HMN4013A4

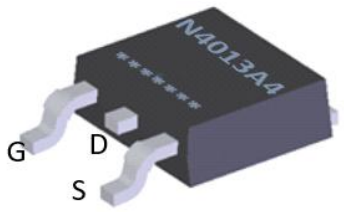
HM Silicon N-Channel Power MOSFET

General Description :

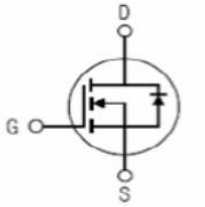
The HMN4013A4 uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications. The package form is TO-252, which accords with the RoHS standard.

V_{DSS}	40	V
I_D	40	A
P_D	34	W
$R_{DS(ON)\ TYPE}$	10.6	mΩ

TO-252



Inner Equivalent Principium Chart



Features :

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

Applications :

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

Package Marking and Ordering Information:

Device Marking	Device	Device Package	Quantity
N4013A4	HMN4013A4	TO-252	2500 units

Absolute Maximum Ratings (TA= 25℃ unless otherwise specified):

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	40	V
I_D	Continuous Drain Current	40	A
	Continuous Drain Current T_C = 100 °C	28	A
I_{DM} [a1]	Pulsed Drain Current	140	A
V_{GS}	Gate-to-Source Voltage	±20	V
E_{AS} [a2]	Single Pulse Avalanche Energy	80	mJ
dv/dt [a3]	Peak Diode Recovery dv/dt	5.0	V/ns
P_D	Power Dissipation	34	W
T_J , T_{stg}	Operating Junction and Storage Temperature Range	150 , –55 to 175	℃
T_L	Maximum Temperature for Soldering	300	℃

Electrical Characteristics (Tc= 25℃ 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=250μA	40	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	BVdss Temperature Coefficient	ID=250uA,Reference 25℃	--	0.1	--	V/℃
I_{DSS}	Drain to Source Leakage Current	V_{DS} = 40V, V_{GS}= 0V, T_j = 25℃	--	--	1	μA
		V_{DS} =40V, V_{GS}= 0V, T_j = 55℃	--	--	5	
$I_{GSS(F)}$	Gate to Source Forward Leakage	V_{GS} =+20V	--	--	100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	V_{GS} =-20V	--	--	-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=20A	--	10.6	13.0	mΩ
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	1.0	1.5	2.5	V
Pulse width tp≤380μs,δ≤2%						

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 20V f = 1.0MHz	--	750	--	pF
C_{oss}	Output Capacitance		--	150	--	
C_{rss}	Reverse Transfer Capacitance		--	80	--	

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	I_D =20A V_{DS} = 20V V_{GS} = 10V R_G = 3.0Ω R_L = 1.0Ω	--	6.0	--	ns
tr	Rise Time		--	36.0	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	29.0	--	
t_f	Fall Time		--	7.0	--	
Q_g	Total Gate Charge	I_D =20A V_{DD} =20V V_{GS} = 10V	--	15	--	nC
Q_{gs}	Gate to Source Charge		--	3	--	
Q_{gd}	Gate to Drain (“Miller”) Charge		--	2.5	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)		--	--	40	A
V_{SD}	Diode Forward Voltage	I_S=20A, V_{GS}=0V	--	0.85	1.2	V
trr	Reverse Recovery Time	I_S=20A,T_j = 25° dI_F/dt=100A/us, V_{GS}=0V	--	40	--	ns
Qrr	Reverse Recovery Charge		--	21	--	nC
Pulse width tp≤380μs,δ≤2%						

Thermal Characteristics

Symbol	Parameter	Typ.	Units
$R_{\theta JC}$	Junction-to-Case	4.4	℃/W

[a1] : Repetitive rating; pulse width limited by maximum junction temperature
[a2] : L=10.0mH, I_D=3A, Start T_J=25℃
[a3] : I_{SD} =20A,di/dt ≤100A/us, V_{DD}≤$BV_{DS,}$ Start T_J=25℃

