

# NJ10N60 POWER MOSFET



## 10A 600V N-CHANNEL POWER MOSFET

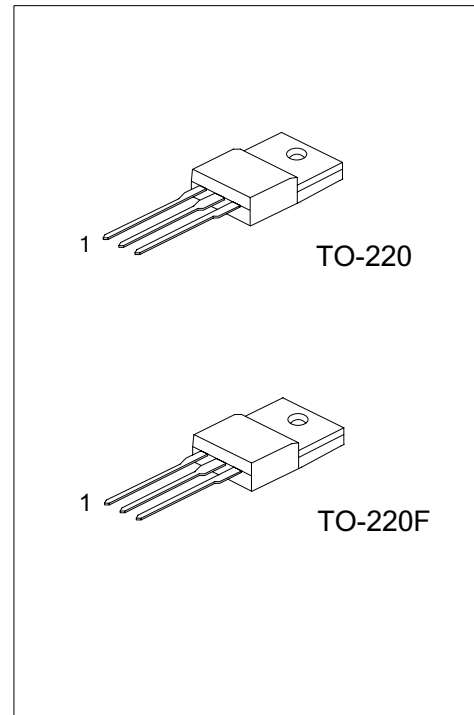
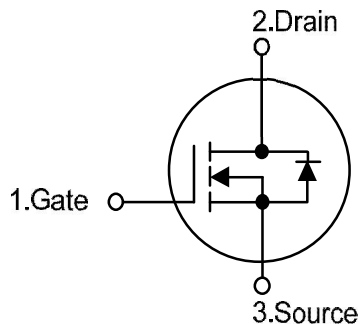
### DESCRIPTION

The NJ10N60 is a high voltage and high current power MOSFET, designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

### FEATURES

- \*  $V_{DS} = 600V$
- \*  $I_D = 10A$
- \*  $R_{DS(ON)} = 0.75\Omega @ V_{GS} = 10V$ .
- \* Low gate charge ( typical 44nC)
- \* Low CRSS ( typical 18 pF)
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability

### SYMBOL



### ORDERING INFORMATION

Ordering Number	Package	Pin Assignment			Packing
		1	2	3	
NJ10N60-LI	TO-220	G	D	S	Tape Box
NJ10N60-BL	TO-220	G	D	S	Bulk
NJ10N60F-LI	TO-220F	G	D	S	Tube

Note: Pin Assignment: G: Gate D: Drain S: Source

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## ■ ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub>=25°C unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V <sub>DSS</sub>	600	V
Gate-Source Voltage		V <sub>GSS</sub>	± 30	V
Avalanche Current (Note 2)		I <sub>AR</sub>	10	A
Drain Current	Continuous	I <sub>D</sub>	10	A
	Pulsed (Note 2)	I <sub>DM</sub>	38	A
Avalanche Energy	Single Pulsed (Note 3)	E <sub>AS</sub>	700	mJ
	Repetitive (Note 2)	E <sub>AR</sub>	15.6	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220	P <sub>D</sub>	156	W
	TO-220F		50	
Junction Temperature		T <sub>J</sub>	+150	°C
Operating Temperature		T <sub>OPR</sub>	-55 ~ +150	°C
Storage Temperature		T <sub>STG</sub>	-55 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating: Pulse width limited by maximum junction temperature

3. L = 14.2mH, I<sub>AS</sub> = 10A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25 Ω Starting T<sub>J</sub> = 25°C

4. I<sub>SD</sub> ≤ 9.5A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C

## ■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient		θ <sub>JA</sub>	62.5	°C/W
Junction to Case	TO-220	θ <sub>JC</sub>	0.8	°C/W
	TO-220F		2.5	

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## ■ ELECTRICAL CHARACTERISTICS (T<sub>C</sub>=25°C, unless otherwise specified)

