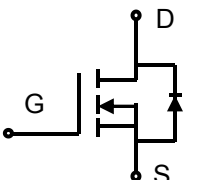


## Lonten N-channel 800V, 4A Power MOSFET

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |      |       |    |                  |             |             |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|-------|----|------------------|-------------|-------------|-------------------|
| <p><b>Description</b></p> <p>The Power MOSFET is fabricated using the advanced planer VDMOS technology. The resulting device has low conduction resistance, superior switching performance and high avalanche energy.</p> <p><b>Features</b></p> <ul style="list-style-type: none"> <li>◆ Low <math>R_{DS(on)}</math></li> <li>◆ Low gate charge (typ. <math>Q_g = 18.9 \text{ nC}</math>)</li> <li>◆ 100% UIS tested</li> <li>◆ RoHS compliant</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>◆ Power factor correction.</li> <li>◆ Switched mode power supplies.</li> <li>◆ LED driver.</li> </ul> | <p><b>Product Summary</b></p> <table> <tr> <td><math>V_{DSS}</math></td><td>800V</td></tr> <tr> <td><math>I_D</math></td><td>4A</td></tr> <tr> <td><math>R_{DS(on),max}</math></td><td><math>3.8\Omega</math></td></tr> <tr> <td><math>Q_{g,typ}</math></td><td><math>18.9 \text{ nC}</math></td></tr> </table> <div>    </div> <div> <p>TO-220      TO-220F      TO-247</p>   </div> <div> <p>TO-252      TO-251</p>  </div> <p style="text-align: right;">(Pb)</p> <p style="text-align: center;">N-Channel MOSFET</p> | $V_{DSS}$ | 800V | $I_D$ | 4A | $R_{DS(on),max}$ | $3.8\Omega$ | $Q_{g,typ}$ | $18.9 \text{ nC}$ |
| $V_{DSS}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 800V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |      |       |    |                  |             |             |                   |
| $I_D$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |      |       |    |                  |             |             |                   |
| $R_{DS(on),max}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $3.8\Omega$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |      |       |    |                  |             |             |                   |
| $Q_{g,typ}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $18.9 \text{ nC}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |      |       |    |                  |             |             |                   |

### Absolute Maximum Ratings

| Parameter                                                    | Symbol         | Value       | Unit                |
|--------------------------------------------------------------|----------------|-------------|---------------------|
| Drain-Source Voltage                                         | $V_{DSS}$      | 800         | V                   |
| Continuous drain current ( $T_C = 25^\circ\text{C}$ )        | $I_D$          | 4           | A                   |
| ( $T_C = 100^\circ\text{C}$ )                                |                | 2.5         | A                   |
| Pulsed drain current <sup>1)</sup>                           | $I_{DM}$       | 16          | A                   |
| Gate-Source voltage                                          | $V_{GSS}$      | $\pm 30$    | V                   |
| Avalanche energy, single pulse <sup>2)</sup>                 | $E_{AS}$       | 125         | mJ                  |
| Peak diode recovery $dv/dt$ <sup>3)</sup>                    | $dv/dt$        | 5           | V/ns                |
| Power Dissipation TO-220F ( $T_C = 25^\circ\text{C}$ )       | $P_D$          | 35          | W                   |
| Derate above $25^\circ\text{C}$                              |                | 0.28        | W/ $^\circ\text{C}$ |
| Power Dissipation TO-247/TO-220 ( $T_C = 25^\circ\text{C}$ ) |                | 95          | W                   |
| Derate above $25^\circ\text{C}$                              |                | 0.76        | W/ $^\circ\text{C}$ |
| Operating junction and storage temperature range             | $T_J, T_{STG}$ | -55 to +150 | $^\circ\text{C}$    |
| Continuous diode forward current                             | $I_S$          | 4           | A                   |
| Diode pulse current                                          | $I_{S,pulse}$  | 16          | A                   |

### Thermal Characteristics

| Parameter | Symbol | Value   |               | Unit |
|-----------|--------|---------|---------------|------|
|           |        | TO-220F | TO-247/TO-220 |      |

|                                         |                 |      |      |                      |
|-----------------------------------------|-----------------|------|------|----------------------|
| Thermal resistance, Junction-to-case    | $R_{\theta JC}$ | 3.57 | 1.32 | $^{\circ}\text{C/W}$ |
| Thermal resistance, Junction-to-ambient | $R_{\theta JA}$ | 62.5 | 62   | $^{\circ}\text{C/W}$ |

### Package Marking and Ordering Information

| Device  | Device Package | Marking | Units/Tube | Units/Reel |
|---------|----------------|---------|------------|------------|
| LNB4N80 | TO-247         | LNB4N80 | 30         |            |
| LND4N80 | TO-220F        | LND4N80 | 50         |            |
| LNC4N80 | TO-220         | LNC4N80 | 50         |            |
| LNG4N80 | TO-252         | LNG4N80 |            | 2500       |
| LNH4N80 | TO-251         | LNH4N80 | 72         |            |

