

## N-Channel Power MOSFET (3A, 800Volts)

### DESCRIPTION

The Nell **3N80** is a three-terminal silicon device with current conduction capability of 3A, fast switching speed, low on-state resistance, breakdown voltage rating of 800V, and max. threshold voltage of 5 volts.

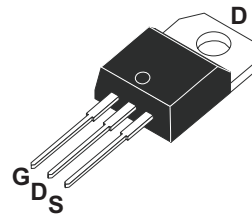
They are designed for use in applications, such as switched mode power supplies, DC to DC converters, **PWM** motor controls, bridge circuits, and general purpose switching applications.

### FEATURES

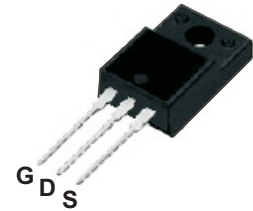
- $R_{DS(ON)} = 3.80\Omega$  (typ.) @  $V_{GS} = 10V$
- Ultra low gate charge(35nC max.)
- Low reverse transfer capacitance ( $C_{RSS} = 23pF$  typical)
- Fast switching capability
- 100% avalanche energy specified
- Improved dv/dt capability
- 150°C operation temperature

### PRODUCT SUMMARY

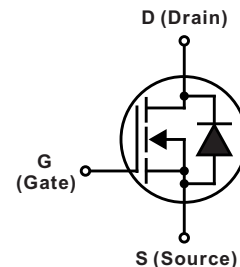
$I_D$ (A)	3
$V_{DSS}$ (V)	800
$R_{DS(ON)}$ ( $\Omega$ ) (typ.)	3.80 @ $V_{GS} = 10V$
$Q_G$ (nC) max.	35



TO-220AB  
(3N80A)



TO-220F  
(3N80AF)



### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ C$ unless otherwise specified)

SYMBOL	PARAMETER	TEST CONDITIONS	VALUE	UNIT	
$V_{DSS}$	Drain to Source voltage	$T_J = 25^\circ C$ to $150^\circ C$	800	V	
$V_{DGR}$	Drain to Gate voltage	$R_{GS} = 20K\Omega$	800		
$V_{GS}$	Gate to Source voltage		$\pm 30$		
$I_D$	Continuous Drain Current	$T_C = 25^\circ C$	3	A	
		$T_C = 100^\circ C$	1.9		
$I_{DM}$	Pulsed Drain current(Note 1)		12		
$I_{AR}$	Avalanche current(Note 1)		3		
$E_{AR}$	Repetitive avalanche energy(Note 1)	$I_{AR} = 3A, R_{GS} = 50\Omega, V_{GS} = 10V$	10	mJ	
$E_{AS}$	Single pulse avalanche energy(Note 2)	$I_{AS} = 3A, L = 50mH$	240		
dv/dt	Peak diode recovery dv/dt(Note 3)		2.0	V/ns	
$P_D$	Total power dissipation (Derate above $25^\circ C$ )	$T_C = 25^\circ C$	TO-220AB	100 (0.80)	W/(W/°C)
			TO-220F	54 (0.43)	
$T_J$	Operation junction temperature		-55 to 150	°C	
$T_{STG}$	Storage temperature		-55 to 150		
$T_L$	Maximum soldering temperature, for 10 seconds	1.6mm from case	300		
	Mounting torque, #6-32 or M3 screw		10 (1.1)	lbf-in (N-m)	

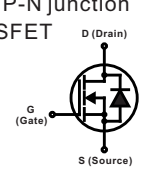
Note: 1. Repetitive rating: pulse width limited by junction temperature..

2.  $I_{AS} = 3A, V_{DD} = 50V, L = 50mH, R_{GS} = 27\Omega$ , starting  $T_J = 25^\circ C$ .

3.  $I_{SD} \leq 3A, di/dt \leq 100A/\mu s, V_{DD} \leq V_{(BR)DSS}$ , starting  $T_J = 25^\circ C$ .

