



# STW29NK50ZD

N-CHANNEL 500 V - 0.095Ω - 29A TO-247  
Fast Diode SuperMESH™ MOSFET

**Table 1: General Features**

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>	P <sub>W</sub>
STW29NK50ZD	500 V	< 0.13 Ω	29 A	350 W

- TYPICAL R<sub>DS(on)</sub> = 0.095 Ω
- HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- GATE CHARGE MINIMIZED
- LOW INTRINSIC CAPACITANCES
- VERY GOOD MANUFACTURING REPEATABILITY
- FAST INTERNAL RECOVERY TIME

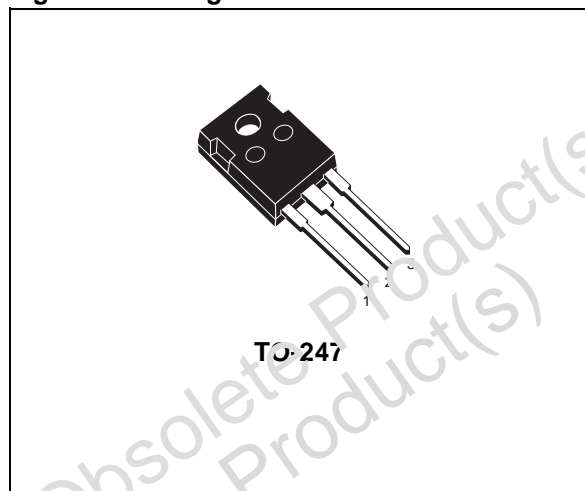
## DESCRIPTION

The Fast SuperMesh™ series associates all advantages of reduced on-resistance, zener gate protection and very good dv/dt capability with a Fast body-drain recovery diode. Such series complements the "FDmesh™" Advanced Technology.

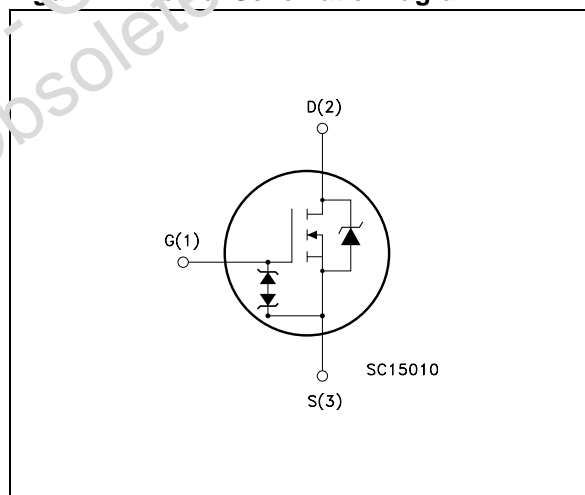
## APPLICATIONS

- HID BALLAST
- ZVS PHASE-SHIFT FULL BRIDGE

**Figure 1: Package**



**Figure 2: Internal Schematic Diagram**



**Table 2: Order Codes**

PART NUMBER	MARKING	PACKAGE	PACKAGING
STW29NK50ZD	W29NK50ZD	TO-247	TUBE

**Table 3: Absolute Maximum ratings**

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	500	V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 KΩ)	500	V
V <sub>GS</sub>	Gate- source Voltage	± 30	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	29	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	18.27	A
I <sub>DM</sub> (*)	Drain Current (pulsed)	116	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	350	W
	Derating Factor	2.77	W/°C
V <sub>ESD(G-S)</sub>	Gate source ESD (HBM-C = 100pF, R = 1.5 KΩ)	6000	V
dv/dt (1)	Peak Diode Recovery voltage slope	4.5	V/μs
T <sub>stg</sub> T <sub>j</sub>	Storage Temperature Operating Junction Temperature	-55 to 150	°C

(\*) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 29 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ 400V**Table 4: Thermal Data**

R <sub>thj-case</sub>	Thermal Resistance Junction-case Max	0.36	°C/W
R <sub>thj-amb</sub> T <sub>I</sub>	Thermal Resistance Junction-ambient Max Maximum Lead Temperature For Soldering Purpose	50 300	°C/W °C

**Table 5: Avalanche Characteristics**

Symbol	Parameter	Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Non-Repitative (pulse width limited by T <sub>j</sub> max)	29	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> = 50 V)	500	mJ

**Table 6: Gate-Source Zener Diode**

Symbol	Parameter	Test Condition	Min.	Typ.	Max	Unit
BV <sub>GSO</sub>	Gate-Source Breakdown Voltage	I <sub>gs</sub> = ± 1mA (Open Drain)	30			A

