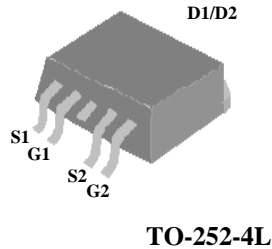




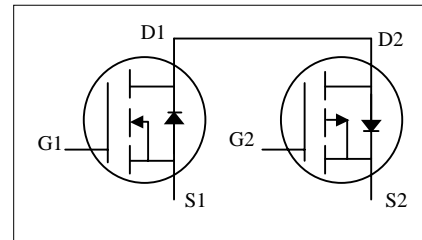
- ▼ Simple Drive Requirement
- ▼ Good Thermal Performance
- ▼ Fast Switching Performance



N-CH	$BV_{DSS}$	35V
	$R_{DS(ON)}$	32m $\Omega$
	$I_D$	7.7A
P-CH	$BV_{DSS}$	-35V
	$R_{DS(ON)}$	68m $\Omega$
	$I_D$	-5.5A

### 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.



### Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-channel	P-channel	
$V_{DS}$	Drain-Source Voltage	35	-35	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$	V
$I_D @ T_A = 25^\circ C$	Continuous Drain Current <sup>3</sup>	7.7	-5.5	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current <sup>3</sup>	6.2	-4.4	A
$I_{DM}$	Pulsed Drain Current <sup>1</sup>	40	-40	A
$P_D @ T_A = 25^\circ C$	Total Power Dissipation	3.125		W
	Linear Derating Factor	0.025		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	Units
Rthj-c	Thermal Resistance Junction-case	Max. 10	$^\circ C/W$
Rthj-a	Thermal Resistance Junction-ambient <sup>3</sup>	Max. 40	$^\circ C/W$



# AP4513GH-A

## N-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	35	-	-	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> =7A	-	-	32	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =5A	-	-	54	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> =7A	-	10	-	S
I <sub>DSS</sub>	Drain-Source Leakage Current (T <sub>j</sub> =25°C)	V <sub>DS</sub> =35V, V <sub>GS</sub> =0V	-	-	1	uA
	Drain-Source Leakage Current (T <sub>j</sub> =150°C)	V <sub>DS</sub> =28V, V <sub>GS</sub> =0V	-	-	25	uA
I <sub>GSS</sub>	Gate-Source Leakage	V <sub>GS</sub> =±20V	-	-	±100	nA
Q <sub>g</sub>	Total Gate Charge <sup>2</sup>	I <sub>D</sub> =7A	-	6	10	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>DS</sub> =28V	-	2	-	nC
Q <sub>gd</sub>	Gate-Drain ("Miller") Charge	V <sub>GS</sub> =4.5V	-	3	-	nC
t <sub>d(on)</sub>	Turn-on Delay Time <sup>2</sup>	V <sub>DS</sub> =15V	-	8	-	ns
t <sub>r</sub>	Rise Time	I <sub>D</sub> =1A	-	7	-	ns
t <sub>d(off)</sub>	Turn-off Delay Time	R <sub>G</sub> =3.3Ω, V <sub>GS</sub> =10V	-	20	-	ns
t <sub>f</sub>	Fall Time	R <sub>D</sub> =15Ω	-	4	-	ns
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V	-	460	740	pF
C <sub>oss</sub>	Output Capacitance	V <sub>DS</sub> =25V	-	85	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	f=1.0MHz	-	60	-	pF
R <sub>g</sub>	Gate Resistance	f=1.0MHz	-	1	1.5	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> =7A, V <sub>GS</sub> =0V	-	-	1.2	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>S</sub> =7A, V <sub>GS</sub> =0V	-	18	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI/dt=100A/μs	-	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	-35	-	-	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	-	-	68	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-3A	-	-	105	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	-	7	-	S
I <sub>DSS</sub>	Drain-Source Leakage Current (T <sub>j</sub> =25°C)	V <sub>DS</sub> =-35V, V <sub>GS</sub> =0V	-	-	-1	uA
	Drain-Source Leakage Current (T <sub>j</sub> =150°C)	V <sub>DS</sub> =-28V, V <sub>GS</sub> =0V	-	-	-25	uA
I <sub>GSS</sub>	Gate-Source Leakage	V <sub>GS</sub> =±20V	-	-	±100	nA
Q <sub>g</sub>	Total Gate Charge <sup>2</sup>	I <sub>D</sub> =-5A	-	6	10	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>DS</sub> =-28V	-	1.2	-	nC
Q <sub>gd</sub>	Gate-Drain ("Miller") Charge	V <sub>GS</sub> =-4.5V	-	3	-	nC
t <sub>d(on)</sub>	Turn-on Delay Time <sup>2</sup>	V <sub>DS</sub> =-15V	-	7	-	ns
t <sub>r</sub>	Rise Time	I <sub>D</sub> =-1A	-	7	-	ns
t <sub>d(off)</sub>	Turn-off Delay Time	R <sub>G</sub> =3.3Ω, V <sub>GS</sub> =-10V	-	16	-	ns
t <sub>f</sub>	Fall Time	R <sub>D</sub> =15Ω	-	3	-	ns
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V	-	400	640	pF
C <sub>oss</sub>	Output Capacitance	V <sub>DS</sub> =-25V	-	90	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	f=1.0MHz	-	60	-	pF
R <sub>g</sub>	Gate Resistance	f=1.0MHz	-	7.2	11	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> =-5A, V <sub>GS</sub> =0V	-	-	-1.2	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>S</sub> =-5A, V <sub>GS</sub> =0V	-	21	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI/dt=-100A/μs	-	14	-	nC

