

# AP4804MT

**Halogen-Free Product**

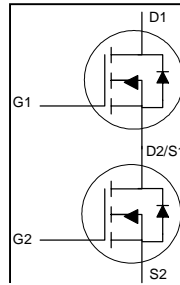


**Advanced Power  
Electronics Corp.**

*DUAL N-CHANNEL ENHANCEMENT*

*MODE POWER MOSFET*

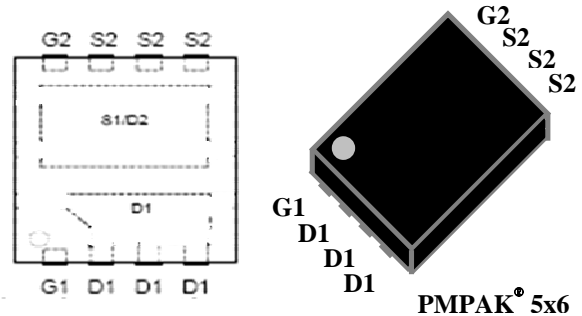
- ▼ Simple Drive Requirement
- ▼ Easy for Synchronous Buck Converter Application
- ▼ RoHS Compliant & Halogen-Free



CH-1	$BV_{DSS}$	40V
	$R_{DS(ON)}$	12.5m $\Omega$
	$I_D$	36A
CH-2	$BV_{DSS}$	40V
	$R_{DS(ON)}$	8m $\Omega$
	$I_D$	55A

## Description

AP4804 series are from Advanced Power innovated design and silicon process technology to achieve the lowest possible on-resistance and fast switching performance. It provides the designer with an extreme efficient device for use in a wide range of power applications. The control MOSFET (CH-1) and synchronous MOSFET (CH-2) co-package for synchronous buck converters.



## Absolute Maximum Ratings @ $T_J=25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Rating		Units
		CH-1	CH-2	
$V_{DS}$	Drain-Source Voltage	40	40	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$	V
$I_D @ T_C=25^\circ\text{C}$	Drain Current (Chip Limited)	36	55	A
$I_D @ T_A=25^\circ\text{C}$	Drain Current, $V_{GS} @ 10V^3$	11.8	16.9	A
$I_D @ T_A=70^\circ\text{C}$	Drain Current, $V_{GS} @ 10V^3$	7	10	A
$I_{DM}$	Pulsed Drain Current <sup>1</sup>	30	40	A
$P_D @ T_A=25^\circ\text{C}$	Total Power Dissipation	3.13	3.9	W
$T_{STG}$	Storage Temperature Range	-55 to 150		$^\circ\text{C}$
$T_J$	Operating Junction Temperature Range	-55 to 150		$^\circ\text{C}$

## Thermal Data

Symbol	Parameter	Rating		Units
		CH-1	CH-2	
Rthj-c	Maximum Thermal Resistance, Junction-case	4.2	3	$^\circ\text{C}/\text{W}$
Rthj-a	Maximum Thermal Resistance, Junction-ambient <sup>3</sup>	40	32	$^\circ\text{C}/\text{W}$
Rthj-a	Maximum Thermal Resistance, Junction-ambient <sup>4</sup>	70	60	$^\circ\text{C}/\text{W}$



# AP4804MT

## CH-1 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
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =10V, I <sub>D</sub> =10A	-	-	12.5	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =6A	-	-	20	mΩ
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA	1	-	3	V
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =10V, I <sub>D</sub> =10A	-	30	-	S
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =32V, V <sub>GS</sub> =0V	-	-	10	uA
I <sub>GSS</sub>	Gate-Source Leakage	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
Q <sub>g</sub>	Total Gate Charge	I <sub>D</sub> =6A	-	8	12.8	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	-	4	-	nC
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DS</sub> =20V	-	4.5	-	ns
t <sub>r</sub>	Rise Time	I <sub>D</sub> =1A	-	19	-	ns
t <sub>d(off)</sub>	Turn-off Delay Time	R <sub>G</sub> =3.3Ω	-	18	-	ns
t <sub>f</sub>	Fall Time	V <sub>GS</sub> =10V	-	20	-	ns
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V	-	610	980	pF
C <sub>oss</sub>	Output Capacitance	V <sub>DS</sub> =15V	-	185	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	f=1.0MHz	-	100	-	pF
R <sub>g</sub>	Gate Resistance	f=1.0MHz	-	2.1	4.2	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> =10A, V <sub>GS</sub> =0V	-	-	1.2	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>S</sub> =10A, V <sub>GS</sub> =0V,	-	19	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	di/dt=100A/μs	-	5	-	nC

