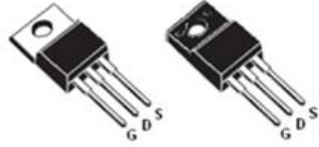
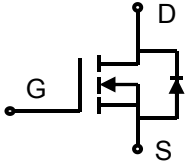


## Lonten N-channel 600V, 16A Power MOSFET

|   |  |           |      |       |     |                  |              |             |         |
|---|--|-----------|------|-------|-----|------------------|--------------|-------------|---------|
| <p><b>Description</b><br/>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 = 53.2</math> nC)</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>600V</td> </tr> <tr> <td><math>I_D</math></td> <td>16A</td> </tr> <tr> <td><math>R_{DS(on),max}</math></td> <td>0.5<math>\Omega</math></td> </tr> <tr> <td><math>Q_{g,typ}</math></td> <td>53.2 nC</td> </tr> </table> <div style="text-align: center;">  <p>TO-220      TO-220F</p>  <p>N-Channel MOSFET</p> </div> | $V_{DSS}$ | 600V | $I_D$ | 16A | $R_{DS(on),max}$ | 0.5 $\Omega$ | $Q_{g,typ}$ | 53.2 nC |
| $V_{DSS}$   | 600V   |           |      |       |     |                  |              |             |         |
| $I_D$   | 16A  |           |      |       |     |                  |              |             |         |
| $R_{DS(on),max}$  | 0.5 $\Omega$   |           |      |       |     |                  |              |             |         |
| $Q_{g,typ}$   | 53.2 nC  |           |      |       |     |                  |              |             |         |

### Absolute Maximum Ratings

| Parameter  | Symbol         | Value       | Unit                |
|--|----------------|-------------|---------------------|
| Drain-Source Voltage                                   | $V_{DSS}$      | 600         | V                   |
| Continuous drain current ( $T_C = 25^\circ\text{C}$ )  | $I_D$          | 16          | A                   |
| ( $T_C = 100^\circ\text{C}$ )                          |                | 11.5        | A                   |
| Pulsed drain current <sup>1)</sup>                     | $I_{DM}$       | 64          | A                   |
| Gate-Source voltage                                    | $V_{GSS}$      | $\pm 30$    | V                   |
| Avalanche energy, single pulse <sup>2)</sup>           | $E_{AS}$       | 720         | mJ                  |
| Peak diode recovery $dv/dt$ <sup>3)</sup>              | $dv/dt$        | 5           | V/ns                |
| Power Dissipation TO-220F ( $T_C = 25^\circ\text{C}$ ) | $P_D$          | 44          | W                   |
| Derate above $25^\circ\text{C}$                        |                | 0.35        | W/ $^\circ\text{C}$ |
| Power Dissipation TO-220 ( $T_C = 25^\circ\text{C}$ )  | $P_D$          | 180         | W                   |
| Derate above $25^\circ\text{C}$                        |                | 1.44        | W/ $^\circ\text{C}$ |
| Operating junction and storage temperature range       | $T_J, T_{STG}$ | -55 to +150 | $^\circ\text{C}$    |
| Continuous diode forward current                       | $I_S$          | 16          | A                   |
| Diode pulse current                                    | $I_{S,pulse}$  | 64          | A                   |

### Thermal Characteristics

| Parameter                               | Symbol          | Value   |        | Unit                      |
|---|-----------------|---------|--------|---------------------------|
|   |                 | TO-220F | TO-220 |                           |
| Thermal resistance, Junction-to-case    | $R_{\theta JC}$ | 2.85    | 0.69   | $^\circ\text{C}/\text{W}$ |
| Thermal resistance, Junction-to-ambient | $R_{\theta JA}$ | 110     | 62.5   | $^\circ\text{C}/\text{W}$ |

**Package Marking and Ordering Information**

| Device   | Device Package | Marking  | Units/Tube | Units/Real |
|----------|----------------|----------|------------|------------|
| LNC16N60 | TO-220         | LNC16N60 | 50         |            |
| LND16N60 | TO-220F        | LND16N60 | 50         |            |