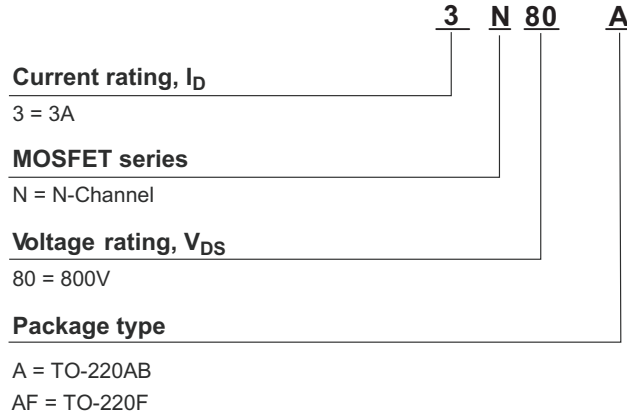
THERMAL RESISTANCE						
SYMBOL	PARAMETER		Min.	Typ.	Max.	UNIT
R <sub>th(j-c)</sub>	Thermal resistance, junction to case	TO-220AB			1.25	°C/W
		TO-220F			3.20	
R <sub>th(j-a)</sub>	Thermal resistance, junction to ambient	TO-220AB/TO-220F			62.5	

ELECTRICAL CHARACTERISTICS (T <sub>C</sub> = 25°C unless otherwise specified)						
SYMBOL	PARAMETER	TEST CONDITIONS	Min.	Typ.	Max.	UNIT
⊙ OFF CHARACTERISTICS						
V <sub>(BR)DSS</sub>	Drain to source breakdown voltage	I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V	800			V
ΔV <sub>(BR)DSS</sub> /ΔT <sub>J</sub>	Breakdown voltage temperature coefficient	I <sub>D</sub> = 250μA, V <sub>DS</sub> = V <sub>GS</sub>		1.00		V/°C
I <sub>DSS</sub>	Drain to source leakage current	V <sub>DS</sub> = 800V, V <sub>GS</sub> = 0V, T <sub>C</sub> = 25°C			1	μA
		V <sub>DS</sub> = 640V, V <sub>GS</sub> = 0V, T <sub>C</sub> = 125°C			20	
I <sub>GSS</sub>	Gate to source forward leakage current	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V			100	nA
	Gate to source reverse leakage current	V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V			-100	
⊙ ON CHARACTERISTICS						
R <sub>DS(ON)</sub>	Static drain to source on-state resistance	I <sub>D</sub> = 1.5A, V <sub>GS</sub> = 10V		3.8	4.5	Ω
V <sub>GS(TH)</sub>	Gate threshold voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250μA	2.5		4.5	V
g <sub>fs</sub>	Forward transconductance (Note 1)	V <sub>DS</sub> = 50V, I <sub>D</sub> = 1.5A		2.2		S
⊙ DYNAMIC CHARACTERISTICS						
C <sub>ISS</sub>	Input capacitance	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1MHz		580	750	pF
C <sub>OSS</sub>	Output capacitance		60	75		
C <sub>RSS</sub>	Reverse transfer capacitance		23	30		
⊙ SWITCHING CHARACTERISTICS						
t <sub>d(ON)</sub>	Turn-on delay time	V <sub>DD</sub> = 400V, V <sub>GS</sub> = 10V, I <sub>D</sub> = 3A, R <sub>GS</sub> = 25Ω (Note 1, 2)		20	40	ns
t <sub>r</sub>	Rise time		28	80		
t <sub>d(OFF)</sub>	Turn-off delay time		45	100		
t <sub>f</sub>	Fall time		30	75		
Q <sub>G</sub>	Total gate charge	V <sub>DD</sub> = 640V, V <sub>GS</sub> = 10V, I <sub>D</sub> = 3A (Note 1, 2)		27	35	nC
Q <sub>GS</sub>	Gate to source charge		5			
Q <sub>GD</sub>	Gate to drain charge (Miller charge)		10			

