
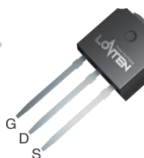
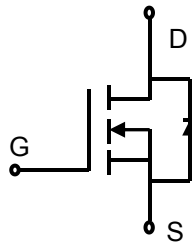



## Lonten N-channel 40V, 39A, 16.5mΩ Power MOSFET

|   |   |           |     |                             |        |       |     |
|---|---|-----------|-----|-----------------------------|--------|-------|-----|
| <p><b>Description</b><br/>                 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, 39A, <math>R_{DS(ON),max}=16.5m\Omega@V_{GS}=10V</math></li> <li>◆ Improved dv/dt capability</li> <li>◆ Fast switching</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;">16.5mΩ</td> </tr> <tr> <td style="padding: 2px;"><math>I_D</math></td> <td style="padding: 2px;">39A</td> </tr> </table> <p><b>Pin Configuration</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p><b>TO-252</b></p> </div> <div style="text-align: center;">  <p><b>TO-251</b></p> </div> </div> <div style="text-align: right; margin-top: 20px;">  </div> <p style="text-align: center; margin-top: 20px;">N-Channel MOSFET </p> | $V_{DSS}$ | 40V | $R_{DS(on),max}@V_{GS}=10V$ | 16.5mΩ | $I_D$ | 39A |
| $V_{DSS}$   | 40V   |           |     |                             |        |       |     |
| $R_{DS(on),max}@V_{GS}=10V$   | 16.5mΩ  |           |     |                             |        |       |     |
| $I_D$   | 39A   |           |     |                             |        |       |     |

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

| Parameter  | Symbol    | Value       | Unit       |
|--|-----------|-------------|------------|
| Drain-Source Voltage                             | $V_{DSS}$ | 40          | V          |
| Continuous drain current ( $T_C = 25^\circ C$ )  | $I_D$     | 39          | A          |
| Continuous drain current ( $T_C = 100^\circ C$ ) |           | 24.5        | A          |
| Pulsed drain current <sup>1)</sup>               | $I_{DM}$  | 156         | A          |
| Gate-Source voltage                              | $V_{GSS}$ | $\pm 20$    | V          |
| Power Dissipation ( $T_C = 25^\circ C$ )         | $P_D$     | 37          | W          |
| Avalanche energy <sup>2)</sup>                   | $E_{AS}$  | 27.5        | mJ         |
| 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 | $R_{\theta JC}$ | 3.4   | $^\circ C/W$ |

**Package Marking and Ordering Information**

| Device    | Device Package | Marking   |
|-----------|----------------|-----------|
| LNG04R165 | TO-252         | LNG04R165 |
| LNH04R165 | TO-251         | LNH04R165 |

