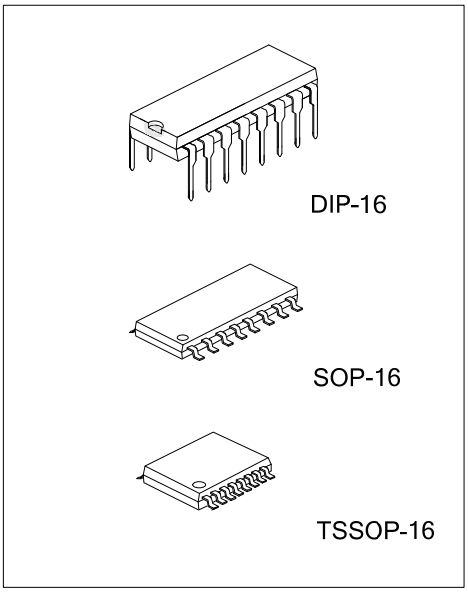
4051 **CMOS IC**

8-CHANNEL ANALOG MULTIPLEXERS/DEMULTIPLEXERS



■ DESCRIPTION

UTC **4051** is single 8-channel analog multiplexers/demultiplexers for application as digitally–controlled analog switches.

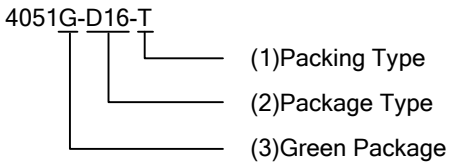
The device has three binary control inputs and an inhibit input. It feature low ON impedance and very low OFF leakage current. Control of analog signals up to the complete supply voltage range can be achieved.

■ FEATURES

* Wide Analog Voltage Range: V_{DD}–V_{EE} = 3V~18V.
  (Note: V_{EE} must be≦V_{SS})
* Break-Before-Make Switching Eliminates Channel Overlap.
* Linearized Transfer Characteristics
* Implement an SP8T solid state switch effectively.
* Pin–to–Pin Replacement for CD4051

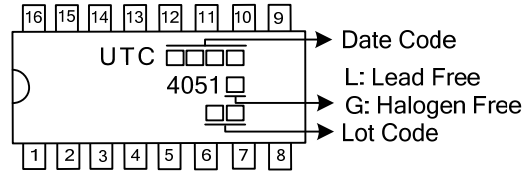
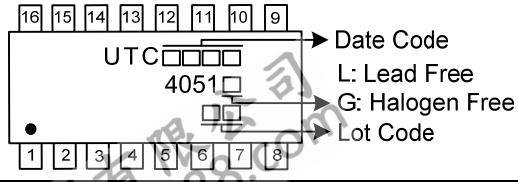
■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
4051L-D16-T	4051G-D16-T	DIP-16	Tube
4051L-S16-R	4051G-S16-R	SOP-16	Tape Reel
4051L-P16-R	4051G-P16-R	TSSOP-16	Tape Reel

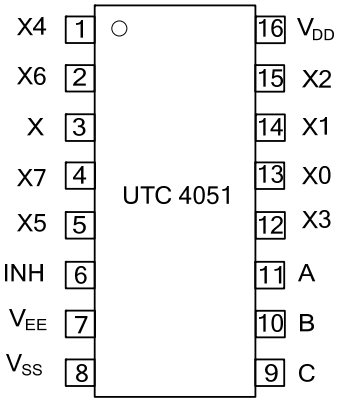


(1) T: Tube, R: Tape Reel
(2) D16: DIP-16, S16: SOP-16, P16: TSSOP-16
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

DIP-16	SOP-16 / TSSOP-16
	

■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN No.	SYMBAL	I/O	NAME AND FUNCTION
3	X	I/O	Common Input/Output
6	INH	I	Inhibit Inputs
7	V_{EE}		Supply Voltage
8	V_{SS}		Ground
11,10,9	A,B,C	I	Binary Control Inputs
13,14,15,12,1,5,2,4	X0~X7	I/O	Independent Inputs/Outputs
16	V_{DD}		Positive Supply Voltage