### Electrical Characteristics $T_c = 25^{\circ}\text{C}$ unless otherwise noted

| Parameter                        | Symbol               | Test Condition                                                                                   | Min.   | Typ. | Max.    | Unit |
|----------------------------------|----------------------|--------------------------------------------------------------------------------------------------|--------|------|---------|------|
| Static characteristics           |                      |                                                                                                  |        |      |         |      |
| Drain-source breakdown voltage   | BV <sub>DSS</sub>    | V <sub>GS</sub> =0 V, I <sub>D</sub> =0.25 mA                                                    | 800    | -    | -       | V    |
| Gate threshold voltage           | V <sub>GS(th)</sub>  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =0.25 mA                                       | 2      | -    | 4       | V    |
| Drain cut-off current            | I <sub>DSS</sub>     | V <sub>DS</sub> =800 V, V <sub>GS</sub> =0 V,<br>T <sub>J</sub> = 25°C<br>T <sub>J</sub> = 125°C | -<br>- | -    | 1<br>10 | μA   |
| Gate leakage current, Forward    | I <sub>GSSF</sub>    | V <sub>GS</sub> =30 V, V <sub>DS</sub> =0 V                                                      | -      | -    | 100     | nA   |
| Gate leakage current, Reverse    | I <sub>GSSR</sub>    | V <sub>GS</sub> =-30 V, V <sub>DS</sub> =0 V                                                     | -      | -    | -100    | nA   |
| Drain-source on-state resistance | R <sub>DS(on)</sub>  | V <sub>GS</sub> =10 V, I <sub>D</sub> =2A                                                        | -      | 3.4  | 3.8     | Ω    |
| Dynamic characteristics          |                      |                                                                                                  |        |      |         |      |
| Input capacitance                | C <sub>iss</sub>     | V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V,<br>f = 1 MHz                                      | -      | 499  | -       | pF   |
| Output capacitance               | C <sub>oss</sub>     |                                                                                                  | -      | 57.4 | -       |      |
| Reverse transfer capacitance     | C <sub>rss</sub>     |                                                                                                  | -      | 6.8  | -       |      |
| Turn-on delay time               | t <sub>d(on)</sub>   | V <sub>DD</sub> = 400 V, I <sub>D</sub> = 4A<br>R <sub>G</sub> = 10 Ω, V <sub>GS</sub> =15 V     | -      | 10.6 | -       | ns   |
| Rise time                        | t <sub>r</sub>       |                                                                                                  | -      | 26   | -       |      |
| Turn-off delay time              | t <sub>d(off)</sub>  |                                                                                                  | -      | 46   | -       |      |
| Fall time                        | t <sub>f</sub>       |                                                                                                  | -      | 32   | -       |      |
| Gate charge characteristics      |                      |                                                                                                  |        |      |         |      |
| Gate to source charge            | Q <sub>gs</sub>      | V <sub>DD</sub> =640 V, I <sub>D</sub> =4 A,<br>V <sub>GS</sub> =0 to 10 V                       | -      | 3.96 | -       | nC   |
| Gate to drain charge             | Q <sub>gd</sub>      |                                                                                                  | -      | 10.5 | -       |      |
| Gate charge total                | Q <sub>g</sub>       |                                                                                                  | -      | 21.2 | -       |      |
| Gate plateau voltage             | V <sub>plateau</sub> |                                                                                                  | -      | 4.3  | -       | V    |
| Reverse diode characteristics    |                      |                                                                                                  |        |      |         |      |
| Diode forward voltage            | V <sub>SD</sub>      | V <sub>GS</sub> =0 V, I <sub>F</sub> =4A                                                         | -      | -    | 1.5     | V    |
| Reverse recovery time            | t <sub>rr</sub>      | V <sub>R</sub> =400 V, I <sub>F</sub> =4A<br>dI <sub>F</sub> /dt=100 A/μs                        | -      | 380  | -       | ns   |
| Reverse recovery charge          | Q <sub>rr</sub>      |                                                                                                  | -      | 1.6  | -       | μC   |
| Peak reverse recovery current    | I <sub>rrm</sub>     |                                                                                                  | -      | 8.4  | -       | A    |

#### Notes:

- Pulse width limited by maximum junction temperature.
- $L=10\text{ mH}, I_{AS}=5\text{ A}$ , Starting  $T_j=25^{\circ}\text{C}$ .
- $I_{SD}=4\text{ A}, di/dt \leq 100\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DS}$ , Starting  $T_j=25^{\circ}\text{C}$ .

