

### General Description

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

| Product Summary |                                |           |          |
|-----------------|--------------------------------|-----------|----------|
| $V_{DS}$        | $R_{DS(on)}$ (m $\Omega$ ) Typ | $I_D$ (A) | Qg (Typ) |
| 100V            | 2.7 @ 10V                      | 240       | 169nc    |

### Features

- Fast switching
- Low on-resistance
- Low gate charge and input capacitance
- 100% avalanche tested

### Mechanical Data

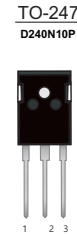
- Case: TO-220, TO-263, TO-247, TO-3P Package

### Application

- Switching applications

### Ordering Information

| Part No. | Package Type | Package     | Quality(box) |
|----------|--------------|-------------|--------------|
| D240N10  | TO-220       | Tube        | 1000         |
| D240N10D | TO-263       | Tape & Reel | 800          |
| D240N10P | TO-247       | Tube        | 300          |
| D240N10K | TO-3P        | Tube        | 300          |



### Block Diagram

Pin Definition:

1. Gate
2. Drain
3. Source

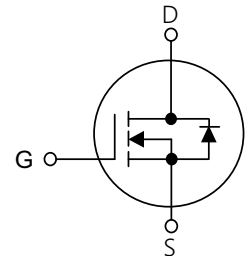


Table1 Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ , unless otherwise specified)

| Parameter                                  | Symbol        | D240N10/D240N10D        | D240N10P/D240N10K | Unit             |
|--|---------------|-------------------------|-------------------|------------------|
| Drain-Source Voltage                       | $V_{DS}$      | 100                     |                   | V                |
| Gate-Source Voltage                        | $V_{GS}$      | $\pm 20$                |                   | V                |
| Continuous Drain Current                   | $I_D$         | $T_C=25^\circ\text{C}$  | 240               | A                |
|  |               | $T_C=100^\circ\text{C}$ | 177               |                  |
| Pulsed Drain Current (Note 1)              | $I_{DM}$      | 960                     |                   | A                |
| Single Pulse Avalanche Energy (Note 2)     | $E_{AS}$      | 529                     |                   | mJ               |
| Power Dissipation $T_C=25^\circ\text{C}$   | $P_D$         | 395                     | 454               | W                |
| Operating Junction and Storage Temperature | $T_J/T_{STG}$ | -55~+175                |                   | $^\circ\text{C}$ |

Table 2. Thermal Characteristics

| Parameter                              | Symbol          | D240N10/<br>D240N10D | D240N10P/<br>D240N10K | Unit          |
|--|-----------------|----------------------|-----------------------|---------------|
| Thermal resistance Junction to Ambient | $R_{\theta JA}$ | 75                   | 50                    | $^{\circ}C/W$ |
| Thermal resistance Junction to Case    | $R_{\theta JC}$ | 0.38                 | 0.33                  | $^{\circ}C/W$ |

Table 3. Electrical Characteristics ( $T_J=25^{\circ}C$ , unless otherwise specified)

| Parameter  | Symbol       | Test Conditions                                    | Min | Typ   | Max  | Unit       |
|--|--------------|--|-----|-------|------|------------|
| Off Characteristics                                    |              |  |     |       |      |            |
| Drain-Source Breakdown Voltage                         | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$                          | 100 | -     | -    | V          |
| Drain-Source Leakage Current                           | $I_{DSS}$    | $V_{DS}=100V, V_{GS}=0V$                           | -   | -     | 1    | $\mu A$    |
| Gate- Source Leakage Current                           | Forward      | $V_{GS}=20V, V_{DS}=0V$                            | -   | -     | 100  | nA         |
|  | Reverse      | $V_{GS}=-20V, V_{DS}=0V$                           | -   | -     | -100 | nA         |
| On Characteristics(Note 4)                             |              |  |     |       |      |            |
| Gate Threshold Voltage                                 | $V_{GS(TH)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$                      | 2.2 | 3.0   | 3.8  | V          |
| Static Drain-Source On-State Resistance                | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=20A$                              | -   | 2.7   | 3.2  | m $\Omega$ |
|  |              | $V_{GS}=4.5V, I_D=30A$                             | -   | -     | -    | m $\Omega$ |
| Dynamic Characteristics(Note 5)                        |              |  |     |       |      |            |
| Input Capacitance                                      | $C_{ISS}$    | $V_{DS}=50V, V_{GS}=0V, f=1MHz$                    | -   | 11355 | -    | pF         |
| Output Capacitance                                     | $C_{OSS}$    |  | -   | 1446  | -    | pF         |
| Reverse Transfer Capacitance                           | $C_{RSS}$    |  | -   | 54    | -    | pF         |
| Switching Characteristics (Note 5)                     |              |  |     |       |      |            |
| Turn-On Delay Time                                     | $t_d(on)$    | $V_{DD}=50V, I_D=20A$<br>$V_{GS}=10V, R_L=3\Omega$ | -   | 35    | -    | ns         |
| Turn-On Rise Time                                      | $t_r$        |  | -   | 111   | -    | ns         |
| Turn-Off Delay Time                                    | $t_d(off)$   |  | -   | 84    | -    | ns         |
| Turn-Off Fall Time                                     | $t_f$        |  | -   | 112   | -    | ns         |
| Total Gate Charge                                      | $Q_G$        | $V_{DS}=50V, I_D=90A,$<br>$V_{GS}=10V, f=1MHz$     | -   | 169   | -    | nC         |
| Gate-Source Charge                                     | $Q_{GS}$     |  | -   | 67    | -    | nC         |
| Gate-Drain Charge                                      | $Q_{GD}$     |  | -   | 30    | -    | nC         |
| Drain-Source Diode Characteristics and Maximum Ratings |              |  |     |       |      |            |
| Drain-Source Diode Forward Voltage                     | $V_{SD}$     | $V_{GS}=0V, I_S=90A$                               | -   | 0.9   | 1.4  | V          |
| Maximum Continuous Drain-Source Diode Forward Current  | $I_S$        |  | -   | -     | -    | A          |
| Reverse Recovery Time                                  | $t_{rr}$     | $V_R=50V, I_F=90A$                                 | -   | 101   | -    | ns         |
| Reverse Recovery Charge                                | $Q_{RR}$     | $dI_F/dt=100A/\mu s$ (Note 1)                      | -   | 338   | -    | nC         |

