

N-Channel Power MOSFET (7A, 600Volts)

DESCRIPTION

The Nell 7N60 is a three-terminal silicon device with current conduction capability of 7A, fast switching speed, low on-state resistance, breakdown voltage rating of 600V, and max. threshold voltage of 4 volts.

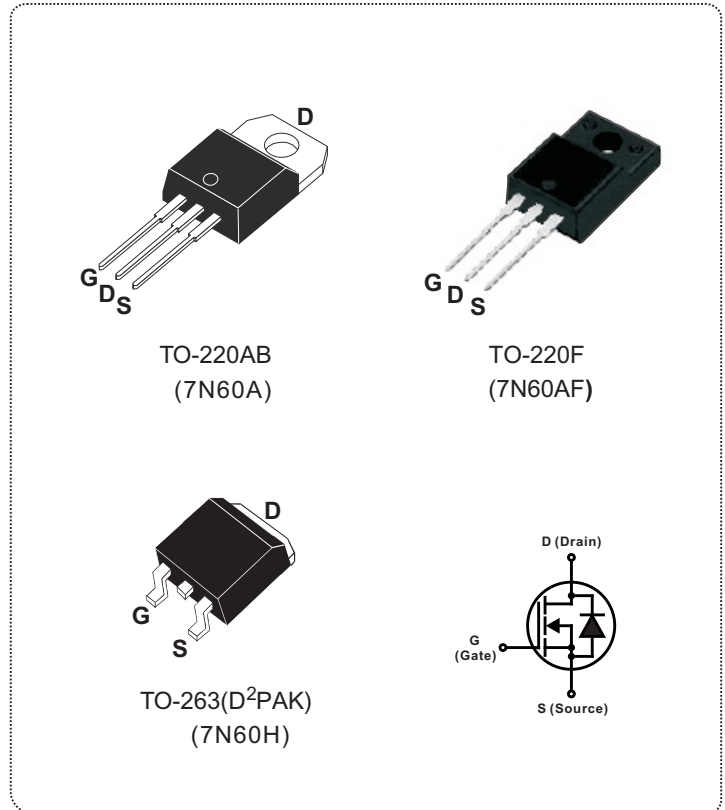
They are designed for use in applications, such as switched mode power supplies, DC to DC converters, **PWM** motor controls, bridge circuits, and general purpose switching applications.

FEATURES

- $R_{DS(ON)} = 1.0\Omega @ V_{GS} = 10V$
- Ultra low gate charge(38nC max.)
- Low reverse transfer capacitance ($C_{RSS} = 16pF$ typical)
- Fast switching capability
- 100% avalanche energy specified
- Improved dv/dt capability
- 150°C operation temperature

PRODUCT SUMMARY

I_D (A)	7
V_{DSS} (V)	600
$R_{DS(ON)}$ (Ω)	1.0 @ $V_{GS} = 10V$
Q_G (nC) max.	38



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 $150^\circ C$	600	V	
V_{DGR}	Drain to Gate voltage	$R_{GS} = 20K\Omega$	600		
V_{GS}	Gate to Source voltage		± 30		
I_D	Continuous Drain Current	$T_C = 25^\circ C$	7	A	
		$T_C = 100^\circ C$	4.3		
I_{DM}	Pulsed Drain current(Note 1)		28		
I_{AR}	Avalanche current(Note 1)		7		
E_{AR}	Repetitive avalanche energy(Note 1)	$I_{AR} = 7A, R_{GS} = 50\Omega, V_{GS} = 10V$	14	mJ	
E_{AS}	Single pulse avalanche energy(Note 2)	$I_{AS} = 7A, L = 19.5mH$	500		
dv/dt	Peak diode recovery dv/dt(Note 3)		4.5	V/ns	
P_D	Total power dissipation	$T_C = 25^\circ C$	TO-220AB/TO-263	140	W
			TO-220F	48	
T_J	Operation junction temperature		-55 to 150	$^\circ C$	
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)	

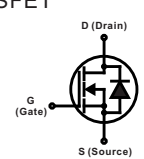
Note: 1. Repetitive rating: pulse width limited by junction temperature..

