

## Silicon N-Channel Power MOSFET

### General Description :

HMB9N30 the silicon N-channel Enhanced VDMOSFET, is obtained by the self-aligned planar Technology which reduce the conduction loss, improve switching performance and enhance the avalanche energy. The transistor can be used in various power switching circuit for system miniaturization and higher efficiency. The package form is TO-220AB, which accords with the RoHS standard.

### Features :

- Fast Switching
- Low ON Resistance( $R_{dson} \leq 0.55\Omega$ )
- Low Gate Charge
- Low Reverse transfer capacitances
- 100% Single Pulse avalanche energy Test

### Applications:

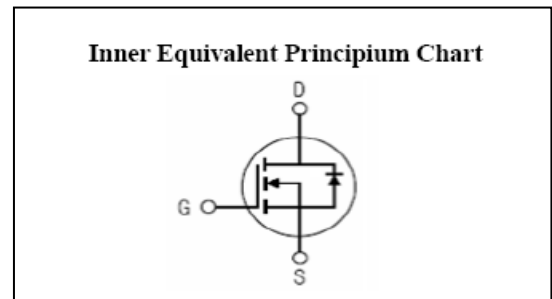
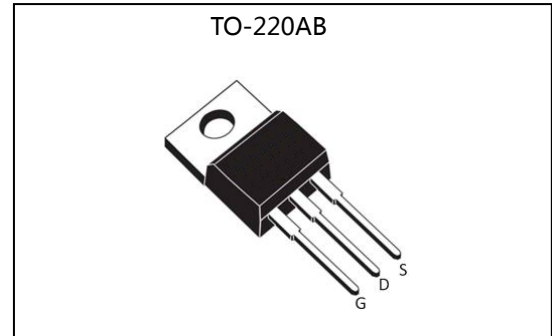
- Power switch circuit of adaptor and charger

### Absolute ( $T_c=25^\circ\text{C}$ unless otherwise specified ) :

Symbol	Parameter	Rating	Units
$V_{DSS}$	Drain-to-Source Voltage	300	V
$I_D$	Continuous Drain Current	9	A
	Continuous Drain Current $T_c=100^\circ\text{C}$	5.7	A
$I_{DM}^{a1}$	Pulsed Drain Current	36	A
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulse Avalanche Energy	420	mJ
$E_{AR}^{a1}$	Avalanche Energy ,Repetitive	9.8	mJ
$I_{AR}^{a1}$	Avalanche Current	9	A
$dv/dt^{a3}$	Peak Diode Recovery $dv/dt$	5.0	V/ns
$P_D$	Power Dissipation	98	W
	Derating Factor above $25^\circ\text{C}$	0.78	W/ $^\circ\text{C}$
$T_J, T_{stg}$	Operating Junction and Storage Temperature Range	150 , $-55$ to $150$	$^\circ\text{C}$
$T_L$	Maximum Temperature for Soldering	300	$^\circ\text{C}$

Caution Stresses greater than those in the "Absolute Maximum Ratings" may cause permanent damage to the device

$V_{DSS}$	300	V
$I_D$	9	A
$P_D(T_c=25^\circ\text{C})$	98	W
$R_{DS(ON).TYP.}$	400	m $\Omega$



**Thermal Characteristics**

Symbol	Parameter	Rating	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.28	°C/ W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	°C/ W

**Electrical Characteristics** (  $T_c = 25^\circ\text{C}$  unless otherwise specified ) :

**OFF Characteristics**

Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$V_{DSS}$	Drain to Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	300	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Bvdss Temperature Coefficient	$I_D=250\mu A, \text{Reference } 25^\circ\text{C}$	--	0.3	--	V/°C
$I_{DSS}$	Drain to Source Leakage Current	$V_{DS}=300V, V_{GS}=0V, T_a=25^\circ\text{C}$	--	--	1	$\mu A$
		$V_{DS}=240V, V_{GS}=0V, T_a=125^\circ\text{C}$	--	--	10	
$I_{GSS(F)}$	Gate to Source Forward Leakage	$V_{GS}=+30V$	--	--	100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	$V_{GS}=-30V$	--	--	-100	nA