■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
DC Supply Voltage (Referenced to V_{EE}, $V_{SS} \geqq V_{EE}$)	V_{DD}	-0.5 ~ +18	V
Input or Output Voltage (DC or Transient) (Referenced to V_{SS} for Control Inputs and V_{EE} for Switch I/O)	V_{IN}, V_{OUT}	-0.5 ~ V_{DD} +0.5	V
Input Current (DC or Transient), per Control Pin	I_{IN}	±10	mA
Switch Through Current	I_{SW}	±25	mA
Power Dissipation	P_D	500	mW
Derating above 65℃		7	mW/°C
Junction Temperature	T_J	125	°C
Operating Temperature	T_{OPR}	-40 ~ +125	°C
Storage Temperature	T_{STG}	-40 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ ELECTRICAL CHARACTERISTICS (T_A=25℃, unless otherwise specified.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SUPPLY REQUIREMENTS (Voltages Referenced to V_{EE})							
Power Supply Voltage Range		V_{DD}	$V_{DD} - 3.0 \geqq V_{SS} \geqq V_{EE}$	3		18	V
Quiescent Current per Package	V_{DD}=5V	I_Q	Control Inputs: V_{IN} = V_{SS} or V_{DD} Switch I/O: $V_{EE} \leqq V_{I/O} \leqq V_{DD}$, $\Delta V_{SW} \leqq$ 500mV(Note 2)		0.005	5	μA
	V_{DD}=10V				0.010	10	
	V_{DD}=15V				0.015	20	
Total Supply Current (Dynamic Plus Quiescent, Per Package)	V_{DD}=5V	$I_{D(AV)}$	T_A=25℃ only (The channel component, (V_{IN}-V_{OUT})/Ron, is not included.)	(0.07 μA/kHz) f + I_Q			μA
	V_{DD}=10V			(0.20 μA/kHz) f + I_Q			
	V_{DD}=15V			(0.36 μA/kHz) f + I_Q			
SWITCHES IN/OUT AND COMMONS OUT/IN -- X, Y, Z (Voltages Referenced to V_{EE})							
Recommended Peak–to–Peak Voltage Into or Out of the Switch		$V_{I/O}$	Channel On or Off	0		V_{DD}	V_{PP}
Recommended Static or Dynamic Voltage Across the Switch		ΔV_{SW}	Channel On	0		600	mV
Output Offset Voltage		$V_{O(OFF)}$	V_{IN} = 0V, No Load		10		μV
ON Resistance	V_{DD}=5V	R_{ON}	$\Delta V_{SW} \leqq$ 500mV V_{IN} = V_{IL} or V_{IH} (Control), V_{IN} = 0 to V_{DD} (Switch)		250	1050	Ω
	V_{DD}=10V				120	500	
	V_{DD}=15V				80	280	
ΔON Resistance Between Any Two Channels in the Same Package	V_{DD}=5V	ΔR_{ON}			25	70	Ω
	V_{DD}=10V				10	50	
	V_{DD}=15V				10	45	
Off–Channel Leakage Current		I_{OFF}	V_{IN} = V_{IL} or V_{IH} (Control) Channel to Channel or Any One Channel, V_{DD}=15V		±0.05	±100	nA
Capacitance, Switch I/O		$C_{I/O}$	Inhibit = V_{DD}		10		pF
Capacitance, Common O/I		$C_{O/I}$	Inhibit = V_{DD}		17		pF
Capacitance, Feedthrough (Channel Off)		$C_{I/O}$	Pins Not Adjacent		0.15		pF
			Pins Adjacent		0.47		

■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
CONTROL INPUTS – INHIBIT A, B, C (Voltages Referenced to V_{SS})							
Low Level Input Voltage	V_{DD}=5V	V_{IL}	R_{ON}= per spec, I_{OFF} = per spec		2.25	1.5	V
	V_{DD}=10V				4.50	3.0	
	V_{DD}=15V				6.75	4.0	
High Level Input Voltage	V_{DD}=5V	V_{IH}	R_{ON}= per spec, I_{OFF} = per spec	3.5	2.75		V
	V_{DD}=10V			7	5.5		
	V_{DD}=15V			11	8.25		
Input Leakage Current		I_{LEAK}	V_{IN}= 0 or V_{DD}, V_{DD}=15V		±0.00001	±0.1	μA
Input Capacitance		C_{IN}			5.0	7.5	pF

■ DYNAMIC ELECTRICAL CHARACTERISTICS

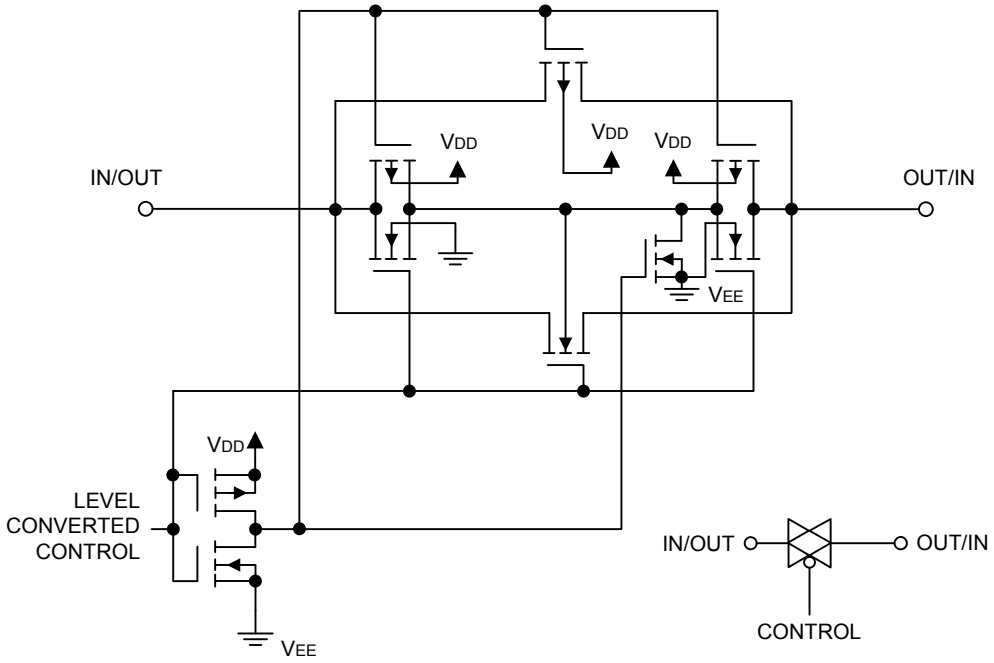
(C_L = 50pF, T_A=25℃, $V_{EE} \leqq V_{SS}$, unless otherwise specified)

