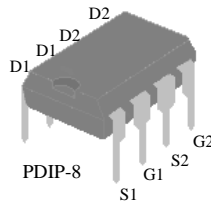




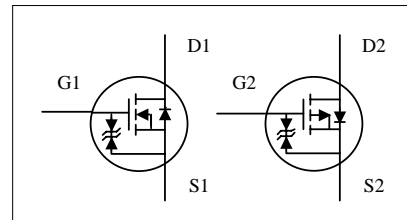
- ▼ Simple Drive Requirement
- ▼ Lower Gate Charge
- ▼ Fast Switching Performance
- ▼ RoHS Compliant & Halogen-Free



N-CH	$BV_{DSS}$	40V
	$R_{DS(ON)}$	28m $\Omega$
	$I_D$	6A
P-CH	$BV_{DSS}$	-40V
	$R_{DS(ON)}$	42m $\Omega$
	$I_D$	-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.



### Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-channel	P-channel	
$V_{DS}$	Drain-Source Voltage	40	-40	V
$V_{GS}$	Gate-Source Voltage	$\pm 16$	$\pm 16$	V
$I_D@T_A=25^\circ C$	Continuous Drain Current <sup>3</sup>	6.0	-5.0	A
$I_D@T_A=70^\circ C$	Continuous Drain Current <sup>3</sup>	5.0	-4.0	A
$I_{DM}$	Pulsed Drain Current <sup>1</sup>	30	-30	A
$P_D@T_A=25^\circ C$	Total Power Dissipation	2.0		W
	Linear Derating Factor	0.016		W/ $^\circ C$
$T_{STG}$	Storage Temperature Range	-55 to 150		$^\circ C$
$T_J$	Operating Junction Temperature Range	-55 to 150		$^\circ C$

### Thermal Data

Symbol	Parameter	Value	Unit
Rthj-a	Maximum Thermal Resistance, Junction-ambient <sup>3</sup>	62.5	$^\circ C/W$



# AP4511GED-HF

## N-CH 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	$V_{GS}=0V, I_D=250\mu A$	40	-	-	V
$\Delta BV_{DSS}/\Delta T_j$	Breakdown Voltage Temperature Coefficient	Reference to $25^\circ\text{C}$ , $I_D=1\text{mA}$	-	0.03	-	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=10V, I_D=6A$	-	-	28	$\text{m}\Omega$
		$V_{GS}=4.5V, I_D=4A$	-	-	36	$\text{m}\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1	-	3	V
$g_{fs}$	Forward Transconductance	$V_{DS}=10V, I_D=6A$	-	6	-	S
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=40V, V_{GS}=0V$	-	-	1	$\mu A$
	Drain-Source Leakage Current ( $T_j=70^\circ\text{C}$ )	$V_{DS}=32V, V_{GS}=0V$	-	-	25	$\mu A$
$I_{GSS}$	Gate-Source Leakage	$V_{GS}=\pm 16V, V_{DS}=0V$	-	-	$\pm 30$	$\mu A$
$Q_g$	Total Gate Charge <sup>2</sup>	$I_D=6A$	-	8.2	13	nC
$Q_{gs}$	Gate-Source Charge	$V_{DS}=20V$	-	1.5	-	nC
$Q_{gd}$	Gate-Drain ("Miller") Charge	$V_{GS}=4.5V$	-	3.6	-	nC
$t_{d(on)}$	Turn-on Delay Time <sup>2</sup>	$V_{DS}=20V$	-	7	-	ns
$t_r$	Rise Time	$I_D=6A$	-	20	-	ns
$t_{d(off)}$	Turn-off Delay Time	$R_G=3\Omega, V_{GS}=10V$	-	20	-	ns
$t_f$	Fall Time	$R_D=3.3\Omega$	-	4	-	ns
$C_{iss}$	Input Capacitance	$V_{GS}=0V$	-	590	940	pF
$C_{oss}$	Output Capacitance	$V_{DS}=20V$	-	110	-	pF
$C_{rss}$	Reverse Transfer Capacitance	$f=1.0\text{MHz}$	-	80	-	pF
$R_g$	Gate Resistance	$f=1.0\text{MHz}$	-	2	3	$\Omega$

