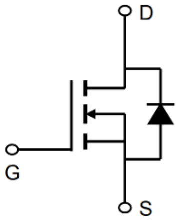
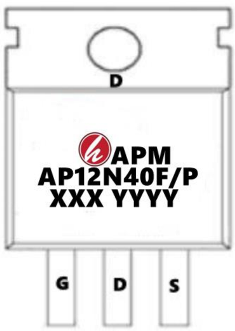
400V N-Channel Enhancement Mode MOSFET





Description

The AP12N40F/P is silicon N-channel Enhanced VDMOSFETs, is obtained by the self-aligned planar 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.

General Features

V_{DS} = 400V I_D =12A

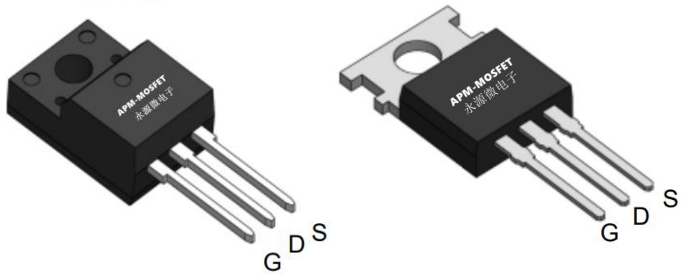
$R_{DS(ON)}$ < 500mΩ @ V_{GS}=10V （**Type：430mΩ**）

Application

Uninterruptible Power Supply(UPS)

Power Factor Correction (PFC)

TO-220F　　TO-220



Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
AP12N40F	TO-220F-3L	AP12N40F XXX YYYY	1000
AP12N40P	TO-220-3L	AP12N40P XXX YYYY	1000

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

Symbol	Parameter	Value TO-220F TO-220	Unit
VDSS	Drain-Source Voltage (V_{GS} = 0V)	400	V
ID	Continuous Drain Current	12	A
IDM	Pulsed Drain Current (note1)	44	A
VGS	Gate-Source Voltage	±30	V
E_{AS}	Single Pulse Avalanche Energy (note2)	368	mJ
IAR	Avalanche Current (note1)	11	A
E_{AR}	Repetitive Avalanche Energy note1)	28	mJ
P_D	Power Dissipation (T_C = 25ºC)	33.2	W
TJ, Tstg	Operating Junction and Storage Temperature Range	-55~+150	ºC
RthJC	Thermal Resistance, Junction-to-Case	3.8	ºC/W
RthJA	Thermal Resistance, Junction-to-Ambient	62.5	ºC/W

400V N-Channel Enhancement Mode MOSFET

Electrical Characteristics (T_J=25℃, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	400	450		V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage TemperatureCoefficient	I_D=250μA,Referenced to 25°C		0.43		V/°C
IDSS	Zero Gate Voltage Drain Current	V_{DS} = 400 V, V_{GS} = 0 V			1	μA
		V_{DS} = 320 V, TC = 125°C			10	μA
IGSSF	Gate-Body Leakage Current, Forward	V_{GS} = 30 V, V_{DS} = 0 V			100	nA
IGSSR	Gate-Body Leakage Current, Reverse	V_{GS} = -30 V, V_{DS} = 0 V			-100	nA
VGS(TH)	Gate Threshold voltage	V_{DS}=V_{GS}, I_D =250 uA	2.0		4.0	V
RDS(On)	Drain-Source on-state resistance	V_{GS}=10V, I_D = 5.5A, T_J=25°C		0.460	0.575	Ω
gFS	Forward Transconductance	V_{DS}=40V, I_D= 5.5A (Note 4)		6.5		S
C_{iss}	Input capacitance	V_{DS}= 25V, V_{GS}=0V, f=1.0MHz		755		pF
C_{oss}	Output capacitance			132		pF
C_{rss}	Reverse transfer capacitance			9.0		pF
td(on)	Turn On Delay Time	V_{DD}=200 V, ID=11A, R_G = 25Ω (Note 4, 5)		11		ns
t_r	Rising Time			25		ns
td(off)	Turn Off Delay Time			28		ns
t_f	Fall Time			26		ns
Q_g	Total Gate Charge	V_{DS} = 320 V, ID = 11 A, V_{GS} = 10 V (Note 4, 5)		9.6		nC
Q_{gs}	Gate-Source Charge			3.0		nC
Q_{gd}	Gate-Drain Charge			2.5		nC
ISM	Maximum Pulsed Drain-Source Diode Forward Current				44	A
V_{SD}	Diode Forward Voltage	V_{GS}= 0 V, I_S = 11 A			1.2	V
trr	Reverse Recovery Time	V_{GS} = 0 V, I_S = 11 A, dI_F / dt = 100 A/μs Note 4)		356		ns
Q_{rr}	Reverse Recovery Charge			2.4		μC

