EVALUATION KIT AVAILABLE

MAXIM

Multirate SMPTE SD/HD Cable Driver with Selectable Slew Rate

MAX3812

General Description

The MAX3812 is a multirate SMPTE cable driver designed to operate at data rates up to 1.485Gbps, driving one or two 75Ω coaxial cables. Two selectable slew rates are provided for compliance to SMPTE 292M, SMPTE 344M, and SMPTE 259M. The MAX3812 is pin compatible with the Gennum GS1528.

The MAX3812 inputs are internally biased and compatible with differential swings of CML, LVPECL, and LVDS. Output voltage swing is adjustable with a single external resistor.

The MAX3812 operates over a 0°C to +85°C temperature range. It typically consumes 106mW with a +3.3V power supply and is available in an 8-pin SO package.

Applications

SMPTE 292M, SMPTE 344M, SMPTE 259M, and DVB-ASI Coaxial Cable Serial Digital Interfaces

Professional Digital Video Switchers and Routers

Professional Digital Video Cameras and Recording Devices
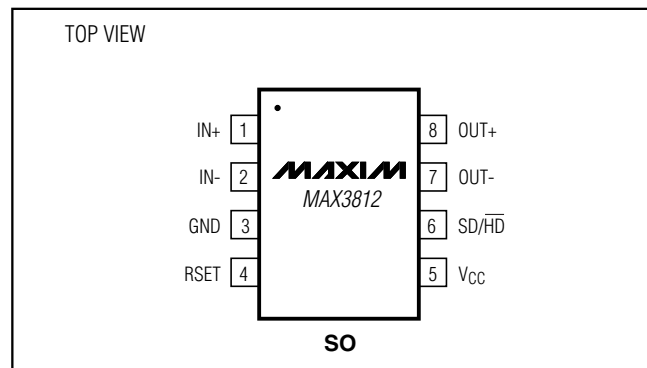
Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX3812USA	0°C to +85°C	8 SO
MAX3812USA+	0°C to +85°C	8 SO

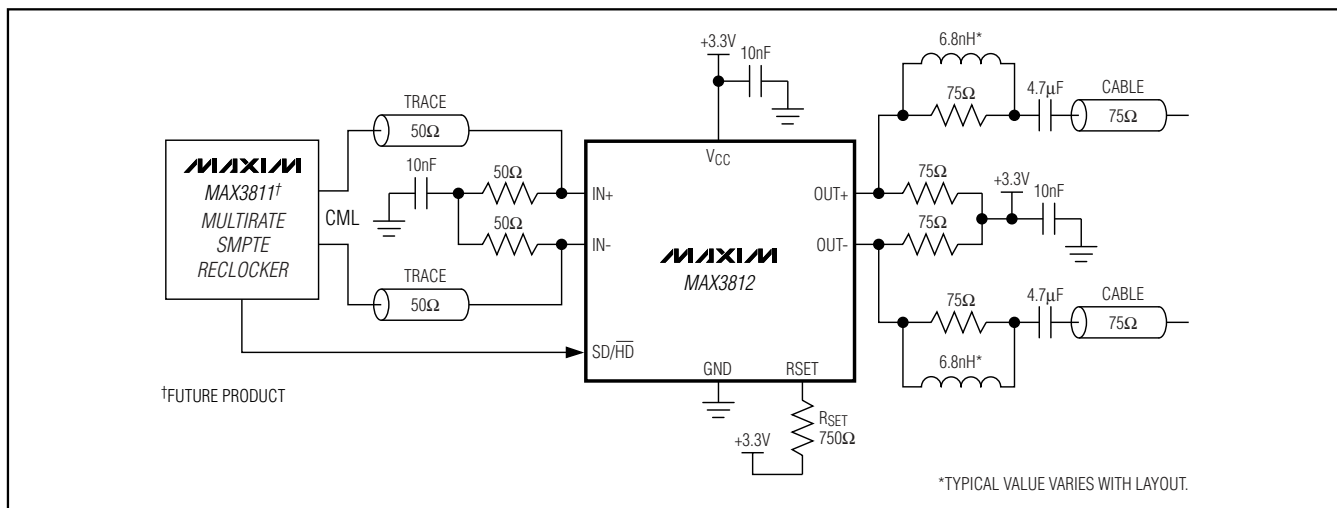*+Denotes lead-free package. Contact factory for availability.*

