



## IRF740

N-channel 400V - 0.46Ω - 10A TO-220  
PowerMESH™ II Power MOSFET

### General features

| Type   | V <sub>DSS</sub><br>(@T <sub>jmax</sub> ) | R <sub>DS(on)</sub> | I <sub>D</sub> |
|--------|-------------------------------------------|---------------------|----------------|
| IRF740 | 400V                                      | <0.55Ω              | 10A            |

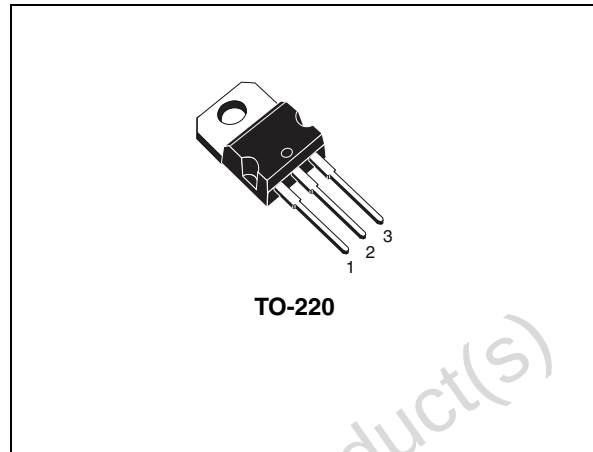
- Exceptional dv/dt capability
- 100% avalanche tested
- Low gate charge
- Very low intrinsic capacitances

### Description

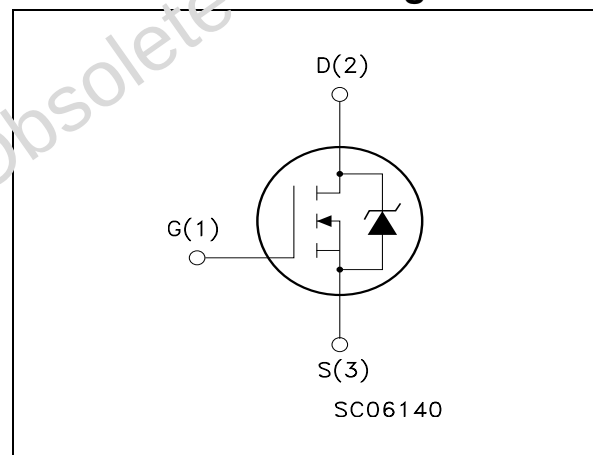
The PowerMESH™II is the evolution of the first generation of MESH OVERLAY™. The layout refinements introduced greatly improve the Ron\*area figure of merit while keeping the device at the leading edge for what concerns switching speed, gate charge and ruggedness.

### Applications

- Switching application



### Internal schematic diagram



### Order codes

| Part number | Marking | Package | Packaging |
|-------------|---------|---------|-----------|
| IRF740      | IRF740@ | TO-220  | Tube      |

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Obsolete Product(s) - Obsolete Product(s)

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol         | Parameter                                               | Value      | Unit                |
|----------------|---------------------------------------------------------|------------|---------------------|
| $V_{DS}$       | Drain-source voltage ( $V_{GS} = 0$ )                   | 400        | V                   |
| $V_{DGR}$      | Drain-gate voltage ( $R_{GS} = 20\text{ k}\Omega$ )     | 400        | V                   |
| $V_{GS}$       | Gate- source voltage                                    | $\pm 20$   | V                   |
| $I_D$          | Drain current (continuous) at $T_C = 25^\circ\text{C}$  | 10         | A                   |
| $I_D$          | Drain current (continuous) at $T_C = 100^\circ\text{C}$ | 6.3        | A                   |
| $I_{DM}^{(1)}$ | Drain current (pulsed)                                  | 40         | A                   |
| $P_{tot}$      | Total dissipation at $T_C = 25^\circ\text{C}$           | 125        | W                   |
|                | Derating Factor                                         | 1.0        | W/ $^\circ\text{C}$ |
| $dv/dt^{(2)}$  | Peak diode recovery voltage slope                       | 4.0        | V/ns                |
| $T_{stg}$      | Storage temperature                                     | -65 to 150 | $^\circ\text{C}$    |
| $T_j$          | Max. operating junction temperature                     |            |                     |