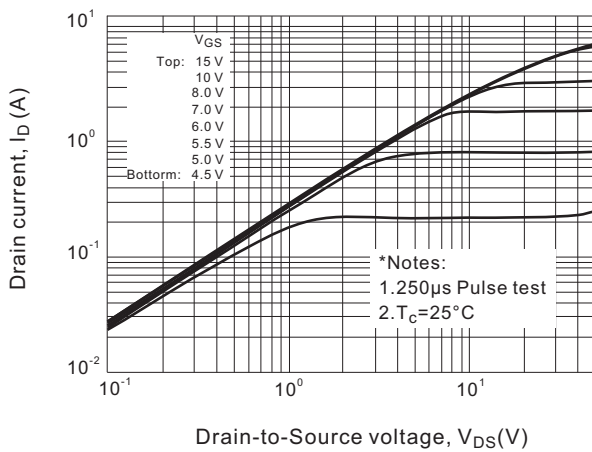
SOURCE TO DRAIN DIODE RATINGS AND CHARACTERISTICS (T <sub>C</sub> = 25°C unless otherwise specified)						
SYMBOL	PARAMETER	TEST CONDITIONS	Min.	Typ.	Max.	UNIT
V <sub>SD</sub>	Diode forward voltage	I <sub>SD</sub> = 3A, V <sub>GS</sub> = 0V			1.4	V
I <sub>S</sub> (I <sub>SD</sub> )	Continuous source to drain current	Integral reverse P-N junction diode in the MOSFET 			3	A
I <sub>SM</sub>	Pulsed source current		12			
t <sub>rr</sub>	Reverse recovery time	I <sub>SD</sub> = 3A, V <sub>GS</sub> = 0V,		380		ns
Q <sub>rr</sub>	Reverse recovery charge	dI <sub>F</sub> /dt = 100A/μs		1.6		μC

Note: 1. Pulse test: Pulse width ≤ 250μs, duty cycle ≤ 2%.  
 2. Essentially independent of operating temperature.

