DEVICE SPECIFICATION

apQ10SN40A

400V/10A N-Channel MOSFET

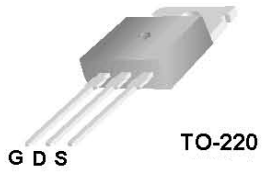
1 Description

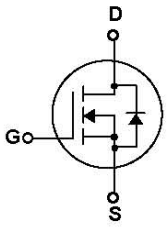
These N-Channel enhancement mode power field effect transistors are produced using planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies, active power factor correction based on half bridge topology.

2 Features

- 400V / 10A ,$R_{DS(on)}$ =0.49Ω(typ) @ V_{GS} =10V, I_D =6A
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- Fast switch





3 Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter	apQ10SN40A	Units
V_{DSS}	Drain-Source Voltage	400	V
I_D	Drain Current - Continuous (T_C= 25°C)	10	A
	- Continuous (T_C= 100°C)	6	A
I_{DM}	Drain Current – Pulsed ①	40	A
V_{GS}	Gate-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy ②	520	mJ
dv/dt	Peak Diode Recovery dv/dt ③	4.0	V/ns
P_D	Power Dissipation (T_C= 25°C)	134	W
	- De-ate above 25°C	1.08	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	°C
T_L	Maximum lead temperature for soldering purposes, 1/8"from case for 5 seconds	300	°C

*note :

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

② V_{DD}=50V, starting T_J=25℃, L=9.1mH, R_G=25Ω, I_{AS}=10A

③ I_{SD} ≤ 10A, di/dt ≤ 300A/μs, VDD ≤ VB_{DSS}, TJ ≤ 150℃

4 Thermal Characteristics

Symbol	Parameter	apQ10SN40A	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.93	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	°C/W

5 Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}= 0 V, I_D= 250 μA	400	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D= 250 μA, Referenced to 25°C	--	0.4	--	V/°C
I_{DSS}	Gate to Source leakage current	V_{DS}= 400 V, V_{GS} = 0 V	--	--	20	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS}= 30 V, V_{DS}= 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS}= -30 V, V_{DS}= 0 V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}= VGS, I_D= 250 μA	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS}= 10 V, I_D= 6 A ④	--	0.49	0.55	Ω
g_{FS}	Forward Transconductance	V_{DS}= 15 V, I_D = 5 A ①	--	--	10	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS}= 25 V, V_{GS}= 0 V, f = 1.0 MHz	--	1400	--	pF
C_{oss}	Output Capacitance		--	330	--	pF
C_{rss}	Reverse Transfer Capacitance		--	120	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD}= 200 V, I_D= 10A, R_G= 9.1 Ω , RD=20Ω ④	--	14	--	ns
t_r	Turn-On Rise Time		--	27	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	50	--	ns
t_f	Turn-Off Fall Time		--	24	--	ns
Q_g	Total Gate Charge	V_{DS}= 320 V, I_D= 10A, V_{GS}= 10 V ④	--	--	63	nC
Q_{gs}	Gate-Source Charge		--	--	9.0	nC
Q_{gd}	Gate-Drain Charge		--	--	32	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode forward Current		--	--	10	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	40	A

V_{SD}	Drain-Source Diode Forward Voltage	V_{GS}= 0 V, I_S= 10 A	--	--	2.0	V
t_{rr}	Reverse Recovery Time	V_{GS}= 0 V, I_F= 10 A, dI_F/dt = 100 A/μs ④	--	370	790	ns
Q_{rr}	Reverse Recovery Charge		--	3.8	8.2	μC

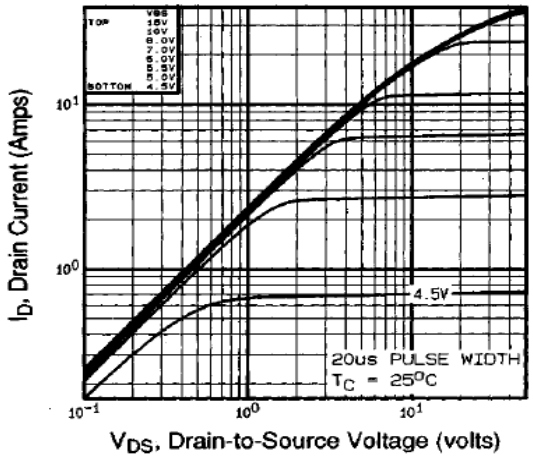
Notes:

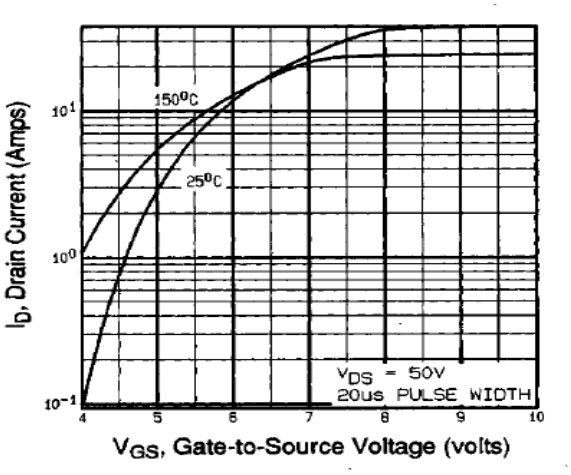
① Repetitive Rating: Pulse width limited by maximum junction temperature.

