

## N-Channel Enhancement Mode MOSFET

Primary characteristics			
Symbol	Parameter	Value	Unit
$I_D$	Continuous drain current	9.5	A
$V_{DSS}$	Drain source voltage	20	V
$R_{DS(ON)}$	Static drain-source on-resistance	29	$\text{m}\Omega$ MAX

Case dimensions											
DFN2020-6L											
	A	B	C	D	E	F	G	H	J	K	L
TYP	0.80	0.2	0.025	2.00	2.00	0.56	0.96	0.30	0.275	0.30	0.65
MIN	0.75		0.000	1.95	1.95	0.44	0.84	0.25	0.175	0.25	
MAX	0.85		0.050	2.05	2.05	0.69	1.09	0.35	0.375	0.35	

All measurements in mm

Maximum ratings ( $T_A = 25^\circ\text{C}$ unless otherwise noted)			
Characteristic	Symbol	Value	Unit
Drain-source voltage	$V_{DSS}$	20	V
Gate-source voltage	$V_{GSS}$	$\pm 8$	V
Continuous drain current	$I_D$	9.5	A
Pulsed drain current ( $T_{J(\max)}=150^\circ\text{C}$ )	$I_{DM}$	38	A
Thermal resistance junction-to-air	$R_{\theta JA}$	52	$^\circ\text{C}/\text{W}$
Power Dissipation ( $T_c=25^\circ\text{C}$ , $T_{J(\max)}=150^\circ\text{C}$ )	$P_D$	2.4	W
Operating junction temperature range	$T_J$ , $T_{STG}$	-55 ~ 150	$^\circ\text{C}$

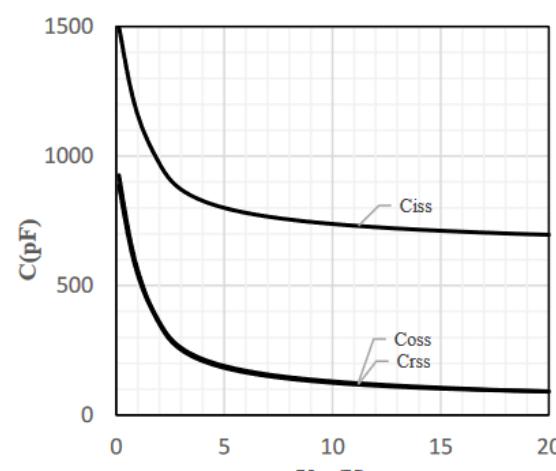
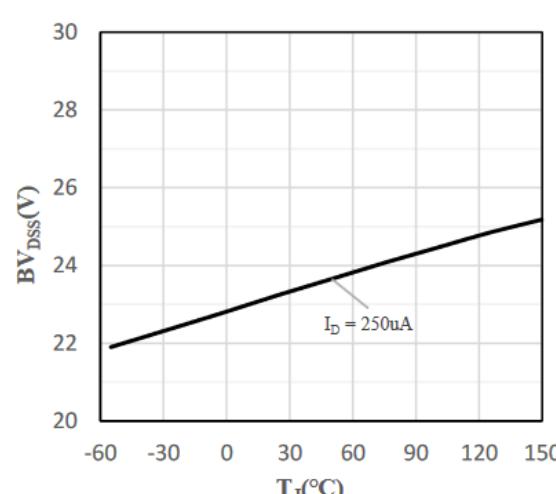
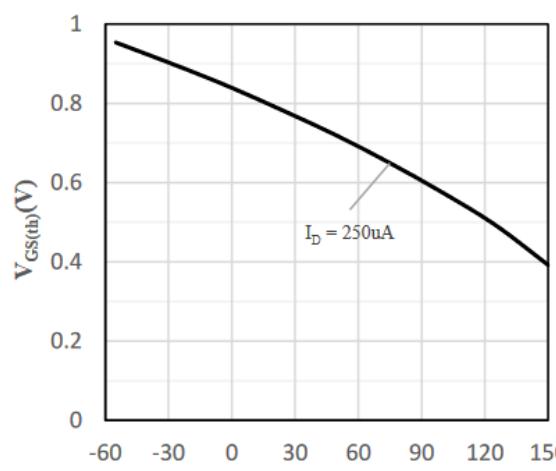
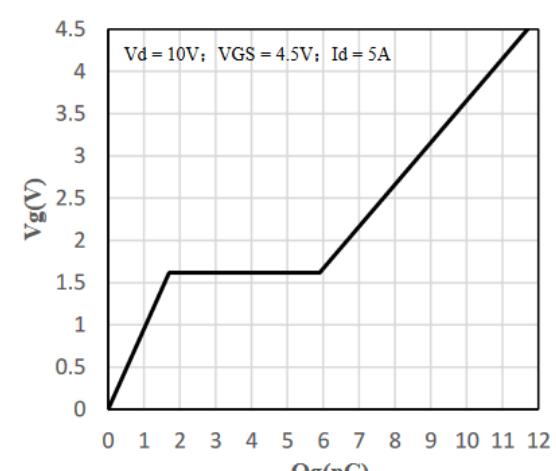
Electrical characteristics ( $T_A = 25^\circ\text{C}$ )						
Characteristic	Test condition	Symbol	Value			Unit
			Min.	Typ.	Max.	
Drain-source breakdown voltage	$V_{GS}=0\text{V}, I_D=250\mu\text{A}$	$V_{DSS}$	20	-	-	V
Zero gate voltage drain current	$V_{DS}=20\text{V}, V_{GS}=0\text{V}$	$I_{DSS}$	-	-	1.0	$\mu\text{A}$
Gate body leakage current	$V_{GS}=\pm 8\text{V}, V_{DS}=0\text{V}$	$I_{GSS}$	-	-	$\pm 100$	nA
Gate threshold voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	$V_{GS(\text{TH})}$	0.4	0.8	1.0	V
Static drain-source on-state resistance <sup>2)</sup>	$V_{GS}=10\text{V}, I_D=20\text{A}$	$R_{DS(\text{ON})}$	-	16	23	$\text{m}\Omega$
	$V_{GS}=4.5\text{V}, I_D=10\text{A}$		-	20	29	
Dynamic electrical characteristics						
Characteristic	Test condition	Symbol	Value			Unit
			Min.	Typ.	Max.	
Input capacitance	$V_{DS}=8.0\text{V}$ $V_{GS}=0\text{V}$ $f=1.0\text{MHz}$	$C_{ISS}$	-	754	-	$\text{pF}$
Output capacitance		$C_{OSS}$	-	145	-	
Reverse transfer capacitance		$C_{RSS}$	-	139	-	
Switching characteristics						
Characteristic	Test condition	Symbol	Value			Unit
			Min.	Typ.	Max.	
Turn ON delay time	$V_{DD}=10\text{V}$ $V_{GS}=4.5\text{V}$ $I_D=1.0\text{A}$ $R_G=6.0\Omega$	$t_{d(\text{ON})}$	-	15	-	$\text{ns}$
Turn ON rise time		$t_r$	-	40	-	
Turn OFF delay time		$t_{d(\text{OFF})}$	-	48	-	
Turn OFF fall time		$t_f$	-	31	-	
Total gate-charge	$V_{DD}=10\text{V}$ $V_{GS}=4.5\text{V}$ $I_D=5.0\text{A}$	$Q_G$	-	12	-	$\text{nC}$
Gate to source charge		$Q_{GS}$	-	1.7	-	
Gate to drain (Miller) charge		$Q_{GD}$	-	4.2	-	
Source-drain diode characteristics						
Characteristic	Test condition	Symbol	Value			Unit
			Min.	Typ.	Max.	
Diode forward voltage <sup>2)</sup>	$I_{SD}=1.8\text{A}, V_{GS}=0\text{V}, T_J=25^\circ\text{C}$	$V_{SD}$	-	-	1.2	V
Diode continuous forward current	$T_A=25^\circ\text{C}$	$I_S$	-	-	9.5	A
Pulsed source-drain current <sup>2)</sup>		$I_{SM}$	-	-	38	

