STFW4N150
STP4N150, STW4N150

N-channel 1500 V, 5 Ω, 4 A, PowerMESH™ Power MOSFET in TO-220, TO-247, TO-3PF

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D	Pw
STFW4N150	1500 V	< 7 Ω	4 A	63 W
STP4N150	1500 V	< 7 Ω	4 A	160 W
STW4N150	1500 V	< 7 Ω	4 A	160 W

- 100% avalanche tested
- Intrinsic capacitances and Qg minimized
- High speed switching
- Fully isolated TO-3PF plastic packages
- Creepage distance path is 5.4 mm (typ.) for TO-3PF

TO-220

TO-247

TO-3PF

Application

- Switching applications

Description

Using the well consolidated high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of very high voltage Power MOSFETs with outstanding performances. The strengthened layout coupled with the company's proprietary edge termination structure, gives the lowest $R_{DS(on)}$ per area, unrivalled gate charge and switching characteristics.

Figure 1. Internal schematic diagram.

AM01475v1

Table 1. Device summary

Order codes	Marking	Package	Packaging
STFW4N150	4N150	TO-3PF	Tube
STP4N150	P4N150	TO-220	Tube
STW4N150	W4N150	TO-247	Tube

Contents

1   Electrical ratings

Table 2.   Absolute maximum ratings

Symbol	Parameter	Value			Unit
		TO-220	TO-247	TO-3PF	
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	1500			V
V_{GS}	Gate- source voltage	± 30			V
I_D	Drain current (continuous) at $T_C = 25$ °C	4	4	4 [1]	A
I_D	Drain current (continuous) at $T_C = 100$ °C	2.5	2.5	2.5 [1]	A
I_{DM} [1]	Drain current (pulsed)	12	12	12 [1]	A
P_{TOT}	Total dissipation at $T_C = 25$ °C	160		63	W
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s;T_C=25 °C)			3500	V
T_{stg}	Storage temperature	-55 to 150			°C
T_j	Max. operating junction temperature	150			°C

1.   Pulse width limited by safe operating area

Table 3.   Thermal data

Symbol	Parameter	Value			Unit
		TO-220	TO-247	TO-3PF	
$R_{thj-case}$	Thermal resistance junction-case max	0.78		2	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	50		°C/W

Table 4.   Avalanche characteristics

Symbol	Parameter	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 $T_j = 25$ °C, $I_D = I_{AR}$, $V_{DD} = 50$ V)	350	mJ

2   Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified)

Table 5.   On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown voltage	I_D = 1 mA, V_{GS} = 0	1500			V
I_{DSS}	Zero gate voltage Drain current (V_{GS} = 0)	V_{DS} = Max rating V_{DS} = Max rating, T_C = 125 °C			10 500	μA μA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 30 V			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 μA	3	4	5	V
$R_{DS(on}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 2 A		5	7	Ω

Table 6.   Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} [1]	Forward transconductance	V_{DS} = 30 V, I_D = 2 A	-	3.5		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	1300 120 12		pF pF pF
$t_{d(on)}$ T_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD} = 750 V, I_D = 2 A, R_G = 4.7 Ω, V_{GS} = 10 V *Figure 19*	-	35 30 45 45		ns ns ns ns
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 600 V, I_D = 4 A, V_{GS} = 10 V *Figure 20*	-	30 10 9	50	nC nC nC

1.   Pulsed: pulse duration=300 μs, duty cycle 1.5%

Table 7.   Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}[1]	Source-drain current Source-drain current (pulsed)		-		4 12	A A
V_{SD}[2]	Forward on voltage	I_{SD} = 4 A, V_{GS} = 0	-		2	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 4 A, di/dt = 100 A/µs V_{DD} = 45 V *Figure 21*	-	510 3 12		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 4 A, di/dt = 100 A/µs V_{DD} = 45 V, T_j = 150°C *Figure 21*	-	615 4 12.6		ns µC A

