

## Silicon N-Channel Power MOSFET

### General Description:

The HMP110N20 uses advanced trench technology and design to provide excellent RDS(ON) with low gate charge. It can be used in a wide variety of applications. The package form is TO-247, which accords with the RoHS standard.

### Features:

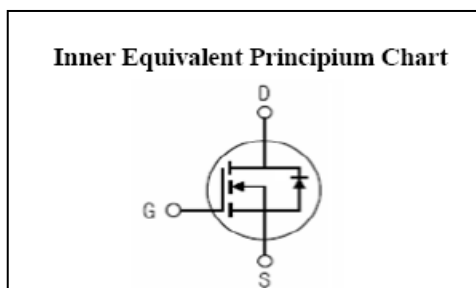
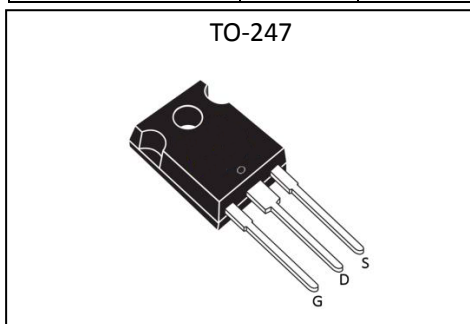
- Fast Switching
- Low Gate Charge and Rdson
- Low Reverse transfer capacitances
- 100% Single Pulse avalanche energy Test

### Applications:

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

**Absolute** (Tc= 25°C unless otherwise specified):

V <sub>DSS</sub>	200	V
I <sub>D</sub>	110	A
P <sub>D</sub>	330	W
R <sub>DS(ON)type</sub>	9.5	mΩ



Symbol	Parameter	Rating	Units
V <sub>DSS</sub>	Drain-to-Source Voltage	200	V
I <sub>D</sub>	Continuous Drain Current	110	A
	Continuous Drain Current T <sub>c</sub> = 100 °C	78	A
I <sub>DM</sub>	Pulsed Drain Current	440	A
V <sub>GS</sub>	Gate-to-Source Voltage	± 20	V
E <sub>AS</sub> <sup>a2</sup>	Single Pulse Avalanche Energy	2000	mJ
E <sub>AR</sub> <sup>a1</sup>	Avalanche Energy ,Repetitive	160	mJ
I <sub>AR</sub> <sup>a1</sup>	Avalanche Current	110	A
dv/dt <sup>a3</sup>	Peak Diode Recovery dv/dt	5.0	V/ns
P <sub>D</sub>	Power Dissipation	330	W
T <sub>J</sub> , T <sub>stg</sub>	Operating Junction and Storage Temperature Range	175, -55 to 175	°C
T <sub>L</sub>	MaximumTemperature for Soldering	300	°C

**Electrical Characteristics** (T<sub>c</sub> = 25 °C unless otherwise specified):

OFF Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
V <sub>DSS</sub>	Drain to Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	200	--	--	V
Δ BV <sub>DSS</sub> / Δ T <sub>J</sub>	Bvdss Temperature Coefficient	I <sub>D</sub> =250uA, Reference 25 °C	--	0.1	--	V/ °C
I <sub>DSS</sub>	Drain to Source Leakage Current	V <sub>DS</sub> = 200V, V <sub>GS</sub> = 0V, T <sub>a</sub> = 25 °C	--	--	1	μA
		V <sub>DS</sub> = 160V, V <sub>GS</sub> = 0V, T <sub>a</sub> = 125 °C	--	--	100	
I <sub>GSS(F)</sub>	Gate to Source Forward Leakage	V <sub>GS</sub> = +20V	--	--	100	nA
I <sub>GSS(R)</sub>	Gate to Source Reverse Leakage	V <sub>GS</sub> = -20V	--	--	-100	nA

ON Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
R <sub>DS(ON)</sub>	Drain-to-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =55A	--	9.5	10.5	mΩ
V <sub>GS(TH)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.5	--	4.5	V
Pulse width tp ≤ 380μs, δ ≤ 2%						

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =10V, I <sub>D</sub> =55A	70	--	--	S
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0V V <sub>DS</sub> = 100V f = 1.0MHz	--	6630	--	pF
C <sub>OSS</sub>	Output Capacitance		--	450	--	
C <sub>RSS</sub>	Reverse Transfer Capacitance		--	12	--	