**ON Characteristics**

Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$R_{DS(ON)}$	Drain-to-Source On-Resistance	$V_{GS}=10V, I_D=4.5A$	--	0.4	0.55	$\Omega$
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	--	4.0	V
$g_{fs}$	Forward Trans conductance	$V_{DS}=50V, I_D=4.5A$	--	4.9	--	S

Pulse width < 380 $\mu$ s; duty cycle < 2%.

**Dynamic Characteristics**

Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$C_{iss}$	Input Capacitance	$V_{GS}=0V, V_{DS}=25V$ $f=1.0\text{MHz}$	--	570	--	pF
$C_{oss}$	Output Capacitance		--	120	--	
$C_{rss}$	Reverse Transfer Capacitance		--	16	--	

**Resistive Switching Characteristics**

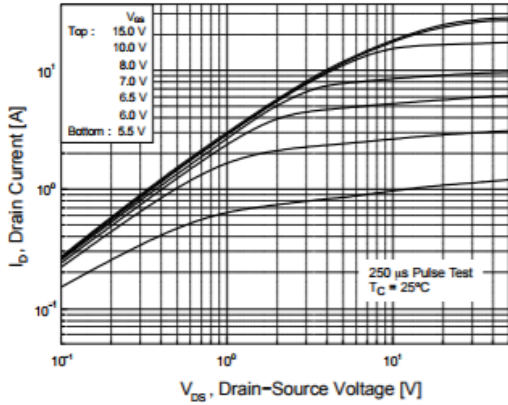
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	$I_D=9A, V_{DD}=150V$ $V_{GS}=10V, R_g=25\Omega$	--	17	--	ns
$t_r$	Rise Time		--	120	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	28	--	
$t_f$	Fall Time		--	49	--	
$Q_g$	Total Gate Charge	$I_D=9A, V_{DD}=150V$ $V_{GS}=10V$	--	15	--	nC
$Q_{gs}$	Gate to Source Charge		--	3.5	--	
$Q_{gd}$	Gate to Drain ( "Miller" ) Charge		--	9	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$I_{SD}$	Continuous Source Current (Body Diode)		--	--	9	A
$I_{SM}$	Maximum Pulsed Current (Body Diode)		--	--	36	A
$V_{SD}$	Diode Forward Voltage	$I_S=9A, V_{GS}=0V$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$I_S=9A, T_J=25^\circ C$	--	170	--	ns
$Q_{rr}$	Reverse Recovery Charge	$dI_F/dt=100A/\mu s, V_{GS}=0V$	--	1.5	--	$\mu C$

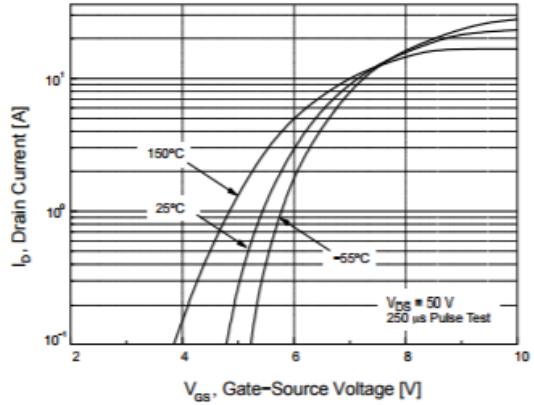
a1 : Repetitive rating; pulse width limited by maximum junction temperature

