Advanced Power Electronics Corp.

N AND P-CHANNEL ENHANCEMENT

MODE POWER MOSFET

▼ **Simple Drive Requirement**

▼ **Low Gate Charge**

▼ **Fast Switching Performance**

SO-8
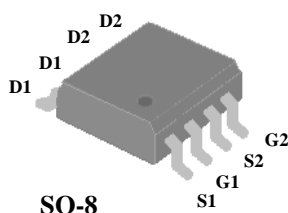
N-CH	BV_{DSS}	20V
	$R_{DS(ON)}$	30mΩ
	I_D	6A
P-CH	BV_{DSS}	-20V
	$R_{DS(ON)}$	50mΩ
	I_D	-5A

Description

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 widely preferred for commercial-industrial surface mount applications and suited for low voltage applications such as DC/DC converters.
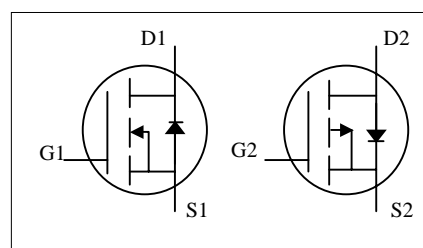
Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-channel	P-channel	
V_{DS}	Drain-Source Voltage	20	-20	V
V_{GS}	Gate-Source Voltage	±12	±12	V
I_D@T_A=25℃	Continuous Drain Current[3]	6	-5	A
I_D@T_A=70℃	Continuous Drain Current[3]	4.8	-4	A
I_{DM}	Pulsed Drain Current[1]	20	-20	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	Maximum Thermal Resistance, Junction-ambient[3]	62.5	℃/W

Data and specifications subject to change without notice

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	20	-	-	V
R$_{DS(ON)}$	Static Drain-Source On-Resistance[2]	V$_{GS}$=4.5V, I$_D$=6A	-	-	30	mΩ
		V$_{GS}$=2.5V, I$_D$=5.2A	-	-	45	mΩ
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS}$, I$_D$=250uA	0.5	-	1.2	V
g$_{fs}$	Forward Transconductance	V$_{DS}$=10V, I$_D$=6A	-	6	-	S
I$_{DSS}$	Drain-Source Leakage Current	V$_{DS}$=20V, V$_{GS}$=0V	-	-	1	uA
	Drain-Source Leakage Current (T$_j$=70°C)	V$_{DS}$=20V ,V$_{GS}$=0V	-	-	25	uA
I$_{GSS}$	Gate-Source Leakage	V$_{GS}$=±12V, V$_{DS}$=0V	-	-	±100	nA
Q$_g$	Total Gate Charge[2]	I$_D$=6A	-	10	15	nC
Q$_{gs}$	Gate-Source Charge	V$_{DS}$=16V	-	1.1	-	nC
Q$_{gd}$	Gate-Drain ("Miller") Charge	V$_{GS}$=4.5V	-	4.1	-	nC
t$_{d(on)}$	Turn-on Delay Time[2]	V$_{DS}$=10V	-	7	-	ns
t$_r$	Rise Time	I$_D$=1A	-	10	-	ns
t$_{d(off)}$	Turn-off Delay Time	R$_G$=3.3Ω,V$_{GS}$=5V	-	21	-	ns
t$_f$	Fall Time	R$_D$=10Ω	-	5	-	ns
C$_{iss}$	Input Capacitance	V$_{GS}$=0V	-	570	910	pF
C$_{oss}$	Output Capacitance	V$_{DS}$=20V	-	90	-	pF
C$_{rss}$	Reverse Transfer Capacitance	f=1.0MHz	-	85	-	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,	-	21	-	ns
Q$_{rr}$	Reverse Recovery Charge	dI/dt=100A/μs	-	14	-	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	-30	-	-	V
R$_{DS(ON)}$	Static Drain-Source On-Resistance[2]	V$_{GS}$=-4.5V, I$_D$=-2.2A	-	-	50	mΩ
		V$_{GS}$=-2.5V, I$_D$=-1.8A	-	-	90	mΩ
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS}$, I$_D$=-250uA	-0.5	-	-1	V
g$_{fs}$	Forward Transconductance	V$_{DS}$=-10V, I$_D$=-2.2A	-	2.2	-	S
I$_{DSS}$	Drain-Source Leakage Current	V$_{DS}$=-20V, V$_{GS}$=0V	-	-	-1	uA
	Drain-Source Leakage Current (T$_j$=70°C)	V$_{DS}$=-16V, V$_{GS}$=0V	-	-	-25	uA
I$_{GSS}$	Gate-Source Leakage	V$_{GS}$=±12V, V$_{DS}$=0V	-	-	±100	nA
Q$_g$	Total Gate Charge[2]	I$_D$=-5A	-	13	20	nC
Q$_{gs}$	Gate-Source Charge	V$_{DS}$=-16V	-	1.5	-	nC
Q$_{gd}$	Gate-Drain ("Miller") Charge	V$_{GS}$=-4.5V	-	4.5	-	nC
t$_{d(on)}$	Turn-on Delay Time[2]	V$_{DS}$=-10V	-	8	-	ns
t$_r$	Rise Time	I$_D$=-1A	-	17	-	ns
t$_{d(off)}$	Turn-off Delay Time	R$_G$=3.3Ω,V$_{GS}$=-5V	-	24	-	ns
t$_f$	Fall Time	R$_D$=10Ω	-	36	-	ns
C$_{iss}$	Input Capacitance	V$_{GS}$=0V	-	920	1500	pF
C$_{oss}$	Output Capacitance	V$_{DS}$=-20V	-	90	-	pF
C$_{rss}$	Reverse Transfer Capacitance	f=1.0MHz	-	85	-	pF

