

AP2309N-VB Datasheet

P-Channel 30 V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω) Typ.	I_D (A) ^a	Q_g (Typ.)
- 30	0.046 at $V_{GS} = -10$ V	- 5.6	11.4 nC
	0.049 at $V_{GS} = -6$ V	- 5	
	0.054 at $V_{GS} = -4.5$ V	-4.5	

FEATURES

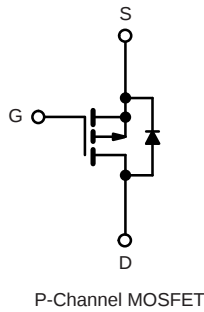
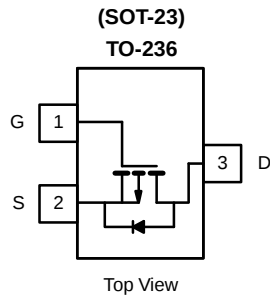
- Trench Power MOSFET
- 100 % R_g Tested



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- For Mobile Computing
 - Load Switch
 - Notebook Adaptor Switch
 - DC/DC Converter



ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	- 30	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current ($T_J = 150$ °C)	I_D	$T_C = 25$ °C	A
		$T_C = 70$ °C	
		$T_A = 25$ °C	
		$T_A = 70$ °C	
Pulsed Drain Current ($t = 100$ μ s)	I_{DM}	- 18	A
Continuous Source-Drain Diode Current	I_S	$T_C = 25$ °C	
		$T_A = 25$ °C	
Maximum Power Dissipation	P_D	$T_C = 25$ °C	W
		$T_C = 70$ °C	
		$T_A = 25$ °C	
		$T_A = 70$ °C	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 150	°C

THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^{b,d}	$t \leq 5$ s	R_{thJA}	75	100	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	40	50	

Notes:

- Based on $T_C = 25$ °C.
- Surface mounted on 1" x 1" FR4 board.
- $t = 5$ s.
- Maximum under steady state conditions is 166 °C/W.