**Notes:**

- 1.Pulse width limited by Max. junction temperature.
- 2.Pulse test
- 3.N-CH , P-CH are same , mounted on 2oz FR4 board t ≤ 10s.

THIS PRODUCT IS AN ELECTROSTATIC SENSITIVE, PLEASE HANDLE WITH CAUTION.

THIS PRODUCT HAS BEEN QUALIFIED FOR CONSUMER MARKET. APPLICATIONS OR USES AS CRITERIAL COMPONENT IN LIFE SUPPORT DEVICE OR SYSTEM ARE NOT AUTHORIZED.



## N-Channel

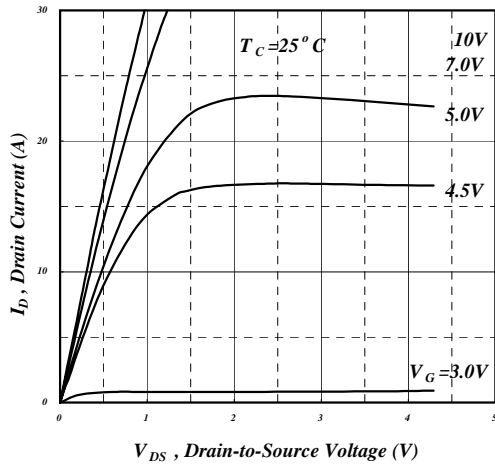


Fig 1. Typical Output Characteristics

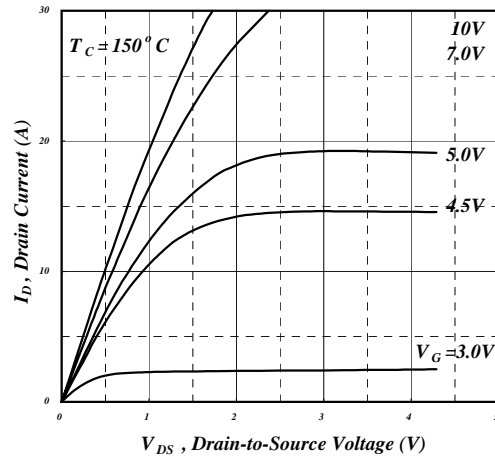