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
t <sub>d(ON)</sub>	Turn-on Delay Time	I <sub>D</sub> =55A V <sub>DD</sub> = 100V V <sub>GS</sub> = 10V R <sub>G</sub> = 4.7Ω	--	20	--	ns
t <sub>r</sub>	Rise Time		--	28	--	
t <sub>d(OFF)</sub>	Turn-Off Delay Time		--	48	--	
t <sub>f</sub>	Fall Time		--	15	--	
Q <sub>g</sub>	Total Gate Charge	I <sub>D</sub> =55A V <sub>DD</sub> =100V V <sub>GS</sub> = 10V	--	88	--	nC
Q <sub>gs</sub>	Gate to Source Charge		--	40	--	
Q <sub>gd</sub>	Gate to Drain ("Miller") Charge		--	16	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$I_S$	Continuous Source Current (Body Diode)		--	--	110	A
$I_{SM}$	Maximum Pulsed Current (Body Diode)		--	--	440	A
$V_{SD}$	Diode Forward Voltage	$I_S=110A, V_{GS}=0V$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$I_S=55A, T_J = 25^\circ C$	--	180	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di_f/dt=100A/us, V_{GS}=0V$	--	1.9	--	$\mu C$
Pulse width $t_p \leq 380\mu s, \delta \leq 2\%$						

Symbol	Parameter	Typ.	Units
$R_{\theta c}$	Junction-to-Case	0.46	$^\circ C/W$

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

<sup>a2</sup>: EAS condition :  $T_J=25^\circ C, V_{DD}=50V, V_G=10V, L=0.5mH, R_G=25\Omega$

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

### Test Circuit and Waveform

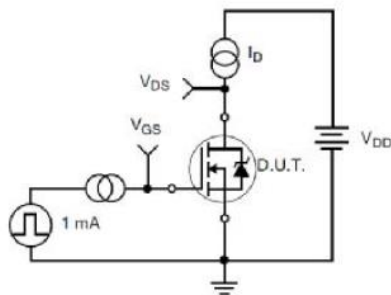


Figure 17. Gate Charge Test Circuit

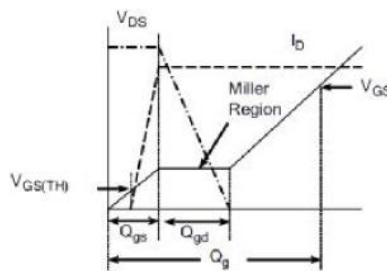


Figure 18. Gate Charge Waveform

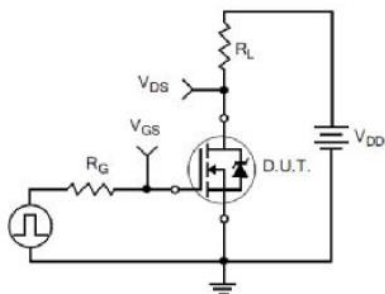


Figure 19. Resistive Switching Test Circuit

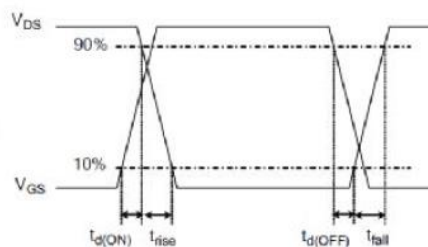
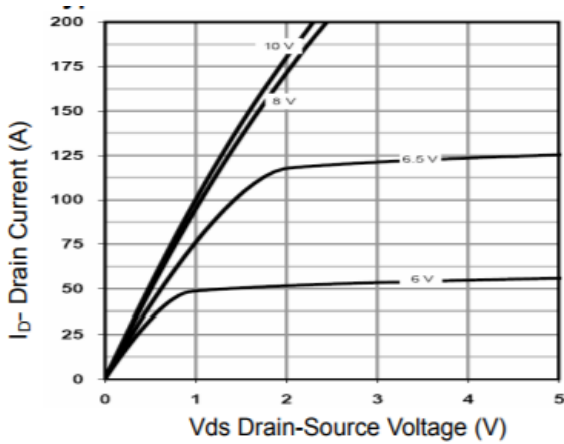
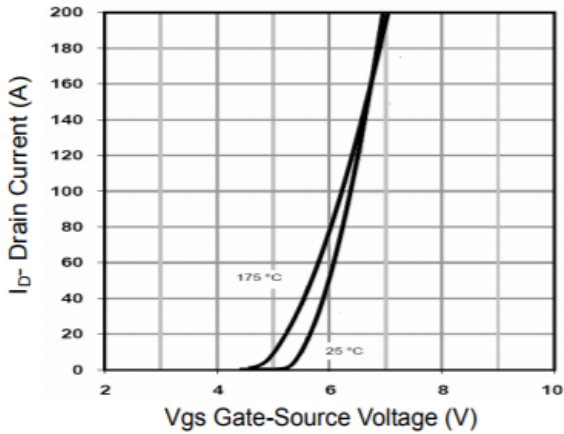


