



DG381A/384A/387A/390A General Purpose CMOS Analog Switches

T-51-11

FEATURES

- ± 15 V Input Range
- Low $r_{DS(ON)}$ ($< 75 \Omega$)
- Single Supply Operation
- Pin and Function Compatible with the JFET DG180 Family

BENEFITS

- Full Rail to Rail Analog Signal Range
- Minimizes Signal Error
- Low Power Dissipation

APPLICATIONS

- Low Level Switching Circuits
- Programmable Gain Amplifiers
- Portable Battery Operation

DESCRIPTION

The DG38XA series of monolithic CMOS analog switches was designed for applications in instrumentation, communications, and process control. This series is suited for applications requiring fast switching and nearly flat ON resistance over the entire voltage range.

Designed on Siliconix' PLUS-40 CMOS process, the DG38XA series achieves low power consumption (3 mW typical) and excellent ON/OFF switch performance. This switch is ideal for battery powered applications, without sacrificing switching speed. Break-before-make switching action is guaranteed, and an epitaxial layer prevents

latchup. Single supply operation is allowed by connecting the V^- rail to 0 volts.

Each switch conducts equally well in both directions when ON, and blocks up to 30 volts peak-to-peak when OFF. These switches are quasi TTL and CMOS logic compatible.

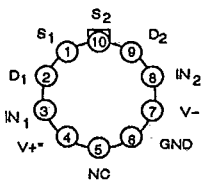
Packaging for this series includes the 14-pin CerDIP for the DG381A/DG387A, and the 16-pin CerDIP for the DG384A/DG390A. A 10-pin metal can option is available for the DG381A/DG387A. All devices are available in the plastic DIP version. Performance grades include the military, A suffix (-55 to 125°C), commercial, C suffix (0 to 70°C), and industrial, B suffix (-25 to 85°C) temperature ranges.

5

PIN CONFIGURATION

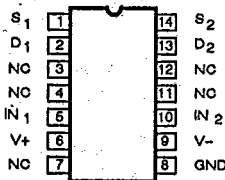
FUNCTIONAL BLOCK DIAGRAM

Metal Can Package
Top View

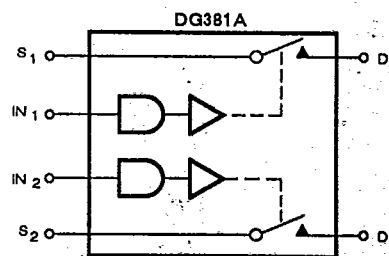


Order Numbers:
DG381AAA, DG381ABA
(SUBSTRATE & CASE)

Dual-In-Line Package
Top View



Order Numbers:
CerDIP: DG381AAK, DG381AAK/883
DG381ABK, DG381ACK
Plastic: DG381ACJ



Two SPST Switches per Package**

LOGIC	SWITCH
0	ON
1	OFF

Logic "0" ≤ 0.8 V
Logic "1" ≥ 4.0 V

**Switches Shown for Logic "1" Input

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DG381A/384A/387A/390A

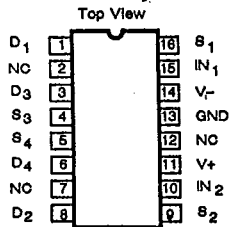


PIN CONFIGURATION (Cont'd)

FUNCTIONAL BLOCK DIAGRAM (Cont'd)

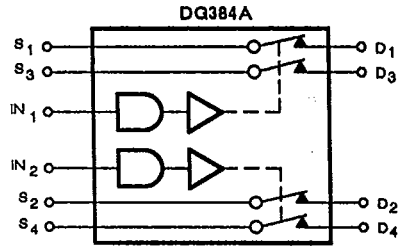
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Dual-In-Line Package



Order Numbers:

CerDIP: DG384AAK, DG384AAK/883
 DG384ABK, DG384ACK
 Plasto: DG384ACJ

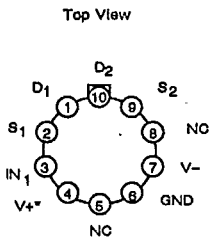


Two DPST Switches per Package*

TRUTH TABLE**

LOGIC	SWITCH
0	OFF
1	ON

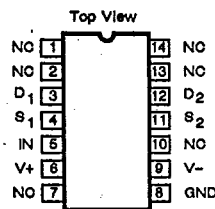
Metal Can Package



Order Numbers:
 DG387AAA, DG387AAA/883
 DG387ABA, DG387ACA

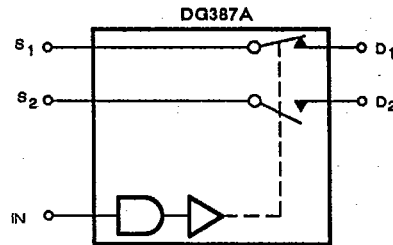
*(Substrate and Case)

