485 Transceivers

Feature

- Fail-safe circuitry
- Low power consumption
- Up to 256 transceivers can be attached to the bus
- Maximum transmission rate：10Mbps(Vcc=5V)
- ESD：≥±15kV
- SOP8 Package

Applications

- RS485 Communications
- Level Translators
- Security Equipment
- Industrial Control Equipment
- Watt-hour meter

General Description

The FC485 is high-speed transceivers for RS-485 communication, which contain one driver and one receiver. The FC485 feature fail-safe circuitry, which guarantees a logic-high receiver output when the receiver inputs are open or shorted. This means that the receiver output will be a logic high if all transmitters on a terminated bus are disabled (high impedance). The FC485 driver slew rates are not limited, making transmit speeds up to 10Mbps possible.. And this device has a 1/8-unit-load receiver input impedance that allows up to 256 transceivers on the bus.

Typical application circuit
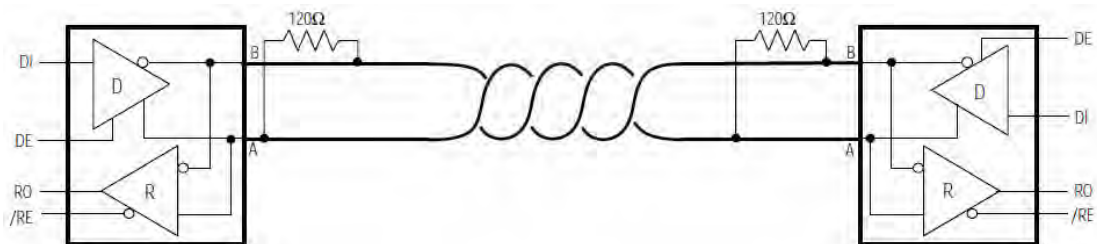
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Absolute Maximum Ratings（TA=25℃）

Supply Voltage（VCC）　..+7V

Operating voltage [1].....................................+3~5.5V

Control Input Voltage（/RE, DE）….. -0.3~Vcc+0.3V

Driver Input Voltage（DI）............... -0.3~Vcc+0.3V

Driver Output Voltage（A,B）.................... ±13V

Receiver Input Voltage（A,B）..................... ±13V

Receiver Output Voltage（RO）...... -0.3~Vcc+0.3V

Operating Temperature（TOPR）……. -40℃~+105℃

Storage Temperature（TSTG）.......... -65℃~+150℃

Note1: Recommended operating voltage is 5V, but can be compatible with 3V. If using a 3V or 3.3V supply voltage, please reduce the transmission rate.

DC ELECTRICAL CHARACTERISTICS（VCC=5.0V，TA=25℃）[1]

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Differential Driver Output（no load）	V_{OD1}			---	---	VCC	V
Differential Driver Output	V_{OD2}			1.5	---	---	V
Change in Magnitude of Differential Output Voltage	ΔV_{OD}	R=27Ω, Figure 1		---	---	0.2	V
Driver Common-Mode Output Voltage	V_{OC}			1.0	---	3.0	V
Change in Magnitude of Common-Mode Voltage[2]	ΔV_{OC}			---	---	0.2	V
Input High Voltage	V_{IH}	DE, DI, /RE		2.0	---	---	V
Input Low Voltage	V_{IL}	DE, DI, /RE		---	---	0.8	V
DI Input Hysteresis	V_{HYS}	---		---	100	---	mV
Driver Input Current（A And B）	I_{IN1}	VIN=12V	DE=0V, Vcc=5.0V	---	---	250	uA
		VIN=-7V		-150	---	---	uA
Driver Short-Circuit Output Current[3]	I_{OSD}	A and B Short-Circuit		-100	---	100	mA
Receiver Differential Threshold Voltage	V_{TH}	-7V≤V_{CM}≤12V		-200	-125	-50	mV
Receiver Input Hysteresis	$\triangle V_{TH}$	---		---	40	---	mV
Receiver Output High Voltage	V_{OH}	I_O=-8mA		VCC-1	---	---	V
Receiver Output Low Voltage	V_{OL}	I_O=8mA		---	---	0.4	V
Three-State Output Current at Receiver	I_{OZR}	Vo=1V		-1	---	1	μA
Receiver Input Resistance	R_{IN}	-7V≤V_{CM}≤12V		96	---	---	KΩ
Receiver Output Short-Circuit Current	I_{OSR}	0V≤V_{RO}≤VCC		±7	---	±100	mA
Supply Current	I_{CC}	DE=VCC	No Load /RE=DI=VCC/GND	---	700	1200	μA
		DE=GND		---	600	1200	μA
Supply Current in Shutdown Mode	I_{SHDN}	DE=GND, /RE=VCC, DI=VCC/GND		---	---	3	μA