Source-Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	30
V$_{SD}$	Forward On Voltage[2]	I$_S$=-1.8A, V$_{GS}$=0V	-	-	-1.2	V
t$_{rr}$	Reverse Recovery Time[2]	I$_S$=-5A, V$_{GS}$=0V,	-	28	-	ns
Q$_{rr}$	Reverse Recovery Charge	dI/dt=100A/µs	-	16	-	nC

Notes:

1.Pulse width limited by Max. junction temperature.

2.Pulse test

3.Surface mounted on 1 in^2 copper pad of FR4 board ; 135 ℃/W when mounted on Min. copper pad.
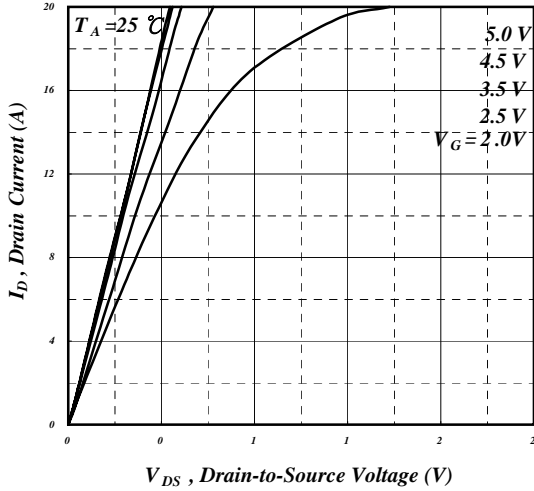
AP4500GM

N-Channel

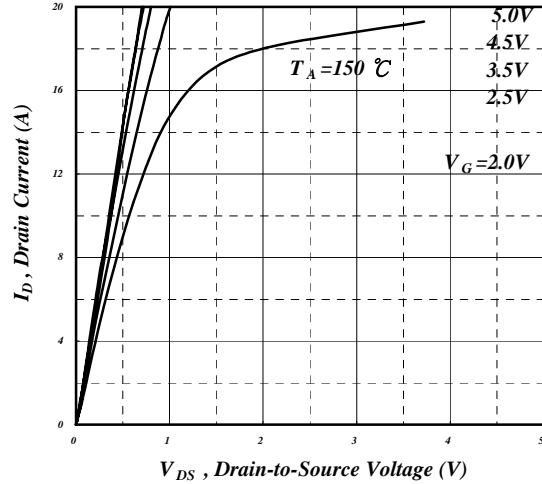**Fig 1. Typical Output Characteristics**

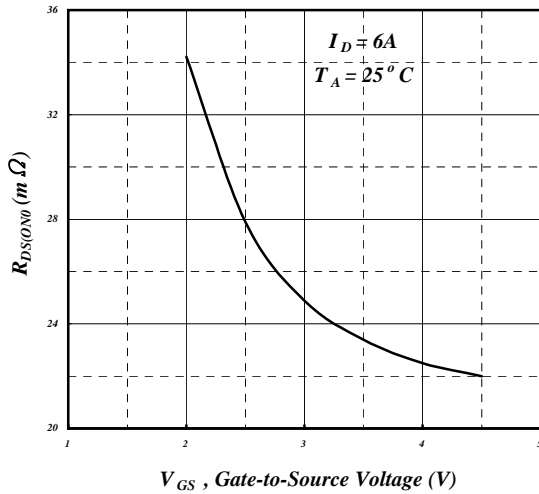**Fig 2. Typical Output Characteristics**