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

| Parameter                            | Symbol        | Test Condition   | Min. | Typ.  | Max.     | Unit          |
|--------------------------------------|---------------|--|------|-------|----------|---------------|
| <b>Static characteristics</b>        |               |  |      |       |          |               |
| Drain-source breakdown voltage       | $BV_{DSS}$    | $V_{GS}=0\text{ V}, I_D=0.25\text{ mA}$  | 600  | -     | -        | V             |
| Gate threshold voltage               | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=0.25\text{ mA}$  | 2    | -     | 4        | V             |
| Drain cut-off current                | $I_{DSS}$     | $V_{DS}=600\text{ V}, V_{GS}=0\text{ V},$<br>$T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ | -    | -     | 1<br>100 | $\mu\text{A}$ |
| Gate leakage current, Forward        | $I_{GSSF}$    | $V_{GS}=30\text{ V}, V_{DS}=0\text{ V}$  | -    | -     | 100      | nA            |
| Gate leakage current, Reverse        | $I_{GSSR}$    | $V_{GS}=-30\text{ V}, V_{DS}=0\text{ V}$   | -    | -     | -100     | nA            |
| Drain-source on-state resistance     | $R_{DS(on)}$  | $V_{GS}=10\text{ V}, I_D=8\text{ A}$   | -    | 0.40  | 0.5      | $\Omega$      |
| <b>Dynamic characteristics</b>       |               |  |      |       |          |               |
| Input capacitance                    | $C_{iss}$     | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1\text{ MHz}$                                 | -    | 2640  | -        | pF            |
| Output capacitance                   | $C_{oss}$     |  | -    | 230   | -        |               |
| Reverse transfer capacitance         | $C_{rss}$     |  | -    | 15    | -        |               |
| Turn-on delay time                   | $t_{d(on)}$   | $V_{DD} = 300\text{ V}, I_D = 16\text{ A}$<br>$R_G = 10\ \Omega, V_{GS}=15\text{ V}$               | -    | 13.3  | -        | ns            |
| Rise time                            | $t_r$         |  | -    | 39.0  | -        |               |
| Turn-off delay time                  | $t_{d(off)}$  |  | -    | 88.2  | -        |               |
| Fall time                            | $t_f$         |  | -    | 16.5  | -        |               |
| <b>Gate charge characteristics</b>   |               |  |      |       |          |               |
| Gate to source charge                | $Q_{gs}$      | $V_{DD}=480\text{ V}, I_D=16\text{ A},$<br>$V_{GS}=0\text{ to }10\text{ V}$                        | -    | 13.5  | -        | nC            |
| Gate to drain charge                 | $Q_{gd}$      |  | -    | 18.2  | -        |               |
| Gate charge total                    | $Q_g$         |  | -    | 53.2  | -        |               |
| Gate plateau voltage                 | $V_{plateau}$ |  | -    | 5     | -        | V             |
| <b>Reverse diode characteristics</b> |               |  |      |       |          |               |
| Diode forward voltage                | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=16\text{ A}$   | -    | -     | 1.5      | V             |
| Reverse recovery time                | $t_{rr}$      | $V_R=300\text{ V}, I_F=16\text{ A},$<br>$di_F/dt=100\text{ A}/\mu\text{s}$                         | -    | 419.2 | -        | ns            |
| Reverse recovery charge              | $Q_{rr}$      |  | -    | 4.86  | -        | $\mu\text{C}$ |
| Peak reverse recovery current        | $I_{rrm}$     |  | -    | 23.2  | -        | A             |

**Notes:**

- Pulse width limited by maximum junction temperature.
- $L=10\text{mH}, I_{AS} = 12\text{A}$ , Starting  $T_j= 25^\circ\text{C}$ .
- $I_{SD} = 16\text{A}, di/dt \leq 100\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_j= 25^\circ\text{C}$ .

