



4052

CMOS IC

DIFFERENTIAL 4-CHANNEL ANALOG MULTIPLEXERS/ DEMULTIPLEXERS

■ DESCRIPTION

The UTC **4052** is differential 4-channel analog multiplexers/demultiplexers for application as digitally-controlled analog switches.

The device has two 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.

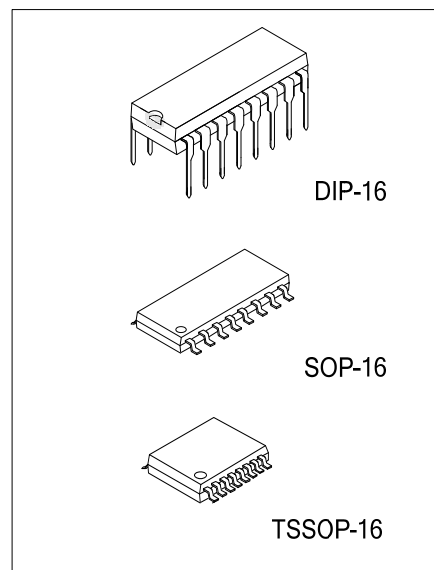
■ FEATURES

- * Wide Analog Voltage Range: $V_{DD}-V_{EE} = 3V \sim 18V$.
(Note: V_{EE} must be $\leq V_{SS}$)
- * Break-Before-Make Switching Eliminates Channel Overlap.
- * Linearized Transfer Characteristics
- * Implement an DP4T Switch Effectively.
- * Pin to Pin Replacement for CD4052

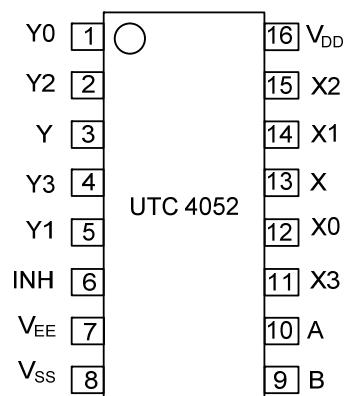
■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
4052L-D16-T	4052G-D16-T	DIP-16	Tube
4052L-P16-R	4052G-P16-R	TSSOP-16	Tape Reel
4052L-P16-T	4052G-P16-T	TSSOP-16	Tube
4052L-S16-R	4052G-S16-R	SOP-16	Tape Reel
4052L-S16-T	4052G-S16-T	SOP-16	Tube

4052L-D16-R (1)Packing Type (2)Package Type (3)Lead Free	(1) T: Tube, R: Tape Reel (2) D16: DIP-16, P16: TSSOP-16, S16: SOP-16 (3) G: Halogen Free, L: Lead Free
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■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN No.	SYMBOL	NAME AND FUNCTION
13, 3	X,Y	Commons Input/Output
6	INH	Inhibit Input
7	V_{EE}	Supply Voltage
8	V_{SS}	Ground
10,9	A,B	Binary Control Inputs
12,14,15,11	X0~X3	X Channel Inputs/Outputs
1,5,2,4	Y0~Y3	Y Channel Inputs/Outputs
16	V_{DD}	Positive Supply Voltage

Note: Control Inputs referenced to V_{SS} . Analog Inputs and Outputs reference to V_{EE} . V_{EE} must be $< V_{SS}$.

■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
DC Supply Voltage (Referenced to V_{EE} , $V_{SS} \geq V_{EE}$)	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	700	mW
Derating above 65°C		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 ($T_A = 25^\circ\text{C}$, 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 ≥ V _{SS} ≥ 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} ≤ V _{I/O} ≤ V _{DD} , and ΔV _{SW} ≤ 500mV(Note 2)		0.005	5	μA
	V _{DD} =10V				0.010	10	μA
	V _{DD} =15V				0.015	20	μA
Total Supply Current (Dynamic Plus Quiescent, Per Package)	V _{DD} =5V	I _{D(AV)}	T _A =25°C only (The channel component, (V _{IN} -V _{OUT})/R _{ON} , is excluded.)		(0.07 μA/kHz) f + I _Q		μA
	V _{DD} =10V				(0.20 μA/kHz) f + I _Q		μA
	V _{DD} =15V				(0.36 μA/kHz) f + I _Q		μA
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 (Note2)		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}	ΔV _{SW} ≤ 500mV (Note2) V _{IN} = V _{IL} or V _{IH} (Control), and V _{IN} = 0 to V _{DD} (Switch)		250	1050	Ω
	V _{DD} =10V				120	500	Ω
	V _{DD} =15V				80	280	Ω
Δ ON Resistance Between Any Two Channels in the Same Package	V _{DD} =5V	ΔR _{ON}			25	70	Ω
	V _{DD} =10V				10	50	Ω
	V _{DD} =15V				10	45	Ω
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		
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
	V _{DD} =15V				6.75	4.0	V
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			7.0	5.50		V
	V _{DD} =15V			11	8.25		V
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

