



STP4N150 STW4N150

N-CHANNEL 1500V - 5Ω - 4A TO-220/TO-247 Very High Voltage PowerMESH™ MOSFET

Table 1: General Features

TYPE	V _{DSS}	R _{DS(on)}	I _D	P _w
STP4N150	1500 V	< 7 Ω	4 A	160 W
STW4N150	1500 V	< 7 Ω	4 A	160 W

- TYPICAL R_{DS(on)} = 5 Ω
- AVALANCHE RUGGEDNESS
- GATE CHARGE MINIMIZED
- VERY LOW INTRINSIC CAPACITANCES
- HIGH SPEED SWITCHING

DESCRIPTION

Using the well consolidated high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of 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.

APPLICATIONS

- SWITCH MODE POWER SUPPLIES

Figure 1: Package

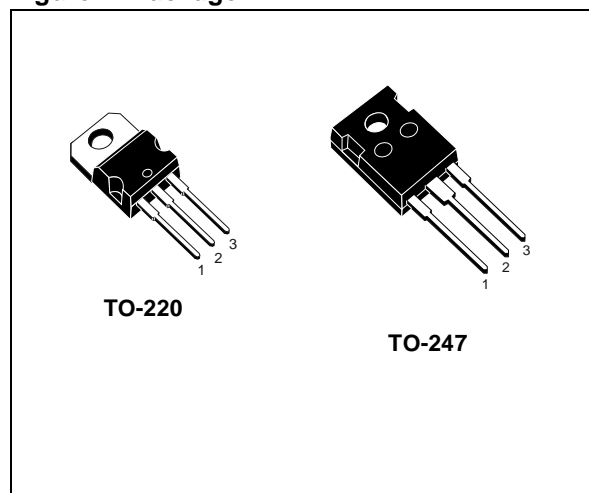


Figure 2: Internal Schematic Diagram

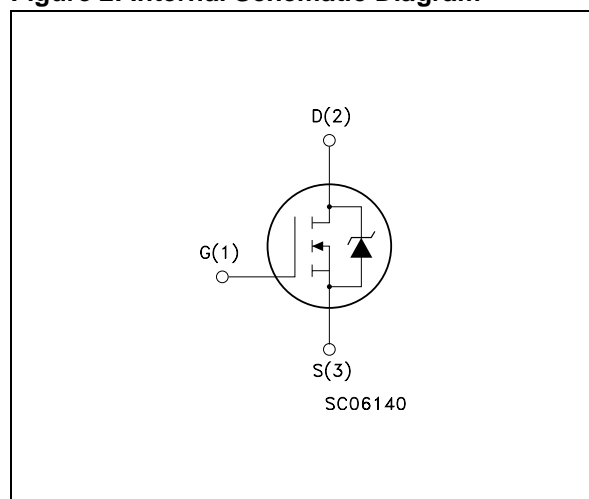


Table 2: Order Codes

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP4N150	P4N150	TO-220	TUBE
STW4N150	W4N150	TO-247	TUBE

Table 3: Absolute Maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage ($V_{GS} = 0$)	1500	V
V_{DGR}	Drain-gate Voltage ($R_{GS} = 20\text{ k}\Omega$)	1500	V
V_{GS}	Gate- source Voltage	± 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
$I_{DM}(\bullet)$	Drain Current (pulsed)	12	A
P_{TOT}	Total Dissipation at $T_C = 25^\circ\text{C}$	160	W
	Derating Factor	1	W/ $^\circ\text{C}$
T_j T_{stg}	Operating Junction Temperature Storage Temperature	-55 to 150	$^\circ\text{C}$

(\bullet) Pulse width limited by safe operating area

(*) Limited only by maximum temperature allowed

Table 4: Thermal Data

		TO-220	TO-247	
Rthj-case	Thermal Resistance Junction-case Max	0.78		$^\circ\text{C}/\text{W}$
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	50	$^\circ\text{C}/\text{W}$

Table 5: 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 $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	350	mJ

ELECTRICAL CHARACTERISTICS ($T_{CASE} = 25^\circ\text{C}$ UNLESS OTHERWISE SPECIFIED)
Table 6: On /Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0$	1500			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}, T_C = 125^\circ\text{C}$			10 500	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 30\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$, $I_D = 2\text{ A}$		5	7	Ω