- Notes : 1 Repetitive Rating: Pulse width limited by maximum junction temperature  
 2  $L=0.5mH, I_D=46A, V_{DD}=50V, Starting T_J=25^{\circ}C$   
 3 Surface mounted on Fr4 Board,  $t_s \leq 10sec$   
 4 Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$   
 5 Guaranteed by design, not subject to production

Typical Characteristics Diagrams

Fig 1: Output Characteristics

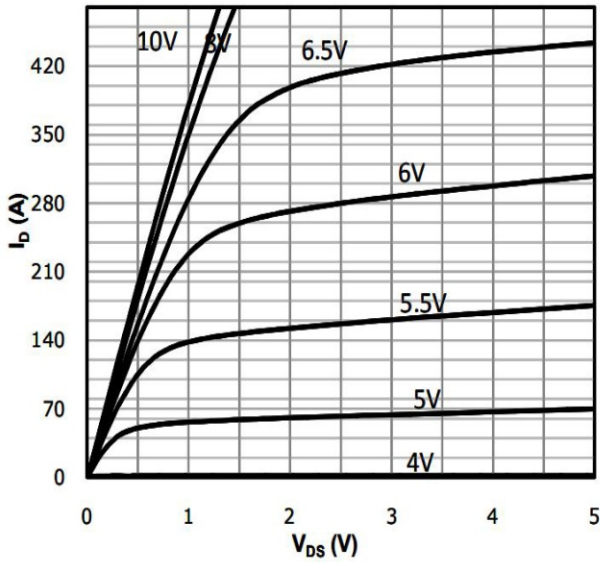
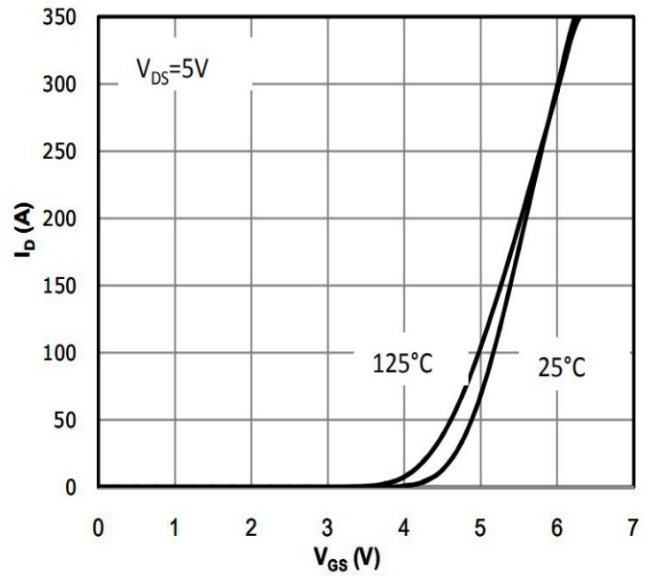


