



**THE DATASHEET OF
ISL4489EIBZ**



ISL4489E, ISL4491E

±15kV ESD Protected, 1/8 Unit Load, 5V, Low Power, High Speed and Slew Rate Limited, Full Duplex, RS-485/RS-422 Transceivers

FN6074
Rev.4.00
Sep 17, 2018

The [ISL4489E](#) and [ISL4491E](#) are ESD protected, “fractional” Unit Load (UL), BiCMOS, 5V powered, single transceivers that meet both the RS-485 and RS-422 standards for balanced communication. Each driver output and receiver input is protected against ±15kV ESD strikes without latch-up. Unlike competitive versions, these devices are specified for 10% tolerance supplies (4.5V to 5.5V).

The Rx inputs and Tx outputs present a 1/8 unit load to the RS-485 bus, which allows a total of 256 transmitters and receivers on the network for large node count systems.

These devices are configured for full duplex (separate Rx input and Tx output pins) applications, so they are ideal for RS-422 networks requiring high ESD tolerance on the bus pins.

The ISL4489E uses a slew rate limited driver that reduces EMI and minimizes reflections from improperly terminated transmission lines, or unterminated stubs in multidrop and multipoint applications.

Data rates up to 15Mbps are achievable using the ISL4491E, which features higher slew rates.

The receiver (Rx) inputs feature a “fail-safe if open” design, which ensures a logic high Rx output if Rx inputs are floating.

The driver (Tx) outputs are short-circuit protected, even for voltages exceeding the power supply voltage. Additionally, on-chip thermal shutdown circuitry disables the Tx outputs to prevent damage if power dissipation becomes excessive.

Related Literature

For a full list of related documents, visit our website:

- [ISL4489E](#), [ISL4491E](#) product pages

Features

- Pb-free (RoHS compliant)
- RS-485 I/O pin ESD protection ±15kV HBM
 - Class 3 ESD level on all other pins >7kV HBM
- 1/8 unit load allows up to 256 devices on the bus
- High data rates (ISL4491E) up to 15Mbps
- Slew rate limited version for error free data transmission (ISL4489E)
- Very low quiescent current:
 - 140µA (ISL4489E)
 - 370µA (ISL4491E)
- -7V to +12V common-mode input voltage range
- Tri-statable Rx and Tx outputs
- Full duplex pinout
- Operates from a single +5V supply (10% tolerance)
- Current limiting and thermal shutdown for driver overload protection

Applications

- Factory automation
- Security networks
- Building environmental control systems
- Industrial/process control networks
- Level translators (for example, RS-232 to RS-422)
- RS-232 “extension cords”

TABLE 1. SUMMARY OF FEATURES

| PART NUMBER | HALF/FULL DUPLEX | HIGH ESD? | NO. OF DEVICES ALLOWED ON BUS | DATA RATE (Mbps) | SLEW-RATE LIMITED? | RECEIVER/ DRIVER ENABLE? | QUIESCENT I _{CC} (µA) | PIN COUNT |
|-------------|------------------|-----------|-------------------------------|------------------|--------------------|--------------------------|--------------------------------|-----------|
| ISL4489E | Full | Yes | 256 | 0.25 | Yes | Yes | 140 | 14 |
| ISL4491E | Full | Yes | 256 | 15 | No | Yes | 370 | 14 |

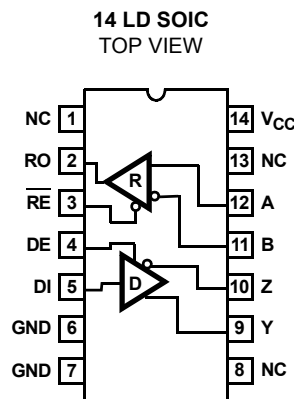
Ordering Information

| PART NUMBER (Notes 2, 3) | PART MARKING | TEMP. RANGE (°C) | TAPE AND REEL (UNITS) (Note 1) | PACKAGE (RoHS Compliant) | PKG. DWG. # |
|-----------------------------|--------------|---------------------|-----------------------------------|-----------------------------|----------------|
| ISL4489EIBZ | 4489EIBZ | -40 to +85 | - | 14 Ld SOIC | M14.15 |
| ISL4489EIBZ-T | 4489EIBZ | -40 to +85 | 2.5k | 14 Ld SOIC | M14.15 |
| ISL4491EIBZ | 4491EIBZ | -40 to +85 | - | 14 Ld SOIC | M14.15 |
| ISL4491EIBZ-T | 4491EIBZ | -40 to +85 | 2.5k | 14 Ld SOIC | M14.15 |

NOTES:

- Refer to [TB347](#) for details about reel specifications.
- Pb-free plus anneal products employ special Pb-free material sets; molding compounds/die attach materials and 100% matte tin plate termination finish, which are RoHS compliant and compatible with both SnPb and Pb-free soldering operations. Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.
- For Moisture Sensitivity Level (MSL), see the [ISL4489E](#) and [ISL4491E](#) product information pages. For more information on MSL, see [TB363](#).

Pinout



Pin Descriptions

| PIN | FUNCTION |
|-----------------|---|
| RO | Receiver output. RO is high if A > B by at least 0.2V; RO is low if A < B by 0.2V or more; RO = High if A and B are unconnected (floating). |
| \overline{RE} | Receiver output enable. RO is enabled when \overline{RE} is low; RO is high impedance when \overline{RE} is high. |
| DE | Driver output enable. The driver outputs Y and Z are enabled by bringing DE high. They are high impedance when DE is low. |
| DI | Driver input. A low on DI forces output Y low and output Z high. Similarly, a high on DI forces output Y high and output Z low. |
| GND | Ground connection. |
| A | $\pm 15\text{kV}$ HBM ESD protected, noninverting receiver input. |
| B | $\pm 15\text{kV}$ HBM ESD protected, inverting receiver input. |
| Y | $\pm 15\text{kV}$ HBM ESD protected, noninverting driver output. |
| Z | $\pm 15\text{kV}$ HBM ESD protected, inverting driver output. |
| V _{CC} | System power supply input (4.5V to 5.5V). |
| NC | No connection. |