ELECTRICAL CHARACTERISTICS (CONTINUED)**Table 7: Dynamic**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	$V_{DS} = 30\text{ V}$, $I_D = 2\text{ A}$		3.5		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$		1300		pF
C_{oss}	Output Capacitance			120		pF
C_{rss}	Reverse Transfer Capacitance			12		pF
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 750\text{ V}$, $I_D = 2\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 19)		35		ns
t_r	Rise Time			30		ns
$t_{d(off)}$	Turn-off-Delay Time			45		ns
t_f	Fall Time			45		ns
Q_g	Total Gate Charge	$V_{DD} = 600\text{ V}$, $I_D = 4\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 22)		30	50	nC
Q_{gs}	Gate-Source Charge			10		nC
Q_{gd}	Gate-Drain Charge			9		nC

Table 8: Source Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				4	A
I_{SDM} (2)	Source-drain Current (pulsed)				12	A
V_{SD} (1)	Forward On Voltage	$I_{SD} = 4\text{ A}$, $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 4\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 45\text{ V}$ (see Figure 20)		510		ns
Q_{rr}	Reverse Recovery Charge			3		μC
I_{RRM}	Reverse Recovery Current			12		A
t_{rr}	Reverse Recovery Time	$I_{SD} = 4\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 45\text{ V}$, $T_j = 150^\circ\text{C}$ (see Figure 20)		650		ns
Q_{rr}	Reverse Recovery Charge			4		μC
I_{RRM}	Reverse Recovery Current			12.6		A

(1) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %.

(2) Pulse width limited by safe operating area.