Fig 2: Transfer Characteristics



3:  $R_{DS(on)}$  vs Drain Current and Gate Voltage

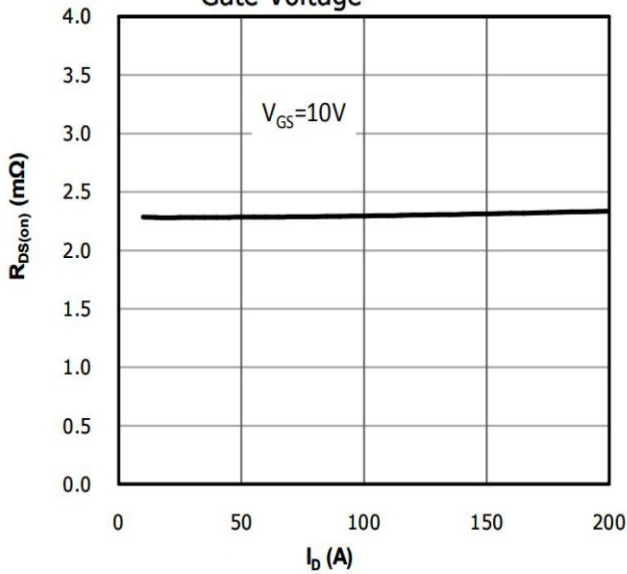
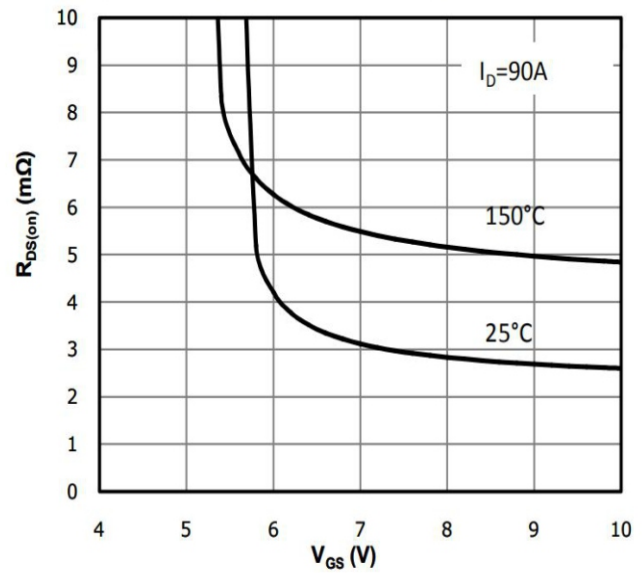