## Electrical Characteristics Diagrams

Figure 1. Typical Output Characteristics

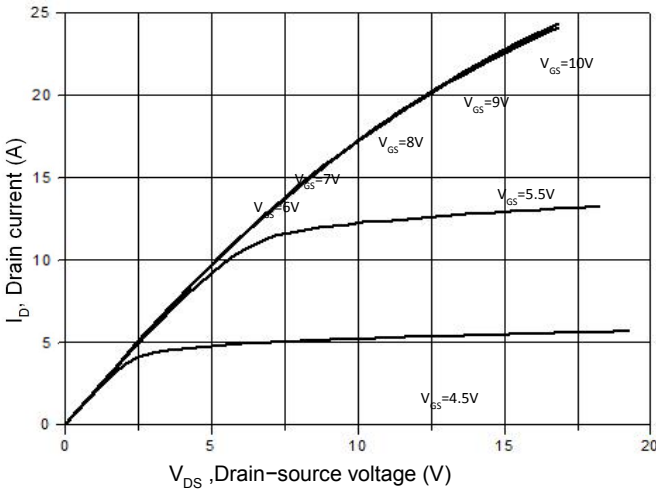


Figure 3. On-Resistance Variation vs. Drain Current

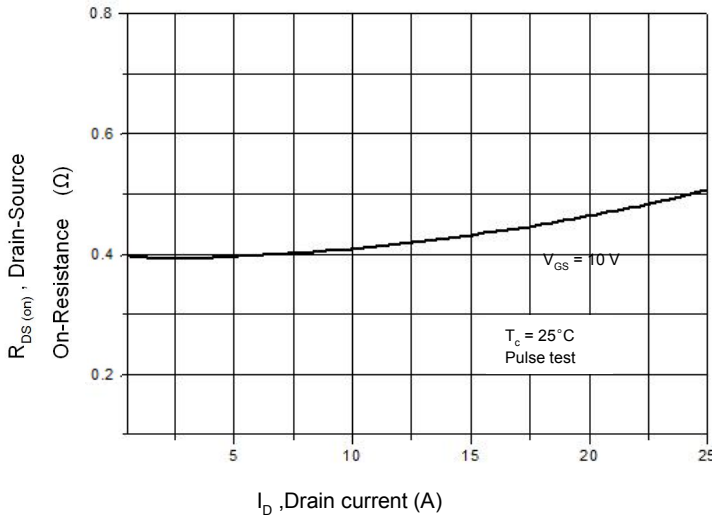


Figure 5. Breakdown Voltage vs. Temperature

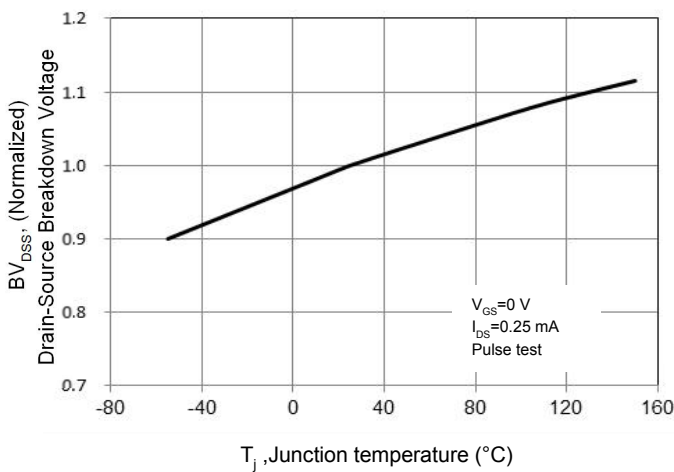


Figure 2. Transfer Characteristics