**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  | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu\text{A}$                                     | 1.0  | 1.5  | 2.0  | V                |
| Drain-source leakage current                                  | $I_{DSS}$    | $V_{DS}=40\text{ V}, V_{GS}=0\text{ V}, T_J = 25^\circ\text{C}$         | ---  | ---  | 1    | $\mu\text{A}$    |
|   |              | $V_{DS}=32\text{ V}, V_{GS}=0\text{ V}, T_J = 125^\circ\text{C}$        | ---  | ---  | 10   | $\mu\text{A}$    |
| 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                              | $R_{DS(on)}$ | $V_{GS}=10\text{ V}, I_D=10\text{ A}$                                   | ---  | 14.5 | 16.5 | $\text{m}\Omega$ |
|   |              | $V_{GS}=4.5\text{ V}, I_D=5\text{ A}$                                   | ---  | 19.5 | 23   | $\text{m}\Omega$ |
| Forward transconductance                                      | $g_{fs}$     | $V_{DS} = 5\text{ V}, I_D=10\text{ A}$                                  | ---  | 35   | ---  | S                |
| <b>Dynamic characteristics</b>                                |              |   |      |      |      |                  |
| Input capacitance   | $C_{iss}$    | $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V},$<br>$F = 1\text{ MHz}$      | ---  | 1061 | ---  | pF               |
| Output capacitance  | $C_{oss}$    |   | ---  | 127  | ---  |                  |
| Reverse transfer capacitance                                  | $C_{rss}$    |   | ---  | 102  | ---  |                  |
| Turn-on delay time  | $t_{d(on)}$  | $V_{DD} = 20\text{ V}, V_{GS}=10\text{ V}, I_D = 20\text{ A}$           | ---  | 12.3 | ---  | ns               |
| Rise time   | $t_r$        |   | ---  | 18.6 | ---  |                  |
| Turn-off delay time   | $t_{d(off)}$ |   | ---  | 47.2 | ---  |                  |
| Fall time   | $t_f$        |   | ---  | 16.3 | ---  |                  |
| <b>Gate charge characteristics</b>                            |              |   |      |      |      |                  |
| Gate to source charge   | $Q_{gs}$     | $V_{DS}=20\text{ V}, I_D=20\text{ A},$<br>$V_{GS}= 10\text{ V}$         | ---  | 7.2  | ---  | nC               |
| Gate to drain charge  | $Q_{gd}$     |   | ---  | 4.3  | ---  |                  |
| Gate charge total   | $Q_g$        |   | ---  | 24   | ---  |                  |
| <b>Drain-Source diode characteristics and Maximum Ratings</b> |              |   |      |      |      |                  |
| Continuous Source Current                                     | $I_S$        |   | ---  | ---  | 39   | A                |
| Pulsed Source Current   | $I_{SM}$     |   | ---  | ---  | 156  | A                |
| Diode Forward Voltage <sup>2)</sup>                           | $V_{SD}$     | $V_{GS}=0\text{ V}, I_S=10\text{ A}, T_J=25^\circ\text{C}$              | ---  | ---  | 1.2  | V                |
| Reverse Recovery Time   | $t_{rr}$     | $I_S=20\text{ A}, di/dt=100\text{ A}/\mu\text{s}, T_J=25^\circ\text{C}$ | ---  | 32   | ---  | ns               |
| Reverse Recovery Charge                                       | $Q_{rr}$     |   | ---  | 24   | ---  | nC               |

**Notes:**

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

 2:  $V_{DD}=20\text{ V}, V_{GS}=10\text{ V}, L=0.5\text{ mH}, I_{AS}=10.5\text{ A}, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$ .

