DSV14196 Qualification Package

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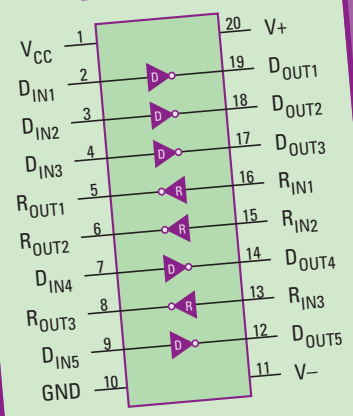
DSV14196

Now a 3.3V Low Voltage version of this Industry Standard Driver/Receiver.

Key Features

- Conforms to EIA/TIA-232-E and ITU-T V.28
- 5 Drivers and 3 Receivers
- Flow-through pinout
- Failsafe receiver outputs high when inputs open
- 20-pin wide SOIC package
- LapLink® compatible 230.4 kbps data rate
- Pin compatible with: DS14196, SN75196, GD75323

Functional Diagram



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DSV14196/DSV14196T
5 DRIVER x 3 RECEIVER RS-232
QUALIFICATION PACKAGE

Fall 1998

Table of Contents

1.0 INTRODUCTION

1.1 General Product Description

This qualification booklet covers the DSV14196/DSV14196T, EIA/TIA-232 5 driver x 3 receiver device. It is available in a 20-pin wide SOIC package. It features a low voltage operation (+3.0V to 3.6V) for the receivers and (±9.0V to ±13.2V) for the drivers. The DSV14196 is the commercial temperature range option (0°C to 70°C) and the DSV14196T is the industrial temperature range option (-40°C to +85°C).

1.2 Reliability/Qualification Overview

The DS14196 was used as a qualification vehicle. The DSV14196/DSV14196T is a low voltage 3.3V option of the DS14196. They share similarities in die layout, manufacturing process flow, and package type. The device was subjected to extensive reliability stress testing. Please refer to the Reliability Test Report, FSC9600132, under the Reliability Report Section for further information.

1.3 Technical Assistance

Design & Product Engineer

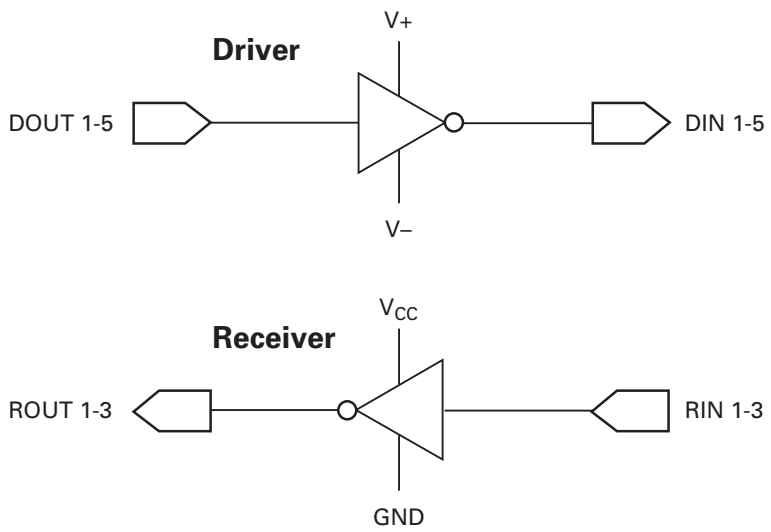
Dinh Nguyen
email: Dinh.Nguyen@nsc.com
Tel: 408.721.6240

Applications Engineer

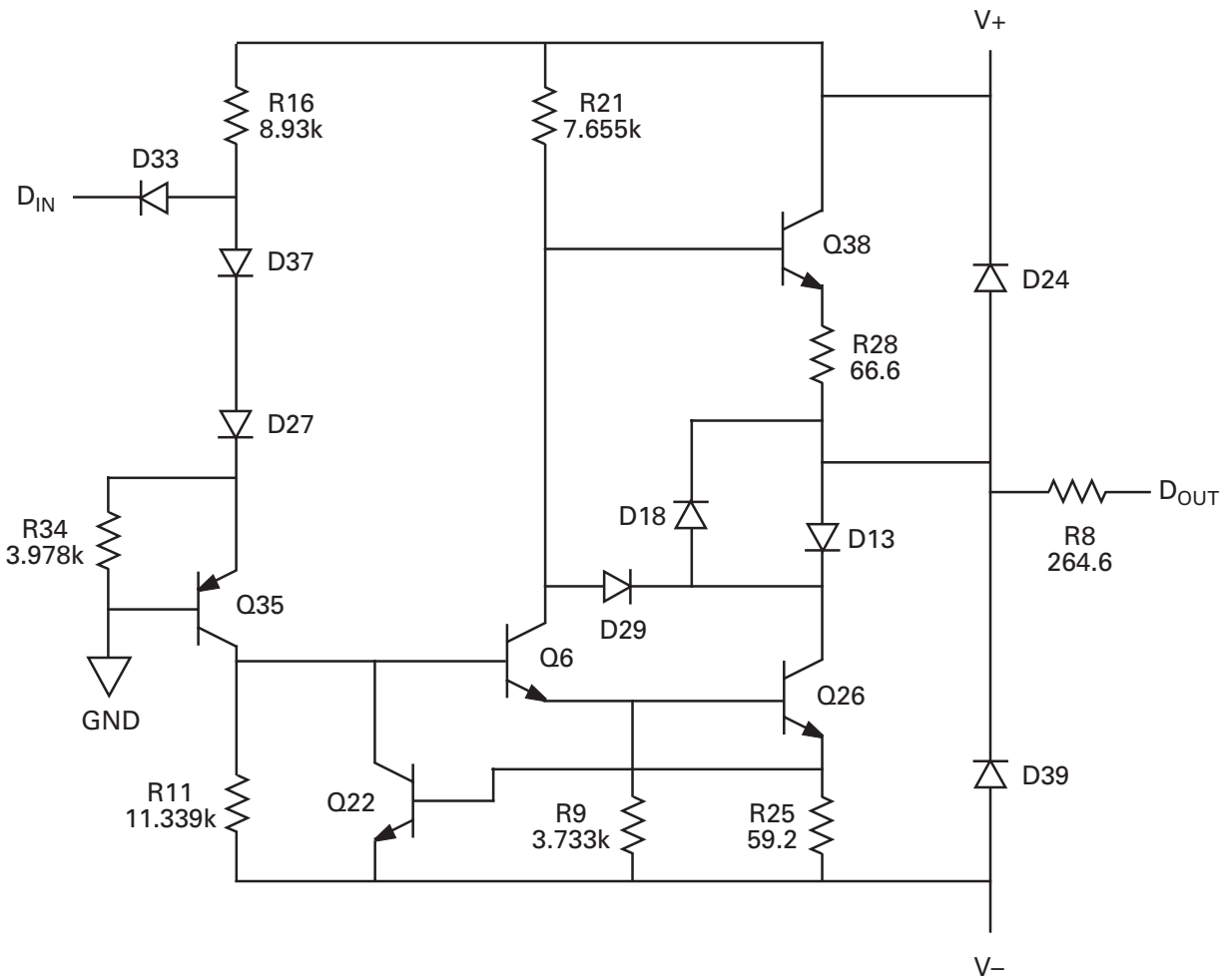
Hensen Wong
email: Hensen.Wong@nsc.com
Tel: 408.721.4663

2.0 DEVICE INFORMATION

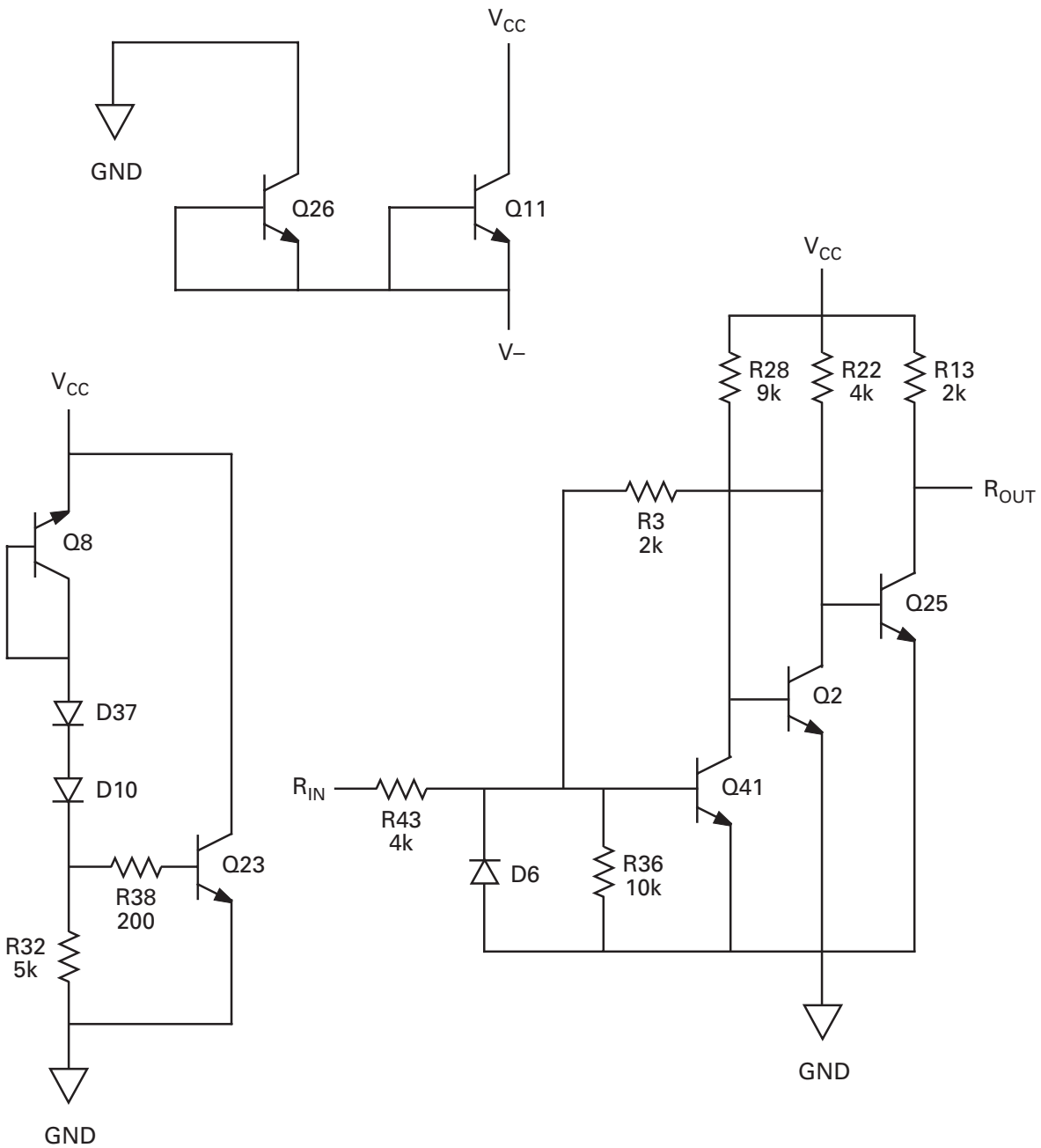
2.1 Device Schematic



2.2 DSV14196WM/DSV14196TWM Driver



2.3 DSV14196WM/DSV14196TWM Receiver



2.4 Datasheet

National Semiconductor

September 1998

DSV14196/DSV14196T
Receiver +3.3V Supply EIA/TIA-232 5 Driver x 3 Receiver

General Description

The DSV14196/DSV14196T is a five driver, three receiver device which conforms to the EIA/TIA-232-E and the ITU-T V.28 standards.