Features

♦ **SMPTE 292M, SMPTE 344M, SMPTE 259M, and DVB-ASI Compliant**

♦ **106mW Power Consumption Using a +3.3V Power Supply**

♦ **Smooth Rise/Fall Transitions for Low EMI**

♦ **Selectable Slew Rate for HD and SD Rates**

♦ **Pin Compatible with Gennum GS1528**

♦ **Dual Coaxial Cable Driving Outputs**

♦ **Adjustable Output Voltage Swing**

♦ **Input Compatibility with Differential Swings of CML, LVPECL, and LVDS**

♦ **0°C to +85°C Operating Temperature Range**

Pin Configuration

TOP VIEW

Pin	Name		Pin	Name
1	IN+		8	OUT+
2	IN-		7	OUT-
3	GND		6	SD/$\overline{\text{HD}}$
4	RSET		5	V$_{CC}$

MAX3812

SO

Typical Application Circuit

†FUTURE PRODUCT

*TYPICAL VALUE VARIES WITH LAYOUT.

MAXIM _____ **_Maxim Integrated Products_** **1**

For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

Multirate SMPTE SD/HD Cable Driver
with Selectable Slew Rate

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) ....-0.5V to +4.0V
Voltage at IN+, IN-, RSET, SD/$\overline{HD}$,
    OUT+, OUT- ....-0.5V to (V_{CC} + 0.5V)

Continuous Power Dissipation (T_A = +85°C)
    8-Pin SO (derate 5.9mW/°C above +85°C).................384mW
Storage Temperature Range ....-55°C to +150°C
Lead Temperature (soldering, 10s) ....+300°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC ELECTRICAL CHARACTERISTICS

(V_{CC} = +3.0V to +3.6V, T_A = 0°C to +85°C. Typical values are at V_{CC} = +3.3V, T_A= +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current	I_{CC}	R_{SET} = 750Ω		32	45	mA
Power Consumption		R_{SET} = 750Ω		106		mW
Output Common-Mode Voltage	V_{CMOUT}	Figure 1, AC-coupled output		V_{CC} - V_{OUT}		V
Input Common-Mode Voltage	V_{CMIN}	Figure 1	1.6 + V_{INDIFF} / 4		V_{CC} - V_{INDIFF} / 4	V
SD/$\overline{HD}$ Input-High Voltage	V_{IH}		2.0			V
SD/$\overline{HD}$ Input-Low Voltage	V_{IL}				0.8	V
SD/$\overline{HD}$ Input-High Current	I_{IH}	2.0V ≤ $V_{SD/\overline{HD}}$ ≤ V_{CC}	-110	-40		µA
SD/$\overline{HD}$ Input-Low Current	I_{IL}	0V ≤ $V_{SD/\overline{HD}}$ ≤ 0.8V	-150	-90		µA

AC ELECTRICAL CHARACTERISTICS

(V_{CC} = +3.0V to +3.6V, T_A = 0°C to +85°C. Typical values are at V_{CC} = +3.3V, T_A= +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Serial Input Data Rate			19		1485	Mb/s
Supply-Noise Tolerance		60Hz ≤ f_{NOISE} ≤ 27MHz		100		mV_{P-P}
		27MHz < f_{NOISE} ≤ 1.5GHz		40		
Total Intrinsic Jitter (Notes 1, 2)	TJ	1.485Gb/		0.03	0.05	UI_{P-P}
		540Mb/s		0.04	0.07	
		19Mb/s, 143Mb/s, 177Mb/s, 270Mb/s, 360Mb/s		0.02	0.05	
Output Rise/Fall Time	t_r, t_f	20% to 80%, SD/$\overline{HD}$ = low		145	220	ps
		20% to 80%, SD/$\overline{HD}$ = high	450	675	750	
Mismatch in Rise/Fall Time		(Notes 1, 3)		5	30	ps
Duty-Cycle Distortion		(Notes 1, 3)		2		ps
Output Return Loss		5MHz to 1.485GHz (Note 4)		19		dB
Output Voltage Swing	V_{OUT}	Single-ended, R_{SET} = 750Ω, Figure 1	750	800	850	mV_{P-P}
		Single-ended, R_{SET} = 570Ω, Figure 1		1050		
		Single-ended, R_{SET} = 1000Ω, Figure 1		600		
Input Voltage Swing	V_{INDIFF}	Differential, Figure 1	300		2000	mV_{P-P}
Input Rise/Fall Time		20% to 80% (Note 5)			230	ps