2. $I_{AS} = 7A, V_{DD} = 50V, L = 19.5mH, R_{GS} = 25\Omega$, starting $T_J = 25^\circ C$.

3. $I_{SD} \leq 7A, di/dt \leq 200A/\mu s, V_{DD} \leq V_{(BR)DSS}$, starting $T_J = 25^\circ C$.

THERMAL RESISTANCE						
SYMBOL	PARAMETER		Min.	Typ.	Max.	UNIT
$R_{th(j-c)}$	Thermal resistance, junction to case	TO-220AB/TO-263			0.85	°C/W
		TO-220F			2.5	
$R_{th(j-a)}$	Thermal resistance, junction to ambient	TO-220AB/TO-263			62.5	
		TO-220F			62.5	

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise specified)						
SYMBOL	PARAMETER	TEST CONDITIONS	Min.	Typ.	Max.	UNIT
$V_{(BR)DSS}$	Drain to source breakdown voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	600			V
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown voltage temperature coefficient	$I_D = 250\mu\text{A}, V_{DS} = V_{GS}$		0.53		V/°C
I_{DSS}	Drain to source leakage current	$V_{DS} = 600\text{V}, V_{GS} = 0\text{V}$ $T_C = 25^\circ\text{C}$			10	μA
		$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}$ $T_C = 125^\circ\text{C}$			100	
I_{GSS}	Gate to source forward leakage current	$V_{GS} = 30\text{V}, V_{DS} = 0\text{V}$			100	nA
	Gate to source reverse leakage current	$V_{GS} = -30\text{V}, V_{DS} = 0\text{V}$			-100	
$R_{DS(ON)}$	Static drain to source on-state resistance	$I_D = 3.5\text{A}, V_{GS} = 10\text{V}$		0.85	1.0	Ω
$V_{GS(TH)}$	Gate threshold voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2		4	V
C_{ISS}	Input capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$			1400	pF
C_{OSS}	Output capacitance				180	
C_{RSS}	Reverse transfer capacitance			16	21	
$t_{d(ON)}$	Turn-on delay time	$V_{DD} = 300\text{V}, V_{GS} = 10\text{V}, I_D = 7\text{A}, R_{GS} = 25\Omega$ (Note 1, 2)			70	ns
t_r	Rise time				170	
$t_{d(OFF)}$	Turn-off delay time				140	
t_f	Fall time				130	
Q_G	Total gate charge	$V_{DD} = 480\text{V}, V_{GS} = 10\text{V}, I_D = 7\text{A}$ (Note 1, 2)		28	38	nC
Q_{GS}	Gate to source charge			7		
Q_{GD}	Gate to drain charge (Miller charge)			14		

SOURCE TO DRAIN DIODE RATINGS AND CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise specified)						
SYMBOL	PARAMETER	TEST CONDITIONS	Min.	Typ.	Max.	UNIT
V_{SD}	Diode forward voltage	$I_{SD} = 7\text{A}, V_{GS} = 0\text{V}$			1.4	V
$I_S (I_{SD})$	Continuous source to drain current	Integral reverse P-N junction diode in the MOSFET 			7	A
I_{SM}	Pulsed source current				28	
t_{rr}	Reverse recovery time	$I_{SD} = 7\text{A}, V_{GS} = 0\text{V}, dI_F/dt = 100\text{A}/\mu\text{s}$		320		ns
Q_{rr}	Reverse recovery charge			2.4		μC

Note: 1. Pulse test: Pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
 2. Essentially independent of operating temperature.

