Zywyn

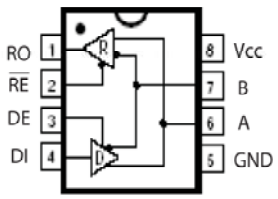
ZT1308xS

Low Power 5V 250kbps/500kbps/16Mbps 256-Fanout RS485 Transceivers with True Fail Safe and Hot-Swap

Features

- Meets or exceeds the requirements of ANSI Standard TIA/EIA-485-A and ISO 8482:1987(E) specifications for V_{CC} at +5V ±10%
- Low quiescent current: 1.2mA typ., 1.8mA max.
- Low shutdown current (where applicable): 2.8µA typical, 10µA max.
- Guaranteed standard data rate 250kbps, 500kbps, or 16Mbps
- True Fail-Safe (Open, Short, Bus Idle) Receiver
- -7V to +12V common-mode input voltage range
- Half-Duplex or Full-Duplex mode configuration
- Allows up to 1/8 unit load (256 devices) on the same common bus
- Controlled driver output slew rate and receiver input filtering
- Active-high driver enable and active-low receiver enable
- Hot-Swap circuitry on the DE and $\overline{RE}$ enable pins
- ESD protection on bus terminals
  ±15kV Human Body Model (HBM)
- Alternative replacement for MAX1308xE series, SN75HVD3082E, and SN65HVD3082E series.

ZT13082S



General Description

The ZT1308xS series devices are 5V differential data line transceivers for RS485/RS422 communication that consist of one driver and one receiver with high level of ESD protection. They are designed for balanced transmission lines interface that meet ANSI standard TIA/EIA-485-A and ISO 8482:1987(E) specifications.

The ZT1308xS series devices spans out with half or full duplex, data rate guaranteed at 250kbps, 500kbps, or 16Mbps and allow one-eighth of an unit load that fan out 256 devices sharing a common bus. The I/Os are enhanced-electrostatic discharge (ESD) protected, exceeding ±15kV Human Body Model (HBM).

Applications

- RS422/RS485 communications
- Utility meters
- Industrial process control
- Building automation
- Level translators
- Transceivers for EMI-sensitive applications
- Routers and HUBs
- Industrial-controlled Local Area Networks
- Industrial PCs, embedded PCs and peripherals
- Industrial, security CATV and camera applications

Product Selection Guide And Cross Reference

Part Number	Duplex	# 0f Tx/ Rx	Data Rate (Mbps)	# of Tx/ Rx on Bus	Slew Rate Limit	Low-Power Shutdown	Tx/ Rx Enable	ESD on Tx/ Rx	Package Types	Pin-to-Pin Cross Reference	Industry Standard Pinout
ZT13080S	Full	1/1	0.250	256	Yes	Yes	Yes	± 15kV	14-PDIP, 14-nSOIC	MAX13080E	75180
ZT13081S	Full	1/1	0.250	256	Yes	No	No	± 15kV	8-PDIP, 8-nSOIC, 8-MSOP	MAX13081E SN75HVD3082E, SN65HVD3082E	75179
ZT13082S	Half	1/1	0.250	256	Yes	Yes	Yes	± 15kV	8-PDIP, 8-nSOIC, 8-MSOP	MAX3082E, SN75HVD3082E, SN65HVD3082E	75176
ZT13083S	Full	1/1	0.5	256	Yes	Yes	Yes	± 15kV	14-PDIP, 14-nSOIC	MAX13083E	75180
ZT13084S	Full	1/1	0.5	256	Yes	No	No	± 15kV	8-PDIP, 8-nSOIC, 8-MSOP	MAX13084E	75179
ZT13085S	Half	1/1	0.5	256	Yes	Yes	Yes	± 15kV	8-PDIP, 8-nSOIC, 8-MSOP	MAX13085E	75176
ZT13086S	Full	1/1	16	256	No	Yes	Yes	± 15kV	14-PDIP, 14-nSOIC	MAX13086E	75180
ZT13087S	Full	1/1	16	256	No	No	No	± 15kV	8-PDIP, 8-nSOIC, 8-MSOP	MAX13087E	75179
ZT13088S	Half	1/1	16	256	No	Yes	Yes	± 15kV	8-PDIP, 8-nSOIC, 8-MSOP	MAX13088E	75176

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Absolute Maximum Ratings

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

Power Supply, (V_{CC}).....–0.3V to +7.0V

Input Voltages

DI, DE, $\overline{RE}$ .....–0.3V to (V_{CC} +0.3V)

Differential Input Voltage, (V_{ID}) ..... -12V to +12V

A, B (V_I) ..... -9V to +13V

Output Voltages

RO .....–0.3V to +6.0V

Y, Z (A & B on Half Duplex) .....-9V to +13.0V

Operating Temperature.....–40°C to +85°C

Storage Temperature.....–65°C to +150°C

Power Dissipation Per Package

8-pin PDIP (derate 9.09mW/°C above +70°C) 722mW

8-pin nSOIC (derate 6.14mW/°C above +70°C)..... 500mW

8-pin MSOP (derate 4.85mW/°C above +70°C)..... 400mW

14-pin PDIP (derate 10.00mW/°C above +70°C) 800mW

14-pin nSOIC (derate 8.33mW/°C above +70°C).... 667mW

Storage Considerations

Storage in a low humidity environment is preferred. Large high density plastic packages are moisture sensitive and should be stored in Dry Vapor Barrier Bags. Prior to usage, the parts should remain bagged and stored below 40°C and 60%RH. If the parts are removed from the bag, they should be used within 168 hours or stored in an environment at or below 20%RH. If the above conditions cannot be followed, the parts should be baked for 12 hours at 125°C in order to remove moisture prior to soldering. Zywyn ships product in Dry Vapor Barrier Bags with a humidity indicator card and desiccant pack. The humidity indicator should be below 30%RH. The MSL of this product is 3.

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DC Electrical Characteristics

Unless otherwise stated, V_{CC} = +5.0V ±10%, $T_A = T_{min}$ to T_{max}, typical values apply at V_{CC} = +5.0V and T_A = 25°C.

Parameter	Condition	Min	Typ	Max	Units
Operating Voltage & Temperature					
Temperature	Industrial Grade	–40	25	85	°C
V_{CC} Voltage Range	V_{CC} = +5.0V	4.5	5	5.5	V
Supply Current					
I_{CC}, Tx and Rx active	DI=V_{CC}/GND, DE=V_{CC}, $\overline{RE}$=GND, RS485 I/O=Open		1.2	1.8	mA
I_{CC}, Tx active	DI=V_{CC}/GND, DE=V_{CC}, $\overline{RE}$=V_{CC}, RS485 I/O=Open		1.2	1.8	mA
I_{CC}, Rx active	DI=V_{CC}/GND, DE=GND, $\overline{RE}$=GND, RS485 I/O=Open		1.2	1.8	mA
I_{SD}, Shutdown Current (except ZT13081S, ZT13084S, and ZT13087S)	DI=V_{CC}/GND, DE = GND, $\overline{RE}$ = V_{CC}, RS485 I/O=Open		2.8	10	µA
TTL LOGIC Input, Driver					
Input Threshold Low, V_{IL}	V_{CC} = +5.0V, DE, DI, and $\overline{RE}$			0.8	V
Input Threshold High, V_{IH}	V_{CC} = +5.0V, DE, DI, and $\overline{RE}$	3			V
TTL LOGIC Output, Receiver					
Output Voltage Low, V_{OL}	I_{OUT} = +1mA			0.4	V
Output Voltage High, V_{OH}	I_{OUT} = –1mA	V_{CC}-0.6			V
Output Leakage Current	Receiver Outputs Disabled, V_{OUT} = 0.4V to 2.4V			±1	µA
Short Circuit Current	V_{OUT} = 0V to V_{CC}			±110	mA
Receiver Input					
Input Current	DE = 0V, V_{CC} = 0V to 5.5V, VIN = +12V			125	µA
	DE = 0V, V_{CC} = 0V to 5.5V, VIN = –7V			-75	µA
Differential Threshold Voltage, V_{TH}	V_{CM} = 0V, V_{CC}=+5.0V, TA=25°C	–200	-125	-50	mV
Input Hysteresis			15		mV
Input Resistance, R_{IN}	V_{CM} = -7V to +12V	96			kΩ
Transmitter Output					
Differential Output Voltage, V_{OD1}	No Load			5	V
Differential Output Voltage, V_{OD2}	With R_L = 50Ω, Refer to Figure 1. (RS422)	2			V
	With R_L = 27Ω, Refer to Figure 1. (RS485)	1.5		5	V
Driver Common Mode Output, V_{OC}	With R_L = 27Ω or 50Ω. C_L = 50pF. Refer to Figure 3.			3	V
Change in Voltage Magnitude for Differential States, ΔV_{OD}	Differential Output Voltage, with R_L = 27Ω or 50Ω, Refer to Figure 1			0.2	V
Change in Voltage Magnitude for Common Mode States, ΔV_{OC}	Common-Mode Output Voltage, with R_L = 27Ω or 50Ω. Refer to Figure 2.			0.2	V
Transmitter Short-Circuit Current	V_{OUT}= -7V to +12V. Refer to Figure 7.	-250		250	mA

AC Electrical Characteristics (ZT13080S - ZT13082S)

Unless otherwise stated, V_{CC} = +5.0V, T_A = T_{min} to T_{max}, typical values apply at V_{CC} = +5.0V and T_A = 25°C.