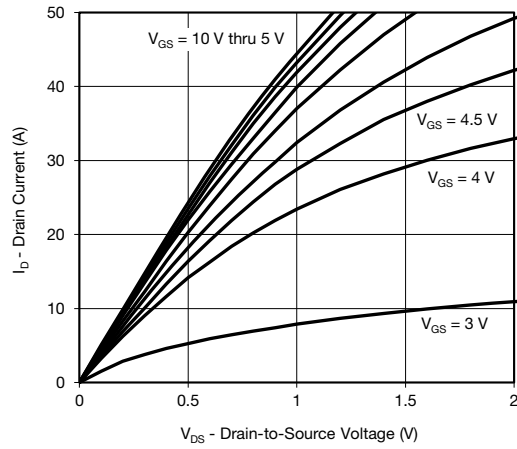
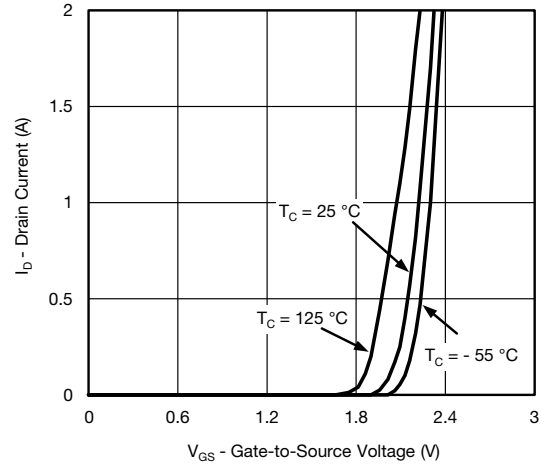
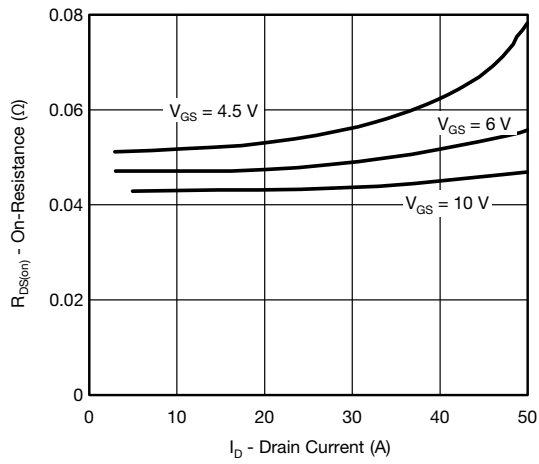
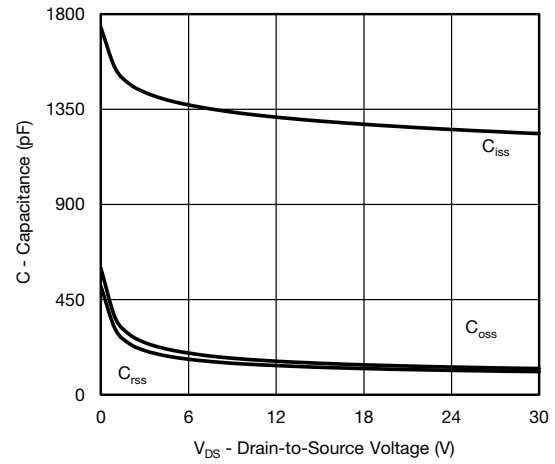
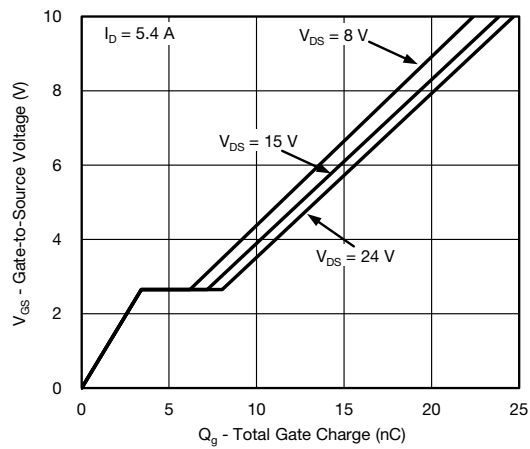
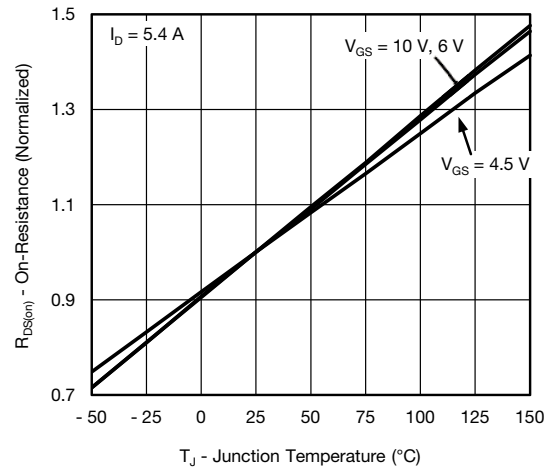
SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = - 250 μA	- 30			V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = - 250 μA		- 19		mV/°C
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J			4		
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = - 250 μA	- 0.5		- 2.0	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			- 5	
On-State Drain Current ^a	I _{D(on)}	V _{DS} ≤ - 5 V, V _{GS} = - 10 V	- 2.5			A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = - 10 V, I _D = - 4.4 A		0.046		Ω
		V _{GS} = - 6 V, I _D = - 4 A		0.049		
		V _{GS} = - 4.5 V, I _D = - 3.6 A		0.054		
Forward Transconductance ^a	g _{fs}	V _{DS} = - 15 V, I _D = - 3.4 A		18		S
Dynamic ^b						
Input Capacitance	C _{iss}	V _{DS} = - 15 V, V _{GS} = 0 V, f = 1 MHz		1295		pF
Output Capacitance	C _{oss}			150		
Reverse Transfer Capacitance	C _{rss}			130		
Total Gate Charge	Q _g	V _{DS} = - 15 V, V _{GS} = - 10 V, I _D = - 5.4 A		24	36	nC
		V _{DS} = - 15 V, V _{GS} = - 4.5 V, I _D = - 5.4 A		11.4	17	
Gate-Source Charge	Q _{gs}			3.4		
Gate-Drain Charge	Q _{gd}			3.8		
Gate Resistance	R _g	f = 1 MHz	1.5	7.7	15.4	Ω
Turn-On Delay Time	t _{d(on)}	V _{DD} = - 15 V, R _L = 3.5 Ω I _D ≅ - 4.3 A, V _{GEN} = - 10 V, R _g = 1 Ω		13	20	ns
Rise Time	t _r			4	8	
Turn-Off Delay Time	t _{d(off)}			38	57	
Fall Time	t _f			6	12	
Turn-On Delay Time	t _{d(on)}	V _{DD} = - 15 V, R _L = 3.5 Ω I _D ≅ - 4.3 A, V _{GEN} = - 4.5 V, R _g = 1 Ω		28	42	
Rise Time	t _r			16	24	
Turn-Off Delay Time	t _{d(off)}			30	45	
Fall Time	t _f			10	20	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C			- 2.1	A
Pulse Diode Forward Current (t = 100 μs)	I _{SM}				- 80	
Body Diode Voltage	V _{SD}	I _S = - 4.3 A, V _{GS} = 0 V		- 0.8	- 1.2	V
Body Diode Reverse Recovery Time	t _{rr}	I _F = - 4.3 A, dI/dt = 100 A/μs, T _J = 25 °C		15	23	ns
Body Diode Reverse Recovery Charge	Q _{rr}			7	14	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.

