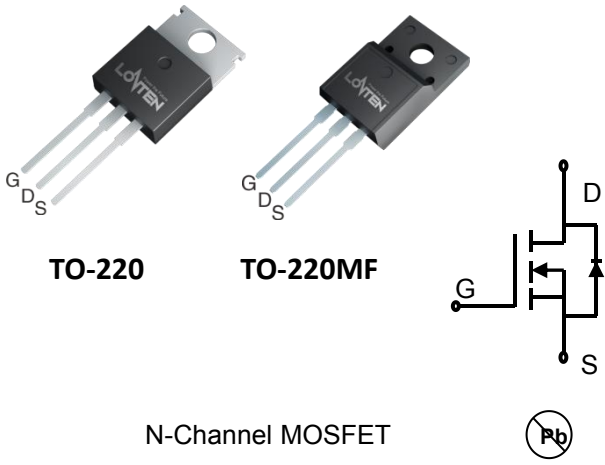


## Lonten N-channel 40V, 120A, 3.5mΩ Power MOSFET

|  |   |           |     |                             |       |       |      |
|--|---|-----------|-----|-----------------------------|-------|-------|------|
| <p><b>Description</b></p> <p>These N-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and with stand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.</p> <p><b>Features</b></p> <ul style="list-style-type: none"> <li>◆ 40V,120A,<math>R_{DS(on),max}=3.5m\Omega@V_{GS} = 10V</math></li> <li>◆ Improved dv/dt capability</li> <li>◆ Fast switching</li> <li>◆ 100% EAS Guaranteed</li> <li>◆ Green device available</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>◆ Motor Drives</li> <li>◆ UPS</li> <li>◆ DC-DC Converter</li> </ul> | <p><b>Product Summary</b></p> <table style="width: 100%; border: none;"> <tr> <td style="padding: 2px;"><math>V_{DSS}</math></td> <td style="padding: 2px;">40V</td> </tr> <tr> <td style="padding: 2px;"><math>R_{DS(on),max}@V_{GS}=10V</math></td> <td style="padding: 2px;">3.5mΩ</td> </tr> <tr> <td style="padding: 2px;"><math>I_D</math></td> <td style="padding: 2px;">120A</td> </tr> </table> <p><b>Pin Configuration</b></p> <div style="text-align: center;">  <p style="margin: 0;">TO-220      TO-220MF</p> <p style="margin: 0;">N-Channel MOSFET</p> </div> | $V_{DSS}$ | 40V | $R_{DS(on),max}@V_{GS}=10V$ | 3.5mΩ | $I_D$ | 120A |
| $V_{DSS}$  | 40V   |           |     |                             |       |       |      |
| $R_{DS(on),max}@V_{GS}=10V$  | 3.5mΩ   |           |     |                             |       |       |      |
| $I_D$  | 120A  |           |     |                             |       |       |      |

### Absolute Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted

| Parameter  | Symbol    | Value       | Unit       |
|--|-----------|-------------|------------|
| Drain-Source Voltage   | $V_{DSS}$ | 40          | V          |
| Continuous drain current ( $T_C = 25^\circ C$ ) <sup>1)</sup>  | $I_D$     | 120         | A          |
| Continuous drain current ( $T_C = 100^\circ C$ ) <sup>1)</sup> |           | 82          | A          |
| Pulsed drain current <sup>2)</sup>                             | $I_{DM}$  | 480         | A          |
| Gate-Source voltage  | $V_{GSS}$ | $\pm 20$    | V          |
| Avalanche energy <sup>3)</sup>                                 | $E_{AS}$  | 1040        | mJ         |
| Power Dissipation ( $T_C = 25^\circ C$ ) TO-220                | $P_D$     | 150         | W          |
| Power Dissipation ( $T_C = 25^\circ C$ ) TO-220MF              |           | 48          | W          |
| Storage Temperature Range                                      | $T_{STG}$ | -55 to +150 | $^\circ C$ |
| Operating Junction Temperature Range                           | $T_J$     | -55 to +150 | $^\circ C$ |

### Thermal Characteristics

| Parameter  | Symbol          | Value | Unit         |
|--|-----------------|-------|--------------|
| Thermal Resistance, Junction-to-Case TO-220      | $R_{\theta JC}$ | 0.83  | $^\circ C/W$ |
| Thermal Resistance, Junction-to-Case TO-220MF    |                 | 2.6   | $^\circ C/W$ |
| Thermal Resistance, Junction-to-Ambient TO-220   | $R_{\theta JA}$ | 62    | $^\circ C/W$ |
| Thermal Resistance, Junction-to-Ambient TO-220MF |                 | 80    | $^\circ C/W$ |

