

## AP2311GK-VB Datasheet

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

#### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
- 60	0.055 at $V_{GS} = -10$ V	- 7.0	30 nC
	0.065 at $V_{GS} = -4.5$ V	- 6.0	

#### FEATURES

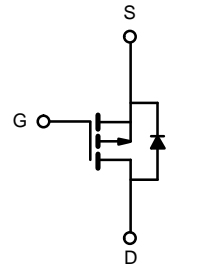
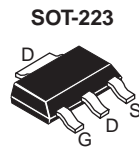
- Trench Power MOSFET
- 100 % UIS Tested

#### APPLICATIONS

- Load Switch



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**



P-Channel MOSFET

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

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		$V_{DS}$	- 60	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 150$ °C)	$T_C = 25$ °C	$I_D$	- 7.0 <sup>a</sup>	A
	$T_C = 70$ °C		- 5.2	
	$T_A = 25$ °C		- 4.8 <sup>b</sup>	
	$T_A = 70$ °C		- 4.1 <sup>b</sup>	
Pulsed Drain Current		$I_{DM}$	- 25	
Avalanche Current Pulse		$I_{AS}$	- 4.5	mJ
Single Pulse Avalanche Energy		$E_{AS}$	10.1	
Continuous Source-Drain Diode Current	$T_C = 25$ °C	$I_S$	6.9 <sup>a</sup>	A
	$T_A = 25$ °C		3.5 <sup>b</sup>	
Maximum Power Dissipation	$T_C = 25$ °C	$P_D$	10.4 <sup>a</sup>	W
	$T_C = 70$ °C		6.6 <sup>a</sup>	
	$T_A = 25$ °C		2.1 <sup>b</sup>	
	$T_A = 70$ °C		1.1 <sup>b</sup>	
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 <sup>b</sup>	Steady State	$R_{thJA}$	33	40	°C/W
	Steady State	$R_{thJC}$	0.98	1.2	

Notes:

a. Based on  $T_C = 25$  °C.

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

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	- 60			V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = - 250 μA		68		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			- 5.2		
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> = - 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> = 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	- 25			A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 3 A		0.055		Ω
		V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 2 A		0.065		
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = - 15 V, I <sub>D</sub> = - 5 A	20			S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = - 25 V, V <sub>GS</sub> = 0 V, f = 1 MHz		1500		pF
Output Capacitance	C <sub>oss</sub>			200		
Reverse Transfer Capacitance	C <sub>rss</sub>			150		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 5 A		38	56	nC
		V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 5 A		19	30	
Gate-Source Charge	Q <sub>gs</sub>			9		
Gate-Drain Charge	Q <sub>gd</sub>			10		
Gate Resistance	R <sub>g</sub>	f = 1 MHz		5.2		Ω
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = - 2 V, R <sub>L</sub> = 2 Ω I <sub>D</sub> ≅ - 5 A, V <sub>GEN</sub> = - 10 V, R <sub>g</sub> = 1 Ω		10	15	ns
Rise Time	t <sub>r</sub>			7	15	
Turn-Off Delay Time	t <sub>d(off)</sub>			70	110	
Fall Time	t <sub>f</sub>			40	60	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			- 6.9	A
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				- 15	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = - 3 A		- 1	- 1.5	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = - 5 A, di/dt = 10 A/μs, T <sub>J</sub> = 25 °C		45	68	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			59	120	nC
Reverse Recovery Fall Time	t <sub>a</sub>			29		ns
Reverse Recovery Rise Time	t <sub>b</sub>			16		

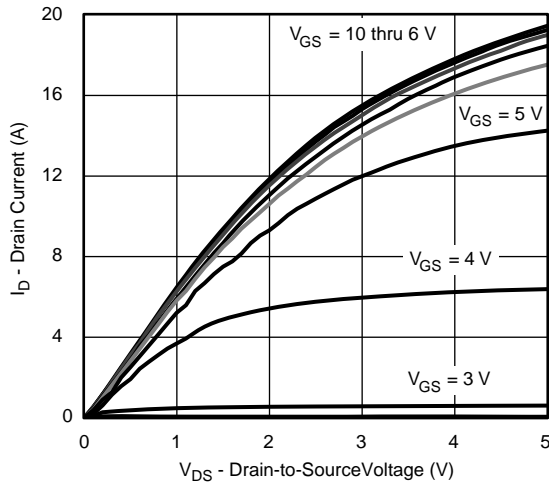
Notes:

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

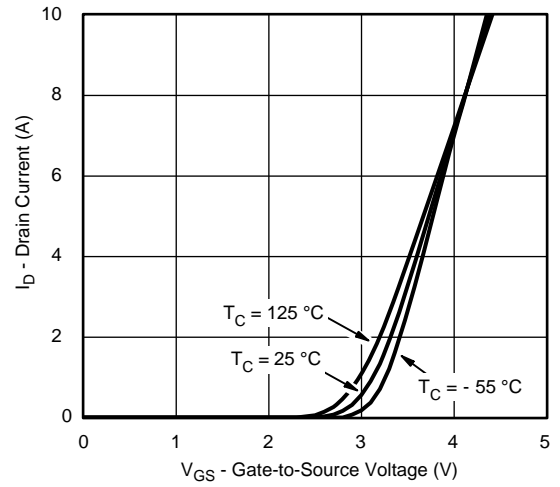
b. Guaranteed by design, not subject to production testing.

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**



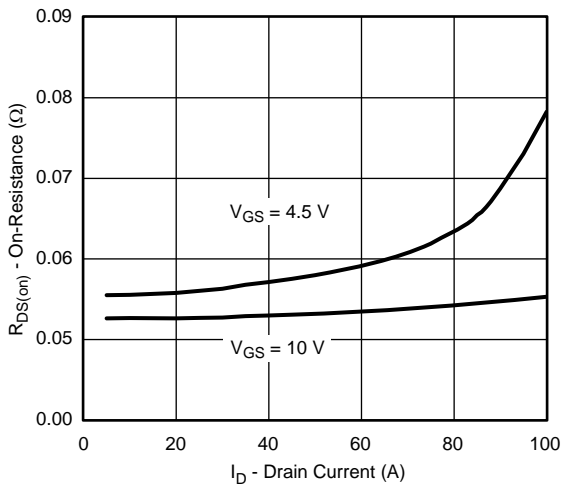
**Transfer Characteristics**



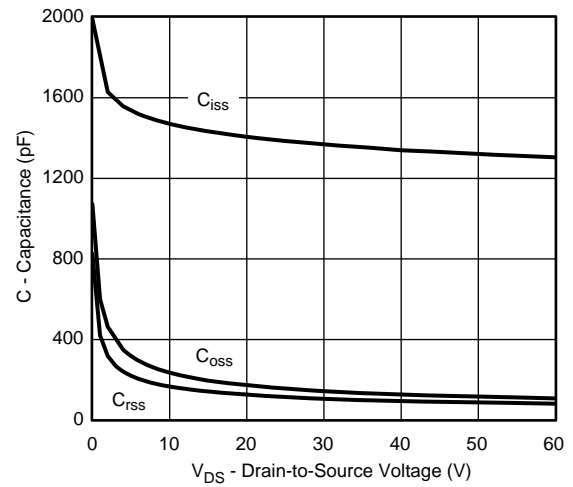
