LINEAR TECHNOLOGY

LTC1382

5V Low Power RS232 Transceiver with Shutdown

FEATURES

- **Operates from a Single 5V Supply**
- **Low Supply Current: I_{CC} = 220μA**
- **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
- RS232 I/O Lines Can Be Forced to ±25V Without Damage
- Pin Compatible with LT1180A

APPLICATIONS

- Notebook Computers
- Palmtop Computers

DESCRIPTION

The LTC1382 is an ultra-low power 2-driver/2-receiver RS232 transceiver that operates from a single 5V supply. The charge pump requires only four space-saving 0.1μF capacitors.

The transceiver operates in one of two modes, Normal and Shutdown. In the Normal mode, I_{CC} is only 220μA with the driver outputs unloaded. In the Shutdown mode, the charge pump is turned off, the driver outputs are forced into three-state, both receivers are off and I_{CC} drops to 0.2μA.

The LTC1382 is fully compliant with all data rate and overvoltage RS232 specifications. The transceiver can operate up to 120kbaud with a 2500pF, 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

LTC1382 • TA01
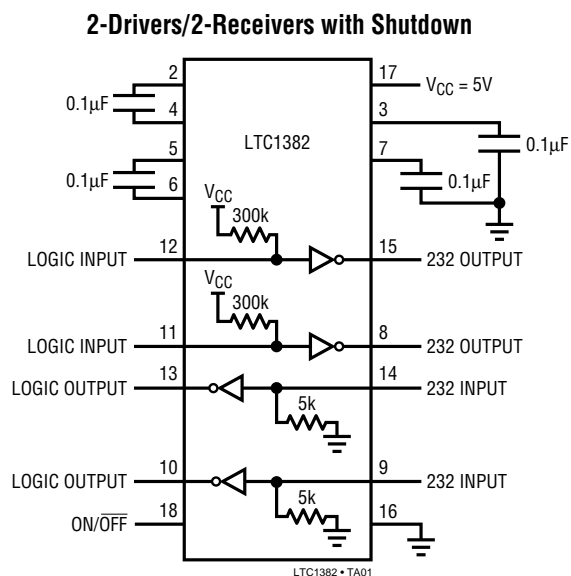
Quiescent and Shutdown Supply Current vs Temperature

LTC1382 • TA02
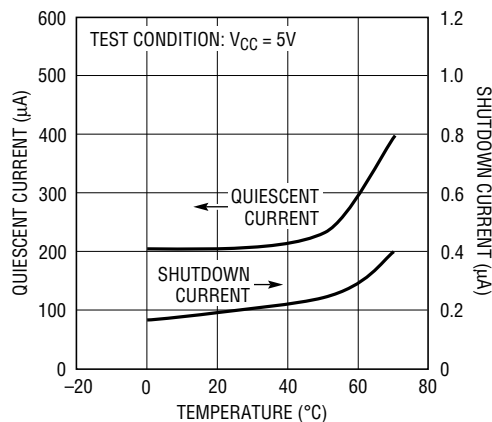
ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) 6V
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 .... 0°C to 70°C
Storage Temperature Range .... −65°C to 150°C
Lead Temperature (Soldering, 10 sec)................. 300°C

PACKAGE/ORDER INFORMATION

TOP VIEW

NC	1	18	ON/$\overline{\text{OFF}}$
C1$^+$	2	17	V_{CC}
V$^+$	3	16	GND
C1$^-$	4	15	TR1 OUT
C2$^+$	5	14	RX1 IN
C2$^-$	6	13	RX1 OUT
V$^-$	7	12	TR1 IN
TR2 OUT	8	11	TR2 IN
RX2 IN	9	10	RX2 OUT

N PACKAGE   S PACKAGE
18-LEAD PLASTIC DIP 18-LEAD PLASTIC SOL

T_{JMAX} = 125°C, θ_{JA} = 56°C/W (N)
T_{JMAX} = 125°C, θ_{JA} = 85°C/W (S)

ORDER PART NUMBER
LTC1382CN LTC1382CS

Consult factory for Industrial and Military grade parts.

DC ELECTRICAL CHARACTERISTICS

V_{CC} = 5V, C1 = C2 = C3 = C4 = 0.1μF, $V_{ON/\overline{OFF}}$ = V_{CC} unless otherwise noted.