**Package Marking and Ordering Information**

| Device     | Device Package | Marking    |
|------------|----------------|------------|
| LNC04R035B | TO-220         | LNC04R035B |
| LND04R035B | TO-220MF       | LND04R035B |

**Electrical Characteristics**
 $T_J = 25^\circ\text{C}$  unless otherwise noted

| Parameter   | Symbol       | Test Condition  | Min. | Typ. | Max. | Unit             |
|---|--------------|---|------|------|------|------------------|
| <b>Static characteristics</b>                                 |              |   |      |      |      |                  |
| Drain-source breakdown voltage                                | $BV_{DSS}$   | $V_{GS}=0\text{ V}, I_D=250\mu\text{A}$                                       | 40   | ---  | ---  | V                |
| Gate threshold voltage  | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu\text{A}$   | 1.3  | ---  | 2.5  | V                |
| Drain-source leakage current                                  | $I_{DSS}$    | $V_{DS}=40\text{ V}, V_{GS}=0\text{ V}, T_J = 25^\circ\text{C}$               | ---  | ---  | 1    | $\mu\text{A}$    |
|   |              | $V_{DS}=40\text{ V}, V_{GS}=0\text{ V}, T_J = 125^\circ\text{C}$              | ---  | ---  | 5    | $\mu\text{A}$    |
| Gate leakage current, Forward                                 | $I_{GSSF}$   | $V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$                                       | ---  | ---  | 100  | nA               |
| Gate leakage current, Reverse                                 | $I_{GSSR}$   | $V_{GS}=-20\text{ V}, V_{DS}=0\text{ V}$                                      | ---  | ---  | -100 | nA               |
| Drain-source on-state resistance                              | $R_{DS(on)}$ | $V_{GS}=10\text{ V}, I_D=20\text{ A}$   | ---  | 2.7  | 3.5  | $\text{m}\Omega$ |
|   |              | $V_{GS}=4.5\text{ V}, I_D=10\text{ A}$  | ---  | 3.8  | 6.0  | $\text{m}\Omega$ |
| Forward transconductance                                      | $g_{fs}$     | $V_{DS}=5\text{ V}, I_D=50\text{ A}$  | 26   | ---  | ---  | S                |
| <b>Dynamic characteristics</b>                                |              |   |      |      |      |                  |
| Input capacitance   | $C_{iss}$    | $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V},$<br>$F = 1\text{ MHz}$            | ---  | 7810 | ---  | pF               |
| Output capacitance  | $C_{oss}$    |   | ---  | 677  | ---  |                  |
| Reverse transfer capacitance                                  | $C_{riss}$   |   | ---  | 370  | ---  |                  |
| Turn-on delay time  | $t_{d(on)}$  | $V_{DD} = 20\text{ V}, V_{GS}=10\text{ V}, I_D = 20\text{ A}$                 | ---  | 15   | ---  | ns               |
| Rise time   | $t_r$        |   | ---  | 17   | ---  |                  |
| Turn-off delay time   | $t_{d(off)}$ |   | ---  | 52   | ---  |                  |
| Fall time   | $t_f$        |   | ---  | 23   | ---  |                  |
| Gate resistance   | $R_g$        | $V_{GS}=0\text{ V}, V_{DS}=0\text{ V}, F=1\text{ MHz}$                        | ---  | 2.12 | ---  | $\Omega$         |
| <b>Gate charge characteristics</b>                            |              |   |      |      |      |                  |
| Gate to source charge   | $Q_{gs}$     | $V_{DS}=20\text{ V}, I_D=100\text{ A},$<br>$V_{GS}= 10\text{ V}$              | ---  | 36.4 | ---  | nC               |
| Gate to drain charge  | $Q_{gd}$     |   | ---  | 37.3 | ---  |                  |
| Gate charge total   | $Q_g$        |   | ---  | 139  | ---  |                  |
| <b>Drain-Source diode characteristics and Maximum Ratings</b> |              |   |      |      |      |                  |
| Continuous Source Current                                     | $I_S$        |   | ---  | ---  | 120  | A                |
| Pulsed Source Current <sup>4)</sup>                           | $I_{SM}$     |   | ---  | ---  | 480  | A                |
| Diode Forward Voltage   | $V_{SD}$     | $V_{GS}=0\text{ V}, I_S=50\text{ A}, T_J=25^\circ\text{C}$                    | ---  | ---  | 1.2  | V                |
| Reverse Recovery Time   | $t_{rr}$     | $I_S=100\text{ A}, di/dt=100\text{ A}/\mu\text{s},$<br>$T_J=25^\circ\text{C}$ | ---  | 42   | ---  | ns               |
| Reverse Recovery Charge                                       | $Q_{rr}$     |   | ---  | 120  | ---  | nC               |

