

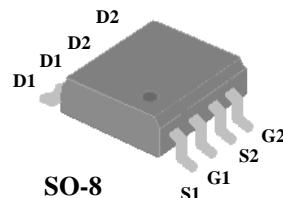
AP9960GM-HF
Halogen-Free Product



**Advanced Power
Electronics Corp.**

*N-CHANNEL ENHANCEMENT MODE
POWER MOSFET*

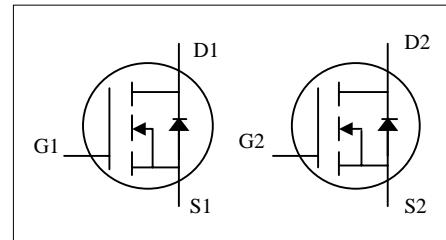
- ▼ Low On-Resistance
- ▼ Fast Switching Speed
- ▼ Surface Mount Package
- ▼ RoHS Compliant & Halogen-Free



BV_{DSS}	40V
$R_{DS(ON)}$	20mΩ
I_D	7.8A

Description

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



Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	40	V
V_{GS}	Gate-Source Voltage	± 20	V
$I_D @ T_A = 25^\circ C$	Continuous Drain Current ³	7.8	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current ³	6.2	A
I_{DM}	Pulsed Drain Current ¹	20	A
$P_D @ T_A = 25^\circ C$	Total Power Dissipation	2	W
	Linear Derating Factor	0.016	W/°C
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
$R_{thj-amb}$	Maximum Thermal Resistance, Junction-ambient ³	62.5	°C/W



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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{\text{GS}}=0\text{V}$, $I_{\text{D}}=250\mu\text{A}$	40	-	-	V
$\Delta \text{BV}_{\text{DSS}}/\Delta T_j$	Breakdown Voltage Temperature Coefficient	Reference to 25°C , $I_{\text{D}}=1\text{mA}$	-	0.032	-	$\text{V}/^\circ\text{C}$
$R_{\text{DS}(\text{ON})}$	Static Drain-Source On-Resistance ²	$V_{\text{GS}}=10\text{V}$, $I_{\text{D}}=7\text{A}$	-	-	20	$\text{m}\Omega$
		$V_{\text{GS}}=4.5\text{V}$, $I_{\text{D}}=5\text{A}$	-	-	32	$\text{m}\Omega$
$V_{\text{GS}(\text{th})}$	Gate Threshold Voltage	$V_{\text{DS}}=V_{\text{GS}}$, $I_{\text{D}}=250\mu\text{A}$	1	-	3	V
g_{fs}	Forward Transconductance	$V_{\text{DS}}=10\text{V}$, $I_{\text{D}}=7\text{A}$	-	25	-	S
I_{DSS}	Drain-Source Leakage Current	$V_{\text{DS}}=40\text{V}$, $V_{\text{GS}}=0\text{V}$	-	-	1	uA
	Drain-Source Leakage Current ($T_j=70^\circ\text{C}$)	$V_{\text{DS}}=32\text{V}$, $V_{\text{GS}}=0\text{V}$	-	-	25	uA
I_{GSS}	Gate-Source Leakage	$V_{\text{GS}}=\pm 20\text{V}$, $V_{\text{DS}}=0\text{V}$	-	-	± 100	nA
Q_g	Total Gate Charge ²	$I_{\text{D}}=7\text{A}$	-	14.7	-	nC
Q_{gs}	Gate-Source Charge	$V_{\text{DS}}=20\text{V}$	-	7.1	-	nC
Q_{gd}	Gate-Drain ("Miller") Charge	$V_{\text{GS}}=4.5\text{V}$	-	6.8	-	nC
$t_{\text{d}(\text{on})}$	Turn-on Delay Time ²	$V_{\text{DS}}=20\text{V}$	-	11.5	-	ns
t_r	Rise Time	$I_{\text{D}}=1\text{A}$	-	6.3	-	ns
$t_{\text{d}(\text{off})}$	Turn-off Delay Time	$R_G=3.3\Omega$, $V_{\text{GS}}=10\text{V}$	-	28.2	-	ns
t_f	Fall Time	$R_D=20\Omega$	-	12.6	-	ns
C_{iss}	Input Capacitance	$V_{\text{GS}}=0\text{V}$	-	1725	-	pF
C_{oss}	Output Capacitance	$V_{\text{DS}}=25\text{V}$	-	235	-	pF
C_{rss}	Reverse Transfer Capacitance	f=1.0MHz	-	145	-	pF

