- **Operates With Single 5-V Power Supply**
- **Generates ±9-V Supply Voltages With Only 1-μF Capacitors**
- **Designed to Avoid Latch-Up**
- **CMOS Comparable Low Power . . . 60 mW**
- **Features Superior to CMOS:**
  - **Improved Speed . . . Operates Over 64K Baud**
  - **Improved Protection . . . Outputs Can Be Forced to ±30 V Without Damage**
  - **3-State Outputs Are at High Impedance When Off**
- **Power Additional EIA-232 Drivers . . . 10 mA**
- **1-μA Supply Current in Shutdown**
- **Available With or Without Shutdown**
- **Suitable for ANSI/EIA-232-D-1986 Applications (Revision of EIA Std RS-232-C)**
- **Designed to Be Interchangeable With Linear Technology LT1080 and LT1081**

LT1080C, LT1080I . . . DW OR N PACKAGE
(TOP VIEW)

NC	1	18	ON/$\overline{\text{OFF}}$
C1 +	2	17	V_{CC}
V_{S+}	3	16	GND
C1 –	4	15	T1OUT
C2 +	5	14	R1IN
C2 –	6	13	R1OUT
V_{S-}	7	12	T1IN
T2OUT	8	11	T2IN
R2IN	9	10	R2OUT

NC – No internal connection

LT1081C, LT1081I . . . DW OR N PACKAGE
(TOP VIEW)

C1 +	1	16	V_{CC}
V_{S+}	2	15	GND
C1 –	3	14	T1OUT
C2 +	4	13	R1IN
C2 –	5	12	R1OUT
V_{S-}	6	11	T1IN
T2OUT	7	10	T2IN
R2IN	8	9	R2OUT

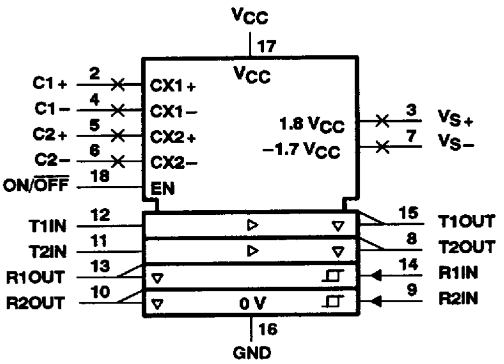
description

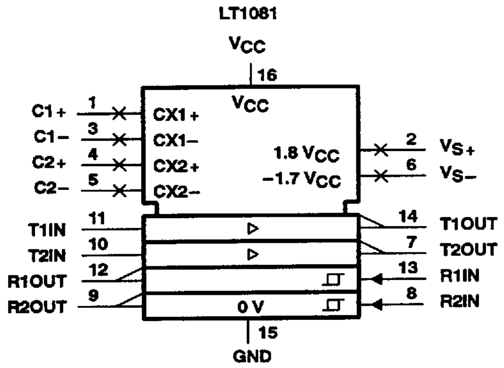
The LT1080 and LT1081 are dual driver/receivers that include a charge pump to supply EIA-232 voltage levels from a single 5-V supply. These interface-optimized devices are designed to avoid latch-up and provide a realistic balance between CMOS levels of power dissipation and real-world requirements for ruggedness. The driver outputs are fully protected against overload and can be shorted to ±30 V. Unlike CMOS devices, the advanced architecture of the LT1080 and LT1081 does not load the signal line when shut down or when the power is off. Both the receiver and EIA-232 outputs are put into a high-impedance state. An advanced output stage allows driving higher capacitive loads at higher speeds with exceptional resistance to ESD.

Applications for these devices include portable computers, battery-powered EIA-232 systems, power-supply generators, terminals, and modems.