**Notes:**

- 1: The maximum junction current rating is package limited.
- 2: Repetitive Rating: Pulse width limited by maximum junction temperature.
- 3:  $V_{DD}=20\text{ V}, V_{GS}=10\text{ V}, L=1\text{ mH}, I_{AS}=45.6\text{ A}, R_G=25\Omega,$  Starting  $T_J=25^\circ\text{C}$ .
- 4: Pulse Test: Pulse Width  $\leq 300\ \mu\text{s},$  Duty Cycle  $\leq 2\%$ .

**Electrical Characteristics Diagrams**

Figure 1. Typ. Output Characteristics

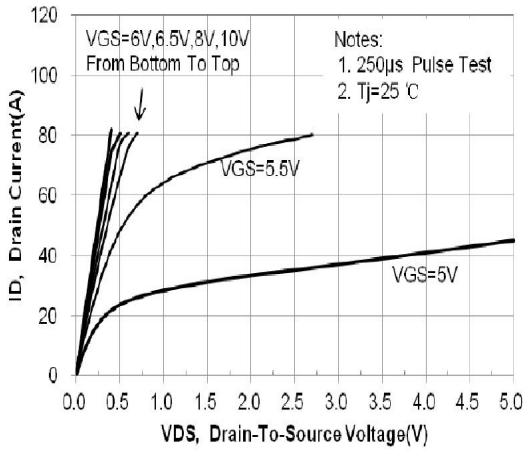


Figure 2. Transfer Characteristics