**CH-2 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
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =10V, I <sub>D</sub> =12A	-	-	8	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =8A	-	-	10.5	mΩ
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA	1	-	3	V
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =10V, I <sub>D</sub> =12A	-	50	-	S
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =32V, V <sub>GS</sub> =0V	-	-	10	uA
I <sub>GSS</sub>	Gate-Source Leakage	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
Q <sub>g</sub>	Total Gate Charge	I <sub>D</sub> =8A	-	14	22	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>DS</sub> =20V	-	3	-	nC
Q <sub>gd</sub>	Gate-Drain ("Miller") Charge	V <sub>GS</sub> =4.5V	-	8	-	nC
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DS</sub> =20V	-	7	-	ns
t <sub>r</sub>	Rise Time	I <sub>D</sub> =1A	-	19	-	ns
t <sub>d(off)</sub>	Turn-off Delay Time	R <sub>G</sub> =3.3Ω	-	26	-	ns
t <sub>f</sub>	Fall Time	V <sub>GS</sub> =10V	-	23	-	ns
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V	-	1065	1700	pF
C <sub>oss</sub>	Output Capacitance	V <sub>DS</sub> =15V	-	300	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	f=1.0MHz	-	155	-	pF
R <sub>g</sub>	Gate Resistance	f=1.0MHz	-	1	2	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> =12A, V <sub>GS</sub> =0V	-	-	1.2	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>S</sub> =12A, V <sub>GS</sub> =0V,	-	24	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	di/dt=100A/μs	-	9	-	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.
- 4.Surface mounted on 1 in<sup>2</sup> copper pad of FR4 board, on steady-state

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.



