

## AP9972GS-HF-VB Datasheet

### N-Channel 60-V (D-S) MOSFET

#### PRODUCT SUMMARY

$V_{DS}$	60	V
$R_{DS(on)} V_{GS} = 10\text{ V}$	11	$m\Omega$
$R_{DS(on)} V_{GS} = 4.5\text{ V}$	12	$m\Omega$
$I_D$	75	A
Configuration	Single	

#### FEATURES

- 175 °C Junction Temperature
- Trench Power MOSFET



**RoHS**  
COMPLIANT



N-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current ( $T_J = 175\text{ }^\circ\text{C}$ ) <sup>b</sup>	$I_D$	75	A
		50 <sup>a</sup>	
Pulsed Drain Current	$I_{DM}$	200	
Continuous Source Current (Diode Conduction)	$I_S$	50 <sup>a</sup>	
Avalanche Current	$I_{AS}$	50	
Single Avalanche Energy (Duty Cycle $\leq 1\%$ )	$E_{AS}$	125	mJ
Maximum Power Dissipation	$P_D$	136	W
		3 <sup>b</sup> , 8.3 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 175	$^\circ\text{C}$

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>a</sup>	$R_{thJA}$	15	18	$^\circ\text{C/W}$
		40	50	
Maximum Junction-to-Case	$R_{thJC}$	0.85	1.1	

Notes:

a. Package limited.

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

c.  $t \leq 10\text{ s}$ .

SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ. <sup>a</sup>	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	60			V
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1		3	
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C			50	
		V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175 °C			250	
On-State Drain Current <sup>b</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 10 V	60			A
Drain-Source On-State Resistance <sup>b</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A		0.011		Ω
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A, T <sub>J</sub> = 125 °C		0.016		
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A, T <sub>J</sub> = 175 °C		0.020		
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 15 A		0.012		
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 20 A		60		S
Dynamic						
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1 MHz		4300		pF
Output Capacitance	C <sub>oss</sub>			470		
Reverse Transfer Capacitance	C <sub>rss</sub>			225		
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 50 A		47		nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>			10		
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			12		
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = 30 V, R <sub>L</sub> = 0.6 Ω I <sub>D</sub> ≅ 50 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 2.5 Ω		10	20	ns
Rise Time <sup>c</sup>	t <sub>r</sub>			15	25	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			35	50	
Fall Time <sup>c</sup>	t <sub>f</sub>			20	30	
Source-Drain Diode Ratings and Characteristics (T <sub>C</sub> = 25 °C)						
Pulsed Current	I <sub>SM</sub>				60	A
Diode Forward Voltage	V <sub>SD</sub>	I <sub>F</sub> = 20 A, V <sub>GS</sub> = 0 V		1	1.5	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 20 A, di/dt = 100 A/μs		45	100	ns

Notes:

- a. For design aid only; not subject to production testing.  
 b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 c. Independent of operating temperature.

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 noted)



Output Characteristics



Transfer Characteristics



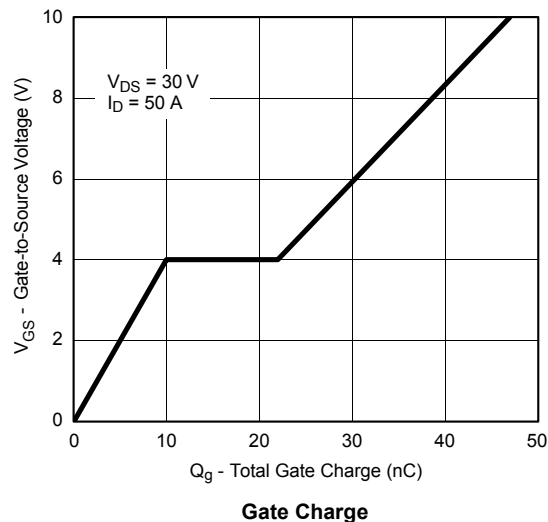
Transconductance



$R_{DS(on)}$  vs. Drain Current



Capacitance



Gate Charge

**TYPICAL CHARACTERISTICS** (25 °C unless noted)**On-Resistance vs. Junction Temperature****Source-Drain Diode Forward Voltage**