Fig 4:  $R_{DS(on)}$  vs Gate Voltage



Typical Characteristics Diagrams

Fig 5:  $R_{ds(on)}$  vs. Temperature

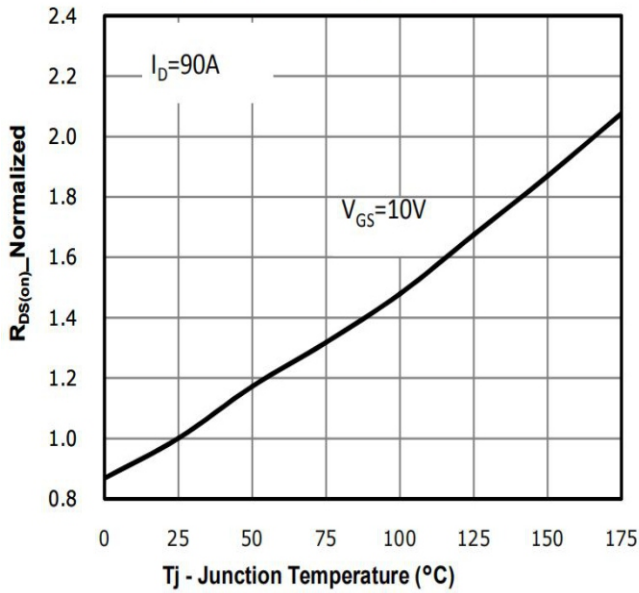


Fig 6: Capacitance Characteristics

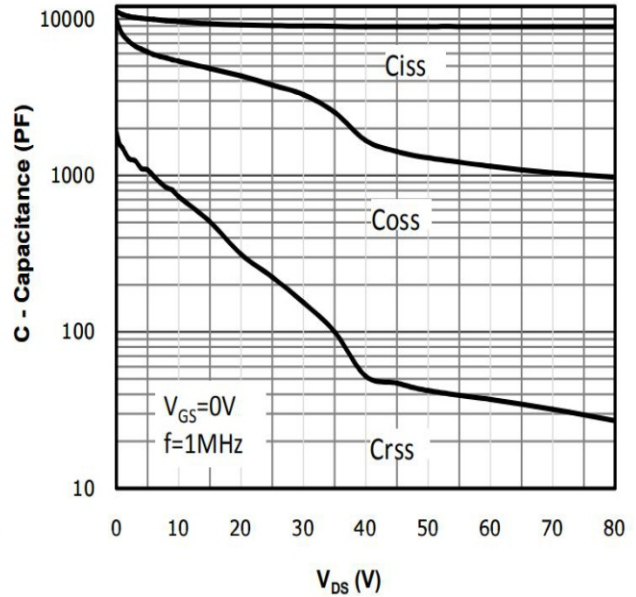


Fig 7: Gate Charge Characteristics

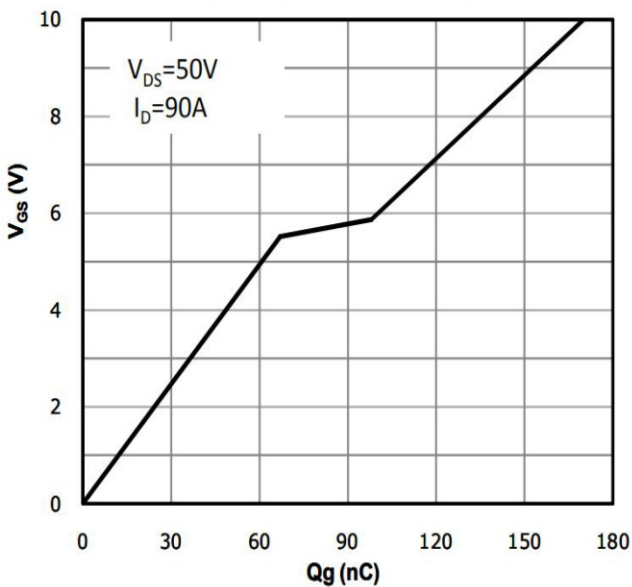
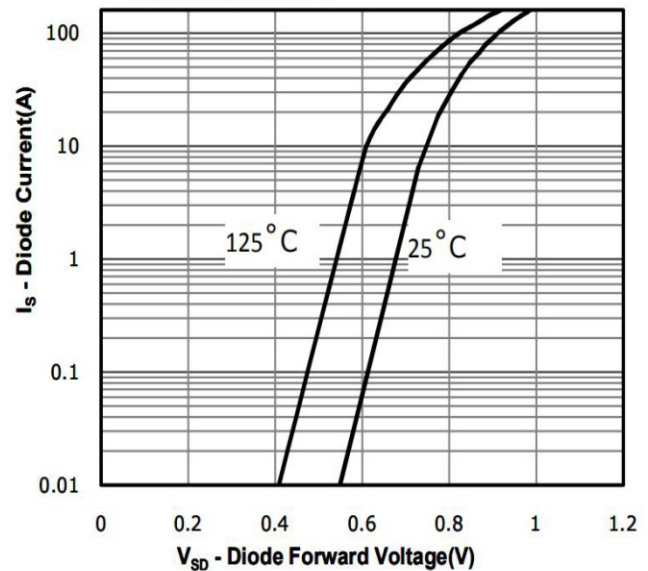