 3: Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

**Electrical Characteristics Diagrams**

Figure 1. Typ. Output Characteristics

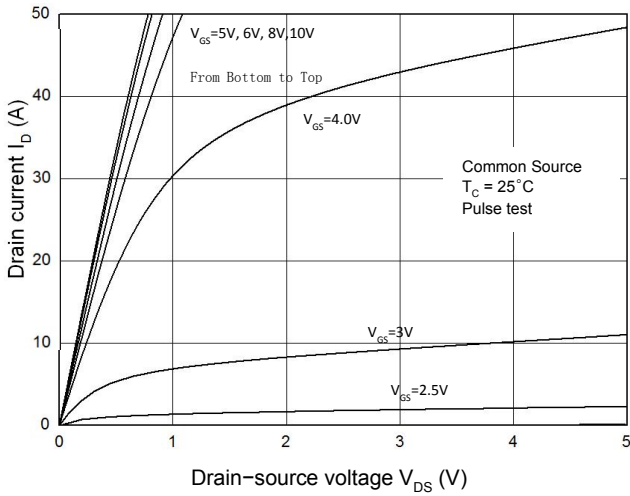


Figure 2. Transfer Characteristics

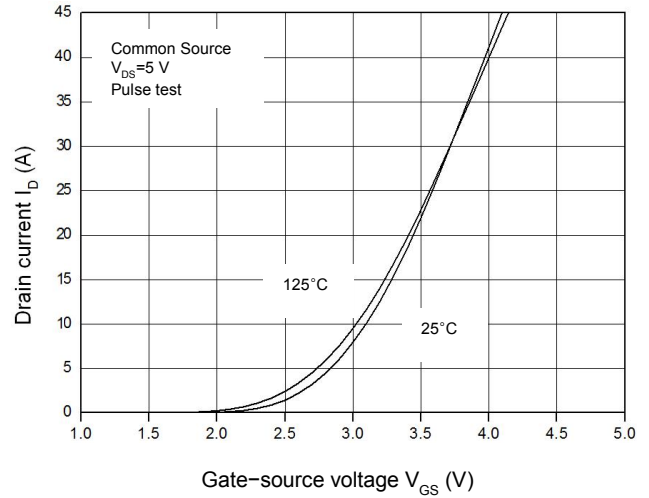


Figure 3. Capacitance Characteristics

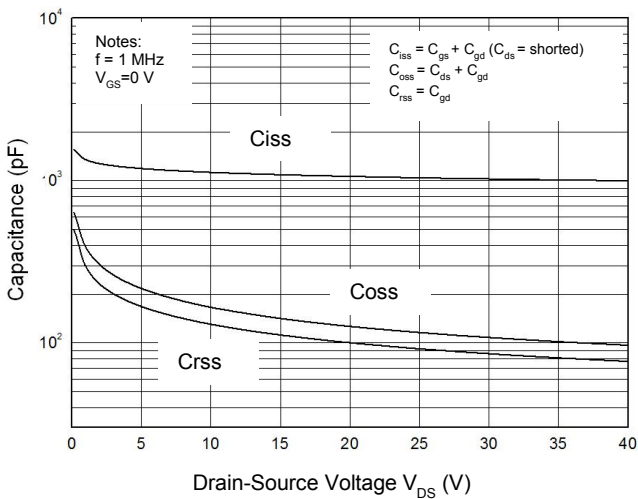


Figure 4. Gate Charge Waveform

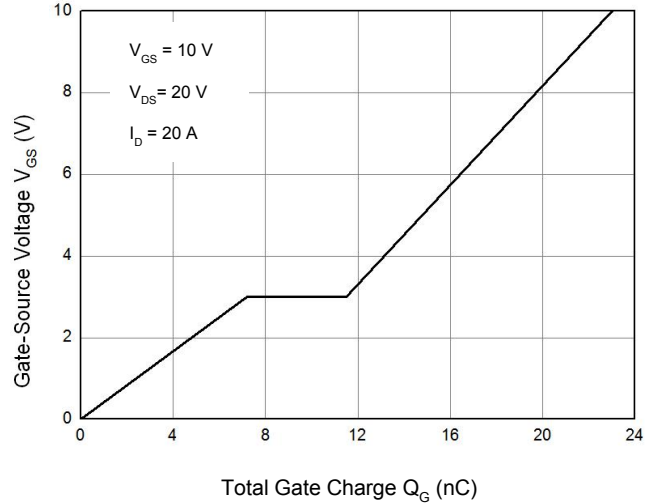


Figure 5. Body-Diode Characteristics

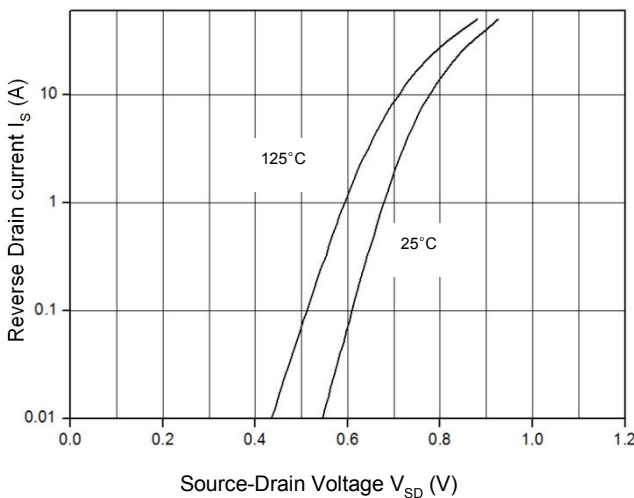


Figure 6. Rds(on)-Drain Current

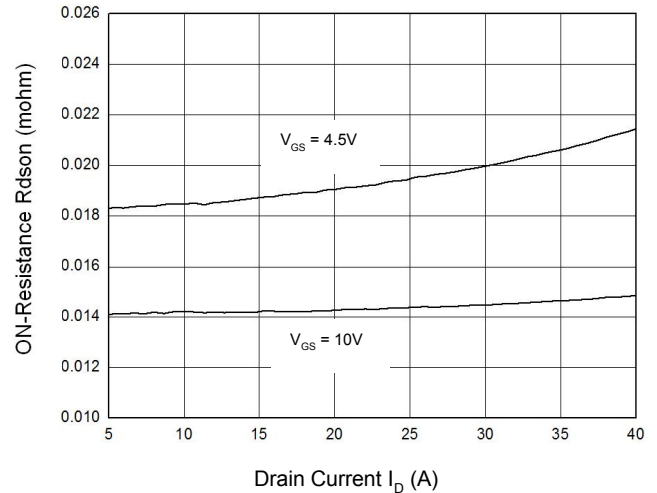


Figure 7. R<sub>ds(on)</sub>-Junction Temperature(°C)