The LT1080C and LT1081C are characterized for operation from 0°C to 70°C. The LT1080I and LT1081I are characterized for operation from −40°C to 85°C.

logic symbols†





† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

Terminal Functions

PIN NAME	PIN NO.†	I/O	DESCRIPTION
C1+ C1−	2 [1] 4 [3]		External capacitor C1
C2+ C2−	5 [4] 6 [5]		External capacitor C2
GND	16 [15]		Ground pin
ON/OFF	18	I	Controls the operation mode and is TTL/CMOS compatible. A low logic level places the device in the shutdown mode, which reduces input supply current to near zero and places both driver and receiver outputs in a high-impedance state. This input is not available on the LT1081.
R1IN	14 [13]	I	Receiver input. Accepts EIA-232 voltage levels (±30 V) and has hysteresis to provide noise immunity.
R2IN	9 [8]	I	Same as R1IN
R1OUT	13 [12]	O	Receiver output with TTL/CMOS voltage levels. Output is in a high-impedance state when in the shutdown mode or when $V_{CC} = 0$ to allow bus operation. Fully short-circuit protected to GND or V_{CC} with power on, power off, or in the shutdown mode.
R2OUT	10 [9]	O	Same as R1OUT
T1IN	12 [11]	I	EIA-232 driver input pin. Input is TTL/CMOS compatible. Unused inputs should be tied to V_{CC}.
T2IN	11 [10]	I	Same as T1IN
T1OUT	15 [14]	O	Driver output with EIA-232 voltage levels. Outputs are in a high-impedance state when in the shutdown mode or when $V_{CC} = 0$ to allow bus operation. Fully short-circuit protected to GND or V_{CC} with power on, power off, or in the shutdown mode.
T2OUT	8 [7]	O	Same as T1OUT
V_{S+}	3 [2]		Positive supply for EIA-232 drivers. Requires an external capacitor (1-µF) for charge storage.
V_{S-}	7 [6]		Negative supply for EIA-232 drivers. Requires an external capacitor (1-µF) for charge storage.
V_{CC}	17 [16]		Input supply pin. Supply current drops to near zero in the shutdown mode. Driver and receiver outputs are in a high-impedance state when $V_{CC} = 0$.

† Pin numbers in brackets are for the LT1081.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1) .... 6 V
Positive output supply voltage .... 12 V
Negative output supply voltage .... −12 V
Input voltage range: Driver .... ±12 V
Receiver .... ±30 V
ON/$\overline{OFF}$ .... GND to 12 V
Output voltage range: T1OUT, T2OUT .... V_{S-} + 30 V to V_{S+} − 30 V
R1OUT, R2OUT .... −0.3 V to V_{CC} + 0.3 V
Duration of output short circuit at (or below) 25°C: V_{S+} .... 30 s
V_{S-} .... 30 s
Driver or receiver output .... unlimited
Continuous total dissipation .... See Dissipation Rating Table
Operating free-air temperature range: LT1080C, LT1081C .... 0°C to 70°C
LT1080I, LT1081I .... −40°C to 85°C
Storage temperature range .... −65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds .... 260°C

NOTE 1: All voltage values are with respect to network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING	$T_A = 85°C$ POWER RATING
DW	1025 mW	8.2 mW/°C	656 mW	533 mW
N	1150 mW	9.2 mW/°C	736 mW	598 mW

recommended operating conditions

	LT1080C, LT1081C			LT1080I, LT1081I			UNIT
	MIN	TYP	MAX	MIN	TYP	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.5	5	5.5	V
High-level input voltage, V_{IH} (T1IN, T2IN)	2		5.5	2		5.5	V
Low-level input voltage, V_{IL} (T1IN, T2IN)			0.8			0.8	V
Operating free-air temperature, T_A	0		70	−40		85	°C

