MOTOROLA

MC34050
MC34051

Dual EIA-422/423 Transceivers

DUAL EIA–422/423 TRANSCEIVERS

SEMICONDUCTOR TECHNICAL DATA

The MC34050/51 are dual transceivers which comply with EIA Standards EIA–422 (Balanced line) and EIA–423 (Unbalanced line). Each device contains two drivers and two receivers.

The MC34050 has a DRIVER ENABLE (for both drivers) and a $\overline{\text{RECEIVER ENABLE}}$ (for both receivers). Connecting the two ENABLES together provides Driver–to–Receiver switching from a single line.

The MC34051 has a DRIVER ENABLE for each driver. The two receivers are permanently enabled.

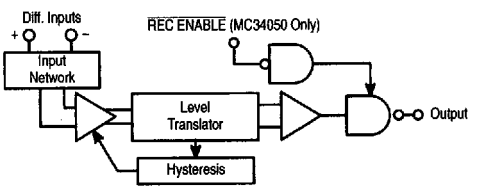
The Driver inputs, Receiver outputs, and Enable inputs are 74LS TTL compatible.

- Two Independent Drivers and Receivers Per Package
- 3–State Outputs
- Single 5.0 V Supply
- Internal Hysteresis (50 mV Typical) on Receivers
- Receivers Provide Fail–Safe Function. Output Stays High if Inputs are Open, Shorted (floating), or Terminated (floating)
- Receivers May Be Used in EIA–422 or 423 Systems
- Drivers Meet Full EIA–422 Standards

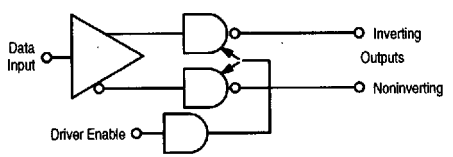
D SUFFIX
PLASTIC PACKAGE
CASE 751B
(SO–16)

P SUFFIX
PLASTIC PACKAGE
CASE 648

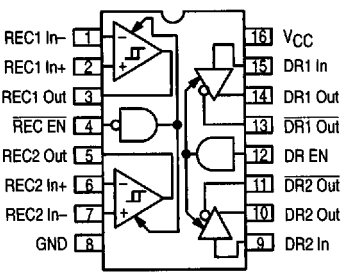
Receiver Block Diagram



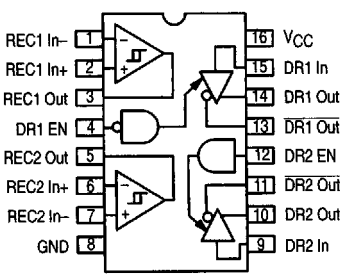
Driver Block Diagram



PIN CONNECTIONS



(MC34050)



(MC34051)

TRUTH TABLE

Driver				Receiver		
Data	EN	Inv. Out	Noninv. Out	Input	$\overline{\text{EN}}$	Output
L	H	H	L	> + 0.2 V Diff.	L	H
H	H	L	H	< – 0.2 V Diff.	L	L
X	L	Z	Z	X	H	Z

ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC34050D		SO–16
MC34050P		Plastic DIP
MC34051P	T_A = 0° to +70°C	Plastic DIP
MC34051D		SO–16

MAXIMUM RATINGS

Rating	Value	Units
Power Supply Voltage (V_{CC})	7.0	Vdc
Input Common Mode Voltage (Receivers)	±25	Vdc
Input Differential Voltage (Receivers)	±25	Vdc
Output Sink Current (Receivers)	50	mA
Enable Input Voltage (Drivers and Receivers)	5.5	Vdc
Input Voltage (Drivers)	5.5	Vdc
Applied Output Voltage (3–State mode) – Receivers	−1.0 to + 7.0	Vdc
Applied Output Voltage (3–State mode) – Drivers	−1.0 to + 7.0	Vdc
Junction Temperature	− 65 to +150	°C
Storage Temperature	− 65 to +150	°C

Devices should not be operated at these values.
The "Recommended Operating Limits" provide for actual device operation.