Note :

1、The data tested by surface mounted on a 1 inch2 FR-4 board with 2OZ copper.

2、The EAS data shows Max. rating . L=4.1Mh IAS=11A, VDD=50V, RG=25Ω, Starting TJ = 25 ºC

3、The test condition is Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 1%

4、The power dissipation is limited by 150℃ junction temperature

5、The data is theoretically the same as ID and IDM , in real applications , should be limited by total power dissipation.

Typical Characteristics

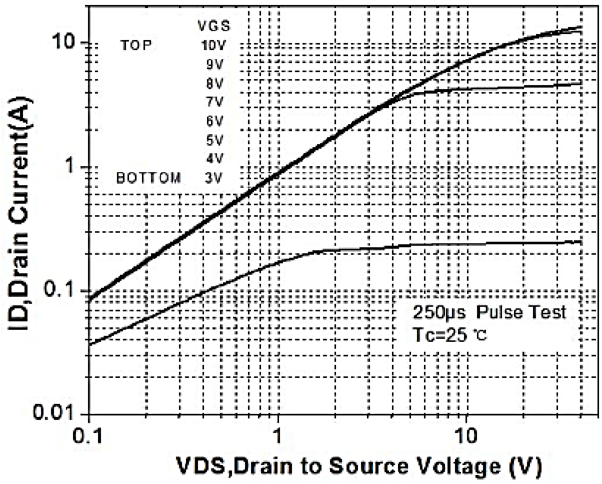


Figure 1. On-Region Characteristics

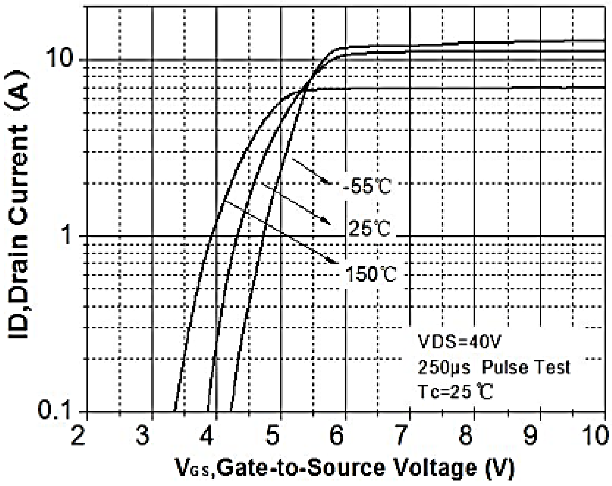