Source-Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
I_S	Continuous Source Current (Body Diode)	$V_D=V_G=0\text{V}$, $V_S=1.3\text{V}$	-	-	1.54	A
V_{SD}	Forward On Voltage ²	$T_j=25^\circ\text{C}$, $I_S=2.3\text{A}$, $V_{\text{GS}}=0\text{V}$	-	-	1.3	V

Notes:

- 1.Pulse width limited by Max. junction temperature.
- 2.Pulse width $\leq 300\text{us}$, duty cycle $\leq 2\%$.
- 3.Surface mounted on 1 in² copper pad of FR4 board ; $135^\circ\text{C}/\text{W}$ when mounted on Min. copper pad.

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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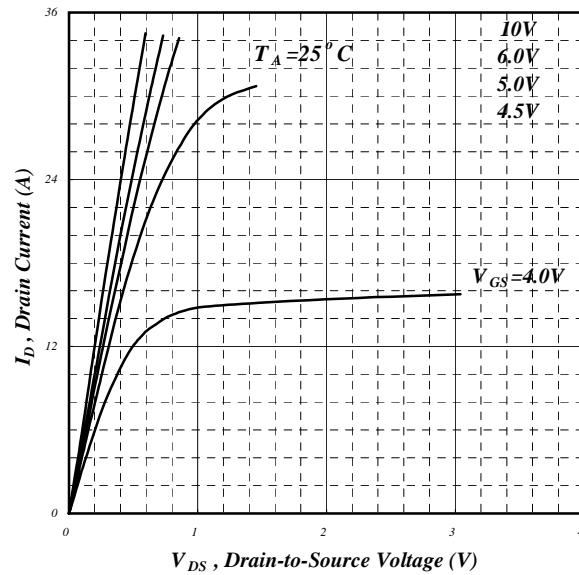