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature, V_I = 3 V (unless otherwise noted)

driver section

PARAMETER		TEST CONDITIONS			MIN	TYP†	MAX	UNIT
V_{OM+}	Positive-peak output voltage	R_L = 3 kΩ to GND			5	7.5		V
V_{OM-}	Negative-peak output voltage	R_L = 3 kΩ to GND			−5	−6.5		V
I_{IH}	High-level input current	V_I = 2 V to 5.5 V				5	20	μA
I_{IL}	Low-level input current	$V_I \le$ 0.8 V				−5	−20	μA
I_{OHS}	Output short-circuit current (sourcing)	V_I = 0,	V_O = 0,	T_A = 25°C	−7	12		mA
I_{OLS}	Output short-circuit current (sinking)	V_I = 2 V,	V_O = 0,	T_A = 25°C	7	−12		mA
I_{OZ}	High-impedance output current	Shutdown mode,	V_O = ±30 V				100	μA

receiver section

PARAMETER		TEST CONDITIONS			MIN	TYP†	MAX	UNIT
V_{T+}	Positive-going input threshold voltage		LT1080C, LT1081C			1.7	2.4	V
			LT1080I, LT1081I			1.7	3	
V_{T-}	Negative-going input threshold voltage		LT1080C, LT1081C		0.8	1.3		V
			LT1080I, LT1081I		0.2	1.3		
V_{hys}	Input hysteresis				0.1	0.4	1	V
r_i	Input resistance	T_A = 25°C			3	5	7	kΩ
V_{OH}	High-level output voltage	I_{OH} = −160 μA,	V_{CC} = 5 V		3.5	4.8		V
V_{OL}	Low-level output voltage	I_{OL} = 1.6 mA				0.2	0.4	V
I_{OSH}	Output short-circuit current (sourcing)	V_I = 3 V,	V_O = 0,	T_A = 25°C	−0.6	−1		mA
I_{OSL}	Output short-circuit current (sinking)	V_I = 3 V,	V_O = V_{CC},	T_A = 25°C	10	20		mA
I_{OZ}	High-impedance output current	Shutdown mode,	V_O = 0 to V_{CC}				10	μA

power supply section, V_{CC} = 5 V, driver outputs low (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{S+}	Supply output voltage	I_S = 0,	T_A = 25°C	8	9		V
		I_S = 10 mA,	T_A = 25°C	7	8		
		I_S = 15 mA,	T_A = 25°C	6.5	7.5		
V_{S-}	Supply output voltage	I_S = 0,	T_A = 25°C	−7.5	−8.5		V
		I_S = 10 mA,	T_A = 25°C	−5.5	−6.5		
		I_S = 15 mA,	T_A = 25°C	−5	−6		
I_{CC}	Supply current				10	22	mA
$I_{CC(off)}$	Off-state supply current (LT1080)	ON/$\overline{OFF}$ at 0.4 V				100	μA
I_I	Input current (ON/OFF) (LT1080)	V_I = 5 V				80	μA
		V_I = 0 V				−15	

† All typical values are at V_{CC} = 5 V, T_A = 25°C.

operating characteristics over recommended range of supply voltage, V_I = 3 V, T_A = 25°C

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
SR	Driver slew rate	R_L = 3 kΩ to 7 kΩ,	C_L = 560 pF,	See Note 2	4	15	30	V/μs
$t_{r(supply)}$	Supply rise time (see Note 3)	C1 − C4 = 1 μF				1		ms

NOTES: 2. Meets EIA-232-D specifications for capacitive loads greater than 560 pF.

3. Time from either shutdown input ON/$\overline{OFF}$ (LT1080) goes active high or V_{CC} power on (LT1081) until the output voltages reach $V_{S+} \ge$ 6 V and $V_{S-} \le$ −6 V.

