

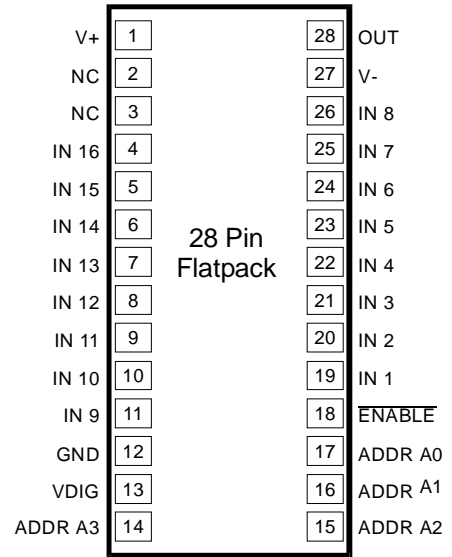
NGCL3571, NGC3580, NGCP3580

Radiation Hardened 16:1 Analog Multiplexers

Northrop Grumman Corporation
August 2007

Features

- 10 V (NGCL3571) / 30 V (NGCP3580, NGC3580) CMOS using SOI starting material
- Recommended Operating Voltages
NGCL3571 @ $V_+ - V_- = 10V$ (+/- 10%)
 [$V_- = 0V$, $V_+ = +10V$ or $V_- = -5V$, $V_+ = +5V$]
NGC3580, NGCP3580 @ ($V_+ = 15 \pm 10\%V$, $V_- = -15 \pm 10\%V$)
- Total Dose up to 300 krad (Si)
- No Single Event Upset (SEU) effects (no latched data)
- CMOS analog switching allows rail to rail operation and low switch impedance
- < 250 (500) Ohm nominal CMOS (PMOS) switch impedance
- < 500 (1000) Ohm worst case CMOS (PMOS) switch impedance
- Break before make switching
- < 500 ns access time over temperature and post rad
- > 100 MOhm OFF switch impedance
- High OFF state impedance maintained under powered down conditions - ideal for redundant applications
- Low power dissipation: <100 μA standby current
- > 1kV electrostatic discharge protection (Human Body Model)
- Available in 28 pin flatpacks, or bare die
- Full military operating temperature range, screened to specific test methods for commercial, Class B, or modified Hi Rel.



PINOUT
(Top View)

