

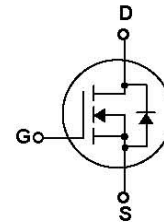
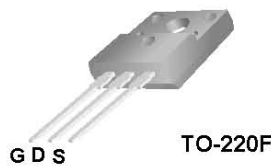
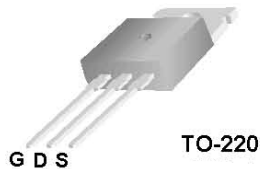
1 Description

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

- 600V / 4A , $R_{DS(on)} = 1.72\Omega$ (typ) @ $V_{GS} = 10V, I_D = 2A$
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability..



3 Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	apQ04SN60A(F)		Units
		TO-220	TO-220F	
V_{DSS}	Drain-Source Voltage	600		V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$)	4		A
		2.5		A
I_{DM}	Drain Current - Pulsed ①	16		A
V_{GS}	Gate-Source Voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy ②	240		mJ
I_{AR}	Avalanche Current ①	4		A
E_{AR}	Repetitive Avalanche Energy ①	10		mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.5		V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$) - De-rate above 25°C	100	33	W
		0.8	0.26	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		$^\circ\text{C}$
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300		$^\circ\text{C}$

* note :

- ① Repetitive Rating: Pulse width limited by maximum junction temperature.
- ② $V_{DD} = 50V$, starting $T_J = 25^\circ\text{C}$, $L = 27.5\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 4A$
- ③ $I_{SD} \leq 4A$, $di/dt \leq 100A/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 150^\circ\text{C}$.



DEVICE SPECIFICATION

apQ04SN60A(F)

600V/4A N-Channel MOSFET

4 Thermal Characteristics

Symbol	Parameter	apQ04SN60A(F)		Units
		TO-220	TO-220F	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.25	3.79	$^{\circ}\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^{\circ}\text{C}/\text{W}$

5 Electrical Characteristics $T_C = 25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	600	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	--	0.65	--	$\text{V}/^{\circ}\text{C}$
I_{DSS}	Gate to Source leakage current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	--	--	20	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 2.0\text{ A}$	--	1.72	2.3	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 2.0\text{ A}$ ④	--	4.7	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	--	715	--	pF
C_{oss}	Output Capacitance		--	67	--	pF
C_{rss}	Reverse Transfer Capacitance		--	8	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 300\text{ V}, I_D = 4\text{ A}, R_G = 25\ \Omega$ ④	--	18	45	ns
t_r	Turn-On Rise Time		--	50	110	ns
$t_{d(off)}$	Turn-Off Delay Time		--	60	135	ns
t_f	Turn-Off Fall Time		--	50	110	ns
Q_g	Total Gate Charge	$V_{DS} = 480\text{ V}, I_D = 4\text{ A}, V_{GS} = 10\text{ V}$ ④	--	19	25	nC
Q_{gs}	Gate-Source Charge		--	4.2	--	nC
Q_{gd}	Gate-Drain Charge		--	7.8	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	4	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	18	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 4\text{ A}$	--	--	1.4	V



