

DS3896/DS3897 BTL Trapezoidal™ Transceivers

General Description

These advanced transceivers are specifically designed to overcome problems associated with driving a densely populated backplane, and thus provide significant improvement in both speed and data integrity. Their low output capacitance, low output signal swing and noise immunity features make them ideal for driving low impedance buses with minimum power consumption.

The DS3896 is an octal high speed schottky bus transceiver with common control signals, whereas the DS3897 is a quad device with independent driver input and receiver output pins. The DS3897 has a separate driver disable for each driver and is, therefore, suitable for arbitration lines. The separate driver disable pins (En) feature internal pull ups and may be left open if not required. On the other hand, the DS3896 provides high package density for data/address lines.

The open collector drivers generate precise trapezoidal waveforms, which are relatively independent of capacitive loading conditions on the outputs. This significantly reduces noise coupling to adjacent lines. In addition, the receivers use a low pass filter in conjunction with a high speed comparator, to further enhance the noise immunity and provide equal rejection to both negative and positive going noise pulses on the bus.

To minimize bus loading, these devices also feature a schottky diode in series with the open collector output that isolates the driver output capacitance in the disabled state. The output low voltage is typically "1V" and the output high level is intended to be 2V. This is achieved by terminating the bus

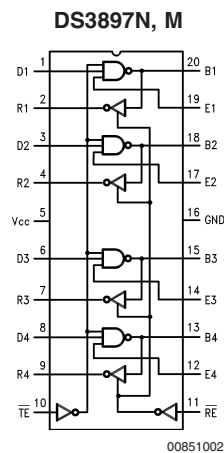
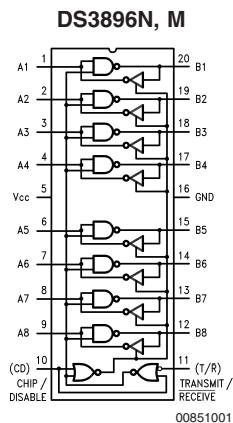
with a pull up resistor to 2V at both ends. The device can drive an equivalent DC load of 18.5Ω (or greater) in the above configuration.

These signalling requirements, including a 1 volt signal swing, low output capacitance and precise receiver thresholds are referred to as Bus Transceiver Logic (BTL).

Features

- 8 bit DS3896 transceiver provides high package density
- 4 bit DS3897 transceiver provides separate driver input and receiver output pins
- BTL compatible
- Less than 5 pF output capacitance for minimal bus loading
- 1 Volt bus signal swing reduces power consumption
- Trapezoidal driver waveforms (t_r , $t_f \approx 6$ ns typical) reduce noise coupling to adjacent lines
- Temperature insensitive receiver thresholds track the bus logic high level to maximize noise immunity in both high and low states
- Guaranteed A.C. specifications on noise immunity and propagation delay over the specified temperature and supply voltage range
- Open collector driver output allows wire-or connection
- Advanced low power schottky technology
- Glitch free power up/down protection on driver and receiver outputs
- TTL compatible driver and control inputs and receiver outputs

Logic Diagrams



Order Numbers DS3896M, DS3896N, DS3897M or DS3897N
See NS Package Number M20B or N20A

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	6V
Control Input Voltage	5.5V
Driver Input and Receiver Output	5.5V
Receiver Input and Driver Output	2.5V
Power Dissipation at 70°C N	
Package	1480 mW
M Package	TBD mW

Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 4 sec.)	260°C

Recommended Operating Conditions

	Min	Max	Units
Supply Voltage, V_{CC}	4.75	5.25	V
Bus Termination Voltage	1.90	2.10	V
Operating Free Air Temperature	0	70	°C

Electrical Characteristics: (Notes 2, 3)

(0°C ≤ T_A ≤ 70°C, 4.75V ≤ V_{CC} ≤ 5.25V unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Driver and Control Inputs: (An, Dn, En, CD, T/R, RE, TE)						
V_{IH}	Logical "1" Input Voltage		2.0			V
V_{IL}	Logical "0" Input Voltage				0.8	V
I_I	Logical "1" Input Current	An = Dn = En = V_{CC}			1	mA
I_{IH}	Logical "1" Input Current	An = Dn = En = 2.4V			40	μA
I_{IHC}	Logical "1" Input Current	CD = T/R = RE = TE = 2.4V			80	μA
I_{IL}	Logical "0" Input Current	An = Dn = En = 0.4V		-1	-1.6	mA
I_{ILC}	Logical "0" Input Current	CD = T/R = RE = TE = 0.4V		-180	-400	μA
V_{CL}	Input Diode Clamp Voltage	Iclamp = -12 mA		-0.9	-1.5	V
Driver Output/Receiver Input: (Bn)						
V_{OLB}	Low Level Bus Voltage	An = Dn = En = T/R = 2V, VL = 2V RL = 18.5Ω, CD = TE = 0.8V (Figure 1)	0.75	1.0	1.2	V
I_{IHB}	Maximum Bus Current (Power On)	An = Dn = En = 0.8V, V_{CC} = 5.25V Bn = 2V		10	100	μA
I_{ILB}	Maximum Bus Current (Power Off)	An = Dn = En = 0.8V, V_{CC} = 0V Bn = 2V			100	μA
V_{TH}	Receiver Input Threshold	V_{CC} = 5V	1.47	1.55	1.62	V
Receiver Output: (An, Rn)						
V_{OH}	Logical "1" Output Voltage	Bn = 1.2V, I_{OH} = -400 μA CD = T/R = RE = 0.8V	2.4	3.2		V
V_{OL}	Logical "0" Output Voltage	Bn = 2V, I_{OL} = 16 mA CD = T/R = RE = 0.8V		0.35	0.5	V
I_{OS}	Output Short Circuit Current	Bn = 1.2V CD = T/R = RE = 0.8V	-20	-70	-100	mA
I_{CC}	Supply Current (DS3896)	V_{CC} = 5.25V		90	135	mA
I_{CC}	Supply Current (DS3897)	V_{CC} = 5.25V		50	80	mA

Note 1: "Absolute maximum ratings" are those beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The table of "Electrical Characteristic" provide conditions for actual device operation.

Note 2: All currents into device pins are positive; all currents out of device pins are negative. All voltages are referenced to device ground unless otherwise specified.

Note 3: All typicals are given for V_{CC} = 5V and T_a = 25°C.

DS3896 Switching Characteristics

(0°C ≤ T_A ≤ 70°C, 4.75V ≤ V_{CC} ≤ 5.25V unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Driver:						
t_{DLH}	An to Bn	CD = 0.8V, T/R = 2.0V, VL = 2V	5	9	15	ns
t_{DHL}		(Figure 2)	5	9	15	ns

DS3896 Switching Characteristics (Continued) $(0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}, 4.75\text{V} \leq V_{CC} \leq 5.25\text{V}$ unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Driver:						
t_{DLHC}	CD to Bn	An = T/\bar{R} = 2.0V, VL = 2V (Figure 2)	5	10	18	ns
t_{DHLC}			5	12	20	ns
t_{DLHT}	T/\bar{R} to Bn	VCI = An, VC = 5V, (Figure 5) CD = 0.8V, RC = 390 Ω , CL = 30 pF RL1 = 18 Ω , RL2 = NC, VL = 2V	5	15	25	ns
t_{DHLT}			5	22	35	ns
t_R	Driver Output Rise Time	CD = 0.8V, T/\bar{R} = 2V, VL = 2V (Figure 2)	3	6	10	ns
t_F	Driver Output Fall Time		3	6	10	ns
Receiver:						
t_{RLH}	Bn to An	CD = 0.8V, T/\bar{R} = 0.8V (Figure 3)	5	12	18	ns
t_{RHL}			5	10	18	ns
t_{RLZC}	CD to An	Bn = 2.0V, T/\bar{R} = 0.8V, CL = 5 pF RL1 = 390 Ω , RL2 = NC, VL = 5V (Figure 4)	5	10	18	ns
t_{RZLC}			5	8	15	ns
t_{RHZC}			2	4	8	ns
t_{RZHC}			3	7	12	ns
t_{RLZT}	T/\bar{R} to An	VCI = Bn, VC = 2V, RC = 18 Ω , CD = 0.8V, VL = 5V, RL1 = 390 Ω , RL2 = NC, CL = 5 pF (Figure 5)	5	10	18	ns
t_{RZLT}			14	24	40	ns
t_{RHZT}			2	4	8	ns
t_{RZHT}			2	8	15	ns
t_{NR}	Receiver Noise Rejection Pulse Width	(Figure 6)	3	6		ns

Note: NC means open

DS3897 Switching Characteristics $(0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}, 4.75\text{V} \leq V_{CC} \leq 5.25\text{V}$ unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Driver:						
t_{DLH}	Dn, En to Bn	$\bar{T}\bar{E}$ = 0.8V, $\bar{R}\bar{E}$ = 2.0V, VL = 2V (Figure 2)	5	9	15	ns
t_{DHL}			5	9	15	ns
t_{DLHT}	$\bar{T}\bar{E}$ to Bn	An = $\bar{R}\bar{E}$ = 2.0V, VL = 2V, (Figure 2) RC = 390 Ω , VCI = An, VC = 5V, CL = 30 pF RL1 = 18 Ω , RL2 = NC, VL = 2V (Figure 5)	5	10	18	ns
t_{DHHT}			5	12	20	ns
t_R	Driver Output Rise Time	CD = 0.8V, T/\bar{R} = 2V, VL = 2V (Figure 2)	3	6	10	ns
t_F	Driver Output Fall Time		3	6	10	ns
Receiver:						
t_{RLH}	Bn to Rn	$\bar{T}\bar{E}$ = 2.0V, $\bar{R}\bar{E}$ = 0.8V (Figure 3)	5	10	18	ns

DS3897 Switching Characteristics (Continued)

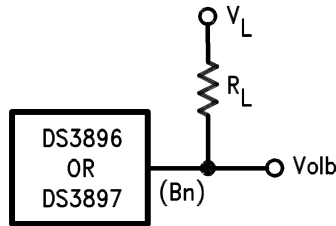
($0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$, $4.75\text{V} \leq V_{CC} \leq 5.25\text{V}$ unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{RHL}			5	12	18	ns
t_{RLZR}	\overline{RE} to Rn	$Bn = \overline{TE} = 2\text{V}$, $VL = 5\text{V}$, $CL = 5\text{ pF}$ $RL1 = 390\Omega$, $RL2 = \text{NC}$ (Figure 4)	5	10	18	ns
t_{RZLR}		$Bn = \overline{TE} = 2\text{V}$, $VL = 5\text{V}$, $CL = 30\text{ pF}$ $RL1 = 390\Omega$, $RL2 = 1.6\text{k}$ (Figure 4)	5	8	15	ns
t_{RHZR}		$Bn = 0.8\text{V}$, $\overline{TE} = 2\text{V}$, $VL = 0\text{V}$, $RL1 = 390\Omega$, $RL2 = \text{NC}$, $CL = 5\text{ pF}$ (Figure 4)	2	4	8	ns
t_{RZHR}		$Bn = 0.8\text{V}$, $\overline{TE} = 2\text{V}$, $VL = 0\text{V}$, $RL1 = \text{NC}$, $RL2 = 1.6\text{k}$, $CL = 30\text{ pF}$ (Figure 4)	3	7	12	ns
t_{NR}		Receiver Noise Rejection Pulse Width (Figure 6)	3	6		ns

Driver plus Receiver:

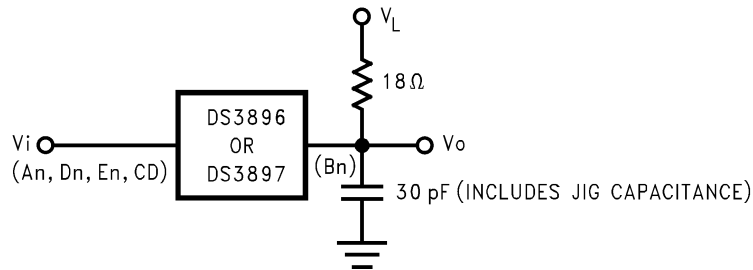
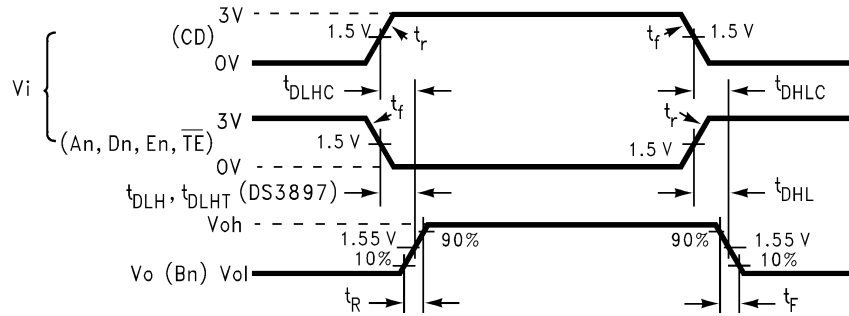
t_{DRLH}	Dn to Rn	$\overline{TE} = \overline{RE} = 0.8\text{V}$ (Figure 7)	10	20	30	ns
t_{DRHL}			10	20	30	ns

Note: NC means open



00851003

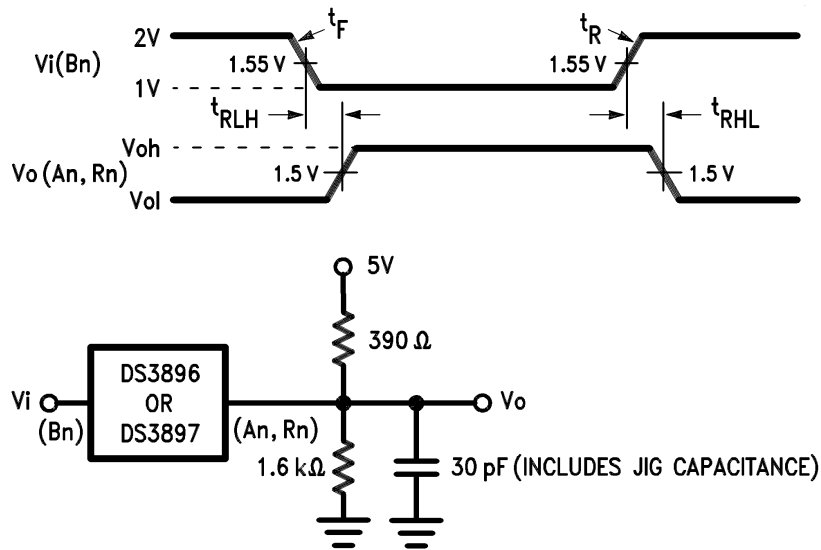
FIGURE 1. Driver Output Low Voltage Test



Note: $t_r = t_f \leq 5\text{ ns}$ from 10% to 90%

00851004

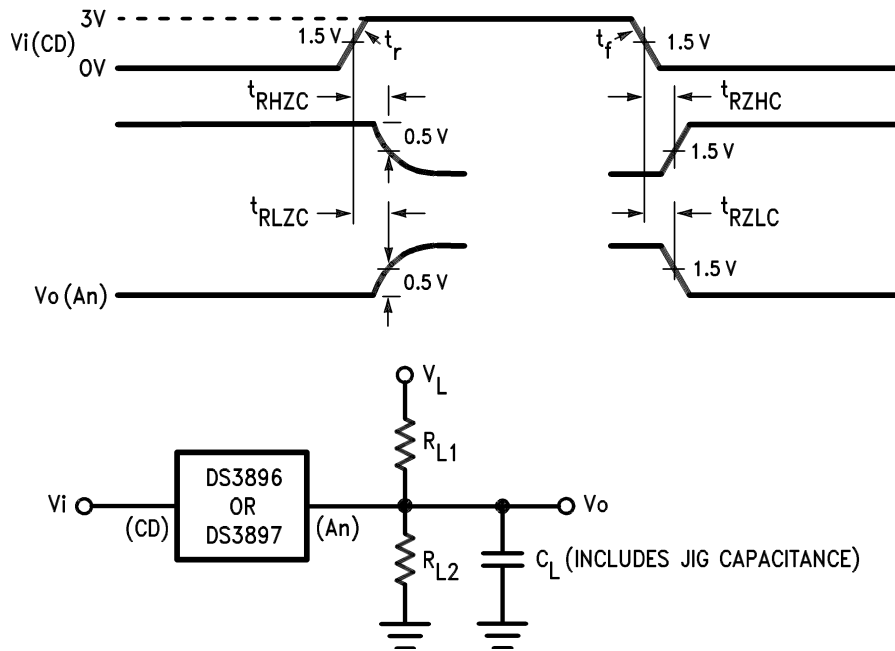
FIGURE 2. Driver Propagation Delays



Note: $t_R = t_F \leq 10$ ns from 10% to 90%

00851005

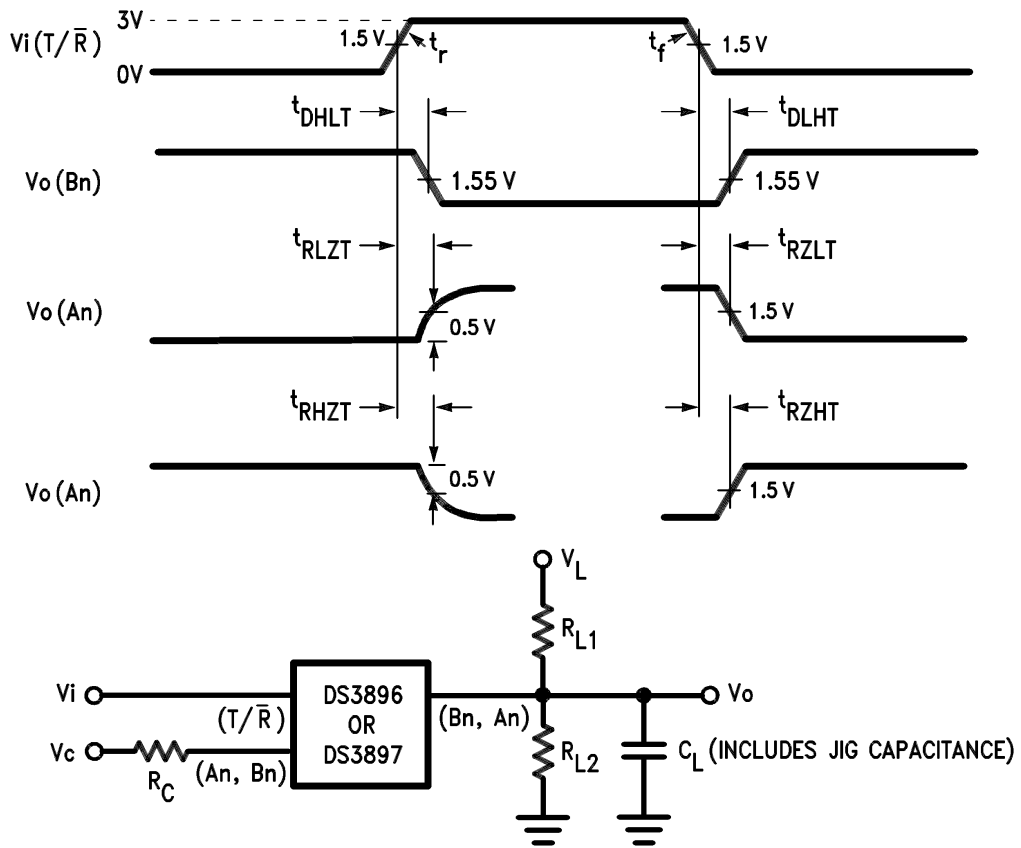
FIGURE 3. Receiver Propagation Delays



Note: $t_r = t_f \leq 5$ ns from 10% to 90%

00851006

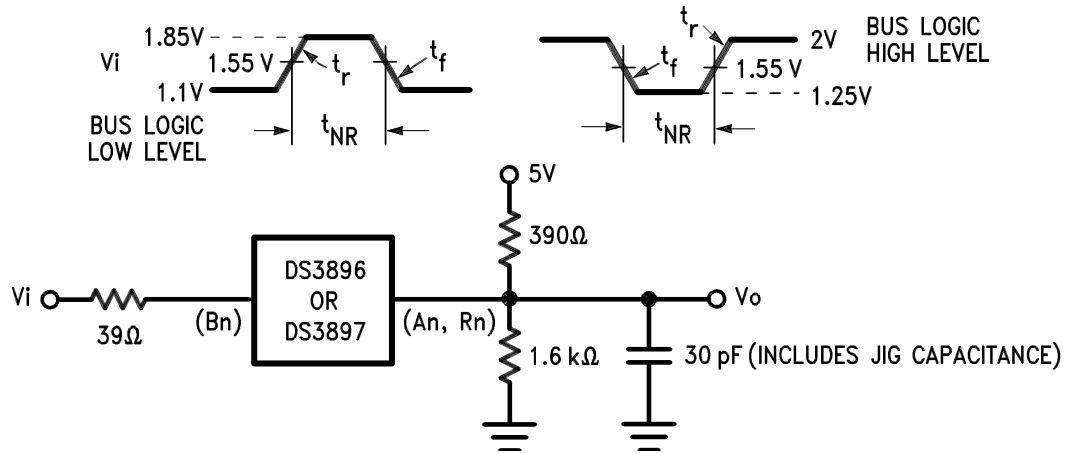
FIGURE 4. Propagation Delay from CD pin to An



Note: $t_r = t_f \leq 5$ ns from 10% to 90%

00851007

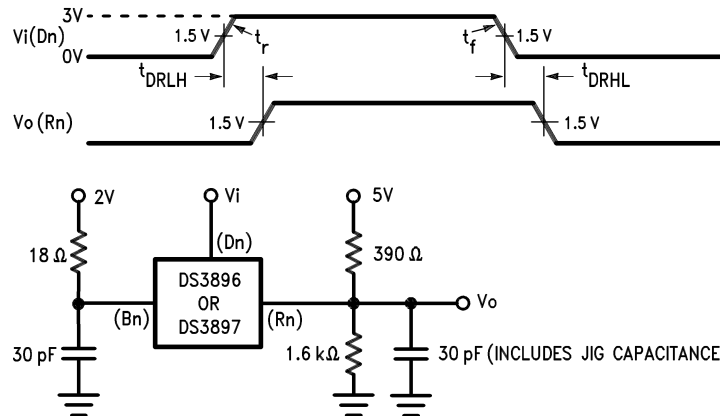
FIGURE 5. Propagation Delay from T/R pin to An or Bn



Note: $t_r = t_f = 2$ ns from 10% to 90%

00851008

FIGURE 6. Receiver Noise Immunity: “No Response at Output” Input Waveforms

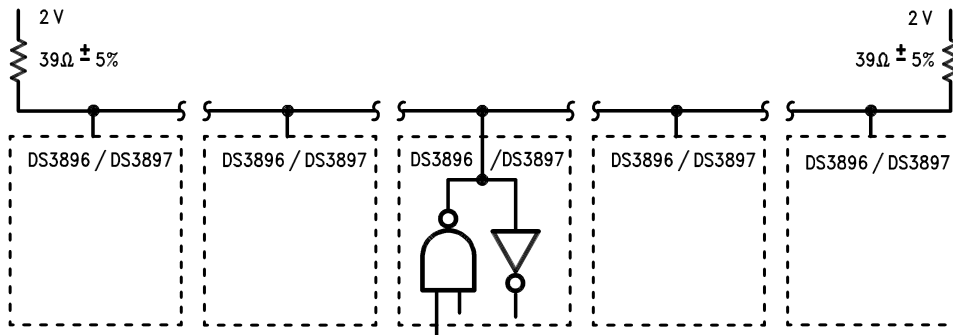


00851009

Note: $t_r = t_f \leq 5$ ns from 10% to 90%

FIGURE 7. Driver Plus Receiver Delays

Typical Application



00851010

Notes

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.

For the most current product information visit us at www.national.com.

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

BANNED SUBSTANCE COMPLIANCE

National Semiconductor certifies that the products and packing materials meet the provisions of the Customer Products Stewardship Specification (CSP-9-111C2) and the Banned Substances and Materials of Interest Specification (CSP-9-111S2) and contain no "Banned Substances" as defined in CSP-9-111S2.



National Semiconductor
Americas Customer
Support Center
 Email: new.feedback@nsc.com
 Tel: 1-800-272-9959

National Semiconductor
Europe Customer Support Center
 Fax: +49 (0) 180-530 85 86
 Email: europe.support@nsc.com
 Deutsch Tel: +49 (0) 69 9508 6208
 English Tel: +44 (0) 870 24 0 2171
 Français Tel: +33 (0) 1 41 91 8790

National Semiconductor
Asia Pacific Customer
Support Center
 Email: ap.support@nsc.com

National Semiconductor
Japan Customer Support Center
 Fax: 81-3-5639-7507
 Email: jpn.feedback@nsc.com
 Tel: 81-3-5639-7560

National Semiconductor was acquired by Texas Instruments.

http://www.ti.com/corp/docs/investor_relations/pr_09_23_2011_national_semiconductor.html

This file is the datasheet for the following electronic components:

DS3897N - <http://www.ti.com/product/ds3897n?HQS=TI-null-null-dscatalog-df-pf-null-wwe>

DS3896M - <http://www.ti.com/product/ds3896m?HQS=TI-null-null-dscatalog-df-pf-null-wwe>

DS3896MX - <http://www.ti.com/product/ds3896mx?HQS=TI-null-null-dscatalog-df-pf-null-wwe>

DS3896N - <http://www.ti.com/product/ds3896n?HQS=TI-null-null-dscatalog-df-pf-null-wwe>

DS3897M - <http://www.ti.com/product/ds3897m?HQS=TI-null-null-dscatalog-df-pf-null-wwe>

DS3897MX - <http://www.ti.com/product/ds3897mx?HQS=TI-null-null-dscatalog-df-pf-null-wwe>



LittleDiode supplies new, hard to find or obsolete electronic components and semiconductors all over the world.

With over two million different components listed you are sure to find the part you need.

Feel free to visit us today at our online store:

LittleDiode.com

Looking forward to providing you with the best possible service.