LTC1350

3.3V Low Power EIA/TIA-562 3-Driver/ 5-Receiver Transceiver

FEATURES

- **Low Supply Current** **300µA**
- **Receivers 4 and 5 Kept Alive in SHUTDOWN** **35µA**
- **ESD Protection** **±10kV**
- **Operates from a Single 3.3V Supply**
- Uses Small Capacitors 0.1µF
- Operates to 120k Baud
- Three-State Outputs are High Impedance When Off
- Output Overvoltage Does Not Force Current Back into Supplies
- EIA/TIA-562 I/O Lines Can Be Forced to ±25V Without Damage
- Flowthrough Architecture

APPLICATIONS

- Notebook Computers
- Palmtop Computers

DESCRIPTION

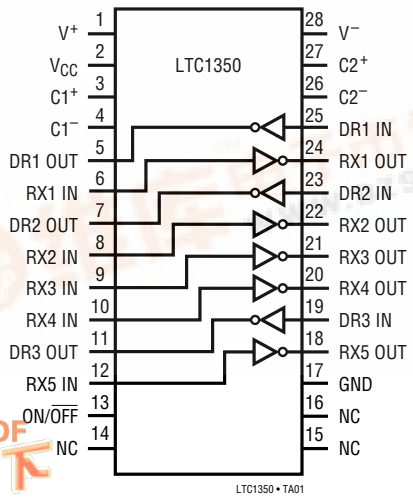
The LTC1350 is a 3-driver/5-receiver EIA/TIA-562 transceiver with very low supply current. In the no load condition, the supply current is only 300µA. The charge pump only requires four 0.1µF capacitors.

In SHUTDOWN mode, two receivers are kept alive and the supply current is only 35µA. All RS232 outputs assume a high impedance state in SHUTDOWN or with the power off.

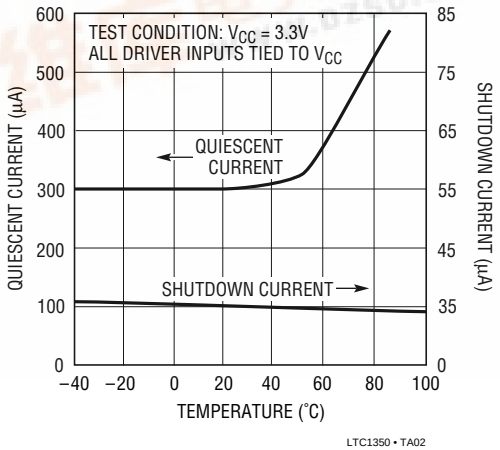
The LTC1350 is fully compliant with all data rate and overvoltage EIA/TIA-562 specifications. The transceiver can operate up to 120k baud with a 1000pF and 3kΩ load. Both driver outputs and receiver inputs can be forced to ±25V without damage and can survive multiple ±10kV ESD strikes.

TYPICAL APPLICATION

3-Drivers/5-Receivers with Shutdown



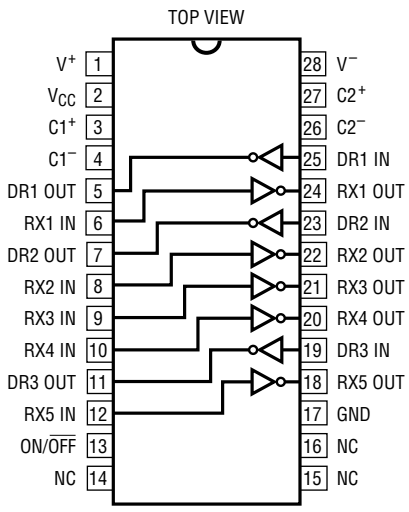
Quiescent and Shutdown Supply Current vs Temperature



ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) 5V
Input Voltage
  Driver ..... $-0.3V$ to $V_{CC} + 0.3V$
  Receiver ..... $-25V$ to $25V$
  ON/$\overline{OFF}$ Pin ..... $-0.3V$ 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
  Commercial (LTC1350C) ..... 0°C to 70°C
  Industrial (LTC1350I) ..... -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
28-LEAD SSOP

N PACKAGE
28-LEAD PLASTIC DIP

S PACKAGE
28-LEAD PLASTIC SOL

$T_{JMAX} = 125°C$, $\theta_{JA} = 96°C/W$ (G)
$T_{JMAX} = 125°C$, $\theta_{JA} = 56°C/W$ (N)
$T_{JMAX} = 125°C$, $\theta_{JA} = 85°C/W$ (S)

