

## MOSFET

75A,200V,24mΩ,N-CHANNEL MOSFET

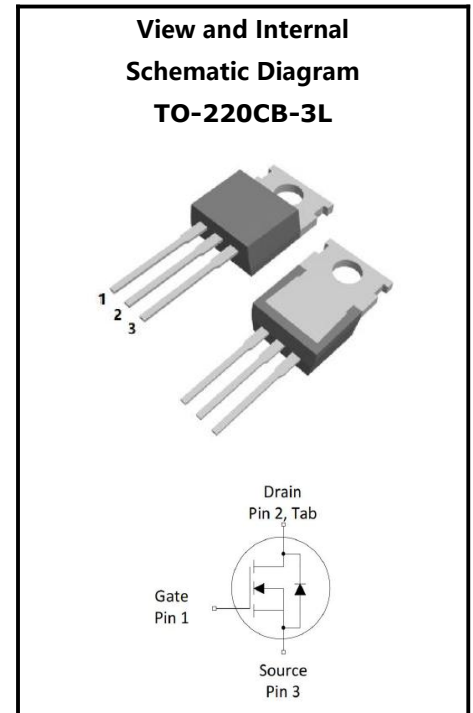
### Features

- ◆ Extremely low on-resistance  $R_{DS(on)}$
- ◆ Excellent Low Ciss

### Applications

- ◆ Synchronous Rectification for AC/DC Quick Charger
- ◆ Battery management
- ◆ UPS(Uninterruptible Power Supplies)

| Parameter         | Values | Unit |
|-------------------|--------|------|
| $BV_{DSS}$        | 200    | V    |
| $I_D$             | 75     | A    |
| $R_{Dson(max)}$   | 24     | mΩ   |
| $V_{GS(th)}(Typ)$ | 4      | V    |



| Ordering Code | Marking    | Package     | Packaging |
|---------------|------------|-------------|-----------|
| X24N20THP3    | X24N20THP3 | TO-220CB-3L | Tube      |

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

| Parameter                                        | Symbol           | Values |     |     | Unit               | Note/Test Conditions                |
|--------------------------------------------------|------------------|--------|-----|-----|--------------------|-------------------------------------|
|                                                  |                  | Min    | Typ | Max |                    |                                     |
| Drain-Source Voltage                             | $V_{DSS}$        | -      | -   | 200 | V                  | -                                   |
| Gate-Source Voltage                              | $V_{GS}$         | -20    | -   | 20  | V                  | -                                   |
| Continuous Drain Current(Note 1)                 | $I_D$            | -      | -   | 75  | A                  | $T_C=25^{\circ}\text{C}$            |
|                                                  |                  | -      | -   | 47  | A                  | $T_C=100^{\circ}\text{C}$           |
| Pulsed Drain Current(Note 2)                     | $I_{DM}$         | -      | -   | 300 | A                  | -                                   |
| Single Pulse Avalanche Energy                    | $E_{AS}$         | -      | -   | 233 | mJ                 | $L=0.5\text{mH}, V_{DS}=50\text{V}$ |
| Maximum Power Dissipation                        | $P_D$            | -      | -   | 347 | W                  | $T_C=25^{\circ}\text{C}$            |
|                                                  |                  | -      | -   | 1.6 | W                  | $T_A=25^{\circ}\text{C}$            |
| Operating Junction and Storage Temperature Range | $T_{j}, T_{STG}$ | -55    | -   | 150 | $^{\circ}\text{C}$ | -                                   |

### Thermal Characteristics

| Parameter                                | Symbol        | Values |      |      | Unit                        | Note/Test Conditions |
|------------------------------------------|---------------|--------|------|------|-----------------------------|----------------------|
|                                          |               | Min    | Typ  | Max  |                             |                      |
| Thermal resistance , junction to Case    | $R_{th(j-c)}$ | -      | 0.24 | 0.36 | $^{\circ}\text{C}/\text{W}$ | -                    |
| Thermal resistance , junction to Ambient | $R_{th(j-a)}$ | -      | -    | 76   |                             | -                    |

