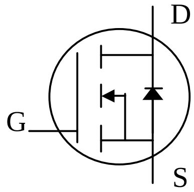
Advanced Power Electronics Corp.

AP09N70P-A-HF-3

N-channel Enhancement-mode Power MOSFET

Simple Drive Requirement
100% Avalanche Tested
Fast Switching Performance
RoHS-compliant, halogen-free

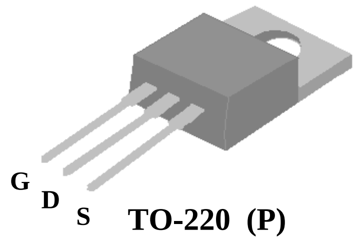


BV_{DSS}	650V
$R_{DS(ON)}$	0.75Ω
I_D	9A

Description

Advanced Power MOSFETs from APEC provide the designer with the best combination of fast switching, low on-resistance and cost-effectiveness.

The AP09N70P-A-HF-3 is in the popular TO-220 through-hole package which is widely used in commercial and industrial applications where a small PCB footprint or an attached heatsink is required.
This device is well suited for use in high voltage applications such as off-line AC/DC converters.



TO-220 (P)

Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	650	V
V_{GS}	Gate-Source Voltage	±30	V
I_D at T_C=25°C	Continuous Drain Current [3]	9	A
I_D at T_C=100°C	Continuous Drain Current[3]	5	A
I_{DM}	Pulsed Drain Current[1]	40	A
P_D at T_C=25°C	Total Power Dissipation	156	W
	Linear Derating Factor	1.25	W/°C
E_{AS}	Single Pulse Avalanche Energy[2]	305	mJ
I_{AR}	Avalanche Current	9	A
E_{AR}	Repetitive Avalanche Energy	9	mJ
T_{STG}	Storage Temperature Range	-55 to 150	°C
T_J	Operating Junction Temperature Range	-55 to 150	°C

Thermal Data

Symbol	Parameter	Value	Unit
Rthj-c	Maximum Thermal Resistance, Junction-case	0.8	°C/W
Rthj-a	Maximum Thermal Resistance, Junction-ambient	62	°C/W

Ordering Information

AP09N70P-A-HF-3TB **RoHS-compliant halogen-free TO-220, shipped in tubes**

Electrical Specifications at T_j=25°C (unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=1mA	650	-	-	V
$\Delta BV_{DSS}/\Delta T_j$	Breakdown Voltage Temperature Coefficient	Reference to 25°C, I_D=1mA	-	0.6	-	V/°C
$R_{DS(ON)}$	Static Drain-Source On-Resistance[3]	V_{GS}=10V, I_D=4.5A	-	-	0.75	Ω
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, I_D=250uA	2	-	4	V
g_{fs}	Forward Transconductance	V_{DS}=10V, I_D=4.5A	-	4.5	-	S
I_{DSS}	Drain-Source Leakage Current	V_{DS}=600V, V_{GS}=0V	-	-	10	uA
	Drain-Source Leakage Current (T_j=125°C)	V_{DS}=480V, V_{GS}=0V	-	-	100	uA
I_{GSS}	Gate-Source Leakage	V_{GS}=±30V, V_{DS}=0V	-	-	±100	nA
Q_g	Total Gate Charge[3]	I_D=9A	-	44	-	nC
Q_{gs}	Gate-Source Charge	V_{DS}=480V	-	11	-	nC
Q_{gd}	Gate-Drain ("Miller") Charge	V_{GS}=10V	-	12	-	nC
$t_{d(on)}$	Turn-on Delay Time[3]	V_{DD}=300V	-	19	-	ns
t_r	Rise Time	I_D=9A	-	21	-	ns
$t_{d(off)}$	Turn-off Delay Time	R_G=10Ω , V_{GS}=10V	-	56	-	ns
t_f	Fall Time	R_D=34Ω	-	24	-	ns
C_{iss}	Input Capacitance	V_{GS}=0V	-	2660	-	pF
C_{oss}	Output Capacitance	V_{DS}=25V	-	170	-	pF
C_{rss}	Reverse Transfer Capacitance	f=1.0MHz	-	10	-	pF

Source-Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
I_S	Continuous Source Current (Body Diode)	$V_D=V_G$=0V , V_S=1.5V	-	-	9	A
I_{SM}	Pulsed Source Current (Body Diode)[1]		-	-	40	A
V_{SD}	Forward On Voltage[3]	T_j=25°C, I_S=9A, V_{GS}=0V	-	-	1.5	V

Notes:

1. Pulse width limited by maximum junction temperature.
2. Starting T_j=25°C , V_{DD}=50V , L=6.8mH , R_G=25Ω , I_{AS}=9A.
3. Pulse test - pulse width ≤ 300μs , duty cycle ≤ 2%