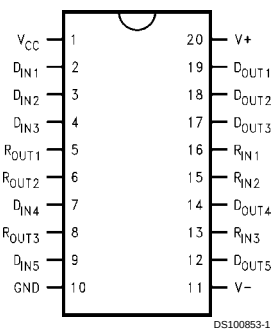
The flow-through pinout facilitates simple non-crossover board layout. The DSV14196/DSV14196T provides a peripheral side one-chip solution for the common 9-pin serial RS-232 interface between data terminals and data communications equipment.

Features

- Conforms to EIA/TIA-232-E and ITU-T V.28
- 5 drivers and 3 receivers
- Flow-through pinout
- Failsafe receiver outputs high when inputs open
- 20-pin wide SOIC package
- LapLink® compatible — 230.4 kbps data rate
- +3.3V Logic Interface
- Commercial temperature range option DSV14196 (0˚C to 70˚C)
- Industrial temperature range option DSV14196T (−40˚C to +85˚C)

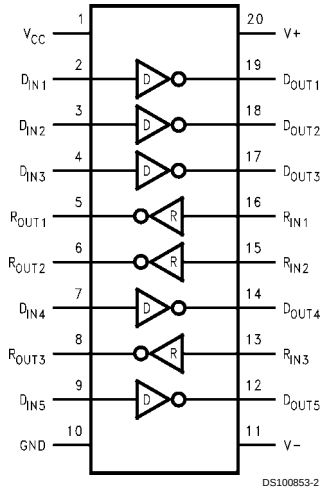
Connection Diagram

SOP



Order Number DSV14196WM,DSV14196TWM
See NS Package Number M20B

Functional Diagram



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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 (V_{CC})	+7V
Supply Voltage (V^+)	+15V
Supply Voltage (V^-)	−15V
Driver Input Voltage	0V to V_{CC}
Driver Output Voltage (Power Off)	±15V
Receiver Input Voltage	±25V
Receiver Output Voltage (R_{OUT})	0V to V_{CC}
Maximum Power Package Dissipation @ +25˚C	
M Package	1524 mW
Derate M Package	12.2 mW/˚C above 25˚C
Storage Temperature Range	−65˚C to +150˚C
Lead Temperature Range (Soldering, 4 sec.)	+260˚C
ESD Ratings (HBM. 1.5 kΩ, 100 pF)	≥1.5 kV

Recommended Operating Conditons

	Min	Nom	Max	Units
Supply Voltage (V_{CC})	+3.0	+3.3	+3.6	V
Supply Voltage (V^+)	+9.0	+12.0	+13.2	V
Supply Voltage (V^-)	−13.2	−12.0	−9.0	V
Operating Free Air Temperature (T_A)				
DSV14196	0	+25	+70	˚C
DSV14196T	−40	+25	+85	˚C

Electrical Characteristics (Note 2) (Note 3)

DSV14196

Over recommended operating supply and temperature ranges unless otherwise specified

Symbol	Parameter	Conditions		Min	Typ	Max	Units
DEVICE CHARACTERISTICS							
I_{CC}	V_{CC} Supply Current	No Load, All Inputs at +3.3V			9	16	mA
I^+	V^+ Supply Current	No Load, All Driver Inputs at 0.8V or +2V. All Receiver Inputs at 0.7V or 2.4V.	V^+ = +9V, V^- = −9V		20	26	mA
			V^+ = +13.2V, V^- = −13.2V		30	36	mA
I^-	V^- Supply Current		V^+ = +9V, V^- = −9V		−20	−26	mA
			V^+ = +13.2V, V^- = −13.2V		−30	−36	mA
DRIVER CHARACTERISTICS							
V_{IH}	High Level Input Voltage			2.0			V
V_{IL}	Low Level Input Voltage					0.8	V
I_{IH}	High Level Input Current	V_{IN} = 3.3V				10	µA
I_{IL}	Low Level Input Current	V_{IN} = 0V			−1.1	−1.5	mA
V_{OH}	High Level Output Voltage	R_L = 3 kΩ, V_{IN} = 0.8V, V^+ = +9V, V^- = −9V		6	7		V
		R_L = 3 kΩ, V_{IN} = 0.8V, V^+ = +12V, V^- = −12V		8	10		V
		R_L = 7 kΩ, V_{IN} = 0.8V, V^+ = +13.2V, V^- = −13.2V		10	11.5		V
V_{OL}	Low Level Output Voltage	R_L = 3 kΩ, V_{IN} = 2V, V^+ = +9V, V^- = −9V			−7	−6	V
		R_L = 3 kΩ, V_{IN} = 2V, V^+ = +12V, V^- = −12V			−10	−8	V
		R_L = 7 kΩ, V_{IN} = 2V, V^+ = +13.2V, V^- = −13.2V			−11.5	−10	V
I_{OS}+	Output High Short Circuit Current (Note 4)	V_{OUT} = 0V, V_{IN} = 0.8V		−6	−12	−18	mA
I_{OS}−	Output Low Short Circuit Current (Note 4)	V_{OUT} = 0V, V_{IN} = 2.0V		6	12	18	mA
R_O	Output Resistance	−2V ≤ V_{OUT} ≤ +2V, V^+ = V^- = V_{CC} = 0V		300			Ω
		−2V ≤ V_{OUT} ≤ +2V, V^+ = V^- = V_{CC} = Open Circuit		300			Ω

Electrical Characteristics(Note 2) (Note 3)
DSV14196 (Continued)

Over recommended operating supply and temperature ranges unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
RECEIVER CHARACTERISTICS						
V_{TH}	Input High Threshold (Recognized as a High Signal)	$V_{OUT} \leq 0.4V$, $I_O = 3.2$ mA	1.5	2.1	2.4	V
V_{TL}	Input Low Threshold (Recognized as a Low Signal)	$V_{OUT} \geq 1.7V$, $I_O = -0.5$ mA	0.7	0.9	1.3	V
R_{IN}	Input Resistance	$V_{IN} = \pm 3V$ to $\pm 15V$	3.0	3.8	7.0	kΩ
I_{IN}	Input Current	$V_{IN} = +15V$	2.1	4.0	5.0	mA
		$V_{IN} = +3V$	0.43	0.7	1.0	mA
		$V_{IN} = -15V$	−2.1	−4.0	−5.0	mA
		$V_{IN} = -3V$	−0.43	−0.7	−1.0	mA
V_{OH}	High Level Output Voltage (Note 7)	$I_{OH} = -0.5$ mA, $V_{IN} = -3V$	1.7	2.4		V
		$I_{OH} = -10$ µA, $V_{IN} = -3V$	2.7	3.2		V
		$I_{OH} = -0.5$ mA, V_{IN} = Open Circuit	1.7	2.4		V
		$I_{OH} = -10$ µA, V_{IN} = Open Circuit	2.7	3.2		V
V_{OL}	Low Level Output Voltage	$I_{OL} = 3.2$ mA, $V_{IN} = +3V$		0.2	0.4	V
I_{OSR}	Short Circuit Current	$V_{OUT} = 0V$, $V_{IN} = 0V$ (Note 4)	−0.6	−1.8	−3.0	mA

Electrical Characteristics(Note 2) (Note 3)
DSV14196T

Over recommended operating supply and temperature ranges unless otherwise specified

Symbol	Parameter	Conditions		Min	Typ	Max	Units
DEVICE CHARACTERISTICS							
I_{CC}	V_{CC} Supply Current	No Load, All Inputs at +3.3V			9	16	mA
I^+	V^+ Supply Current	No Load, All Driver Inputs at 0.8V or +2V. All Receiver Inputs at 0.7V or 2.4V.	$V^+ = +9V$, $V^- = -9V$		20	26	mA
			$V^+ = +13.2V$, $V^- = -13.2V$		30	36	mA
I^-	V^- Supply Current		$V^+ = +9V$, $V^- = -9V$		−20	−26	mA
			$V^+ = +13.2V$, $V^- = -13.2V$		−30	−36	mA
DRIVER CHARACTERISTICS							
V_{IH}	High Level Input Voltage			2.0			V
V_{IL}	Low Level Input Voltage					0.8	V
I_{IH}	High Level Input Current	$V_{IN} = 3.3V$				10	µA
I_{IL}	Low Level Input Current	$V_{IN} = 0V$			−1.1	−1.9	mA
V_{OH}	High Level Output Voltage	$R_L = 3$ kΩ, $V_{IN} = 0.8V$, $V^+ = +9V$, $V^- = -9V$		5.5	7		V
		$R_L = 3$ kΩ, $V_{IN} = 0.8V$, $V^+ = +12V$, $V^- = -12V$		7.5	10		V
		$R_L = 7$ kΩ, $V_{IN} = 0.8V$, $V^+ = +13.2V$, $V^- = -13.2V$		9	11.5		V
V_{OL}	Low Level Output Voltage	$R_L = 3$ kΩ, $V_{IN} = 2V$, $V^+ = +9V$, $V^- = -9V$			−7	−5.5	V
		$R_L = 3$ kΩ, $V_{IN} = 2V$, $V^+ = +12V$, $V^- = -12V$			−10	−7.5	V
		$R_L = 7$ kΩ, $V_{IN} = 2V$, $V^+ = +13.2V$, $V^- = -13.2V$			−11.5	−9	V
$I_{OS}+$	Output High Short Circuit Current (Note 4)	$V_{OUT} = 0V$, $V_{IN} = 0.8V$		−4	−12	−22	mA
$I_{OS}-$	Output Low Short Circuit Current (Note 4)	$V_{OUT} = 0V$, $V_{IN} = 2.0V$		4	12	22	mA
R_O	Output Resistance	$-2V \leq V_{OUT} \leq +2V$, $V^+ = V^- = V_{CC} = 0V$		300			Ω
		$-2V \leq V_{OUT} \leq +2V$, $V^+ = V^- = V_{CC}$ = Open Circuit		300			Ω

Electrical Characteristics(Note 2) (Note 3)
DSV14196T (Continued)

Over recommended operating supply and temperature ranges unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
RECEIVER CHARACTERISTICS						
V_{TH}	Input High Threshold (Recognized as a High Signal)	$V_{OUT} \leq 0.5V$, $I_O = 3.2$ mA	1.4	2.1	2.8	V
V_{TL}	Input Low Threshold (Recognized as a Low Signal)	$V_{OUT} \geq 1.7V$, $I_O = -0.5$ mA	0.5	0.9	1.4	V
R_{IN}	Input Resistance	$V_{IN} = \pm 3V$ to $\pm 15V$, TA = 0˚C to 70˚C	3.0	3.8	7.0	kΩ
I_{IN}	Input Current	$V_{IN} = +15V$, TA = 0˚C to +70˚C	2.1	4.0	5.0	mA
		$V_{IN} = +3V$, TA = 0˚C to +70˚C	0.43	0.7	1.0	mA
		$V_{IN} = -15V$, TA = 0˚C to +70˚C	−2.1	−4.0	−5.0	mA
		$V_{IN} = -3V$, TA = 0˚C to +70˚C	−0.43	−0.7	−1.0	mA
V_{OH}	High Level Output Voltage (Note 7)	$I_{OH} = -0.5$ mA, $V_{IN} = -3V$, $V_{CC} = 3.3V$	1.8	2.4		V
		$I_{OH} = -10$ µA, $V_{IN} = -3V$, $V_{CC} = 3.3V$	3.0	3.2		V
		$I_{OH} = -0.5$ mA, V_{IN} = Open Circuit, $V_{CC} = 3.3V$	1.8	2.4		V
		$I_{OH} = -10$ µA, V_{IN} = Open Circuit, $V_{CC} = 3.3V$	3.0	3.2		V
V_{OL}	Low Level Output Voltage	$I_{OL} = 3.2$ mA, $V_{IN} = +3V$		0.2	0.5	V
I_{OSR}	Short Circuit Current	$V_{OUT} = 0V$, $V_{IN} = 0V$ (Note 4)	−0.4	−1.8	−3.2	mA

