AP4565GM

Advanced Power Electronics Corp.

N AND P-CHANNEL ENHANCEMENT

MODE POWER MOSFET

▼ **Simple Drive Requirement**

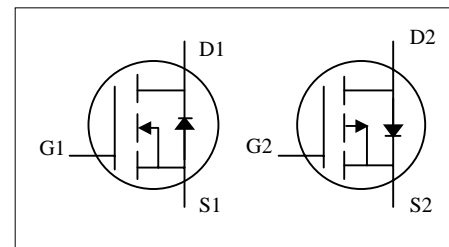▼ **Low On-resistance**

▼ **Fast Switching Performance**

SO-8

N-CH	BV_{DSS}	40V
	$R_{DS(ON)}$	25mΩ
	I_D	7.6A
P-CH	BV_{DSS}	-40V
	$R_{DS(ON)}$	33mΩ
	I_D	-6.5A

Description

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

The SO-8 package is universally preferred for all commercial-industrial surface mount applications and suited for low voltage applications such as DC/DC converters.

Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-channel	P-channel	
V_{DS}	Drain-Source Voltage	40	-40	V
V_{GS}	Gate-Source Voltage	±20	±20	V
I_D@T_A=25℃	Continuous Drain Current[3]	7.6	-6.5	A
I_D@T_A=70℃	Continuous Drain Current[3]	6	-5.2	A
I_{DM}	Pulsed Drain Current[1]	30	-30	A
P_D@T_A=25℃	Total Power Dissipation	2.0		W
	Linear Derating Factor	0.016		W/℃
T_{STG}	Storage Temperature Range	-55 to 150		℃
T_J	Operating Junction Temperature Range	-55 to 150		℃

Thermal Data

Symbol	Parameter		Value	Unit
Rthj-a	Thermal Resistance Junction-ambient[3]	Max.	62.5	℃/W

N-CH Electrical Characteristics@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=250uA	40	-	-	V
$\triangle BV_{DSS}/\triangle T_j$	Breakdown Voltage Temperature Coefficient	Reference to 25℃, I_D=1mA	-	0.03	-	V/℃
$R_{DS(ON)}$	Static Drain-Source On-Resistance[2]	V_{GS}=10V, I_D=7A	-	-	25	mΩ
		V_{GS}=4.5V, I_D=5A	-	-	32	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=250uA	1	-	3	V
g_{fs}	Forward Transconductance	V_{DS}=10V, I_D=7A	-	12	-	S
I_{DSS}	Drain-Source Leakage Current (T_j=25°C)	V_{DS}=40V, V_{GS}=0V	-	-	1	uA
	Drain-Source Leakage Current (T_j=70°C)	V_{DS}=32V, V_{GS}=0V	-	-	25	uA
I_{GSS}	Gate-Source Leakage	V_{GS}=±20V	-	-	±100	nA
Q_g	Total Gate Charge[2]	I_D=7A	-	17	27	nC
Q_{gs}	Gate-Source Charge	V_{DS}=32V	-	4	-	nC
Q_{gd}	Gate-Drain ("Miller") Charge	V_{GS}=4.5V	-	10	-	nC
$t_{d(on)}$	Turn-on Delay Time[2]	V_{DS}=20V	-	11	-	ns
t_r	Rise Time	I_D=1A	-	8	-	ns
$t_{d(off)}$	Turn-off Delay Time	R_G=3.3Ω,V_{GS}=10V	-	30	-	ns
t_f	Fall Time	R_D=20Ω	-	11	-	ns
C_{iss}	Input Capacitance	V_{GS}=0V	-	1400	2240	pF
C_{oss}	Output Capacitance	V_{DS}=25V	-	250	-	pF
C_{rss}	Reverse Transfer Capacitance	f=1.0MHz	-	170	-	pF

Source-Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{SD}	Forward On Voltage[2]	I_S=1.7A, V_{GS}=0V	-	-	1.2	V
t_{rr}	Reverse Recovery Time[2]	I_S=7A, V_{GS}=0V	-	26	-	ns
Q_{rr}	Reverse Recovery Charge	dI/dt=100A/μs	-	21	-	nC

