Zywyn

ZT483E, ZT485E, ZT488E ZT489E, ZT490E, ZT491E

Low Power 5V 250kbps/10Mbps RS485E Transceivers

Features

- Meets or exceeds the requirements of ANSI Standard TIA/EIA-485-A and ISO 8482:1987(E) specifications for V_{CC} at +5V ±5%
- Low quiescent current – 0.5mA typ., 1mA max.
- Low shutdown current (where applicable) - 0.01µA typical, 10µA max.
- Guaranteed standard data rate 250kbps or 10Mbps
- True Fail-Safe (Open and Short) Receiver
- Thermal shutdown protection
- -7V to +12V common-mode input voltage range
- Half-Duplex or Full-Duplex configuration
- Allows up to 1 unit load (32 devices) on the same common bus
- Controlled driver output slew rate and receiver input filtering
- Active-high driver enable and active-low receiver enable
- ESD Protection on bus terminals
  ±15kV Human Body Model (HBM)
- Drop-in Replacements for MAX483E, MAX485E, MAX488E, MAX489E, MAX490E, MAX491E.
- High fanout driving 1/4 unit load (128 devices) available on ZT485ER Series

General Description

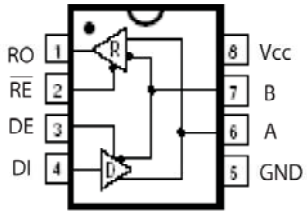
The ZT485E series devices are 5V differential data line transceivers for RS485/RS422 communication that consist of one driver and one receiver with high level of ESD protection. They are designed for balanced transmission lines interface that meet ANSI standard TIA/EIA-485-A and ISO 8482:1987(E) specifications.

The ZT485E series devices spans out with half or full duplex, data rate guaranteed at 250k bit per second or 10Mbps, and allow one unit load that fan out 32 devices sharing a common bus. The I/Os are enhanced-electrostatic discharge (ESD) protected, exceeding ±15kV Human Body Model (HBM).

Applications

- RS-422/RS-485 communications
- Utility meters
- Industrial process control
- Building automation
- Level tranlators
- Transceivers for EMI-sensitive applications
- Routers and HUBs
- Industrial-controlled Local Area Networks
- Industrial PCs, embedded PCs and peripherals

ZT483E/ZT485E



Product Selection Guide And Cross Reference

Part Number	Duplex	# 0f Tx/Rx	Data Rate (Mbps)	# of Tx/Rx on Bus	Slew Rate Limit	Rx Input Filtering	Low-Power Shutdown	Tx/Rx Enable	ESD on Tx/Rx	Number of Pins	Pin-to-Pin Cross Reference
ZT483E	Half	1/1	0.25	32	Yes	Yes	Yes	Yes	± 15kV	8	MAX483E
ZT485E	Half	1/1	10	32	No	No	Yes	Yes	± 15kV	8	MAX485E
ZT488E	Full	1/1	0.25	32	Yes	Yes	No	No	± 15kV	8	MAX488E
ZT489E	Full	1/1	0.25	32	Yes	Yes	Yes	Yes	± 15kV	14	MAX489E
ZT490E	Full	1/1	10	32	No	No	No	No	± 15kV	8	MAX490E
ZT491E	Full	1/1	10	32	No	No	Yes	Yes	± 15kV	14	MAX491E

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 +6.0V

Input Voltages

DI, DE, $\overline{RE}$ (V_{IH}), High Input Voltage .... +2V to +6.0V

DI, DE, $\overline{RE}$ (V_{IL}), Low Input Voltage ..... 0V to +0.8V

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

A, B (V_I) ..... +12V to -7V

Output Voltages

RO .....–0.3V to (V_{CC} +0.3V)

