

## N-Channel Power MOSFET (110A, 55Volts)

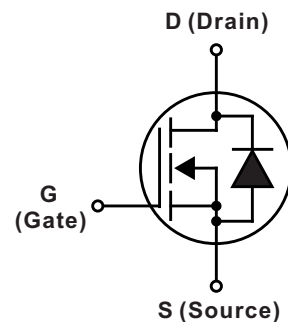
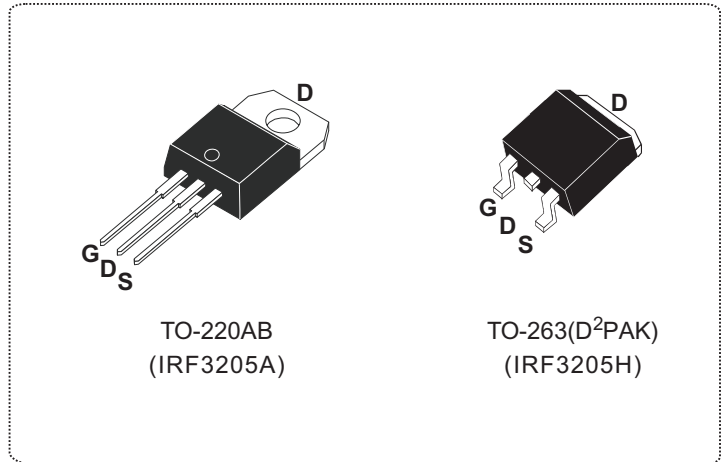
### DESCRIPTION

The Nell **IRF3205** is a three-terminal silicon device with current conduction capability of 110A, fast switching speed, low on-state resistance, breakdown voltage rating of 55V, and max. threshold voltage of 4 volts.

They are designed as an extremely efficient and reliable device for use in a wide variety of applications. These transistors can be operated directly from integrated circuits.

### FEATURES

- $R_{DS(ON)} = 0.010\Omega @ V_{GS} = 10V$
- Ultra low gate charge(150nC max.)
- Low reverse transfer capacitance ( $C_{RSS} = 210pF$  typical)
- Fast switching capability
- 100% avalanche energy specified
- Improved dv/dt capability
- 175°C operation temperature



| PRODUCT SUMMARY            |                        |
|----------------------------|------------------------|
| $I_D$ (A)                  | 110                    |
| $I_D$ (A), Package Limited | 75                     |
| $V_{DSS}$ (V)              | 55                     |
| $R_{DS(ON)}$ ( $\Omega$ )  | 0.010 @ $V_{GS} = 10V$ |
| $Q_G$ (nC) max.            | 150                    |

| 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 $150^\circ C$ | 55         | V             |
| $V_{DGR}$   | Drain to Gate voltage                         | $R_{GS} = 20K\Omega$                | 55         |               |
| $V_{GS}$  | Gate to Source voltage                        |                                     | $\pm 20$   |               |
| $I_D$   | Continuous Drain Current (Note 1)             | $V_{GS} = 10V, T_C = 25^\circ C$    | 110        | A             |
|   |   | $V_{GS} = 10V, T_C = 100^\circ C$   | 80         |               |
| $I_{DM}$  | Pulsed Drain current (Note 2)                 |                                     | 390        |               |
| $I_{AR}$  | Avalanche current (Note 2)                    |                                     | 62         |               |
| $E_{AR}$  | Repetitive avalanche energy (Note 2)          |                                     | 20         | mJ            |
| dv/dt   | Peak diode recovery dv/dt (Note 3)            |                                     | 5          | V/ns          |
| $P_D$   | Total power dissipation                       | $T_C = 25^\circ C$                  | 200        | W             |
|   | Derating factor above $25^\circ C$            |                                     | 1.3        | W/ $^\circ C$ |
| $T_J$   | Operation junction temperature                |                                     | -55 to 175 | $^\circ C$    |
| $T_{STG}$   | Storage temperature                           |                                     | -55 to 175 |               |
| $T_L$   | 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)  |

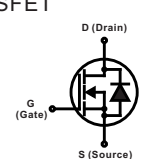
Note: 1. Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.

