



STW45NM50FD

N-CHANNEL 500V - 0.07Ω - 45A TO-247
FDmesh™ MOSFET (With FAST DIODE)

Table 1: General Features

TYPE	V _{DSS}	R _{DS(on)}	I _D
STW45NM50FD	500V	< 0.1Ω	45 A

- TYPICAL R_{DS(on)} = 0.07Ω
- HIGH dv/dt AND AVALANCHE CAPABILITIES
- 100% AVALANCHE TESTED
- LOW INPUT CAPACITANCE AND GATE CHARGE
- LOW GATE INPUT RESISTANCE
- TIGHT PROCESS CONTROL AND HIGH MANUFACTURING YIELDS

DESCRIPTION

The FDmesh™ associates all advantages of reduced on-resistance and fast switching with an intrinsic fast-recovery body diode. It is therefore strongly recommended for bridge topologies, in particular ZVS phase-shift converters.

APPLICATIONS

- ZVS PHASE-SHIFT FULL BRIDGE CONVERTERS FOR SMPS AND WELDING EQUIPMENT

Figure 1: Package

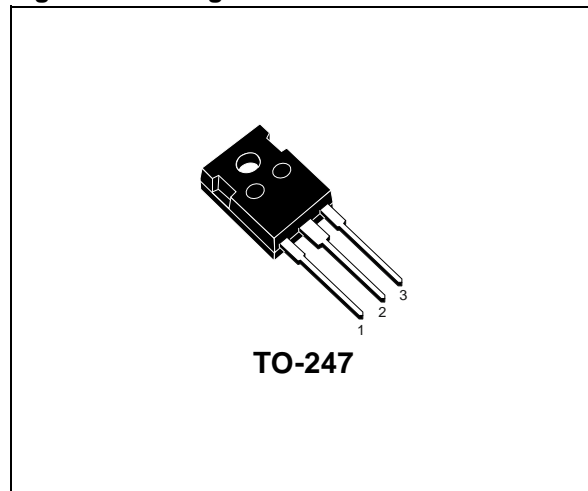


Figure 2: Internal Schematic Diagram

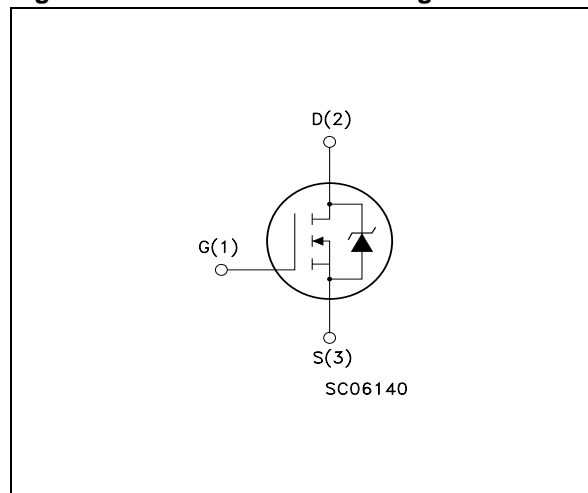


Table 2: Order Codes

SALES TYPE	MARKING	PACKAGE	PACKAGING
STW45NM50FD	W45NM50FD	TO-247	TUBE

Table 3: Absolute Maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage ($V_{GS} = 0$)	500	V
V_{DGR}	Drain-gate Voltage ($R_{GS} = 20\text{ k}\Omega$)	500	V
V_{GS}	Gate- source Voltage	± 30	V
I_D	Drain Current (continuous) at $T_C = 25^\circ\text{C}$	45	A
I_D	Drain Current (continuous) at $T_C = 100^\circ\text{C}$	28.4	A
$I_{DM}(\bullet)$	Drain Current (pulsed)	180	A
P_{TOT}	Total Dissipation at $T_C = 25^\circ\text{C}$	417	W
	Derating Factor	2.08	W/ $^\circ\text{C}$
dv/dt (*)	Peak Diode Recovery voltage slope	20	V/ns
T_{stg}	Storage Temperature	-65 to 150	$^\circ\text{C}$
T_j	Max. Operating Junction Temperature	150	$^\circ\text{C}$