## Electrical Characteristics Diagrams

Figure 1. Typical Output Characteristics

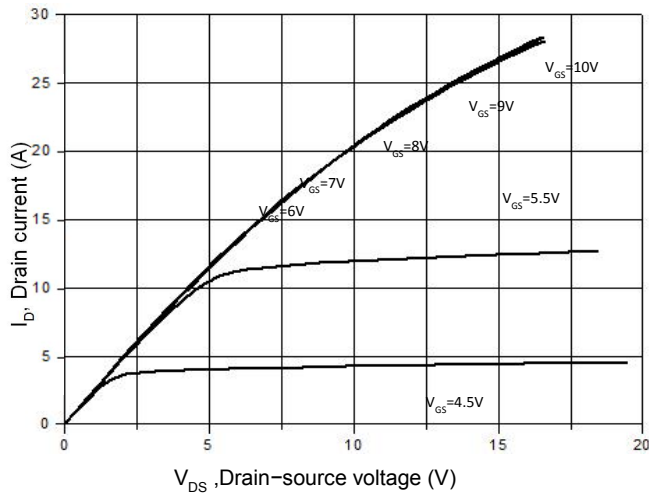


Figure 2. Transfer Characteristics

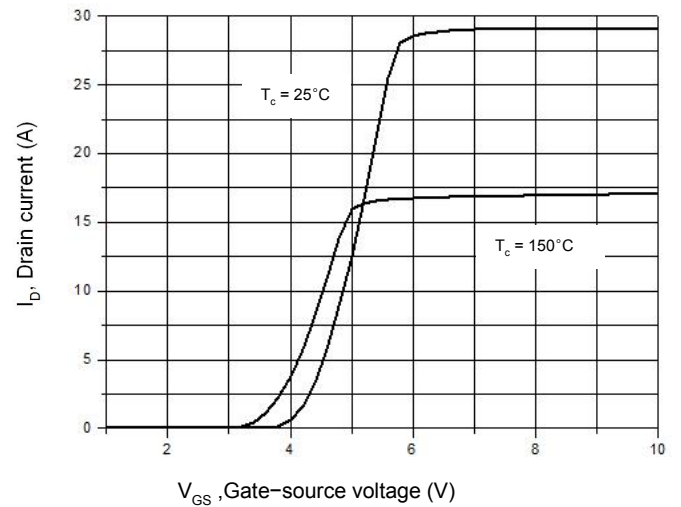


Figure 3. On-Resistance Variation vs. Drain Current

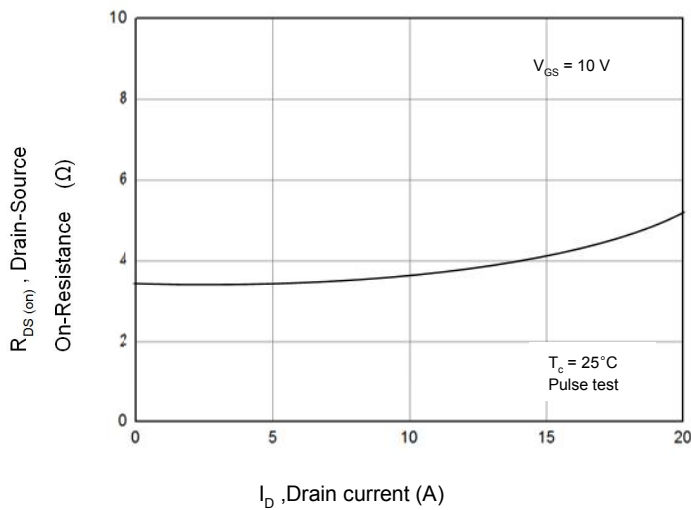


Figure 4. Threshold Voltage vs. Temperature

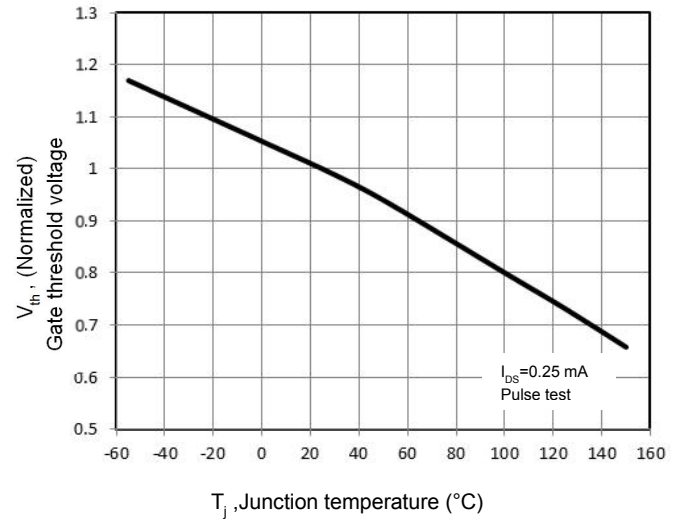


Figure 5. Breakdown Voltage vs. Temperature

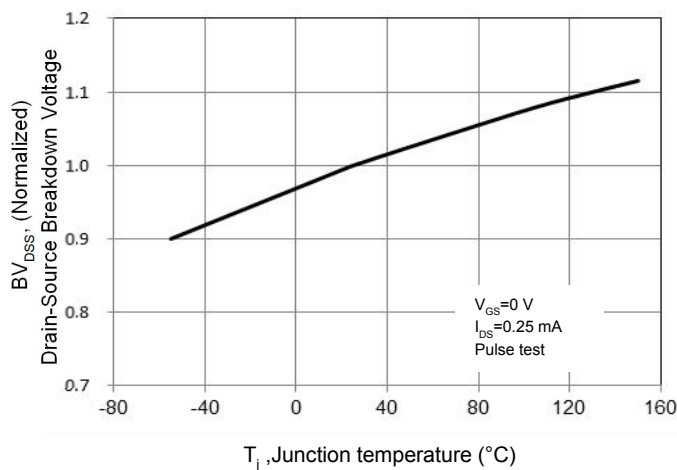


Figure 6. On-Resistance vs. Temperature

