N-Channel Trench Power MOSFET

General Description

The HD40N04 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a wide variety of applications.

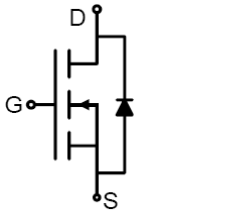
Features

- V_{DS} = 40V,ID =40A
  $R_{DS(ON)}$ < 15 mΩ @ V_{GS} =10V
  $R_{DS(ON)}$ < 21 mΩ @ V_{GS} =4.5V
- High Power and current handing capability
- Lead free product is acquired
- Surface Mount Package

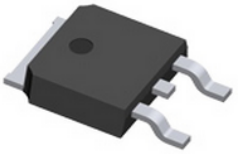
Application

- PWM applications
- Load switch
- Power management

100% UIS TESTED!
100% ΔVds TESTED!



Schematic Diagram


TO-252(DPAK) top view

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
HD40N04	HD40N04	TO-252	325mm	16mm	2500

Table 1. Absolute Maximum Ratings (T_A=25℃)

Symbol	Parameter	Value	Unit
V_{DS}	Drain-Source Voltage (V_{GS}=0V)	40	V
V_{GS}	Gate-Source Voltage (V_{DS}=0V)	±20	V
I_D	Drain Current-Continuous(T_C=25℃)	40	A
	Drain Current-Continuous(T_C=100℃)	28	A
$I_{DM\ (pluse)}$	Drain Current-Continuous@ Current-Pulsed **(Note 1)**	160	A
P_D	Maximum Power Dissipation(T_C=25℃)	50	W
	Maximum Power Dissipation(T_C=100℃)	25	
E_{AS}	Avalanche energy **(Note 2)**	90	mJ
T_J,T_{STG}	Operating Junction and Storage Temperature Range	-55 To 175	℃

Table 2. Thermal Characteristic

Symbol	Parameter	Typ	Max	Unit
$R_{\theta JC}$	Thermal Resistance,Junction-to-Case	-	3	℃/W

Table 3. Electrical Characteristics (TA=25℃unless otherwise noted)

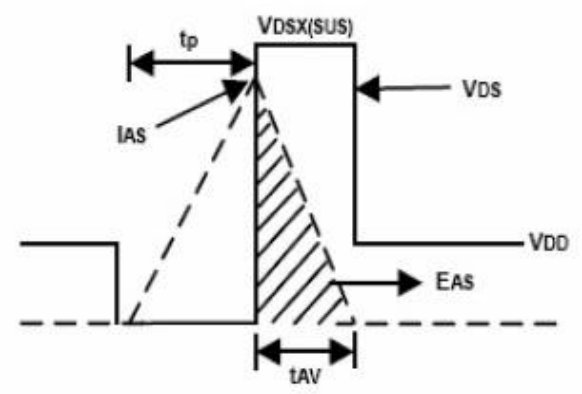
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
On/Off States						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V I_D=250μA	40			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=40V,V_{GS}=0V			1	μA
I_{GSS}	Gate-Body Leakage Current	V_{GS}=±20V,V_{DS}=0V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS},I_D=250μA	1	1.7	2.5	V
g_{FS}	Forward Transconductance	V_{DS}=5V,I_D=10A		21		S
$R_{DS(ON)}$	Drain-Source On-State Resistance	V_{GS}=10V, I_D=20A		10.5	15	mΩ
		V_{GS}=4.5V, I_D=10A		15	21	mΩ
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS}=25V,V_{GS}=0V, f=1.0MHz		944		pF
C_{oss}	Output Capacitance			83		pF
C_{rss}	Reverse Transfer Capacitance			70		pF
Rg	Gate resistance	V_{GS}=0V, V_{DS}=0V,f=1.0MHz		2.5		Ω
Switching Times						
$t_{d(on)}$	Turn-on Delay Time	V_{GS}=10V, V_{DS}=20V, R_L=1Ω,R_{GEN}=3Ω		5.5		nS
t_r	Turn-on Rise Time			12		nS
$t_{d(off)}$	Turn-Off Delay Time			22		nS
t_f	Turn-Off Fall Time			6		nS
Q_g	Total Gate Charge	V_{GS}=10V, V_{DS}=25V, I_D=14A		23.5		nC
Q_{gs}	Gate-Source Charge			2.1		nC
Q_{gd}	Gate-Drain Charge			8.9		nC
Source-Drain Diode Characteristics						
I_{SD}	Source-Drain Current(Body Diode)				40	A
V_{SD}	Forward on Voltage	V_{GS}=0V,I_S=20A			1.2	V
trr	Body Diode Reverse Recovery Time	I_F=20A, dI/dt=100A/μs		6		ns
Qrr	Body Diode Reverse Recovery Charge	I_F=20A, dI/dt=100A/μs		4.2		nC

