

### General Description

These N-channel enhancement mode power mosfets used SGT technology design, provided excellent  $R_{DS(on)}$  and low gate charge. Which accords with the RoHS standard.

### Features

- Fast switching
- Low reverse transfer capacitances
- Low gate charge and Low on-resistance
- 100% avalanche tested

### Mechanical Data

- Case: TO-220, TO-263, TO-247 Package

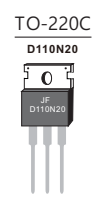
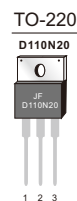
### Application

- DC/DC Converter
- Ideal for high-frequency switching and
- synchronous rectification

### Ordering Information

| Part No. | Package Type | Package     | Quality(box) |
|----------|--------------|-------------|--------------|
| D110N20  | TO-220       | Tube        | 1000         |
| D110N20  | TO-220C      | Tube        | 1000         |
| D110N20D | TO-263       | Tape & Reel | 800          |
| D110N20P | TO-247       | Tube        | 360          |

| Product Summary |                                |           |             |
|-----------------|--------------------------------|-----------|-------------|
| $V_{DS}$        | $R_{DS(on)}$ (m $\Omega$ ) Typ | $I_D$ (A) | $Q_g$ (Typ) |
| 200V            | 8.8 @ 10V 50A                  | 110       | 70nc        |



### Block Diagram

Pin Definition:

1. Gate
2. Drain
3. Source

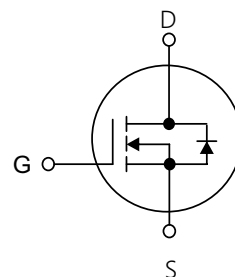


Table1 Absolute Maximum Ratings (Tc=25°C, unless otherwise specified)

| Parameter                                  | Symbol        | Rating   | Unit |
|--|---------------|----------|------|
| Drain-Source Voltage                       | $V_{DS}$      | 200      | V    |
| Gate-Source Voltage                        | $V_{GS}$      | $\pm 20$ | V    |
| Continuous Drain Current                   | $I_D$         | Tc=25°C  | 110  |
|  |               | Tc=100°C | 75   |
| Pulsed Drain Current (Note 1)              | $I_{DM}$      | 420      | A    |
| Single Pulse Avalanche Energy(Note 2)      | $E_{AS}$      | 1332     | mJ   |
| Power Dissipation Tc=25°C                  | $P_D$         | 278      | W    |
| Operating Junction and Storage Temperature | $T_J/T_{STG}$ | -55~+150 | °C   |

Table 2. Thermal Characteristics

| Parameter                              | Symbol          | Rating | Unit                 |
|--|-----------------|--------|----------------------|
| Thermal resistance Junction to Ambient | $R_{\theta JA}$ | 62     | $^{\circ}\text{C/W}$ |
| Thermal resistance Junction to Case    | $R_{\theta JC}$ | 0.45   | $^{\circ}\text{C/W}$ |

Table 3. Electrical Characteristics (Tc=25°C, unless otherwise specified)

