



**THE DATASHEET OF  
DG413AK/883B**



**SCOPE: IMPROVED, QUAD, SPST ANALOG SWITCHES**

<u>Device Type</u>	<u>Generic Number</u>
01	DG411A(x)/883B
02	DG412A(x)/883B
03	DG413A(x)/883B

**Case Outline(s).** The case outlines shall be designated in Mil-Std-1835 and as follows:

<u>Outline Letter</u>	<u>Mil-Std-1835</u>	<u>Case Outline</u>	<u>Package Code</u>
K	GDIP1-T16 or CDIP2-T16	16 LEAD CERDIP	J16
L	CDFP4-F16	16 LEAD FLATPACK	F16
Z	CQCC1-N20	20-Pin Ceramic LCC	L20

**Absolute Maximum Ratings**

Voltage Referenced to V<sup>-</sup>

V <sup>+</sup> to V <sup>-</sup> .....	44V
GND .....	25V
V <sub>L</sub> .....	(GND-0.3V) to V <sup>+</sup> +0.3V)
Digital Inputs, V <sub>S</sub> , V <sub>D</sub> <u>1/</u> .....	(V <sup>-</sup> -2V) to (V <sup>+</sup> +2V) or 30mA whichever occurs first.
Continuous Current, Any terminal .....	30mA
Peak Current, S or D (Pulsed at 1ms, 10% duty cycle max) .....	100mA
Lead Temperature (soldering, 10 seconds) .....	+300°C
Storage Temperature .....	-65°C to +150°C
Continuous Power Dissipation .....	T <sub>A</sub> =+70°C
16 lead CERDIP(derate 10.0mW/°C above +70°C) .....	800mW
16 lead FLATPACK(derate 6.1mW/°C above +70°C) .....	485mW
20 lead LCC (derate 9.1 mW/°C above +70°C) .....	727mW
Junction Temperature T <sub>J</sub> .....	+150°C
Thermal Resistance, Junction to Case, $\theta_{JC}$ :	
Case Outline 16 lead CERDIP.....	50°C/W
Case Outline 16 lead FLATPACK .....	65°C/W
Case Outline 20 lead LCC .....	20°C/W
Thermal Resistance, Junction to Ambient, $\theta_{JA}$ :	
Case Outline 16 lead CERDIP.....	100°C/W
Case Outline 16 lead FLATPACK .....	165°C/W
Case Outline 20 lead LCC .....	110°C/W

**Recommended Operating Conditions**

Ambient Operating Range (T <sub>A</sub> ) .....	-55°C to +125°C
Positive Supply Voltage (V <sup>+</sup> ) .....	+15V
Negative Supply Voltage (V <sup>-</sup> ) .....	-15V
V <sub>INL</sub> (max) .....	0.8V
V <sub>INH</sub> (min) .....	2.4V
Logic Supply Voltage (V <sub>L</sub> ) .....	+5V

1/ Signals on S, D or IN exceeding V<sup>+</sup> or V<sup>-</sup> are clamped by internal diodes. Limit forward current to maximum current ratings.

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.