## Electrical Characteristics ( $T_j=25^{\circ}\text{C}$ , unless otherwise noted)

### Static characteristics

| Parameter                          | Symbol       | Values |     |      | Unit       | Note/Test Conditions                  |
|------------------------------------|--------------|--------|-----|------|------------|---------------------------------------|
|                                    |              | Min    | Typ | Max  |            |                                       |
| Drain-Source Breakdown Voltage     | $BV_{DSS}$   | 200    | -   | -    | V          | $V_{GS}=0V, I_D=250\mu A$             |
| Zero Gate Voltage Drain Current    | $I_{DSS}$    | -      | -   | 1    | $\mu A$    | $V_{DS}=200V, V_{GS}=0V$              |
| Gate-Body Leakage Current, Forward | $I_{GSSF}$   | -      | -   | 100  | nA         | $V_{GS}=20V, V_{DS}=0V$               |
| Gate-Body Leakage Current, Reverse | $I_{GSSR}$   | -      | -   | -100 | nA         | $V_{GS}=-20V, V_{DS}=0V$              |
| Gate-Source Threshold Voltage      | $V_{GS(th)}$ | 3      | -   | 5    | V          | $V_{DS}=V_{GS}, I_D=250\mu A$         |
| Drain-Source On-State Resistance   | $R_{DS(on)}$ | -      | 20  | 24   | m $\Omega$ | $V_{GS}=10V, I_D=50A$                 |
| Gate Resistance                    | $R_g$        | -      | 1.8 | -    | $\Omega$   | $V_{GS}=0V, V_{DS}=0V, f=1\text{MHz}$ |
| Forward Transconductance           | $g_{fs}$     | -      | 78  | -    | S          | $V_{DS}=5V, I_D=50A$                  |

### Dynamic characteristics

| Parameter                    | Symbol       | Values |      |     | Unit | Note/Test Conditions                              |
|------------------------------|--------------|--------|------|-----|------|---------------------------------------------------|
|                              |              | Min    | Typ  | Max |      |                                                   |
| Input Capacitance            | $C_{iss}$    | -      | 5064 | -   | pF   | $V_{DS}=100V, V_{GS}=0V, f=1.0\text{MHz}$         |
| Output Capacitance           | $C_{oss}$    | -      | 267  | -   | pF   |                                                   |
| Reverse Transfer Capacitance | $C_{rss}$    | -      | 88   | -   | pF   |                                                   |
| Turn-On Delay Time           | $t_{d(on)}$  | -      | 21   | -   | ns   | $V_{DD}=100V, R_G=1.6\Omega, V_{GS}=10V, I_D=50A$ |
| Turn-On Rise Time            | $t_r$        | -      | 38   | -   | ns   |                                                   |
| Turn-Off Delay Time          | $t_{d(off)}$ | -      | 45   | -   | ns   |                                                   |
| Turn-Off Fall Time           | $t_f$        | -      | 41   | -   | ns   |                                                   |

### Gate charge characteristics

| Parameter          | Symbol   | Values |     |     | Unit | Note/Test Conditions               |
|--------------------|----------|--------|-----|-----|------|------------------------------------|
|                    |          | Min    | Typ | Max |      |                                    |
| Total Gate Charge  | $Q_g$    | -      | 101 | -   | nC   | $V_{DS}=100V, I_D=50A, V_{GS}=10V$ |
| Gate-Source Charge | $Q_{gs}$ | -      | 37  | -   | nC   |                                    |
| Gate-Drain Charge  | $Q_{gd}$ | -      | 39  | -   | nC   |                                    |

### Reverse diode

| Parameter                        | Symbol         | Values |     |     | Unit | Note/Test Conditions                                     |
|----------------------------------|----------------|--------|-----|-----|------|----------------------------------------------------------|
|                                  |                | Min    | Typ | Max |      |                                                          |
| Continuous Diode Forward Current | $I_S$          | -      | -   | 75  | A    | -                                                        |
| Pulsed Diode Forward Current     | $I_{S\ pulse}$ | -      | -   | 300 | A    | -                                                        |
| Diode Forward Voltage            | $V_{SD}$       | -      | -   | 1.2 | V    | $I_S=50A, V_{GS}=0V$                                     |
| Reverse Recovery Time            | $t_{rr}$       | -      | 96  | -   | ns   | $V_{DS}=100V, V_{GS}=0V, I_F=50A,$<br>$di/dt=100A/\mu s$ |
| Reverse Recovery Charge          | $Q_{rr}$       | -      | 458 | -   | nC   |                                                          |

### Notes

1. Computed continuous current assumes the condition of  $T_{j\_Max}$  while the actual continuous current depends on the thermal & electro-mechanical application board design.
2. This single-pulse measurement was taken under  $T_{j\_Max} = 150^{\circ}\text{C}$ .