Fig 2. Typical Output Characteristics

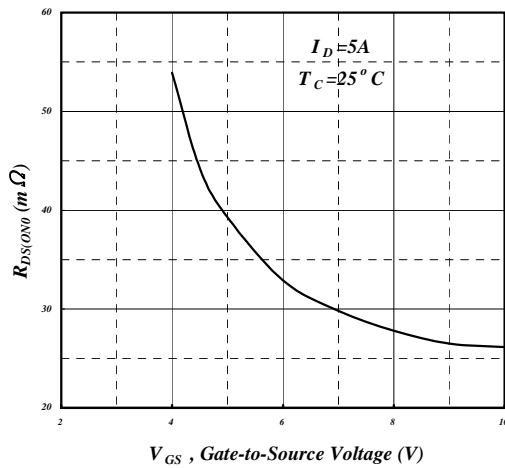


Fig 3. On-Resistance v.s. Gate Voltage

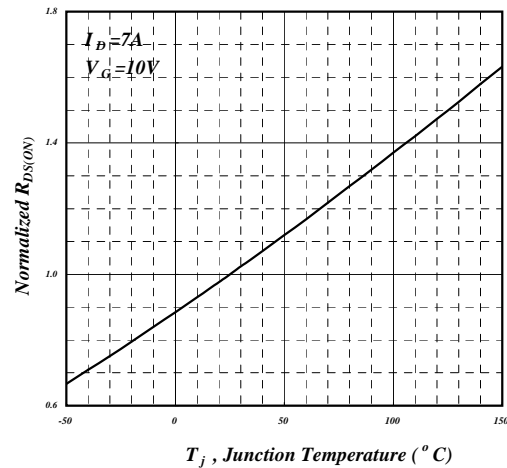


Fig 4. Normalized On-Resistance v.s. Junction Temperature

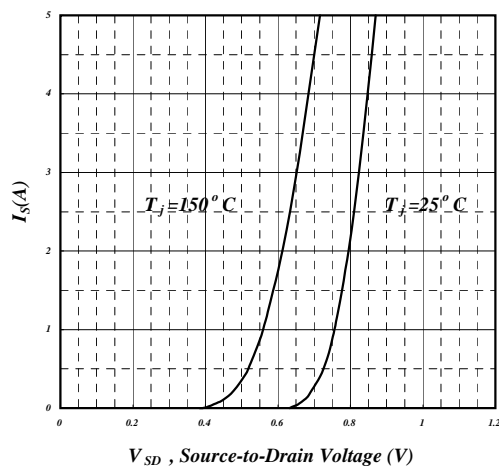


Fig 5. Forward Characteristic of Reverse Diode

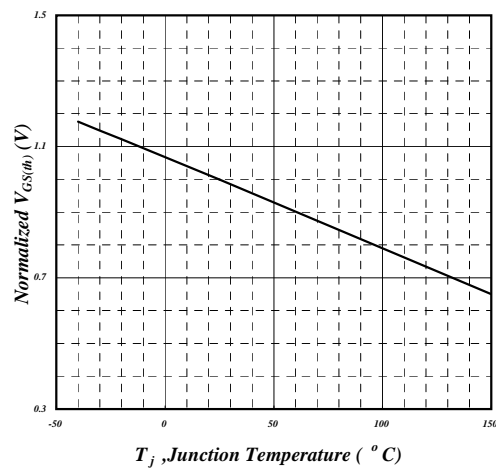


Fig 6. Gate Threshold Voltage v.s. Junction Temperature



N-Channel

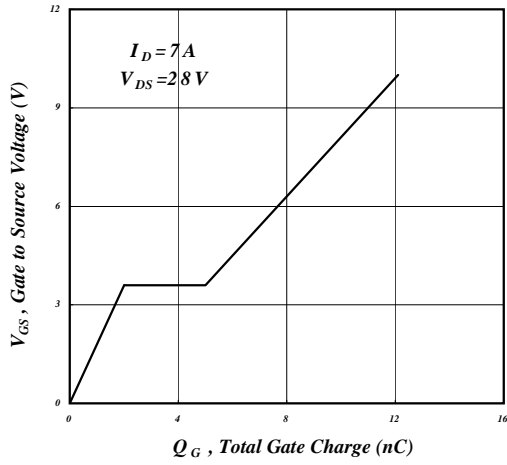


Fig 7. Gate Charge Characteristics