| Parameter  |         | Symbol              | Test Conditions   | Min | Typ  | Max  | Unit |
|--|---------|---------------------|---|-----|------|------|------|
| Off Characteristics                                    |         |                     |   |     |      |      |      |
| Drain-Source Breakdown Voltage                         |         | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V,I <sub>D</sub> =250μA   | 200 | -    | -    | V    |
| Drain-Source Leakage Current                           |         | I <sub>DSS</sub>    | V <sub>DS</sub> =200V,V <sub>GS</sub> =0V   | -   | -    | 1    | μA   |
| Gate- Source Leakage Current                           | Forward | I <sub>GSS</sub>    | V <sub>GS</sub> =20V,V <sub>DS</sub> =0V  | -   | -    | 100  | nA   |
|  | Reverse |                     | V <sub>GS</sub> = -20V,V <sub>DS</sub> =0V  | -   | -    | -100 | nA   |
| On Characteristics(Note 3)                             |         |                     |   |     |      |      |      |
| Gate Threshold Voltage                                 |         | V <sub>GS(TH)</sub> | V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA                                   | 2.5 | -    | 4. 5 | V    |
| Static Drain-Source On-State Resistance                |         | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V,I <sub>D</sub> =35A  | -   | 8.8  | 10   | mΩ   |
| Dynamic Characteristics(Note 4)                        |         |                     |   |     |      |      |      |
| Input Capacitance                                      |         | C <sub>ISS</sub>    | V <sub>DS</sub> =100V,V <sub>GS</sub> =0V,f=1MHz  | -   | 5357 | -    | pF   |
| Output Capacitance                                     |         | C <sub>OSS</sub>    |   | -   | 457  | -    | pF   |
| Reverse Transfer Capacitance                           |         | C <sub>RSS</sub>    |   | -   | 40   | -    | pF   |
| Switching Characteristics (Note 4)                     |         |                     |   |     |      |      |      |
| Turn-On Delay Time                                     |         | t <sub>d(on)</sub>  | V <sub>DD</sub> =100V,I <sub>D</sub> =50A<br>V <sub>GS</sub> =10V,R <sub>GEN</sub> =4.7Ω, | -   | 16   | -    | ns   |
| Turn-On Rise Time                                      |         | t <sub>r</sub>      |   | -   | 82   | -    | ns   |
| Turn-Off Delay Time                                    |         | t <sub>d(off)</sub> |   | -   | 55   | -    | ns   |
| Turn-Off Fall Time                                     |         | t <sub>f</sub>      |   | -   | 84   | -    | ns   |
| Total Gate Charge                                      |         | Q <sub>G</sub>      | V <sub>DD</sub> =100V,I <sub>D</sub> =50A,<br>V <sub>GS</sub> =10V                        | -   | 70   | -    | nC   |
| Gate-Source Charge                                     |         | Q <sub>GS</sub>     |   | -   | 25   | -    | nC   |
| Gate-Drain Charge                                      |         | Q <sub>GD</sub>     |   | -   | 16   | -    | nC   |
| Drain-Source Diode Characteristics and Maximum Ratings |         |                     |   |     |      |      |      |
| Drain-Source Diode Forward Voltage                     |         | V <sub>SD</sub>     | V <sub>GS</sub> =0V,I <sub>S</sub> =50A   | -   | -    | 1.2  | V    |
| Maximum Continuous Drain-Source Diode Forward Current  |         | I <sub>S</sub>      |   | -   | -    | 110  | A    |
| Reverse Recovery Time                                  |         | t <sub>rr</sub>     | V <sub>GS</sub> =0V,I <sub>F</sub> =50A<br>dI <sub>F</sub> /dt=100A/μs(Note 1)            | -   | 130  | -    | ns   |
| Reverse Recovery Charge                                |         | Q <sub>RR</sub>     |   | -   | 753  | -    | nC   |