## RATING AND CHARACTERISTIC CURVES



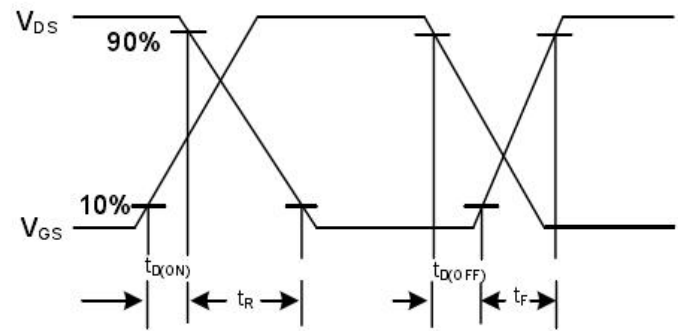
Peak Diode Recovery  $dv/dt$  Test Circuit



Peak Diode Recovery  $dv/dt$  Waveforms



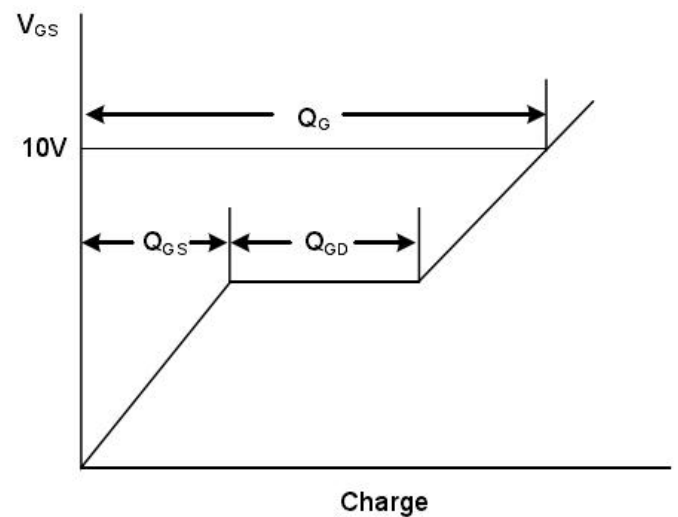
Switching Test Circuit



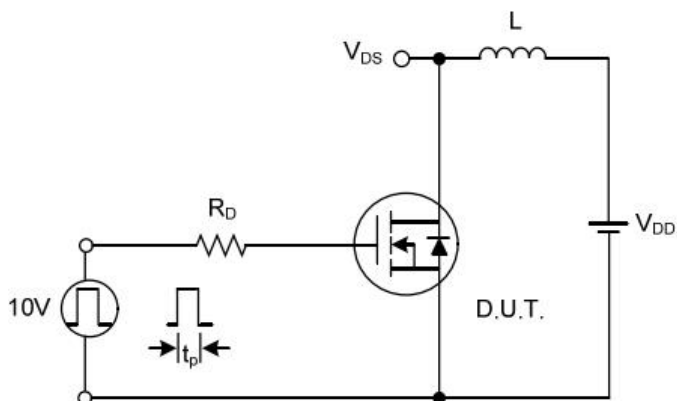
Switching Waveforms



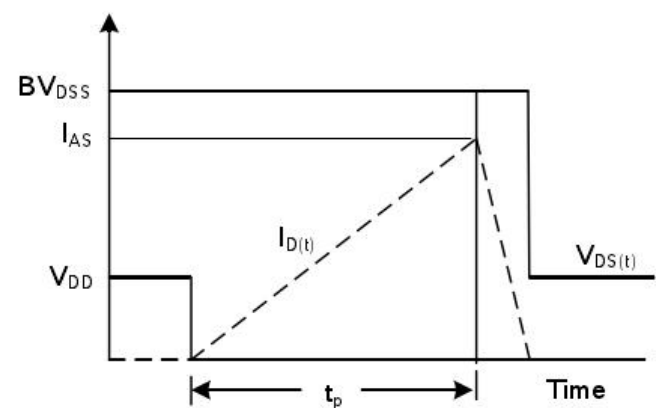
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