**TABLE 1. ELECTRICAL TESTS: DUAL SUPPLIES**

TEST	Symbol	CONDITIONS	Group A Subgroup	Device type	Limits	Limits	Units
		-55 °C <=T <sub>A</sub> <= +125°C V <sup>+</sup> =+15V, V <sup>-</sup> =-15V, GND=0V V <sub>INH</sub> =2.4V, V <sub>INL</sub> =0.8V, V <sub>L</sub> =5V Unless otherwise specified			Min 2/	Max 2/	
<b>SWITCH</b>							
Analog-Signal Range	V <sub>ANALOG</sub>	3/	1,2,3	All	-15	15	V
Drain-Source ON Resistance	r <sub>DS(ON)</sub>	V <sup>+</sup> =+13.5V, V <sup>-</sup> =-13.5V, I <sub>S</sub> =-10mA, V <sub>D</sub> =±8.5V	1 2,3	All		30 45	Ω
Drain-Source ON Resistance Matching between Channels 4/	Δr <sub>DS(ON)</sub>	V <sup>+</sup> =+15V, V <sup>-</sup> =-15V, I <sub>S</sub> =-10mA, V <sub>D</sub> =±10V	1 2,3	All		3.0 5.0	Ω
On-Resistance Flatness 4/	r <sub>FLAT(ON)</sub>	V <sup>+</sup> =+15V, V <sup>-</sup> =-15V, I <sub>S</sub> =-10mA, V <sub>D</sub> =±5V, 0V	1 2,3	All		4.0 6.0	Ω
Source-OFF Leakage Current	I <sub>S(OFF)</sub>	V <sup>+</sup> =+16.5V, V <sup>-</sup> =-16.5V, V <sub>D</sub> =±15.5V, V <sub>S</sub> =±15.5V	1 2,3	All	-0.25 -10	0.25 10	nA
Drain-OFF Leakage Current	I <sub>D(OFF)</sub>	V <sup>+</sup> =+16.5V, V <sup>-</sup> =-16.5V, V <sub>D</sub> =±15.5V, V <sub>S</sub> =±15.5V	1 2,3	All	-0.25 -10	0.25 10	nA
Drain-ON Leakage Current	I <sub>D(ON)</sub> or I <sub>S(ON)</sub>	V <sup>+</sup> =+16.5V, V <sup>-</sup> =-16.5V, V <sub>D</sub> =±15.5V, V <sub>S</sub> =±15.5V	1 2,3	All	0.4 40	0.4 40	nA
<b>INPUT</b>							
Input Current/Voltage High	I <sub>INH</sub>	V <sub>IN</sub> = 2.4V, all others = 0.8V	1,2,3	All	-0.5	0.5	μA
Input Current/Voltage Low	I <sub>INL</sub>	V <sub>IN</sub> = 0.8V, all others = 2.4V	1,2,3	All	-0.5	0.5	μA
<b>SUPPLY</b>							
Power-Supply Range					±4.5	±20	V
Positive Supply Current	I <sub>+</sub>	All channels on or off, V <sup>+</sup> =+16.5V, V <sup>-</sup> =-16.5V, V <sub>IN</sub> =0V or 5V	1 2,3	All	-1.0 -5.0	1.0 5.0	μA
Negative Supply Current	I <sub>-</sub>	All channels on or off, V <sup>+</sup> =+16.5V, V <sup>-</sup> =-16.5V, V <sub>IN</sub> =0V or 5V	1 2,3	All	-1.0 -5.0	1.0 5.0	μA
Logic Supply Current	I <sub>L</sub>	All channels on or off, V <sup>+</sup> =+16.5V, V <sup>-</sup> =-16.5V, V <sub>IN</sub> =0V or 5V	1 2,3	All	-1.0 -5.0	1.0 5.0	μA
Ground Current	I <sub>GND</sub>	All channels on or off, V <sup>+</sup> =+16.5V, V <sup>-</sup> =-16.5V, V <sub>IN</sub> =0V or 5V	1 2,3	All	-1.0 -5.0	1.0 5.0	μA

TEST	Symbol	CONDITIONS	Group A Subgroup	Device type	Limits Min 2/	Limits Max 2/	Units
		-55 °C ≤ T <sub>A</sub> ≤ +125°C V <sup>+</sup> =+15V, V <sup>-</sup> =-15V, GND=0V V <sub>INH</sub> =2.4V, V <sub>INL</sub> =0.8V, V <sub>L</sub> =5V Unless otherwise specified					
<b>DYNAMIC</b>							
Turn-On Time	t <sub>ON</sub>	VD=±10V, Figure 2	9 10,11	All		175 220	ns
Turn-Off Time	t <sub>OFF</sub>	VD=±10V, Figure 2	9 10,11	All		145 160	ns
Charge Injection 3/	Q	C <sub>L</sub> =1.0nF, V <sub>GEN</sub> =0V, R <sub>GEN</sub> =0Ω Figure 4	9	All		10	pC