Figure A：Gate Charge Test Circuit and Waveform

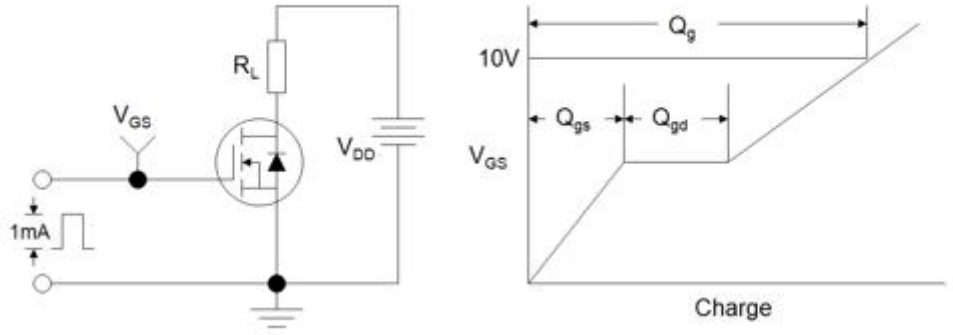


Figure B：Resistive Switching Test Circuit and Waveform

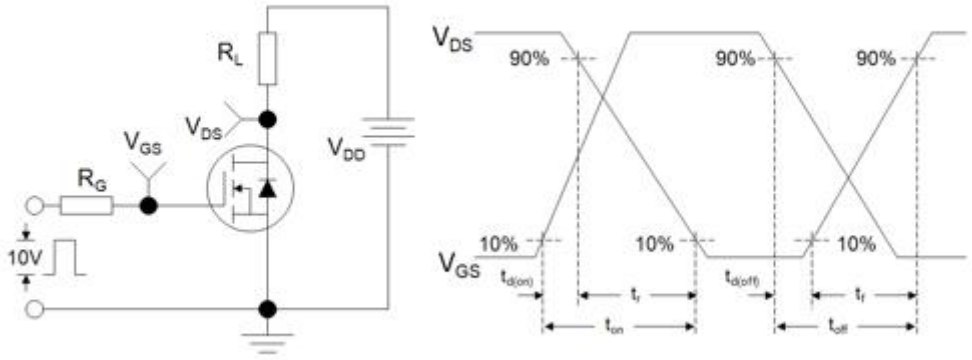
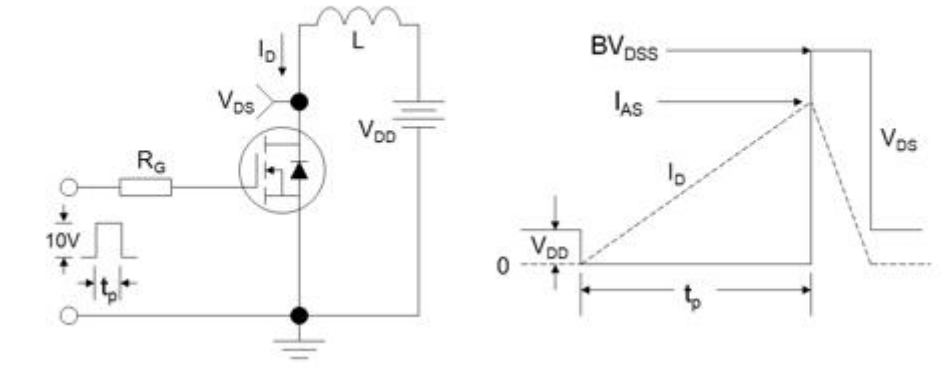