## RATING AND CHARACTERISTIC CURVES

Figure.1 Output Characteristics

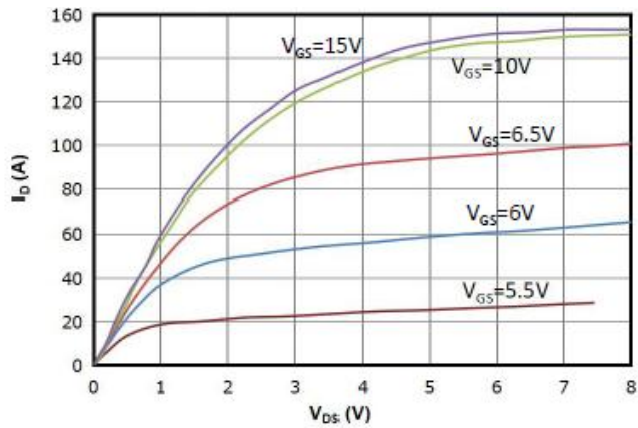


Figure.2 Transfer Characteristics

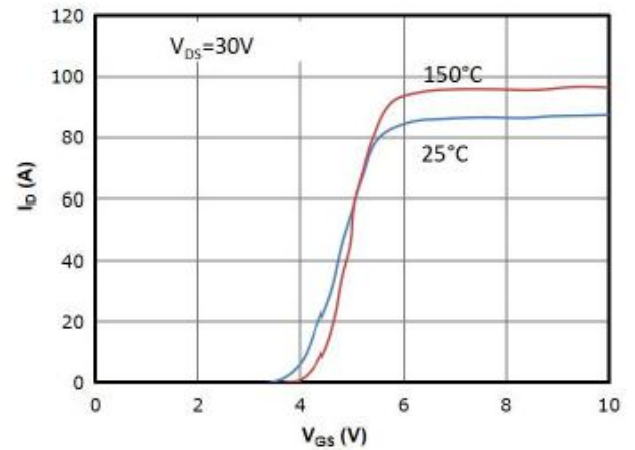
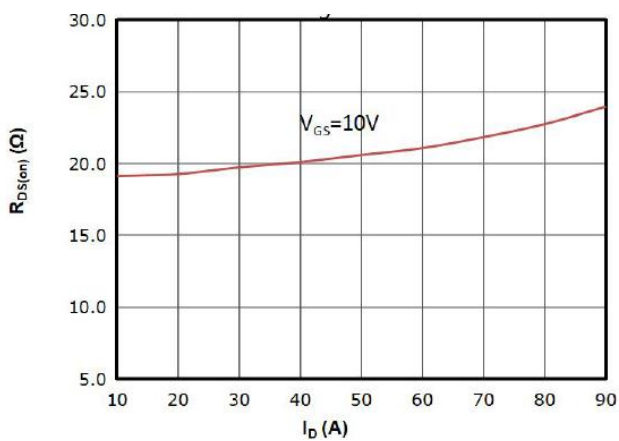
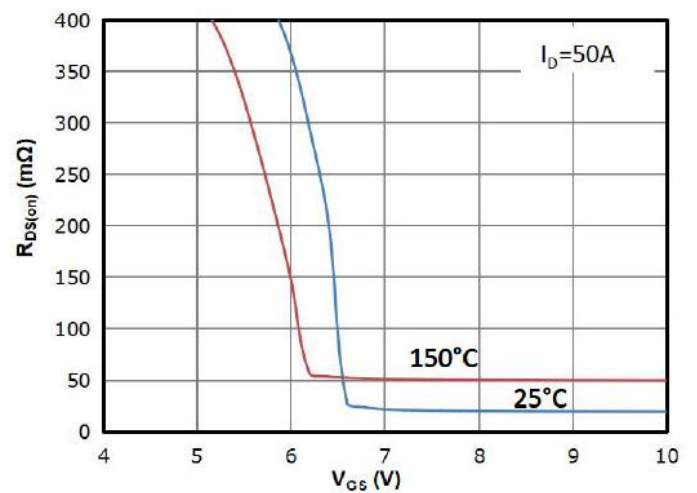

