

## 40V N-Channel Enhancement Mode MOSFET

### Description

The AP10N04MSI uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

### General Features

$V_{DS} = 40V$   $I_D = 10A$

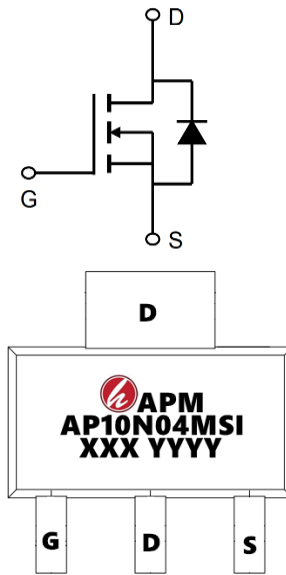
$R_{DS(ON)} < 20m\Omega @ V_{GS}=10V$  (Type: 15m $\Omega$ )

### Application

Automotive lighting

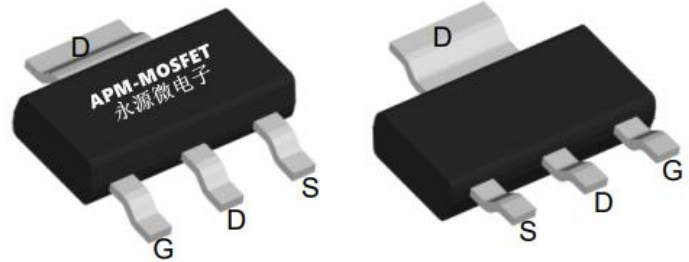
Load switch

Uninterruptible power supply



Top View

Bottom View



### Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
AP10N04MSI	SOT223-3L	AP10N04MSI XXX YYYYY	3000

### Absolute Maximum Ratings (TC=25°C unless otherwise noted)

Symbol	Parameter	Rating	Units
V <sub>DS</sub>	Drain-Source Voltage	40	V
V <sub>GS</sub>	Gate-Source Voltage	±20	V
I <sub>D</sub> @T <sub>A</sub> =25°C	Continuous Drain Current <sup>1</sup>	10	A
I <sub>D</sub> @T <sub>A</sub> =70°C	Continuous Drain Current <sup>1</sup>	6.7	A
IDM	Pulsed Drain Current <sup>2</sup>	50	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	31	mJ
IAS	Avalanche Current	25	A
P <sub>D</sub> @T <sub>A</sub> =25°C	Total Power Dissipation <sup>4</sup>	1.9	W
TSTG	Storage Temperature Range	-55 to 150	°C
T <sub>J</sub>	Operating Junction Temperature Range	-55 to 150	°C
R <sub>θJA</sub>	Thermal Resistance Junction-ambient <sup>1</sup>	65	°C/W