Dual-In-Line Package



Order Numbers:

CerDIP: DG387AAK, DG387AAK/883
 DG387ABK, DG387ACK
 Plasto: DG387ACJ

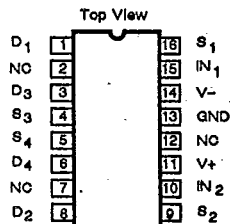


One SPDT Switch per Package*

TRUTH TABLE**

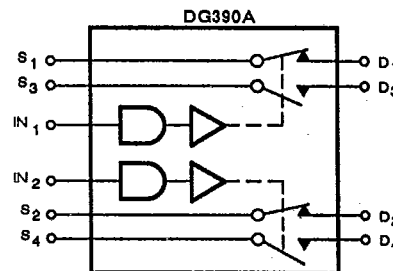
LOGIC	SW1	SW2
0	OFF	ON
1	ON	OFF

Dual-In-Line Package



Order Numbers:

CerDIP: DG390AAK, DG390AAK/883
 DG390ABK, DG390ACK
 Plasto: DG390ACJ



Two SPDT Switches per Package*

TRUTH TABLE**

LOGIC	SW1 SW2	SW3 SW4
0	OFF	ON
1	ON	OFF

* Switches Shown for Logic "1" Input
 ** Logic "0" ≤ 0.8 V, Logic "1" ≥ 4.0 V

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DG381A/384A/387A/390A

ABSOLUTE MAXIMUM RATINGS

T-51-11

Voltages Referenced to V-

- V+ 44 V
- GND 25 V
- Digital Inputs, V_S, V_D° (V-) -2 V to (V+) +2V or
..... 30 mA, whichever occurs first.
- Current, Any Terminal Except S or D 30 mA
- Continuous Current, S or D 30 mA
(Pulsed at 1 ms, 10% duty cycle max) 100 mA
- Storage Temperature (A & B Suffix) -65 to 150°C
(C Suffix) -65 to 125°C

- Operating Temperature (A Suffix) -55 to 125°C
- (B Suffix) -25 to 85°C
- (C Suffix) 0 to 70°C

- Power Dissipation*
 - 14-Pin Cerdip (K)** 825 mW
 - 14-Pin Plastic DIP (J)*** 470 mW
 - 10-Pin Metal Can (A)**** 450 mW

- * Device mounted with all leads soldered or welded to PC board.
- ** Derate 11 mW/°C above 75°C.
- *** Derate 6.5 mW/°C above 25°C.
- **** Derate 6 mW/°C above 75°C.

ELECTRICAL CHARACTERISTICS ^a									
PARAMETER	SYMBOL	Test Conditions Unless otherwise specified: $V_+ = 15\text{ V}$ $V_- = -15\text{ V}$ $GND = 0\text{ V}$	LIMITS						UNIT
			1=25°C 2=125, 85, 70°C 3=-55, -25, 0°C		A SUFFIX -55 to 125°C		B, C SUFFIX		
			TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b	
SWITCH									
Analog Signal Range ^o	V_{ANALOG}	$I_S = 10\text{ mA}$ $V_{IN} = 0.8\text{ V to } 4.0\text{ V}^f$	1,2,3		-15	15	-15	15	V
Drain-Source ON Resistance	$r_{DS(ON)}$	$V_{IN} = 0.8\text{ V}$ or $V_{IN} = 4.0\text{ V}^f$	1,3 2	30		50 75		50 75	Ω
Source OFF Leakage Current	$I_{S(OFF)}$		1 2	0.1		1 100		5 100	nA
Drain OFF Leakage Current	$I_{D(OFF)}$		1 2	0.1		-1 -100		-5 -100	
Drain ON Leakage Current	$I_{D(ON)}$		1 2	0.1		1 100		5 100	
		1 2	-0.1		-2 -200		-5 -200		
								$V_D = V_S = -14\text{ V}$	
INPUT									
Input Current with Input Voltage HIGH	I_{INH}	$V_{IN} = 5\text{ V}$	1 2,3	-0.001	-1 -1		-1		μA
Input Current with Input Voltage LOW	I_{INL}	$V_{IN} = 0\text{ V}$	1 2,3	-0.001	-1 -1		-1		