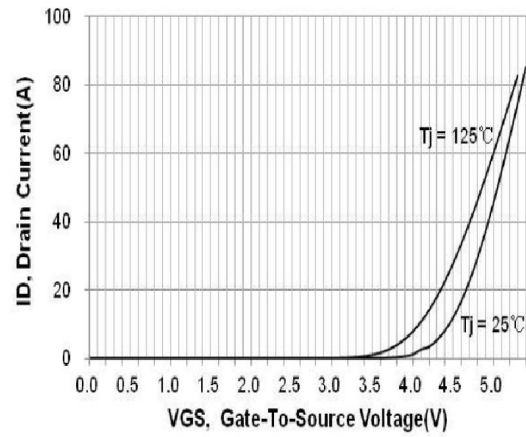


Figure 3. Capacitance Characteristics

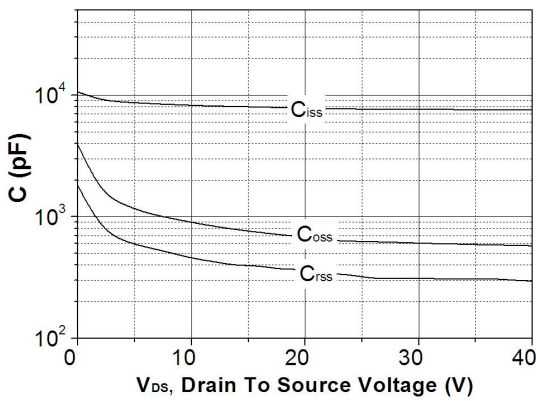


Figure 4. Gate Charge Waveform

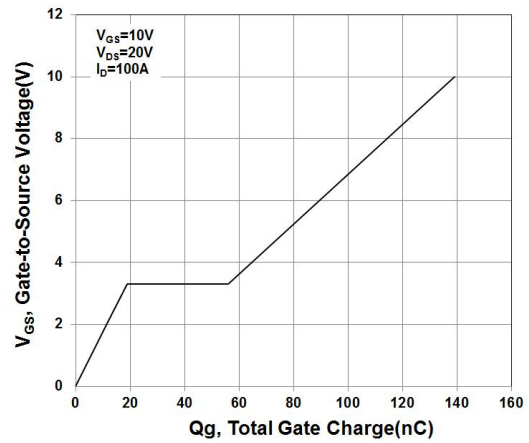


Figure 5. Body-Diode Characteristics

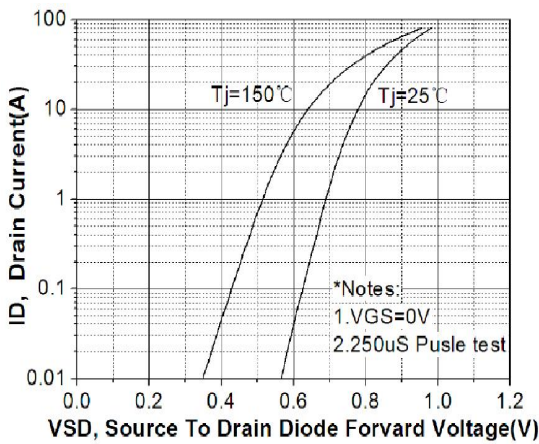


Figure 6. Normalized Maximum Transient Thermal Impedance (RthJC)

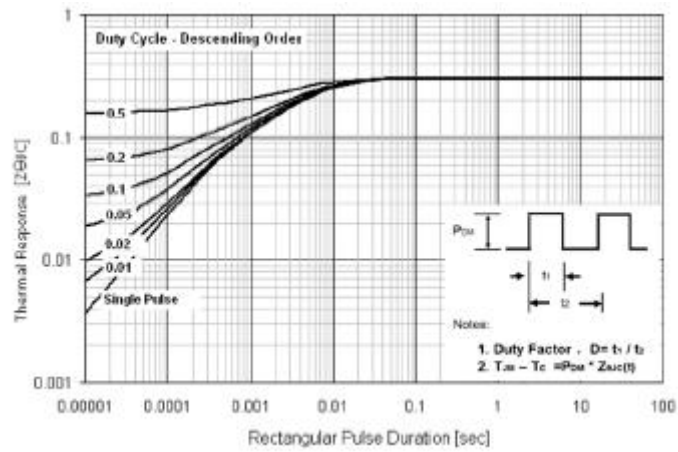
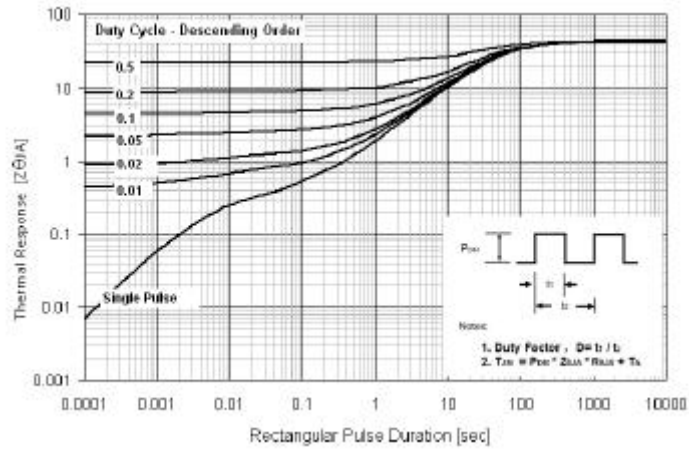


Figure 7. Normalized Maximum Transient Thermal Impedance (RthJA)