Fig 1. Typical Output Characteristics

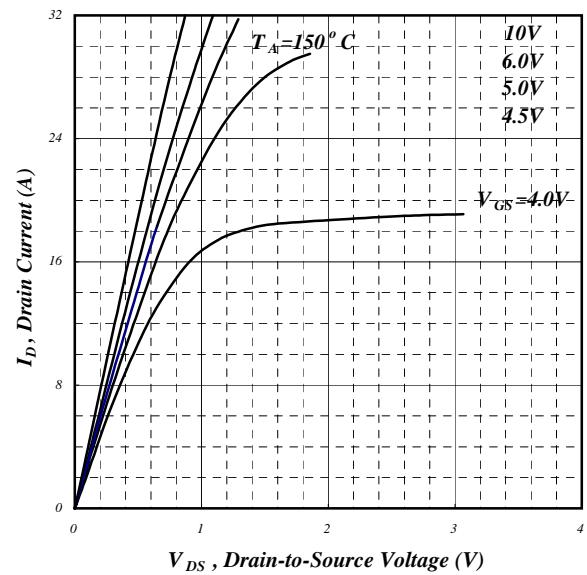


Fig 2. Typical Output Characteristics

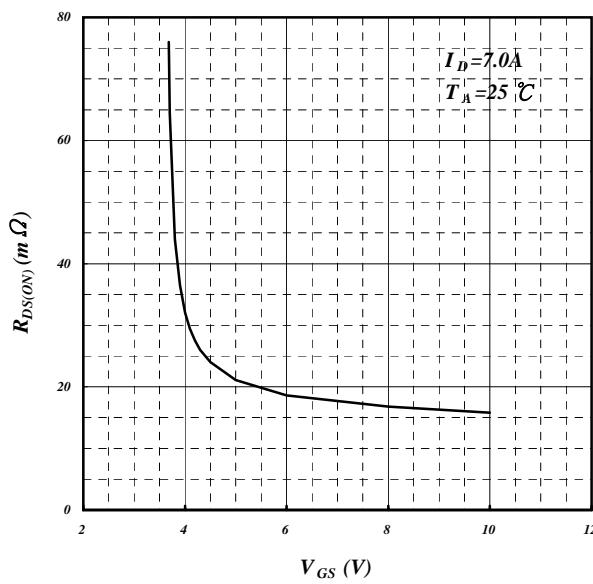


Fig 3. On-Resistance v.s. Gate Voltage

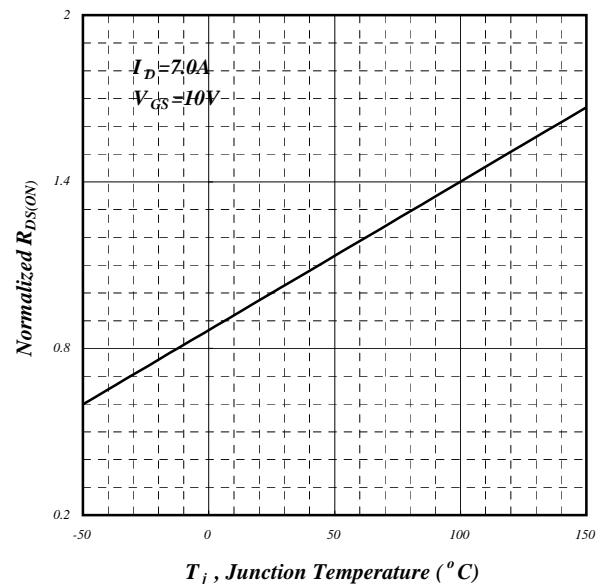
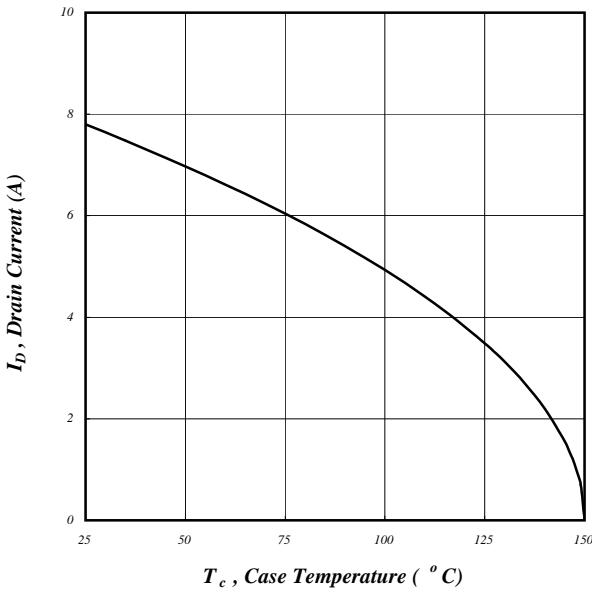