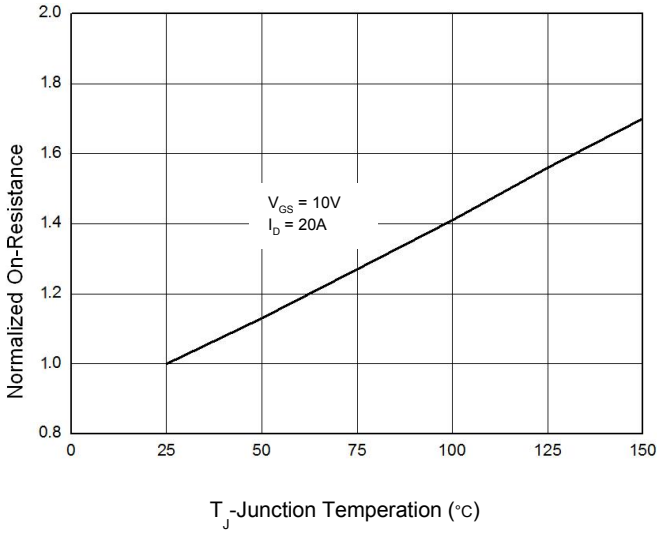


Figure 8. Maximum Safe Operating Area

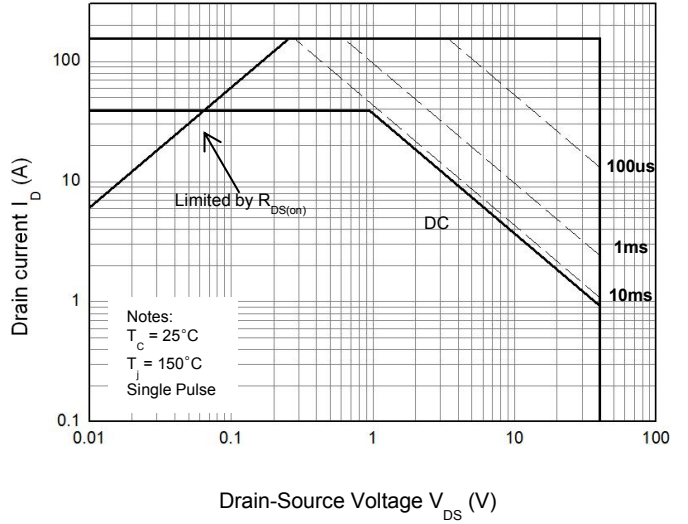
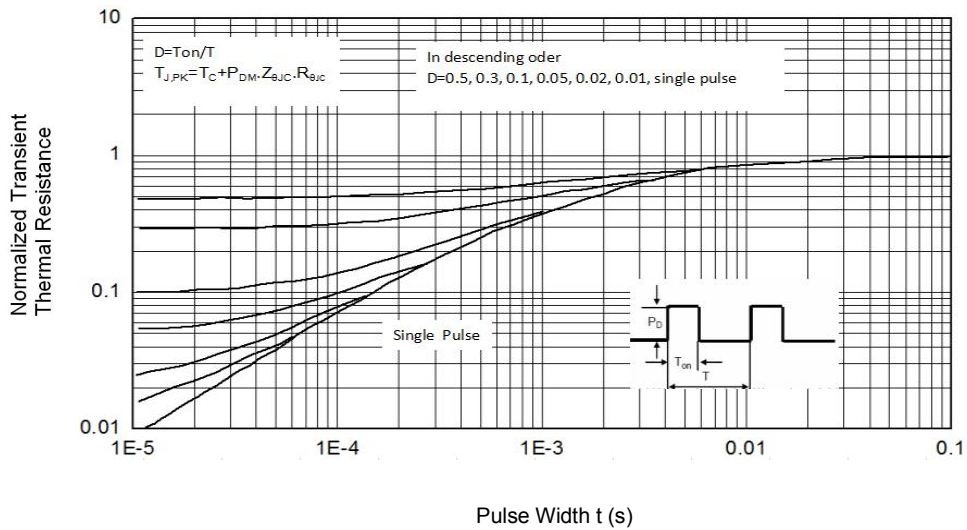


Figure 9. Normalized Maximum Transient Thermal Impedance (R<sub>thJA</sub>)