**PROTECTION FEATURES OF GATE-TO-SOURCE ZENER DIODES**

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

**TABLE 7: ELECTRICAL CHARACTERISTICS** ( $T_{CASE} = 25^{\circ}C$  UNLESS OTHERWISE SPECIFIED)**On /Off**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1 \text{ mA}, V_{GS} = 0$	500			S
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}, T_C = 125^{\circ}C$			1 50	$\mu A$ $\mu A$
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20 \text{ V}$			$\pm 10$	$\mu A$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 150 \mu A$	3	3.75	4.5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 14.5 \text{ A}$		0.095	0.13	$\Omega$

**Table 8: Dynamic**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (1)$	Forward Transconductance	$V_{DS} = 15 \text{ V}, I_D = 14.5 \text{ A}$		28		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}, V_{GS} = 0$		6450 710 165		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	$V_{DD} = 400 \text{ V}, I_D = 14.5 \text{ A},$ $R_G = 4.7 \Omega, V_{GS} = 10 \text{ V}$ (d see Figure 17)		45 43 133 25		ns ns ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 490 \text{ V}, I_D = 14.5 \text{ A},$ $V_{GS} = 10 \text{ V}$		180 33 108	200	nC nC nC

**Table 9: Source Drain Diode**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM} (2)$	Source-Drain Current Source-Drain Current (pulsed)				29 116	A A
$V_{SD} (1)$	Forward On Voltage	$I_{SD} = 29 \text{ A}, V_{GS} = 0$			1.6	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 29 \text{ A}, di/dt = 100 \text{ A}/\mu s$ $V_{DD} = 30 \text{ V}, T_j = 25^{\circ}C$ (see Figure 18)		264 2.08 15.7		ns $\mu C$ A
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 29 \text{ A}, di/dt = 100 \text{ A}/\mu s$ $V_{DD} = 30 \text{ V}, T_j = 150^{\circ}C$ (see Figure 18)		395 4.164 21.1		ns $\mu C$ A

(1) Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %.

(2) Pulse width limited by safe operating area.