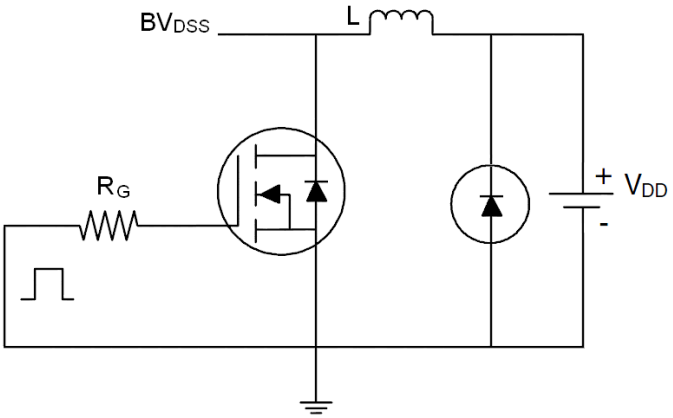
Notes 1.Repetitive Rating: Pulse width limited by maximum junction temperature

Notes 2.EAS condition: T_J=25℃,VDD=30V,V_G=10V, RG=25Ω

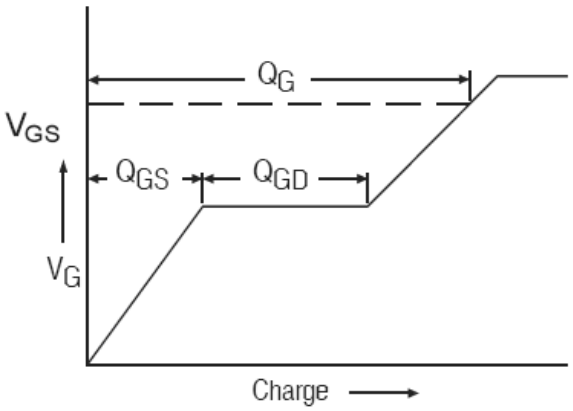
Test Circuit

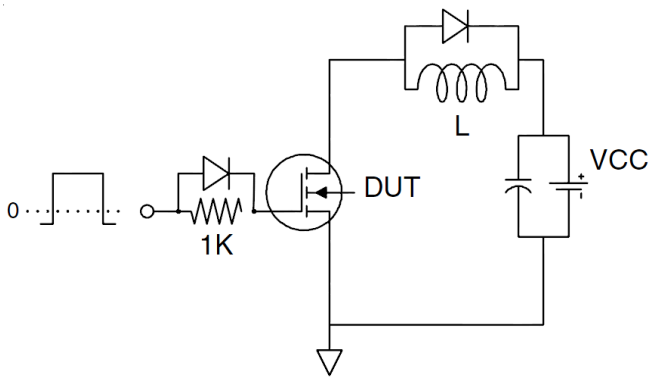
1) E_{AS} Test Circuits



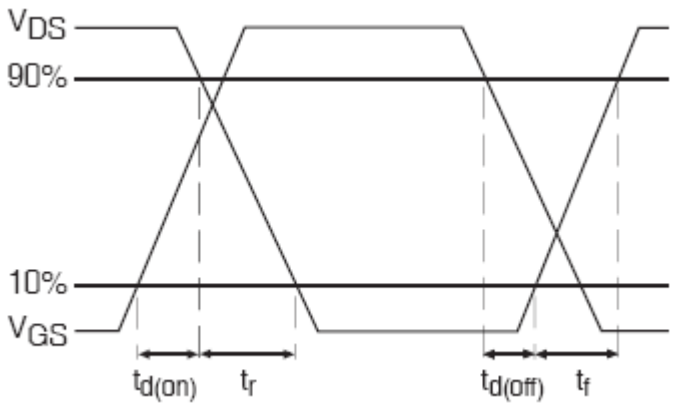


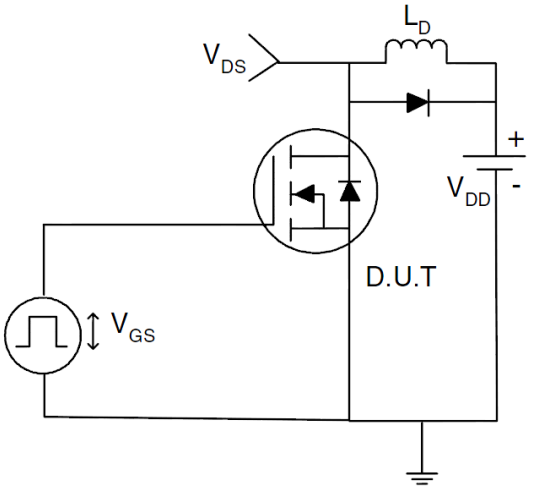
2) Gate Charge Test Circuit:





3) Switch Time Test Circuit:





TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

Figure 1. Output Characteristics

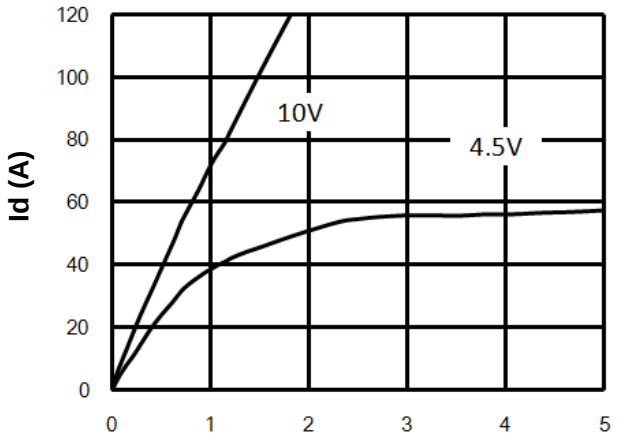


Figure 2. Transfer Characteristics

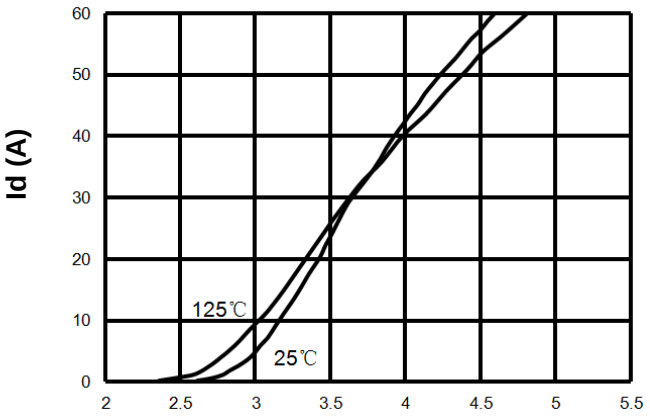


Figure 3. Max BV_{DSS} vs Junction Temperature

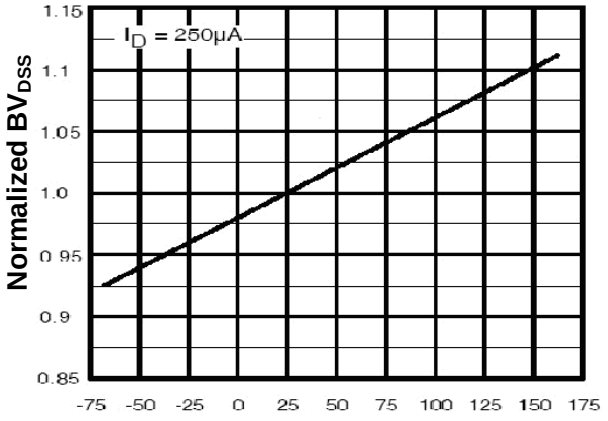


Figure 4. Drain Current

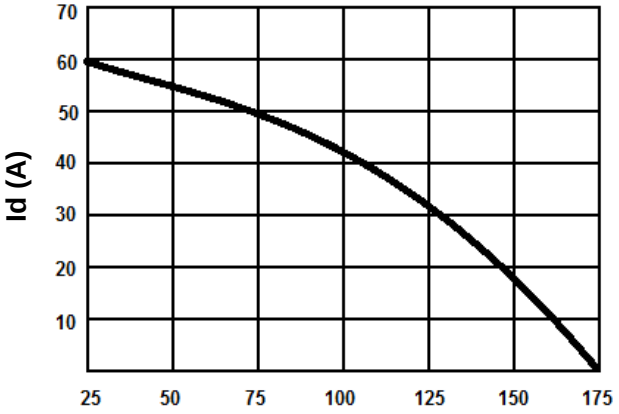


Figure 5. $V_{GS(th)}$ vs Junction Temperature

