3.3V Low Power EIA/TIA-562 Transceiver

FEATURES

- **Operates from a Single 3.3V Supply**
- **Low Supply Current: I_{CC} = 200μA**
- **I_{CC} = 35μA in Driver Disable Mode**
- **I_{CC} = 0.2μA in Shutdown Mode**
- **ESD Protection Over ±10kV**
- Uses Small Capacitors: 0.1μF
- Operates to 120kBaud
- Output Overvoltage Does Not Force Current Back into Supplies
- EIA/TIA-562 I/O Lines Can Be Forced to ±25V Without Damage
- Pin Compatible with LT1180A

APPLICATIONS

- Notebook Computers
- Palmtop Computers

DESCRIPTION

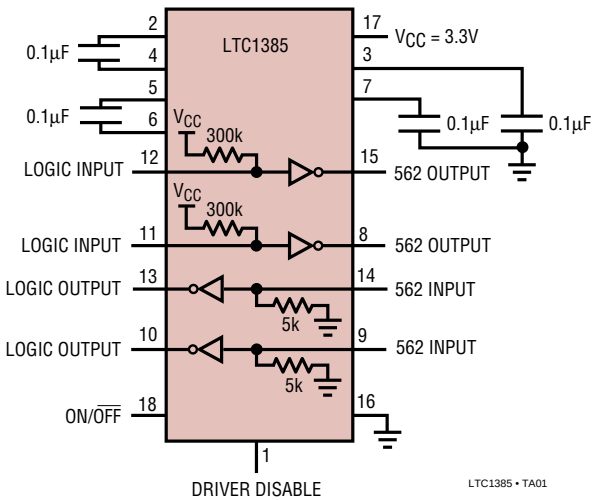
The LTC®1385 is an ultra-low power, 2-driver/2-receiver EIA/TIA-562 transceiver which operates from a single 3.3V supply. The charge pump requires only four space-saving 0.1μF capacitors.

The transceiver operates in one of three modes: Normal, Driver Disable or Shutdown. In the Normal mode, I_{CC} is only 200μA in the unloaded condition. In the Driver Disable mode, the charge pump is turned off, the driver outputs are forced into three-state, both receivers are kept active, and I_{CC} drops to 35μA. In the Shutdown mode, everything is turned off and I_{CC} drops to 0.2μA.

The LTC1385 is fully compliant with all data rate and overvoltage EIA/TIA-562 specifications. The transceiver can operate up to 120kbaud with a 1000pF, 3kΩ load. Both driver outputs and receiver inputs can be forced to ±25V without damage, and can survive multiple ±10kV ESD strikes.

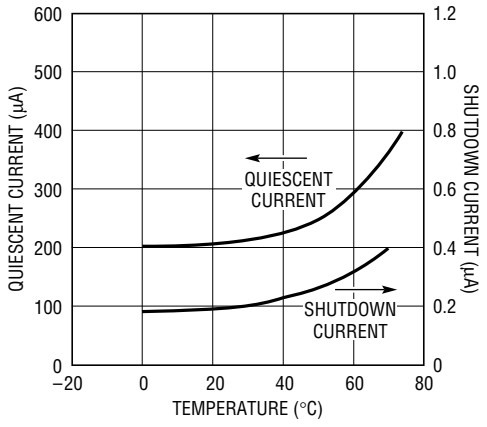
TYPICAL APPLICATION

2-Drivers/2-Receivers with Shutdown and Driver Disable



LTC1385 • TA01

Quiescent and Shutdown Supply Current vs Temperature



TEST CONDITION: V_{CC} = 3.3V

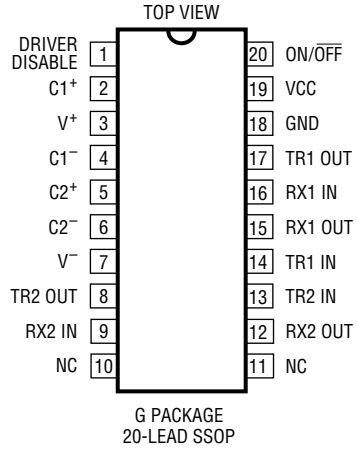
LTC1385 • TA02

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) 5V
Input Voltage
  Driver ..... –0.3V to V_{CC} + 0.3V
  Receiver ..... –25V to 25V
  Digital Input ..... –0.3V to V_{CC} + 0.3V
Output Voltage
  Driver ..... –25V to 25V
  Receiver ..... –0.3V to V_{CC} + 0.3V