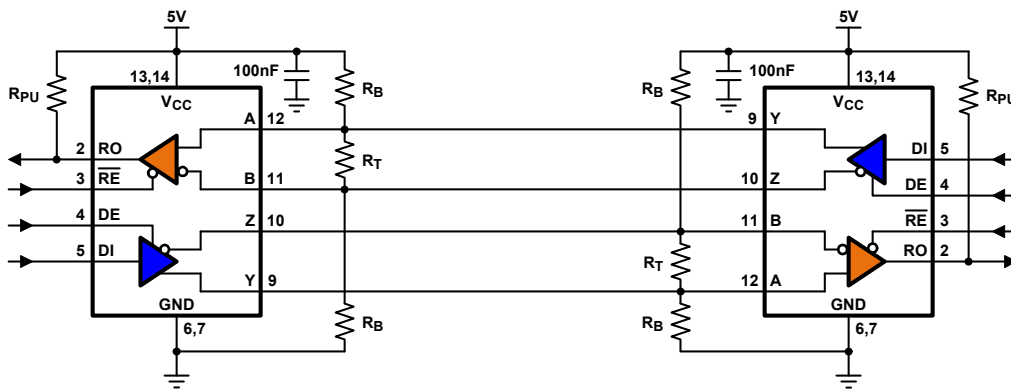
Truth Tables

| TRANSMITTING | | | | |
|-----------------|----|----|---------|--------|
| INPUTS | | | OUTPUTS | |
| \overline{RE} | DE | DI | Z | Y |
| X | 1 | 1 | 0 | 1 |
| X | 1 | 0 | 1 | 0 |
| X | 0 | X | High-Z | High-Z |

| RECEIVING | | | |
|-----------------|----|--------------|--------|
| INPUTS | | | OUTPUT |
| \overline{RE} | DE | A-B | RO |
| 0 | X | $\geq +0.2V$ | 1 |
| 0 | X | $\leq -0.2V$ | 0 |
| 0 | X | Inputs Open | 1 |
| 1 | X | X | High-Z |

Typical Operating Circuit

ISL4489E, ISL4491E



To calculate the resistor values, refer to [TB509](#)

Absolute Maximum Ratings

| | |
|---------------------------|---|
| V _{CC} to Ground | 7V |
| Input Voltages | |
| DI, DE, RE | -0.5V to (V _{CC} + 0.5V) |
| Input/Output Voltages | |
| A, B, Y, Z | -8V to +12.5V |
| RO | -0.5V to (V _{CC} + 0.5V) |
| Short-Circuit Duration | |
| Y, Z | Continuous |
| ESD Rating | See "ESD PERFORMANCE" on page 5 |

Thermal Information

| | |
|--|----------------------|
| Thermal Resistance (Typical, Note 4) | θ_{JA} (°C/W) |
| 14 Ld SOIC Package | 128 |
| Maximum Junction Temperature (Plastic Package) | +150°C |
| Maximum Storage Temperature Range | -65°C to +150°C |
| Maximum Lead Temperature (Soldering 10s) (Lead Tips Only) | +300°C |

Operating Conditions

| | |
|-------------------|----------------|
| Temperature Range | -40°C to +85°C |
|-------------------|----------------|

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" can permanently damage the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

4. θ_{JA} is measured with the component mounted on a low-effective thermal conductivity test board in free air. See [TB379](#) for details.

Electrical Specifications Test Conditions: V_{CC} = 4.5V to 5.5V; Unless Otherwise Specified. Typicals are at V_{CC} = 5V, T_A = +25°C, [Note 5](#)

| PARAMETER | SYMBOL | TEST CONDITIONS | TEMP (°C) | MIN | TYP | MAX | UNIT | |
|---|-------------------|--|-----------------------|------|------|-----------------|------|----|
| DC CHARACTERISTICS | | | | | | | | |
| Driver Differential V _{OUT} (no load) | V _{OD1} | | Full | - | - | V _{CC} | V | |
| Driver Differential V _{OUT} (with load) | V _{OD2} | R = 50Ω (RS-422) (Figure 1) | Full | 2 | 3 | - | V | |
| | | R = 27Ω (RS-485) (Figure 1) | Full | 1.5 | 2.3 | 5 | V | |
| Change in Magnitude of Driver Differential V _{OUT} for Complementary Output States | ΔV _{OD} | R = 27Ω or 50Ω (Figure 1) | Full | - | 0.01 | 0.2 | V | |
| Driver Common-Mode V _{OUT} | V _{OC} | R = 27Ω or 50Ω (Figure 1) | Full | - | - | 3 | V | |
| Change in Magnitude of Driver Common-Mode V _{OUT} for Complementary Output States | ΔV _{OC} | R = 27Ω or 50Ω (Figure 1) | Full | - | 0.01 | 0.2 | V | |
| Logic Input High Voltage | V _{IH} | DE, DI, \overline{RE} | Full | 2 | - | - | V | |
| Logic Input Low Voltage | V _{IL} | DE, DI, \overline{RE} | Full | 0.8 | - | - | V | |
| Logic Input Current | I _{IN1} | DI | Full | -2 | - | 2 | μA | |
| | | DE, \overline{RE} | Full | -40 | - | 40 | μA | |
| Input Current (A, B) (Note 8) | I _{IN2} | DE = 0V, V _{CC} = 0V or 4.5 to 5.5V | V _{IN} = 12V | Full | - | - | 130 | μA |
| | | | V _{IN} = -7V | Full | -100 | - | - | μA |
| Driver Tri-State (High Impedance) Output Current (Y, Z) | I _{OZD} | -7V ≤ V _O ≤ 12V | Full | -100 | - | 100 | μA | |
| Receiver Differential Threshold Voltage | V _{TH} | -7V ≤ V _{CM} ≤ 12V | Full | -0.2 | - | 0.2 | V | |
| Receiver Input Hysteresis | ΔV _{TH} | V _{CM} = 0V | +25 | - | 70 | - | mV | |
| Receiver Output High Voltage | V _{OH} | I _O = -4mA, V _{ID} = 200mV | Full | 3.5 | - | - | V | |
| Receiver Output Low Voltage | V _{OL} | I _O = -4mA, V _{ID} = 200mV | Full | - | - | 0.4 | V | |
| Tri-State (high impedance) Receiver Output Current | I _{OZR} | 0.4V ≤ V _O ≤ 2.4V | Full | - | - | ±1 | μA | |
| Receiver Input Resistance | R _{IN} | -7V ≤ V _{CM} ≤ 12V | Full | 92 | 120 | - | kΩ | |
| No-Load Supply Current (Note 6) | I _{CC} | ISL4489E, DE, DI, \overline{RE} = 0V or V _{CC} | Full | - | 140 | 190 | μA | |
| | | ISL4491E, DE, DI, \overline{RE} = 0V or V _{CC} | Full | - | 370 | 460 | μA | |
| Driver Short-Circuit Current, V _O = High or Low | I _{OSD1} | DE = V _{CC} , -7V ≤ V _Y or V _Z ≤ 12V (Note 7) | Full | 35 | - | 250 | mA | |
| Receiver Short-Circuit Current | I _{OSR} | 0V ≤ V _O ≤ V _{CC} | Full | 7 | - | 85 | mA | |