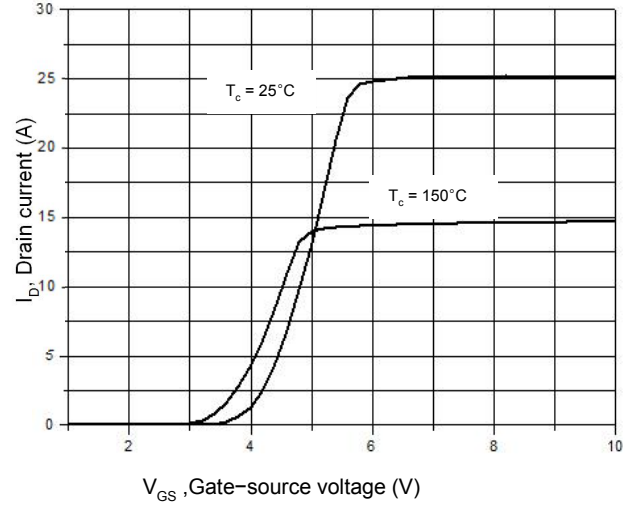


Figure 4. Threshold Voltage vs. Temperature

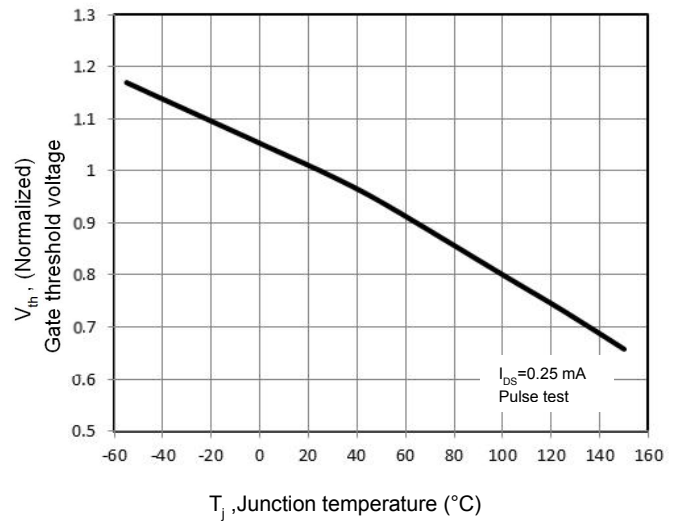


Figure 6. On-Resistance vs. Temperature

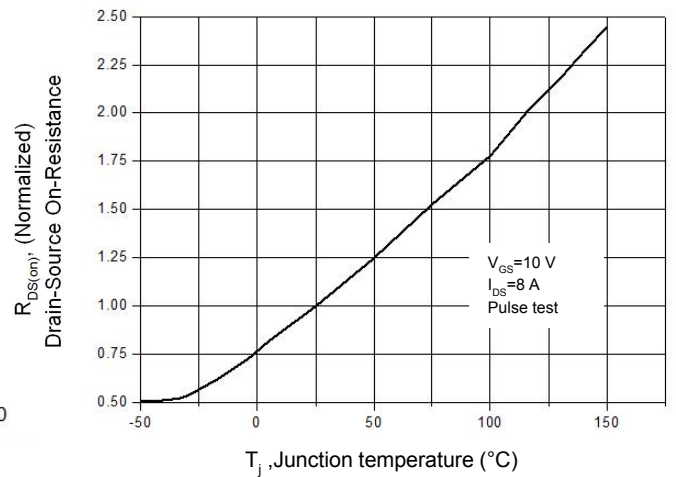


Figure 7. Capacitance Characteristics

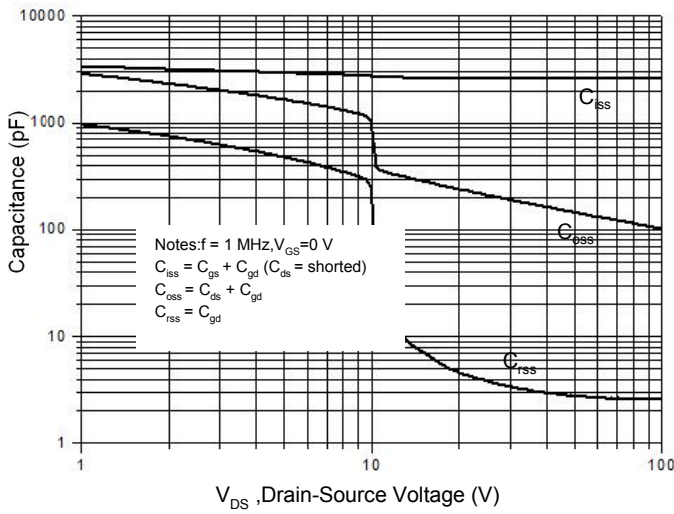


Figure 8. Gate Charge Characteristics