**TABLE 1. ELECTRICAL TESTS: SINGLE SUPPLY**

TEST	Symbol	CONDITIONS	Group A Subgroup	Device type	Limits Min 2/	Limits Max 2/	Units
		-55 °C ≤ T <sub>A</sub> ≤ +125°C V <sup>+</sup> =+15V, V <sup>-</sup> =-15V, GND=0V V <sub>INH</sub> =2.4V, V <sub>INL</sub> =0.8V, V <sub>L</sub> =5V Unless otherwise specified					
<b>SWITCH</b>							
Analog-Signal Range	V <sub>ANALOG</sub>	3/	1,2,3	All	0	12	V
Drain-Source ON Resistance	r <sub>DS(ON)</sub>	V <sup>+</sup> =+10.8V, I <sub>S</sub> =-10mA, V <sub>D</sub> =3.8V	1 2,3	All		80 100	Ω
<b>SUPPLY</b>							
Positive Supply Current	I <sub>+</sub>	All channels on or off, V <sup>+</sup> =+13.2, V <sub>IN</sub> =0V or 5V	1 2,3	All	-1.0 -5.0	1.0 5.0	μA
Negative Supply Current	I <sub>-</sub>	All channels on or off, V <sup>+</sup> =+13.2V, V <sub>IN</sub> =0V or 5V	1 2,3	All	-1.0 -5.0	1.0 5.0	μA
Logic Supply Current	I <sub>L</sub>	All channels on or off, V <sub>L</sub> =5.25V, V <sub>IN</sub> =0V or 5V	1 2,3	All	-1.0 -5.0	1.0 5.0	μA
Ground Current	I <sub>GND</sub>	All channels on or off, V <sub>L</sub> =5.25V, V <sub>IN</sub> =0V or 5V	1 2,3	All	-1.0 -5.0	1.0 5.0	μA
<b>DYNAMIC</b>							
Turn-On Time	t <sub>ON</sub>	V <sub>S</sub> =8V, Figure 2	9 10,11	All		250 315	ns
Turn-Off Time	t <sub>OFF</sub>	V <sub>S</sub> =8V, Figure 2	9 10,11	All		125 140	ns
Charge Injection 3/	Q	C <sub>L</sub> =1.0nF, V <sub>GEN</sub> =0V, R <sub>GEN</sub> =0Ω Figure 8	9	All		10	pC

NOTE 2: This data sheet uses the algebraic convention, where the most negative value is a minimum and the most positive value is a maximum.

NOTE 3: Guaranteed by design.

NOTE 4: Δr<sub>ON</sub>=Δr<sub>ON(max)</sub>-Δr<sub>ON(min)</sub>. On-resistance match between channels and flatness are guarantee only with specified voltages. Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured at the extremes of the specified analog signal range.

**FIGURE 2: SWITCHING TIME TEST CIRCUIT:** See Commercial Data Sheet

**FIGURE 3: BREAK-BEFORE-MAKE INTERVAL:** See Commercial Data Sheet

**FIGURE 4: CHARGE INJECTION:** See Commercial Data Sheet

Package		ORDERING INFORMATION:	
16 pin CERDIP	DG411AK/883B	DG412AK/883B	DG413AK/883B
16 pin Flatpack	DG411AL/883B	DG412AL/883B	DG413AL/883B
20 pin LCC	DG411AZ/883B	DG412AZ/883B	DG413AZ/883B

**TRUTH TABLES:**

DG411 LOGIC	DG411 SWITCH	DG412 LOGIC	DG412 SWITCH	DG413 LOGIC	DG413 SWITCHES 1,2	DG413 SWITCHES 3,4
0	ON	0	OFF	0	ON	OFF
1	OFF	1	ON	1	OFF	ON

**TERMINAL CONNECTIONS:**

	DG411/412/413	DG411/412/413
	J16	LCC20
1	IN1	NC
2	D1	IN1
3	S1	D1
4	V-	S1
5	GND	V-
6	S4	NC
7	D4	GND
8	IN4	S4
9	IN3	D4
10	D3	IN4
11	S3	NC
12	V <sub>L</sub>	IN3
13	V+	D3
14	S2	S3
15	D2	V <sub>L</sub>
16	IN2	NC
17		V+
18		S2
19		D2
20		IN2

**QUALITY ASSURANCE**

Sampling and inspection procedures shall be in accordance with MIL-Prf-38535, Appendix A as specified in Mil-Std-883.

Screening shall be in accordance with Method 5004 of Mil-Std-883. Burn-in test Method 1015:

1. Test Condition, A, B, C, or D.
2. TA = +125°C minimum.
3. Interim and final electrical test requirements shall be specified in Table 2.

Quality conformance inspection shall be in accordance with Method 5005 of Mil-Std-883, including Groups A, B, C, and D inspection.

Group A inspection:

1. Tests as specified in Table 2.
2. Selected subgroups in Table 1, Method 5005 of Mil-Std-883 shall be omitted.

Group C and D inspections:

- a. End-point electrical parameters shall be specified in Table 1.
- b. Steady-state life test, Method 1005 of Mil-Std-883:
  1. Test condition A, B, C, D.
  2. TA = +125°C, minimum.
  3. Test duration, 1000 hours, except as permitted by Method 1005 of Mil-Std-883.

**TABLE 2. ELECTRICAL TEST REQUIREMENTS**

Mil-Std-883 Test Requirements	Subgroups per Method 5005, Table 1
Interim Electric Parameters Method 5004	1
Final Electrical Parameters Method 5005	1*, 2, 3, 9
Group A Test Requirements Method 5005	1, 2, 3, 9,10,11
Group C and D End-Point Electrical Parameters Method 5005	1

\* PDA applies to Subgroup 1 only.

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