## THERMAL RATINGS



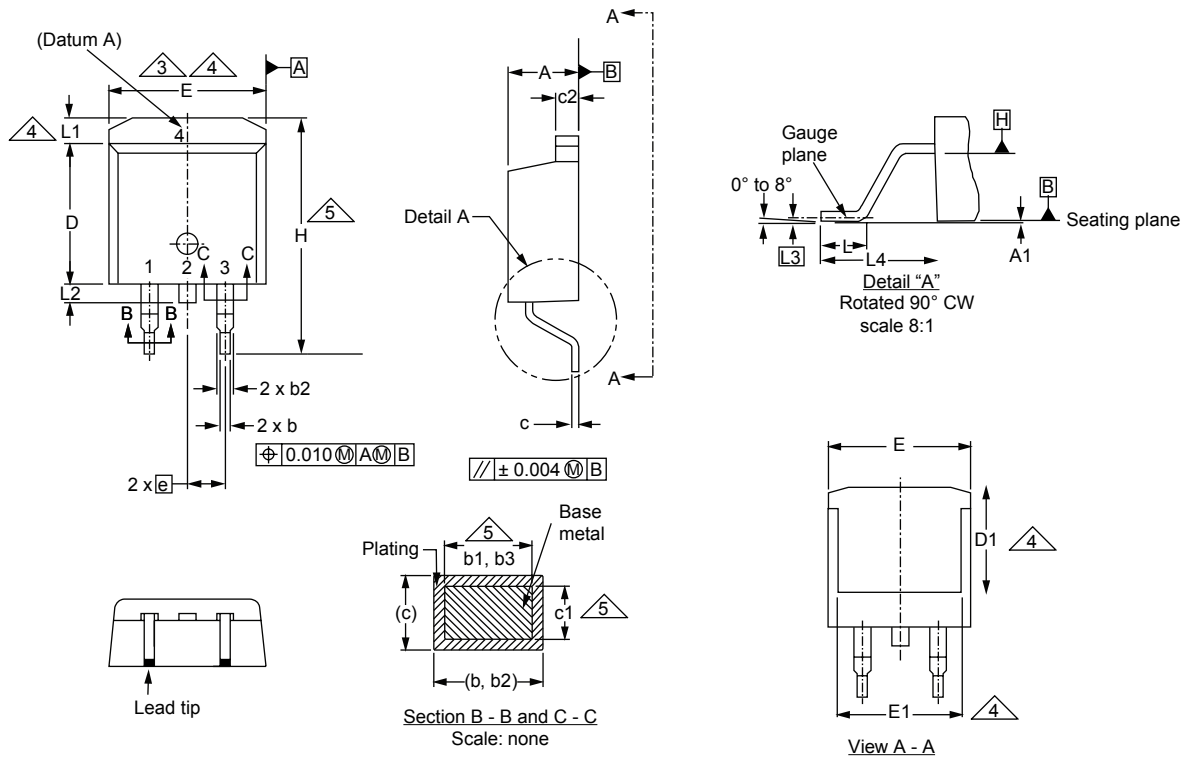
Maximum Drain Current vs. Ambient Temperature



Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

**TO-263AB (HIGH VOLTAGE)**

DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
b1	0.51	0.89	0.020	0.035
b2	1.14	1.78	0.045	0.070
b3	1.14	1.73	0.045	0.068
c	0.38	0.74	0.015	0.029
c1	0.38	0.58	0.015	0.023
c2	1.14	1.65	0.045	0.065
D	8.38	9.65	0.330	0.380

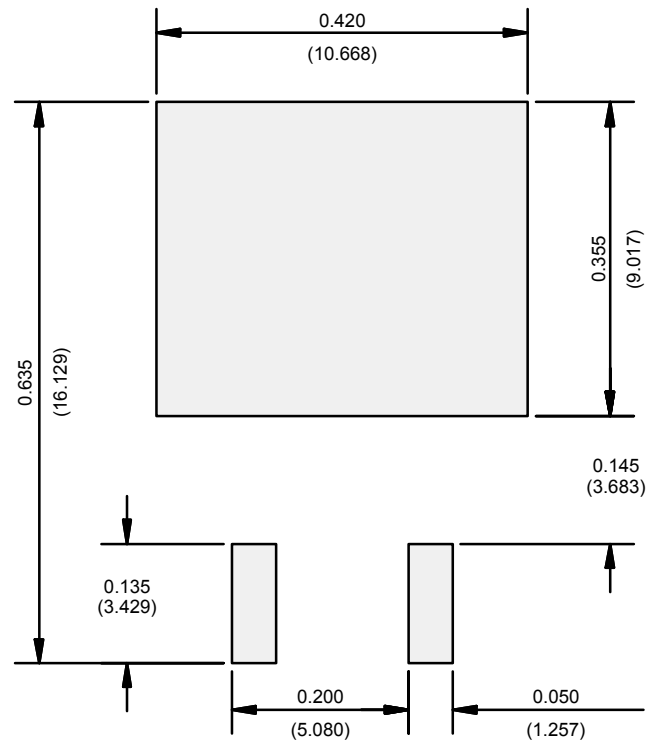
DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
D1	6.86	-	0.270	-
E	9.65	10.67	0.380	0.420
E1	6.22	-	0.245	-
e	2.54 BSC		0.100 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	-	1.65	-	0.066
L2	-	1.78	-	0.070
L3	0.25 BSC		0.010 BSC	
L4	4.78	5.28	0.188	0.208

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 DWG: 5970

**Notes**

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body at datum A.
4. Thermal PAD contour optional within dimension E, L1, D1 and E1.
5. Dimension b1 and c1 apply to base metal only.
6. Datum A and B to be determined at datum plane H.
7. Outline conforms to JEDEC outline to TO-263AB.

**RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead**



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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