

## Silicon N-Channel Power MOSFET

### General Description :

The HMR12N06L uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications. The package form is TO-252, which accords with the RoHS standard.

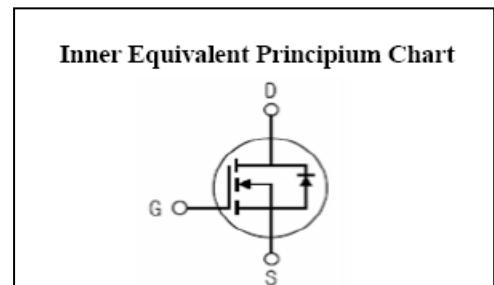
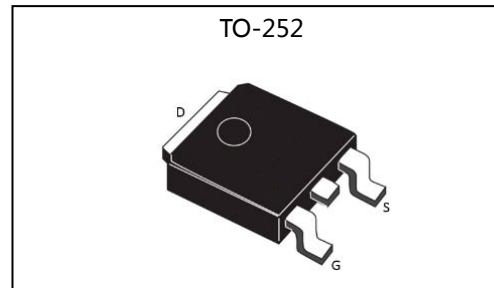
### Features :

- Fast Switching
- Low Gate Charge and  $R_{dson}$
- Low Reverse transfer capacitances
- 100% Single Pulse avalanche energy Test

### Applications :

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

$V_{DSS}$	60	V
$I_D$	12	A
$P_D$	35	W
$R_{DS(ON)typ}$	58	$m\Omega$



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

Symbol	Parameter	Rating	Units
$V_{DSS}$	Drain-to-Source Voltage	60	V
$I_D$	Continuous Drain Current	12	A
	Continuous Drain Current $T_c = 100^\circ\text{C}$	8.5	A
$I_{DM}$	Pulsed Drain Current	48	A
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}^{a2}$	Single Pulse Avalanche Energy	30	mJ
$E_{AR}^{a1}$	Avalanche Energy ,Repetitive	10	mJ
$I_{AR}^{a1}$	Avalanche Current	6	A
$dv/dt^{a3}$	Peak Diode Recovery $dv/dt$	5.0	V/ns
$P_D$	Power Dissipation	35	W
$T_J, T_{stg}$	Operating Junction and Storage Temperature Range	175 , $-55$ to 175	$^\circ\text{C}$
$T_L$	Maximum Temperature for Soldering	300	$^\circ\text{C}$

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

<b>OFF Characteristics</b>						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$V_{DSS}$	Drain to Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	60	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Bvdss Temperature Coefficient	$I_D=250\mu A, \text{Reference } 25^\circ\text{C}$	--	0.1	--	V/ $^\circ\text{C}$
$I_{DSS}$	Drain to Source Leakage Current	$V_{DS}=60V, V_{GS}=0V, T_a=25^\circ\text{C}$	--	--	1	$\mu A$
		$V_{DS}=48V, V_{GS}=0V, T_a=125^\circ\text{C}$	--	--	250	
$I_{GSS(F)}$	Gate to Source Forward Leakage	$V_{GS}=+20V$	--	--	1	$\mu A$
$I_{GSS(R)}$	Gate to Source Reverse Leakage	$V_{GS}=-20V$	--	--	-1	$\mu A$

<b>ON Characteristics</b>						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$R_{DS(ON)}$	Drain-to-Source On-Resistance	$V_{GS}=10V, I_D=6A$	--	58	85	m $\Omega$
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1.0	1.4	2.5	V
Pulse width $t_p \leq 380\mu s, \delta \leq 2\%$						

<b>Dynamic Characteristics</b>						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$g_{fs}$	Forward Transconductance	$V_{DS}=15V, I_D=3A$	2	--	--	S
$C_{iss}$	Input Capacitance	$V_{GS}=0V, V_{DS}=30V$ $f=1.0\text{MHz}$	--	250	--	pF
$C_{oss}$	Output Capacitance		--	35	--	
$C_{riss}$	Reverse Transfer Capacitance		--	20	--	