Notes: 1 Repetitive Rating:Pulse width limited by maximum junction temperature

2 L=0.5mH, Rg=25 $\Omega$ , Starting Tj=25°C

3 Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ 

4 Guaranteed by design, not subject to production

## Typical Characteristics Diagrams

Figure 1. Output Characteristics

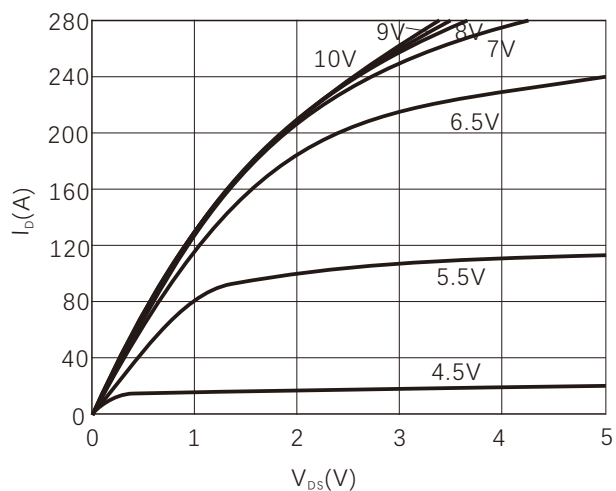


Figure 2. Transfer Characteristics

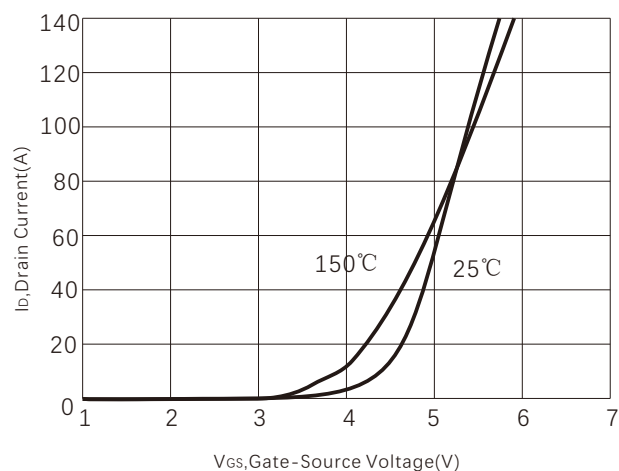


Figure 3.  $BV_{DSS}$  vs Junction Temperature

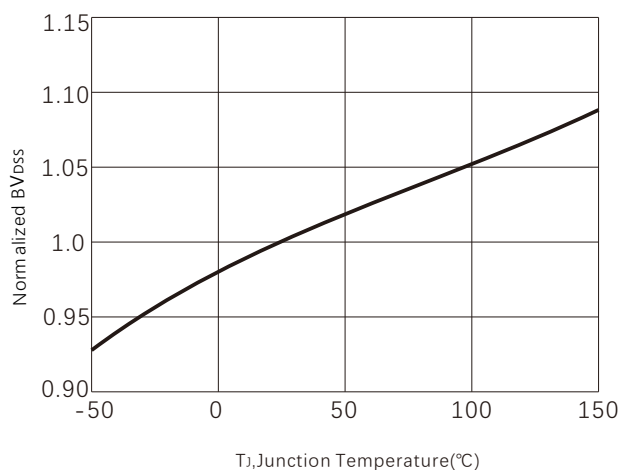


Figure 4. Capacitance