Figure 3: Safe Operating Area For TO-220

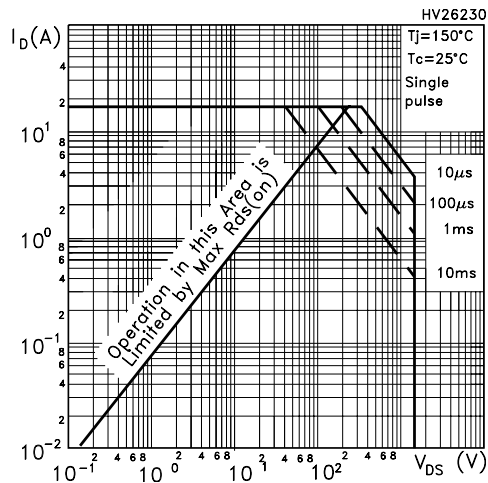


Figure 4: Safe Operating Area For TO-247

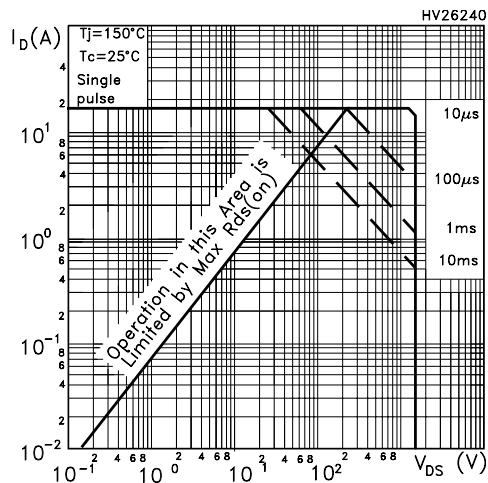


Figure 5: Output Characteristics

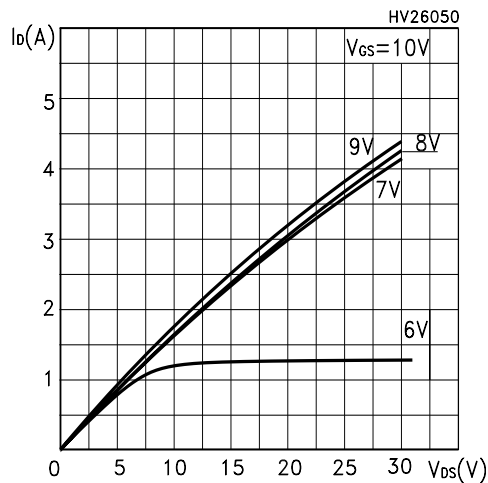


Figure 6: Thermal Impedance For TO-220

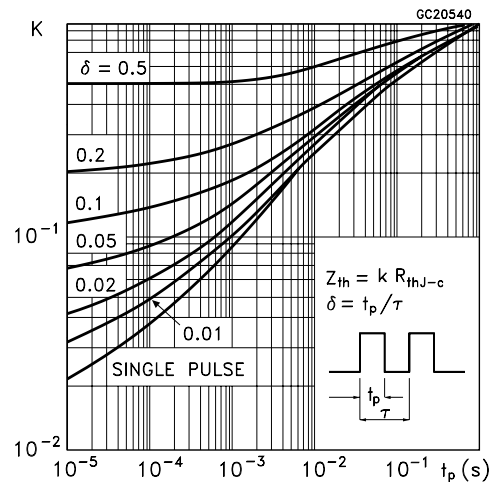


Figure 7: Thermal Impedance For TO-247