5

DG381A/384A/387A/390A



ELECTRICAL CHARACTERISTICS ^a		T-51-11								
PARAMETER	SYMBOL	Test Conditions Unless otherwise specified: V ₊ = 15 V V ₋ = -15 V GND = 0V	LIMITS						UNIT	
			1=25°C 2=125,85,70°C 3=-55,-25,0°C		A SUFFIX -55 to 125°C		B, C SUFFIX			
			TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b		
DYNAMIC										
Turn-ON Time	t _{ON}	See Switching Time Test Circuit	1	150		300			ns	
Turn-OFF Time	t _{OFF}		1	130		250				
Break-Before-Make Interval	t _{ON} - t _{OFF}		1	50						
Charge Injection	Q	C _L = 0.01 μF, R _{gen} = 0Ω V _{gen} = 0 V	1	10					pC	
Source-OFF Capacitance	C _{S(OFF)}	V _{IN} = 0.8 V or V _{IN} = 4.0 V ^f f = 1 MHz	V _S = 0 V	1	14				pF	
Drain-OFF Capacitance	C _{D(OFF)}			V _S = V _D = 0	1	14				
Channel-ON Capacitance	C _{D(ON)} + C _{S(ON)}				1	40				
Input Capacitance	C _{in}				V _{IN} = 0 V	1	6			
		V _{IN} = 15 V	1		7					
OFF Isolation ^f		V _{IN} = 0 V R _L = 1kΩ V _S = 1 V _{rms} f = 500 kHz	1	62					dB	
Crosstalk (Channel-to-Channel)			1	74						
SUPPLY										
Positive Supply Current	I ₊	V _{IN} = 4 V (One Input) (All Others = 0)	1,2 3	0.23		0.5 1.0		1	mA	
Negative Supply Current	I ₋		1,3 2	-0.001		-10 -100		-100		
Positive Supply Current	I ₊	V _{IN} = 0.8 V (All Inputs)	1,3 2	0.001		10 100		100	μA	
Negative Supply Current	I ₋		1,3 2	-0.001		-10 -100		-100		

NOTES:

- a. Refer to PROCESS OPTION FLOWCHART for additional information.
- b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- c. Guaranteed by design, not subject to production test.
- d. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- e. Signals on S_x, D_x, or IN_x exceeding V₊ or V₋ will be clamped by internal diodes. Limit diode forward current to maximum current ratings.
- f. OFF Isolation: 20 log (V_S/V_D). V_S = Input to OFF switch, V_D = Output.
- g. V_{IN} = Input voltage to perform proper function.

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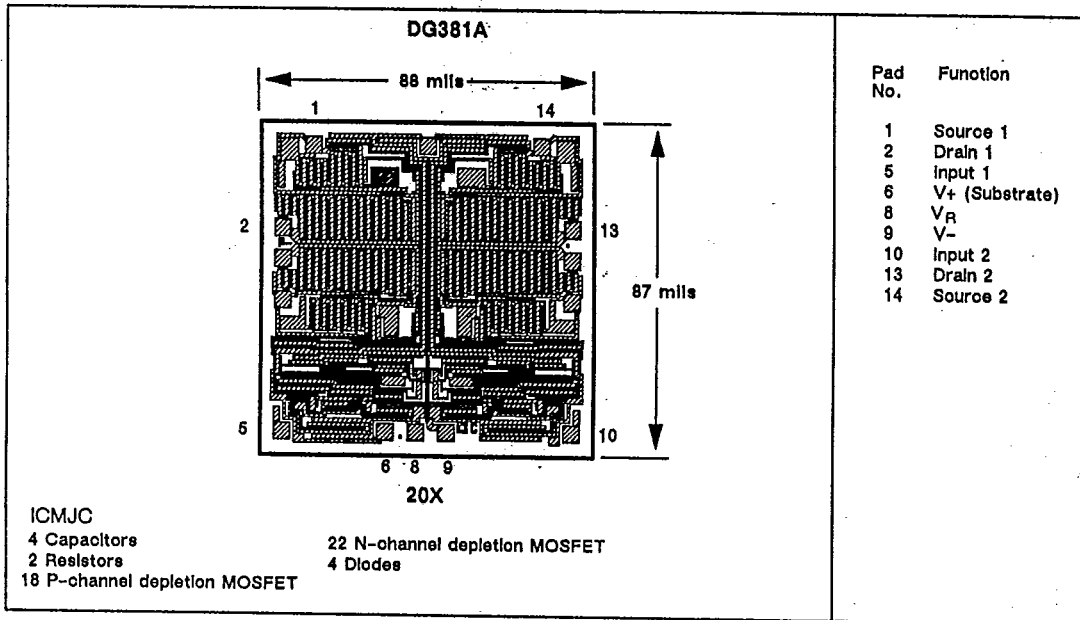
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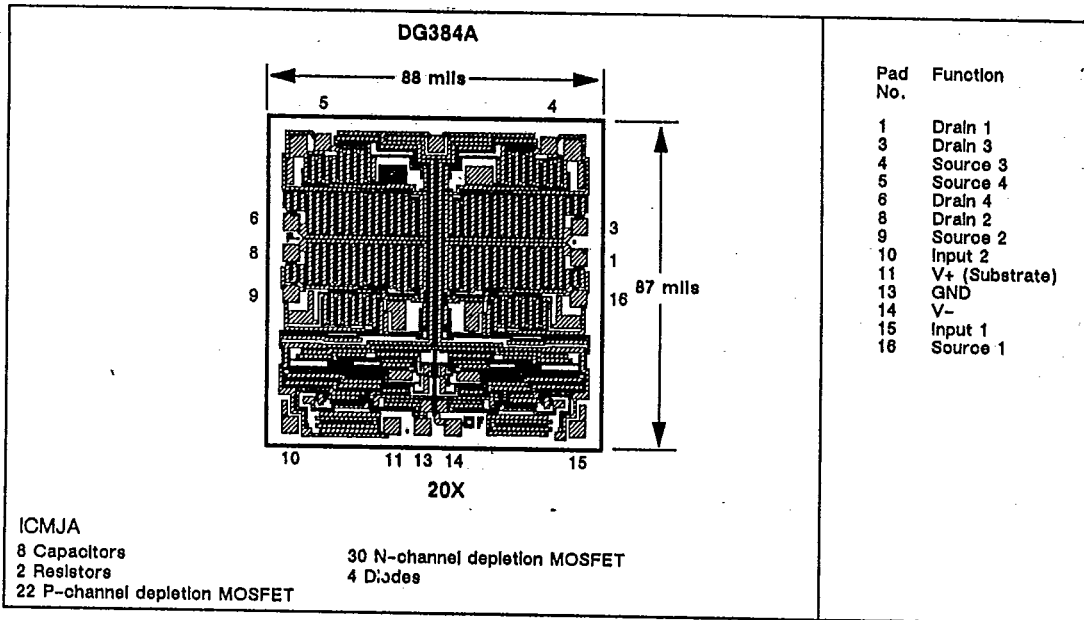
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DIE TOPOGRAPHY