## Source-Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{SD}$	Forward On Voltage <sup>2</sup>	$I_S=1.25A, V_{GS}=0V$	-	-	1.6	V
$t_{rr}$	Reverse Recovery Time <sup>2</sup>	$I_S=6A, V_{GS}=0V$	-	20	-	ns
$Q_{rr}$	Reverse Recovery Charge	$dI/dt=100A/\mu s$	-	12	-	nC

**P-CH Electrical Characteristics @T<sub>j</sub>=25°C (unless otherwise specified)**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =-250uA	-40	-	-	V
ΔBV <sub>DSS</sub> /ΔT <sub>j</sub>	Breakdown Voltage Temperature Coefficient	Reference to 25°C, I <sub>D</sub> =-1mA	-	-0.03	-	V/°C
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-5A	-	-	42	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-3A	-	-	60	mΩ
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250uA	-0.8	-	-2.5	V
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =-10V, I <sub>D</sub> =-5A	-	5	-	S
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =-40V, V <sub>GS</sub> =0V	-	-	-1	uA
	Drain-Source Leakage Current (T <sub>j</sub> =70°C)	V <sub>DS</sub> =-32V, V <sub>GS</sub> =0V	-	-	-25	uA
I <sub>GSS</sub>	Gate-Source Leakage	V <sub>GS</sub> =±16V, V <sub>DS</sub> =0V	-	-	±30	uA
Q <sub>g</sub>	Total Gate Charge <sup>2</sup>	I <sub>D</sub> =-5A	-	9	24	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>DS</sub> =-20V	-	2	-	nC
Q <sub>gd</sub>	Gate-Drain ("Miller") Charge	V <sub>GS</sub> =-4.5V	-	5	-	nC
t <sub>d(on)</sub>	Turn-on Delay Time <sup>2</sup>	V <sub>DS</sub> =-20V	-	8.5	-	ns
t <sub>r</sub>	Rise Time	I <sub>D</sub> =-5A	-	15	-	ns
t <sub>d(off)</sub>	Turn-off Delay Time	R <sub>G</sub> =3Ω, V <sub>GS</sub> =-10V	-	27	-	ns
t <sub>f</sub>	Fall Time	R <sub>D</sub> =4Ω	-	25	-	ns
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V	-	770	1230	pF
C <sub>oss</sub>	Output Capacitance	V <sub>DS</sub> =-20V	-	165	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	f=1.0MHz	-	115	-	pF
R <sub>g</sub>	Gate Resistance	f=1.0MHz	-	6	9	Ω

**Source-Drain Diode**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V <sub>SD</sub>	Forward On Voltage <sup>2</sup>	I <sub>S</sub> =-1.25A, V <sub>GS</sub> =0V	-	-	-1.6	V
t <sub>rr</sub>	Reverse Recovery Time <sup>2</sup>	I <sub>S</sub> =-5A, V <sub>GS</sub> =0V	-	20	-	ns
Q <sub>rr</sub>	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<sup>2</sup> copper pad of FR4 board, t ≤ 10sec ; 90°C/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.

APEC DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

APEC RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN.



