



## IRF820

N-channel 500V - 2.5Ω - 4A TO-220  
PowerMesh™II MOSFET

### General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
IRF820	500V	<0.3Ω	4A

- Extremely high dv/dt capability
- 100% avalanche tested
- New high voltage benchmark
- Gate charge minimized

### Description

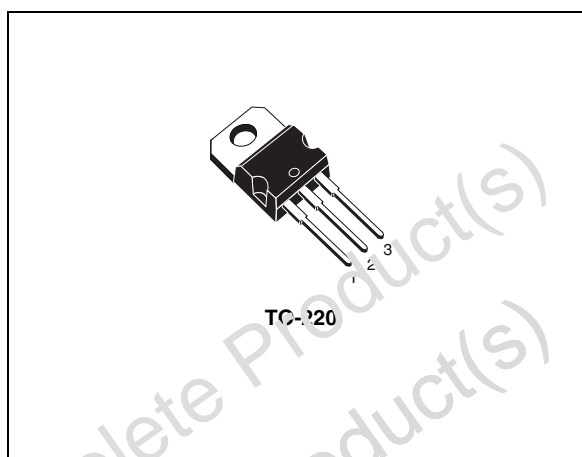
The PowerMESH™II is the evolution of the first generation of MESH OVERLAY™. The layout refinements introduced greatly improve the Ron\*area figure of merit while keeping the device at the leading edge for what concerns switching speed, gate charge and ruggedness.

### Applications

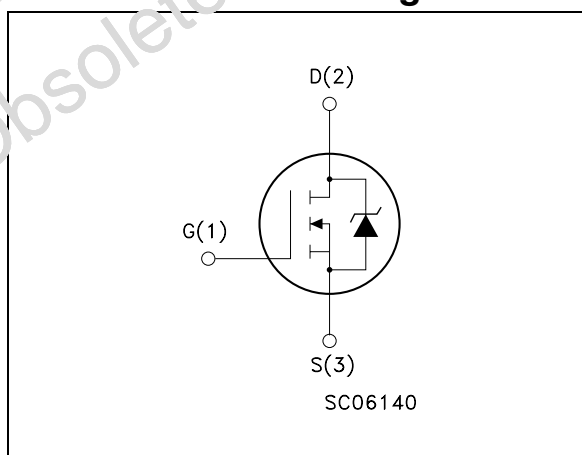
- Switching application

### Order codes

Part number	Marking	Package	Packaging
IRF820	IRF820	TO-220	Tube



### Internal schematic diagram



# Contents

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	500	V
$V_{DGR}$	Drain-gate voltage ( $R_{GS} = 20 \text{ kW}$ )	500	V
$V_{GS}$	Gate- source voltage	$\pm 30$	V
$I_D$	Drain current (continuous) at $t_c = 25^\circ\text{C}$	4	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	2.5	A
$I_{DM}^{(1)}$	Drain current (pulsed)	12	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	80	W
	Derating factor	0.64	$W/^\circ\text{C}$
$dv/dt^{(2)}$	Peak diode recovery voltage slope	3.5	V/ns
$T_{stg}$	Storage temperature	-65 to 150	$^\circ\text{C}$
$T_j$	Max. operating junction temperature	150	$^\circ\text{C}$

1. Pulse width limited by safe operating area
2.  $I_{SD} \leq 5\text{A}$ ,  $di/dt \leq 50\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_j \leq T_{j,MAX}$

**Table 2. Thermal data**

$R_{thj-case}$	Thermal resistance junction-case max	1.56	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$
$R_{thc-sink}$	Thermal resistance case-sink typ	0.5	$^\circ\text{C}/\text{W}$
$T$	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

**Table 3. Avalanche characteristics**

Symbol	Parameter	Max Value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ max)	4	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50 \text{ V}$ )	210	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	$I_D = 250 \mu\text{A}$ , $V_{GS} = 0$	500			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{max rating}$ $V_{DS} = \text{max rating}$ , $T_C = 125^{\circ}\text{C}$			1 50	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 30\text{V}$			$\pm 100$	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	$V_{GS} = 10\text{V}$ , $I_D = 1.5 \text{ A}$		2.5	3	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ , $I_D = 2\text{A}$		3		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25\text{V}$ , $f = 1 \text{ MHz}$ , $V_{GS} = 0$		315 52 7.7		pF pF pF
$t_{d(on)}$ $t_r$ $t_r(\text{off})$ $t_f$	Turn-on delay time Rise time Off-voltage rise time Fall time	$V_{DD} = 300 \text{ V}$ , $I_D = 2 \text{ A}$ $R_G = 4.7\Omega$ , $V_{GS} = 10 \text{ V}$		10 13 15 13		ns ns ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 400\text{V}$ , $I_D = 4 \text{ A}$ , $V_{GS} = 10\text{V}$		12.5 2.7 6.1	17	nC nC 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
$I_{SD}$ $I_{SDM}^{(1)}$	Source-drain Current Source-drain Current (pulsed)				4 16	A A
$V_{SD}^{(2)}$	Forward On Voltage	$I_{SD} = 4 \text{ A}, V_{GS} = 0$			1.6	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 4 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 100 \text{ V}, T_j = 150^\circ\text{C}$		400 1.64 8.2		ns $\mu\text{C}$ A

