Advanced Low Power 5V RS232 Dual Driver/Receiver

FEATURES

- Absolutely No Latchup
- CMOS Comparable Low Power — 60mW
- **Superior to CMOS**
  - Improved Speed — Operates Over 64K Baud
  - Improved Protection — Outputs Can be Forced to ±30V Without Damage
  - Three-State Outputs are High Impedance When Off
  - Only Needs 1μF Capacitors
- Can Power Additional RS232 Drivers — 10mA
- 1μA Supply Current in Shutdown
- Available in SO Package
- Available With or Without Shutdown

APPLICATIONS

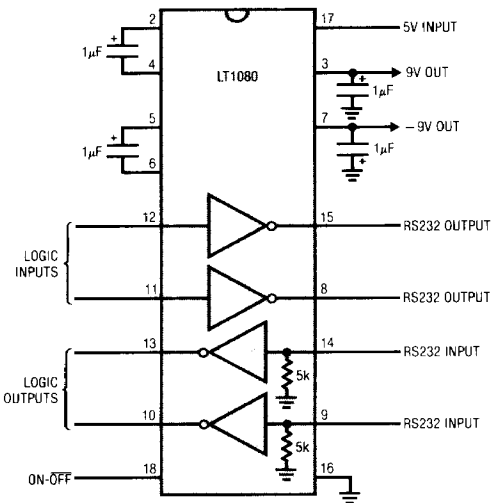
- Portable Computers
- Battery Powered RS232 Systems
- Power Supply Generator
- Terminals
- Modems

DESCRIPTION

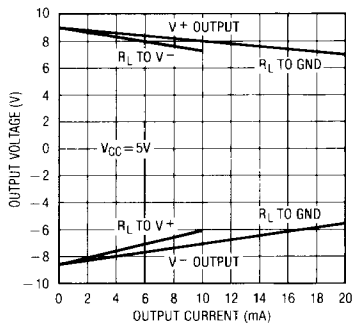
The LT1080 and LT1081 are the only dual RS232 driver/receiver with charge pump to guarantee absolutely no latchup. These interface optimized devices provide a realistic balance between CMOS levels of power dissipation and real world requirements for ruggedness. The driver outputs are fully protected against overload and can be shorted to ±30V. Unlike CMOS, the advanced architecture of the LT1080/LT1081 does not load the signal line when "shut down" or when power is off. Both the receiver and RS232 outputs are put into a high impedance state. An advanced output stage allows driving higher capacitive loads at higher speeds with exceptional ruggedness against ESD.

For applications requiring up to 5 drivers and 5 receivers with charge pump in one package see the LT1130 Series data sheet. A version of the LT1080/81, the LT1180 and LT1181 which use only 0.1μF capacitors is also available. All of Linear Technology's RS232 IC's are available in standard surface mount packages.

TYPICAL APPLICATION



Supply Generator Outputs



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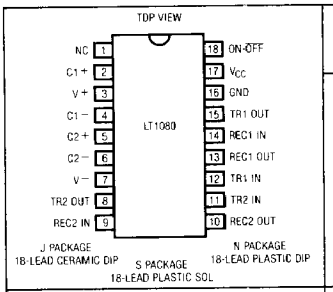
ABSOLUTE MAXIMUM RATINGS

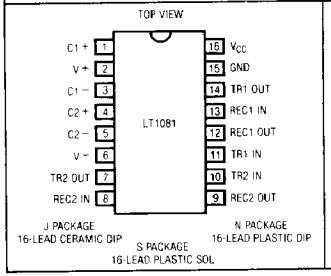
Supply Voltage (V_{CC}) 6V
V+ 12V
V− ..... −12V
Input Voltage
  Driver. ..... V− to V+
  Receiver. ..... −30V to 30V
  On-$\overline{\text{Off}}$ Pin. ..... GND to 12V
Output Voltage
  Driver. ..... V− +30V to V+ −30V
  Receiver. ..... −0.3V to V_{CC} +0.3V
Short Circuit Duration
  V+ ..... 30 Seconds
  V− ..... 30 Seconds
  Driver Output. ..... Indefinite
  Receiver Output. ..... Indefinite
Operating Temperature Range
  LT1080M/LT1081M ..... −55°C to 125°C
  LT1080I/LT1081I ..... −40°C to 85°C
  LT1080C/LT1081C ..... 0°C to 70°C
Lead Temperature (Soldering, 10 sec.) ..... 300°C

PACKAGE/ORDER INFORMATION



ORDER PART NUMBER

LT1080MJ
LT1080IJ
LT1080IN
LT1080CJ
LT1080CN
LT1080CS



LT1081MJ
LT1081IJ
LT1081IN
LT1081CJ
LT1081CN
LT1081CS

ELECTRICAL CHARACTERISTICS (Note 1)

PARAMETER	CONDITIONS			MIN	TYP	MAX	UNITS
Driver							
Output Voltage Swing	Load = 3k to GND, Both Outputs.	Positive	●	5.0	7.3		V
		Negative	●	−5.0	−6.5		V
Logic Input Voltage Level	Input Low Level (V_{OUT} = High)		●		1.4	0.8	V
	Input High Level (V_{OUT} = Low)		●	2.0	1.4		V
Logic Input Current	$V_{IN} \geq 2.0V$		●		5	20	μA
	$V_{IN} \leq 0.8V$		●		5	20	μA
Output Short Circuit Current	Sourcing Current, V_{OUT} = 0V			7	12		mA
	Sinking Current, V_{OUT} = 0V			−7	−12		mA
Output Leakage Current	SHUTDOWN (Note 2), V_{OUT} = ±30V		●		10	100	μA
Slew Rate	R_L = 3kΩ, C_L = 51pF			4	15	30	V/μs
Receiver							
Input Voltage Thresholds	Input Low Threshold, LT1080C, LT1081C		●	0.8	1.3		V
	LT1080I, M/LT1081I, M		●	0.2	1.3		V
	Input High Threshold, LT1080C/LT1081C		●		1.7	2.4	V
	LT1080I, M/LT1081I, M		●		1.7	3.0	V
Hysteresis			●	0.1	0.4	1.0	V
Input Resistance				3	5	7	kΩ
Output Voltage	Output Low, I_{OUT} = −1.6mA		●		0.2	0.4	V
	Output High, I_{OUT} = 160μA (V_{CC} = 5V)		●	3.5	4.8		V
Output Short Circuit Current	Sinking Current, $V_{OUT} = V_{CC}$			−10	−20		mA
	Sourcing Current, V_{OUT} = 0V			0.6	1		mA
Output Leakage Current	SHUTDOWN (Note 2), $0V \leq V_{OUT} \leq V_{CC}$		●		1	10	μA

ELECTRICAL CHARACTERISTICS (Note 1)

PARAMETER	CONDITIONS			MIN	TYP	MAX	UNITS
Power Supply Generator (Note 3)							
V^+ Output Voltage	I_{OUT} = 0mA I_{OUT} = 10mA I_{OUT} = 15mA			8 7 6.5	9 8 7.5		V V V
V^- Output Voltage	I_{OUT} = 0mA I_{OUT} = −10mA I_{OUT} = −15mA			−7.5 −5.5 −5	−8.5 −6.5 −6		V V V
Supply Current			●		12	22	mA
Supply Leakage Current (V_{CC})	SHUTDOWN (Note 2)	(LT1080 Only)	●		1	100	μA
On-$\overline{\text{Off}}$ Pin Current	$0V \le V_{ON\text{-}\overline{OFF}} \le 5V$	(LT1080 Only)	●	−15		80	μA
Supply Rise Time	(Note 4)	(LT1080 Only)			1		ms

The ● denotes specifications which apply over the operating temperature range ($0°C \le T_A \le 70°C$ for commercial grade, $-40°C \le T_A \le 85°C$ for industrial grade or $-55°C \le T_A \le 125°C$ for military grade devices).