(●) Pulse width limited by safe operating area

(*) $I_{SD} \leq 45\text{A}$, $di/dt \leq 400\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$

Table 4: Thermal Data

Rthj-case	Thermal Resistance Junction-case	Max	0.3	$^\circ\text{C}/\text{W}$
Rthj-amb	Thermal Resistance Junction-ambient	Max	30	$^\circ\text{C}/\text{W}$
T_I	Maximum Lead Temperature For Soldering Purpose		300	$^\circ\text{C}$

Table 5: Avalanche Characteristics

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max)	22.5	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 35\text{ V}$)	800	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	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0$	500			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}$, $T_C = 125^\circ\text{C}$			10 100	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	$V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{V}$, $I_D = 22.5\text{A}$		0.07	0.10	Ω

ELECTRICAL CHARACTERISTICS (CONTINUED)

Table 7: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (2)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$, $I_D=22.5A$		20		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25V$, $f = 1$ MHz, $V_{GS} = 0$		3600 610 80		pF pF pF
$C_{oss\ eq.}$ (3)	Equivalent Output Capacitance	$V_{GS} = 0V$, $V_{DS} = 0V$ to 400V		350		pF
R_G	Gate Input Resistance	$f=1$ MHz Gate DC Bias = 0 Test Signal Level = 20mV Open Drain		2		Ω
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	$V_{DD} = 250V$, $I_D = 22.5A$ $R_G = 4.7\Omega$ $V_{GS} = 10V$ (see Figure 14)		28 28		ns ns
$t_{d(off)}$ t_f t_c	Turn-off Delay Time Fall Time Cross-over Time	$V_{DD} = 400V$, $I_D = 45A$, $V_{GS} = 10V$ (see Figure 14)		11 25 44		ns ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400V$, $I_D = 45A$, $V_{GS} = 10V$ (see Figure 18)		92 22 40	120	nC nC nC

Table 8: Source Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				45	A
I_{SDM} (2)	Source-drain Current (pulsed)				180	A
V_{SD} (1)	Forward On Voltage	$I_{SD} = 45A$, $V_{GS} = 0$			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 45A$, $di/dt = 100A/\mu s$, $V_{DD} = 100V$ (see Figure 16)		245 2.2 18		ns μC A

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

2. Pulse width limited by safe operating area.

3. $C_{oss\ eq.}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS} .

