

AP9960AGM-VB Datasheet

Dual N-Channel 30 V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^a	Q_g (Typ.)
30	0.016 at $V_{GS} = 10$ V	8.5	7.1
	0.020 at $V_{GS} = 4.5$ V	7.6	

FEATURES

- Trench Power MOSFET
- 100 % R_g Tested
- 100 % UIS Tested
- Compliant to RoHS Directive 2002/95/EC


RoHS
 COMPLIANT

APPLICATIONS

- Notebook System Power
- Low Current DC/DC



ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$, unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	30	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current ($T_J = 150^\circ\text{C}$)	I_D	$T_C = 25^\circ\text{C}$	A
		$T_C = 70^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	
		$T_A = 70^\circ\text{C}$	
Pulsed Drain Current	I_{DM}	30	A
Source-Drain Current Diode Current	I_S	$T_C = 25^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	
Pulsed Source-Drain Current	I_{SM}	30	
Single Pulse Avalanche Current	I_{AS}	10	W
Single Pulse Avalanche Energy	E_{AS}	L = 0.1 mH	
Maximum Power Dissipation	P_D	$T_C = 25^\circ\text{C}$	
		$T_C = 70^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	
		$T_A = 70^\circ\text{C}$	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 150	$^\circ\text{C}$

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typ.	Max.	Unit
Maximum Junction-to-Ambient ^{b, d}	R_{thJA}	52	62.5	$^\circ\text{C/W}$
Maximum Junction-to-Foot (Drain)	R_{thJF}	30	40	

Notes:

 a. Based on $T_C = 25^\circ\text{C}$.

b. Surface mounted on 1" x 1" FR4 board.

 c. $t = 10$ s.

 d. Maximum under steady state conditions is 110°C/W .

SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA	30			V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA		3.0		mV/°C
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J	I _D = 250 μA		- 5.2		
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	1.2		2.5	V
Gate-Body Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V			100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 30 V, V _{GS} = 0 V			1	μA
		V _{DS} = 30 V, V _{GS} = 0 V, T _J = 55 °C			10	
On -State Drain Current ^b	I _{D(on)}	V _{DS} = 5 V, V _{GS} = 10 V	20			A
Drain-Source On-State Resistance ^b	R _{DS(on)}	V _{GS} = 10 V, I _D = 8 A		0.016		Ω
		V _{GS} = 4.5 V, I _D = 5 A		0.020		
Forward Transconductance ^b	g _{fs}	V _{DS} = 15 V, I _D = 8 A		27		S
Dynamic ^a						
Input Capacitance	C _{iss}	V _{DS} = 15 V, V _{GS} = 0 V, I _D = 1 MHz		660		pF
Output Capacitance	C _{oss}			140		
Reverse Transfer Capacitance	C _{rss}			86		
Total Gate Charge	Q _g	V _{DS} = 15 V, V _{GS} = 10 V, I _D = 8 A		14.5	22	nC
		V _{DS} = 15 V, V _{GS} = 4.5 V, I _D = 8 A		7.1	11	
Gate-Source Charge	Q _{gs}			1.9		
Gate-Drain Charge	Q _{gd}			2.7		
Gate Resistance	R _g	f = 1 MHz	0.5	2.6	5.2	Ω
Turn-On Delay Time	t _{d(on)}	V _{DD} = 15 V, R _L = 3 Ω I _D ≅ 5 A, V _{GEN} = 4.5 V, R _g = 1 Ω		14	28	ns
Rise Time	t _r			45	80	
Turn-Off Delay Time	t _{d(off)}			18	35	
Fall Time	t _f			12	24	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 15 V, R _L = 3 Ω I _D ≅ 5 A, V _{GEN} = 10 V, R _g = 1 Ω		7	14	
Rise Time	t _r			10	20	
Turn-Off Delay Time	t _{d(off)}			15	30	
Fall Time	t _f			7	14	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C			2.8	A
Pulse Diode Forward Current ^a	I _{SM}				30	
Body Diode Voltage	V _{SD}	I _S = 2 A		0.77	1.1	V
Body Diode Reverse Recovery Time	t _{rr}	I _F = 5 A, dI/dt = 100 A/μs, T _J = 25 °C		17	34	ns
Body Diode Reverse Recovery Charge	Q _{rr}			9	18	nC
Reverse Recovery Fall Time	t _a			10		nS
Reverse Recovery Rise Time	t _b			7		