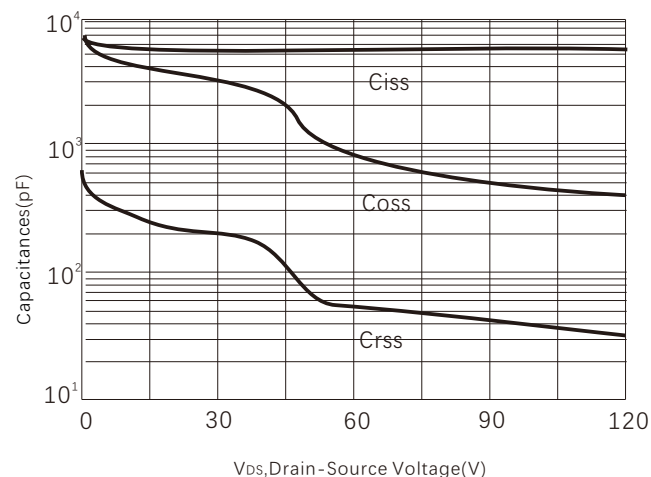


Figure 5. Gate charge

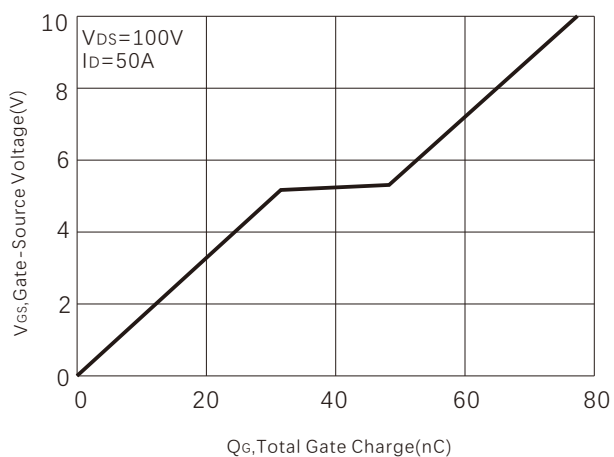


Figure 6. Source-Drain Diode Forward Voltage

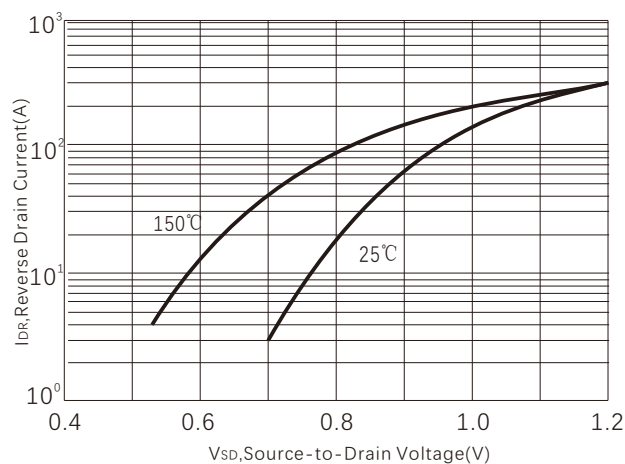


Figure7.Maximum Drain Current vs Temperature

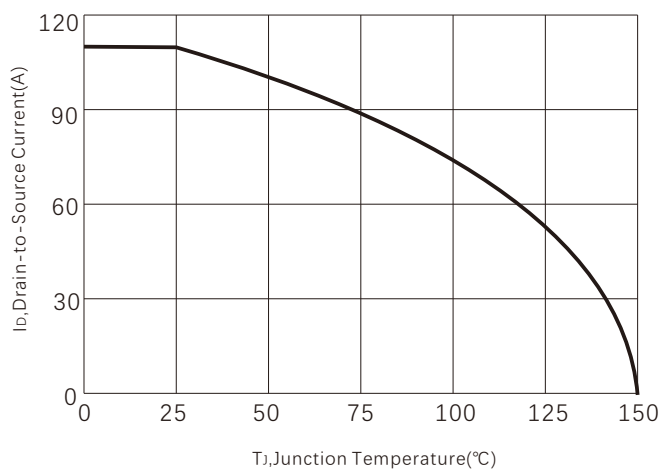


Figure8.RDS(ON) vs Junction Temperature

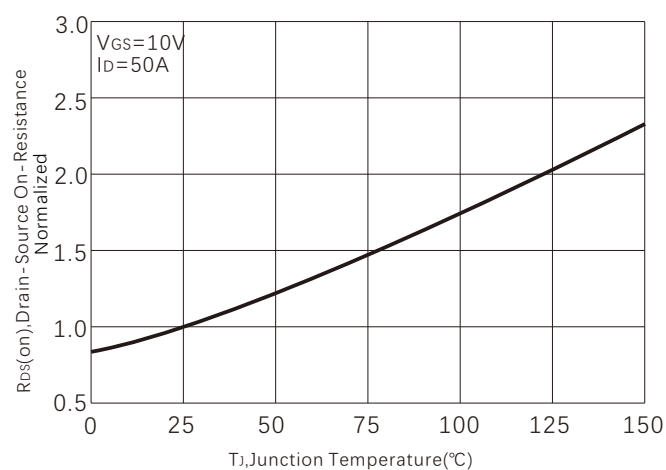


Figure 9. Safe operating area

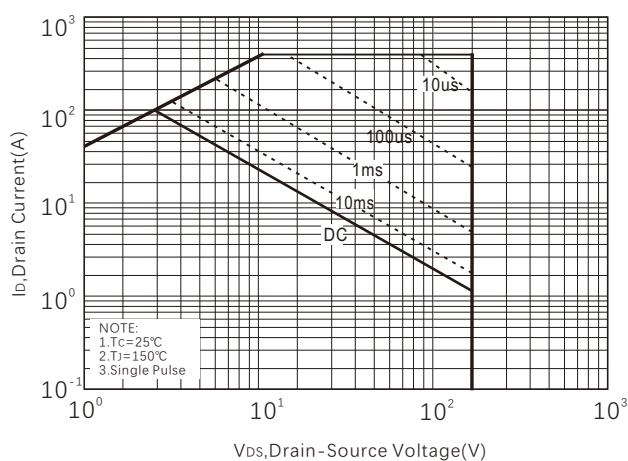
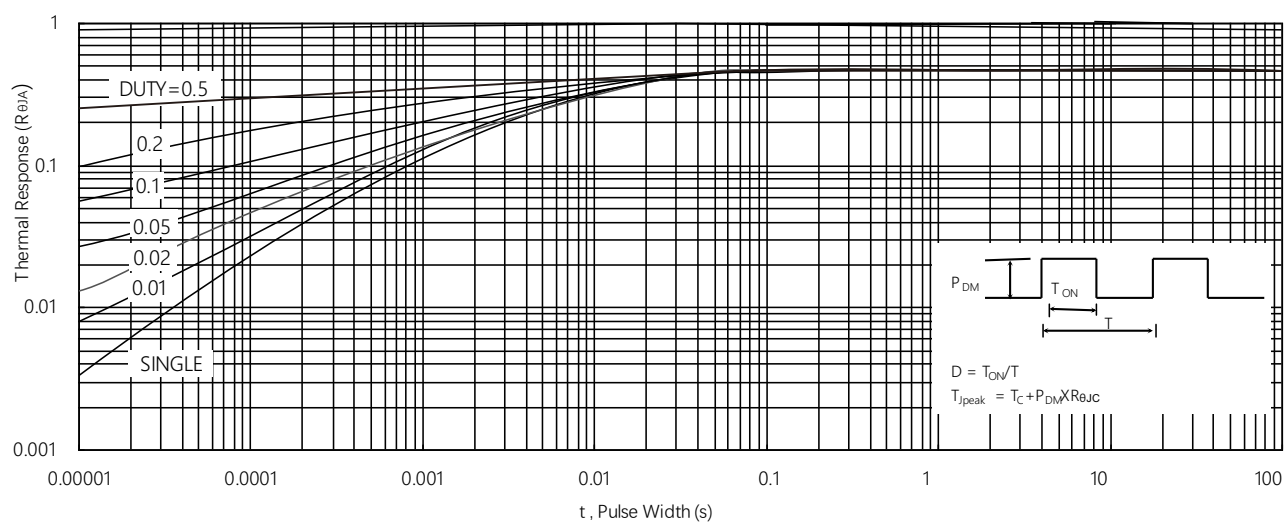
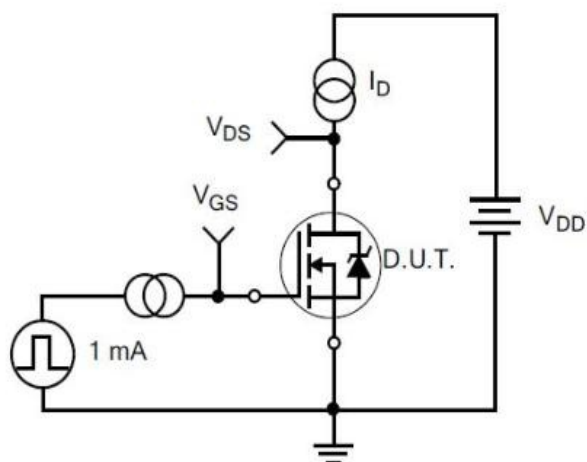