Figure 3: Safe Operating Area

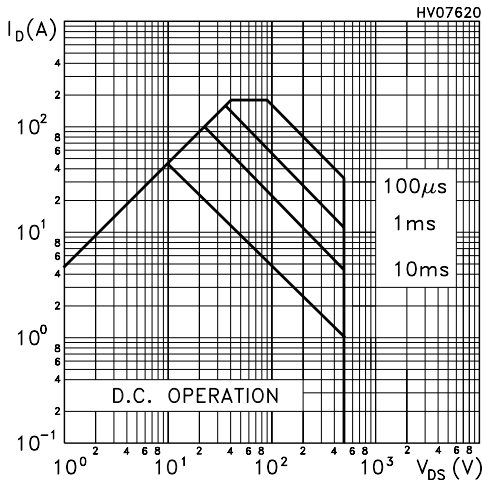


Figure 4: Output Characteristics

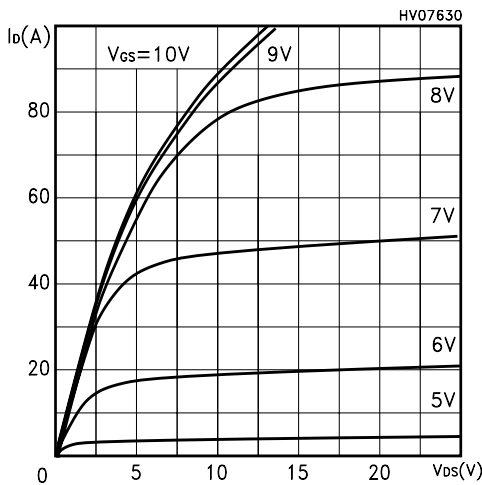


Figure 5: Transconductance

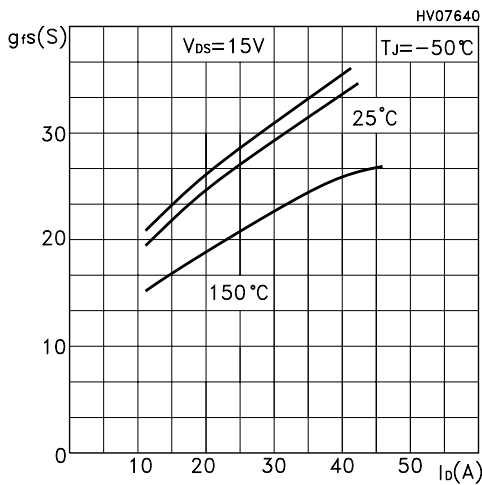


Figure 6: Thermal Impedance

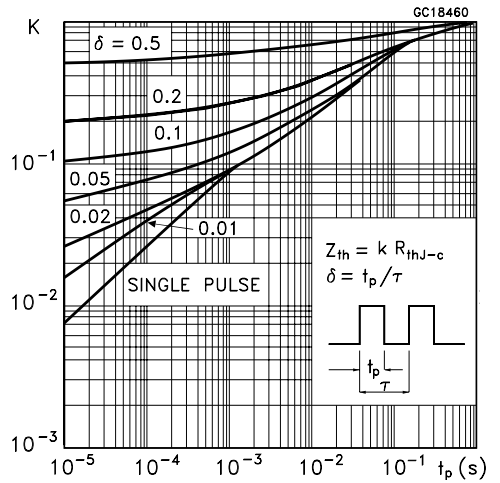


Figure 7: Transfer Characteristics

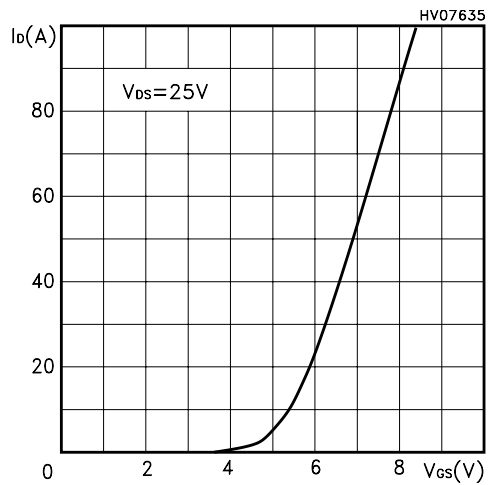


Figure 8: Static Drain-source On Resistance