ORDERING INFORMATION SCHEME

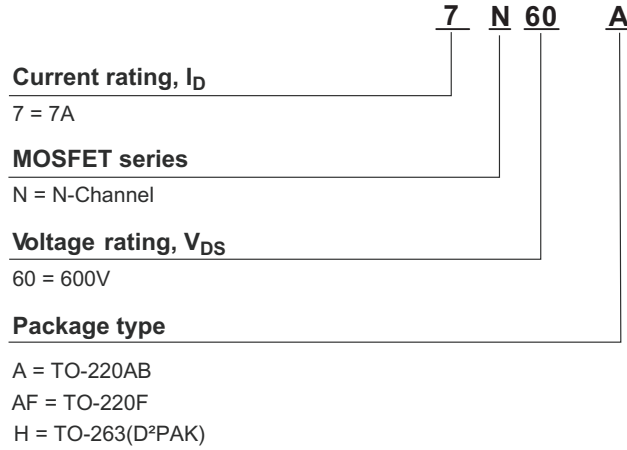


Fig.1 On-State characteristics

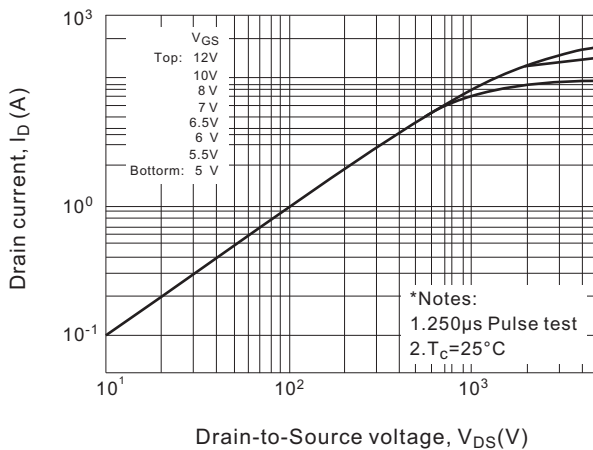


Fig.2 Transfer characteristics

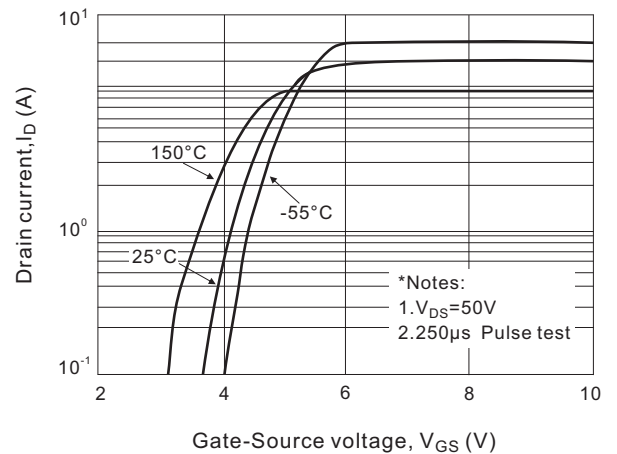


Fig.3 On-resistance variation vs. drain current and gate voltage

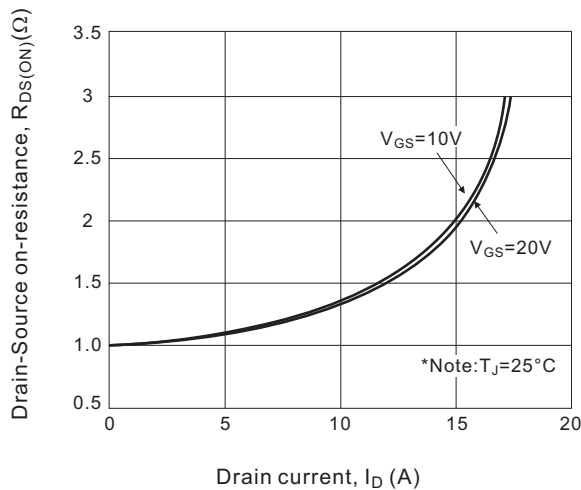


Fig.4 Body diode forward voltage variation with source current and temperature