Y, Z (A & B on ZT485)..... +12V to -7V

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

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, 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
TTL Logic Input	DE, DI, $\overline{RE}$				
TTL Logic Output	RO		High $Z_{O/P}$ when disabled		
RS-485 Input	A, B				
RS-485 Output	Y, Z		High $Z_{O/P}$ when disabled		
Power Pin	V_{CC}, V_{GND}				
Temp 0°C to +70°C	Commercial Grade	0	+25	+70	°C
Temp –40°C to +85°C	Industrial Grade	–40	+25	+85	°C
V_{CC} Voltage Range	V_{CC} = +5.0V Supply	4.75	5.0	5.25	V
Supply Current					
I_{CC}, Tx and Rx active	DI=V_{CC}/GND, DE=V_{CC}, $\overline{RE}$=GND, RS-485 I/P=Open		400	1000	µA
I_{CC}, Tx active	DI=V_{CC}/GND, DE=V_{CC}, $\overline{RE}$=V_{CC}, RS-485 I/P=Open		400	1000	µA
I_{CC}, Rx active	DI=V_{CC}/GND, DE=GND, $\overline{RE}$=GND, RS-485 I/P=Open		400	1000	µA
I_{SD}, Shutdown Current	DI=V_{CC}/GND, DE = GND, $\overline{RE}$ = $V_{CC,}$ RS-485 I/P=Open		1.0	10	µA
TTL LOGIC Input					
Input Threshold Low	V_{CC} = +5.0V Supply, DE, DI, and $\overline{RE}$			0.8	V
Input Threshold High	V_{CC} = +5.0V Supply, DE, DI, and $\overline{RE}$	2.0			V
TTL LOGIC Output					
Output Voltage Low	I_{OUT} = +4mA, Input Differential Voltage = 200mV			0.4	V
Output Voltage High	I_{OUT} = –4mA, Input Differential Voltage = 200mV	3.5			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}	7		95	mA
Receiver Input					
Input Current	DE = 0V, V_{CC} = 0V to 5.25V, V_{IN} = +12V			1.0	mA
	DE = 0V, V_{CC} = 0V to 5.25V, V_{IN} = –7V			–0.8	mA
DIfferential Threshold Voltage,V_{TH}	V_{CM} = -7V to +12V, V_{CC}=+5.0V, T_A=25°C	–0.2		+0.2	V
Input Hysteresis	V_{CM} = 0V		20		mV
Input Resistance, R_{IN}	V_{CM} = -7V to +12V	12			kΩ
Transmitter Output					
DIfferential Output Voltage, V_{OD}	No Load			5	V
DIfferential Output Voltage, dV_{OD}	With R_L = 50Ω, C_L = 50pF. Refers to figure 1. (RS422)	2			V
	With R_L = 27Ω. C_L = 50pF. Refers to figure 1. (RS485)	1.5		5	V
Driver Common Mode Output	With R_L = 27Ω or 50Ω. C_L = 50pF.Refers to figure 3.			3	V
Change in Voltage Magnitude for Complimentary States, dV_{OC}	Differential Output Voltage, with R_L = 27Ω or 50Ω, C_L = 50pF. Refers to figure 1.			0.2	V
Change in Voltage Magnitude for Complimentary States, V_{OC}	Common-Mode Output Voltage, with R_L = 60Ω, 375Ω, 375Ω. Refers to figure 2.			0.2	V
Transmitter Short-Circuit Current	Output HIGH, V_{OUT}= -7V to +12V. Refers to figure 7.			250	mA
	Output LOW, V_{OUT}= -7V to +12V. Refers to figure 7.			250	mA

AC Electrical Characteristics (ZT485E, ZT490E, and ZT491E)

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, Refers to figure 4.		35	60	ns
Transmitter Propagation t_{PHL}	R_{DIFF} = 54Ω, C_L = 50pF, Refers to figure 4.		35	60	ns
Transmitter Output Skew t_{SK}	|tPLH - tPHL|		3	10	ns
Transmitter Rise/Fall Time	t_R, t_f , R_{DIFF} = 54Ω, C_L = 50pF, ZT485E. Refers to figure 4.		15	25	ns
	t_R, t_f , R_{DIFF} = 54Ω, C_L = 50pF, ZT490E and ZT491E, refer fig.4.		15	25	ns
Transmitter Output Enable	To Output HIGH, C_L = 50pF, R_L = 110Ω. Refers to figure 5.		50		ns
	To Output LOW, C_L = 50pF, R_L = 110Ω. Refers to figure 6.		50		ns
Transmitter Output Disable	From Output HIGH, C_L = 50pF, R_L = 110Ω. Refers to figure 5.		50		ns
	From Output LOW, C_L = 50pF, R_L = 110Ω. Refers to figure 6.		50		ns
Receiver Timing					
Receiver Propagation t_{PLH}	C_L = 15pF, Refers to figure 9.		50	150	ns
Receiver Propagation t_{PHL}	C_L = 15pF, Refers to figure 9.		50	150	ns
Differential Receiver Skew t_{SK}	|tPHL - tPLH|		10		ns
Receiver Output Enable	To Output HIGH, C_L = 15pF, Refers to figure 10.		50		ns
	To Output LOW, C_L = 15pF, Refers to figure 11.		50		ns
Receiver Output Disable	From Output HIGH, C_L = 15pF, Refers to figure 10.		50		ns
	From Output LOW, C_L = 15pF, Refers to figure 11.		50		ns
Transceiver Throughput					
Maximum Data Rate	R_L = 54Ω, C_L = 50pF, One Transmitter Switching, T_A = 25°C	10			Mbps
ESD Tolerance					
ESD HBM	RS-485 Inputs and Outputs		±15		kV

AC Electrical Characteristics (ZT483E, ZT488E, and ZT489E)

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, Refers to figure 4.	250	800	2000	ns
Transmitter Propagation t_{PHL}	R_{DIFF} = 54Ω, C_L = 50pF, Refers to figure 4.	250	800	2000	ns
Transmitter Output Skew t_{SK}	|tPLH - tPHL|		20	800	ns
Transmitter Rise/Fall Time	t_R, t_f , R_{DIFF} = 54Ω, C_L = 50pF, Refers to figure 4.	250		2000	ns
Transmitter Output Enable	To Output HIGH, C_L = 50pF, R_L = 110Ω. Refers to figure 5. To Output LOW, C_L = 50pF, R_L = 110Ω. Refers to figure 6.		100 100		ns ns
Transmitter Output Disable	From Output HIGH, C_L = 15pF, R_L = 110Ω. Refers to figure 5. From Output LOW, C_L = 15pF, R_L = 110Ω. Refers to figure 6.		100 100		ns ns
Receiver Timing					
Receiver Propagation t_{PLH}	C_L = 15pF, Refers to figure 9.	250		2000	ns
Receiver Propagation t_{PHL}	C_L = 15pF, Refers to figure 9.	250		2000	ns
Differential Receiver Skew t_{SK}	|tPHL - tPLH|		10		ns
Receiver Output Enable	To Output HIGH, C_L = 15pF, Refers to figure 10. To Output LOW, C_L = 15pF, Refers to figure 11.		100 100		ns ns
Receiver Output Disable	From Output HIGH, C_L = 15pF, Refers to figure 10. From Output LOW, C_L = 15pF, Refers to figure 11.		100 100		ns ns
Shutdown Timing					
Time to Shutdown	ZT = 483E	50	200	600	ns
Transmitter Enable from SHUTDOWN to Output HIGH	C_L = 50pF, R_L = 110Ω. Refers to figure 5.		200		ns
Transmitter Enable from SHUTDOWN to Output LOW	C_L = 50pF, R_L = 110Ω. Refers to figure 6.		200		ns
Receiver Enable from SHUTDOWN to Output HIGH	C_L = 15pF, R_L = 1kΩ. Refers to figure 12.		200		ns
Receiver Enable from SHUTDOWN to Output LOW	C_L = 15pF, R_L = 1kΩ. Refers to figure 12.		200		ns
Transceiver Throughput					
Maximum Data Rate	R_L = 54Ω, C_L = 50pF, One Transmitter Switching, T_A = 25°C	0.25			Mbps
ESD Tolerance					
ESD HBM	RS-485 Inputs and Outputs		±15		kV