1. Pulse width limited by safe operating area

2. Pulsed: pulse duration=300µs, duty cycle 1.5%

2.1   Electrical characteristics (curves)

Figure 2.   Safe operating area for TO-220
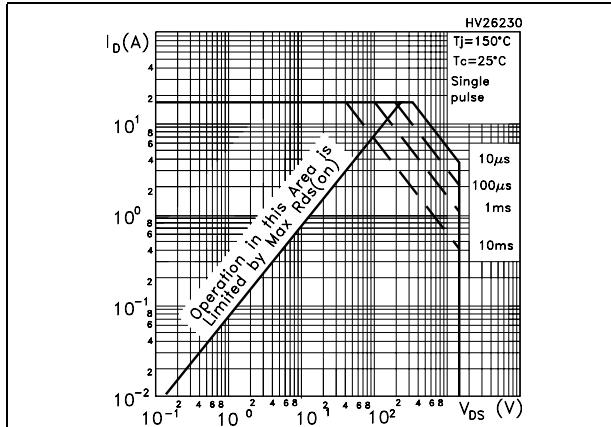
Figure 3.   Thermal impedance for TO-220
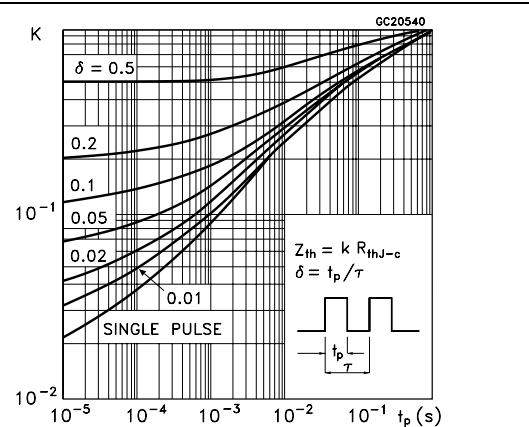