Fig 4. Normalized On-Resistance v.s. Junction Temperature



**Fig 5. Maximum Drain Current v.s.
Case Temperature**

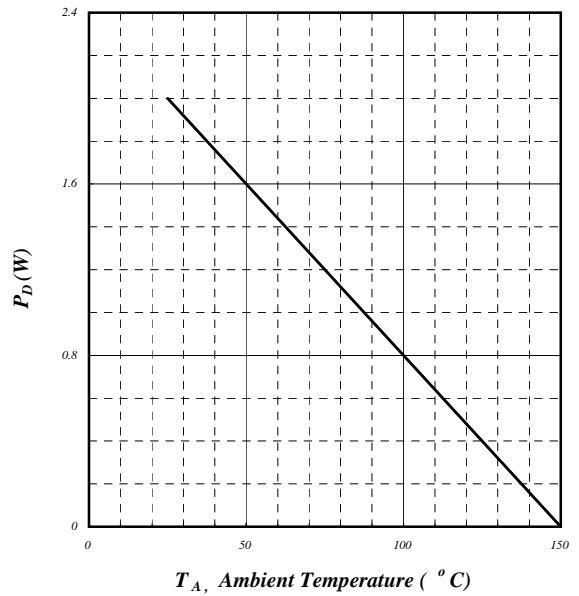


Fig 6. Typical Power Dissipation

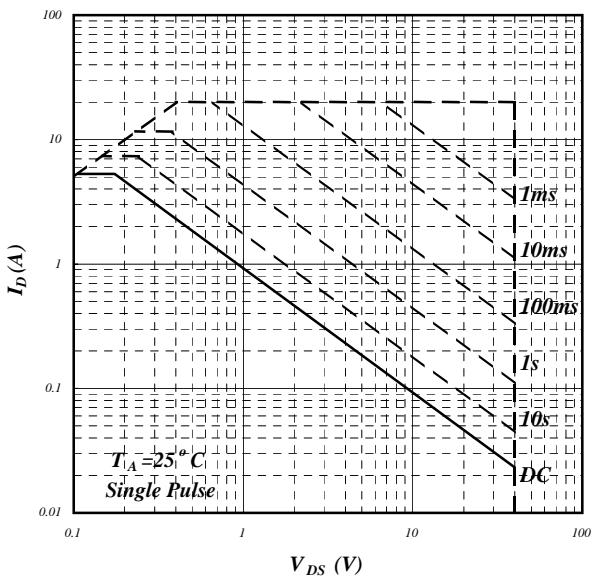


Fig 7. Maximum Safe Operating Area

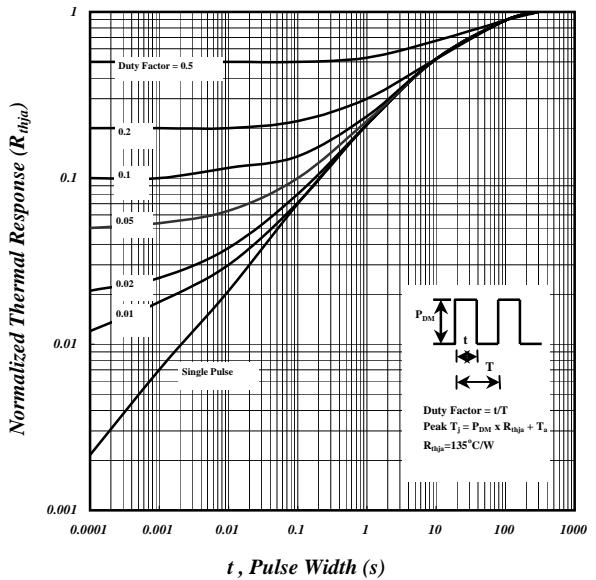


Fig 8. Effective Transient Thermal Impedance