Fig 8: Body-diode Forward Characteristics



Typical Characteristics Diagrams

Fig 9: Power Dissipation

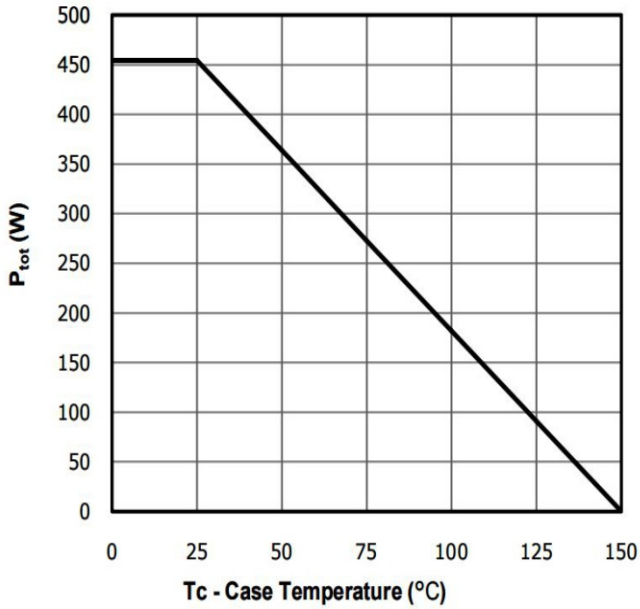


Fig 10: Drain Current Derating

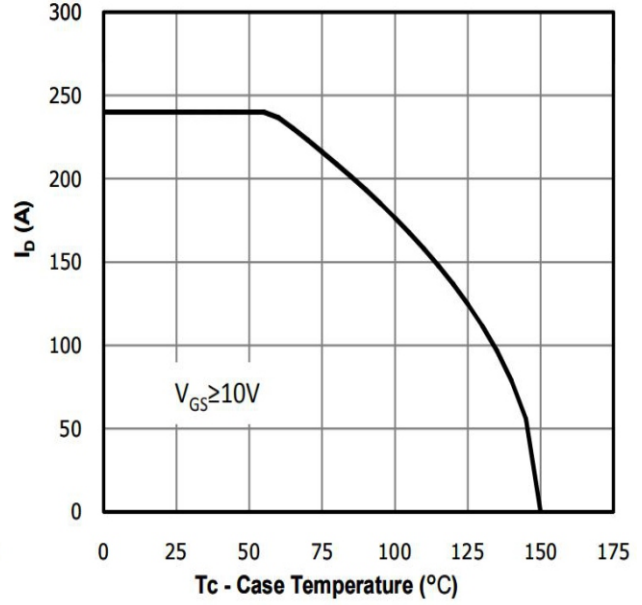


Fig 11: Safe Operating Area

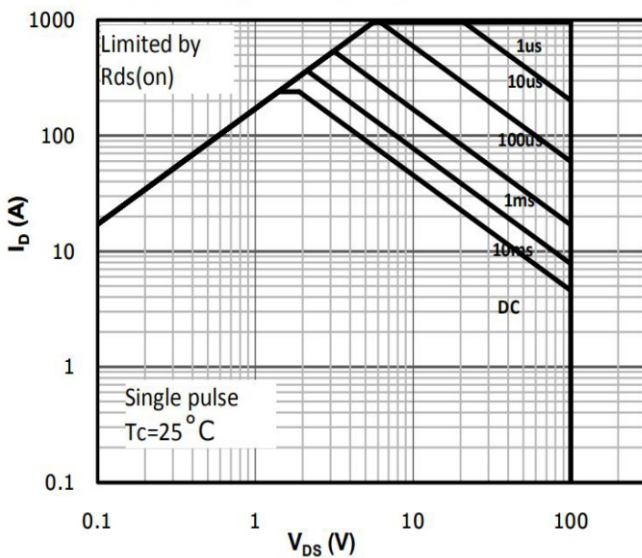
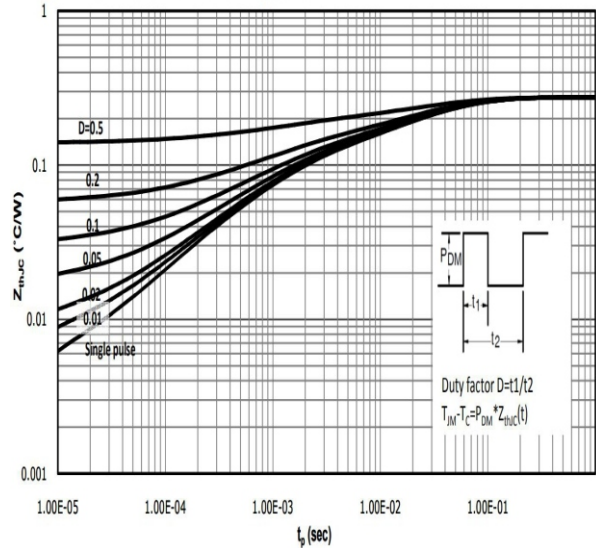
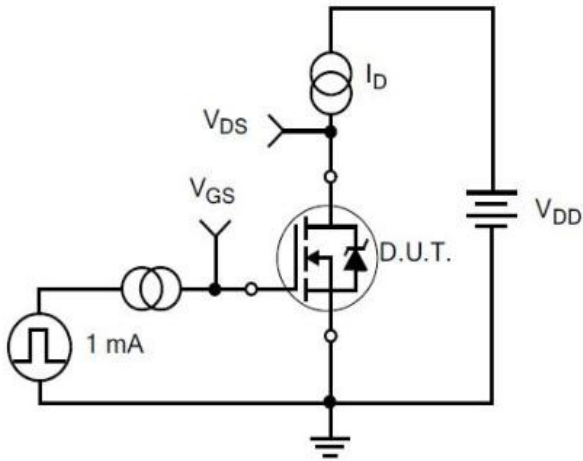


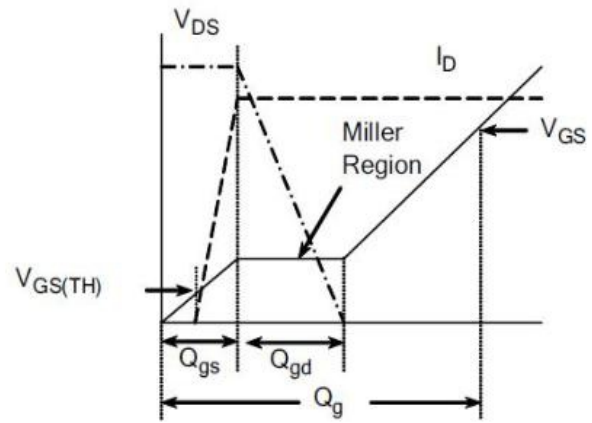
Fig 12: Max. Transient Thermal Impedance