## N-Channel

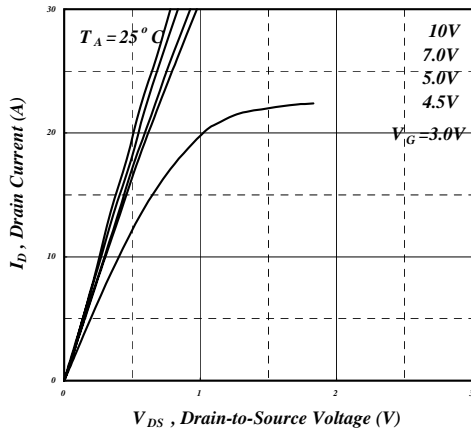


Fig 1. Typical Output Characteristics

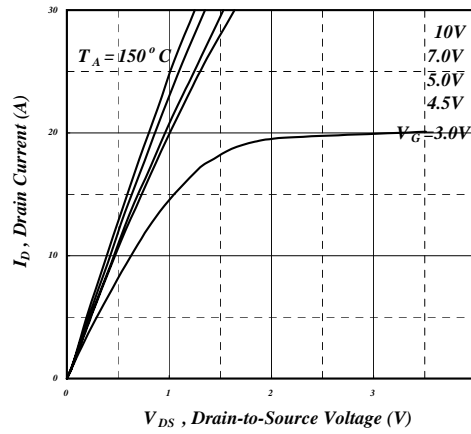


Fig 2. Typical Output Characteristics

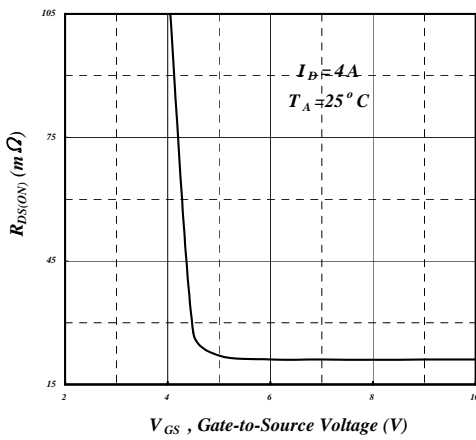


Fig 3. On-Resistance v.s. Gate Voltage

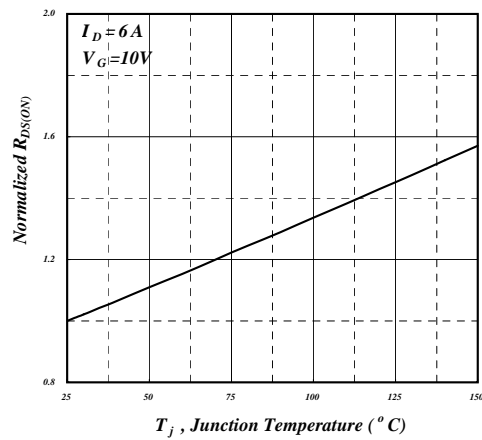


Fig 4. Normalized On-Resistance v.s. Junction Temperature

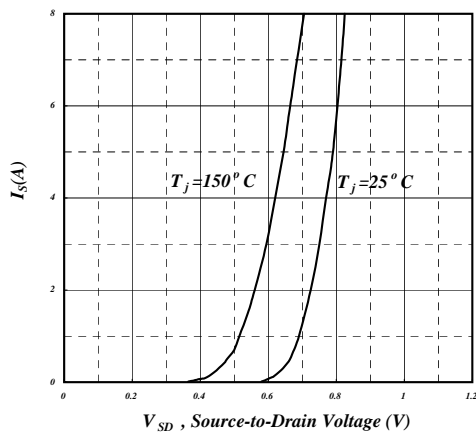


Fig 5. Forward Characteristic of Reverse Diode

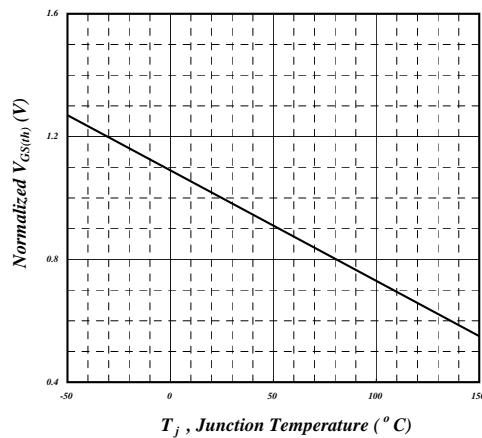


Fig 6. Gate Threshold Voltage v.s. Junction Temperature