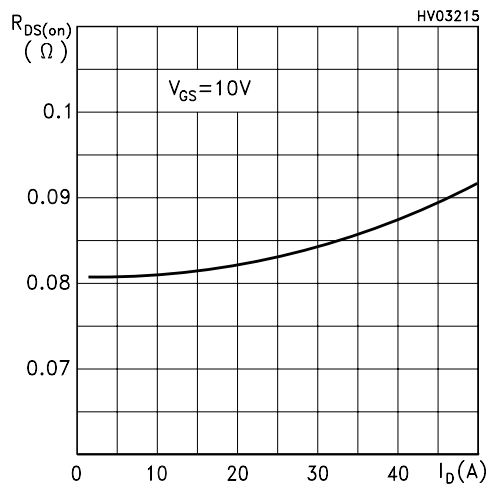


Figure 9: Gate Charge vs Gate-source Voltage

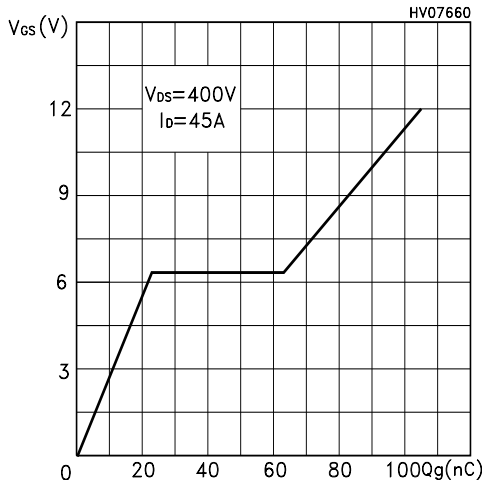


Figure 10: Normalized Gate Threshold Voltage vs Temperature

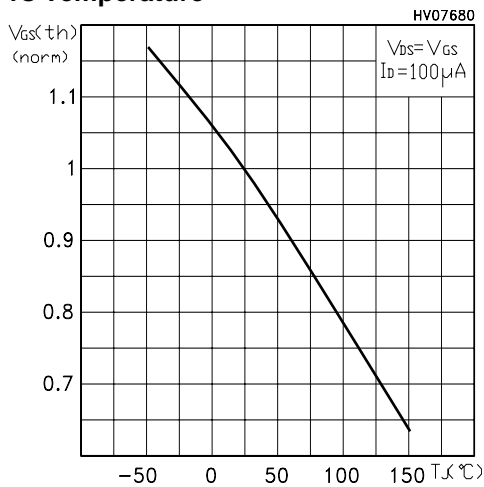


Figure 11: Source-Drain Diode Forward Characteristics

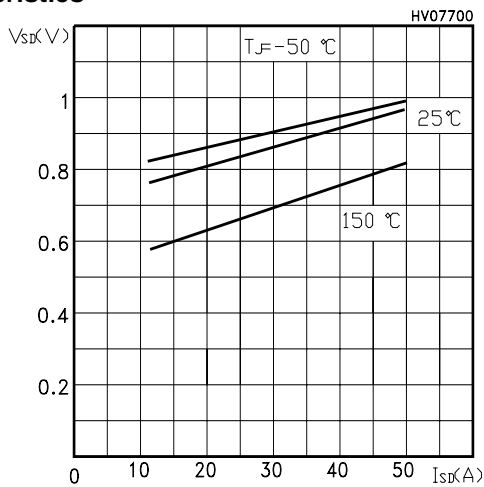


Figure 12: Capacitance Variations

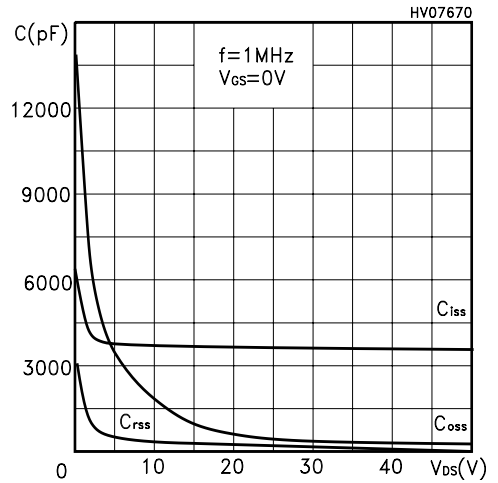


