

NP60N04VDK

R07DS1014EJ0200

Rev.2.00

May 24, 2018

40 V – 60 A – N-channel Power MOS FET

Application: Automotive

Description

The NP60N04VDK is N-channel MOS Field Effect Transistors designed for high current switching applications.

Features

- Super low on-state resistance
 $R_{DS(on)} = 3.85 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 30 \text{ A)}$
- Low C_{iss} : $C_{iss} = 2450 \text{ pF TYP. (} V_{DS} = 25 \text{ V)}$
- Logic level drive type
- Designed for automotive application and AEC-Q101 qualified

Ordering Information

Part No.	Lead Plating	Packing		Package
NP60N04VDK-E1-AY *1	Pure Sn (Tin)	Tape 2500 p/reel	Taping (E1 type)	TO-252 (MP-3ZP)
NP60N04VDK-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}	40	V
Gate to Source Voltage ($V_{DS} = 0 \text{ V}$)	V_{GSS}	± 20	V
Drain Current (DC) ($T_C = 25^\circ\text{C}$)	$I_{D(DC)}$	± 60	A
Drain Current (pulse) *1, 3	$I_{D(pulse)}$	± 240	A
Total Power Dissipation ($T_C = 25^\circ\text{C}$)	P_{T1}	105	W
Total Power Dissipation ($T_A = 25^\circ\text{C}$)	P_{T2}	1.2	W
Channel Temperature	T_{ch}	175	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 to +175	$^\circ\text{C}$
Repetitive Avalanche Current *2, 3	I_{AR}	28	A
Repetitive Avalanche Energy *2, 3	E_{AR}	78	mJ

Thermal Resistance

Channel to Case Thermal Resistance	$R_{th(ch-C)}$ *3	1.43	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$ *3	125	$^\circ\text{C/W}$

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

*2 $R_G = 25 \Omega$, $V_{GS} = 20 \text{ V} \rightarrow 0 \text{ V}$

*3. Not subject of production test. Verified by design/characterization.

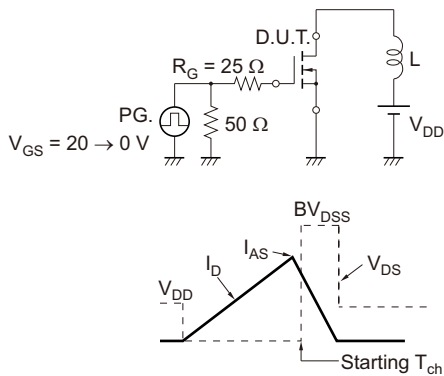
Electrical Characteristics (T_A = 25°C)

Item	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Zero Gate Voltage Drain Current	I _{DSS}	—	—	1	μA	V _{DS} = 40 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	1.8	2.5	V	V _{DS} = V _{GS} , I _D = 250 μA
Forward Transfer Admittance *1	y _{fs}	33	66	—	S	V _{DS} = 5 V, I _D = 30 A
Drain to Source On-state Resistance *1	R _{DS(on)1}	—	3.20	3.85	mΩ	V _{GS} = 10 V, I _D = 30 A
	R _{DS(on)2}	—	4.30	8.60	mΩ	V _{GS} = 4.5 V, I _D = 15 A
Input Capacitance *2	C _{iss}	—	2450	3680	pF	V _{DS} = 25 V V _{GS} = 0 V f = 1 MHz
Output Capacitance *2	C _{oss}	—	340	510	pF	
Reverse Transfer Capacitance *2	C _{rss}	—	140	260	pF	
Turn-on Delay Time *2	t _{d(on)}	—	14	31	ns	V _{DD} = 20 V, I _D = 30 A V _{GS} = 10 V R _G = 0 Ω
Rise Time *2	t _r	—	6	15	ns	
Turn-off Delay Time *2	t _{d(off)}	—	49	98	ns	
Fall Time *2	t _f	—	6	15	ns	
Total Gate Charge *2	Q _G	—	42	63	nC	V _{DD} = 32 V V _{GS} = 10 V I _D = 60 A
Gate to Source Charge	Q _{GS}	—	11	—	nC	
Gate to Drain Charge	Q _{GD}	—	6	—	nC	
Body Diode Forward Voltage *1	V _{F(S-D)}	—	0.9	1.5	V	I _F = 60 A, V _{GS} = 0 V
Reverse Recovery Time	t _{rr}	—	36	—	ns	I _F = 60 A, V _{GS} = 0 V
Reverse Recovery Charge	Q _{rr}	—	44	—	nC	di/dt = 100 A/μs