N-Channel

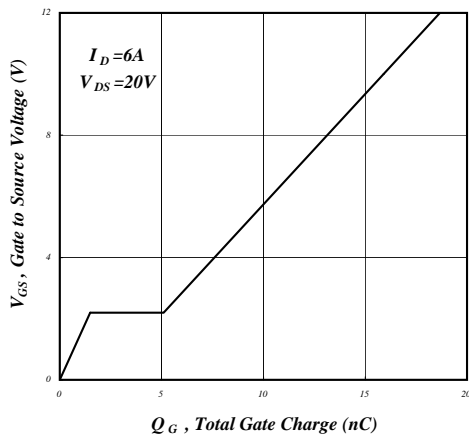


Fig 7. Gate Charge Characteristics

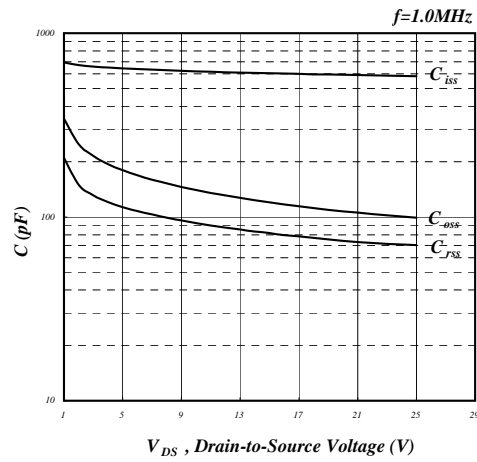


Fig 8. Typical Capacitance Characteristics

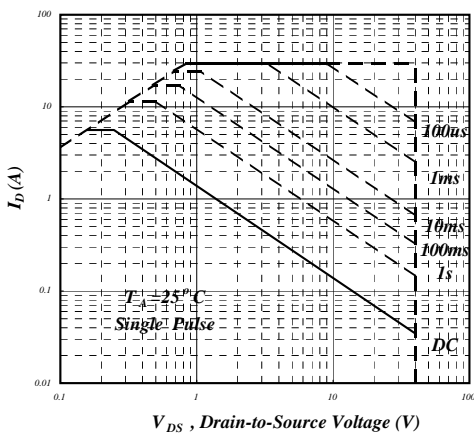


Fig 9. Maximum Safe Operating Area

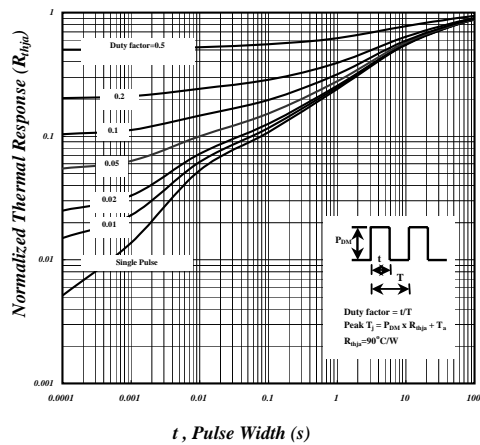


Fig 10. Effective Transient Thermal Impedance

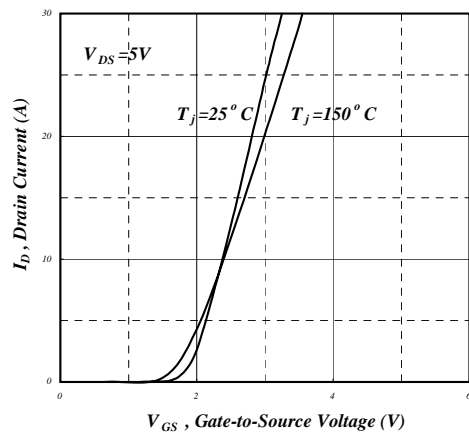


Fig 11. Transfer Characteristics

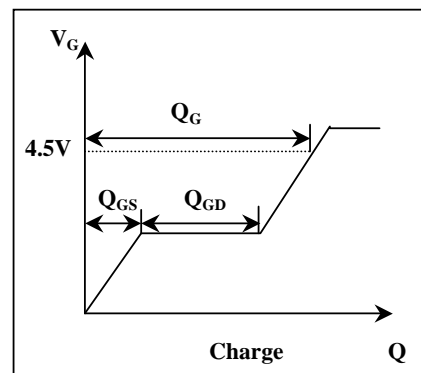


Fig 12. Gate Charge Waveform



