

## AP9980M-VB Datasheet

### N-Channel 80 V (D-S) MOSFET

PRODUCT SUMMARY			
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
80	0.062 at $V_{GS} = 10$ V	3.5	7.3 nC

#### FEATURES

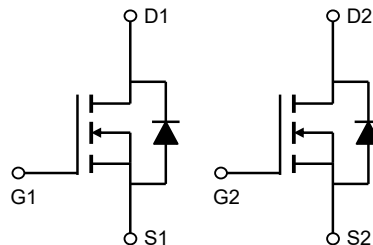
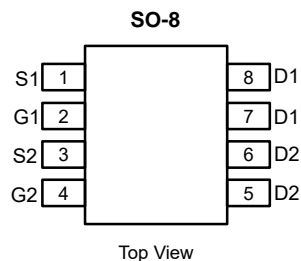
- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 %  $R_g$  and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

#### APPLICATIONS

- DC/DC Conversion  
- Notebook System Power



#### Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	80	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	V
Continuous Drain Current	$I_D$	3.5	A
		2.9	
Pulsed Drain Current <sup>c</sup>	$I_{DM}$	18	
Avalanche Current <sup>c</sup>	$I_{AR}$	16	A
Repetitive avalanche energy $L=0.1\text{mH}$ <sup>c</sup>	$E_{AR}$	12.8	mJ
Power Dissipation <sup>b</sup>	$P_D$	2	W
		1.3	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$

#### Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	48	62.5	$^\circ\text{C/W}$
Maximum Junction-to-Ambient <sup>A,D</sup>		74	90	$^\circ\text{C/W}$
Maximum Junction-to-Lead	$R_{\theta JL}$	32	40	$^\circ\text{C/W}$

Electrical Characteristics ( $T_J=25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$	80			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=80\text{V}$ , $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			1 5	$\mu\text{A}$
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 30\text{V}$			100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$	3.5	4.2	5	V
$I_{D(ON)}$	On state drain current	$V_{GS}=10\text{V}$ , $V_{DS}=5\text{V}$	18			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}$ , $I_D=3.5\text{A}$ $T_J=125^\circ\text{C}$		62 113.0		m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=5\text{V}$ , $I_D=3.5\text{A}$		15		S
$V_{SD}$	Diode Forward Voltage	$I_S=1\text{A}$ , $V_{GS}=0\text{V}$		0.77	1	V
$I_S$	Maximum Body-Diode Continuous Current				2.5	A
$I_{SM}$	Pulsed Body-diode Current <sup>C</sup>				18	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=40\text{V}$ , $f=1\text{MHz}$	510	640	770	pF
$C_{oss}$	Output Capacitance		28	40	52	pF
$C_{rss}$	Reverse Transfer Capacitance		12	20	30	pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$	0.9	1.8	2.7	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_{g(10V)}$	Total Gate Charge	$V_{GS}=10\text{V}$ , $V_{DS}=40\text{V}$ , $I_D=3.5\text{A}$	8	11	13	nC
$Q_{g(4.5V)}$	Total Gate Charge		4	5.5	7	
$Q_{gs}$	Gate Source Charge		4	5	6	nC
$Q_{gd}$	Gate Drain Charge		0.7	1.2	1.7	nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=10\text{V}$ , $V_{DS}=40\text{V}$ , $R_L=8\Omega$ , $R_{GEN}=3\Omega$		7.2		ns
$t_r$	Turn-On Rise Time			2.2		ns
$t_{D(off)}$	Turn-Off DelayTime			17		ns
$t_f$	Turn-Off Fall Time			2		ns
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F=3.5\text{A}$ , $dI/dt=300\text{A}/\mu\text{s}$	14	20	26	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=3.5\text{A}$ , $dI/dt=300\text{A}/\mu\text{s}$	35	50	65	nC

A. The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The value in any given application depends on the user's specific board design.

B. The power dissipation  $P_D$  is based on  $T_{J(MAX)}=150^\circ\text{C}$ , using  $\leq 10\text{s}$  junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature  $T_{J(MAX)}=150^\circ\text{C}$ . Ratings are based on low frequency and duty cycles to keep initial  $T_J=25^\circ\text{C}$ .