Figure 3: Safe Operating Area

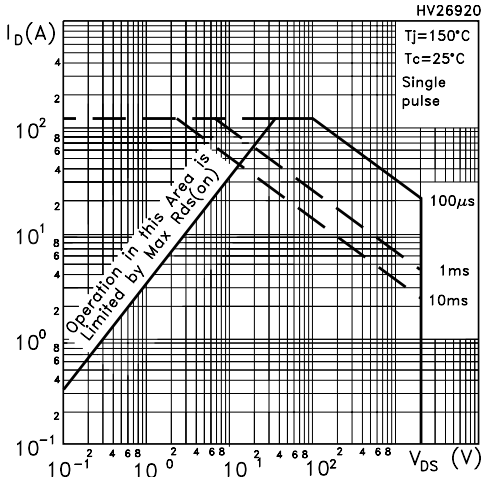


Figure 4: Output Characteristics

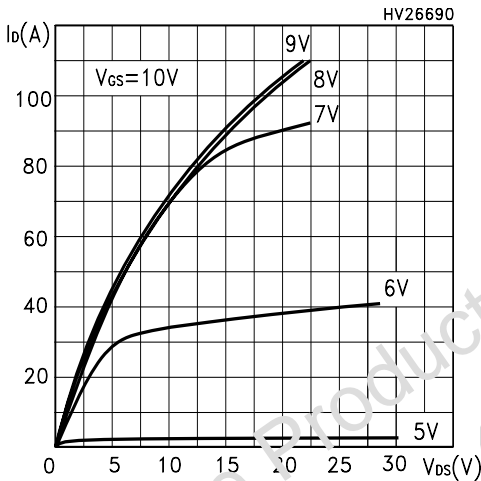


Figure 5: Transconductance

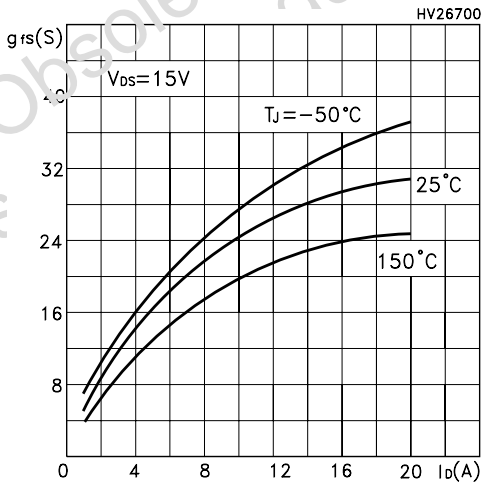


Figure 6: Thermal Impedance

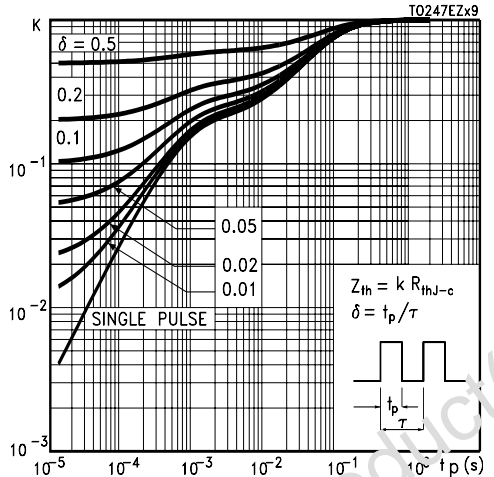


Figure 7: Transfer Characteristics

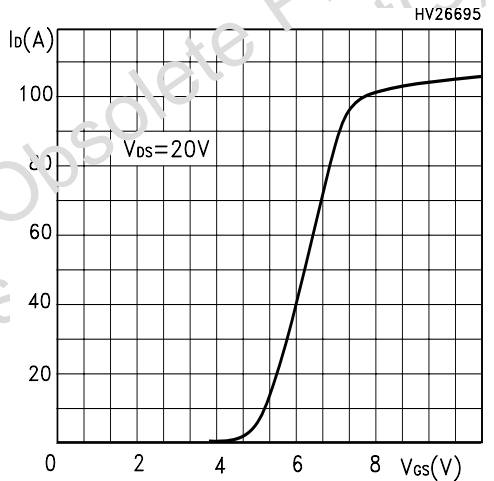


Figure 8: Static Drain-source On Resistance

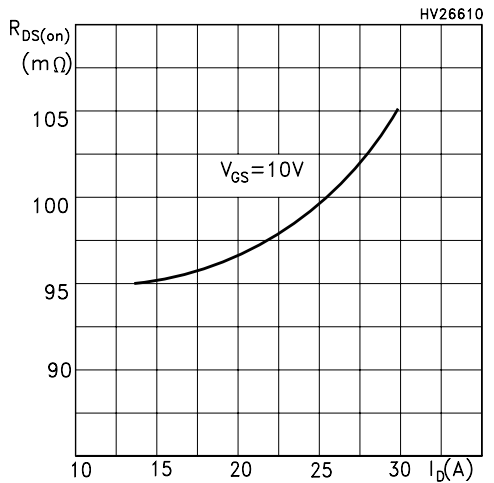


Figure 9: Gate Charge vs Gate-source Voltage

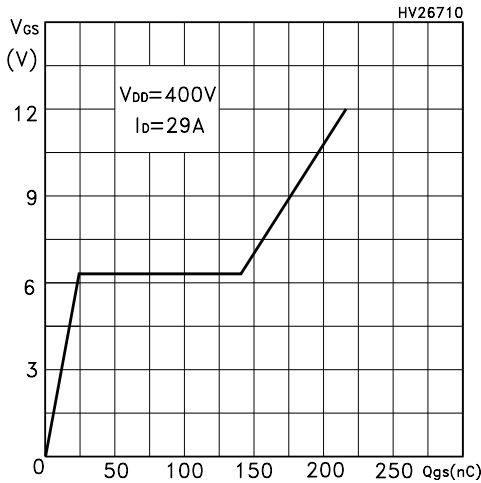


Figure 10: Normalized Gate Threshold Voltage vs Temperature