Parameter	Condition	Min	Typ	Max	Units
Transmitter Timing					
Transmitter Propagation t_{PLH}	R_{DIFF} = 54Ω, C_L = 50pF. Refer to Figure 4.	350		1800	ns
Transmitter Propagation t_{PHL}	R_{DIFF} = 54Ω, C_L = 50pF. Refer to Figure 4.	350		1800	ns
Transmitter Output Skew t_{SK}	$\|t_{PLH} - t_{PHL}\|$			±250	ns
Transmitter Rise/Fall Time	t_r, t_f, R_{DIFF} = 54Ω, C_L = 100pF, Refer to Figure 4.	400		1900	ns
Transmitter Output Enable	t_{PZH},To Output HIGH, C_L = 50pF, R_L = 500Ω. Refer to Figure 5.			2500	ns
	t_{PZL}, To Output LOW, C_L = 50pF, R_L = 500Ω. Refer to Figure 6.			2500	ns
Transmitter Output Disable	t_{PHZ},From Output HIGH, C_L = 50pF, R_L = 500Ω. Refer to Figure 5.			100	ns
	t_{PLZ}, From Output LOW, C_L = 50pF, R_L = 500Ω. Refer to Figure 6.			100	ns
Receiver Timing					
Receiver Propagation t_{PLH}	C_L = 15pF, $\|V_{ID}\|$ ≥ 2.0V ; rise and fall time of V_{ID} ≤ 15ns Refer to Figure 9.			200	ns
Receiver Propagation t_{PHL}	C_L = 15pF, $\|V_{ID}\|$ ≥ 2.0V ; rise and fall time of V_{ID} ≤ 15ns Refer to Figure 9.			200	ns
Differential Receiver Skew t_{SK}	$\|t_{PLH} - t_{PHL}\|$			±30	ns
Receiver Output Enable	To Output HIGH, C_L = 15pF. Refer to Figure 10.			50	ns
	To Output LOW, C_L = 15pF. Refer to Figure 11.			50	ns
Receiver Output Disable	From Output HIGH, C_L = 15pF. Refer to Figure 10.			50	ns
	From Output LOW, C_L = 15pF. Refer to Figure 11.		20	50	ns
Shutdown Timing					
Time to Shutdown, t_{SHDN}		50	340	700	ns
Transmitter Enable from SHUTDOWN to Output HIGH	C_L = 15pF, R_L = 1KΩ. Refer to Figure 5.			5500	ns
Transmitter Enable from SHUTDOWN to Output LOW	C_L = 15pF, R_L = 1KΩ. Refer to Figure 6.			5500	ns
Receiver Enable from SHUTDOWN to Output HIGH	C_L = 15pF, R_L = 1KΩ. Refer to Figure 11.			5500	ns
Receiver Enable from SHUTDOWN to Output LOW	C_L = 15pF, R_L = 1KΩ. Refer to Figure 11.			5500	ns
Transceiver Throughput					
Maximum Data Rate		250			kbps
ESD Tolerance					
ESD HBM	RS485 Inputs and Outputs		±15		kV
ESD HBM(1)	All Pins		±4		kV

(1) Tested in accordance with JEDEC Standard 22, Test Method A114-A and IEC 60749-26

AC Electrical Characteristics (ZT13083S - ZT13085S)

Unless otherwise stated, V_{CC} = +5.0V, T_A = T_{min} to T_{max}, typical values apply at V_{CC} = +5.0V and T_A = 25°C.

Parameter	Condition	Min	Typ	Max	Units
Transmitter Timing					
Transmitter Propagation t_{PLH}	R_{DIFF} = 54Ω, C_L = 50pF. Refer to Figure 4.	200		1000	ns
Transmitter Propagation t_{PHL}	R_{DIFF} = 54Ω, C_L = 50pF. Refer to Figure 4.	200		1000	ns
Transmitter Output Skew t_{SK}	$\|t_{PLH} - t_{PHL}\|$			±140	ns
Transmitter Rise/Fall Time	t_r, t_f, R_{DIFF} = 54Ω, C_L = 100pF, Refer to Figure 4.	250		900	ns
Transmitter Output Enable	t_{PZH},To Output HIGH, C_L = 50pF, R_L = 500Ω. Refer to Figure 5.			2500	ns
	t_{PZL}, To Output LOW, C_L = 50pF, R_L = 500Ω. Refer to Figure 6.			2500	ns
Transmitter Output Disable	t_{PHZ},From Output HIGH, C_L = 50pF, R_L = 500Ω. Refer to Figure 5.			100	ns
	t_{PLZ}, From Output LOW, C_L = 50pF, R_L = 500Ω. Refer to Figure 6.			100	ns
Receiver Timing					
Receiver Propagation t_{PLH}	C_L = 15pF, $\|V_{ID}\|$ ≥ 2.0V ; rise and fall time of V_{ID} ≤ 15ns Refer to Figure 9.			200	ns
Receiver Propagation t_{PHL}	C_L = 15pF, $\|V_{ID}\|$ ≥ 2.0V ; rise and fall time of V_{ID} ≤ 15ns Refer to Figure 9.			200	ns
Differential Receiver Skew t_{SK}	$\|t_{PLH} - t_{PHL}\|$			±30	ns
Receiver Output Enable	To Output HIGH, C_L = 15pF. Refer to Figure 10.			50	ns
	To Output LOW, C_L = 15pF. Refer to Figure 11.			50	ns
Receiver Output Disable	From Output HIGH, C_L = 15pF. Refer to Figure 10.			50	ns
	From Output LOW, C_L = 15pF. Refer to Figure 11.			50	ns
Shutdown Timing					
Time to Shutdown, t_{SHDN}		50	340	700	ns
Transmitter Enable from SHUTDOWN to Output HIGH	C_L = 15pF, R_L = 1KΩ. Refer to Figure 5.			5500	ns
Transmitter Enable from SHUTDOWN to Output LOW	C_L = 15pF, R_L = 1KΩ. Refer to Figure 6.			5500	ns
Receiver Enable from SHUTDOWN to Output HIGH	C_L = 15pF, R_L = 1kΩ. Refer to Figure 11.			5500	ns
Receiver Enable from SHUTDOWN to Output LOW	C_L = 15pF, R_L = 1kΩ. Refer to Figure 11.			5500	ns
Transceiver Throughput					
Maximum Data Rate		500			kbps
ESD Tolerance					
ESD HBM	RS485 Inputs and Outputs		±15		kV
ESD HBM(1)	All Pins		±4		kV

(1) Tested in accordance with JEDEC Standard 22, Test Method A114-A and IEC 60749-26

AC Electrical Characteristics (ZT13086S - ZT13088S)

Unless otherwise stated, V_{CC} = +5.0V, T_A = T_{min} to T_{max}, typical values apply at V_{CC} = +5.0V and T_A = 25°C.

Parameter	Condition	Min	Typ	Max	Units
Transmitter Timing					
Transmitter Propagation t_{PLH}	R_{DIFF} = 54Ω, C_L = 50pF. Refer to Figure 4.			50	ns
Transmitter Propagation t_{PHL}	R_{DIFF} = 54Ω, C_L = 50pF. Refer to Figure 4.			50	ns
Transmitter Output Skew t_{SK}	$\|t_{PLH} - t_{PHL}\|$			±8	ns
Transmitter Rise/Fall Time	t_r, t_f, R_{DIFF} = 54Ω, C_L = 100pF, Refer to Figure 4.			15	ns
Transmitter Output Enable	t_{PZH},To Output HIGH, C_L = 50pF, R_L = 500Ω. Refer to Figure 5.			150	ns
	t_{PZL}, To Output LOW, C_L = 50pF, R_L = 500Ω. Refer to Figure 6.			150	ns
Transmitter Output Disable	t_{PHZ},From Output HIGH, C_L = 50pF, R_L = 500Ω. Refer to Figure 5.			100	ns
	t_{PLZ}, From Output LOW, C_L = 50pF, R_L = 500Ω. Refer to Figure 6.			100	ns
Receiver Timing					
Receiver Propagation t_{PLH}	C_L = 15pF, $\|V_{ID}\|$ ≥ 2.0V ; rise and fall time of V_{ID} ≤ 15ns Refer to Figure 9.		50	80	ns
Receiver Propagation t_{PHL}	C_L = 15pF, $\|V_{ID}\|$ ≥ 2.0V ; rise and fall time of V_{ID} ≤ 15ns Refer to Figure 9.		50	80	ns
Differential Receiver Skew t_{SK}	$\|t_{PLH} - t_{PHL}\|$		0	±13	ns
Receiver Output Enable	To Output HIGH, C_L = 15pF. Refer to Figure 10.			50	ns
	To Output LOW, C_L = 15pF. Refer to Figure 11.			50	ns
Receiver Output Disable	From Output HIGH, C_L = 15pF. Refer to Figure 10.			50	ns
	From Output LOW, C_L = 15pF. Refer to Figure 11.			50	ns
Shutdown Timing					
Time to Shutdown, t_{SHDN}		50	340	700	ns
Transmitter Enable from SHUTDOWN to Output HIGH	C_L = 15pF, R_L = 1KΩ. Refer to Figure 5.			2200	ns
Transmitter Enable from SHUTDOWN to Output LOW	C_L = 15pF, R_L = 1KΩ. Refer to Figure 6.			2200	ns
Receiver Enable from SHUTDOWN to Output HIGH	C_L = 15pF, R_L = 1kΩ. Refer to Figure 11.			2200	ns
Receiver Enable from SHUTDOWN to Output LOW	C_L = 1KpF, R_L = 1kΩ. Refer to Figure 11.			2200	ns
Transceiver Throughput					
Maximum Data Rate		16			Mbps
ESD Tolerance					
ESD HBM	RS485 Inputs and Outputs		±15		kV
ESD HBM(1)	All Pins		±4		kV

(1) Tested in accordance with JEDEC Standard 22, Test Method A114-A and IEC 60749-26

Pin Description

Pin Numbers			Name	Description
Half Duplex	Full Duplex			
ZT13082S ZT13085S ZT13088S	ZT13081S ZT13084S ZT13087S	ZT13080S ZT13083S ZT13086S		
1	2	2	RO	Receiver Output. If A>B by 200mV, then RO = HIGH; If A<B by 200mV, then RO = LOW
2	n/a	3	$\overline{RE}$	Receiver Output Enable. Low active input. RO is high-Z when RE = HIGH
3	n/a	4	DE	Driver Output Enable. The transmitter outputs, Y and Z, are enabled when DE = HIGH. The outputs are high-Z when DE = LOW.
4	3	5	DI	Driver Input. A low on DI forces output Y low and output Z high. A high on DI will bring output Y high and output Z low
5	4	6, 7	GND	Analog Ground
n/a	5	9	Y	Non-inverting transmitter output
n/a	6	10	Z	Inverting transmitter output
6	n/a	n/a	A	Non-inverting transmitter output and non-inverting receiver input.
n/a	8	12	A	Non-inverting receiver input.
7	n/a	n/a	B	Inverting transmitter output and inverting receiver input.
n/a	7	11	B	Inverting receiver input
8	1	14	V_{CC}	Power Supply Input, 5V ±10%
n/a	n/a	1, 8, 13	NC	No Connect, Not internally connected

Circuit Description

The ZT1308xS series are low-power transceivers for RS-485 and RS-422 communications. The RS-485 standard is ideal for multi-drop applications and for long-distance interfaces. The TIA/EIA-485 specification allows up to 256 drivers and 256 receivers to be connected to a data bus, making it an ideal choice for multi-drop applications. RS-485 transceivers are equipped with a wide (-7V to +12V) common mode range to accommodate ground potential differences since the cabling can be as long as 4,000 feet. As RS-485 is a differential interface, data is virtually immune to noise in the transmission line.