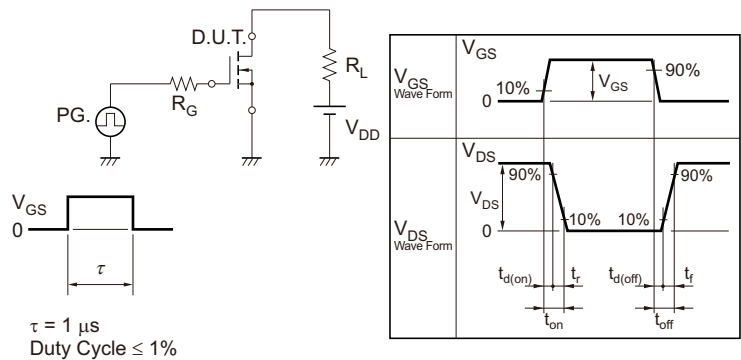
Note: *1 Pulsed test

Note: *2 Not subject of production test. Verified by design/characterization.

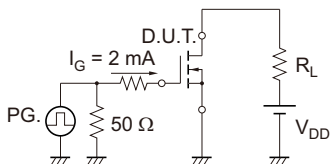
TEST CIRCUIT 1 AVALANCHE CAPABILITY



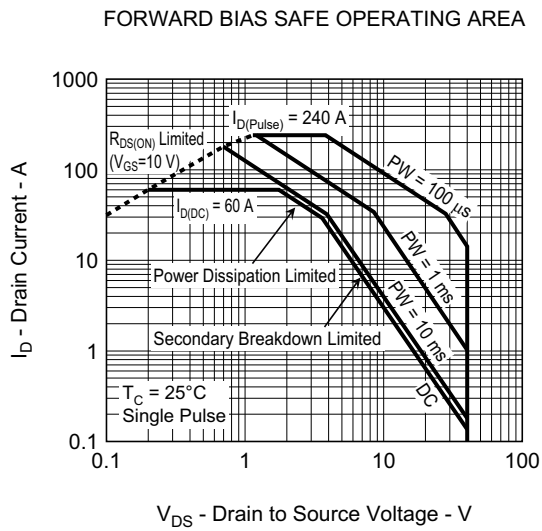
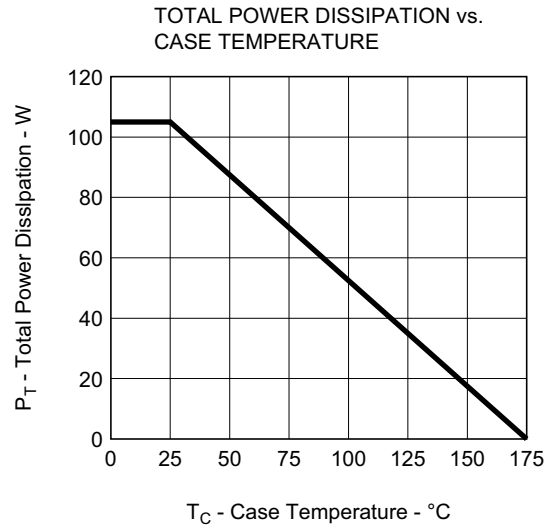
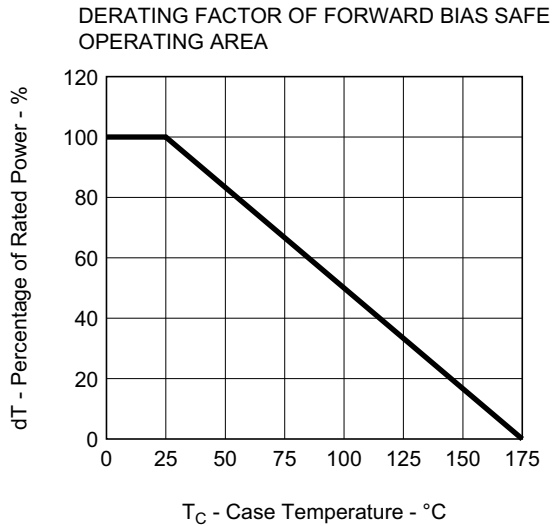
TEST CIRCUIT 2 SWITCHING TIME