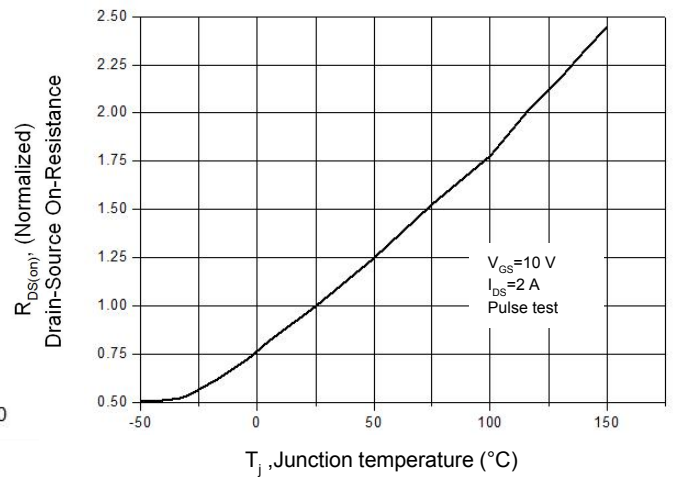


Figure 7. Capacitance Characteristics

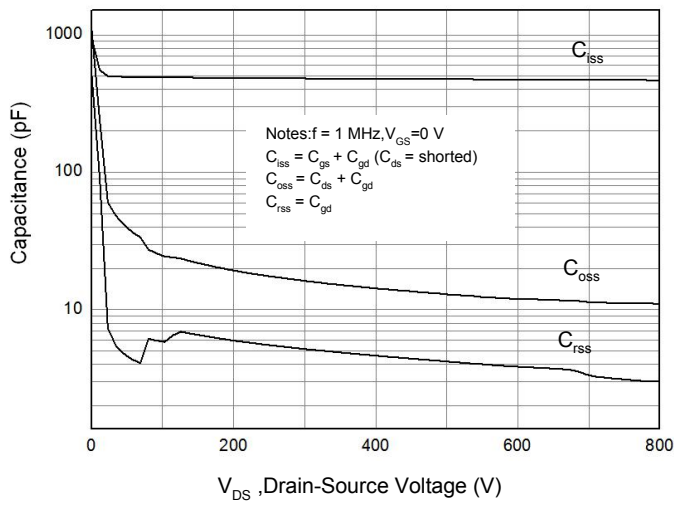


Figure 8. Gate Charge Characteristics

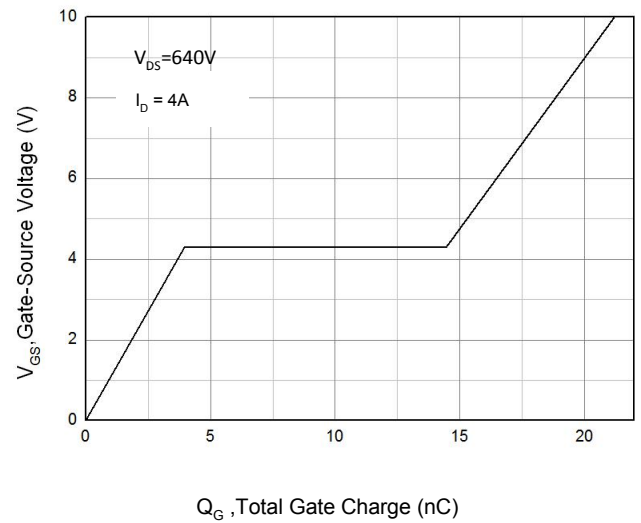


Figure 9. Maximum Safe Operating Area  
TO-220F

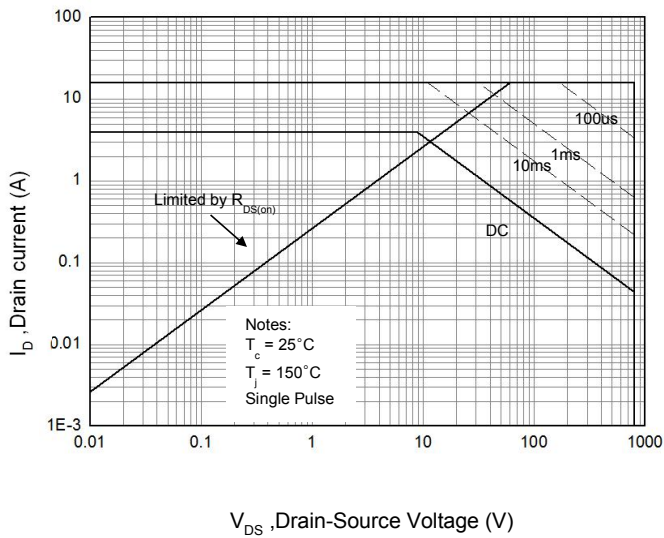


Figure 10. Maximum Safe Operating Area  
TO-247/TO-220

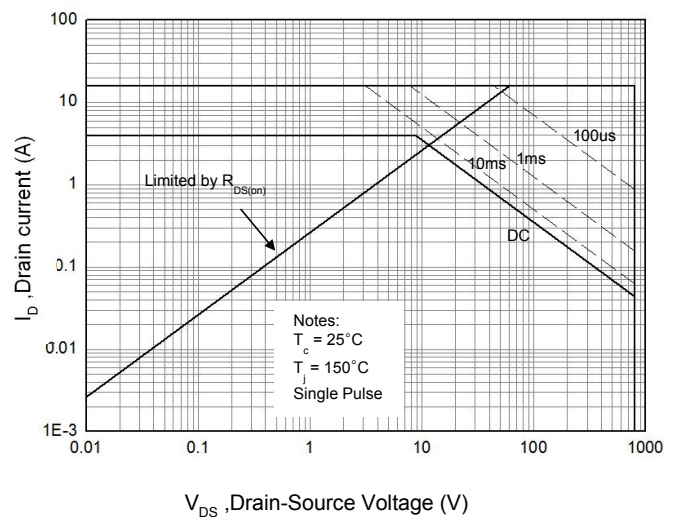


Figure 11. Power Dissipation vs. Temperature  
TO-220F

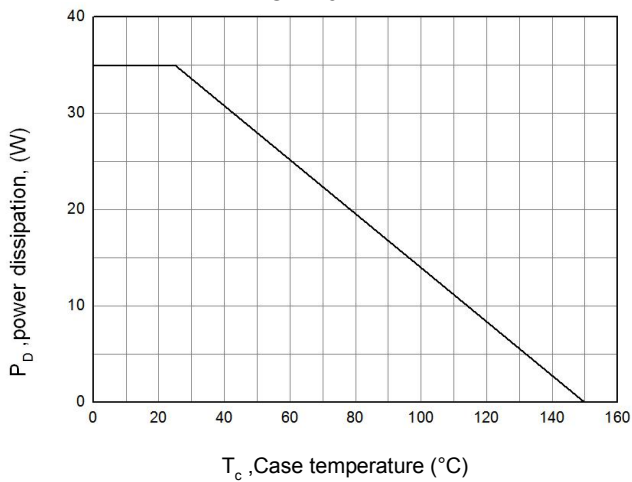