Figure.3 R<sub>DS(on)</sub> vs Drain Current and Gate Voltage

Figure.4 R<sub>DS(on)</sub> vs Gate Voltage


Figure.5 Rds(on) vs. Temperature

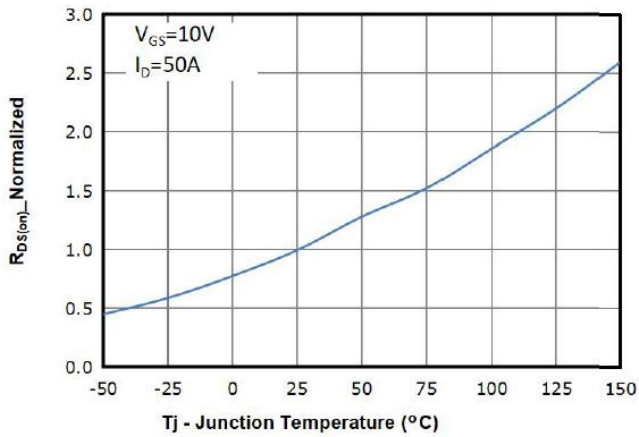


Figure.6 Vgs(th) vs. Temperature

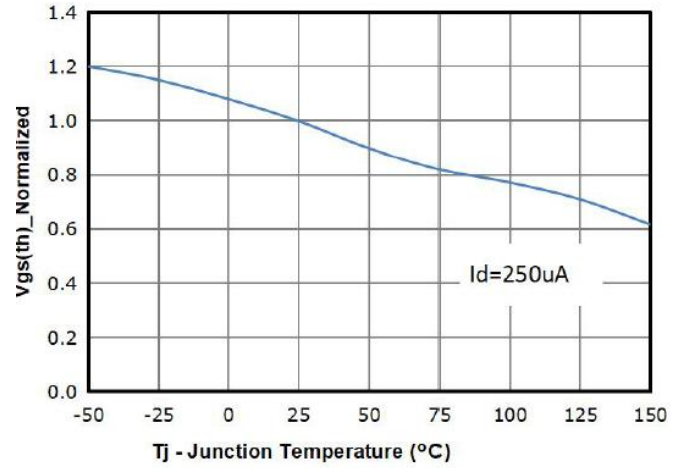


Figure.7 BVdss vs. Temperature