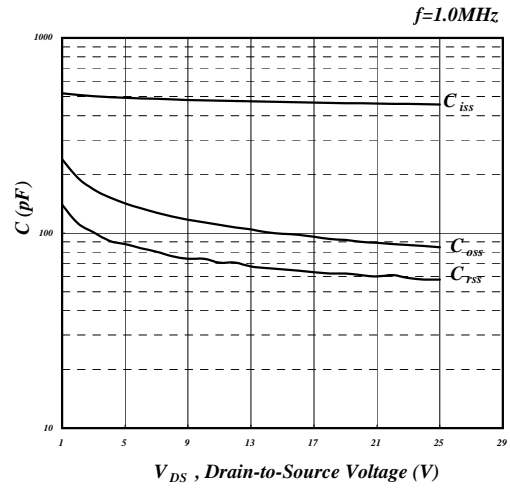


Fig 8. Typical Capacitance Characteristics

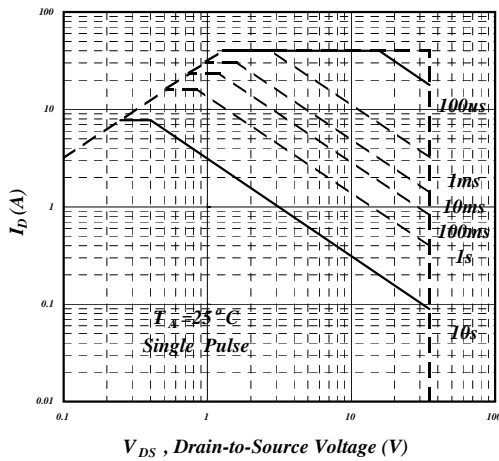


Fig 9. Maximum Safe Operating Area

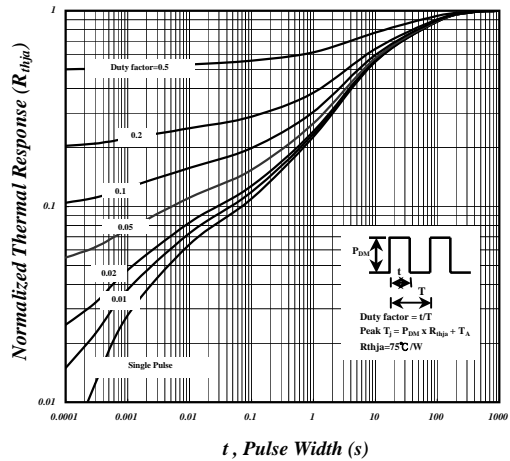


Fig 10. Effective Transient Thermal Impedance

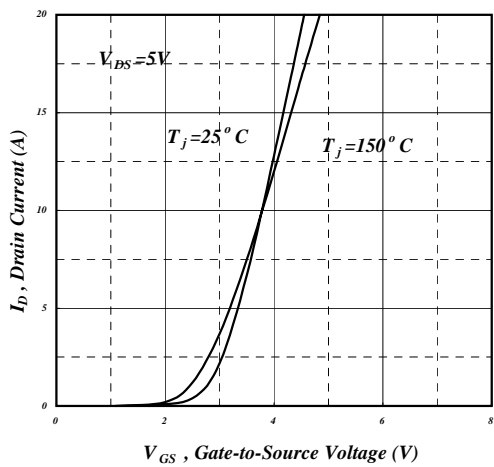


Fig 11. Transfer Characteristics

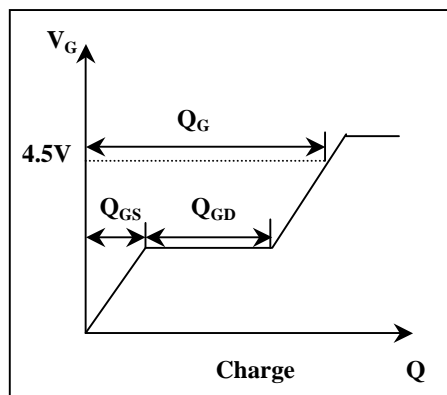


Fig 12. Gate Charge Waveform



# AP4513GH-A

## P-Channel

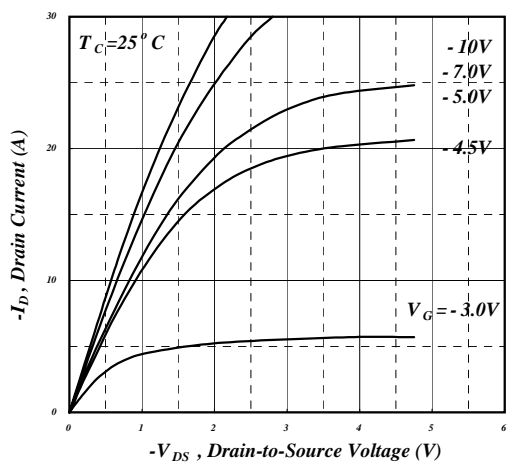


Fig 1. Typical Output Characteristics