RECOMMENDED OPERATING LIMITS

Characteristic	Min	Typ	Max	Unit
Power Supply Voltage	+4.75	+5.0	+5.25	Vdc
Input Common Mode Voltage (Receivers)	−7.0	–	+7.0	Vdc
Input Differential Voltage (Receivers)	−6.0	–	+6.0	Vdc
Enable Input Voltage (Drivers and Receivers)	0	–	+5.25	Vdc
Input Voltage (Drivers)	0	–	+5.25	Vdc
Ambient Temperature Range	0	–	+70	°C

ELECTRICAL CHARACTERISTICS (Unless otherwise noted, specifications apply for 4.75 < V_{CC} < 5.25 V, and 0° < T_A < 70°C).

Characteristic	Symbol	Min	Typ	Max	Unit
DRIVERS					
Input Voltage – Low	V_{ILD}	–	–	0.8	Vdc
Input Voltage – High	V_{IHD}	2.0	–	–	Vdc
Input Current @ V_{IL} = 0.4 V	I_{ILD}	−360	–	–	µA
Input Current @ V_{IH} = 2.7 V V_{IH} = 5.25 V	I_{IHD}	– –	– –	+20 +100	µA
Input Clamp Voltage (I_{IK} = −18 mA)	V_{IKD}	−1.5	–	–	Vdc
Output Voltage – Low (I_{OL} = 20 mA)	V_{OLD}	–	–	0.5	Vdc
Output Voltage – High (I_{OH} = −20 mA)	V_{OHD}	2.5	–	–	Vdc
Output Offset Voltage Difference (Note 1)	V_{OSD}	−0.4	–	+0.4	Vdc
Output Differential Voltage (Note 1)	V_T	2.0	–	–	Vdc
Output Differential Voltage Difference (Note 1)	V_{TD}	−0.4	–	+0.4	Vdc
Short Circuit Current (V_{CC} = 5.25 V) (From High Output, Note 2)	I_{OSD}	−150	–	−30	mA
Output Leakage Current – Hi–Z State (V_{out} = 0.5 V, DR EN = 0.8 V) (V_{out} = 2.7 V, DR EN = 0.8 V)	I_{OZD}	 −100 −100	 – –	 +100 +100	µA
Output Leakage – Power Off (V_{out} = − 0.25 V, V_{CC} = 0 V) (V_{out} = 6.0 V, V_{CC} = 0 V)	$I_{O(off)}$	 −100 –	 – –	 – +100	µA

NOTES: 1. See EIA Standard EIA–422 and Figure 1 for exact test conditions.
2. Only one output in a package should be shorted at a time, for no longer than 1 second.

ELECTRICAL CHARACTERISTICS (Unless otherwise noted, specifications apply for 4.75 < V_{CC} < 5.25 V, and 0° < T_A < 70°C).

Characteristic	Symbol	Min	Typ	Max	Unit
RECEIVERS					
Differential Input Threshold Voltage (Note 3) (−7.0 V < V_{ICM} < 7.0, V_{out} ≥ 2.7 V) (−7.0 V < V_{ICM} < 7.0, V_{out} ≤ 0.45 V)	V_{THR}	 – −0.2	 – –	 +0.2 –	Vdc
Input Bias Current (0 ≤ V_{CC} ≤ 5.25 V, V_{in} = 15 V) (0 ≤ V_{CC} ≤ 5.25 V, V_{in} = −15 V)	I_{IBR}	 – −2.8	 – –	 +2.3 –	mA
Input Balance and Output Level (−7.0 ≤ V_{ICM} ≤ 7.0 V) (V_{ID} = 0.4 V, I_O = −400 µA) (V_{ID} = −0.4 V, I_O = 8.0 mA)	 V_{OHR} V_{OLR}	 2.7 –	 – –	 – 0.45	Vdc
Output Leakage Current – 3–State (Pin 4 = 2.0 V, MC34050 only) (V_{ID} = 3.0 V, V_O = 0.4 V) (V_{ID} = −3.0 V, V_O = 2.4 V)	I_{OZR}	 −100 −100	 – –	 +100 +100	µA
Output Short Circuit Current (Note 2, V_{CC} = 5.25 V) (V_{ID} = 3.0 V, MC34050 Pin 4 = 0.4 V, V_O = 0 V)	I_{OSR}	−85	–	−15	mA
ENABLES					
Input Voltage – Low	V_{ILE}	–	–	0.8	Vdc
Input Voltage – High	V_{IHE}	2.0	–	–	Vdc
Input Current @ V_{IL} = 0.4 V (Receiver EN) (Driver EN)	I_{ILER} I_{ILED}	−100 −360	– –	– –	µA
Input Current @ V_{IH} = 2.7 V V_{IH} = 5.25 V	I_{IHE}	– –	– –	+20 +100	µA
Input Clamp Voltage (I_{IK} = −18 mA)	V_{IKE}	−1.5	–	–	Vdc
POWER SUPPLY					
Power Supply Current @ V_{CC} = 5.25 V	I_{CC}	–	55	80	mA