a2 : L=10mH,  $I_D=9.5A$ , Start  $T_J=25^\circ C$

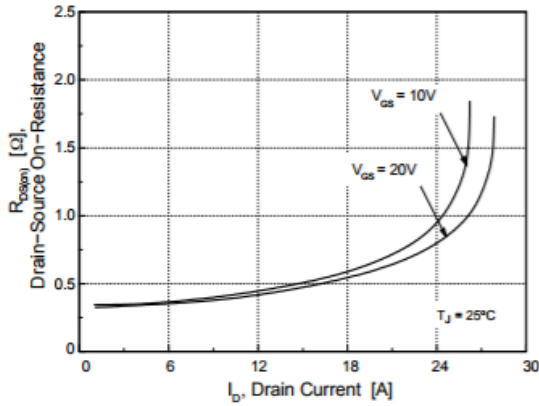
## Characteristics Curve :



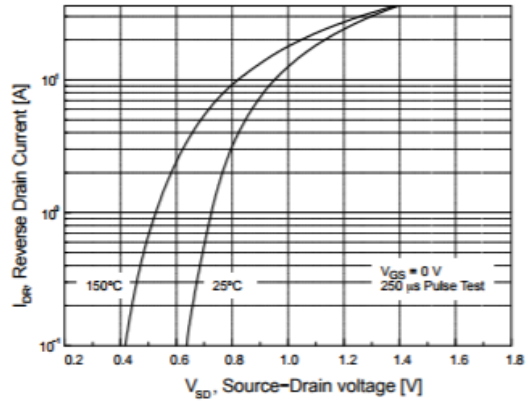
**Figure 1. On-Region Characteristics**



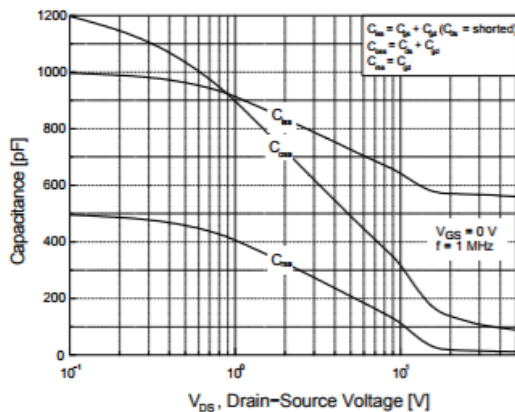
**Figure 2. Transfer Characteristics**



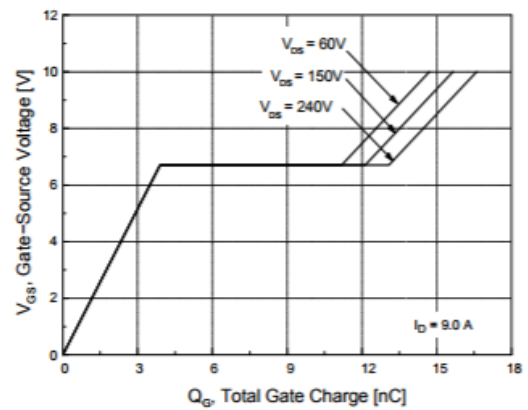
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



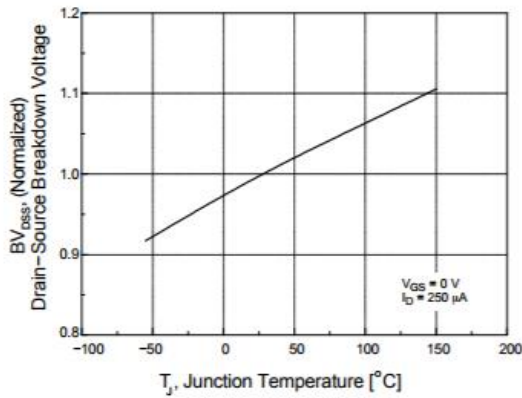
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