Channel-1

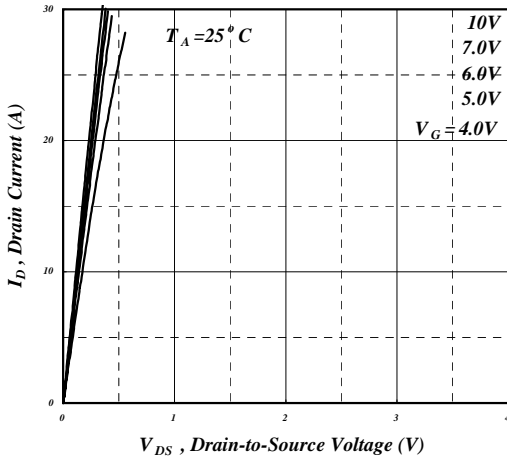


Fig 1. Typical Output Characteristics

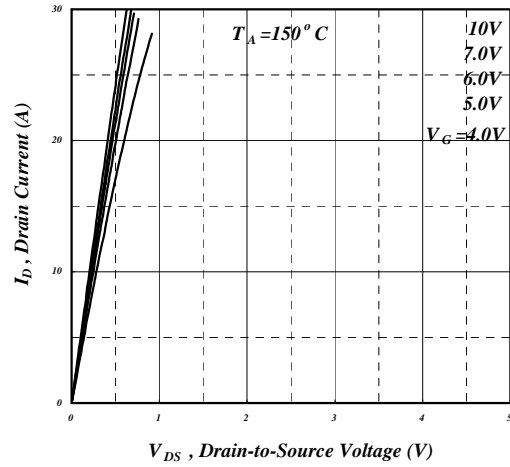


Fig 2. Typical Output Characteristics

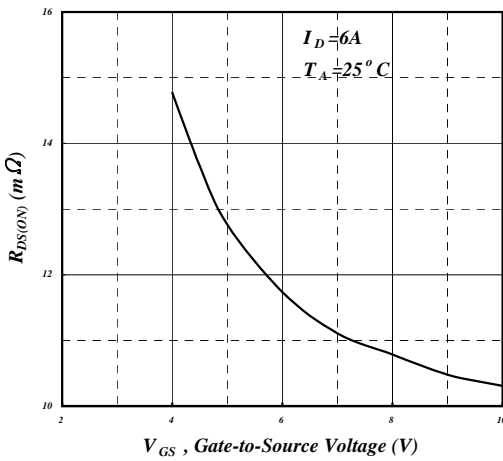


Fig 3. On-Resistance v.s. Gate Voltage

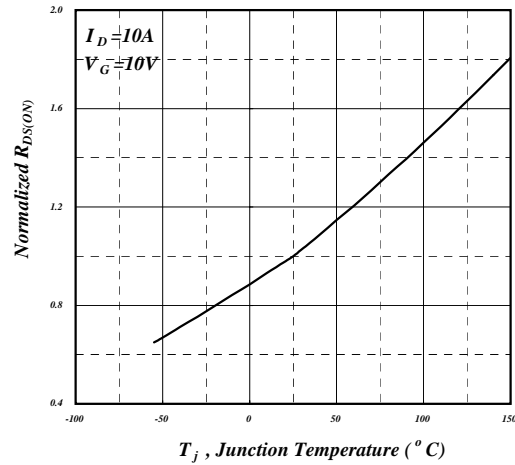


Fig 4. Normalized On-Resistance v.s. Junction Temperature

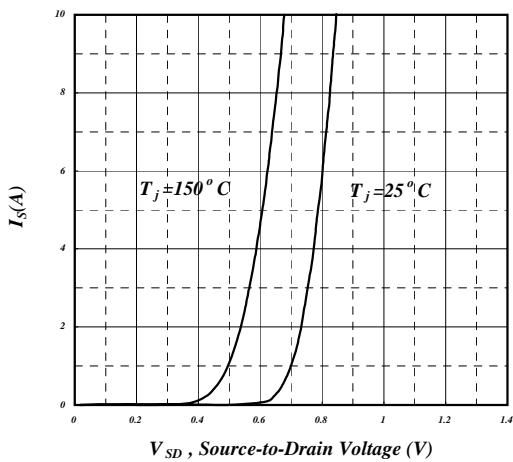


Fig 5. Forward Characteristic of Reverse Diode