**Test Circuit & Waveform**

Figure 8. Gate Charge Test Circuit & Waveform

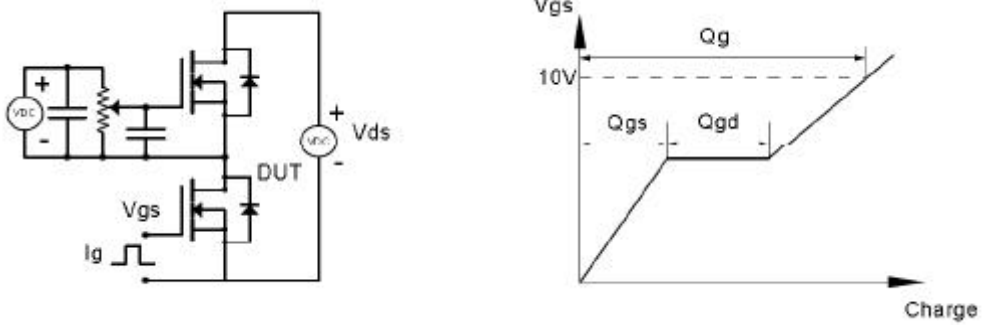


Figure 9. Resistive Switching Test Circuit & Waveforms

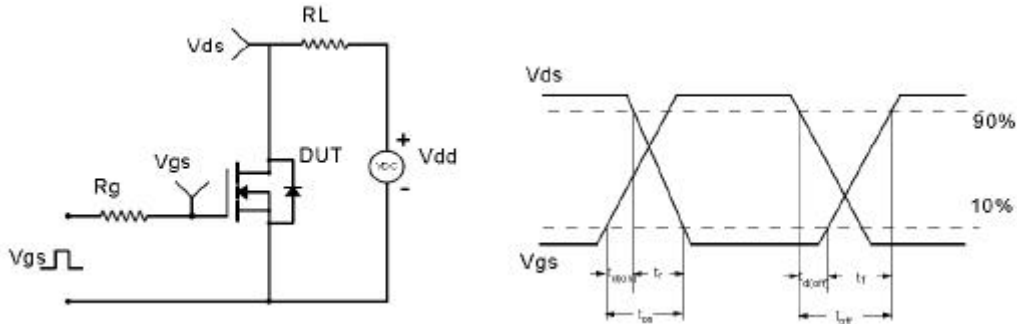


Figure 10. Unclamped Inductive Switching (UIS) Test Circuit & Waveform

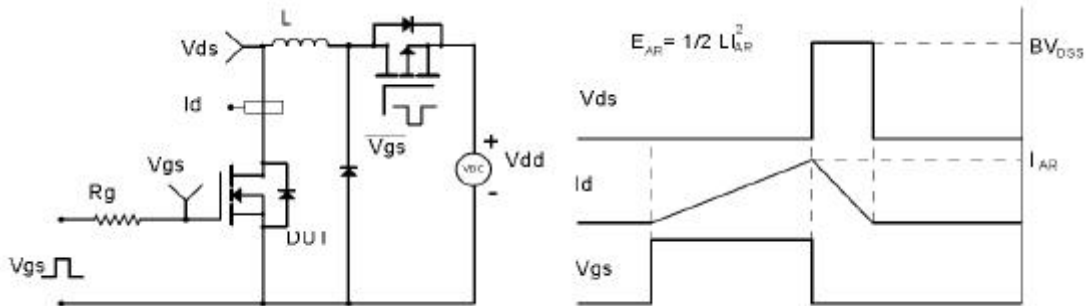
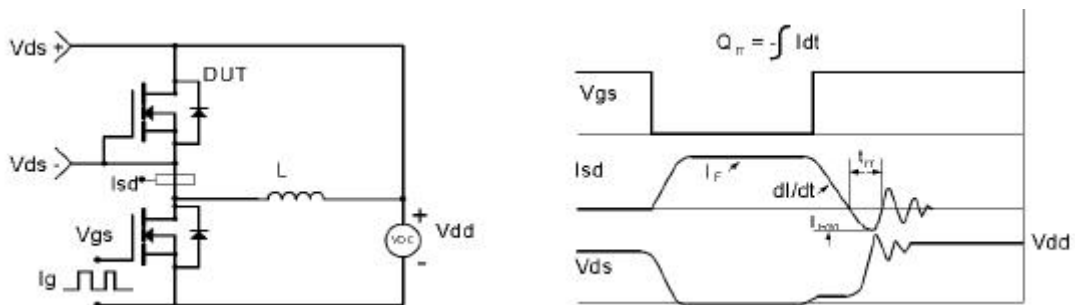
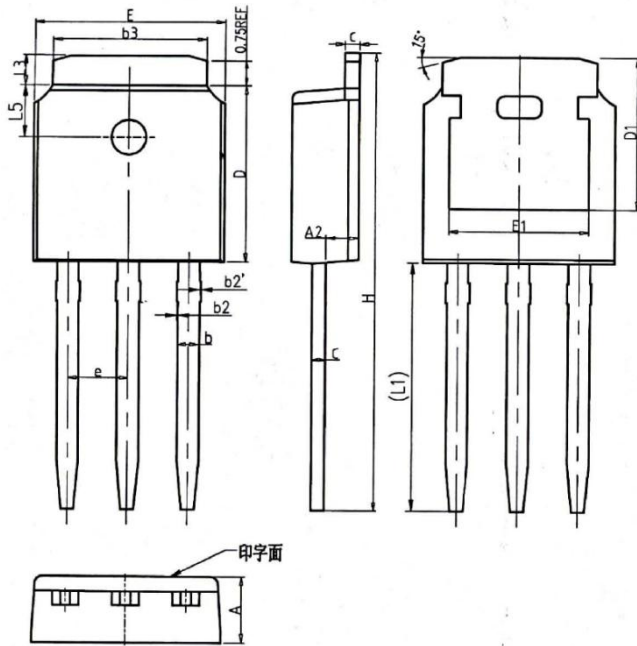