Figure 2. Transfer Characteristics

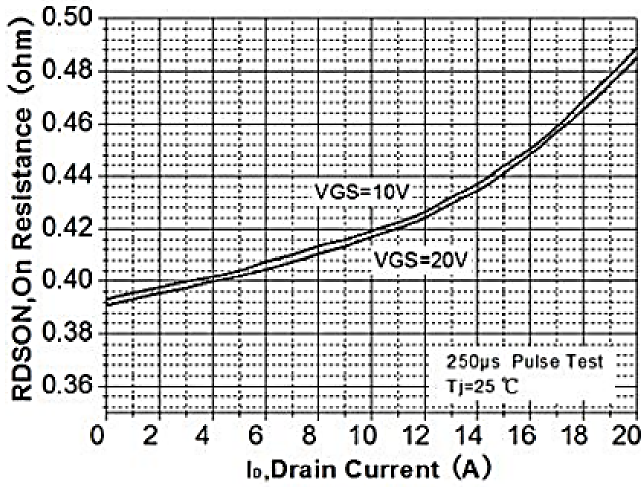


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

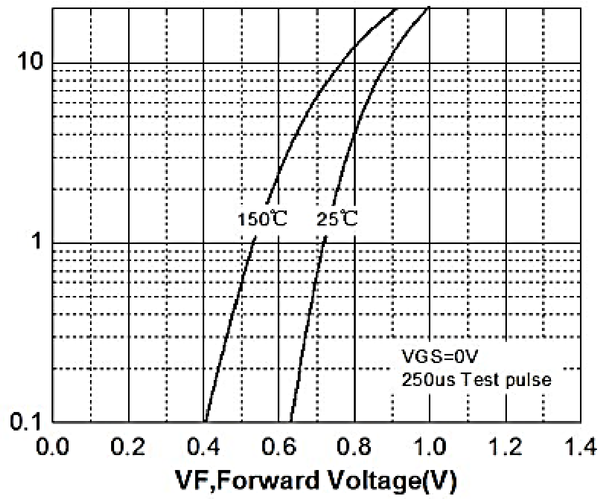


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

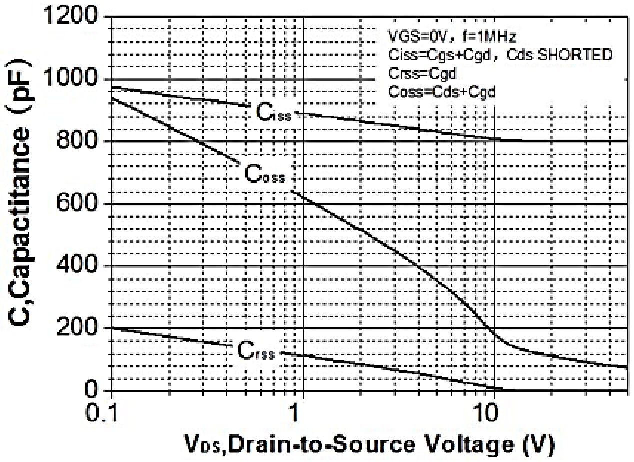


Figure 5. Capacitance Characteristics

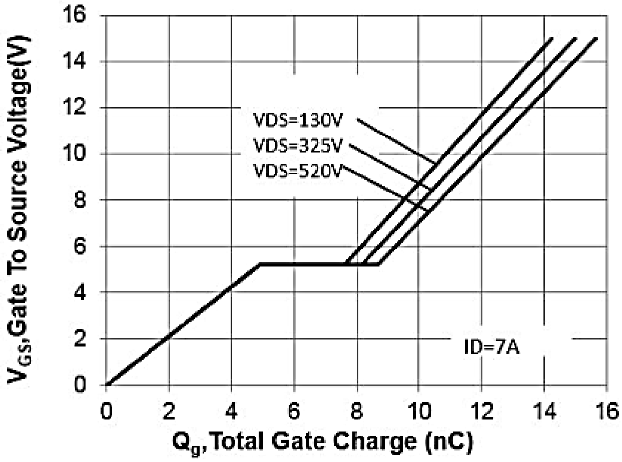


Figure 6. Gate Charge Characteristics

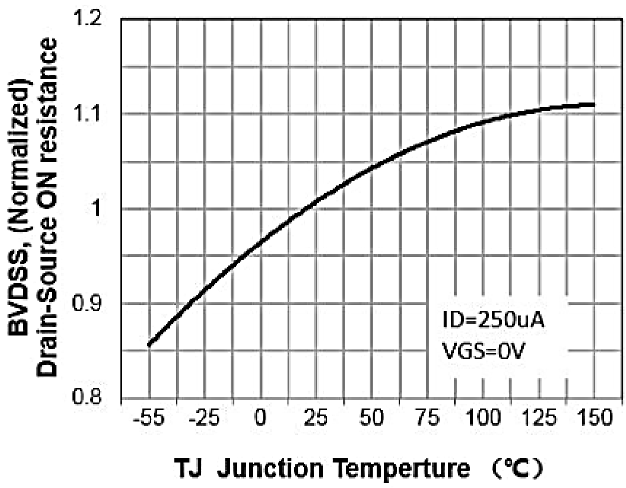


Figure 7. Breakdown Voltage Variation vs Temperature

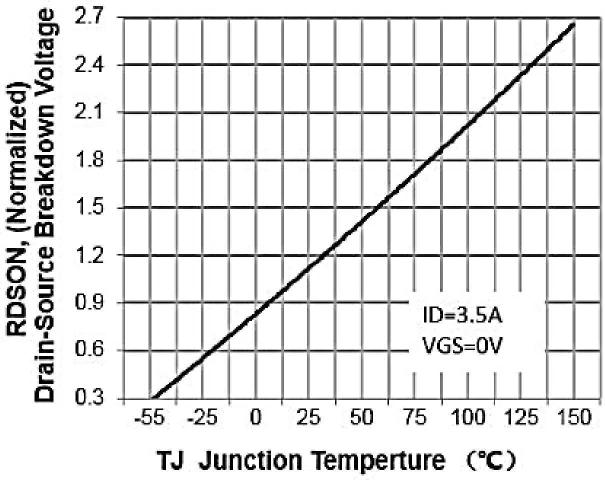


Figure 8. On-Resistance Variation vs Temperature

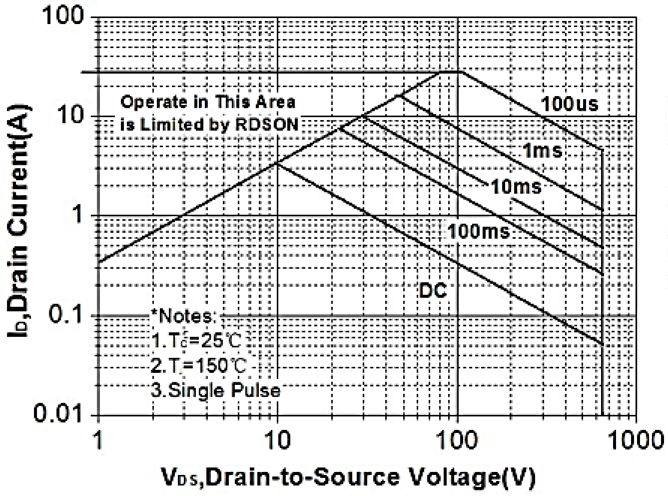