Short-Circuit Duration
  V^+ ..... 30 sec
  V^- ..... 30 sec
  Driver Output ..... Indefinite
  Receiver Output ..... Indefinite
Operating Temperature Range
  LTC1385C ..... 0°C to 70°C
  LTC1385I ..... –40°C to 85°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

PACKAGE/ORDER INFORMATION

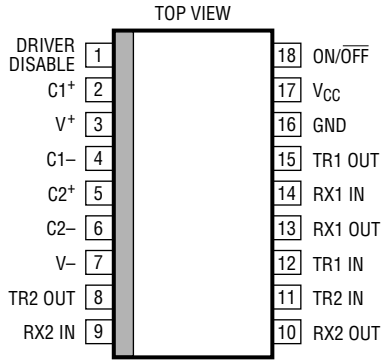


G PACKAGE
20-LEAD SSOP

T_{JMAX} = 125°C, θ_{JA} = 135°C/W

ORDER PART NUMBER

LTC1385CG
LTC1385IG



N PACKAGE
18-LEAD PDIP

SW PACKAGE
18-LEAD PLASTIC SO

T_{JMAX} = 125°C, θ_{JA} = 85°C/W

ORDER PART NUMBER

LTC1385CN
LTC1385CSW
LTC1385IN
LTC1385ISW

Consult LTC Marketing for parts specified with wider operating temperature ranges.

DC ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range. V_{CC} = 3.3V, C1 = C2 = C3 = C4 = 0.1µF, $V_{ON/\overline{OFF}}$ = V_{CC}, Driver Disable = V_{CC}, unless noted.

PARAMETER	CONDITIONS			MIN	TYP	MAX	UNITS
Any Driver							
Output Voltage Swing	3k to GND	Positive	●	3.7	4.5		V
		Negative	●	–3.7	–4.5		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} = V_{CC}		●			5	µA
	V_{IN} = 0V		●		–20	–40	µA
Output Short-Circuit Current	V_{OUT} = 0V				±10		mA
Output Leakage Current	Shutdown or Driver Disable or V_{CC} = 0V (Note 3,4), V_{OUT} = ±20V		●		±10	±500	µA

DC ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range. V_{CC} = 3.3V, C1 = C2 = C3 = C4 = 0.1µF, $V_{ON/\overline{OFF}}$ = V_{CC}, Driver Disable = V_{CC}, unless noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Any Receiver						
Input Voltage Thresholds	Input Low Threshold	●	0.8	1.3		V
	Input High Threshold	●		1.7	2.4	V
Hysteresis		●	0.1	0.4	1.0	V
Input Resistance	$-10V \le V_{IN} \le 10V$		3	5	7	kΩ
Output Voltage	Output Low, $I_{OUT} = -1.6mA$ (V_{CC} = 3.3V)	●		0.2	0.4	V
	Output High, $I_{OUT} = 160\mu A$ (V_{CC} = 3.3V)	●	3.0	3.2		V
Output Short-Circuit Current	Sinking Current, $V_{OUT} = V_{CC}$		−5	−20		mA
	Sourcing Current, V_{OUT} = 0V		2	7		mA
Output Leakage Current	Shutdown (Note 4), $0V \le V_{OUT} \le V_{CC}$	●		1	10	µA
Power Supply Generator						
V^+ Output Voltage	I_{OUT} = 0mA			5.7		V
	I_{OUT} = 5mA			5.5		V
V^- Output Voltage	I_{OUT} = 0mA			−5.3		V
	I_{OUT} = −5mA			−5.0		V
Supply Rise Time	Shutdown or Driver Disable to Turn-On			0.2		ms
Power Supply						
V_{CC} Supply Current	No Load (Note 2), 0°C to 70°C	●		0.2	0.5	mA
	No Load (Note 2), −40°C to 85°C	●		3.5	1.0	mA
Supply Leakage Current (V_{CC})	Shutdown (Note 4)	●		0.2	10	µA
	Driver Disable (Note 3)	●		35	50	µA
Digital Input Threshold Low		●		1.4	0.8	V
Digital Input Threshold High		●	2.0	1.4		V

