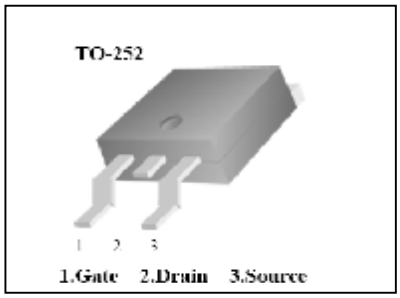
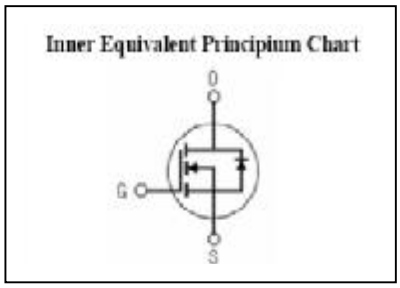
CS60N04 A4

General Description:

CS60N04A4,the silicon N-channel Enhanced VDMOSFETs, is obtained by advanced trench 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-252, which accords with the RoHS standard.

V_{DSS}	40	V
I_D	60	A
$P_D(T_C=25℃)$	52	W
$R_{DS(ON)Typ}$	8.5	mΩ





Features:

- **Rds(on) =8.5mΩ @V_{GS}=10V , I_D=60A**
- **High Performance Trench Technology for extremely lows rdson**
- **High Power and Current Handing Capability**
- **100% Avalanche Energy Test**
- **40V@ TJ =150°**

Applications:

Power switch circuit of adaptor and charger.

Absolute（Tc= 25℃ unless otherwise specified）:

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	40	V
I_D	Continuous Drain Current	60	A
	Continuous Drain Current T_C = 100 °C	36	A
I_{DM} [a1]	Pulsed Drain Current	240	A
V_{GS}	Gate-to-Source Voltage	±20	V
E_{AS} [a2]	Single Pulse Avalanche Energy	190	mJ
dv/dt [a3]	Peak Diode Recovery dv/dt	15	V/ns
P_D	Power Dissipation	52	W
	Derating Factor above 25°C	0.4	W/°C
T_J, T_{stg}	Operating Junction and Storage Temperature Range	–55 to 150	°C
T_L	Maximum Temperature for Soldering	300	°C

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℃	--	0.03	--	V/℃
I_{DSS}	Drain to Source Leakage Current	V_{DS} = 40V, Tc = 25℃	--	--	1	μA
		V_{DS} = 40V, T_a = 150℃	--	--	200	
$I_{GSS(F)}$	Gate to Source Forward Leakage	V_{GS}=0V, I_D=250μA	40	--	--	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	V_{DS} =0V,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=60A	--	8.5	13	mΩ
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	1	--	2	V
Pulse width tp≤300μs,δ≤2%						

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
g_{fs}	Forward Trans conductance	V_{DS}= 10V，Id=50A	--	300	--	S
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1.0MHz	--	1920		pF
C_{oss}	Output Capacitance		--	150		
C_{rss}	Reverse Transfer Capacitance		--	115		

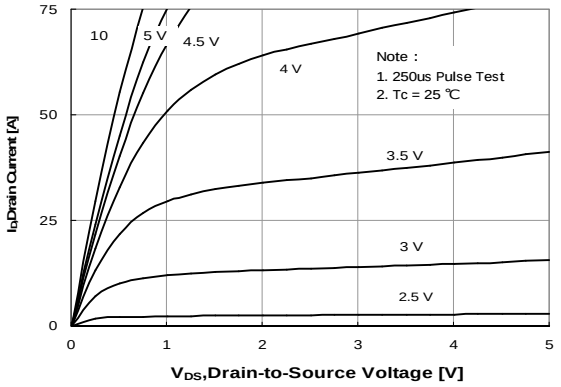
Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	I_D = 60A V_{DD} = 20V V_{GS} = 10V R_G = 10Ω	--	15	--	ns
tr	Rise Time		--	14	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	63	--	
t_f	Fall Time		--	20	--	
Q_g	Total Gate Charge	ID = 30A VDD = 32V VGS = 10V	--	37.5		nC
Q_{gs}	Gate to Source Charge		--	10		
Q_{gd}	Gate to Drain (“Miller”)Charge		--	5.47		