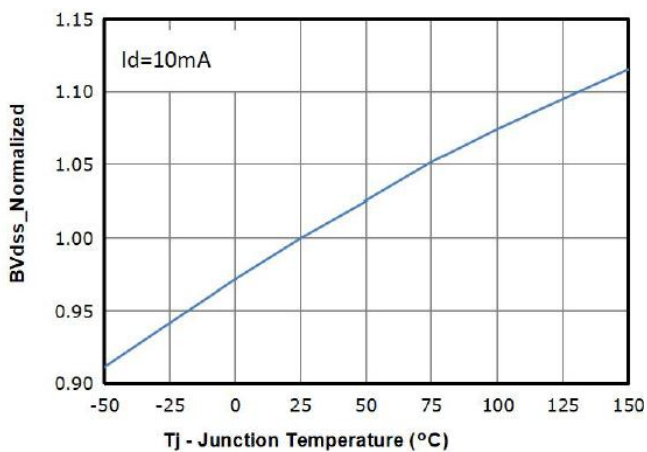


Figure.8 Capacitance Characteristics

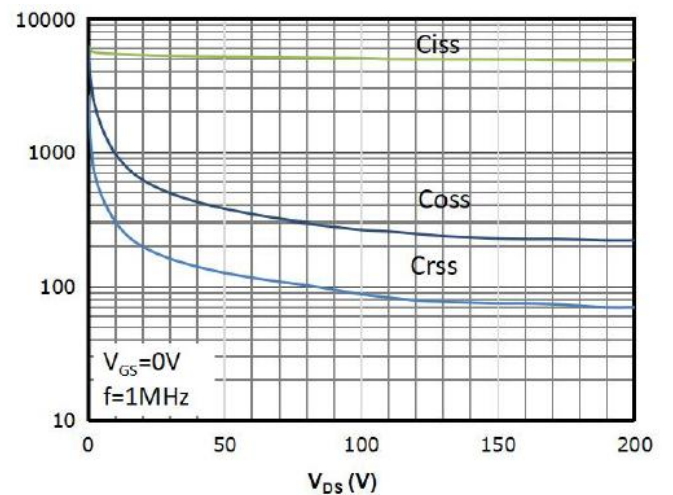


Figure.9 Gate Charge Characteristics

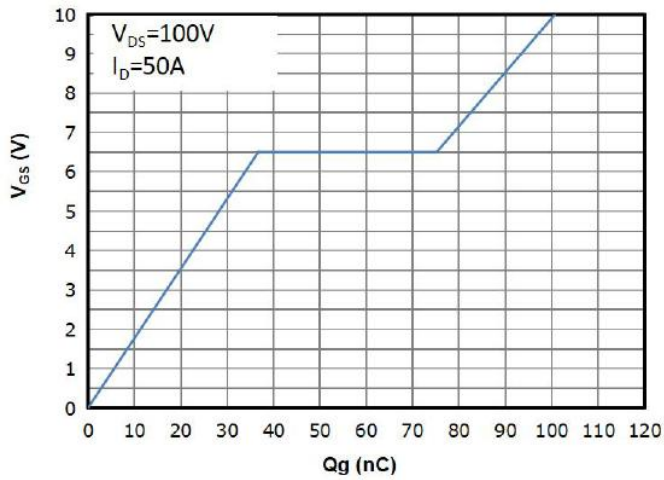


Figure.10 Body-diode Forward Characteristics

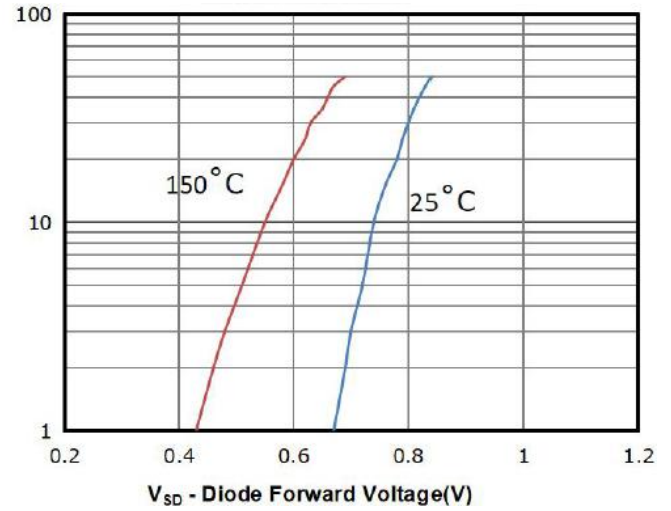