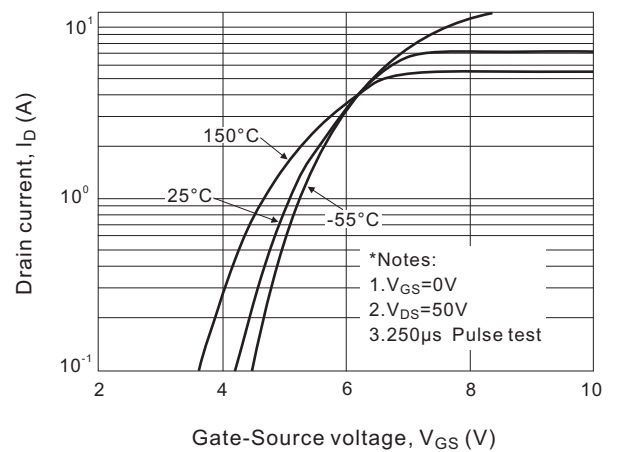
**ORDERING INFORMATION SCHEME**



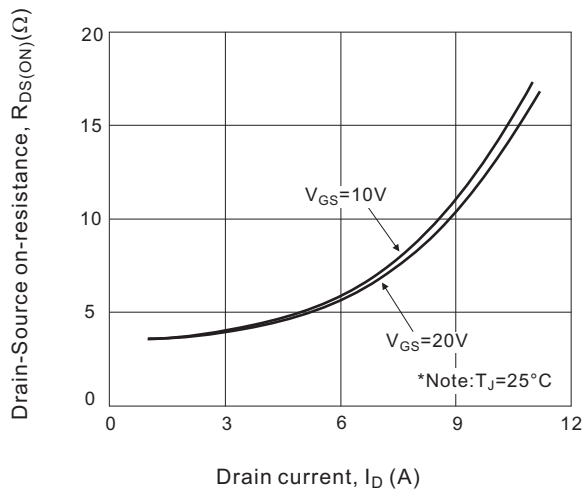
**Fig.1 Output characteristics**



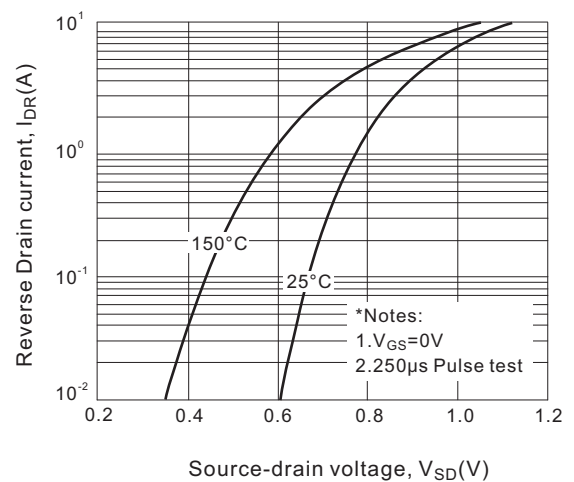
**Fig.2 Transfer characteristics**



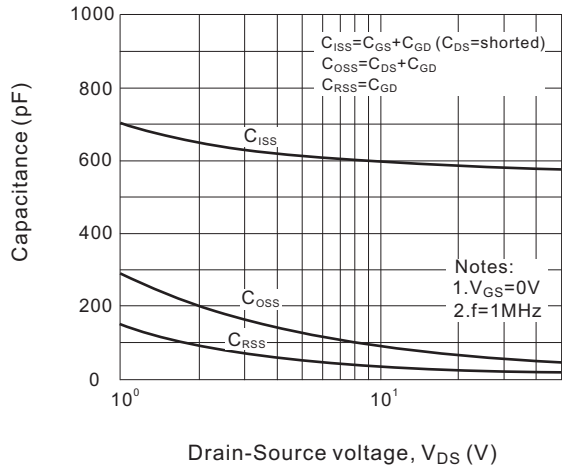
**Fig.3 On-resistance variation vs. drain current**



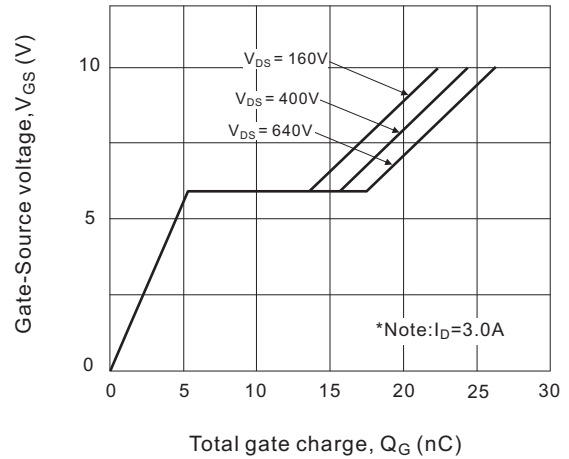
**Fig.4 Source-drain diode forward voltage**



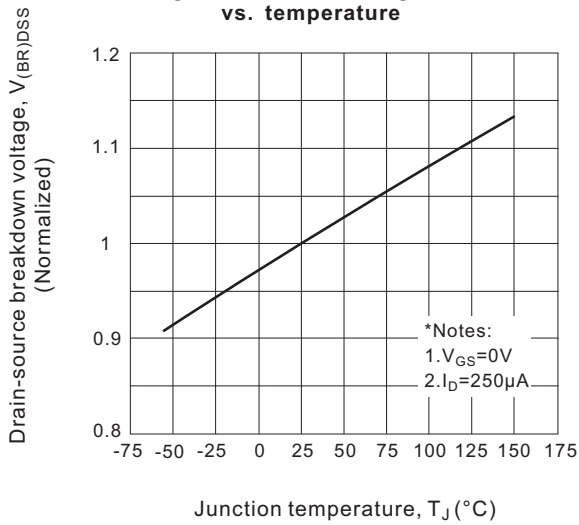
**Fig.5 Capacitance vs. drain-source voltage**



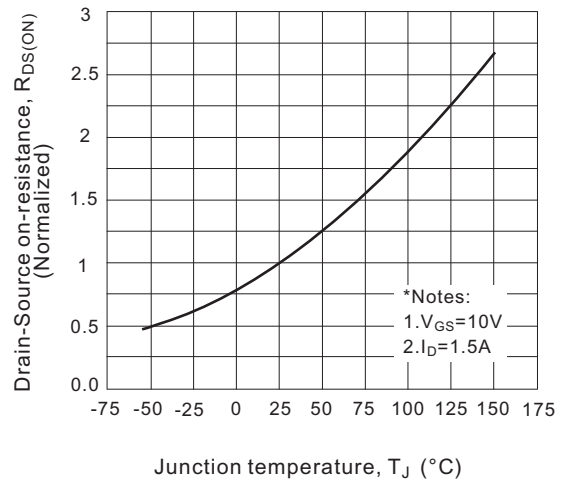
**Fig.6 Gate charge vs. gate-source voltage**



