



N-channel Enhancement-mode Power MOSFET

- Simple Drive Requirement**
- Low On-resistance**
- Fast Switching Performance**
- RoHS-compliant, halogen-free**

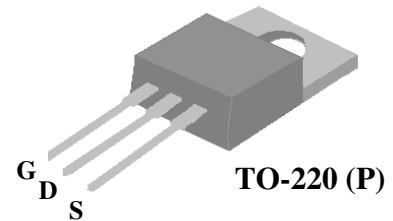


BV_{DSS}	60V
$R_{DS(ON)}$	3.2mΩ
I_D	240A

Description

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

The AP9970GP-HF-3 is in the TO-220 package, which is widely used for commercial and industrial applications, and is well-suited for low voltage applications such as DC/DC converters and motor drives. The TO-220 through-hole package is often used where a small PCB footprint or an attached heatsink is required.



Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	60	V
V_{GS}	Gate-Source Voltage	±20	V
I_D at $T_C=25^\circ C$	Continuous Drain Current, (Silicon Limited)	240	A
I_D at $T_C=100^\circ C$	Continuous Drain Current, (Silicon Limited)	170	A
I_D at $T_C=25^\circ C$	Continuous Drain Current, (Package Limited)	120	A
I_{DM}	Pulsed Drain Current ¹	960	A
P_D at $T_C=25^\circ C$	Total Power Dissipation	375	W
T_{STG}	Storage Temperature Range	-55 to 175	°C
T_J	Operating Junction Temperature Range	-55 to 175	°C

Thermal Data

Symbol	Parameter	Value	Units
Rthj-c	Maximum Thermal Resistance, Junction-case	0.4	°C/W
Rthj-a	Maximum Thermal Resistance, Junction-ambient	62	°C/W

Ordering Information

AP9970GP-HF-3TB RoHS-compliant, halogen-free TO-220, shipped in tubes



Electrical Specifications at $T_j=25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	60	-	-	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=10V, I_D=60A$	-	-	3.2	m Ω
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2	-	4	V
g_{fs}	Forward Transconductance	$V_{DS}=10V, I_D=60A$	-	105	-	S
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=60V, V_{GS}=0V$	-	-	10	μA
I_{GSS}	Gate-Source Leakage	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA
Q_g	Total Gate Charge ²	$I_D=40A$	-	100	160	nC
Q_{gs}	Gate-Source Charge	$V_{DS}=48V$	-	14	-	nC
Q_{gd}	Gate-Drain ("Miller") Charge	$V_{GS}=10V$	-	54	-	nC
$t_{d(on)}$	Turn-on Delay Time ²	$V_{DS}=30V$	-	60	-	ns
t_r	Rise Time	$I_D=40A$	-	200	-	ns
$t_{d(off)}$	Turn-off Delay Time	$R_G=25\Omega, V_{GS}=10V$	-	180	-	ns
t_f	Fall Time	$R_D=0.75\Omega$	-	240	-	ns
C_{iss}	Input Capacitance	$V_{GS}=0V$	-	4020	6430	pF
C_{oss}	Output Capacitance	$V_{DS}=25V$	-	1280	-	pF
C_{rss}	Reverse Transfer Capacitance	$f=1.0\text{MHz}$	-	420	-	pF
R_g	Gate Resistance	$f=1.0\text{MHz}$	-	2	-	Ω

Source-Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{SD}	Forward On Voltage ²	$I_S=40A, V_{GS}=0V$	-	-	1.3	V
t_{rr}	Reverse Recovery Time ²	$I_S=40A, V_{GS}=0V$	-	80	-	ns
Q_{rr}	Reverse Recovery Charge	$di/dt=100A/\mu s$	-	165	-	nC

Notes:

1. Pulse width limited by maximum junction temperature.
2. Pulse test - pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$

THIS PRODUCT IS SENSITIVE TO ELECTROSTATIC DISCHARGE, PLEASE HANDLE WITH CAUTION.

USE OF THIS PRODUCT AS A CRITICAL COMPONENT IN LIFE SUPPORT OR OTHER SIMILAR SYSTEMS IS NOT AUTHORIZED.