Switching Characteristics (Note 3) (Note 5) (Note 6)
DSV14196 & DSV14196T

T_A = +25˚C

Symbol	Parameter	Conditions	Min	Typ	Max	Units
DRIVER CHARACTERISTICS						
t_{PHL}	Propagation Delay High to Low	R_L = 3 kΩ, C_L = 50 pF (*Figures 1, 2*)		90	350	ns
t_{PLH}	Propagation Delay Low to High			210	350	ns
t_r, t_f	Rise/Fall Time (Note 8)			40		ns
RECEIVER CHARACTERISTICS						
t_{PHL}	Propagation Delay High to Low	R_L = 1.5 kΩ, C_L = 15 pF (includes fixture plus probe), (*Figures 3, 4*)		27	100	ns
t_{PLH}	Propagation Delay Low to High			60	160	ns
t_r	Rise Time			22	175	ns
t_f	Fall Time			10	50	ns

Note 1: Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of Electrical Characteristics specifies conditions of device operation.

Note 2: Current into device pins is defined as positive. Current out of the device pins is defined as negative. All voltages are referenced to ground unless otherwise specified. For current, minimum and maximum values are specified as an absolute value and the sign is used to indicate direction. For voltage logic levels, the more positive value is designated as maximum. For example, if −6V is a maximum, the typical value −6.8V is more negative.

Note 3: All typicals are given for: V_{CC} = +3.3V, V^+ = +12V, V^- = −12V, T_A = +25˚C.

Note 4: Only one driver output shorted at a time.

Note 5: Generator characteristics for driver input: f = 64 kHz (128 kbps), $t_r = t_f < 10$ ns, V_{IH} = 3V, V_{IL} = 0V, duty cycle = 50%.

Note 6: Generator characteristics for receiver input: f = 64 kHz (128 kbps), $t_r = t_f$ = 200 ns, V_{IH} = 3V, V_{IL} = −3V, duty cycle = 50%.

Note 7: If receiver inputs are unconnected, receiver output is a logic high.

Note 8: Refer to typical curves. Driver output slew rate is measured from the +3V to the −3V level on the output waveform. Inputs not under test are connected to V_{CC} or GND. Slew rate is determined by load capacitance. To comply with a 30 V/µs maximum slew rate, a minimum load capacitance of 390 pF for DSV14196 or 620 pF for DSV14196T is recommended.

Parameter Measurement Information

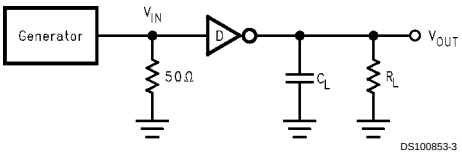


FIGURE 1. Driver Propagation Delay and Transition Time Test Circuit (Note 5)

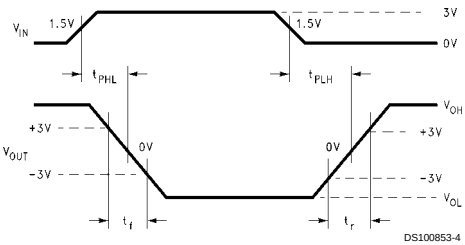


FIGURE 2. Driver Propagation Delay and Transition Time Waveforms Slew Rate (SR) = 6V/(t_r or t_f)

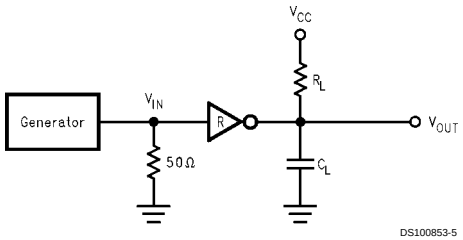


FIGURE 3. Receiver Propagation Delay and Transition Time Test Circuit (Note 6)

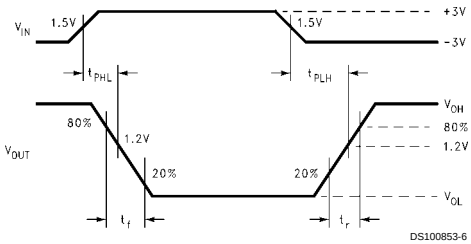


FIGURE 4. Receiver Propagation Delay and Transition Time Waveform

Pin Descriptions

Pin #	Pin Name	Description
2, 3, 4, 7, 9	D_{IN}	Driver Input Pins
12, 14, 17, 18, 19	D_{OUT}	Driver Output Pins, RS232 Levels
13, 15, 16	R_{IN}	Receiver Input Pins, RS-232 Levels
5, 6, 8	R_{OUT}	Receiver Output Pins
10	GND	Ground
20	V^+	Positive Power Supply Pin ($+9.0 \le V^+ \le +13.2$)
11	V^-	Negative Power Supply Pin ($-9.0 \le V^- \le -13.2$)
1	V_{CC}	Positive Power Supply Pin (+3.3V ±10%)

Applications Information

In a typical Data Terminal Equipment (DTE) to Data Circuit-Terminating Equipment (DCE) 9-pin de-facto interface implementation, 2 data lines and 6 control lines are required. The data lines are TXD and RXD. The control lines are RTS, DTR, DSR, DCD, CTS and RI.

The DSV14196/DSV14196T is a 5 x 3 Driver/Receiver and offers a single chip solution for this DTE interface. As shown in *Figure 5*, this interface allows for direct flow-thru interconnect. For a more conservative design, the user may wish to insert ground traces between the signal lines to minimize cross talk.

FAILSAFE RECEIVER OUTPUTS

The DSV14196/DSV14196T features failsafe receiver outputs. In failsafe mode, if the receiver input becomes zero or an open-circuit, the receiver output is pulled to a high level.

LapLink COMPATIBILITY

The DSV14196/DSV14196T can easily provide 128 kbps data rate under maximum driver load conditions of C_L = 2500 pF and R_L = 3 kΩ, while power supplies are:

V_{CC} = +3.0V, V^+ = 10.8V, V^- = −10.8V

MOUSE DRIVING

A typical mouse can be powered from the drivers. Two driver outputs connected in parallel and set to V_{OH} can be used to supply power to the V^+ pin of the mouse. The third driver output is set to V_{OL} to sink the current from the V^-terminal. Refer to typical curves of V_{OUT}/I_{OUT}.Typical mouse specifications are:

10 mA at +6V 5 mA at −6V

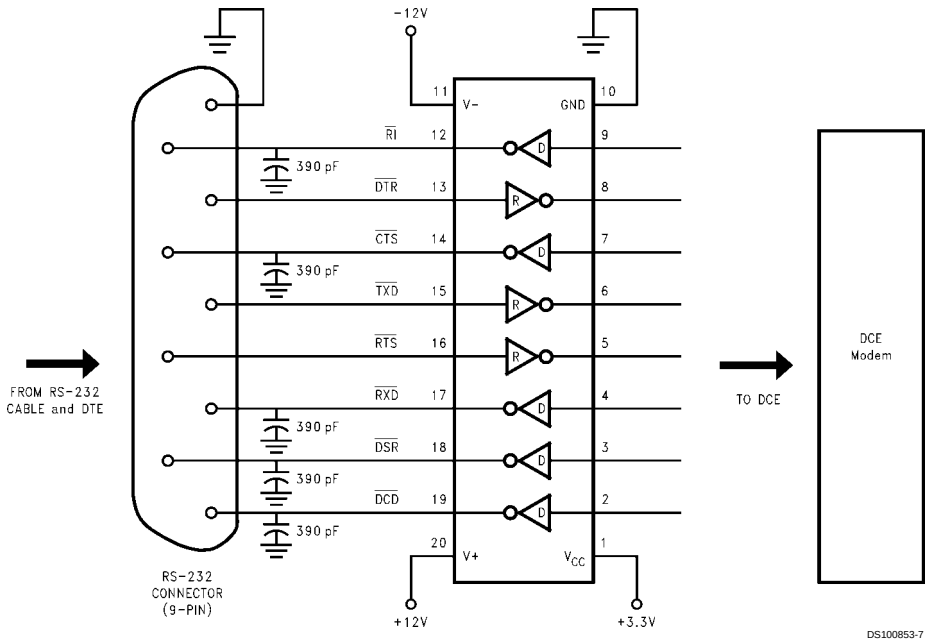
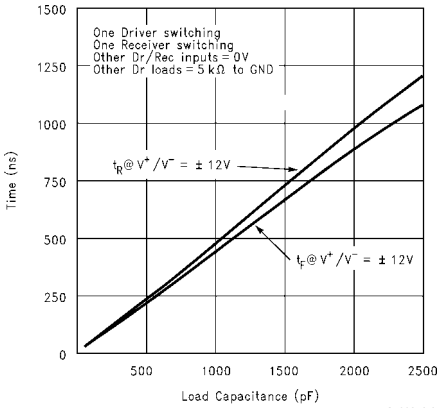


FIGURE 5. Typical DCE Application

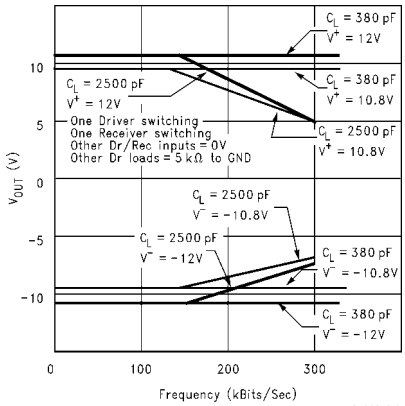
Typical Performance Characteristics

Driver Output Slew Rate between +3V and −3V vs Load Capacitance
Conditions: V_{CC} = 3.3V, R_L = 5 kΩ, T_A = 25°C, f_{IN} = 64 kHz Square Wave



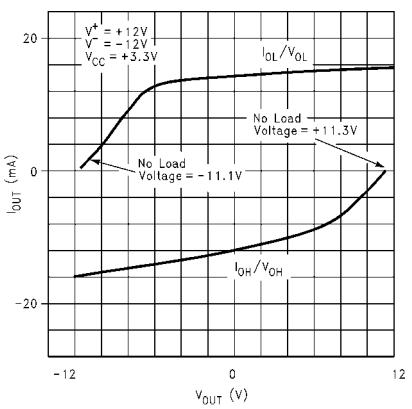
DS100853-8

Driver Output Voltage vs Frequency and C_L
Conditions: V_{CC} = 3.3V, R_L = 5 kΩ, T_A = 25°C