TYPICAL CHARACTERISTICS†

HIGH- AND LOW-LEVEL
DRIVER OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

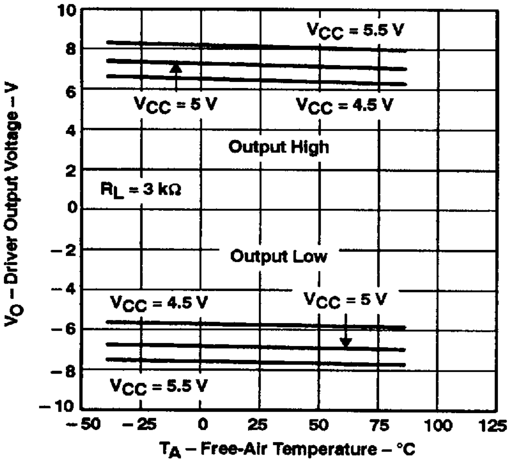


Figure 1

HIGH-IMPEDANCE
DRIVER OUTPUT CURRENT
vs
FREE-AIR TEMPERATURE

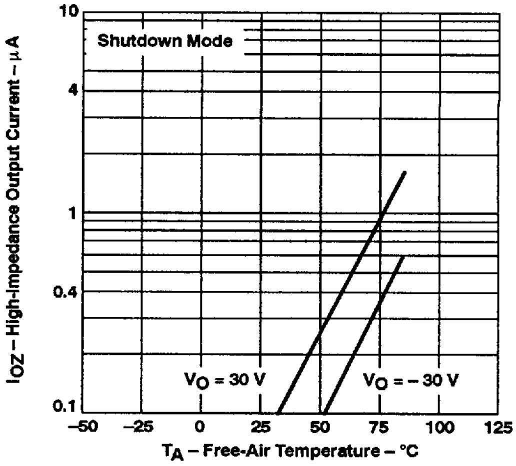


Figure 2

POSITIVE-GOING AND NEGATIVE-GOING
RECEIVER INPUT THRESHOLD VOLTAGE
vs
FREE-AIR TEMPERATURE

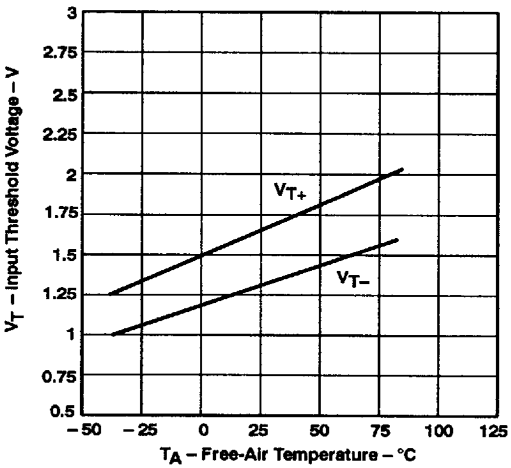


Figure 3

RECEIVER SOURCE CURRENT
AND SINK CURRENT
vs
FREE-AIR TEMPERATURE

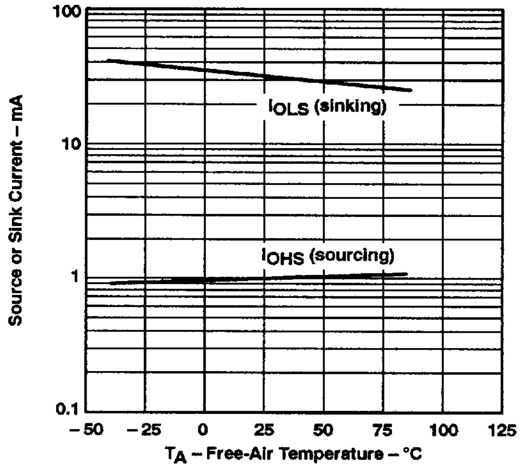


Figure 4

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS†