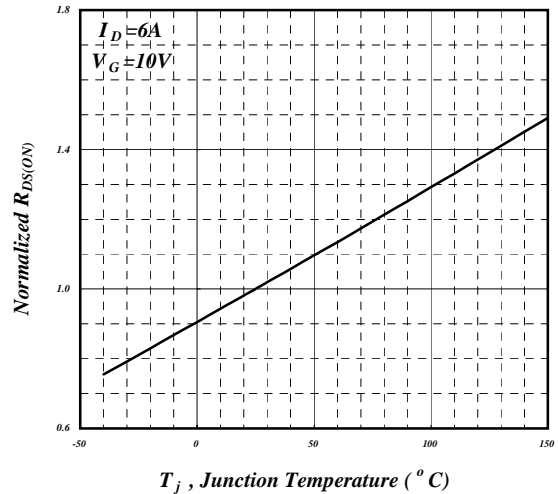**Fig 3. On-Resistance v.s. Gate Voltage**

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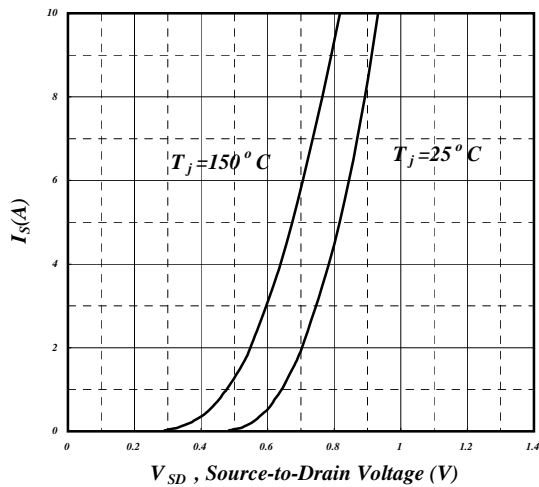v.s. Junction Temperature**

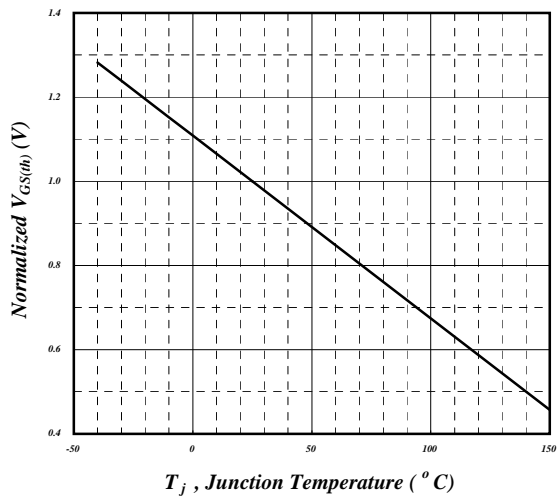**Fig 5. Forward Characteristic of
Reverse Diode**

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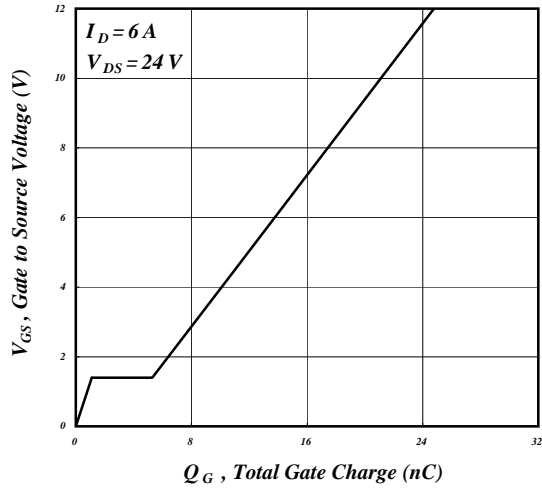Junction Temperature**