1. Pulse width limited by safe operating area.
2. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

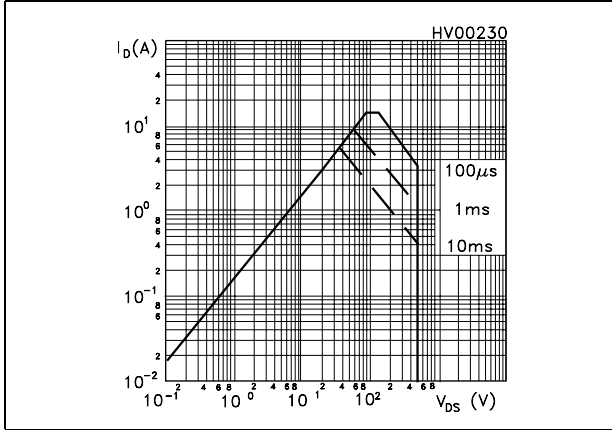


Figure 2. Thermal impedance

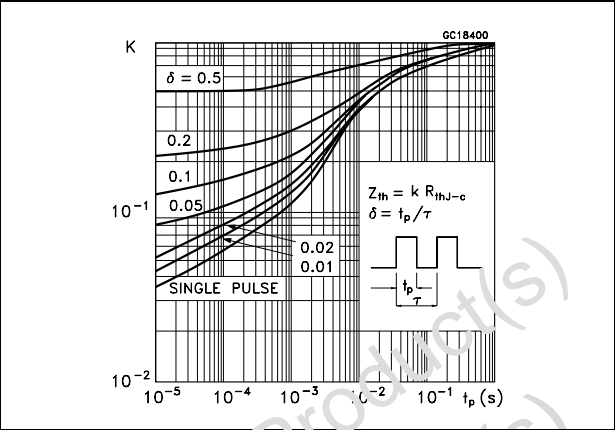


Figure 3. Output characteristics

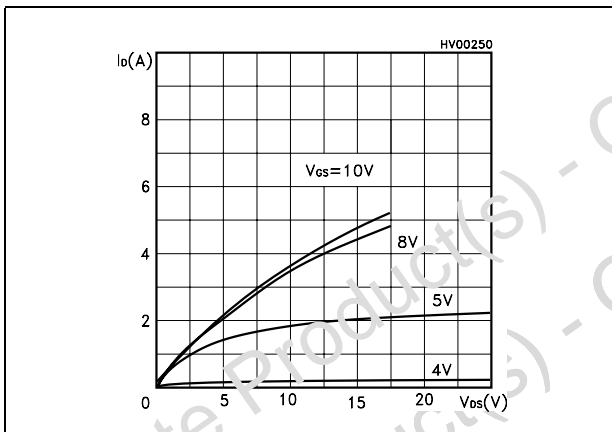


Figure 4. Transfer characteristics

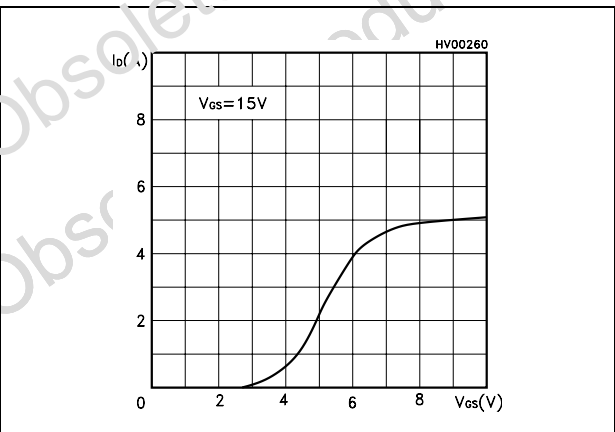