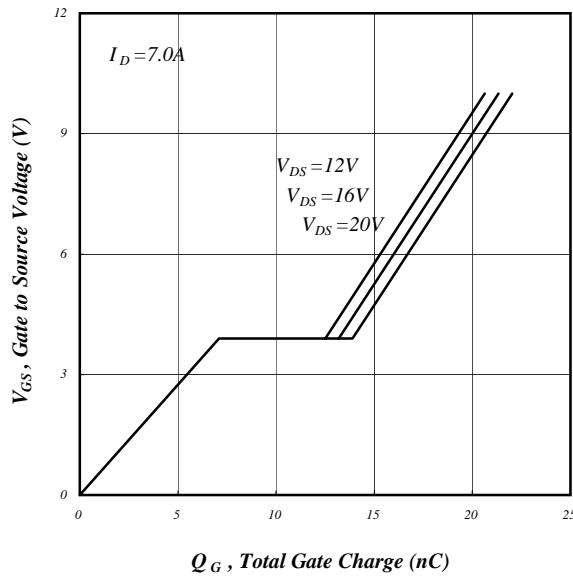


Fig 9. Gate Charge Characteristics

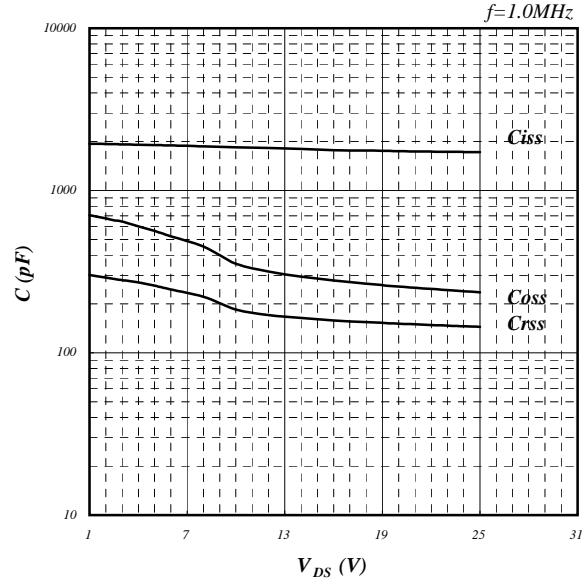


Fig 10. Typical Capacitance Characteristics

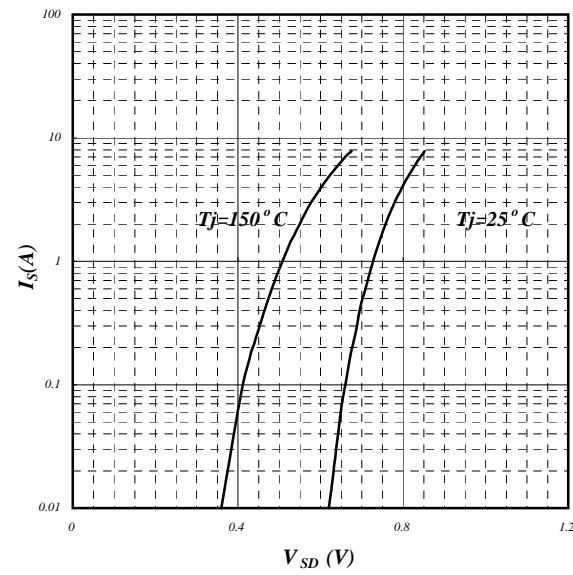


Fig 11. Forward Characteristic of Reverse Diode

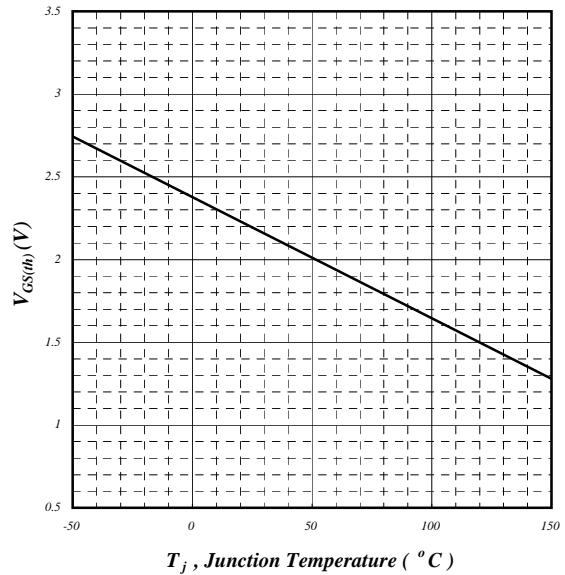