T-51-11



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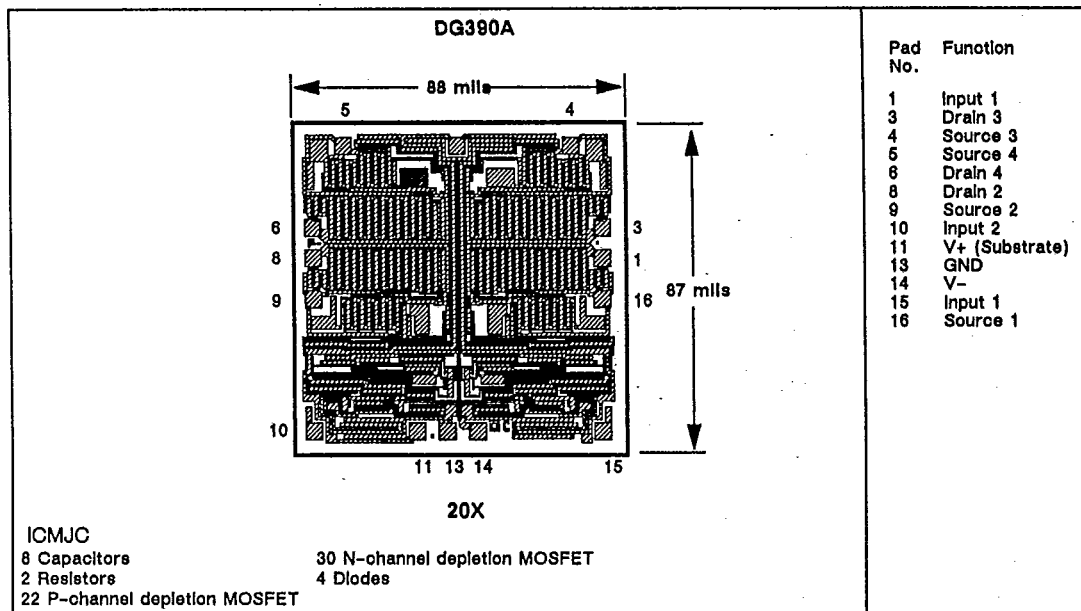
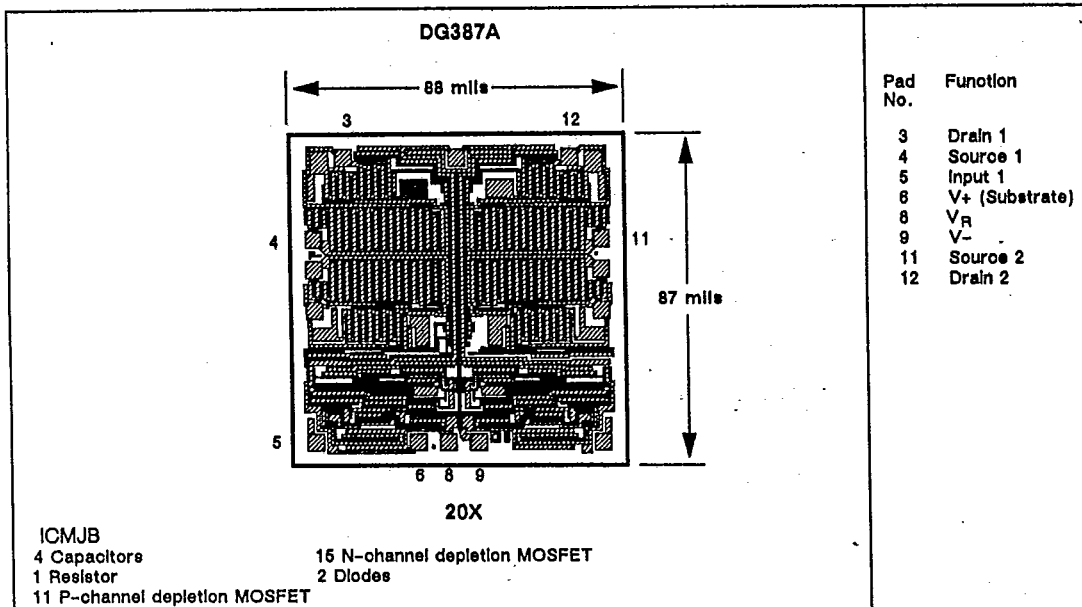
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DIE TOPOGRAPHY (Cont'd)