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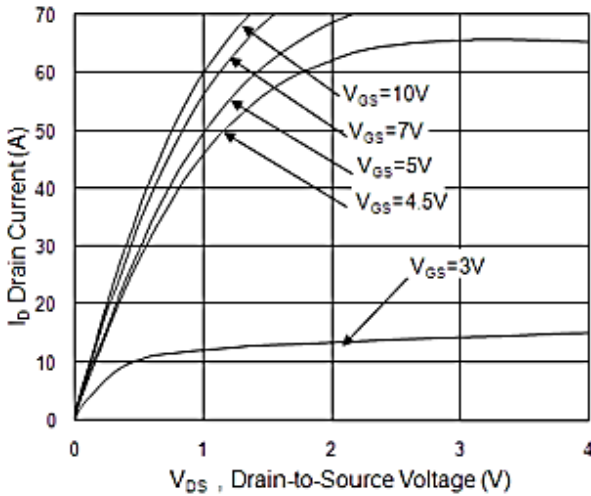
### Electrical Characteristics@T<sub>J</sub>=25°C(unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA	40	44	---	V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	BVDSS Temperature Coefficient	Reference to 25°C, I <sub>D</sub> =1mA	---	0.032	---	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	---	15	20	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =6A	---	18	25	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA	1.0	---	2.5	V
ΔV <sub>GS(th)</sub>	V <sub>GS(th)</sub> Temperature Coefficient		---	-4.8	---	mV/°C
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =32V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	---	---	1	uA
		V <sub>DS</sub> =32V, V <sub>GS</sub> =0V, T <sub>J</sub> =55°C	---	---	5	
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	---	---	±100	nA
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =7A	---	32	---	S
R <sub>g</sub>	Gate Resistance	V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz	---	2.1	---	Ω
Q <sub>g</sub>	Total Gate Charge (4.5V)	V <sub>DS</sub> =32V, V <sub>GS</sub> =4.5V, I <sub>D</sub> =7A	---	9.8	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	2.8	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	3.9	---	
T <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =20V, V <sub>GS</sub> =10V, R <sub>G</sub> =3.3Ω I <sub>D</sub> =7A	---	2.8	---	ns
T <sub>r</sub>	Rise Time		---	40.4	---	
T <sub>d(off)</sub>	Turn-Off Delay Time		---	22.8	---	
T <sub>f</sub>	Fall Time		---	6.4	---	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, f=1MHz	---	1013	---	pF
C <sub>oss</sub>	Output Capacitance		---	107	---	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	76	---	
I <sub>S</sub>	Continuous Source Current <sup>1,5</sup>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	8.4	A
I <sub>SM</sub>	Pulsed Source Current <sup>2,5</sup>	V <sub>GS</sub> =0V, I <sub>S</sub> =1A, T <sub>J</sub> =25°C	---	---	50	A
V <sub>SD</sub>	Diode Forward Voltage <sup>2</sup>		---	---	1	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> =7A, dI/dt=100A/μs, T <sub>J</sub> =25°C	---	10	---	nS
Q <sub>rr</sub>	Reverse Recovery Charge		---	3.3	---	nC

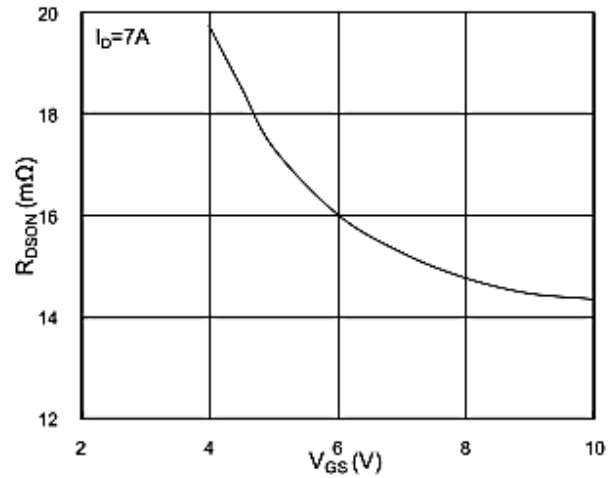
#### Note :

- 1、 The data tested by surface mounted on a 1 inch 2 FR-4 board with 2OZ copper.
- 2、 The data tested by pulsed , pulse width ≤ 300us , duty cycle ≤ 2%
- 3、 The power dissipation is limited by 150°C junction temperature
- 4、 The data is theoretically the same as I<sub>D</sub> and I<sub>DM</sub> , in real applications , should be limited by total power dissipation.