**Transfer Characteristics**



**Transconductance**

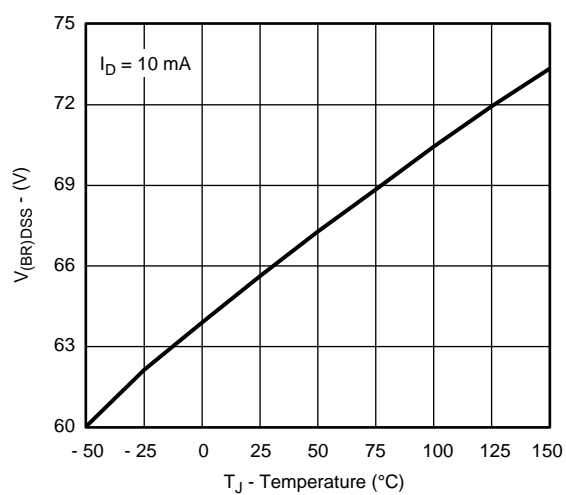
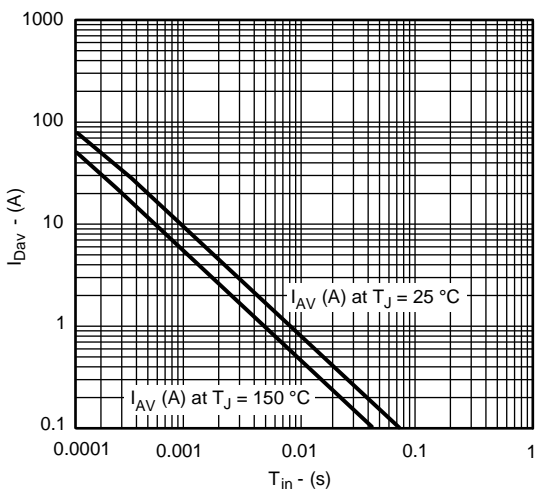
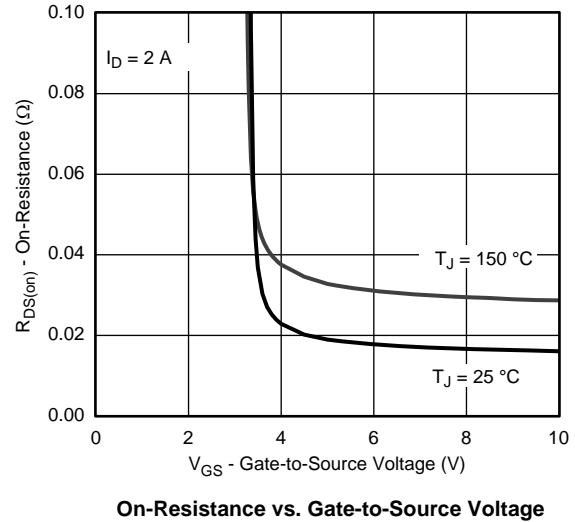
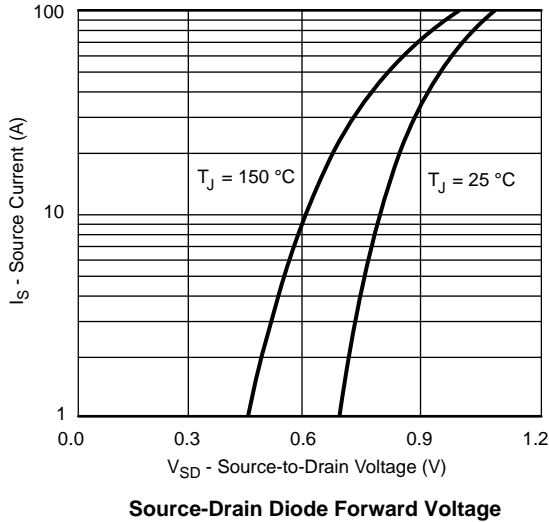
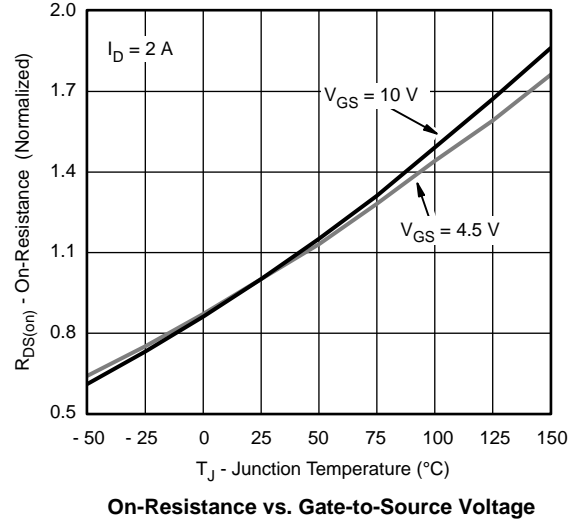
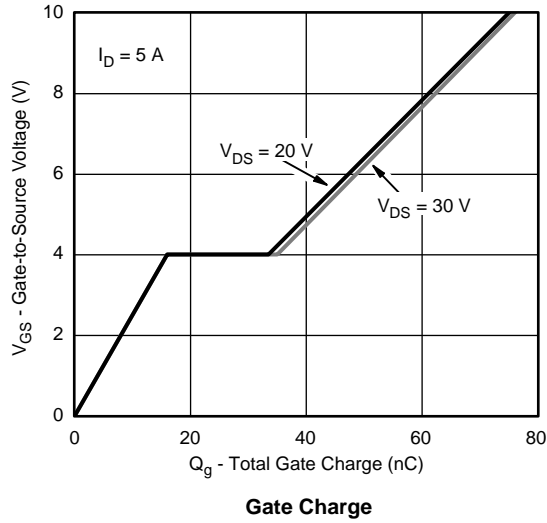