AC CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range. V_{CC} = 3.3V, C1 = C2 = C3 = C4 = 0.1µF, unless noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Slew Rate	R_L = 3k, C_L = 51pF			8	30	V/µs
	R_L = 3k, C_L = 1000pF		3	5		V/µs
Driver Propagation Delay (TTL to EIA/TIA-562)	t_{HLD} (Figure 1)	●		2	3.5	µs
	t_{LHD} (Figure 1)	●		2	3.5	µs
Receiver Propagation Delay (EIA/TIA-562 to TTL)	t_{HLR} (Figure 2)	●		0.3	0.8	µs
	t_{LHR} (Figure 2)	●		0.2	0.8	µs

Note 1: Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.

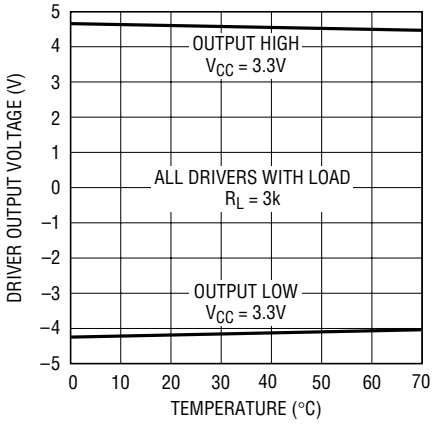
Note 2: Supply current is measured with driver and receiver outputs unloaded.

Note 3: Measurements made in the Driver Disable mode are performed with $V_{DRIVER\ DISABLE}$ = GND and $V_{ON/\overline{OFF}} = V_{CC}$.

Note 4: Measurements made in the Shutdown mode are performed with $V_{ON/\overline{OFF}}$ = 0V.