Figure 11. Diode Recovery Circuit & Waveform

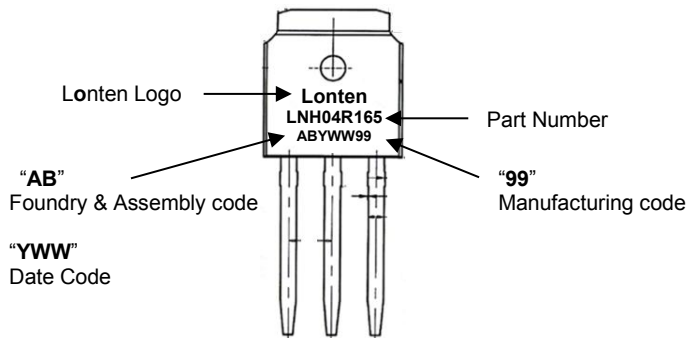


**Mechanical Dimensions for TO-251**

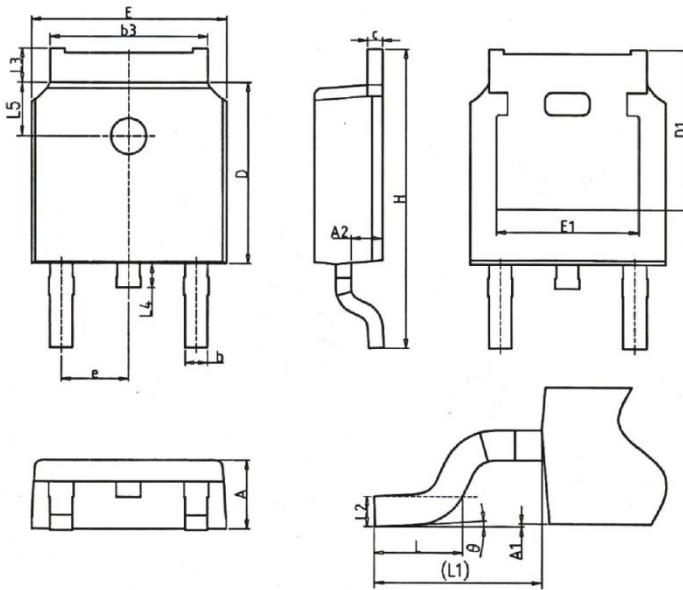


| COMMON DIMENSIONS |          |       |       |          |       |       |
|-------------------|----------|-------|-------|----------|-------|-------|
| SYMBOL            | MM       |       |       | INCH     |       |       |
|                   | MIN      | NOM   | MAX   | MIN      | NOM   | MAX   |
| A                 | 2.20     | 2.30  | 2.38  | 0.087    | 0.091 | 0.094 |
| A2                | 0.97     | 1.07  | 1.17  | 0.038    | 0.042 | 0.046 |
| b                 | 0.68     | 0.78  | 0.90  | 0.027    | 0.031 | 0.035 |
| b2                | 0.00     | 0.04  | 0.10  | 0.000    | 0.002 | 0.004 |
| b2'               | 0.00     | 0.04  | 0.10  | 0.000    | 0.002 | 0.004 |
| b3                | 5.20     | 5.33  | 5.46  | 0.205    | 0.210 | 0.215 |
| c                 | 0.43     | 0.53  | 0.61  | 0.017    | 0.021 | 0.024 |
| D                 | 5.98     | 6.10  | 6.22  | 0.235    | 0.240 | 0.245 |
| D1                | 5.30REF  |       |       | 0.209REF |       |       |
| E                 | 6.40     | 6.60  | 6.73  | 0.252    | 0.260 | 0.265 |
| E1                | 4.63     | -     | -     | 0.182    | -     | -     |
| e                 | 2.286BSC |       |       | 0.090BSC |       |       |
| H                 | 16.22    | 16.52 | 16.82 | 0.639    | 0.650 | 0.662 |
| L1                | 9.15     | 9.40  | 9.65  | 0.360    | 0.370 | 0.380 |
| L3                | 0.88     | 1.02  | 1.28  | 0.035    | 0.040 | 0.050 |
| L5                | 1.65     | 1.80  | 1.95  | 0.065    | 0.071 | 0.077 |

**TO-251 Part Marking Information**

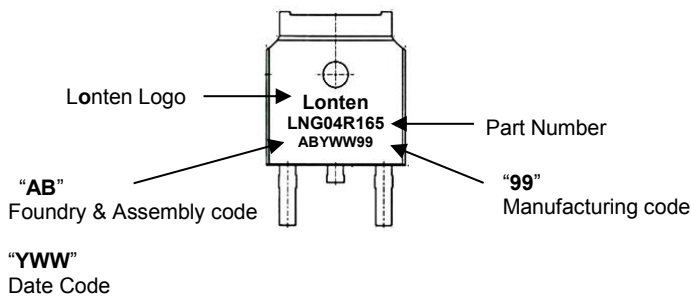