2. Repetitive rating: pulse width limited by junction temperature.

3.  $I_{SD} \leq 62A$ ,  $di/dt \leq 207A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 175^\circ C$ .

| THERMAL RESISTANCE |   |      |      |      |      |
|--------------------|---|------|------|------|------|
| SYMBOL             | PARAMETER                               | Min. | Typ. | Max. | UNIT |
| $R_{th(j-c)}$      | Thermal resistance, junction to case    |      |      | 0.75 | °C/W |
| $R_{th(c-s)}$      | Thermal resistance, case to heatsink    |      | 0.50 |      |      |
| $R_{th(j-a)}$      | Thermal resistance, junction to ambient |      |      | 62   |      |

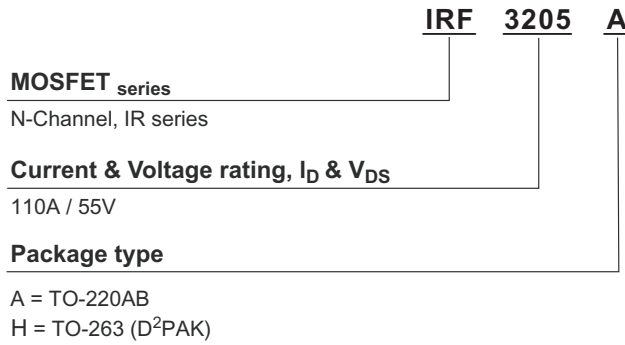
| ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise specified) |  |   |      |       |      |         |
|---|--|---|------|-------|------|---------|
| SYMBOL  | PARAMETER                                  | TEST CONDITIONS   | Min. | Typ.  | Max. | UNIT    |
| $V_{(BR)DSS}$   | Drain to source breakdown voltage          | $V_{GS} = 0V, I_D = 250\mu A$                                     | 55   |       |      | V       |
| $\Delta V_{(BR)DSS}/\Delta T_J$   | Breakdown voltage temperature coefficient  | $I_D = 1mA$ , referenced to $25^\circ\text{C}$                    |      | 0.057 |      | V/°C    |
| $I_{DSS}$   | Drain to source leakage current            | $V_{DS}=55V, V_{GS}=0V$ $T_C = 25^\circ\text{C}$                  |      |       | 25   | $\mu A$ |
|   |  | $V_{DS}=44V, V_{GS}=0V$ $T_C = 150^\circ\text{C}$                 |      |       | 250  |         |
| $I_{GSS}$   | Gate to source forward leakage current     | $V_{GS} = 20V, V_{DS} = 0V$                                       |      |       | 100  | nA      |
|   | Gate to source reverse leakage current     | $V_{GS} = -20V, V_{DS} = 0V$                                      |      |       | -100 |         |
| $R_{DS(ON)}$  | Static drain to source on-state resistance | $V_{GS} = 10V, I_D = 62A$ (Note 1)                                |      | 8.0   | 10   | mΩ      |
| $V_{GS(TH)}$  | Gate threshold voltage                     | $V_{GS}=V_{DS}, I_D=250\mu A$                                     | 2    |       | 4    | V       |
| $g_{fs}$  | Forward transconductance                   | $V_{DS}=25V, I_D=62A$   | 44   |       |      | S       |
| $C_{ISS}$   | Input capacitance                          | $V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$                             |      | 3240  |      | pF      |
| $C_{OSS}$   | Output capacitance                         |   |      | 780   |      |         |
| $C_{RSS}$   | Reverse transfer capacitance               |   |      | 210   |      |         |
| $t_{d(ON)}$   | Turn-on delay time                         | $V_{DD} = 28V, I_D = 62A, R_G = 4.5\Omega, V_{GS} = 10V$ (Note 1) |      | 14    |      | ns      |
| $t_r$   | Rise time                                  |   |      | 100   |      |         |
| $t_{d(OFF)}$  | Turn-off delay time                        |   |      | 50    |      |         |
| $t_f$   | Fall time                                  |   |      | 65    |      |         |
| $L_D$   | Internal drain inductance                  | Between lead, 6mm from package and center of die                  |      | 1.5   |      | nH      |
| $L_S$   | Internal source inductance                 |   |      | 7.5   |      |         |
| $Q_G$   | Total gate charge                          | $V_{DS} = 44V, V_{GS} = 10V, I_D = 62A$                           |      |       | 150  | nC      |
| $Q_{GS}$  | Gate to source charge                      |   |      |       | 35   |         |
| $Q_{GD}$  | Gate to drain charge (Miller charge)       |   |      |       | 55   |         |
| $E_{AS}$  | Single pulse avalanche energy(Note 2)      | $I_{AS} = 62A, L = 138\mu H$                                      |      | 1050  | 270  | mJ      |