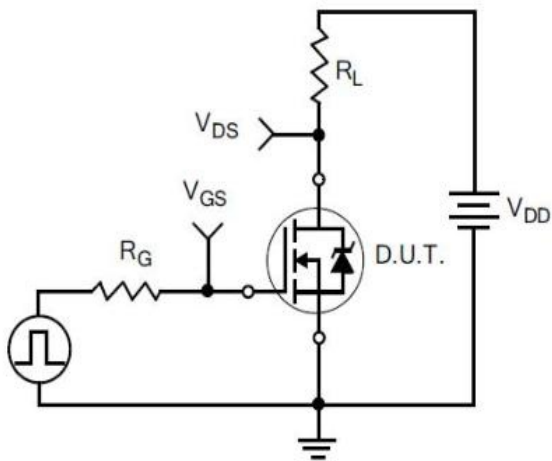
Typical Test Circuit



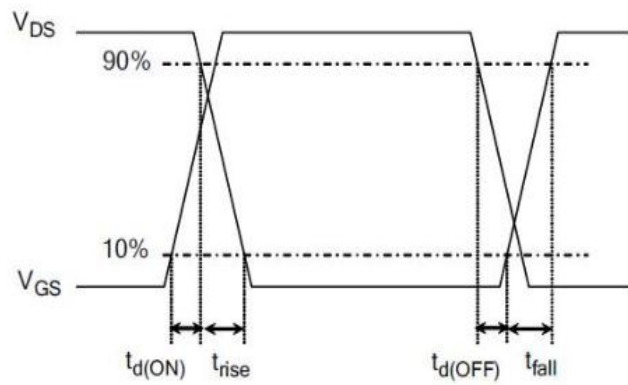
1) Gate Charge Test Circuit



2) Gate Charge Waveform

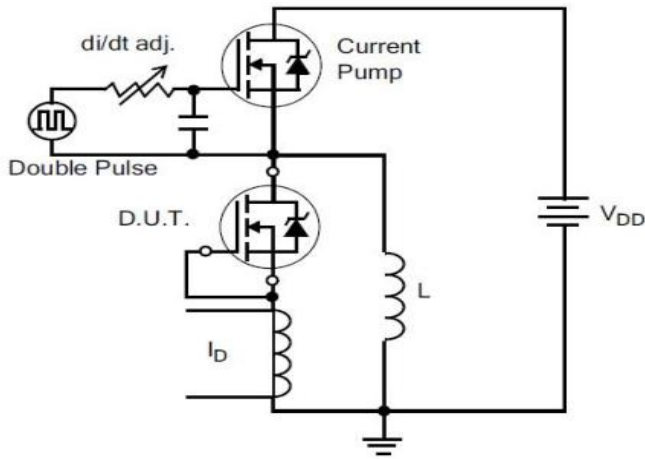


3) Resistive Switching Test Circuit

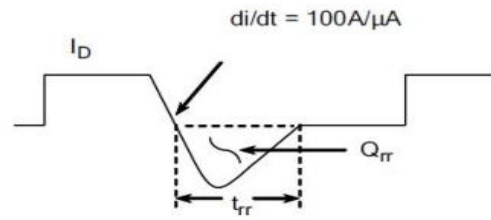


4) Resistive Switching Waveforms

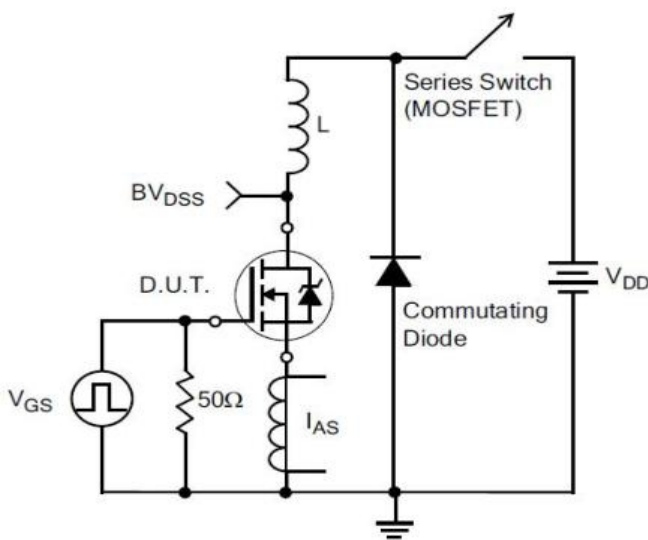
Typical Test Circuit



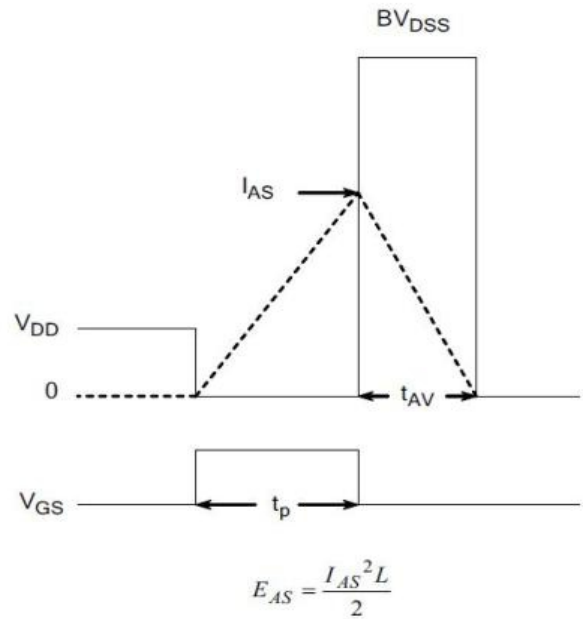
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform



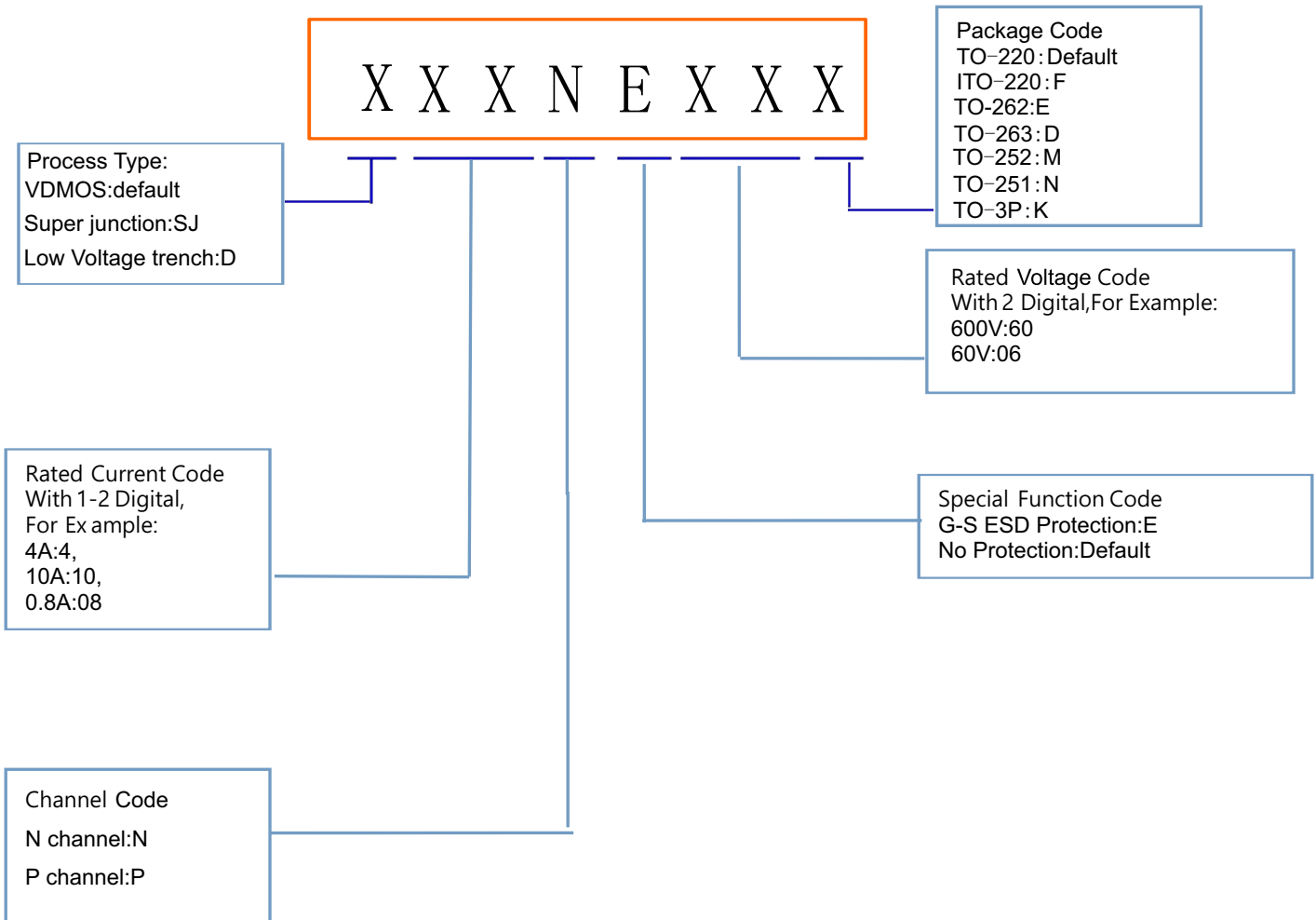
7) . Unclamped Inductive Switching Test Circuit