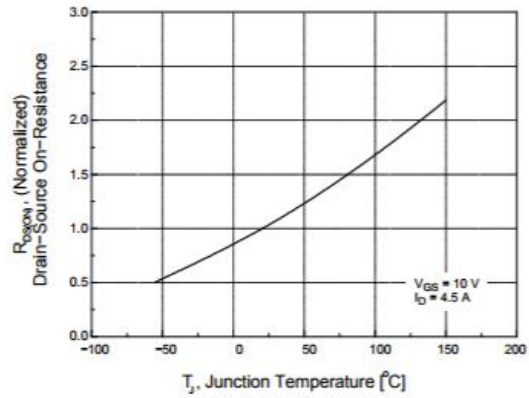
**Figure 5. Capacitance Characteristics**



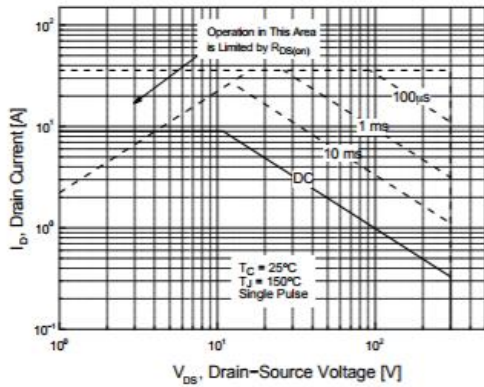
**Figure 6. Gate Charge Characteristics**



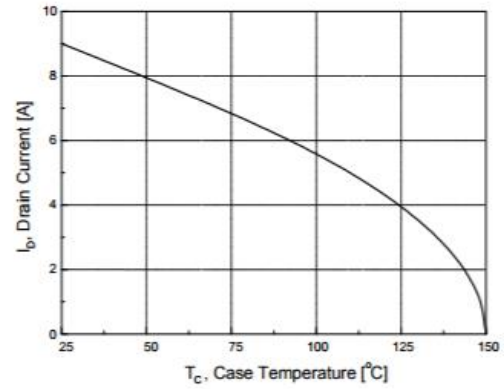
**Figure 7. Breakdown Voltage Variation vs. Temperature**



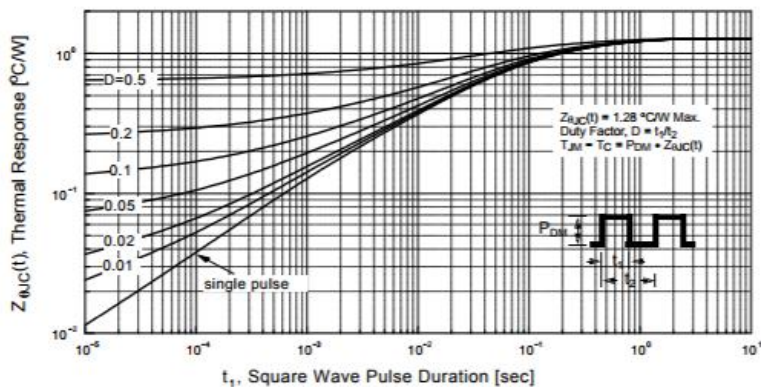
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**