Figure 12. Power Dissipation vs. Temperature  
TO-247/TO-220

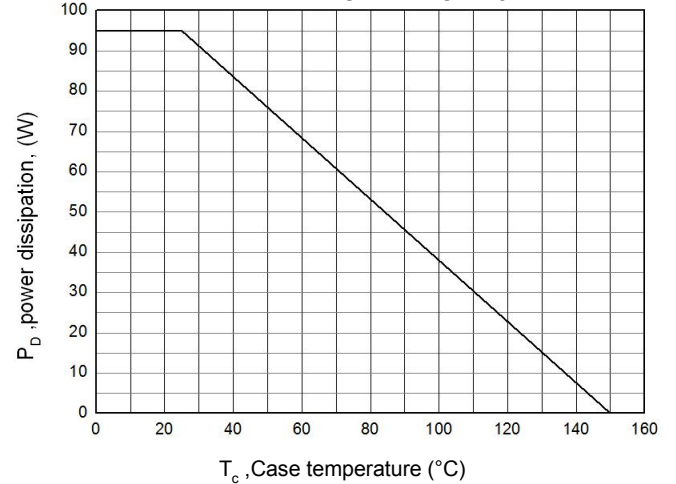


Figure 13. Continuous Drain Current vs. Temperature

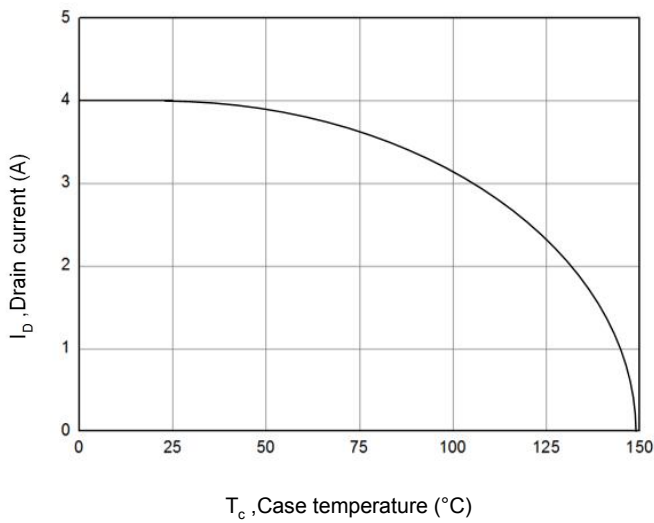


Figure 14. Body Diode Transfer Characteristics

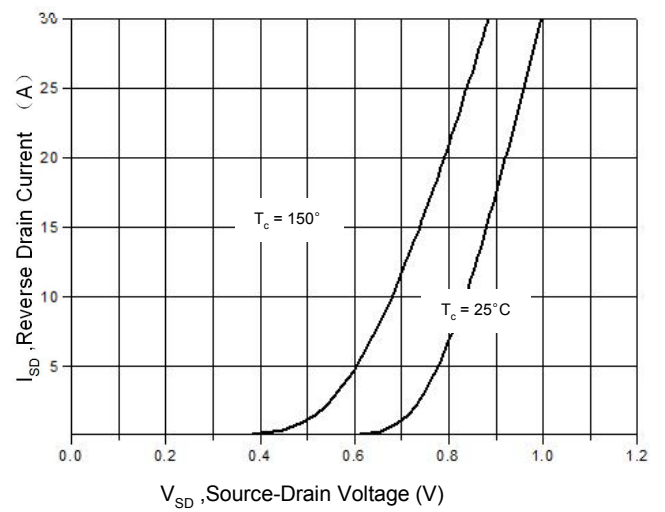


Figure 15 Transient Thermal Impedance , Junction to Case, TO-220F

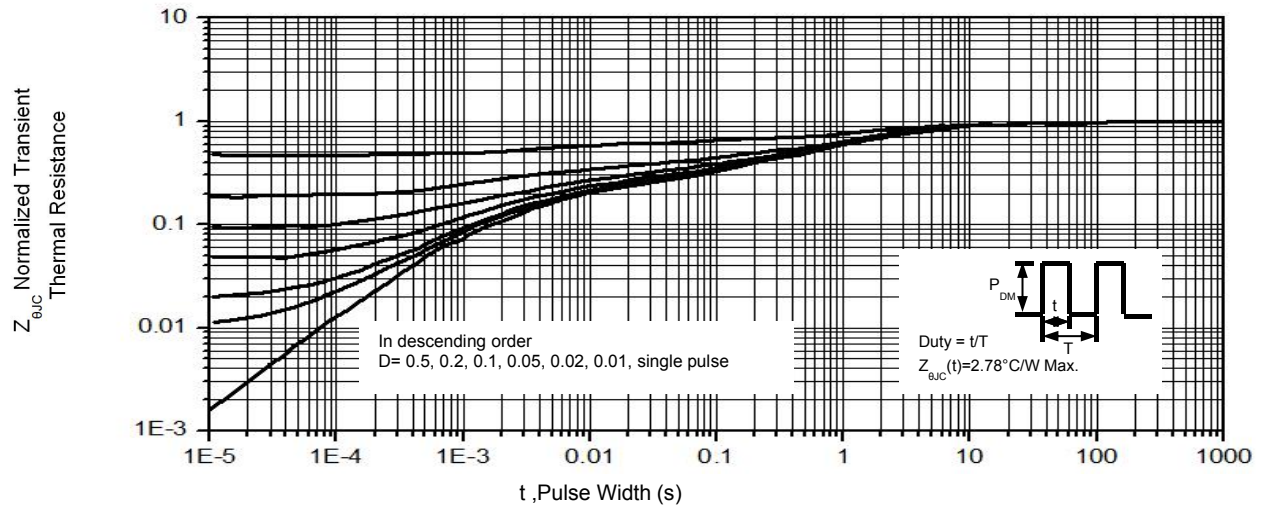
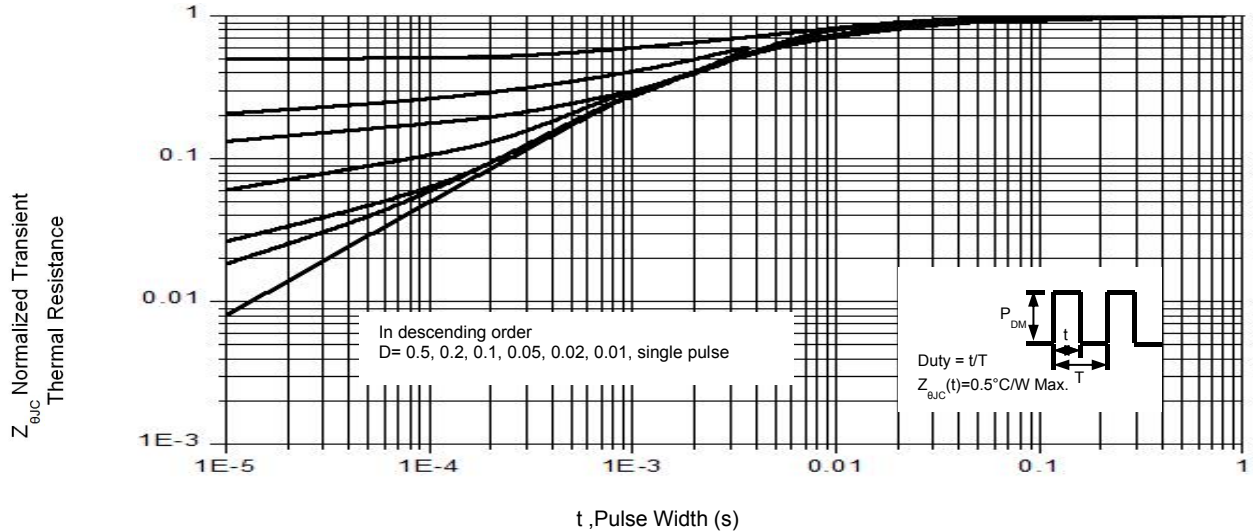
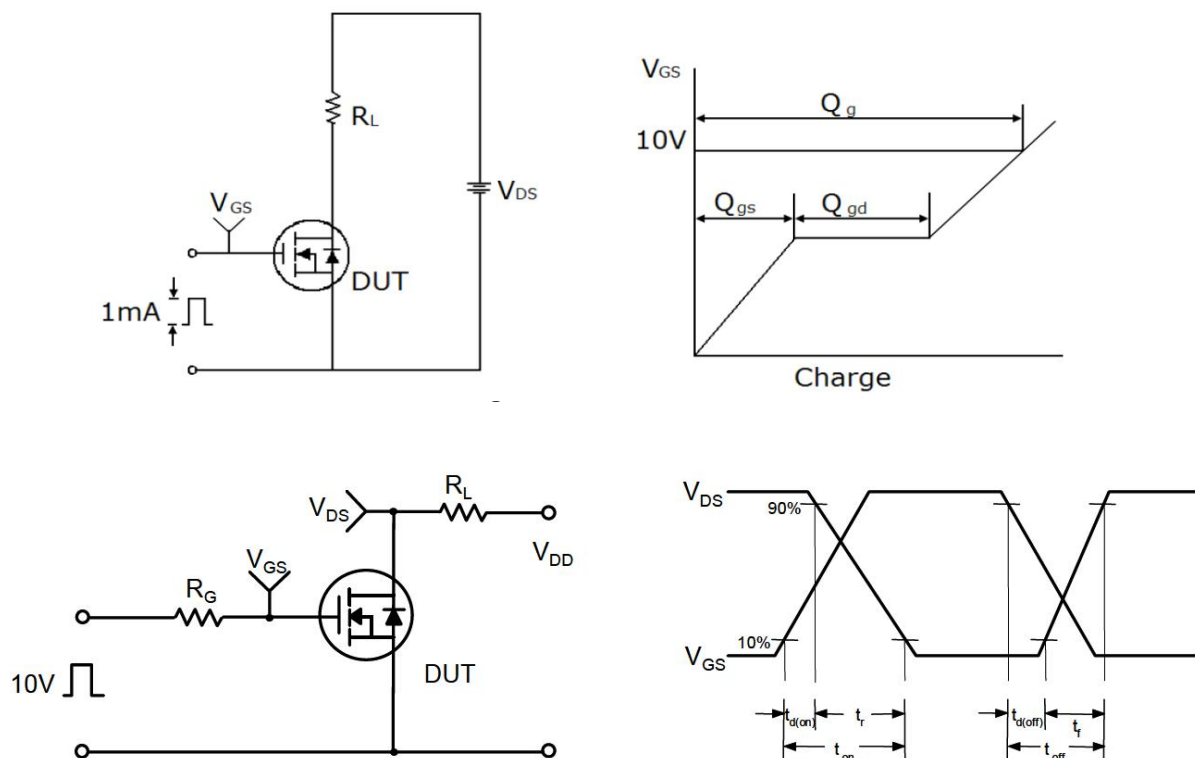


