40V N-Channel Enhancement Mode MOSFET

Description

The NP12N04ER uses trench MOSFET technology that is uniquely optimized to provide the most efficient high frequency switching performance. Conduction and switching losses are minimized due to an extremely low combination of $R_{DS(ON)}$ and Crss.

General Features

- V_{DS} =40V, I_D =12A
  $R_{DS(ON)}$(Typ.)=12.7mΩ @ V_{GS}=10V
  $R_{DS(ON)}$(Typ.)=14.5mΩ @ V_{GS}=4.5V
- Lead free product is acquired
- Surface mount package

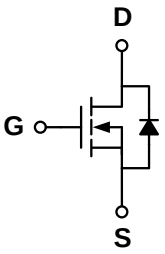
Application

- High Frequency Point-of-Load Synchronous Buck Converter for MB/NB/UMPC/VGA
- Networking DC-DC Power System
- Load switch

Package

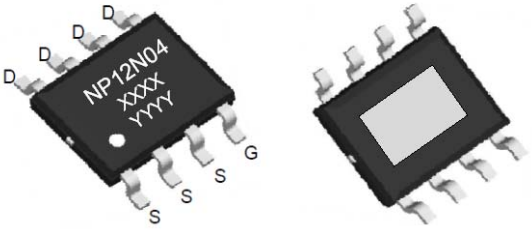
- ESOP-8

Schematic diagram



Marking and pin assignment

ESOP-8



XXXX—Wafer Lot No.
YYYY—Quality Code

Ordering Information

Part Number	Storage Temperature	Package	Devices Per Reel
NP12N04ER--G	-55°C to +150°C	ESOP-8	4000

Absolute Maximum Ratings (TA=25℃ unless otherwise noted)

parameter		symbol	limit	unit
Drain-source voltage		V_{DS}	40	V
Gate-source voltage		V_{GS}	±20	V
Continuous Drain Current	TC=25°C	I_D	12	A
	TC=100°C		8	
Pulsed Drain Current		I_{DP}	60	A
Avalanche energy(L=0.1mH)		EAS	14	mJ
Maximum power dissipation	TC=25°C	P_D	2.5	W
Power Dissipation – Derate above 25℃	TC=25°C		2	
Operating junction Temperature range		Tj	-55—150	℃

Electrical Characteristics (TA=25℃ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Static Characteristics						
Drain-source breakdown voltage	BV_{DSS}	V_{GS}=0V, I_D=250μA	40	-	-	V
BVDSS Temperature Coefficient	$\triangle BV_{DSS}/\triangle T_J$	Reference to 25℃,ID=1mA	-	33		mV/℃
Zero gate voltage drain current	I_{DSS}	V_{DS}=40V, V_{GS}=0V	-	-	1	μA
		T_J=85°C	-	-	30	
Gate Leakage Current	I_{GSS}	V_{DS}=0V, V_{GS}=±20V	-	-	±100	nA
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=250μA	1.0	1.55	2.2	V
Drain-source on-state resistance[1]	$R_{DS(ON)}$	V_{GS}=10V, I_D=12A	-	12.7	20	mΩ
		V_{GS}=4.5V, I_D=10A	-	14.5	24	
On Status Drain Current	$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	14	-	-	A
Diode Characteristics						
Diode Forward Voltage[1]	V_{SD}	I_{SD}=1A,V_{GS}=0V	-	0.8	1.1	V
Diode Continuous Forward Current	I_S		-	-	12	A
Reverse Recovery Time	t_{rr}	I_F=12A, dI/dt=100A/us	-	9	-	ns
Reverse Recovery Charge	Q_{rr}		-	15	-	nC
Dynamic Characteristics[2]						
Gate Resistance	R_G	V_{GS}=0V, V_{DS}=0V,f=1MHz	-	3.3	-	Ω
Input capacitance	C_{ISS}	V_{GS}=0V ,V_{DS}=20V f=1.0MHz	-	1063	-	pF
Output capacitance	C_{OSS}		-	96	-	
Reverse transfer capacitance	C_{RSS}		-	83	-	
Turn-on delay time	$t_{D(ON)}$	V_{GS}=10V, V_{DS}=20V, R_L=20Ω, I_D=12A, R_G=3.3Ω	-	4.5	-	ns
Turn-on Rise time	tr		-	2.5	-	
Turn-off delay time	$t_{D(OFF)}$		-	14.5	-	
Turn-off Fall time	tf		-	3.5	-	
Total gate charge	Q_g	V_{GS}=4.5V,I_D=12A V_{DS}=20V	-	24.7	-	nC
Gate-source charge	Q_{gs}		-	3.3	-	
Gate-drain charge	Q_{gd}		-	5.8	-	
Drain-Source Diode Characteristics						
Diode forward voltage	V_{SD}	I_{SD}=1A,V_{GS}=0V	-	0.8	1.1	V