**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. Transient Thermal Response Curve**

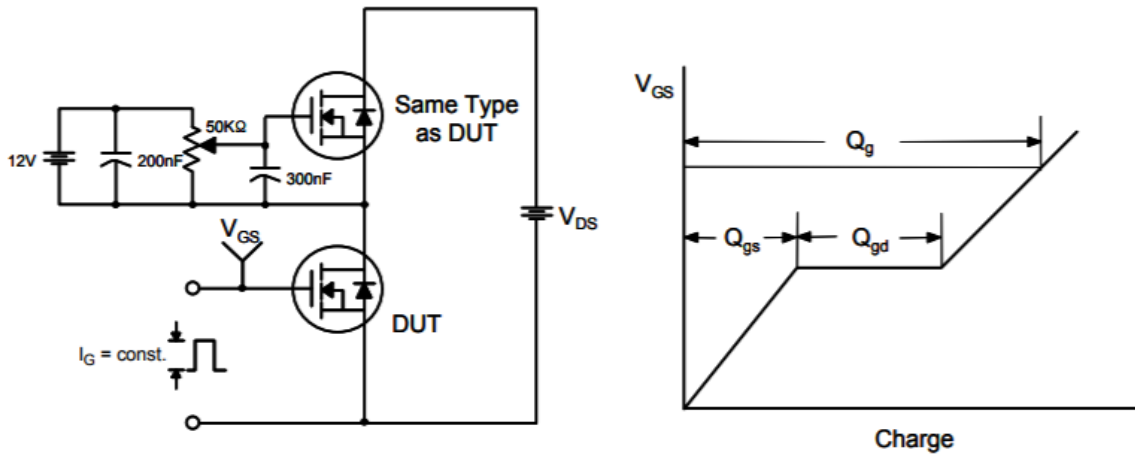


Figure 12. Gate Charge Test Circuit & Waveforms

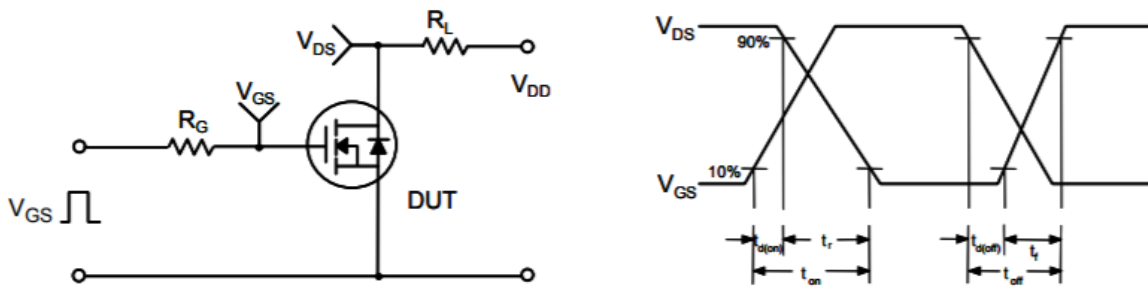


Figure 13. Resistive Switching Test Circuit & Waveforms