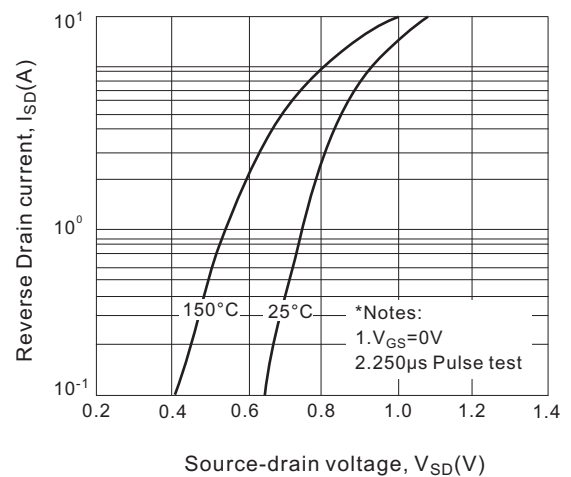


Fig.5 Capacitance characteristics

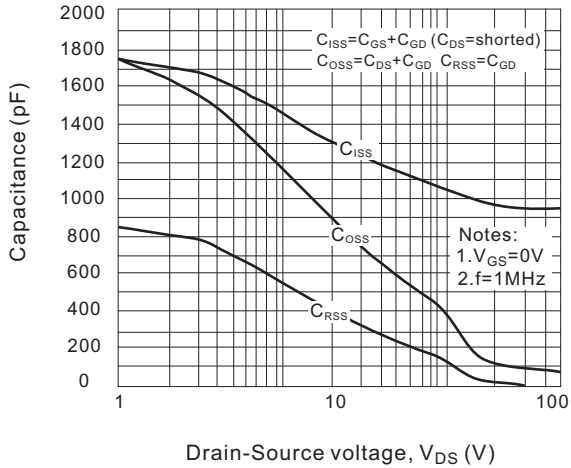


Fig.6 Gate charge characteristics

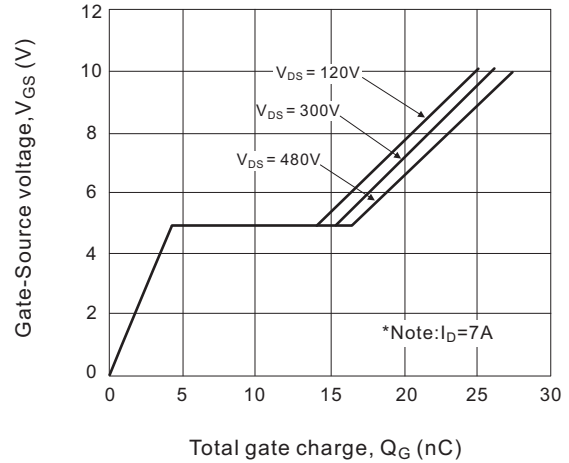


Fig.7 Breakdown voltage variation vs. Junction temperature

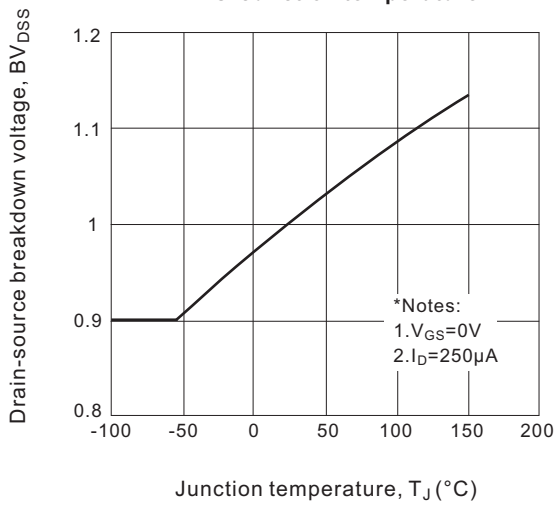


Fig.8 On-resistance variation vs. Junction temperature