Electrical Specifications Test Conditions: $V_{CC} = 4.5V$ to $5.5V$; Unless Otherwise Specified. Typicals are at $V_{CC} = 5V$, $T_A = +25^{\circ}C$, [Note 5 \(Continued\)](#)

| PARAMETER | SYMBOL | TEST CONDITIONS | TEMP (°C) | MIN | TYP | MAX | UNIT |
|---|--------------------|--|-----------|-----|----------|------|------|
| SWITCHING CHARACTERISTICS (ISL4489E) | | | | | | | |
| Driver Input to Output Delay | t_{PLH}, t_{PHL} | $R_{DIFF} = 54\Omega$, $C_L = 100pF$ (Figure 2) | Full | 250 | 400 | 2000 | ns |
| Driver Output Skew | t_{SKEW} | $R_{DIFF} = 54\Omega$, $C_L = 100pF$ (Figure 2) | Full | - | 160 | 800 | ns |
| Driver Differential Rise or Fall Time | t_R, t_F | $R_{DIFF} = 54\Omega$, $C_L = 100pF$ (Figure 2) | Full | 250 | 600 | 2000 | ns |
| Driver Enable to Output High | t_{ZH} | $C_L = 100pF$, SW = GND (Figure 3) | Full | 250 | 1000 | 2000 | ns |
| Driver Enable to Output Low | t_{ZL} | $C_L = 100pF$, SW = V_{CC} (Figure 3) | Full | 250 | 860 | 2000 | ns |
| Driver Disable from Output High | t_{HZ} | $C_L = 15pF$, SW = GND (Figure 3) | Full | 300 | 660 | 3000 | ns |
| Driver Disable from Output Low | t_{LZ} | $C_L = 15pF$, SW = V_{CC} (Figure 3) | Full | 300 | 640 | 3000 | ns |
| Receiver Input to Output Delay | t_{PLH}, t_{PHL} | Figure 4 | Full | 250 | 500 | 2000 | ns |
| Receiver Skew $t_{PLH} - t_{PHL}$ | t_{SKD} | Figure 4 | +25 | - | 60 | - | ns |
| Receiver Enable to Output High | t_{ZH} | $C_L = 15pF$, SW = GND (Figure 5) | Full | - | 10 | 50 | ns |
| Receiver Enable to Output Low | t_{ZL} | $C_L = 15pF$, SW = V_{CC} (Figure 5) | Full | - | 10 | 50 | ns |
| Receiver Disable from Output High | t_{HZ} | $C_L = 15pF$, SW = GND (Figure 5) | Full | - | 10 | 50 | ns |
| Receiver Disable from Output Low | t_{LZ} | $C_L = 15pF$, SW = V_{CC} (Figure 5) | Full | - | 10 | 50 | ns |
| Maximum Data Rate | f_{MAX} | | Full | 250 | - | - | kbps |
| SWITCHING CHARACTERISTICS (ISL4491E) | | | | | | | |
| Driver Input to Output Delay | t_{PLH}, t_{PHL} | $R_{DIFF} = 54\Omega$, $C_L = 100pF$ (Figure 2) | Full | 13 | 24 | 40 | ns |
| Driver Output Skew | t_{SKEW} | $R_{DIFF} = 54\Omega$, $C_L = 100pF$ (Figure 2) | Full | - | 3 | 10 | ns |
| Driver Differential Rise or Fall Time | t_R, t_F | $R_{DIFF} = 54\Omega$, $C_L = 100pF$ (Figure 2) | Full | 5 | 12 | 20 | ns |
| Driver Enable to Output High | t_{ZH} | $C_L = 100pF$, SW = GND (Figure 3) | Full | - | 14 | 70 | ns |
| Driver Enable to Output Low | t_{ZL} | $C_L = 100pF$, SW = V_{CC} (Figure 3) | Full | - | 14 | 70 | ns |
| Driver Disable from Output High | t_{HZ} | $C_L = 15pF$, SW = GND (Figure 3) | Full | - | 44 | 70 | ns |
| Driver Disable from Output Low | t_{LZ} | $C_L = 15pF$, SW = V_{CC} (Figure 3) | Full | - | 21 | 70 | ns |
| Receiver Input to Output Delay | t_{PLH}, t_{PHL} | Figure 4 | Full | 30 | 90 | 150 | ns |
| Receiver Skew $t_{PLH} - t_{PHL}$ | t_{SKD} | Figure 4 | +25 | - | 5 | - | ns |
| Receiver Enable to Output High | t_{ZH} | $C_L = 15pF$, SW = GND (Figure 5) | Full | - | 9 | 50 | ns |
| Receiver Enable to Output Low | t_{ZL} | $C_L = 15pF$, SW = V_{CC} (Figure 5) | Full | - | 9 | 50 | ns |
| Receiver Disable from Output High | t_{HZ} | $C_L = 15pF$, SW = GND (Figure 5) | Full | - | 9 | 50 | ns |
| Receiver Disable from Output Low | t_{LZ} | $C_L = 15pF$, SW = V_{CC} (Figure 5) | Full | - | 9 | 50 | ns |
| Maximum Data Rate | f_{MAX} | | Full | 15 | - | - | Mbps |
| ESD PERFORMANCE | | | | | | | |
| RS-485 Pins (A, B, Y, Z) | | Human Body Model | +25 | - | ± 15 | - | kV |
| All Other Pins | | | +25 | - | $>\pm 7$ | - | kV |

NOTES:

- All currents into device pins are positive; all currents out of device pins are negative. All voltages are referenced to device ground unless otherwise specified.
- Supply current specification is valid for loaded drivers when DE = 0V.
- Applies to peak current. See ["Typical Performance Curves" on page 9](#) for more information.
- Devices meeting these limits are denoted as "1/8 unit load (1/8 UL)" transceivers. The RS-485 standard allows up to 32 UL on the bus, so there can be 256 1/8 UL devices on a bus.