MAXIM

MAX3812

AC ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = +3.0V to +3.6V, T_A = 0°C to +85°C. Typical values are at V_{CC} = +3.3V, T_A= +25°C, unless otherwise noted.)

Note 1: Guaranteed by design and characterization.
Note 2: Total intrinsic jitter is defined as the summation of deterministic jitter (DJ) and random jitter (RJ) using the formula:
$TJ(UI_{P-P}) = DJ(UI_{P-P}) + 14.1 \times RJ(UI_{RMS})$
Note 3: Measured at 1.485Gb/s using a 0011 pattern.
Note 4: See the Output Return Loss graph in the *Typical Operating Characteristics*.
Note 5: Input signals must reach the full amplitude levels within the unit interval.
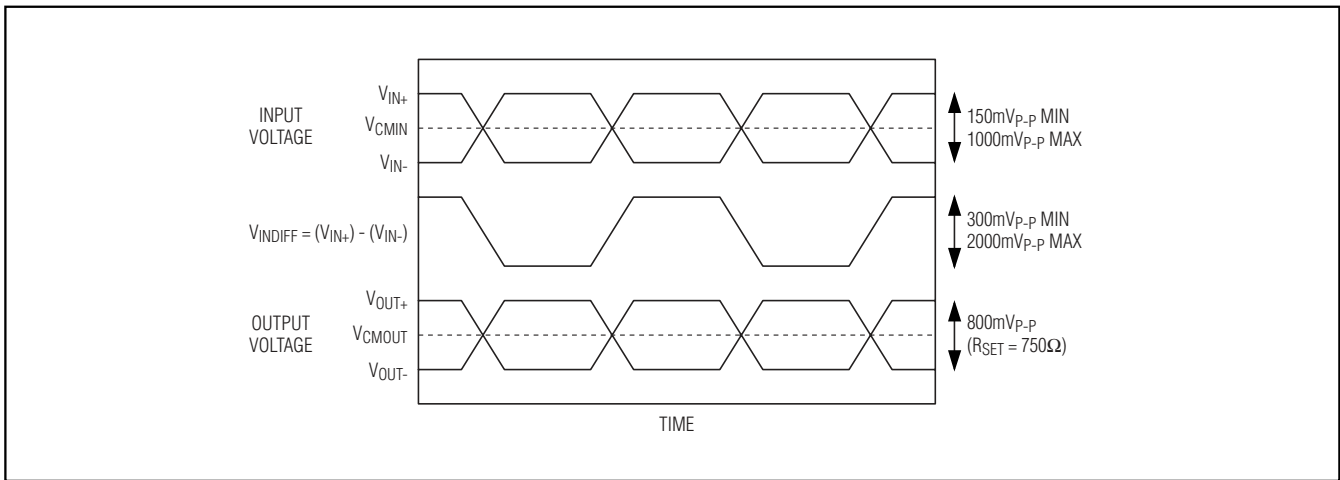
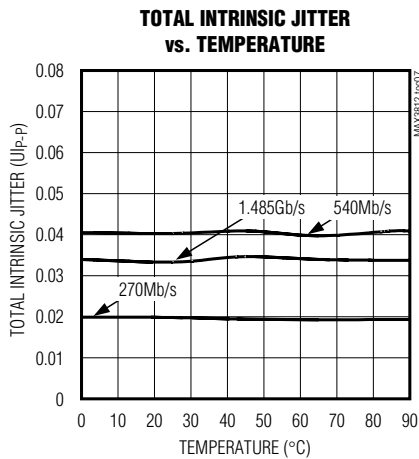Figure 1. Definition of Input and Output Voltage