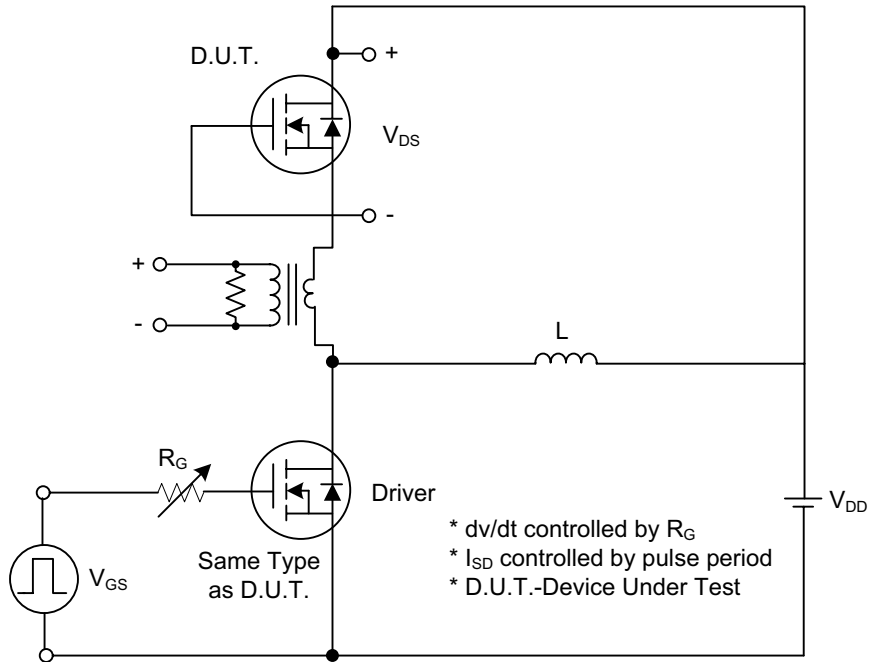
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	600			V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =600V, V <sub>GS</sub> =0V			1	μA
Gate-Source Leakage Current	Forward	I <sub>GSS</sub> V <sub>GS</sub> =30 V, V <sub>DS</sub> =0V			100	nA
	Reverse		V <sub>GS</sub> =-30 V, V <sub>DS</sub> =0V			-100
Breakdown Voltage Temperature Coefficient	ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> =250μA, Referenced to 25°C		0.7		V/°C
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2.0		4.0	V
Static Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =5A		0.68	0.75	Ω
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0 MHz		1570	2040	pF
Output Capacitance	C <sub>OSS</sub>			166	215	pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			18	24	pF
Gate Resistance	R <sub>G</sub>	V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz	0.25		1.4	Ω
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	t <sub>D(ON)</sub>	V <sub>DD</sub> =300V, I <sub>D</sub> =10A, R <sub>G</sub> =25Ω (Note 1, 2)		23	55	ns
Turn-On Rise Time	t <sub>R</sub>			69	150	ns
Turn-Off Delay Time	t <sub>D(OFF)</sub>			144	300	ns
Turn-Off Fall Time	t <sub>F</sub>			77	165	ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DS</sub> =480V, I <sub>D</sub> =10A, V <sub>GS</sub> =10 V (Note 1, 2)		44	57	nC
Gate-Source Charge	Q <sub>GS</sub>			6.7		nC
Gate-Drain Charge	Q <sub>GD</sub>			18.5		nC
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0 V, I <sub>S</sub> =10A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I <sub>S</sub>				10	A
Maximum Pulsed Drain-Source Diode Forward Current	I <sub>SM</sub>				38	A
Reverse Recovery Time	t <sub>rr</sub>	V <sub>GS</sub> =0 V, I <sub>S</sub> =10A,		420		ns
Reverse Recovery Charge	Q <sub>RR</sub>	di <sub>F</sub> /dt=100A/μs (Note 1)		4.2		μC