Figure 20. Resistive Switching Waveforms

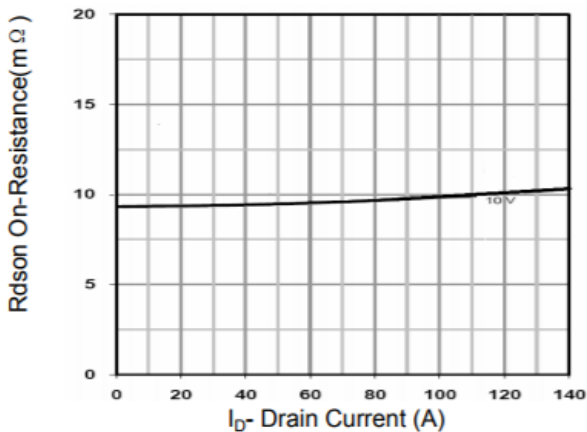
**Characteristics Curve :**



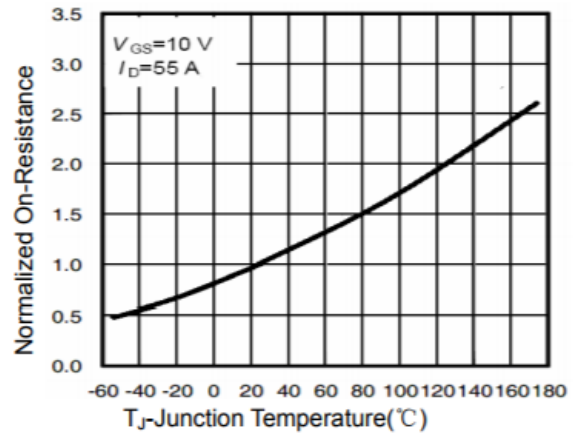
**Figure 1 Output Characteristics**



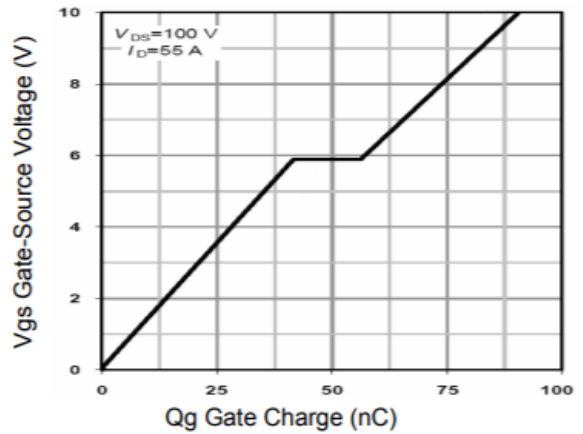
**Figure 2 Transfer Characteristics**



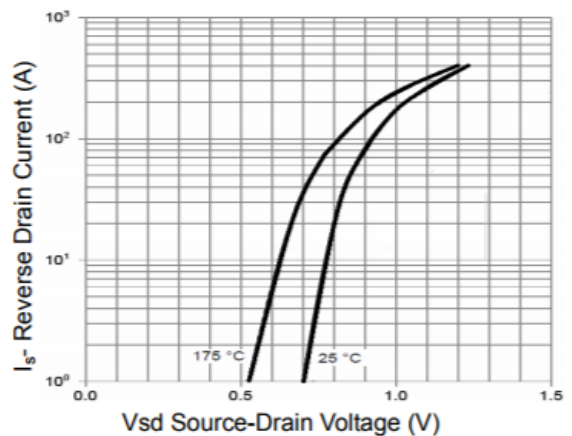
**Figure 3 Rdson- Drain Current**



**Figure 4 Rdson-Junction Temperature**