Note 1: These parameters apply for $4.5V \le V_{CC} \le 5.5V$ and $V_{ON\text{-}\overline{OFF}} = 3V$, unless otherwise specified.

Note 2: $V_{ON\text{-}\overline{OFF}} = 0.4V$ for $-55°C \le T_A \le 100°C$, and $V_{ON\text{-}\overline{OFF}} = 0.2V$ for $100°C \le T_A \le 125°C$. (LT1080 only)

Note 3: Unless otherwise specified, $V_{CC} = 5V$, external loading of V^+ and V^- equals zero and the driver outputs are low (inputs high).

Note 4: Time from either SHUTDOWN high or power on until $V^+ \ge 6V$ and $V^- \le -6V$. All external capacitors are 1μF.

PIN FUNCTIONS (Pin numbers refer to LT1080)

V_{CC} (Pin 17): Input supply pin. Supply current drops to zero in the SHUTDOWN mode.

GND (Pin 16): Ground pin.

On-$\overline{\text{Off}}$ (Pin 18): Controls the operation mode of the LT1080 and is TTL/CMOS compatible. A logic low puts the device in the SHUTDOWN mode which reduces input supply current to zero and places both driver and receiver outputs in a high impedance state. A logic high fully enables the device.

V^+ (Pin 3): Positive supply for RS232 drivers. $V^+ \approx 2V_{CC} - 1.5V$. Requires an external capacitor ($\ge 1\mu F$) for charge storage. May be loaded (up to 15mA) for external system use. Loading does reduce V^+ voltage (see graphs). Capacitor may be tied to ground or +5V input supply. With multiple transceiver, the V^+ and V^- pins may be paralleled into common capacitors.

V^- (Pin 7): Negative supply for RS232 drivers. $V^- \approx -(2V_{CC} - 2.5V)$. Requires an external capacitor ($\ge 1\mu F$) for charge storage. May be loaded (up to −15mA) for external system use. Loading does reduce V^- voltage (see graphs). With multiple transceiver, the V^+ and V^- pins may be paralleled into common capacitors.

TR1 IN; TR2 IN (Pins 12, 11): RS232 driver input pins. Inputs are TTL/CMOS compatible. Inputs should not be allowed to float. Tie unused inputs to V_{CC}.

TR1 OUT; TR2 OUT (Pins 15, 8): Driver outputs with RS232 voltage levels. Outputs are in a high impedance state when in the SHUTDOWN mode or when power is off ($V_{CC} = 0V$) to allow data line sharing. Outputs are fully short circuit protected from V^- +30V to V^+ −30V with power on, off, or in the SHUTDOWN mode. Typical output breakdowns are greater than ±45V and higher applied voltages will not damage the device if moderately current limited. Shorting one output will affect output from the other.

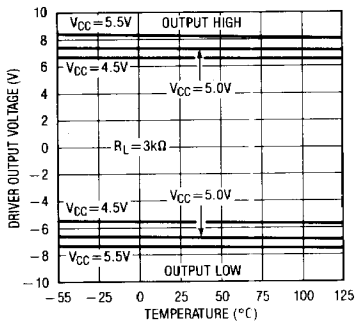
REC1 IN; REC2 IN (Pins 14, 9): Receiver inputs. Accepts RS232 voltage levels (±30V) and has 0.4V of hysteresis to provide noise immunity. Input impedance is nominally 5kΩ.

REC1 OUT; REC2 OUT (Pins 13, 10): Receiver outputs with TTL/CMOS voltage levels. Outputs are in a high impedance state when in the SHUTDOWN mode to allow data line sharing. Outputs are fully short circuit protected to ground or V_{CC} with power on, off, or in the SHUTDOWN mode.