DEVICE SPECIFICATION

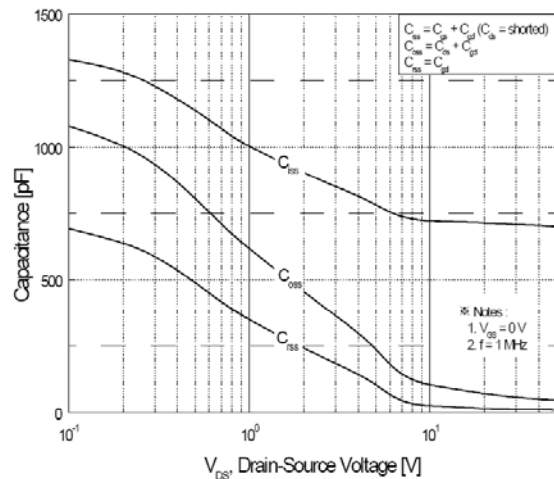
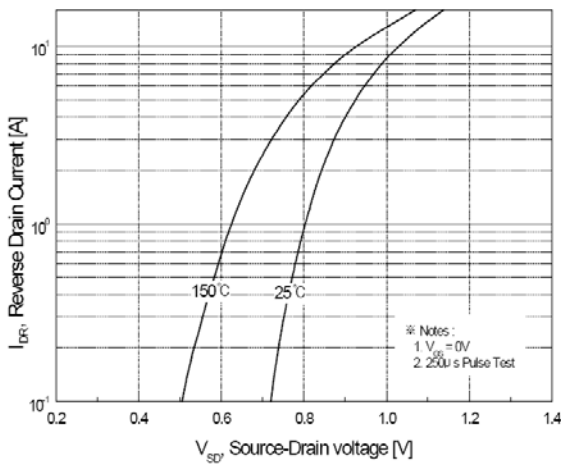
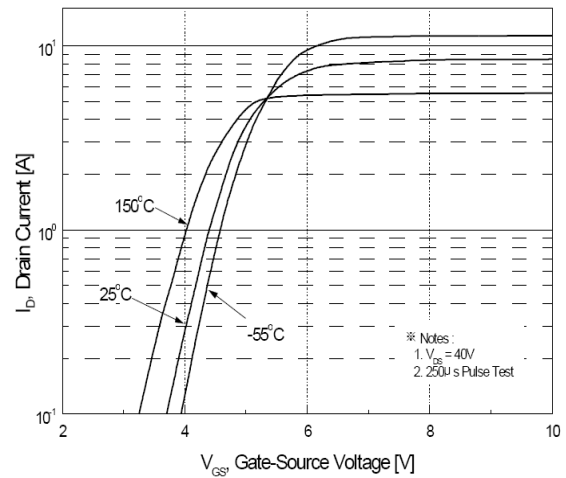
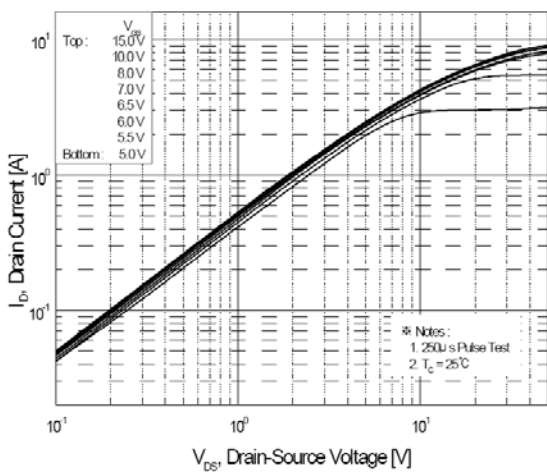
apQ04SN60A(F)