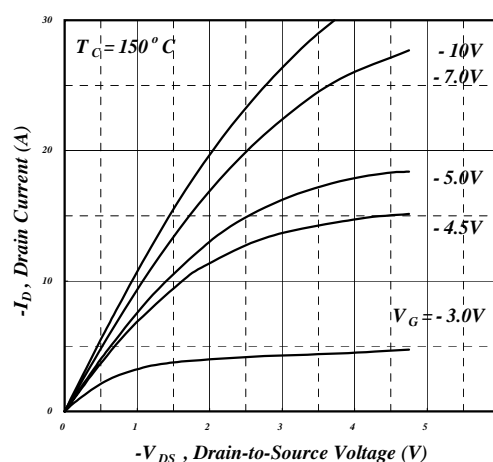


Fig 2. Typical Output Characteristics

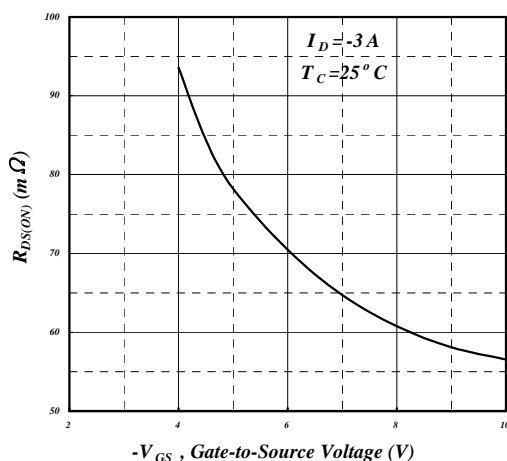


Fig 3. On-Resistance v.s. Gate Voltage

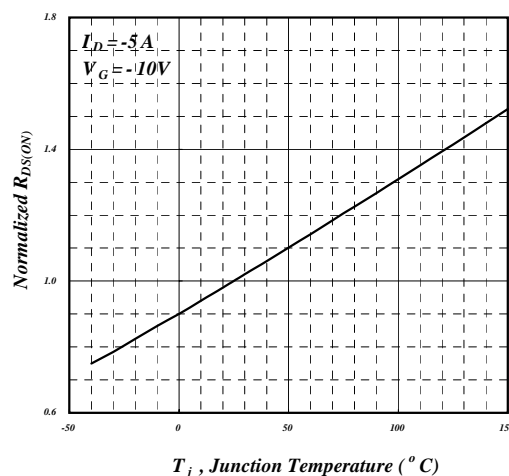


Fig 4. Normalized On-Resistance v.s. Junction Temperature

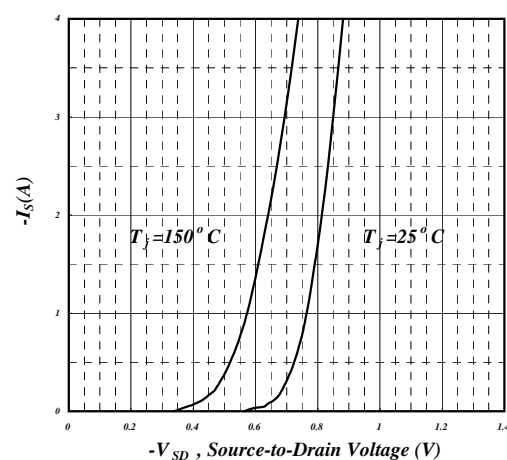


Fig 5. Forward Characteristic of Reverse Diode

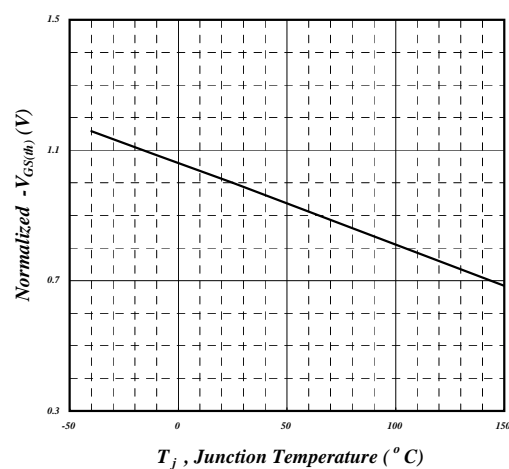


Fig 6. Gate Threshold Voltage v.s. Junction Temperature



P-Channel