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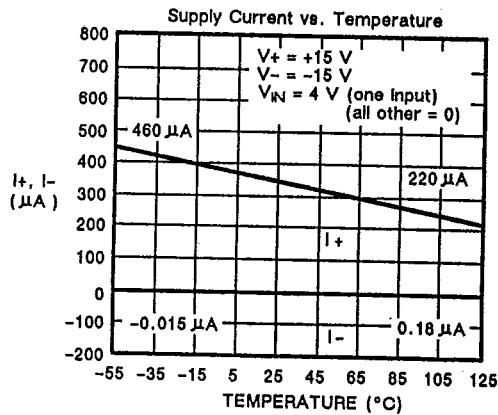
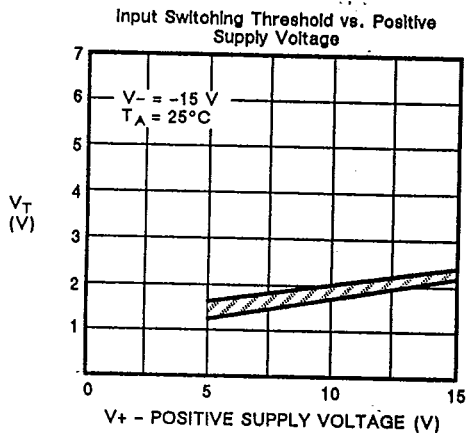
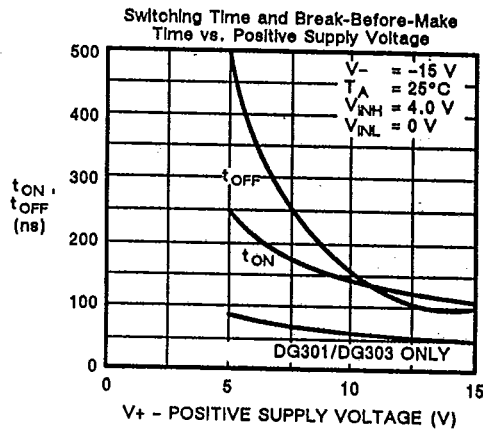
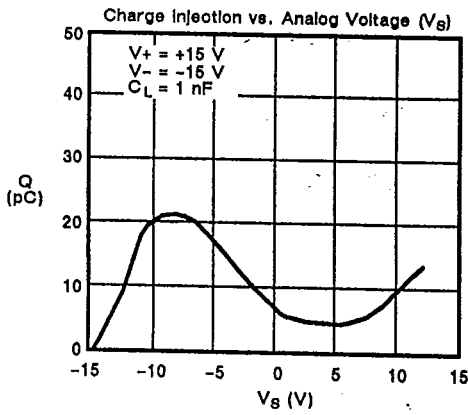
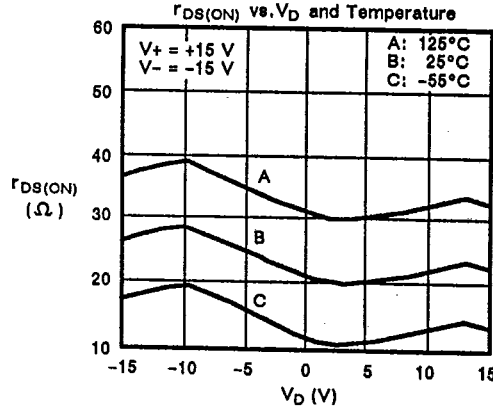
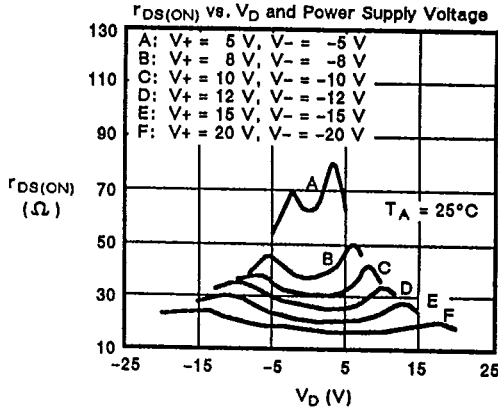