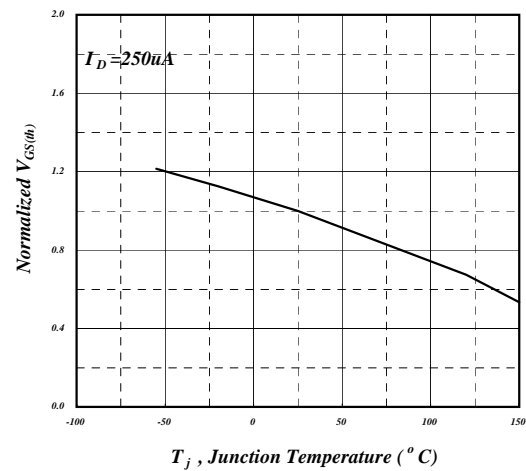


Fig 6. Gate Threshold Voltage v.s. Junction Temperature



# AP4804MT

## Channel-1

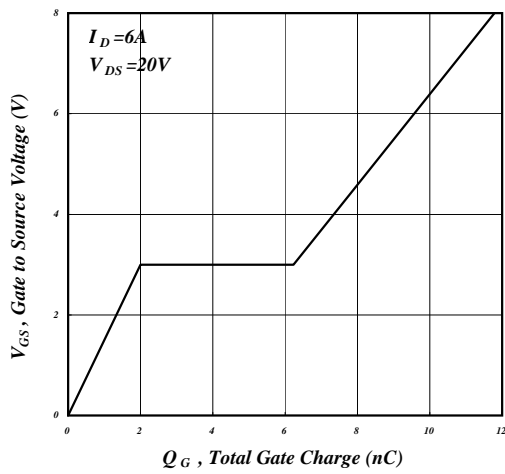


Fig 7. Gate Charge Characteristics

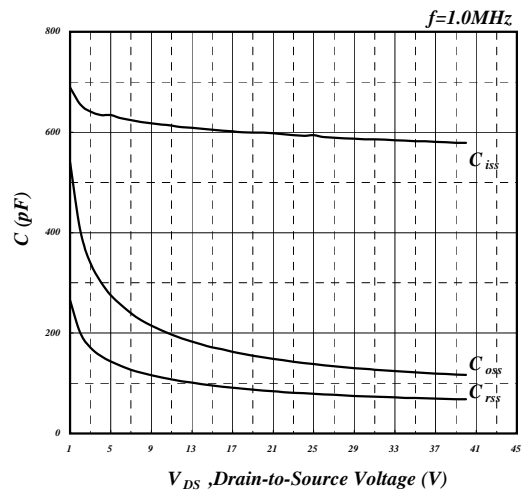


Fig 8. Typical Capacitance Characteristics

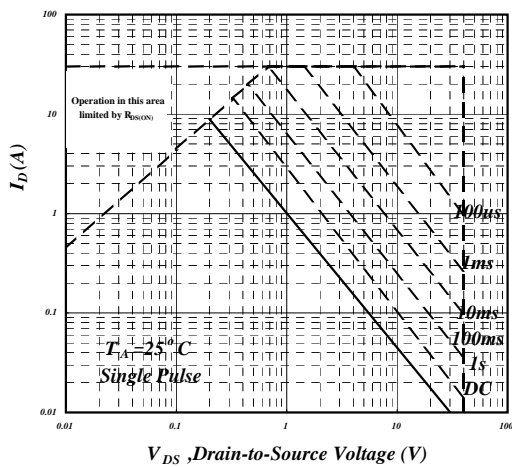


Fig 9. Maximum Safe Operating Area

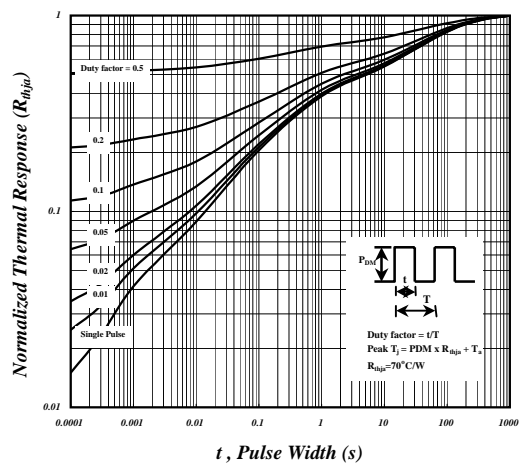