ORDER PART NUMBER
LTC1350CG
LTC1350CN
LTC1350CS
LTC1350IG
LTC1350IN
LTC1350IS

Consult factory for Military grade parts

DC ELECTRICAL CHARACTERISTICS

$V_{CC} = 3.3V$, C1 = C2 = C3 = C4 = 0.1µF, unless otherwise 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
	$V_{IN} = 0V$		●			–5	µA
Output Short-Circuit Current	$V_{OUT} = 0V$				±10		mA
Output Leakage Current	SHUTDOWN (Note 3), $V_{OUT} = \pm 20V$				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	$V_{IN} = \pm 10V$			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, $V_{OUT} = V_{CC}$			–3	–20		mA
Output Leakage Current	SHUTDOWN (Note 3), $0V \le V_{OUT} \le V_{CC}$		●		1	10	µA

DC ELECTRICAL CHARACTERISTICS

V_{CC} = 3.3V, C1 = C2 = C3 = C4 = 0.1μF, unless otherwise noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
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 to Turn-On			0.2		ms
Power Supply						
V_{CC} Supply Current	No Load (All Drivers $V_{IN} = V_{CC}$)(Note 2) 0°C ≤ T_A ≤ 70°C	●		0.3	0.6	mA
	No Load (All Drivers V_{IN} = 0)(Note 2) 0°C ≤ T_A ≤ 70°C	●		0.5	1.0	mA
	No Load (All Drivers $V_{IN} = V_{CC}$)(Note 2) –40°C ≤ T_A ≤ 85°C	●		0.3	1.0	mA
	No Load (All Drivers V_{IN} = 0)(Note 2) –40°C ≤ T_A ≤ 85°C	●		0.5	1.5	mA
	SHUTDOWN (Note 3)	●		35	50	μA
ON/$\overline{OFF}$ Threshold Low		●		1.4	0.8	V
ON/$\overline{OFF}$ 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 = 1000pF		3	5		V/μs
Driver Propagation Delay	t_{HLD} (Figure 1)	●		2	3.5	μs
(TTL to EIA/TIA-562)	t_{LHD} (Figure 1)	●		2	3.5	μs
Receiver Propagation Delay	t_{HLR} (Figure 2)	●		0.3	0.8	μs
(EIA/TIA-562 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 for commercial grade, –40°C ≤ T_A ≤ 85°C for Industrial grade.

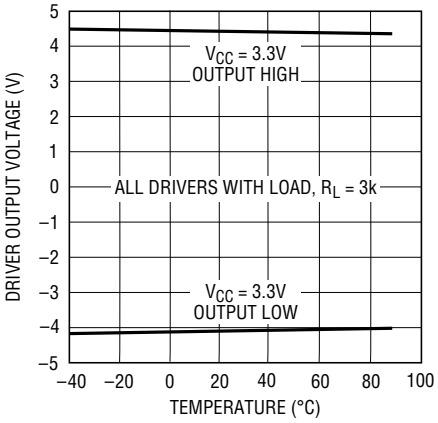
Note 1: Absolute maximum ratings are those values beyond which the life of the device may be impaired.

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

Note 3: Supply current measurement in SHUTDOWN mode is performed with $V_{ON/\overline{OFF}}$ = 0V.

