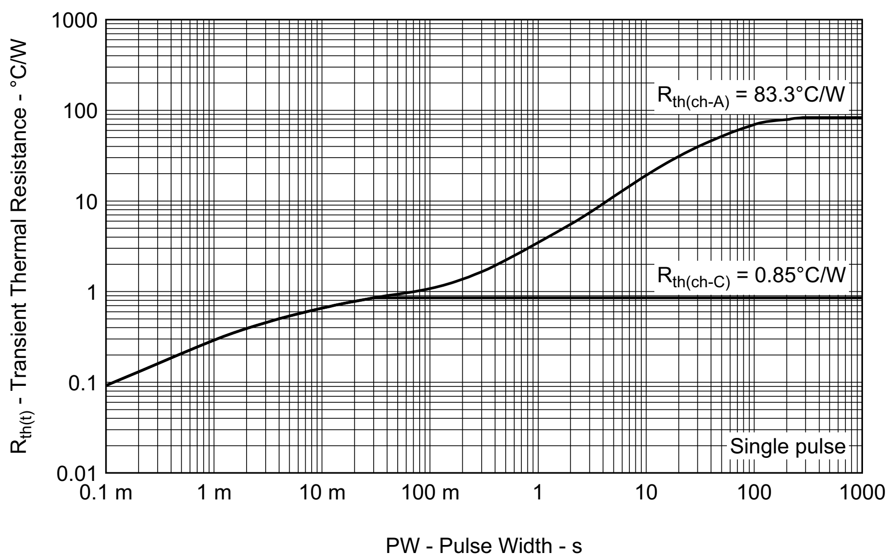
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