Fig 12. Gate Threshold Voltage v.s. Junction Temperature



AP9960GM-HF

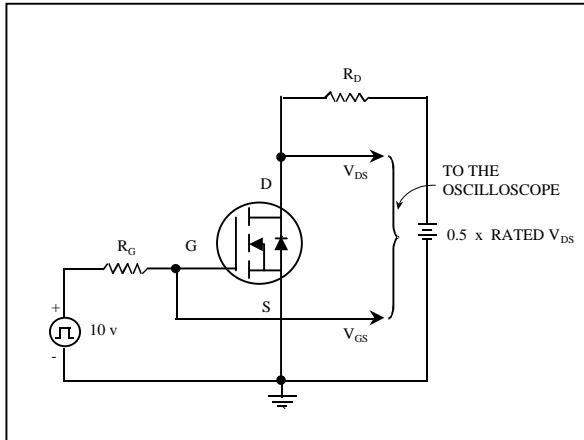


Fig 13. Switching Time Circuit

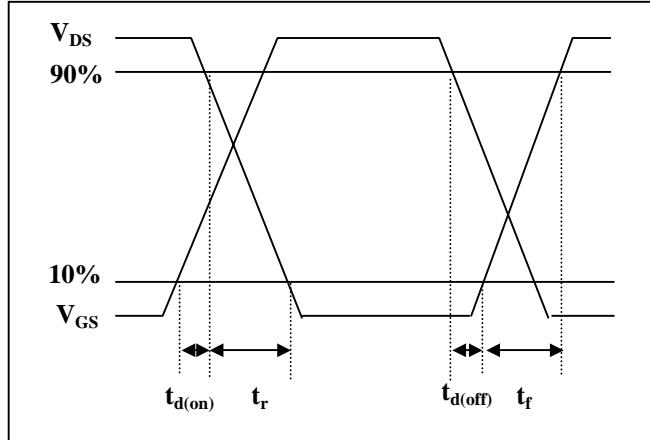


Fig 14. Switching Time Waveform

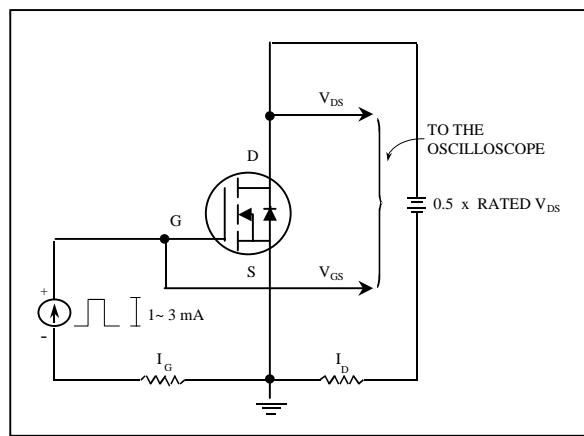


Fig 15. Gate Charge Circuit

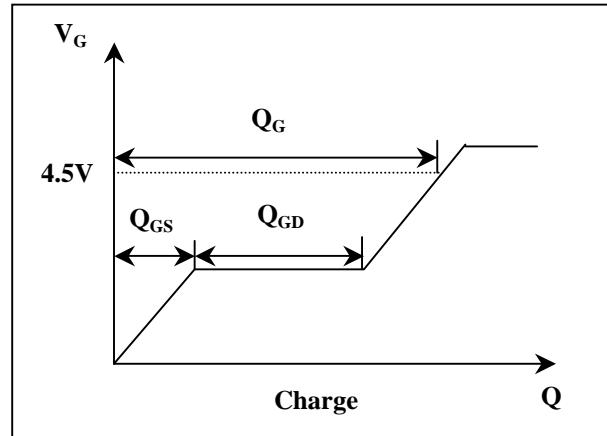


Fig 16. Gate Charge Waveform