Typical Electrical Characteristics

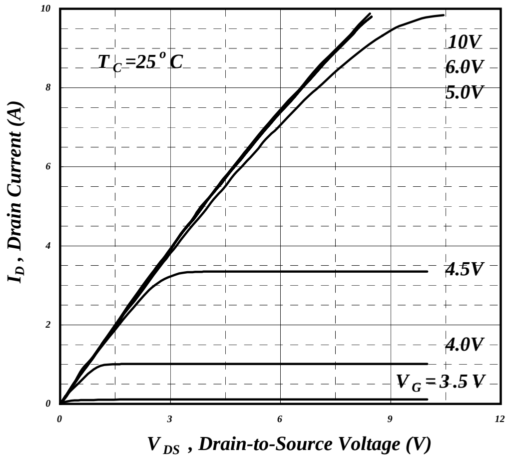


Fig 1. Typical Output Characteristics

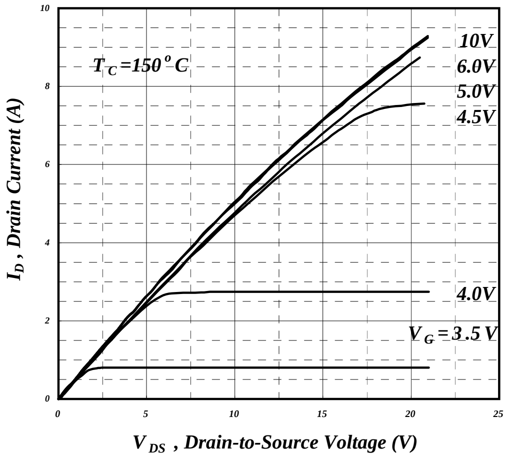


Fig 2. Typical Output Characteristics

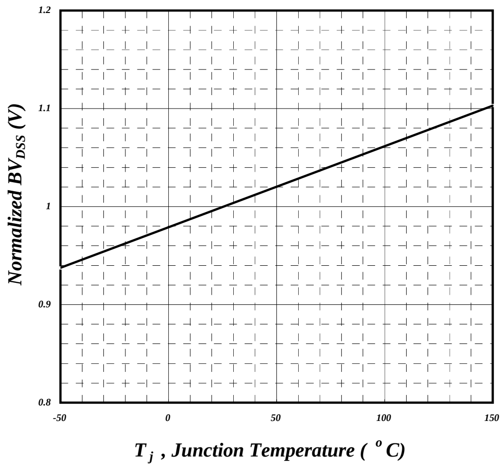


Fig 3. Normalized BV_{DSS} vs. Junction Temperature

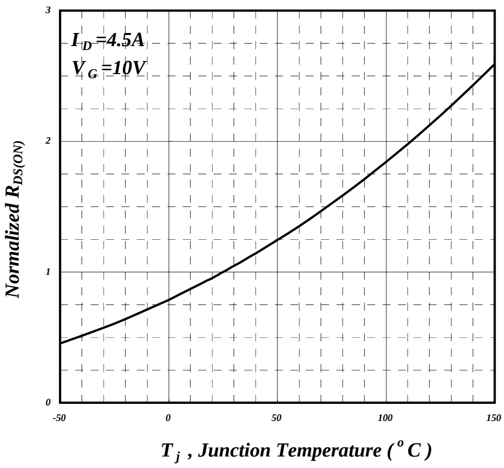


Fig 4. Normalized On-Resistance vs. Junction Temperature

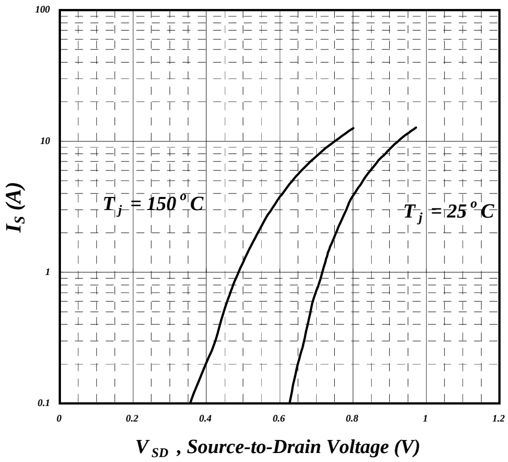


Fig 5. Forward Characteristic of Reverse Diode

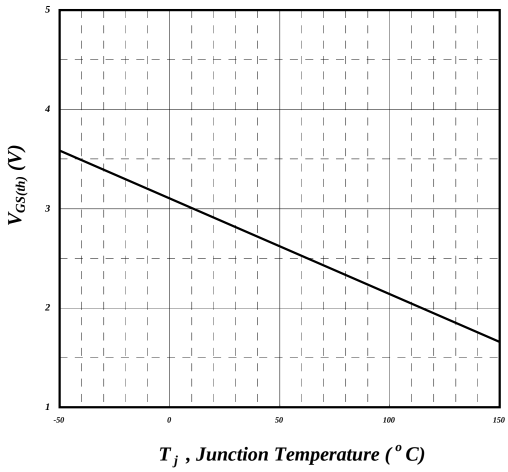


Fig 6. Gate Threshold Voltage vs. Junction Temperature

Typical Electrical Characteristics (cont.)