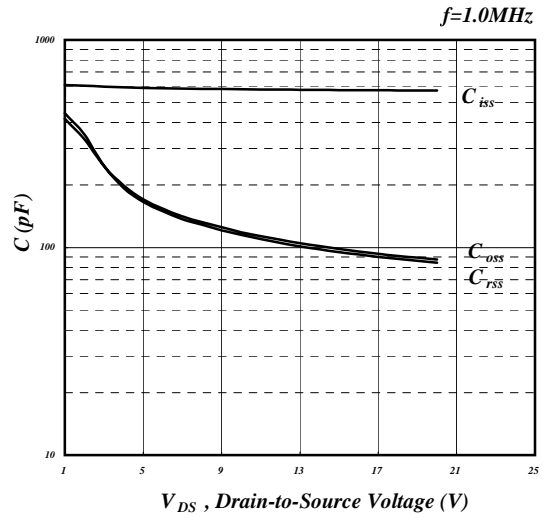## N-Channel

Fig 7. Gate Charge Characteristics
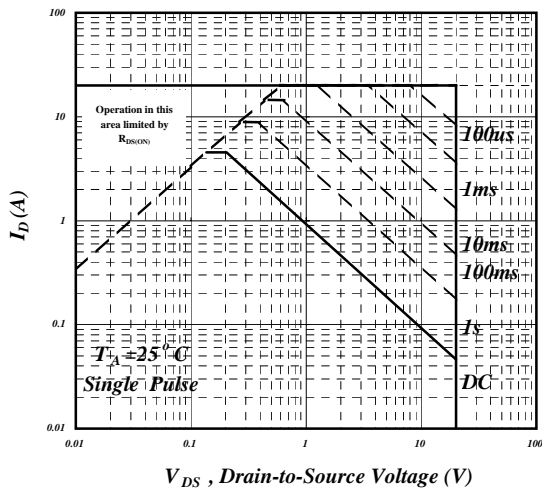

Fig 8. Typical Capacitance Characteristics

Fig 9. Maximum Safe Operating Area
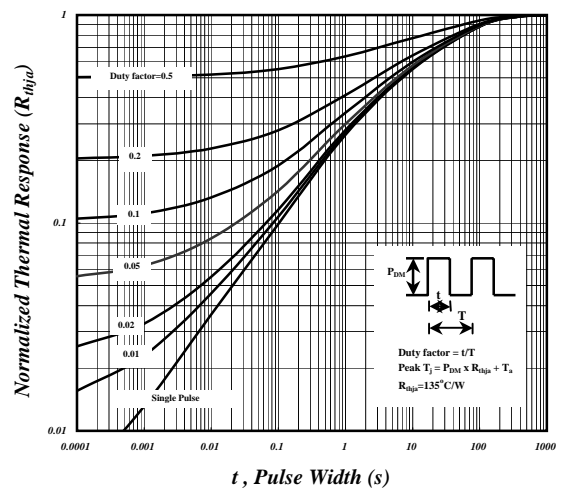
Fig 10. Effective Transient Thermal Impedance
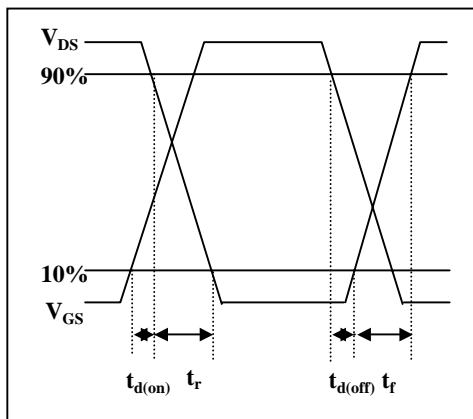
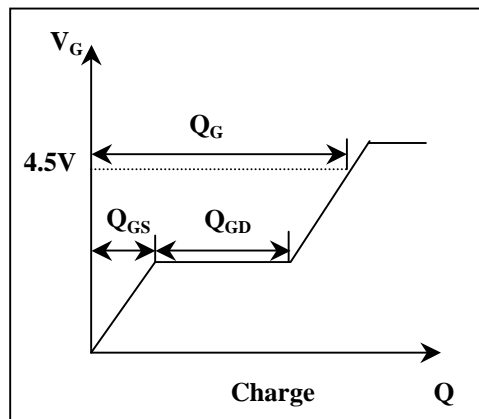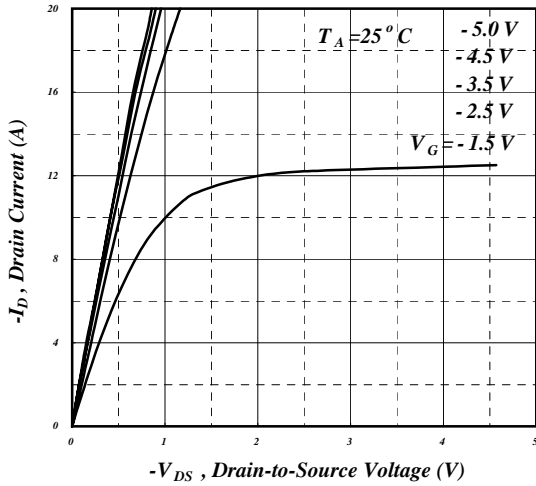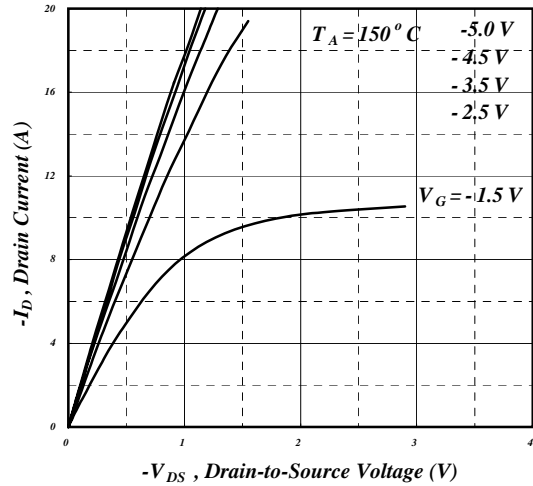