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Output Characteristics



Transfer Characteristics



On-Resistance vs. Drain Current and Gate Voltage



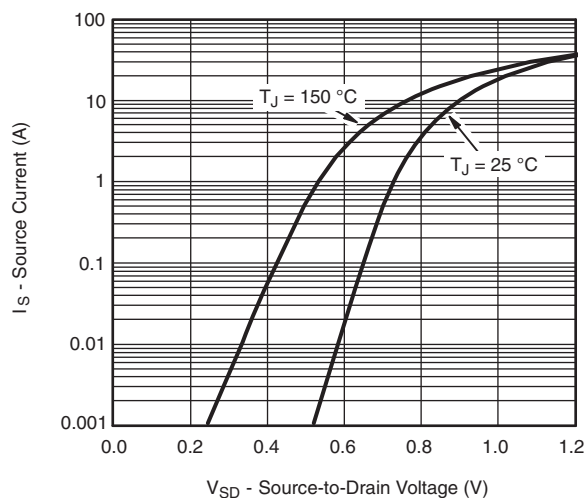
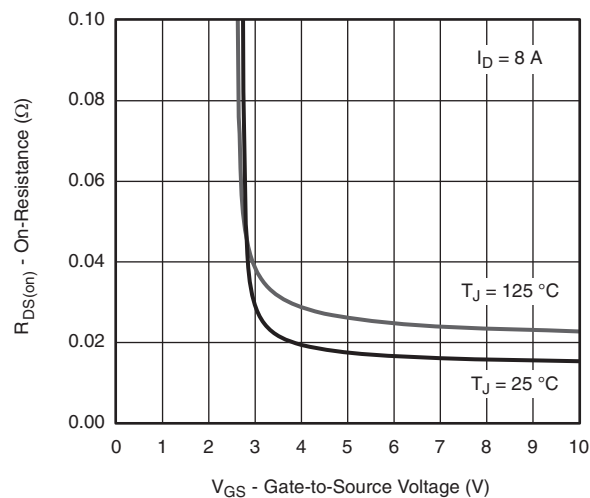
Capacitance



Gate Charge



On-Resistance vs. Junction Temperature

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Source-Drain Diode Forward Voltage

On-Resistance vs. Gate-to-Source Voltage

Threshold Voltage

Single Pulse Power, Junction-to-Ambient


* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

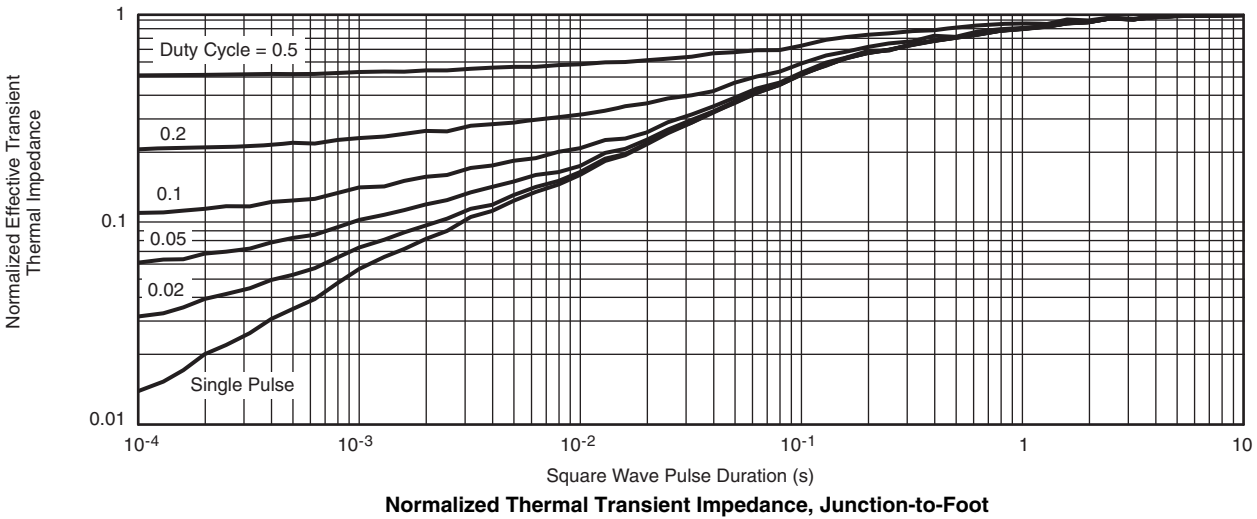
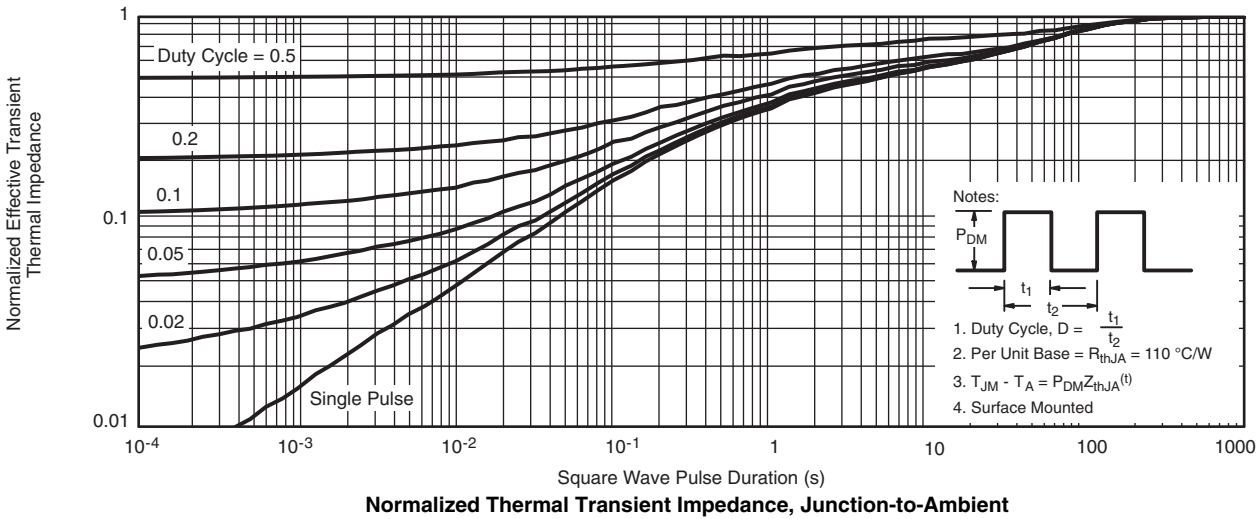
Current Derating*