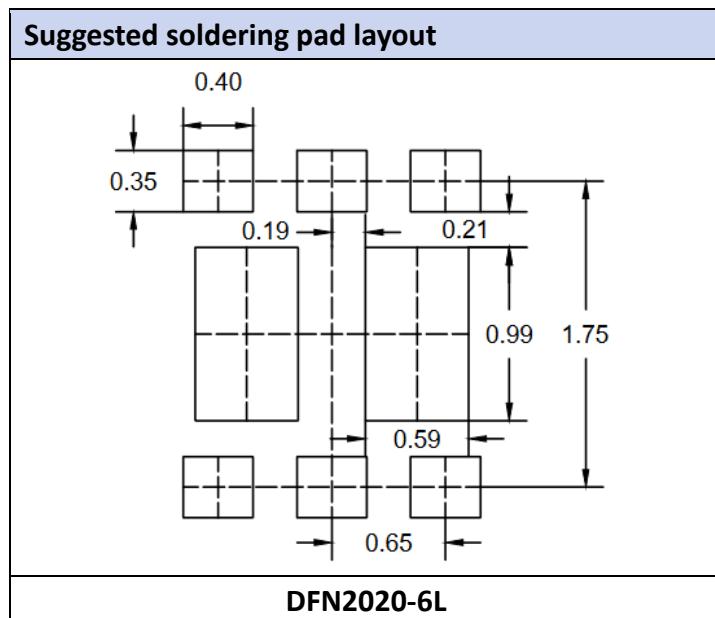
Notes:

- 1) The data tested when surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2oz copper
- 2) The data tested by pulsed, pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$