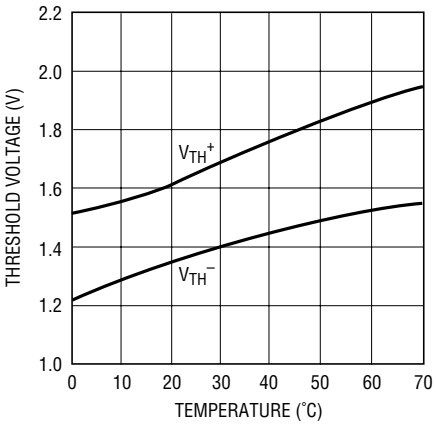
TYPICAL PERFORMANCE CHARACTERISTICS

Driver Output Voltage vs Temperature



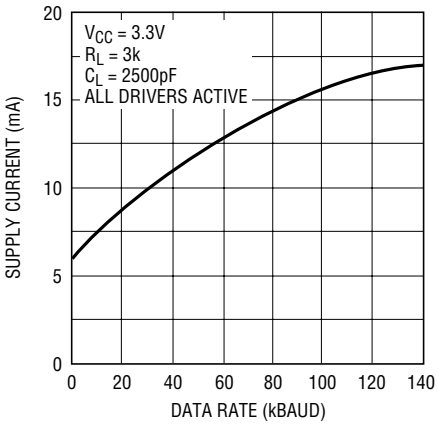
LTC1385 • TPC01

Receiver Input Thresholds vs Temperature



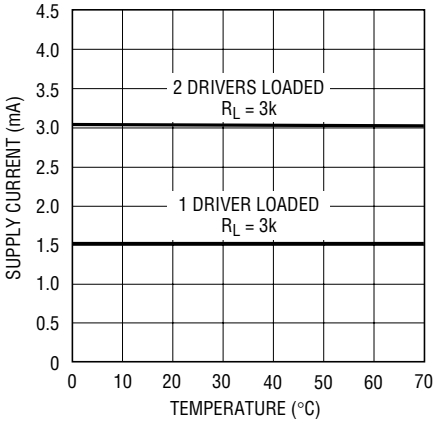
LTC1385 • TPC02

Supply Current vs Data Rate



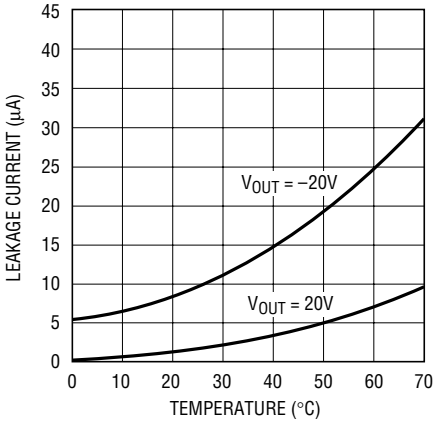
LTC1385 • TPC03

V_{CC} Supply Current vs Temperature



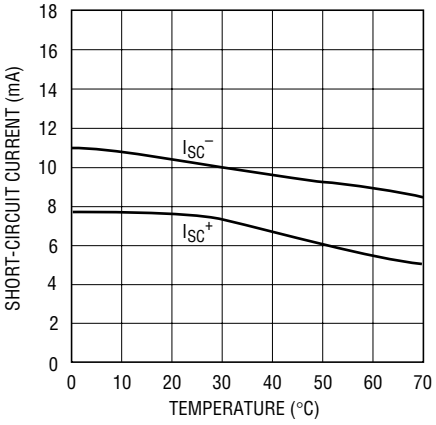
LTC1385 • TPC04

Driver Leakage in Shutdown vs Temperature



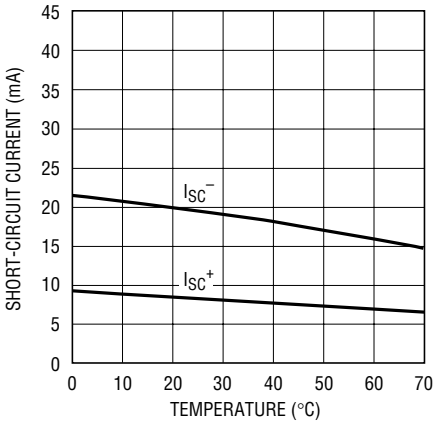
LTC1385 • TPC05

Driver Short-Circuit Current vs Temperature



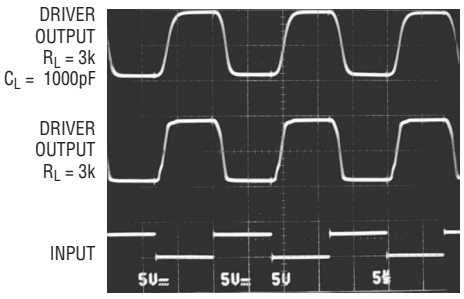
LTC1385 • TPC06

Receiver Short-Circuit Current vs Temperature



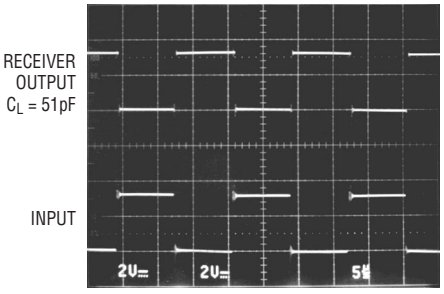
LTC1385 • TPC06

Driver Output Waveforms



LTC1385 • TPC08

Receiver Output Waveform



LTC1385 • TPC09

PIN FUNCTIONS

V_{CC}: 3.3V Input Supply Pin. This pin should be decoupled with a 0.1µF ceramic capacitor.

GND: Ground Pin.

ON/$\overline{OFF}$: TTL/CMOS Compatible Shutdown Pin. A logic low puts the device in the Shutdown mode independent of the Driver Disable pin. The supply current drops to 0.2µA and all driver and receiver outputs are forced into three-state.

DRIVER DISABLE: TTL/CMOS Compatible Input Pin. With the ON/$\overline{OFF}$ pin held high, a logic low forces the part into the Driver Disable mode with the charge pump turned off and the driver outputs forced into three-state. Both receivers remain active and the supply current drops to 35µA. A logic high forces the part into the Normal mode.

V^+: Positive Supply Output (EIA/TIA-562 Drivers). $V^+ \cong 2V_{CC} - 1V$. This pin requires an external capacitor C = 0.1µF for charge storage. The capacitor may be tied to ground or V_{CC}. With multiple devices, the V^+ and V^- pins may share a common capacitor. For a large number of devices, increasing the size of the shared common storage capacitors is recommended to reduce ripple.