Pin Description

Pin Numbers			Name	Description
ZT483E/ZT485E	ZT488E/ZT490E	ZT489E/ZT491E		
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	$\overline{DE}$	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 ±5%
n/a	n/a	1, 8, 13	NC	No Connect, Not internally connected

Circuit Description

The ZT483E, ZT485E, ZT489E, ZT490E, and ZT491E 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 32 drivers and 32 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.

The ZT483E, ZT488E, and ZT489E are slew-rate limited, minimizing EMI and reducing reflections caused by improperly terminated cables.

RS-485 Transmitters

Each device in the ZT4xxE 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 32 receivers on the line.

The ZT485E transmitter has 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 15 kohms. A wide common mode range of -7V to +12V allows for large ground potential differences between systems.

The ZT485E, ZT489E, and ZT491E receivers have a enable control input. A logic LOW on /RE will enable the receiver, a logic HIGH on /RE will disable the receiver. The receivers are equipped with the fail-safe feature, which guarantees that the receiver output will be in a HIGH state when the input is left unconnected. This applies for both cases where the receiver inputs are either shorted or open.

The ZT485E, ZT490E, and ZT491E can transmit and receive at data rates up to 10Mbps. The ZT483E, ZT488E, and ZT489E are specified for data rates up to 250kbps.

Bus Configuration

The ZT489E, ZT490E, and ZT491E are full-duplex transceivers, while the MAX483E and MAX485E are half-duplex.

For full duplex, the devices are used as a four-wire bus transceiver with a configuration 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 at up to 10Mbps (up to 250kbps for the ZT489E).

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 configuraitons 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 ZT485E family 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 from normal to powered down. After multiple ESD events, Zywyn's ZT485E 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.

Function Table

ZT483E/ZT485E

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	X	Open	Z
				Open circuit	L	H*
				Short circuit	L	H*

ZT488E/ZT490E

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
Open	H	L	$+0.2V \le V_{ID}$	H
			Open circuit	H*
			Short circuit	H*

ZT489E/ZT491E

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
				Open circuit	L	H*
				Short circuit	L	H*

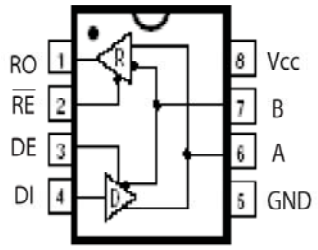
Note:

H = High Level; L = Low Level; Z = High Impedance; X = Irrelevant; U = Undertermine State.

* = Fail Safe (Receiver Output High) when Receiver Inputs are Open or Short and Common Mode equals to 0V.