<b>Resistive Switching Characteristics</b>						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	$I_D=2A, V_{DD}=30V$ $V_{GS}=10V, R_G=3.0\Omega$	--	6	--	ns
$t_r$	Rise Time		--	15	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	15	--	
$t_f$	Fall Time		--	10	--	
$Q_g$	Total Gate Charge	$I_D=3A, V_{DD}=30V$ $V_{GS}=10V$	--	6.6	--	nC
$Q_{gs}$	Gate to Source Charge		--	1.2	--	
$Q_{gd}$	Gate to Drain ( "Miller" ) Charge		--	1.5	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$I_S$	Continuous Source Current (Body Diode)		--	--	12	A
$I_{SM}$	Maximum Pulsed Current (Body Diode)		--	--	48	A
$V_{SD}$	Diode Forward Voltage	$I_S=12A, V_{GS}=0V$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$I_S=10A, T_j = 25^\circ C$	--	28	--	ns
$Q_{rr}$	Reverse Recovery Charge	$dI_F/dt=100A/us, V_{GS}=0V$	--	38	--	nC

Pulse width  $t_p \leq 380\mu s, \delta \leq 2\%$

Symbol	Parameter	Typ.	Units
$R_{\theta JC}$	Junction-to-Case	3.58	$^\circ C/W$

<sup>a1</sup> : Repetitive rating; pulse width limited by maximum junction temperature

<sup>a2</sup> : EAS condition :  $T_j=25^\circ C, V_{DD}=30V, V_G=10V, L=0.5mH, R_g=25\Omega$

<sup>a3</sup> :  $I_{SD}=10A, di/dt \leq 100A/us, V_{DD} \leq BV_{DS}, \text{Start } T_j=25^\circ C$

### Test Circuit and Waveform

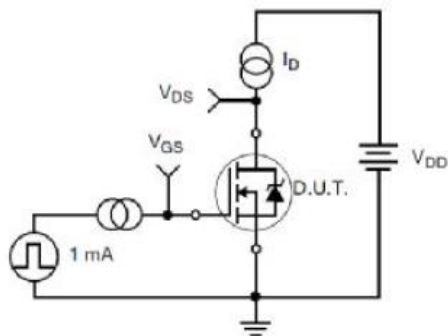


Figure 17. Gate Charge Test Circuit

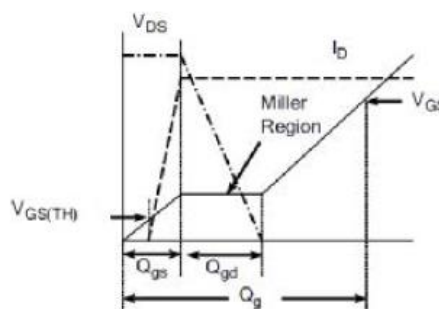


Figure 18. Gate Charge Waveform

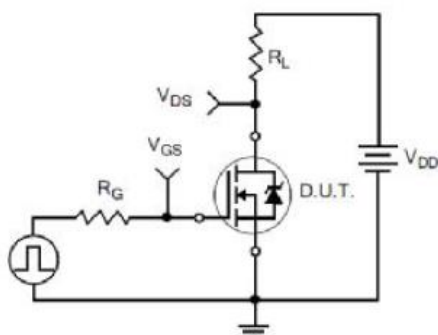


Figure 19. Resistive Switching Test Circuit

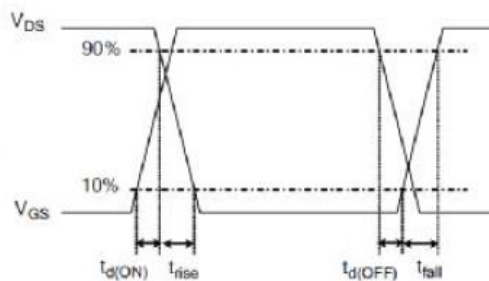
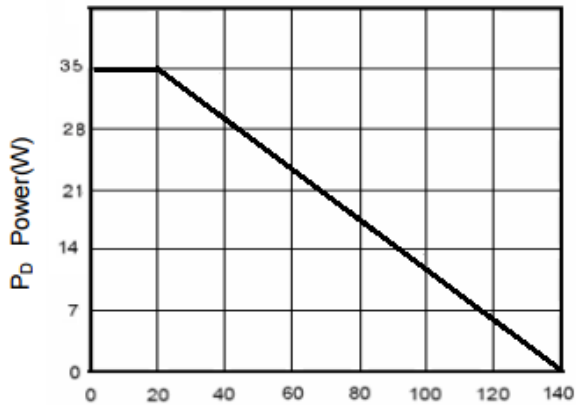
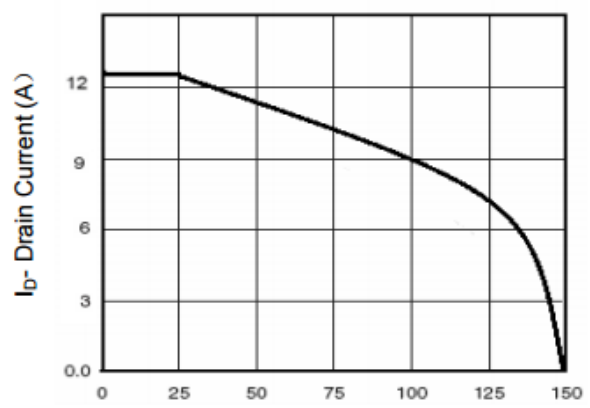