Notes: 1. Pulse Test : Pulse width ≤300μs, Duty cycle ≤2%

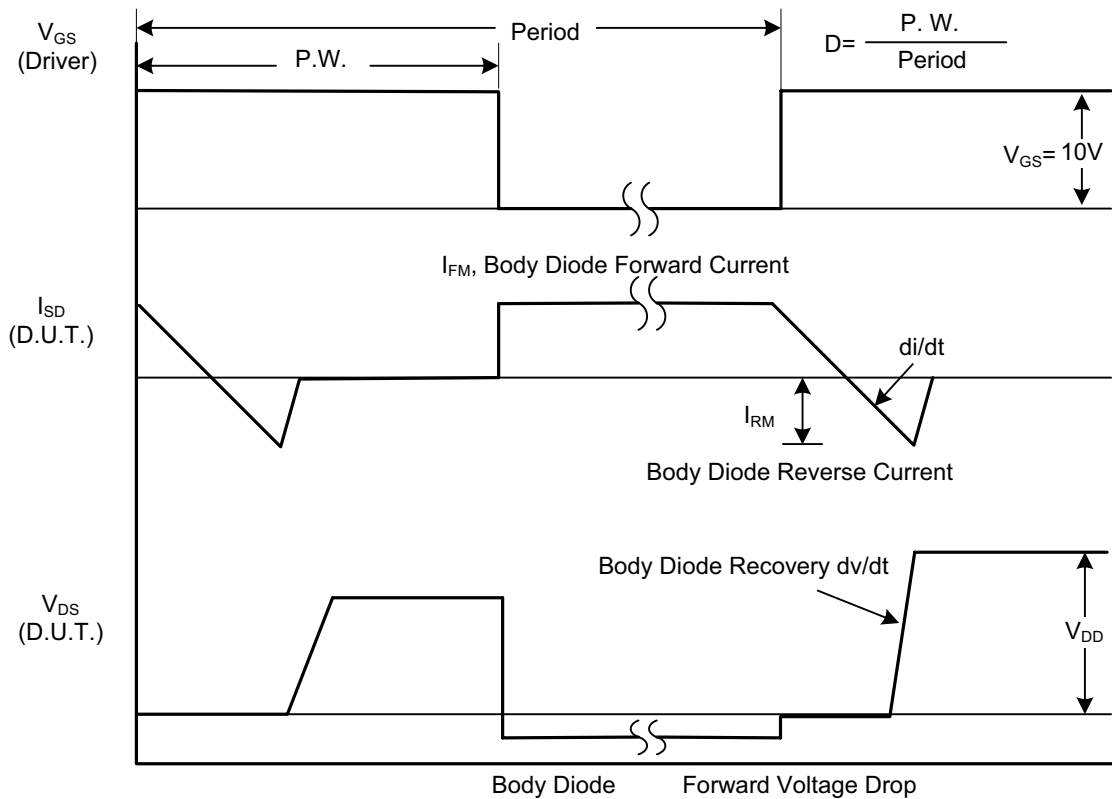
2. Essentially independent of operating temperature

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## ■ TEST CIRCUITS AND WAVEFORMS



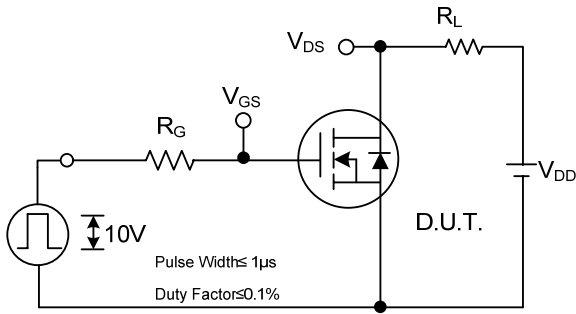
**Peak Diode Recovery  $dv/dt$  Test Circuit**



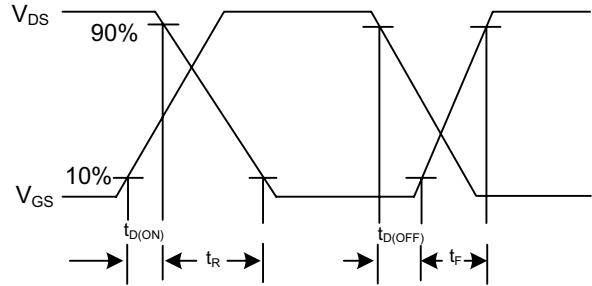
**Peak Diode Recovery  $dv/dt$  Waveforms**

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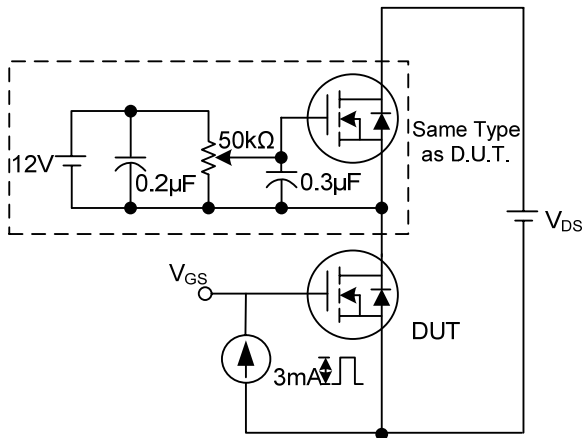
## ■ TEST CIRCUITS AND WAVEFORMS (Cont.)