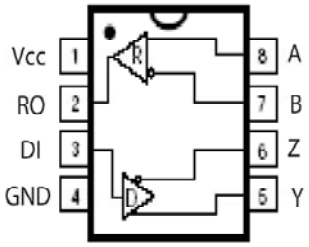
Pin Configuration

ZT483E/ZT485E



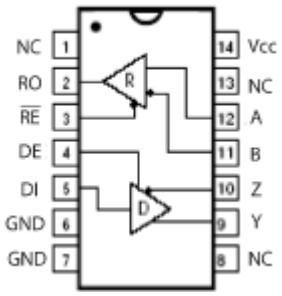
8-Pin PDIP/nSOIC

ZT488E/ZT490E



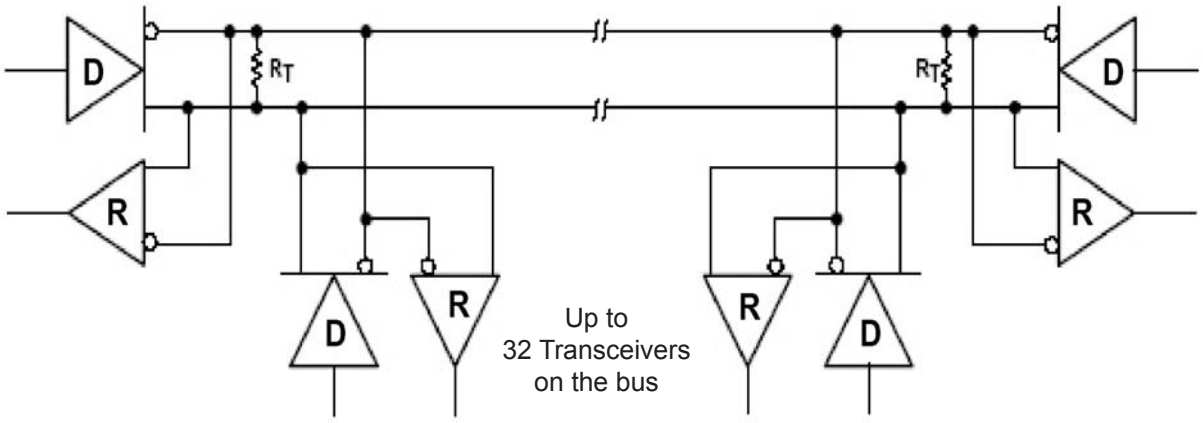
8-Pin PDIP/nSOIC

ZT489E/ZT491E



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 32 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.

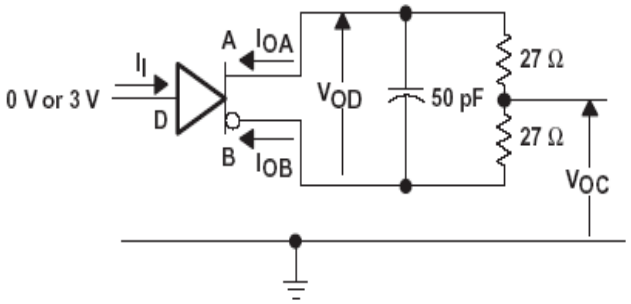


Figure 1. Driver Test Circuit, V_{OD} and V_{OC} Without Common-Mode Loading

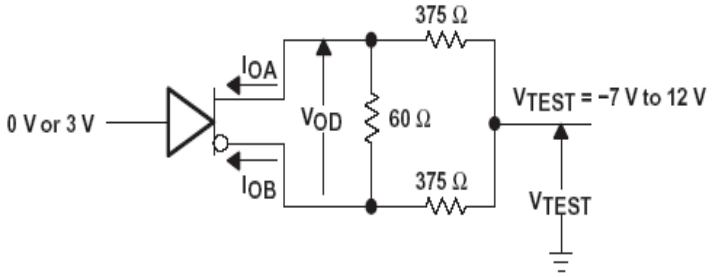


Figure 2. Driver Test Circuit, V_{OD} With Common-Mode Loading

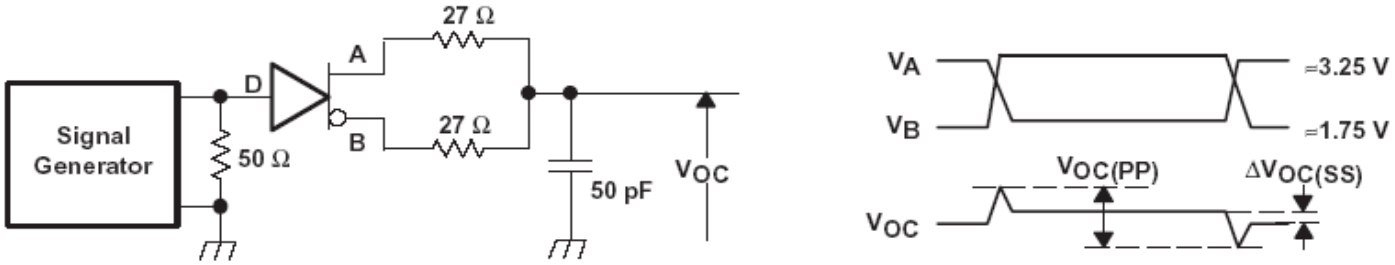


Figure 3. Driver Common-Mode Output Voltage (V_{OC}) Test Circuit and Waveforms

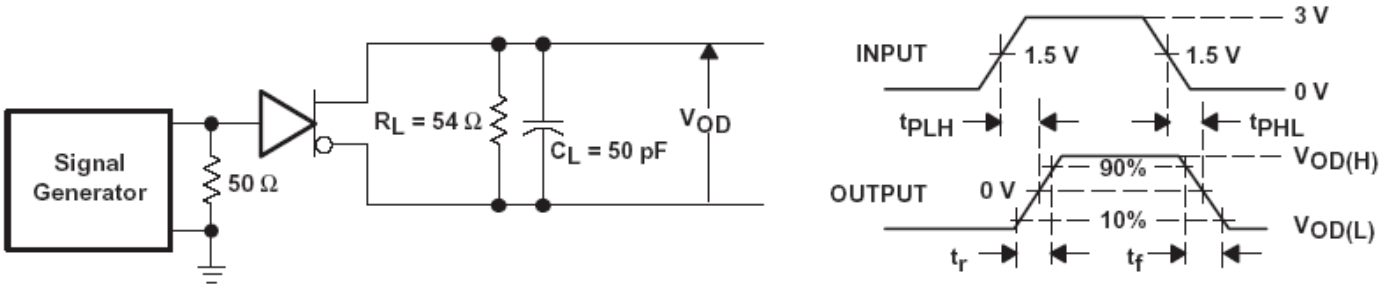


Figure 4. Driver Differential Output Voltage (V_{OD}) Switching Test Circuit and Waveforms