**On-Resistance vs. Drain Current**



**Capacitance**

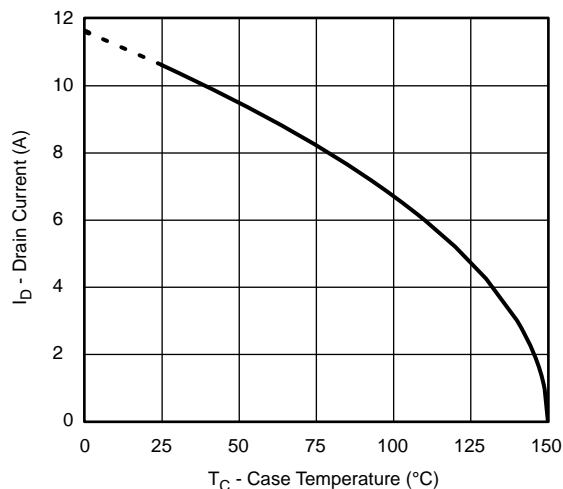
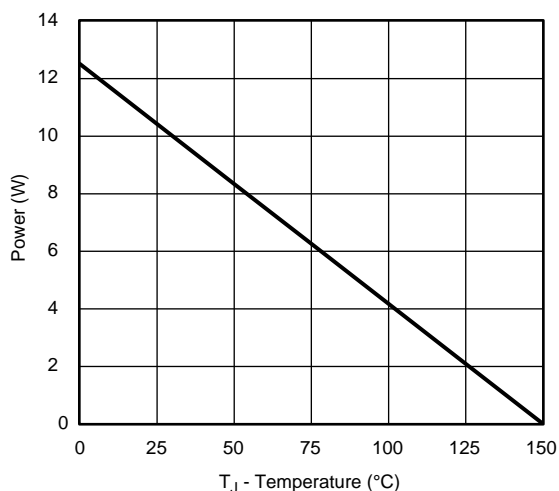
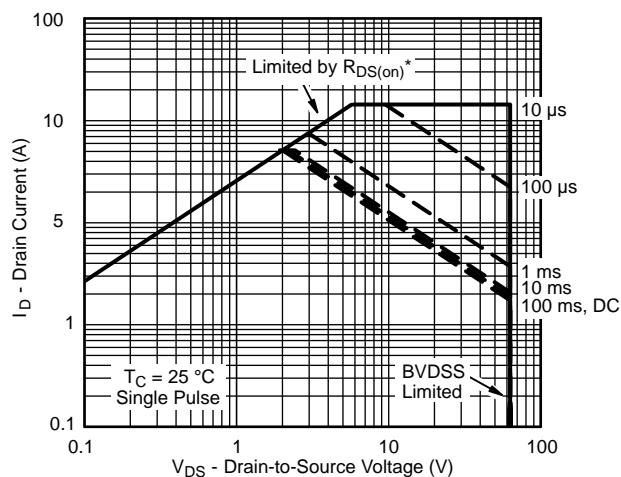
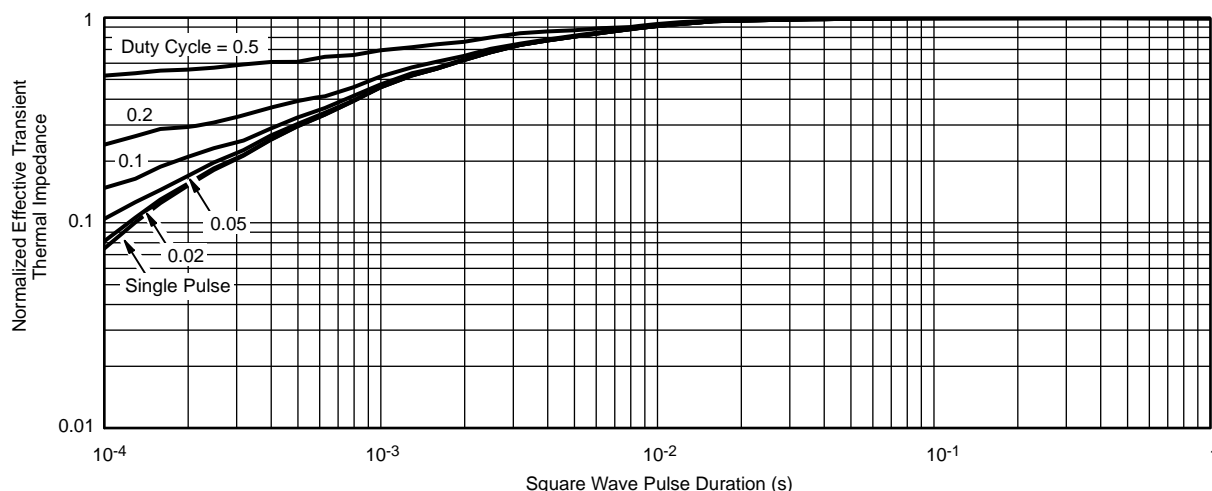
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