DG381A/384A/387A/390A

TYPICAL CHARACTERISTICS

T-51-11

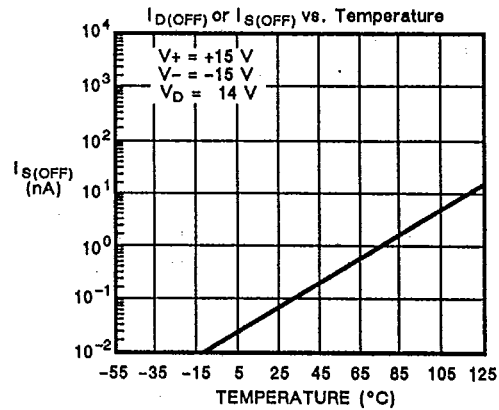
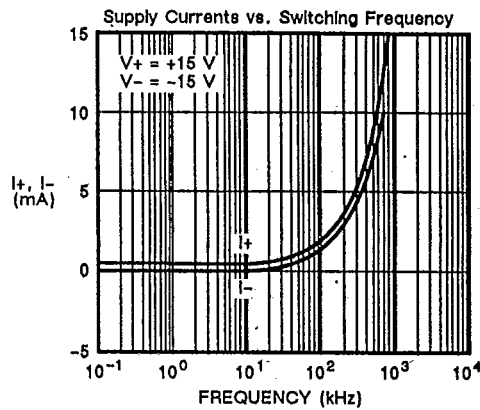
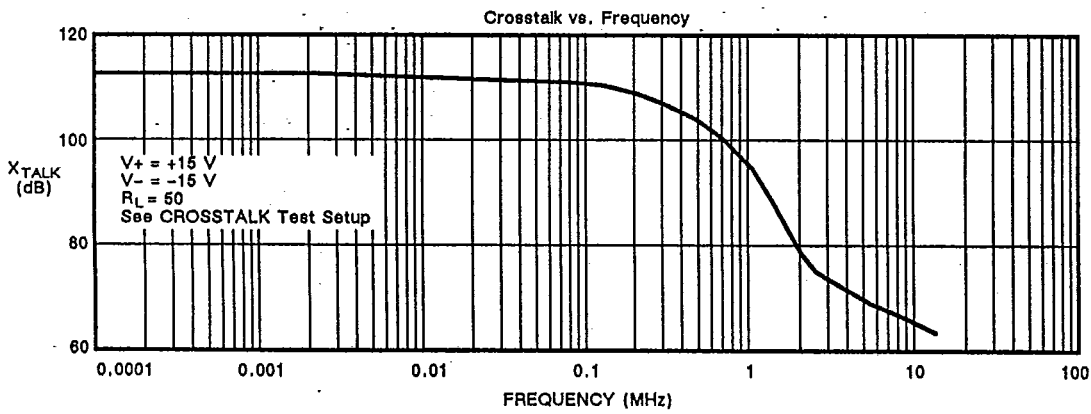
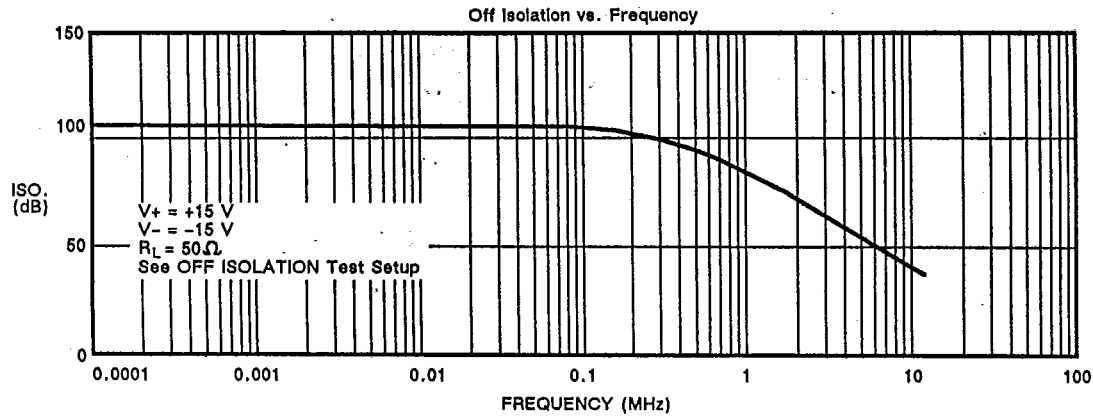