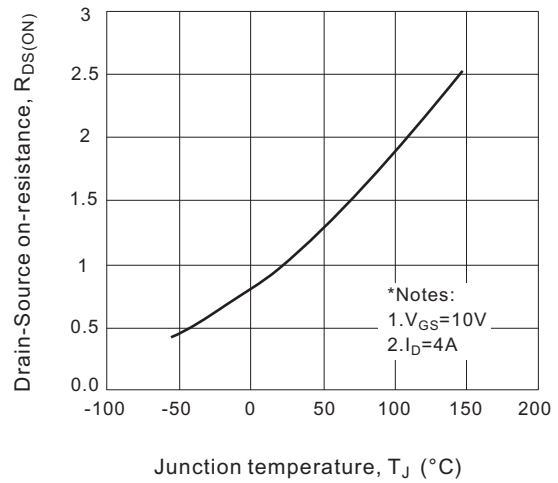


Fig.9 Maximum safe operating area for TO-220

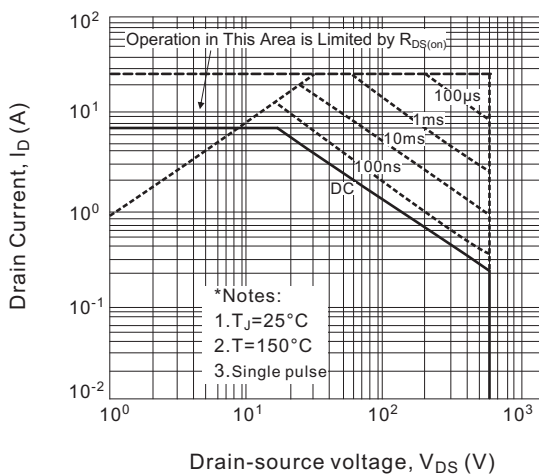


Fig.10 Maximum safe operating area for TO-220F

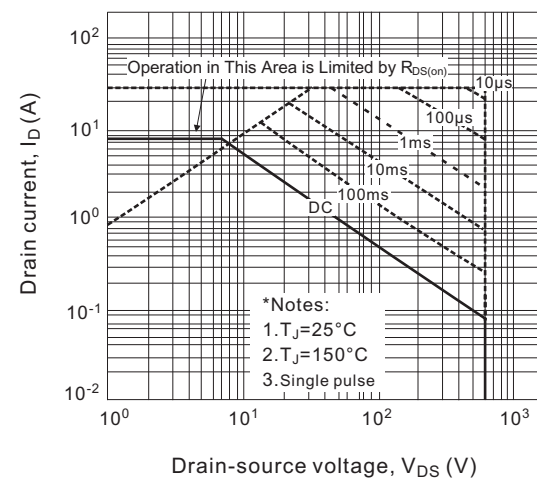


Fig.11 Maximum drain current vs. case temperature

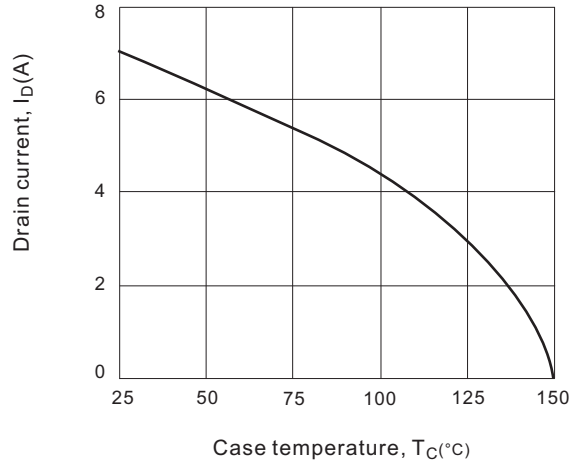


Fig.12 Transient thermal response curve (for 7N60A & 7N60H)