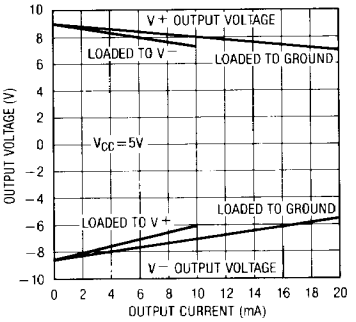
C1+; C1−; C2+; C2− (Pins 2, 4, 5, 6): Requires an external capacitor ($\ge 1\mu F$) from C1+ to C1− and another from C2+ to C2−. Pin 2 can be used for connecting a second positive supply. When a separate positive supply is used, C1 can be deleted.

TYPICAL PERFORMANCE CHARACTERISTICS

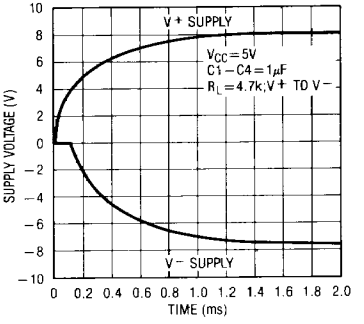
Driver Output Voltage



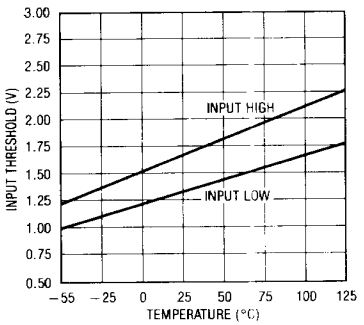
Supply Generator Outputs



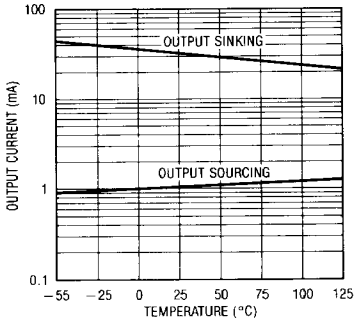
Supply Generation from V_{CC} or Shutdown



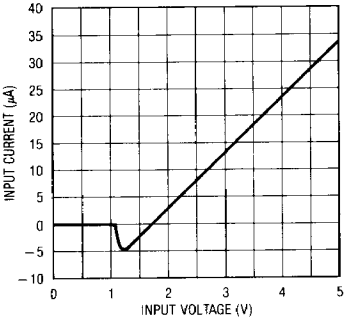
Receiver Input Thresholds



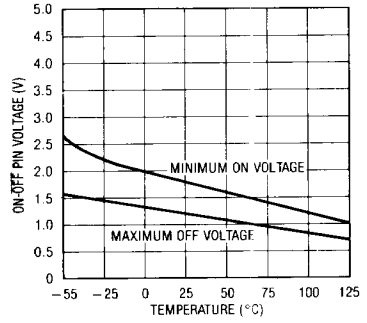
Receiver Output Short Circuit Current



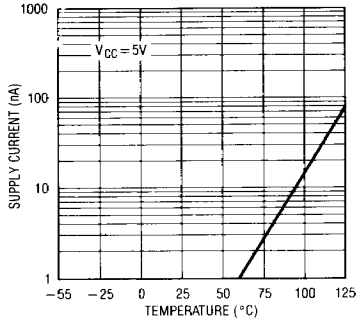
On-$\overline{\text{Off}}$ Pin Current vs Voltage



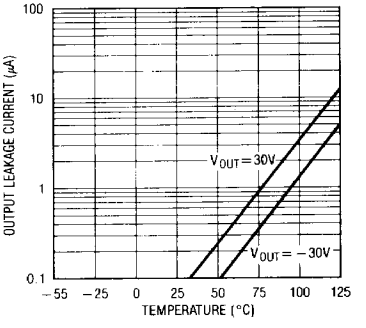
On-$\overline{\text{Off}}$ Pin Thresholds