Fig 10. Effective Transient Thermal Impedance

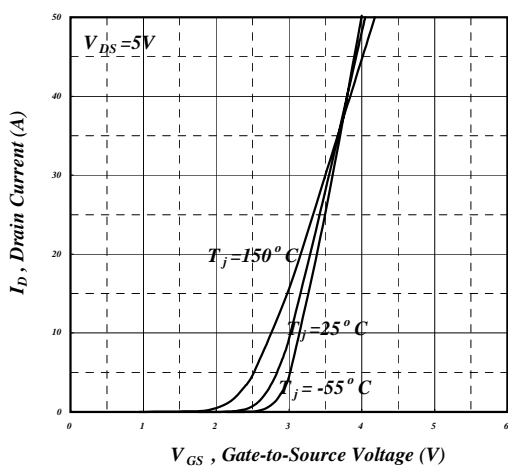


Fig 11. Transfer Characteristics

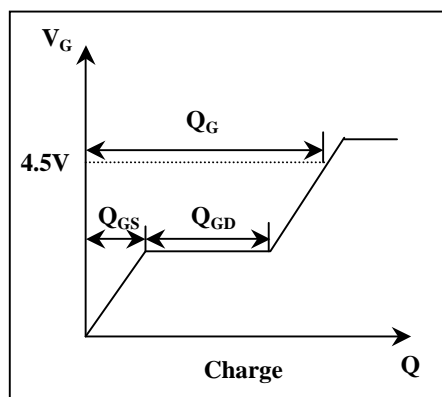


Fig 12. Gate Charge Waveform



Channel-2

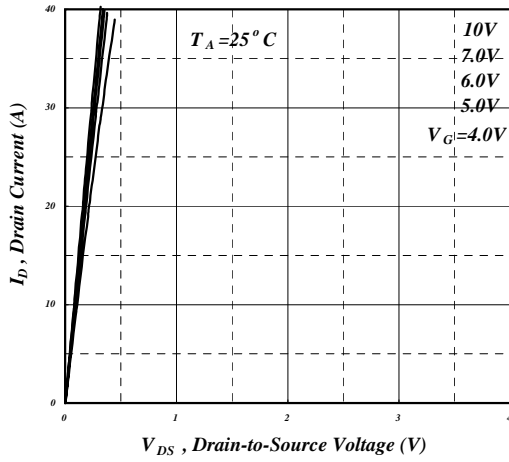


Fig 1. Typical Output Characteristics

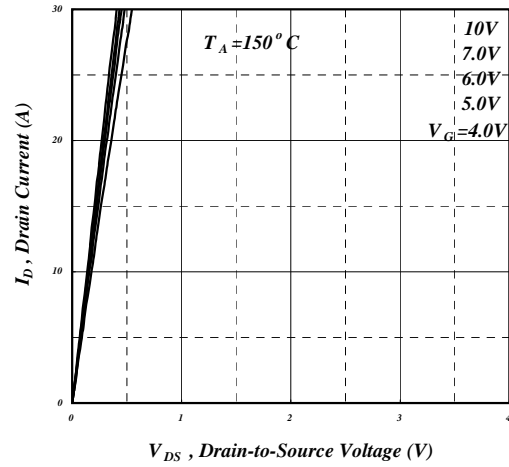


Fig 2. Typical Output Characteristics

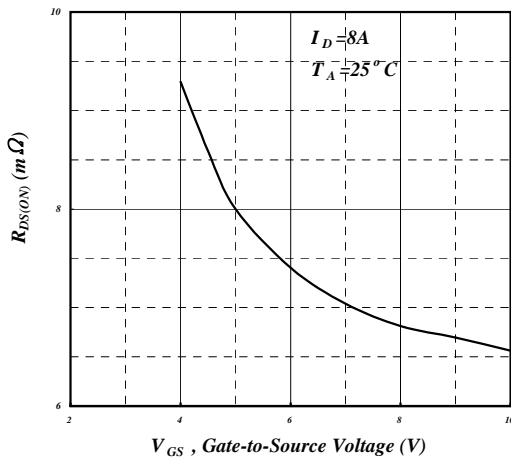