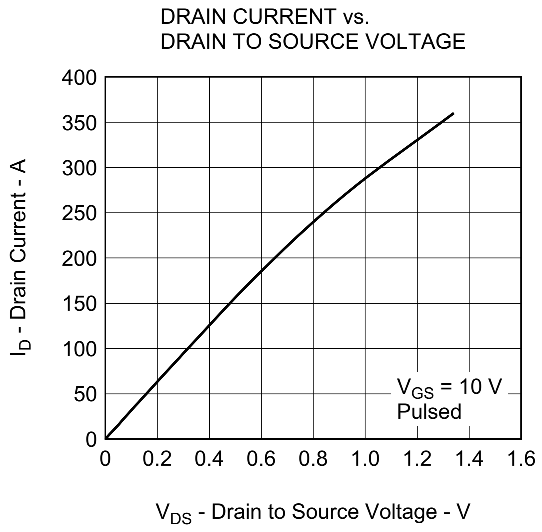


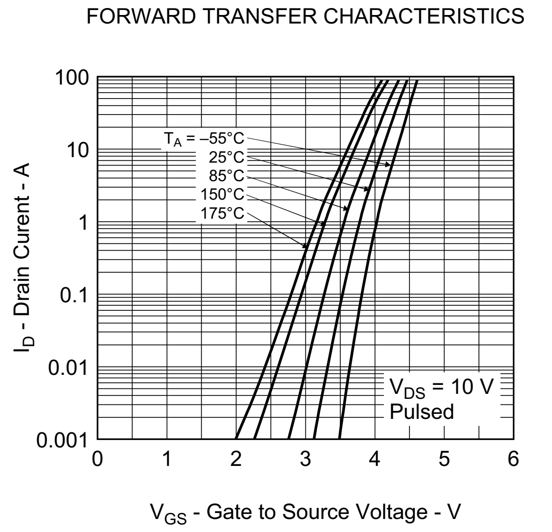
FORWARD BIAS SAFE OPERATING AREA

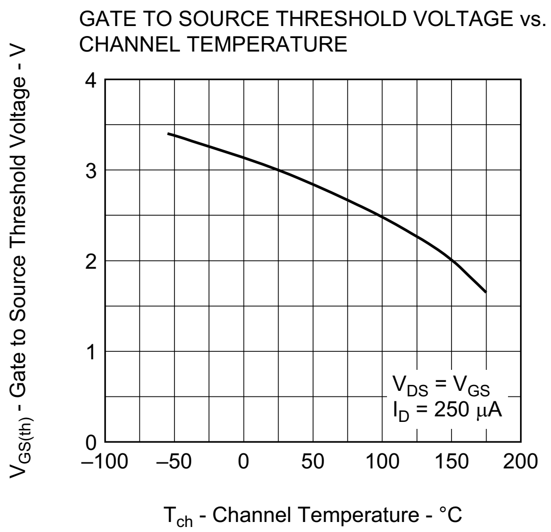


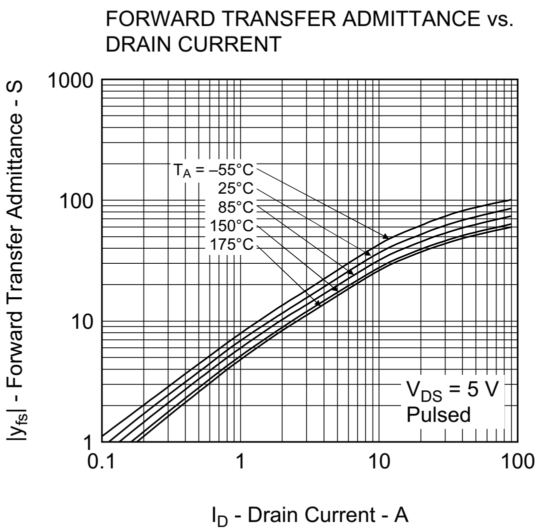
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

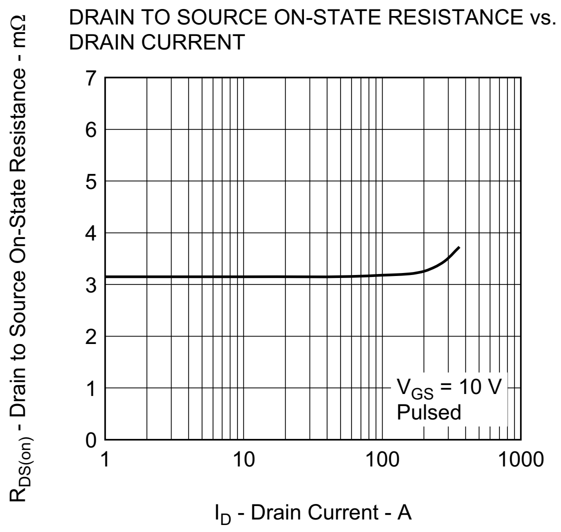


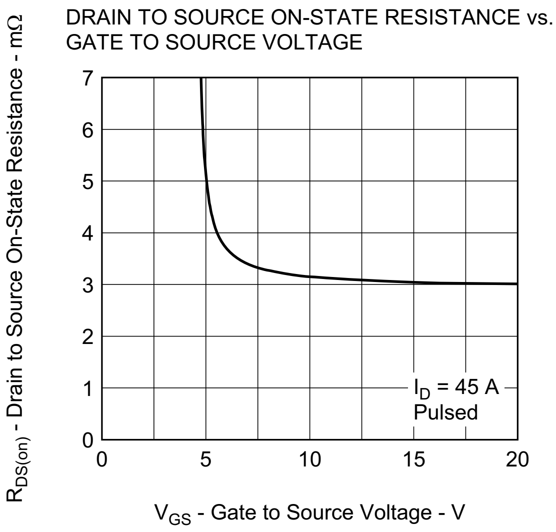

DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE
I_D - Drain Current - A
V_{GS} = 10 V
Pulsed
V_{DS} - Drain to Source Voltage - V


FORWARD TRANSFER CHARACTERISTICS
T_A = –55°C
25°C
85°C
150°C
175°C
I_D - Drain Current - A
V_{DS} = 10 V
Pulsed
V_{GS} - Gate to Source Voltage - V

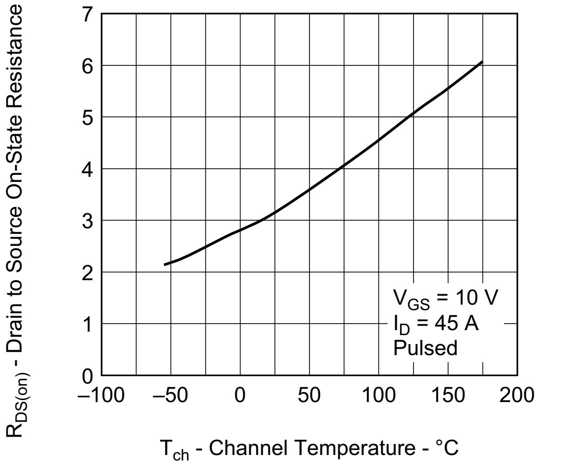

GATE TO SOURCE THRESHOLD VOLTAGE vs.
CHANNEL TEMPERATURE
$V_{GS(th)}$ - Gate to Source Threshold Voltage - V
V_{DS} = V_{GS}
I_D = 250 μA
T_{ch} - Channel Temperature - °C


FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT
T_A = –55°C
25°C
85°C
150°C
175°C
$|y_{fs}|$ - Forward Transfer Admittance - S
V_{DS} = 5 V
Pulsed
I_D - Drain Current - A

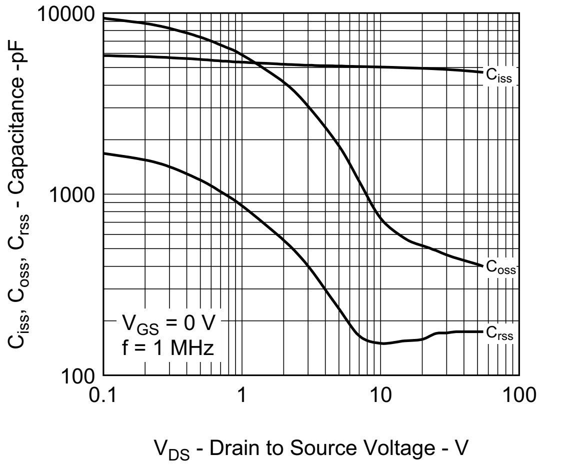

DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT
$R_{DS(on)}$ - Drain to Source On-State Resistance - mΩ
V_{GS} = 10 V
Pulsed
I_D - Drain Current - A


DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE
$R_{DS(on)}$ - Drain to Source On-State Resistance - mΩ
I_D = 45 A
Pulsed
V_{GS} - Gate to Source Voltage - V

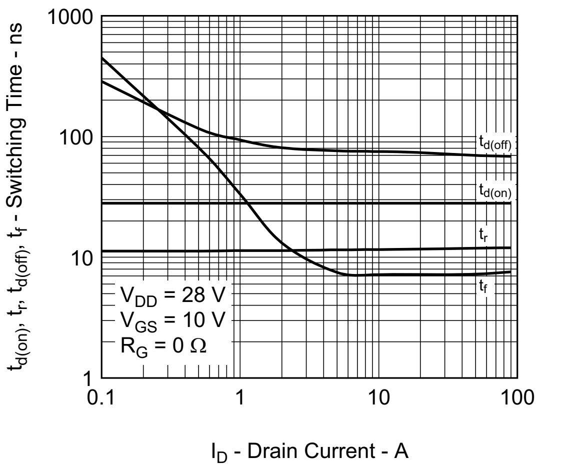
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
CHANNEL TEMPERATURE



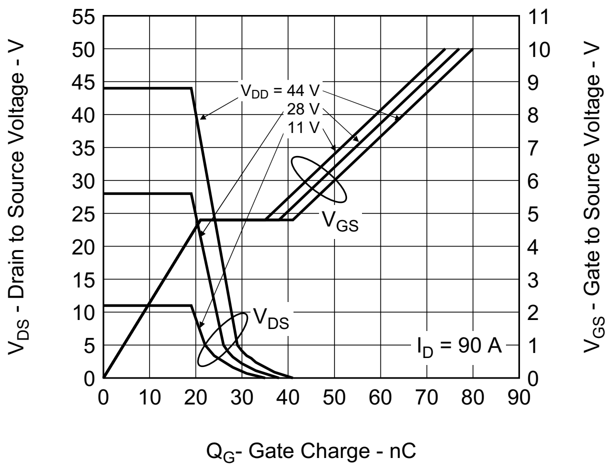
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