Figure 5. Transconductance

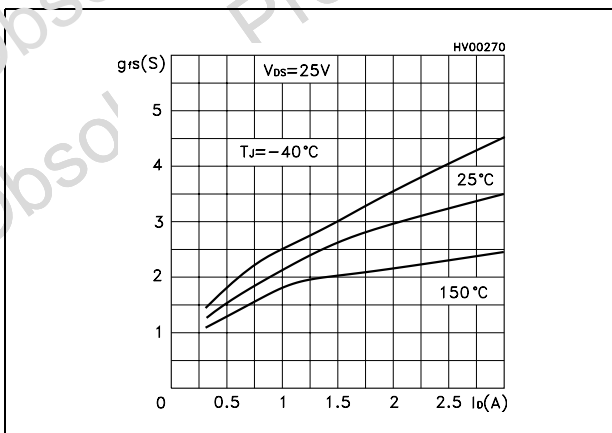


Figure 6. Static drain-source on resistance

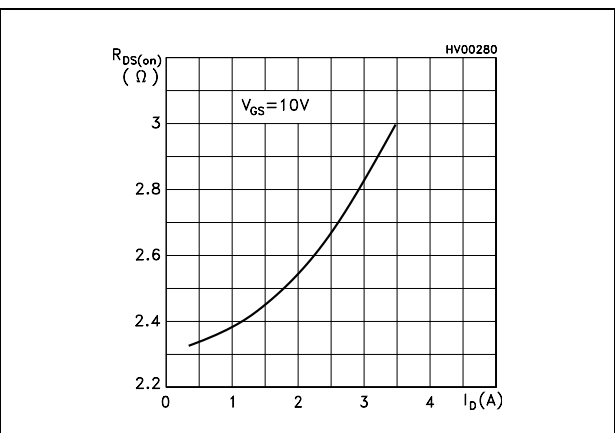


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

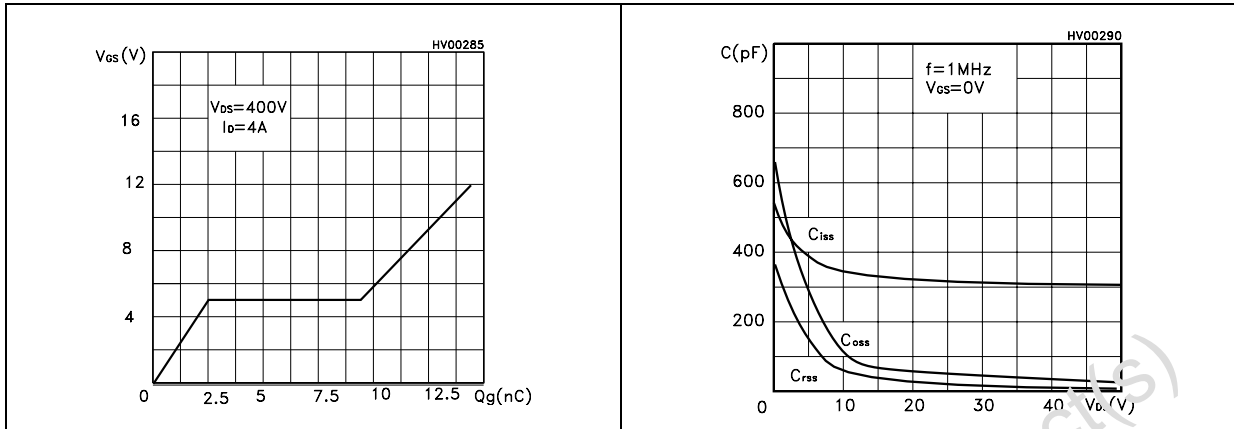


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

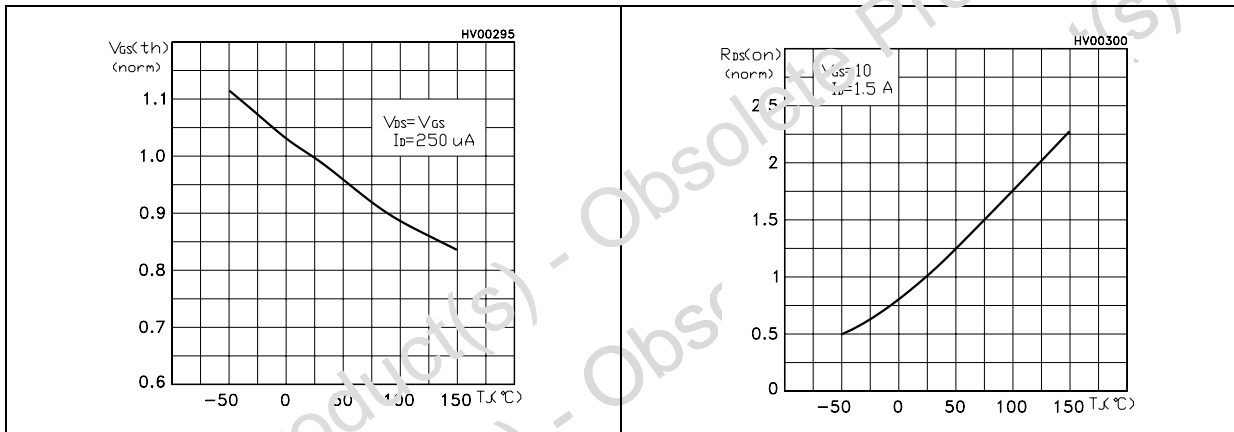
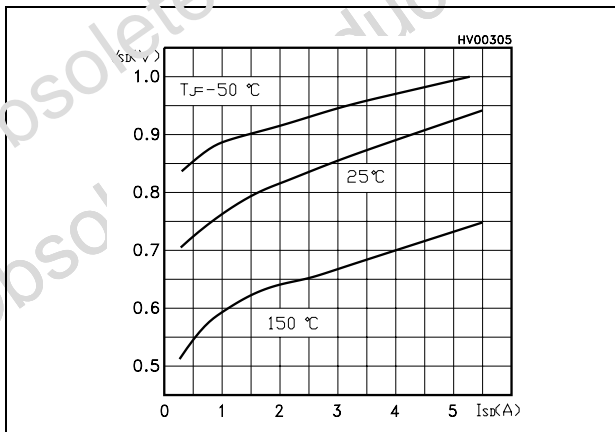