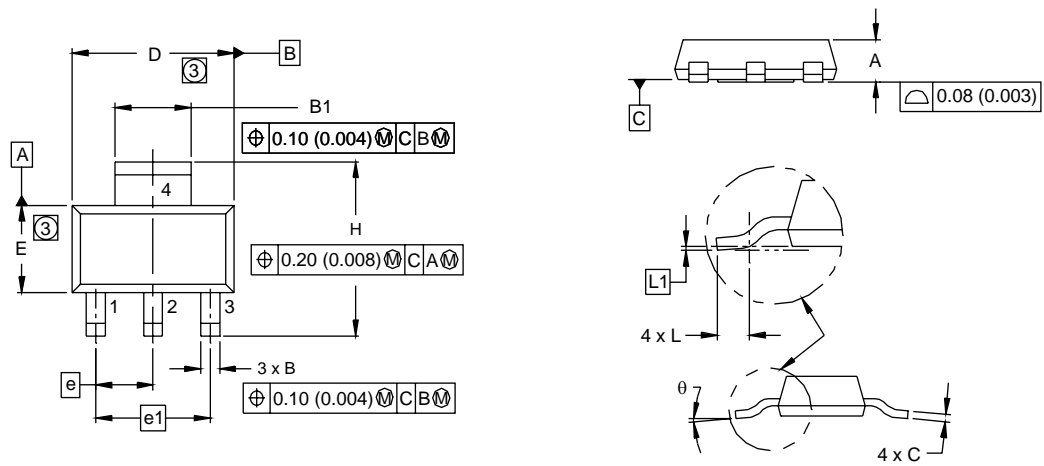
Single Pulse Avalanche Current Capability vs. Time

Drain-Source Breakdown Voltage vs. Junction Temperature

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

**Threshold Voltage**

**Max. Drain Current vs. Case Temperature**

**Power Derating, Junction-to-Case**

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

**Normalized Thermal Transient Impedance, Junction-to-Case**

**SOT-223 (HIGH VOLTAGE)**



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	1.55	1.80	0.061	0.071
B	0.65	0.85	0.026	0.033
B1	2.95	3.15	0.116	0.124
C	0.25	0.35	0.010	0.014
D	6.30	6.70	0.248	0.264
E	3.30	3.70	0.130	0.146
e	2.30 BSC		0.0905 BSC	
e1	4.60 BSC		0.181 BSC	
H	6.71	7.29	0.264	0.287
L	0.91	-	0.036	-
L1	0.061 BSC		0.0024 BSC	
θ	-	10°	-	10°
ECN: S-82109-Rev. A, 15-Sep-08 DWG: 5969				

**Notes**

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension do not include mold flash.
4. Outline conforms to JEDEC outline TO-261AA.

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