RS-485 Transmitters

Each device in the ZT1308xS family contains a differential output line transmitter that can drive voltage into multiple loads on a terminated two-wire pair, and a receiver that accepts a differential voltage down to 200mV. The transmitter's differential output can comply with RS-485 and also RS-422 standards. The typical voltage output swing with no load is 0V to V_{CC}. With worst case loading of 54 ohms across the differential outputs, the drivers can maintain greater than 1.5V voltage levels, which is more than adequate for a differential receiver to acknowledge a logic state. The 54 ohms is the equivalent of two 120 ohm termination resistors placed on each side of the transmission line and the input impedance of 256 receivers on the line. The ZT13082S, ZT13085S, and ZT13088S transmitter have an enable control line which is active HIGH. A logic HIGH on DE (pin 3) will enable the differential outputs. A logic LOW on DE (pin 3) will disable the transmitter outputs. While disabled, the transmitter outputs are in high impedance.

RS-485 Receivers

Each transceiver contains one differential receiver that has an input sensitivity of 200mV. The input impedance of the receivers is typically 96 kohms. A wide common mode range of -7V to +12V allows for large ground potential differences between systems.

The ZT13082S, ZT13085S, and ZT13088S receivers have an enable control input. A logic LOW on $\overline{RE}$ will enable the receiver, a logic HIGH on $\overline{RE}$ will disable the receiver. The receivers are equipped with the true fail-safe feature, which guarantees that the receiver output to be in a HIGH-IMPEDANCE state when the input is left unconnected. When the receiver inputs are either open or short circuit, the receiver output will be in a HIGH state when $\overline{RE}$ enable is LOW.

The ZT13080S, ZT13081S, and ZT13082S can transmit and receive at data rates up to 250kbps. The ZT13083S, ZT13084S, and ZT13085S can transmit and receive at data rates up to 500kbps. The ZT13086S, ZT13087S, and ZT13088S can transmit and receive at data rates up to 16Mbps.

Bus Configuration

The ZT13080S, ZT13081S, ZT13083S, ZT13084S, ZT13086S, and ZT13087S are full-duplex transceivers, while the ZT13082S,

ZT13085S, and ZT13088S are half-duplex.

For full duplex, the devices are used as a four-wire bus transceiver with a confi guration that the transmitters and receivers are moving data independent of each other. Transmit can occur on a dedicated two-wire pair and receive can occur on an adjacent two-wire pair, with each pair transferring data.

Half duplex is a configuration where the transmitter outputs are connected to its receiver inputs. This application is common for two-wire interfaces where either the transmitter is active or the receiver is active. It is common to connect the enable inputs for the transmitter and receiver together so that a logic HIGH will enable the transmitter and disable the receiver. Conversely, a logic LOW will disable the transmitter and enable the transmitter. Half-duplex configurations and these devices are designed for bidirectional data transmission on multipoint twisted-pair cables for applications, such as digital motor controllers, remote sensors and terminals, industrial process control, security stations and environmental control systems.

ESD Immunity

Electro-Static Discharge (ESD) is an important factor when implementing a serial port into a system, especially in harsh environmental conditions. These industrial strength devices provide extra protection against ESD and are intended for harsh environments where high-speed data communication is important.

All of the devices in the ZT1308xS series of transceivers incorporate internal protection structures on all pins to protect against ESD charges encountered during handling and assembly. The driver outputs and receiver inputs have extra protection against static electricity as they are directly interfacing to the outside environment. As such, these pins against ESD of ±15kV without damage in all states of the transceiver's operation in the static state. After multiple ESD events, Zywyn's ZT1308xS family of transceivers keep working without latchup. These devices eliminate the need for external transient suppressor diodes and the associated high capacitance loading, allowing reliable high-speed data communications.

The Human Body Model has been the generally accepted ESD testing method for semiconductors. This test is intended to simulate the human body's potential to store electrostatic energy and discharge it to an integrated circuit upon close proximity or contact. This method will test the IC's capability to withstand an ESD transient during normal handling such as in manufacturing areas where the ICs tend to be handled frequently.

Hot-Swap

When a circuit board is plugged into a powered backplane, there is a period of time in which the processor is unable to drive the RS-485 enable lines (DE, $\overline{RE}$) to a defined logic state. Leakage current or parasitic coupling may prematurely enable the transceiver which causes disturbances to the data bus and leads to data errors. By monitoring Vcc during power-up and power-down, the hot-swap circuitry incorporated in ZT1308xS holds DE low and $\overline{RE}$ high, disables Tx and RX outputs until Vcc reaches 2V or above, and therefore prevents the transceiver from prematurely driving the data bus. After the power-up sequence, the processor becomes stabilized and drives the DE and $\overline{RE}$ to proper states.

Function Table

ZT13082S, ZT13085S, and ZT13088S

DRIVER				RECEIVER		
Input DI	Enable DE	Outputs A	Outputs B	Differential Inputs $V_{ID} = V_A - V_B$	Enable $\overline{RE}$	Output RO
H	H	H	L	$V_{ID} \le -0.2V$	L	L
L	H	L	H	$-0.2V < V_{ID} < +0.2V$	L	U
X	L	Z	Z	$+0.2V \le V_{ID}$	L	H
Open	H	H	L	X	H	Z
X	Open	Z	Z	Open circuit	L	H*
				Short circuit	L	H*
				X	Open	Z

ZT13081S, ZT13084S, and ZT13087S

DRIVER			RECEIVER	
Input DI	Outputs Y	Outputs Z	Differential Inputs $V_{ID} = V_A - V_B$	Output RO
H	H	L	$V_{ID} \le -0.2V$	L
L	L	H	$-0.2V < V_{ID} < +0.2V$	U
X	Z	Z	$+0.2V \le V_{ID}$	H
Open	H	L	X	Z
X	Z	Z	X	Z

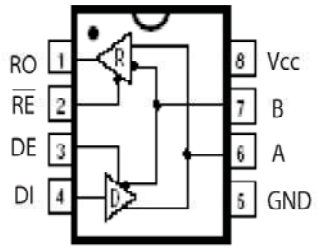
ZT13080S, ZT13083S, and ZT13086S

DRIVER				RECEIVER		
Input DI	Enable DE	Outputs Y	Outputs Z	Differential Inputs $V_{ID} = V_A - V_B$	Enable $\overline{RE}$	Output RO
H	H	H	L	$V_{ID} \le -0.2V$	L	L
L	H	L	H	$-0.2V < V_{ID} < +0.2V$	L	U
X	L	Z	Z	$+0.2V \le V_{ID}$	L	H
Open	H	H	L	X	H	Z
X	Open	Z	Z	X	Open	Z

Note:
H = High Level; L = Low Level; Z = High Impedance; X = Irrelevant; U = Undetermined State.
* = Fail Safe (Receiver Output High) when Receiver Inputs are Open or Short and Common Mode equals to 0V.

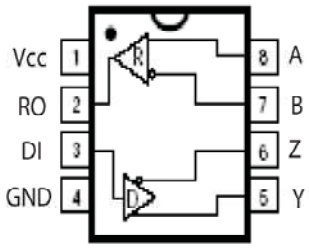
Pin Configuration

ZT13082S/ZT13085S/ ZT13088S



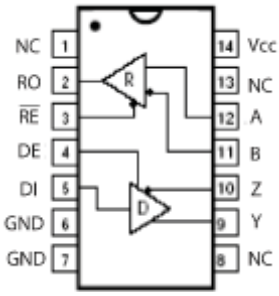
8-Pin PDIP/nSOIC/ MSOP

ZT13081S/ZT13084S/ ZT13087S



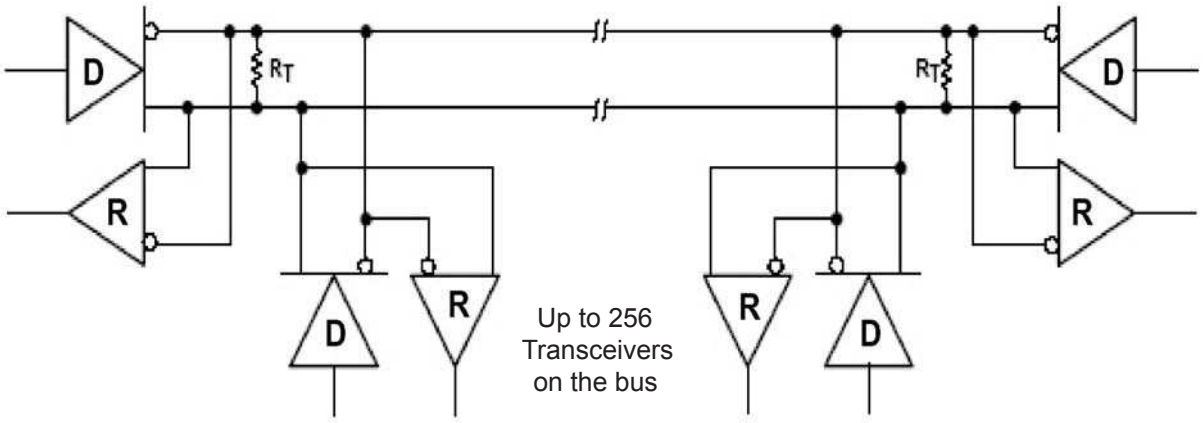
8-Pin PDIP/nSOIC/ MSOP

ZT13080S/ZT13083S/ ZT13086S



14-Pin PDIP/nSOIC

Typical Application Circuits



Notes:
A. The bus should be terminated at both ends in its characteristic impedance of $R_T = Z_O$.
B. Stub lengths off the main bus should be kept as short as possible.
C. Can connect up to 256 devices on the same common bus.