Introduction

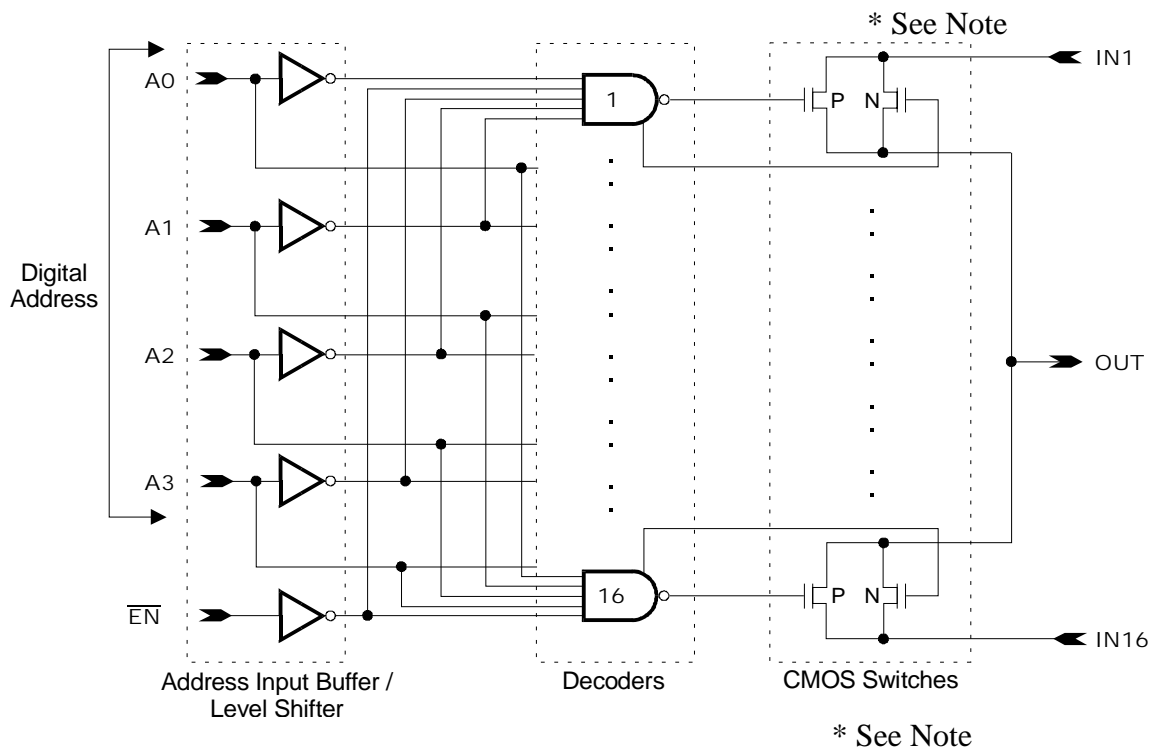
The NGC3571/3580 series is a family of radiation hardened 16:1 Analog Multiplexers designed by the Northrop Grumman Advanced Technology Center, Baltimore MD, using 10 V and 30 V CMOS technologies on Silicon On Insulator (SOI) starting material. The NGCL3571 uses a low voltage (10V) process and features CMOS analog switches. The NGC3580 and NGCP3580 use a high voltage (30V) process and feature CMOS and PMOS analog switches, respectively. CMOS analog switches result in rail to rail operation with minimal variation in switch impedance. CMOS switches offer the advantage of low switch impedance (<500 Ohms) and fast access time (<500 ns) over temperature, voltage and radiation level. All switches maintain high OFF state impedance even under power down conditions for redundant applications. SOI technology coupled with special design techniques makes this part immune to latch-up. Part has no latched data and is not subject to Single Event Upset (SEU) failures.

Caution: These devices are sensitive to electrostatic discharge. Users should follow proper I.C. handling procedures.

Absolute Maximum Ratings

	NGCL3571	NGC3580	NGCP3580	Units
Supply Voltage, V+ to V-	15	40	40	volts
Supply Voltage, V+ to GND	7.5	20	20	volts
Supply Voltage, VDIG to GND	7.5	7.5	7.5	volts
Digital input overvoltage range min	-0.5	-0.5	-0.5	
Digital input overvoltage range max	$V_{DIG} + 0.5$	$V_{DIG} + 0.5$	$V_{DIG} + 0.5$	volts
Analog input overvoltage range min	V- minus 0.5	V- minus 0.5	V- minus 10	volts
Analog input overvoltage range max	V+ plus 5	V+ plus 10	V+ plus 10	volts
Storage temperature				
Min	-65	-65	-65	deg C
Max	150	150	150	deg C

Functional Diagram (NGCL3571 / NGC3580)



Note: * - NGCP3580 functional diagram is the same as NGCL3571 / NGC3580 except analog switches are PMOS only (no NMOS).

DC Operating Characteristics NGCL3571**Recommended Operating Condition:** $V+ - V- = 10V(+/- 10\%)$ [$V- = 0V$, $V+ = +10V$ or $V- = -5V$, $V+ = +5V$]