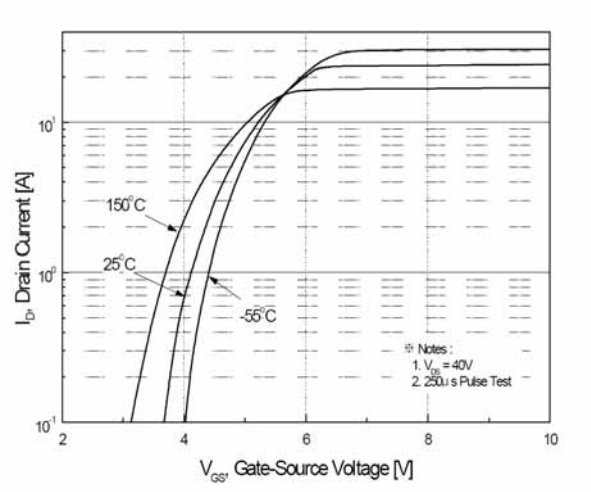
② V_{DD}=50V, starting T_J=25℃, L=9.1mH, RG=25Ω, I_{AS}=10A

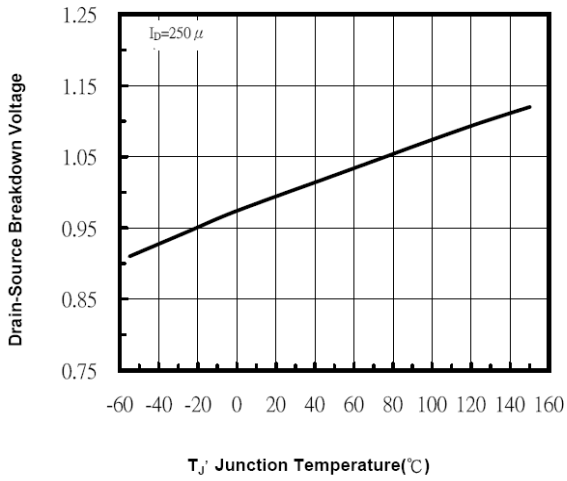
③ I_{SD} ≤ 10A, di/dt ≤ 100A/μs, V_{DD} ≤ $V_{(BR)DSS}$, TJ ≤ 150℃

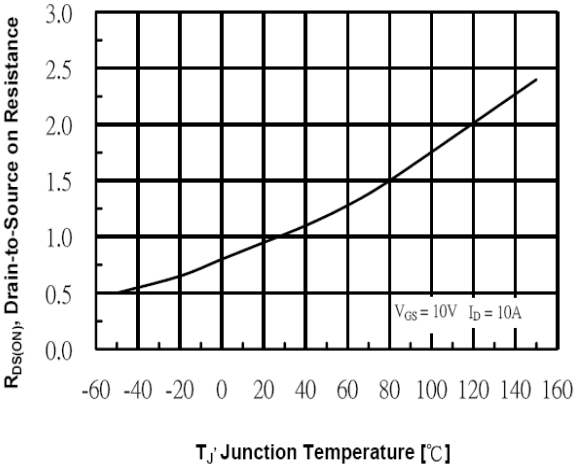
④ Pulse Test: Pulse width ≤300μs, Duty cycle ≤ 2%. Depend on FT Test.