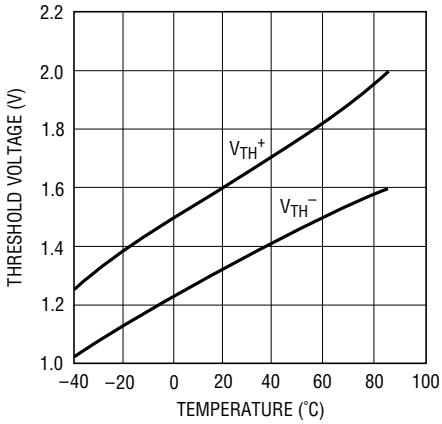
TYPICAL PERFORMANCE CHARACTERISTICS

Driver Output Voltage vs Temperature



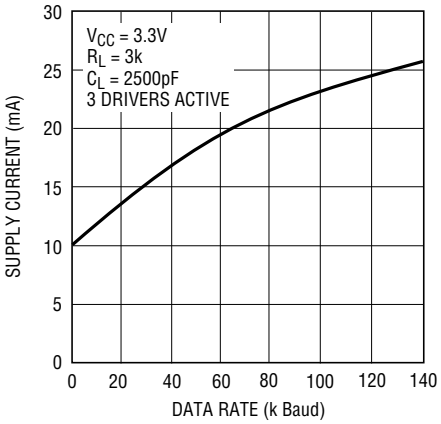
LTC1350 • TPC01

Receiver Input Thresholds vs Temperature



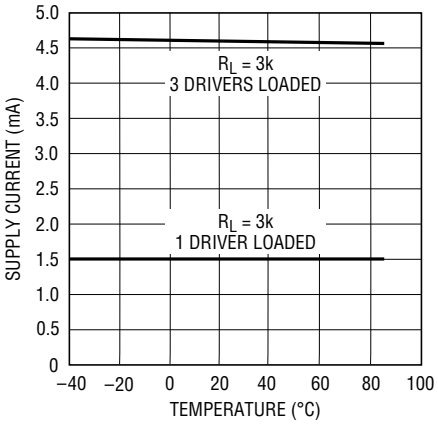
LT1350 • TPC02

Supply Current vs Data Rate



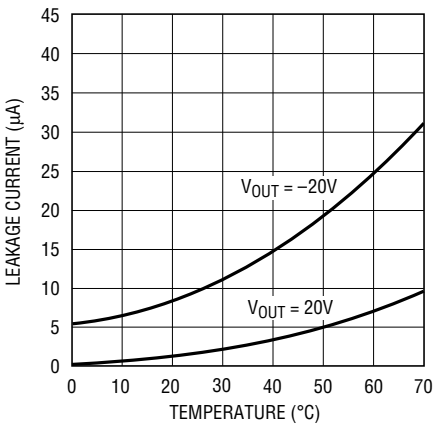
LTC1350 • TPC03

V_{CC} Supply Current vs Temperature



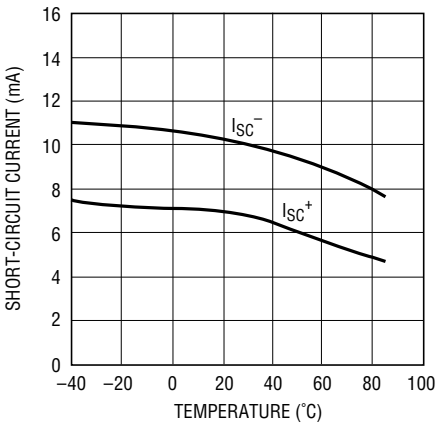
LTC1350 • TPC04

Driver Leakage in Shutdown vs Temperature



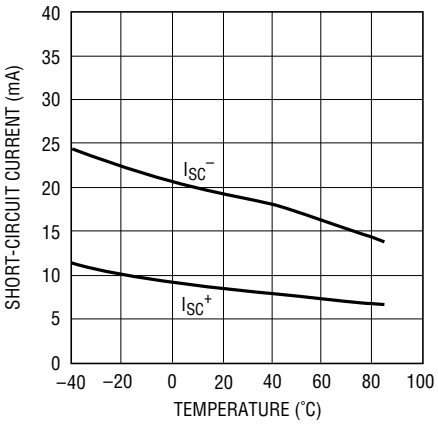
LTC1350 • TPC05

Driver Short-Circuit Current vs Temperature



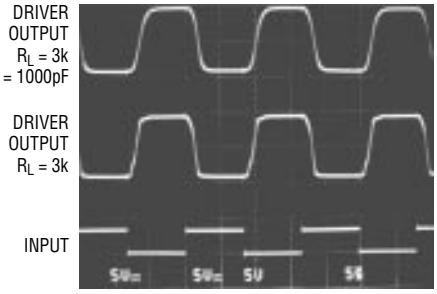
LTC1350 • TPC06

Receiver Short-Circuit Current vs Temperature



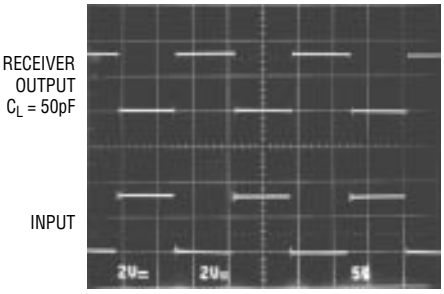
LTC1350 • TPC07

Driver Output Waveforms



LTC1350 • TPC08

Receiver Output Waveform



LTC1350 • TPC09

PIN FUNCTIONS

V_{CC}: 3.3V Input Supply Pin. Supply current is typically 35μA in the SHUTDOWN mode. 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 with receivers 4 and 5 kept alive and the supply current equal to 35μA. All driver and other receiver outputs are in high impedance state. This pin cannot float.