Figure 4.   Safe operating area for TO-3PF
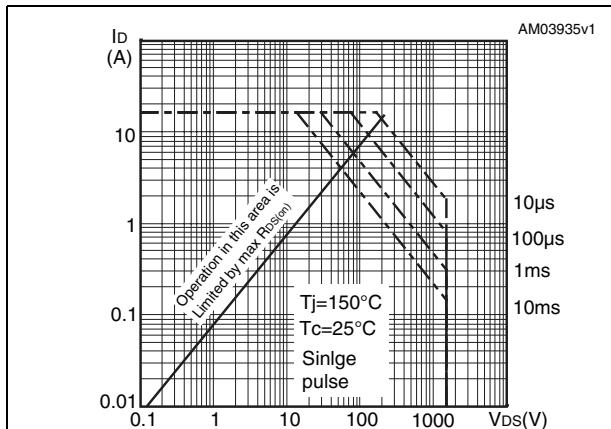
Figure 5.   Thermal impedance for TO-3PF
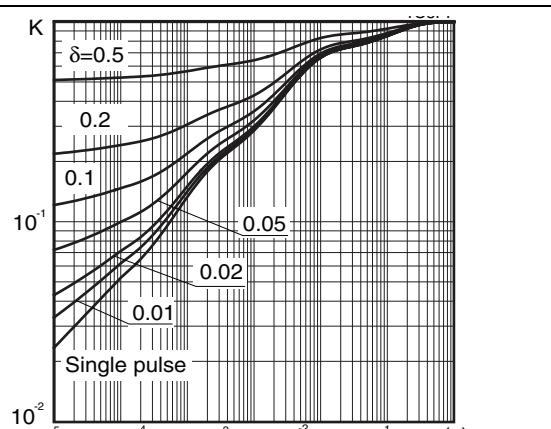
Figure 6.   Safe operating area for TO-247
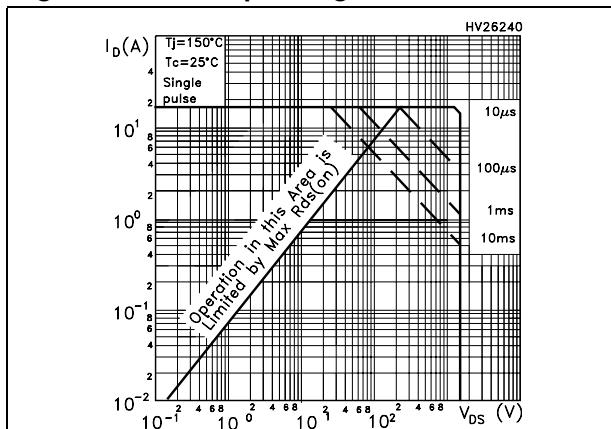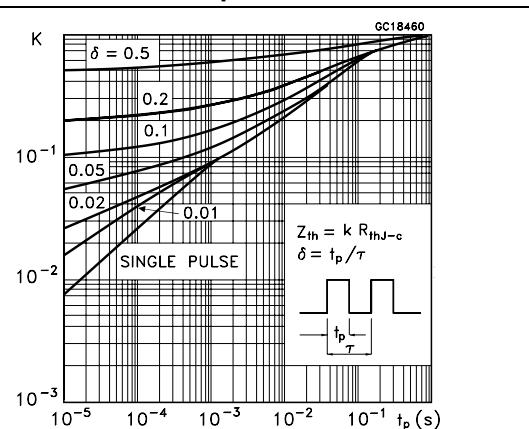