Typical Test Circuits

Notes:
A. The test load capacitance includes probe and test jig capacitance, unless otherwise specified.
B. The signal generator had the following characteristics:
Pulse rate = 1000 kHz, 50% duty cyle, Z_O = 50Ω , t_r & t_f < 6ns, unless otherwise specified.

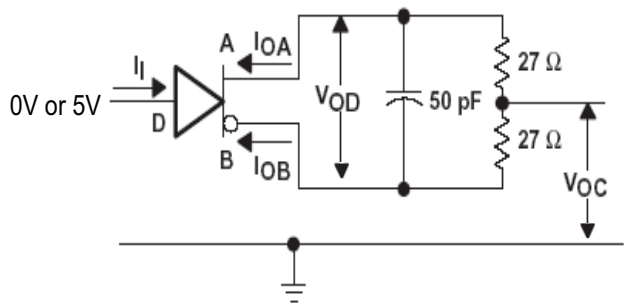


Figure 1. Driver Test Circuit, V_{OD} and V_{OC} Without Common-Mode Loading

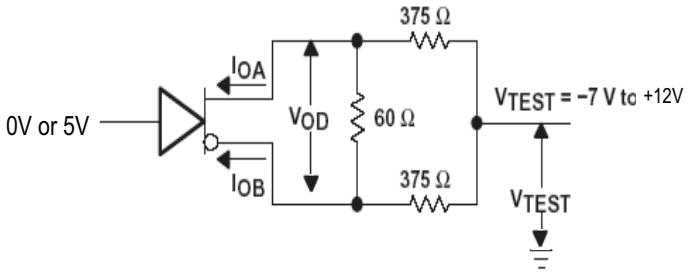


Figure 2. Driver Test Circuit, V_{OD} With Common-Mode Loading

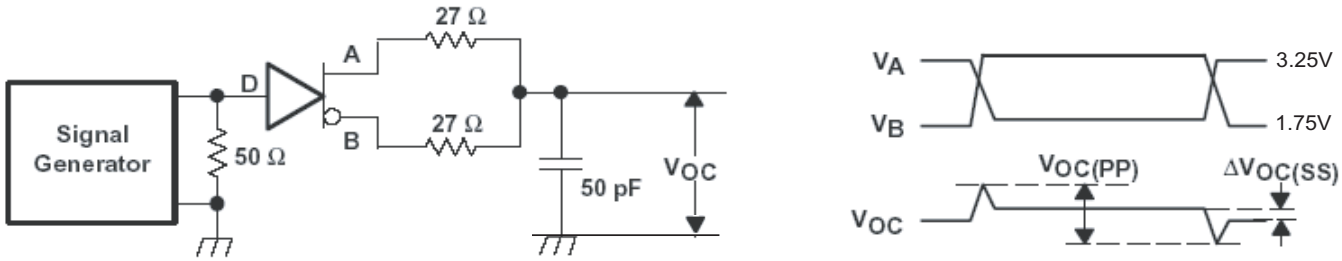


Figure 3. Driver Common-Mode Output Voltage (V_{OC}) Test Circuit and Waveforms

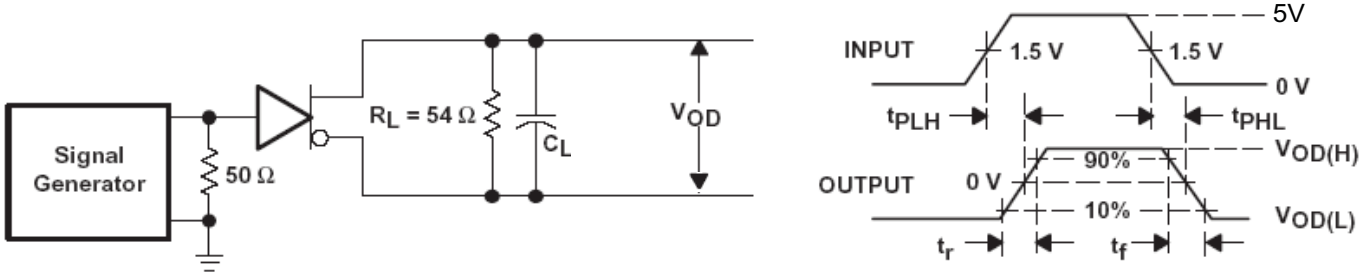


Figure 4. Driver Differential Output Voltage (V_{OD}) Switching Test Circuit and Waveforms

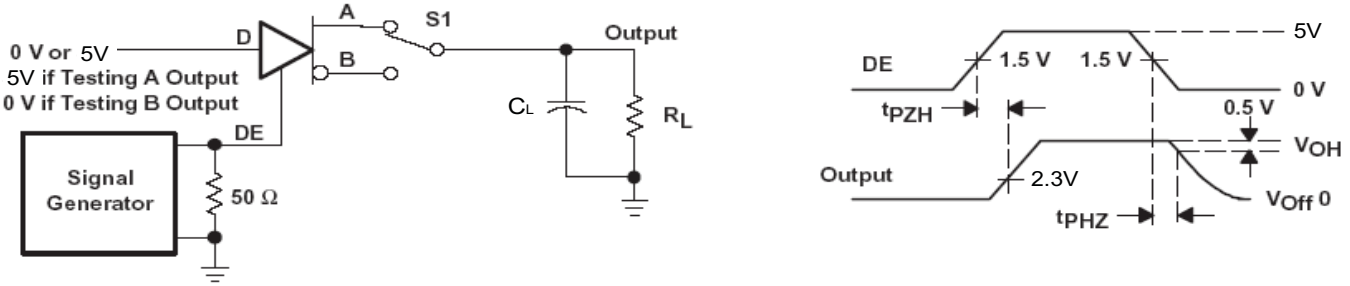


Figure 5. Driver Enable/Disable Test Circuit and Waveforms, High Output

Typical Test Circuits

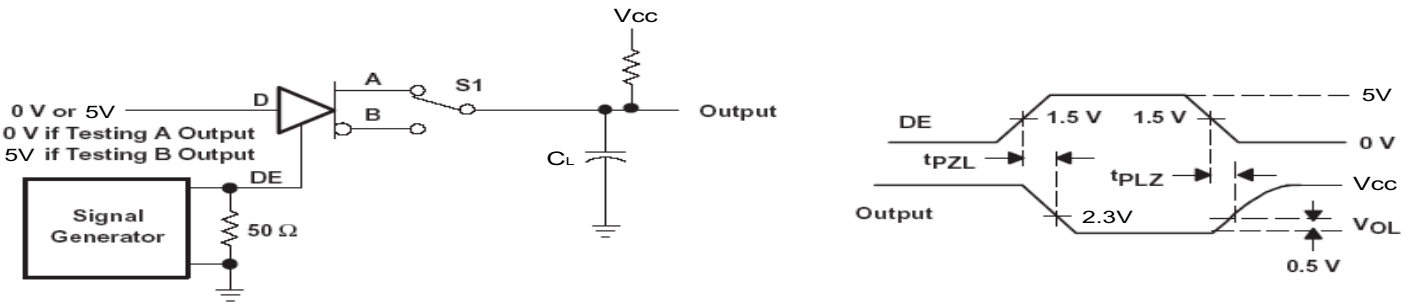


Figure 6. Driver Enable/Disable Test Circuit and Waveforms, Low Output

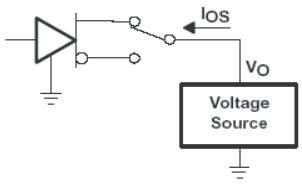


Figure 7. Driver Short-Circuit Test Configuration

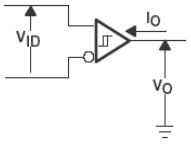
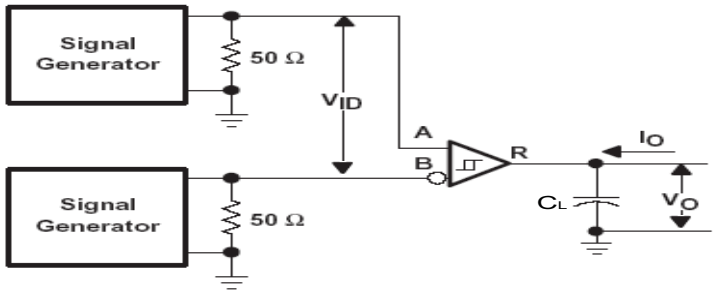


Figure 8. Receiver Parameter Definitions



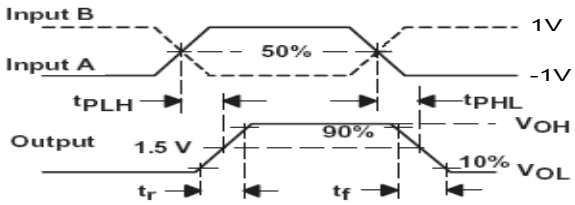
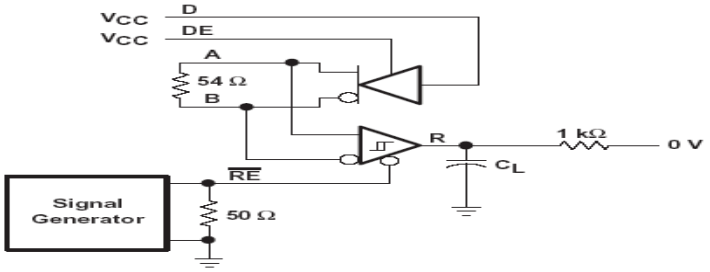