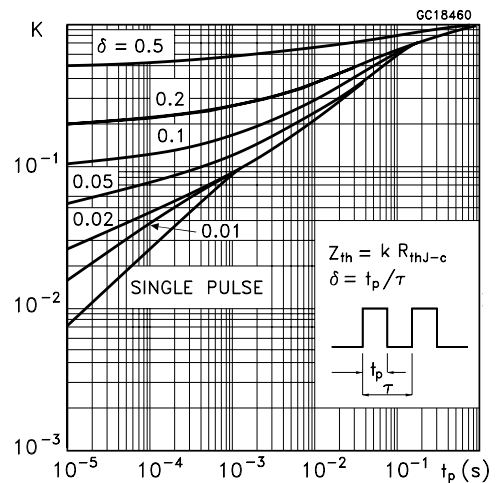


Figure 8: Transfer Characteristics

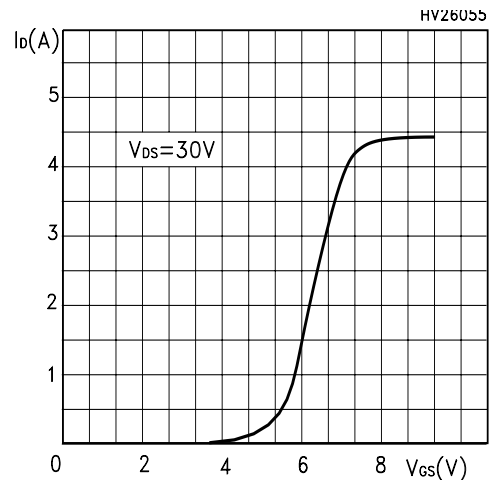


Figure 9: Transconductance

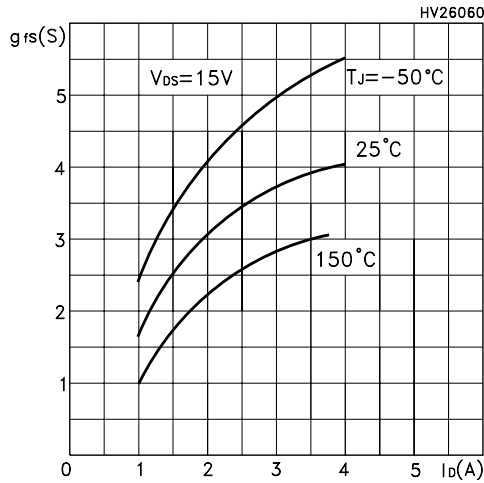


Figure 10: Gate Charge vs Gate-source Voltage

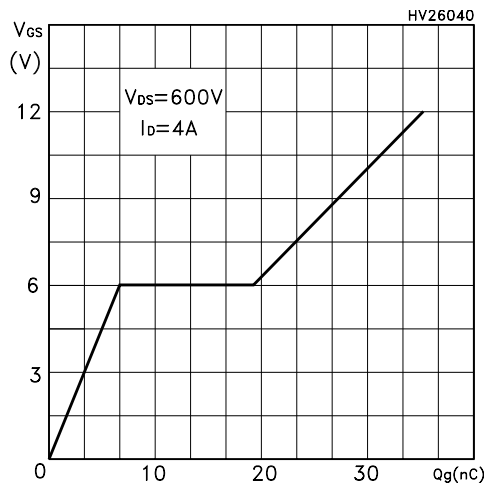


Figure 11: Normalized Gate Threshold Voltage vs Temperature

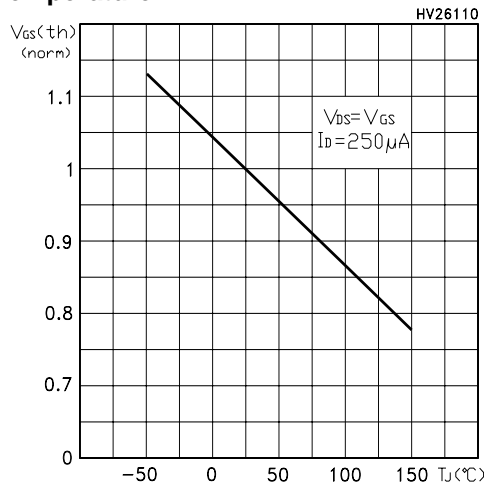