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DC ELECTRICAL CHARACTERISTICS（VCC=3.0V，TA=25℃）[1]

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Differential Driver Output（no load）	V_{OD1}	R=27Ω, Figure 1		---	---	VCC	V
Differential Driver Output	V_{OD2}			0.9	---	---	V
Change in Magnitude of Differential Output Voltage	ΔV_{OD}			---	---	0.2	V
Driver Common-Mode Output Voltage	V_{OC}			1.0	---	3.0	V
Change in Magnitude of Common-Mode Voltage[2]	ΔV_{OC}			---	---	0.2	V
Input High Voltage	V_{IH}	DE, DI, /RE		1.5	---	---	V
Input Low Voltage	V_{IL}	DE, DI, /RE		---	---	0.6	V
DI Input Hysteresis	V_{HYS}	---		---	100	---	mV
Driver Input Current（A And B）	I_{IN1}	VIN=12V	DE=0V, Vcc=3V	---	---	150	uA
		VIN=-7V		-150	---	---	uA
Driver Short-Circuit Output Current[3]	I_{OSD}	A and B Short-Circuit		-100	---	100	mA
Receiver Differential Threshold Voltage	V_{TH}	---		-200	---	200	mV
Receiver Input Hysteresis	$\triangle V_{TH}$	---		---	40	---	mV
Receiver Output High Voltage	V_{OH}	I_O=-8mA		VCC-1	---	---	V
Receiver Output Low Voltage	V_{OL}	I_O=8mA		---	---	0.6	V
Three-State Output Current at Receiver	I_{OZR}	Vo=1V		-1	---	1	μA
Receiver Input Resistance	R_{IN}	-7V≤V_{CM}≤12V		96	---	---	KΩ
Receiver Output Short-Circuit Current	I_{OSR}	0V≤V_{RO}≤VCC		±7	---	±100	mA
Supply Current	I_{CC}	DE=VCC	No Load /RE=DI=VCC/GND	---	---	1000	μA
		DE=GND		---	---	1000	μA
Supply Current in Shutdown Mode	I_{SHDN}	DE=GND, /RE=VCC, DI=VCC/GND		---	---	3	μA

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SWITCHING CHARACTERISTICS（VCC=5.0V，TA=25℃）

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Rise or Fall Time	t_R, t_F	Figure 3 and 5，R_{DIFF}=54 C_{L1}=C_{L2}=100pF	---	30	---	ns
Driver Input to Output	t_{PLH}, t_{PHL}		---	30	60	ns
Driver Output Skew $|T_{DPLH} - T_{DPHL}|$	t_{SKEW}		---	---	20	ns
Driver Enable time	t_{LZ}, t_{HZ}	Figure 4 and 6，C_L=100pF （Receiver enabled）	---	---	70	ns
Driver Enable time	$t_{LZ(SHDN)}$, $t_{HZ(SHDN)}$	Figure 4 and 6，C_L=100pF （Receiver disabled）	---	1400	3000	ns
Driver disable time	t_{LZ}, t_{ZL}	Figure 4 and 6，C_L=100pF	---	---	70	ns
Maximum Data Rate	F_{MAX}	---	10	---	---	Mbps
Receiver Rise or Fall Time	t_R, t_F	Figure 7	---	20	---	ns
Receiver propagation delay time	t_{PLH}, t_{PHL}		---	90	250	ns
$|T_{RPLH}-T_{RPHL}|$ Differential Receiver Skew	t_{SKD}		---	30	---	ns
Receiver enable time	t_{ZL}, t_{ZH}	Figure 2 and 8，C_{RL}=15pF (Driver enabled)	---	30	70	ns
Receiver enable time	$t_{ZL(SHDN)}$, $t_{ZH(SHDN)}$	Figure 2 and 8，C_{RL}=15pF (Driver disabled)	---	1400	3000	ns
Receiver disable time	t_{LZ}, t_{HZ}	Figure 2 and 8，C_{RL}=15pF	---	30	70	ns
Time to Shutdown	t_{SHDN}	---	---	200	600	ns