**Mechanical Dimensions for TO-252**



| COMMON DIMENSIONS |          |       |       |          |       |       |
|-------------------|----------|-------|-------|----------|-------|-------|
| SYMBOL            | MM       |       |       | INCH     |       |       |
|                   | MIN      | NOM   | MAX   | MIN      | NOM   | MAX   |
| A                 | 2.20     | 2.30  | 2.38  | 0.087    | 0.091 | 0.094 |
| A1                | 0.00     | -     | 0.20  | 0.000    | -     | 0.008 |
| A2                | 0.97     | 1.07  | 1.17  | 0.038    | 0.042 | 0.046 |
| b                 | 0.68     | 0.78  | 0.90  | 0.027    | 0.031 | 0.035 |
| b3                | 5.20     | 5.33  | 5.46  | 0.205    | 0.210 | 0.215 |
| c                 | 0.43     | 0.53  | 0.61  | 0.017    | 0.021 | 0.024 |
| D                 | 5.98     | 6.10  | 6.22  | 0.235    | 0.240 | 0.245 |
| D1                | 5.30REF  |       |       | 0.209REF |       |       |
| E                 | 6.40     | 6.60  | 6.73  | 0.252    | 0.260 | 0.265 |
| E1                | 4.63     | -     | -     | 0.182    | -     | -     |
| e                 | 2.286BSC |       |       | 0.090BSC |       |       |
| H                 | 9.40     | 10.10 | 10.50 | 0.370    | 0.398 | 0.413 |
| L                 | 1.38     | 1.50  | 1.75  | 0.054    | 0.059 | 0.069 |
| L1                | 2.90REF  |       |       | 0.114REF |       |       |
| L2                | 0.51BSC  |       |       | 0.020BSC |       |       |
| L3                | 0.88     | -     | 1.28  | 0.035    | -     | 0.050 |
| L4                | 0.50     | -     | 1.00  | 0.020    | -     | 0.039 |
| L5                | 1.65     | 1.80  | 1.95  | 0.065    | 0.071 | 0.077 |
| θ                 | 0°       | -     | 8°    | 0°       | -     | 8°    |

**TO-252 Part Marking Information**



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