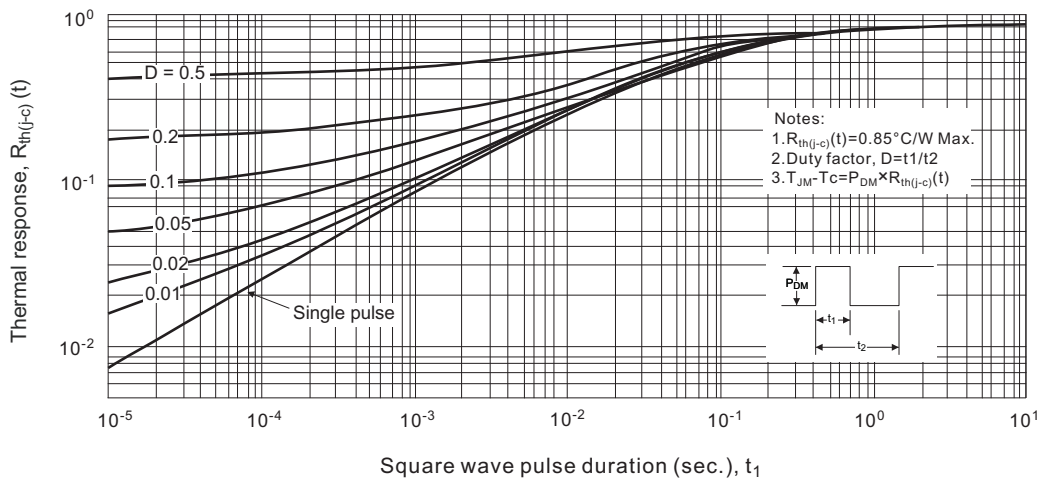
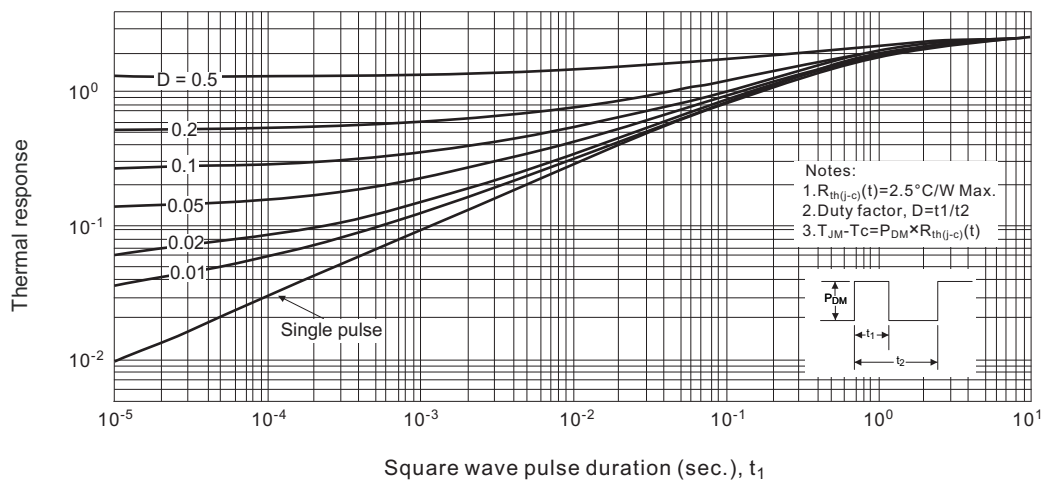


Fig.13 Transient thermal response curve (for 7N60AF)