Figure 12: Static Drain-source On Resistance

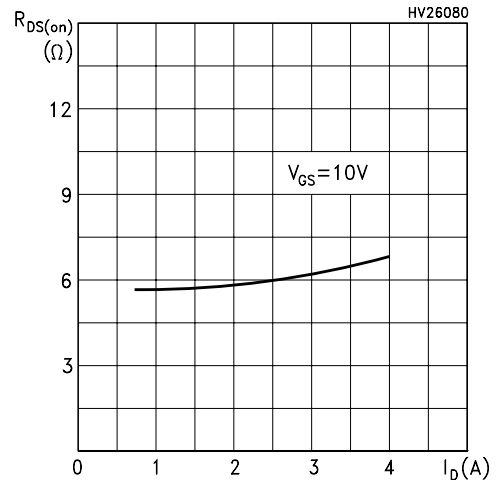


Figure 13: Capacitance Variations

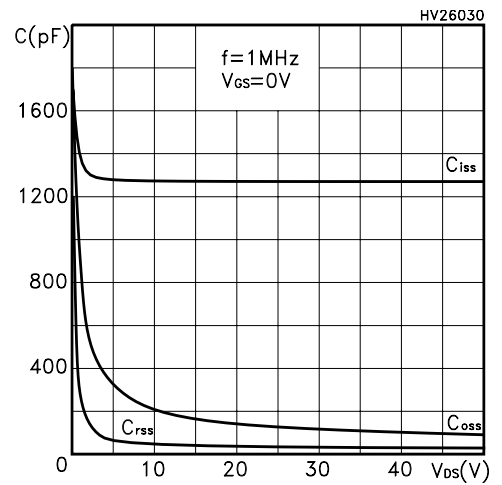


Figure 14: Normalized On Resistance vs Temperature

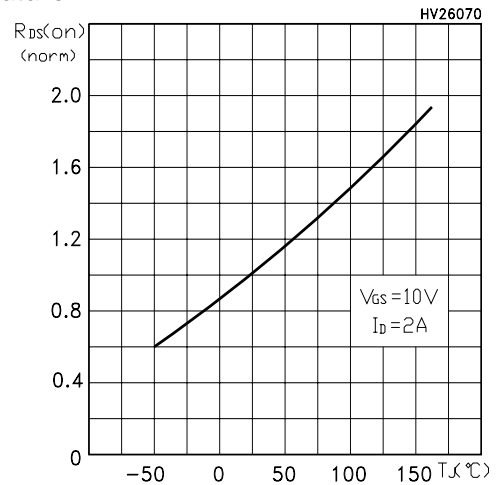


Figure 15: Source-Drain Forward Characteristics

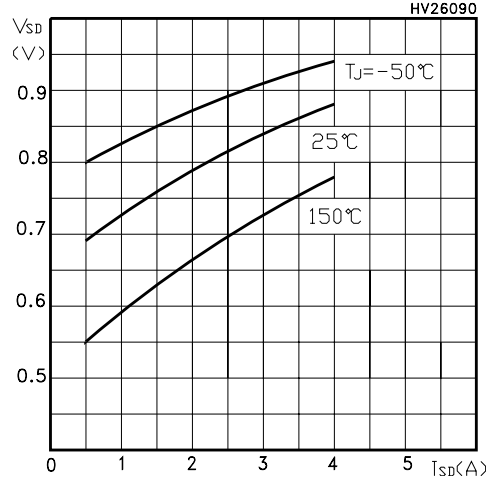


Figure 17: Normalized BV_{DSS} vs Temperature

