

## High Performance Pin Driver

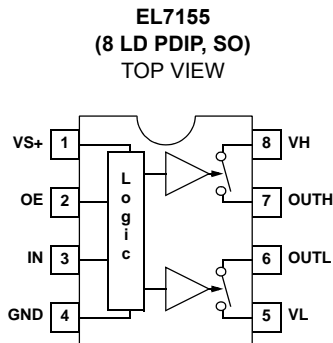
The EL7155 high performance pin driver with 3-state is suited to many ATE and level-shifting applications. The 3.5A peak drive capability makes this part an excellent choice when driving high capacitance loads.

Output pins  $OUT_H$  and  $OUT_L$  are connected to input pins  $V_H$  and  $V_L$  respectively, depending on the status of the IN pin. One of the output pins is always in tri-state, except when the OE pin is active low, in which case both outputs are in 3-state mode. The isolation of the output FETs from the power supplies enables  $V_H$  and  $V_L$  to be set independently, enabling level-shifting to be implemented.

This pin driver has improved performance over existing pin drivers. It is specifically designed to operate at voltages down to 0V across the switch elements while maintaining good speed and on-resistance characteristics.

Available in 8 Ld SO and 8 Ld PDIP packages, the EL7155 is specified for operation over the full  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  temperature range.

## Pinout



## Features

- Clocking speeds up to 40MHz
- 15ns tr/tf at 2000pF  $C_{LOAD}$
- 0.5ns rise and fall times mismatch
- 0.5ns  $T_{ON}-T_{OFF}$  prop delay mismatch
- 3.5pF typical input capacitance
- 3.5A peak drive
- Low on resistance of  $3.5\Omega$
- High capacitive drive capability
- Operates from 4.5V up to 16.5V
- Pb-free plus anneal available (RoHS compliant)

## Applications

- ATE/burn-in testers
- Level shifting
- IGBT drivers
- CCD drivers

## Ordering Information

PART NUMBER	PART MARKING	TAPE & REEL	PACKAGE	PKG. DWG. #
EL7155CN	EL7155CN	-	8 Ld PDIP	MDP0031
EL7155CS	7155CS	-	8 Ld SO	MDP0027
EL7155CS-T7	7155CS	7"	8 Ld SO	MDP0027
EL7155CS-T13	7155CS	13"	8 Ld SO	MDP0027
EL7155CSZ (Note)	7155CSZ	-	8 Ld SO (Pb-free)	MDP0027
EL7155CSZ-T7 (Note)	7155CSZ	7"	8 Ld SO (Pb-free)	MDP0027
EL7155CSZ-T13 (Note)	7155CSZ	13"	8 Ld SO (Pb-free)	MDP0027

NOTE: Intersil 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. Intersil 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.

**Absolute Maximum Ratings** ( $T_A = 25^\circ\text{C}$ )

Supply Voltage ( $V_{S+}$  to  $V_L$ ) ..... +18V  
 $V_H$ - $V_L$ ,  $V_H$  to GND,  $V_{S+}$  to  $V_H$  ..... 16.5V  
 Input Voltage ..... -0.3V below  $V_L$  to +0.3V above  $V_S$   
 Continuous Output Current ..... 200mA  
 Storage Temperature Range ..... -65°C to +150°C

Ambient Operating Temperature ..... -40°C to +85°C  
 Operating Junction Temperature ..... 125°C  
 Power Dissipation ..... see curves

*CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to 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.*

*IMPORTANT NOTE: All parameters having Min/Max specifications are guaranteed. Typical values are for information purposes only. Unless otherwise noted, all tests are at the specified temperature and are pulsed tests, therefore:  $T_J = T_C = T_A$*

**Electrical Specifications**  $V_{S+} = +15\text{V}$ ,  $V_H = +15\text{V}$ ,  $V_L = 0\text{V}$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise specified.

