

## AP20N03P-VB Datasheet

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

PRODUCT SUMMARY	
$V_{DS}$ (V)	30
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 10$ V	0.006
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 4.5$ V	0.009
$I_D$ (A)	80
Configuration	Single
Package	TO-220AB

TO-220AB



#### FEATURES

- Trench Power MOSFET
- 100 %  $R_g$  and UIS Tested
- Compliant to RoHS Directive 2011/65/EU


**RoHS**  
 COMPLIANT


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		$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 175^\circ\text{C}$ )	$T_C = 25^\circ\text{C}$	$I_D$	80	A
	$T_C = 70^\circ\text{C}$		65	
	$T_A = 25^\circ\text{C}$		25.8 <sup>b, c</sup>	
	$T_A = 70^\circ\text{C}$		20 <sup>b, c</sup>	
Pulsed Drain Current		$I_{DM}$	200	mJ
Avalanche Current Pulse		$I_{AS}$	39	
Single Pulse Avalanche Energy		$E_{AS}$	94.8	
Continuous Source-Drain Diode Current	$T_C = 25^\circ\text{C}$	$I_S$	50 <sup>a, e</sup>	A
	$T_A = 25^\circ\text{C}$		3.13 <sup>b, c</sup>	
Maximum Power Dissipation	$T_C = 25^\circ\text{C}$	$P_D$	120 <sup>a</sup>	W
	$T_C = 70^\circ\text{C}$		85	
	$T_A = 25^\circ\text{C}$		3.75 <sup>b, c</sup>	
	$T_A = 70^\circ\text{C}$		2.63 <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	Typ.	Max.	Unit
Maximum Junction-to-Ambient <sup>b, d</sup>	$t \leq 10$ sec	$R_{thJA}$	32	40	$^\circ\text{C/W}$
Maximum Junction-to-Case	Steady State	$R_{thJC}$	0.5	0.6	

Notes:

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

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

c.  $t = 10$  sec.d. Maximum under steady state conditions is  $90^\circ\text{C/W}$ .

e. Calculated based on maximum junction temperature. Package limitation current is 90 A.

SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	30			V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA		35		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			- 7.5		
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1.0		2.5	V
Gate-Source 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> = 30 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			10	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 5 V, V <sub>GS</sub> = 10 V	90			A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 28.8 A		0.006		Ω
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 30 A		0.009		
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 28.8 A		160		S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V, f = 1 MHz		1600		pF
Output Capacitance	C <sub>oss</sub>			525		
Reverse Transfer Capacitance	C <sub>rss</sub>			370		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 28.8 A		35	45	nC
		V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 28.8 A		25	35	
Gate-Source Charge	Q <sub>gs</sub>			15		
Gate-Drain Charge	Q <sub>gd</sub>			20		
Gate Resistance	R <sub>g</sub>	f = 1 MHz		1.4	2.1	Ω
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 15 V, R <sub>L</sub> = 0.625 Ω I <sub>D</sub> ≅ 24 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω		18	27	ns
Rise Time	t <sub>r</sub>			11	17	
Turn-Off Delay Time	t <sub>d(off)</sub>			70	105	
Fall Time	t <sub>f</sub>			10	15	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 15 V, R <sub>L</sub> = 0.67 Ω I <sub>D</sub> ≅ 22.5 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω		55	83	
Rise Time	t <sub>r</sub>			180	270	
Turn-Off Delay Time	t <sub>d(off)</sub>			55	83	
Fall Time	t <sub>f</sub>			12	18	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			120	A
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				120	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = 22 A		0.8	1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 20 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C		52	78	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			70.2	105	nC
Reverse Recovery Fall Time	t <sub>a</sub>			27		ns
Reverse Recovery Rise Time	t <sub>b</sub>			25		

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



Transconductance

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

Capacitance



Gate Charge

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**On-Resistance vs. Junction Temperature**



**Forward Diode Voltage vs. Temperature**



**$R_{DS(on)}$  vs.  $V_{GS}$  vs. Temperature**

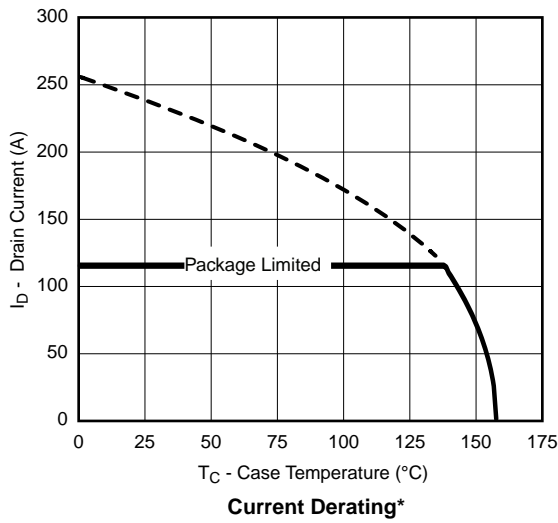


**Threshold Voltage**



**Safe Operating Area, Junction-to-Ambient**

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



\*The power dissipation  $P_D$  is based on  $T_{J(max)} = 175$  °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.



## TO-220AB



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
$\varnothing P$	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118
ECN: X12-0208-Rev. N, 08-Oct-12				
DWG: 5471				

### Notes

\*  $M = 1.32 \text{ mm to } 1.62 \text{ mm}$  (dimension including protrusion)  
 Heatsink hole for HVM

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