### Typical characteristics

ON region characteristics	$R_{DS(ON)}$ vs. drain current
<p>Graph showing drain current (<math>I_D</math>) versus drain-to-source voltage (<math>V_{DS}</math>). The x-axis ranges from 0 to 6 V, and the y-axis ranges from 0 to 15 A. Multiple curves are plotted for different gate-to-source voltages (<math>V_{GS}</math>): 1.5 V, 2 V, 2.5 V, 3 V, 4 V, 5 V, 6 V, 7 V, 8 V, 9 V, and 10 V. The current increases with <math>V_{DS}</math> and decreases as <math>V_{GS}</math> increases.</p>	<p>Graph showing drain-to-source on-resistance (<math>R_{DS(ON)}</math>) versus drain current (<math>I_D</math>). The x-axis ranges from 0 to 15 A, and the y-axis ranges from 0 to 0.1 Ω. Three curves are shown for <math>V_{GS} = 1.8V</math>, <math>2.5V</math>, and <math>4.5V</math>. The resistance increases with <math>I_D</math> and decreases as <math>V_{GS}</math> increases.</p>
ON resistance vs. gate-source voltage	Body-diode characteristics
<p>Graph showing drain-to-source on-resistance (<math>R_{DS(ON)}</math>) versus gate-source voltage (<math>V_{GS}</math>) at <math>I_D = 5A</math>. The x-axis ranges from 1 to 10 V, and the y-axis ranges from 0 to 0.1 Ω. Three curves are shown for temperatures <math>-55^{\circ}C</math>, <math>25^{\circ}C</math>, and <math>150^{\circ}C</math>. The resistance decreases as <math>V_{GS}</math> increases and increases with temperature.</p>	<p>Graph showing drain current (<math>I_S</math>) versus drain-to-source voltage (<math>V_{SD}</math>). The x-axis ranges from 0 to 1.2 V, and the y-axis is logarithmic from 0.1 to 100 A. Three curves are shown for temperatures <math>150^{\circ}C</math>, <math>25^{\circ}C</math>, and <math>-55^{\circ}C</math>. The current increases with <math>V_{SD}</math> and increases with temperature.</p>
ON-resistance vs. junction temperature	Transfer characteristics
<p>Graph showing drain-to-source on-resistance (<math>R_{DS(ON)}</math>) versus junction temperature (<math>T_J</math>). The x-axis ranges from -60 to 150 °C, and the y-axis ranges from 0 to 0.05 Ω. Three curves are shown for <math>V_{GS} = 1.8V; I_D = 4A</math>, <math>V_{GS} = 2.5V; I_D = 4.5A</math>, and <math>V_{GS} = 4.5V; I_D = 5A</math>. The resistance increases with <math>T_J</math>.</p>	<p>Graph showing drain current (<math>I_D</math>) versus gate-source voltage (<math>V_{GS}</math>). The x-axis ranges from 0 to 2 V, and the y-axis ranges from 0 to 15 A. Three curves are shown for temperatures <math>150^{\circ}C</math>, <math>25^{\circ}C</math>, and <math>-55^{\circ}C</math>. The current increases with <math>V_{GS}</math> and increases with temperature.</p>

Typical characteristics	
Capacitance characteristics	Drain-source vs. Junction temperature
 <p>This graph shows the capacitance characteristics of the AKS2312DF1 MOSFET. The Y-axis represents capacitance <math>C</math> in pF, ranging from 0 to 1500. The X-axis represents drain-to-source voltage <math>V_{DS}</math> in V, ranging from 0 to 20. Three curves are plotted: <math>C_{iss}</math> (total input capacitance), <math>C_{oss}</math> (output capacitance), and <math>C_{rss}</math> (reverse transfer capacitance). All three capacitances decrease as <math>V_{DS}</math> increases, with <math>C_{oss}</math> being the dominant component at higher voltages.</p>	 <p>This graph plots the drain-to-source breakdown voltage <math>BV_{DSS}</math> in V against junction temperature <math>T_J</math> in °C. The Y-axis ranges from 20 to 30 V, and the X-axis ranges from -60 to 150 °C. A single curve is shown, labeled <math>I_D = 250\mu A</math>, which shows a gradual increase in <math>BV_{DSS}</math> as temperature increases.</p>
Gate voltage vs. junction temperature	Gate charge characteristics
 <p>This graph shows the gate-to-source threshold voltage <math>V_{GS(th)}</math> in V versus junction temperature <math>T_J</math> in °C. The Y-axis ranges from 0 to 1 V, and the X-axis ranges from -60 to 150 °C. A curve is plotted for <math>I_D = 250\mu A</math>, showing a linear decrease in <math>V_{GS(th)}</math> as temperature increases.</p>	 <p>This graph plots gate voltage <math>V_g</math> in V against gate charge <math>Q_g</math> in nC. The Y-axis ranges from 0 to 4.5 V, and the X-axis ranges from 0 to 12 nC. The graph shows a piecewise linear relationship between <math>V_g</math> and <math>Q_g</math>. The operating conditions are specified as <math>V_d = 10V</math>, <math>V_{GS} = 4.5V</math>, and <math>I_d = 5A</math>.</p>



#### Ordering information

Part Number	Marking	Package	Shipping Quantity	Dimensions
AKS2312DF1	2312	DFN2020-6L	3000 pcs / tape & reel	---

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