Figure 9. Maximum Safe Operating Area

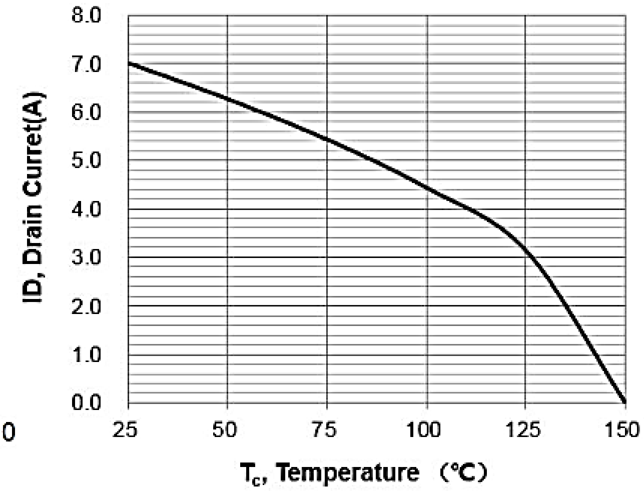


Figure 10. Maximum Drain Current vs Case Temperature

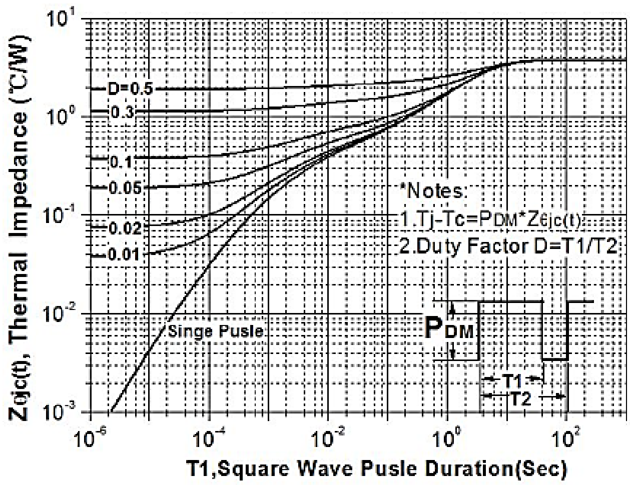


Figure 11. Transient Thermal Response Curve

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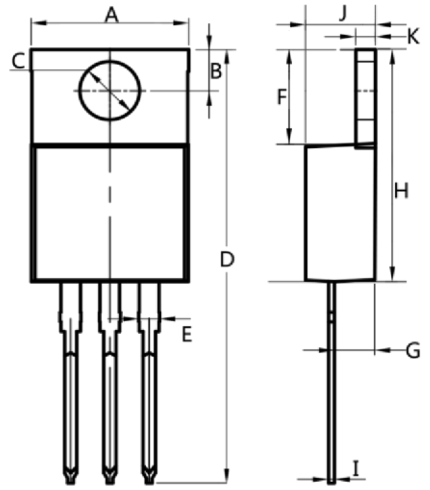

Dim.	Min.	Max.
A	10.0	10.4
B	2.5	3.0
C	3.5	4.0
D	28.0	30.0
E	1.1	1.5
F	6.2	6.6
G	2.9	3.3
H	15.0	16.0
I	0.35	0.45
J	4.3	4.7
K	1.2	1.4
All Dimensions in millimeter		

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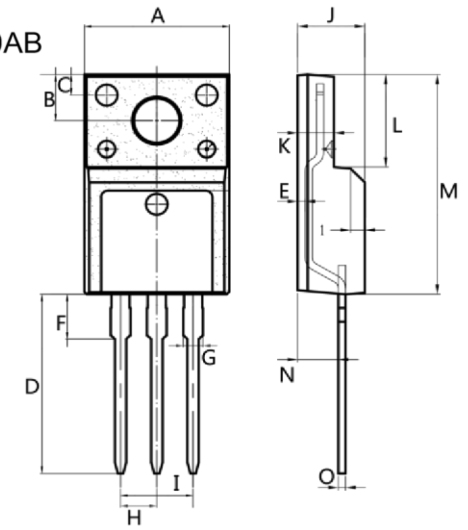

Dim.	Min.	Max.
A	9.9	10.3