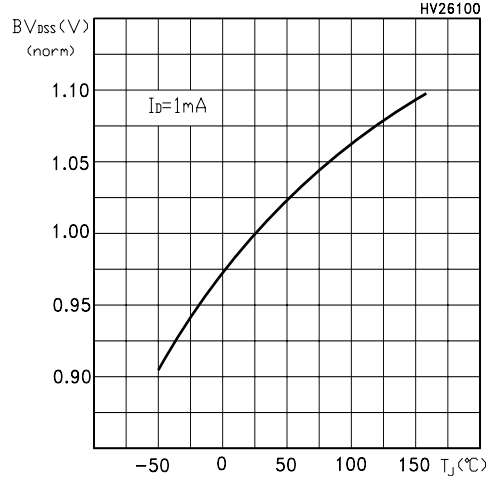


Figure 16: Maximum Avalanche Energy vs Temperature

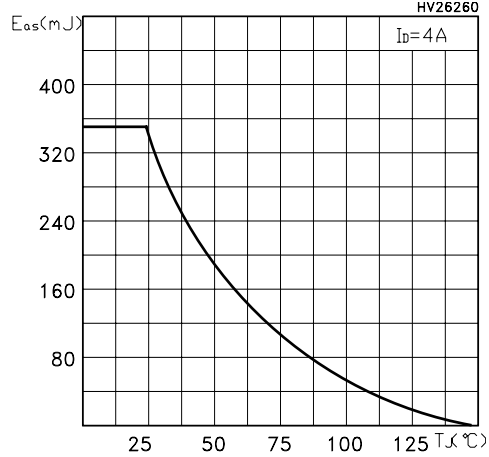
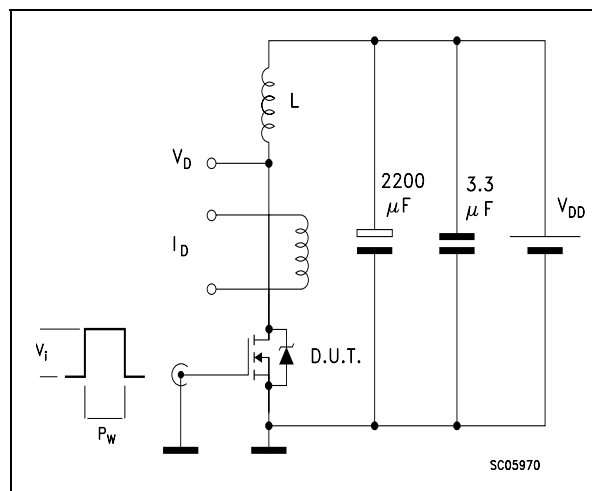
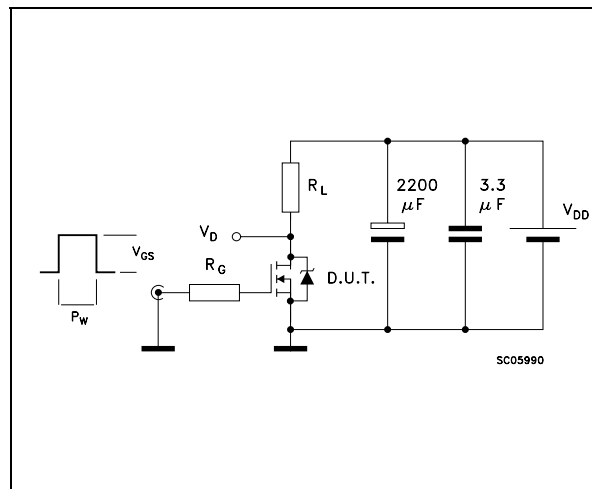
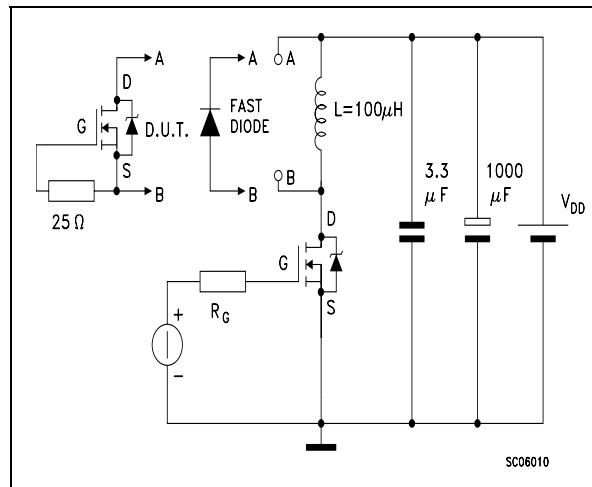
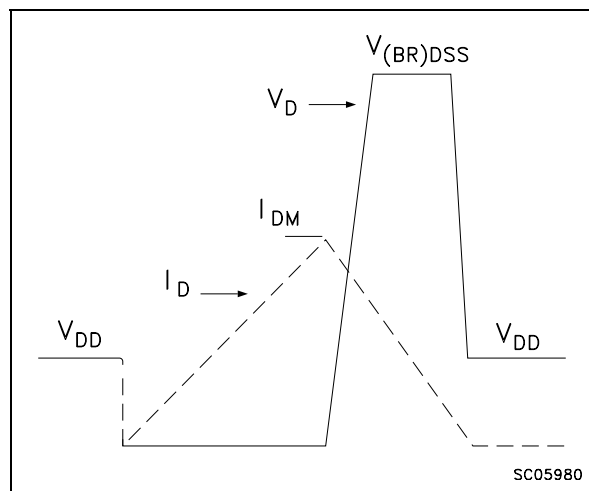
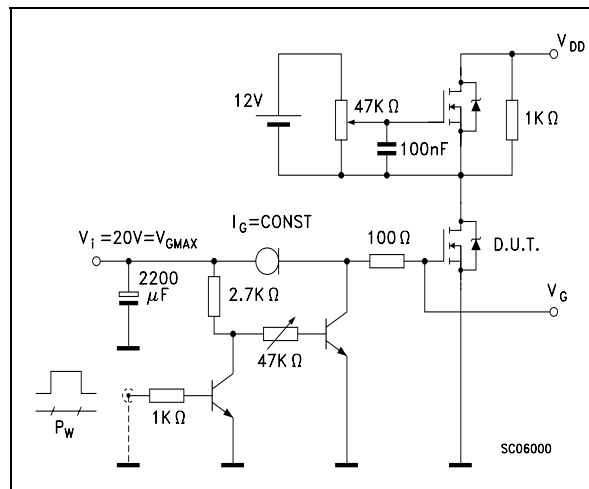
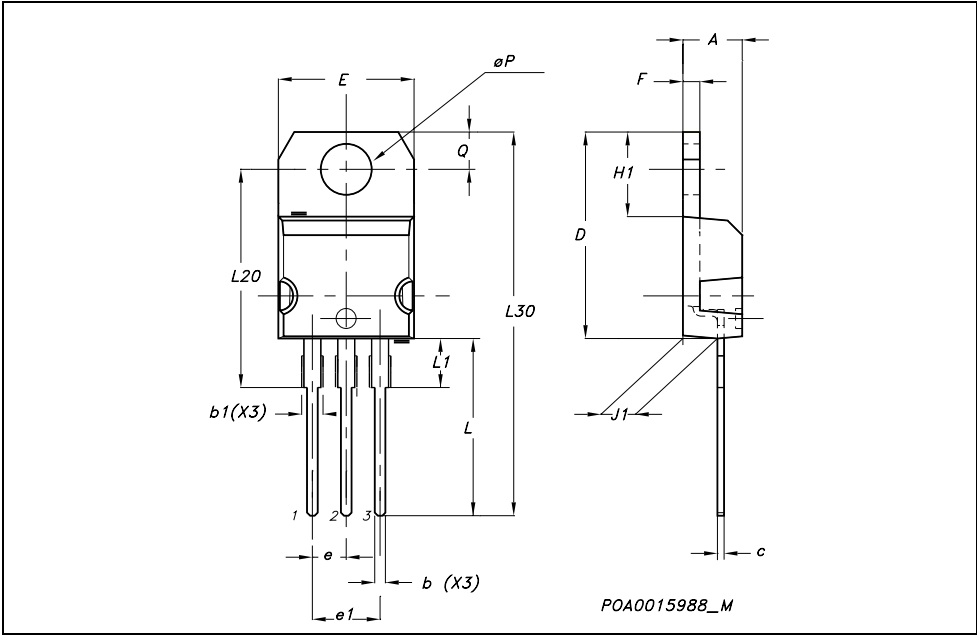