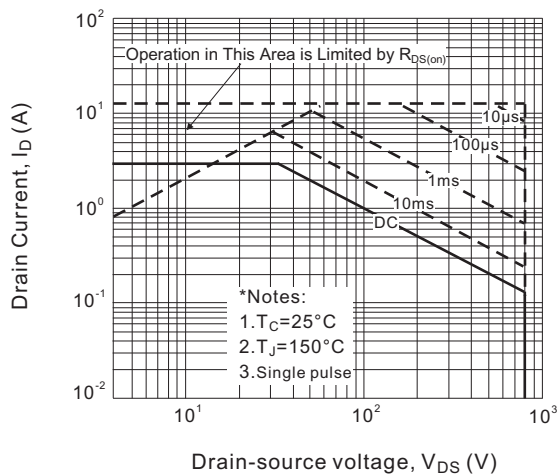
**Fig.7 Breakdown voltage variation vs. temperature**



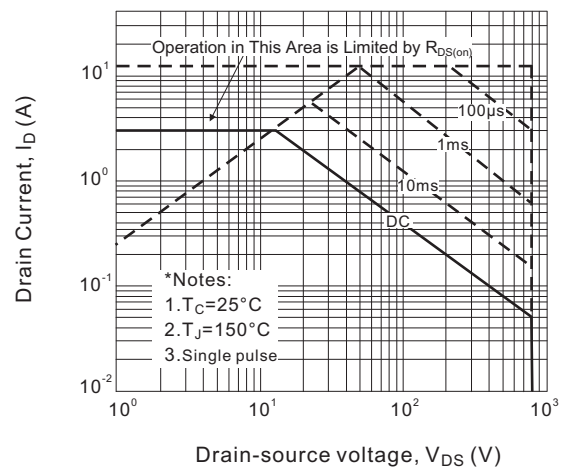
**Fig.8 On-resistance vs. temperature**



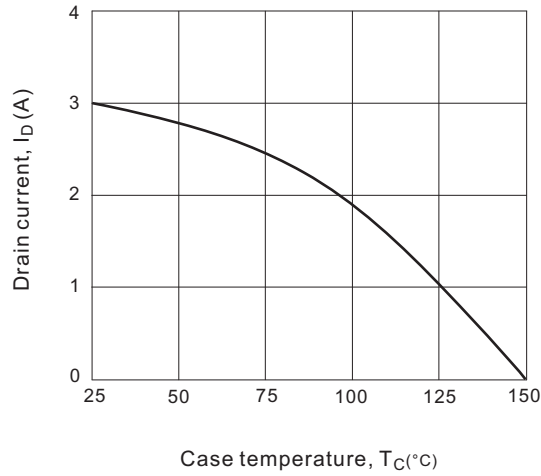
**Fig.9-1 Maximum safe operating area for 3N80A**



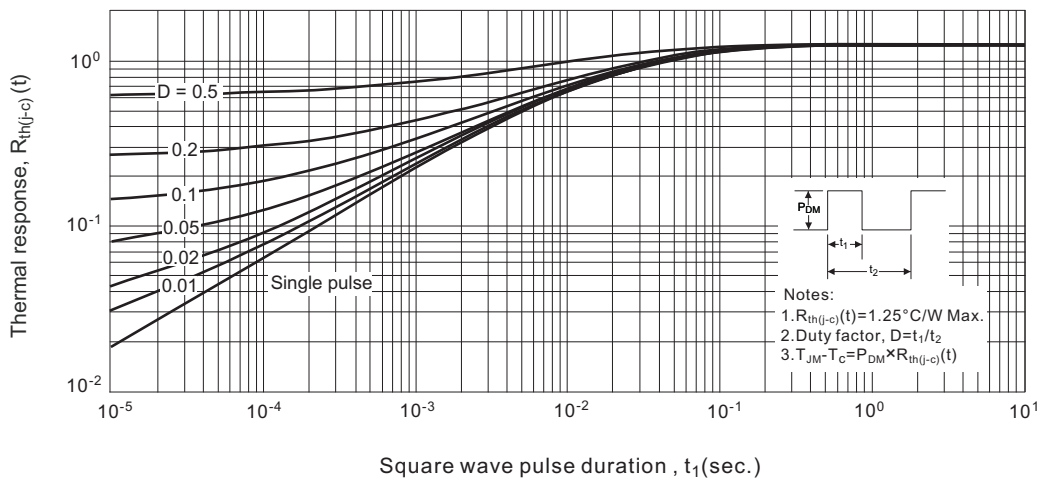
**Fig.9-2 Maximum safe operating area for 3N80AF**