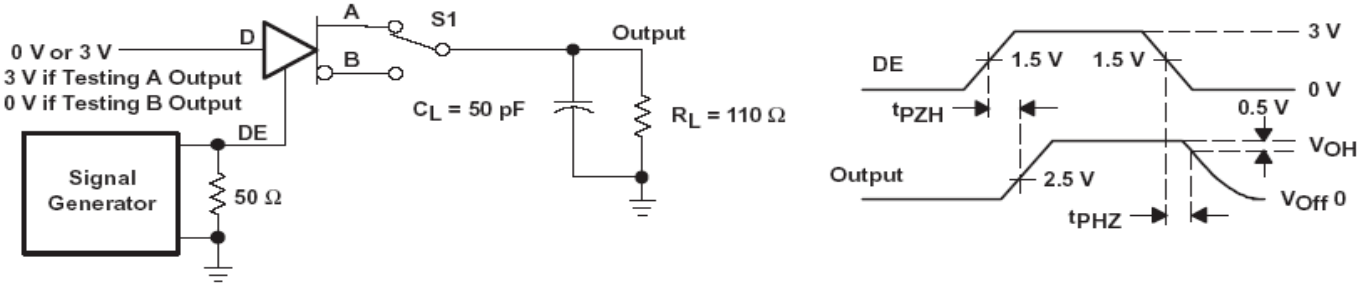


Figure 5. Driver Enable/Disable Test Circuit and Waveforms, High Output

Typical Test Circuits

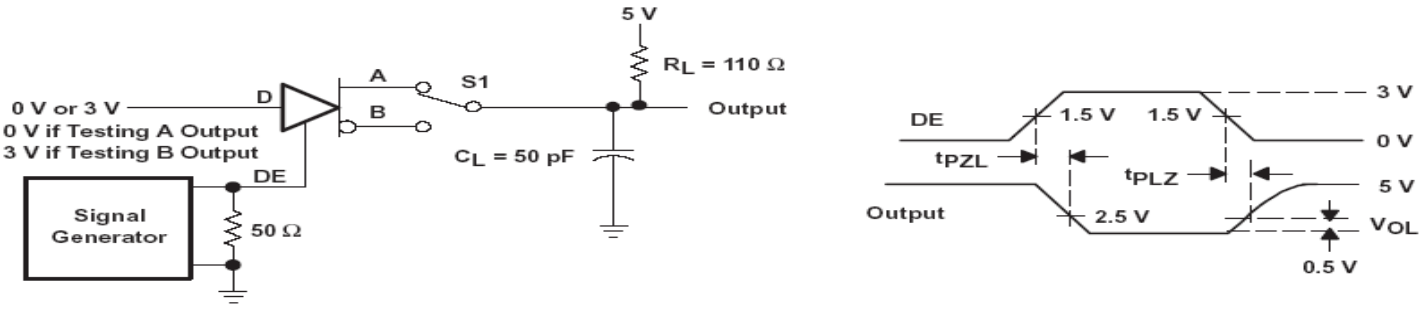


Figure 6. Driver Enable/Disable Test Circuit and Waveforms, Low Output

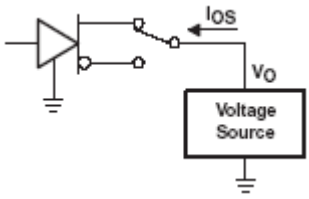


Figure 7. Driver Short-Circuit Test Configuration

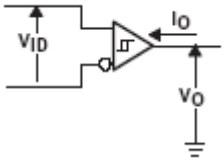
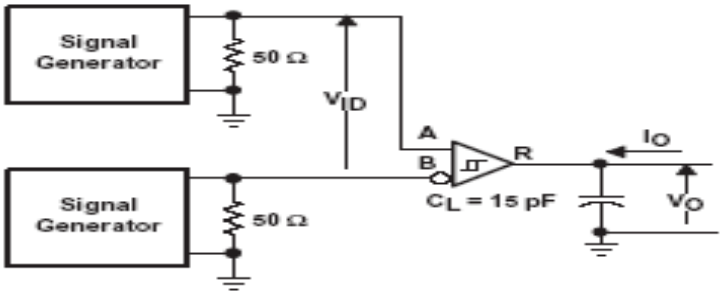


Figure 8. Receiver Parameter Definitions



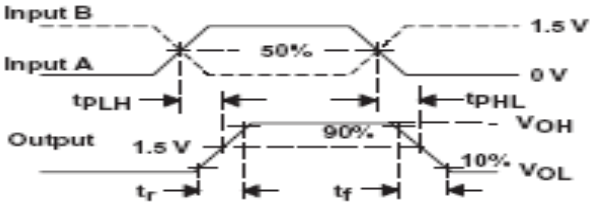
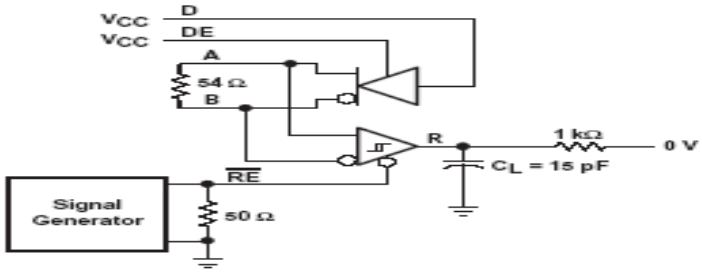