Figure 13: Normalized On Resistance vs Temperature

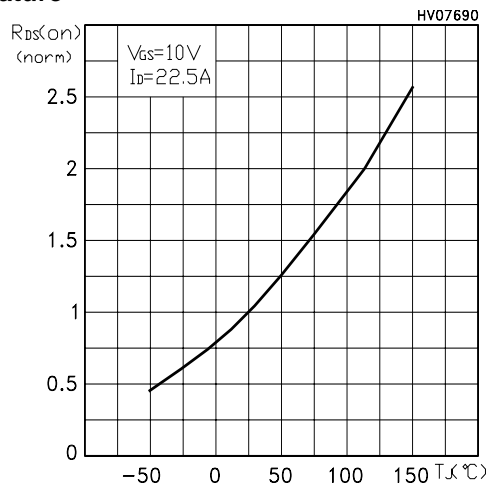


Figure 14: Unclamped Inductive Load Test Circuit

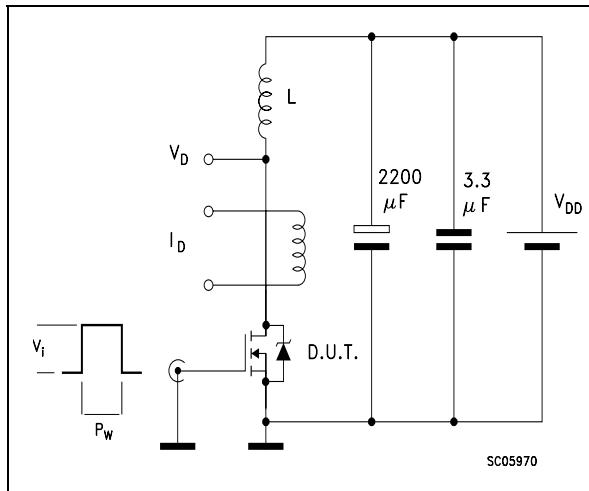


Figure 15: Switching Times Test Circuit For Resistive Load

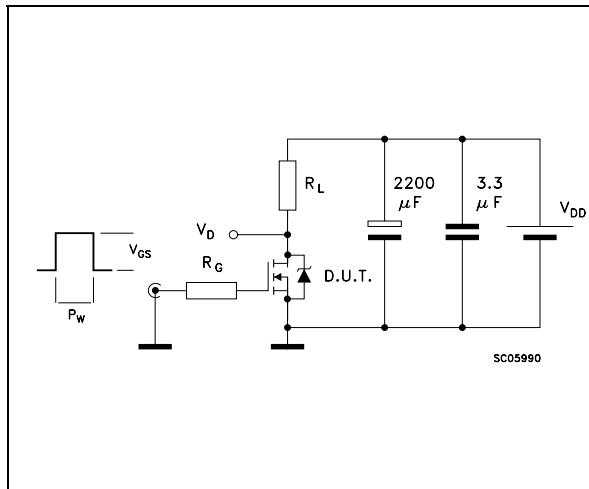


Figure 16: Test Circuit For Inductive Load Switching and Diode Recovery Times

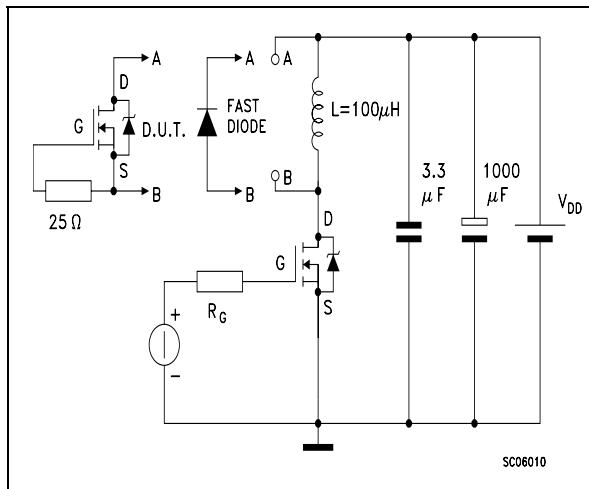