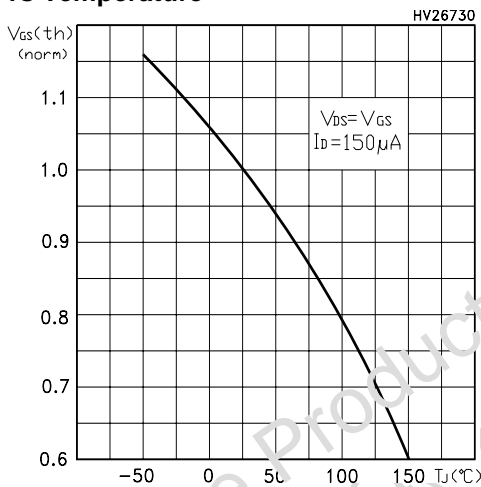


Figure 11: Source-Drain Diode Forward Characteristics

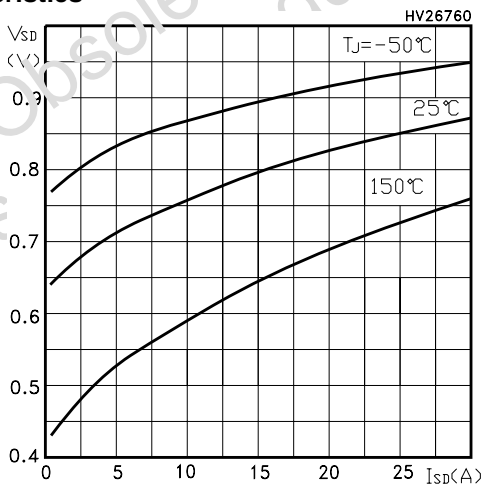


Figure 12: Capacitance Variations

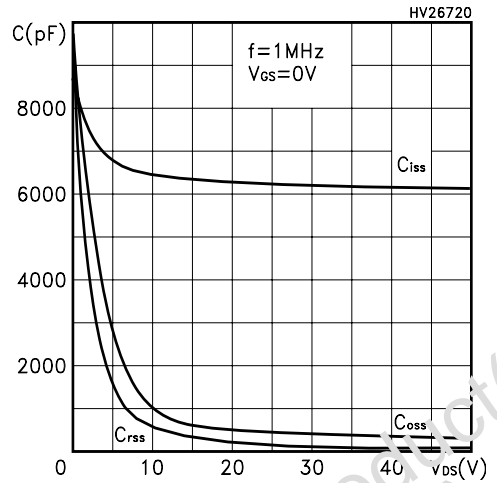


Figure 13: Normalized On Resistance vs Temperature

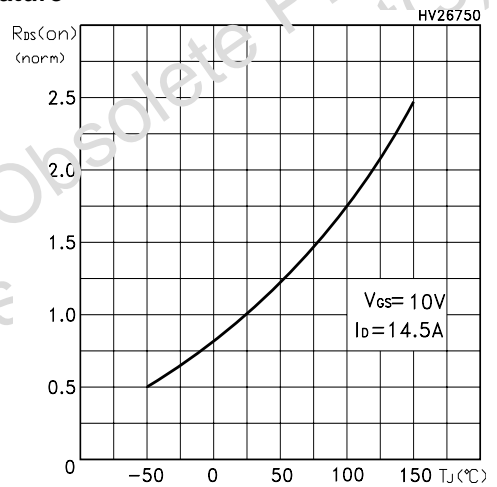


Figure 14: Normalized BVds vs Temperature

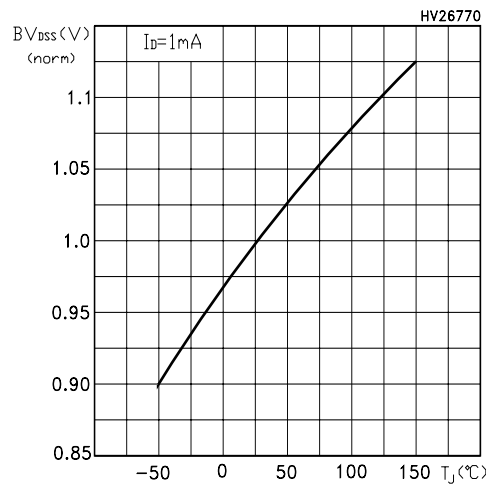
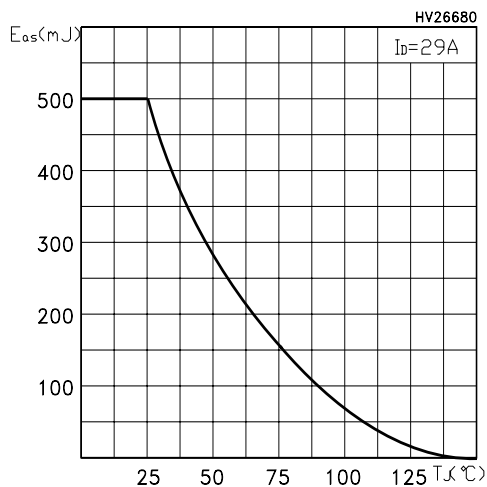


Figure 15: Avalanche Energy vs Starting Tj



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Figure 16: Unclamped Inductive Load Test Circuit