Figure 18: Unclamped Inductive Load Test Circuit**Figure 19: Switching Times Test Circuit For Resistive Load****Figure 20: Test Circuit For Inductive Load Switching and Diode Recovery Times****Figure 21: Unclamped Inductive Waveform****Figure 22: Gate Charge Test Circuit**

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



TO-247 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
A1	2.20		2.60	0.086		0.102
b	1.0		1.40	0.039		0.055
b1	2.0		2.40	0.079		0.094
b2	3.0		3.40	0.118		0.134
c	0.40		0.80	0.015		0.03
D	19.85		20.15	0.781		0.793
E	15.45		15.75	0.608		0.620
e		5.45			0.214	
L	14.20		14.80	0.560		0.582
L1	3.70		4.30	0.14		0.17
L2		18.50			0.728	
øP	3.55		3.65	0.140		0.143
øR	4.50		5.50	0.177		0.216
S		5.50			0.216	

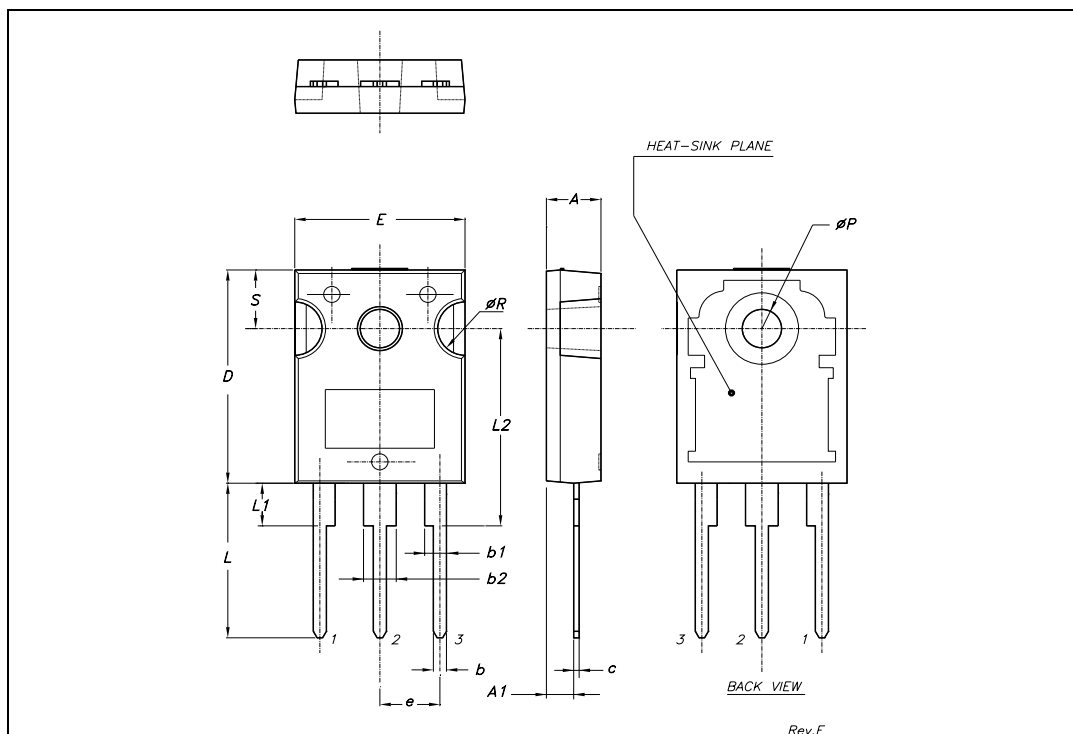


Table 9: Revision History

Date	Revision	Description of Changes
11-Mar-2005	1	First release.
27-Apr-2005	2	Removed TO-220FP
07-Jul-2005	3	Complete version

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