D. The  $R_{\theta JA}$  is the sum of the thermal impedance from junction to lead  $R_{\theta JL}$  and lead to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using  $<300\mu\text{s}$  pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in<sup>2</sup> FR-4 board with

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

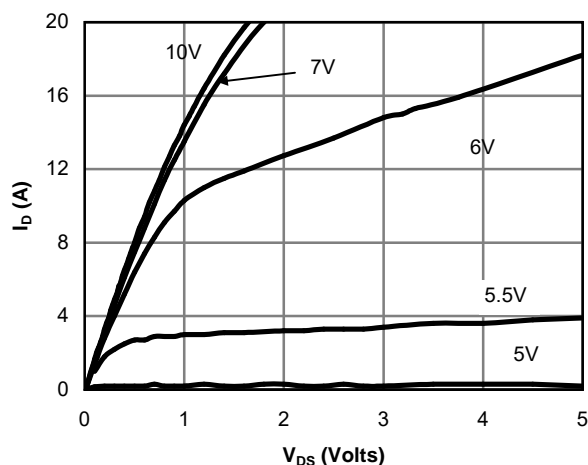


Fig 1: On-Region Characteristics (Note E)

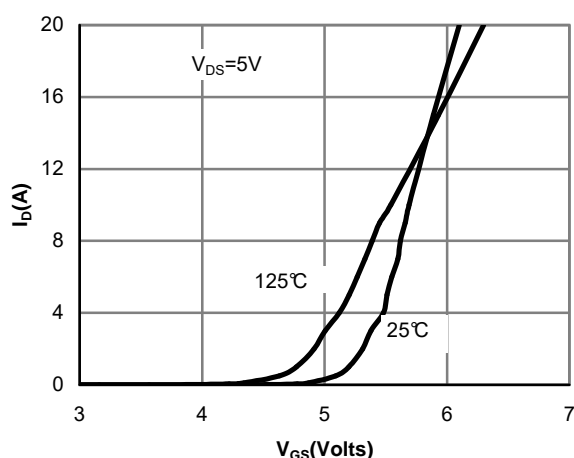


Figure 2: Transfer Characteristics (Note E)

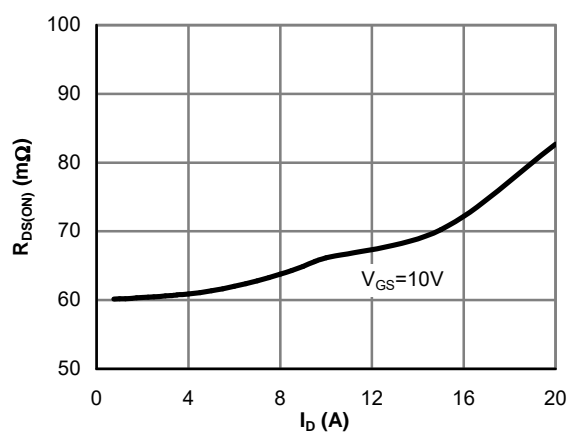


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

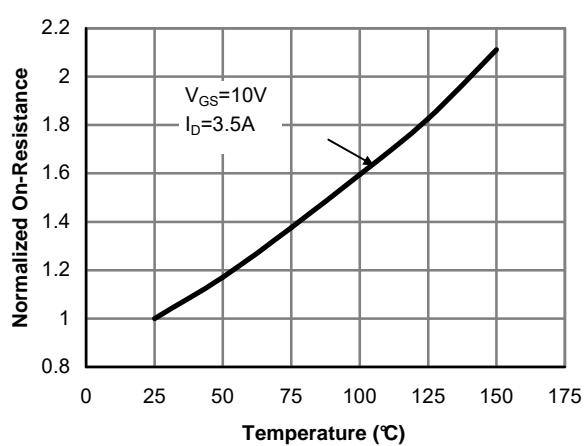


Figure 4: On-Resistance vs. Junction Temperature (Note E)