_____*Typical Operating Characteristics*
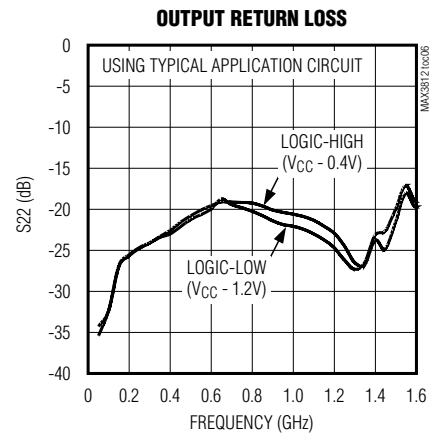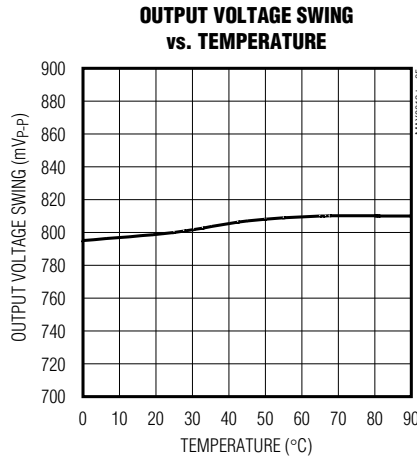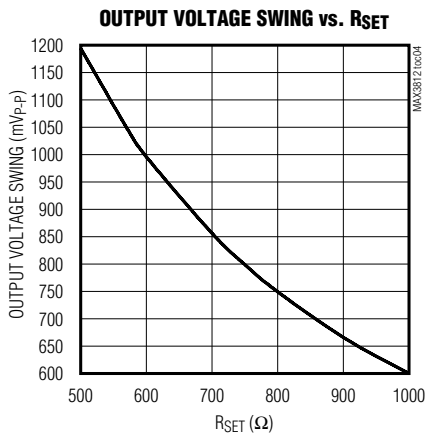
(V_{CC} = +3.3V, T_A = +25°C, R_{SET} = 750Ω, unless otherwise noted.)
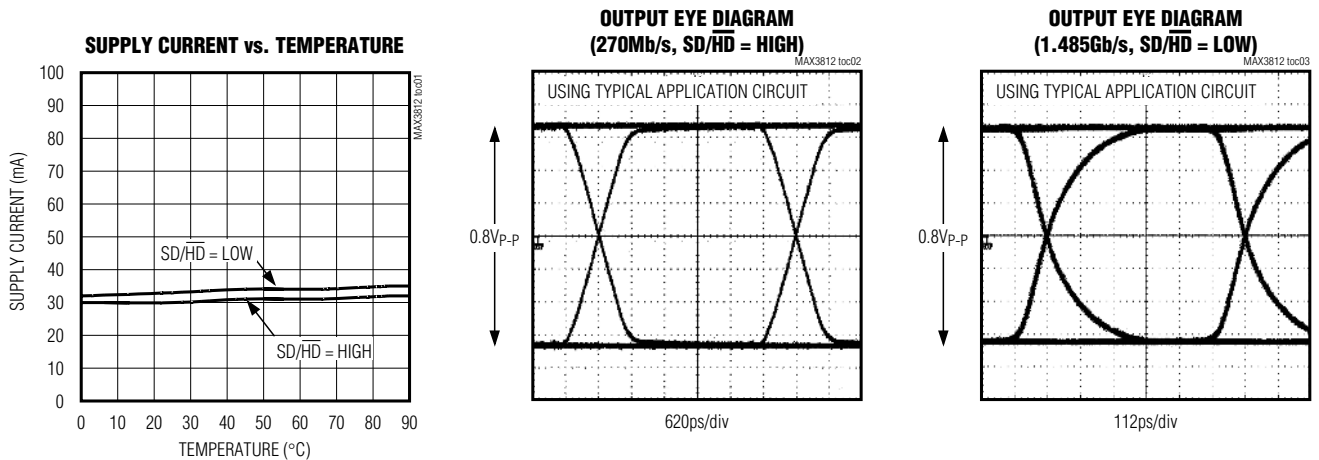
Multirate SMPTE SD/HD Cable Driver with Selectable Slew Rate

Typical Operating Characteristics (continued)

(V_{CC} = +3.3V, T_A = +25°C, R_{SET} = 750Ω, unless otherwise noted.)

