



# STW45NM50

## N-CHANNEL 550V @ Tjmax - 0.08Ω - 45A TO-247

### MDmesh™ MOSFET

**Table 1: General Features**

TYPE	V <sub>DSS</sub> (@Tjmax)	R <sub>DS(on)</sub>	I <sub>D</sub>
STW45NM50	550V	< 0.1Ω	45 A

- TYPICAL R<sub>DS(on)</sub> = 0.08Ω
- 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

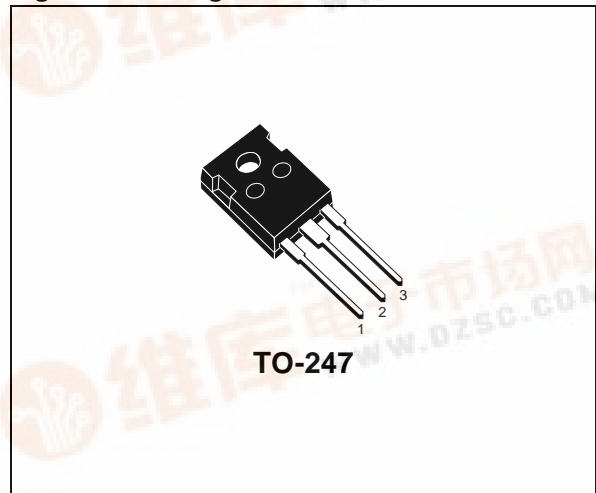
**DESCRIPTION**

The MDmesh™ is a new revolutionary MOSFET technology that associates the Multiple Drain process with the Company's PowerMESH™ horizontal layout. The resulting product has an outstanding low on-resistance, impressively high dv/dt and excellent avalanche characteristics. The adoption of the Company's proprietary strip technique yields overall dynamic performance that is significantly better than that of similar competition's products.

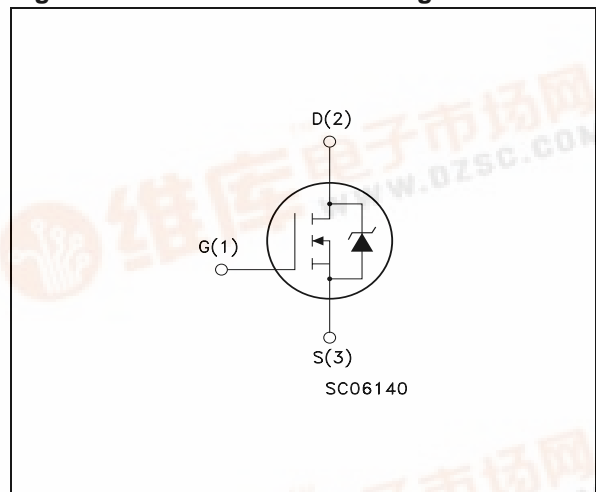
**APPLICATIONS**

The MDmesh™ family is very suitable for increasing power density of high voltage converters allowing system miniaturization and higher efficiencies.

**Figure 1: Package**



**Figure 2: Internal Schematic Diagram**



**Table 2: Order Codes**

SALES TYPE	MARKING	PACKAGE	PACKAGING
STW45NM50	W45NM50	TO-247	TUBE

## STW45NM50

**Table 3: Absolute Maximum ratings**

Symbol	Parameter	Value	Unit
V <sub>GS</sub>	Gate- source Voltage	±30	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	45	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	28.4	A
I <sub>DM</sub> (*)	Drain Current (pulsed)	180	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	417	W
	Derating Factor	2.08	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	15	V/ns
T <sub>stg</sub>	Storage Temperature	-65 to 150	°C
T <sub>j</sub>	Max. Operating Junction Temperature	150	°C

(\*)Pulse width limited by safe operating area

(1)I<sub>SD</sub> ≤ 45A, di/dt ≤ 400A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>.