Note: 1：Pulse test; pulse width ≦ 300ns, duty cycle ≦ 2%.

2：Guaranteed by design, not subject to production testing.

Thermal Characteristics

Parameter	Symbol	Typical	Unit
Thermal Resistance-Junction to Case	Rθjc	1.7	℃/W
Thermal Resistance junction-to ambient	Rθja	62.5	

Typical Performance Characteristics

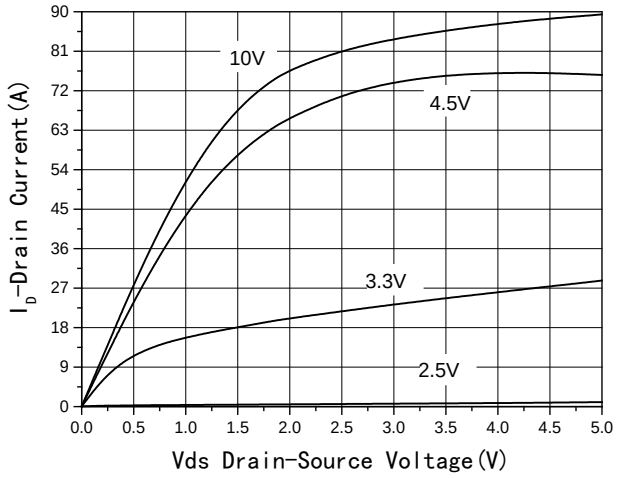


Fig1 Output Characteristics