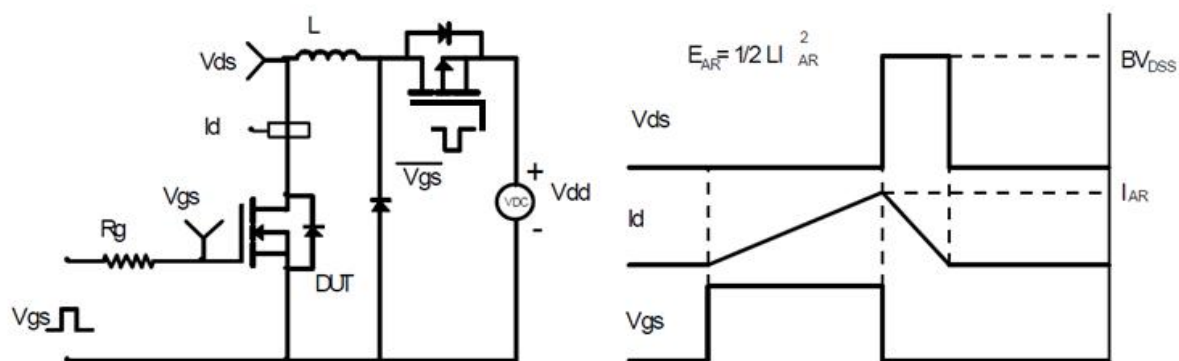
Figure 16. Transient Thermal Impedance, Junction to Case, TO-247/TO-220



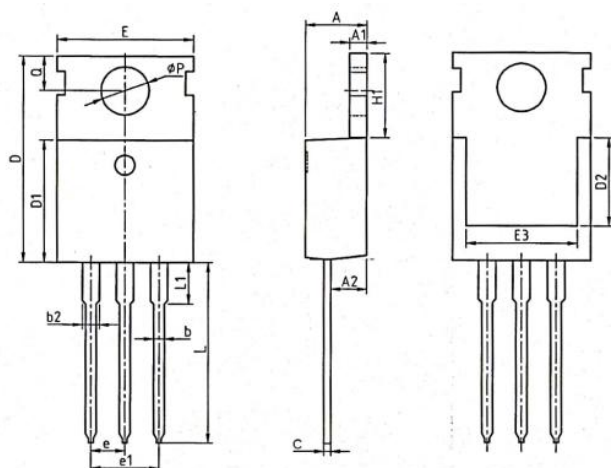
### Gate Charge Test Circuit & Waveform



### Unclamped Inductive Switching Test Circuit & Waveforms

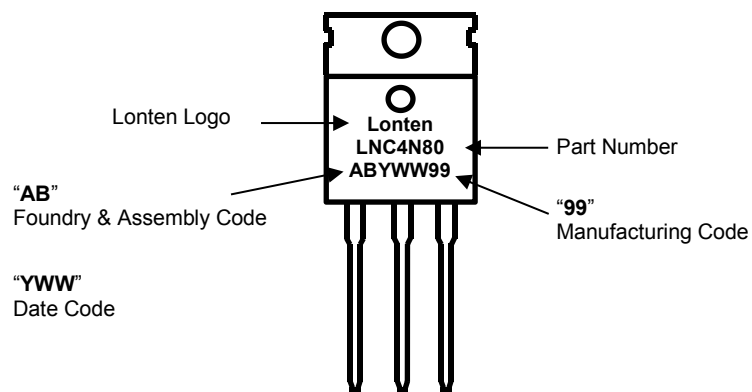


## Mechanical Dimensions for TO-220



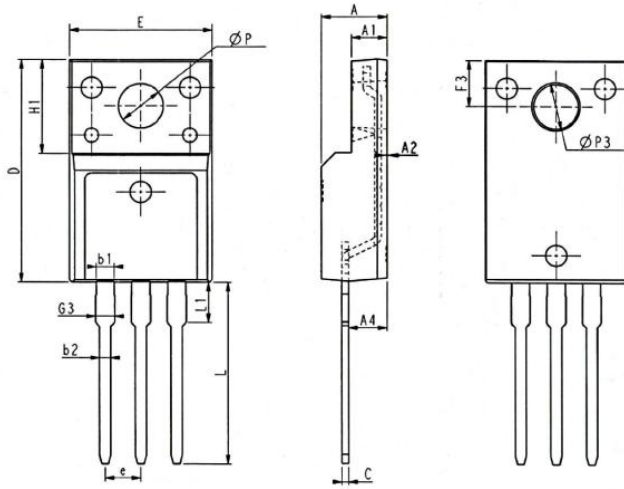
| COMMON DIMENSIONS |         |       |       |        |       |       |
|-------------------|---------|-------|-------|--------|-------|-------|
| SYMBOL            | MM      |       |       | INCH   |       |       |
|                   | MIN     | NOM   | MAX   | MIN    | NOM   | MAX   |
| A                 | 4.37    | 4.57  | 4.70  | 0.172  | 0.180 | 0.185 |
| A1                | 1.25    | 1.30  | 1.40  | 0.049  | 0.051 | 0.055 |
| A2                | 2.20    | 2.40  | 2.60  | 0.087  | 0.094 | 0.102 |
| b                 | 0.70    | 0.80  | 0.95  | 0.028  | 0.031 | 0.037 |
| b2                | 1.17    | 1.27  | 1.47  | 0.046  | 0.050 | 0.058 |
| c                 | 0.45    | 0.50  | 0.60  | 0.018  | 0.020 | 0.024 |
| D                 | 15.10   | 15.60 | 16.10 | 0.594  | 0.614 | 0.634 |
| D1                | 8.80    | 9.10  | 9.40  | 0.346  | 0.358 | 0.370 |
| D2                | 5.50    | —     | —     | 0.217  | —     | —     |
| E                 | 9.70    | 10.00 | 10.30 | 0.382  | 0.394 | 0.406 |
| E3                | 7.00    | —     | —     | 0.276  | —     | —     |
| e                 | 2.54BSC |       |       | 0.1BSC |       |       |
| e1                | 5.08BSC |       |       | 0.2BSC |       |       |
| H1                | 6.25    | 6.50  | 6.85  | 0.246  | 0.256 | 0.270 |
| L                 | 12.75   | 13.50 | 13.80 | 0.502  | 0.531 | 0.543 |
| L1                | —       | 3.10  | 3.40  | —      | 0.122 | 0.134 |
| Øp                | 3.40    | 3.60  | 3.80  | 0.134  | 0.142 | 0.150 |
| Q                 | 2.60    | 2.80  | 3.00  | 0.102  | 0.110 | 0.118 |