Figure C：Unclamped Inductive Switching Test Circuit and Waveform



Test Circuit and Waveform

Characteristics Curve：

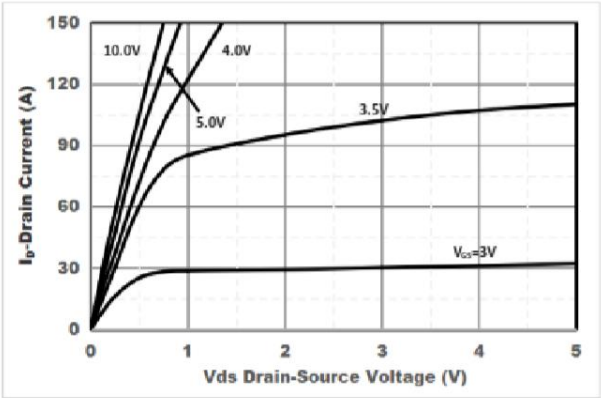


Figure1. Output Characteristics

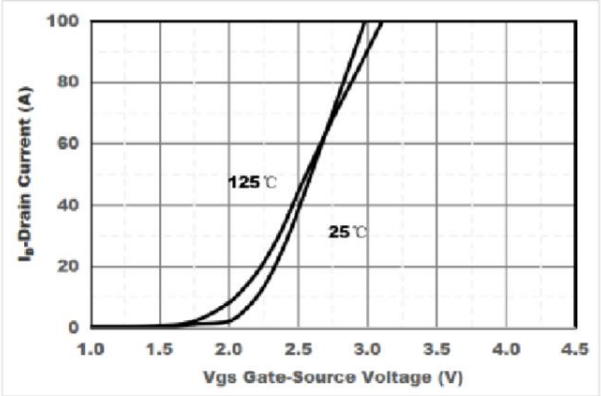


Figure2. Transfer Characteristics

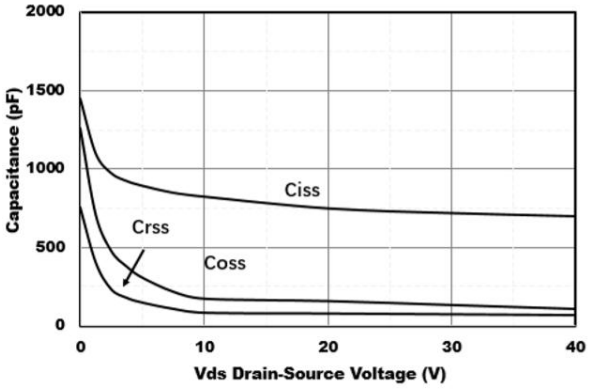


Figure3. Capacitance Characteristics

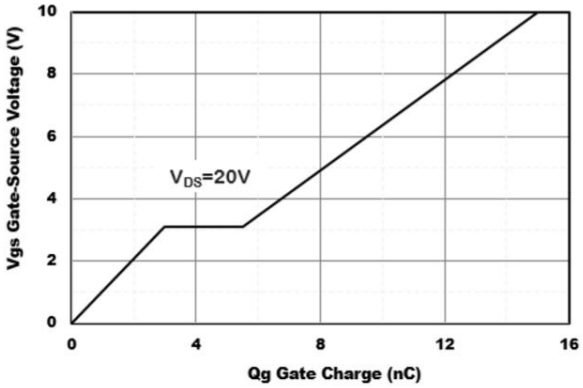


Figure4. Gate Charge

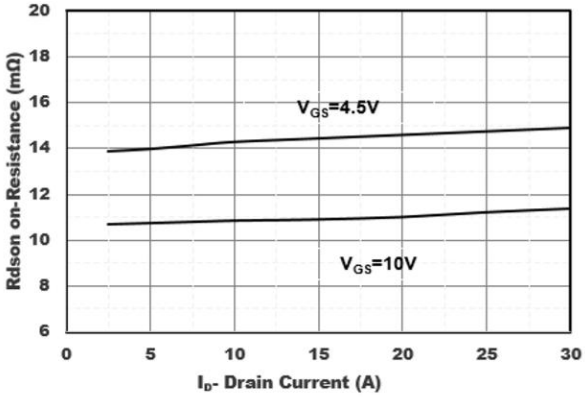


Figure5. Drain-Source on Resistance

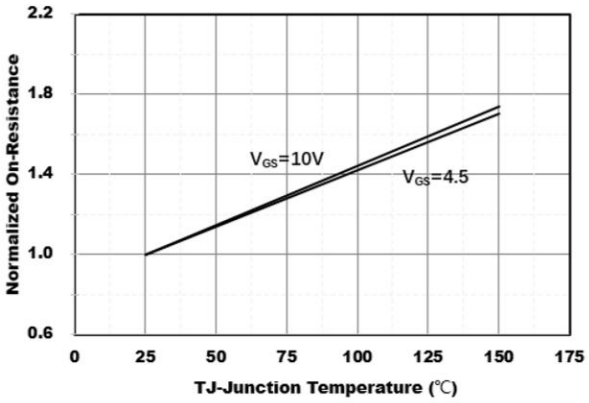


Figure6. Drain-Source on Resistance

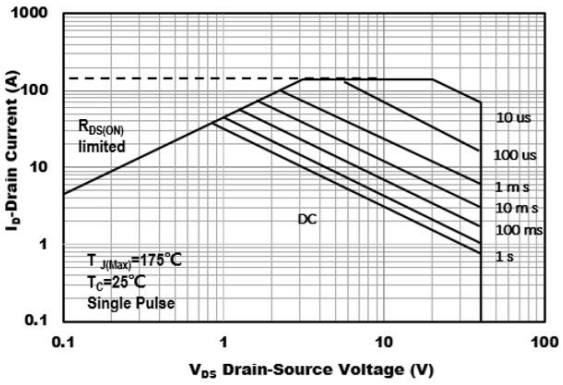


Figure7. Safe Operation Area

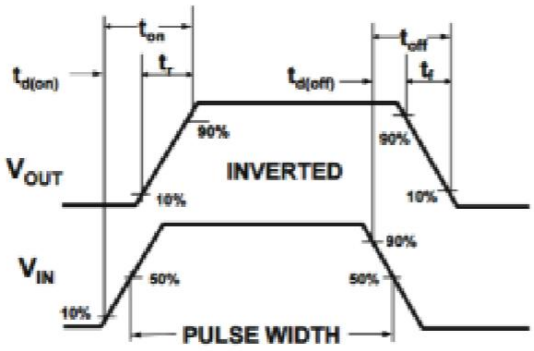


Figure8. Switching wave

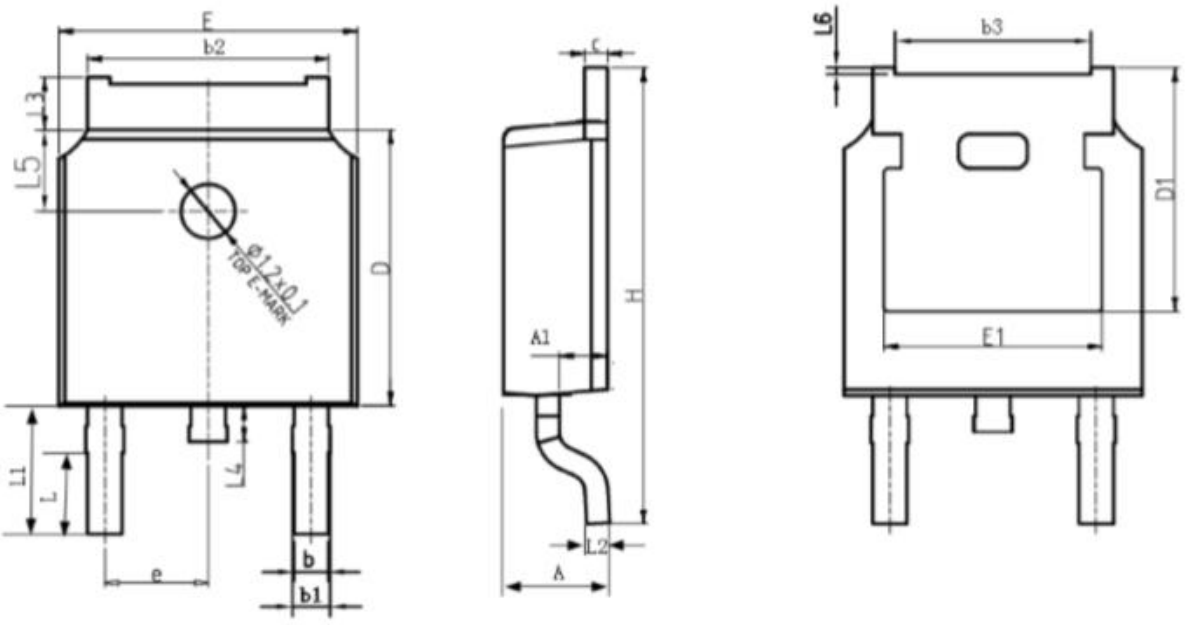
Marking Information

Part NO.

● Y M W SN

Part NO.	HMN4013A4
●	Pin 1 Indicator
Lot NO.	Y：Year； M：Month； W：Week； SN：Pipeline Code

Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.056	0.061
A1	0.970	1.17	0.025	0.030
b	0.720	0.850	0.018	0.022
b1	0.720	0.930	0.018	0.024
b2	5.230	5.460	0.133	0.139
b3	4.270	4.370	0.108	0.111
c	0.470	0.580	0.012	0.015
D	6.000	6.200	0.152	0.157
D1	5.300 TYP.		0.135	
E	6.500	6.700	0.165	0.170
E1	4.700	4.920	0.119	0.125
e	2.286 TYP		0.058	
L	1.400	1.700	0.036	0.043
L1	2.900 TYP.		0.074	
L2	0.510 TYP.		0.013	
L3	0.900	1.250	0.023	0.032
L4	0.600	1.000	0.015	0.025
L5	1.700	1.900	0.043	0.048
L6	0	0.1223	0.000	0.003

Revision History

Revision	Date	Descriptions
REV.1.2	Sep., 2018	"Add Marking Iformation and Package Information" Update
REV.1.1	Aug., 2018	"Typical Performance Characteristics" Update
REV.1.0	July, 2017	Initial Version