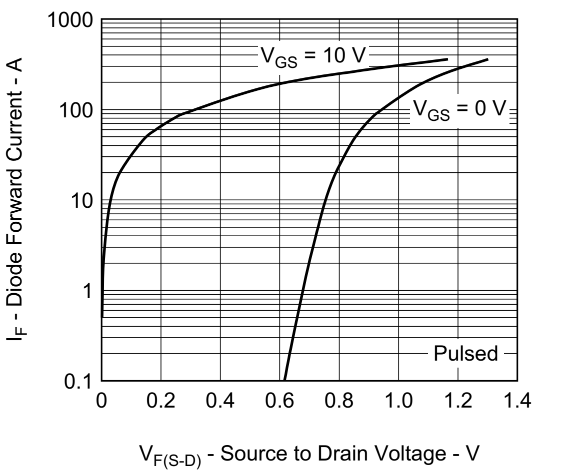
SWITCHING CHARACTERISTICS



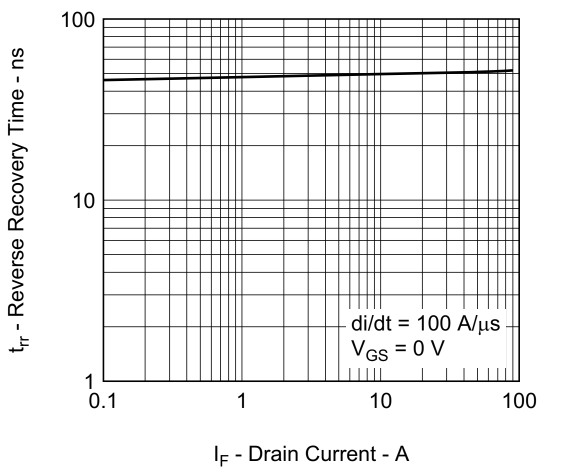
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

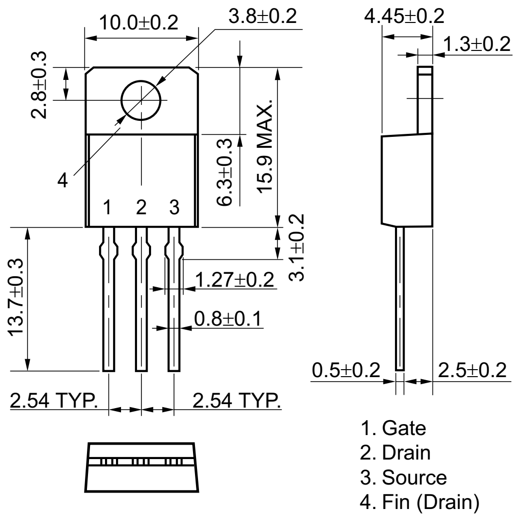


REVERSE RECOVERY TIME vs.
DRAIN CURRENT

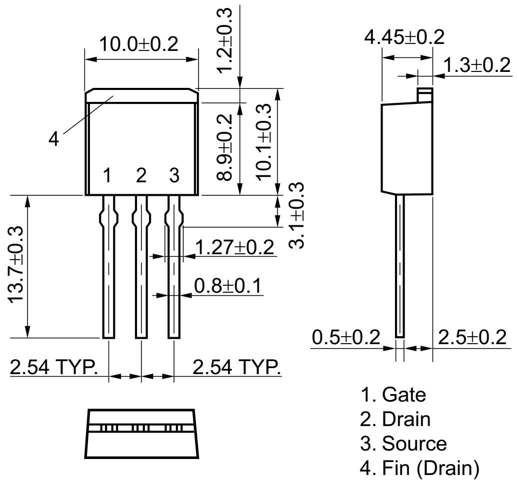


Package Drawing (Unit: mm)

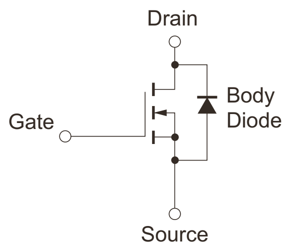
TO-220 (MP-25K) (Mass: 1.9 g TYP.)



TO-262 (MP-25SK) (Mass: 1.8 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.

Revision History	NP90N055MUK, NP90N055NUK Data Sheet

Rev.	Date	Description	
		Page	Summary
1.00	Jan 11, 2012	—	First Edition Issued

RENESAS

SALES OFFICES Renesas Electronics Corporation http://www.renesas.com

Refer to "http://www.renesas.com/" for the latest and detailed information.

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: +44-1628-585-100, Fax: +44-1628-585-900

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.
1 harbourFront Avenue, #06-10, keppel Bay Tower, Singapore 098632
Tel: +65-6213-0200, Fax: +65-6278-8001

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

Colophon 1.1