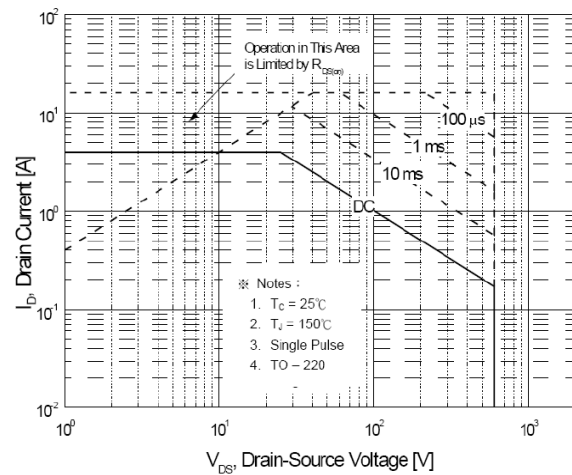
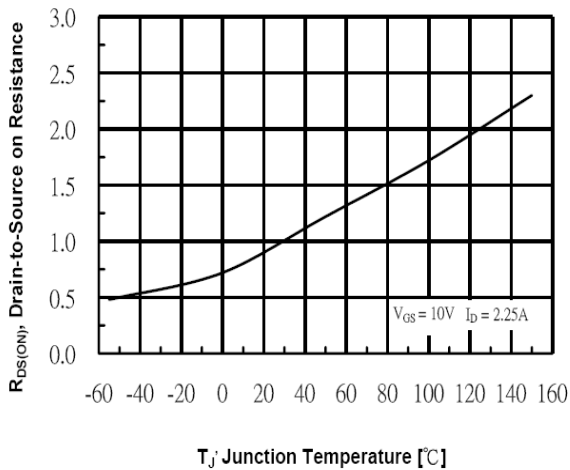
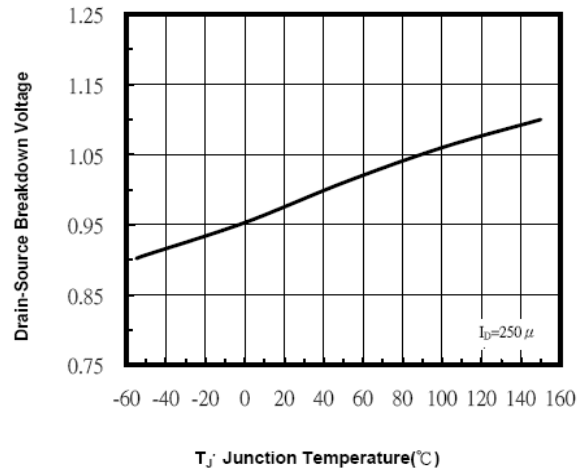
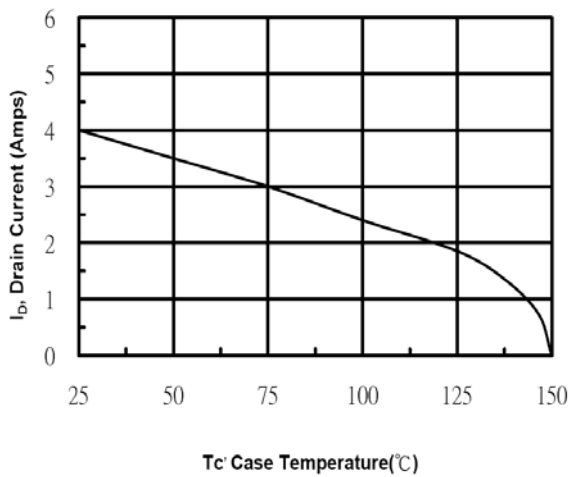
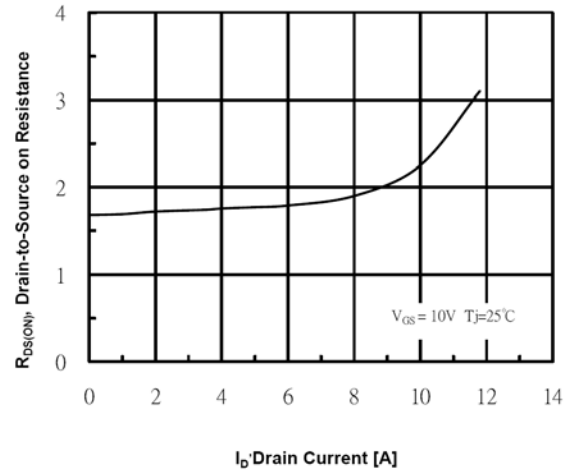
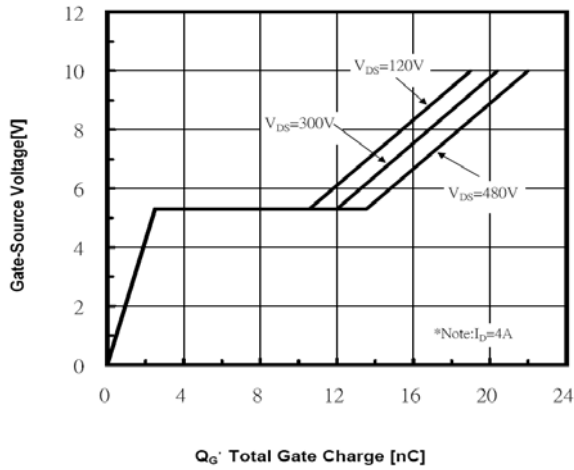
600V/4A N-Channel MOSFET