Fig 3. On-Resistance v.s. Gate Voltage

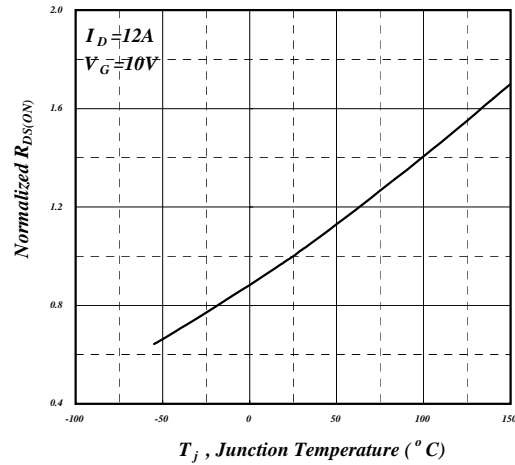


Fig 4. Normalized On-Resistance v.s. Junction Temperature

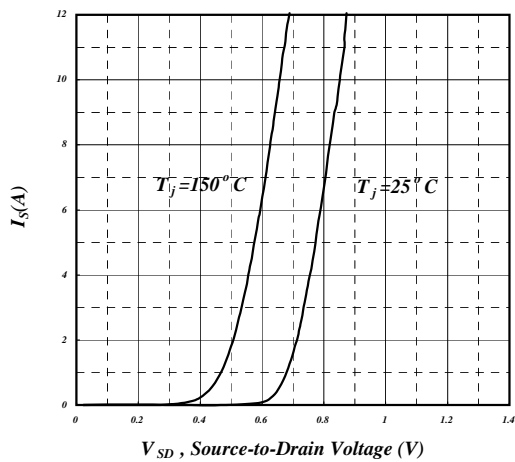


Fig 5. Forward Characteristic of Reverse Diode

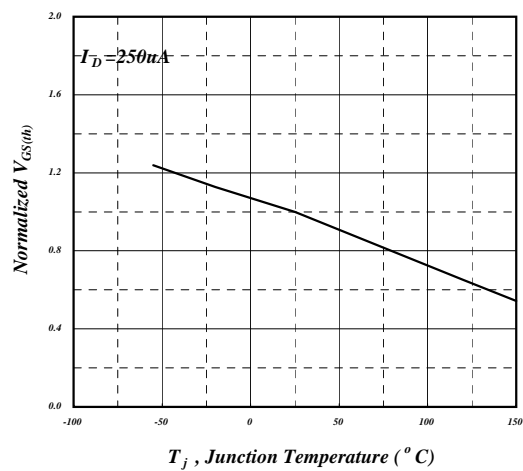


Fig 6. Gate Threshold Voltage v.s. Junction Temperature



# AP4804MT

## Channel-2

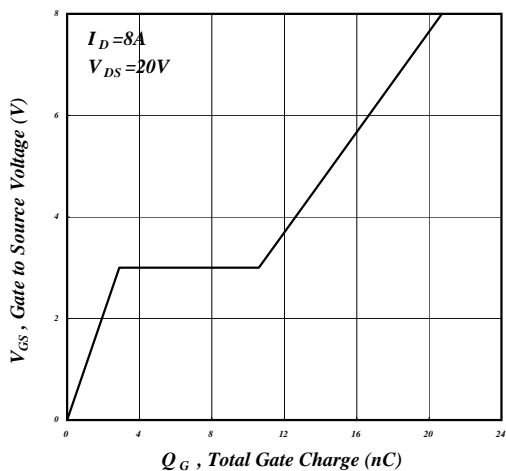


Fig 7. Gate Charge Characteristics