Symbol	Description	25C Max	-55 to +125C Max	units
$I_{SUPPLY+}$	V+ supply current	500	500	μA
$I_{SUPPLY-}$	V- supply current	500	500	μA
I_{STBY+}	V+ standby current	500	500	μA
I_{STBY-}	V- standby current	500	500	μA
I_{AH}	input leakage	1	1	μA
I_{AL}	input leakage	1	1	μA
$I_{S(OFF)-}$	leakage into source of off switch $-V_{in}$	50	50	nA
$I_{S(OFF)+}$	leakage into source of off switch $+V_{in}$	50	50	nA
$I_{S(OFF, Poweroff)}$	leakage into source of off switch, $V+=V-=0$	50	50	nA
$I_{S(OFF) OV+}$	Isoff with overvoltage	1000	1000	nA
$I_{S(OFF) OV-}$	Isoff with overvoltage	N/A (Note 1)	N/A (Note 1)	nA
$I_{D(OFF) OV+}$	leakage into drain of off switch with overvoltage	1	10	μA
$I_{D(OFF) OV-}$	leakage into drain of off switch with overvoltage	N/A (Note 1)	N/A (Note 1)	μA
$I_{D(OFF) +}$	leakage into drain of off switch	50	5000	nA
$I_{D(OFF) -}$	leakage into drain of off switch	50	5000	nA
$I_{D(ON) +}$	leakage from on driver into switch $+V_{in}$	50	5000	nA
$I_{D(ON) -}$	leakage from on driver into switch $-V_{in}$	50	5000	nA
$R_{DS(ON) 5}$	switch on resistance $+V_{in}$	1000	1000	ohms
$R_{DS(ON) -5}$	switch on resistance $-V_{in}$	1000	1000	ohms
$R_{DS(ON) 0}$	switch on resistance $V_{in}=0$	6000	6000	ohms

1. The NGCL3571 does not allow undervoltage operation and maximum recommended undervoltage condition is 0.5 V below $V-$.

DC Operating Characteristics NGC3580 and NGCP3580

Recommended Operating Condition : $V_+ = +15 \pm 10\%V$, $V_- = -15 \pm 10\%V$
 (See Note 3)

Symbol	Description	25C Max	-55 to +125C Max	units
$I_{SUPPLY+}$	V+ supply current	500	500	μA
$I_{SUPPLY-}$	V- supply current	500	500	μA
I_{STBY+}	V+ standby current	500	500	μA
I_{STBY-}	V- standby current	500	500	μA
I_{AH}	input leakage	1	1	μA
I_{AL}	input leakage	1	1	μA
$-I_{S(OFF)}$	leakage into source of off switch $-V_{in}$	50	500	nA
$+I_{S(OFF)}$	leakage into source of off switch $+V_{in}$	50	500	nA
$I_{S(OFF, POWEROFF)}$	leakage into source of of off switch, $V_+ = V_- = 0$	50	2000	nA
$I_{S(OFF) OV+}$	$I_{S(OFF)}$ with overvoltage	1	20	μA
$I_{S(OFF) OV-}$	$I_{S(OFF)}$ with overvoltage	1	10	μA
$I_{D(OFF) OV+}$	leakage into drain of off switch with overvoltage	1	20	μA
$I_{D(OFF) OV-}$	leakage into drain of off switch with overvoltage	1	10	μA
$I_{D(OFF) +}$	leakage into drain of off switch	50	5000	nA
$I_{D(OFF) -}$	leakage into drain of off switch	50	5000	nA
$I_{D(ON) +}$	leakage from on driver into switch $+V_{in}$	50	5000	nA
$I_{D(ON) -}$	leakage from on driver into switch $-V_{in}$	50	5000	nA
$R_{DS(ON) 15}$	switch on resistance $+V_{in}$ (See Note 2)	800	800	ohms
$R_{DS(ON) 5}$	switch on resistance $V_{in}=5$	1500	1500	ohms
$R_{DS(ON) 0}$	switch on resistance $V_{in}=0$	1500	1500	ohms

Notes:

- The NGC3580 features both NMOS and PMOS analog switch transistors, resulting in rail to rail analog input operation with uniform impedance. The worst case analog switch resistance is 800 Ohms at +125 C.
- The NGC3580 does not allow undervoltage operation and maximum recommended undervoltage condition is 0.5 V below V_- .