Figure 20. Resistive Switching Waveforms

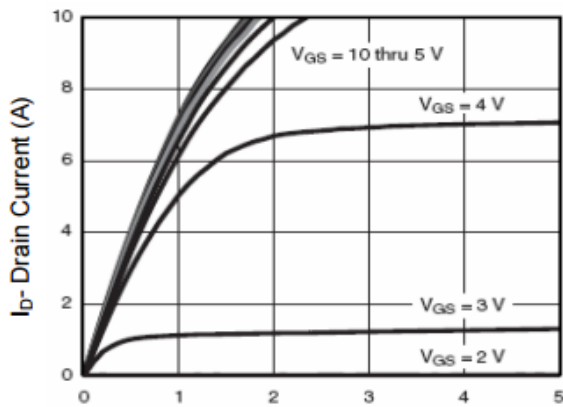
Characteristics Curve :



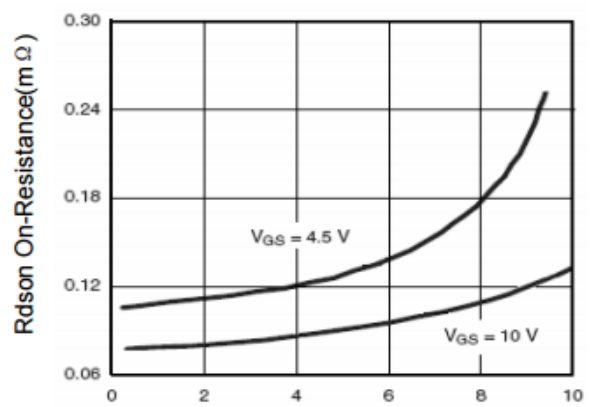
T<sub>J</sub>-Junction Temperature(°C)  
**Figure 3 Power Dissipation**



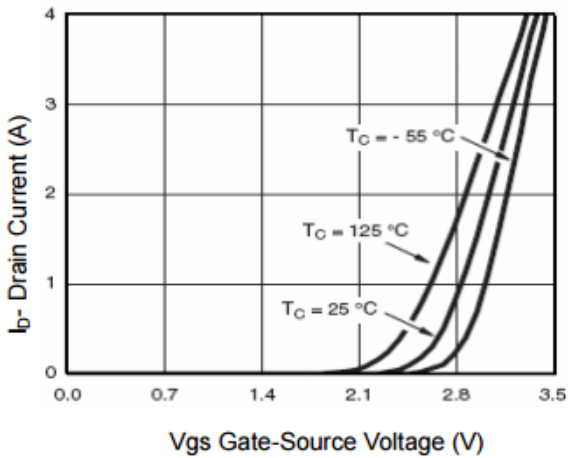
T<sub>J</sub>-Junction Temperature(°C)  
**Figure 4 Drain Current**



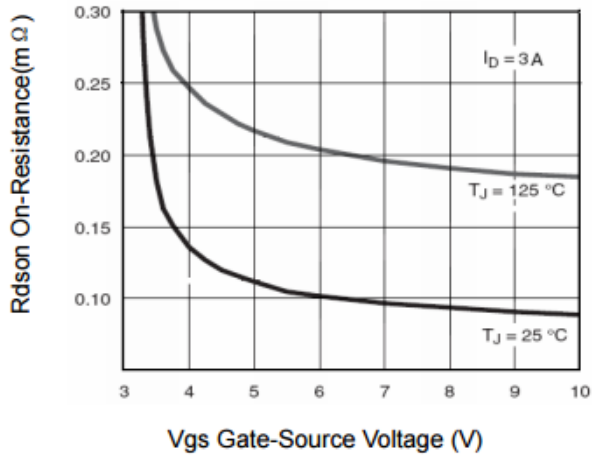
V<sub>GS</sub> = 10 thru 5 V  
 V<sub>GS</sub> = 4 V  
 V<sub>GS</sub> = 3 V  
 V<sub>GS</sub> = 2 V  
 V<sub>ds</sub> Drain-Source Voltage (V)  
**Figure 5 Output Characteristics**