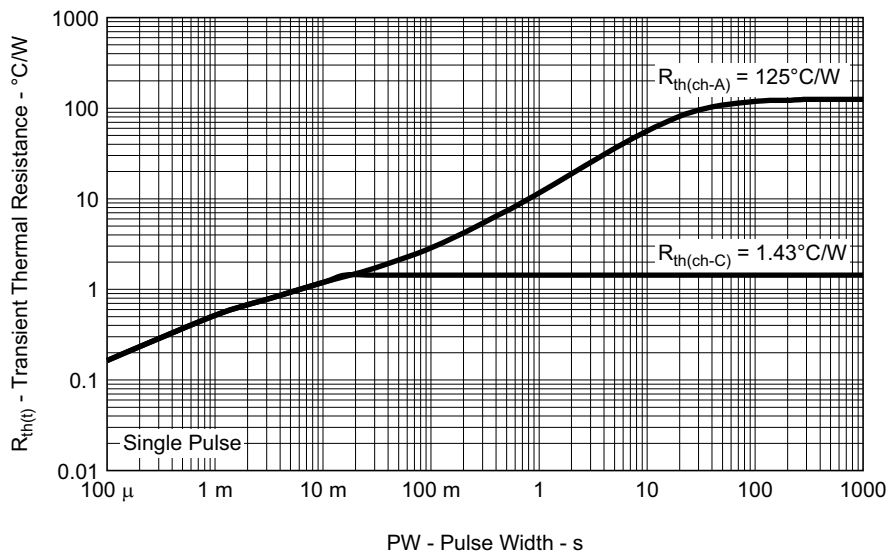
TEST CIRCUIT 3 GATE CHARGE

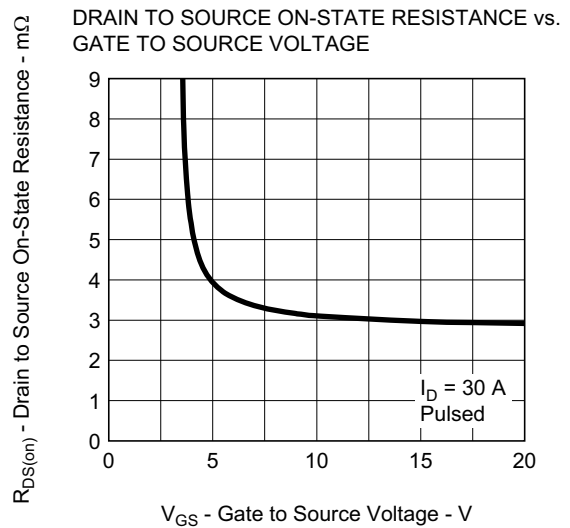
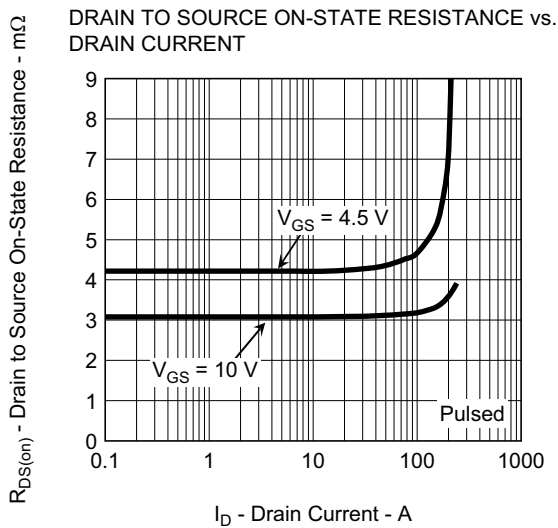
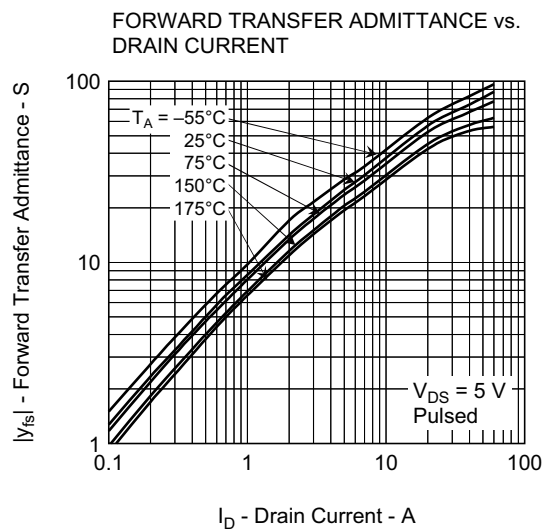
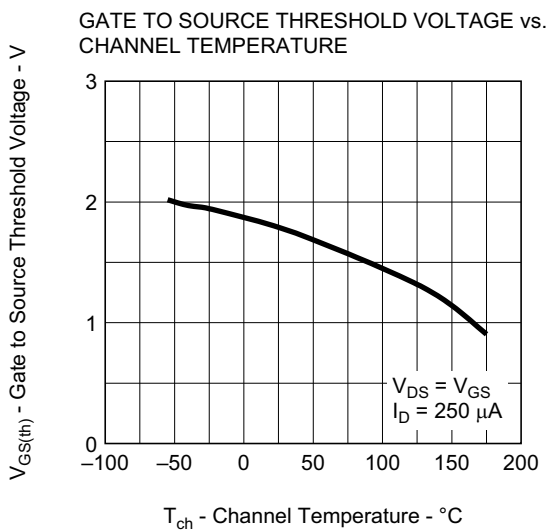
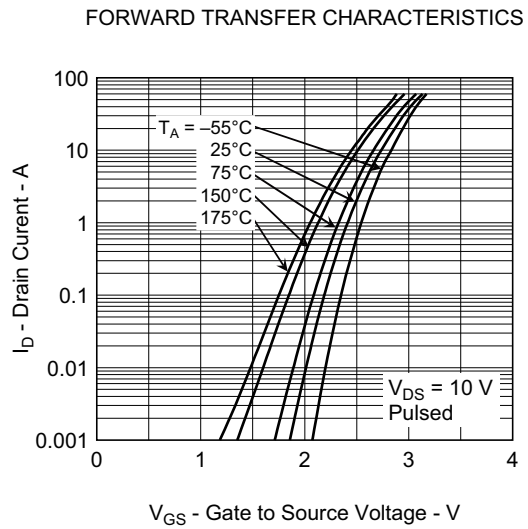
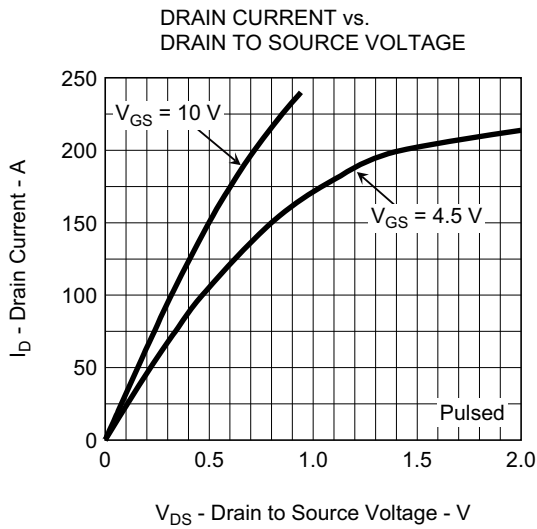


Typical Characteristics ($T_A = 25^\circ\text{C}$)