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Typical Electrical Characteristics

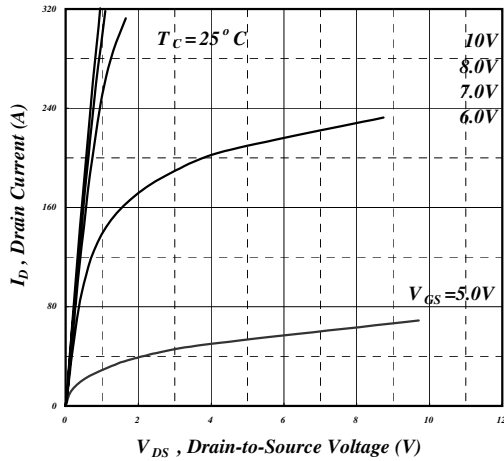


Fig 1. Typical Output Characteristics

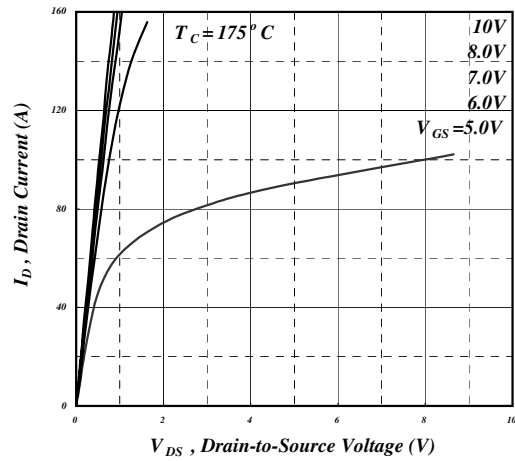


Fig 2. Typical Output Characteristics

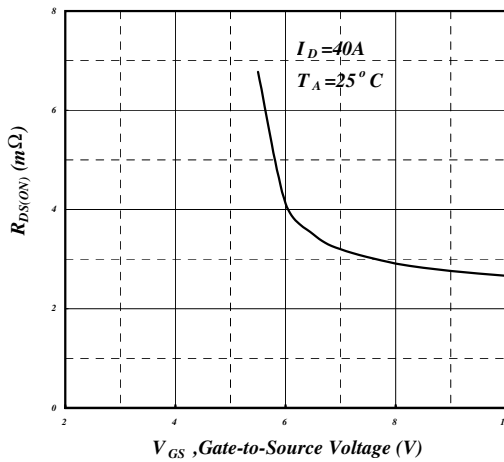


Fig 3. On-Resistance vs. Gate Voltage

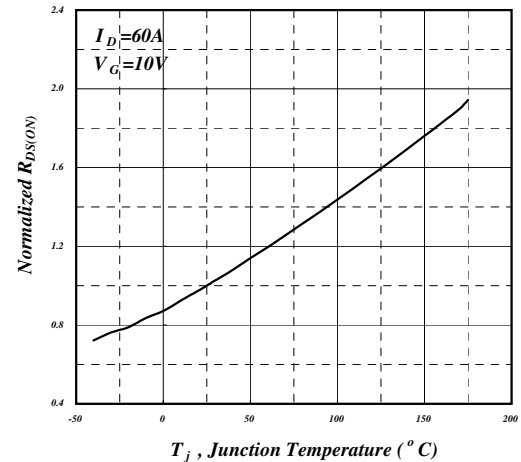


Fig 4. Normalized On-Resistance vs. Junction Temperature

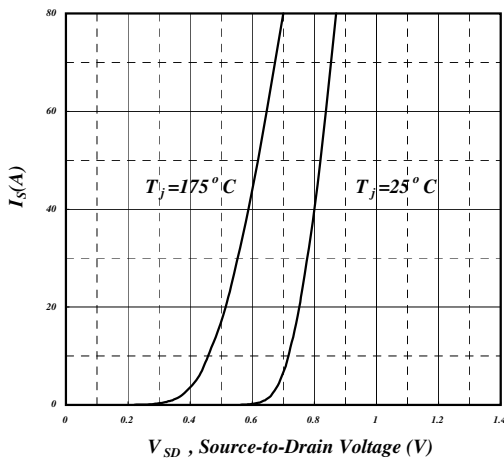


Fig 5. Forward Characteristic of Reverse Diode

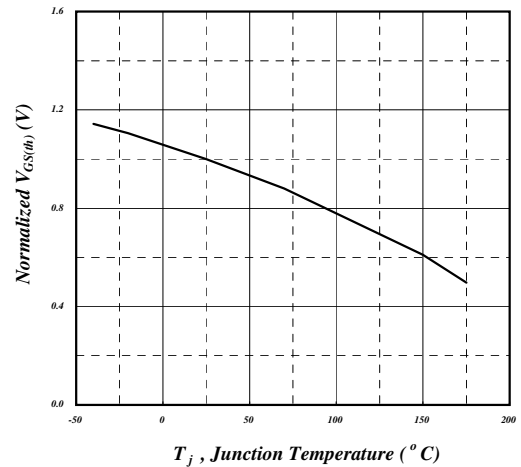


Fig 6. Gate Threshold Voltage vs. Junction Temperature



Typical Electrical Characteristics (cont.)