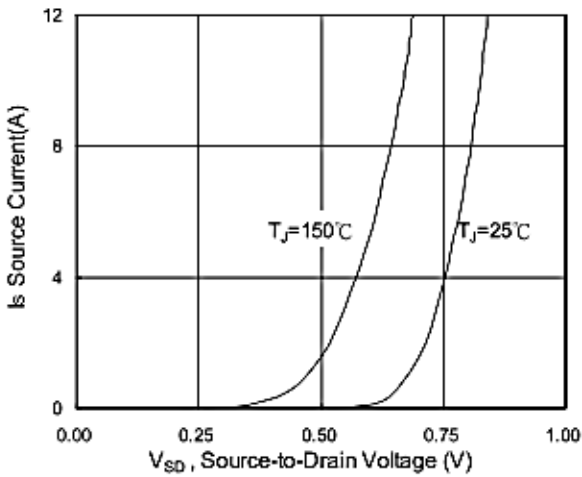
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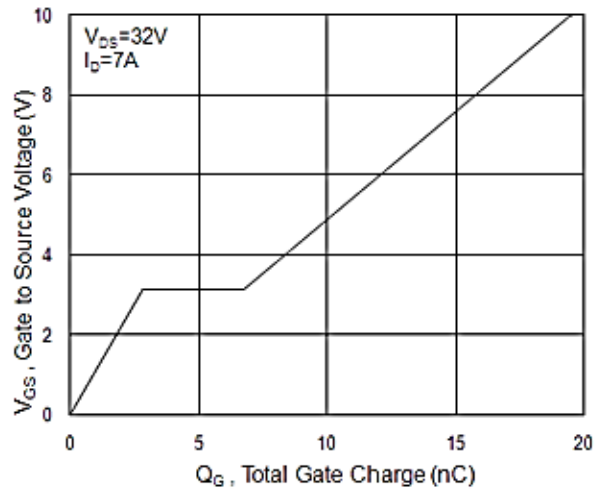
**Fig.1 Typical Output Characteristics**



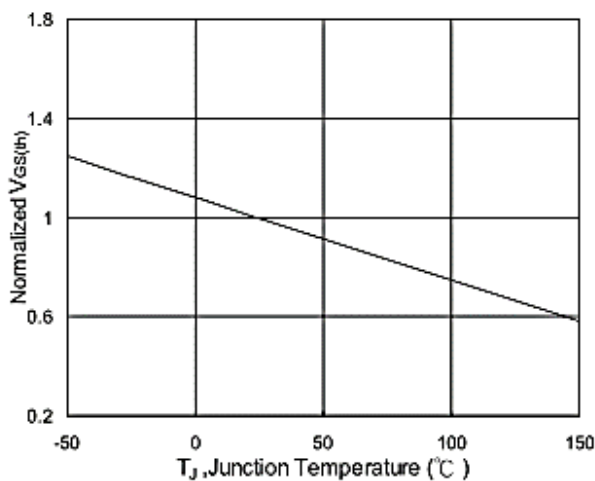
**Fig.2 On-Resistance vs. G-S Voltage**



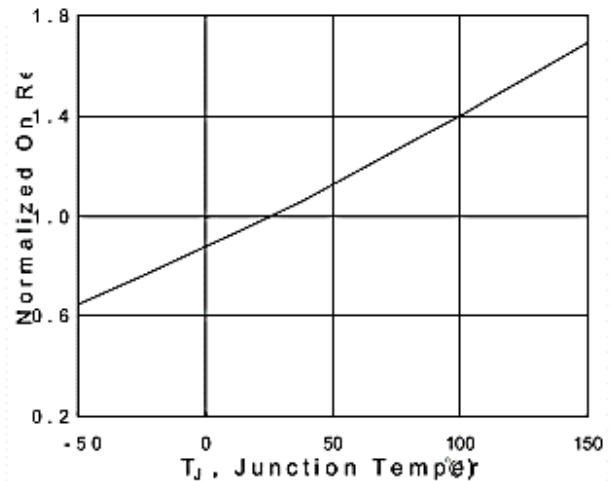
**Fig.3 Forward Characteristics of Reverse**