**Table 4: Thermal Data**

R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	0.3	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	30	°C/W
T <sub>l</sub>	Maximum Lead Temperature For Soldering Purpose		300	°C

**Table 5: Avalanche Characteristics**

Symbol	Parameter	Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max)	20	A
E <sub>AS</sub>	Single Pulse Avalanche Energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 35 V)	810	mJ

## ELECTRICAL CHARACTERISTICS (T<sub>CASE</sub> =25°C UNLESS OTHERWISE SPECIFIED)

**Table 6: On/Off**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0	500			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max Rating V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C			10 100	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ±30 V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	3	4	5	V
R <sub>DSON</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 22.5 A		0.08	0.1	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	$V_{DS} = 25V, f = 1 \text{ MHz}, V_{GS} = 0$		3700 610 80		pF pF pF
$C_{oss \text{ eq.}}$ (3)	Equivalent Output Capacitance	$V_{GS} = 0V, V_{DS} = 0V \text{ to } 400V$		325		pF
$R_G$	Gate Input Resistance	$f=1 \text{ MHz}$ Gate DC Bias = 0 Test Signal Level = 20mV Open Drain		1.7		$\Omega$
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{DD} = 250V, I_D = 24 \text{ A}$ $R_G = 4.7\Omega, V_{GS} = 10 \text{ V}$ (see Figure 14)		40 35		ns ns
$t_{d(off)}$ $t_f$ $t_c$	Turn-off Delay Time Fall Time Cross-over Time	$V_{DD} = 400 \text{ V}, I_D = 45 \text{ A}, R_G = 4.7\Omega,$ $V_{GS} = 10 \text{ V}$ (see Figure 14)		18 23 44		ns ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400V, I_D = 45 \text{ A},$ $V_{GS} = 10V$ (see Figure 18)		87 23 42	117	nC nC nC

Table 8: Source Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				45	A
$I_{SDM}$ (3)	Source-drain Current (pulsed)				180	A
$V_{SD}$ (2)	Forward On Voltage	$I_{SD} = 45 \text{ A}, V_{GS} = 0$			1.5	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 40 \text{ A}, di/dt = 100A/\mu s,$ $V_{DD} = 100 \text{ V}, T_j = 25^\circ C$ (see Figure 16)		520 7.8 30		ns $\mu C$ A
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 40 \text{ A}, di/dt = 100A/\mu s,$ $V_{DD} = 100 \text{ V}, T_j = 150^\circ C$ (see Figure 16)		680 11.2 33		ns $\mu C$ A

(2) Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %.(3)  $C_{oss \text{ eq.}}$  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