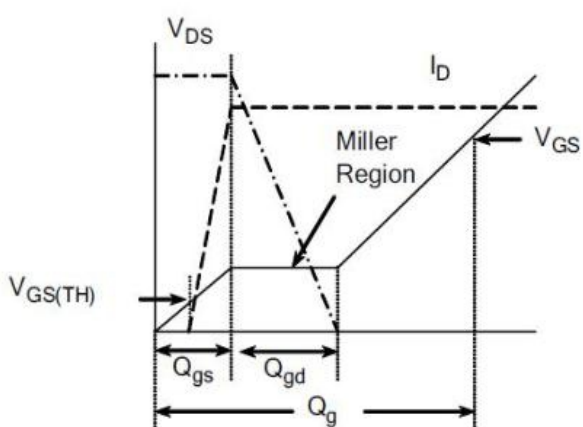
Figure 10. Maximum Transient Thermal Impedance



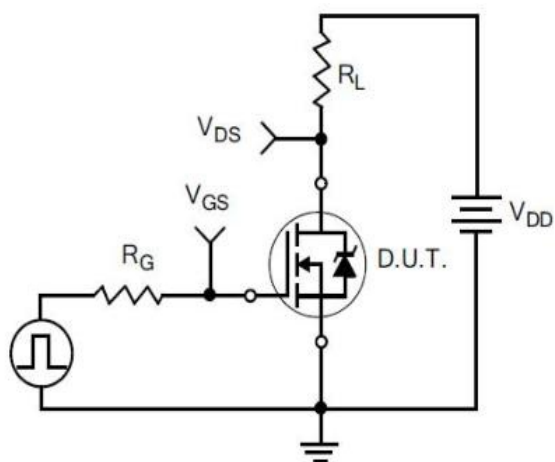
## Typical Test Circuit



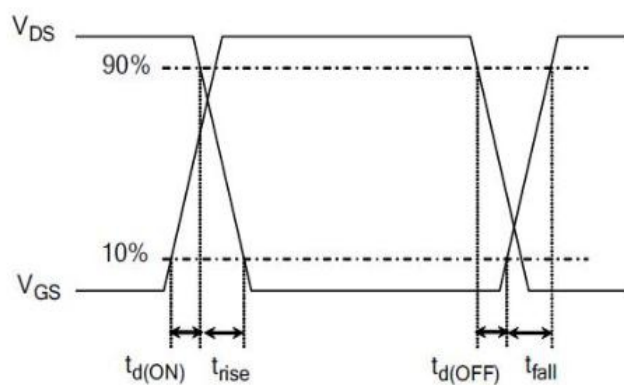
1) Gate Charge Test Circuit



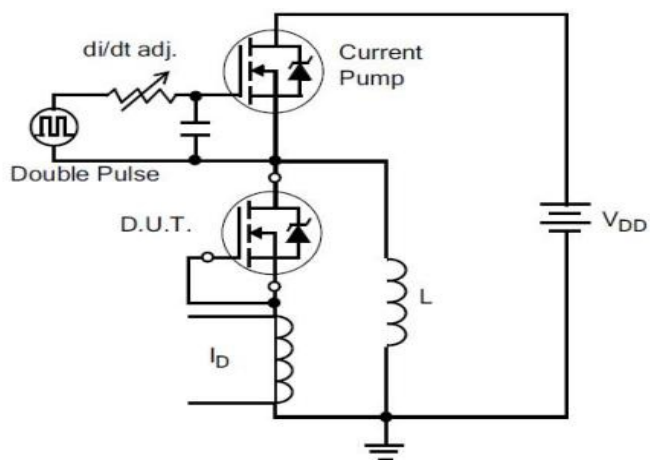
2) Gate Charge Waveform



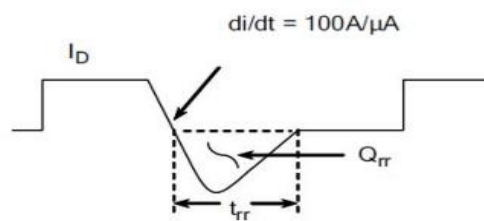
3) Resistive Switching Test Circuit



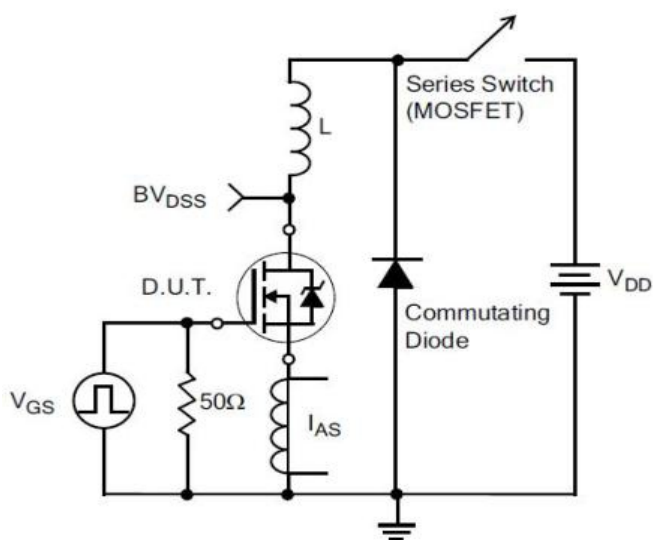
4) Resistive Switching Waveforms



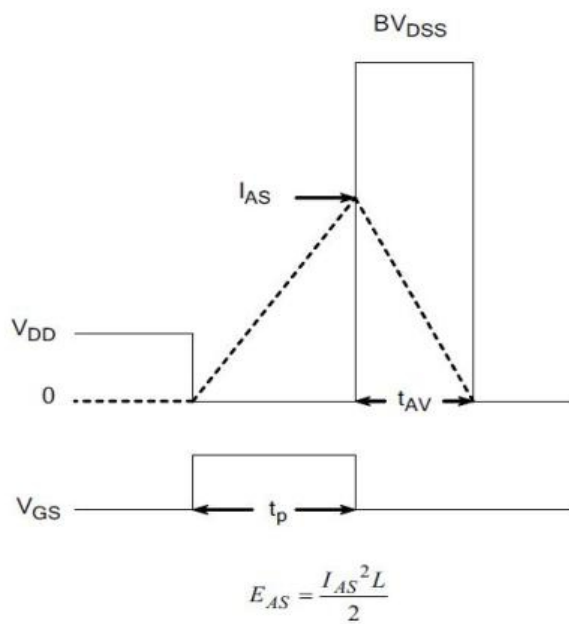
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform



7) . Unclamped Inductive Switching Test Circuit



8) Unclamped Inductive Switching Waveforms

# Product Names Rules

X X X N E X X X-X X X

Process Type:  
VDMOS:default  
Super junction:SJ  
Low Voltage trench:D

Rdson Code  
2Ω :2D0  
9.5mΩ :9M5

Rated Current Code  
With 1-2 Digital,  
For Ex ample:  
4A:4,  
10A:10,  
0.8A:08

Package Code  
TO-220:Default  
TO-220C:Default  
ITO-220:F  
TO-262:E  
TO-263:D  
TO-252:M  
TO-251:N  
TO-263-7L:D7

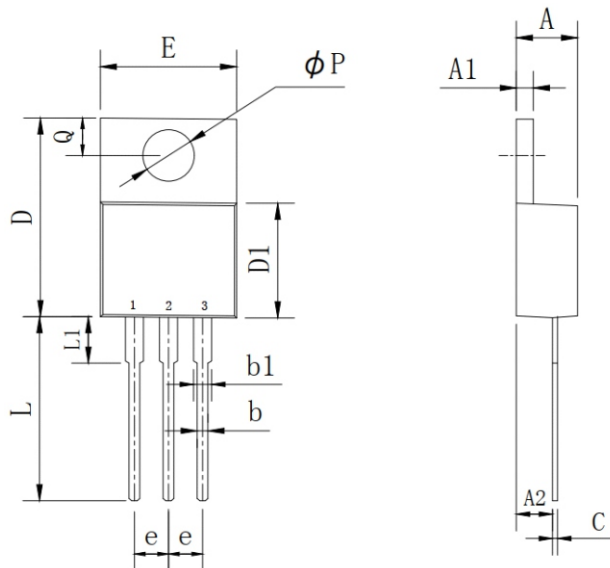
Channel Code  
N channel:N  
P channel:P