Test Circuits and Waveforms

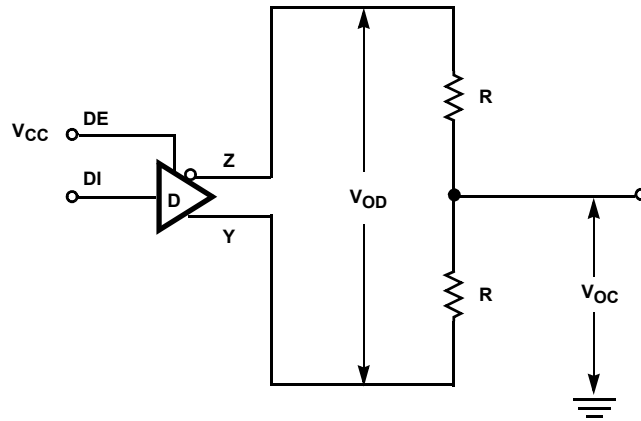


FIGURE 1. DRIVER V_{OD} AND V_{OC}

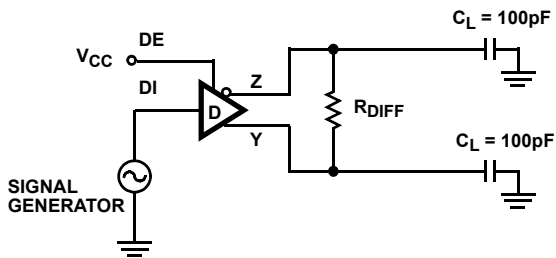
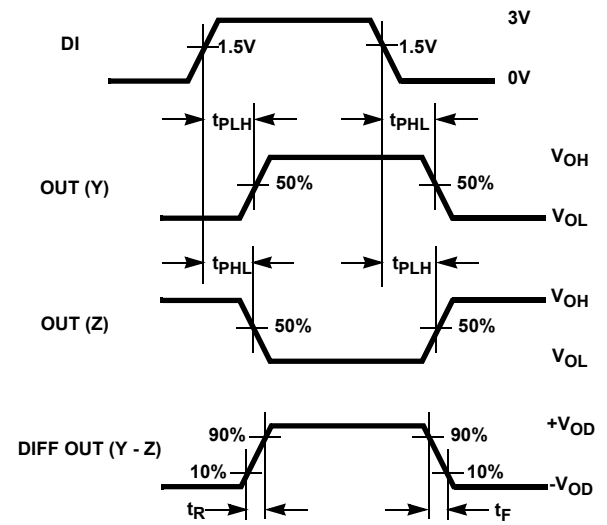


FIGURE 2A. TEST CIRCUIT

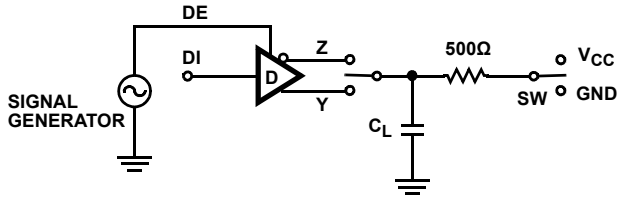


$$SKEW = |t_{PLH}(Y \text{ or } Z) - t_{PHL}(Z \text{ or } Y)|$$

FIGURE 2B. MEASUREMENT POINTS

FIGURE 2. DRIVER PROPAGATION DELAY AND DIFFERENTIAL TRANSITION TIMES

Test Circuits and Waveforms (Continued)



| PARAMETER | OUTPUT | \overline{RE} | DI | SW | C_L (pF) |
|-----------|--------|-----------------|-----|----------|------------|
| t_{HZ} | Y/Z | X | 1/0 | GND | 15 |
| t_{LZ} | Y/Z | X | 0/1 | V_{CC} | 15 |
| t_{ZH} | Y/Z | X | 1/0 | GND | 100 |
| t_{ZL} | Y/Z | X | 0/1 | V_{CC} | 100 |

FIGURE 3A. TEST CIRCUIT

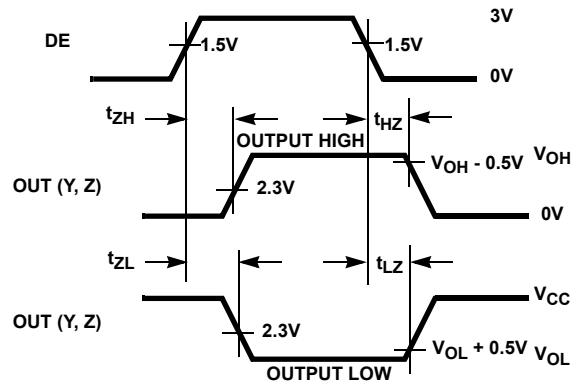


FIGURE 3B. MEASUREMENT POINTS

FIGURE 3. DRIVER ENABLE AND DISABLE TIMES

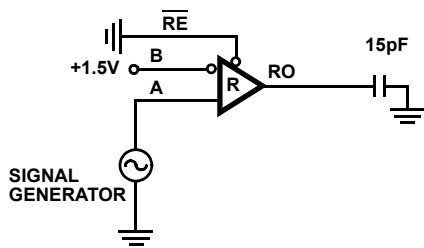


FIGURE 4A. TEST CIRCUIT

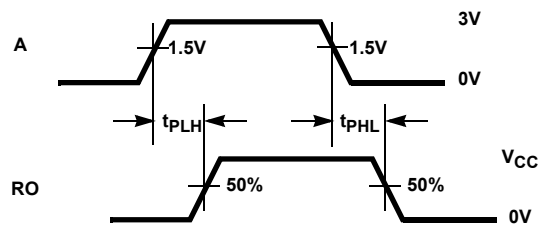
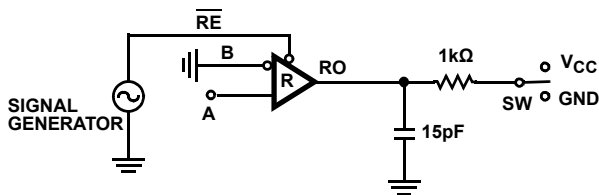


FIGURE 4B. MEASUREMENT POINTS

FIGURE 4. RECEIVER PROPAGATION DELAY



| PARAMETER | DE | A | SW |
|-----------|----|-------|----------|
| t_{HZ} | X | +1.5V | GND |
| t_{LZ} | X | -1.5V | V_{CC} |
| t_{ZH} | X | +1.5V | GND |
| t_{ZL} | X | -1.5V | V_{CC} |