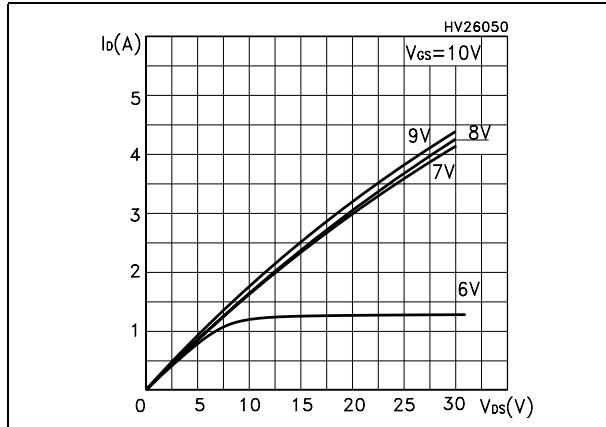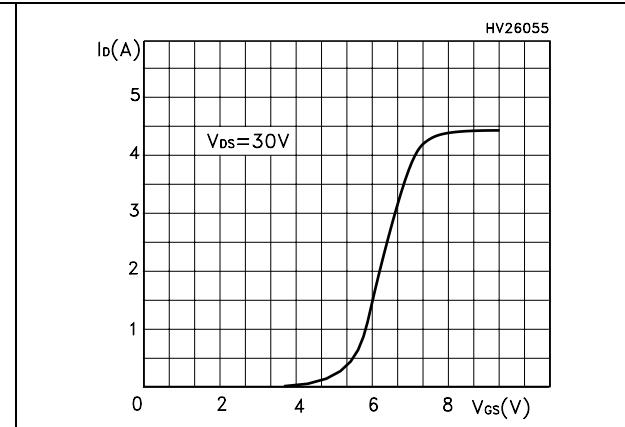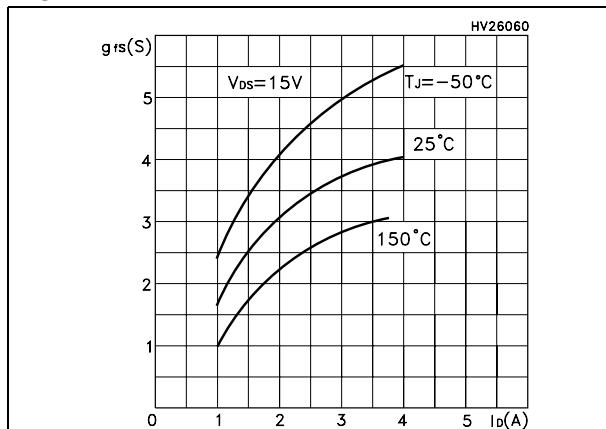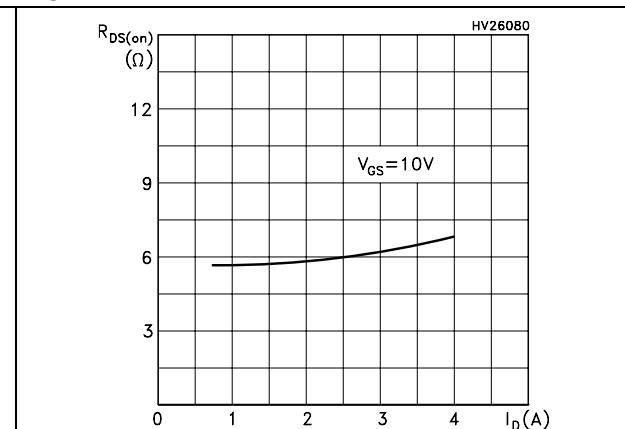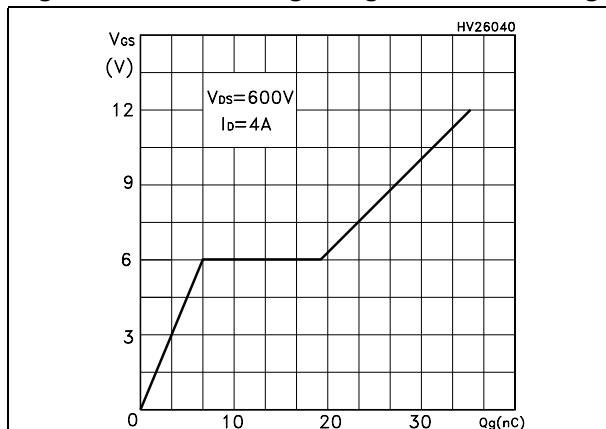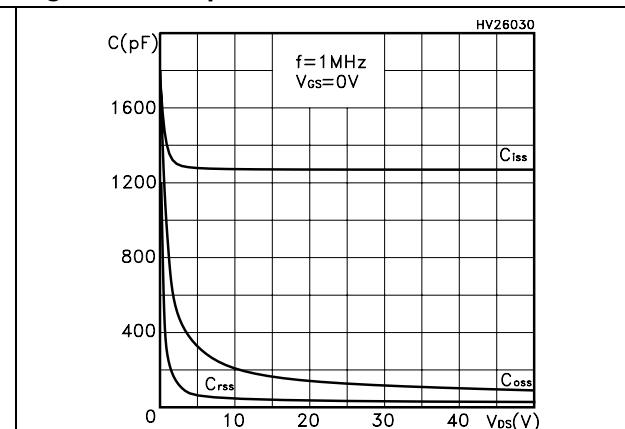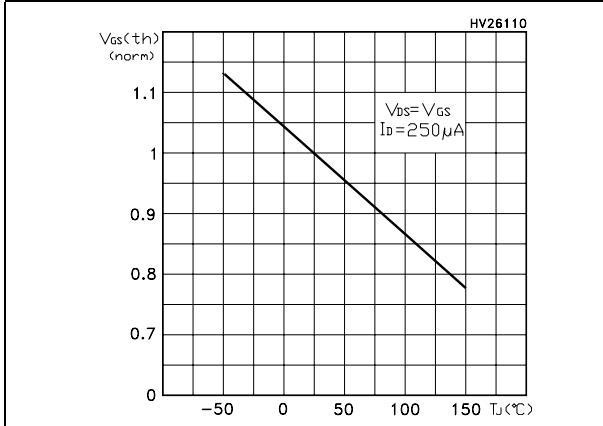