Power Derating, Junction-to-Foot

Power Derating, Junction-to-Ambient

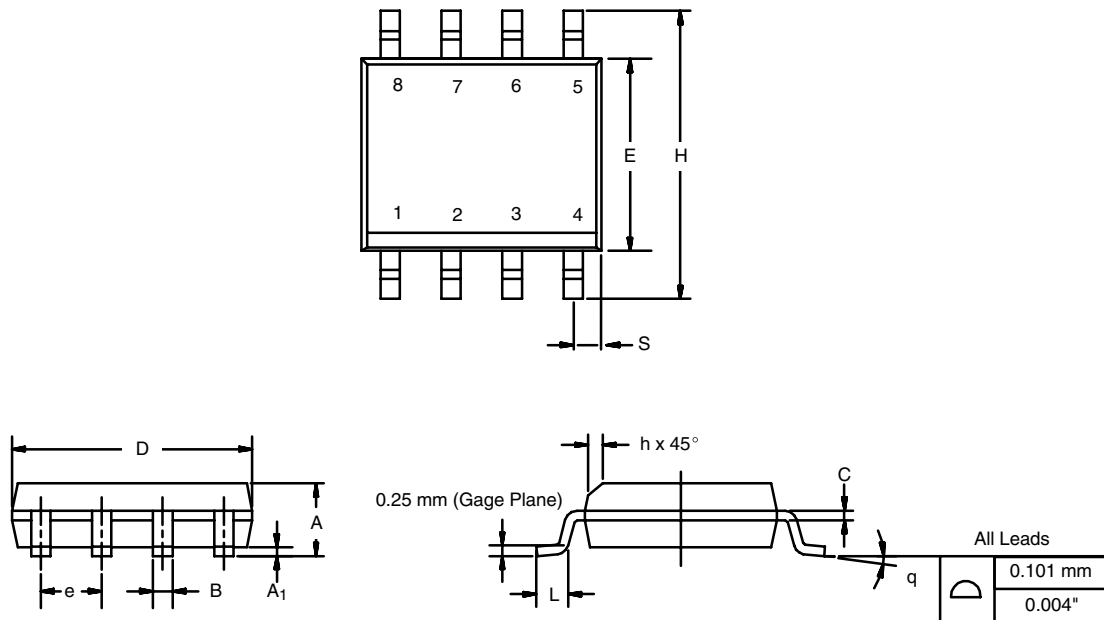
* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



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 ₁	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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