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## P-Channel

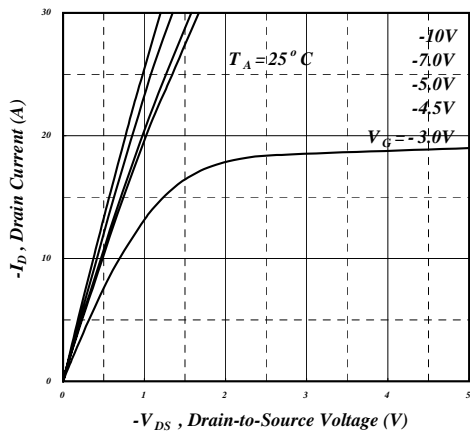


Fig 1. Typical Output Characteristics

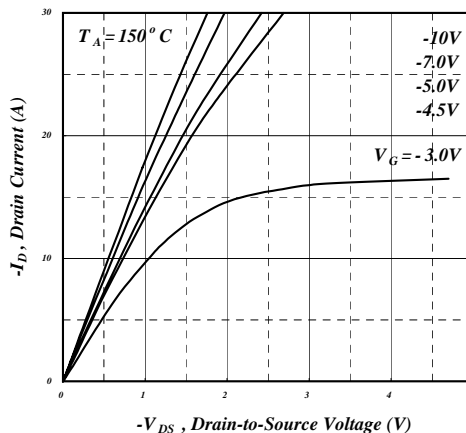


Fig 2. Typical Output Characteristics

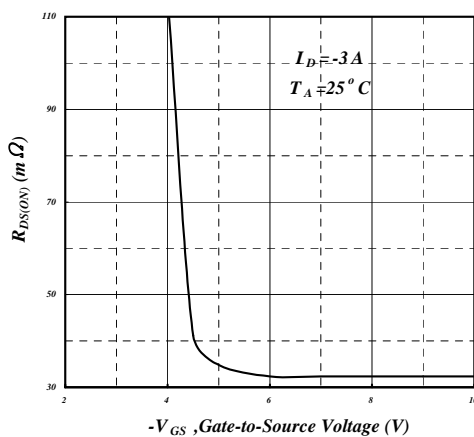


Fig 3. On-Resistance v.s. Gate Voltage

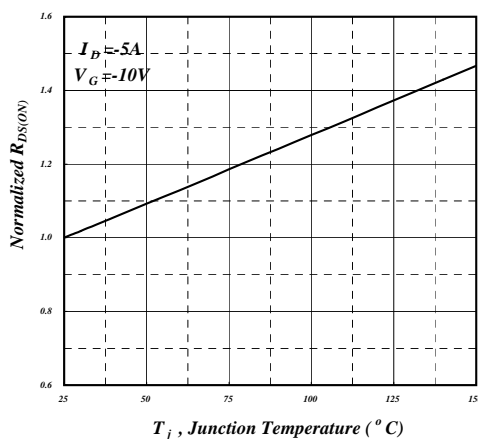


Fig 4. Normalized On-Resistance v.s. Junction Temperature

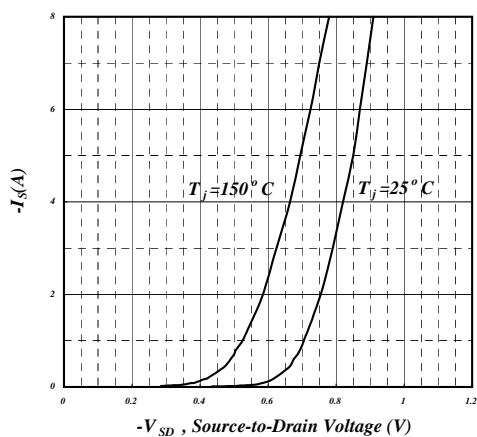


Fig 5. Forward Characteristic of Reverse Diode

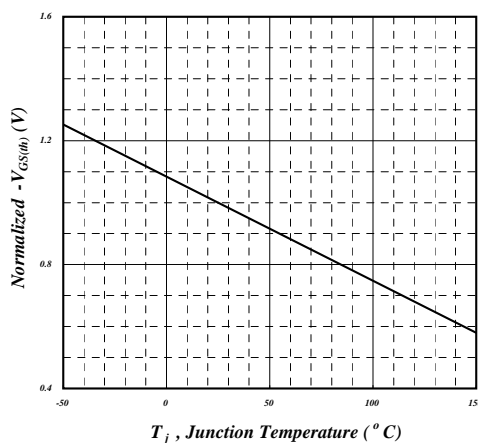


