

AP9404GM-HF-VB Datasheet

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

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^a	Q_g (Typ.)
30	0.008 at $V_{GS} = 10$ V	13	6.1 nC
	0.011 at $V_{GS} = 4.5$ V	11	

FEATURES

- Halogen-free
- Trench Power MOSFET
- Optimized for High-Side Synchronous Rectifier Operation
- 100 % R_g Tested
- 100 % UIS Tested


RoHS
 COMPLIANT

APPLICATIONS

- Notebook CPU Core
- High-Side Switch



N-Channel MOSFET

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 ($T_J = 150^\circ\text{C}$)	$T_C = 25^\circ\text{C}$	13	A
	$T_C = 70^\circ\text{C}$	10	
	$T_A = 25^\circ\text{C}$	9 ^{b, c}	
	$T_A = 70^\circ\text{C}$	7 ^{b, c}	
Pulsed Drain Current	I_{DM}	45	mJ
Continuous Source-Drain Diode Current	$T_C = 25^\circ\text{C}$	3.7	
	$T_A = 25^\circ\text{C}$	2.0 ^{b, c}	
Single Pulse Avalanche Current	$L = 0.1$ mH	20	mJ
Avalanche Energy	E_{AS}	21	
Maximum Power Dissipation	$T_C = 25^\circ\text{C}$	4.1	W
	$T_C = 70^\circ\text{C}$	2.5	
	$T_A = 25^\circ\text{C}$	2.2 ^{b, c}	
	$T_A = 70^\circ\text{C}$	1.3 ^{b, c}	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 150	$^\circ\text{C}$

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^{b, d}	R_{thJA}	39	55	$^\circ\text{C/W}$
Maximum Junction-to-Foot (Drain)	R_{thJF}	25	29	

Notes:

 a. Base 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 85°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		26		mV/°C
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J			- 6		
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	1.0		3.0	V
Gate-Source 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 ^a	I _{D(on)}	V _{DS} ≥ 5 V, V _{GS} = 10 V	20			A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 10 V, I _D = 10 A		0.008		Ω
		V _{GS} = 4.5 V, I _D = 9 A		0.011		
Forward Transconductance ^a	g _{fs}	V _{DS} = 15 V, I _D = 10 A		50		S
Dynamic ^b						
Input Capacitance	C _{iss}	V _{DS} = 15 V, V _{GS} = 0 V, f = 1 MHz		800		pF
Output Capacitance	C _{oss}			165		
Reverse Transfer Capacitance	C _{rss}			73		
Total Gate Charge	Q _g	V _{DS} = 15 V, V _{GS} = 10 V, I _D = 10 A		15	23	nC
		V _{DS} = 15 V, V _{GS} = 5 V, I _D = 10 A		6.8	10.2	
Gate-Source Charge	Q _{gs}			2.5		
Gate-Drain Charge	Q _{gd}			2.3		
Gate Resistance	R _g	f = 1 MHz	0.36	1.8	3.6	Ω
Turn-On Delay Time	t _{d(on)}	V _{DD} = 15 V, R _L = 1.4 Ω I _D ≅ 9 A, V _{GEN} = 4.5 V, R _g = 1 Ω		16	23	ns
Rise Time	t _r			12	16	
Turn-Off Delay Time	t _{d(off)}			16	22	
Fall Time	t _f			10	18	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 15 V, R _L = 1.4 Ω I _D ≅ 9 A, V _{GEN} = 10 V, R _g = 1 Ω		8	16	
Rise Time	t _r			10	20	
Turn-Off Delay Time	t _{d(off)}			16	22	
Fall Time	t _f			8	15	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C			10	A
Pulse Diode Forward Current ^a	I _{SM}				50	
Body Diode Voltage	V _{SD}	I _S = 9 A		0.8	1.2	V
Body Diode Reverse Recovery Time	t _{rr}	I _F = 9 A, di/dt = 100 A/μs, T _J = 25 °C		15	30	ns
Body Diode Reverse Recovery Charge	Q _{rr}			6	12	nC
Reverse Recovery Fall Time	t _a			8		ns
Reverse Recovery Rise Time	t _b			7		

Notes:

a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

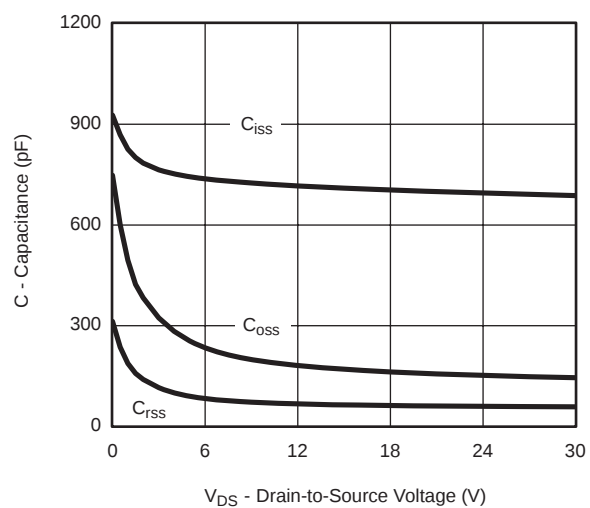
b. Guaranteed by design, not subject to production testing.