AC Operating Characteristics, NGCL3571, NGC3580, NGCP3580

Guaranteed but not tested

Recommended Operating Conditions:

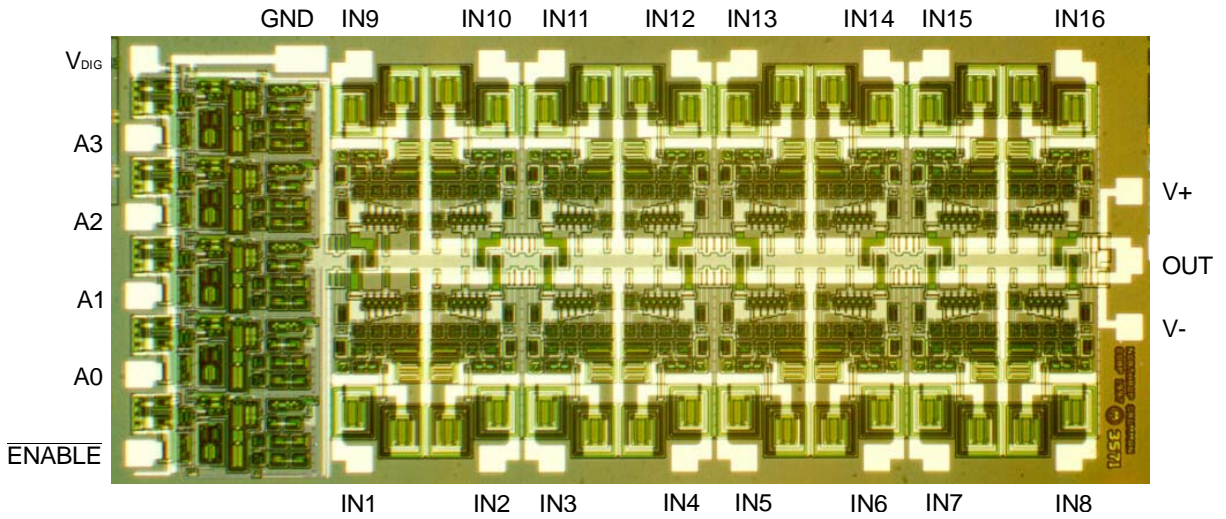
NGCL3571 @ $V_+ - V_- = 10V$ (+/- 10%) [$V_- = 0V$, $V_+ = +10V$ or $V_- = -5V$, $V_+ = +5V$] unless otherwise noted
NGC3580, NGCP3580 @ ($V_+ = 15$ +/-10%V, $V_- = -15$ +/-10%V, unless otherwise noted).

Symbol	Description	Conditions	-55 to +125C Limits		Typ 25C	Units
			Min	Max		
C_A	capacitance, digital Input	$V_+ = V_- = 0V$ $f = 1MHz$, $T_A = 25C$		7	1	pF
$C_{s(off)}$	capacitance, channel Input	$V_+ = V_- = 0V$ $f = 1MHz$, $T_A = 25C$		5	3	pF
$C_{D(OFF)}$	capacitance, channel Output	$V_+ = V_- = 0$ $f = 1MHz$, $T_A = 25C$		50	30	pF
V_{ISO}	off isolation, input or output	$V_{OEN} = 4V$, $f = 200kHz$ $CL = 7pF$, $RL = 1k$ $VS = 3V_{rms}$, $T_A = 25C$	-45		TBD	dB
t_D	break before make time delay	$CL = 50pF$, $RL = 1k$	25		50	ns
t_{ON}	prop delay, address inputs to I/O channels	$CL = 50pF$, $RL = 10M$		0.6	0.4	μs
t_{OFF}	prop delay, address inputs to I/O channels	$CL = 50pF$, $RL = 10M$		0.6	0.4	μs
$t_{ON(EN)}$	prop delay, enable to I/O channels	$CL = 50pF$, $RL = 1k$		0.4	0.2	μs
$t_{OFF(EN)}$	prop delay, enable to I/O channels	$CL = 50pF$, $RL = 1k$		0.6	0.4	μs

Truth Table

A3	A2	A1	A0	ENABLE	ON Channel
X	X	X	X	H	None
L	L	L	L	L	1
L	L	L	H	L	2
L	L	H	L	L	3
L	L	H	H	L	4
L	H	L	L	L	5
L	H	L	H	L	6
L	H	H	L	L	7
L	H	H	H	L	8
H	L	L	L	L	9
H	L	L	H	L	10
H	L	H	L	L	11
H	L	H	H	L	12
H	H	L	L	L	13
H	H	L	H	L	14
H	H	H	L	L	15
H	H	H	H	L	16