**Fig.4 Gate-Charge Characteristics**

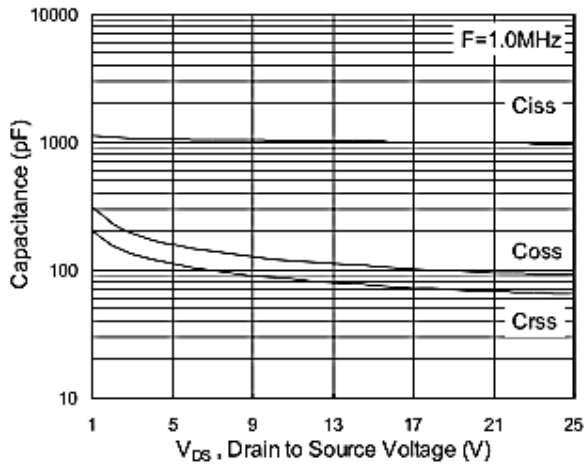


**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**

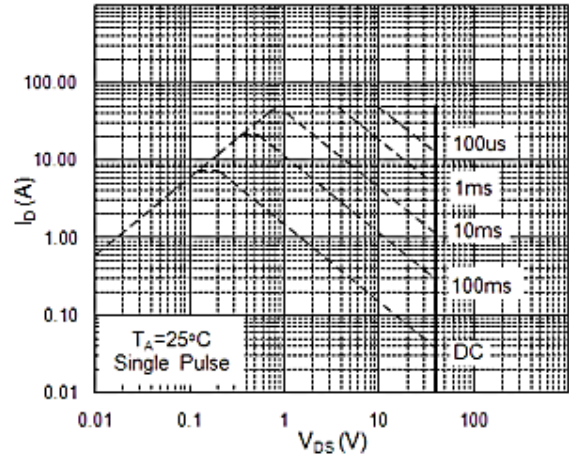


**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**

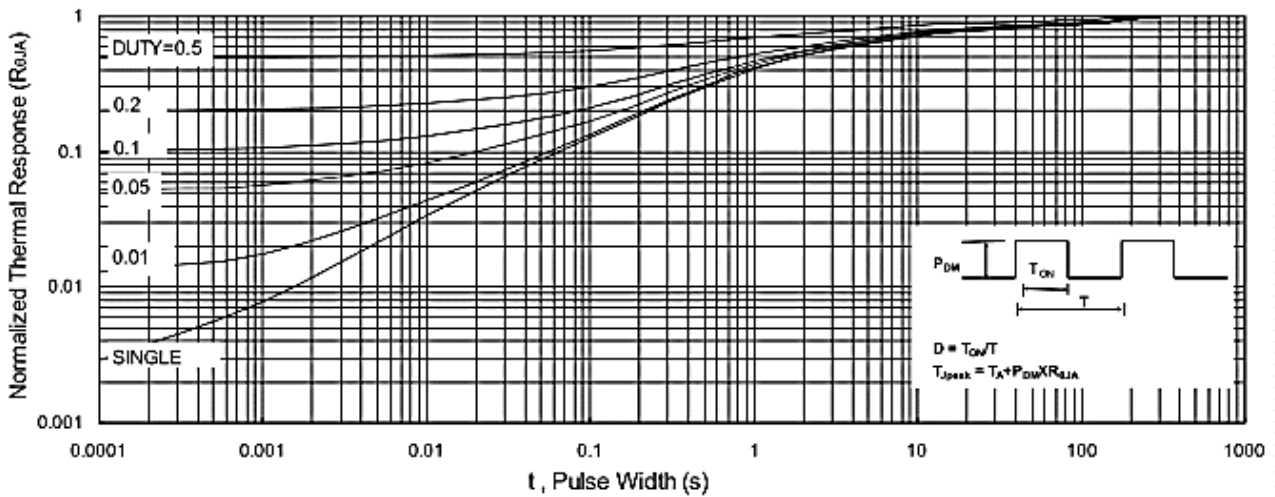
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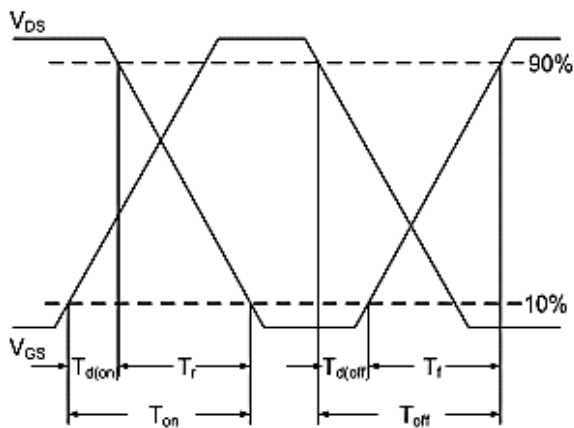
**Fig.7 Capacitance**