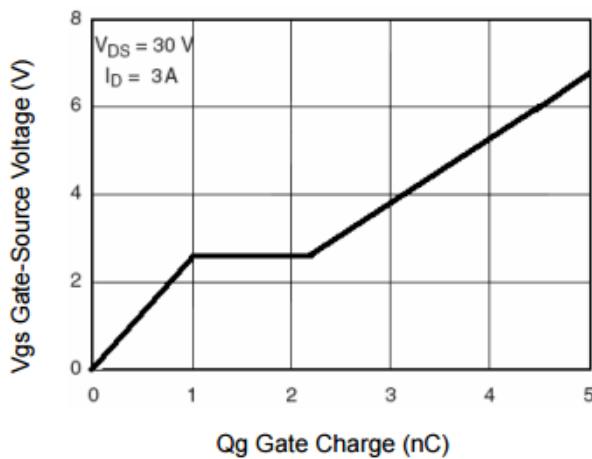
V<sub>GS</sub> = 4.5 V  
 V<sub>GS</sub> = 10 V  
 I<sub>D</sub>- Drain Current (A)  
**Figure 6 Drain-Source On-Resistance**



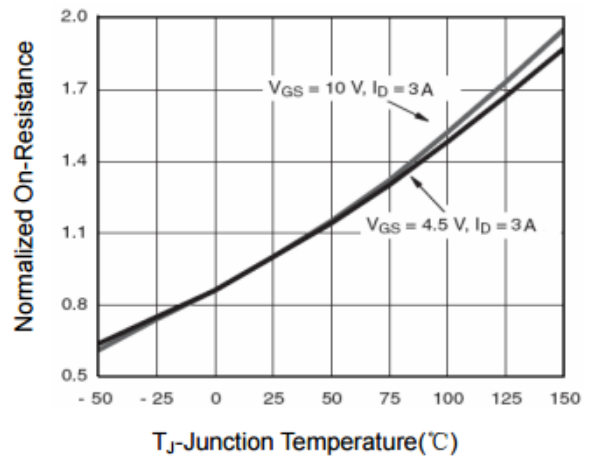
**Figure 7 Transfer Characteristics**



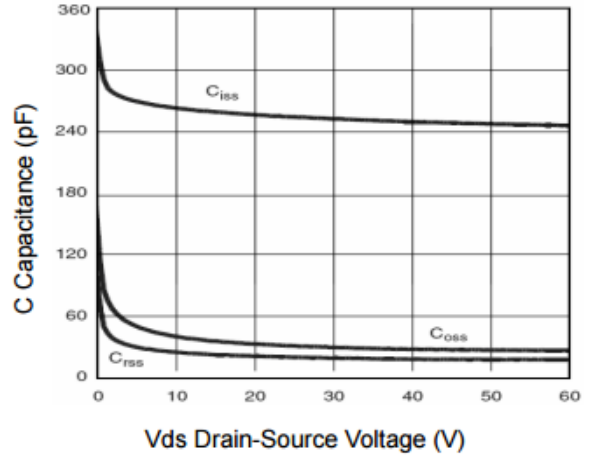
**Figure 9 Rdson vs Vgs**



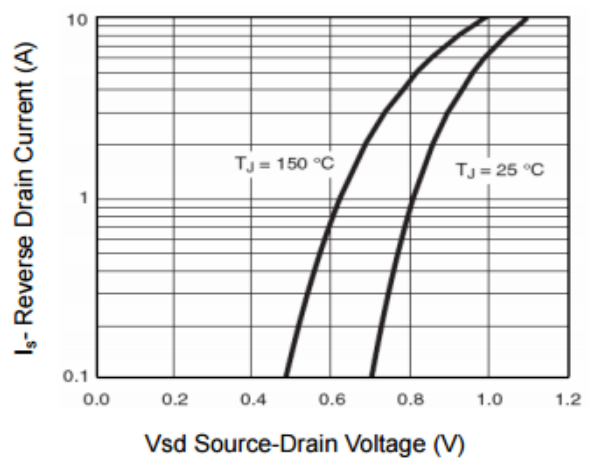
**Figure 11 Gate Charge**



**Figure 8 Drain-Source On-Resistance**



**Figure 10 Capacitance vs Vds**



**Figure 12 Source- Drain Diode Forward**