Rated Voltage Code  
With 2 Digital,For Example:  
600V:60  
60V:06

Special Function Code  
G-S ESD Protection:E  
No Protection:Default

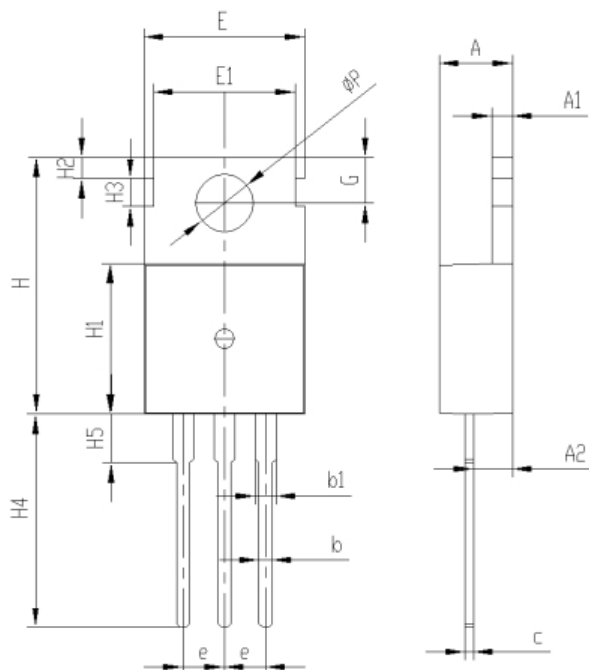
# Dimensions

## TO-220 PACKAGE OUTLINE DIMENSIONS



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | MIN                       | MAX   | MIN                  | MAX   |
| A      | 4.25                      | 4.87  | 0.167                | 0.192 |
| A1     | 1.07                      | 1.47  | 0.042                | 0.058 |
| A2     | 2.03                      | 2.92  | 0.080                | 0.115 |
| b      | 0.51                      | 1.11  | 0.020                | 0.044 |
| b1     | 0.97                      | 1.6   | 0.038                | 0.063 |
| C      | 0.3                       | 0.7   | 0.012                | 0.028 |
| D      | 14.6                      | 15.9  | 0.575                | 0.626 |
| D1     | 8.04                      | 9.3   | 0.317                | 0.366 |
| E      | 9.57                      | 10.57 | 0.377                | 0.416 |
| e      | 2.34                      | 2.74  | 0.092                | 0.108 |
| L      | 12.58                     | 14.3  | 0.495                | 0.563 |
| L1     | 2.8                       | 4.2   | 0.110                | 0.165 |
| P      | 3.4                       | 4.14  | 0.134                | 0.163 |
| Q      | 2.45                      | 3     | 0.096                | 0.118 |

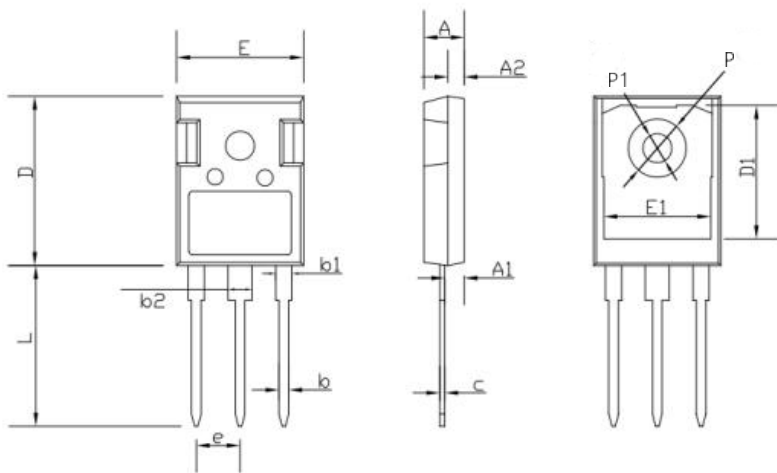
## TO-220C PACKAGE OUTLINE DIMENSIONS



| Symbol | Dimensions (millimeters) |       |
|--------|--------------------------|-------|
|        | Min.                     | Max.  |
| A      | 4.30                     | 4.70  |
| A1     | 1.17                     | 1.37  |
| A2     | 2.20                     | 2.60  |
| b      | 0.60                     | 1.00  |
| b1     | 1.17                     | 1.37  |
| b2     | 1.90                     | 2.30  |
| c      | 0.30                     | 0.70  |
| e      | 2.34                     | 2.74  |
| E      | 9.70                     | 10.1  |
| E1     | 8.50                     | 8.90  |
| H      | 15.5                     | 15.9  |
| H1     | 9.00                     | 9.40  |
| H2     | 1.10                     | 1.50  |
| H3     | 1.50                     | 1.90  |
| H4     | 12.58                    | 13.58 |
| H5     | 2.80                     | 3.20  |
| G      | 2.60                     | 3.00  |
| ΦP     | 3.40                     | 3.80  |

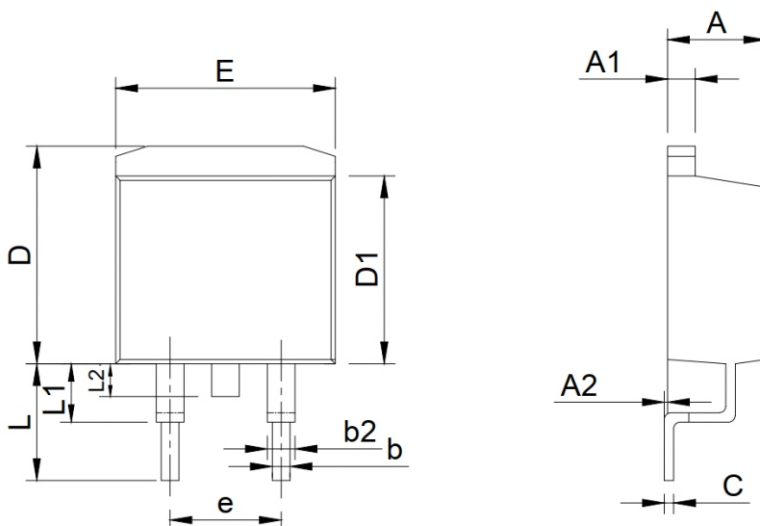
## Dimensions

### TO-247 PACKAGE OUTLINE DIMENSIONS



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |        |
|--------|---------------------------|-------|----------------------|--------|
|        | min.                      | max.  | min.                 | max.   |
| A      | 4.90                      | 5.10  | 0.193                | 0.201  |
| A1     | 2.31                      | 2.51  | 0.091                | 0.099  |
| A2     | 1.90                      | 2.10  | 0.075                | 0.083  |
| b      | 1.16                      | 1.26  | 0.046                | 0.050  |
| b1     | 1.96                      | 2.15  | 0.0772               | 0.085  |
| b2     | 2.96                      | 3.16  | 0.117                | 0.124  |
| c      | 0.59                      | 0.66  | 0.0232               | 0.0260 |
| D      | 20.90                     | 21.10 | 0.8235               | 0.8313 |
| D1     | 16.25                     | 16.85 | 0.6403               | 0.6639 |
| E      | 15.70                     | 15.90 | 0.6186               | 0.6265 |
| E1     | 13.10                     | 13.50 | 0.5161               | 0.5319 |
| e      | 5.44                      |       | 0.2143               |        |
| L      | 19.80                     | 20.10 | 0.7801               | 0.7919 |
| ΦP     | 3.50                      | 3.70  | 0.1379               | 0.1458 |
| ΦP1    | 0                         | 7.30  | 0                    | 0.2876 |

### TO-263 PACKAGE OUTLINE DIMENSIONS



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | MIN                       | MAX   | MIN                  | MAX   |
| A      | 4.25                      | 4.87  | 0.167                | 0.192 |
| A1     | 1.07                      | 1.47  | 0.042                | 0.058 |
| A2     | 0                         | 0.25  | 0.000                | 0.010 |
| b      | 0.61                      | 1.01  | 0.024                | 0.040 |
| b1     | 1.2                       | 1.34  | 0.047                | 0.053 |
| C      | 0.3                       | 0.6   | 0.012                | 0.024 |
| D      | 9.48                      | 10.84 | 0.373                | 0.427 |
| D1     | 8.49                      | 9.3   | 0.334                | 0.366 |
| E      | 9.7                       | 10.31 | 0.382                | 0.406 |
| e      | 4.88                      | 5.28  | 0.192                | 0.208 |
| L      | 4.46                      | 5.85  | 0.176                | 0.230 |
| L1     | 1.33                      | 2.33  | 0.052                | 0.092 |
| L2     | 0                         | 2.2   | 0.000                | 0.087 |

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