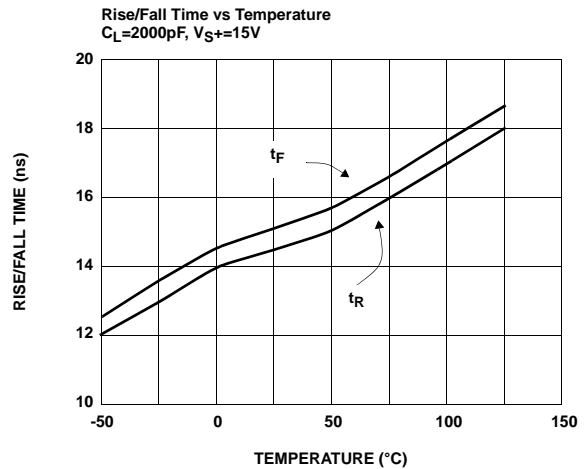
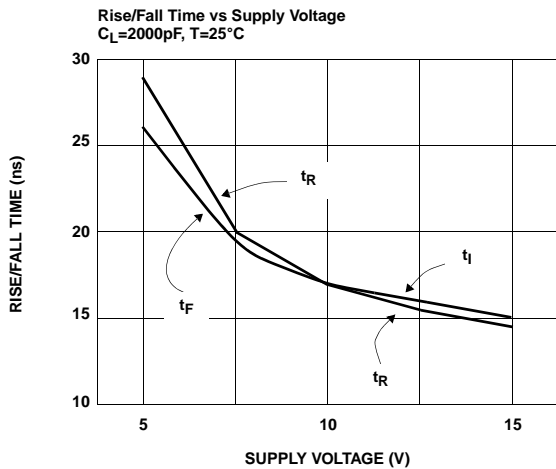
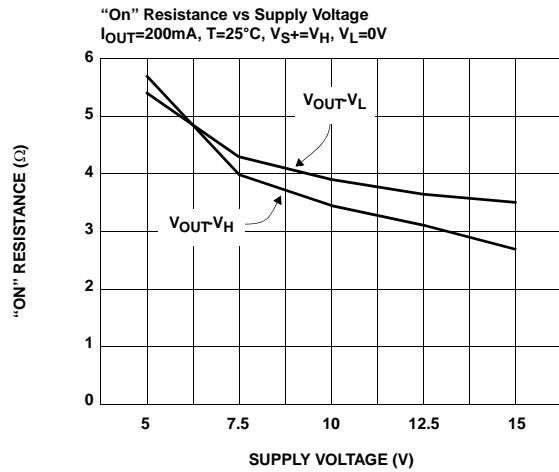
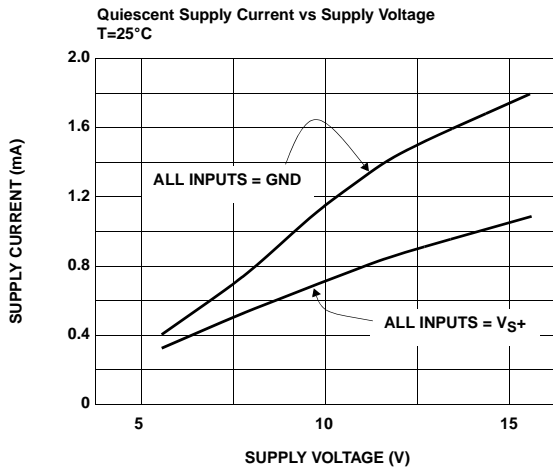
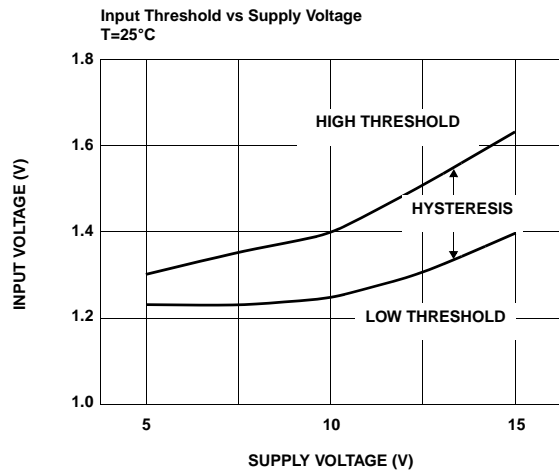
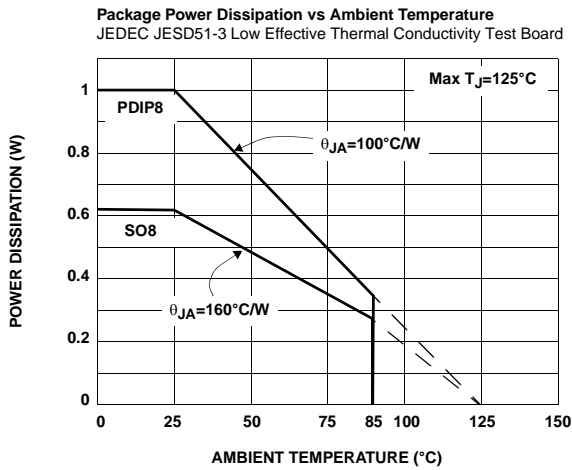
PARAMETER	DESCRIPTION	CONDITION	MIN	TYP	MAX	UNIT
<b>INPUT</b>						
$V_{IH}$	Logic '1' Input Voltage		2.4			V
$I_{IH}$	Logic '1' Input Current	$V_{IH} = V_{S+}$		0.1	10	$\mu\text{A}$
$V_{IL}$	Logic '0' Input Voltage				0.8	V
$I_{IL}$	Logic '0' Input Current	$V_{IL} = 0\text{V}$		0.1	10	$\mu\text{A}$
$C_{IN}$	Input Capacitance			3.5		pF
$R_{IN}$	Input Resistance			50		$\text{M}\Omega$
<b>OUTPUT</b>						
$R_{OVH}$	ON Resistance $V_H$ to $\text{OUT}_H$	$I_{OUT} = -200\text{mA}$		2.7	4.5	$\Omega$
$R_{OVL}$	ON Resistance $V_L$ to $\text{OUT}_L$	$I_{OUT} = +200\text{mA}$		3.5	5.5	$\Omega$