PARAMETER	CONDITIONS			MIN	TYP	MAX	UNITS
Any Driver							
Output Voltage Swing	3k to GND	Positive	●	5.0	7.0		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} = V_{CC}		●			5	μA
	V_{IN} = 0V		●		−20	−40	μA
Output Short-Circuit Current	V_{OUT} = 0V				±12		mA
Output Leakage Current	Shutdown or V_{CC} = 0V (Note 3), V_{OUT} = ±20V		●		±10	±500	μA
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	V
Input Resistance	−10V ≤ V_{IN} ≤ 10V			3	5	7	kΩ
Output Voltage	Output Low, I_{OUT} = −1.6mA (V_{CC} = 5V)		●		0.2	0.4	V
	Output High, I_{OUT} = 160μA (V_{CC} = 5V)		●	3.0	3.2		V
Output Short-Circuit Current	Sinking Current, V_{OUT} = V_{CC}			−15	−40		mA
	Sourcing Current V_{OUT} = 0V			10	20		mA
Output Leakage Current	Shutdown (Note 3), 0V ≤ V_{OUT} ≤ V_{CC}		●		1	10	μA

DC ELECTRICAL CHARACTERISTICS

$V_{CC} = 5V$, C1 = C2 = C3 = C4 = 0.1μF, $V_{ON/\overline{OFF}} = V_{CC}$, unless otherwise noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Power Supply Generator						
V$^+$ Output Voltage	I$_{OUT}$ = 0mA			8.0		V
	I$_{OUT}$ = 8mA			7.5		V
V$^-$ Output Voltage	I$_{OUT}$ = 0mA			−8.0		V
	I$_{OUT}$ = −8mA			−7.0		V
Supply Rise Time	Shutdown to Turn-On			0.2		ms
Power Supply						
V$_{CC}$ Supply Current	No Load (Note 2)	●		0.22	0.5	mA
Supply Leakage Current (V$_{CC}$)	Shutdown (Note 3)	●		0.2	10	μA
Digital Input Threshold Low		●		1.4	0.8	V
Digital Input Threshold High		●	2.0	1.4		V

AC CHARACTERISTICS

$V_{CC} = 5V$, C1 = C2 = C3 = C4 = 0.1μF, unless otherwise noted.

| PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Slew Rate	R$_L$ = 3k, C$_L$ = 51pF			8	30	V/μs
	R$_L$ = 3k, C$_L$ = 2500pF		3	5		V/μs
Driver Propagation Delay	t$_{HLD}$ (Figure 1)	●		2	3.5	μs
(TTL to RS232)	t$_{LHD}$ (Figure 1)	●		2	3.5	μs
Receiver Propagation Delay	t$_{HLR}$ (Figure 2)	●		0.3	0.8	μs
(RS232 to TTL)	t$_{LHR}$ (Figure 2)	●		0.3	0.8	μs

The ● denotes specifications which apply over the operating temperature range of 0°C ≤ T$_A$ ≤ 70°C.

Note 1: Absolute maximum ratings are those values beyond which the life of the device may be impaired.
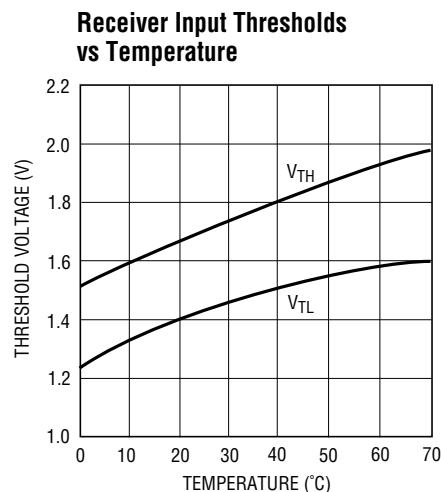
Note 2: Supply current is measured with driver and receiver outputs unloaded.

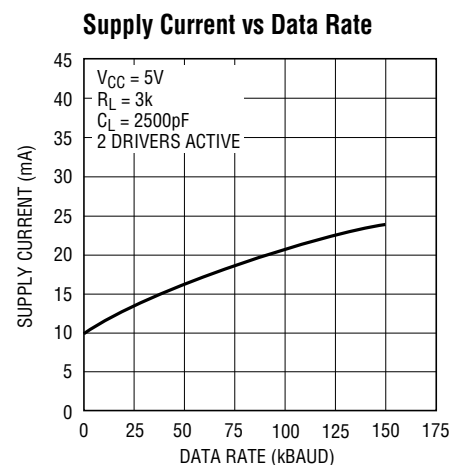**Note 3:** Measurements made in the Shutdown mode are performed with V$_{ON/\overline{OFF}}$ = 0V.