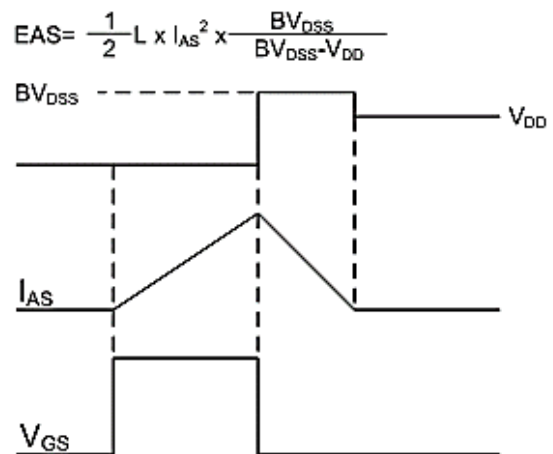
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**



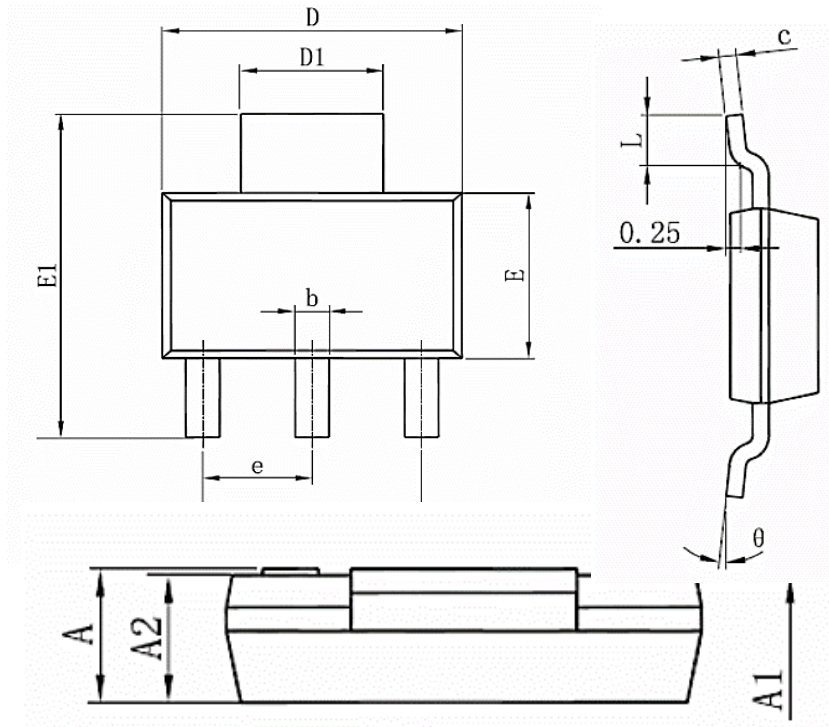
**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Switching Waveform**

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### Package Mechanical Data:SOT223-3L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.52	1.8	0.06	0.049
A1	0.000	0.100	0.000	0.004
A2	1.5	1.7	0.059	0.045
b	0.66	0.82	0.026	0.032
c	0.25	0.35	0.010	0.014
D	6.2	6.4	0.244	0.252
D1	2.9	3.1	0.114	0.122
E	3.3	3.7	0.130	0.146
E1	6.83	7.07	0.269	0.278
e	2.300(BSC)		0.037(BSC)	
e1	4.500	4.700	0.177	0.185
L	0.900	1.15	0.035	0.045
θ	0°	10°	0°	10°

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Edition	Date	Change
Rve1.0	2021/1/31	Initial release

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