V^-: Negative Supply Output (EIA/TIA-562 Drivers). $V^- \cong -(2V_{CC} - 1.3V)$. This pin requires an external capacitor C = 0.1µF for charge storage.

$C1^+$, $C1^-$, $C2^+$, $C2^-$: Commutating Capacitor Inputs. These pins require two external capacitors C = 0.1µF: one from $C1^+$ to $C1^-$, and another from $C2^+$ to $C2^-$. To maintain charge pump efficiency, the capacitor's effective series resistance should be less than 2Ω.

TR IN: EIA/TIA-562 Driver Input Pins. Inputs are TTL/CMOS compatible. The inputs of unused drivers can be left unconnected since 300k input pull-up resistors to V_{CC} are included on chip. To minimize power consumption, the internal driver pull-up resistors are disconnected from V_{CC} in the Shutdown mode.

TR OUT: Driver Outputs at EIA/TIA-562 Voltage Levels. Outputs are in a high impedance state when in the Shutdown or Driver Disable mode or V_{CC} = 0V. The driver outputs are protected against ESD to ±10kV for human body model discharges.

RX IN: Receiver Inputs. These pins can be forced to ±25V without damage. The receiver inputs are protected against ESD to ±10kV for human body model discharges. Each receiver provides 0.4V of hysteresis for noise immunity.

RX OUT: Receiver Outputs with TTL/CMOS Voltage Levels. Outputs are in a high impedance state when in the Shutdown mode.

SWITCHING TIME WAVEFORMS

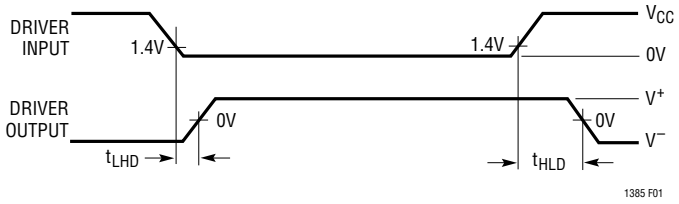


Figure 1. Driver Propagation Delay Timing

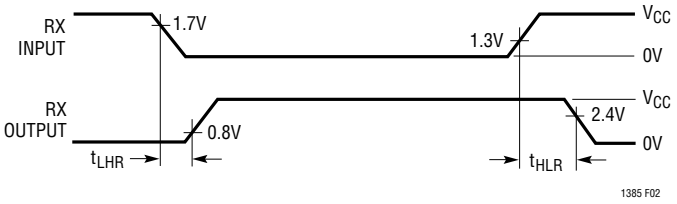
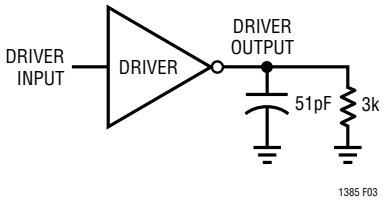


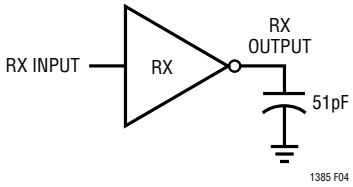
Figure 2. Receiver Propagation Delay Timing