Figure 11. Source-drain diode forward characteristics



### 3 Test circuit

Figure 12. Unclamped Inductive load test circuit

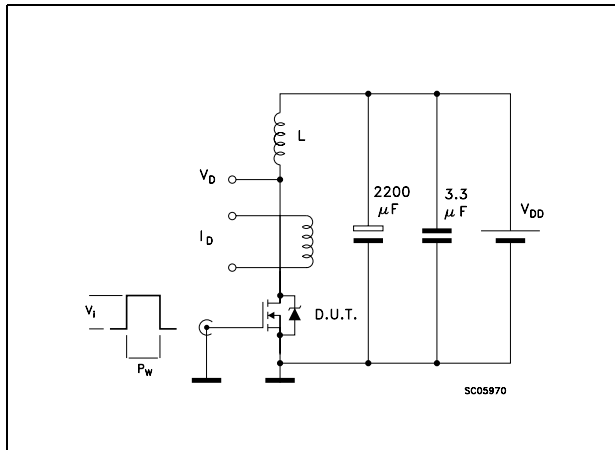


Figure 13. Unclamped inductive waveform

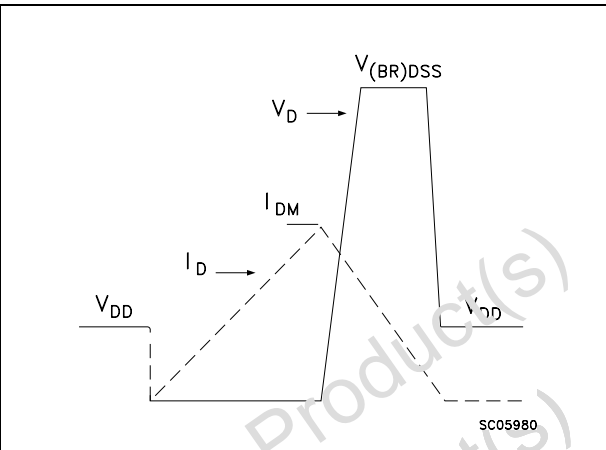


Figure 14. Switching times test circuit for resistive load

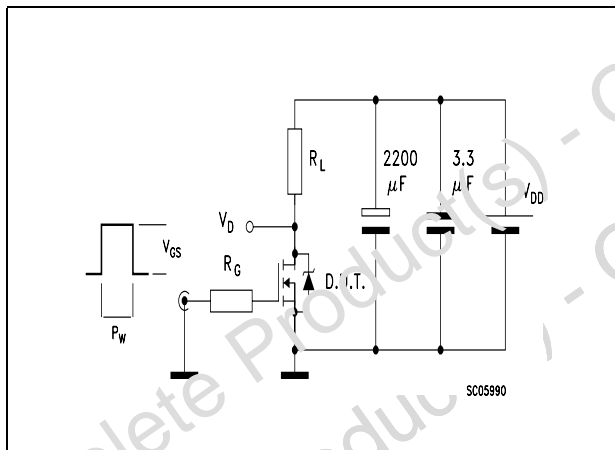


Figure 15. Gate charge test circuit

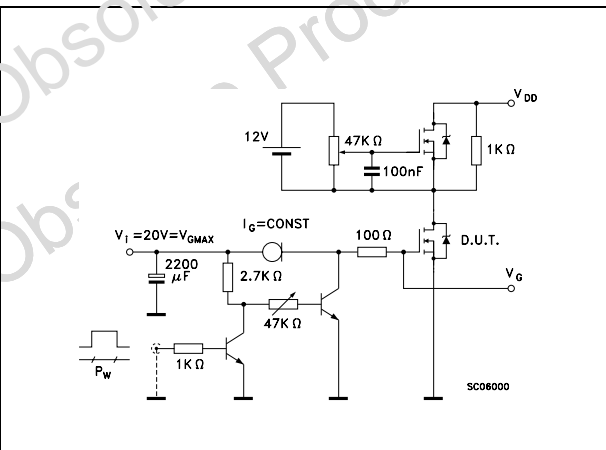
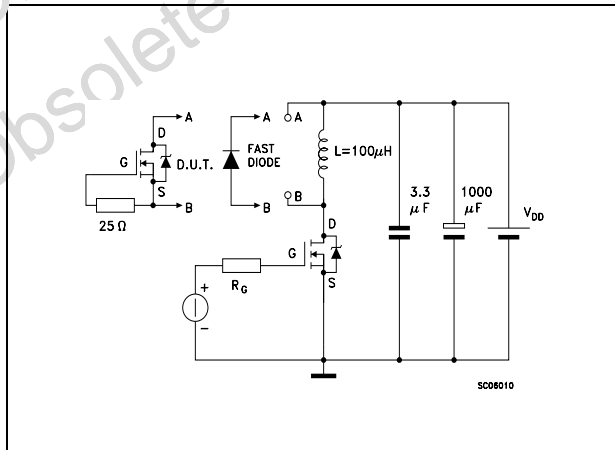