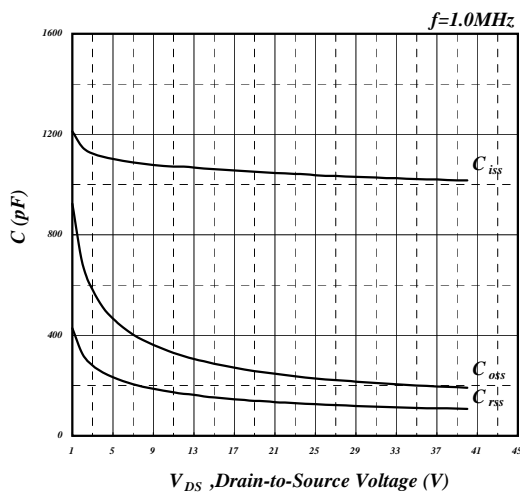


Fig 8. Typical Capacitance Characteristics

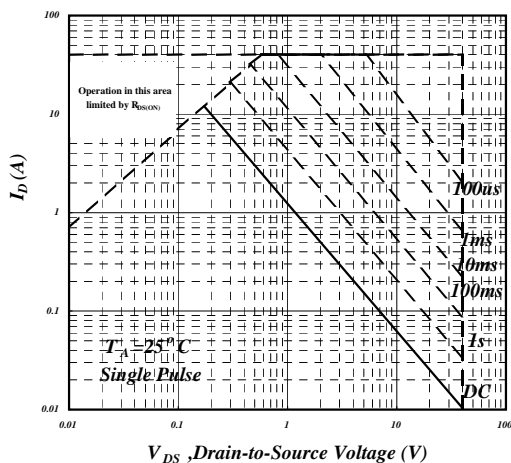


Fig 9. Maximum Safe Operating Area

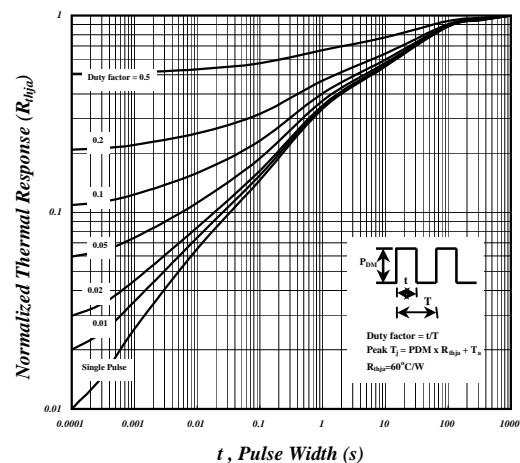


Fig 10. Effective Transient Thermal Impedance

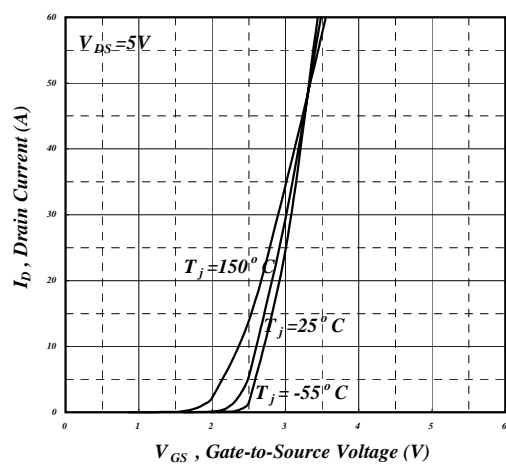


Fig 11. Transfer Characteristics

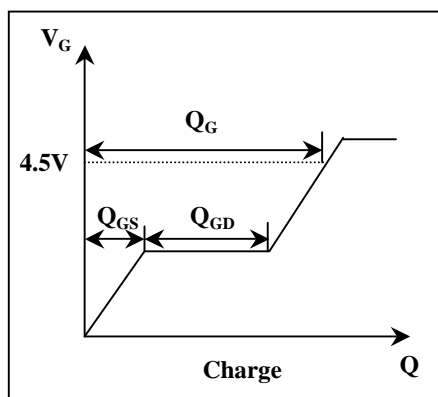
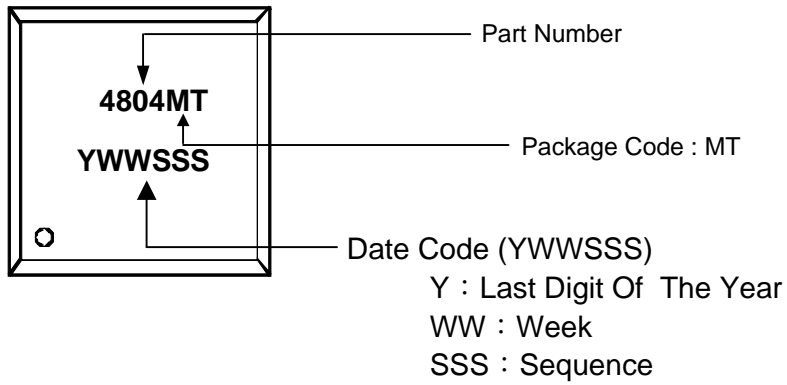