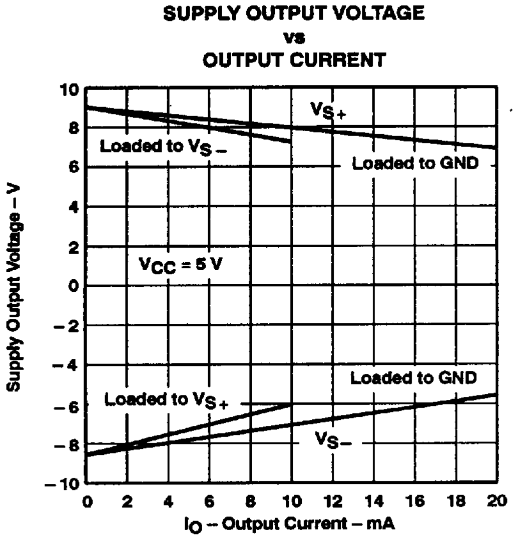


Figure 5

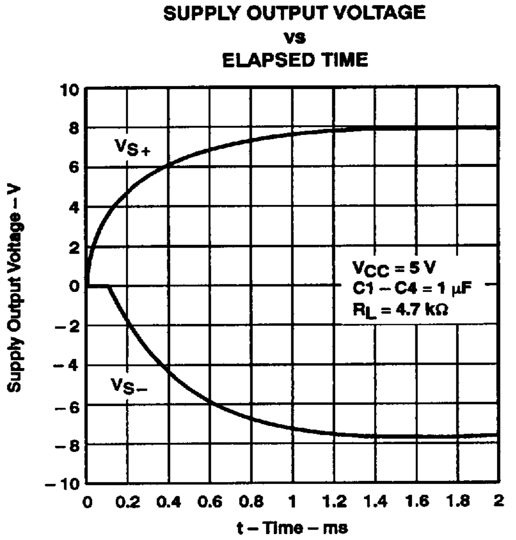


Figure 6

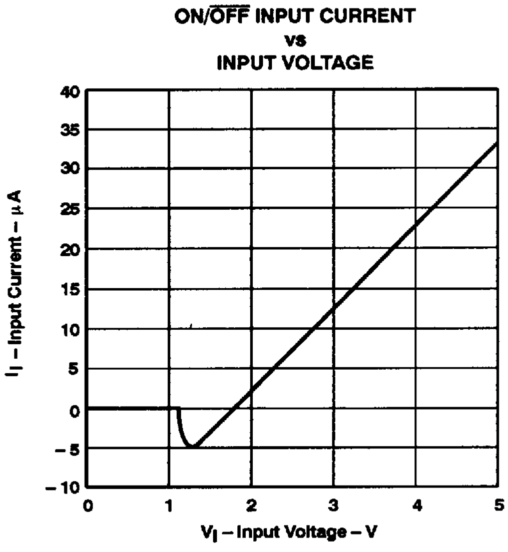


Figure 7

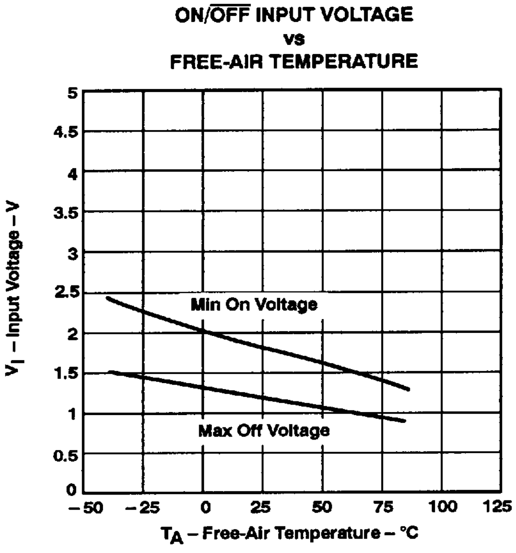


Figure 8

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS†

OFF-STATE SUPPLY CURRENT vs FREE-AIR TEMPERATURE

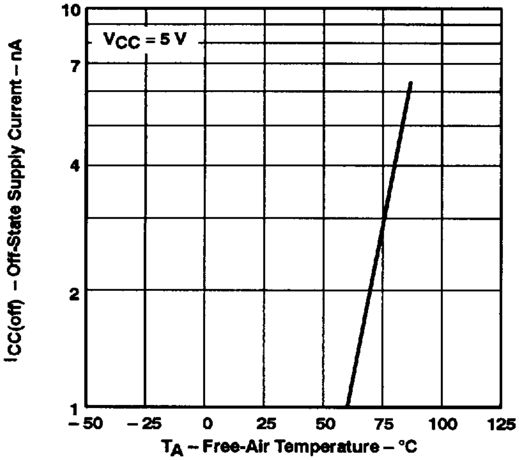


Figure 9

DRIVER and RECEIVER PULSE RESPONSE

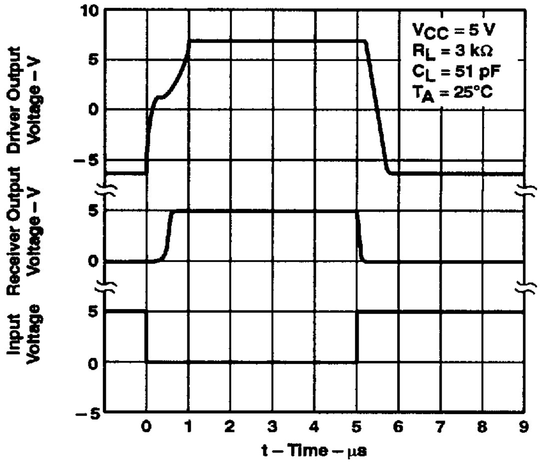


Figure 10

ON/$\overline{\text{OFF}}$ TO DRIVER OUTPUT PULSE RESPONSE

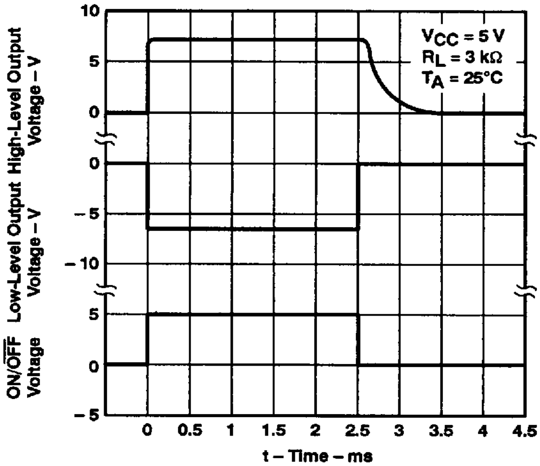


Figure 11

ON/$\overline{\text{OFF}}$ TO RECEIVER PULSE RESPONSE

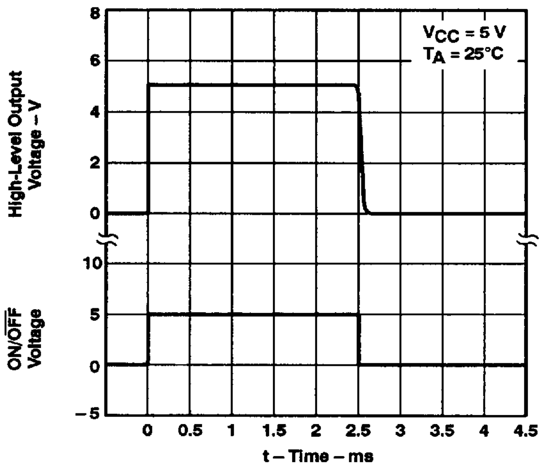


Figure 12

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

APPLICATION INFORMATION

The driver output stage of the LT1080 offers significantly improved protection over older bipolar and CMOS designs (see Figures 13 and 14). In addition to limiting current, the driver output can be externally forced to ±30 V without damage, excessive current flow, or supply disruption. Some drivers have diodes connected between the outputs and the supplies, allowing externally applied voltages to cause excessive supply voltage to develop.