## TO-220 Part Marking Information



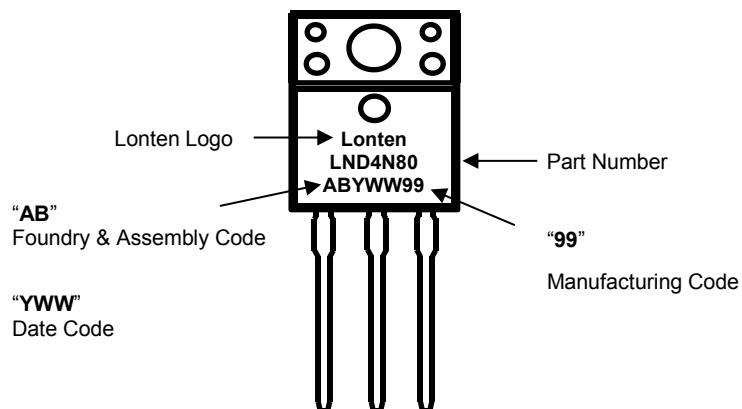


## Mechanical Dimensions for TO-220F



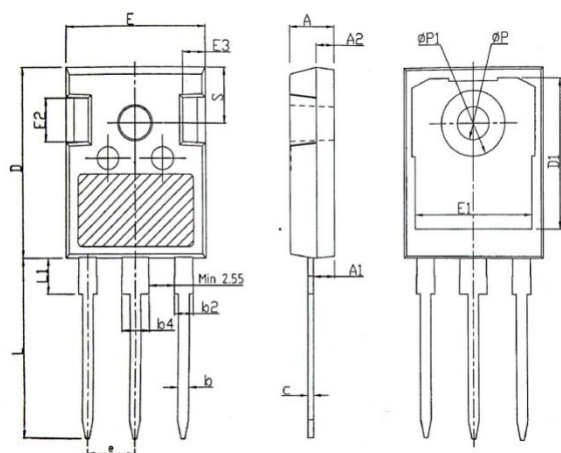
| COMMON DIMENSIONS |         |       |       |          |       |       |
|-------------------|---------|-------|-------|----------|-------|-------|
| SYMBOL            | MM      |       |       | INCH     |       |       |
|                   | MIN     | NOM   | MAX   | MIN      | NOM   | MAX   |
| E                 | 9.96    | 10.16 | 10.36 | 0.392    | 0.400 | 0.408 |
| A                 | 4.50    | 4.70  | 4.90  | 0.177    | 0.185 | 0.193 |
| A1                | 2.34    | 2.54  | 2.74  | 0.092    | 0.100 | 0.108 |
| A2                | 0.30    | 0.45  | 0.60  | 0.012    | 0.002 | 0.024 |
| A4                | 2.65    | 2.76  | 2.96  | 0.104    | 0.109 | 0.117 |
| C                 | 0.40    | 0.50  | 0.65  | 0.016    | 0.020 | 0.026 |
| D                 | 15.57   | 15.87 | 16.17 | 0.613    | 0.625 | 0.637 |
| H1                | 6.70REF |       |       | 0.264REF |       |       |
| e                 | 2.54BSC |       |       | 0.1BSC   |       |       |
| ØP                | 3.03    | 3.18  | 3.38  | 0.119    | 0.125 | 0.133 |
| L                 | 12.68   | 12.98 | 13.28 | 0.499    | 0.511 | 0.523 |
| L1                | 2.88    | 3.03  | 3.18  | 0.113    | 0.119 | 0.125 |
| ØP3               | 3.15REF |       |       | 0.124REF |       |       |
| F3                | 3.15    | 3.30  | 3.45  | 0.124    | 0.130 | 0.136 |
| G3                | 1.25    | 1.35  | 1.55  | 0.049    | 0.053 | 0.061 |
| b1                | 1.18    | 1.28  | 1.43  | 0.046    | 0.050 | 0.056 |
| b2                | 0.70    | 0.80  | 0.95  | 0.028    | 0.031 | 0.037 |