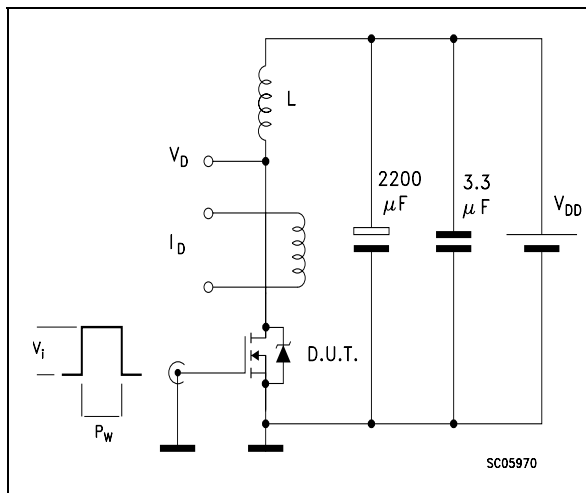


Figure 17: Switching Times Test Circuit For Resistive Load

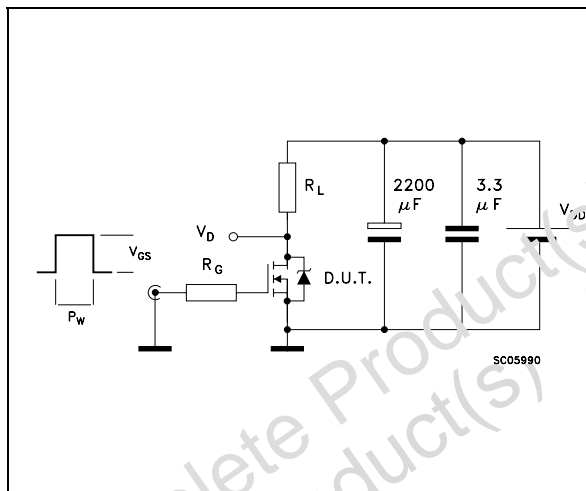


Figure 18: Test Circuit For Inductive Load Switching and Diode Recovery Times

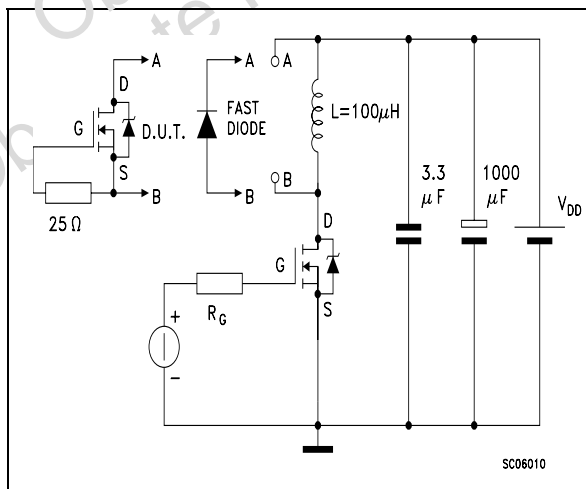


Figure 19: Unclamped Inductive Waferform

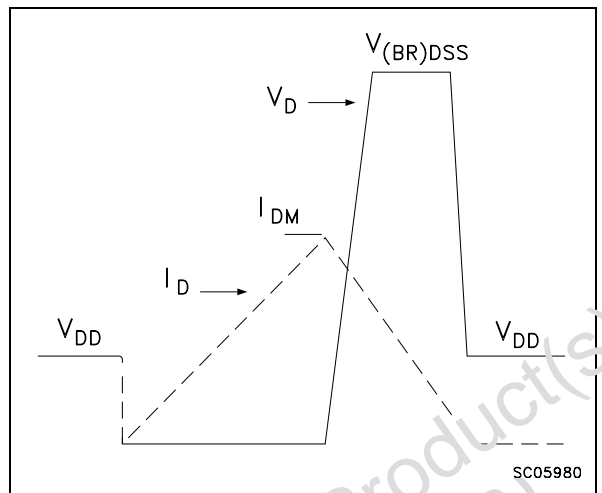
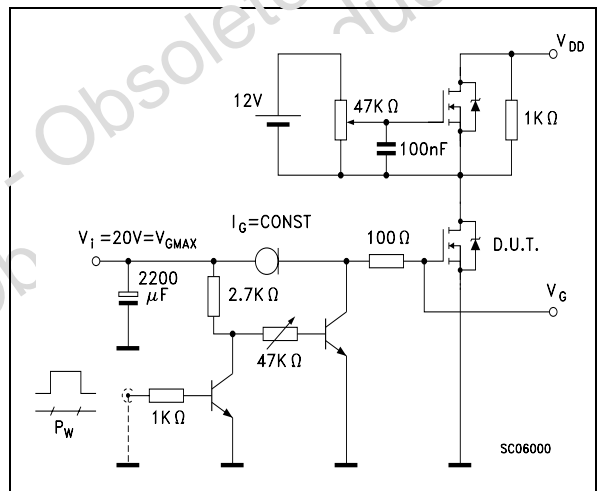
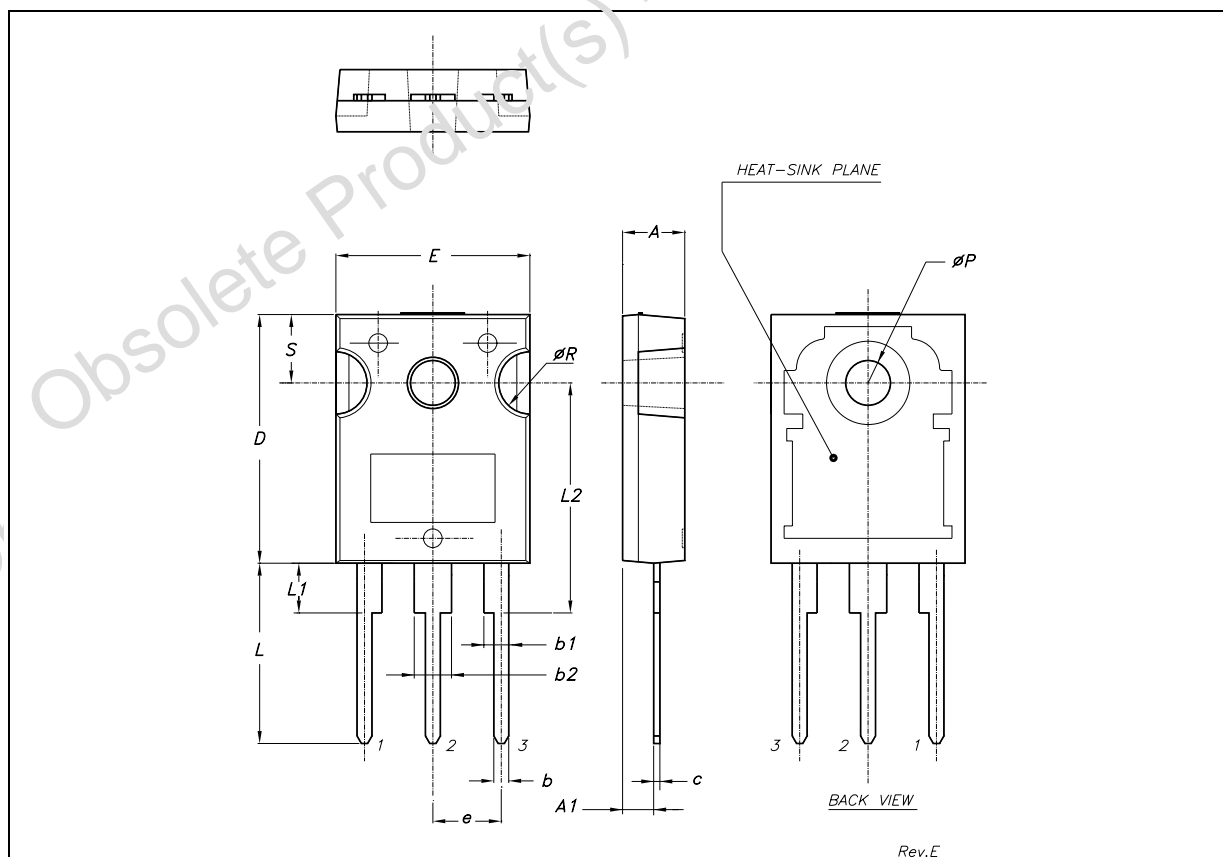


Figure 20: Gate Charge Test Circuit



## 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 10: Revision History**

<b>Date</b>	<b>Revision</b>	<b>Description of Changes</b>
05-Feb-2004	1	First Release.
06-Dec-2004	2	Some electrical value changed
20-Jul-2005	3	Complete version

Obsolete Product(s) - Obsolete Product(s)  
Obsolete Product(s) - Obsolete Product(s)

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