$I_{OUT}$	Output Leakage Current	$\text{OE} = 0\text{V}$ , $\text{OUT}_H = V_L$ , $\text{OUT}_L = V_{S+}$		0.1	10	$\mu\text{A}$
$I_{PK}$	Peak Output Current (linear resistive operation)	Source		3.5		A
		Sink		3.5		A
$I_{DC}$	Continuous Output Current	Source/Sink	200			mA
<b>POWER SUPPLY</b>						
$I_S$	Power Supply Current	Inputs = $V_{S+}$		1.3	3	mA
$I_{VH}$	Off Leakage at $V_H$	$V_H = 0\text{V}$		4	10	$\mu\text{A}$
<b>SWITCHING CHARACTERISTICS</b>						
$t_R$	Rise Time	$C_L = 2000\text{pF}$		14.5		ns
$t_F$	Fall Time	$C_L = 2000\text{pF}$		15		ns
$t_{RF\Delta}$	$t_R$ , $t_F$ Mismatch	$C_L = 2000\text{pF}$		0.5		ns
$t_{D-1}$	Turn-Off Delay Time	$C_L = 2000\text{pF}$		9.5		ns
$t_{D-2}$	Turn-On Delay Time	$C_L = 2000\text{pF}$		10		ns
$t_{D\Delta}$	$t_{D-1}$ - $t_{D-2}$ Mismatch	$C_L = 2000\text{pF}$		0.5		ns
$t_{D-3}$	3-state Delay Enable			10		ns
$t_{D-4}$	3-state Delay Disable			10		ns