Figure.11 Power Dissipation

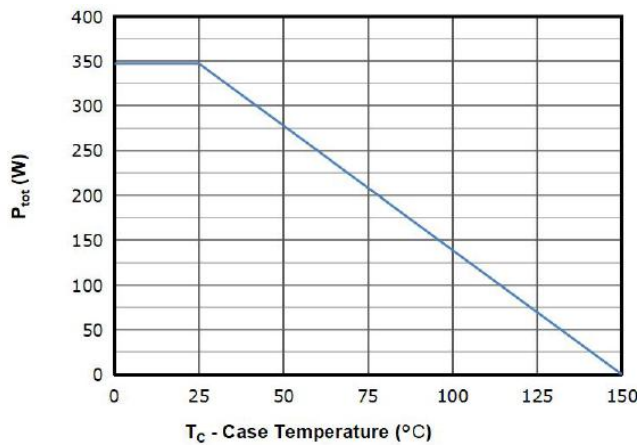


Figure.12 Drain Current Derating

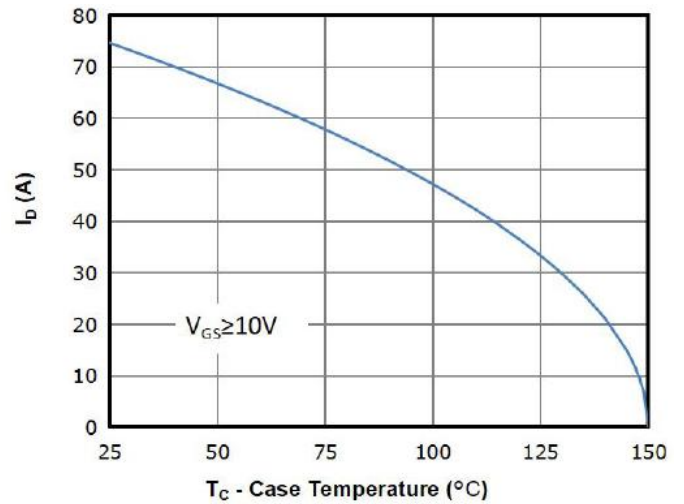


Figure.13 Safe Operating Area

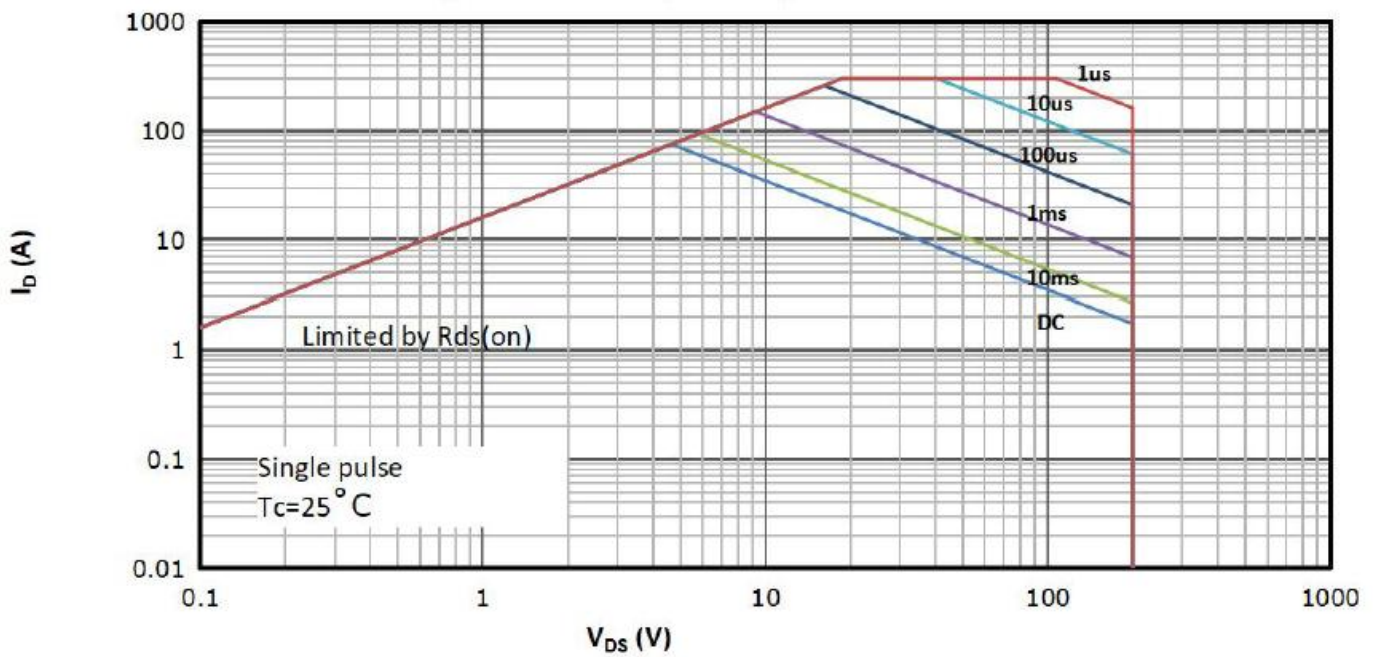
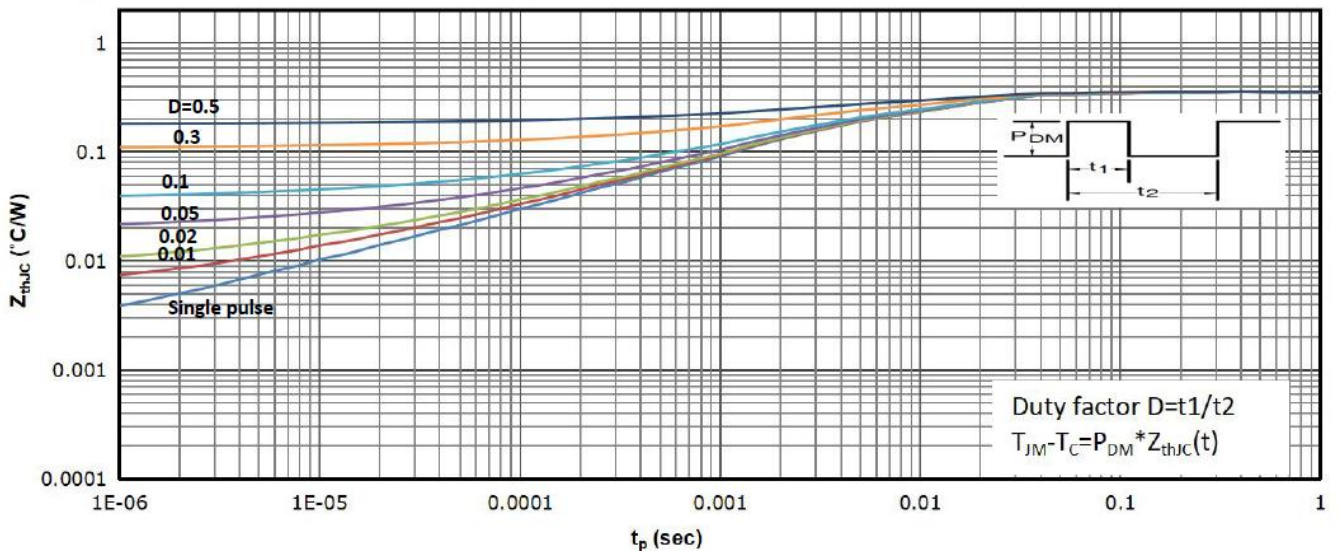
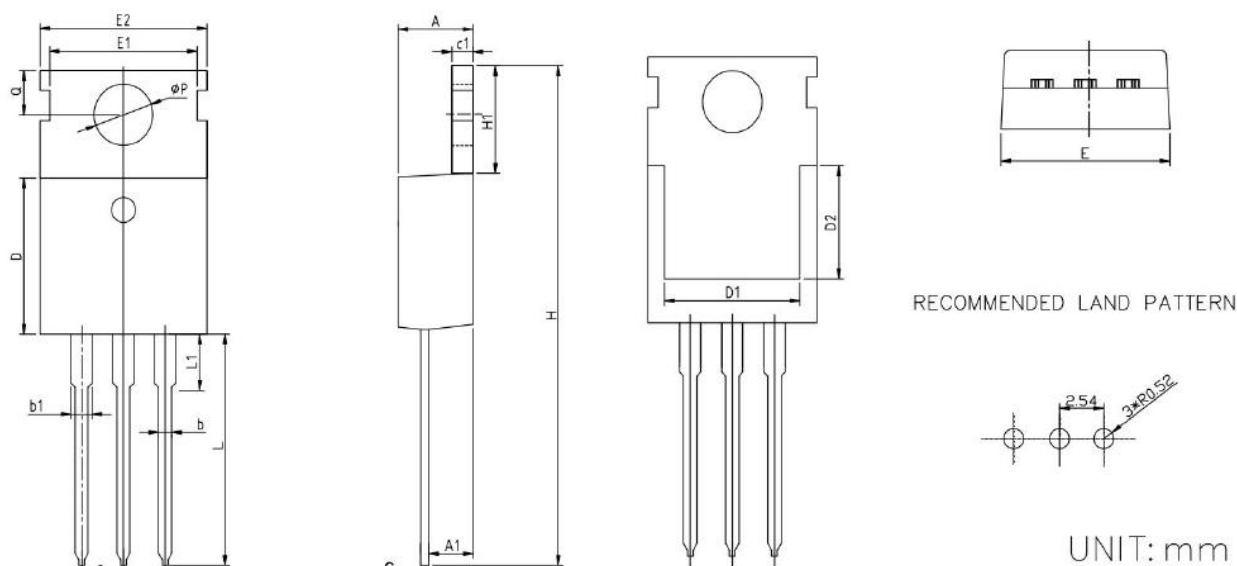