P-CH Electrical Characteristics@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$_D$=-250uA	-40	-	-	V
$\triangle$BV$_{DSS}$/$\triangle$T$_j$	Breakdown Voltage Temperature Coefficient	Reference to 25℃,I$_D$=-1mA	-	-0.03	-	V/℃
R$_{DS(ON)}$	Static Drain-Source On-Resistance[2]	V$_{GS}$=-10V, I$_D$=-6A	-	-	33	mΩ
		V$_{GS}$=-4.5V, I$_D$=-4A	-	-	42	mΩ
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS}$, I$_D$=-250uA	-1	-	-3	V
g$_{fs}$	Forward Transconductance	V$_{DS}$=-10V, I$_D$=-6A	-	10	-	S
I$_{DSS}$	Drain-Source Leakage Current (T=25°C)	V$_{DS}$=-40V, V$_{GS}$=0V	-	-	-1	uA
	Drain-Source Leakage Current (T=70°C)	V$_{DS}$=-32V, V$_{GS}$=0V	-	-	-25	uA
I$_{GSS}$	Gate-Source Leakage	V$_{GS}$=±20V	-	-	±100	nA
Q$_g$	Total Gate Charge[2]	I$_D$=-6A	-	20	32	nC
Q$_{gs}$	Gate-Source Charge	V$_{DS}$=-32V	-	4	-	nC
Q$_{gd}$	Gate-Drain ("Miller") Charge	V$_{GS}$=-4.5V	-	10	-	nC
t$_{d(on)}$	Turn-on Delay Time[2]	V$_{DS}$=-20V	-	11	-	ns
t$_r$	Rise Time	I$_D$=-1A	-	7	-	ns
t$_{d(off)}$	Turn-off Delay Time	R$_G$=3.3Ω,V$_{GS}$=-10V	-	67	-	ns
t$_f$	Fall Time	R$_D$=20Ω	-	43	-	ns
C$_{iss}$	Input Capacitance	V$_{GS}$=0V	-	1440	2300	pF
C$_{oss}$	Output Capacitance	V$_{DS}$=-25V	-	250	-	pF
C$_{rss}$	Reverse Transfer Capacitance	f=1.0MHz	-	190	-	pF

Source-Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V$_{SD}$	Forward On Voltage[2]	I$_S$=-1.7A, V$_{GS}$=0V	-	-	-1.2	V
t$_{rr}$	Reverse Recovery Time[2]	I$_S$=-6A, V$_{GS}$=0V	-	27	-	ns
Q$_{rr}$	Reverse Recovery Charge	dI/dt=-100A/μs	-	23	-	nC

Notes:

1.Pulse width limited by Max. junction temperature.

2.Pulse width $\leq$300us , duty cycle $\leq$2%.

3.Surface mounted on 1 in^2 copper pad of FR4 board ; 135℃/W when mounted on min. copper pad.

N-Channel

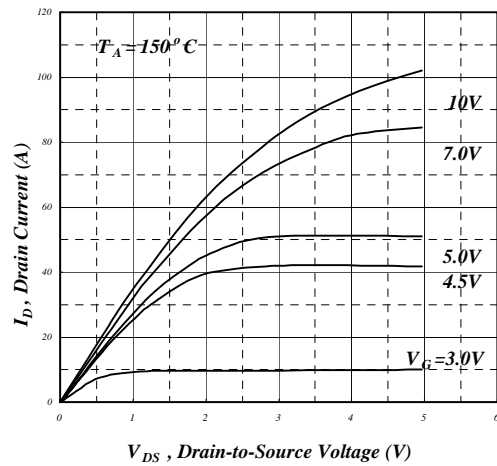Fig 1. Typical Output Characteristics
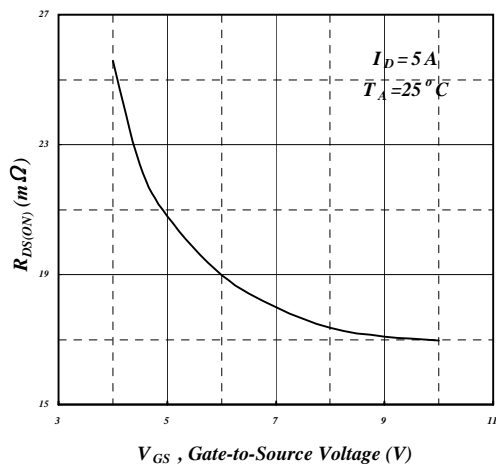