Figure 17: Unclamped Inductive Waferform

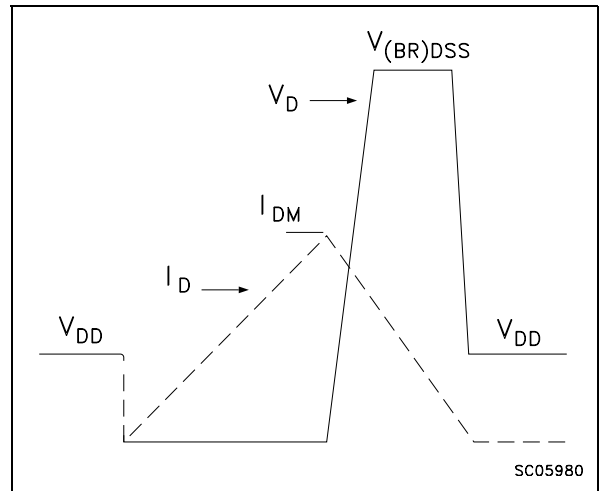
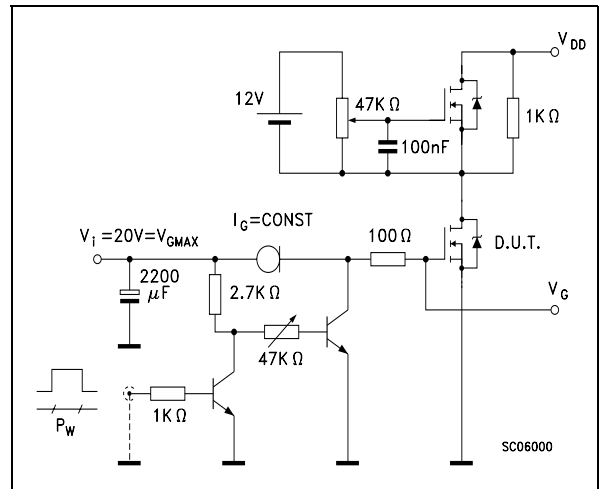


Figure 18: Gate Charge Test Circuit



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	

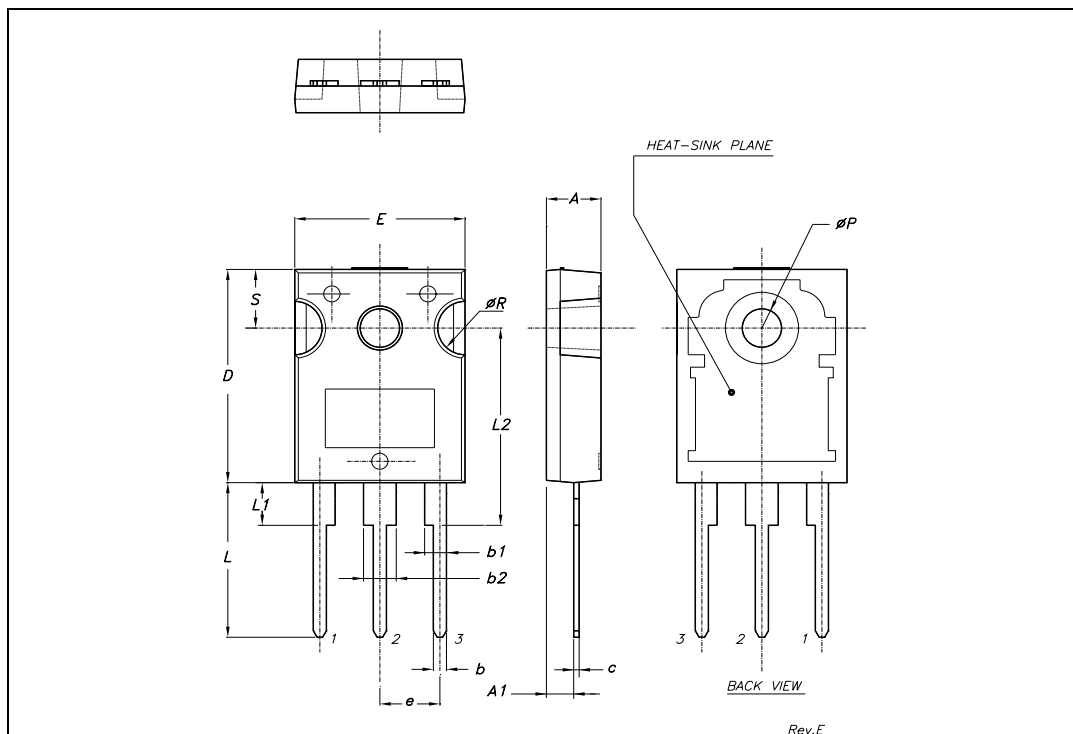


Table 9: Revision History

Date	Revision	Description of Changes
30/Mar/2005	2	Modified value in table 7

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