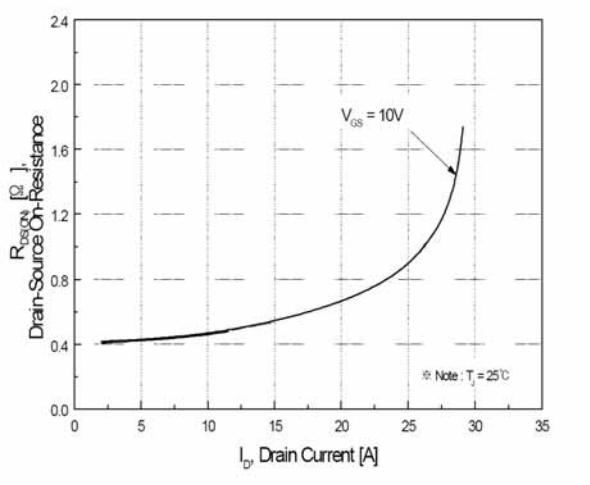


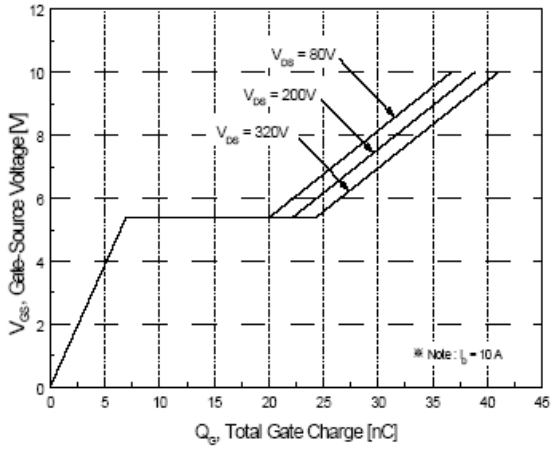


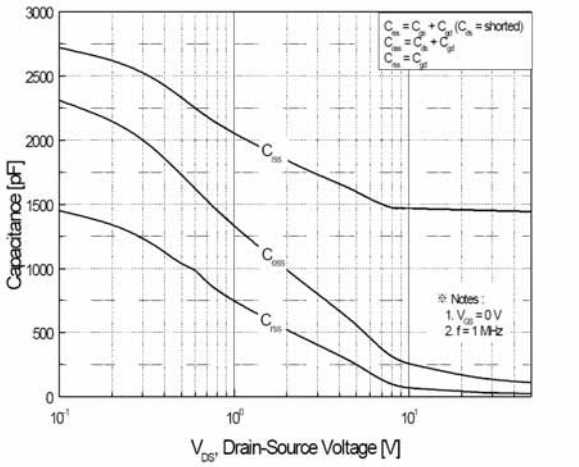


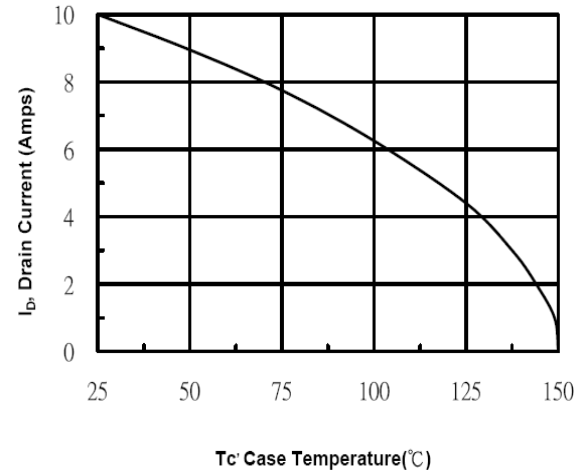


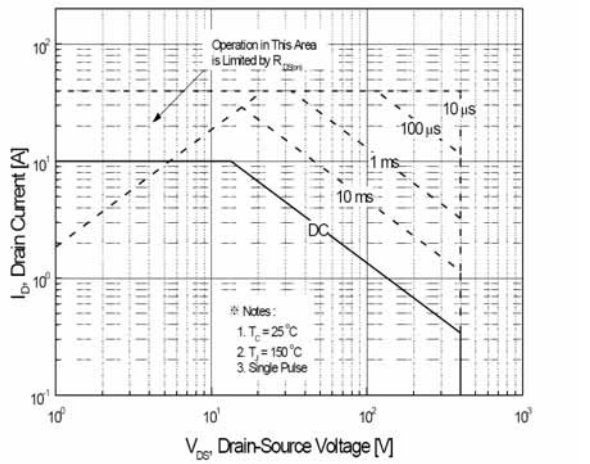

$R_{DS(ON)}$, Drain-to-Source on Resistance
3.0
2.5
2.0
1.5
1.0
0.5
0.0
V_{GS} = 10V I_D = 10A
-60 -40 -20 0 20 40 60 80 100 120 140 160
T_J, Junction Temperature [℃]


$R_{DS(ON)}$ [Ω], Drain-Source On-Resistance
2.4
2.0
1.6
1.2
0.8
0.4
0.0
V_{GS} = 10V
※ Note : T_J = 25℃
0 5 10 15 20 25 30 35
I_D, Drain Current [A]