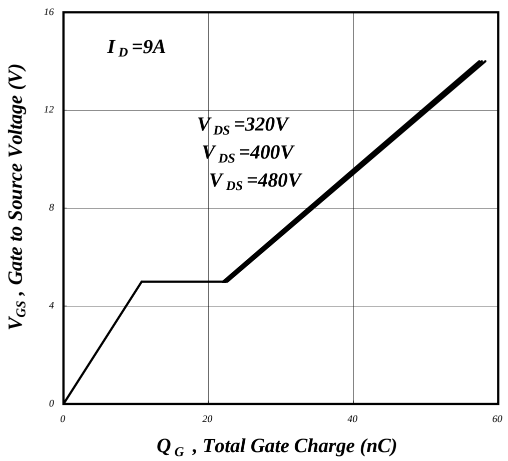


Fig 7. Gate Charge Characteristics

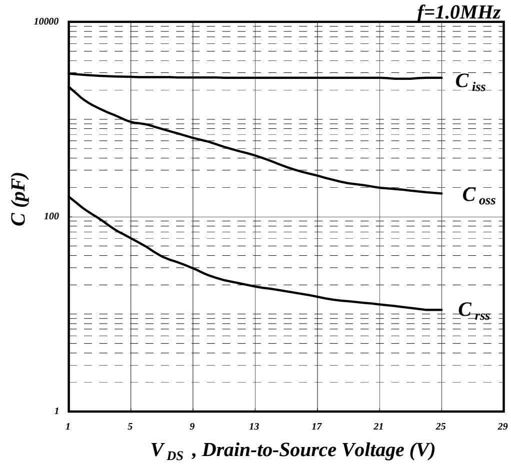


Fig 8. Typical Capacitance Characteristics

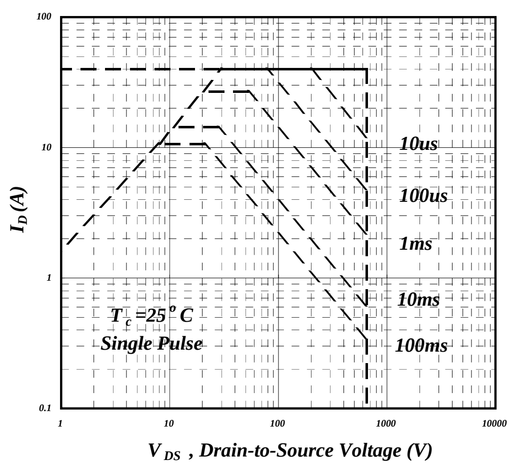


Fig 9. Maximum Safe Operating Area

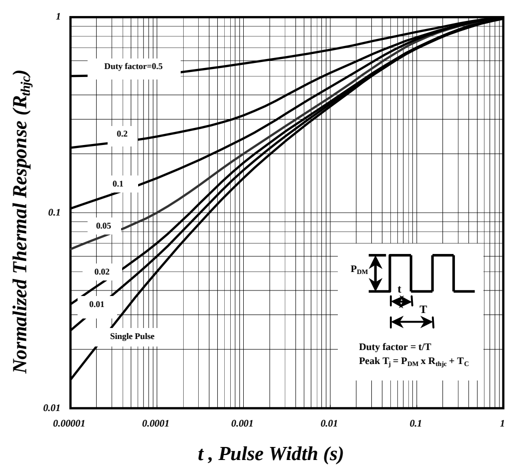


Fig 10. Effective Transient Thermal Impedance

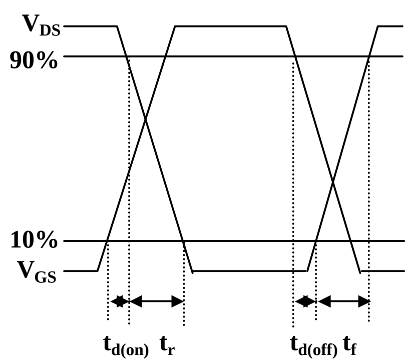


Fig 11. Switching Time Waveforms

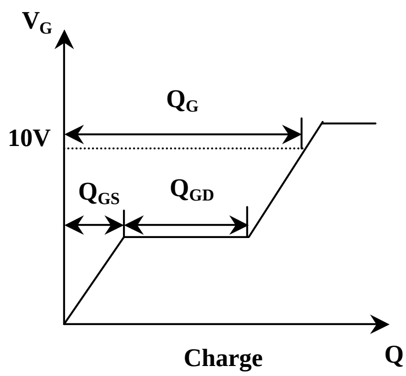
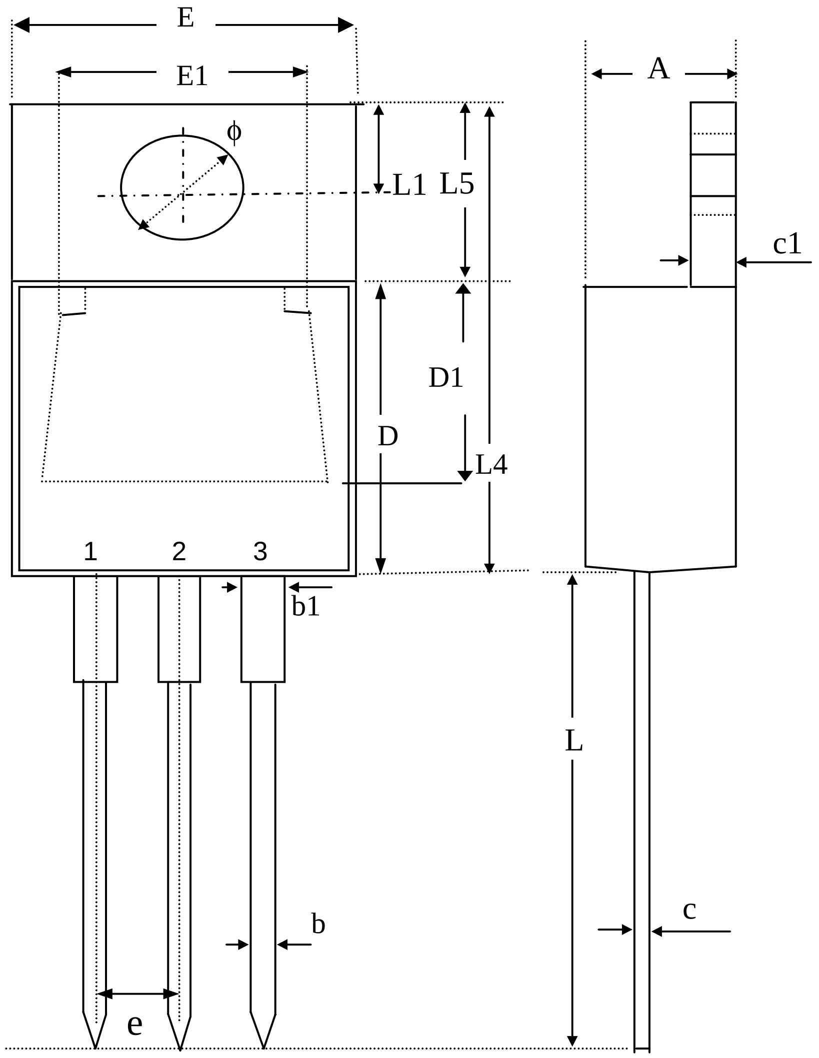


Fig 12. Gate Charge Waveform

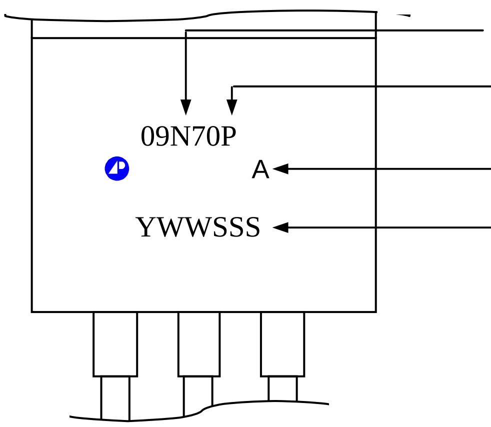
Package Dimensions: TO-220



SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	4.40	4.60	4.80
b	0.76	0.88	1.00
D	8.60	8.80	9.00
c	0.36	0.43	0.50
E	9.80	10.10	10.40
L4	14.70	15.00	15.30
L5	6.20	6.40	6.60
D1	5.10 REF.		
c1	1.25	1.35	1.45
b1	1.17	1.32	1.47
L	13.25	13.75	14.25
e	2.54 REF.		
L1	2.60	2.75	2.89
ϕ	3.71	3.84	3.96
E1	7.4 REF,		

1. All dimensions are in millimeters.
2. Dimensions do not include mold protrusions.

Marking Information: TO-220



Product: AP09N70

Package code
P = RoHS-compliant halogen-free TO-220

Voltage grade A = 650V

Date/lot code (YWWSSS)
Y: Last digit of the year
WW: Work week
SSS: Lot code sequence