Fig 6. Gate Threshold Voltage v.s. Junction Temperature



P-Channel

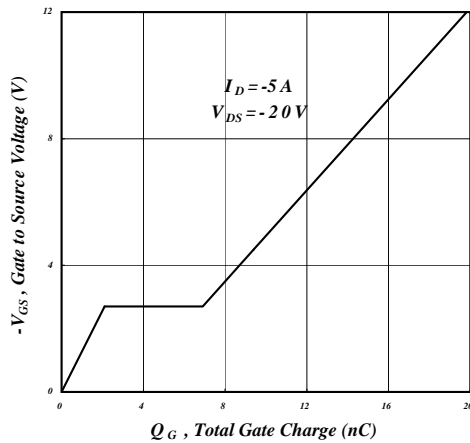


Fig 7. Gate Charge Characteristics

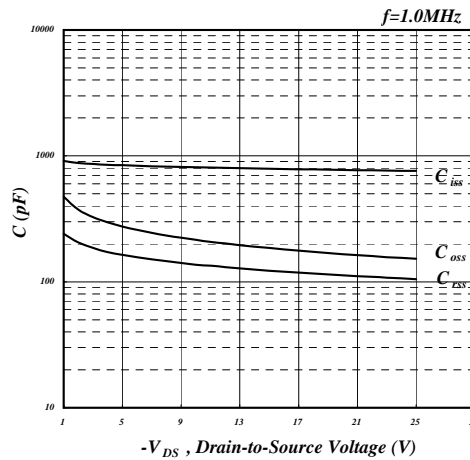


Fig 8. Typical Capacitance Characteristics

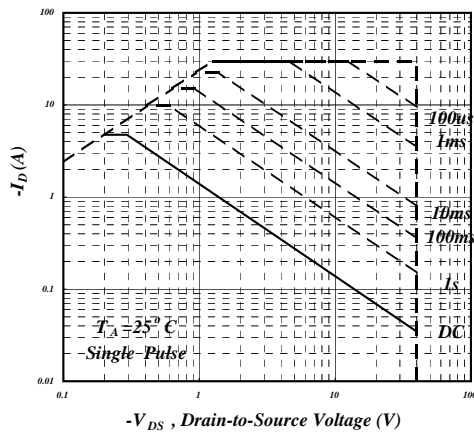


Fig 9. Maximum Safe Operating Area

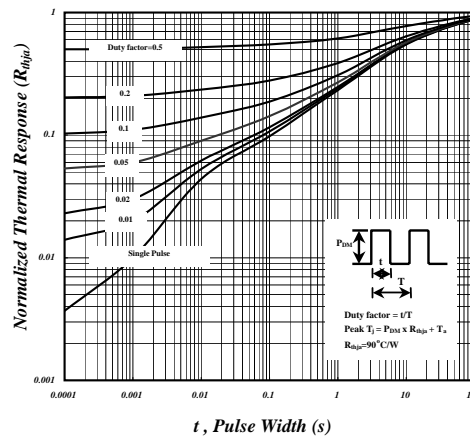


Fig 10. Effective Transient Thermal Impedance

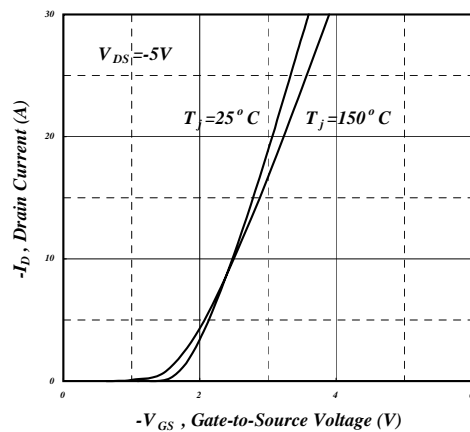


Fig 11. Transfer Characteristics

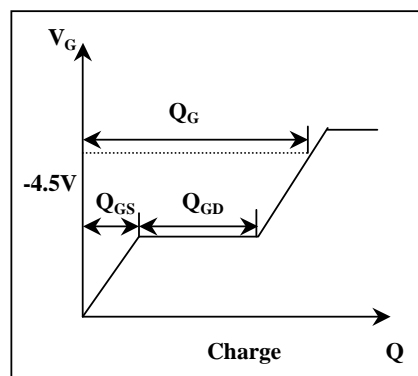


Fig 12. Gate Charge Waveform