FIGURE 5A. TEST CIRCUIT

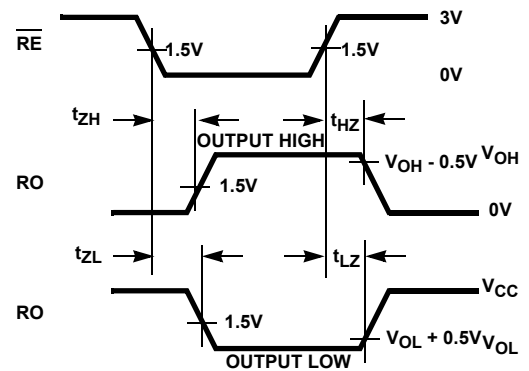


FIGURE 5B. MEASUREMENT POINTS

FIGURE 5. RECEIVER ENABLE AND DISABLE TIMES

Application Information

RS-485 and RS-422 are differential (balanced) data transmission standards for use in long haul or noisy environments. RS-422 is a subset of RS-485, so RS-485 transceivers are also RS-422 compliant. RS-422 is a point-to-multipoint (multidrop) standard that allows only one driver and up to 10 receivers on each bus, assuming one unit load devices. RS-485 is a true multipoint standard, which allows up to 32 one unit load devices (any combination of drivers and receivers) on each bus. To allow for multipoint operation, the RS-485 specification requires that drivers must handle bus contention without sustaining any damage.

An important advantage of RS-485 is the extended Common-Mode Range (CMR), which specifies that the driver outputs and receiver inputs withstand signals that range from +12V to -7V. RS-422 and RS-485 are intended for runs as long as 4000ft, so the wide CMR is necessary to handle ground potential differences and voltages induced in the cable by external fields.

Receiver Features

These devices use a differential input receiver for maximum noise immunity and common-mode rejection. Input sensitivity is $\pm 200\text{mV}$ as required by the RS-422 and RS-485 specifications.

The receiver input resistance of $120\text{k}\Omega$ surpasses the RS-422 specification of $4\text{k}\Omega$, and is more than eight times the RS-485 "UL" requirement of $12\text{k}\Omega$. Thus, these products are known as "one-eighth UL" transceivers. There can be up to 256 of these devices on a network while still complying with the RS-485 loading specification.

Receiver inputs function with common-mode voltages as great as $\pm 7\text{V}$ outside the power supplies (such as +12V and -7V), making them ideal for long networks in which induced voltages are a realistic concern.

All the receivers include a "fail-safe if open" function that ensures a high level receiver output if the receiver inputs are unconnected (floating).

Receivers easily meet the data rate supported by the corresponding driver, and the receiver outputs are tri-statable using the active low RE input.

Driver Features

The RS-485/422 driver is a differential output device that delivers at least 1.5V across a 54Ω load (RS-485) and at least 2V across a 100Ω load (RS-422). The drivers feature low propagation delay skew to maximize bit width and to minimize EMI. The driver outputs are tri-statable using the active high DE input.

The ISL4489E driver outputs are slew rate limited to further reduce EMI and to minimize reflections in unterminated or improperly terminated networks. Data rates on these slew

rate limited versions are a maximum of 250kbps. The ISL4491E driver outputs are not limited, so faster output transition times allow data rates of at least 15Mbps.

Data Rate, Cables, and Terminations

Twisted pair cable is the cable of choice for RS-485/422 networks. Twisted pair cables tend to pick up noise and other electromagnetically induced voltages as common-mode signals, which are effectively rejected by the differential receivers in these ICs.

RS-485/422 are intended for network lengths up to 4000ft, but the maximum system data rate decreases as the transmission length increases. Devices operating at 15Mbps are limited to lengths of a few hundred feet, while the 250kbps versions can operate at full data rates with lengths in excess of 1000ft.

Proper termination is imperative to minimize reflections when using the 15Mbps devices. Short networks using the 250kbps versions do not need to be terminated, but terminations are recommended unless power dissipation is an overriding concern. In point-to-point or point-to-multipoint (single driver on bus) networks, terminate the main cable in its characteristic impedance (typically 120Ω) at the end farthest from the driver. In multi-receiver applications, keep stubs connecting receivers to the main cable as short as possible. In multipoint (multi-driver) systems, terminate the main cable in its characteristic impedance at both ends. Keep stubs connecting a transceiver to the main cable as short as possible.

Built-In Driver Overload Protection

As stated previously, the RS-485 specification requires that drivers survive worst case bus contentions undamaged. The ISL44xxE devices meet this requirement through driver output short-circuit current limits and on-chip thermal shutdown circuitry.

The driver output stages incorporate short-circuit current limiting circuitry which ensures that the output current never exceeds the RS-485 specification, even at the common-mode voltage range extremes. Additionally, these devices use a foldback circuit that reduces the short-circuit current, and thus the power dissipation, when the contending voltage exceeds either supply.

In the event of a major short-circuit condition, the ISL44xxE devices' thermal shutdown feature disables the drivers when the die temperature becomes excessive. This eliminates the power dissipation, allowing the die to cool. The drivers automatically reenables after the die temperature drops about 15°C . If the contention persists, the thermal shutdown/reenable cycle repeats until the fault is cleared. Receivers stay operational during thermal shutdown.

ESD Protection

All pins on these devices include Class 3 Human Body Model (HBM) ESD protection structures, but the RS-485 pins (driver outputs and receiver inputs) incorporate advanced structures allowing them to survive ESD events in excess of $\pm 15\text{kV}$ HBM. The RS-485 pins are particularly vulnerable to ESD damage because they typically connect to an exposed port on the exterior of the finished product. Simply touching the port pins or connecting a cable can

cause an ESD event that might destroy unprotected ICs. The ESD structures protect the device whether or not it is powered up, protect without allowing any latchup mechanism to activate, and without degrading the RS-485 common-mode range of -7V to $+12\text{V}$. This built-in ESD protection eliminates the need for board level protection structures (for example, transient suppression diodes), and the associated undesirable capacitive load they present.