Fig 2. Typical Output Characteristics

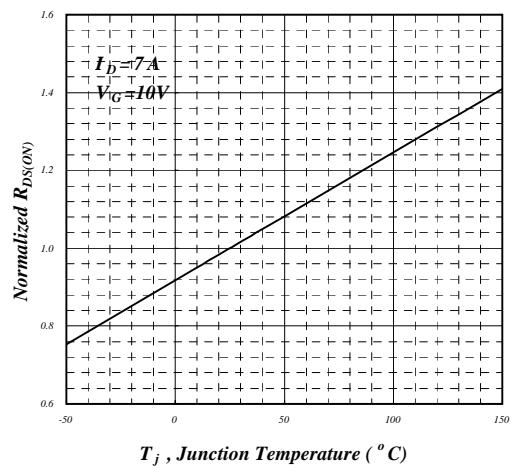Fig 3. On-Resistance v.s. Gate Voltage

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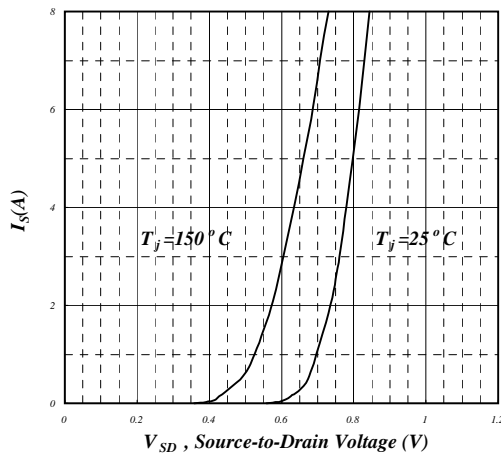v.s. Junction Temperature
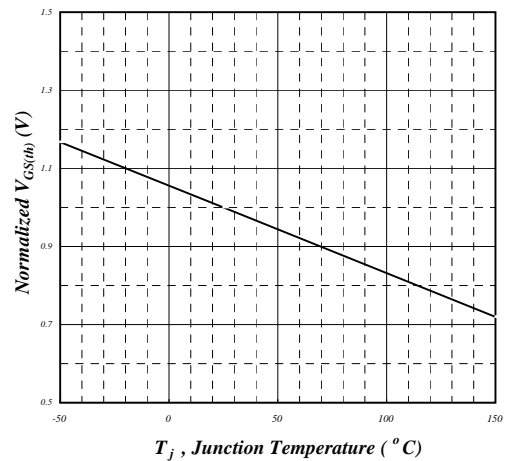

Fig 5. Forward Characteristic of
Reverse Diode

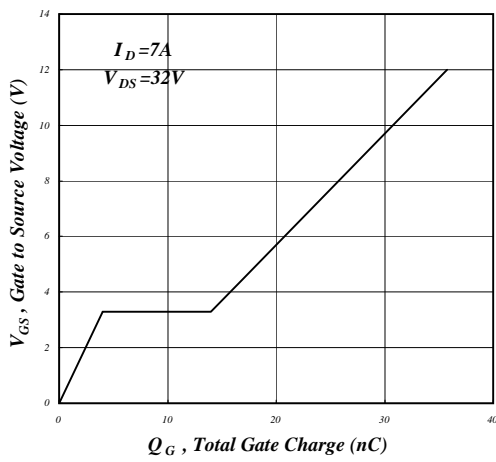Fig 6. Gate Threshold Voltage v.s.
Junction Temperature