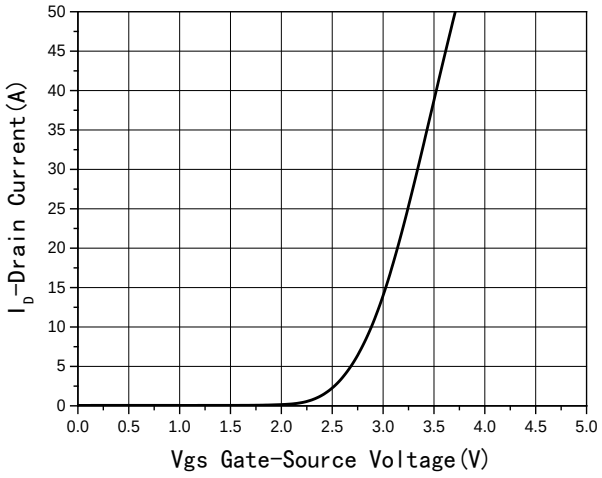


Fig2 Transfer Characteristics

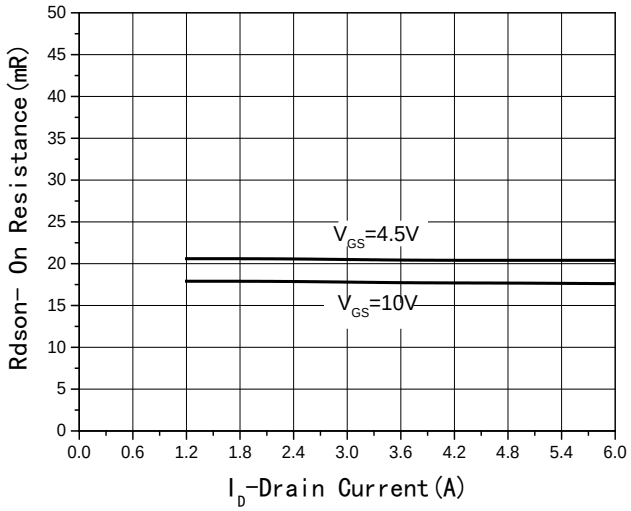


Fig3 Rdson-Drain current

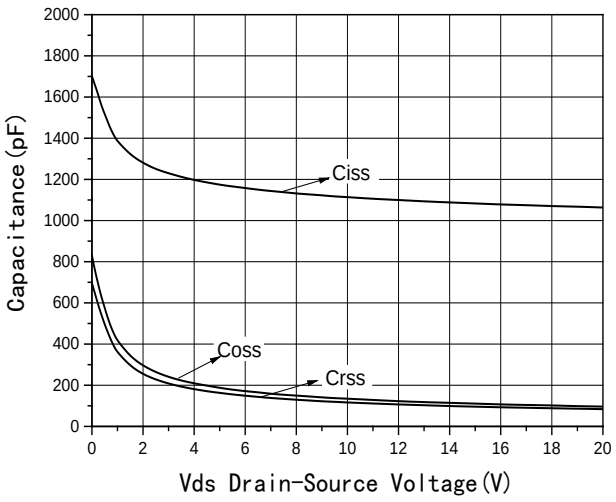


Fig4 Capacitance vs Vds

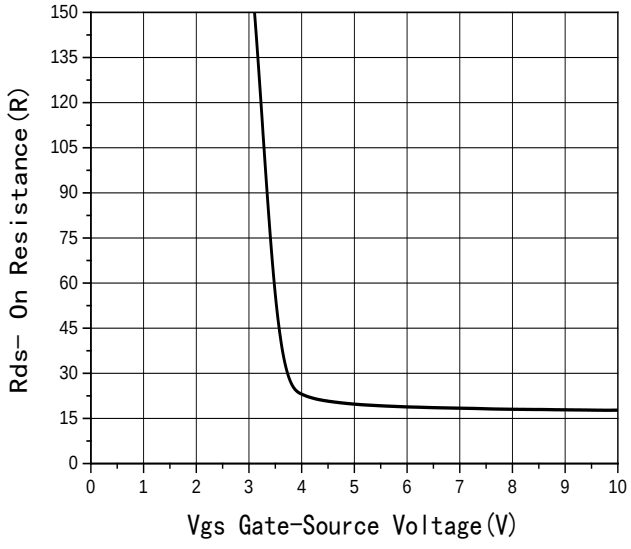


Fig5 Rdson-Gate Drain voltage

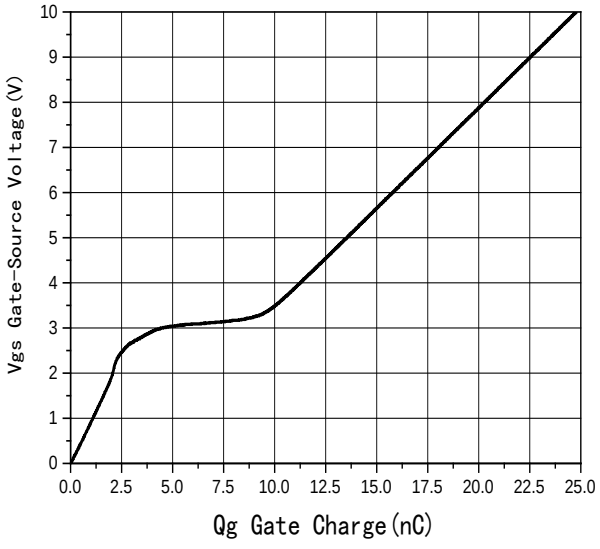


Fig6 Gate Charge

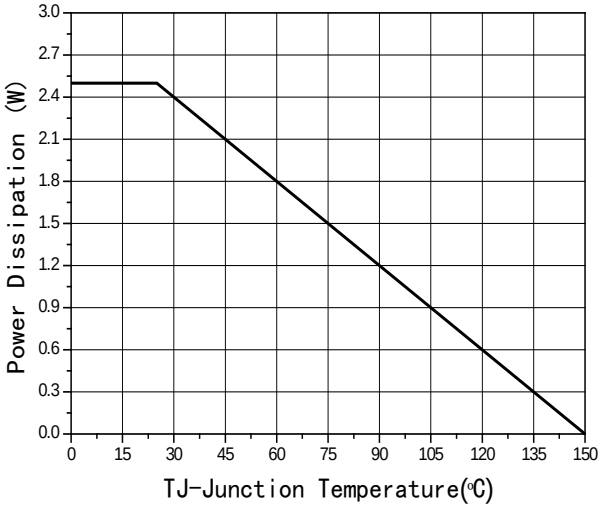