Figure 16. Test circuit for inductive load switching and diode recovery times





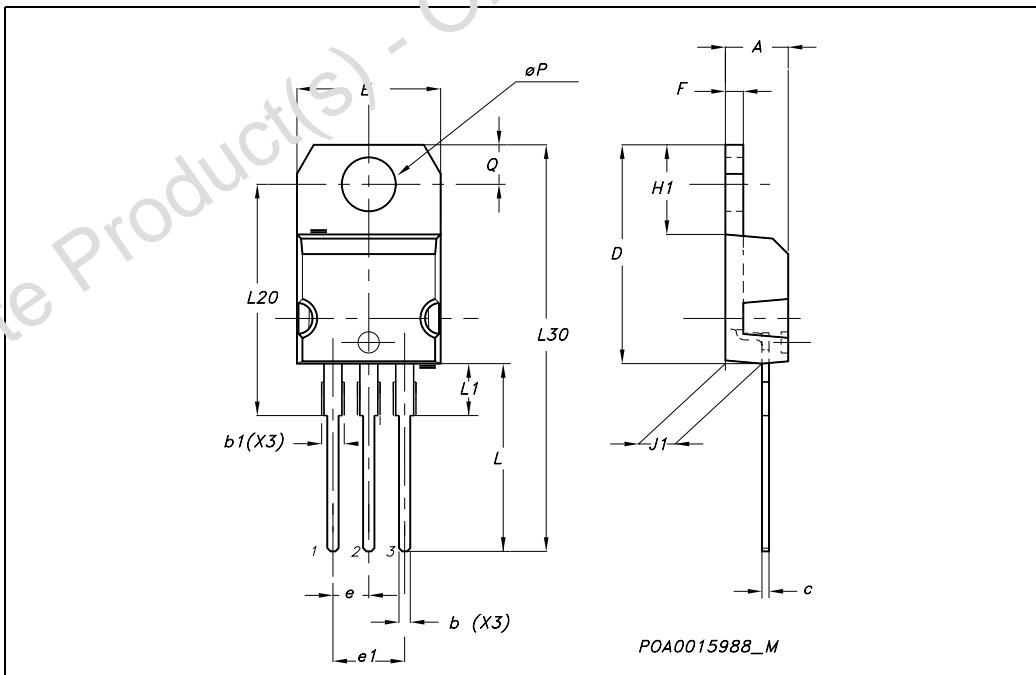
## 4 Package mechanical data

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)

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**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
21-Jun-2004	2	Preliminary version
27-Jun-2006	3	New template, no content change

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