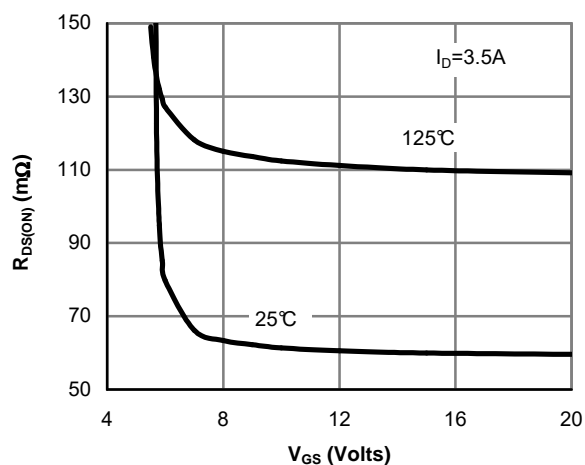


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

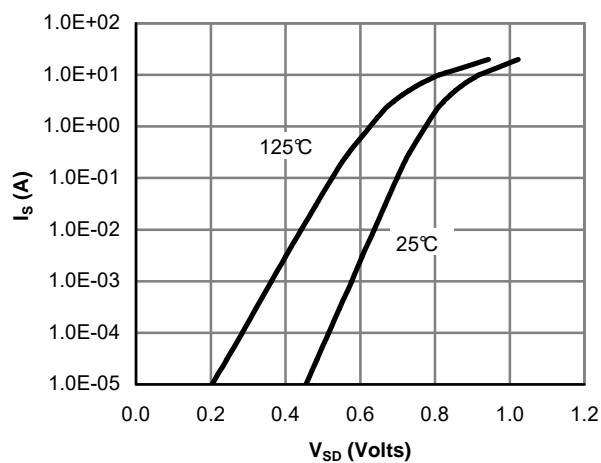
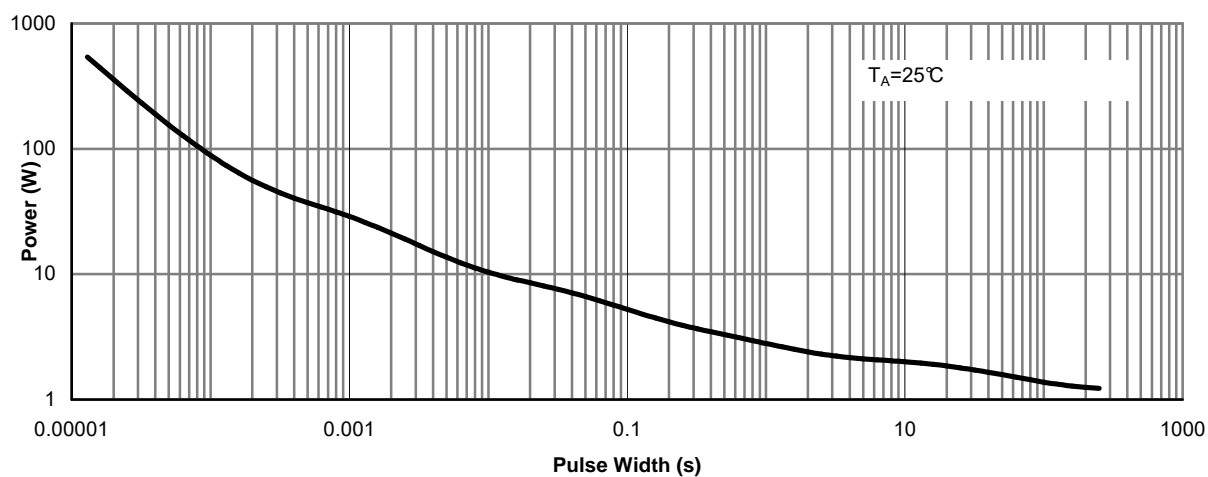
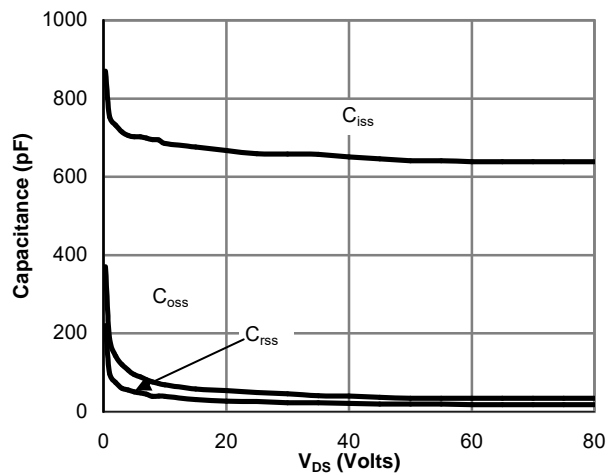


Figure 6: Body-Diode Characteristics (Note E)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