Supply Current in Shutdown

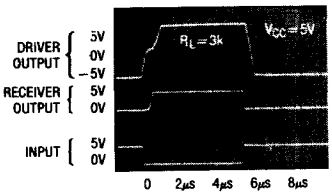


Driver Output Leakage in Shutdown

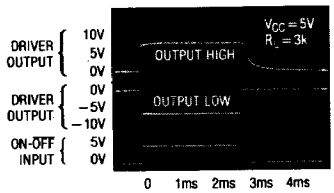


TYPICAL PERFORMANCE CHARACTERISTICS

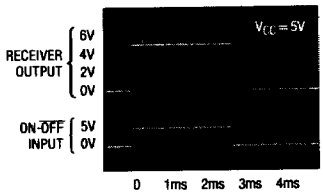
Output Waveforms



Shutdown to Driver Output

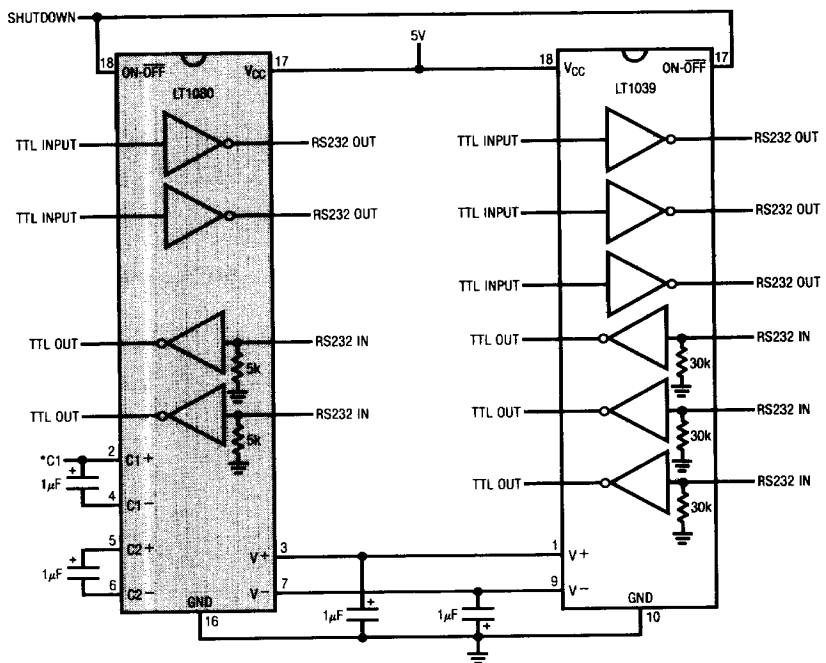


Shutdown to Receiver Output



TYPICAL APPLICATION

Supporting an LT1039 (Triple Driver/Receiver)



*IN APPLICATIONS WHERE A SEPARATE SECOND POSITIVE SUPPLY IS AVAILABLE (SUCH AS +5V AND +12V), THE +12V SUPPLY MAY BE CONNECTED TO PIN 2 AND C1 DELETED. THE POWER SUPPLY CIRCUITRY WILL THEN INVERT THE +12V SUPPLY. THE +5V SUPPLY IS STILL NEEDED TO POWER THE BIASING CIRCUITRY AND RECEIVERS.

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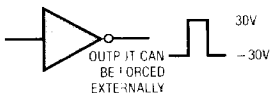
APPLICATION HINTS

The driver output stage of the LT1080 offers significantly improved protection over older bipolar and CMOS designs. In addition to current limiting, the driver output can be externally forced to ±30V with no damage or excessive current flow, and will not disrupt the supplies. Some drivers have diodes connected between the outputs and the supplies, so externally applied voltages can cause excessive supply voltage to develop.