N-Channel

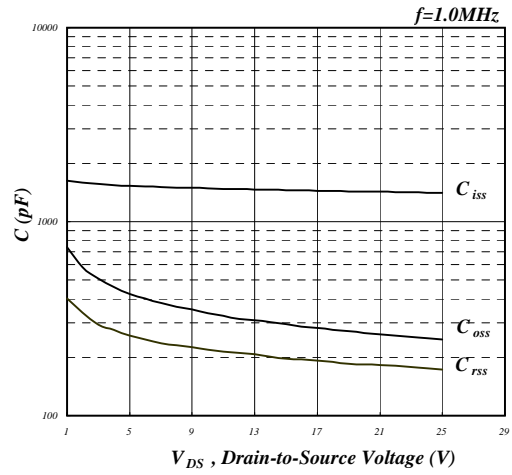

Fig 7. Gate Charge Characteristics
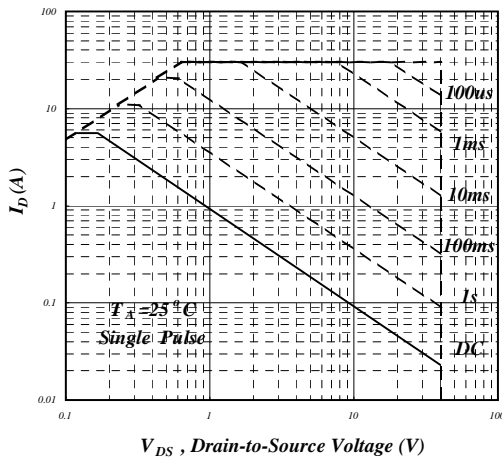

Fig 8. Typical Capacitance Characteristics
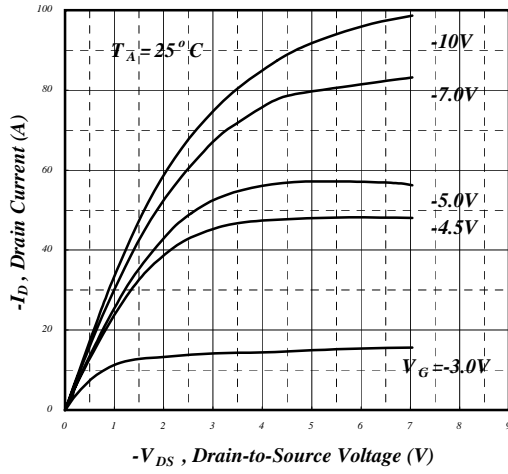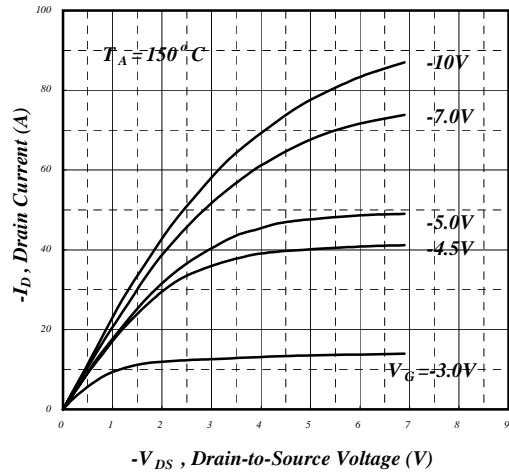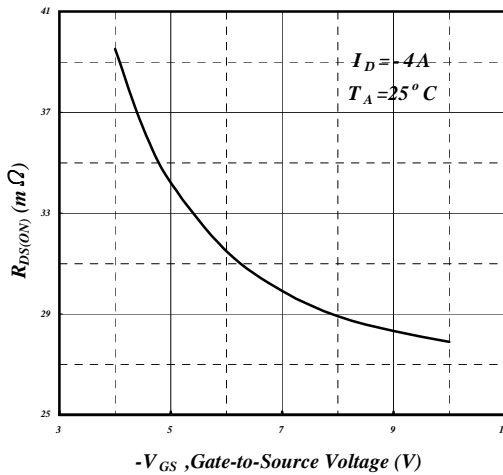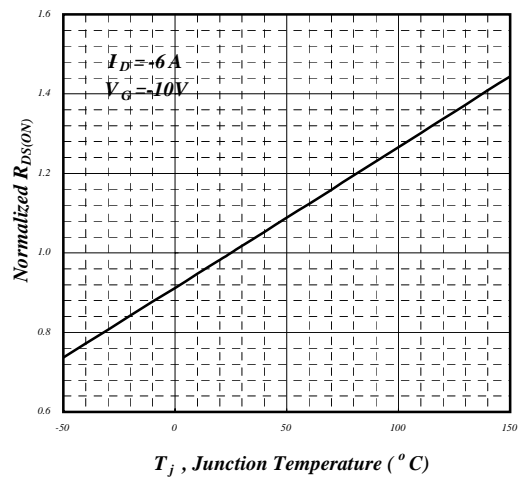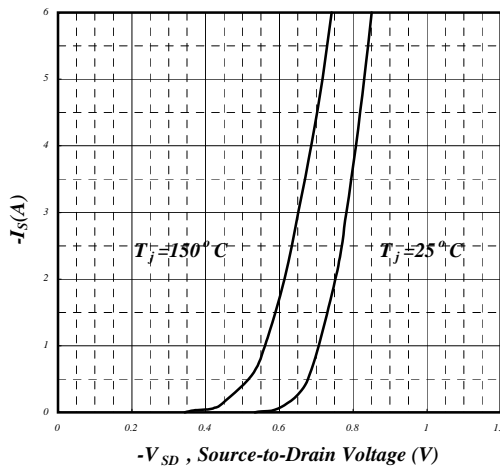