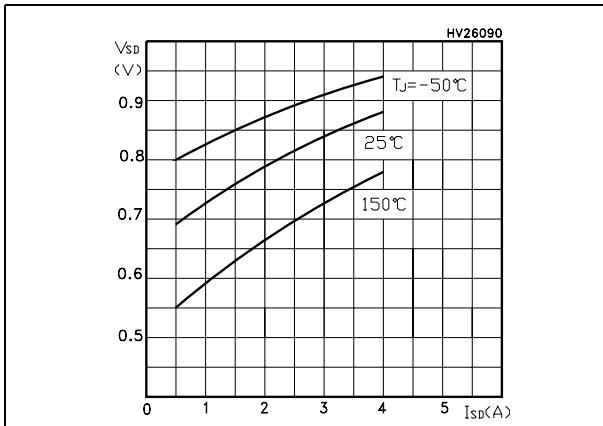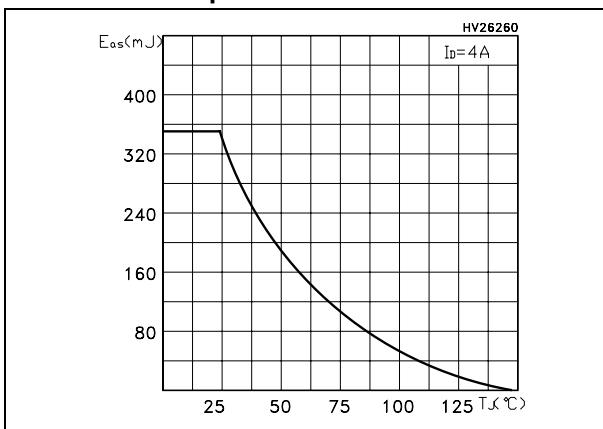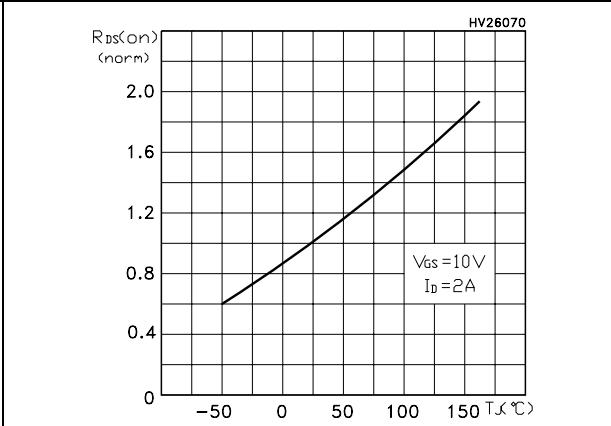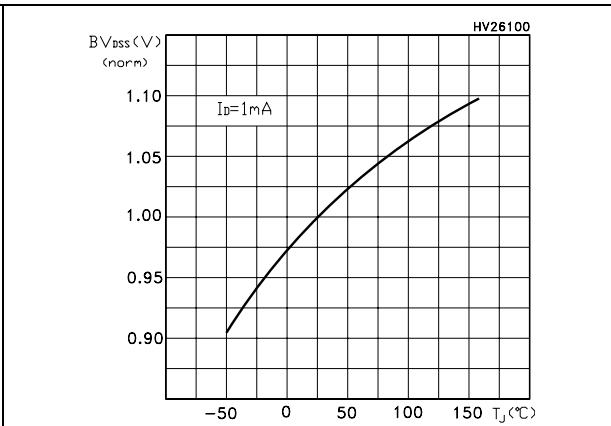
Figure 7.   Thermal impedance for TO-247
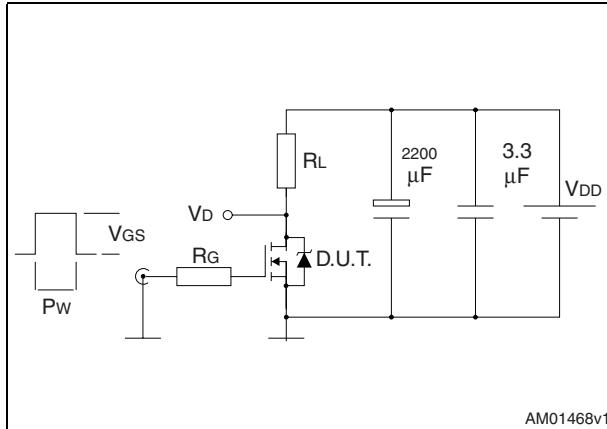
Figure 8.   **Output characteristics**