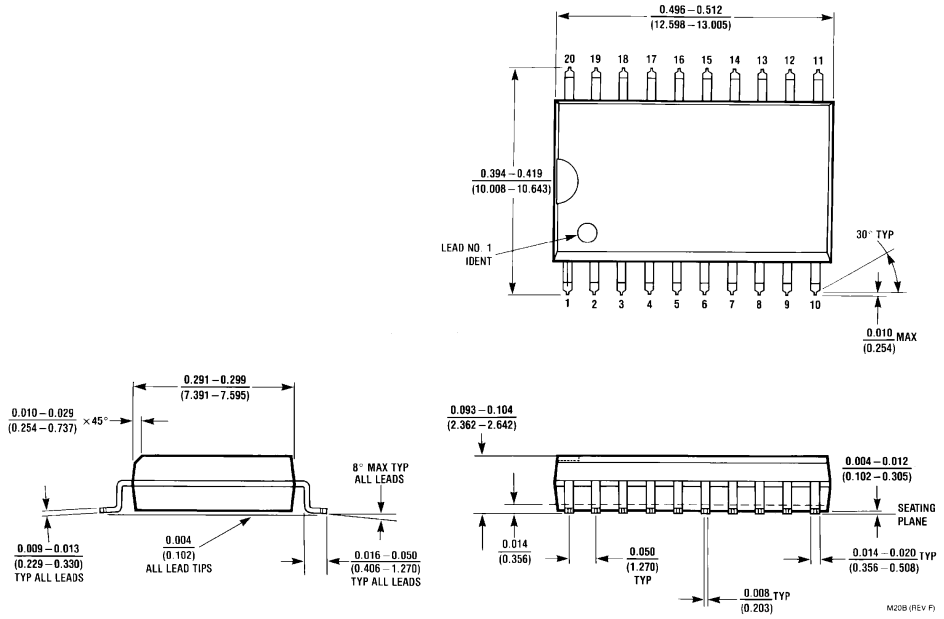
DS100853-9

Driver Output Current vs Output Voltage



DS100853-10

Physical Dimensions inches (millimeters) unless otherwise noted



20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC
Order Number DSV14196WM
NS Package Number M20B

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National Semiconductor Corporation
Americas
Tel: 1-800-272-9959
Fax: 1-800-737-7018
Email: support@nsc.com

www.national.com

National Semiconductor Europe
Fax: +49 (0) 1 80-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 1 80-530 85 85
English Tel: +49 (0) 1 80-532 78 32
Français Tel: +49 (0) 1 80-532 93 58
Italiano Tel: +49 (0) 1 80-534 16 80

National Semiconductor Asia Pacific Customer Response Group
Tel: 65-2544466
Fax: 65-2504466
Email: sea.support@nsc.com

National Semiconductor Japan Ltd.
Tel: 81-3-5620-6175
Fax: 81-3-5620-6179

3.0 PROCESS INFORMATION

3.1 Process Details

Fabrication Site: South Portland, Maine
Process Technology: 5µm Bipolar TTL
Wafer Diameter: 4 inches
Number of Masks: 8
Starting Material: P-type <111> Substrate

Metallization:	Al/Cu	14,000Å
	Ti/W	2,000Å
	Pt	500Å
Passivation:	Si3N4	10,000Å

3.2 Process Flow

1: Initial Oxidation
2: Collector Define
3: Collector Etch
4: Collector Diffusion
5: Epitaxial Preclean
6: Epitaxial Growth
7: Epitaxial Oxidation
8: Isolation Define
9: Isolation Etch
10: Isolation Pre Deposition
11: Isolation Drive
12: Buffered Oxide Etch
13: Isolation Reoxidation
14: Sink Define
15: Sink Etch
16: Sink Pre Deposition
17: Sink Drive
18: Base Define
19: Base Etch
20: Base Pre Deposition
21: Base Drive
22: Emitter Define
23: Emitter Etch
24: Emitter One Step Diffusion
25: Contact Define
26: Contact Etch
27: Aluminum Deposition
28: Aluminum Define
29: Aluminum Etch
30: Aluminum Alloy
31: Passivation Deposit
32: Bond Pad Define
33: Bond Pad Etch
34: Backgrind

3.3 Masking Sequence

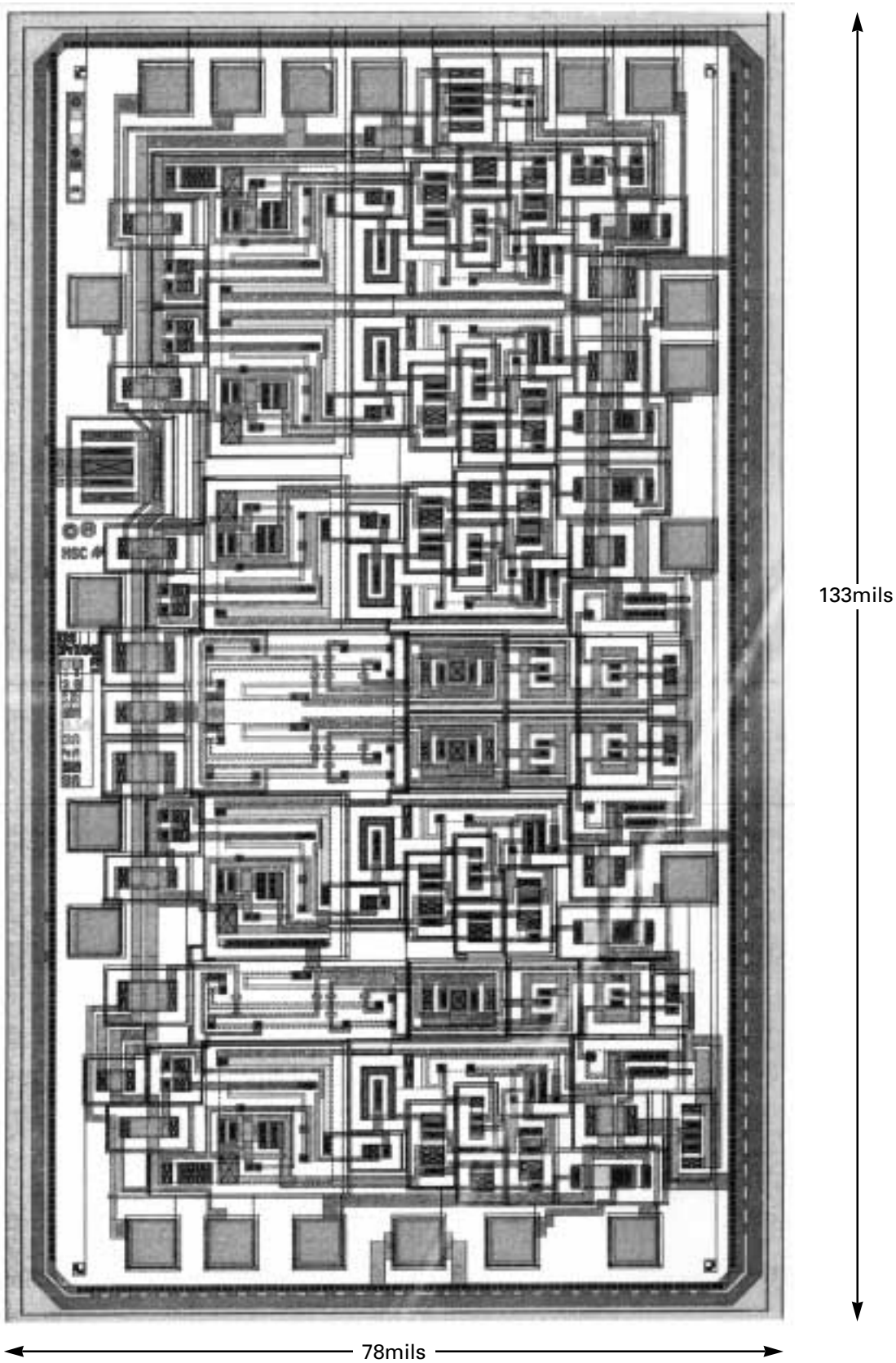
Layer Title	Mask
1	Collector-Buried Layer
2	Isolation
2.1	Sinker
3	Base
4	Emitter
5	Contact
6	Metal
7	Passivation

4.0 PACKAGING INFORMATION

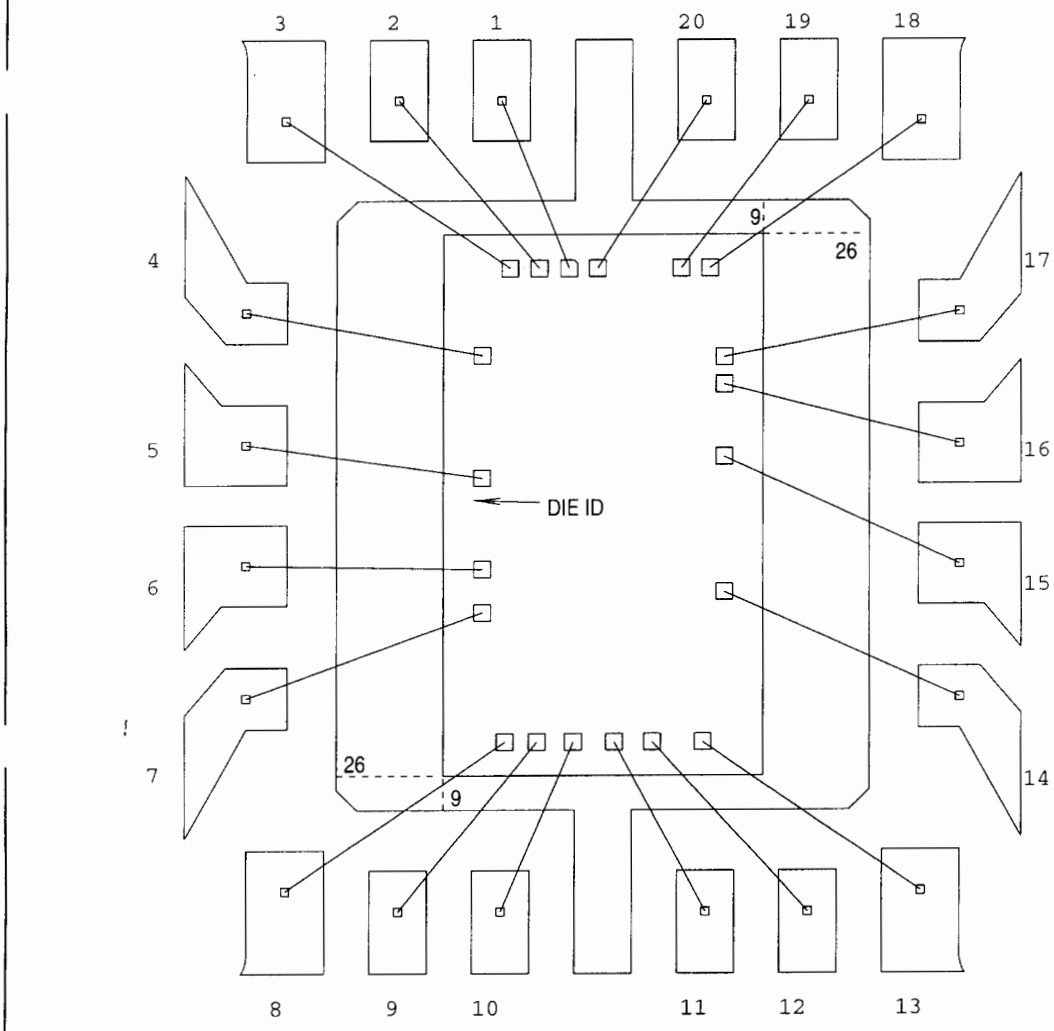
4.1 Package Material

Generic Package Type	**20 Lead SOIC**
NS Package Number	M20B
Package Material Type	Molded Plastic
Package/Compound Manufacturer	Epoxy Cresol Novolac Sumitomo
Package/Compound Manufacturer's Designation	Sumitomo 1100R NSC B-14
Lead Frame Material Manufacturer	Copper Alloy DCI
External Lead Frame Coating	Solder Plate Sn/Pb (85/15)
Internal Lead Frame Coating	Silver
Leads	Gull Wing 8mils thick
Die Attached Method	Polyimide P-6
Bond Wire	Gold, 0.9mils
Bond Type Die Pad Leadframe	 Thermosonic Ball Thermosonic Wedge
Package Thermal	Θ_{JA} = 82°C/W