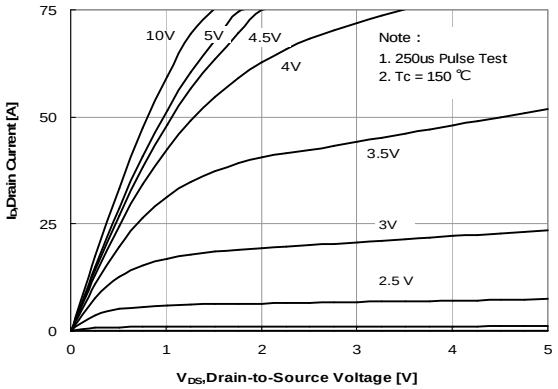
Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)		--	--	60	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	240	A
V_{SD}	Diode Forward Voltage	V_{GS}=0V，I_S=60A,	--	--	0.7	V
trr	Reverse Recovery Time	I_S=20A, T_j = 25°C	--	48	--	ns
Qrr	Reverse Recovery Charge	dI_F/dt=100A/us, V_{GS}=0V	--	6	--	nC
Pulse width tp≤300μs,δ≤2%						

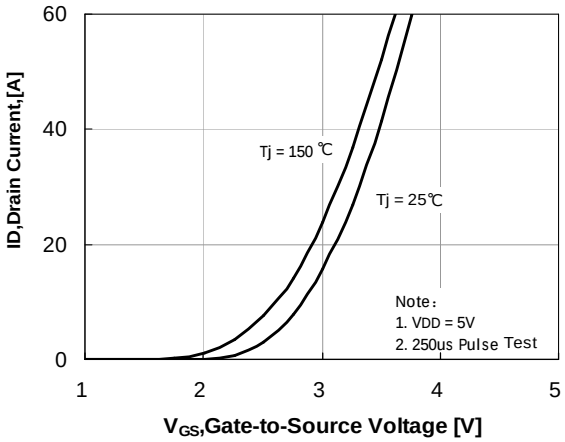
Symbol	Parameter	Typ.	Units
$R_{\theta JC}$	Junction-to-Case	2.4	℃/W
$R_{\theta JA}$	Junction-to-Ambient	50	℃/W

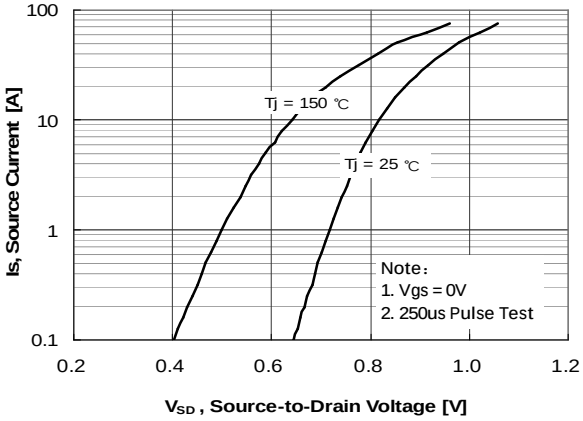
[a1]: Repetitive rating; pulse width limited by maximum junction temperature
[a2]: L=1mH, I_{as}=19.5A, Rg=25 Ω，Vdd=30V, Start T_J=25℃
[a3]: I_{SD} =20A, di/dt ≤200A/us, V_{DD}≤$BV_{DS,}$ Start T_J=25℃

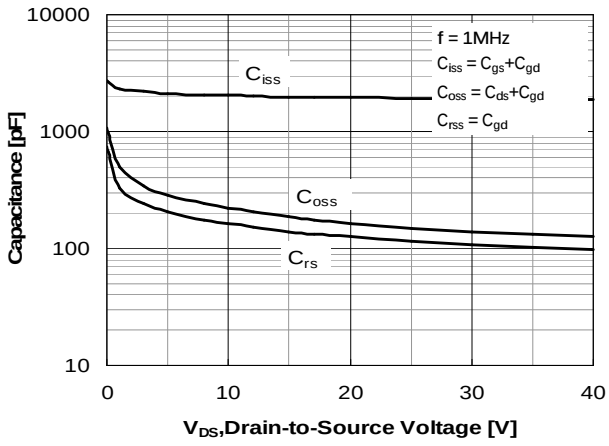
Characteristics Curve:

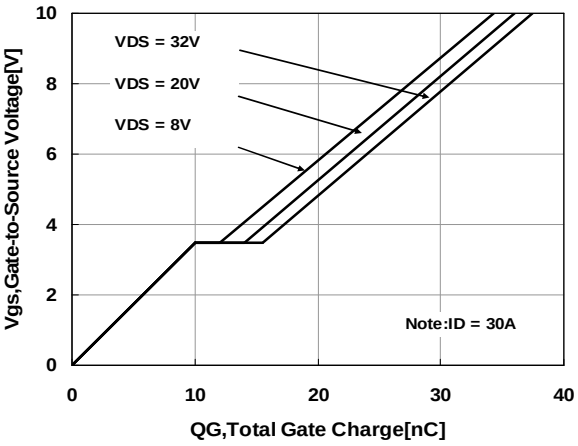


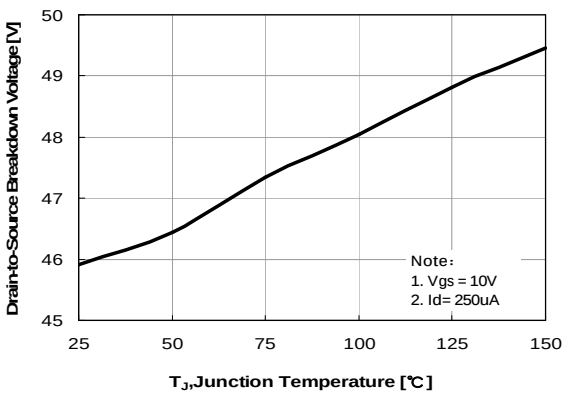


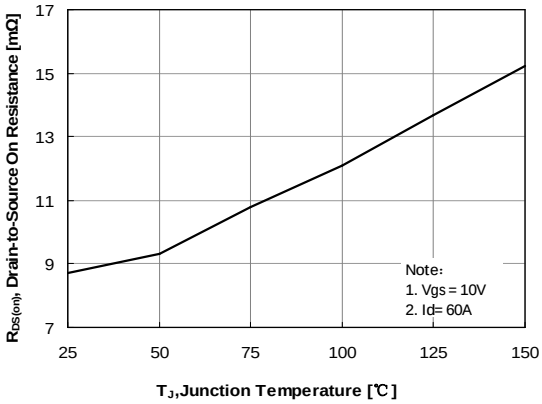


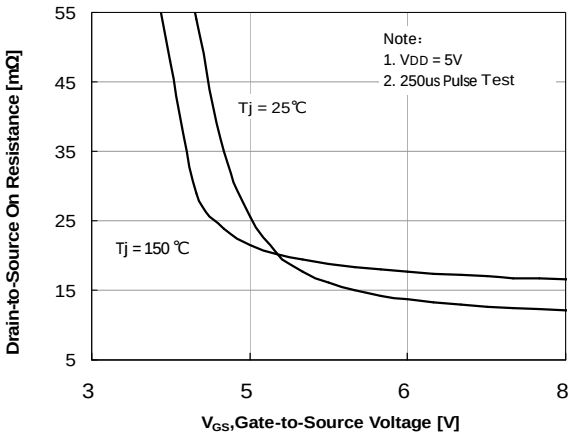


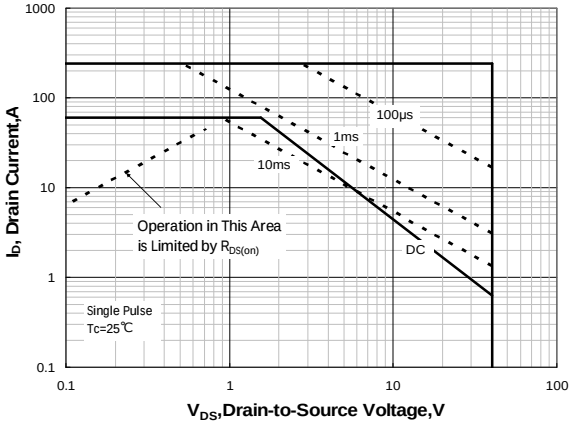


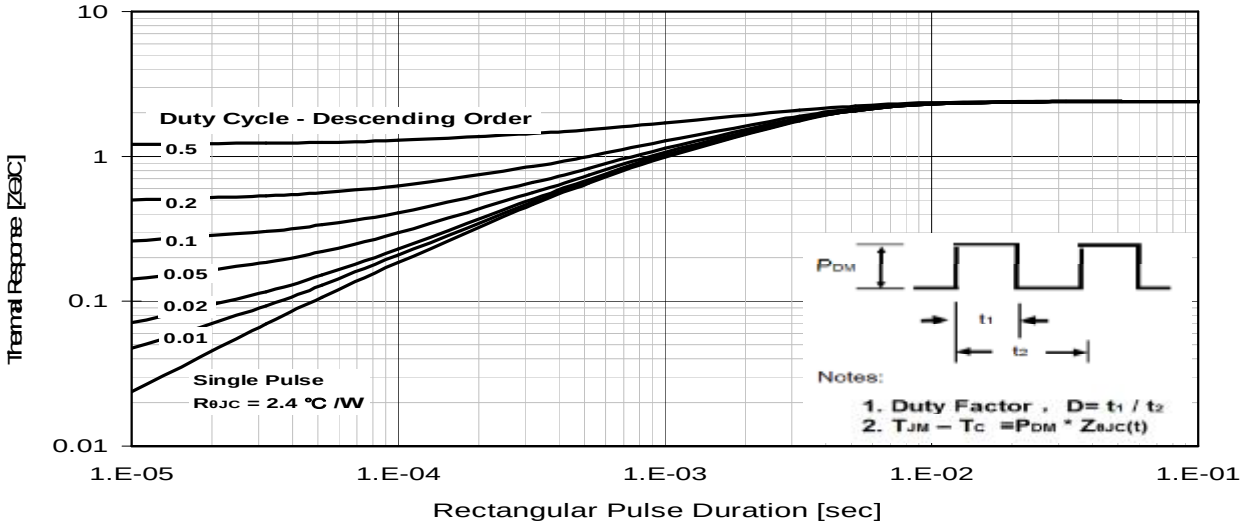



Drain-to-Source Breakdown Voltage [V]
50
49
48
47
46
45
25
50
75
100
125
150
Note:
1. Vgs = 10V
2. Id= 250uA
TJ,Junction Temperature [℃]