Typical Performance Curves $V_{CC} = 5\text{V}$, $T_A = 25^\circ\text{C}$; Unless Otherwise Specified

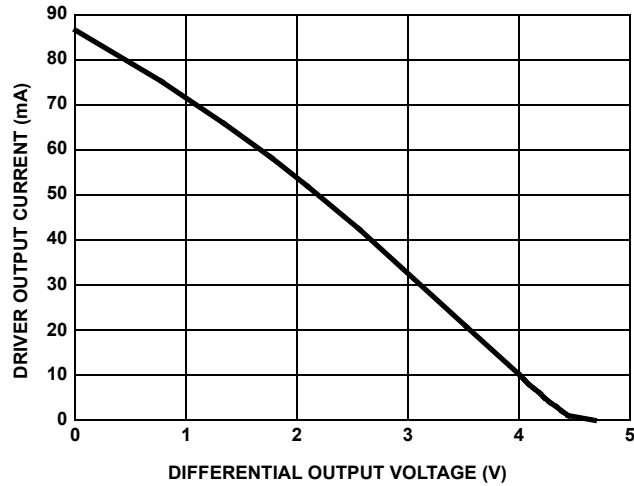


FIGURE 6. DRIVER OUTPUT CURRENT vs DIFFERENTIAL OUTPUT VOLTAGE

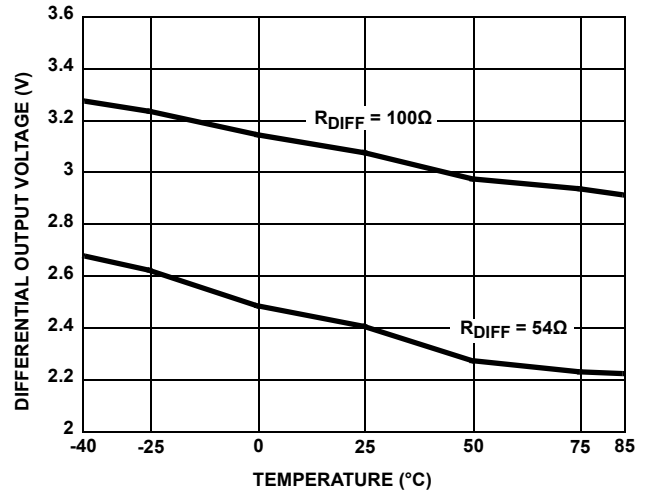


FIGURE 7. DRIVER DIFFERENTIAL OUTPUT VOLTAGE vs TEMPERATURE

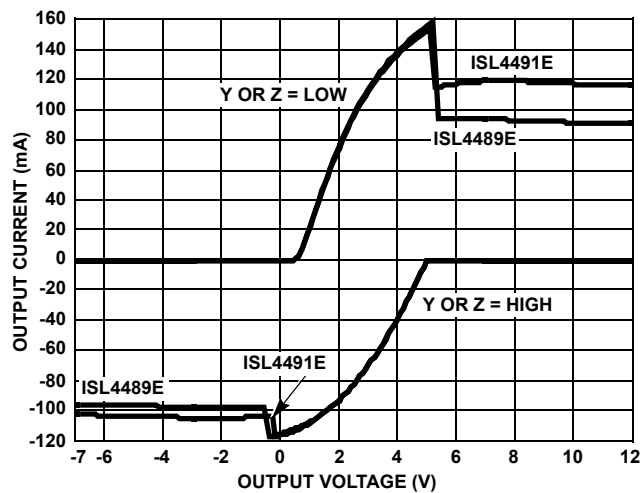


FIGURE 8. DRIVER OUTPUT CURRENT vs SHORT-CIRCUIT VOLTAGE

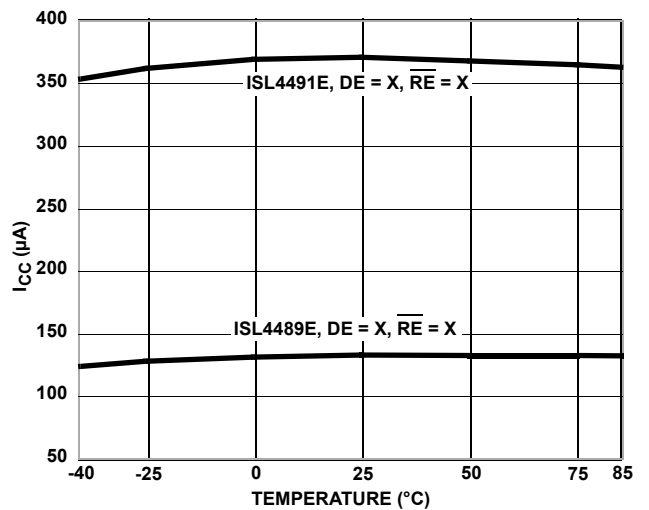


FIGURE 9. SUPPLY CURRENT vs TEMPERATURE

Typical Performance Curves $V_{CC} = 5V, T_A = 25^\circ C$; Unless Otherwise Specified (Continued)

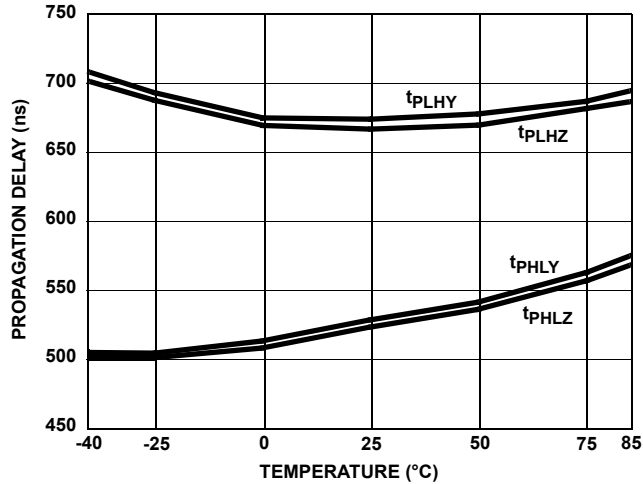


FIGURE 10. DRIVER PROPAGATION DELAY vs TEMPERATURE (ISL4489E)

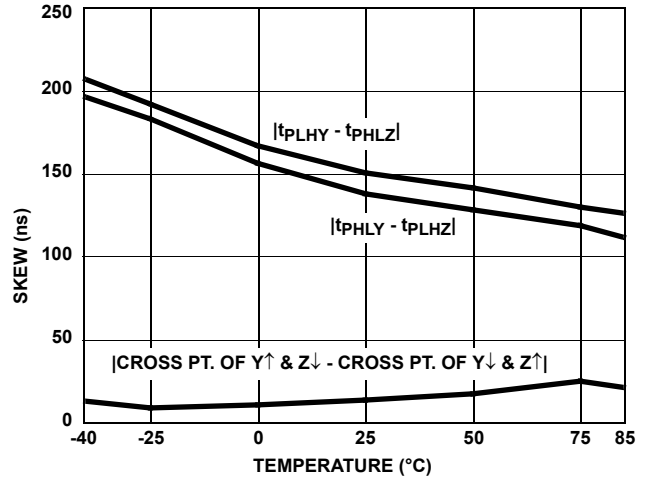


FIGURE 11. DRIVER SKEW vs TEMPERATURE (ISL4489E)