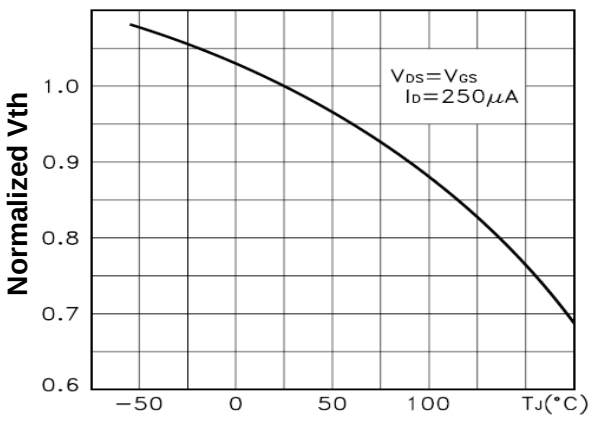


Figure 6. $R_{DS(ON)}$ vs Junction Temperature

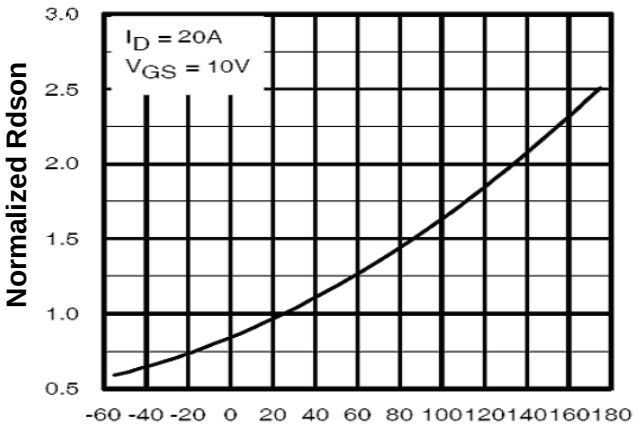


Figure 7. Gate Charge Waveforms

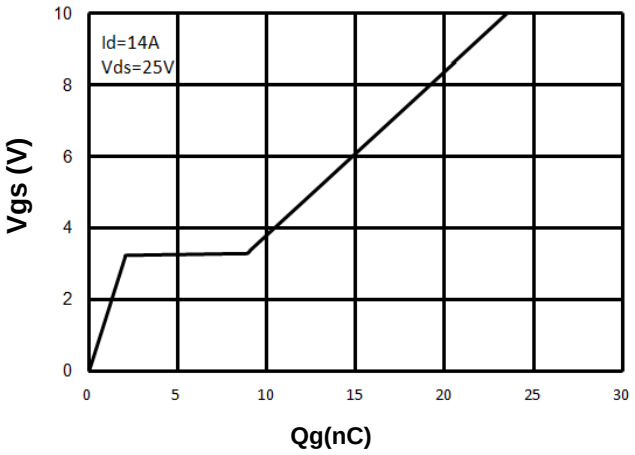


Figure 8. Capacitance

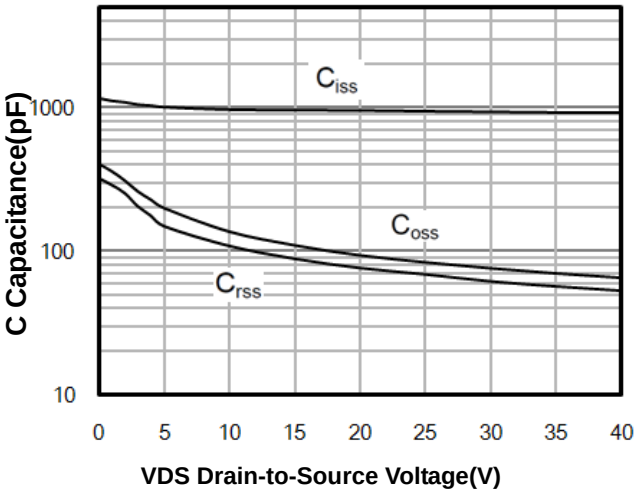


Figure 9. Body-Diode Characteristics

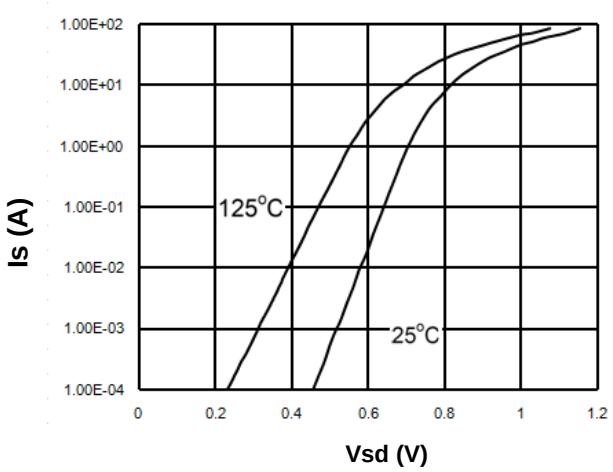
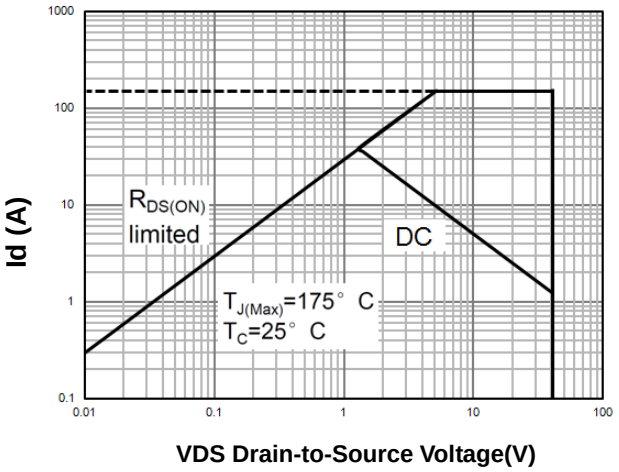
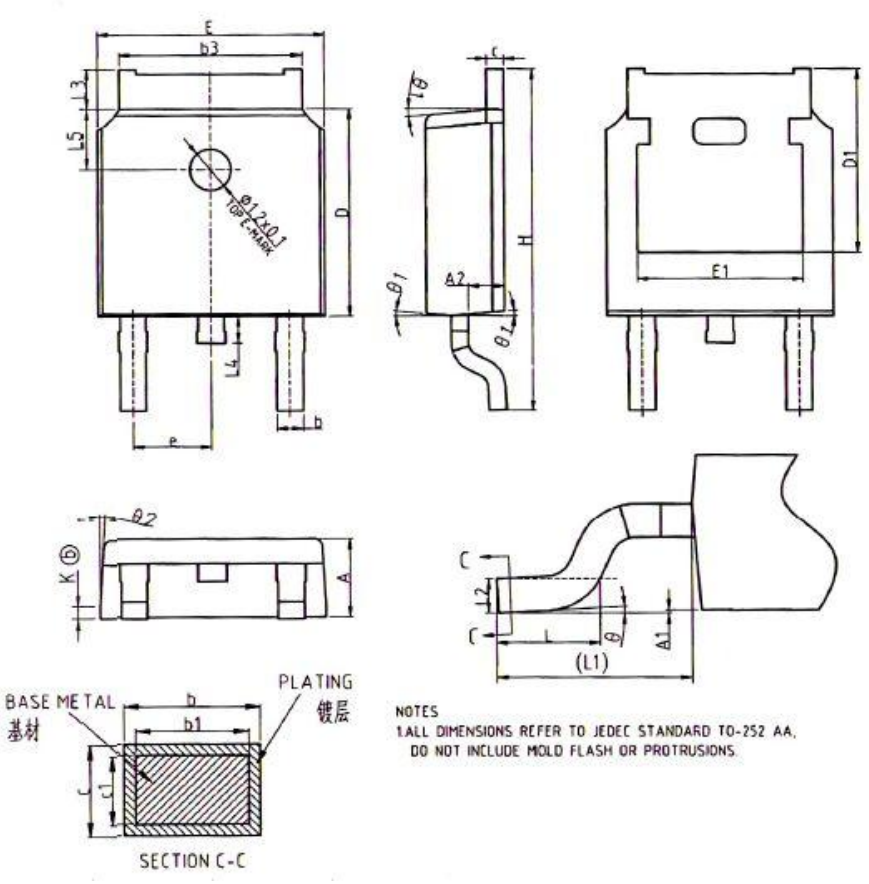


Figure 10. Maximum Safe Operating Area



TO-252 Package Information



COMMON DIMENSIONS			
SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0.00	-	0.10
A2	0.97	1.07	1.17
b	0.72	0.78	0.85
b1	0.71	0.76	0.81
b3	5.23	5.33	5.46
c	0.47	0.53	0.58
c1	0.46	0.51	0.56
D	6.00	6.10	6.20
D1		5.30REF	
E	6.50	6.60	6.70
E1	4.70	4.83	4.92
e		2.286BSC	
H	9.90	10.10	10.30
L	1.40	1.50	1.70
L1		2.90REF	
L2		0.51BSC	
L3	0.90	-	1.25
L4	0.60	0.80	1.00
L5	1.70	1.80	1.90
θ	0°	-	8°
θ1	5°	7°	9°
θ2	5°	7°	9°
K		0.40REF	