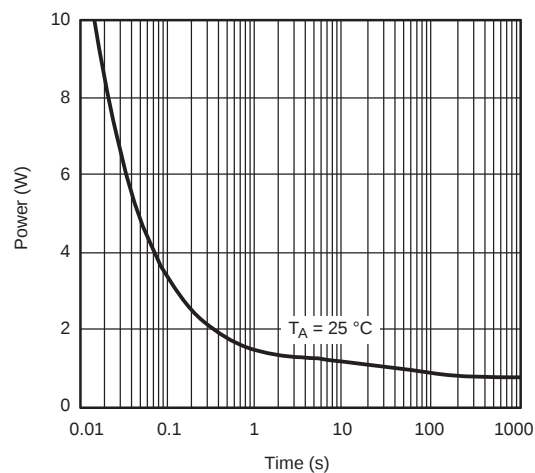
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

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)

Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

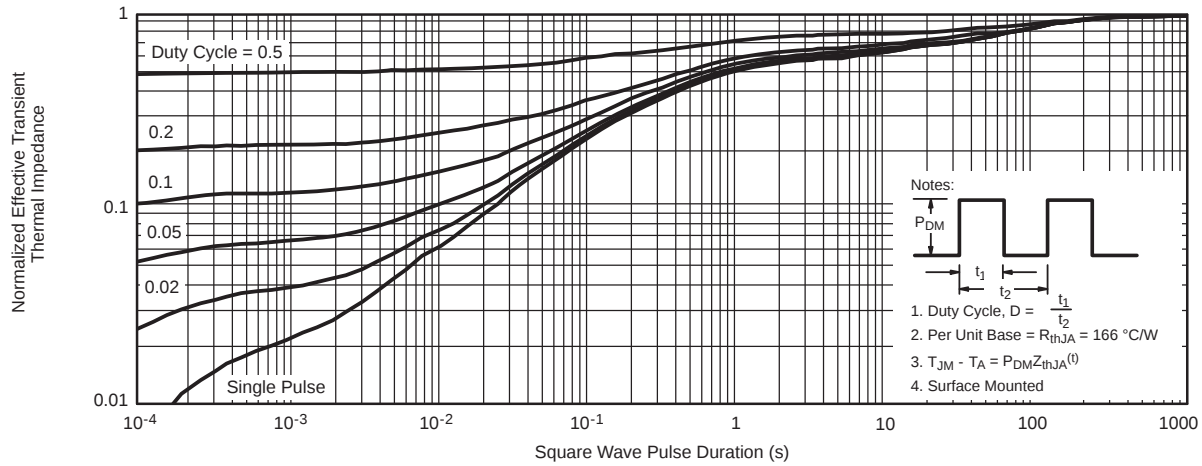
Current Derating*

Power, Junction-to-Foot

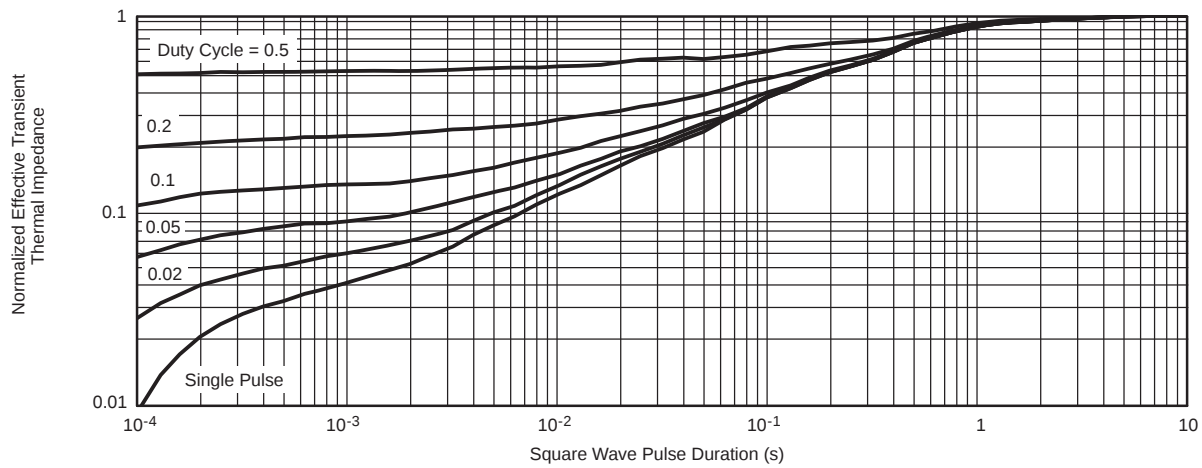
Power, Junction-to-Ambient

* 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.

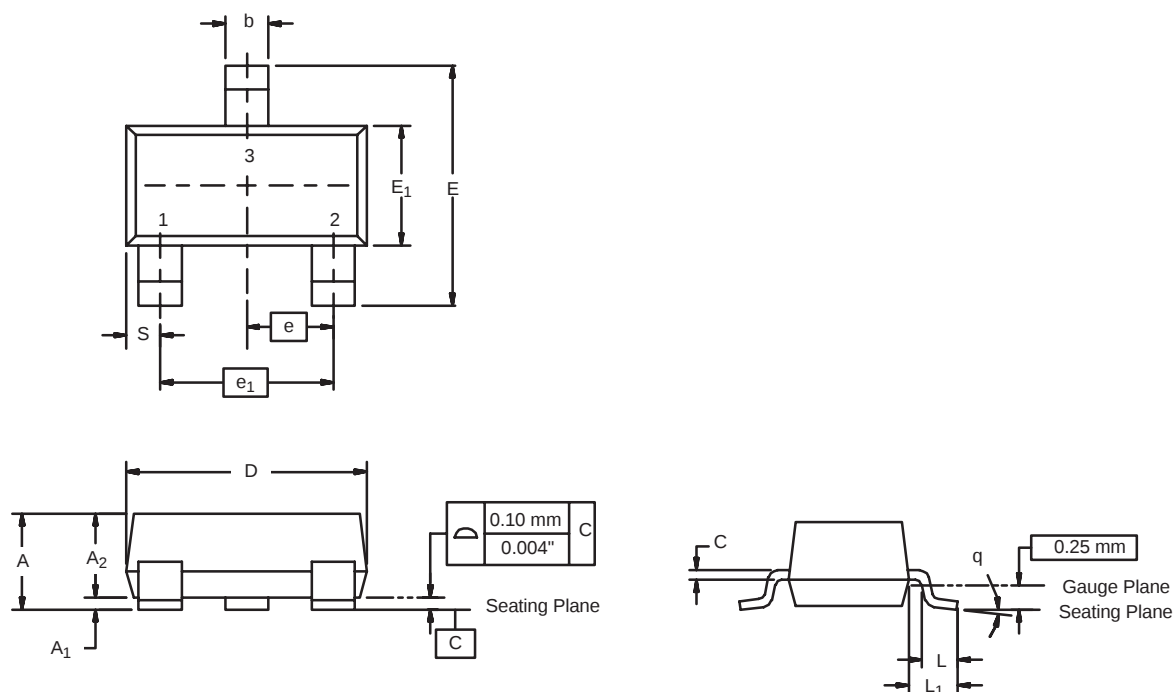
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

SOT-23 (TO-236): 3-LEAD

Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	0.89	1.12	0.035	0.044
A ₁	0.01	0.10	0.0004	0.004
A ₂	0.88	1.02	0.0346	0.040
b	0.35	0.50	0.014	0.020
c	0.085	0.18	0.003	0.007
D	2.80	3.04	0.110	0.120
E	2.10	2.64	0.083	0.104
E ₁	1.20	1.40	0.047	0.055
e	0.95 BSC		0.0374 Ref	
e ₁	1.90 BSC		0.0748 Ref	
L	0.40	0.60	0.016	0.024
L ₁	0.64 Ref		0.025 Ref	
S	0.50 Ref		0.020 Ref	
q	3°	8°	3°	8°
ECN: S-03946-Rev. K, 09-Jul-01				
DWG: 5479				

RECOMMENDED MINIMUM PADS FOR SOT-23



Recommended Minimum Pads
Dimensions in Inches/(mm)

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