NOTES: 2. Only one output in a package should be shorted at a time, for no longer than 1 second.
3. Differential input threshold voltage and guaranteed output levels are done simultaneously for worst case.

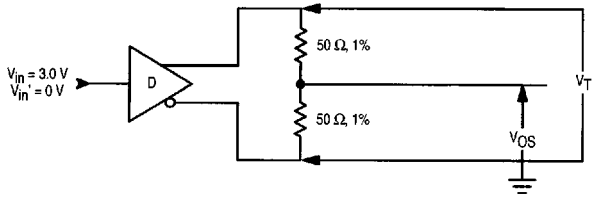
DRIVER SWITCHING CHARACTERISTICS (V_{CC} = 5.0 V, T_A = 25°C, see Figure 2).

Characteristic	Symbol	Min	Typ	Max	Unit
Propagation Delay					ns
Data Input to Output High–to–Low	t_{PHLD}	–	–	20	
Data Input to Output Low–to–High	t_{PLHD}	–	–	20	
Output Skew ($\lvert t_{PHL} - t_{PLH} \rvert$ each driver)	t_{SKD}	–	–	8	
Enable Input to Output					
C_L = 10 pF, R_L = 75 Ω to Gnd	t_{PHZD}	–	–	30	
C_L = 10 pF, R_L = 180 Ω to V_{CC}	t_{PLZD}	–	–	35	
C_L = 30 pF, R_L = 75 Ω to Gnd	t_{PZHD}	–	–	40	
C_L = 30 pF, R_L = 180 Ω to V_{CC}	t_{PZLD}	–	–	45	
Maximum Data Input Transition Time (10% to 90%)	t_{TRD}	–	50	–	ns

RECEIVER SWITCHING CHARACTERISTICS (V_{CC} = 5.0 V, T_A = 25°C, see Figure 3).

Characteristic		Symbol	Min	Typ	Max	Unit
Propagation Delay						ns
Differential Input to Output – High–to–Low		t_{PHLR}	–	–	30	
Differential Input to Output – Low–to–High		t_{PLHR}	–	–	30	
Enable Input – Output Low to 3–State	MC34050 Only	t_{PLZR}	–	–	35	
Enable Input – Output High to 3–State	MC34050 Only	t_{PHZR}	–	–	35	
Enable Input – Output 3–State to High	MC34050 Only	t_{PZHR}	–	–	30	
Enable Input – Output 3–State to Low	MC34050 Only	t_{PZLR}	–	–	30	

Figure 1. Driver Output Test Circuit

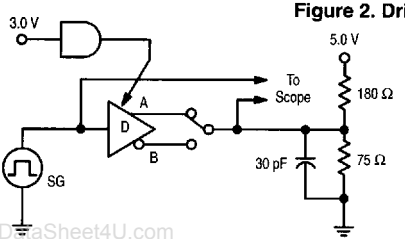


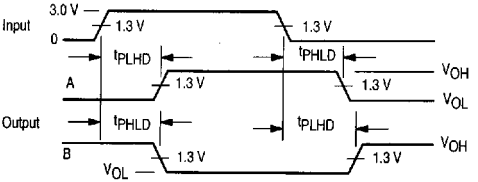
$$V_{OSD} = \left|V_{OS} - V_{OS}'\right|;$$

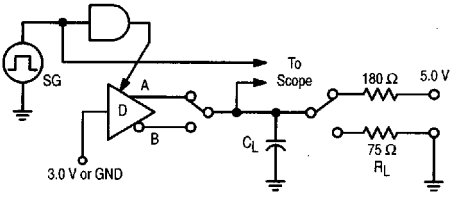
$$V_{ODD} = \left|\left|V_T\right| - \left|V_T'\right|\right|$$