| 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              | $I_{SD} = 62A, V_{GS} = 0V$   |      |      | 1.3  | V    |
| $I_S(I_{SD})$  | Continuous source to drain current | Integral reverse P-N junction diode in the MOSFET<br> |      |      | 110  | A    |
| $I_{SM}$   | Pulsed source current              |   |      |      | 390  |      |
| $t_{rr}$   | Reverse recovery time              | $I_{SD} = 62A, V_{GS} = 0V, di_F/dt = 100A/\mu s$   |      | 70   | 110  | ns   |
| $Q_{rr}$   | Reverse recovery charge            |   |      | 145  | 220  | nC   |
| $t_{ON}$   | Forward turn-on time               | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ )   |      |      |      |      |

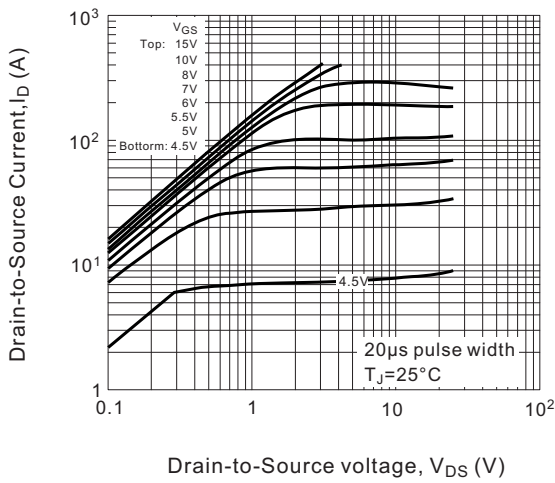
Note: 1. Pulse test: Pulse width  $\leq 400\mu s$ , duty cycle  $\leq 2\%$ .

2.  $L=138\mu H, I_{AS} \leq 62A, R_G=25\Omega, T_J \leq 175^\circ\text{C}$

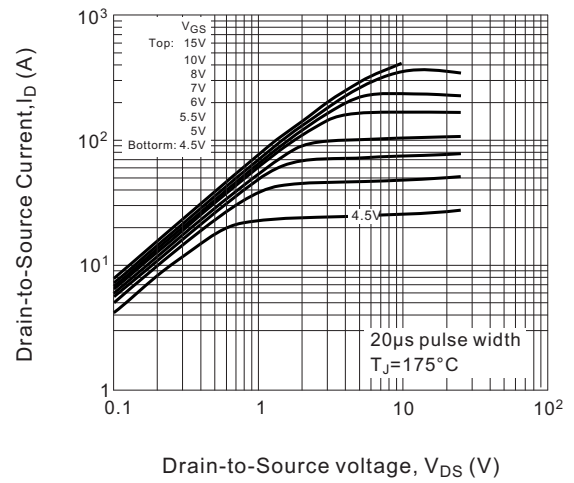
## ORDERING INFORMATION SCHEME



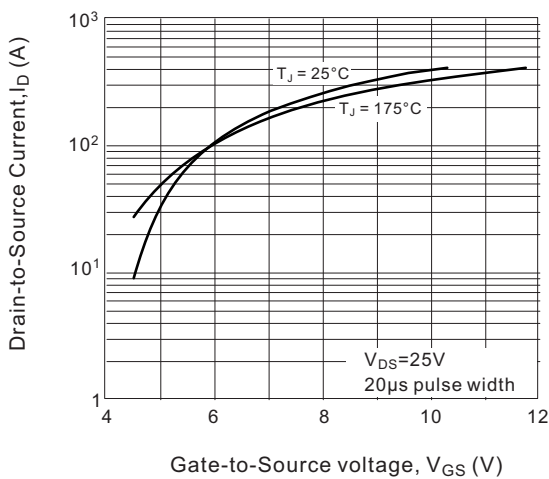
**Fig.1 Typical output characteristics**



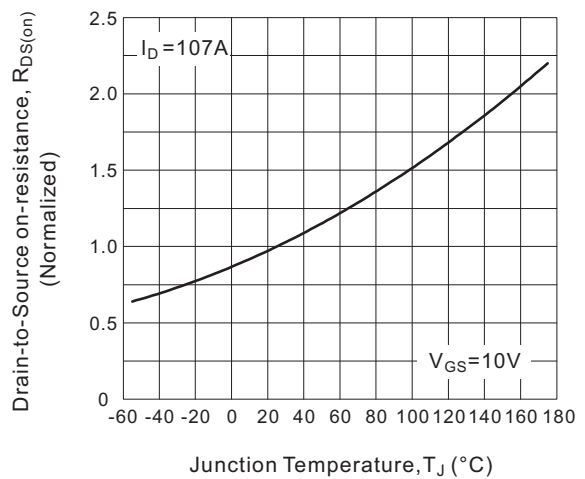
**Fig.2 Typical output characteristics**



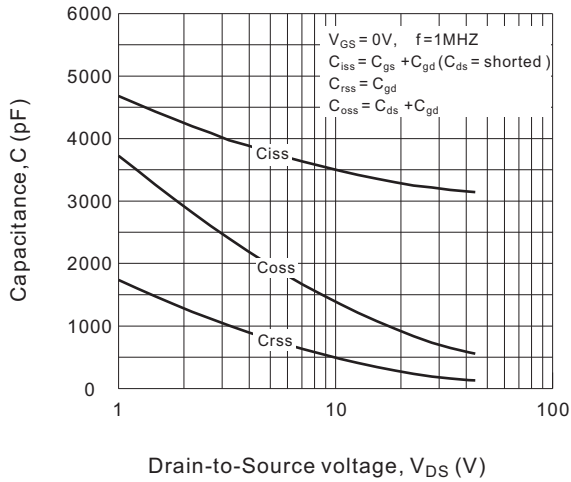
**Fig.3 Typical transfer characteristics**



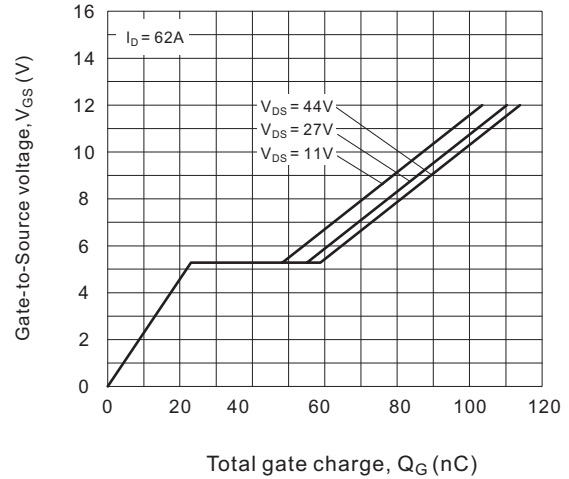
**Fig.4 Normalized On-Resistance vs. Temperature**



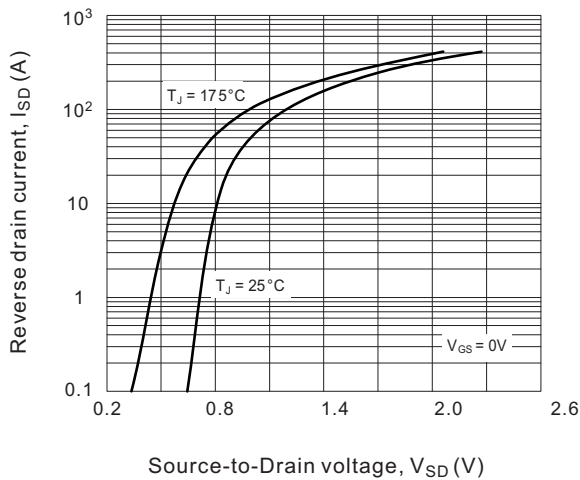
**Fig.5 Typical capacitance vs. Drain-to-Source voltage**



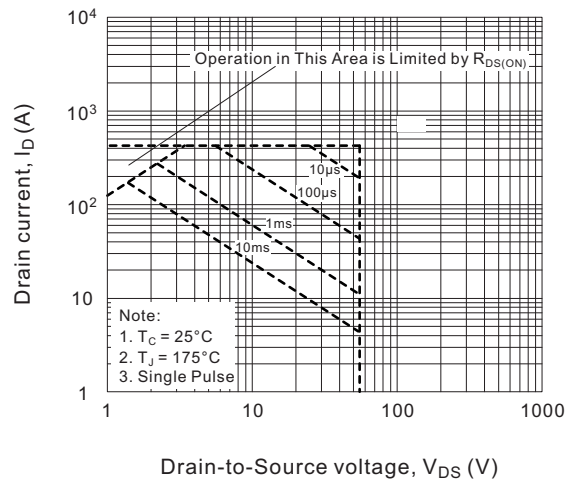
**Fig.6 Typical gate charge vs. Gate-to-Source voltage**



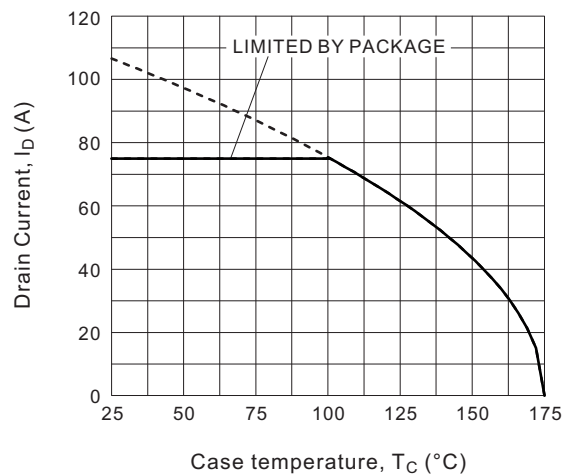
**Fig.7 Typical Source-Drain diode forward voltage**



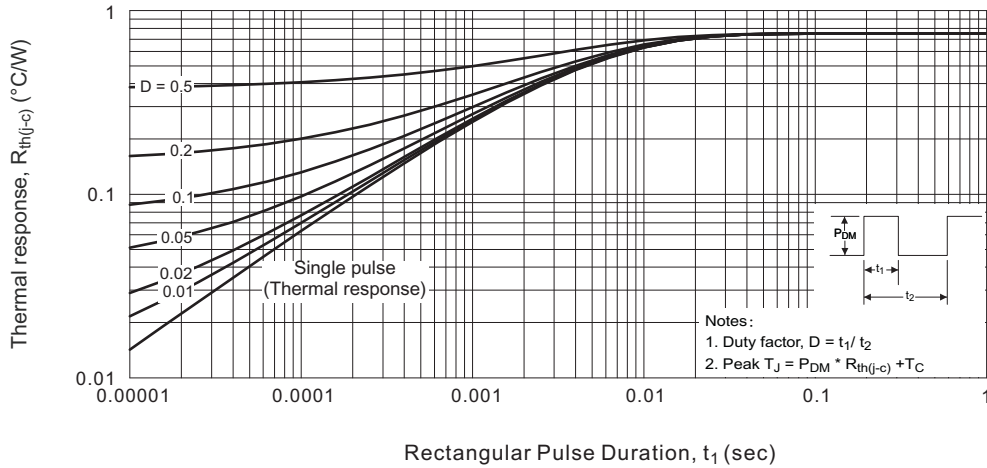
**Fig.8 Maximum safe operating area**



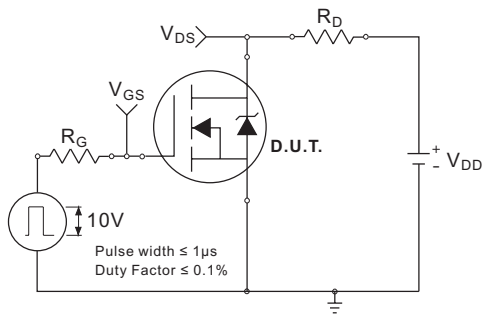
**Fig.9 Maximum drain current vs. Case temperature**



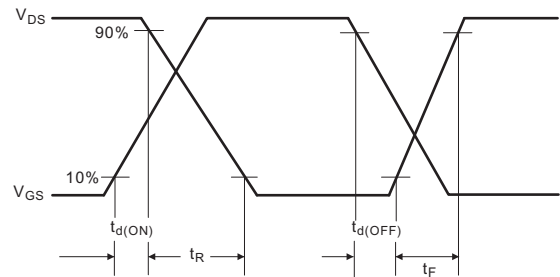
**Fig.10 Maximum effective transient thermal Impedance, Junction-to-Case**



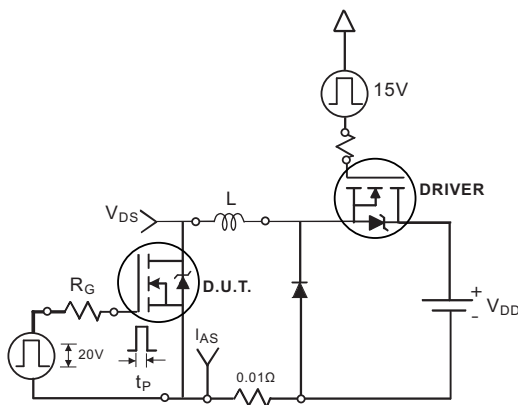
**Fig.11a. Switching time test circuit**



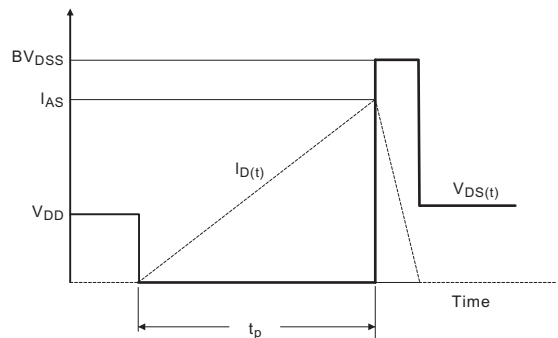
**Fig.11b. Switching time waveforms**



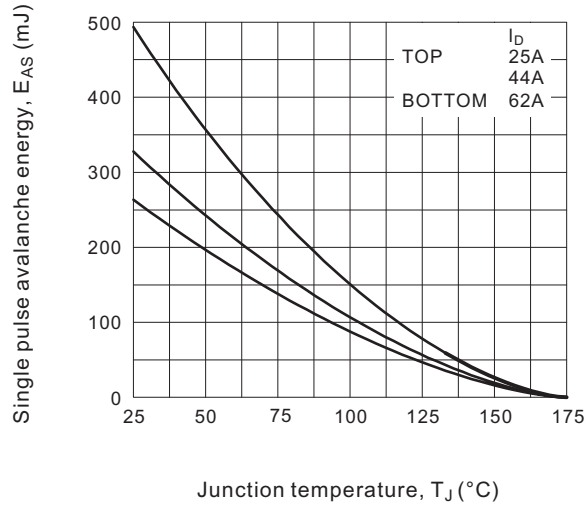
**Fig.12a. Unclamped Inductive test circuit**



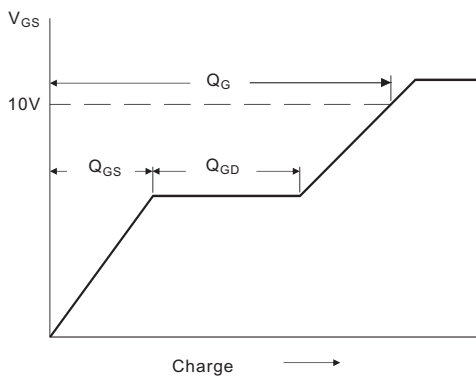
**Fig.12b. Unclamped Inductive waveforms**



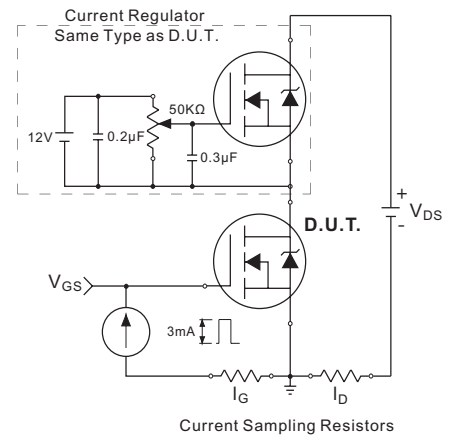
**Fig.12c. Maximum avalanche energy vs. Drain current**



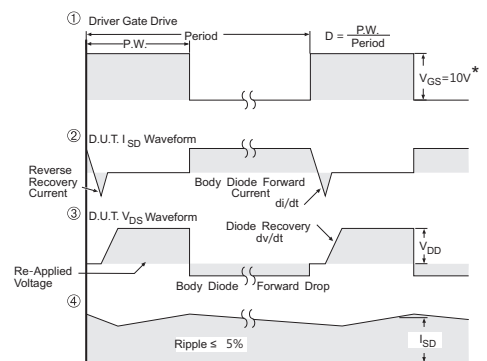
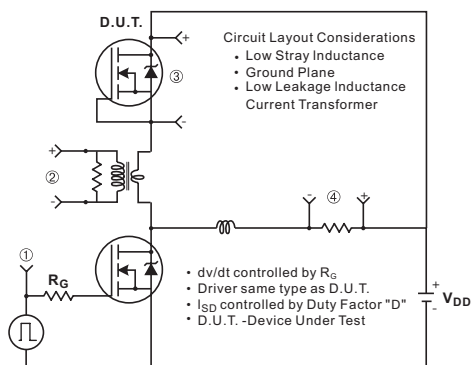
**Fig.13a. Basic gate charge waveform**



**Fig.13b. Gate charge test circuit**

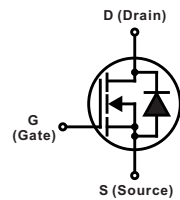
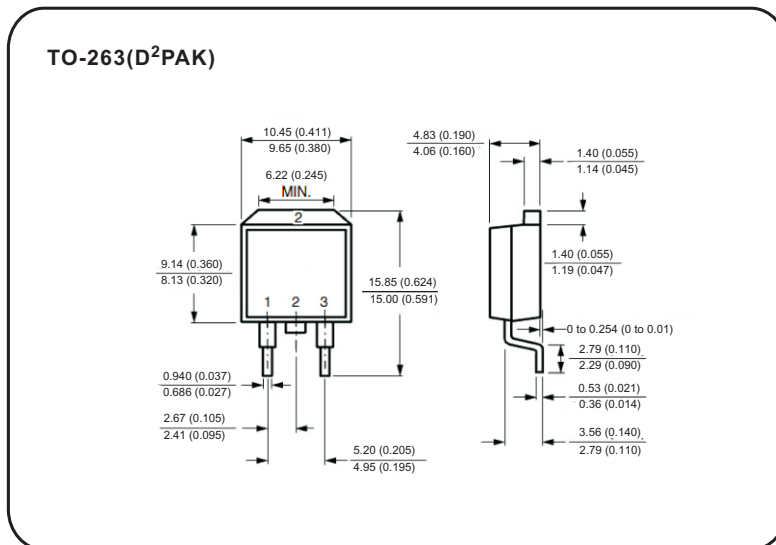
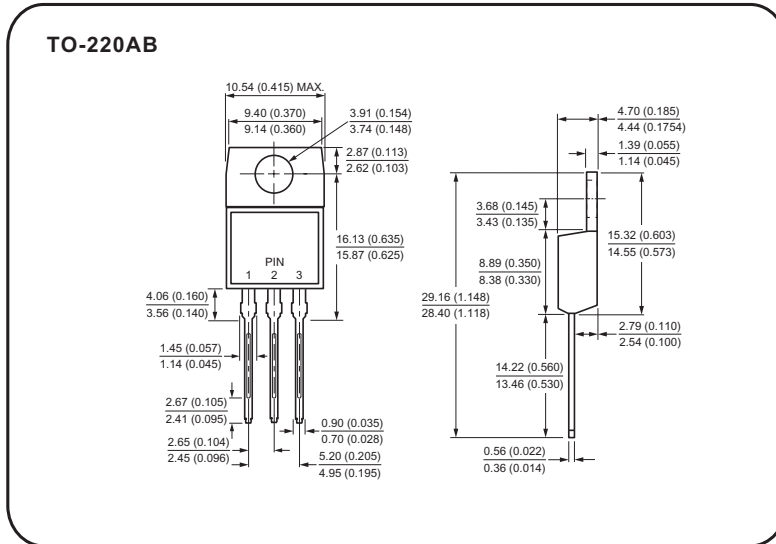


**Fig.14 Peak diode recovery dv/dt test circuit for N-Channel MOSFET**



\* $V_{GS} = 5V$  for Logic Level Devices

## Case Style



All dimensions in millimeters(inches)