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SWITCHING CHARACTERISTICS（VCC=3.0V，TA=25℃）

| PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Rise or Fall Time	t_R, t_F	Figure 3 and 5，R_{DIFF}=54 C_{L1}=C_{L2}=100pF	---	30	---	ns
Driver Input to Output	t_{PLH}. t_{PHL}		---	30	60	ns
Driver Output Skew $\|T_{DPLH} - T_{DPHL}\|$	t_{SKEW}		---	---	20	ns
Driver Enable time	t_{LZ}. t_{HZ}	Figure 4 and 6，C_L=100pF （Receiver enabled）	---	---	70	ns
Driver Enable time	$t_{LZ(SHDN)}$. $t_{HZ(SHDN)}$	Figure 4 and 6，C_L=100pF （Receiver disabled）	---	1600	3000	ns
Driver disable time	t_{LZ} ,t_{ZL}	Figure 4 and 6，C_L=100pF	---	---	70	ns
Maximum Data Rate	F_{MAX}	---	10	---	---	Mbps
Receiver Rise or Fall Time	t_R, t_F	Figure 7	---	20	---	ns
Receiver propagation delay time	t_{PLH}, t_{PHL}		---	90	250	ns
$\|T_{RPLH}-T_{RPHL}\|$ Differential Receiver Skew	t_{SKD}		---	30	---	ns
Receiver enable time	t_{ZL}, t_{ZH}	Figure 2 and 8，C_{RL}=15pF (Driver enabled)	---	25	70	ns
Receiver enable time	$t_{ZL(SHDN)}$, $t_{ZH(SHDN)}$	Figure 2 and 8，C_{RL}=15pF (Driver disabled)	---	1600	3000	ns
Receiver disable time	t_{LZ}, t_{HZ}	Figure 2 and 8，C_{RL}=15pF	---	30	70	ns
Time to Shutdown	t_{SHDN}	---	---	230	800	ns

Note 1: All currents into the device are positive; all currents out of the device are negative. All voltages are referred to device ground unless otherwise noted.

Note 2: ΔV_{OD} and ΔV_{OC} are the changes in V_{OD} and V_{OC}, respectively, when the DI input changes state.

Note 3: Maximum current level applies to peak current just prior to foldback-current limiting; minimum current level applies during current limiting.

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Pin Assignment
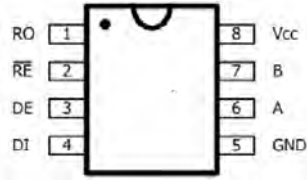
SOP8

Pin Description

PIN	NAME	FUNCTION
1	RO	Receiver Output, When RE is low and if A - B $\geq$ -50mV, RO will be high; if A - B $\leq$ -200mV, RO will be low.
2	/RE	Receiver Output Enable. Drive RE low to enable RO; RO is high impedance when RE is high. Drive RE high and DE low to enter low-power shutdown mode.
3	DE	Driver Output Enable. Drive DE high to enable driver outputs. These outputs are high impedance when DE is low. Drive RE high and DE low to enter low-power shutdown mode.
4	DI	Driver Input. With DE high, a low on DI forces noninverting output low and inverting output high.
5	GND	Ground
6	A	Noninverting Receiver Input and Noninverting Driver Output
7	B	Inverting Receiver Input and Inverting Driver Output
8	VCC	Positive Supply

Function Tables

- **TRANSMITTING**

INPUTS			OUTPUTS	
/RE	DE	DI	A	B
X	1	1	1	0
X	1	0	0	1
0	0	X	High-Z	High-Z
1	0	X	Shutdown	

- **RECEIVING**

INPUTS			OUTPUT
/RE	DE	A-B	RO
0	X	$\geq$-0.05V	1
0	X	$\leq$-0.2V	0
0	X	Open/shorted	1
1	1	X	High-Z
1	0	X	Shutdown

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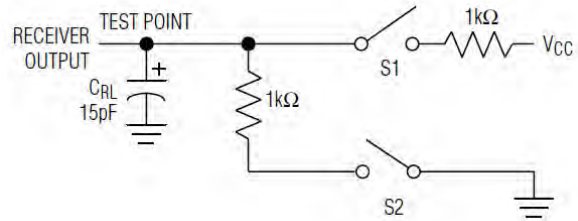### Test circuit
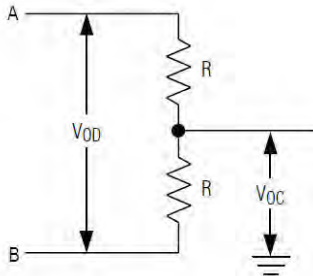
Figure 1. Driver DC Test Load

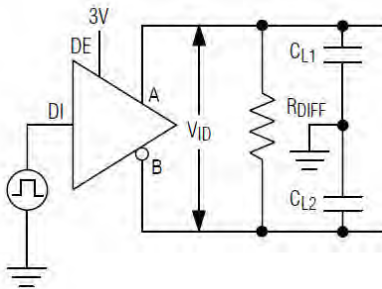Figure 2. Receiver Enable/Disable Timing Test Load