4.2 Die Photo



4.3 Bonding Diagram



□FRAME DWG: 36-0403-02 SK: 024279 PAD: .130 X .150	AD- MA020HAA MB REV: A PKG: MA DIE ID: DS14196 STEP/REV: A	Metalization: 0.3% CU	BOND-CODE:
□DIE ATTACH SK: 010137 TYPE: POLY 6	DIE SIZE(* CALCULATED) (MIL): 78 X 133 (MIC): 1981 X 3378 *	MBS NOTE	SPECIAL INSTRUCTIONS: 1. SO-20 DUAL,.300 WIDE
□WIRE SK: 022628 TYPE: AU DIA = .001 # WIRES: 20	DIE PLACEMENT X= 26 Y= 9 ANGLE= 0.0		
□MOLD COMPOUND SK: 010426 TYPE: B14	□ADHESIVE SK: N/A □HEAT SINK SK: N/A □CHIP CAPS SK: N/A QTY: N/A DWG: N/A		
	NOTE	03/26/96 CVCCEP 03/27/96 CDINSC	
MIN. PAD PITCH: 6.66 MILS	ASS'Y : DS14196WM	DASH- 01 REV: B PDCN: AZE453	

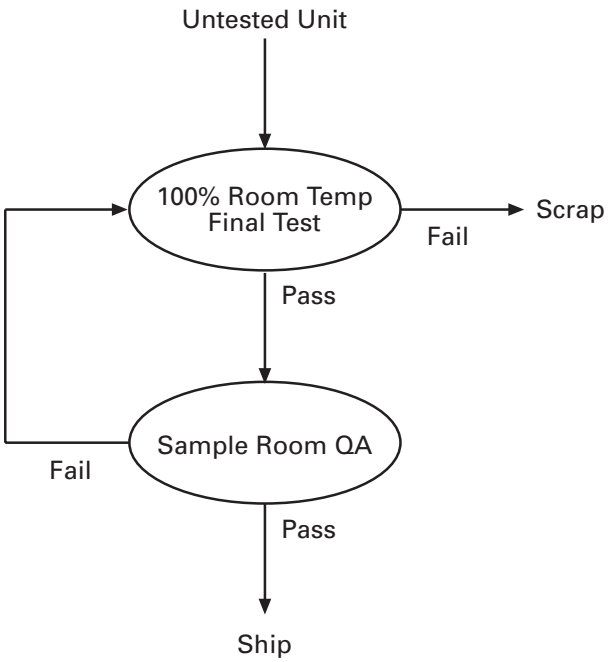
5.0 RELIABILITY DATA

5.1 Test Information

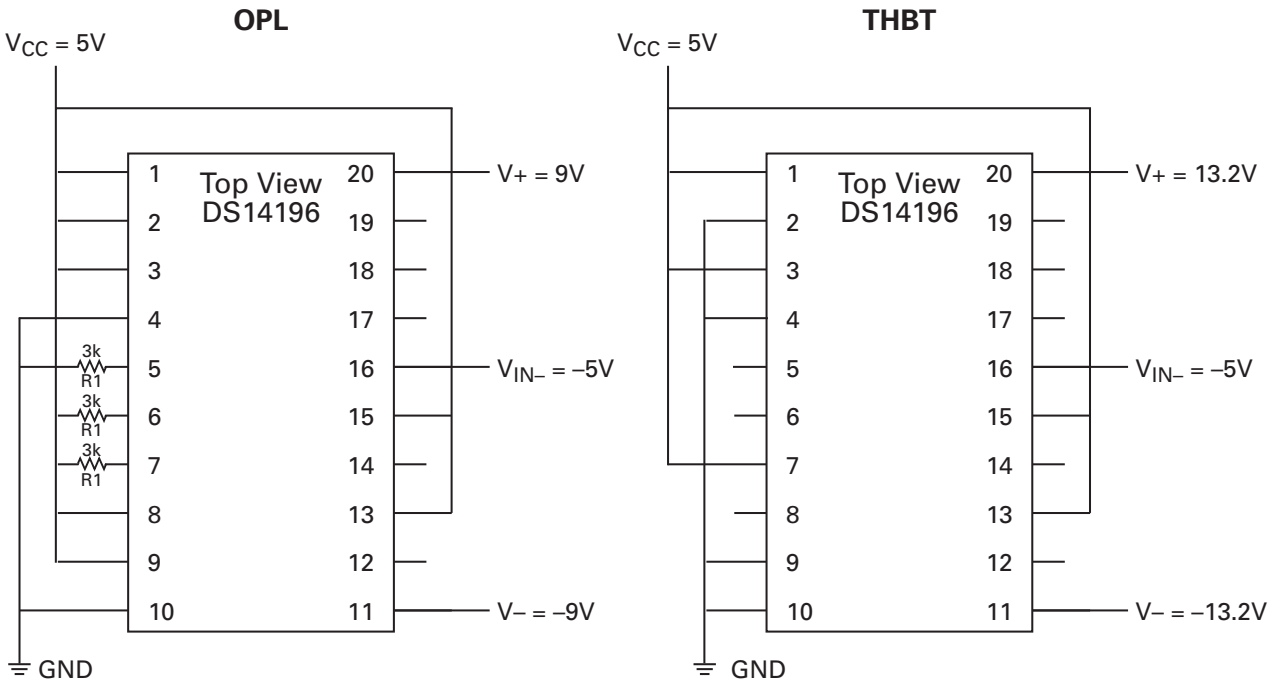
5.1.1 Test Location

Wafer Sort: Penang, Malaysia
Final Test: Penang, Malaysia

5.1.2 Test Flow



5.2 Burn-In Schematics



5.3 Reliability Report

National Semiconductor

Reliability Test Report	File Number: FSC9600132 Originator: Thang Nguyen Date: June 17, 1996

Purpose

DS14196 NEW DEVICE QUALIFICATION

Approvals

Reliability Engineer 7/16/96

Mgr Ref Engineering N/A D.N

Reference File Numbers

QP960002
RSC9600373

Distribution List

Dinh Nguyen, Naresh Shetty, Barry Shaffer A2585

Abstract

New device DS14196 (EIA/TIA-232 5 driver x 3 receiver) is similar to the DS14185 (FSC9500034). Both are assembled in 20-pin SOIC packages at NSEP, fabricated in LS Junction Iso process at NSFM, share the same design rules and power dissipation.
However with a larger die size (133 x 78) than the DS14185-s (108 x 78), the new device needs a one lot Reliability evaluation for production release.

Purpose of Test

To release new device DS14196 assembled in M20B package at NSEP and fabricated in LS Junction Iso at NSFM.

Description

Die Run	Die Size	Fab Loc	Process	Data Code	Package	Assembly Loc	M/C
TF06A645	133 x 78	NSFM	LS4-	9607	M20B	NSEP	B14

Tests Performed

Test	Description	Duration
1. Static Operational Life	T_A = 125°C	1,000 hrs
2. Temperature Cycle	T_{HI} = 150°C, T_{LO} = –65°C	1000 cycles
3. Autoclave	T = 121°C, P = 15psi, RH = 100%	500 hrs
4. Temperature Humidity Bias	T = 85°C, RH = 85%	1,000 hrs
5. Precondition: Performed prior to ACLV, TMCL, and THBT		
a. TMCL	T_{HI} = 150°C, T_{LO} = –65°C	30 cycles
b. Bake	T = 125°C	8 hrs
c. Soak	T = 85°C, RH = 85%	168 cycles
d. Vapor Phase	T_{peak} = 210°C	3 cycles
6. ESD	Human Body Model	2,000V(Min)

Results/Discussions

Test	Time Point	ATE Result (reject samples)
SOPL	168 hrs	0/66
	500 hrs	0/66
	1,000 hrs	0/66
THBT-P7	0 hrs	0/66
	168 hrs	0/66
	500 hrs	0/66
	1,000 hrs	0/66
TMCL-P7	0 hrs	0/77
	500 cycles	0/77
	1,000 cycles	0/77
ACLV-P7	0 hrs	0/43
	168 hrs	0/43
	500 hrs	0/43
ESD	500V	0/5
	1,000V	0/5
	1,500V	0/5
	2,000V	5/5
	2,500V	5/5

Conclusion

Device DS14196 satisfactorily passed all required Reliability stress tests, except for ESD which failed at 2,000V (Human Body Model). The new device can thus be released to production on the condition that the ESD rating is made known to users.

5.4 ESD Data

Human Body Model (1.5KΩ, 100pf)

Sample Size	Voltage Level	Result	Note
5	±500V	5/5 Passed	
5	±1,00V	5/5 Passed	
5	±1,500V	5/5 Passed	
5	±2,000V	0/5 Passed	Receiver Inputs Failed
5	±2,500V	0/5 Passed	V–, $R_{IN,}$ D_{OUT} Failed

5.5 Current Density Calculation (die Rev A)

Max Current: 18mA

Minimum Metal Thickness: 14,000Å

Minimum metal width through which max current passes: 10.4µm

Max Current Density: $J_{S(max)} = I_{(max)}/A_{(min)}$

$A_{(min)}$ = min thickness x 50%(step coverage) x (W_{min} – etchback)
(etchback = 0.3um/side)