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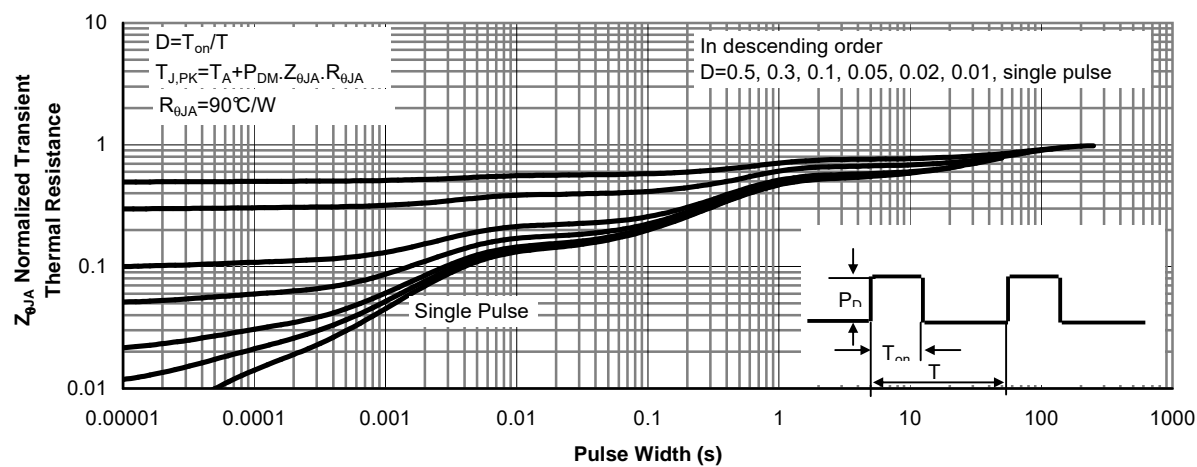
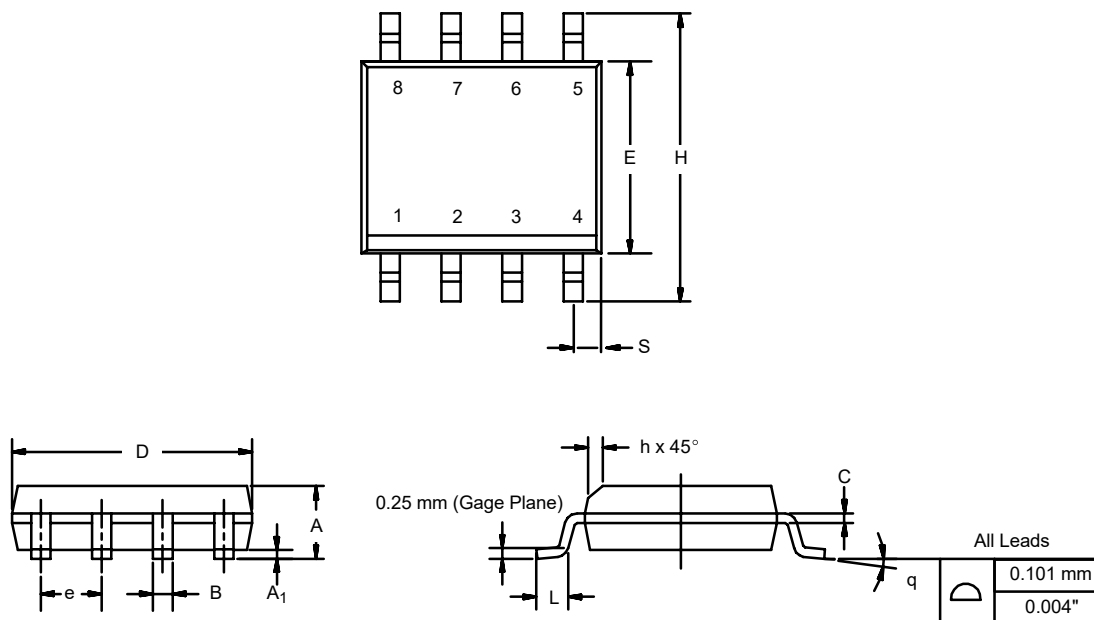


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

**SOIC (NARROW): 8-LEAD**

JEDEC Part Number: MS-012



DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A <sub>1</sub>	0.10	0.20	0.004	0.008
B	0.35	0.51	0.014	0.020
C	0.19	0.25	0.0075	0.010
D	4.80	5.00	0.189	0.196
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.020
L	0.50	0.93	0.020	0.037
q	0°	8°	0°	8°
S	0.44	0.64	0.018	0.026

ECN: C-06527-Rev. I, 11-Sep-06  
DWG: 5498

RECOMMENDED MINIMUM PADS FOR SO-8



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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APPLICATION NOTE

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