**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**

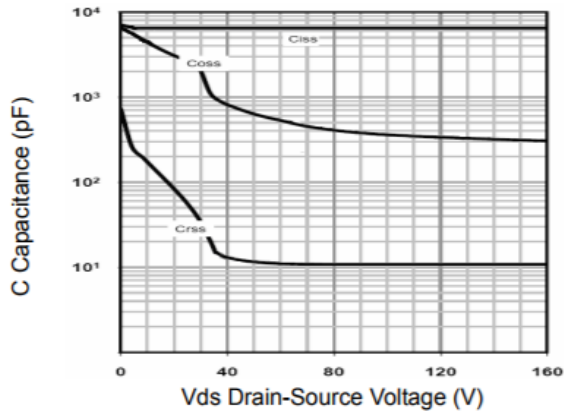


Figure 7 Capacitance vs Vds

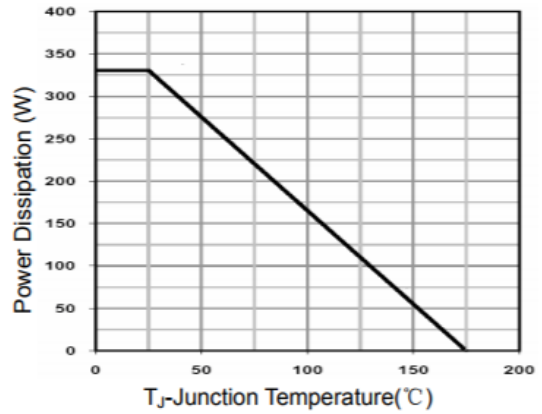


Figure 9 Power De-rating

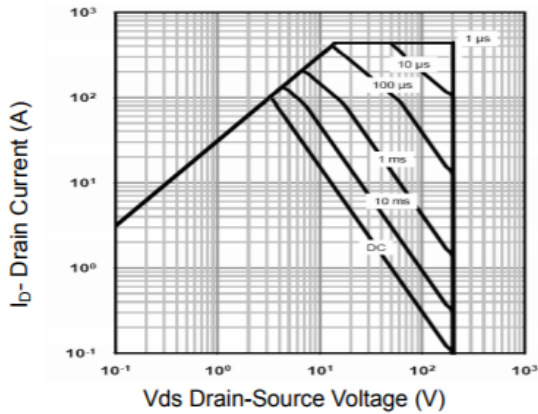


Figure 8 Safe Operation Area

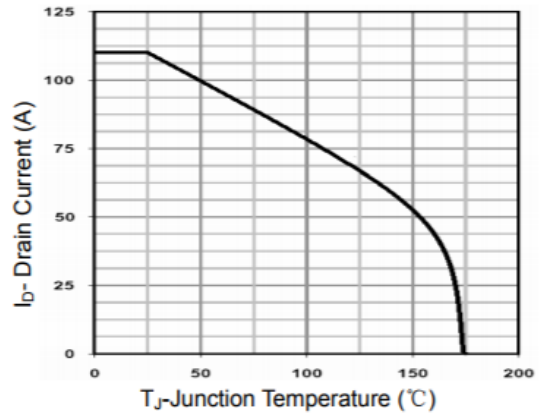


Figure 10 Current De-rating

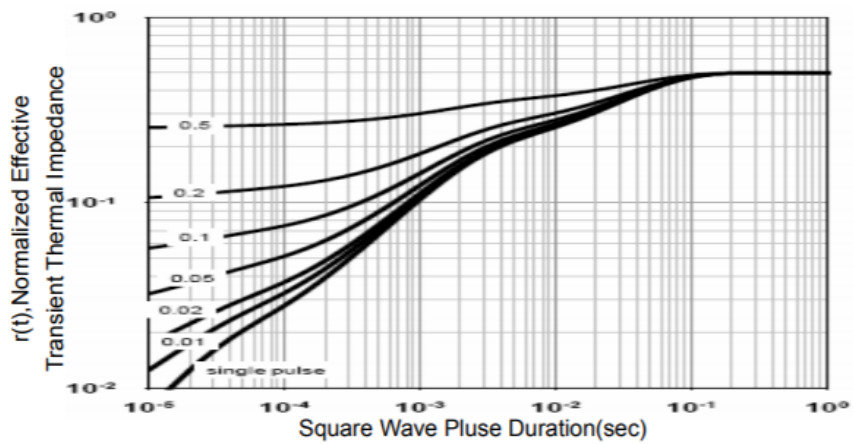


Figure 11 Normalized Maximum Transient Thermal Impedance