Figure 9.   **Transfer characteristics**

Figure 10.   **Transconductance**

Figure 11.   **Static drain-source on resistance**

Figure 12.   **Gate charge vs gate-source voltage**

Figure 13.   **Capacitance variations**
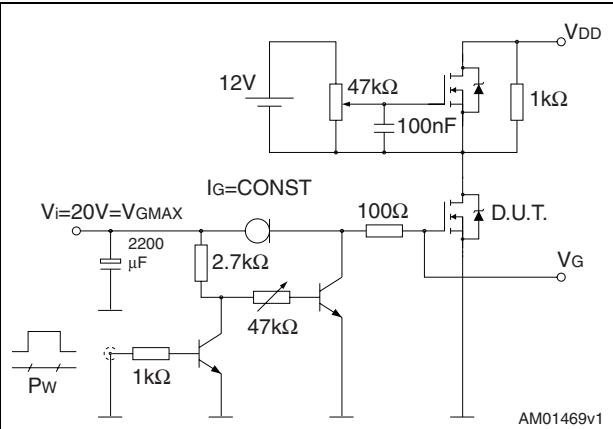
Figure 14. Normalized gate threshold voltage vs temperature

Figure 15. Normalized on resistance vs temperature

Figure 16. Source-drain diode forward characteristics

Figure 17. Normalized B$_{VDSS}$ vs temperature

Figure 18. Maximum avalanche energy vs temperature

3 Test circuits
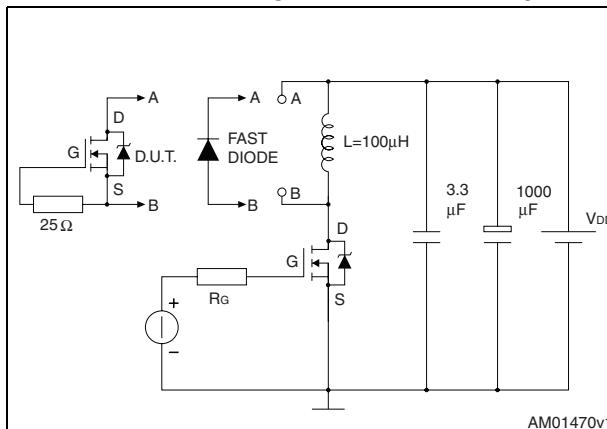
**Figure 19. Switching times test circuit for resistive load**
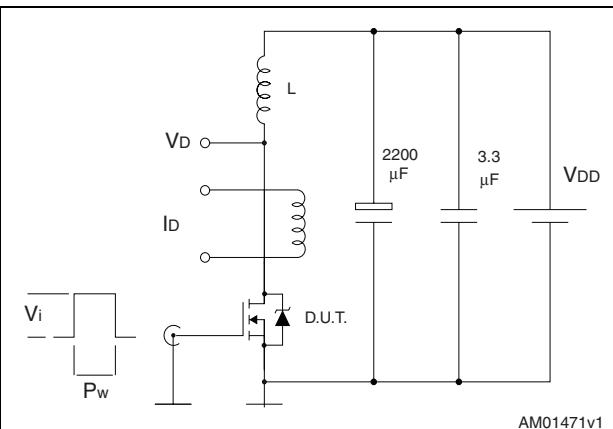

Figure 20. Gate charge test circuit
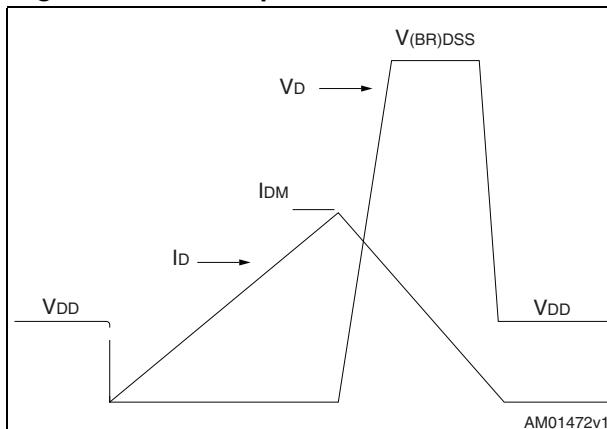
**Figure 21. Test circuit for inductive load switching and diode recovery times**
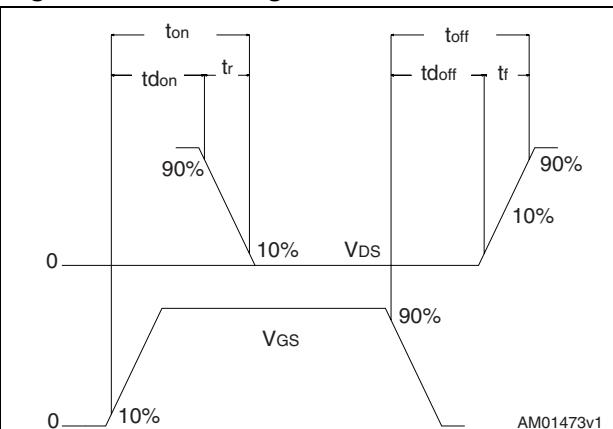