Die Pad Locations



Structural Information

Die Dimensions..... 86 x 200 x 20 mils

Die Attach

Material.....Gold Eutectic

Temperature.....400°C

Lead Temperature<275°C
(10 sec soldering)

Metallization

Type..... TiW/Al/Ti

Thickness 9.8 kÅ ± 1 kÅ

Glassivation

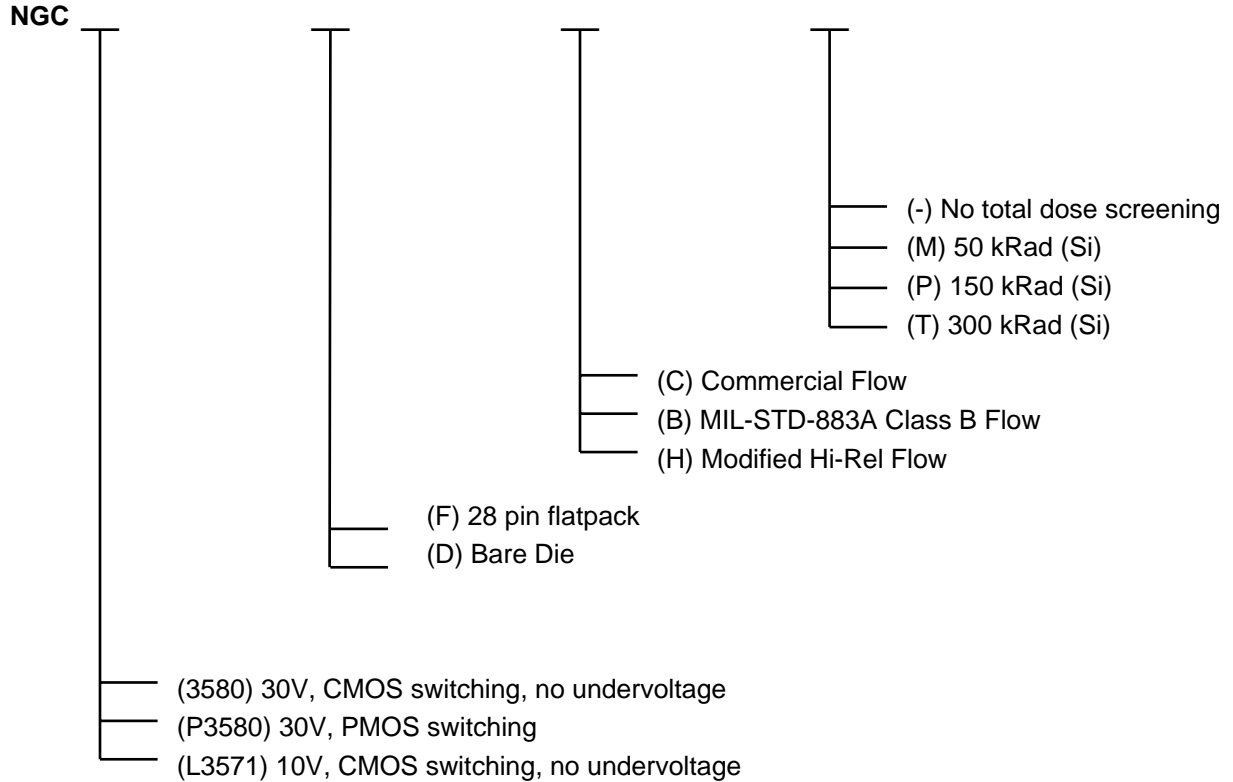
Type..... SiO₂

Thickness 8k Å ± 1 kÅ

Process..... PCBRH40

Ordering Information

To order the NGC radiation hardened 16:1 Analog Multiplexer, use the following part numbers.



Northrop Grumman Corporation
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Baltimore, MD 21203
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