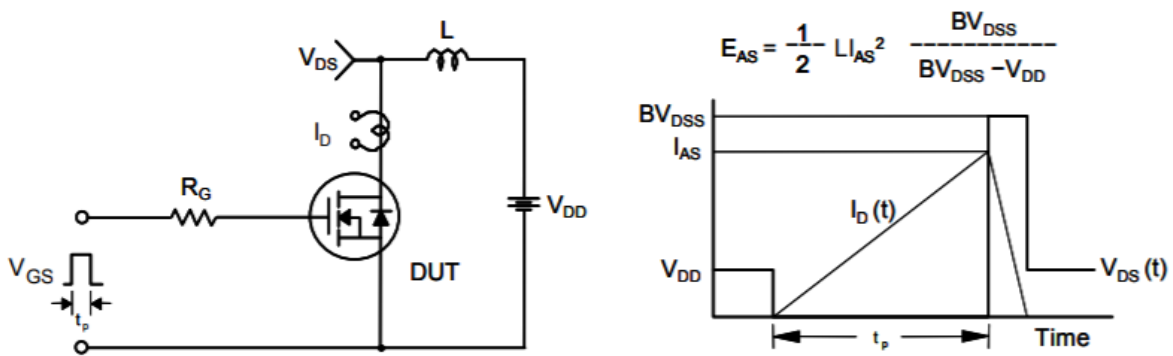


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

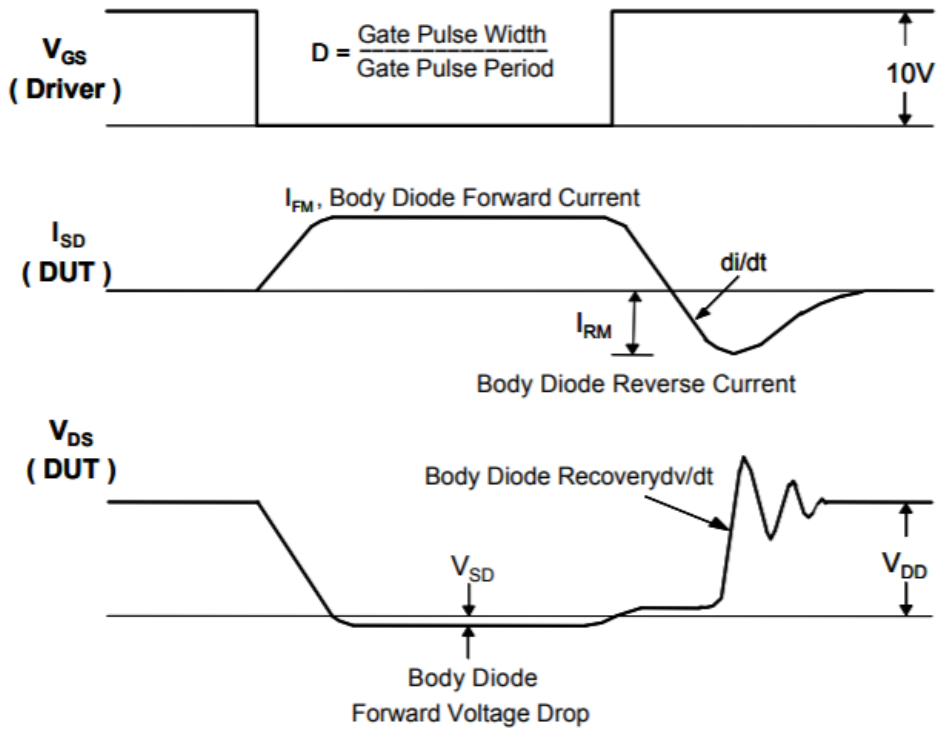
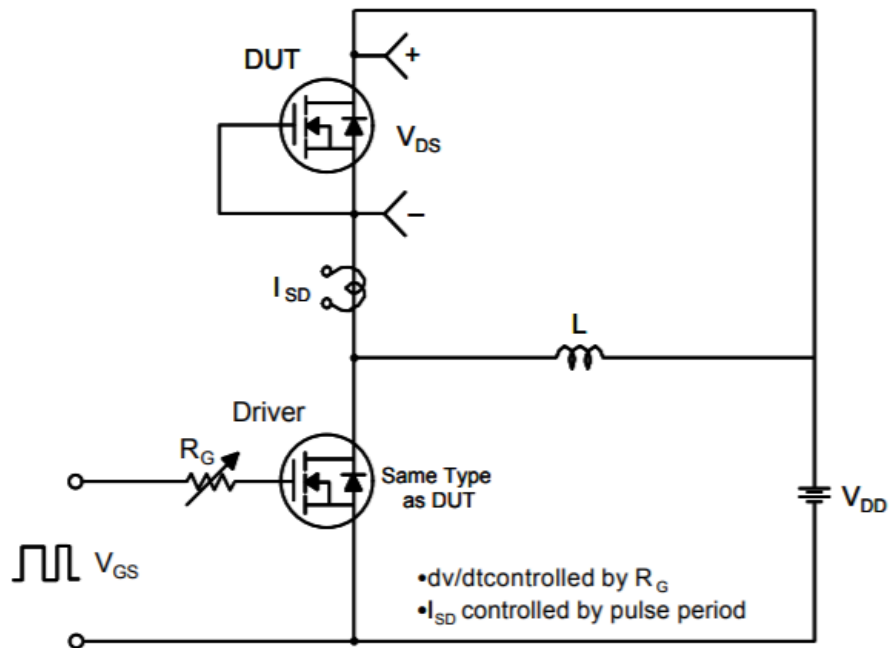


Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms