

## 30 VOLT QUAD-CHANNEL DIFFERENTIAL LINE DRIVER

January 2020

### FEATURES:

- More feature-rich and cost-effective than the OL7272 and ET7273
- Pin to pin replaceable with the OL7272 and functionally equivalent to the ET7273
- Push-Pull or Open-Drain output drivers (LS7272E)
- Open-Drain output drivers only (LS7273E)
- Voltage Range: 4.5V – 30V ( $V_{DD} - V_{SS}$ )
- 120mA Sink/Source output drive
- Operating frequency up to 2 MHz
- Thermal shutdown protection for output driver overload
- Enable input with Thermal Shutdown disconnect feature
- Outputs RS422A compatible
- Inputs CMOS/TTL compatible with hysteresis
- Output drivers fully connected or high-impedance state

### PART NUMBER ORDERING INFORMATION:

This part is available in three package styles, DIP, SOIC, and TSSOP.

For DIP packages: LS7272E, LS7272E-F, LS7273E, LS7272E-20, LS7273E-20  
For SOIC packages: LS7272E-S, LS7272E-F-S, LS7273E-S, LS7272E-S20, LS7273E-S20  
For TSSOP packages: LS7272E-TS, LS7272E-F-TS, LS7273E-TS, LS7272ETS20, LS7273ETS20

### DESCRIPTION:

The LS7272E/LS7273E are short-circuit proof Quad Differential Industrial Power Line Drivers. They can operate up to 30V and have a selectable thermal shutdown feature.

The Data inputs are TTL / CMOS compatible and can also be driven up to the supply voltage  $V_{DD}$ . The ENA input can be used to place all the outputs in a high impedance state. For the LS7272E the OPD input is used to connect the outputs as push-pull drivers or open-drain drivers, where the outputs can be returned through external loads to a maximum voltage of  $V_{DD}$ .

Pin4 is a no-connect in LS7272E-F. LS7272E-F has the outputs always in push-pull mode.

For the LS7273, pin4 is  $\overline{LOW}$  and is tied to ground. The outputs are open drain and the loads can be returned to any voltage between 4.5V and 30V independent of  $V_{DD}$ .

An internal 5V regulated supply is used to power the logic and level converter blocks.

The thermal shutdown block located in the center of the IC can be disabled by setting the  $\overline{ENA}$  input, Pin 12, to a voltage between 7.5V and 12V.

Upon power-up, a Power-On-Reset (POR) circuit block forces all output drivers to the high-impedance state until the power supply voltage reaches a nominal 3.8V. Included in the POR circuit block is a hysteresis of 100mV such that if the power supply drops below 3.7V all output drivers are forced to the high-impedance state until the voltage rises above 3.8V. There is a built-in 5 $\mu$ s delay for disabling the output drivers should the power supply drop below 3.7V. The output drivers are immediately enabled when the voltage rises above 3.8V.

### PIN ASSIGNMENT – TOP VIEW

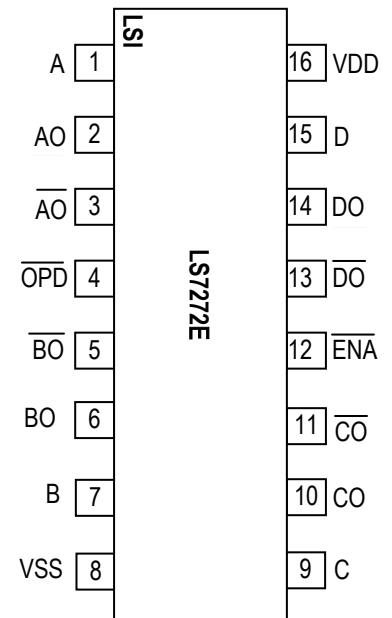


FIGURE 1

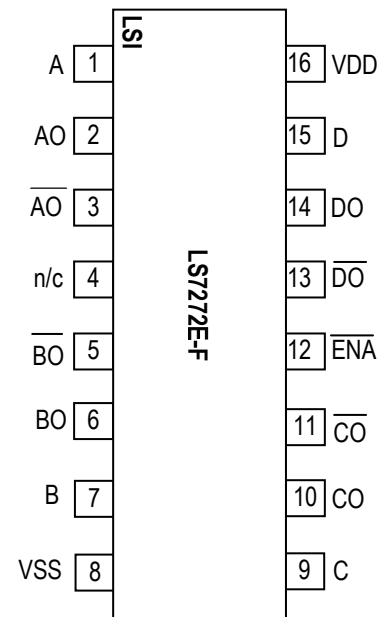


FIGURE 1A

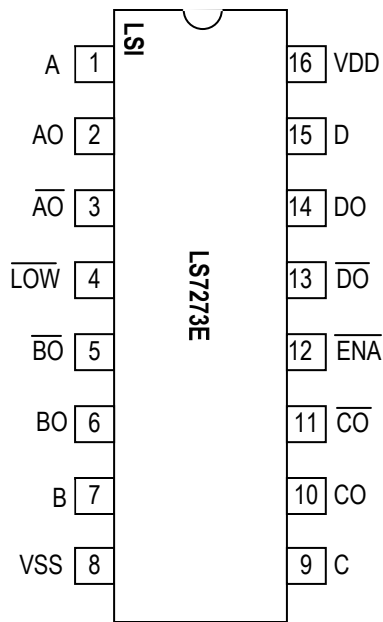


FIGURE 2

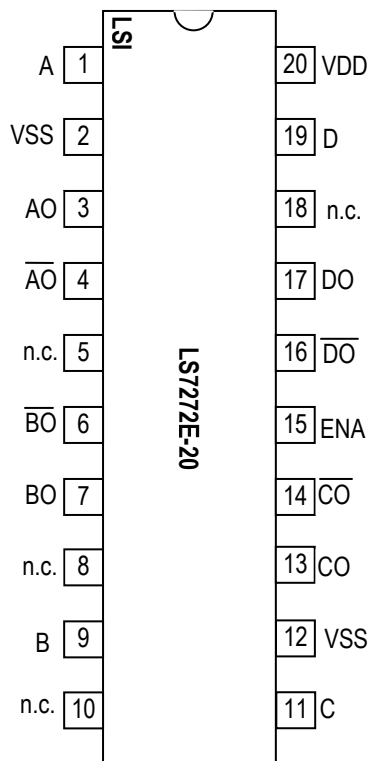


FIGURE 3

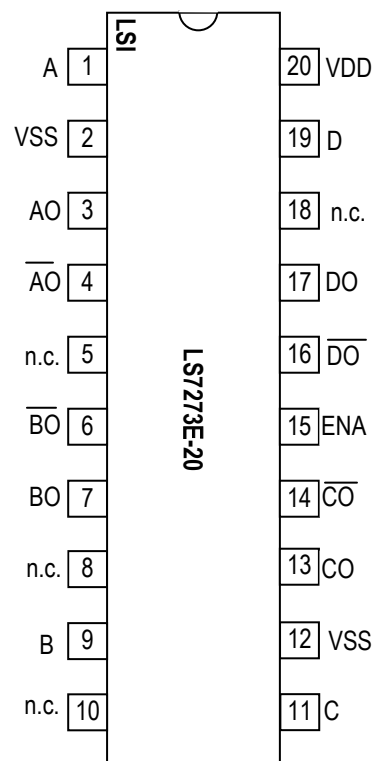


FIGURE 4

NOTE: LS7272E-20 does not have  $\overline{\text{OPD}}$  pin.

#### INPUT / OUTPUT DESCRIPTION:

##### A / B / C / D

These are CMOS / TTL data inputs that can also operate with input levels up to the  $V_{DD}$  power supply. All data input blocks contain hysteresis.

##### AO / BO / CO / DO / $\overline{\text{AO}}$ / $\overline{\text{BO}}$ / $\overline{\text{CO}}$ / $\overline{\text{DO}}$

These outputs can be selected to be push-pull or open-drain using the  $\overline{\text{OPD}}$  input pin (LS7272E only). When in push-pull mode, outputs switch between  $V_{DD}$  and  $V_{SS}$  (Ground).

##### $\overline{\text{ENA}}$

A logic low on this CMOS / TTL compatible input enables the output drivers while logic high forces them into a high-impedance state. This input is also used to enable / disable the output short circuit thermal protection.

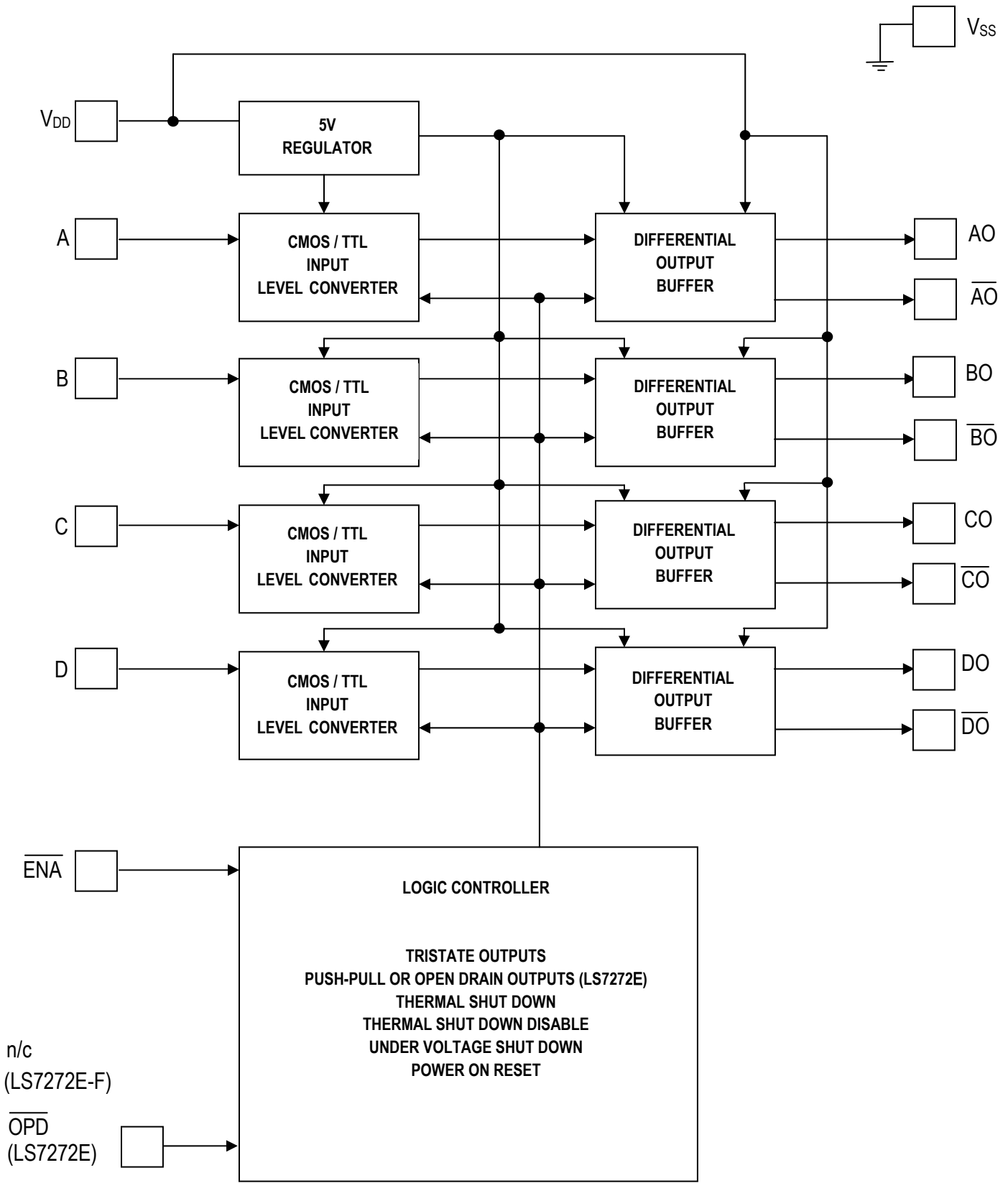
Applying a voltage between 7.5V and 12.5V to the  $\overline{\text{ENA}}$  input will disable the thermal shutdown protection function. When using this feature, the Line Driver Outputs are enabled but no longer protected.

##### $\overline{\text{OPD}}$ (LS7272E only)

A logic low on this connects the outputs as open-drain drivers. If this input is left floating, the outputs are connected as push-pull drivers.

##### $\overline{\text{LOW}}$ (LS7273E only)

This pin must be tied low.



n/c  
(LS7272E-F)

$\overline{OPD}$   
(LS7272E)

(LS7273E)

LOW

Should be tied Low.

FIGURE 4 LS7272E / LS7272E-F / LS7273E BLOCK DIAGRAM

## ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit	
DC Supply Voltage	$V_{DD}$	36	V	
Data Output Voltage	$V_{OUT}$	$V_{DD} + 0.3$	V	
Data Output Voltage	$V_{OUT}$	4.5 to 36	V	Applicable only to LS7273.
Drive Output Current per output	$I_{OUT}$	120	mA average	
Data Input Voltage	$V_{IND}$	$V_{DD} + 0.3$	V	
$\overline{ENA}$ Input Voltage	$V_{INE}$	18	V	
$\overline{OPD}$ Input Voltage	$V_{INO}$	5	V	Applicable only to LS7272E.
$\overline{LOW}$ Input Voltage	$V_{INL}$	5	V	Applicable only to LS7273E.
Operating Temperature	$T_A$	-55 to +125	°C	
Storage Temperature	$T_{STG}$	-65 to +150	°C	

## RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value	Unit	
DC Supply Voltage	$V_{DD}$	4.5 to 30	V	
Data Input Voltage	$V_{IND}$	0 to $V_{DD}$	V	
$\overline{ENA}$ Input Voltage	$V_{INE}$	0 to 5.5	V	
Data Output Voltage	$V_{OUT}$	0 to $V_{DD}$	V	
Data Output Voltage	$V_{OUT}$	4.5 to 30	V (LS7273E)	
Data Output Current per output	$I_{OUT}$	100	mA	See load characteristics
Operating Temperature	$T_{OP}$	-40 to +125	°C	
$\overline{OPD}$	$V_{INO}$	0 to float	V (LS7272E)	
$\overline{LOW}$	$V_{INL}$	0	V (LS7273E)	

## ELECTRICAL CHARACTERISTICS

(V<sub>DD</sub> = 12V, T<sub>A</sub> = 25°C, unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
<b>Inputs:</b>						
Data Input High-Threshold	V <sub>DH</sub>	-	1.7	2.4	V	$\overline{\text{ENA}} \leq 0.8\text{V}$
Data Input Low Threshold	V <sub>DL</sub>	0.8	1.2	-	V	$\overline{\text{ENA}} \leq 0.8\text{V}$
Data Input Hysteresis	V <sub>DHY</sub>	-	0.5	-	V	$\overline{\text{ENA}} \leq 0.8\text{V}$
$\overline{\text{ENA}} / \overline{\text{OPD}}$ Input High-Threshold	V <sub>EH</sub>	-	1.7	2.4	V	-
$\overline{\text{ENA}} / \overline{\text{OPD}}$ Input Low-Threshold	V <sub>EL</sub>	0.8	1.2	-	V	-
$\overline{\text{ENA}} / \overline{\text{OPD}}$ Input Hysteresis	V <sub>EHY</sub>	-	0.5	-	V	-
<b>Inputs:</b>						
Leakage Current	I <sub>LKG</sub>	-5		+5	μA	
$\overline{\text{ENA}}$	I <sub>ESO</sub>	-	100		μA	$\overline{\text{ENA}} = 12\text{V}$
$\overline{\text{OPD}}, \overline{\text{LOW}}$	I <sub>DSI</sub>		-30	-	μA	$\overline{\text{OPD}}, \overline{\text{LOW}} = 0\text{V}$
<b>Outputs:</b>						
High-Level Output Voltage (LS7272E only)	V <sub>OH</sub>		V <sub>DD</sub> - 0.4		V	I <sub>LOAD</sub> = 20mA, V <sub>DD</sub> = 4.75V
	V <sub>OH</sub>		V <sub>DD</sub> - 0.6	-	V	I <sub>LOAD</sub> = 30mA, V <sub>DD</sub> = 30V
Output Resistance	R <sub>DSON</sub>	-	20	-	Ω	I <sub>LOAD</sub> = 30mA
Low Voltage Output Voltage	V <sub>OL</sub>	-	0.3	-	V	I <sub>LOAD</sub> = -20mA, V <sub>DD</sub> = 4.75V
	V <sub>OL</sub>	-	0.4	-	V	I <sub>LOAD</sub> = -30mA, V <sub>DD</sub> = 30V
Quiescent Current	I <sub>DD</sub>	6	-	15	mA	
<b>High-Impedance Output</b>						
Leakage Current (Outputs Disabled)	I <sub>OT</sub>	-10		+10	μA	V <sub>DD</sub> = 20V, 2.4V < $\overline{\text{ENA}}$ < 7.5V
<b>Reset:</b>						
Power-On-Reset (POR)	V <sub>POR</sub>	-	3.6		V	-
POR Hysteresis	V <sub>PORH</sub>		0.1	-	V	-
POR Removal Time	T <sub>PORR</sub>	-	5	-	μS	-
<b>Over-Temperature Protection:</b>						
Junction Temperature Operate Point	T <sub>JTO</sub>		165	185	°C	
Junction Temperature Release Point	T <sub>JTR</sub>	100	135		°C	
$\overline{\text{ENA}}$ Input (Over Temp Protection Inhibit)	V <sub>EPI</sub>	7.0		12.5	V	

NOTE 1: When the thermal shutdown is inhibited, the driver might be destroyed if it is not operated within its normal operating conditions.

NOTE 2: Add 0.1μF to OPD input when the device is used in push-pull mode.

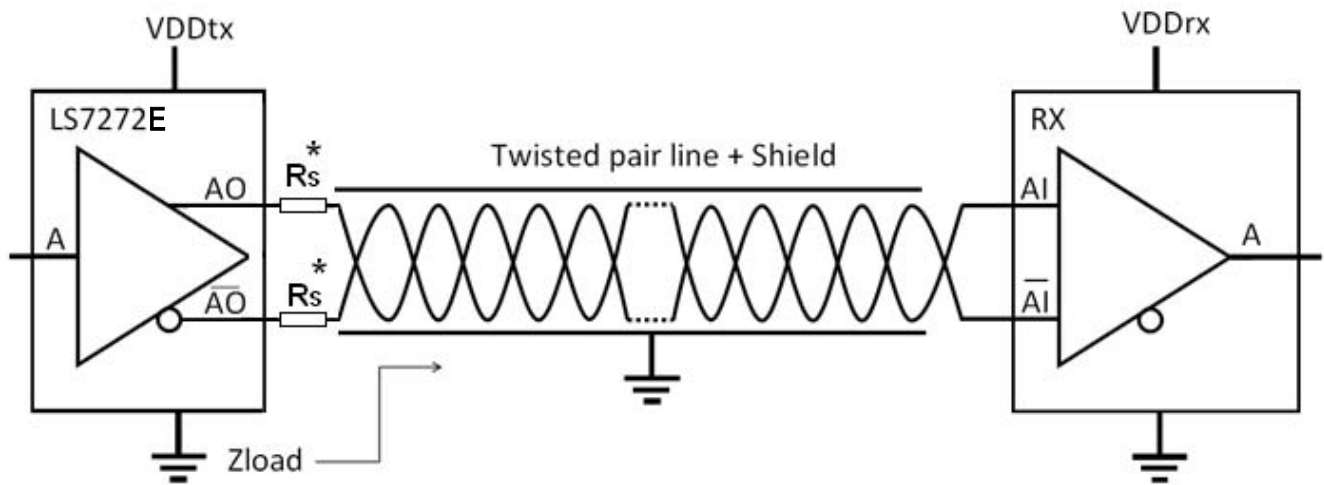
## AC SWITCHING CHARACTERISTICS

(V<sub>DD</sub> = 12V, T<sub>A</sub> = 25°C, Load Capacitance = 1000 pF)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Propagation delay from 50% point of input rising edge to zero crossing of differential outputs	T <sub>PLH</sub>	-	105	150	ns	V <sub>DD</sub> = 5V (LS7272E only)
		-	112	200	ns	V <sub>DD</sub> = 12V (LS7272E only)
		-	135	250	ns	V <sub>DD</sub> = 24V (LS7272E only)
Propagation delay from 50% point of input rising edge to zero crossing of differential outputs	T <sub>PHL</sub>	-	105	150	ns	V <sub>DD</sub> = 5V
		-	112	280	ns	V <sub>DD</sub> = 12V
		-	135	330	ns	V <sub>DD</sub> = 24V
Output Rise Time	T <sub>R</sub>	-	64	125	ns	V <sub>DD</sub> = 5V (LS7272E only)
		-	75	150	ns	V <sub>DD</sub> = 12V (LS7272E only)
		-	98	175	ns	V <sub>DD</sub> = 24V (LS7272E only)
Output Fall Time	T <sub>F</sub>	-	65	125	ns	V <sub>DD</sub> = 5V
		-	73	175	ns	V <sub>DD</sub> = 12V
		-	101	250	ns	V <sub>DD</sub> = 24V
$\overline{\text{ENA}}$ Enable Time	T <sub>ON</sub>	-	60	200	ns	-
$\overline{\text{ENA}}$ Disable Time	T <sub>OFF</sub>	-	80	200	ns	-

The information included herein is believed to be accurate and reliable. However, LSI Computer Systems, Inc. assumes no responsibilities for inaccuracies, or for any infringements of patent rights of others which may result from its use.

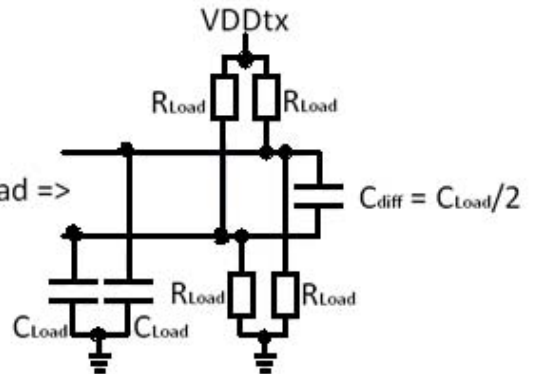
**Typical Differential Driver Load Characteristics :**



$VDDtx/R_L \approx 30mA$

VDDtx	5V	12V	24V	30V
RLoad	120 Ω	330 Ω	680 Ω	820 Ω

Simplified Zload =>



**\* NOTE:** Add series resistors (Rs) in case of abnormal situation where any of the LS7272E's outputs are subject to voltages when either power pins are not connected. See table below.

VDD	Rs
≤ 10V	≥ 10Ω
10V ≤ VDD ≤ 15V	≥ 25Ω
15V ≤ VDD ≤ 30V	≥ 50Ω