OUTPUT VOLTAGE SWING vs. R_{SET}

OUTPUT VOLTAGE SWING vs. TEMPERATURE

OUTPUT RETURN LOSS

TOTAL INTRINSIC JITTER vs. TEMPERATURE

TOTAL INTRINSIC JITTER vs. INPUT VOLTAGE SWING

DUTY-CYCLE DISTORTION vs. TEMPERATURE

DUTY-CYCLE DISTORTION vs. INPUT VOLTAGE SWING

MAXIM
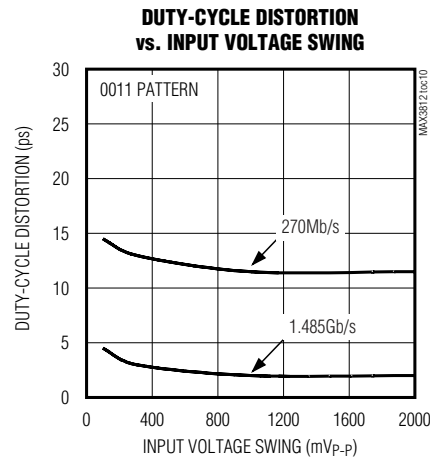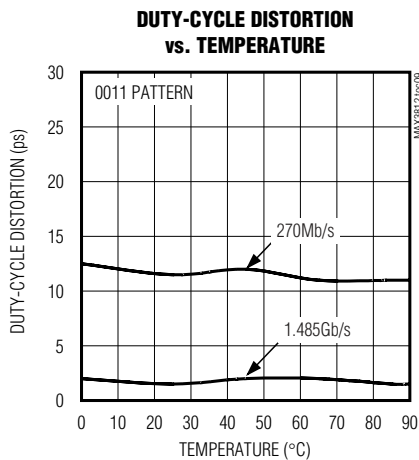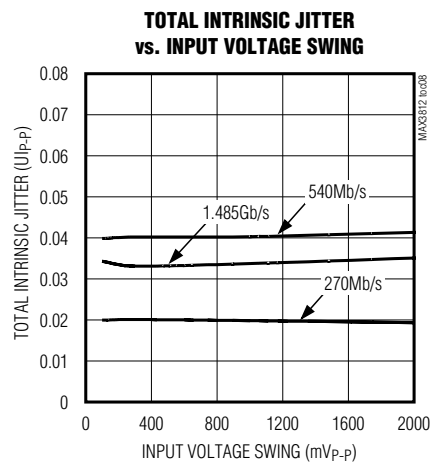
_____**Pin Description**

PIN	NAME	FUNCTION
1	IN+	Positive Data Input
2	IN-	Negative Data Input
3	GND	Supply Ground
4	RSET	Output-Voltage-Swing Control. Connect a resistor between RSET and V_{CC} to set the output voltage swing.
5	V_{CC}	+3.3V Supply Voltage
6	SD/$\overline{HD}$	Output Slew-Rate Control, LVTTL. Set HIGH for SMPTE 259M/344M rise/fall specifications. Set LOW for SMPTE 292M rise/fall specifications.
7	OUT-	Negative Data Output
8	OUT+	Positive Data Output

_____**Detailed Description**

The MAX3812 is a multirate SMPTE cable driver designed to drive 75Ω coaxial cable for serial digital interfaces. The driver consists of a differential input buffer, slew-rate selection switch, output-voltage-swing control, and a differential output buffer (Figure 2).

Differential Data Inputs

The MAX3812 data inputs (IN+, IN-) are high impedance and should be terminated as shown in the *Typical Application Circuit*. When properly terminated, the inputs are compatible with differential swings of CML, LVPECL, and LVDS. For more information about logic interfacing, refer to Maxim application note *HFAN-01.0: Introduction to LVDS, PECL, and CML*.