8) Unclamped Inductive Switching Waveforms



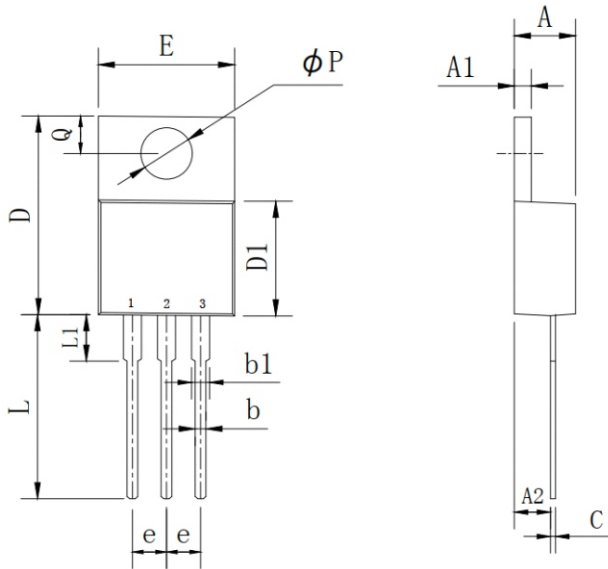
Product Names Rules





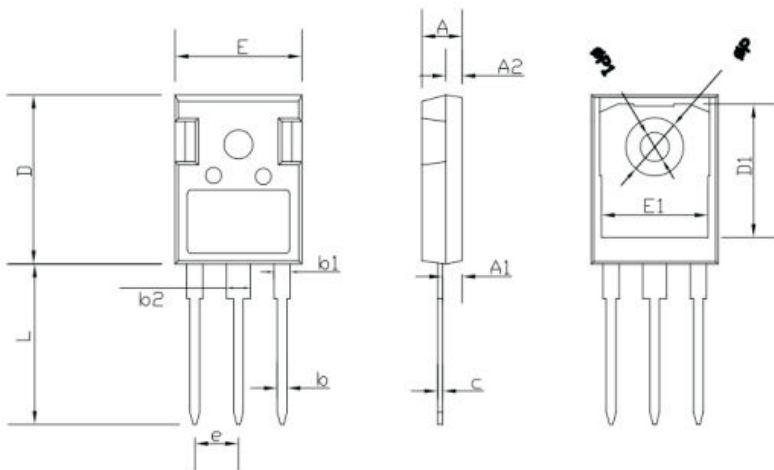
Dimensions

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 |

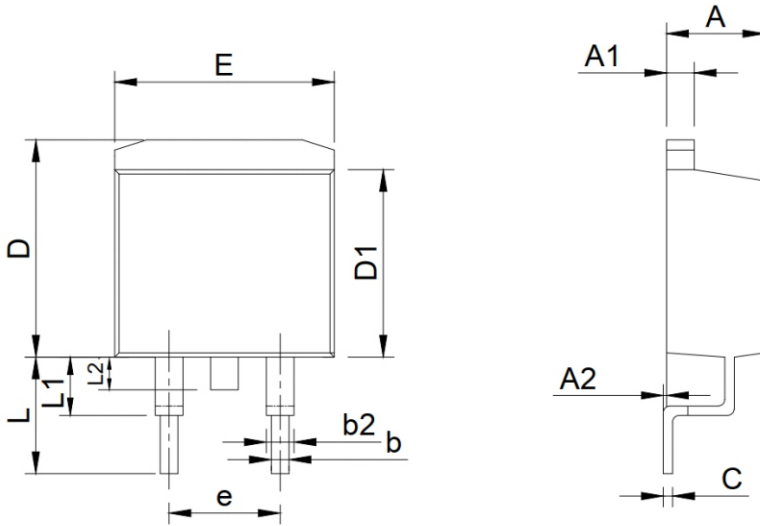
TO-247 PACKAGE OUTLINE DIMENSIONS



| 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                      | 2.06  | 0.0772               | 0.0812 |
| b2        | 2.96                      | 3.06  | 0.117                | 0.121  |
| 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 |
| $\phi P$  | 3.50                      | 3.70  | 0.1379               | 0.1458 |
| $\phi P1$ | 0                         | 7.30  | 0                    | 0.2876 |

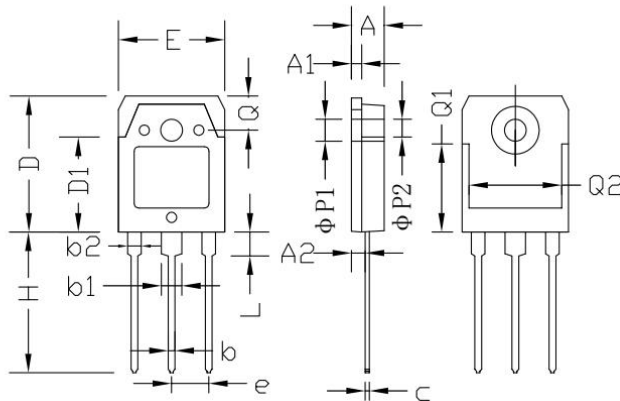
Dimensions

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 |

TO-3PN PACKAGE OUTLINE DIMENSIONS



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | min.                      | max.  | min.                 | max.  |
| A      | 4.60                      | 5.00  | 0.181                | 0.197 |
| A1     | 1.45                      | 1.65  | 0.057                | 0.065 |
| A2     | 2.20                      | 2.60  | 0.087                | 0.102 |
| b      | 0.80                      | 1.20  | 0.032                | 0.047 |
| b1     | 2.80                      | 3.20  | 0.110                | 0.126 |
| b2     | 1.80                      | 2.20  | 0.071                | 0.087 |
| C      | 0.55                      | 0.75  | 0.022                | 0.030 |
| D      | 19.20                     | 19.70 | 0.756                | 0.776 |
| D1     | 13.10                     | 14.70 | 0.516                | 0.578 |
| E      | 15.40                     | 15.80 | 0.607                | 0.623 |
| e      | 5.45 TYP                  |       | 0.215 TYP            |       |
| H      | 19.80                     | 20.20 | 0.780                | 0.826 |
| L      | 3.30                      | 3.70  | 0.130                | 0.146 |
| ΦP1    | 3.20 TYP                  |       | 0.126 TYP            |       |
| ΦP2    | 3.50 TYP                  |       | 0.138 TYP            |       |
| Q      | 5.00 TYP                  |       | 0.197 TYP            |       |
| Q1     | 12.40 TYP                 |       | 0.488 TYP            |       |
| Q2     | 12.6                      | -     | 0.496                | -     |

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