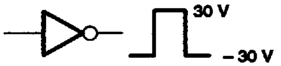


Figure 13. LT1080/LT1081 Driver

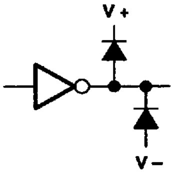


Figure 14. Older EIA-232 Drivers and CMOS Drivers

Placing the LT1080 in the shutdown mode (pin 18 low) puts both the driver and receiver outputs in a high-impedance state. This allows for bus operation and transceiver applications (see Figures 15–17). The shutdown mode also drops input supply current (V_{CC}) to near zero for power-conscious systems.

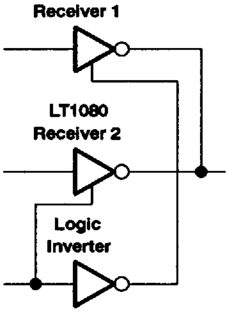


Figure 15. Sharing a Receiver Line

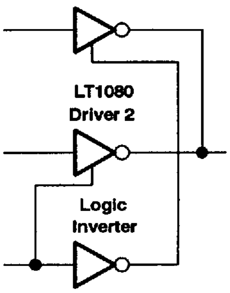


Figure 16. Sharing a Transmitter Line

APPLICATION INFORMATION

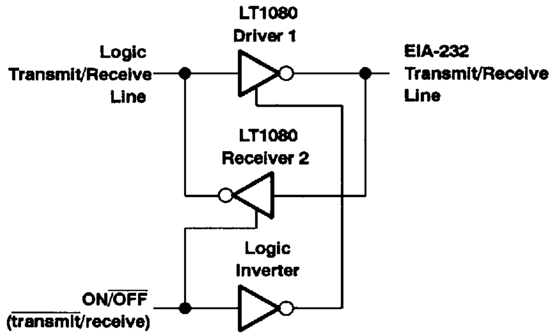
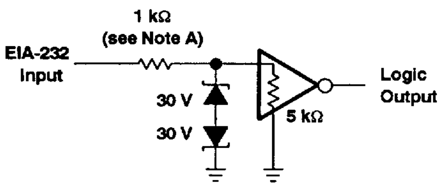


Figure 17. Transceiver

To protect against receiver input overloads in excess of ±30 V, a voltage clamp can be placed on the data line and still maintain EIA-232 compatibility (see Figure 18).

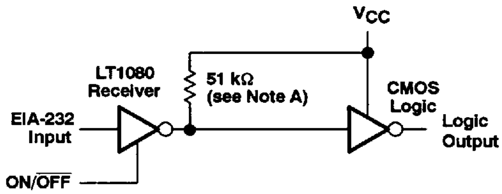
When driving CMOS logic from a receiver that will be used in the shutdown mode and when there is no other active receiver on the line, a 51-kΩ resistor can be placed from the logic input to V_{CC} to force a definite logic level when the receiver output is in a high-impedance state (see Figure 19).

The generated driver supplies (V_{S+} and V_{S-}) may be used to power external circuitry such as other EIA-232 drivers or operational amplifiers (see Figure 20). They should be loaded with care, since excessive loading can cause the generated supply voltages to drop, causing the EIA-232 driver output voltages to fall below EIA-232 requirements. See Figure 5 for a comparison of generated supply voltage versus supply current.



NOTE A: A PTC thermistor will allow continuous overload of greater than ±100 V.

Figure 18. Input Overload Protection



NOTE A: Forces logic input state when V_I is low.