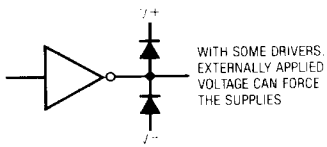
Placing the LT1080 in the SHUTDOWN mode (Pin 18 low) puts both the driver and receiver outputs in a high impedance state. This allows data line sharing and transceiver applications.

The SHUTDOWN mode also drops input supply current (V_{CC}; Pin 17) to zero for power-conscious systems.

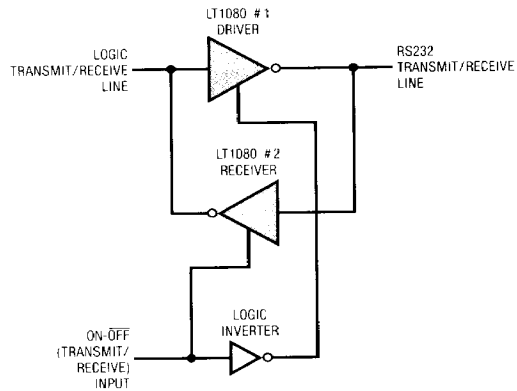
LT1080/LT1081 Driver



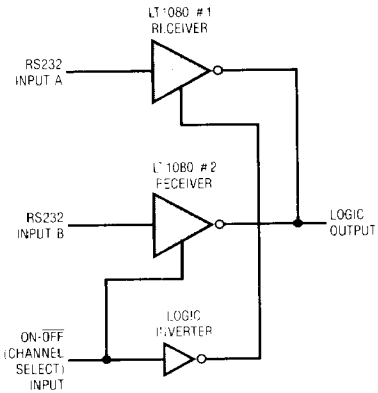
Older RS232 Drivers and CMOS Drivers



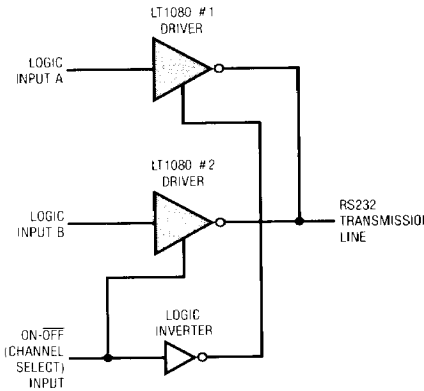
Transceiver



Sharing a Receiver Line

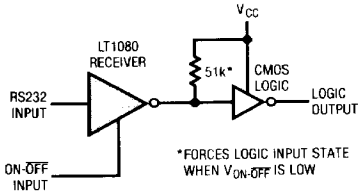


Sharing a Transmitter Line

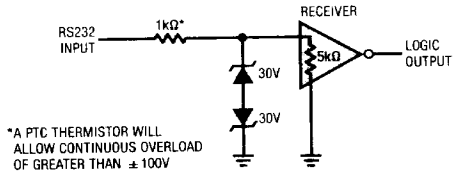


APPLICATION HINTS

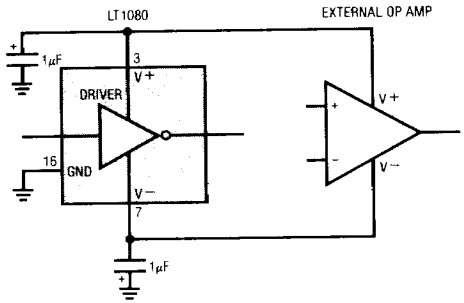
When driving CMOS logic from a receiver that will be used in the SHUTDOWN mode and there is no other active receiver on the line, a 51k resistor can be placed from the logic input to V_{CC} to force a definite logic level when the receiver output is in a high impedance state.



To protect against receiver input overloads in excess of ±30V, a voltage clamp can be placed on the data line and still maintain RS232 compatibility.