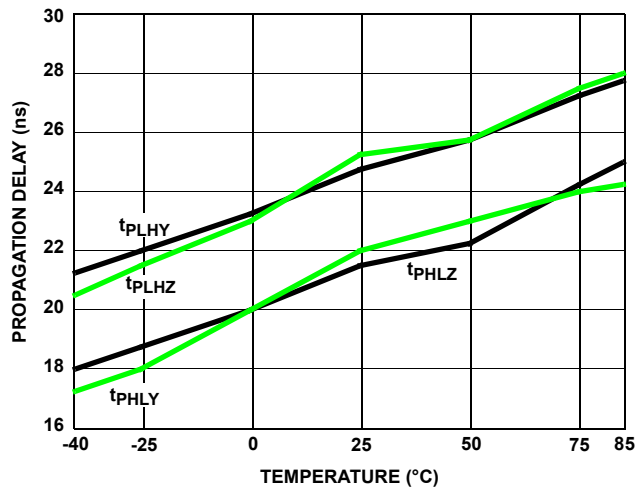


FIGURE 12. DRIVER PROPAGATION DELAY vs TEMPERATURE (ISL4491E)

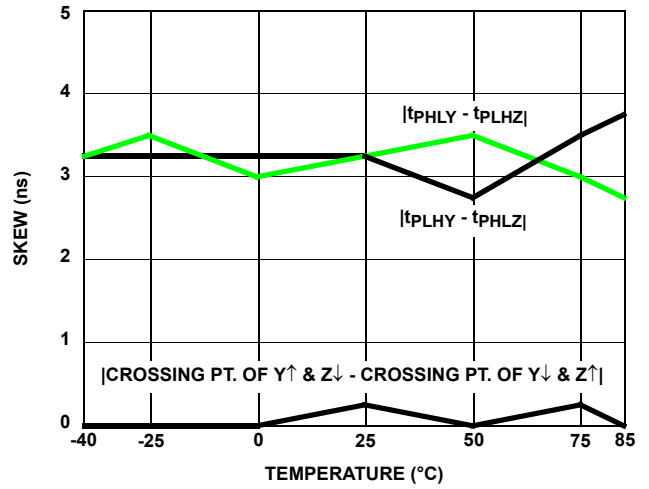


FIGURE 13. DRIVER SKEW vs TEMPERATURE (ISL4491E)

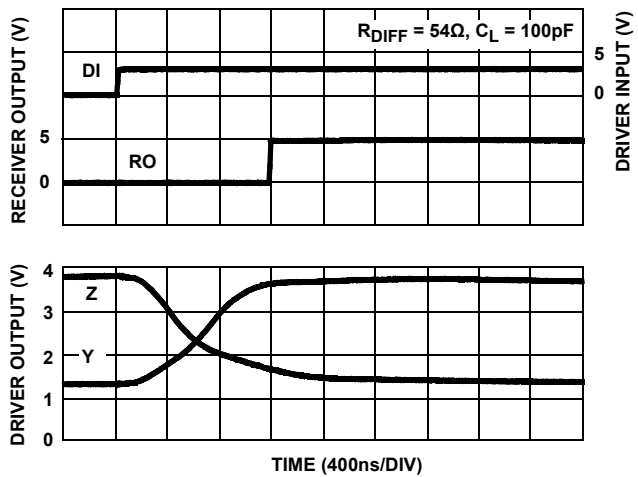


FIGURE 14. DRIVER AND RECEIVER WAVEFORMS, LOW TO HIGH (ISL4489E)

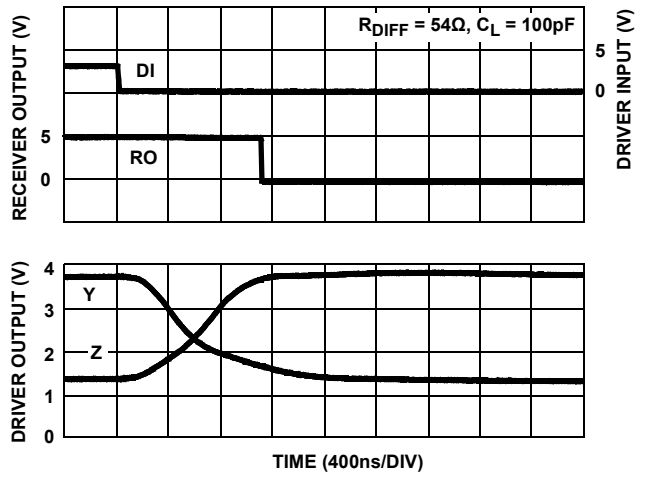


FIGURE 15. DRIVER AND RECEIVER WAVEFORMS, HIGH TO LOW (ISL4489E)

Typical Performance Curves $V_{CC} = 5V$, $T_A = 25^\circ C$; Unless Otherwise Specified (Continued)

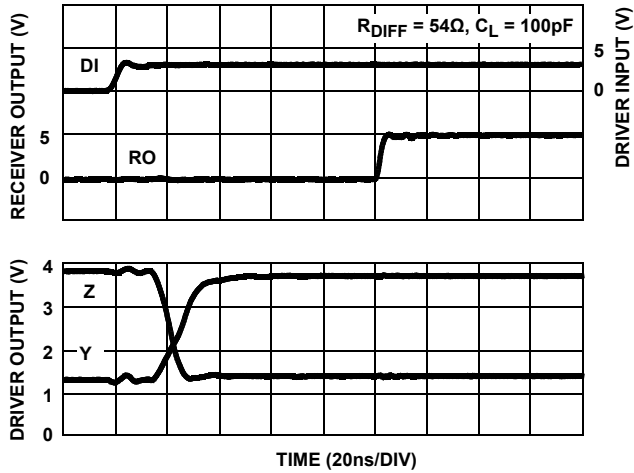


FIGURE 16. DRIVER AND RECEIVER WAVEFORMS, LOW TO HIGH (ISL4491E)