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

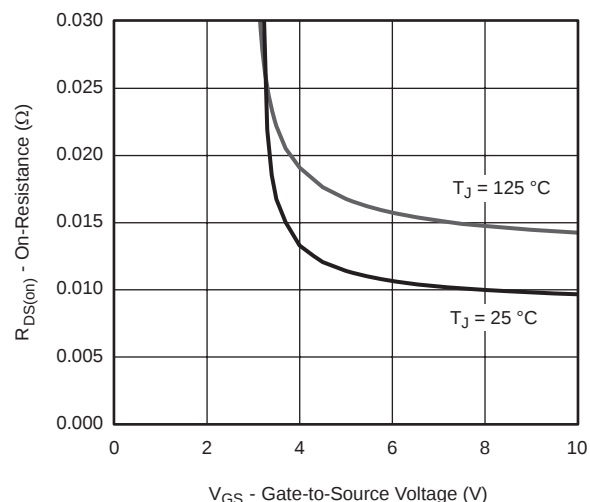
Gate Charge

On-Resistance vs. Junction Temperature

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



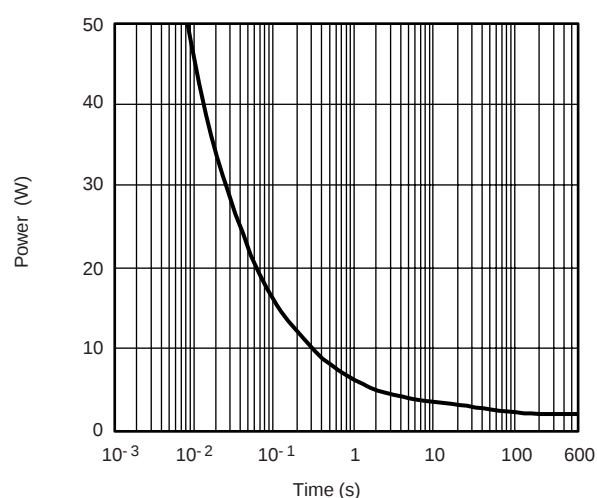
Source-Drain Diode Forward Voltage



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



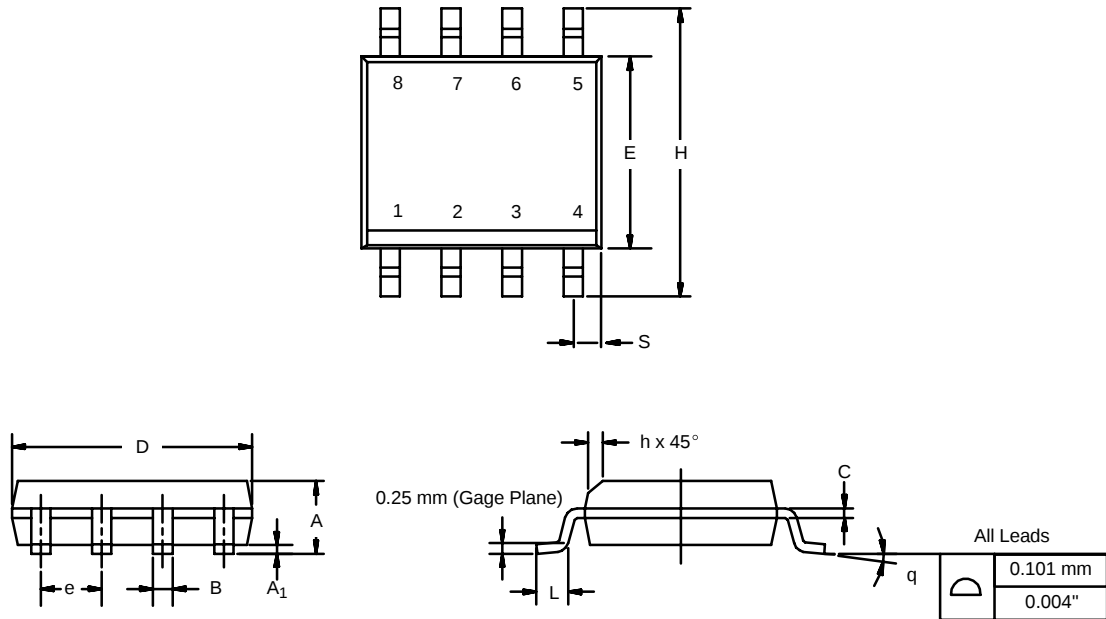
* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Normalized Thermal Transient Impedance, Junction-to-Ambient

Normalized Thermal Transient Impedance, Junction-to-Foot

SOIC (NARROW): 8-LEAD



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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