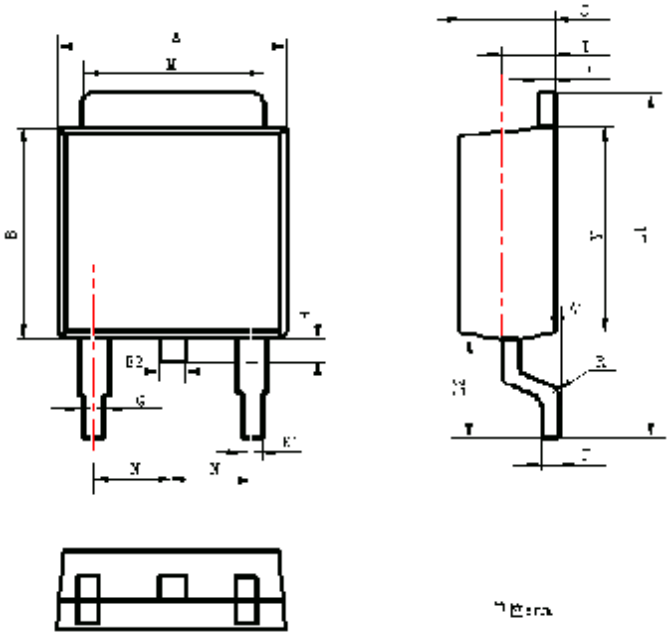

RDS(on), Drain-to-Source On Resistance [mΩ]
17
15
13
11
9
7
25
50
75
100
125
150
Note:
1. Vgs = 10V
2. Id= 60A
TJ,Junction Temperature [℃]


Drain-to-Source On Resistance [mΩ]
55
45
35
25
15
5
3
5
6
8
Note:
1. VDD = 5V
2. 250us Pulse Test
Tj = 25℃
Tj = 150 ℃
VGS,Gate-to-Source Voltage [V]


ID, Drain Current,A
1000
100
10
1
0.1
0.1
1
10
100
100μs
1ms
10ms
DC
Operation in This Area
is Limited by RDS(on)
Single Pulse
Tc=25℃
VDS,Drain-to-Source Voltage,V


Thermal Response [ZθJC]
10
1
0.1
0.01
Duty Cycle - Descending Order
0.5
0.2
0.1
0.05
0.02
0.01
Single Pulse
RθJC = 2.4 ℃ /W
PDM
t1
t2
Notes:
1. Duty Factor , D= t1 / t2
2. TJM – TC =PDM * ZθJC(t)
1.E-05
1.E-04
1.E-03
1.E-02
1.E-01
Rectangular Pulse Duration [sec]

Package Information



Items	Values(mm)	
	MIN	MAX
A	6.30	6.90
A1	0	0.13
B	5.70	6.30
C	2.10	2.50
D	0.30	0.60
E1	0.60	0.90
E2	0.70	1.00
F	0.30	0.60
G	0.70	1.00
L1	9.60	10.30
L2	2.70	3.10
H	0.60	1.00
M	5.10	5.50
N	2.09	2.49
R	0.3	
T	1.40	1.60
Y	5.10	6.30

TO-252 Package

The name and content of poisonous and harmful material in products

Part's Name	Hazardous Substance					
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE
Limit	≤0.1%	≤0.1%	≤0.01%	≤0.1%	≤0.1%	≤0.1%
Lead Frame	○	○	○	○	○	○
Molding Compound	○	○	○	○	○	○
Chip	○	○	○	○	○	○
Wire Bonding	○	○	○	○	○	○
Solder	×	○	○	○	○	○
Note	○：means the hazardous material is under the criterion of SJ/T11363-2006. ×：means the hazardous material exceeds the criterion of SJ/T11363-2006. The plumbum element of solder exist in products presently, but within the allowed range of Eurogroup's RoHS.					

Warnings

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. It is suggested to be used under 80 percent of the maximum ratings of the device.
2. When installing the heatsink, please pay attention to the torsional moment and the smoothness of the heatsink.
3. VDMOSFETs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. This publication is made by Huajing Microelectronics and subject to regular change without notice.

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