Figure 22. Unclamped inductive load test circuit

Figure 23. Unclamped inductive waveform


Figure 24. Switching time waveform
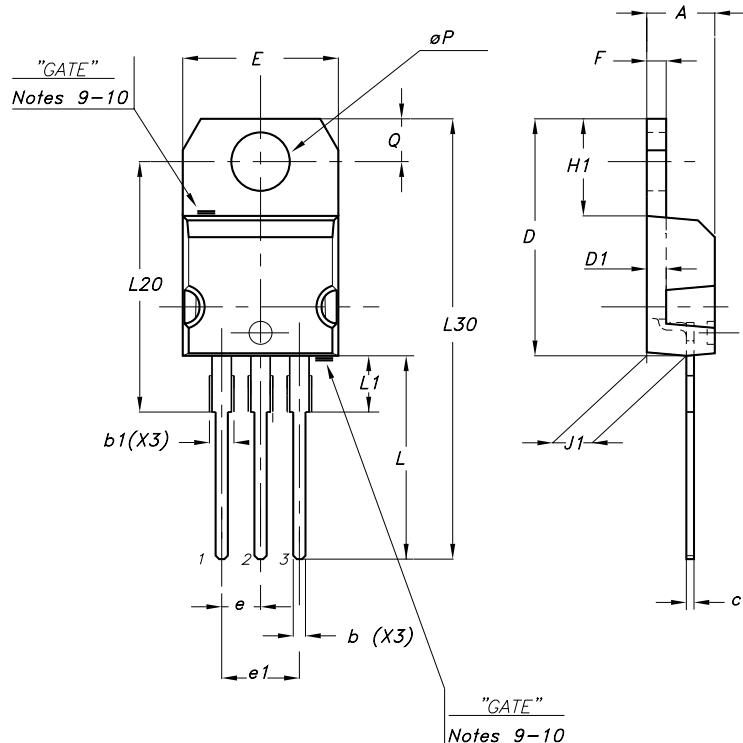
4   Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

TO-220 mechanical data
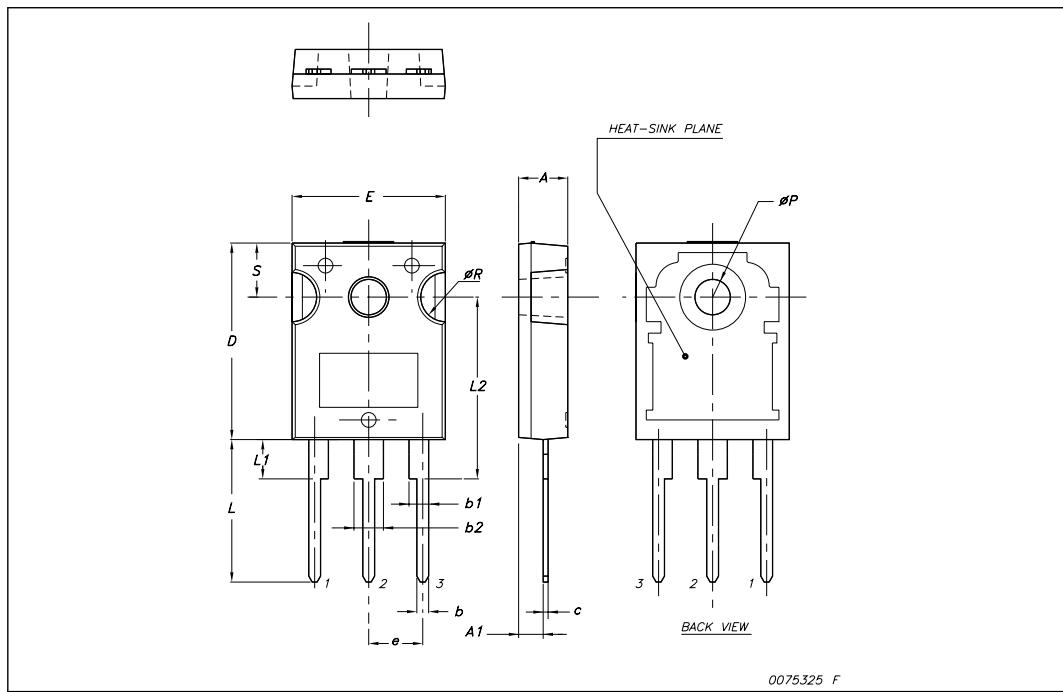
Dim	mm			inch		
	Min	**Typ**	**Max**	**Min**	**Typ**	**Max**
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
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