$J_{S(max)}$ = 2.6E5 A/cm2

6.0 CHARACTERIZATION DATA

6.1 DSV14196 Test Summaries For 25°C

TEST NAME	OBS	AVERAGE	MAX	MIN	RANGE	SIGMA	UNITS
GROSS	80	-1.02861E-07	1.90769E-06	-1.28311E	-072.036E	-062.27632E-07	AMPS
CONTVCC	1280	-0.758485	-0.00831166	-1.80608	1.79777	0.397253	AMPS
ADJP	0	-1E+07	-1E+38	1E+38	-2E+38	-1E+07	ADJP
FUNV	0	-1E+07	-1E+38	1E+38	-2E+38	-1E+07	FUNVCD33
FUNVCR33	0	-1E+07	-1E+38	1E+38	-2E+38	-1E+07	FUNCVR33
ICC	80	0.00882019	0.00921561	0.0086292	0.000586415	0.000128732	AMPS
ICCQ3	80	0.00880757	0.00915046	0.00856404	0.000586415	0.000135864	AMPS
ICCP9Q	160	0.017876	0.0183085	0.0173911	0.000917427	0.000199407	AMPS
ICCN9Q	160	-0.0187236	-0.017031	-0.0203619	0.0033309	0.00113301	AMPS
ICCP3QH	160	0.0268461	0.0275195	0.0260516	0.00146788	0.000302618	AMPS
ICCN3QH	160	-0.0272831	-0.0252647	-0.029157	0.00389229	0.0011731	AMPS
IIH	400	3.04248E-09	2.33343E-08	-2.52664E-08	4.86006E-08	9.04781E-09	AMPS
IIL	400	-0.00122771	-0.0011832	-0.00127915	9.5948E-05	1.64104E-05	AMPS
IINP3Q	240	0.000662541	0.000684868	0.000631948	5.29199E-05	1.00899E-05	AMPS
IINN3Q	240	-0.00067954	-0.000650236	-0.000701126	5.089E-05	1.01853E-05	AMPS
IINN3QQ	240	-0.000680209	-0.000650236	-0.000703158	5.29223E-05	9.95335E-06	AMPS
IINN15Q	240	-0.00413253	-0.00396737	-0.00429392	0.00032655	6.85457E-05	AMPS
IINP15Q	240	0.00417269	0.00432645	0.0039959	0.000330547	6.69671e-05	AMPS
RINQP	240	3419.66	3590.93	3291.6	299.331	58.6543	O
RINQM	240	3476.98	3635.5	3338.13	297.371	60.7457	O
VOLD31Q	400	-7.20432	-7.15847	-7.24326	0.0847955	0.0184558	VOLTS
VOLD32Q	400	-9.99278	-9.83322	-10.1804	0.347213	0.039536	VOLTS
VOLD7Q	400	-11.657	-11.4965	-11.8325	0.335957	0.057916	VOLTS
VOHD32Q	400	9.61814	9.66643	9.45302	0.213414	0.055351	VOLTS
VOHD7Q	400	10.4841	10.5411	10.4426	0.0985155	0.0211018	VOLTS
VOHD31Q	400	7.326	7.36505	7.29409	0.0709605	0.0150574	VOLTS
VOHRQ1	240	3.2661	3.27063	3.26275	0.0078752	0.00227562	VOLTS
VOHRQ5	240	2.38464	2.42928	2.34845	0.0808375	0.0163678	VOLTS
VOHRQ31	240	3.266	3.27063	3.26275	0.0078752	0.00235815	VOLTS
VOHRQ35	240	2.38372	2.42407	2.34584	0.078233	0.0162393	VOLTS

6.1 DSV14196 Test Summaries For 25°C (cont)

TEST NAME	OBS	AVERAGE	MAX	MIN	RANGE	SIGMA	UNITS
VOLR	240	0.208557	0.256507	0.186974	0.0695324	0.0161759	VOLTS
VTH	480	1.98696	2.03467	1.9458	0.08887	0.0181827	VOLTS
VTL	480	0.89224	0.92041	0.872559	0.047851	0.00872671	VOLTS
VOHQVTH	240	2.37897	2.42407	2.34063	0.0834427	0.0168206	VOLTS
VOLQVTH	240	0.210342	0.259916	0.189579	0.0703372	0.0166054	VOLTS
IOSRQ	240	-0.00180689	-0.00169452	-0.00192506	0.000230543	4.53683E-05	AMPS
IOSDQP9	400	-0.0115826	-0.0111037	-0.0120738	0.000970055	0.000190796	AMPS
IOSDQP3	400	-0.0130913	-0.0126013	-0.0136111	0.00100983	0.000203561	AMPS
IOSDQN3	400	0.0131923	0.0138106	0.0125972	0.00121341	0.000243765	AMPS
IOSDQN9	400	0.0137922	0.0143643	0.0132483	0.00111593	0.000231044	AMPS
ROD	400	791.181	2457.39	438.651	2018.74	660.328	O
RODQO	400	1668	3962.01	952.478	3009.53	486.16	O
LHR	240	6.045E-08	7.42175E-08	4.09614E-08	3.3256E-08	1.01129E-08	SECONDS
HLR	240	2.66612E-08	3.15886E-08	2.30649E-08	8.52368E-09	2.18023E-09	SECONDS
LHRR	240	5.72615E-08	7.15847E-08	3.18907E-08	3.9694E-08	1.11604E-08	SECONDS
HLRR	240	4.251E-08	7.36719E-08	3.56435E-08	3.80284E-08	6.64345E-09	SECONDS
LHD	400	2.07158E-07	3.03005E-07	1.33103E-07	1.69902E-07	5.52885E-08	SECONDS
HLD	400	8.30674E-08	8.78046E-08	7.90829E-08	8.72173E-09	2.49313E-09	SECONDS
RIR	240	2.21635E-08	2.44816E-08	2.03942E-08	4.08736E-09	7.58021E-10	SECONDS
FAR	240	1.02996E-08	1.30818E-08	8.94121E-09	4.14061E-09	9.85917E-10	SECONDS

6.2 DSV14196 Test Summaries For 70°C

TEST NAME	OBS	AVERAGE	MAX	MIN	RANGE	SIGMA	UNITS
GROSS	100	9.55664e-07	1.78008e-06	-2.55225e-07	2.0353e-06	9.54201e-07	
CONTVCC	1600	-0.706944	-0.00990801	-1.36887	1.35897	0.30624	AMPS
ADJP	0	-1e+07	-1e+38	1e+38	-2e+38	-1e+07	ADJP
FUNVCD33	0	-1e+07	-1e+38	1e+38	-2e+38	-1e+07	FUNCVD33
FUNVCR33	0	-1e+07	-1e+38	1e+38	-2e+38	-1e+07	FUNCVR33
ICC	100	0.00809964	0.00846631	0.00784865	0.000617657	0.000157908	AMPS
ICCQ3	100	0.00808922	0.00843373	0.00784865	0.000585078	0.00014974	AMPS
ICCP9Q	200	0.0164379	0.0171709	0.0159599	0.001211	0.00028531	AMPS
ICCN9Q	200	-0.0171794	-0.0157211	-0.0189771	0.00325605	0.00109032	AMPS
ICCP3QH	200	0.0246074	0.0256847	0.0239599	0.00172476	0.000417551	AMPS
ICCN3QH	200	-0.0249222	-0.0233185	-0.0269863	0.00366774	0.00111396	AMPS
IIH	500	7.76873e-09	3.22587e-08	-2.52582e-08	5.75169e-08	9.82853e-09	AMPS
IIL	500	-0.00113584	-0.00107902	-0.00119542	0.000116392	2.41437e-05	AMPS
IINP3Q	300	0.000618574	0.000648287	0.000599389	4.88985e-05	1.1078e-05	AMPS
IINN3Q	300	-0.000632845	-0.000609799	-0.000662655	5.28562e-05	1.18375e-05	AMPS
IINN3QQ	300	-0.00063313	-0.000611831	-0.000662655	5.0824e-05	1.17805e-05	AMPS
IINN15Q	300	-0.00375781	-0.00360983	-0.00400321	0.000393379	8.03024e-05	AMPS
IINP15Q	300	0.00380383	0.00400115	0.00364023	0.000360924	7.557e-05	AMPS
RINQP	300	3769.02	3962.27	3572.53	389.737	79.0132	O
RINQM	300	3842.29	4016.13	3592.22	423.918	85.3272	O
VOLD31Q	500	-7.22266	-7.10849	-7.27973	0.171237	0.0278952	VOLTS
VOLD32Q	500	-10.7201	-10.3323	-11.0047	0.672377	0.123197	VOLTS
VOLD7Q	500	-12.3946	-11.999	-12.6869	0.687902	0.134606	VOLTS
VOHD32Q	500	10.7129	10.9534	10.2447	0.708694	0.162998	VOLTS
VOHD7Q	500	12.4048	12.8487	10.828	2.02064	0.534761	VOLTS
VOHD31Q	500	7.23793	7.30644	7.15853	0.147909	0.0315991	VOLTS
VOHRQ1	300	3.26551	3.27258	3.26015	0.0124369	0.00279612	VOLTS
VOHRQ5	300	2.30002	2.34854	2.26419	0.0843449	0.0190534	VOLTS
VOHRQ31	300	3.26544	3.27258	3.26015	0.0124369	0.00275917	VOLTS
VOHRQ35	300	2.29901	2.34593	2.26158	0.0843458	0.018664	VOLTS

6.2 DSV14196 Test Summaries For 70°C (cont)

TEST NAME	OBS	AVERAGE	MAX	MIN	RANGE	SIGMA	UNITS
VOLR	300	0.244045	0.305985	0.199315	0.10667	0.0289291	VOLTS
VTH	600	1.75401	1.88428	1.64502	0.23926	0.0458314	VOLTS
VTL	600	0.787201	0.852051	0.749512	0.102539	0.0185467	VOLTS
VOHQVTH	300	2.29426	2.34333	2.25637	0.0869517	0.019045	VOLTS
VOLQVTH	300	0.246307	0.309891	0.201921	0.107971	0.0294635	VOLTS
IOSRQ	300	-0.00164983	-0.0015625	-0.00179483	0.000232331	4.33174e-05	AMPS
IOSDQP9	500	-0.00998552	-0.00938146	-0.010909	0.0015275	0.000275086	AMPS
IOSDQP3	500	-0.0113148	-0.0107032	-0.0122154	0.00151224	0.000279365	AMPS
IOSDQN3	500	0.0113185	0.0125901	0.0103927	0.00219742	0.000388677	AMPS
IOSDQN9	500	0.0117892	0.0129805	0.010816	0.00216445	0.000393808	AMPS
ROD	500	790.731	2457.39	468.787	1988.61	589.878	O
RODQO	500	1754.96	3509.21	998.469	2510.74	562.213	O
LHR	300	6.71378e-08	8.24082e-08	4.55934e-08	.68148e-08	1.15778e-08	SECONDS
HLR	300	2.6649e-08	3.21736e-08	2.30649e-08	9.10873e-09	2.3141e-09	SECONDS
LHRR	300	5.58858e-08	8.12381e-08	1.5154e-08	6.60841e-08	1.91972e-08	SECONDS
HLRR	300	6.10205e-08	1.80555e-07	3.68411e-08	1.43713e-07	3.05293e-08	SECONDS
LHD	500	2.4656e-07	3.45031e-07	1.5826e-07	1.86771e-07	5.78211e-08	SECONDS
HLD	500	8.93045e-08	9.62748e-08	8.55624e-08	1.07124e-08	2.29231e-09	SECONDS
RIR	300	2.27278e-08	2.47741e-08	1.99587e-08	4.81539e-09	8.43492e-10	SECONDS
FAR	300	1.26049e-08	1.68275e-08	9.8809e-09	6.94664e-09	1.89344e-09	SECONDS