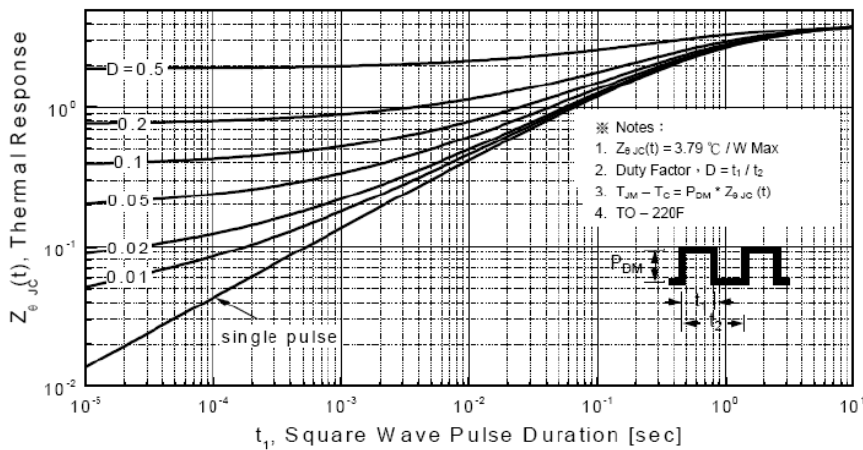
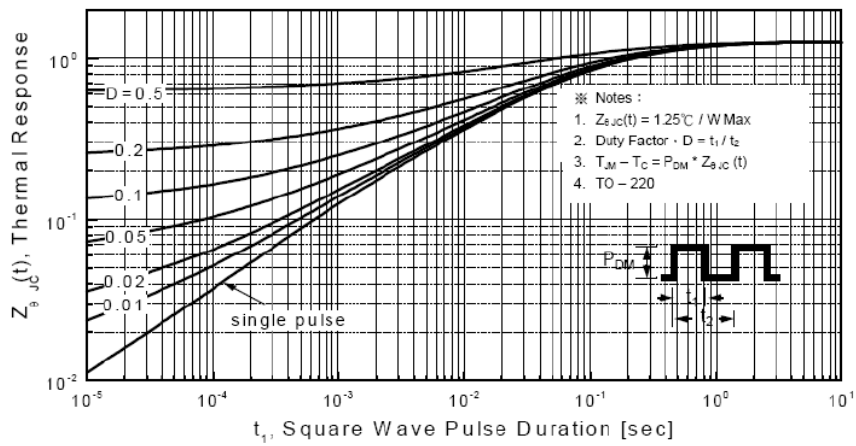
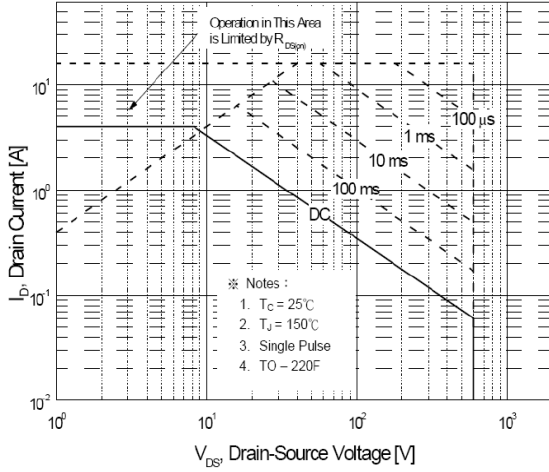
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 4\text{ A},$ $di_F/dt = 100\text{ A}/\mu\text{s}$ ④	--	325	--	ns
Q_{rr}	Reverse Recovery Charge		--	2.59	--	μC

Notes:

- ① Repetitive Rating: Pulse width limited by maximum junction temperature.
- ② VDD=50V, starting $T_J=25^\circ\text{C}$, L=27.5mH, $R_G=25\Omega$, IAS=4A
- ③ $ISD \leq 4\text{ A}$, $di/dt \leq 100\text{ A}/\mu\text{s}$, $V_{DD} \leq V(BR)DSS$, $T_J \leq 150^\circ\text{C}$
- ④ Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$. Depend on FT Test.
- ⑤ CP Test