# EL7155

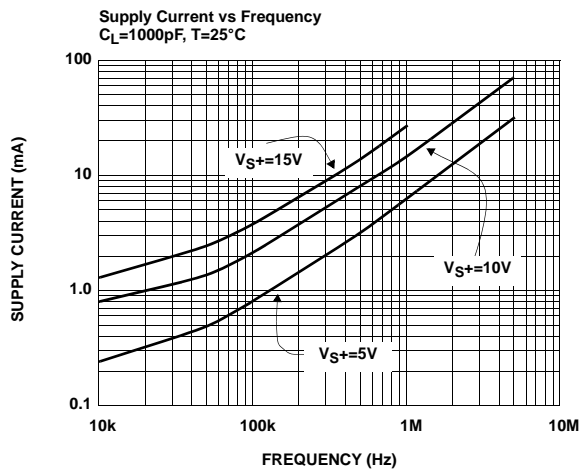
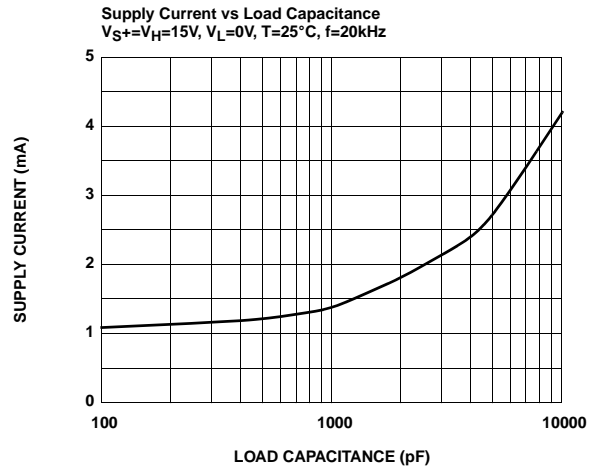
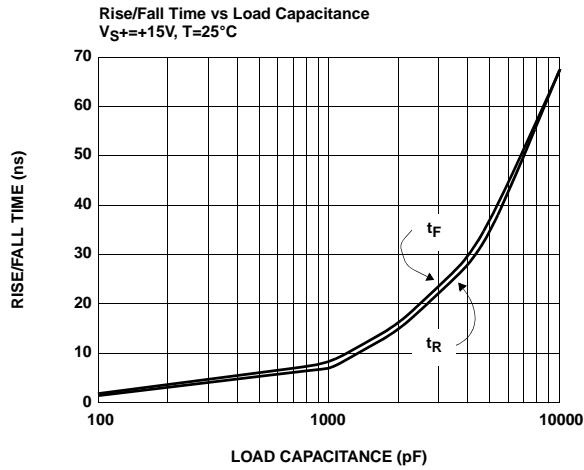
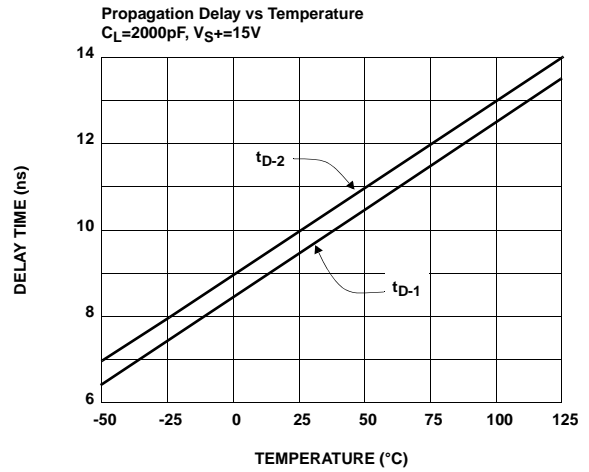
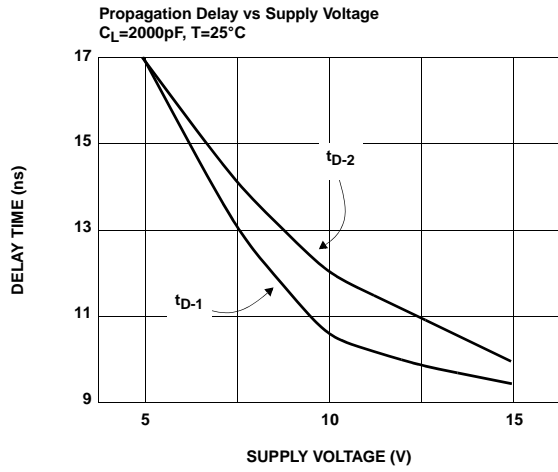
## Electrical Specifications $V_{S+} = +5V, V_H = +5V, V_L = -5V, T_A = 25^\circ C$ , unless otherwise specified.

PARAMETER	DESCRIPTION	CONDITION	MIN	TYP	MAX	UNIT
<b>INPUT</b>						
$V_{IH}$	Logic '1' Input Voltage		2.0			V
$I_{IH}$	Logic '1' Input Current	$V_{IH} = V_{S+}$		0.1	10	$\mu A$
$V_{IL}$	Logic '0' Input Voltage				0.8	V
$I_{IL}$	Logic '0' Input Current	$V_{IL} = 0V$		0.1	10	$\mu A$
$C_{IN}$	Input Capacitance			3.5		pF
$R_{IN}$	Input Resistance			50		$M\Omega$
<b>OUTPUT</b>						
$R_{OVH}$	ON Resistance $V_H$ to $OUT_H$	$I_{OUT} = -200mA$		3.4	5	$\Omega$
$R_{OVL}$	ON Resistance $V_L$ to $OUT_L$	$I_{OUT} = +200mA$		4	6	$\Omega$
$I_{OUT}$	Output Leakage Current	$OE = 0V, OUT_H = V_L, OUT_L = V_{S+}$		0.1	10	$\mu A$
$I_{PK}$	Peak Output Current (linear resistive operation)	Source		3.5		A
		Sink		3.5		A
$I_{DC}$	Continuous Output Current	Source/Sink	200			mA
<b>POWER SUPPLY</b>						
$I_S$	Power Supply Current	Inputs = $V_{S+}$		1	2.5	mA
$I_{VH}$	Off Leakage at $V_H$	$V_H = 0V$		4	10	$\mu A$
<b>SWITCHING CHARACTERISTICS</b>						
$t_R$	Rise Time	$C_L = 2000pF$		17		ns
$t_F$	Fall Time	$C_L = 2000pF$		17		ns
$t_{R\Delta}$	$t_R, t_F$ Mismatch	$C_L = 2000pF$		0		ns
$t_{D-1}$	Turn-Off Delay Time	$C_L = 2000pF$		11.5		ns
$t_{D-2}$	Turn-On Delay Time	$C_L = 2000pF$		12		ns
$t_{D\Delta}$	$t_{D-1} - t_{D-2}$ Mismatch	$C_L = 2000pF$		0.5		ns
$t_{D-3}$	3-state Delay Enable			11		ns
$t_{D-4}$	3-state Delay Disable			11		ns