TYPICAL PERFORMANCE CHARACTERISTICS

Driver Output Voltage vs Temperature

LTC1382 • TPC01

Receiver Input Thresholds vs Temperature
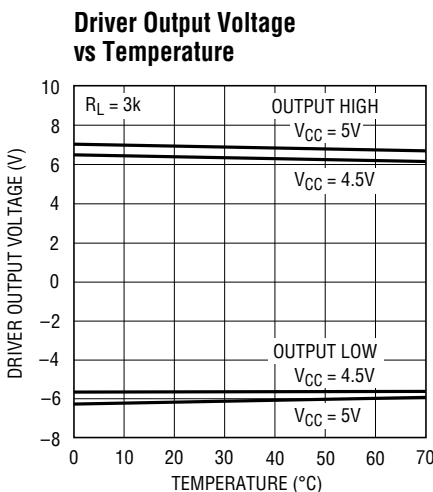
LTC1382 • TPC02

Supply Current vs Data Rate
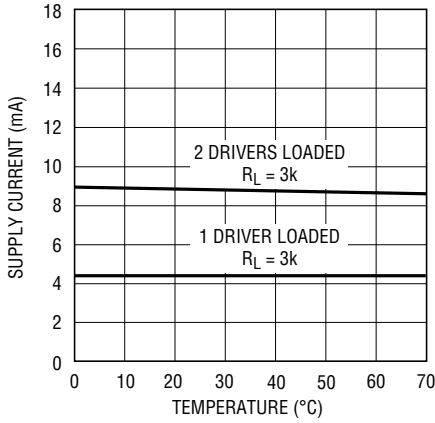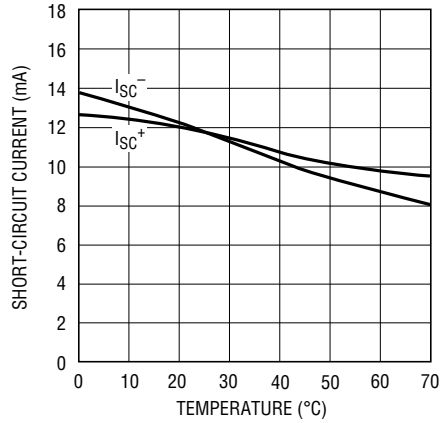

LTC1382 • TPC03

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TYPICAL PERFORMANCE CHARACTERISTICS

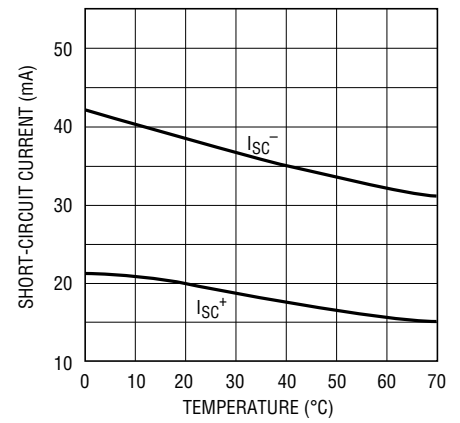**V$_{CC}$ Supply Current vs Temperature**

LTC1382 • TPC04

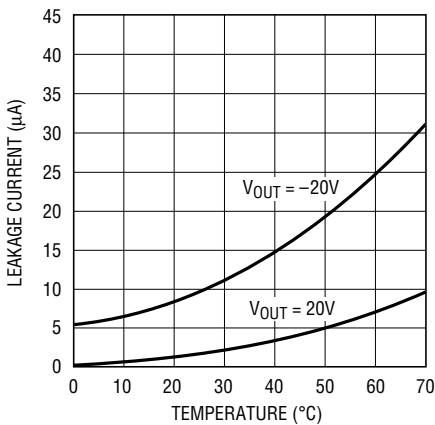**Driver Short-Circuit Current vs Temperature**

LTC1382 • TPC05

Receiver Short-Circuit Current vs Temperature
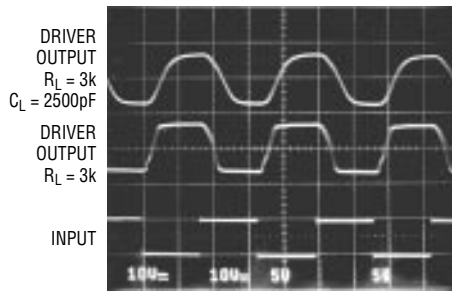

LTC1382 • TPC06
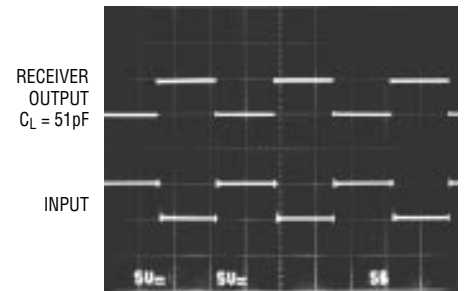
Driver Leakage in Shutdown vs Temperature

LTC1349 • TPC05

Driver Output Waveforms

LTC1382 • TPC08

Receiver Output Waveforms

LTC1382 • TPC09

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PIN FUNCTIONS

V_{CC}: 5V Input Supply Pin. This pin should be decoupled with a 0.1µF ceramic capacitor.