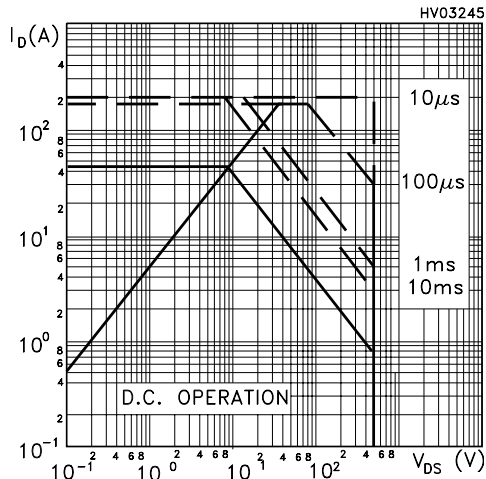


Figure 4: Output Characteristics

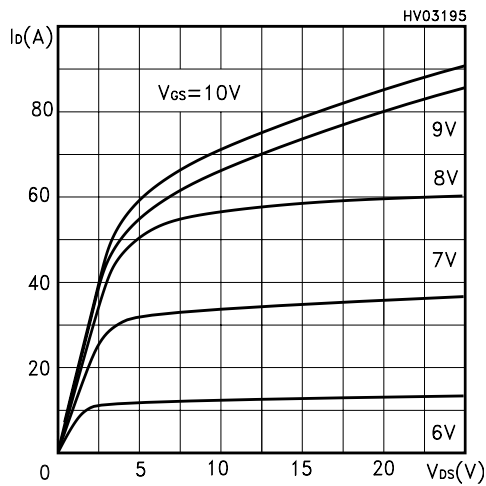


Figure 5: Transconductance

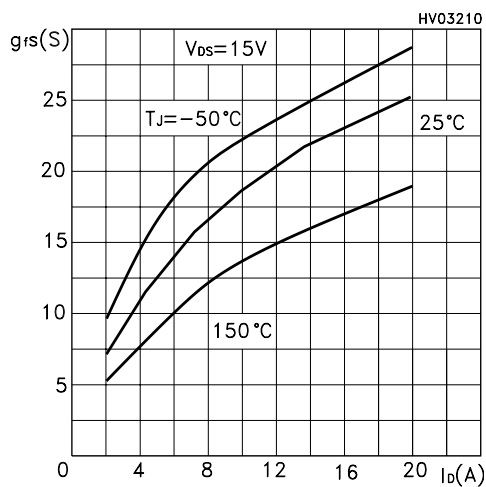


Figure 6: Thermal Impedance

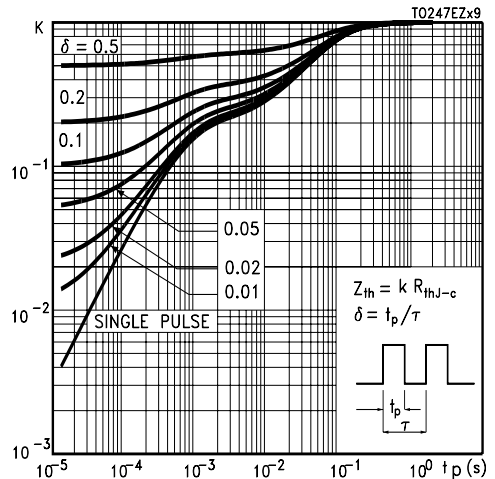


Figure 7: Transfer Characteristics

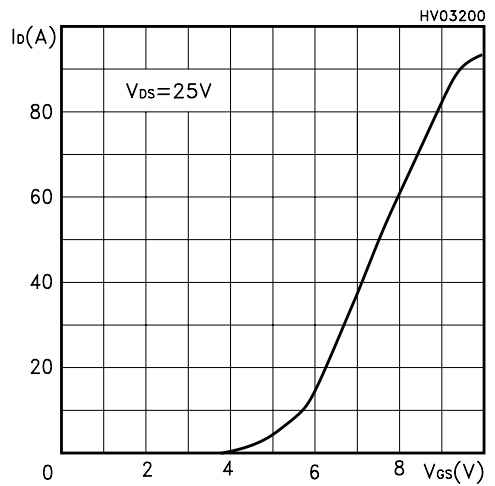


Figure 8: Static Drain-source On Resistance

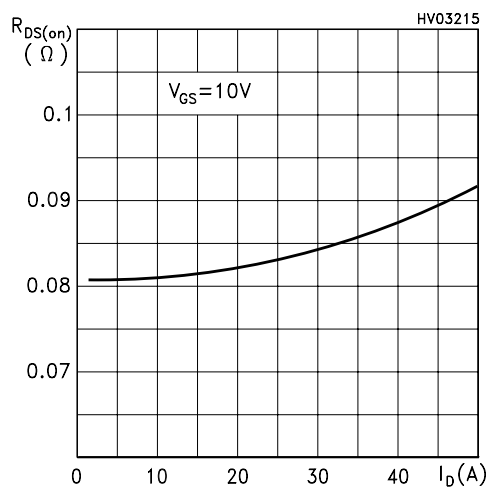