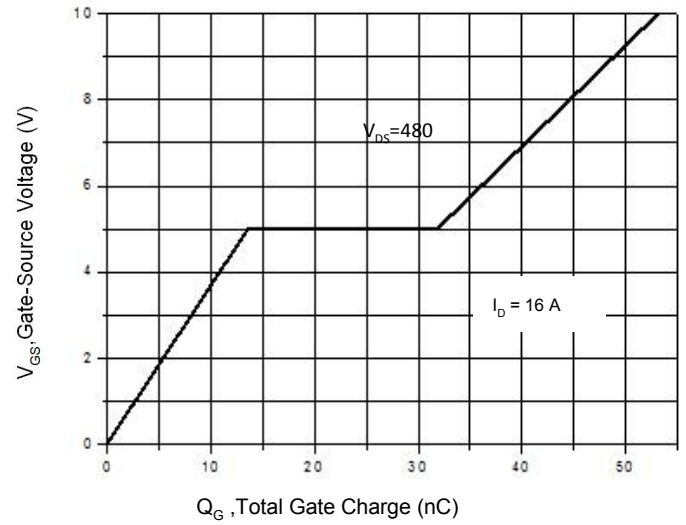


Figure 9. Maximum Safe Operating Area  
TO-220F

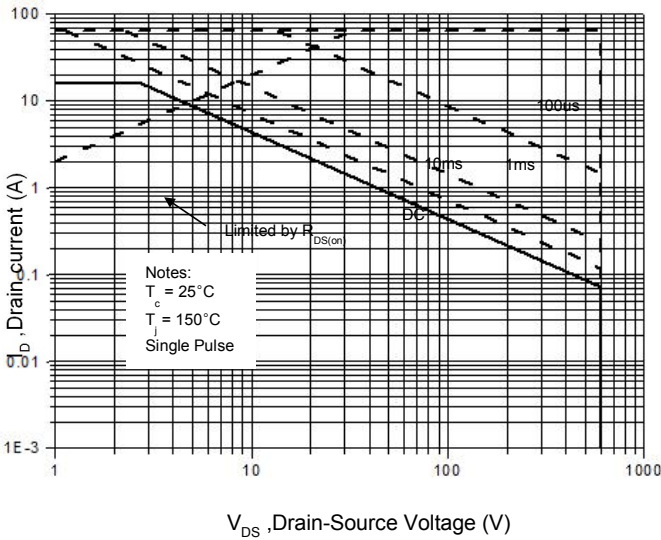


Figure 10. Maximum Safe Operating Area  
TO-220

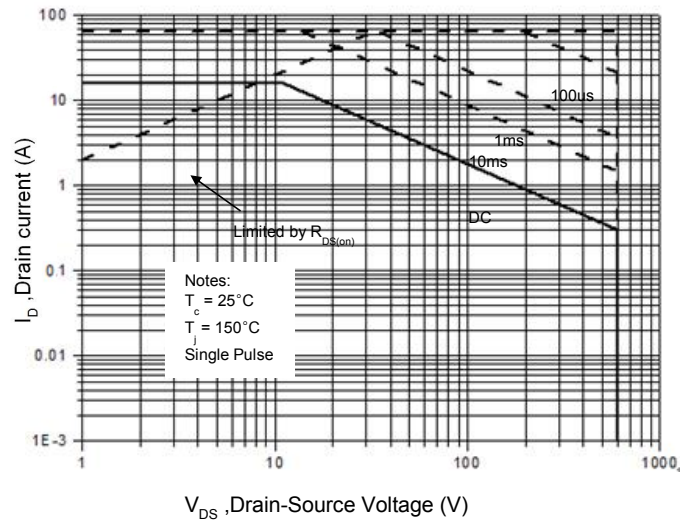


Figure 11. Power Dissipation vs. Temperature  
TO-220F

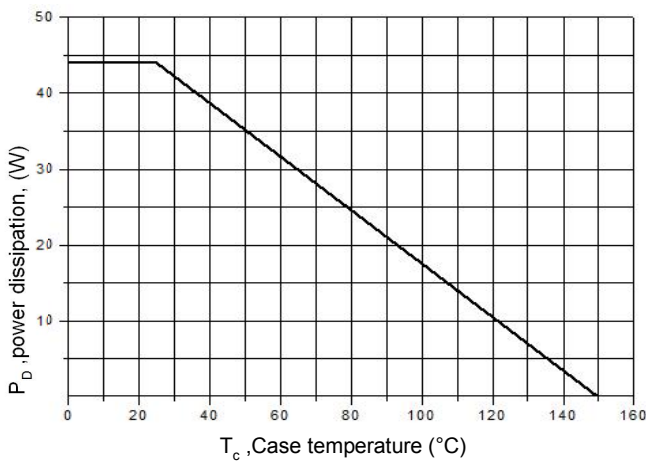