Figure 9. Receiver Propagation (t_{PLH} and t_{PHL})Test Circuit and Waveforms



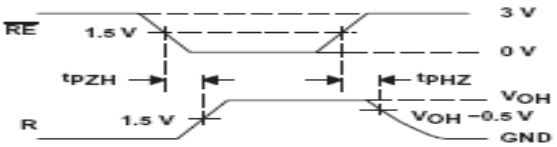
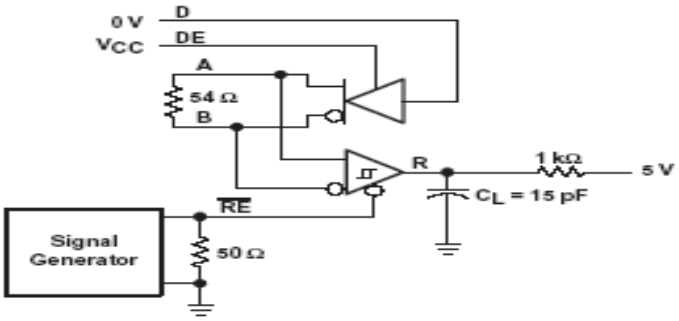


Figure 10. Receiver Output Enable/Disable Test Circuit and Waveforms, Data Output High



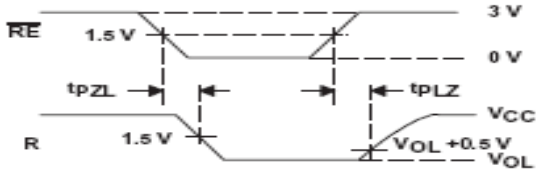
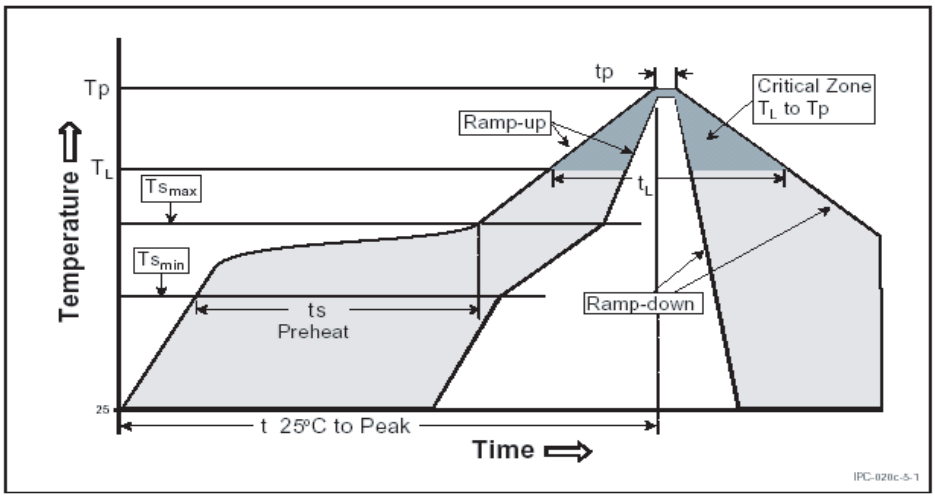


Figure 11. Receiver Output Enable/Disable Test Circuit and Waveforms, Data Output Low

Green Package SMD IR Reflow Profile Information

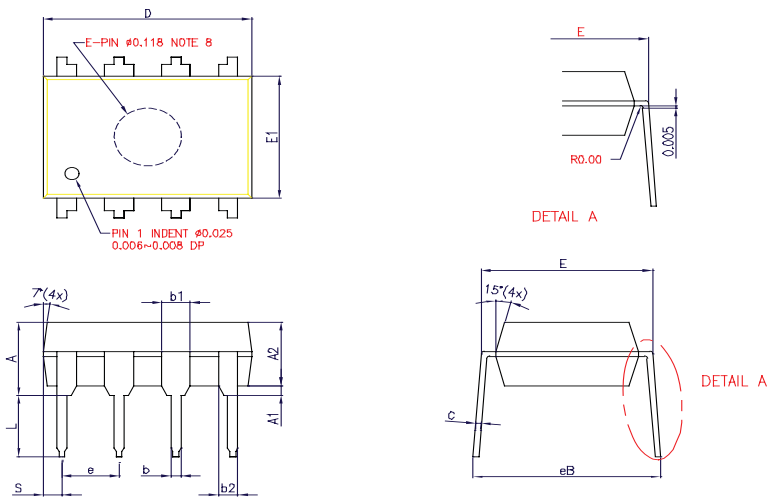
IR Reflow Profile Conditions



Profile Feature	JESD Sn-Pb Eutectic Assembly	JESD Pb-free Assembly
Average Ramp-Up Rate (T_{Smax} to T_P)	3°C/seconds max.	**3°C/seconds 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.