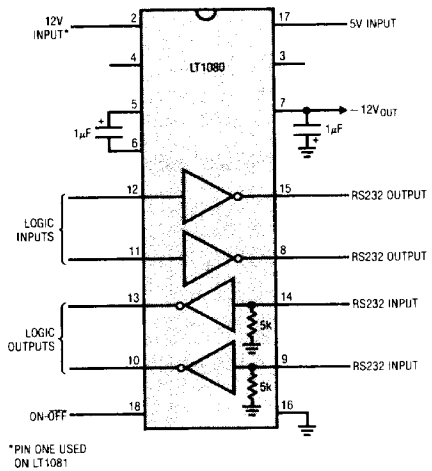


The generated driver supplies (V+ and V−) may be used to power external circuitry such as other RS232 drivers or op amps. They should be loaded with care, since excessive loading can cause the generated supply voltages to drop causing the RS232 driver output voltages to fall below RS232 requirements. See the graph "Supply Generator Outputs" for a comparison of generated supply voltage versus supply current.



TYPICAL APPLICATION

Operating with 5V and 12V



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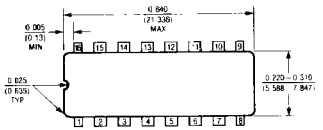
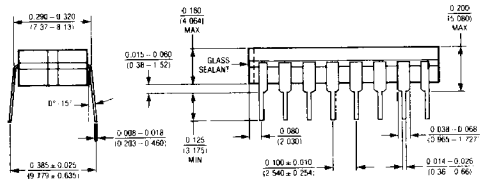
PACKAGE DESCRIPTION

Dimensions in inches (millimeters) unless otherwise noted.

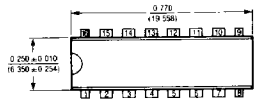
J16 Package Ceramic DIP

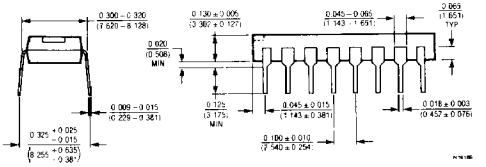




	T_{jmax}	θ_{ja}	θ_{jc}
LT1081MJ/IJ	150°C	100°C/W	40°C/W
LT1081CJ	150°C	100°C/W	40°C/W

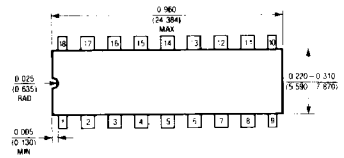
N16 Package Plastic DIP

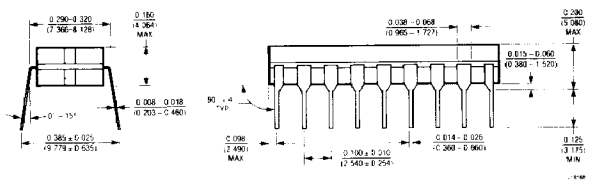




	T_{jmax}	θ_{ja}	θ_{jc}
LT1081CN/IN	125°C	120°C/W	50°C/W

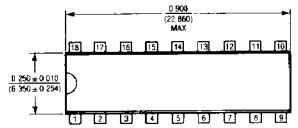
J18 Package Ceramic DIP

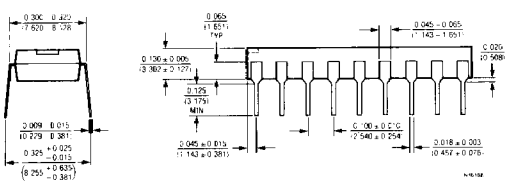




	T_{jmax}	θ_{ja}	θ_{jc}
LT1080MJ/IJ	150°C	100°C/W	40°C/W
LT1080CJ	150°C	100°C/W	40°C/W

N18 Package Plastic DIP





	T_{jmax}	θ_{ja}	θ_{jc}
LT1080CN/IN	125°C	120°C/W	50°C/W