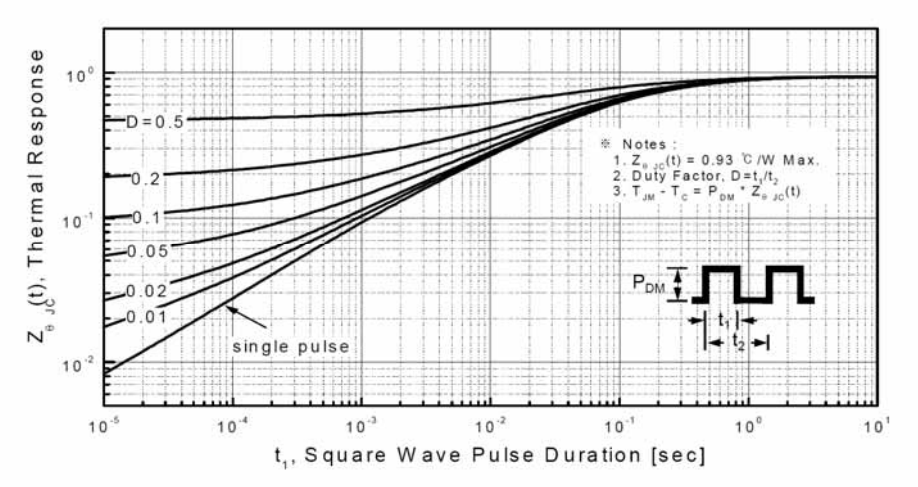

V_{GS}, Gate-Source Voltage [V]
12
10
8
6
4
2
0
V_{DS} = 80V
V_{DS} = 200V
V_{DS} = 320V
※ Note : I_D = 10A
0 5 10 15 20 25 30 35 40 45
Q_G, Total Gate Charge [nC]


Capacitance [pF]
3000
2500
2000
1500
1000
500
0
C_{iss} = C_{gs} + C_{gd} (C_{ds} = shorted)
C_{oss} = C_{ds} + C_{gd}
C_{rss} = C_{gd}
C_{iss}
C_{oss}
C_{rss}
※ Notes :
1. V_{GS} = 0 V
2. f = 1 MHz
10^{-1} 10^{0} 10^{1}
V_{DS}, Drain-Source Voltage [V]


I_D, Drain Current (Amps)
10
8
6
4
2
0
25 50 75 100 125 150
Tc, Case Temperature(℃)


I_D, Drain Current [A]
10^2
10^1
10^0
10^{-1}
Operation in This Area is Limited by $R_{DS(on)}$
10 μs
100 μs
1 ms
10 ms
DC
※ Notes :
1. T_C = 25℃
2. T_J = 150℃
3. Single Pulse
10^0 10^1 10^2 10^3
V_{DS}, Drain-Source Voltage [V]

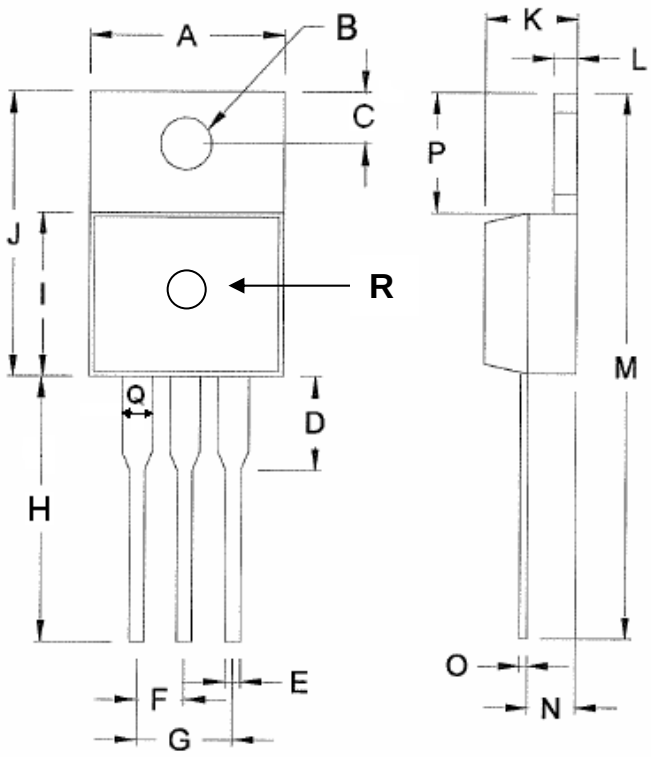
400V/10A N-Channel MOSFET



6 Package Dimensions

TO-220

TO-220 DIMENSION			
DIM	MILLIMETERS		
	MIN	MAX	TYP.
A	10.04	10.41	10.23
B	3.75	3.88	3.82
C	2.50	2.84	2.67
D	3.31	4.50	3.91
E	0.70	0.91	0.81
F	2.54(typ.)		2.54
G	5.08(typ.)		5.08
H	13.47	14.20	13.84
I	8.50	9.00	8.80
J	14.80	15.49	15.15
K	4.32	4.57	4.45
L	1.22	1.37	1.30
M	28.27	29.69	28.98
N	2.40	2.90	2.65
O	0.36	0.53	0.45
P	5.97	6.47	6.22
Q	1.15	1.45	1.30
R	2.0(typ.)		2.00



Note

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