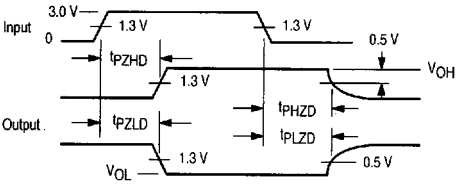
Circuit per EIA–422–A, Dec. 1978

Figure 2. Driver Switching Test Circuits



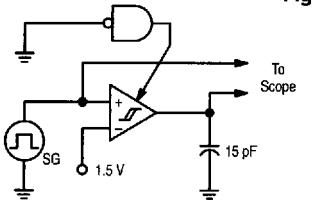


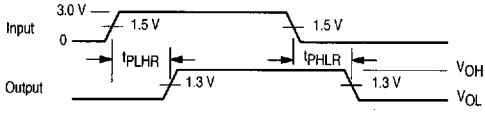


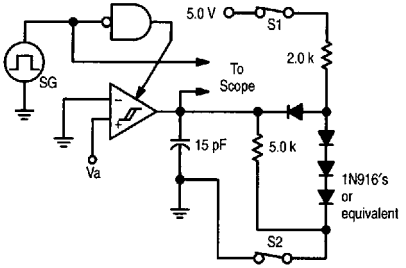


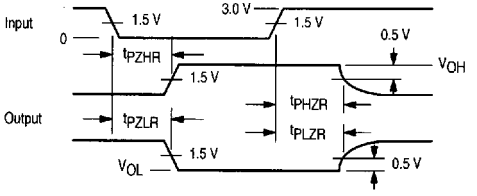
SG: 1.0 MHz, 50% duty cycle, t_R, t_F = 6.0 ns (10% to 90%)
R_L = 75 Ω to GND for t_{PZHD} and t_{PHZD}, 180 Ω to V_{CC} for t_{PZLD} and t_{PLZD};
C_L = 10 pF for t_{PHZD} and t_{PLZD}, 30 pF for t_{PZHD} and t_{PZLD}.

Figure 3. Receiver Switching Test Circuits









SG: 1.0 MHz, 50% duty cycle, t_R, t_F = 6.0 ns (10% to 90%)
Va = +1.5 V for t_{PHZ}, t_{PZH}; Va = −1.5 V for t_{PLZ}, t_{PZL}.
S1, S2 closed for t_{PHZ}, t_{PLZ}; S1 open, S2 closed for t_{PZH}; S1 closed, S2 open for t_{PZL}.