Fig 9. Maximum Safe Operating Area

Fig 10. Effective Transient Thermal Impedance

Fig 11. Switching Time Waveform

Fig 12. Gate Charge Waveform

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**

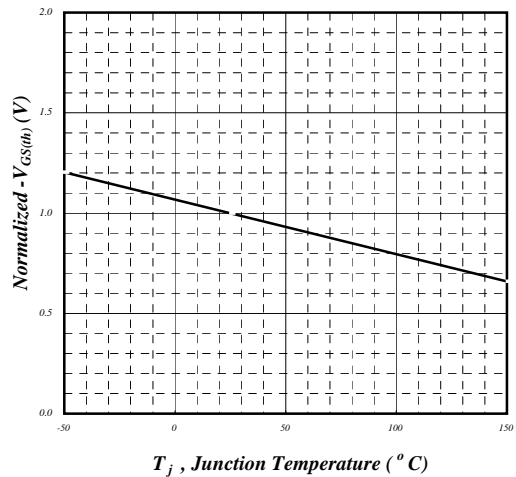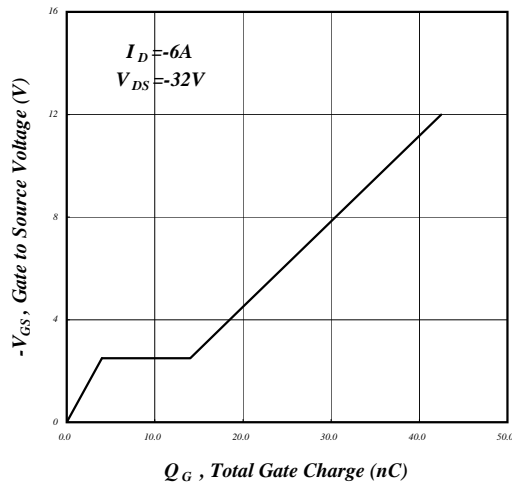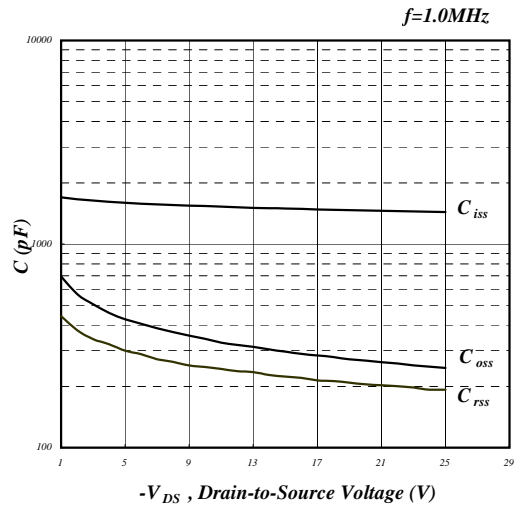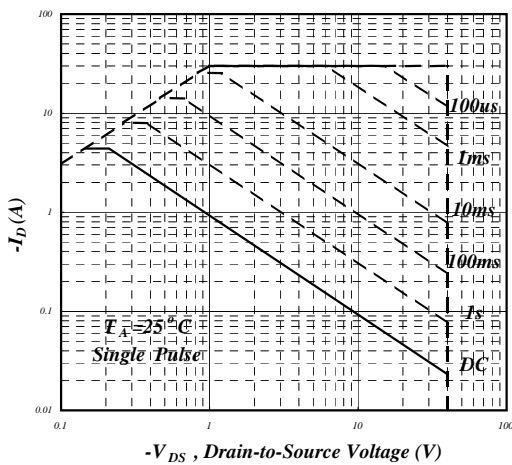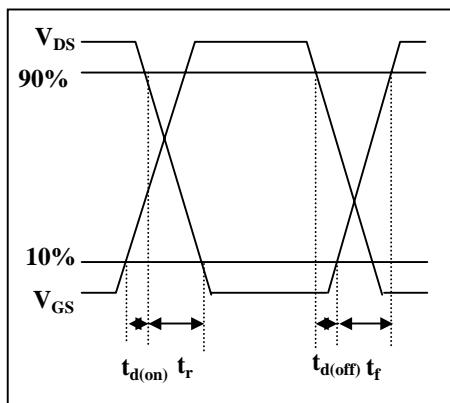**Fig 5. Forward Characteristic of
Reverse Diode**

**Fig 6. Gate Threshold Voltage v.s.
Junction Temperature**

P-Channel

$I_D = -6A$
$V_{DS} = -32V$