Typical Performance Curves



Typical Performance Curves (Continued)



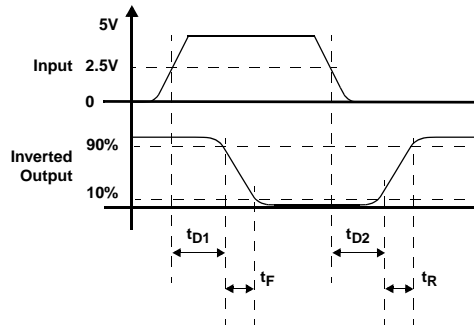
**Truth Table**

OE	IN	V <sub>H</sub> to OUT <sub>H</sub>	OUT <sub>L</sub> to V <sub>S-</sub>
0	0	Open	Open
0	1	Open	Open
1	0	Closed	Open
1	1	Open	Closed

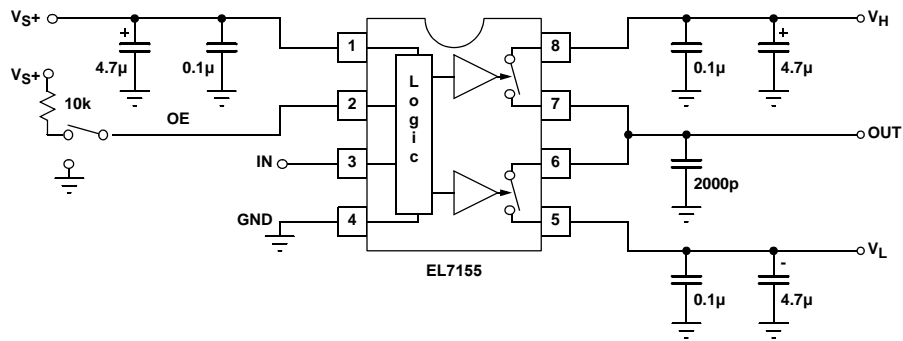
**Operating Voltage Range**

PIN	MIN (V)	MAX (V)
V <sub>L</sub>	-5	0
V <sub>S+</sub> - V <sub>L</sub>	5	16.5
V <sub>H</sub> - V <sub>L</sub>	0	16.5
V <sub>S+</sub> - V <sub>H</sub>	0	16.5
V <sub>S+</sub> - GND	5	16.5
3-State Output	V <sub>L</sub>	V <sub>H</sub>

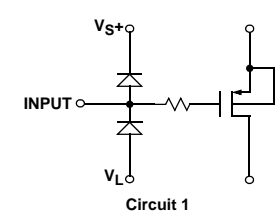
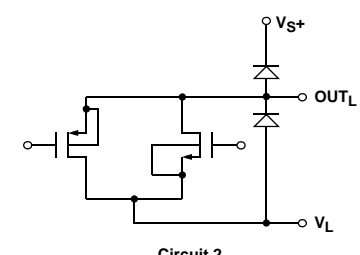
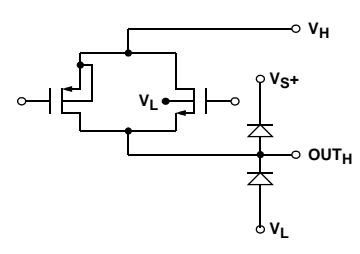
**Timing Diagrams**



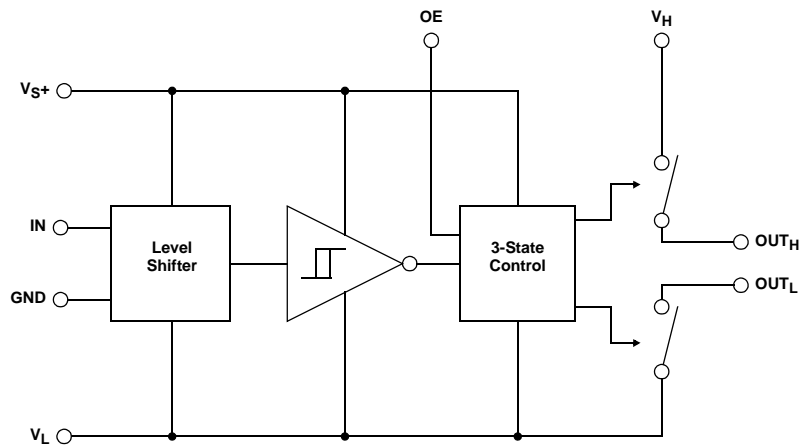
**Standard Test Configuration**



**Pin Descriptions**

Pin	Name	Function	Equivalent Circuit
1	VS+	Positive Supply Voltage	
2	OE	Output Enable	 <p>Circuit 1</p>
3	IN	Input	Reference Circuit 1
4	GND	Ground	
5	VL	Negative Supply Voltage	
6	OUTL	Lower Switch Output	 <p>Circuit 2</p>
7	OUTH	Upper Switch Output	 <p>Circuit 3</p>
8	VH	Upper Output Voltage	