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TYPICAL CHARACTERISTICS (Cont'd)

T-51-11



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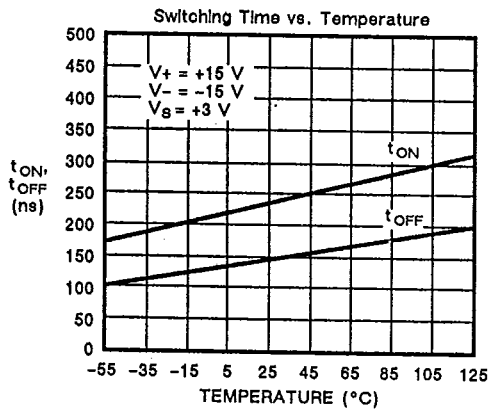
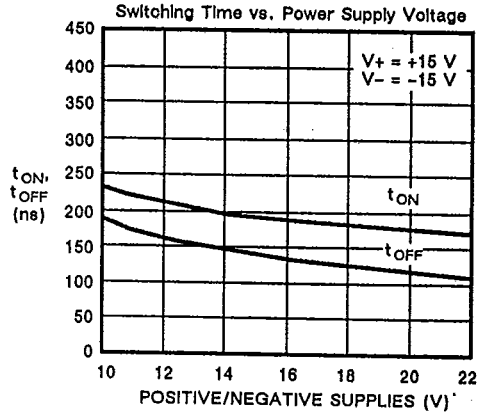
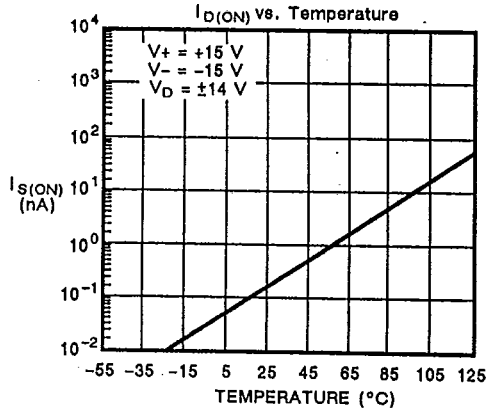
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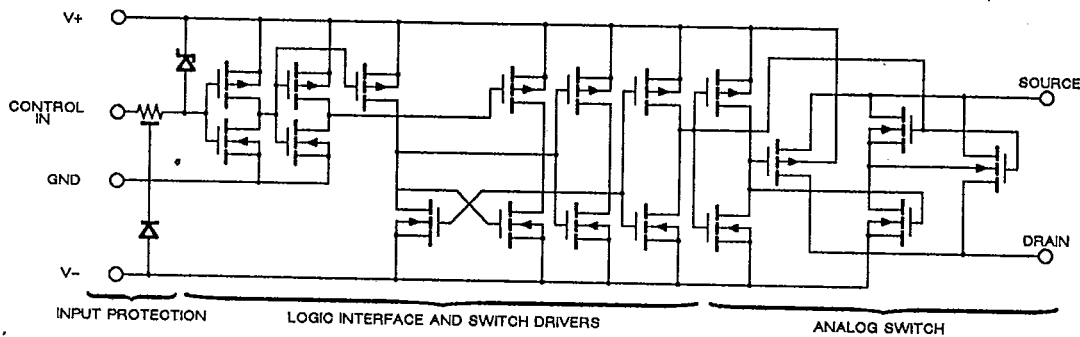
TYPICAL CHARACTERISTICS (Cont'd)

T-51-11



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SCHEMATIC DIAGRAM (Typical Channel)