Fig 7. Gate Charge Characteristics

f=1.0MHz

C_{iss}

C_{oss}

C_{rss}

Fig 8. Typical Capacitance Characteristics

100us
1ms
10ms
100ms
1s
DC

$T_A = 25°C$
Single Pulse

Fig 9. Maximum Safe Operating Area

Duty factor=0.5
0.2
0.1
0.05
0.02
0.01
Single Pulse

Duty factor = t/T
Peak $T_j = P_{DM}$ x R_{thja} + T_a
R_{thja}=135°C/W

Fig 10. Effective Transient Thermal Impedance

V_{DS}
90%
10%
V_{GS}

$t_{d(on)}$ t_r $t_{d(off)}$ t_f
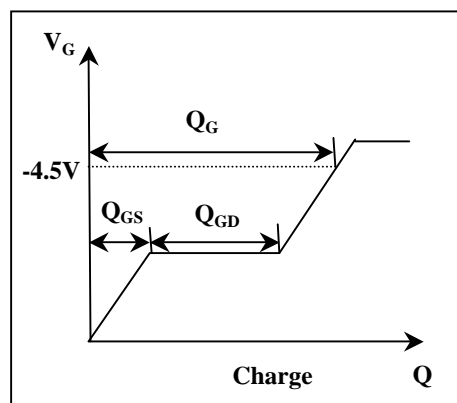
Fig 11. Switching Time Waveform

V_G
Q_G
-4.5V
Q_{GS} Q_{GD}
Charge   Q

Fig 12. Gate Charge Waveform