Figure 9. Receiver Propagation (t_{PLH} and t_{PHL})Test Circuit and Waveforms



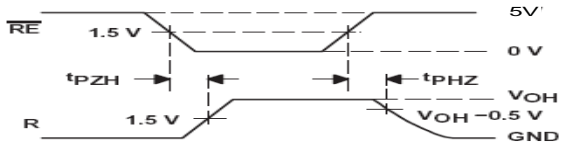
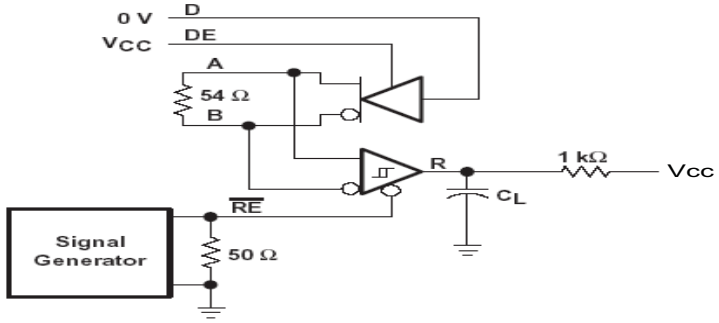


Figure 10. Receiver Output Enable/Disable Test Circuit and Waveforms, Data Output High



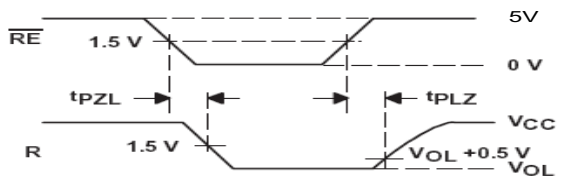
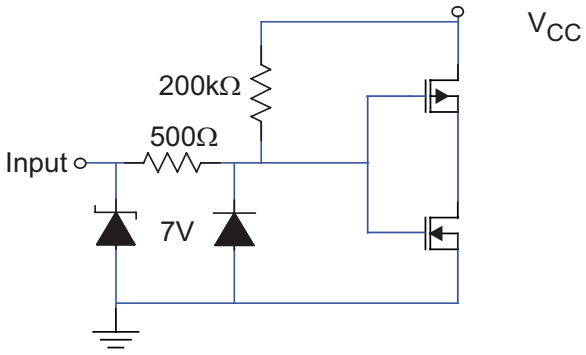


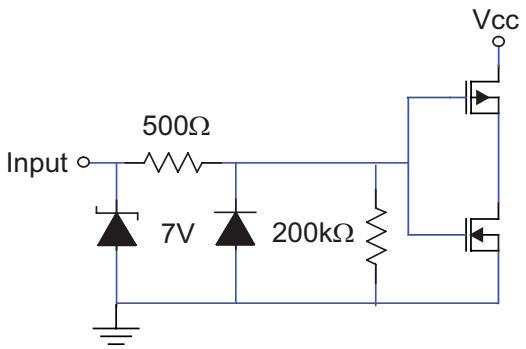
Figure 11. Receiver Output Enable/Disable Test Circuit and Waveforms, Data Output Low