Figure 12. Power Dissipation vs. Temperature  
TO-220

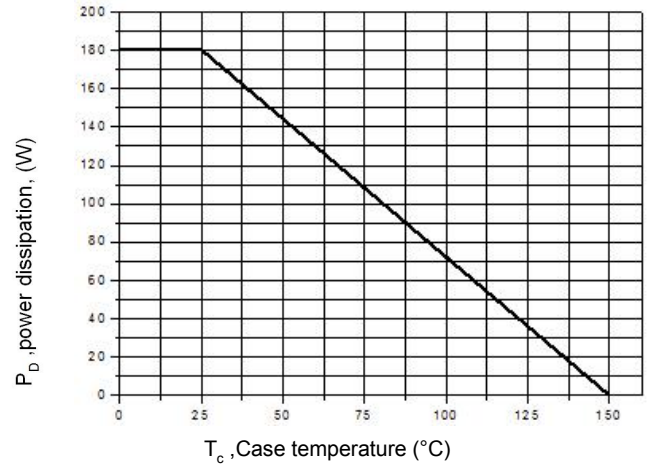


Figure 13. Continuous Drain Current vs. Temperature

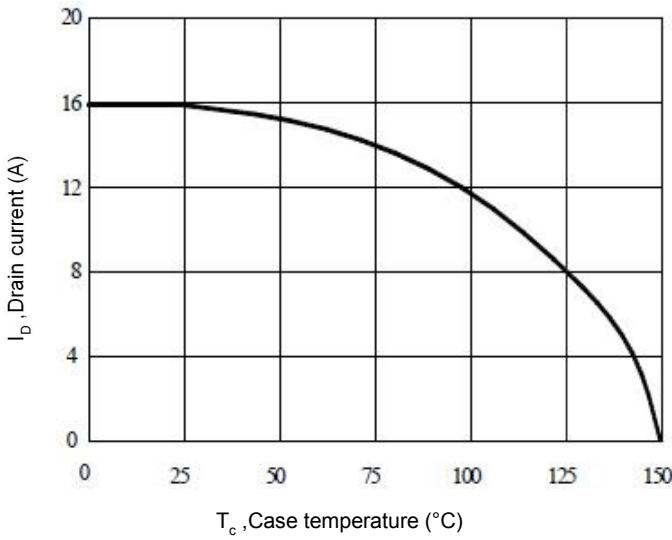


Figure 14. Body Diode Transfer Characteristics

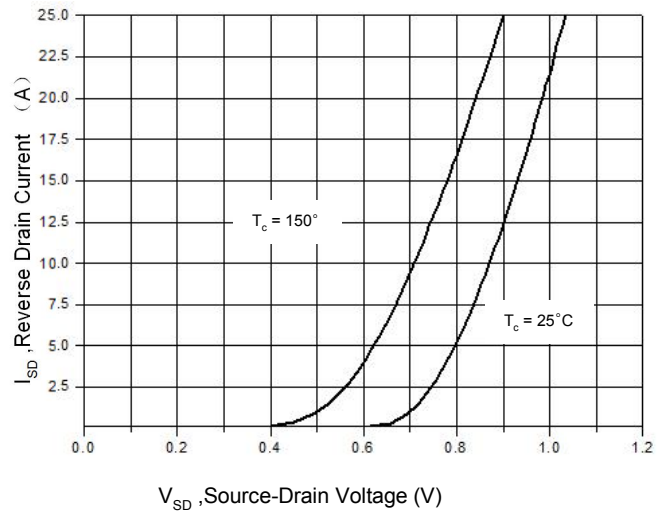


Figure 15 Transient Thermal Impedance, Junction to Case, TO-220F