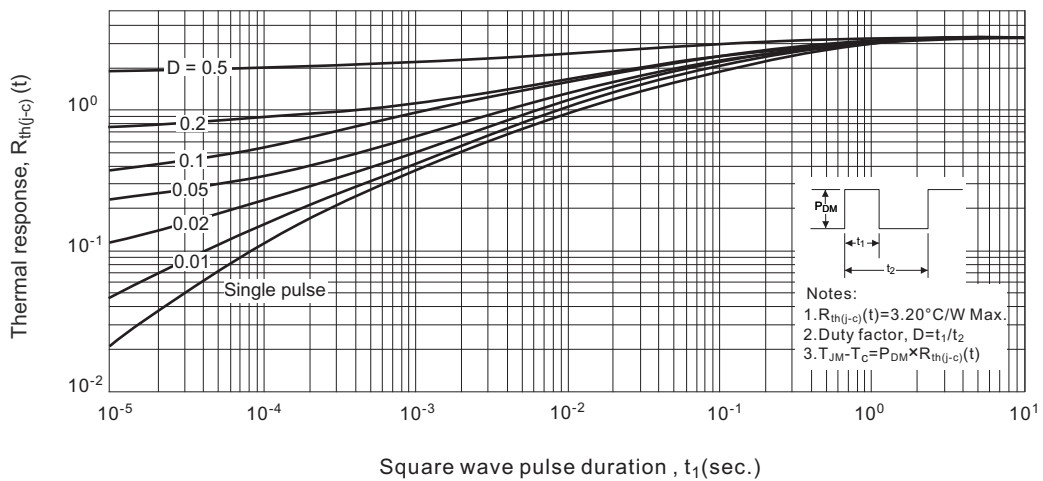
**Fig.10 Maximum drain current vs. case temperature**



**Fig.11-1 Transient Thermal Response Curve for 3N80A**

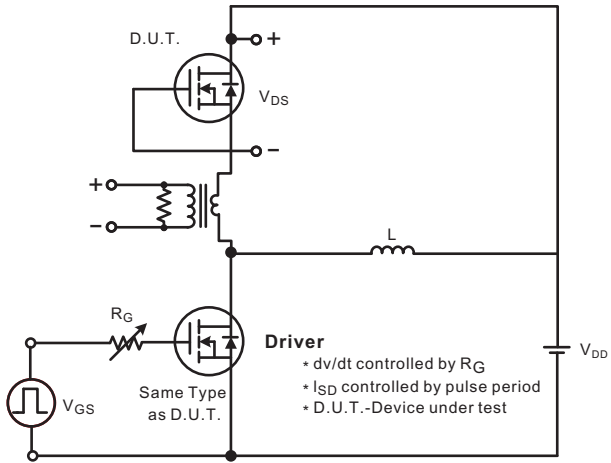


**Fig.11-2 Transient Thermal Response Curve for 3N80AF**

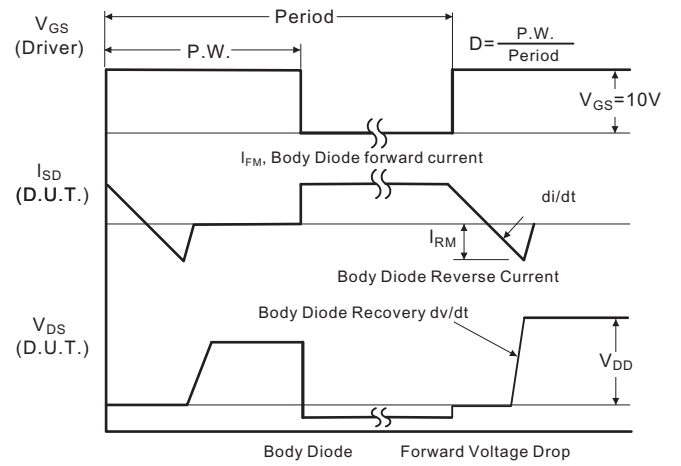


### TEST CIRCUITS AND WAVEFORMS

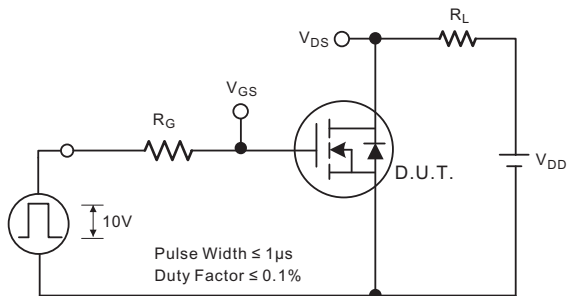
**Fig.1A Peak diode recovery dv/dt test circuit**