■ TEST CIRCUITS AND WAVEFORMS

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

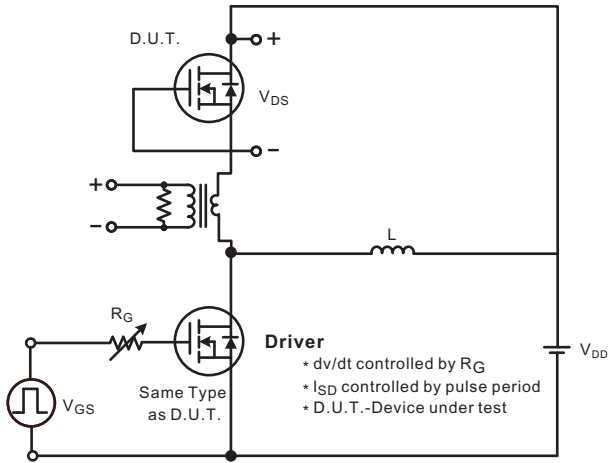


Fig.1B Peak diode recovery dv/dt waveforms

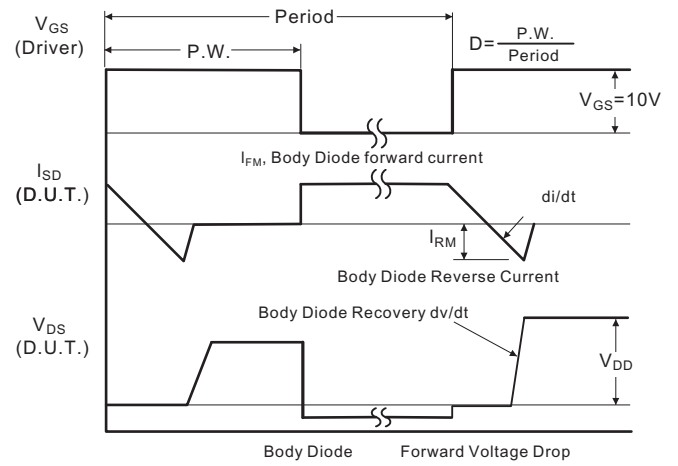


Fig.2A Switching test circuit

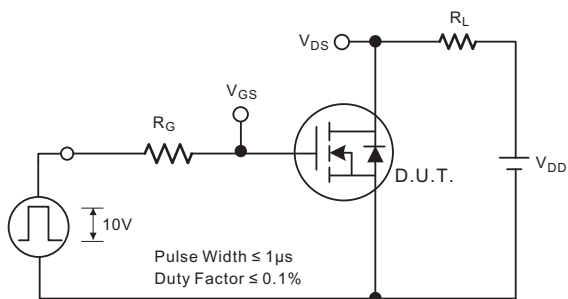


Fig.2B Switching Waveforms

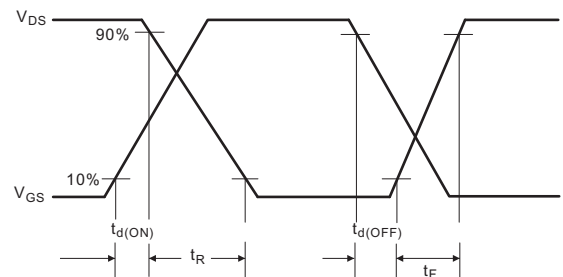


Fig.3A Gate charge test circuit

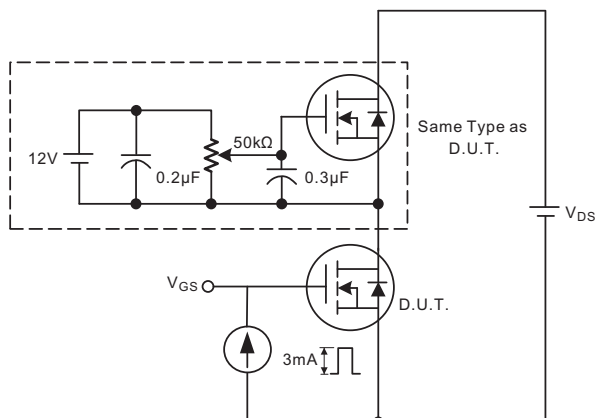


Fig.3B Gate charge waveform

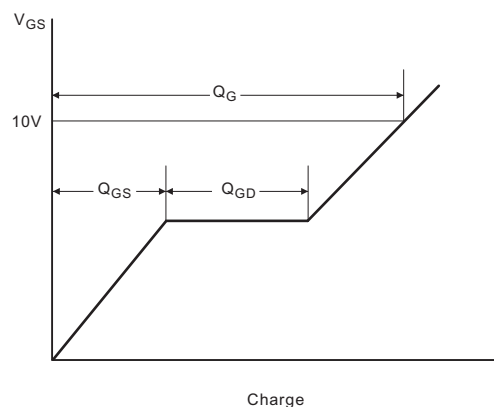


Fig.4A Unclamped Inductive switching test circuit

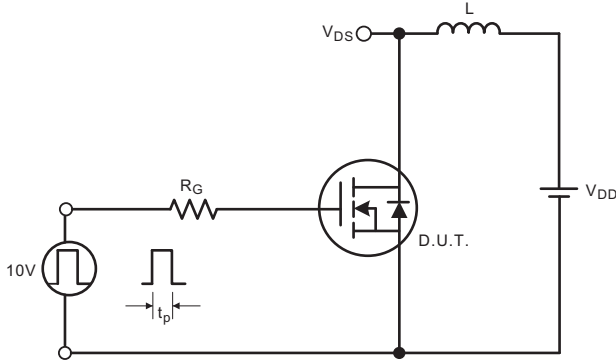
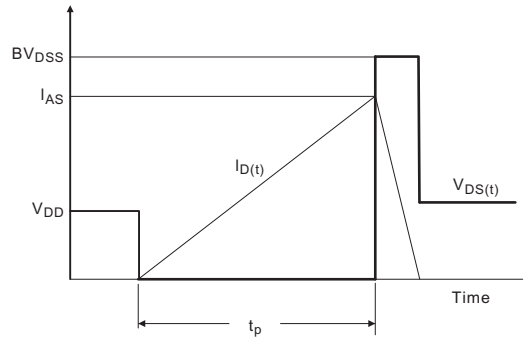
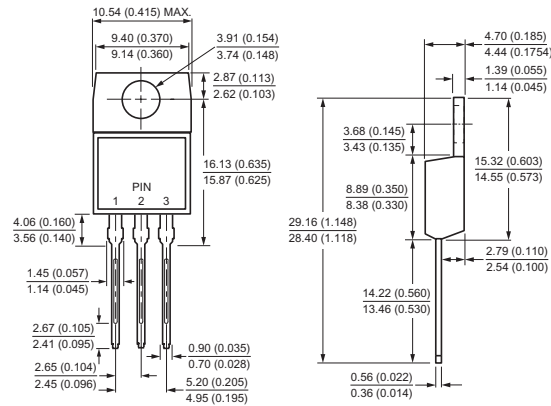