Figure 4. Driver Input Characteristics

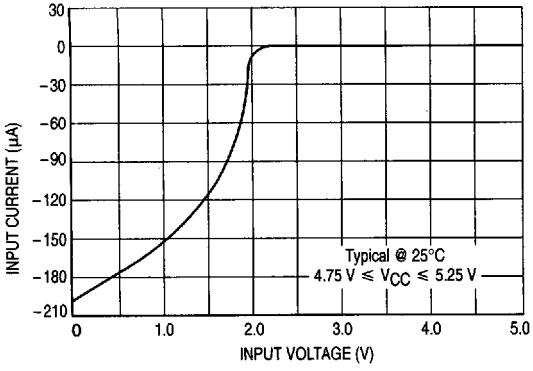


Figure 5. Driver Differential Output Characteristics

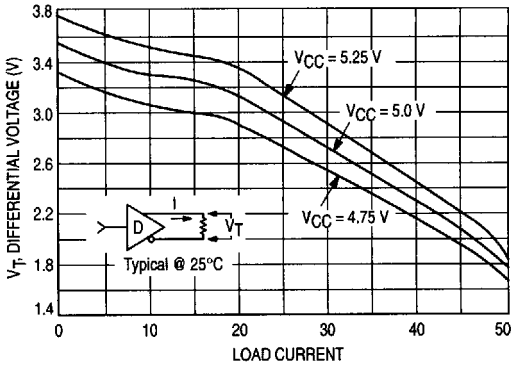


Figure 6. Driver Output Voltage

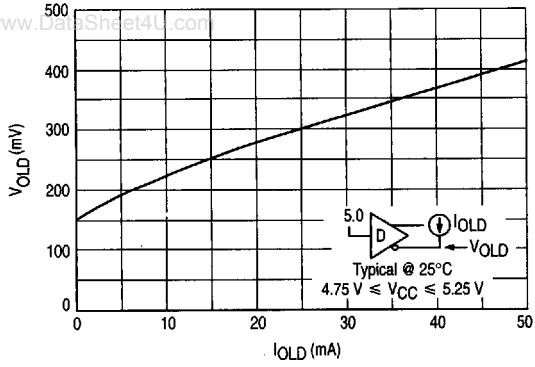


Figure 7. Driver Output Voltage

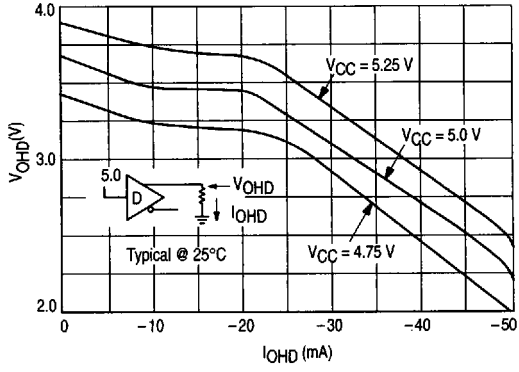


Figure 8. Receiver Output Voltage

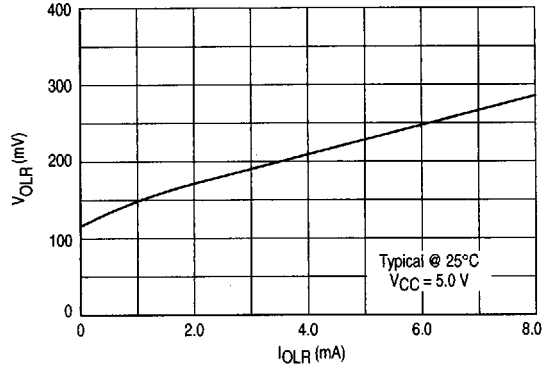


Figure 9. Receiver Output Voltage

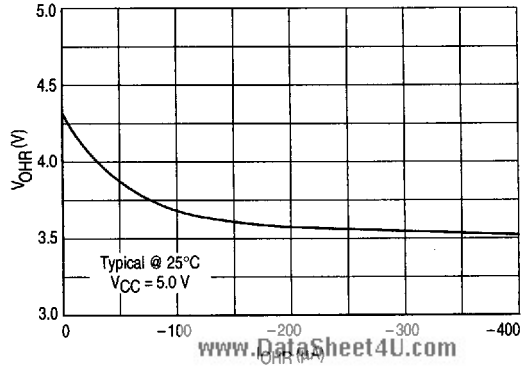


Figure 10. Receiver Input Characteristics