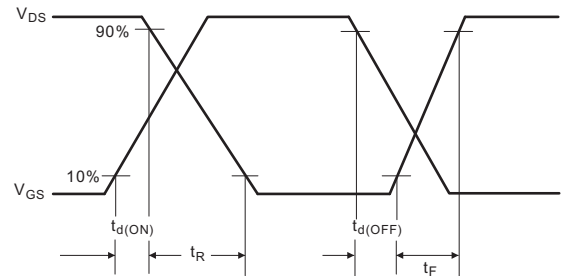
**Fig.1B Peak diode recovery dv/dt waveforms**



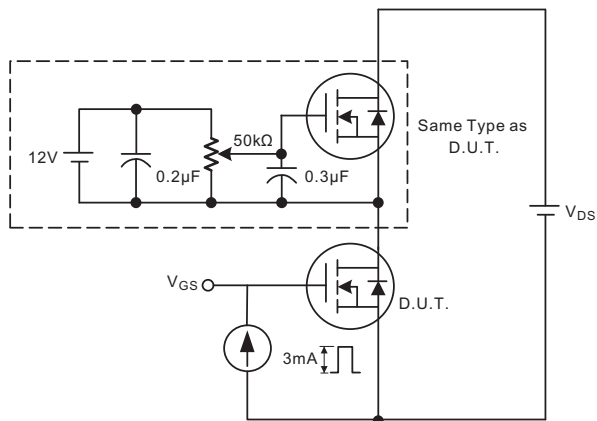
**Fig.2A Switching test circuit**



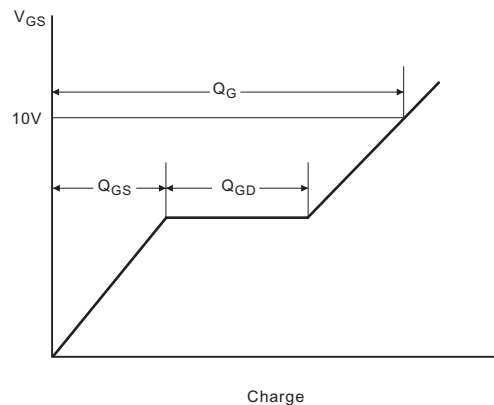
**Fig.2B Switching Waveforms**



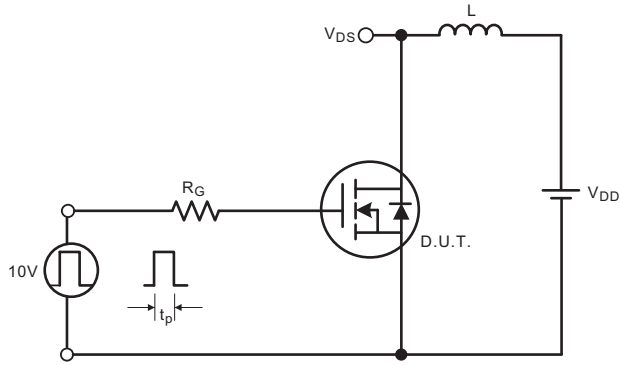
**Fig.3A Gate charge test circuit**



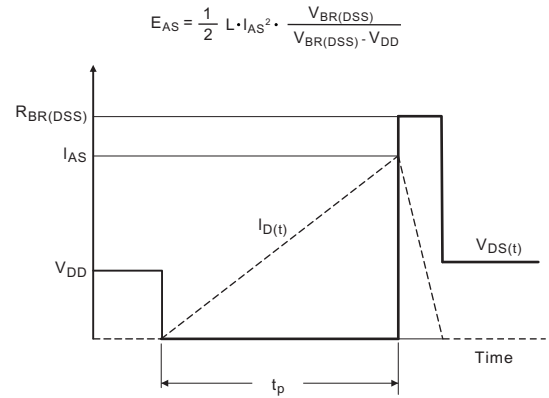