PARAMETER	SYMBOL	V_{DD}-V_{EE} V_{DC}	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay Times Switch Input to Switch Output (R_L = 10kΩ)	t_{PLH}, t_{PHL}	5	t_{PLH}, t_{PHL} =(0.17 ns/pF)C_L + 26.5ns		35	90	ns
		10	t_{PLH}, t_{PHL} =(0.08 ns/pF)C_L + 11ns		15	40	
		15	t_{PLH}, t_{PHL} =(0.06 ns/pF)C_L + 9ns		12	30	
Inhibit to Output	t_{PHZ}, t_{PLZ} t_{PZH}, t_{PZL}	5	(R_L=10kΩ, V_{EE}=V_{SS}) Output “1” or “0” to High Impedance, or High Impedance to “1” or “0” Level		350	700	ns
		10			170	340	
		15			140	280	
Control Input to Output	t_{PLH}, t_{PHL}	5	R_L = 10kΩ, V_{EE} = V_{SS}		360	720	ns
		10			160	320	
		15			120	240	
Total Harmonic Distortion	THD	10	R_L = 10KΩ, f = 1 kHz, Vin = 5 V_{PP}		0.07		%
Bandwidth	BW	10	R_L = 1kΩ, V_{IN} = 1/2 (V_{DD}–V_{EE}) p–p, C_L = 50pF, 20 Log (V_{OUT}/V_{IN}) = -3dB)		17		MHz
Off Channel Feedthrough Attenuation		10	R_L=1KΩ, V_{IN} = 1/2 (V_{DD}–V_{EE}) p–p f_{IN} = 4.5 MHz		-50		dB
Channel Separation		10	R_L = 1kΩ, V_{IN} = 1/2 (V_{DD}–V_{EE}) p–p f_{IN} = 3MHz		-50		dB
Crosstalk, Control Input to Common O/I		10	R_1 = 1kΩ, R_L = 10kΩ Control t_{TLH} = t_{THL} = 20ns, Inhibit = V_{SS}		75		mV

Notes: 1. Data of “TYP” is intended as an indication of the IC’s potential performance.

2. For voltage drops across the switch(ΔV_{SW})>600mV (>300mV at high temperature), excessive V_{DD} current may be drawn, i.e. the current out of the switch may contain both V_{DD} and switch input components. The reliability of the device will be unaffected unless the Maximum Ratings are exceeded.

■ TEST CIRCUIT

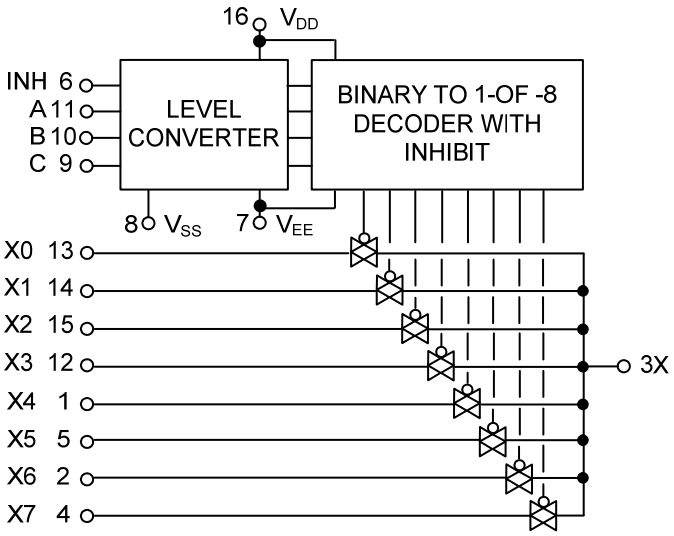


Switch Circuit Schematic

■ TRUTH TABLE

Control Inputs				ON Switches
INHIBIT	C	B	A	
0	0	0	0	X0
0	0	0	1	X1
0	0	1	0	X2
0	0	1	1	X3
0	1	0	0	X4
0	1	0	1	X5
0	1	1	0	X6
0	1	1	1	X7
1	x	x	x	None

x = Don't Care



UTC 4051 Functional Diagram

■ TYPICAL CHARACTERISTICS