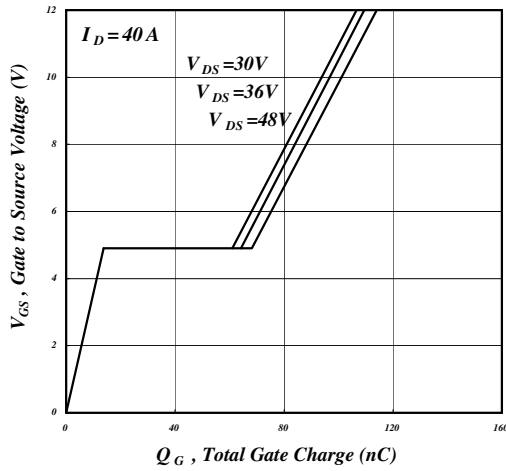


Fig 7. Gate Charge Characteristics

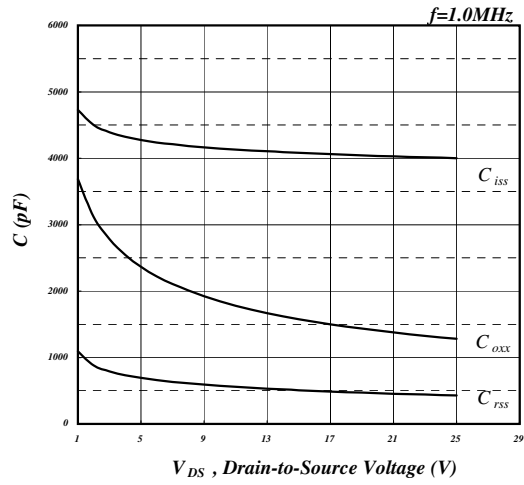


Fig 8. Typical Capacitance Characteristics

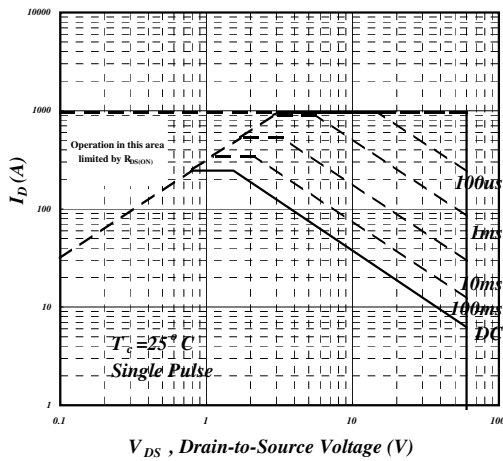


Fig 9. Maximum Safe Operating Area

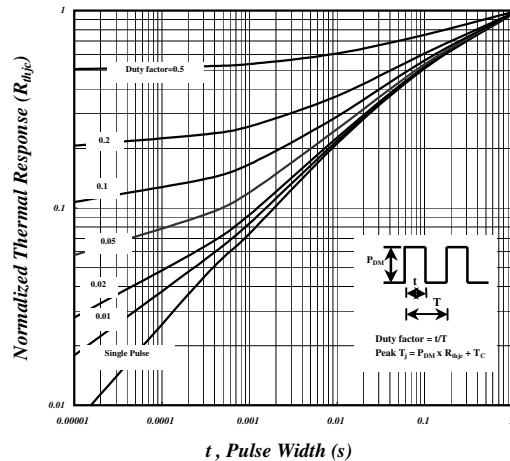


Fig 10. Effective Transient Thermal Impedance