**Test Circuit & Waveform**

Figure 8. Gate Charge Test Circuit & Waveform

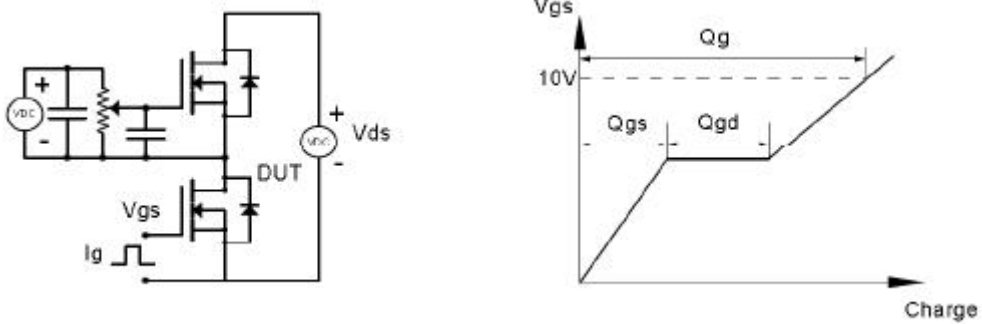


Figure 9. Resistive Switching Test Circuit & Waveforms

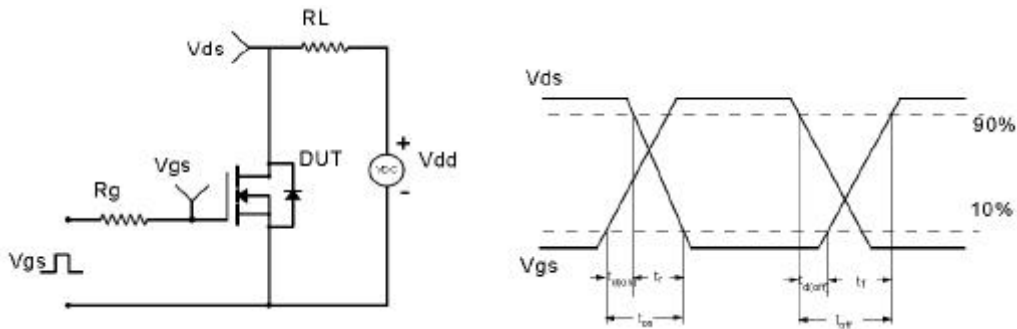


Figure 10. Unclamped Inductive Switching (UIS) Test Circuit & Waveform

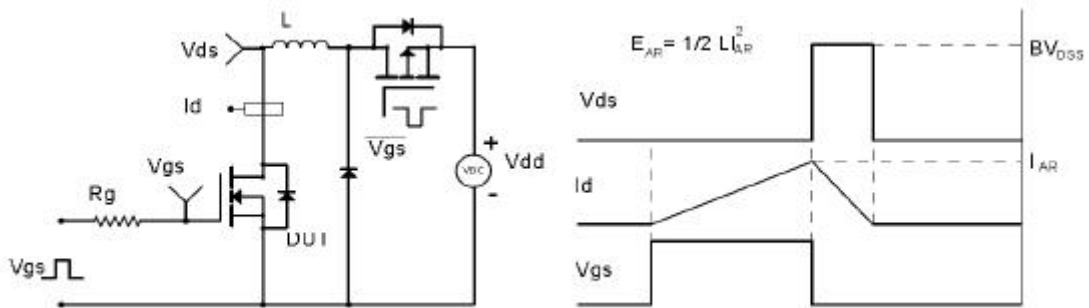
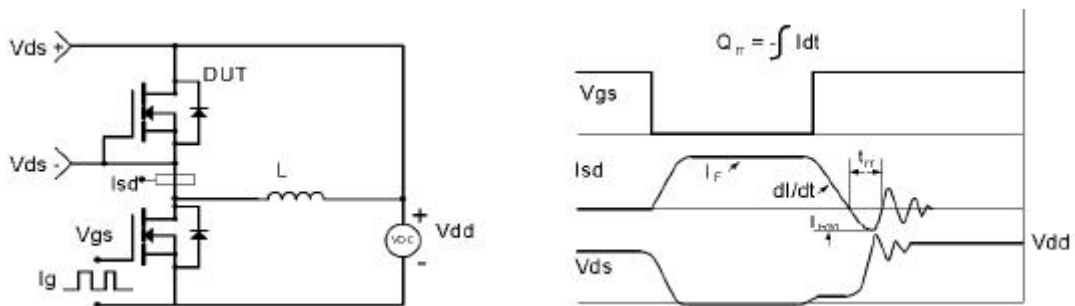
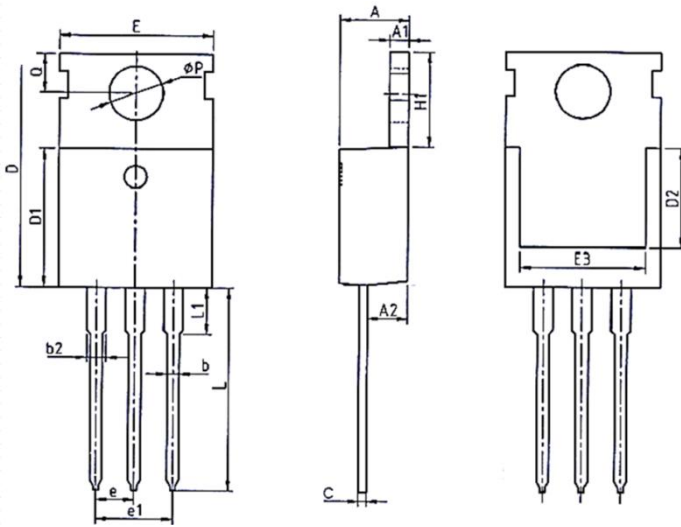