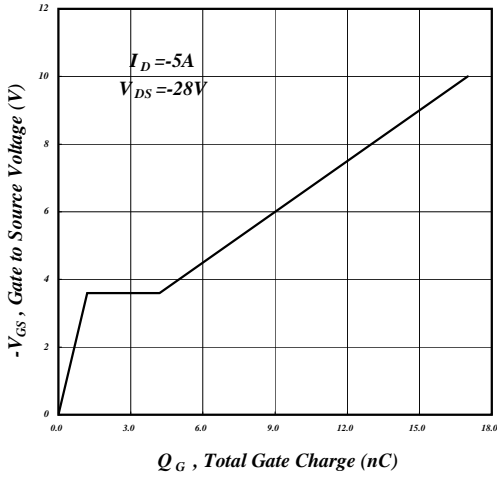


Fig 7. Gate Charge Characteristics

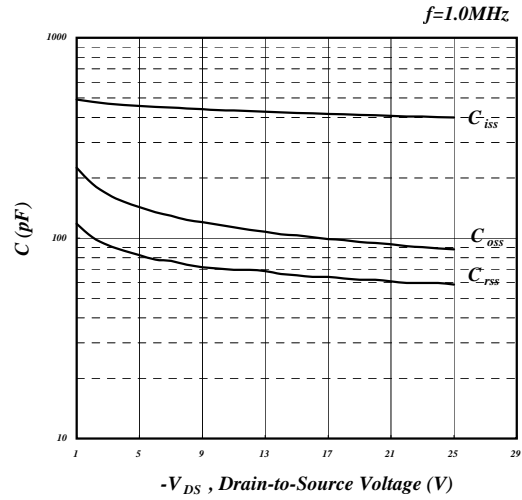


Fig 8. Typical Capacitance Characteristics

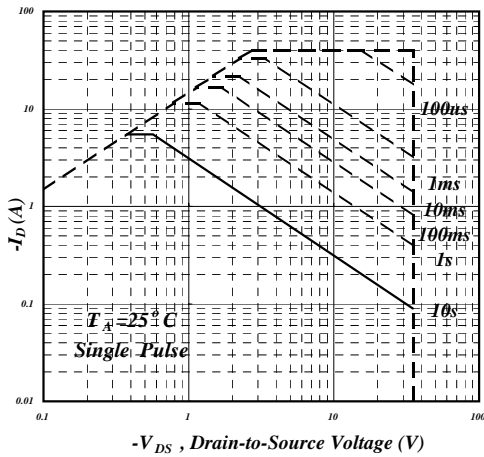


Fig 9. Maximum Safe Operating Area

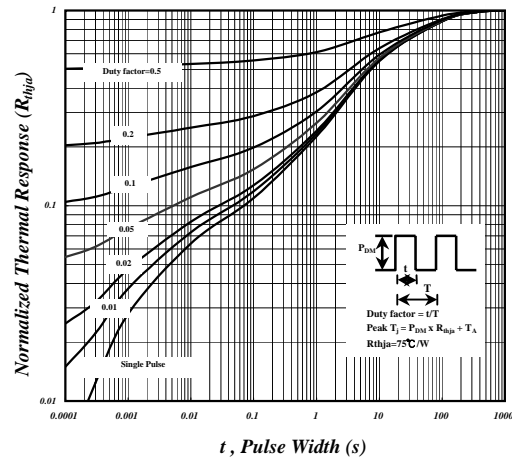


Fig 10. Effective Transient Thermal Impedance

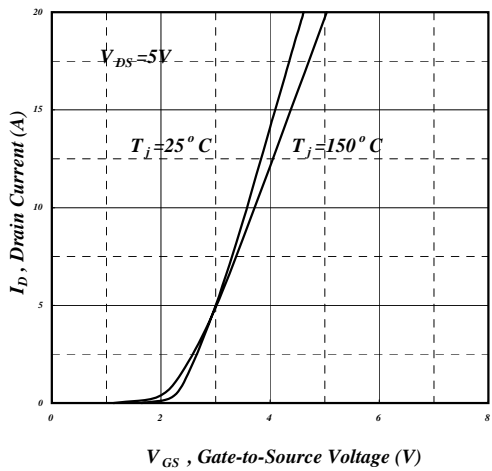


Fig 11. Transfer Characteristics

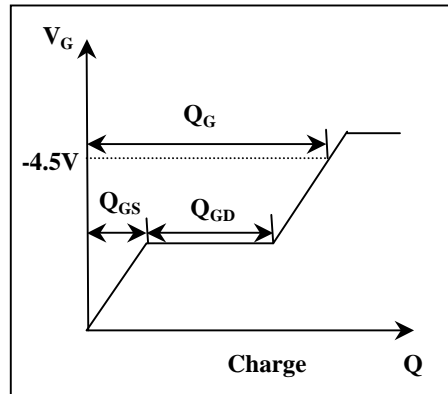
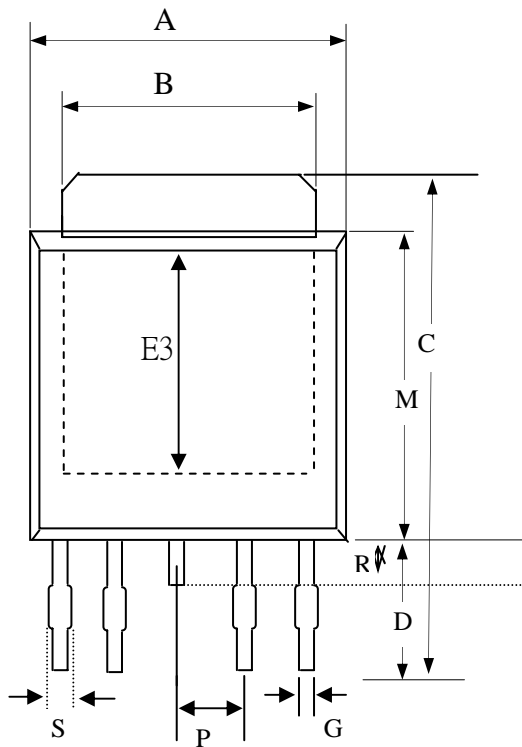


Fig 12. Gate Charge Waveform



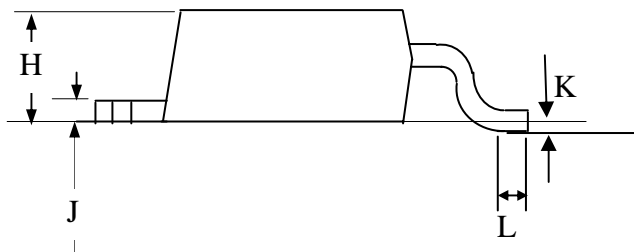
## Package Outline : TO-252(4L)



SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	6.40	6.6	6.80
B	5.2	5.35	5.50
C	9.40	9.80	10.20
D	2.40	2.70	3.00
P	1.27 REF.		
S	0.50	0.65	0.80
E3	3.50	4.00	4.50
R	0.80	1.00	1.20
G	0.40	0.50	0.60
H	2.20	2.30	2.40
J	0.45	0.50	0.55
K	0.00	0.075	0.15
L	0.90	1.20	1.50
M	5.40	5.60	5.80

1.All Dimensions Are in Millimeters.

2.Dimension Does Not Include Mold Protrusions.



## Part Marking Information & Packing : TO-252(4L)