6.3 DSV14196 Test Summaries for 0°C

TEST NAME	OBS	AVERAGE	MAX	MIN	RANGE	SIGMA	UNITS
GROSS	100	1.77945e-06	1.78008e-06	1.77903e-06	1.04797e-09	5.15982e-10	AMPS
CONTVCC	1600	-0.748691	-0.00616254	-1.76963	1.76347	0.378758	AMPS
ADJP	0	-1e+07	-1e+38	1e+38	-2e+38	-1e+07	
FUNVCD33	0	-1e+07	-1e+38	1e+38	-2e+38	-1e+07	
FUNVCR33	0	-1e+07	-1e+38	1e+38	-2e+38	-1e+07	
ICC	100	0.00930579	0.00967336	0.0087625	0.000910864	0.000201136	AMPS
ICCQ3	100	0.00928982	0.00967336	0.00879509	0.000878274	0.000195207	AMPS
ICCP9Q	200	0.0190506	0.0209874	0.0130242	0.00796326	0.000881353	AMPS
ICCN9Q	200	-0.019319	-0.0137749	-0.0223455	0.00857053	0.00134387	AMPS
ICCP3QH	200	0.0286217	0.0322901	0.015703	0.0165871	0.00195178	AMPS
ICCN3QH	200	-0.0282333	-0.0160205	-0.0328621	0.0168416	0.00233495	AMPS
IIH	500	2.35945e-09	1.11687e-07	-2.47938e-08	1.36481e-07	1.22981e-08	AMPS
IIL	500	-0.00129745	-0.00120549	-0.00135643	0.000150938	2.82881e-05	AMPS
IINP3Q	300	0.000687644	0.00071957	0.000646296	7.3274e-05	1.413e-05	AMPS
IINN3Q	300	-0.000703924	-0.00065671	-0.000737865	8.11541e-05	1.47257e-05	AMPS
IINN3QQ	300	-0.000703972	-0.000658743	-0.000737865	7.91213e-05	1.46099e-05	AMPS
IINN15Q	300	-0.00438089	-0.00400316	-0.00462259	0.000619424	0.000103478	AMPS
IINP15Q	300	0.00441443	0.00468669	0.00409673	0.00058996	9.86779e-05	AMPS
RINQP	300	3221.67	3482.01	3024.87	457.147	75.2157	O
RINQM	300	3265.6	3596.9	3084.38	512.522	81.2942	O
VOLD31Q	500	-7.14123	-7.07709	-7.20858	0.131491	0.0313872	VOLTS
VOLD32Q	500	-9.00748	-8.78748	-9.67991	0.892429	0.134867	VOLTS
VOLD7Q	500	-10.6298	-10.4126	-11.3462	0.933661	0.138641	VOLTS
VOHD32Q	500	8.97203	9.66152	8.72579	0.935734	0.134793	VOLTS
VOHD7Q	500	10.7495	10.8405	10.4949	0.345512	0.0463615	VOLTS
VOHD31Q	500	7.15799	7.32184	7.09365	0.228194	0.0248697	VOLTS
VOHRQ1	300	3.26856	3.27525	3.26297	0.0122755	0.00307392	VOLTS
VOHRQ5	300	2.43436	2.48053	2.3797	0.100829	0.0195856	VOLTS
VOHRQ31	300	3.26847	3.27525	3.26297	0.0122755	0.00313086	VOLTS
VOHRQ35	300	2.43361	2.47793	2.37449	0.103434	0.0197917	VOLTS

6.3 DSV14196 Test Summaries For 0°C (cont)

TEST NAME	OBS	AVERAGE	MAX	MIN	RANGE	SIGMA	UNITS
VOLR	300	0.194278	0.227982	0.169429	0.0585532	0.0112066	VOLTS
VTH	600	2.19283	2.26709	2.04834	0.21875	0.0614655	VOLTS
VTL	600	0.98918	1.02295	0.906738	0.116212	0.025751	VOLTS
VOHQVTH	300	2.42866	2.47272	2.36928	0.103432	0.0202981	VOLTS
VOLQVTH	300	0.196176	0.231891	0.169429	0.0624615	0.0113886	VOLTS
IOSRQ	300	-0.0019123	-0.00175841	-0.00205082	0.000292409	5.07982e-05	AMPS
IOSDQP9	500	-0.0128791	-0.0117157	-0.0137129	0.00199721	0.000439134	AMPS
IOSDQP3	500	-0.0145633	-0.0132125	-0.0155047	0.0022922	0.000470058	AMPS
IOSDQN3	500	0.0148533	0.0163849	0.00690224	0.00948262	0.000867969	AMPS
IOSDQN9	500	0.0155623	0.0165222	0.00885628	0.00766595	0.000818971	AMPS
ROD	500	727.777	2317.2	394.774	1922.43	592.044	O
RODQO	500	1930.01	3838.36	840.996	2997.36	703.733	O
LHR	300	5.254e-08	7.28223e-08	3.41786e-08	3.86437e-08	8.69691e-09	SECONDS
HLR	300	2.70791e-08	3.12748e-08	2.39791e-08	7.29569e-09	1.68101e-09	SECONDS
LHRR	300	4.97519e-08	7.13591e-08	3.09591e-08	4.04001e-08	9.21212e-09	SECONDS
HLRR	300	4.05528e-08	5.0287e-08	3.50691e-08	1.52179e-08	3.62139e-09	SECONDS
LHD	500	2.15834e-07	2.95271e-07	1.40754e-07	1.54517e-07	2.84842e-08	SECONDS
HLD	500	7.85486e-08	9.01867e-08	7.38806e-08	1.63061e-08	2.63261e-09	SECONDS
RIR	300	2.16244e-08	2.35457e-08	1.90806e-08	4.46506e-09	8.98719e-10	SECONDS
FAR	300	9.87501e-09	1.14535e-08	8.75507e-09	2.69842e-09	5.68832e-10	SECONDS

6.4 DSV14196T Test Summaries For 25°C

TEST NAME	OBS	AVERAGE	MAX	MIN	RANGE	SIGMA	UNITS
GROSS	100	-0.00129323	0.00381538	-0.00229053	0.00610591	0.00117491	MAMPS
CONTVCC	1600	-1.46893	-0.337235	-9.42136	9.08413	.96568	MAMPS
ADJP	0	-1E+07	-1E+38	1E+38	-2E+38	-1E+07	
FUNVCD33	0	-1E+07	-1E+38	1E+38	-2E+38	-1E+07	
FUNVCR33	0	-1E+07	-1E+38	1E+38	-2E+38	-1E+07	
ICC	100	9.66595	10.0974	9.05465	1.04274	0.258997	MAMPS
ICCQ3	100	9.60111	10.0974	8.98948	1.10791	0.256113	MAMPS
ICCP9Q	200	17.4282	18.702	16.2391	2.46289	0.459887	MAMPS
ICCN9Q	200	-18.3846	-16.081	-20.6095	4.52842	1.24275	MAMPS
ICCP3QH	200	26.293	28.8614	24.5513	4.31006	0.71913	MAMPS
ICCN3QH	200	-26.8625	-23.9482	-30.3954	6.44724	1.3627	MAMPS
IIH(UAMPS)	500	0.00814933	0.0397066	-0.0238239	0.0635305	0.0111516	UAMPS
IIL	500	-1.19177	-1.1035	-1.26949	0.165985	0.0349796	MAMPS
IINP3Q	300	0.652789	0.683471	0.61343	0.0700411	0.0162923	MAMPS
IINN3Q	300	-0.672943	-0.625868	-0.708139	0.0822712	0.0177521	MAMPS
IINN3QQ	300	-0.672705	-0.6279	-0.70962	0.0817207	0.0175027	MAMPS
IINN15Q	300	-4.11575	-3.80815	-4.35919	0.551045	0.112828	MAMPS
IINP15Q	300	4.13001	4.32905	3.86918	0.459861	0.106977	MAMPS
RINQP	300	3453.47	3686.89	3285.63	401.266	92.572	O
RINQM	300	3488.03	3778.12	3282.57	495.547	98.4581	O
VOLD31Q	500	-7.15233	-7.10327	-7.21672	0.113454	0.019193	VOLTS
VOLD32Q	500	-8.74288	-8.65548	-9.29039	0.634911	0.0606517	VOLTS
VOLD7Q	500	-10.2827	-10.1242	-12.681	2.55678	0.416903	VOLTS
VOHD32Q	500	8.6364	8.70496	8.55373	0.151226	0.0321383	VOLTS
VOHD7Q	500	10.9011	11.0064	10.5381	0.46834	0.068282	VOLTS
VOHD31Q	500	7.10124	7.17578	7.02297	0.15281	0.0344936	VOLTS
VOHRQ1	300	3.26795	3.27549	3.26303	0.0124648	0.00290027	VOLTS
VOHRQ5	300	2.37832	2.4261	2.31747	0.108633	0.0260196	VOLTS
VOHRQ31	300	3.26771	3.27289	3.26303	0.00985932	0.00282486	VOLTS
VOHRQ35	300	2.37746	2.42497	2.31486	0.11011	0.0261006	VOLTS

6.4 DSV14196T Test Summaries For 25°C (cont)

TEST NAME	OBS	AVERAGE	MAX	MIN	RANGE	SIGMA	UNITS
VOLR	300	0.21779	0.268368	0.187597	0.0807709	0.0163205	VOLTS
VTH	600	2.02273	2.07568	1.979980	0.095700	0.0176210	VOLTS
VTL	600	0.912298	0.934082	0.899902	0.034180	0.0078226	VOLTS
VOHQVTH	300	2.66932	2.71755	2.60616	0.111385	0.0260726	VOLTS
VOLQVTH	300	0.211465	0.25202	0.184991	0.067029	0.0137232	VOLTS
IOSRQ	300	-1.95442	-1.79044	-2.1159	0.325465	0.0636701	mAMPS
IOSDQP9	500	-11.5985	-10.8702	-12.1466	1.27643	0.242751	mAMPS
IOSDQP3	500	-13.0408	-12.2043	-13.6466	1.44229	0.274387	mAMPS
IOSDQN3	500	13.3464	14.1729	12.4455	1.72742	0.277354	mAMPS
IOSDQN9	500	13.9146	14.7594	12.9625	1.79681	0.287623	mAMPS
ROD	500	776.775	2924.09	420.444	2503.64	664.47	O
RODQO	500	1726.2	3720.29	990.417	2729.87	490.985	O
VTHQD9	1000	1.36131	1.40381	1.3335	0.0703125	0.0145923	VOLTS
VTHQD12	1000	1.34665	1.37744	1.32471	0.0527344	0.0101867	VOLTS
VTHQD13	1000	1.33715	1.36865	1.31592	0.0527344	0.00822527	VOLTS
LHR	300	0.0616405	0.0757355	0.0422811	0.0334544	0.0102331	uSECONDS
HLR	300	0.0289145	0.0333362	0.0253121	0.00802409	0.00220627	uSECONDS
LHD	500	0.233144	0.299021	0.142159	0.156863	0.0491824	uSECONDS
HLD	500	0.0833949	0.092013	0.0793345	0.0126785	0.00303123	uSECONDS
RIR	300	0.023567	0.0255163	0.0222243	0.00329196	0.00073572	uSECONDS
FAR	300	11.0126	13.6812	9.25278	4.42847	0.93457	nSECONDS
RID	500	0.0400758	0.048071	0.0334447	0.0146263	0.00445935	uSECONDS
FAD	500	0.0296445	0.0355216	0.0265915	0.00893002	0.0025491	uSECONDS