V^+: Positive Supply Output. $V^+ \cong 2V_{CC} - 1V$. 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 be paralleled into common capacitors. For a large number of devices, increasing the size of the shared common storage capacitors is recommended to reduce ripple.

V^-: Negative Supply Output. $V^- \cong -(2V_{CC} - 1.3V)$. 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 20Ω.

DR IN: EIA/TIA-562 Driver Input Pins. Inputs are TTL/CMOS compatible. Inputs should not be allowed to float. Tie unused inputs to V_{CC}.

DR OUT: Driver Outputs at EIA/TIA-562 Voltage Levels. Outputs are in a high impedance state when in the SHUTDOWN 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. Receiver 1, 2 and 3 outputs are in a high impedance state when in SHUTDOWN mode to allow data line sharing. Receivers 4 and 5 are kept alive in SHUTDOWN.

SWITCHING TIME WAVEFORMS

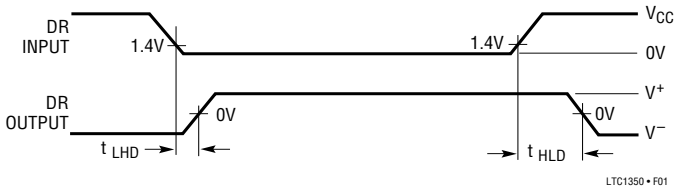


Figure 1. Driver Propagation Delay Timing

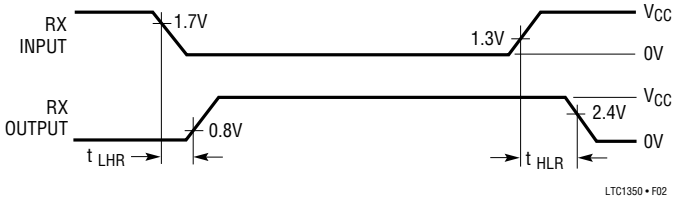
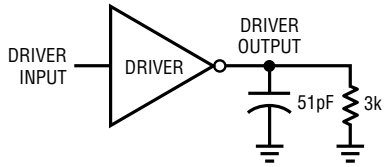


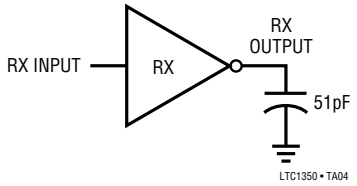
Figure 2. Receiver Propagation Delay Timing