Fig7 Power De-rating

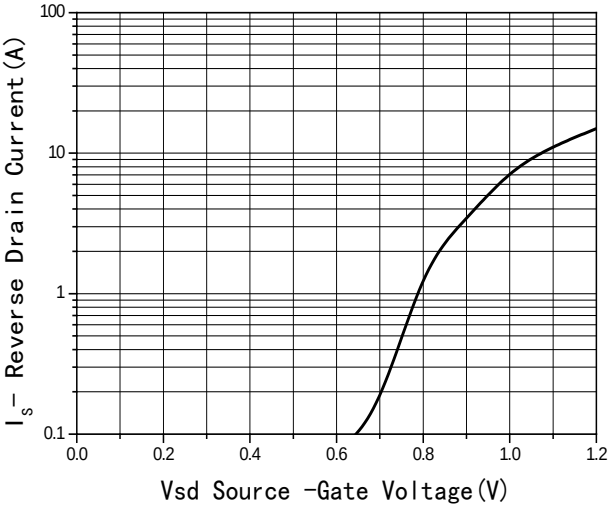
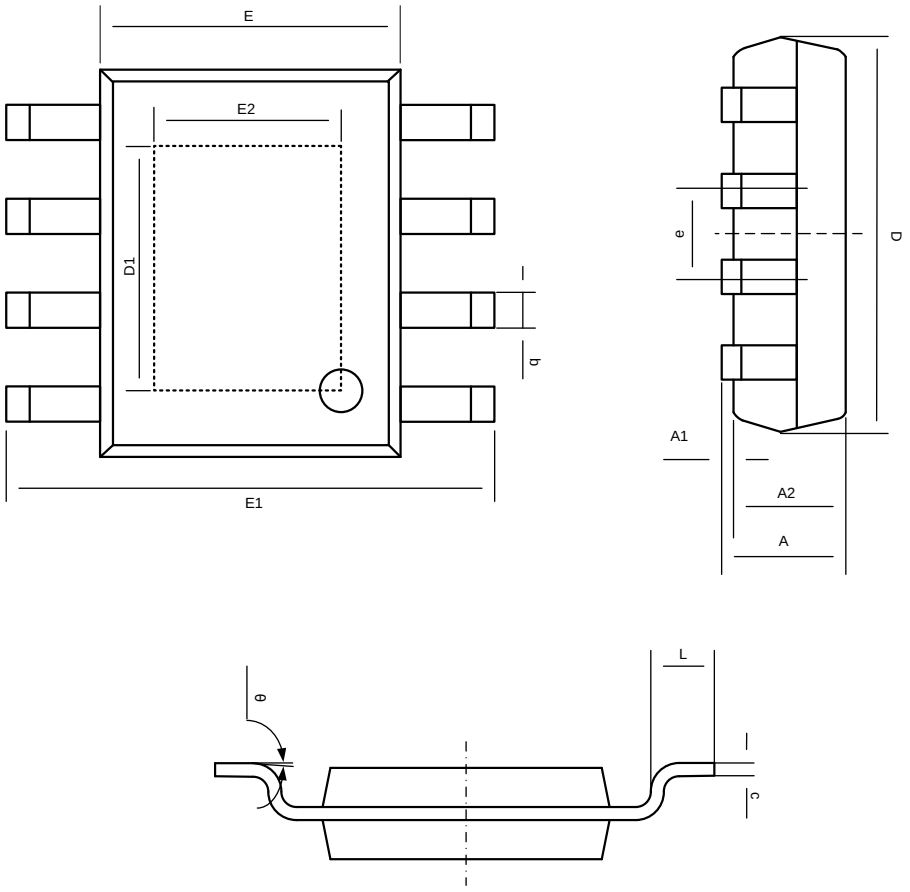


Fig8 Source-Drain Diode Forward

Package Information

- **ESOP-8**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.150	0.002	0.006
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.200
D1	3.202	3.420	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°