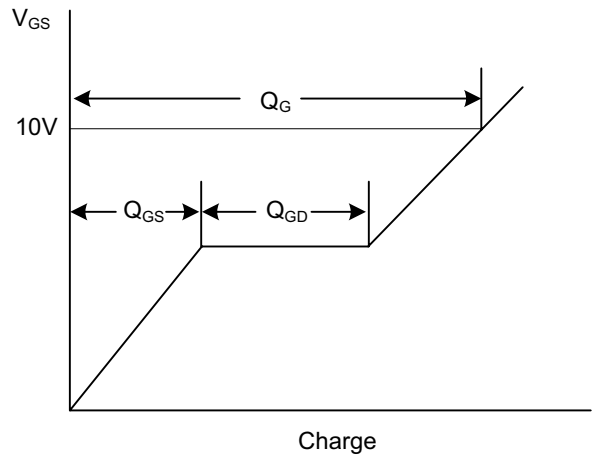
**Switching Test Circuit**



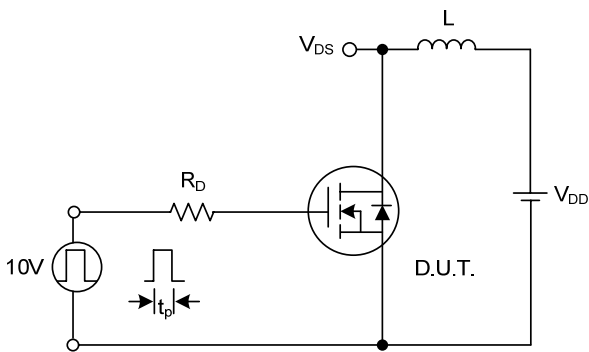
**Switching Waveforms**



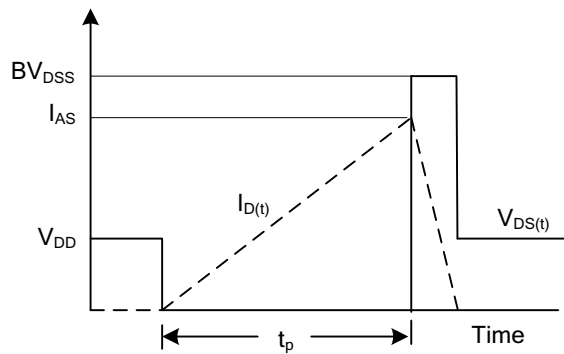
**Gate Charge Test Circuit**



**Gate Charge Waveform**



**Unclamped Inductive Switching Test Circuit**

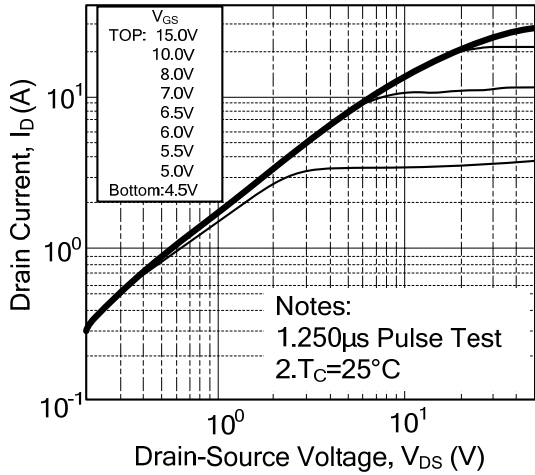


**Unclamped Inductive Switching Waveforms**

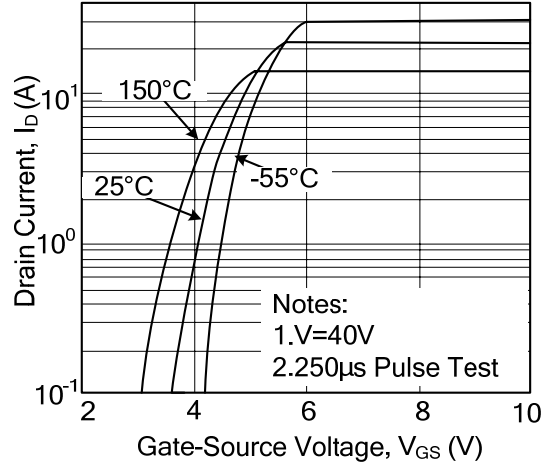
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## TYPICAL CHARACTERISTICS