Fig 12. Gate Charge Waveform



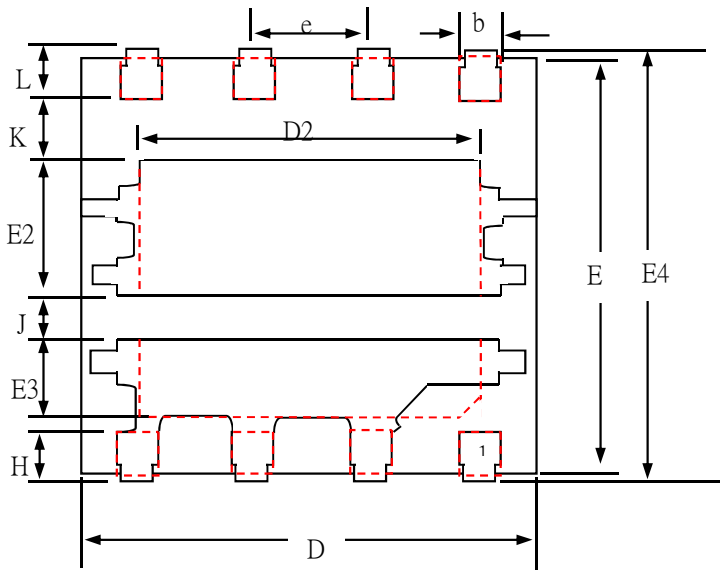
## MARKING INFORMATION



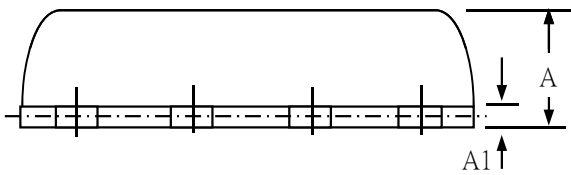




## Package Outline : PMPAK 5x6 (Dual Pad)



BACKSIDE VIEW



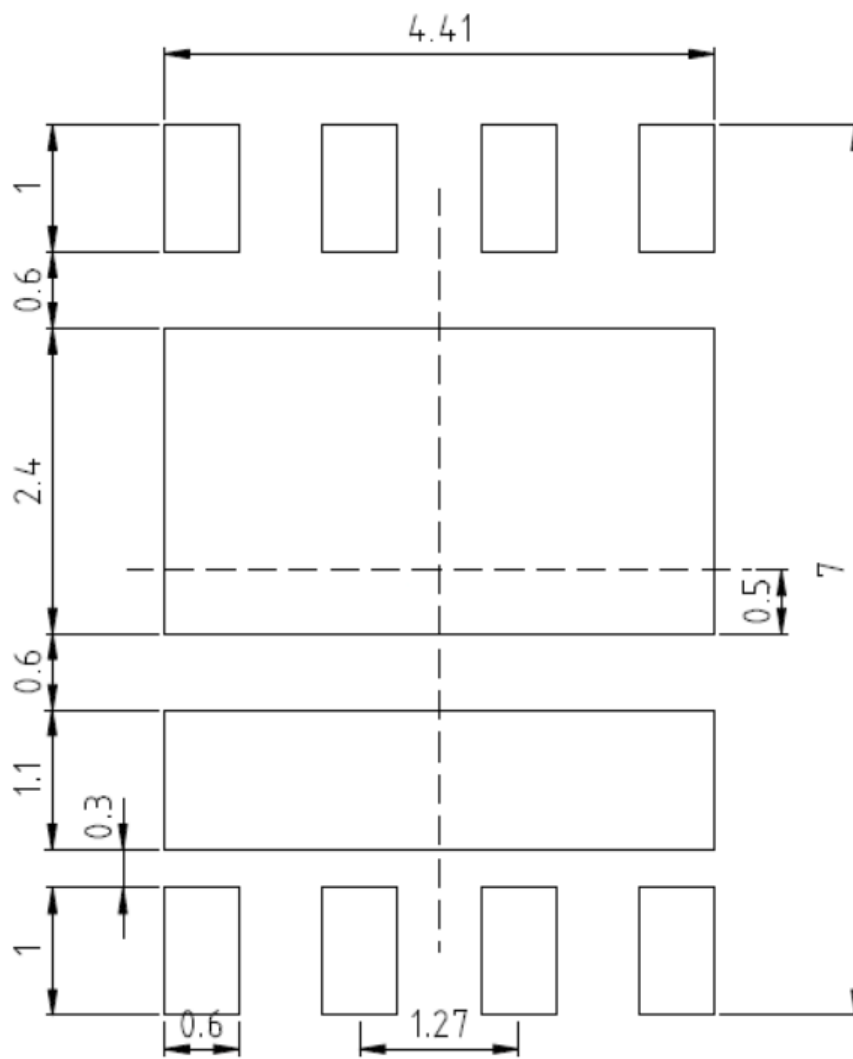
SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	0.70	0.90	1.10
b	0.33	0.45	0.56
A1	0.15	0.23	0.30
D	4.80	4.93	5.05
D2	3.61	3.79	3.96
E4	5.70	5.90	6.10
E	5.70	5.88	6.05
E2	2.02	2.22	2.42
E3	0.87	1.09	1.30
e	1.27 BSC		
J	0.40	0.55	0.70
H	0.38	0.50	0.61
K	0.50	0.75	1.00
L	0.38	0.55	0.71

1.All Dimension Are In Millimeters.

2.Dimension Does Not Include Mold Protrusions.



**PMPAK5X6(Dual Pad,上下) FOOTPRINT :**



UNIT: mm