**Block Diagram**



## Applications Information

### Product Description

The EL7155 is a high performance 40MHz pin driver. It contains two analog switches connecting  $V_H$  to  $OUT_H$  and  $V_L$  to  $OUT_L$ . Depending on the value of the IN pin, one of the two switches will be closed and the other switch open. An output enable (OE) is also supplied which opens both switches simultaneously.

Due to the topology of the EL7155,  $V_L$  should always be connected to a voltage equal to, or lower than GND.  $V_H$  can be connected to any voltage between  $V_L$  and the positive supply,  $V_{S+}$ .

The EL7155 is available in both the 8 Ld SO and the 8 Ld PDIP packages. The relevant package should be chosen depending on the calculated power dissipation.

### 3-state Operation

When the OE pin is low, the output is 3-state (floating.) The output voltage is the parasitic capacitance's voltage. It can be any voltage between  $V_H$  and  $V_L$ , depending on the previous state. At 3-state, the output voltage can be pushed to any voltage between  $V_H$  and  $V_L$ . The output voltage can't be pushed higher than  $V_H$  or lower than  $V_L$  since the body diode at the output stage will turn on.

### Supply Voltage Range and Input Compatibility

The EL7155 is designed for operation on supplies from 5V to 15V (4.5V to 16.5V maximum). The table on page 6 shows the specifications for the relationship between the  $V_{S+}$ ,  $V_H$ ,  $V_L$ , and GND pins.

All input pins are compatible with both 3V and 5V CMOS signals. With a positive supply ( $V_{S+}$ ) of 5V, the EL7155 is also compatible with TTL inputs.

### Power Supply Bypassing

When using the EL7155, it is very important to use adequate power supply bypassing. The high switching currents developed by the EL7155 necessitate the use of a bypass capacitor between the  $V_{S+}$  and GND pins. It is recommended that a 2.2 $\mu$ F tantalum capacitor be used in parallel with a 0.1 $\mu$ F low-inductance ceramic MLC capacitor. These should be placed as close to the supply pins as possible. It is also recommended that the  $V_H$  and  $V_L$  pins have some level of bypassing, especially if the EL7155 is driving highly capacitive loads.

### Power Dissipation Calculation

When switching at high speeds, or driving heavy loads, the EL7155 drive capability is limited by the rise in die temperature brought about by internal power dissipation. For reliable operation die temperature must be kept below  $T_{JMAX}$  (125°C). It is necessary to calculate the power dissipation for a given application prior to selecting the package type.

Power dissipation may be calculated:

$$PD = (V_S \times I_S) + (C_{INT} \times V_S^2 \times f) + (C_L \times V_{OUT}^2 \times f)$$

where:

$V_S$  is the total power supply to the EL7155 (from  $V_{S+}$  to GND)

$V_{OUT}$  is the swing on the output ( $V_H - V_L$ )

$C_L$  is the load capacitance

$C_{INT}$  is the internal load capacitance (100pF max)

$I_S$  is the quiescent supply current (3mA max)

$f$  is frequency

Having obtained the application's power dissipation, a maximum package thermal coefficient may be determined, to maintain the internal die temperature below  $T_{JMAX}$ :

$$\theta_{JA} = \frac{(T_{JMAX} - T_{MAX})}{PD}$$

where:

$T_{JMAX}$  is the maximum junction temperature (125°C)