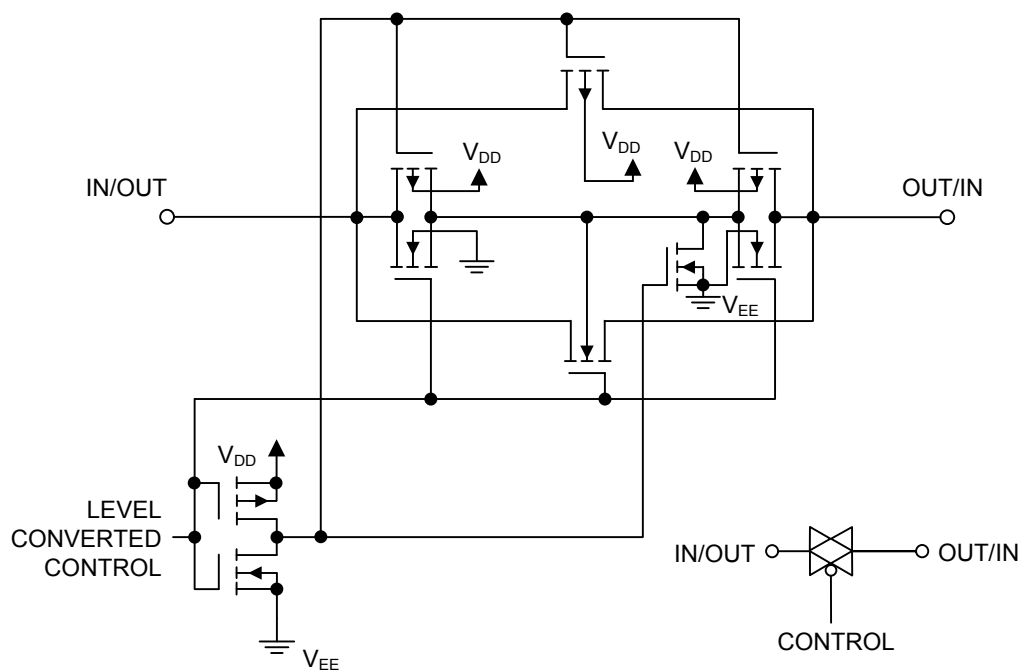
($C_L = 50\text{pF}$, $T_A = 25^\circ\text{C}$, $V_{EE} \leq V_{SS}$, unless otherwise specified)

PARAMETER	SYMBOL	$V_{DD}-V_{EE}$ V_{DC}	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay Times Switch Input to Switch Output ($R_L = 10\text{ k}\Omega$)	t_{PLH} , t_{PHL}	5	t_{PLH} , $t_{PHL} = (0.17\text{ ns/pF})C_L + 21.5\text{ns}$		30	75	ns
		10	t_{PLH} , $t_{PHL} = (0.08\text{ ns/pF})C_L + 8.0\text{ns}$		12	30	ns
		15	t_{PLH} , $t_{PHL} = (0.06\text{ ns/pF})C_L + 7.0\text{ns}$		10	25	ns
Inhibit to Output	t_{PHZ} , t_{PLZ} t_{PZH} , t_{PZL}	5	($R_L = 10\text{ k}\Omega$, $V_{EE} = V_{SS}$)		300	600	ns
		10	Output "1" or "0" to High Impedance,		155	310	ns
		15	or High Impedance to "1" or "0" Level		125	250	ns
Control Input to Output	t_{PLH} , t_{PHL}	5	$R_L = 10\text{ k}\Omega$, $V_{EE} = V_{SS}$		325	650	ns
		10			130	260	ns
		15			90	180	ns
Total Harmonic Distortion	THD	10	$R_L = 10\text{ k}\Omega$, $f = 1\text{ kHz}$, $V_{IN} = 5\text{ V}_{PP}$		0.07		%
Bandwidth	BW	10	$R_L = 1\text{ k}\Omega$, $V_{IN} = 1/2 (V_{DD}-V_{EE})$ p-p, $C_L = 50\text{pF}$, $20\text{ Log } (V_{OUT}/V_{IN}) = -3\text{dB}$		17		MHz
Off Channel Feedthrough Attenuation		10	$R_L = 1\text{ k}\Omega$, $V_{IN} = 1/2 (V_{DD}-V_{EE})$ p-p $f_{IN} = 30\text{MHz}$		-50		dB
Channel Separation		10	$R_L = 1\text{ k}\Omega$, $V_{IN} = 1/2 (V_{DD}-V_{EE})$ p-p $f_{IN} = 3\text{MHz}$		-50		dB
Crosstalk, Control Input to Common O/I		10	$R_1 = 1\text{ k}\Omega$, $R_L = 10\text{ k}\Omega$ Control $t_{TLH} = t_{THL} = 20\text{ns}$, Inhibit = V_{SS}		75		mV