0015988_Rev_R
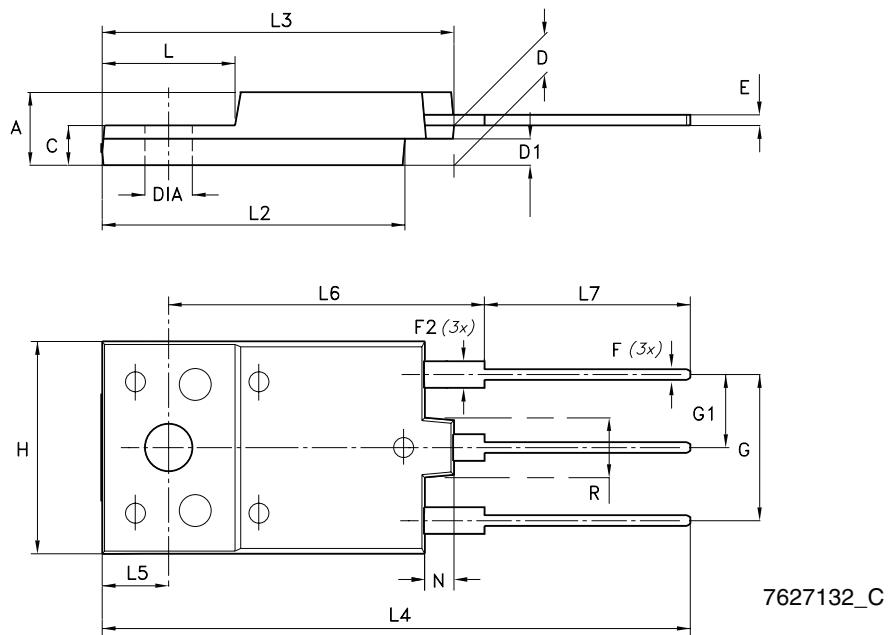
TO-247 Mechanical data

Dim.	mm.		
	Min.	**Typ**	**Max.**
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
øP	3.55		3.65
øR	4.50		5.50
S		5.50	

0075325 F

TO-3PF mechanical data

DIM.	mm.		
	min.	typ	max.
A	5.30		5.70
C	2.80		3.20
D	3.10		3.50
D1	1.80		2.20
E	0.80		1.10
F	0.65		0.95
F2	1.80		2.20
G	10.30		11.50
G1		5.45	
H	15.30		15.70
L	9.80	10	10.20
L2	22.80		23.20
L3	26.30		26.70
L4	43.20		44.40
L5	4.30		4.70
L6	24.30		24.70
L7	14.60		15
N	1.80		2.20
R	3.80		4.20
Dia	3.40		3.80

7627132_C

5 Revision history

Table 8. Document revision history

Date	Revision	Changes
29-Mar-2005	1	Initial release
07-Jul-2005	2	Removed TO-220FP
07-Oct-2005	3	Document status promoted from preliminary data to datasheet
10-Aug-2006	4	Document reformatted, no content change
06-Nov-2007	5	Updated unit on *Table 5: On/off states*
09-Apr-2008	6	Added new packages: TO-220FH, TO-3PF
21-Jan-2009	7	Remove package TO-220FH
23-Feb-2009	8	Added P_{TOT} value for TO-3PF P_{TOT} (*Table 2: Absolute maximum ratings*)
23-Jul-2009	9	Added new figures: *Figure 4: Safe operating area for TO-3PF* and *Figure 5: Thermal impedance for TO-3PF*

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