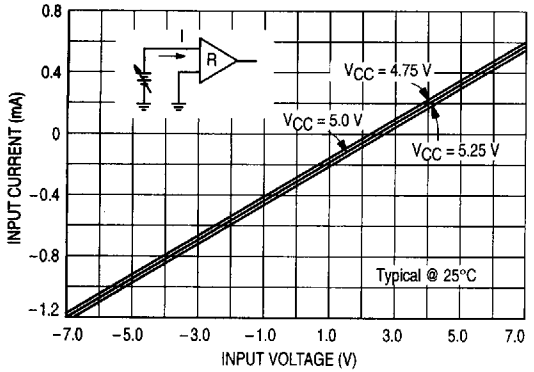


Figure 11. Enable Input Characteristics

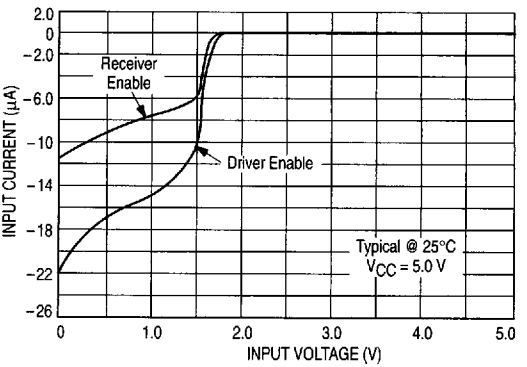


Figure 12. Receiver Input Characteristics

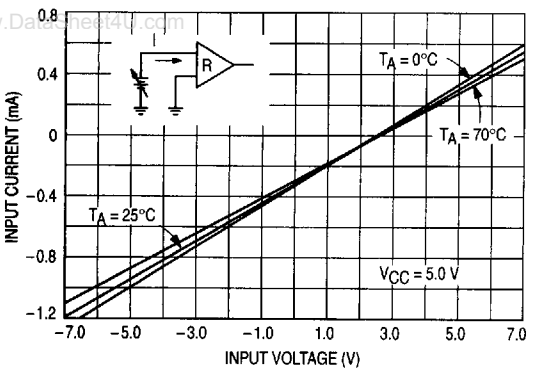


Figure 13. Receiver Output Leakage

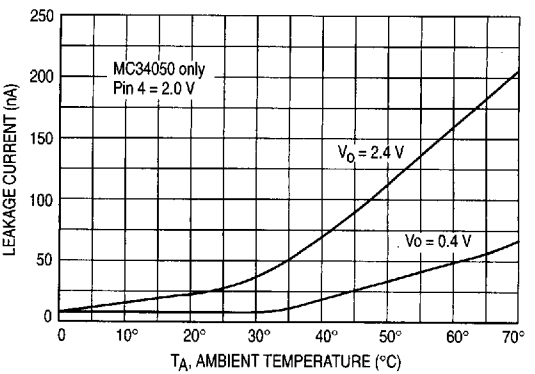


Figure 14. Driver Output Voltage

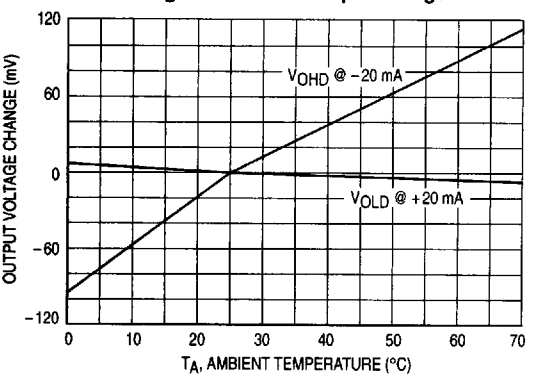


Figure 15. Driver Output Leakage

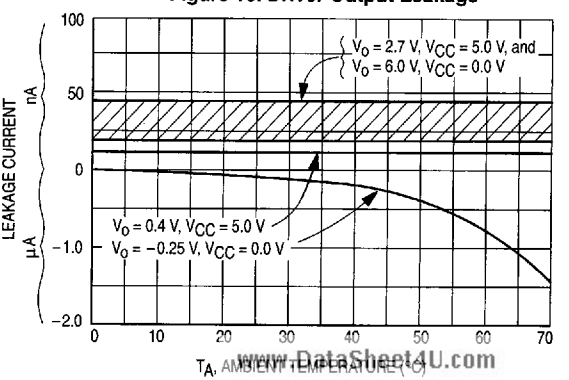


Figure 16. EIA–422 Application

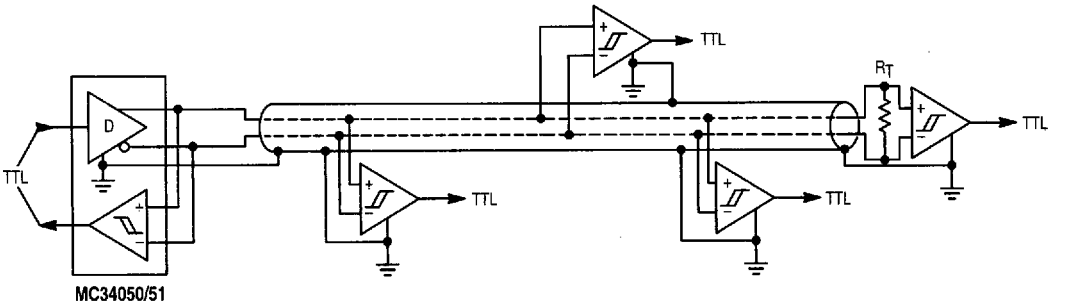


Figure 17. EIA–423 Application