Figure 9: Gate Charge vs Gate-source Voltage

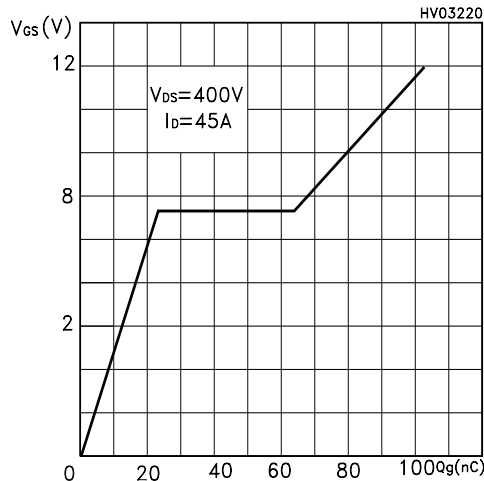


Figure 10: Normalized Gate Threshold Voltage vs Temperature

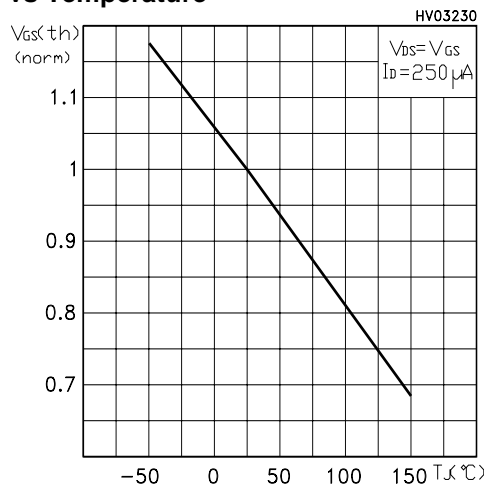


Figure 11: Source-Drain Diode Forward Characteristics

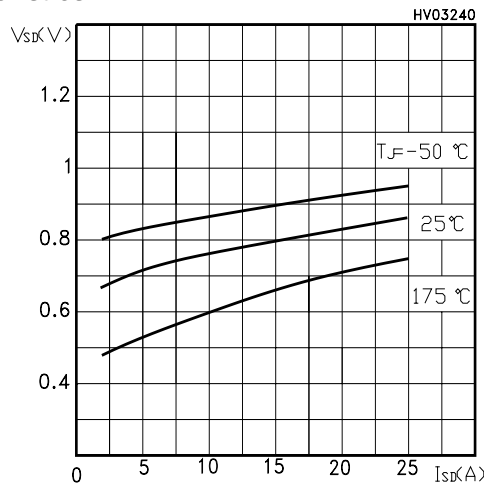


Figure 12: Capacitance Variations

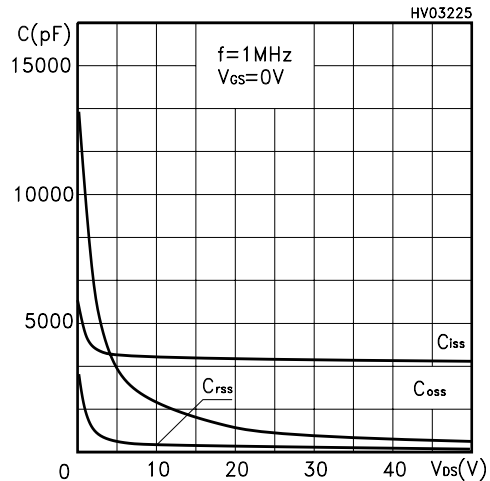
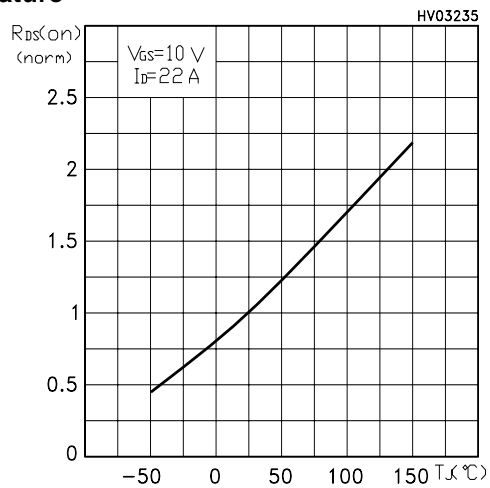
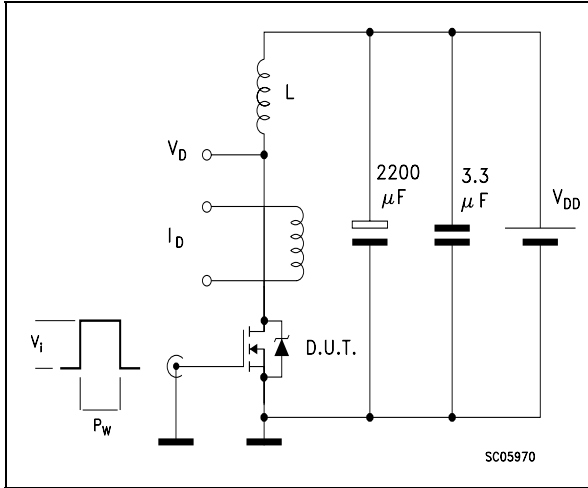