Fig 11. Switching Time Waveform

Fig 12. Gate Charge Waveform

AP4500GM

P-Channel

Fig 1. Typical Output Characteristics
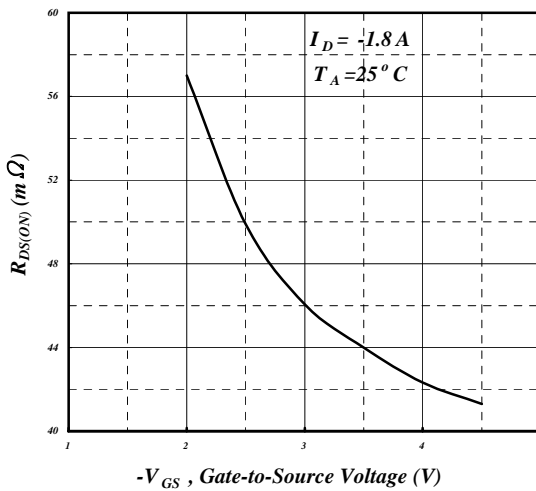

Fig 2. Typical Output Characteristics

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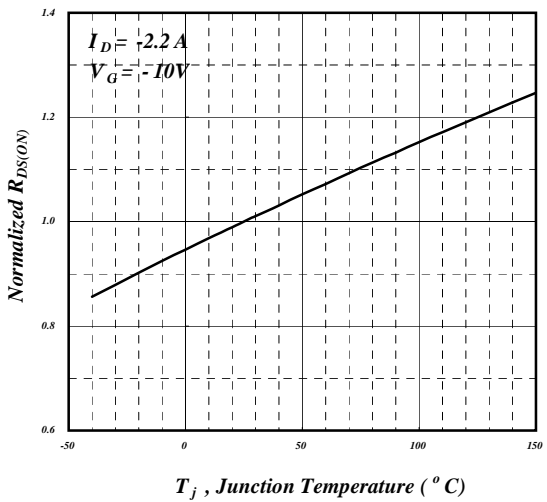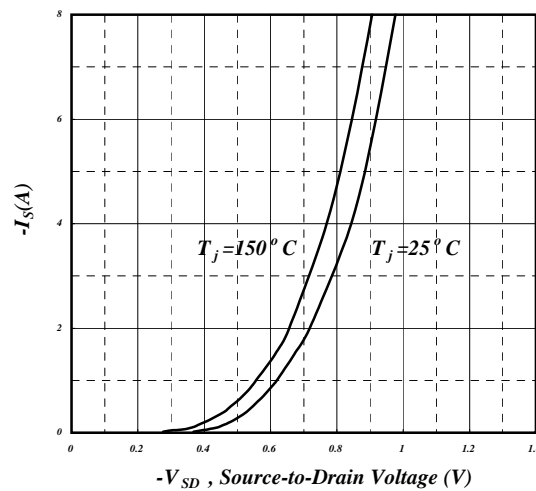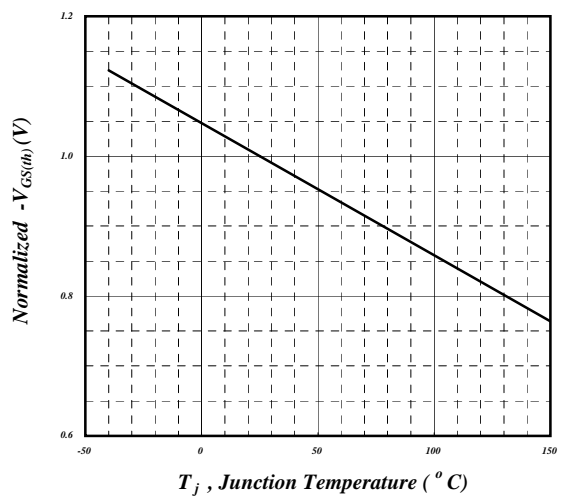