TEST CIRCUITS

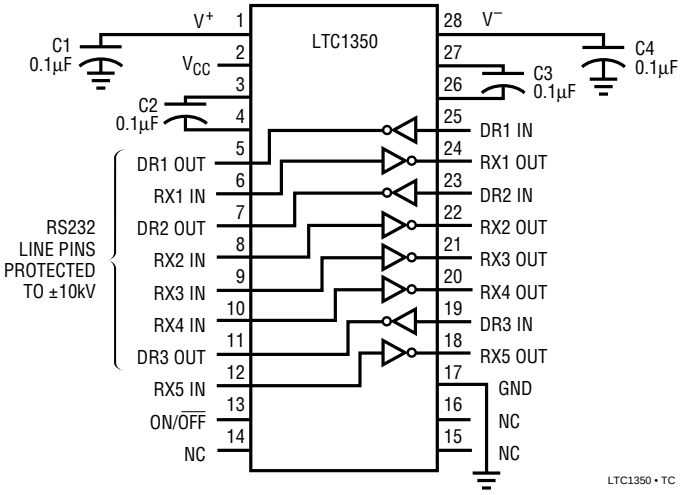
Driver Timing Test Load



Receiver Timing Test Load



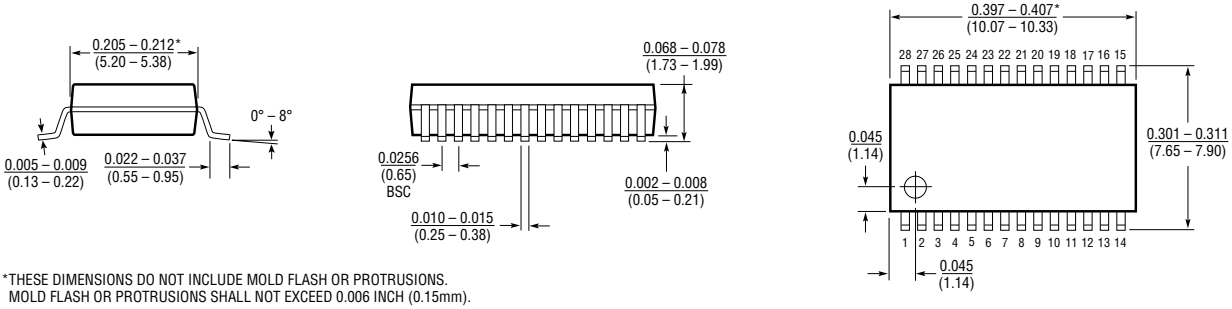
ESD Test Circuit



PACKAGE DESCRIPTION

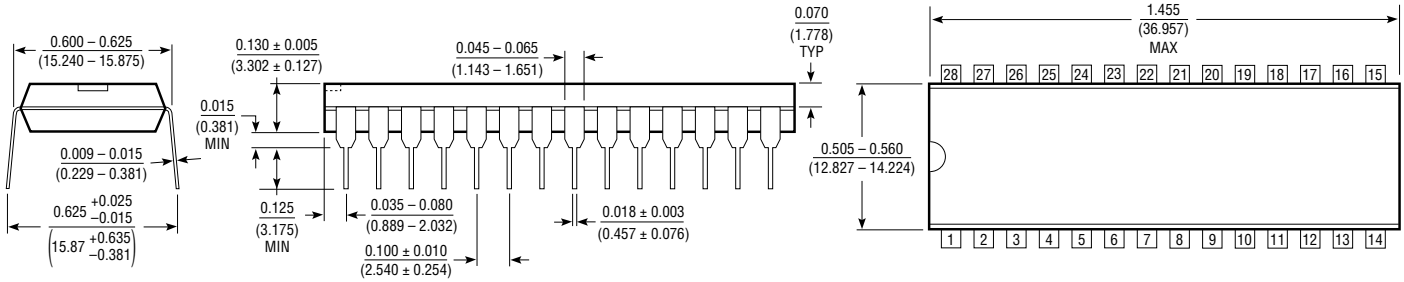
Dimensions in inches (millimeters) unless otherwise noted.

G Package
28-Lead SSOP

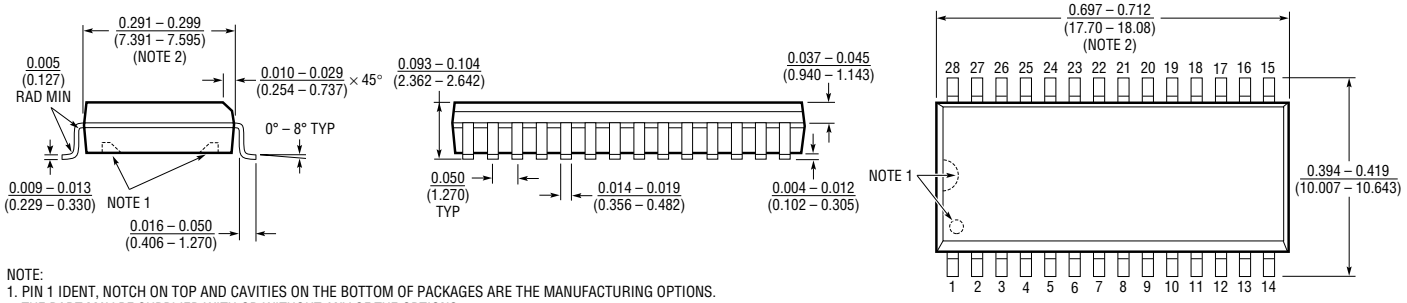


*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.006 INCH (0.15mm).

N Package
28-Lead Plastic DIP



S Package
28-Lead Plastic SOL



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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