Fig.4B Unclamped Inductive switching waveforms

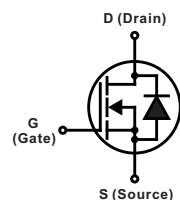
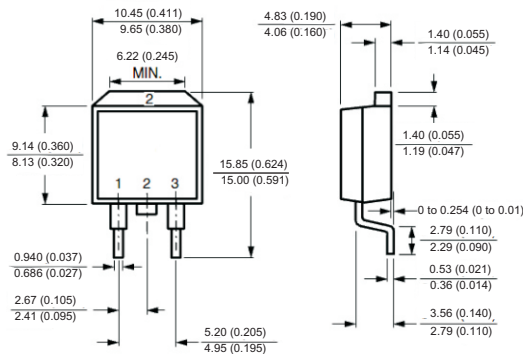


Case Style

TO-220AB



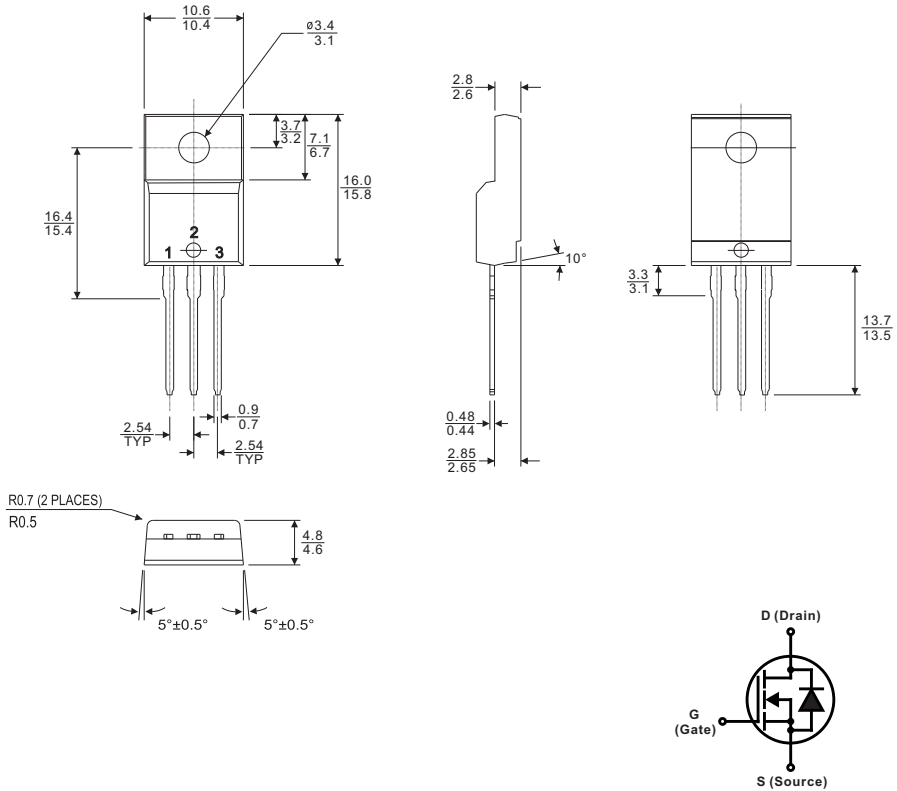
TO-263(D²PAK)



All dimensions in millimeters(inches)

Case Style

TO-220F



All dimensions in millimeters