TEST CIRCUITS

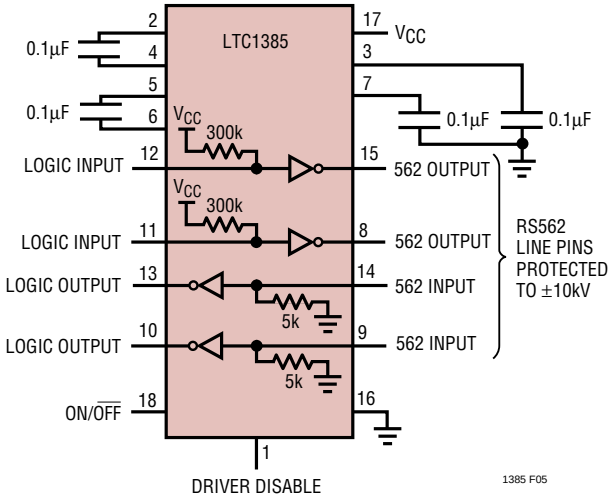
Driver Timing Test Load



Receiver Timing Test Load

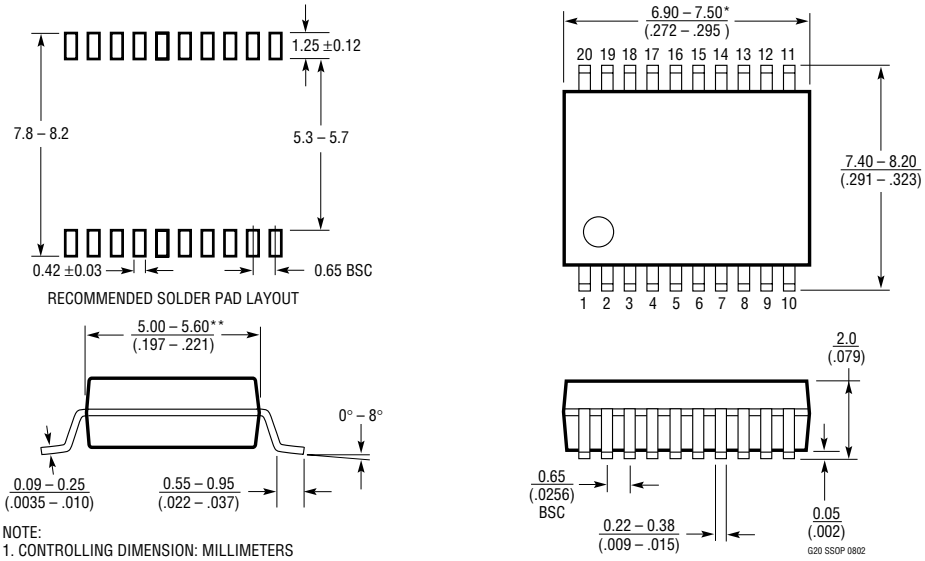


ESD Test Circuit



PACKAGE DESCRIPTION

G Package
20-Lead Plastic SSOP (5.3mm)
(Reference LTC DWG # 05-08-1640)

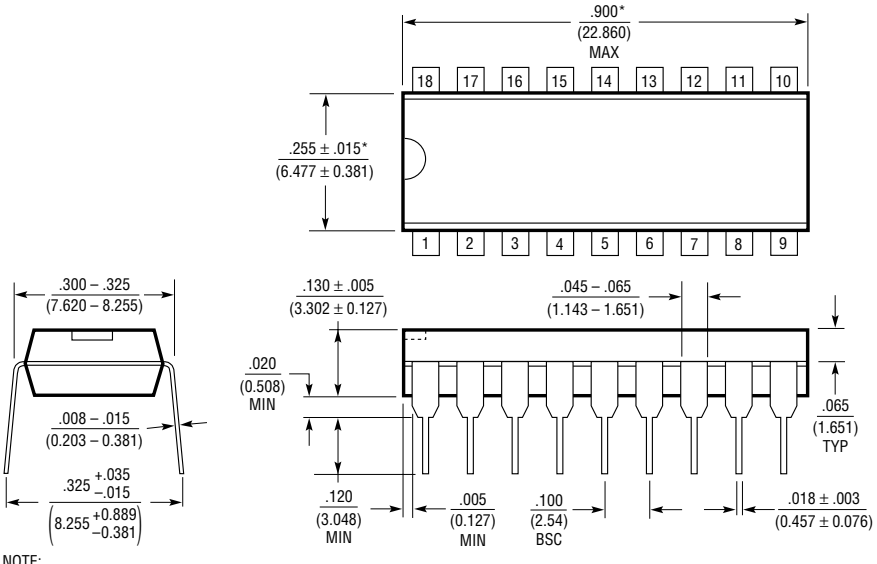


NOTE:
1. CONTROLLING DIMENSION: MILLIMETERS
2. DIMENSIONS ARE IN $\frac{\text{MILLIMETERS}}{\text{(INCHES)}}$
3. DRAWING NOT TO SCALE

*DIMENSIONS DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .152mm (.006") PER SIDE