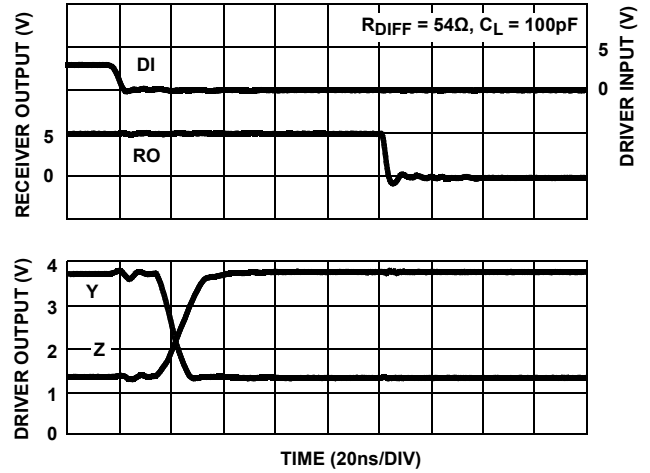


FIGURE 17. DRIVER AND RECEIVER WAVEFORMS, HIGH TO LOW (ISL4491E)

Die Characteristics

SUBSTRATE POTENTIAL (POWERED UP):

GND

TRANSISTOR COUNT:

518

PROCESS:

Si Gate BiCMOS

Revision History The revision history provided is for informational purposes only and is believed to be accurate, but not warranted. Please visit our website to make sure you have the latest revision.

| DATE | REVISION | CHANGE |
|--------------|----------|--|
| Sep 14, 2018 | FN6074.4 | Added Related Literature section. Updated first features bullet. Updated Ordering Information table by removing retired parts, adding Notes 1 and 3, added tape and reel parts and column. Updated the Typical Operating Circuit diagram on page 3. Added Revision History section. Updated POD M14.15 to the latest revision. Changes are as follows: - Add land pattern and moved dimensions from table onto drawing |

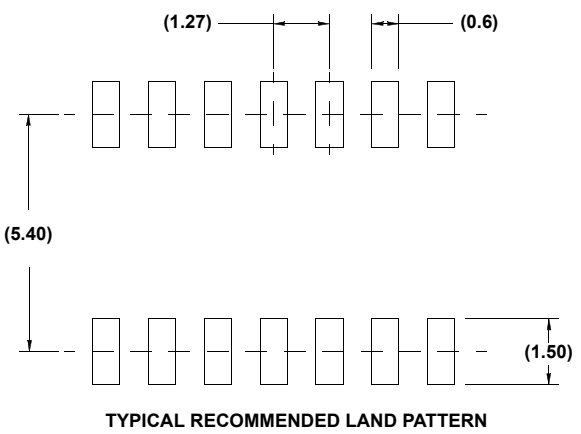
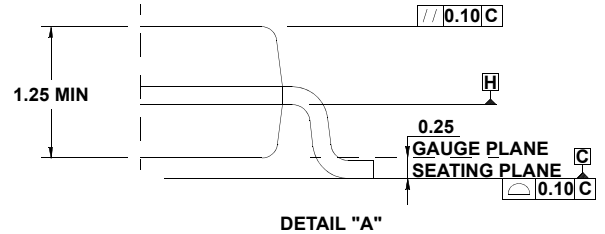
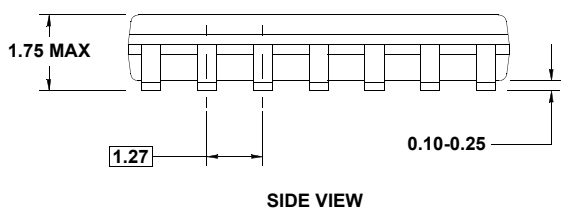
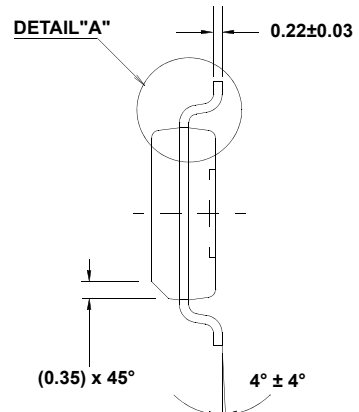
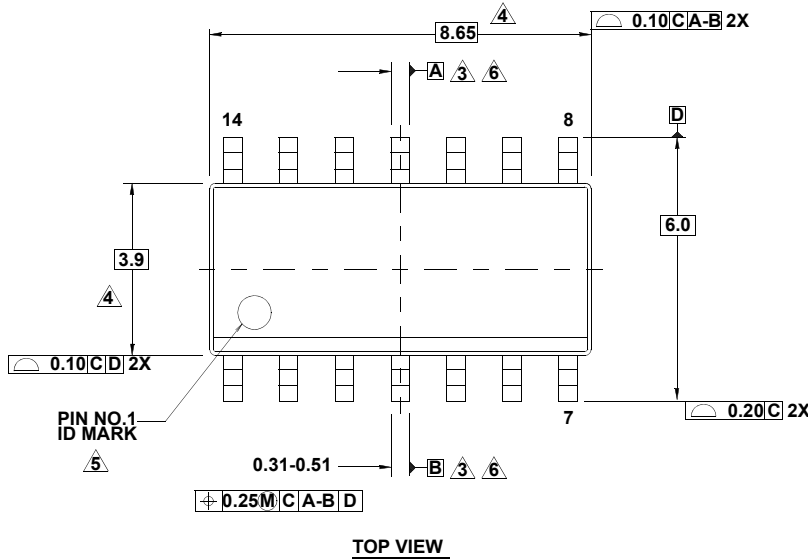
Package Outline Drawing

For the most recent package outline drawing, see [M14.15](#).

M14.15

14 LEAD NARROW BODY SMALL OUTLINE PLASTIC PACKAGE

Rev 1, 10/09



- NOTES:**
1. Dimensions are in millimeters. Dimensions in () for Reference Only.
 2. Dimensioning and tolerancing conform to AMSEY14.5m-1994.
 3. Datums A and B to be determined at Datum H.
 4. Dimension does not include interlead flash or protrusions. Interlead flash or protrusions shall not exceed 0.25mm per side.
 5. The pin #1 indentifier may be either a mold or mark feature.
 6. Does not include dambar protrusion. Allowable dambar protrusion shall be 0.10mm total in excess of lead width at maximum condition.
 7. Reference to JEDEC MS-012-AB.

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.
Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.
(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.
(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)



SALES OFFICES

Renesas Electronics Corporation

<http://www.renesas.com>

Refer to "<http://www.renesas.com/>" for the latest and detailed information.

California Eastern Laboratories, Inc.
4590 Patrick Henry Drive, Santa Clara, California 95054-1817, U.S.A.
Tel: +1-408-919-2500, Fax: +1-408-988-0279

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-651-700

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709 Quantum Plaza, No.27 ZhichunLu, Haidian District, Beijing, 100191 P. R. China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, 200333 P. R. China
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.77C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5338

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View ISL4489EIBZ on WIN SOURCE](#)

 [Intersil Information](#)

Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management