## TO-220F Part Marking Information



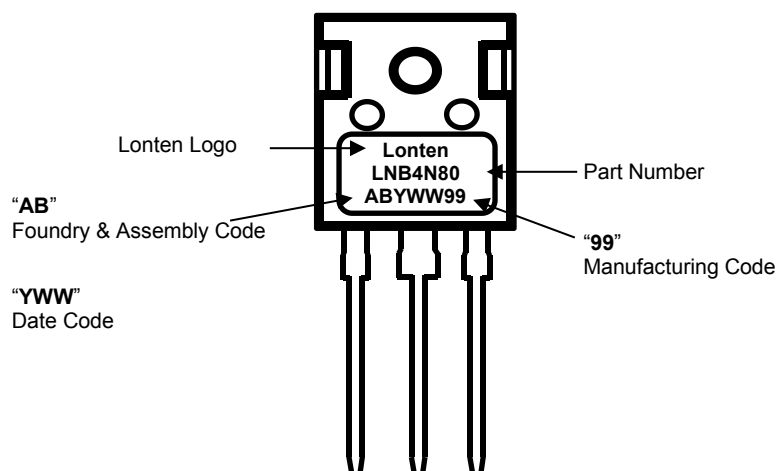


## Mechanical Dimensions for TO-247

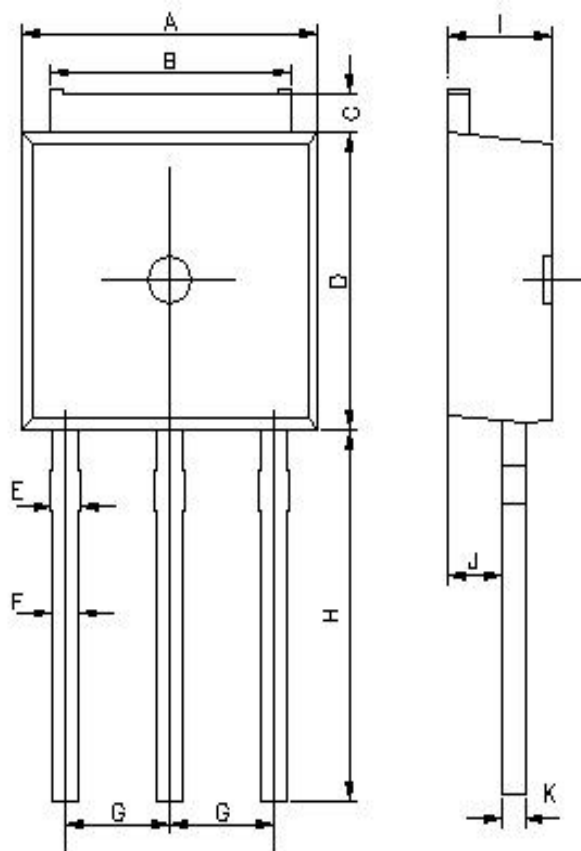


| SYMBOL | mm      |       |       |
|--------|---------|-------|-------|
|        | MIN     | NOM   | MAX   |
| A      | 4.80    | 5.00  | 5.20  |
| A1     | 2.21    | 2.41  | 2.59  |
| A2     | 1.85    | 2.00  | 2.15  |
| b      | 1.11    | 1.21  | 1.36  |
| b2     | 1.91    | 2.01  | 2.21  |
| b4     | 2.91    | 3.01  | 3.21  |
| c      | 0.51    | 0.61  | 0.75  |
| D      | 20.80   | 21.00 | 21.30 |
| D1     | 16.25   | 16.55 | 16.85 |
| E      | 15.50   | 15.80 | 16.10 |
| E1     | 13.00   | 13.30 | 13.60 |
| E2     | 4.80    | 5.00  | 5.20  |
| E3     | 2.30    | 2.50  | 2.70  |
| e      | 5.44BSC |       |       |
| L      | 19.82   | 19.92 | 20.22 |
| L1     | —       | —     | 4.30  |
| ØP     | 3.40    | 3.60  | 3.80  |
| ØP1    | —       | —     | 7.30  |
| S      | 6.15BSC |       |       |

## TO-247 Part Marking Information

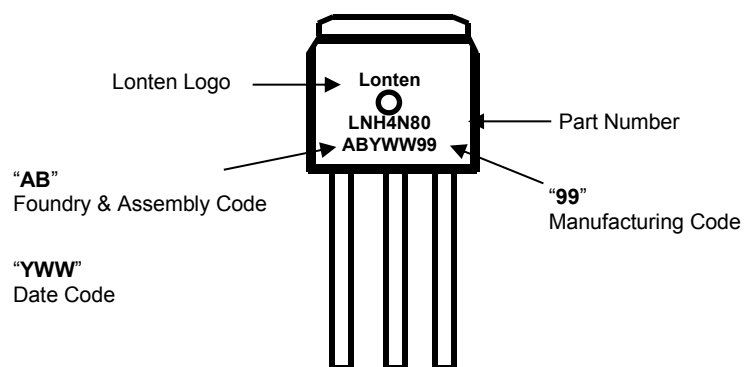


## Mechanical Dimensions for TO-251

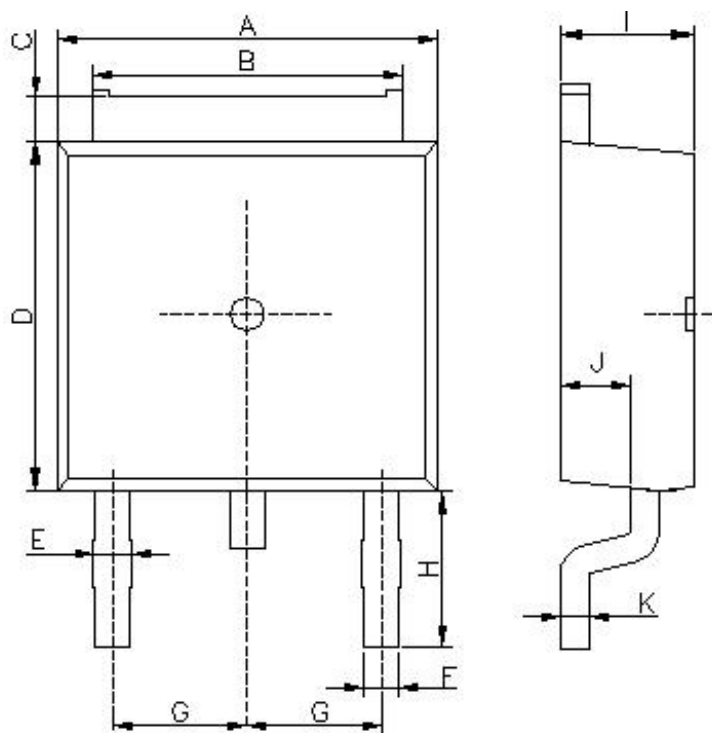


| SYMBOL | COMMON DIMENSIONS |      |       |
|--------|-------------------|------|-------|
|        | MIN               | NOM  | MAX   |
| A      | 6.40              | 6.60 | 6.80  |
| B      | 5.18              | 5.33 | 5.48  |
| C      | 0.75              | 0.89 | 1.02  |
| D      | 5.95              | 6.15 | 6.35  |
| E      | 0.70              | 0.85 | 1.00  |
| F      | 0.70              | 0.80 | 0.90  |
| G      | 2.140             | 2.29 | 2.440 |
| H      | 6.70              | 7.00 | 7.30  |
| I      | 2.10              | 2.30 | 2.50  |
| J      | 0.850             | 1.00 | 1.150 |
| K      | 0.41              | 0.51 | 0.61  |

## TO-251 Part Marking Information

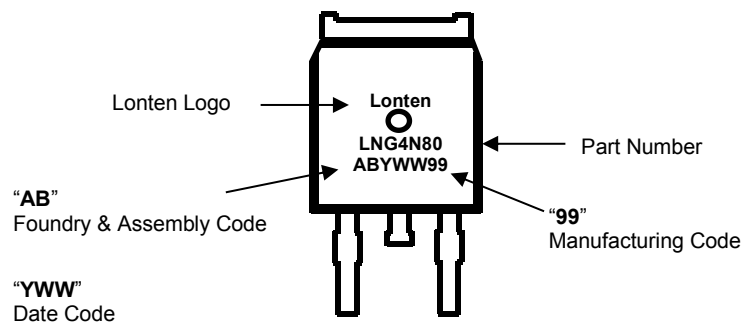


## Mechanical Dimensions for TO-252



| SYMBOL | COMMON DIMENSIONS |      |       |
|--------|-------------------|------|-------|
|        | MIN               | NOM  | MAX   |
| A      | 6.40              | 6.60 | 6.80  |
| B      | 5.18              | 5.33 | 5.48  |
| C      | 0.72              | 0.87 | 1.02  |
| D      | 5.95              | 6.15 | 6.35  |
| E      | 0.75              | 0.90 | 1.05  |
| F      | 0.70              | 0.80 | 0.90  |
| G      | 2.140             | 2.29 | 2.440 |
| H      | 2.40              | 2.70 | 3.00  |
| I      | 2.10              | 2.30 | 2.50  |
| J      | 0.850             | 1.00 | 1.150 |
| K      | 0.41              | 0.51 | 0.61  |

## TO-252 Part Marking Information



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