GND: Ground Pin.

ON/OFF: TTL/CMOS Compatible Shutdown Pin. A logic low puts the device in the Shutdown mode. Both driver outputs are forced into three-state and the supply current is 0.2µA.

V^+: Positive Supply Output (RS232 Drivers). $V^+ \cong 2V_{CC} - 2V$. 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 large numbers of devices, increasing the size of the shared common storage capacitors is recommended to reduce ripple.

V^-: Negative Supply Output (RS232 Drivers). $V^- \cong -(2V_{CC} - 2V)$. 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: RS232 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 RS232 Voltage Levels. Outputs are in a high impedance state when in the Shutdown 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.
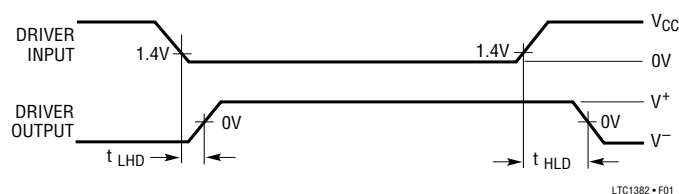
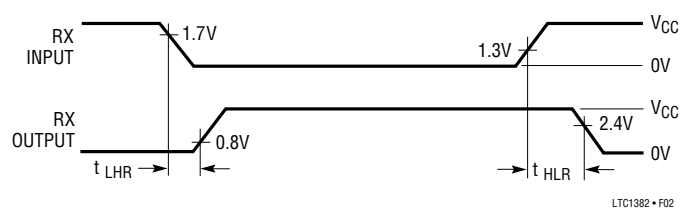# SWITCHING TIME WAVEFORMS

Figure 1. Driver Propagation Delay Timing

Figure 2. Receiver Propagation Delay Timing

TEST CIRCUITS

Driver Timing Test Load

DRIVER
INPUT

DRIVER

DRIVER
OUTPUT

51pF   3k

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Receiver Timing Test Load

RX INPUT

RX

RX
OUTPUT

51pF

LTC1382 • TA04

ESD Test Circuit

2
4   0.1µF
5
6   0.1µF

LTC1382

17   V_{CC} = 5V
3
7   0.1µF
  0.1µF

V_{CC}
300k
LOGIC INPUT   12   15   232 OUTPUT

V_{CC}
300k
LOGIC INPUT   11   8   232 OUTPUT

LOGIC OUTPUT   13   14   232 INPUT
5k

LOGIC OUTPUT   10   9   232 INPUT
5k

ON/OFF   18   16

RS232
LINE PINS
PROTECTED
TO ±10kV

LTC1382 • TA04

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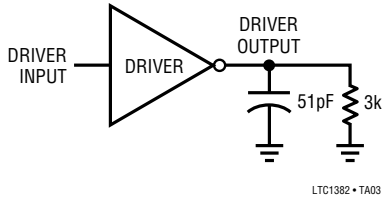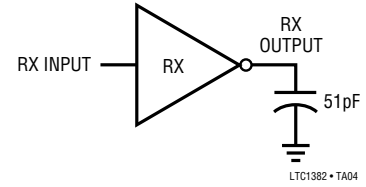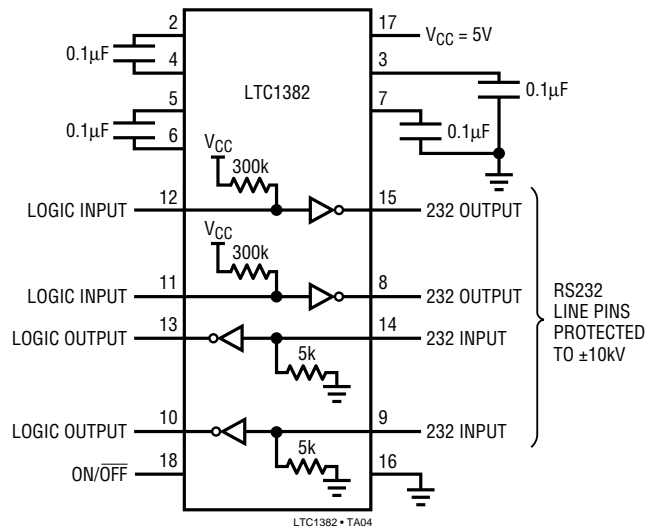
PACKAGE DESCRIPTION

Dimensions in inches (millimeters) unless otherwise noted.