Equivalent Input and Output Schematic Diagrams

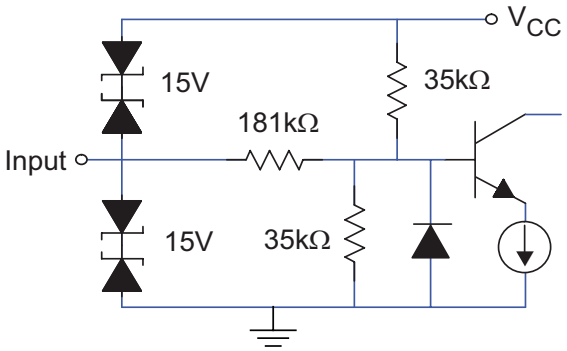
D and RE Input



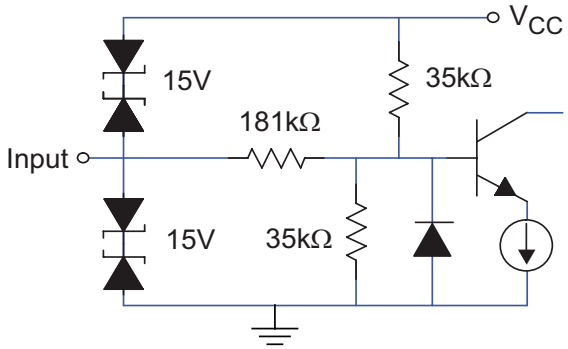
DE Input



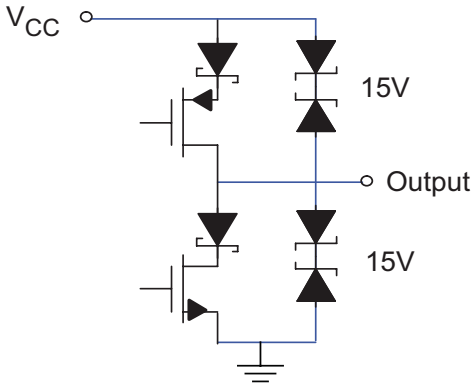
A Input



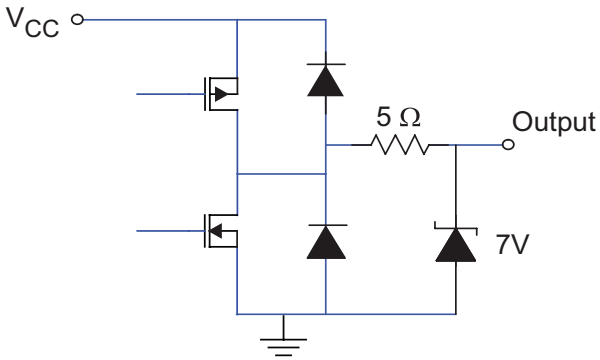
B Input



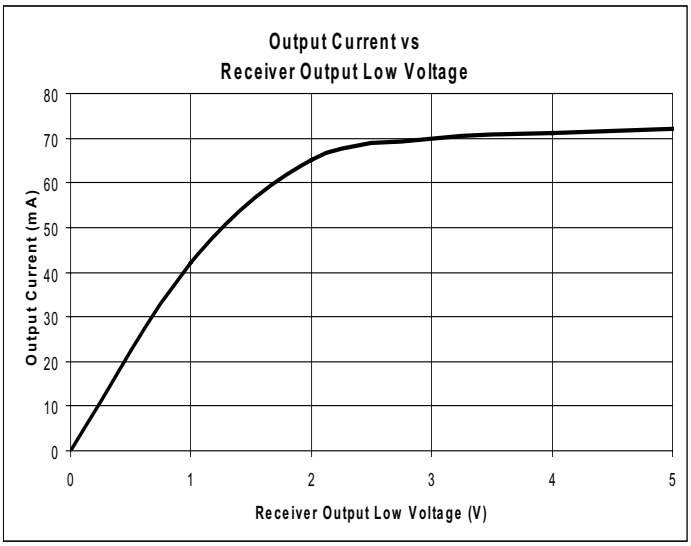
Y and Z Outputs

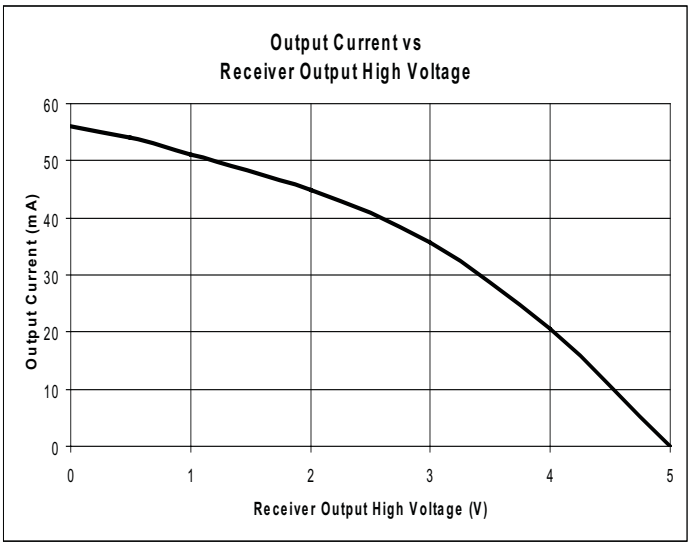


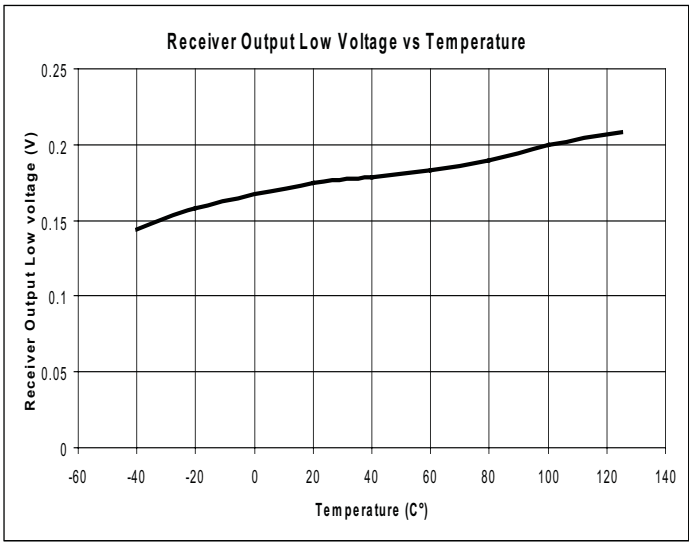
Receiver Output

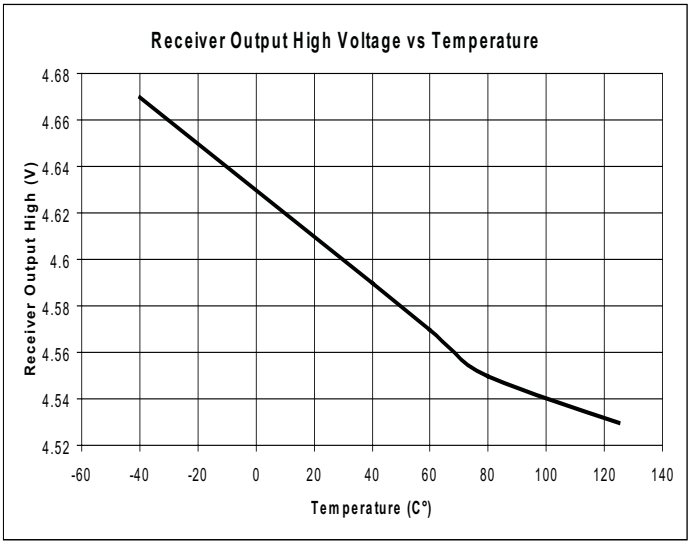


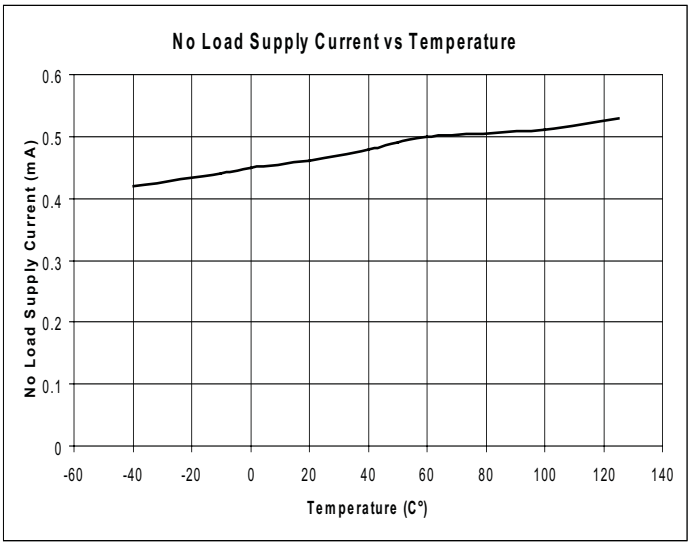
Typical Performance Characteristics

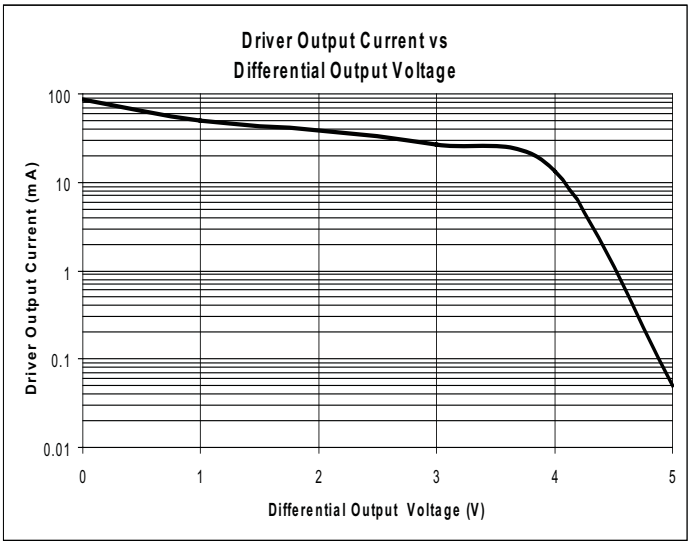




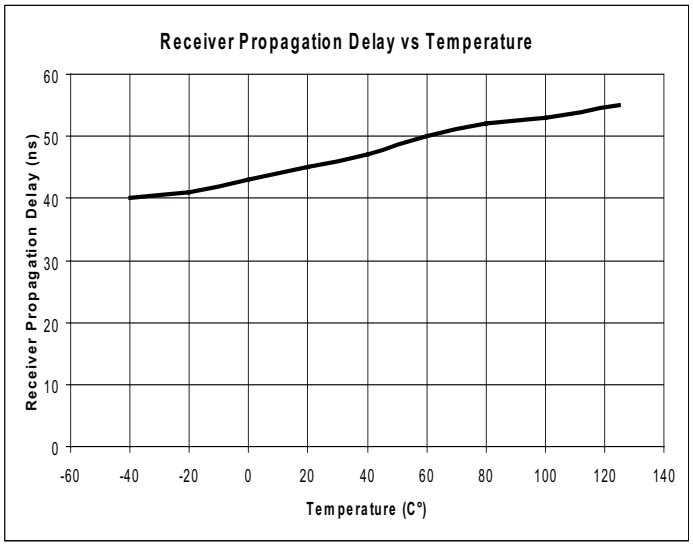


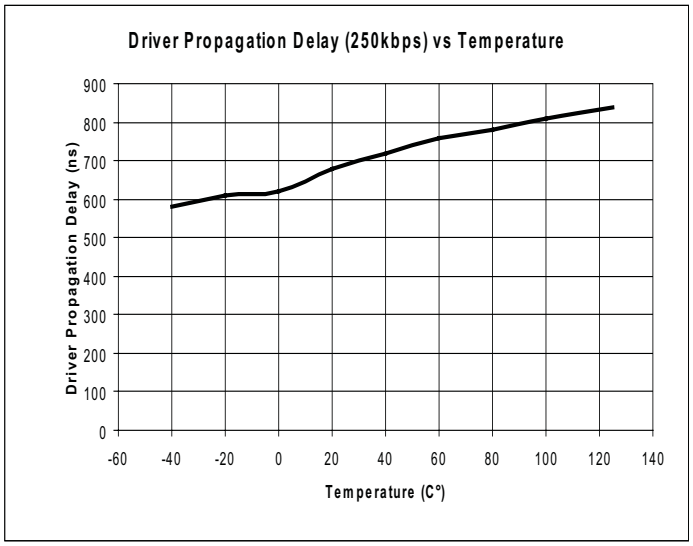


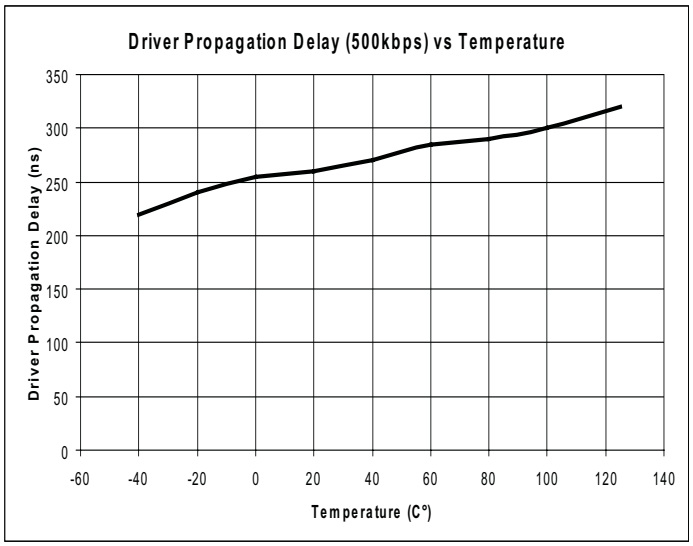


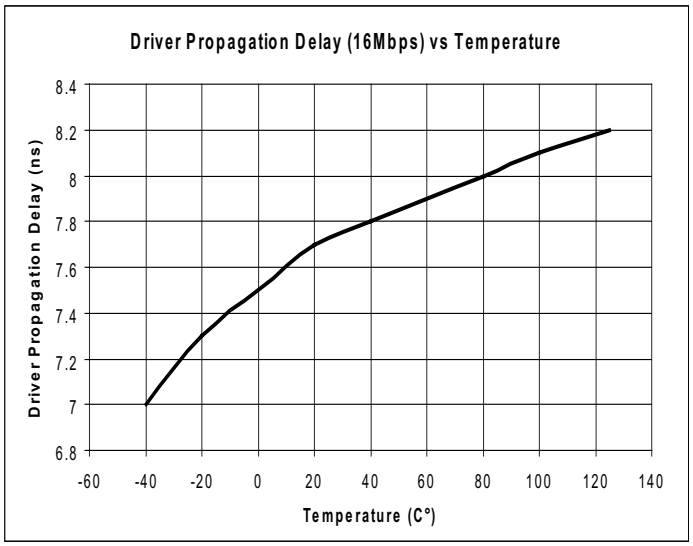


Typical Performance Characteristics

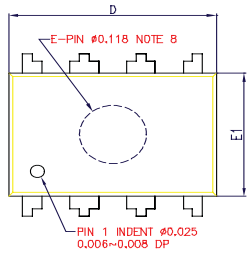


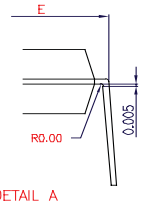


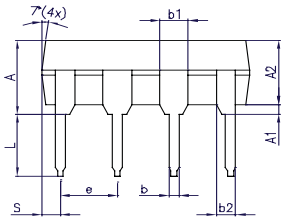


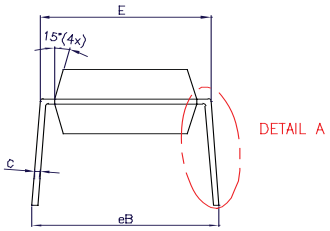


Package Information









NOTE :
1. CONTROLLING DIMENSION : INCH
2. LEAD FRAME MATERIAL : C194
3. DIMENSION D AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010" [0.25mm]
4. DIMENSION "b1" DO NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSIONS SHALL NOT EXCEED 0.010"[0.25mm]. DISTANCE BETWEEN LEADS INCLUDING DAMBER PROTRUSIONS TO BE 0.005"[0.13mm] MININUM.
5. TOLERANCE : ±0.010"[0.25mm] UNLESS OTHERWISE SPECIFIED.
6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC.
7. REFERENCE DOCUMENT : JEDEC SPEC MS-001-BA
8. BOTTOM E-PIN INDENT ARE MARKED AS BELOW:

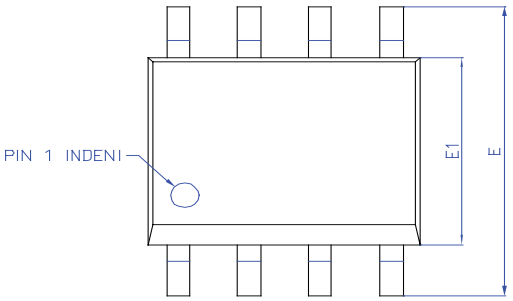
L7 TAIWAN XY

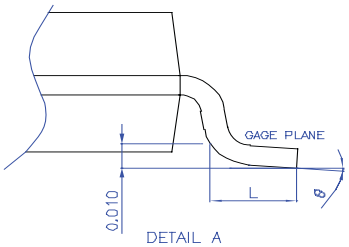
X : A ~ T
Y : 0 ~ 9

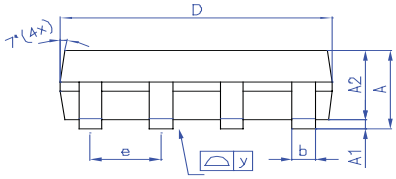
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	3.6	3.9	4.2	0.142	0.154	0.165
A1	0.38	—	—	0.015	—	—
A2	3.25	3.30	3.45	0.128	0.130	0.136
b	0.38	0.48	0.56	0.015	0.019	0.022
b1	1.48	1.58	1.88	0.058	0.062	0.074
b2	0.813	0.99	1.14	0.032	0.039	0.045
C	0.20	0.25	0.30	0.008	0.010	0.012
D	9.12	9.30	9.53	0.359	0.366	0.375
E	7.62	7.87	8.26	0.300	0.310	0.325
E1	6.20	6.35	6.60	0.244	0.250	0.260
e	—	2.54	—	—	0.100	—
eB	8.38	—	9.40	0.330	—	0.370
L	3.18	—	—	0.125	—	—
S	0.71	0.84	0.97	0.028	0.033	0.038

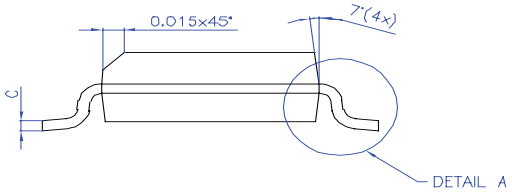
8-pin PDIP

CUSTOMER :		ZYWYN CORPORATION
APPROVED BY	DATE	TITLE : 8L P-DIP PACKAGE OUTLINE DRAWING FOR MITSUMI
DRAW BY: Sandy Sue	01/24/'00	
CHECK BY: Lee Chen	01/26/'00	
APPROVAL: Paul Lee	01/27/'00	DWG. NO. PO-DIP-019 REV. 0
APPROVAL: Barry Chen	1/27/'00	UNIT : INCH SCALE : 6/1 SHEET 1 OF 1









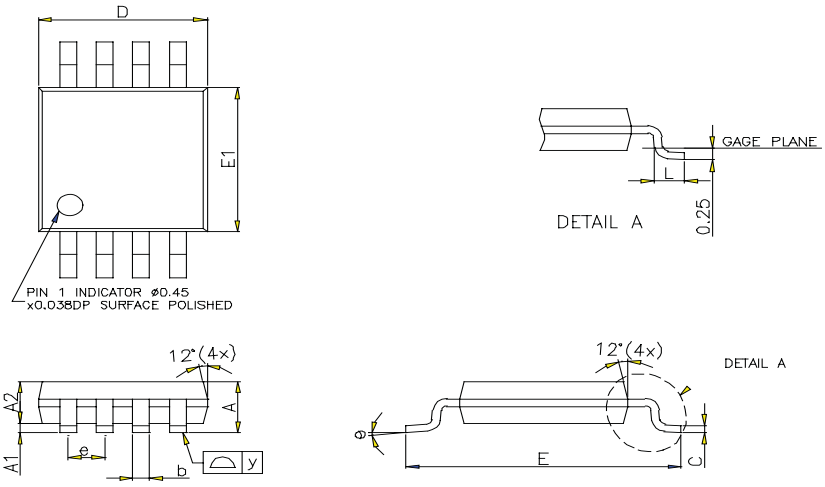
NOTE :
1. CONTROLLING DIMENSION : INCH
2. LEAD FRAME MATERIAL : COPPER 194
3. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006"[0.15mm] PER END DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010"[0.25mm] PER SIDE.
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.003"[0.08mm] TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.0028"[0.07mm]
5. TOLERANCE : ±0.010"[0.25mm] UNLESS OTHERWISE SPECIFIED.
6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC.
7. REFERENCE DOCUMENT : JEDEC SPEC MS-012

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.47	1.60	1.73	0.058	0.063	0.068
A1	0.10	—	0.25	0.004	—	0.010
A2	—	1.45	—	—	0.057	—
b	0.33	0.41	0.51	0.013	0.016	0.020
C	0.19	0.20	0.25	0.0075	0.008	0.0098
D	4.80	4.85	4.95	0.189	0.191	0.195
E	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.154	0.157
e	—	1.27	—	—	0.050	—
⚠ L	0.40	0.71	1.27	0.015	0.028	0.050
y	—	—	0.076	—	—	0.003
θ	0°	—	8°	0°	—	8°

8-pin nSOIC

CUSTOMER :		ZYWYN CORPORATION
APPROVED BY	DATE	TITLE: 8L NARROW BODY SMALL OUTLINE PACKAGE DRAWING
DRAW BY: Ruei Chen	05/21/'01	
CHECK BY: Simon Liu	05/21/'01	
APPROVAL: Simon Tsai	05/21/'01	DWG. NO. PO-SOP-001 REV. 2
APPROVAL: Simon Tsai	05/21/'01	UNIT : INCH SCALE : 15/1 SHEET 1 OF 1

Package Information

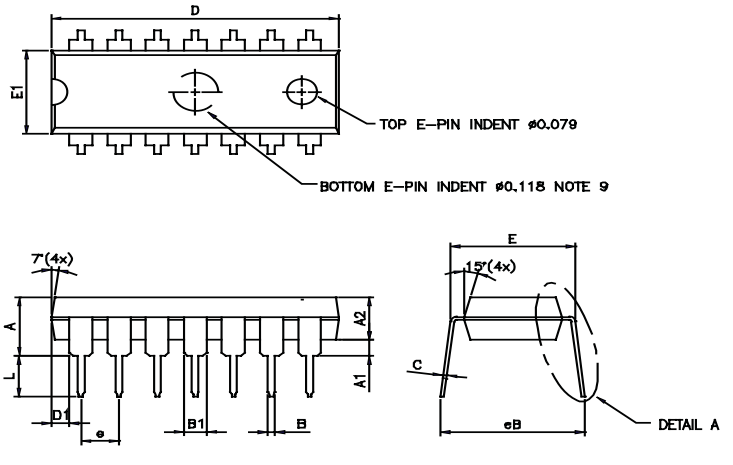


NOTE :
1. CONTROLLING DIMENSION : mm
2. LEAD FRAME MATERIAL : OLIN C7025
3. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006"[0.15mm] PER END. DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010"[0.25mm] PER SIDE.
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTUSION SHALL BE 0.003"[0.08mm] TOTAL IN EXCEED OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MININUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.0028"[0.07mm].
5. TOLERANCE : ±0.010"[0.25mm] UNLESS OTHERWISE SPECIFIED.
6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC.

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.81	1.02	1.10	0.032	0.040	0.043
A1	0.05	—	0.15	0.002	—	0.006
A2	0.76	0.86	0.95	0.030	0.034	0.037
b	0.28	0.30	0.38	0.011	0.012	0.015
C	0.13	0.15	0.23	0.005	0.006	0.009
D	2.90	3.00	3.10	0.114	0.118	0.122
E	4.80	4.90	5.00	0.189	0.193	0.197
E1	2.90	3.00	3.10	0.114	0.118	0.122
e	—	0.65	—	—	0.0256	—
L	0.40	0.53	0.66	0.016	0.021	0.026
y	—	—	0.076	—	—	0.003
θ	0°	3°	6°	0°	3°	6°

8-pin MSOP

CUSTOMER :		ZYWYN CORPORATION
APPROVED BY	DATE	TITLE : 8L MSOP PACKAGE OUTLINE DRAWING
DRAW BY: Sandy Sue	03/01/02	
CHECK BY: Parker Chen	03/02/02	
APPROVAL: Andy Yang	03/04/02	DWG. NO. PO-MSOP-001 REV. 2
APPROVAL: CK Yeh	03-05-2002	UNIT : mm SCALE : 15/1 SHEET 1 OF 1



NOTES :

1. CONTROLLING DIMENSION : INCH
2. LEAD FRAME MATERIAL MATERIAL : C194
3. PACKAGE DIMENSION EXCLUDE MOLDING FLASH
4. AFTER SOLDER PLATING LEAD THICKNESS WILL BE 0.013" MAX
5. AFTER SOLDER DIPPING LEAD THICKNESS WILL BE 0.020" MAX
6. THE MAX. ALLOWABLE MOLDING FLASH IS 0.010"
7. TOLERANCE : 0.002" UNLESS OTHERWISE SPECIFIED
8. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPES
9. THE BOTTOM E- PIN INDENT IS MARKED AS BELOW :

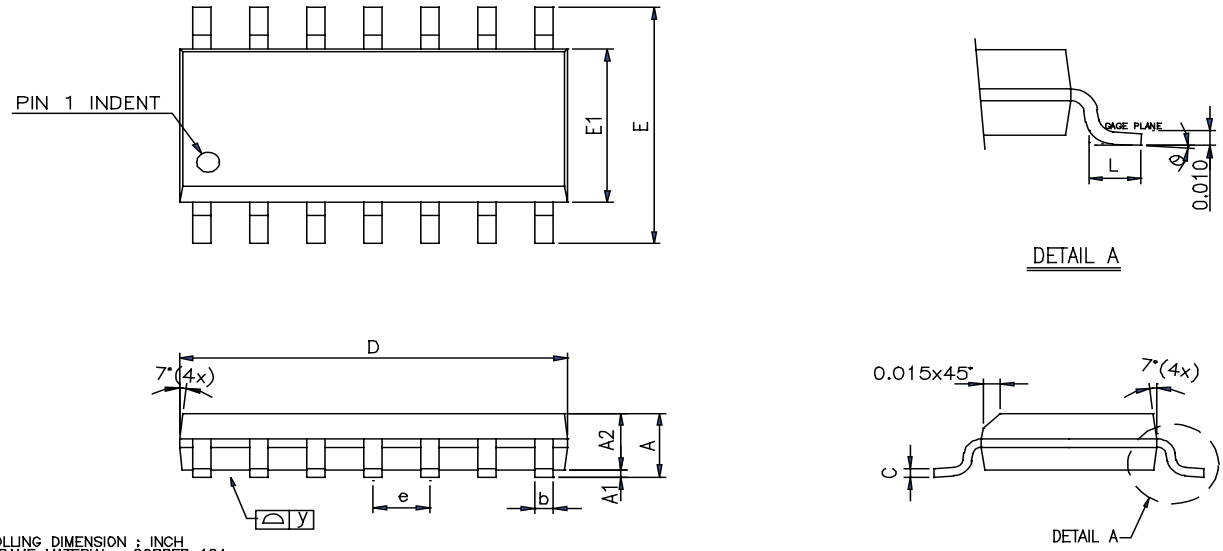
TAIWAN XY

X : A-1
Y : 0-9

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	—	—	4.57	—	—	0.180
A1	0.38	—	—	0.015	—	—
A2	3.25	3.30	3.45	0.128	0.130	0.136
B	0.26	0.46	0.56	0.014	0.018	0.022
B1	1.14	1.27	1.52	0.045	0.050	0.060
C	0.20	0.25	0.33	0.008	0.010	0.013
D	18.19	19.15	19.30	0.744	0.754	0.760
D1	0.81	1.19	1.47	0.032	0.047	0.058
E	7.62	—	8.26	0.300	—	0.325
E1	6.35	6.50	6.65	0.250	0.256	0.262
e	—	2.54	—	—	0.100	—
L	3.18	—	—	0.125	—	—
eB	8.63	—	9.65	0.340	—	0.380