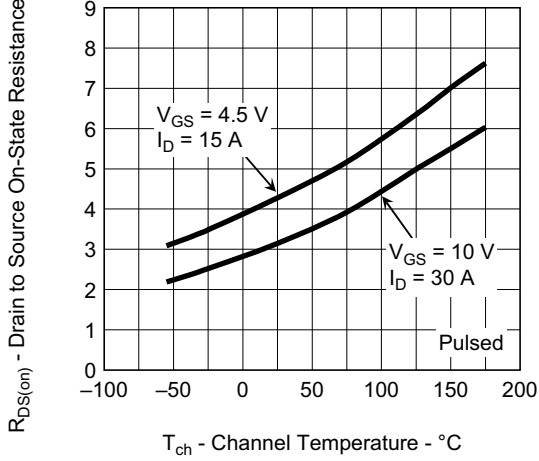


TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

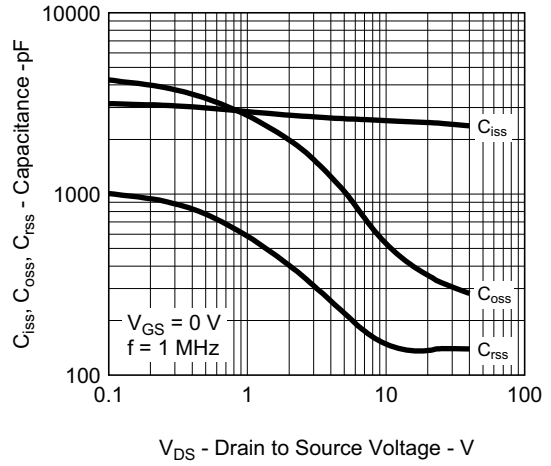




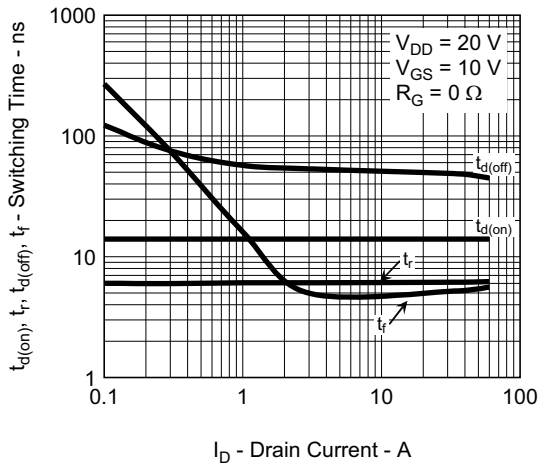
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



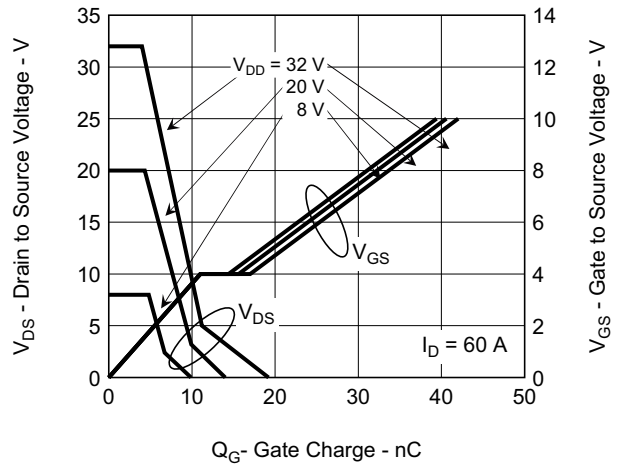
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



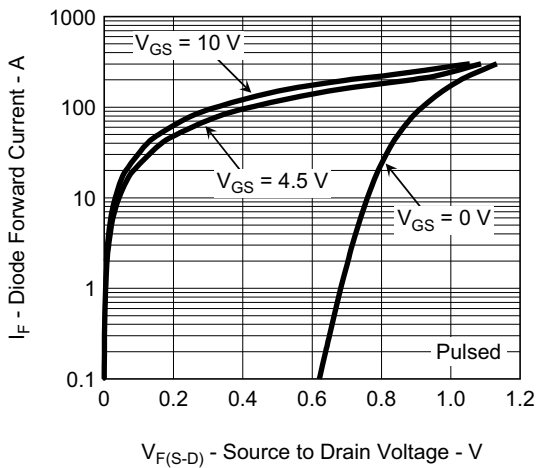
SWITCHING CHARACTERISTICS



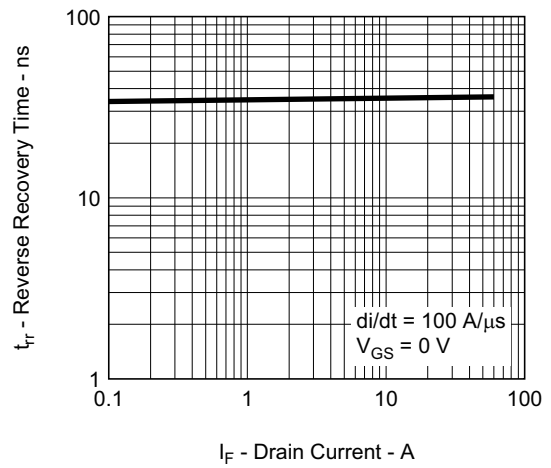
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