Figure 13: Normalized On Resistance vs Temperature

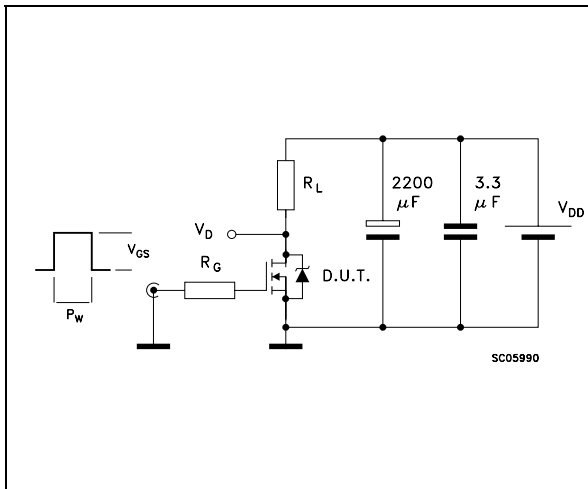


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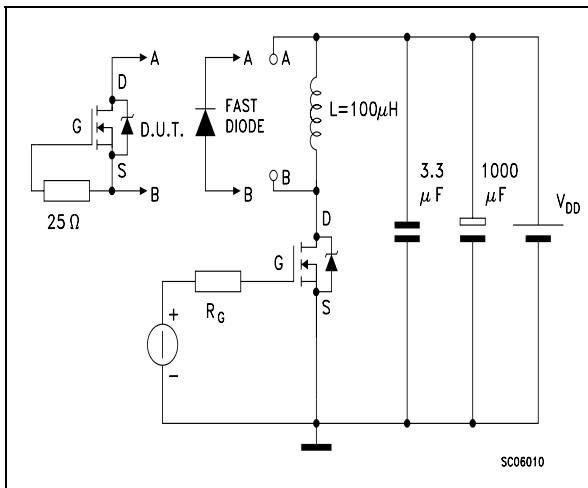
**Figure 14: Unclamped Inductive Load Test Circuit**



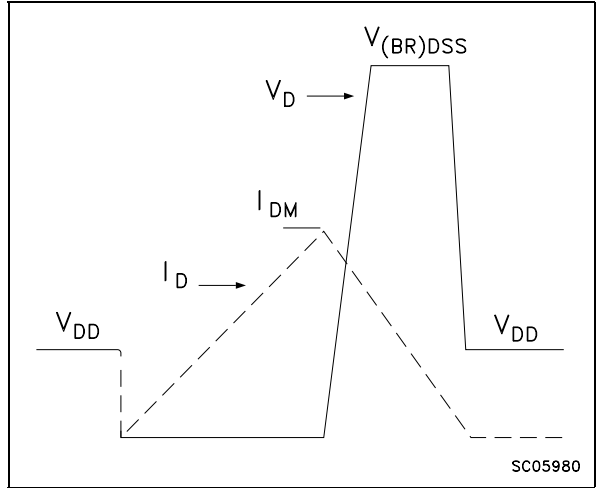
**Figure 15: Switching Times Test Circuit For Resistive Load**