Figure 11. Diode Recovery Circuit & Waveform

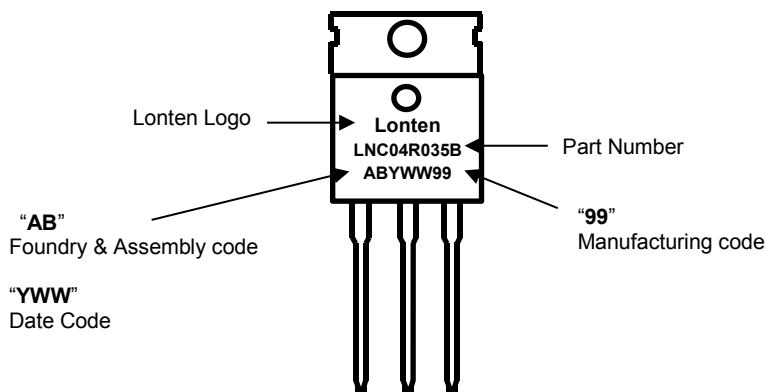


**Mechanical Dimensions for TO-220**

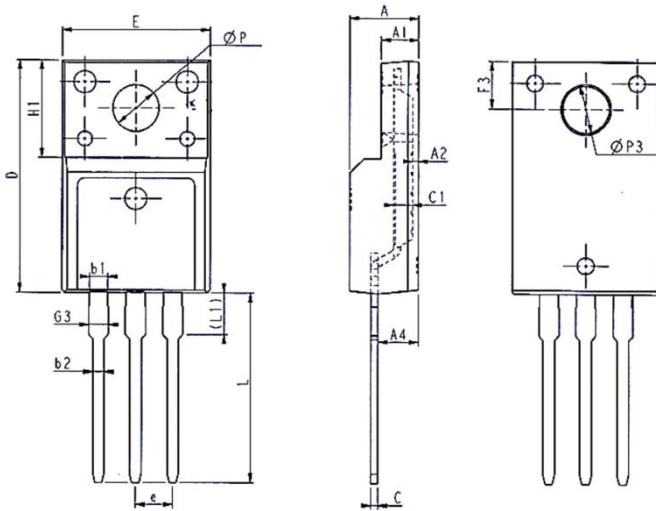


| COMMON DIMENSIONS |         |       |       |        |       |       |
|-------------------|---------|-------|-------|--------|-------|-------|
| SYMBOL            | MM      |       |       | INCH   |       |       |
|                   | MIN     | NOM   | MAX   | MIN    | NOM   | MAX   |
| A                 | 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                 | 2.54BCS |       |       | 0.1BSC |       |       |
| e1                | 5.08BCS |       |       | 0.2REF |       |       |
| 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**

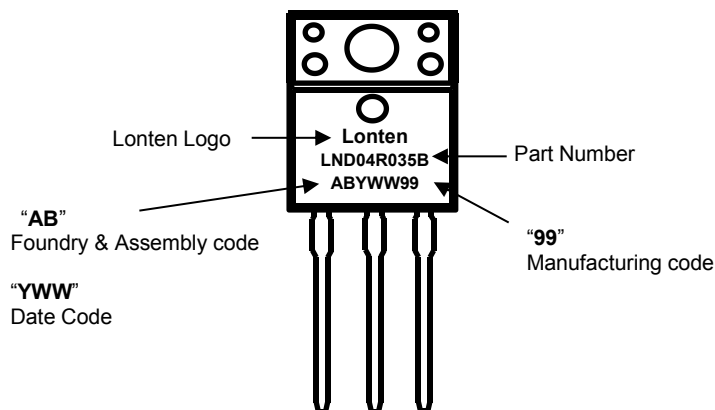


**Mechanical Dimensions for TO-220MF**



| 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    | 0.018 | 0.024 |
| A4                | 2.56    | 2.76  | 2.96  | 0.101    | 0.109 | 0.117 |
| c                 | 0.40    | 0.50  | 0.65  | 0.016    | 0.020 | 0.026 |
| c1                | 1.20    | 1.30  | 1.35  | 0.047    | 0.051 | 0.053 |
| D                 | 15.57   | 15.87 | 16.17 | 0.613    | 0.625 | 0.637 |
| H1                | 6.70REF |       |       | 0.264REF |       |       |
| e                 | 2.54BSC |       |       | 0.1BSC   |       |       |
| 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 |
| ØP                | 3.03    | 3.18  | 3.38  | 0.119    | 0.125 | 0.133 |
| ØP3               | 3.15    | 3.45  | 3.65  | 0.124    | 0.136 | 0.144 |
| 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-220MF Part Marking Information**



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