Figure 19. Forcing a Definite Logic Level

APPLICATION INFORMATION

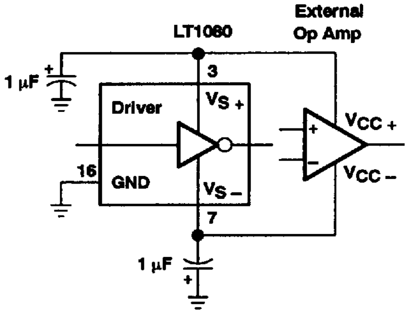
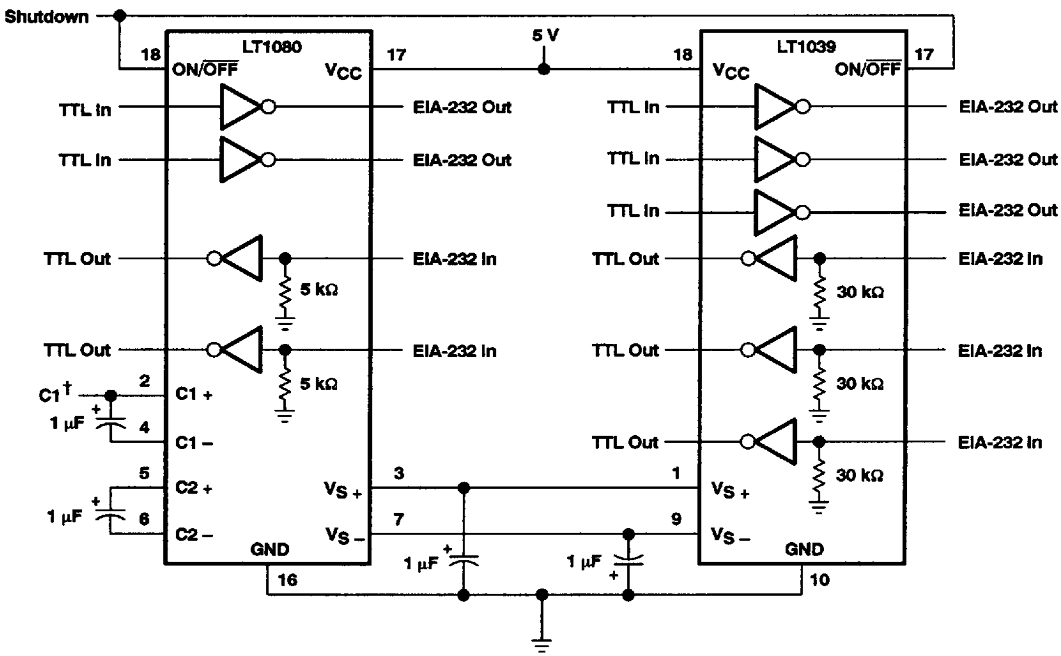


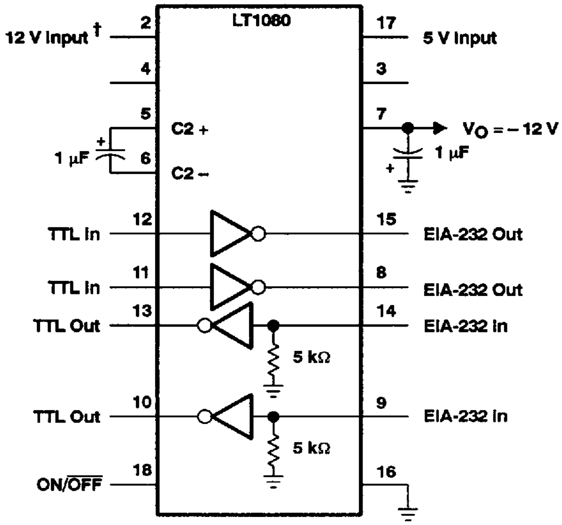
Figure 20. Powering External Circuitry



† In applications in which a separate second positive supply is available (such as 5 V and 12 V), the 12-V supply may be connected to pin 2 and C1 deleted. The power circuitry will then invert the 12-V supply. The 5-V supply is still needed to power the biasing circuitry and receivers.

Figure 21. Supporting an LT1039 (Triple Driver/Receiver)

APPLICATION INFORMATION



† C1 + used on LT1081

Figure 22. Operating With 5 V and 12 V