**Fig.3B Gate charge waveform**



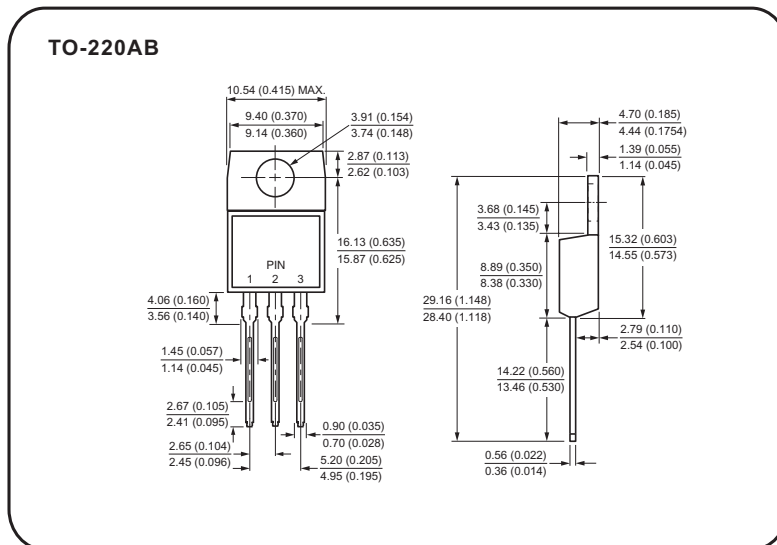
**Fig.4A Unclamped Inductive switching test circuit**



**Fig.4B Unclamped Inductive switching waveforms**

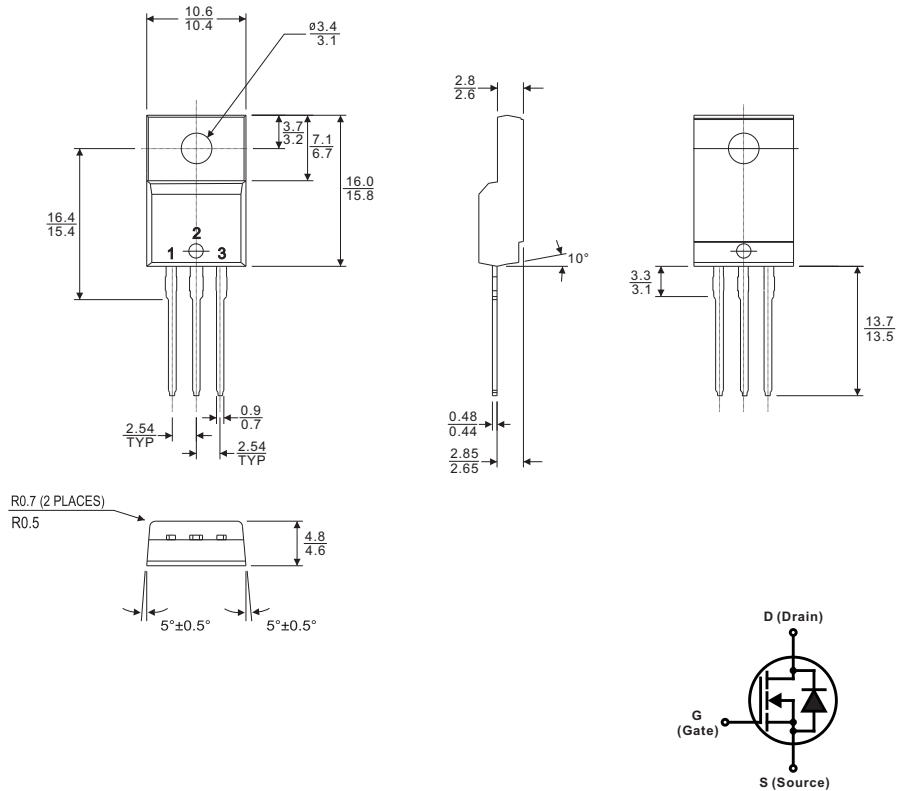


### Case Style



## Case Style

TO-220F



All dimensions in millimeters