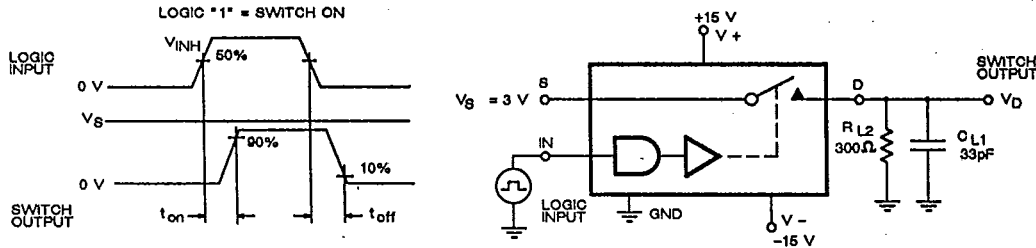


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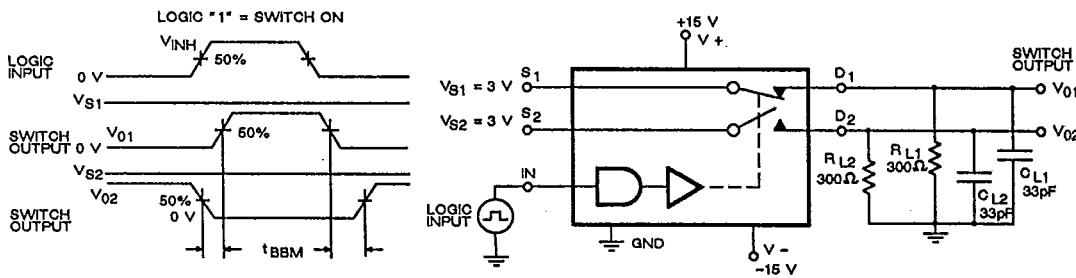


SWITCHING TIME TEST CIRCUIT

T-51-11



BREAK-BEFORE-MAKE TIME TEST CIRCUIT SPDT (DG387A, DG390A)



APPLICATIONS

The DG38XA series of analog switches will switch positive analog signals while using a single positive supply. This allows their use in applications where only one supply is available. The trade-offs or performance given up while using single supplies are: 1) increased $r_{DS(ON)}$; 2) slower switching

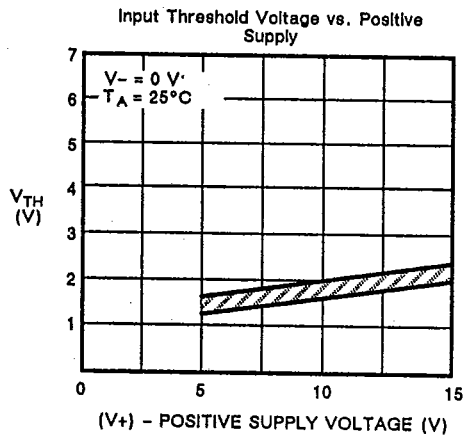
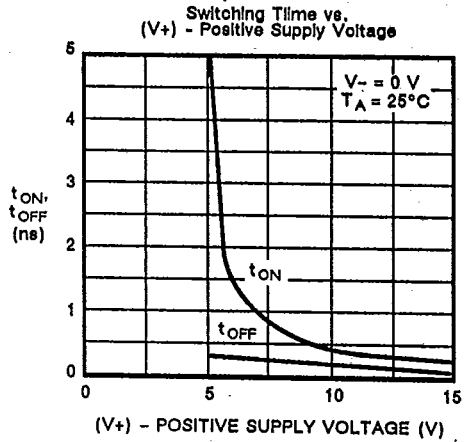
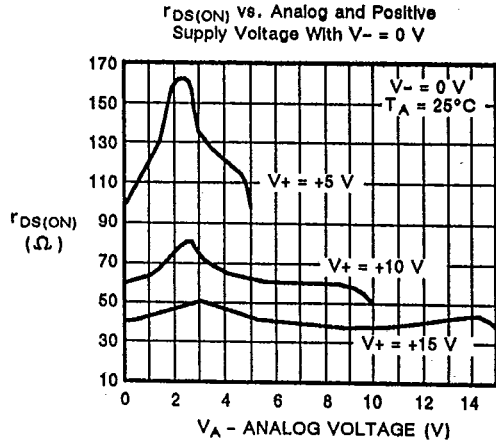
speed. Typical curves for aid in designing with single supplies are supplied in the figures below. The analog voltage should not go above or below the supply voltages which in single operation are $V+$ and 0 volts.



DG381A/384A/387A/390A

APPLICATIONS (Cont'd)

T-51-11



5