$T_{MAX}$  is the maximum operating temperature

PD is the power dissipation calculated above

$\theta_{JA}$  thermal resistance on junction to ambient

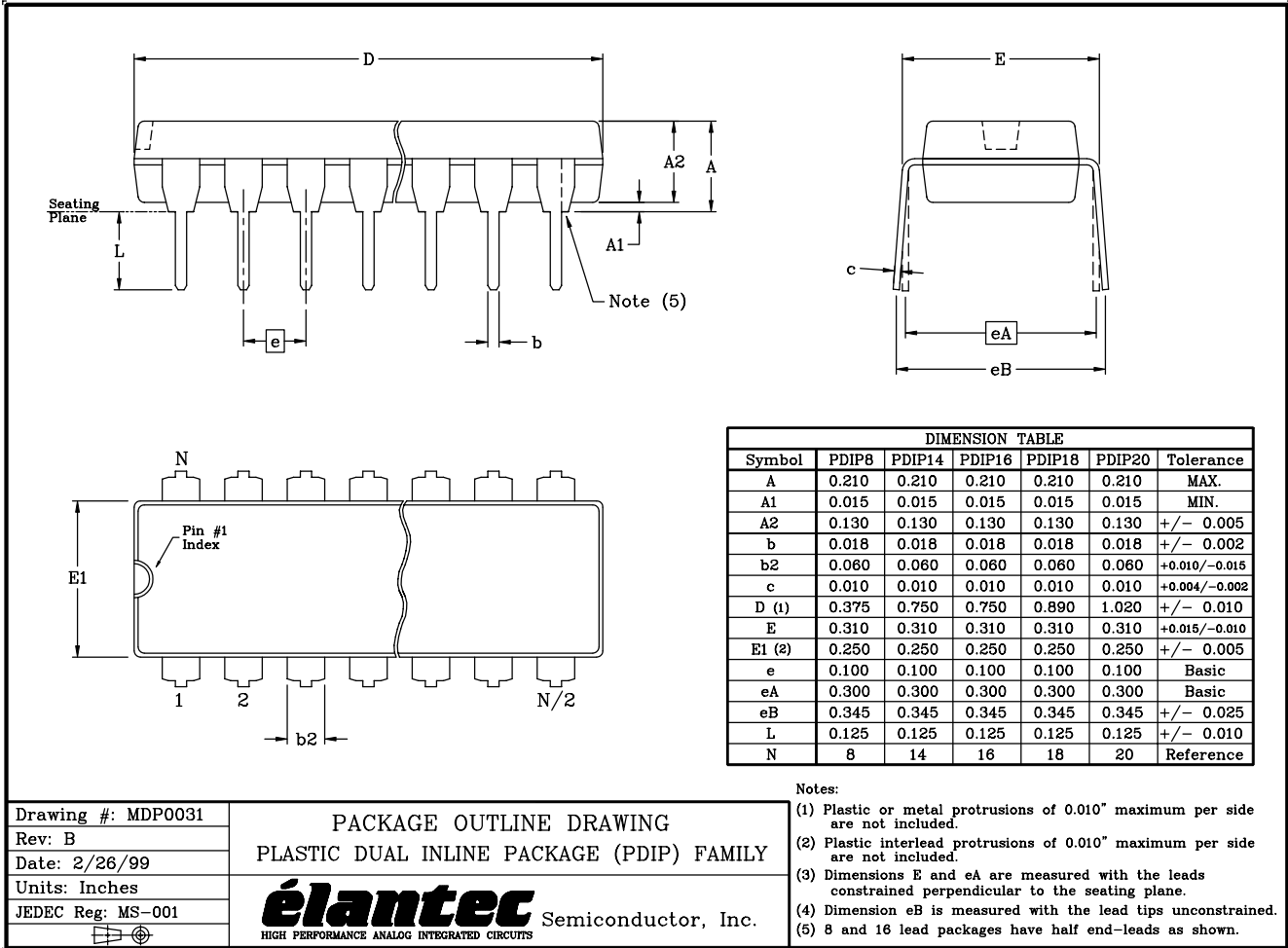
$\theta_{JA}$  is 160°C/W for the SO8 package and 100°C/W for the PDIP8 package when using a standard JEDEC JESD51-3 single-layer test board. If  $T_{JMAX}$  is greater than 125°C when calculated using the equation above, then one of the following actions must be taken:

Reduce  $\theta_{JA}$  the system by designing more heat-sinking into the PCB (as compared to the standard JEDEC JESD51-3)