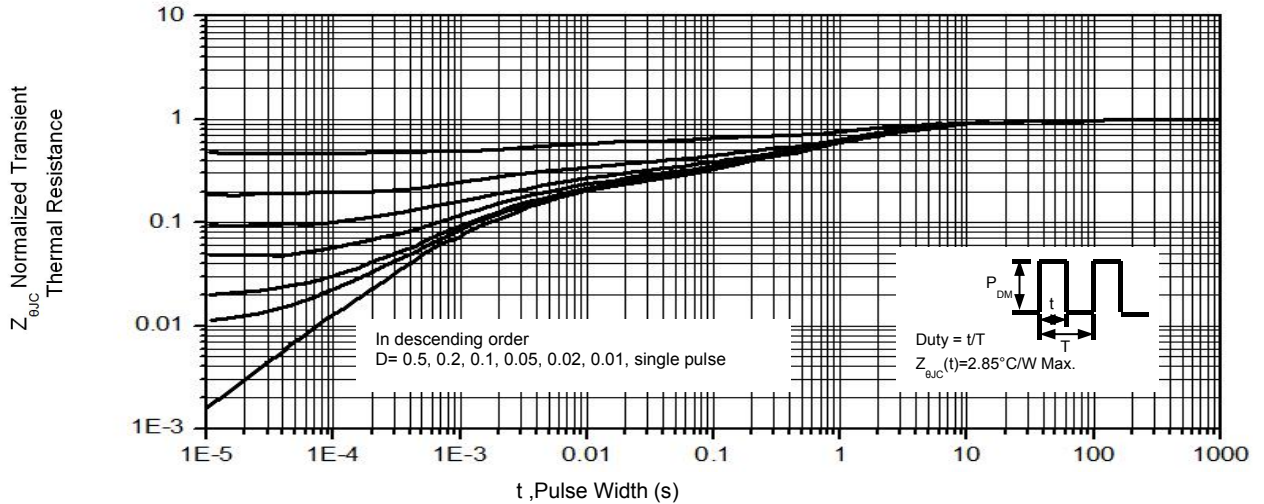
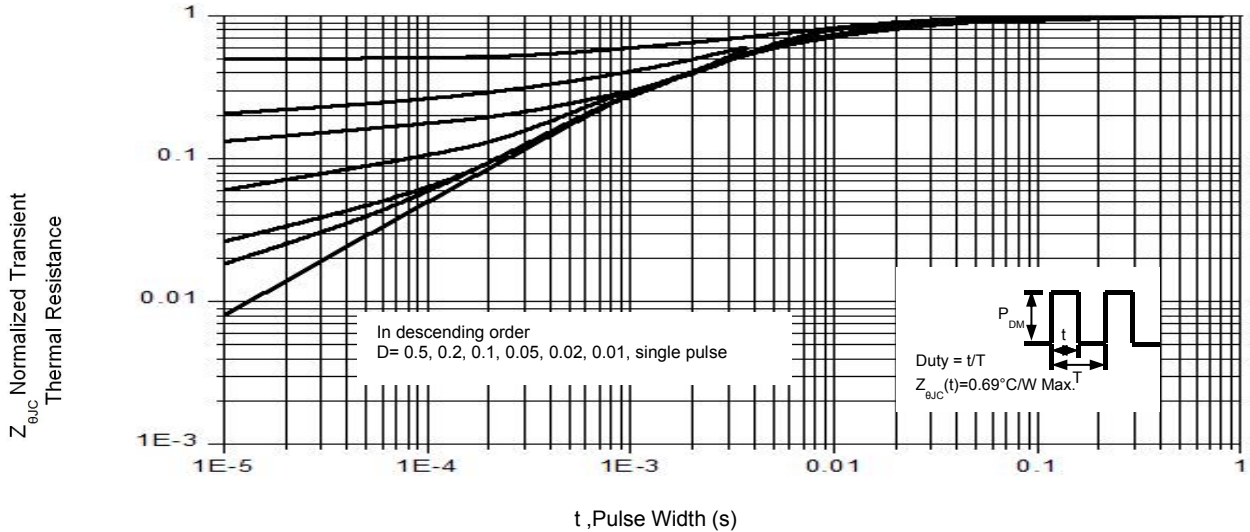
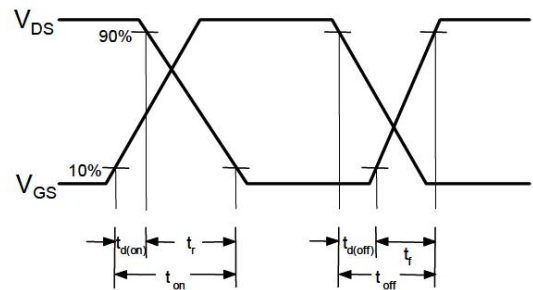
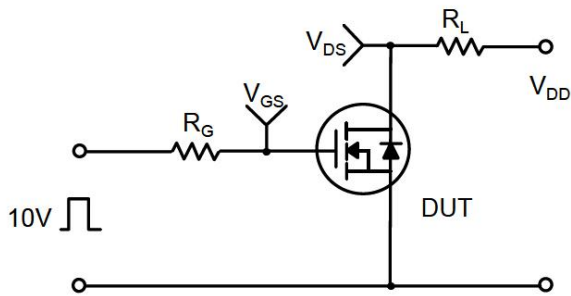
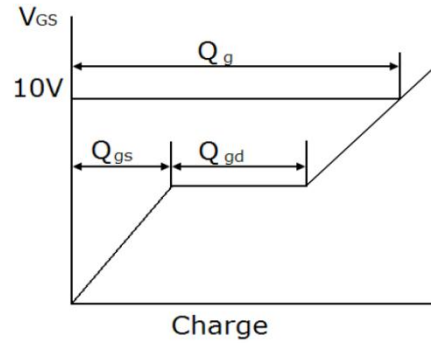


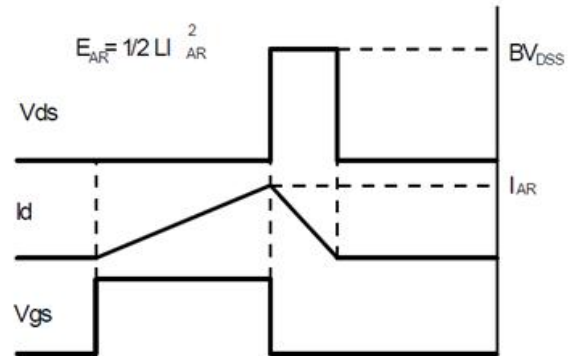
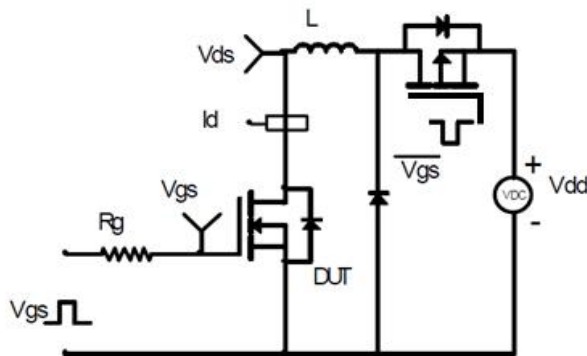
Figure 16. Transient Thermal Impedance, Junction to Case, TO-220