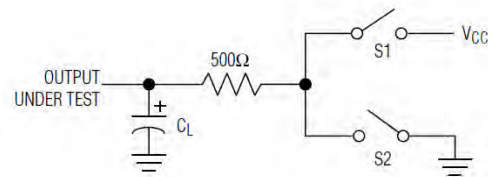Figure 3. Driver Timing Test Circuit

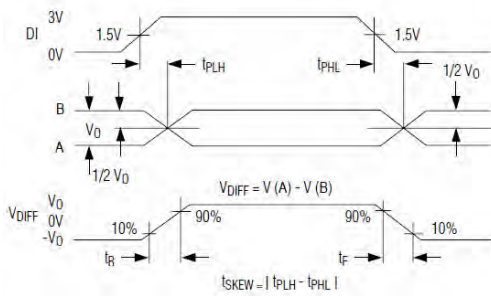Figure 4. Driver Enable/Disable Timing Test Load
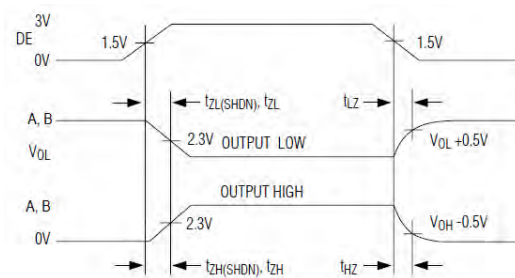

Figure 5. Driver Propagation Delays
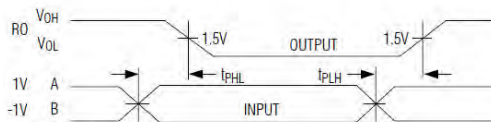

Figure 6. Driver Enable and Disable Times
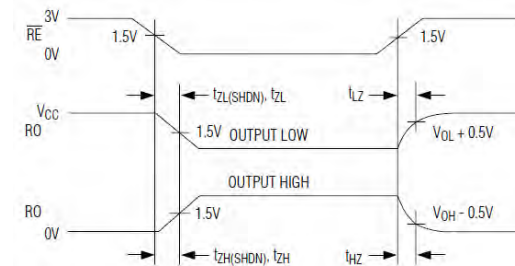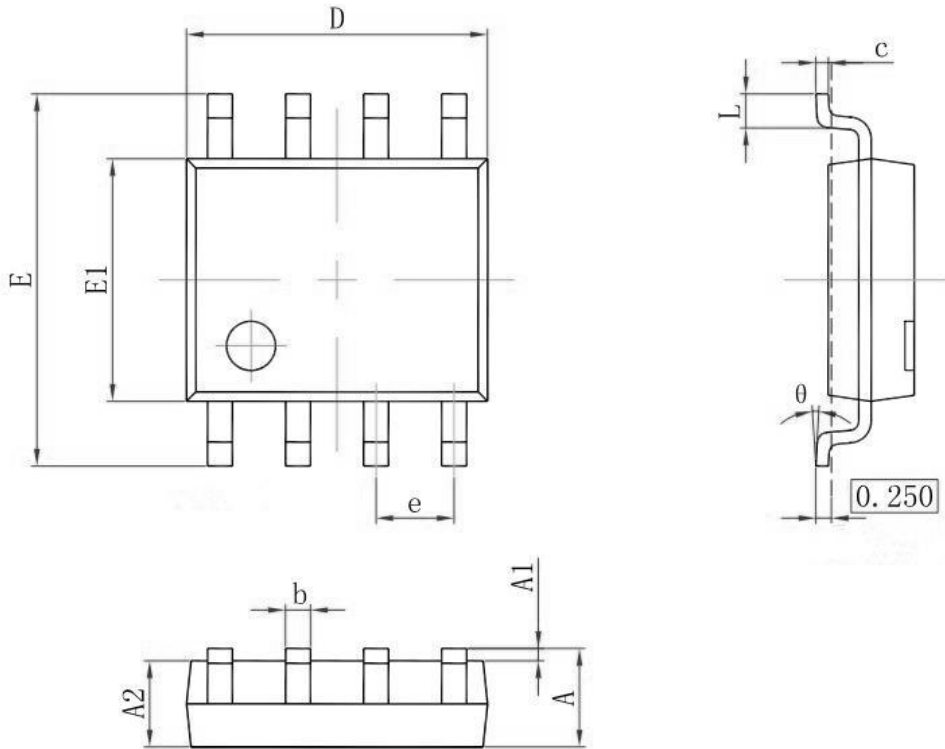

Figure 7. Receiver Propagation Delays

Figure 8. Receiver Enable and Disable Times

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SOP8 Package Information

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.800	5.000	0.189	0.197
e	1.270 (BSC)		0.050 (BSC)	
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.031
θ	0°	8°	0°	8°