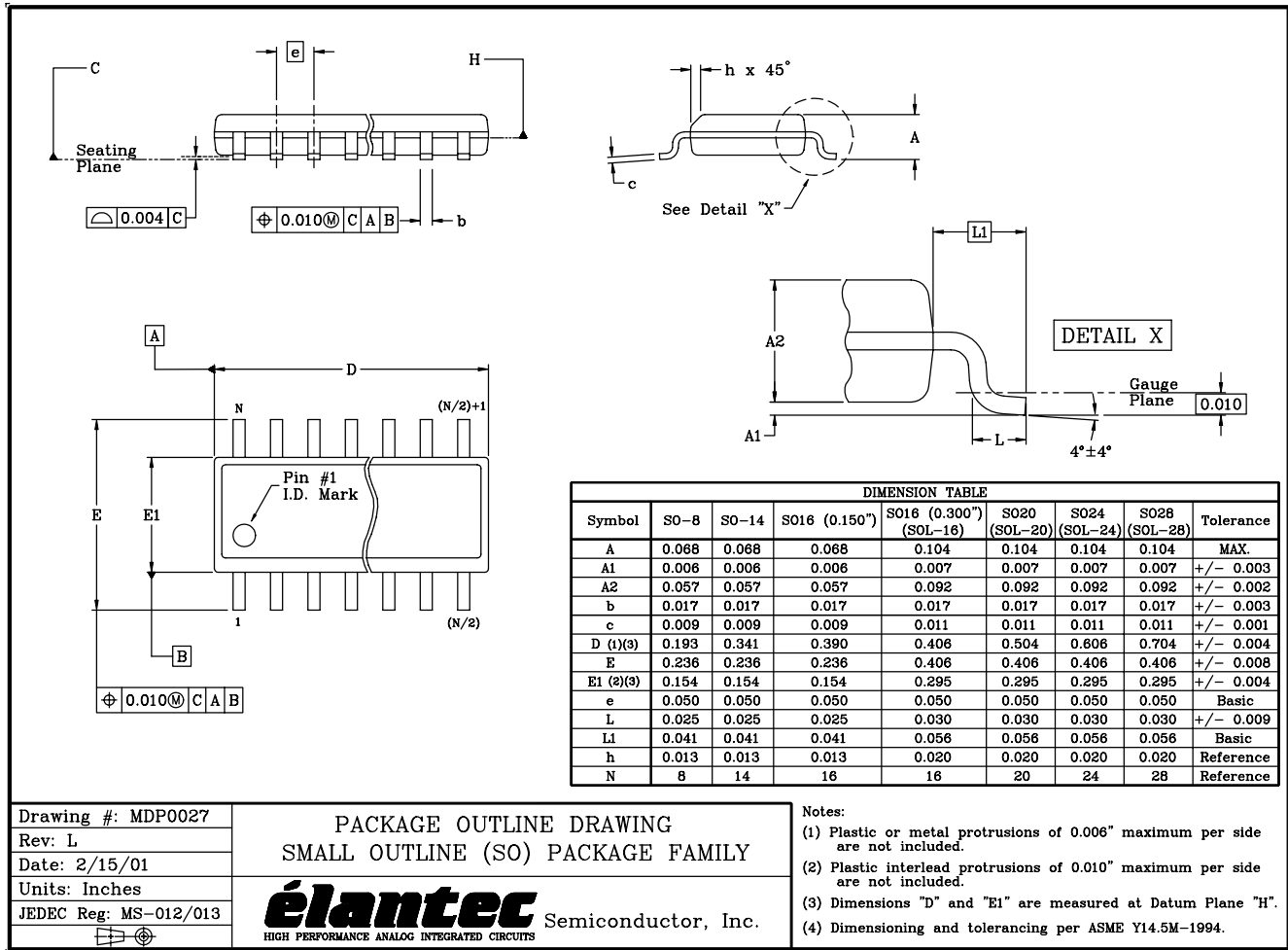
Use the PDIP8 instead of the SO8 package

De-rate the application either by reducing the switching frequency, the capacitive load, or the maximum operating (ambient) temperature ( $T_{MAX}$ )





Drawing #: MDP0031	<p style="text-align: center;">PACKAGE OUTLINE DRAWING PLASTIC DUAL INLINE PACKAGE (PDIP) FAMILY</p> <p style="text-align: center;"><b>élan</b>tec HIGH PERFORMANCE ANALOG INTEGRATED CIRCUITS</p> <p style="text-align: center;">Semiconductor, Inc.</p>
Rev: B	
Date: 2/26/99	
Units: Inches	
JEDEC Reg: MS-001	



Drawing #: MDP0027  
 Rev: L  
 Date: 2/15/01  
 Units: Inches  
 JEDEC Reg: MS-012/013

PACKAGE OUTLINE DRAWING  
 SMALL OUTLINE (SO) PACKAGE FAMILY

**élan** Semiconductor, Inc.  
 HIGH PERFORMANCE ANALOG INTEGRATED CIRCUITS

- Notes:
- (1) Plastic or metal protrusions of 0.006" maximum per side are not included.
  - (2) Plastic interlead protrusions of 0.010" maximum per side are not included.
  - (3) Dimensions "D" and "E1" are measured at Datum Plane "H".
  - (4) Dimensioning and tolerancing per ASME Y14.5M-1994.

NOTE: The package drawing shown here may not be the latest version. To check the latest revision, please refer to the Intersil website at <http://www.intersil.com/design/packages/index.asp>

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