Package Information



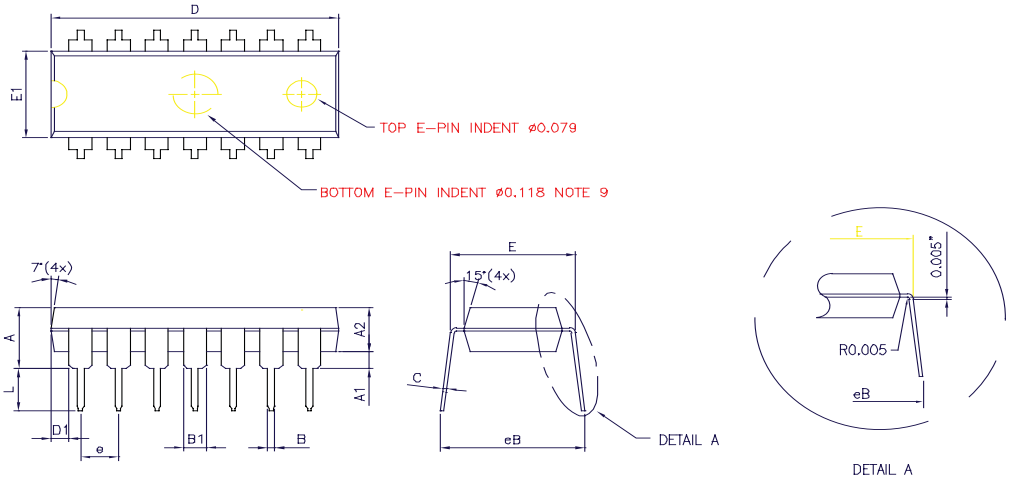
NOTE :
1. CONTROLLING DIMENSION : INCH
2. LEAD FRAME MATERIAL : C194
3. DIMENSION D AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010" [0.25mm]
4. DIMENSION "b1" DO NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSIONS SHALL NOT EXCEED 0.010"[0.25mm]. DISTANCE 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:

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 Tsu	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



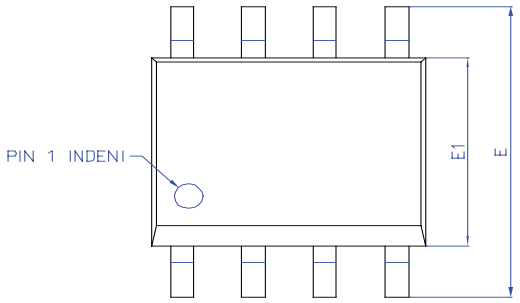
NOTES :
1. CONTROLLING DIMENSION : INCH
2. LEAD FRAME MATERIAL MATERIAL : C194
3. PACKAGE DIMENSION EXCLUDE MOLDING FLASH
4. AFTER SOLDER PLATING LEAD THICKNESS WILL BE 0.013" MAX
5. AFTER SOLDER DIPPING LEAD THICKNESS WILL BE 0.020" MAX
6. THE MAX. ALLOWABLE MOLDING FLASH IS 0.010"
7. TOLERANCE : 0.002"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

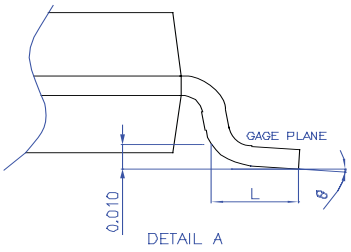
X : A-1
Y : 0-9

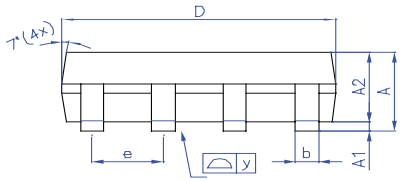
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	—	—	4.57	—	—	0.180
A1	0.38	—	—	0.015	—	—
A2	3.25	3.30	3.45	0.128	0.130	0.136
B	0.26	0.46	0.56	0.014	0.018	0.022
B1	1.14	1.27	1.52	0.045	0.050	0.060
C	0.20	0.25	0.33	0.008	0.010	0.013
D	18.19	19.15	19.30	0.744	0.754	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

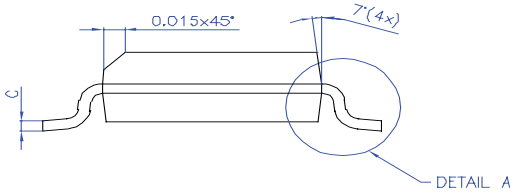
14-pin PDIP

CUSTOMER :		ZYWYN CORPORATION	
APPROVED BY	DATE	TITLE : 14L P-DIP PACKAGE OUTLINE DRAWING	
DRAW BY: Vivi Chen	05/12/'99		
CHECK BY: Thomas Kao	5/12/'99		
APPROVAL: Paul Lee	5/12/'99	DWG. NO. PO-DIP-002	REV. 0
APPROVAL: Barry Chen	5/12/'99	UNIT : INCH / SCALE : 4/1	SHEET 1 OF 1







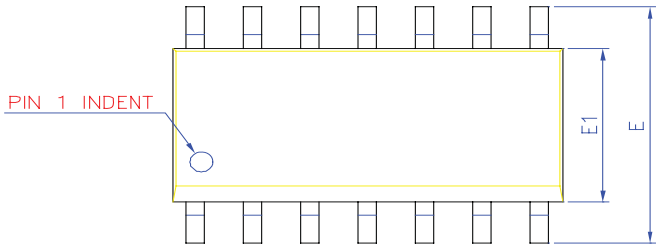


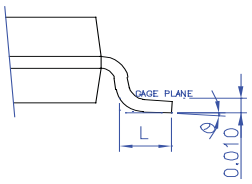
NOTE :
1. CONTROLLING DIMENSION : INCH
2. LEAD FRAME MATERIAL : COPPER 194
3. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006"[0.15mm] PER END DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH, INTERLEAD FLASH SHALL 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	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°