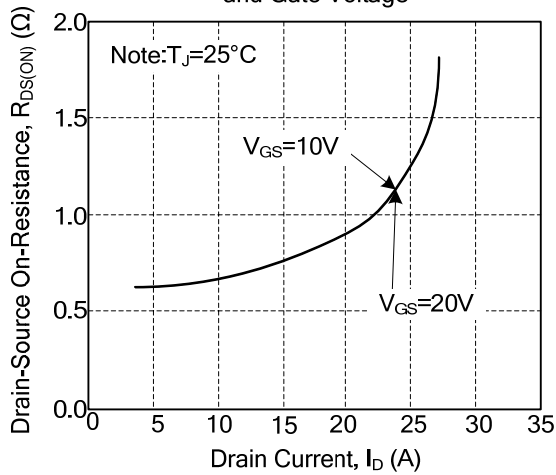
On-Region Characteristics



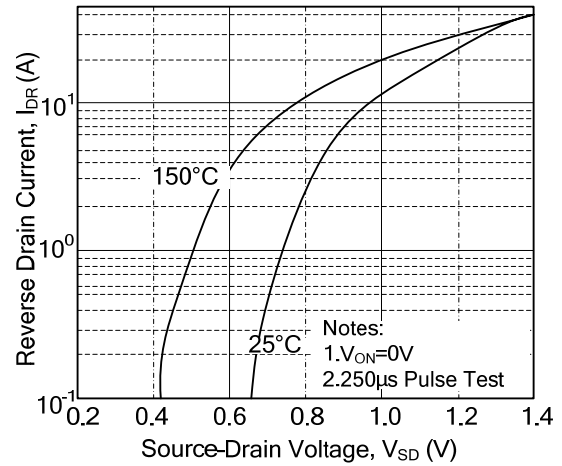
Transfer Characteristics



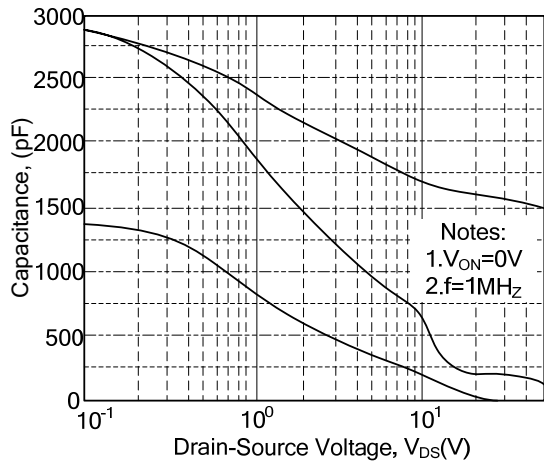
On-Resistance Variation vs. Drain Current and Gate Voltage



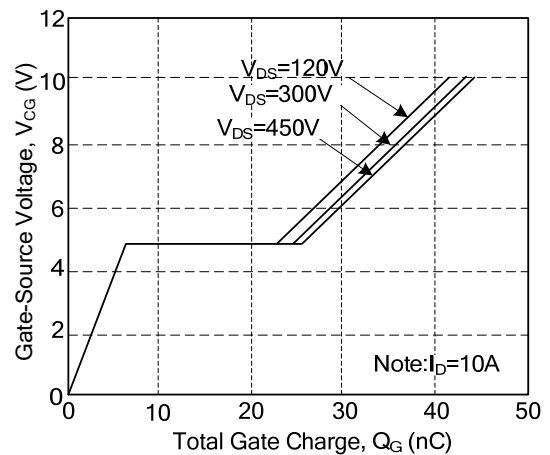
Body Diode Forward Voltage Variation with Source Current and Temperature



Capacitance Characteristics



Gate Charge Characteristics



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## TYPICAL CHARACTERISTICS(Cont.)