**DIMENSIONS DO NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED .254mm (.010") PER SIDE

N Package
18-Lead PDIP (Narrow .300 Inch)
(Reference LTC DWG # 05-08-1510)

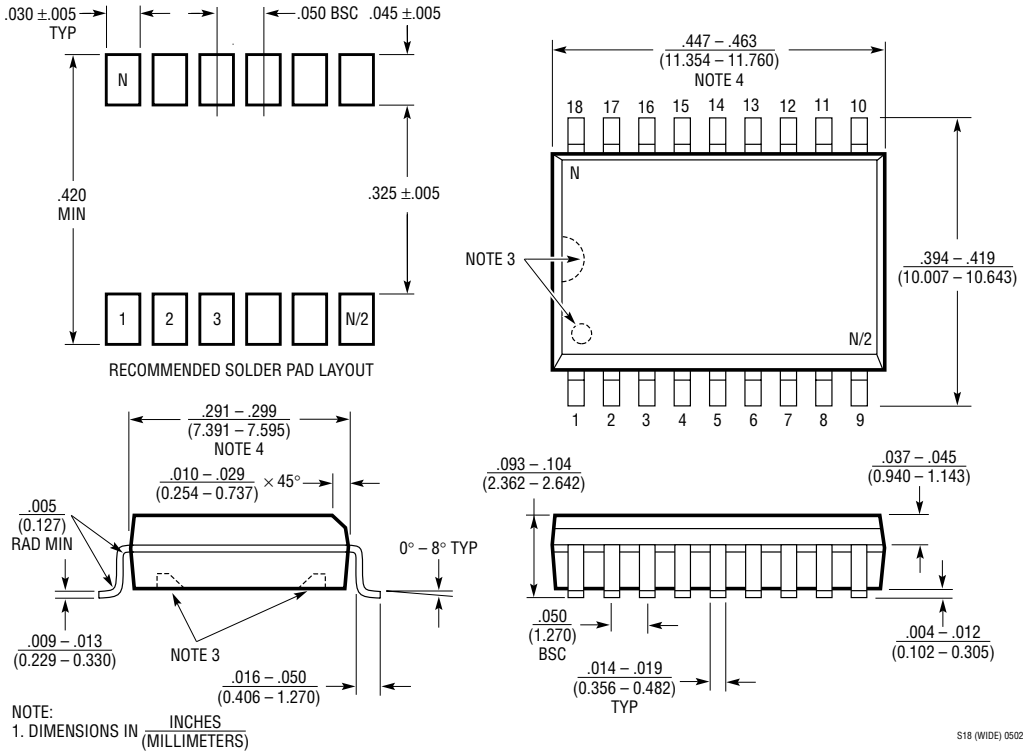


NOTE:
1. DIMENSIONS ARE $\frac{\text{INCHES}}{\text{MILLIMETERS}}$

*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH (0.254mm)

PACKAGE DESCRIPTION

SW Package
18-Lead Plastic Small Outline (Wide .300 Inch)
(Reference LTC DWG # 05-08-1620)



NOTE:
1. DIMENSIONS IN INCHES (MILLIMETERS)
2. DRAWING NOT TO SCALE
3. PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS. THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS
4. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)

RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1780/LT1781	5V, 2 Driver, 2 Receiver RS232 Transceivers	±15kV ESD per IEC 1000-4
LTC1327	3.3V, 3 Driver, 5 Receiver RS562 Transceiver	300µA Supply Current, 0.2µA in Shutdown
LTC1348	3.3V to 5V, 3 Driver, 5 Receiver RS232 Transceiver	True RS232 on 3.3V, 5 Receivers Active in Shutdown
LTC1382	5V, 2 Driver, 2 Receiver RS232 Transceiver	200µA Supply Current, 0.2µA in Shutdown
LTC1383	5V, 2 Driver, 2 Receiver RS232 Transceiver	200µA Supply Current, Narrow 16-Pin SO
LTC1384	5V, 2 Driver, 2 Receiver RS232 Transceiver	200µA Supply Current, 2 Receivers Active in Shutdown
LTC1386	3.3V, 2 Driver, 2 Receiver RS562 Transceiver	200µA Supply Current, Narrow 16-Pin SO

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