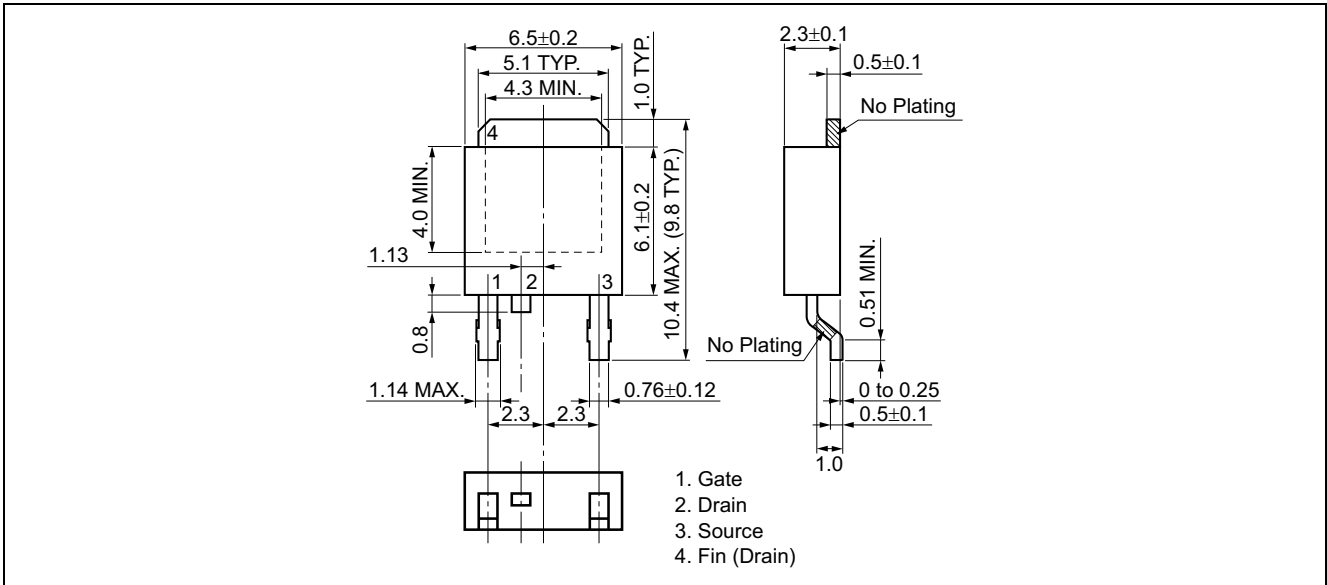


REVERSE RECOVERY TIME vs. DRAIN CURRENT

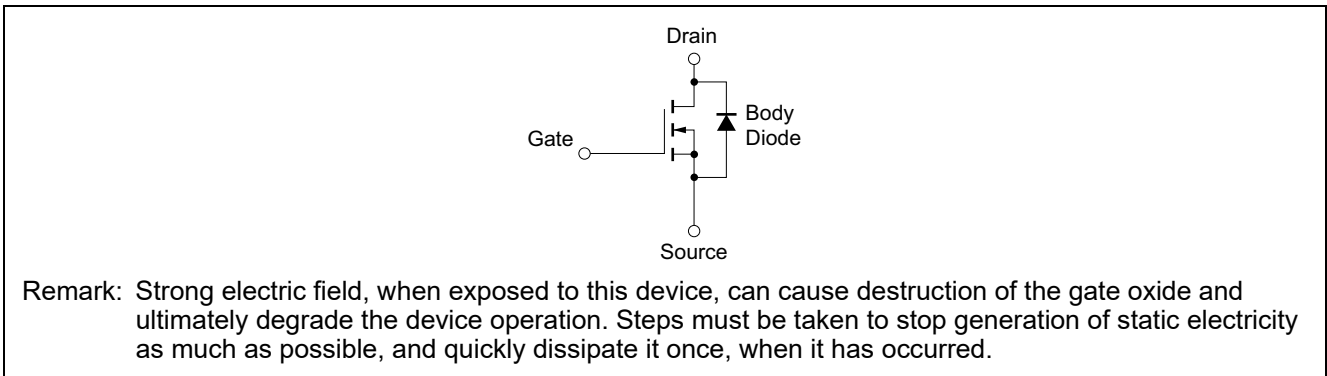


Package Drawing (Unit: mm)

TO-252 (MP-3ZP) (Mass: 0.3g TYP.)



Equivalent Circuit



Revision History	NP60N04VDK Data Sheet
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Rev.	Date	Description	
		Page	Summary
1.00	Feb 21, 2013	—	First Edition Issued
2.00	May 24 ,2018	1	Note 3 was added
		2	Note 2 was added

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