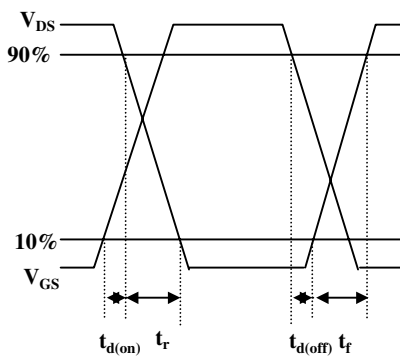


Fig 11. Switching Time Waveform

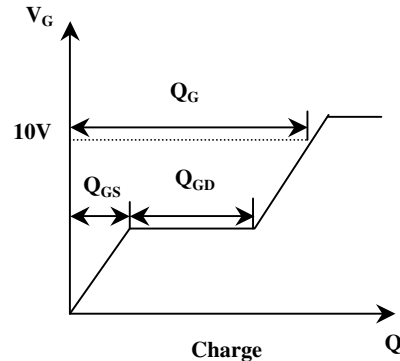
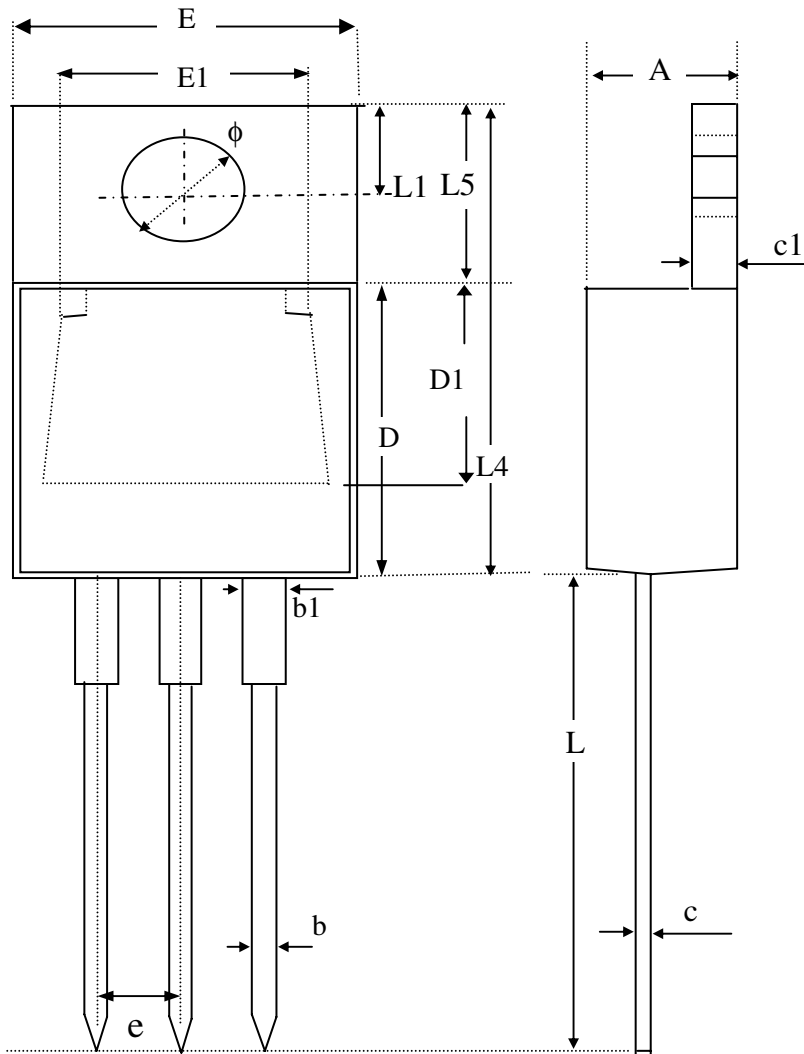


Fig 12. Gate Charge Waveform



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
phi	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