B	2.9	3.5
C	1.15	1.45
D	12.75	13.25
E	0.55	0.75
F	3.1	3.5
G	1.25	1.45
H	Typ 2.54	
I	Typ 5.08	
J	4.55	4.75
K	2.4	2. 7
L	6.35	6.75
M	15.0	16.0
N	2.75	3.15
O	0.45	0.60
All Dimensions in millimeter		

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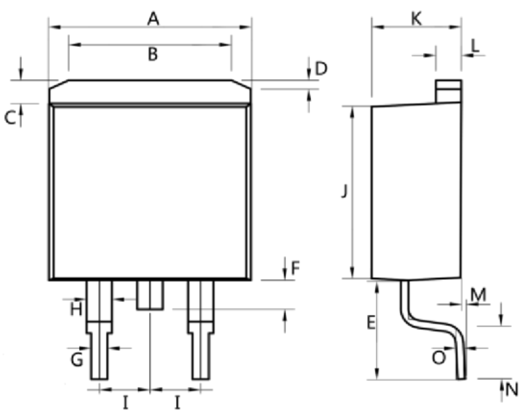

Dim.	Min.	Max.
A	10.0	10. 5
B	7.25	7.75
C	1.3	1.5
D	0.55	0.75
E	5.0	6.0
F	1.4	1.6
G	0.75	0.95
H	1.15	1.35
I	Typ 2.54	
J	8.4	8.6
K	4.4	4.6
L	1.25	1.45
M	0.02	0.1
N	2.4	2.8
O	0.35	0.45
All Dimensions in millimeter		

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Edition	Date	Change
Rve1.0	2020/1/31	Initial release