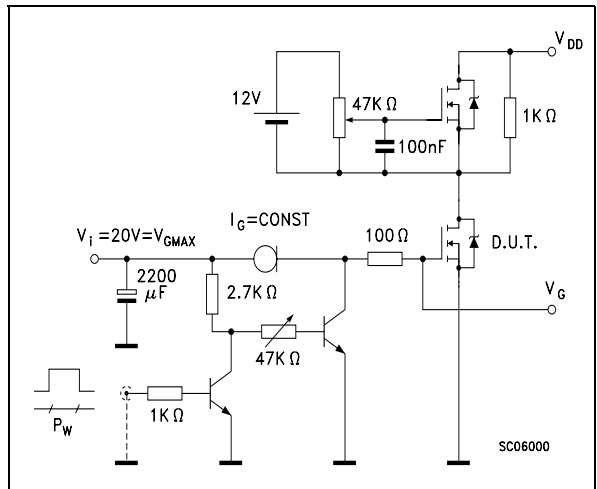
**Figure 16: Test Circuit For Inductive Load Switching and Diode Recovery Times**



**Figure 17: Unclamped Inductive Wafeform**

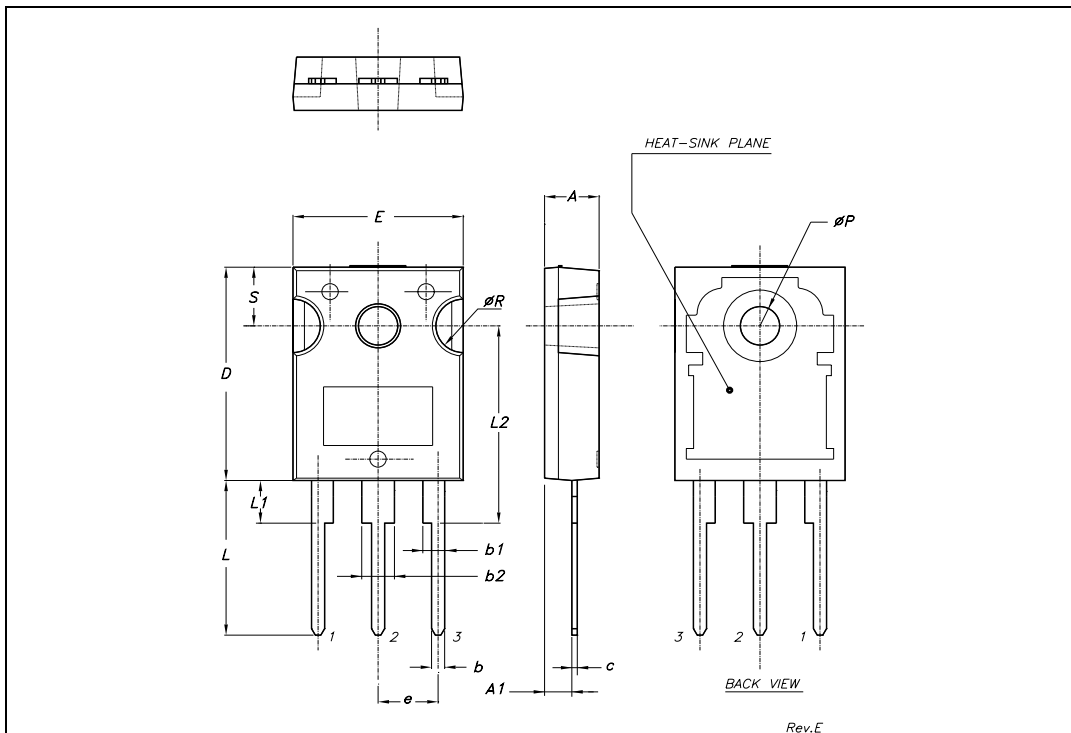


**Figure 18: Gate Charge Test Circuit**



**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	



## STW45NM50

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**Table 9: Revision History**

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



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