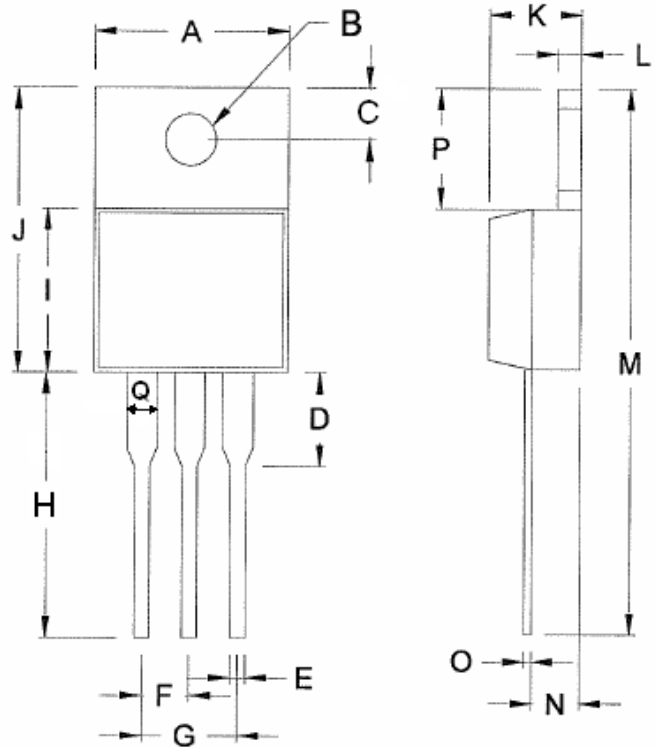




6 Package Dimensions

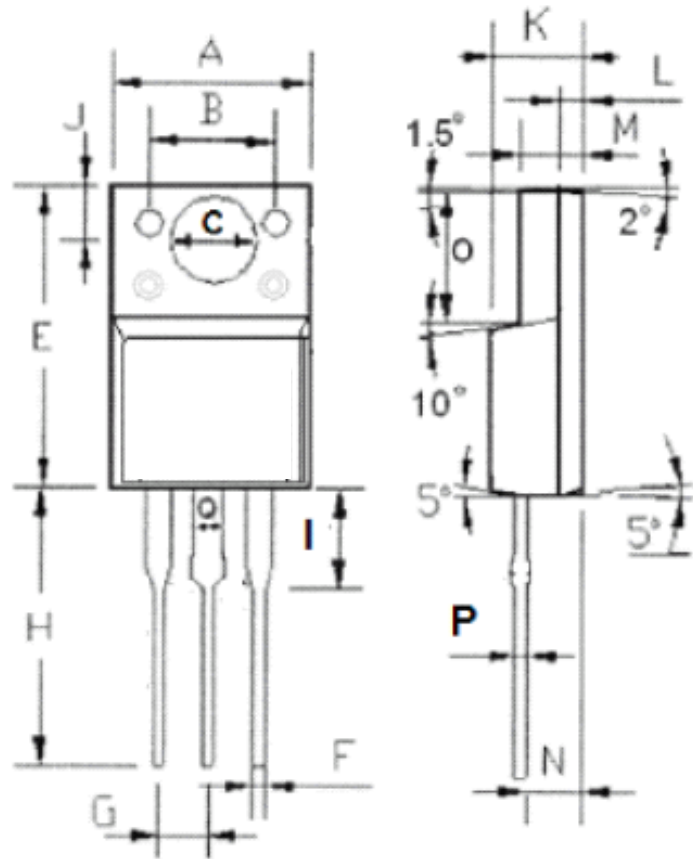
TO-220

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



TO-220F

TO-220F DIMENSION			
DIM	MILLIMETERS		
	MIN	MAX	TYP.
A	6.96	10.36	8.66
B	6.50(typ.)		6.50
C	3.00	3.20	3.10
E	15.10	16.07	15.59
F	0.55	1.39	0.97
G	2.54		2.54
H	12.37	13.5	12.94
I	2.23	3.90	3.07
J	2.90	3.50	3.2
K	4.45	4.93	4.69
L	1.15(typ.)		1.15
M	2.34	2.74	2.54
N	2.56	2.96	2.76
O	6.50	7.10	6.8
P	0.36	0.68	0.52
Q	1.15	1.66	1.41





DEVICE SPECIFICATION

apQ04SN60A(F)

600V/4A N-Channel MOSFET

Note

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