1. Pulse width limited by safe operating area.

2.  $I_{SD} \leq 0\text{A}$ ,  $di/dt \leq 300\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_j \leq T_{JMAX}$

**Table 2. Thermal data**

|                |                                                |      |                           |
|----------------|------------------------------------------------|------|---------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case max           | 1    | $^\circ\text{C}/\text{W}$ |
| $R_{thj-amb}$  | Thermal resistance junction-ambient max        | 62.5 | $^\circ\text{C}/\text{W}$ |
| $T_J$          | Maximum lead temperature for soldering purpose | 300  | $^\circ\text{C}$          |

**Table 3. Avalanche characteristics**

| Symbol   | Parameter                                                                                             | Value | Unit |
|----------|-------------------------------------------------------------------------------------------------------|-------|------|
| $I_{AR}$ | Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ Max)                    | 10    | A    |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_j=25^\circ\text{C}$ , $I_d=I_{AR}$ , $V_{dd}=50\text{V}$ ) | 520   | mJ   |

## 2 Electrical characteristics

( $T_{CASE}=25^{\circ}\text{C}$  unless otherwise specified)

**Table 4. On/off states**

| Symbol        | Parameter                                        | Test conditions                                                                       | Min. | Typ. | Max.      | Unit                           |
|---------------|--------------------------------------------------|---------------------------------------------------------------------------------------|------|------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage                   | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$                                               | 400  |      |           | V                              |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max rating}$ ,<br>$V_{DS} = \text{Max rating @ } 125^{\circ}\text{C}$ |      |      | 1<br>50   | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20\text{V}$                                                             |      |      | $\pm 100$ | nA                             |
| $V_{GS(th)}$  | Gate threshold voltage                           | $V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$                                          | 2    | 3    | 4         | V                              |
| $R_{DS(on)}$  | Static drain-source on resistance                | $V_{GS} = 10\text{V}$ , $I_D = 5.3\text{A}$                                           |      | 0.46 | 0.55      | $\Omega$                       |

**Table 5. Dynamic**

| Symbol                              | Parameter                                                               | Test conditions                                                                                              | Min. | Typ.              | Max. | Unit           |
|-------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|------|-------------------|------|----------------|
| $g_{fs}^{(1)}$                      | Forward transconductance                                                | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$ ,<br>$I_D = 6\text{A}$                                             |      | 7                 |      | S              |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS} = 25\text{V}$ , $f = 1\text{ MHz}$ ,<br>$V_{GS} = 0$                                                 |      | 1400<br>220<br>27 |      | pF<br>pF<br>pF |
| $t_{d(on)}$<br>$t_r$                | Turn-on delay time<br>Rise Time                                         | $V_{DD} = 200\text{V}$ , $I_D = 5\text{A}$ ,<br>$R_G = 4.7\Omega$ , $V_{GS} = 10\text{V}$<br>(see Figure 12) |      | 17<br>10          |      | ns<br>ns       |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$       | Total gate charge<br>Gate-source charge<br>Gate-drain charge            | $V_{DD} = 320\text{V}$ , $I_D = 10.7\text{A}$<br>$V_{GS} = 10\text{V}$                                       |      | 35<br>11<br>12    | 43   | nC<br>nC<br>nC |

1. Pulsed: pulse duration=300 $\mu\text{s}$ , duty cycle 1.5%

**Table 6. Source drain diode**

| Symbol                            | Parameter                                                                    | Test conditions                                                                                   | Min | Typ.             | Max | Unit               |
|-----------------------------------|------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-----|------------------|-----|--------------------|
| $I_{SD}$                          | Source-drain current                                                         |                                                                                                   |     |                  | 10  | A                  |
| $I_{SDM}^{(1)}$                   | Source-drain current (pulsed)                                                |                                                                                                   |     |                  | 40  | A                  |
| $V_{SD}^{(2)}$                    | Forward on voltage                                                           | $I_{SD}=10A$ , $V_{GS}=0$                                                                         |     |                  | 1.6 | V                  |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}=10A$ ,<br>$di/dt = 100A/\mu s$ ,<br>$V_{DD}=100V$ , $T_J=150^{\circ}C$<br>(see Figure 12) |     | 370<br>3.2<br>17 |     | ns<br>$\mu C$<br>A |

1. Pulse width limited by safe operating area

2. Pulsed: pulse duration=300 $\mu s$ , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

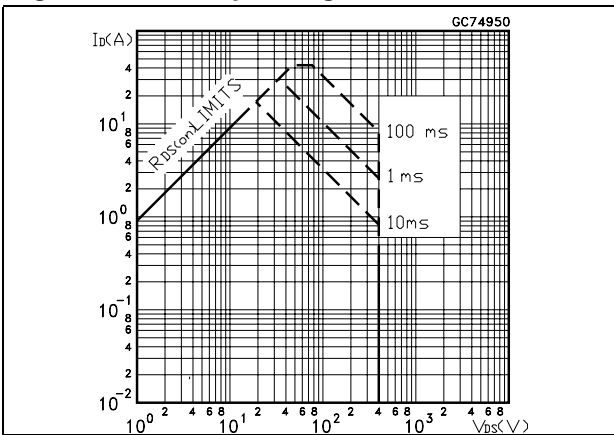


Figure 2. Thermal impedance

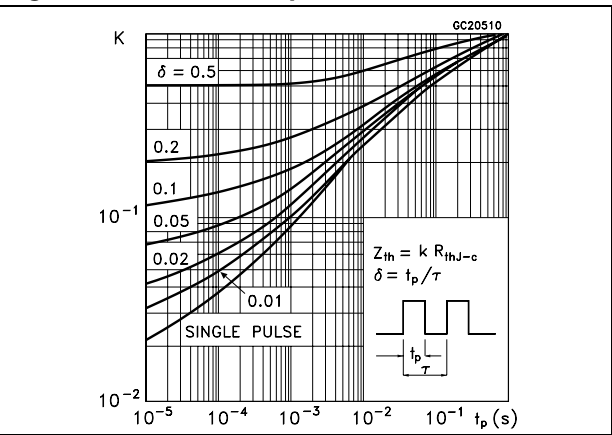


Figure 3. Output characteristics

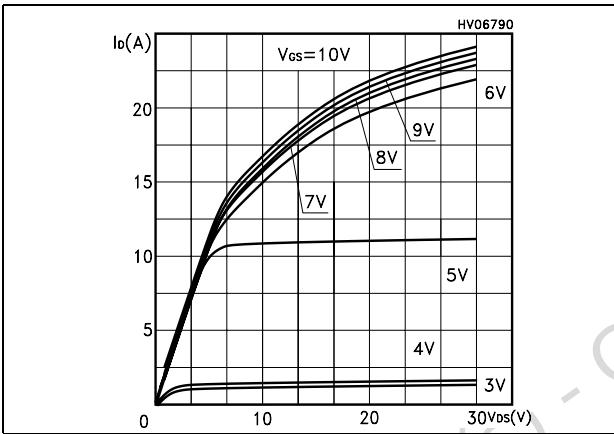


Figure 4. Transfer characteristics

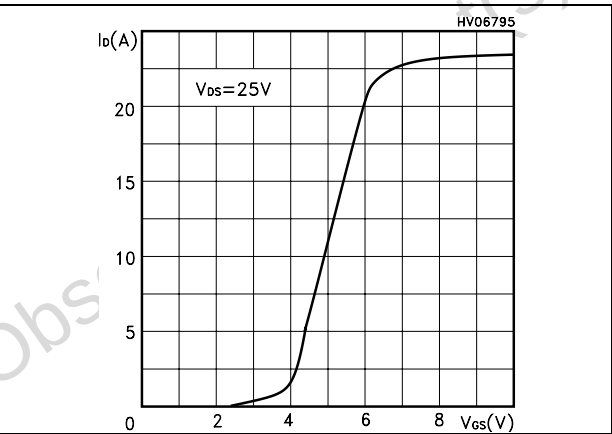


Figure 5. Transconductance

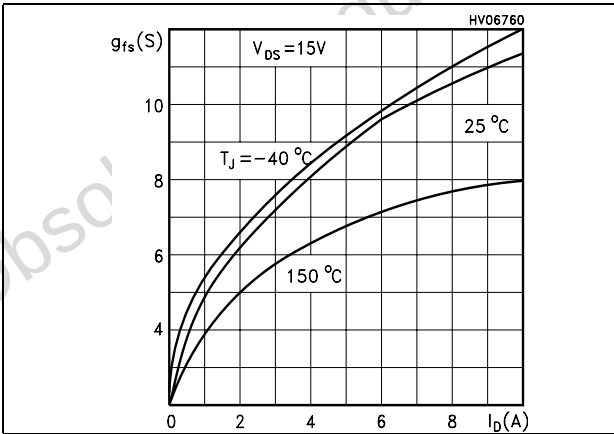


Figure 6. Static drain-source on resistance

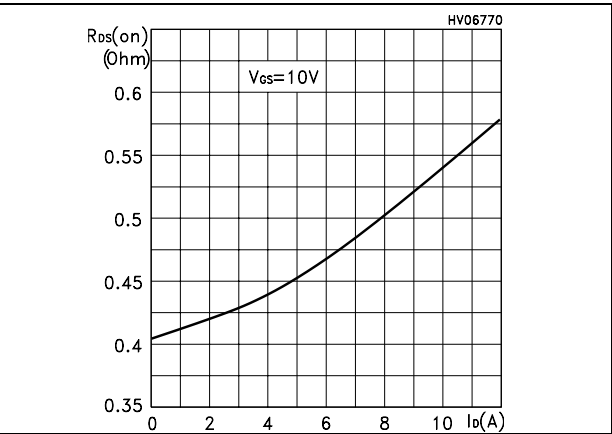


Figure 7. Gate charge vs gate-source voltage    Figure 8. Capacitance variations

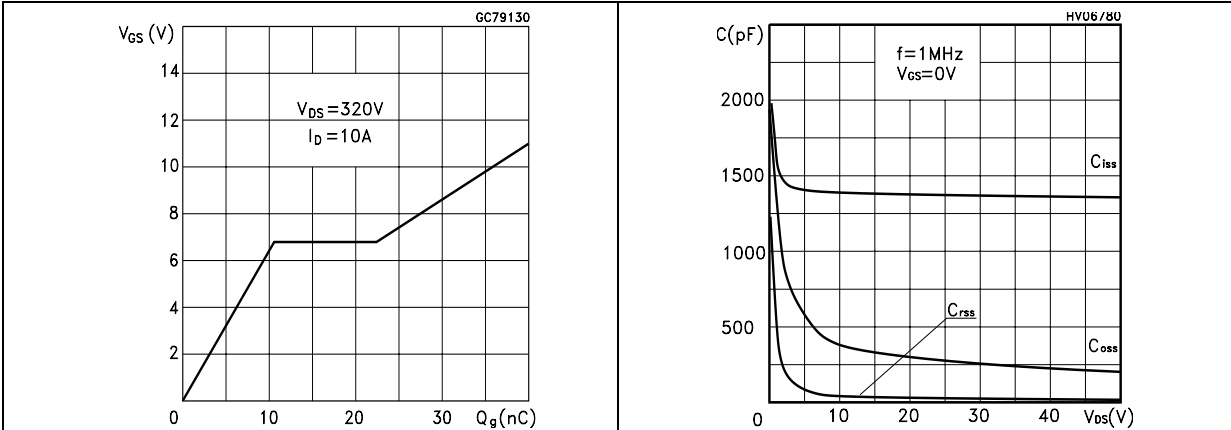


Figure 9. Normalized gate threshold voltage vs temperature    Figure 10. Normalized on resistance vs temperature

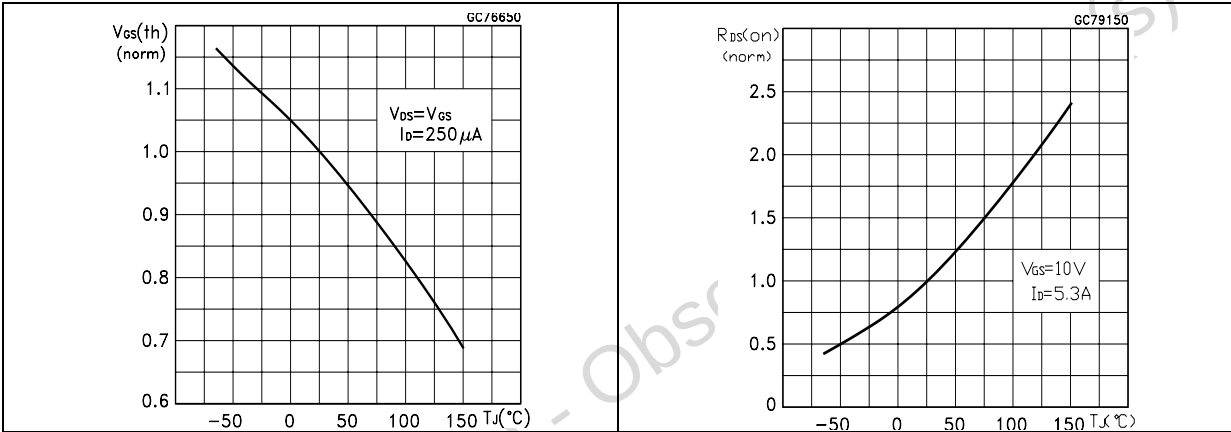
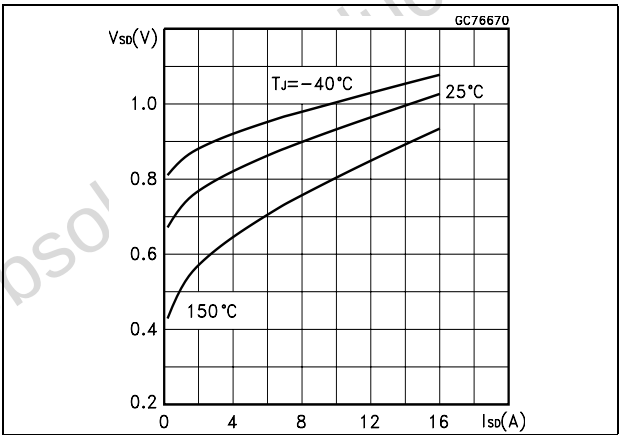


Figure 11. Source-drain diode forward characteristics



### 3 Test circuit

Figure 12. Switching times test circuit for resistive load

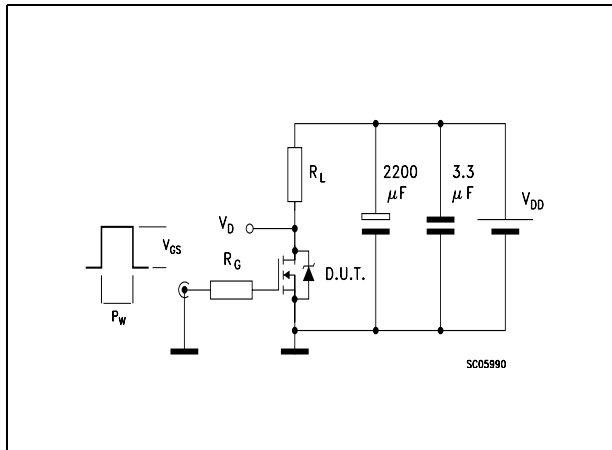


Figure 13. Gate charge test circuit

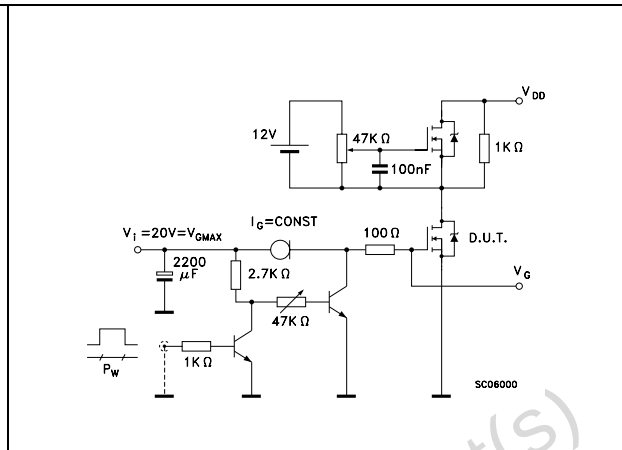


Figure 14. Test circuit for inductive load switching and diode recovery times

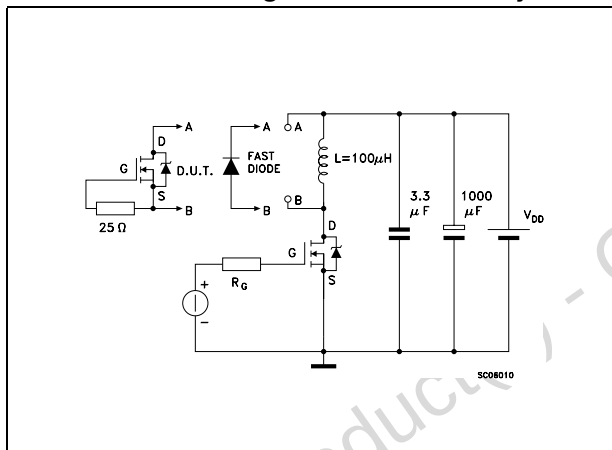


Figure 15. Unclamped Inductive load test circuit

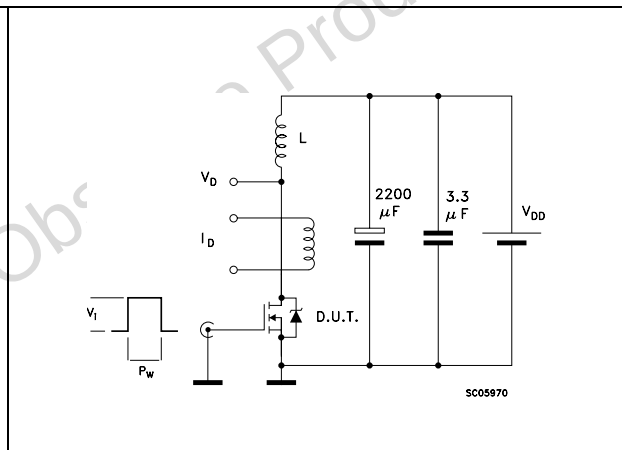


Figure 16. Unclamped inductive waveform

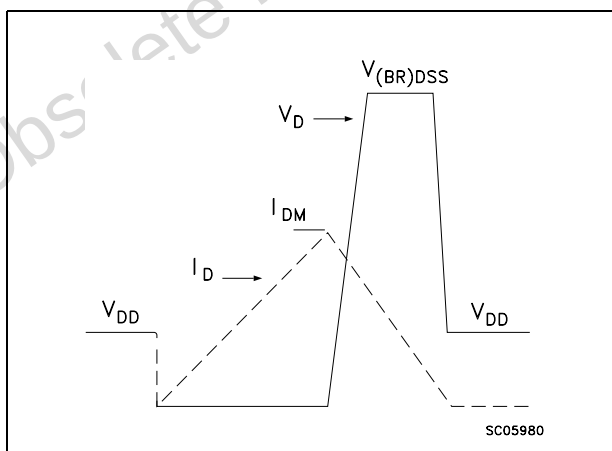
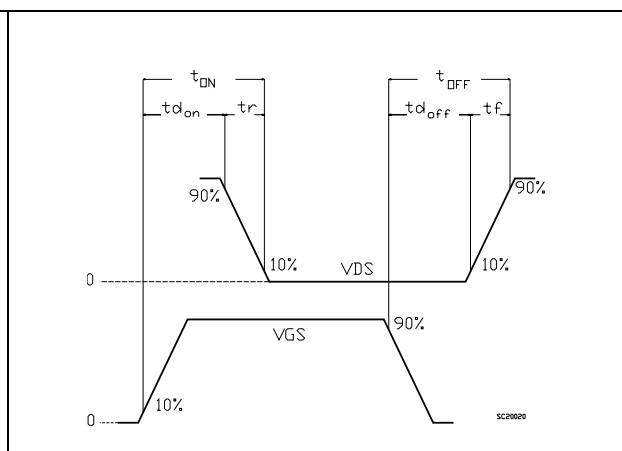


Figure 17. Switching time waveform



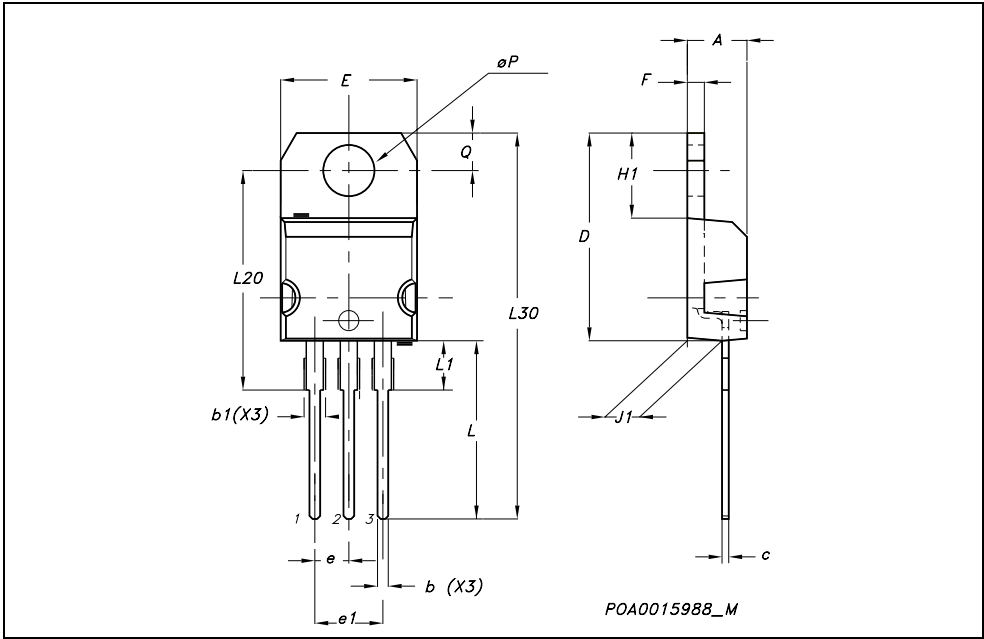
## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

Obsolete Product(s) - Obsolete Product(s)

| TO-220 MECHANICAL DATA |
|------------------------|
|------------------------|

| DIM. | mm.   |       |       | inch  |       |       |
|------|-------|-------|-------|-------|-------|-------|
|      | MIN.  | TYP   | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.40  |       | 4.60  | 0.173 |       | 0.181 |
| b    | 0.61  |       | 0.88  | 0.024 |       | 0.034 |
| b1   | 1.15  |       | 1.70  | 0.045 |       | 0.066 |
| c    | 0.49  |       | 0.70  | 0.019 |       | 0.027 |
| D    | 15.25 |       | 15.75 | 0.60  |       | 0.620 |
| E    | 10    |       | 10.40 | 0.393 |       | 0.409 |
| e    | 2.40  |       | 2.70  | 0.094 |       | 0.106 |
| e1   | 4.95  |       | 5.15  | 0.194 |       | 0.202 |
| F    | 1.23  |       | 1.32  | 0.048 |       | 0.052 |
| H1   | 6.20  |       | 6.60  | 0.244 |       | 0.256 |
| J1   | 2.40  |       | 2.72  | 0.094 |       | 0.107 |
| L    | 13    |       | 14    | 0.511 |       | 0.551 |
| L1   | 3.50  |       | 3.93  | 0.137 |       | 0.154 |
| L20  |       | 16.40 |       |       | 0.645 |       |
| L30  |       | 28.90 |       |       | 1.137 |       |
| øP   | 3.75  |       | 3.85  | 0.147 |       | 0.151 |
| Q    | 2.65  |       | 2.95  | 0.104 |       | 0.116 |



## 5 Revision history

**Table 7. Revision history**

| Date        | Revision | Changes                                                                                |
|-------------|----------|----------------------------------------------------------------------------------------|
| 09-Sep-2004 | 3        | Complete version,new datasheet according to PCN DSG/CT/2C14. special marking: IRF740 @ |
| 03-Aug-2006 | 4        | New template, no content change                                                        |

Obsolete Product(s) - Obsolete Product(s)

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