Figure.14 Maximum Effective Thermal Impedance , Junction to Case



## Package Outline:TO-220CB-3L



| SYMBOL | MILLIMETERS |       | INCHES |       |
|--------|-------------|-------|--------|-------|
|        | MIN         | MAX   | MIN    | MAX   |
| A      | 4.40        | 4.80  | 0.173  | 0.189 |
| A1     | 2.25        | 2.55  | 0.089  | 0.100 |
| b      | 0.72        | 0.92  | 0.028  | 0.036 |
| b1     | 1.12        | 1.42  | 0.044  | 0.056 |
| c      | 0.40        | 0.60  | 0.016  | 0.024 |
| c1     | 1.20        | 1.40  | 0.047  | 0.055 |
| D      | 8.80        | 9.40  | 0.346  | 0.370 |
| D1     | 7.75        | 8.15  | 0.305  | 0.321 |
| D2     | 6.55        | 6.95  | 0.258  | 0.274 |
| e      | 2.54        |       | 0.100  |       |
| E      | 9.65        | 10.35 | 0.380  | 0.407 |
| E1     | 8.70        |       | 0.343  |       |
| E2     | 9.70        | 10.30 | 0.382  | 0.406 |
| H      | 28.70       | 29.70 | 1.130  | 1.169 |
| H1     | 6.25        | 6.85  | 0.246  | 0.270 |
| L      | 13.20       | 13.80 | 0.520  | 0.543 |
| L1     | 2.80        | 3.40  | 0.110  | 0.134 |
| Q      | 2.60        | 3.00  | 0.102  | 0.118 |
| φP     | 3.45        | 3.75  | 0.136  | 0.148 |