**Fig 4. Normalized On-Resistance
v.s. Junction Temperature**

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

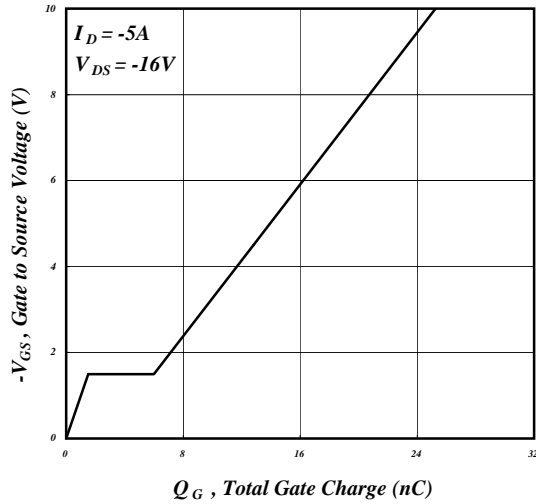

**Fig 6. Gate Threshold Voltage v.s.
Junction Temperature**

P-Channel

$I_D = -5A$
$V_{DS} = -16V$

-V_{GS}, Gate to Source Voltage (V)

Q_G , Total Gate Charge (nC)

Fig 7. Gate Charge Characteristics

f=1.0MHz

C (pF)

C_{iss}

C_{oss}

C_{FSS}

-V_{DS} , Drain-to-Source Voltage (V)

Fig 8. Typical Capacitance Characteristics

Operation in this area limited by $R_{DS(ON)}$

-$I_D(A)$

100us
1ms
10ms
100ms
1s
DC

$T_A = 25^{\circ}C$

Single Pulse

-V_{DS} , Drain-to-Source Voltage (V)

Fig 9. Maximum Safe Operating Area

Normalized Thermal Response (R_{thja})
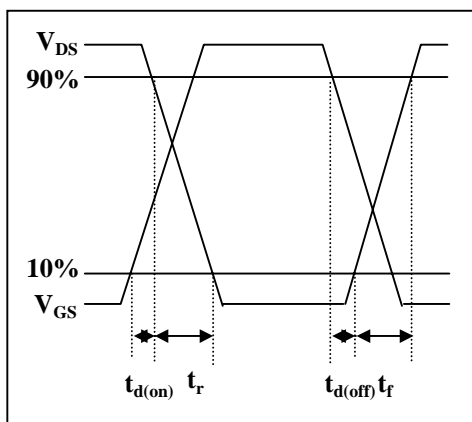
Duty factor=0.5

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

t , Pulse Width (s)

Fig 10. Effective Transient Thermal Impedance

V_{DS}
90%

10%
V_{GS}

$t_{d(on)}$ t_r $t_{d(off)}$ t_f

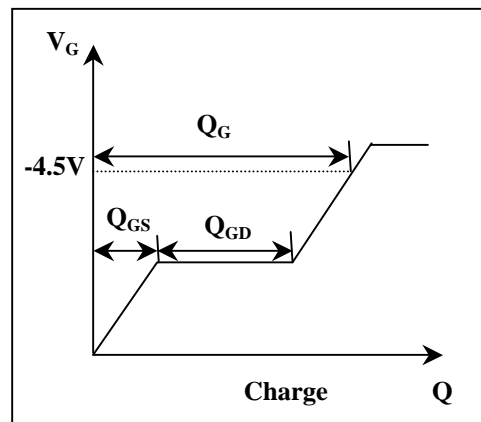**Fig 11. Switching Time Waveform**

V_G

Q_G

-4.5V

Q_{GS} Q_{GD}

Charge   Q

Fig 12. Gate Charge Waveform