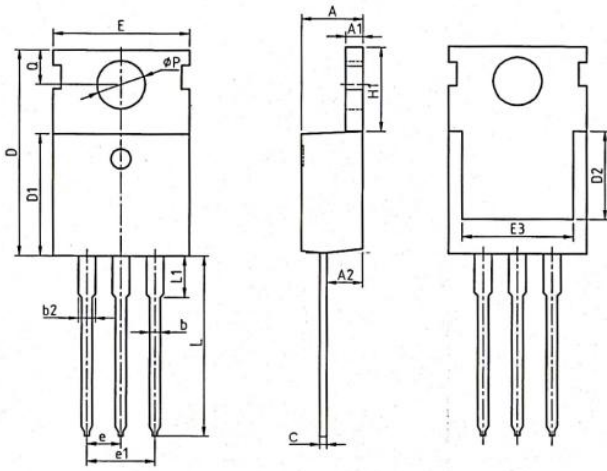
**Gate Charge Test Circuit & Waveform**



**Unclamped Inductive Switching Test Circuit & Waveforms**

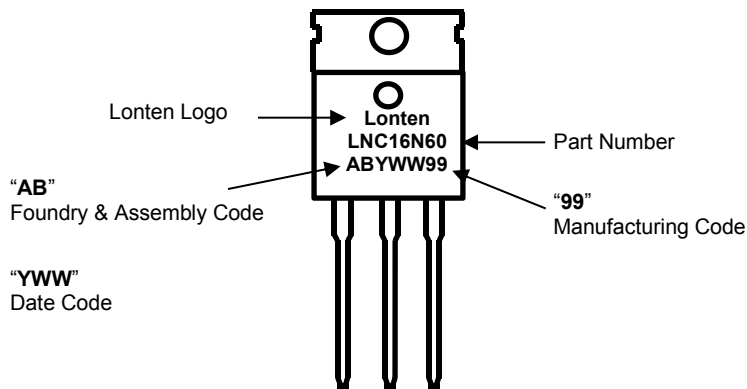


**Mechanical Dimensions for TO-220**



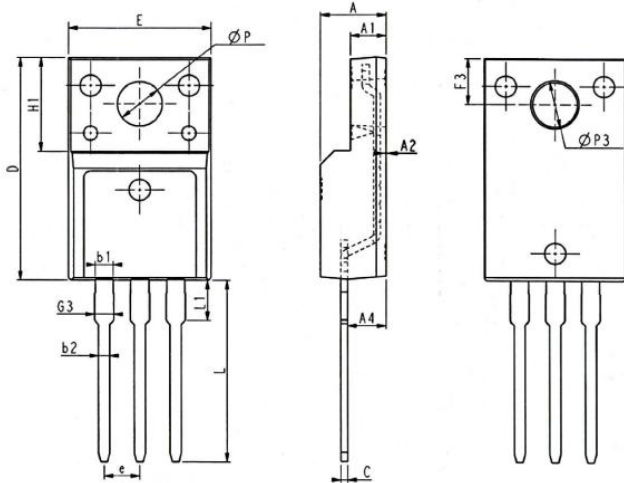
| COMMON DIMENSIONS |         |       |       |        |       |       |
|-------------------|---------|-------|-------|--------|-------|-------|
| SYMBOL            | MM      |       |       | INCH   |       |       |
|                   | MIN     | NOM   | MAX   | MIN    | NOM   | MAX   |
| A                 | 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**



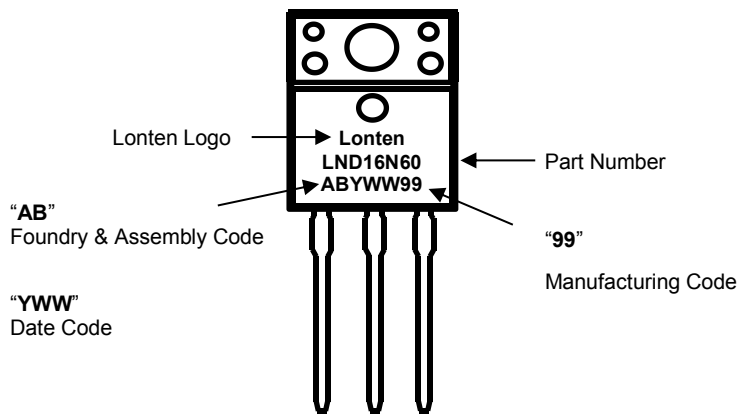


**Mechanical Dimensions for TO-220F**



| SYMBOL | COMMON DIMENSIONS |       |       |          |       |       |
|--------|-------------------|-------|-------|----------|-------|-------|
|        | 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**





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