Note: 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

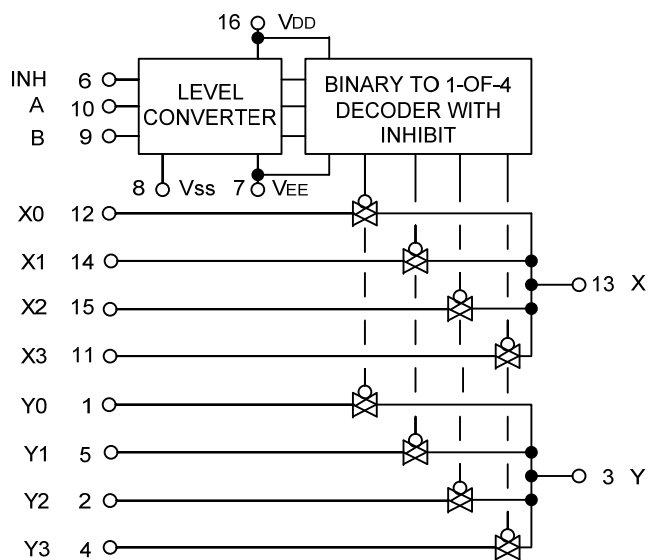


Switch Circuit Schematic

■ TRUTH TABLE

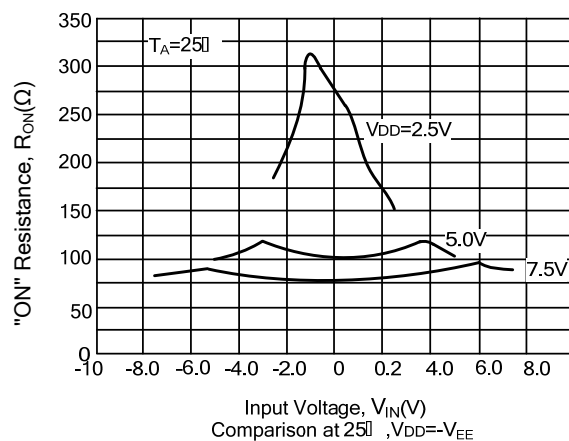
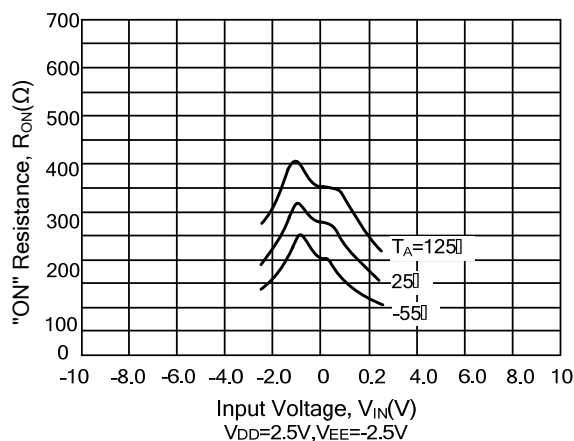
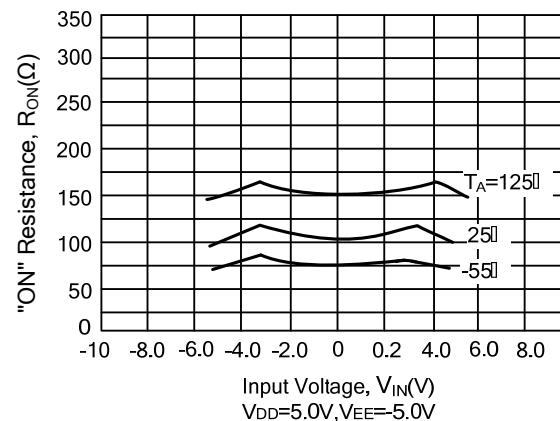
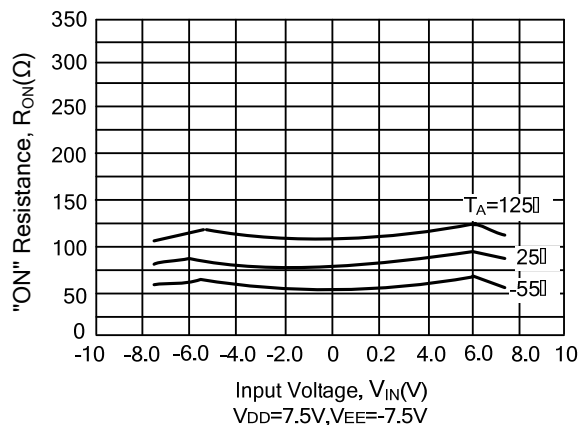
TRUTH TABLE				
Control Inputs			ON Switches	
Inhibit	Select			
	B	A		
0	0	0	Y0	X0
0	0	1	Y1	X1
0	1	0	Y2	X2
0	1	1	Y3	X3
1	X	X	None	

* X=Don't Care



UTC 4052 Functional Diagram

■ TYPICAL CHARACTERISTICS



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