6.5 DSV14196T Test Summaries For 85°C

TEST NAME	OBS	AVERAGE	MAX	MIN	RANGE	SIGMA	UNITS
GROSS	100	0.00182495	0.00200083	4.65707E-05	0.00195426	0.000562092	mAMPS
CONTVCC	1600	-1.25166	-0.380281	-10.1011	9.72084	2.28582	mAMPS
ADJP	0	-1E+07	-1E+38	1E+38	-2E+38	-1E+07	
FUNVCD33	0	-1E+07	-1E+38	1E+38	-2E+38	-1E+07	
FUNVCR33	0	-1E+07	-1E+38	1E+38	-2E+38	-1E+07	
ICC	100	8.48821	8.94545	8.0072	0.938254	0.236677	mAMPS
ICCQ3	100	8.43535	8.8829	7.94465	0.938254	0.239413	mAMPS
ICCP9Q	200	15.7164	16.6266	14.7363	1.89028	0.428498	mAMPS
ICCN9Q	200	-16.6811	-14.6151	-18.5974	3.98227	1.17363	mAMPS
ICCP3QH	200	23.5531	25.4608	22.1045	3.35621	0.654639	mAMPS
ICCN3QH	200	-24.1341	-21.5744	-26.9872	5.41279	1.28156	mAMPS
IIH(UAMPS)	500	-0.00114348	0.0376363	-0.0454744	0.0831107	0.017554	UAMPS
IIL	500	-1.06296	-0.996185	-1.13193	0.135744	0.029329	mAMPS
IINP3Q	300	0.592682	0.62354	0.555531	0.0680088	0.0157423	mAMPS
IINN3Q	300	-0.610289	-0.573136	-0.644946	0.07181	0.0161788	mAMPS
IINN3QQ	300	-0.610433	-0.573136	-0.644946	0.07181	0.0160335	mAMPS
IINN15Q	300	-3.62417	-3.34916	-3.84728	0.498119	0.105819	mAMPS
IINP15Q	300	3.60916	3.81753	3.3789	0.438627	0.0993403	mAMPS
RINQP	300	3981.25	4256.14	3757.06	499.079	111.331	O
RINQM	300	3985.33	4328.83	3742.7	586.131	119.531	O
VOLD31Q	500	-7.11252	-7.065	-7.15193	0.0869255	0.0202972	VOLTS
VOLD32Q	500	-9.43777	-8.7885	-10.094	1.30548	0.289347	VOLTS
VOLD7Q	500	-11.012	-10.4834	-11.6937	1.21024	0.262099	VOLTS
VOHD32Q	500	9.31878	9.84378	9.03939	0.80439	0.185484	VOLTS
VOHD7Q	500	11.6864	12.2041	11.0394	1.16468	0.239288	VOLTS
VOHD31Q	500	7.13591	7.17439	7.09211	0.0822744	0.0166245	VOLTS
VOHRQ1	300	3.2654	3.27157	3.26042	0.0111446	0.00243828	VOLTS
VOHRQ5	300	2.2529	2.31336	2.18327	0.130096	0.0311786	VOLTS
VOHRQ31	300	3.26543	3.26907	3.26042	0.00864291	0.00246519	VOLTS
VOHRQ35	300	2.2524	2.31086	2.18327	0.127594	0.0308762	VOLTS

6.5 DSV14196T Test Summaries For 85°C (cont)

TEST NAME	OBS	AVERAGE	MAX	MIN	RANGE	SIGMA	UNITS
VOLR	300	0.257257	0.322738	0.215159	0.107579	0.0348672	VOLTS
VTH	600	1.66439	1.74756	1.604000	0.143555	0.0288177	VOLTS
VTL	600	0.745547	0.783691	0.722168	0.061523	0.0132131	VOLTS
VOHQVTH	300	2.53868	2.6013	2.4687	0.132598	0.0310815	VOLTS
VOLQVTH	300	0.247128	0.299045	0.208904	0.0901412	0.0289511	mAMPS
IOSRQ	300	-1.72293	-1.56469	-1.84649	0.281803	0.0574735	mAMPS
IOSDQP9	500	-9.12308	-8.54269	-9.6528	1.1101	0.22565	mAMPS
IOSDQP3	500	-10.4009	-9.73179	-10.9961	1.26428	0.255074	mAMPS
IOSDQN3	500	10.4371	11.0741	9.77775	1.29639	0.270833	mAMPS
IOSDQN9	500	10.8024	11.4495	10.0589	1.39061	0.283199	mAMPS
ROD	500	647.068	1777.22	426.247	1350.97	365.737	O
RODQO	500	1511.9	3456.06	706.961	2749.1	415.552	O
VTHQD9	1000	1.12838	1.18408	1.0874	0.0966797	0.0208272	VOLTS
VTHQD12	1000	1.11411	1.1665	1.07861	0.0878906	0.0183686	VOLTS
VTHQD13	1000	1.10567	1.15771	1.06982	0.0878906	0.0163302	VOLTS
LHR	300	0.0774647	0.0963938	0.0510498	0.045344	0.013565	uSECONDS
HLR	300	0.0303349	0.0371846	0.024099	0.0130856	0.0040586	uSECONDS
LHD	500	0.191214	0.246496	0.163052	0.0834442	0.015065	uSECONDS
HLD	500	0.0924649	0.100647	0.084467	0.0161797	0.00298634	uSECONDS
RIR	300	0.024746	0.0271882	0.0233077	0.00388055	0.000719643	uSECONDS
FAR	300	13.5029	17.8245	10.4356	7.38887	2.09339	nSECONDS
RID	500	0.0391386	0.0461737	0.0330233	0.0131503	0.00318845	uSECONDS
FAD	500	0.0308374	0.0349008	0.0284581	0.00644276	0.00157014	uSECONDS

6.6 DSV14196T Test Summaries For -40°C

TEST NAME	OBS	AVERAGE	MAX	MIN	RANGE	SIGMA	UNITS
GROSS	100	-0.000127351	-0.000127351	-0.000127351	0	0 mAMPS	
CONTVCC	1600	-1.06311	-0.300855	-6.19012	5.88927	0.91864	mAMPS
ADJP	0	-1E+07	-1E+38	1E+38	-2E+38	-1E+07	
FUNVCD33	0	-1E+07	-1E+38	1E+38	-2E+38	-1E+07	
FUNVCR33	0	-1E+07	-1E+38	1E+38	-2E+38	-1E+07	
ICC	100	10.6978	11.2342	10.0617	1.17248	0.295556	mAMPS
ICCQ3	100	10.6538	11.2016	10.0291	1.17248	0.293225	mAMPS
ICCP9Q	200	19.6898	22.0884	18.3556	3.73282	0.602134	mAMPS
ICCN9Q	200	-19.117	-17.6161	-21.4921	3.87602	0.668594	mAMPS
ICCP3QH	200	29.829	33.9411	27.9378	6.0033	0.926644	mAMPS
ICCN3QH	200	-28.7896	-26.6346	-32.698	6.06348	0.943477	mAMPS
IIH(UAMPS)	500	0.473021	6.56171	-0.119212	6.68092	0.862751	UAMPS
IIL	500	-1.38788	-1.26627	-1.46624	0.199974	0.0366065	mAMPS
IINP3Q	300	0.705548	0.739289	0.661614	0.0776749	0.0184666	mAMPS
IINN3Q	300	-0.730683	-0.682494	-0.770296	0.0878012	0.0192691	mAMPS
IINN3QQ	300	-0.730629	-0.682494	-0.772328	0.089834	0.0194843	mAMPS
IINN15Q	300	-4.6502	-4.30637	-4.92397	0.617608	0.12954	mAMPS
IINP15Q	300	4.66289	4.95241	4.33066	0.621755	0.134254	mAMPS
RINQP	300	3035	3274.24	2848.24	425.999	90.7477	O
RINQM	300	3064.06	3315.1	2883.22	431.886	88.7191	O
VOLD31Q	500	-7.15127	-7.10452	-7.22877	0.124245	0.0221573	VOLTS
VOLD32Q	500	-9.57795	-9.21696	-9.83362	0.616655	0.166059	VOLTS
VOLD7Q	500	-11.1108	-10.655	-11.8329	1.17787	0.203288	VOLTS
VOHD32Q	500	9.83976	10.3034	9.00543	1.29798	0.279822	VOLTS
VOHD7Q	500	11.5007	12.0467	10.9377	1.10899	0.268578	VOLTS
VOHD31Q	500	7.13733	7.2467	7.08103	0.165667	0.0265082	VOLTS
VOHRQ1	300	3.26717	3.27254	3.26143	0.0111086	0.00213507	VOLTS
VOHRQ5	300	2.47355	2.52021	2.4168	0.103412	0.024799	VOLTS
VOHRQ31	300	2.96683	2.97254	2.96143	0.0111086	0.00216023	VOLTS
VOHRQ35	300	2.47315	2.52021	2.4168	0.103412	0.0247392	VOLTS

6.6 DSV14196T Test Summaries For -40°C (cont)

TEST NAME	OBS	AVERAGE	MAX	MIN	RANGE	SIGMA	UNITS
VOLR	300	0.185557	0.219824	0.157542	0.0622822	0.0159119	VOLTS
VTH	600	2.42015	2.47900	2.287600	0.191406	0.0364165	VOLTS
VTL	600	1.098600	1.139160	1.036620	0.102539	0.0183592	VOLTS
VOHQVTH	300	2.76447	2.81101	2.70856	0.102446	0.0248519	VOLTS
VOLQVTH	300	0.181653	0.212014	0.15624	0.0557747	0.0139038	VOLTS
IOSRQ	300	-2.21114	-2.01653	-2.37788	0.361353	0.073105	mAMPS
IOSDQP9	500	-14.1622	-13.0298	-14.7364	1.70668	0.33152	mAMPS
IOSDQP3	500	-15.9287	-14.5933	-16.6597	2.0664	0.402316	mAMPS
IOSDQN3	500	16.6881	17.765	15.6031	2.16188	0.431596	mAMPS
IOSDQN9	500	17.3689	18.3517	16.2653	2.08642	0.409488	mAMPS
ROD	500	791.357	2992.84	434.653	2558.19	683.071	O
RODQO	500	2853.4	5858.48	1095.59	4762.89	1283.6	O
VTHQD9	1000	1.62102	1.65869	1.52686	0.131836	0.0236022	VOLTS
VTHQD12	1000	1.60912	1.64111	1.50928	0.131836	0.0214683	VOLTS
VTHQD13	1000	1.60085	1.63232	1.48291	0.149414	0.0209304	VOLTS
LHR	300	0.0456618	0.0572364	0.0308837	0.0263527	0.00758955	uSECONDS
HLR	300	0.0336878	0.0396432	0.0296369	0.0100063	0.00229799	uSECONDS
LHD	500	0.18225	0.227752	0.149403	0.0783491	0.0237036	uSECONDS
HLD	500	0.074164	0.081071	0.0672619	0.0138091	0.00283089	uSECONDS
RIR	300	0.0219105	0.0237309	0.0202202	0.0035107	0.000766097	uSECONDS
FAR	300	10.3857	11.451	9.38371	2.06727	0.511769	nSECONDS
RID	500	0.031733	0.0384013	0.02786	0.0105412	0.00280017	uSECONDS
FAD	500	0.0241852	0.0271606	0.0203427	0.00681788	0.00171407	uSECONDS

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Email: support@nsc.com

Europe
Fax: +49 (0) 1 80 5 30 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 1 80 5 30 85 85
English Tel: +49 (0) 1 80 5 32 78 32

Japan
Tel: 81-3-5639-7560
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