N Package
18-Lead Plastic DIP

0.905
(22.860)
MAX

18 17 16 15 14 13 12 11 10

1 2 3 4 5 6 7 8 9

0.260 ± 0.010
(6.604 ± 0.254)

0.300 – 0.325
(7.620 – 8.255)

0.009 – 0.015
(0.229 – 0.381)

0.325 +0.025 −0.015
(8.255 +0.635 −0.381)

0.130 ± 0.005
(3.302 ± 0.127)

0.015
(0.381)
MIN

0.125
(3.175)
MIN

0.045 ± 0.015
(1.143 ± 0.381)
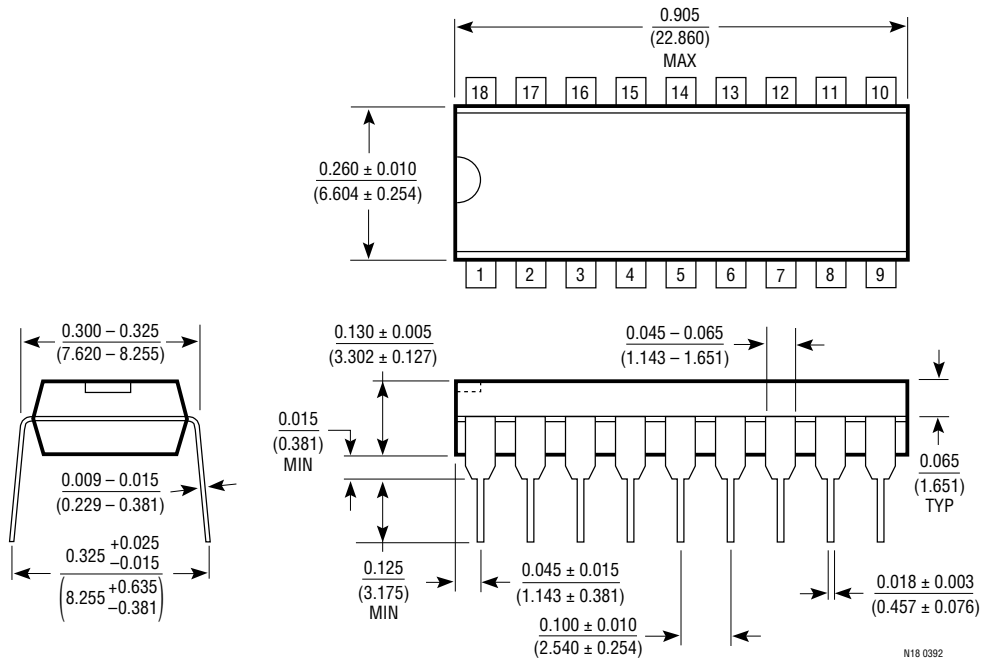
0.100 ± 0.010
(2.540 ± 0.254)

0.045 – 0.065
(1.143 – 1.651)

0.065
(1.651)
TYP

0.018 ± 0.003
(0.457 ± 0.076)

N18 0392

S Package
18-Lead Plastic SOL

0.447 – 0.463
(11.354 – 11.760)
(NOTE 2)

18 17 16 15 14 13 12 11 10

1 2 3 4 5 6 7 8 9

SEE NOTE

0.394 – 0.419
(10.007 – 10.643)

0.291 – 0.299
(7.391 – 7.595)
(NOTE 2)

0.005
(0.127)
RAD MIN

0.010 – 0.029
(0.254 – 0.737) × 45°

0.009 – 0.013
(0.229 – 0.330)

NOTE 1

0.016 – 0.050
(0.406 – 1.270)

0° – 8° TYP

0.093 – 0.104
(2.362 – 2.642)

0.037 – 0.045
(0.940 – 1.143)

0.050
(1.270)
TYP

0.014 – 0.019
(0.356 – 0.482)
TYP

0.004 – 0.012
(0.102 – 0.305)

SOL18 0392

NOTE:
1. 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.

2. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
   MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.006 INCH (0.15mm).

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