14-pin PDIP

CUSTOMER :		ZYWYN CORPORATION
APPROVED BY	DATE	TITLE : 14L P-DIP PACKAGE OUTLINE DRAWING
DRAW BY: Vico Chen	05/12/'09	
CHECK BY: Hannah Kao	5/12/'09	
APPROVAL: Paul Lee	5/12/'09	DWG. NO. PO-DIP-002 REV. 0
APPROVAL: Barry Chen	5/12/'09	UNIT : INCH SCALE : 4/1 SHEET 1 OF 1



NOTE :

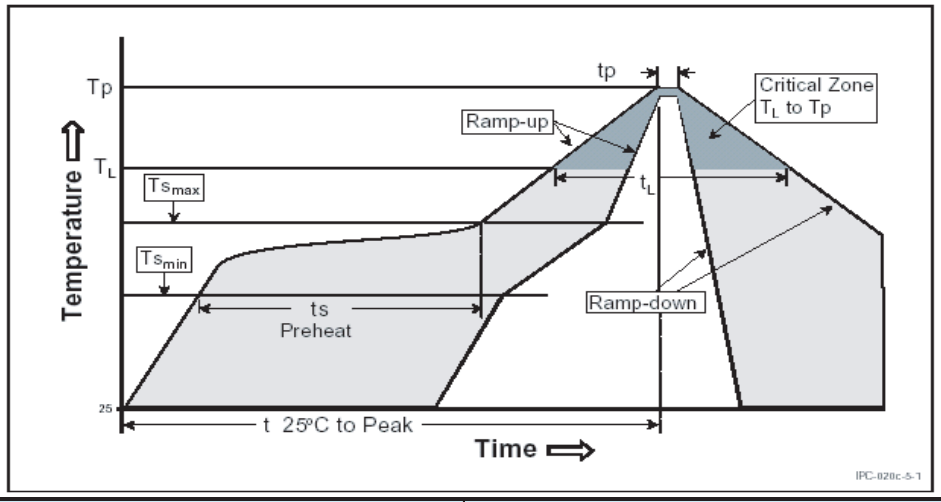
1. CONTROLLING DIMENSION : INCH
2. LEAD FRAME MATERIAL : COPPER 194
3. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006"[0.15mm] PER END DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH, INTERLEAD FLASH SHALL NOT EXCEED 0.010"[0.25mm] PER SIDE.
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.003"[0.08mm] TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.0028"[0.07mm]
5. TOLERANCE : ±0.010"[0.25mm] UNLESS OTHERWISE SPECIFIED.
6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC. ⚠
7. REFERENCE DOCUMENT : JEDEC SPEC MS-012

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.47	1.60	1.73	0.058	0.063	0.068
A1	0.10	——	0.25	0.004	——	0.010
A2	——	1.45	——	——	0.057	——
b	0.33	0.41	0.51	0.013	0.016	0.020
C	0.19	0.20	0.25	0.0075	0.008	0.0098
D	8.53	8.64	8.74	0.336	0.340	0.344
E	5.79	5.99	6.20	0.228	0.236	0.244
E1	3.81	3.91	3.99	0.150	0.154	0.157
e	——	1.27	——	——	0.050	——
L	0.40	0.71	1.27	0.016	0.028	0.050
y	——	——	0.076	——	——	0.003
θ	0°	——	8°	0°	——	8°

14-pin nSOIC

CUSTOMER :		ZYWYN CORPORATION
APPROVED BY	DATE	TITLE: 14L NARROW BODY SMALL OUTLINE PACKAGE DRAWING
DRAW BY: Sandy Sue	01/07/'09	
CHECK BY: Ryan Lin	01/07/'09	
APPROVAL: Parker Chen	01/07/'09	DWG. NO. PO-SOP-002 REV. 1
APPROVAL: Andy Yang	01/07/'09	UNIT : INCH SCALE : 12/1 SHEET 1 OF 1

Green Package SMD IR Reflow Profile Information

IR Reflow Profile Conditions		
Profile Feature	JESD Sn-Pb Eutectic Assembly	**JESD Pb-free Assembly**
Average Ramp-Up Rate (T_{Smax} to T_P)	3°C/second max.	**3°C/second max.**
Pre-heat **- Temperature Min (T_{Smin})** **- Temperature Max (T_{Smax})** **- Time (T_{Smin} to t_{Smax})**	 100°C 150°C 60~120 seconds	 **150°C** **200°C** **60~180 seconds**
Time maintained above: **- Temperature (T_L)** **- Time (t_L)**	 183°C 60~150 seconds	 **217°C** **60~150 seconds**
Peak/Classification Temperature (T_P)	235°C+5/-0°C	**255°C+5/-0°C**
Time within 5°C of actual Peak Temperature (t_P)	10~30 seconds	**20~40 seconds**
Ramp-Down Rate	6°C/second max.	**6°C/second max.**
Time 25°C to Peak Temperature	6 minutes max.	**8 minutes max.**

Zywyn Green Packages are Pb-free and RoHS compliance.

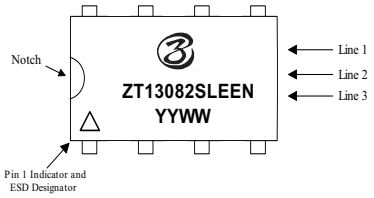
Ordering Information

Part Number	Temperature Range	Package Type (Green)	MOQ/Tube	MOQ/T&R
ZT13080SLEEN	-40°C to +85°C	14-pin Nsoic	100	2500
ZT13080SLEEP	-40°C to +85°C	14-pin PDIP	60	N/A
ZT13081SLEEN	-40°C to +85°C	8-pin Nsoic	100	2500
ZT13081SLEEP	-40°C to +85°C	8-pin PDIP	60	N/A
ZT13081SLEEU	-40°C to +85°C	8-pin MSOP	50	2500
ZT13082SLEEN	-40°C to +85°C	8-pin Nsoic	100	2500
ZT13082SLEEP	-40°C to +85°C	8-pin PDIP	60	N/A
ZT13082SLEEU	-40°C to +85°C	8-pin MSOP	50	2500
ZT13083SLEEN	-40°C to +85°C	14-pin Nsoic	100	2500
ZT13083SLEEP	-40°C to +85°C	14-pin PDIP	60	N/A
ZT13084SLEEN	-40°C to +85°C	8-pin Nsoic	100	2500
ZT13084SLEEP	-40°C to +85°C	8-pin PDIP	60	N/A
ZT13084SLEEU	-40°C to +85°C	8-pin MSOP	50	2500
ZT13085SLEEN	-40°C to +85°C	8-pin Nsoic	100	2500
ZT13085SLEEP	-40°C to +85°C	8-pin PDIP	60	N/A
ZT13085SLEEU	-40°C to +85°C	8-pin MSOP	50	2500
ZT13086SLEEN	-40°C to +85°C	14-pin Nsoic	100	2500
ZT13086SLEEP	-40°C to +85°C	14-pin PDIP	60	N/A
ZT13087SLEEN	-40°C to +85°C	8-pin Nsoic	100	2500
ZT13087SLEEP	-40°C to +85°C	8-pin PDIP	60	N/A
ZT13087SLEEU	-40°C to +85°C	8-pin MSOP	50	2500
ZT13088SLEEN	-40°C to +85°C	8-pin Nsoic	100	2500
ZT13088SLEEP	-40°C to +85°C	8-pin PDIP	60	N/A
ZT13088SLEEU	-40°C to +85°C	8-pin MSOP	50	2500

Please contact the factory for pricing,availabiliy on Tape-and-Reel and Die Sales options.

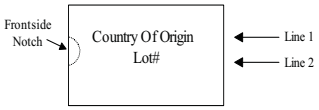
Part Marking Information

TOPSIDE MARK INSTRUCTIONS:



Line 1: Zywyn (logo)
Line 2: Zywyn Part Number "ZT13082SLEEN"
Line 3: Date Code: (Last 2 digits of Prod. Year & Prod. Work Week)
Note: Pin # 1 "△" Indicator Required

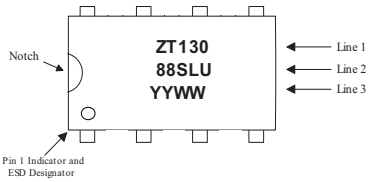
BOTTOMSIDE MARK INSTRUCTIONS:



Line 1: Country of Origin (optional if Country of Origin is in Ejector Pin)
Line 2: Lot Number

8/14-pin PDIP or 8/14-pin nSOIC

TOPSIDE MARK INSTRUCTIONS:



Line 1: Zywyn Part Name "ZT130"
Line 2: Zywyn Part Number "88SLU"
Line 3: Date Code: (Last 2 digits of Prod. Year & Prod. Work Week)
Note: Pin # 1 "○" Indicator Required

BOTTOMSIDE MARK INSTRUCTIONS:

Line 1: Country of Origin (optional if Country of Origin is in Ejector Pin)
Line 2: Lot Number

8-pin MSOP

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