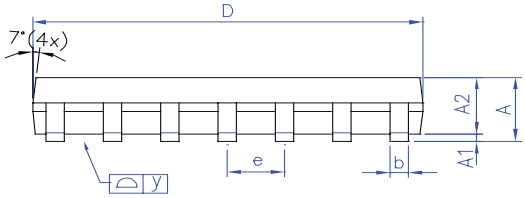
8-pin nSOIC

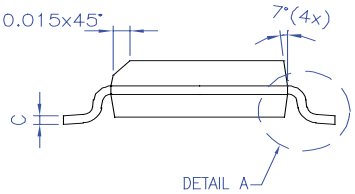
CUSTOMER :		ZYWYN CORPORATION
APPROVED BY	DATE	TITLE: 8L NARROW BODY SMALL OUTLINE PACKAGE DRAWING
DRAW BY: Vivi Chen	05/21/'01	
CHECK BY: Ewen Liu	05/21/'01	
APPROVAL: Trevor Tsai	05/21/'01	DWG. NO. PO-SOP-001 REV. 2
APPROVAL: Trevor Tsai	05/21/'01	UNIT : INCH SCALE : 15/1 SHEET 1 OF 1





DETAIL A





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/'04	
CHECK BY: Ryan Lin	01/07/'04	
APPROVAL: Parker Chen	01/07/'04	DWG. NO. PO-SOP-002 REV. 1
APPROVAL: Andy Yang	01/07/'04	UNIT : INCH SCALE : 12/1 SHEET 1 OF 1

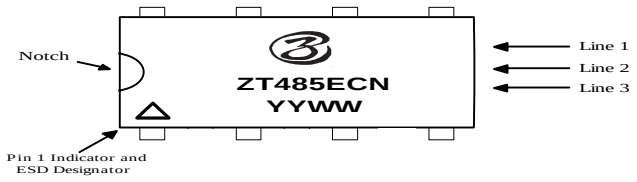
Ordering Information

Part Number	Temperature Range	Package Type	Green Package (Pb-Free &RoHS)	MOQ/Tube
ZT483LEEN	-40°C to +85°C	8-pin nSOIC	✓	100
ZT483LEEP	-40°C to +85°C	8-pin PDIP	✓	60
ZT485LEEN	-40°C to +85°C	8-pin nSOIC	✓	100
ZT485LEEP	-40°C to +85°C	8-pin PDIP	✓	60
ZT488LEEN	-40°C to +85°C	8-pin nSOIC	✓	100
ZT488LEEP	-40°C to +85°C	8-pin PDIP	✓	60
ZT489LEEN	-40°C to +85°C	14-pin nSOIC	✓	58
ZT489LEEP	-40°C to +85°C	14-pin PDIP	✓	30
ZT490LEEN	-40°C to +85°C	8-pin nSOIC	✓	100
ZT490LEEP	-40°C to +85°C	8-pin PDIP	✓	60
ZT491LEEN	-40°C to +85°C	14-pin nSOIC	✓	58
ZT491LEEP	-40°C to +85°C	14-pin PDIP	✓	30
Part Number	**Temperature Range**	**Package Type**	**Green Package (Pb-Free &RoHS)**	**MOQ/T&R**
ZT483LEEN/TR	-40°C to +85°C	8-pin nSOIC	✓	2500
ZT483LEEP	-40°C to +85°C	8-pin PDIP	✓	N/A
ZT485LEEN/TR	-40°C to +85°C	8-pin nSOIC	✓	2500
ZT485LEEP	-40°C to +85°C	8-pin PDIP	✓	N/A
ZT488LEEN/TR	-40°C to +85°C	8-pin nSOIC	✓	2500
ZT488LEEP	-40°C to +85°C	8-pin PDIP	✓	N/A
ZT489LEEN/TR	-40°C to +85°C	14-pin nSOIC	✓	2500
ZT489LEEP	-40°C to +85°C	14-pin PDIP	✓	N/A
ZT490LEEN/TR	-40°C to +85°C	8-pin nSOIC	✓	2500
ZT490LEEP	-40°C to +85°C	8-pin PDIP	✓	N/A
ZT491LEEN/TR	-40°C to +85°C	14-pin nSOIC	✓	2500
ZT491LEEP	-40°C to +85°C	14-pin PDIP	✓	N/A

Please contact the factory for pricing and availabiliy on Tape-on-Reel option.

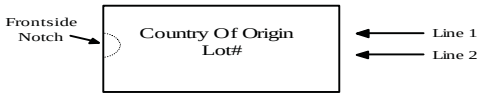
Part Marking Information

TOPSIDE MARK INSTRUCTIONS:



Line 1: Zywyn (logo)
Line 2: Zywyn Part Number "ZT485ECN"
Line 3: Date Code: (Last 2 digits of Prod. Year & Prod. Work Week)
Note: Pin # 1 "△" Indicator Required

BOTTOMSIDE MARK INSTRUCTIONS:



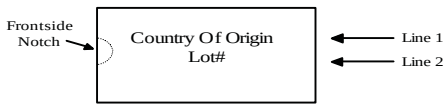
Line 1: Country of Origin (optional if Country of Origin is in Ejector Pin)
Line 2: Lot Number

8/14-nSOIC

TOPSIDE MARK INSTRUCTIONS:

Line 1: Zywyn (logo)
Line 2: Zywyn Part Number "ZT491ECP"
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-PDIP

Zywyn Corporation
Headquarters and Sales Office
1270 Oakmead Parkway, Suite 201 • Sunnyvale, CA 94085 • Tel: (408) 733-3225 • Fax: (408) 733-3206
Email: sales@zywyn.com • www.zywyn.com