While DC-coupled, the MAX3812 operates properly as long as the specified common-mode voltage and differential voltage swings are met. Because of the on-chip biasing network (Figure 3), the inputs self-bias to the proper operating point to accommodate AC-coupling. If the inputs are AC-coupled, a minimum capacitor value of 4.7μF should be used to accommodate SMPTE pathological test signals.
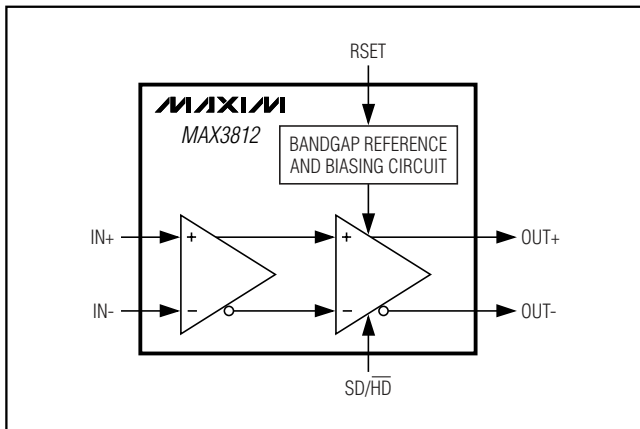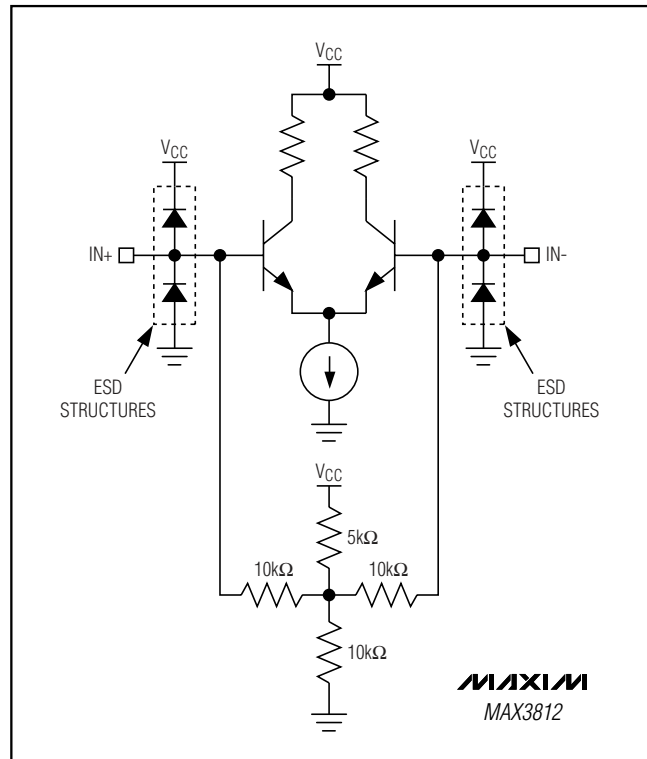

Figure 2. Functional Diagram

Figure 3. Differential Input Circuit

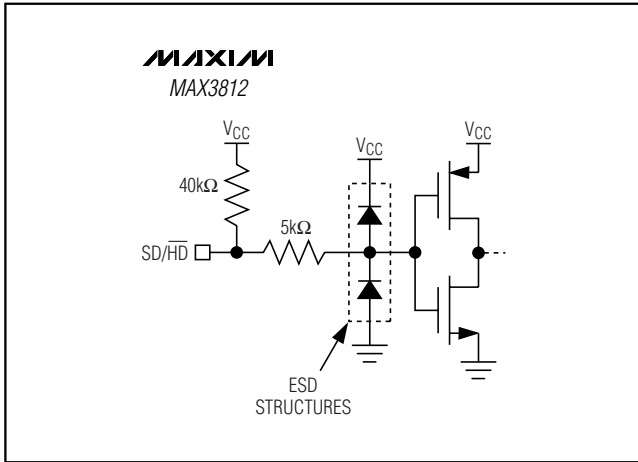# Multirate SMPTE SD/HD Cable Driver with Selectable Slew Rate

Figure 4. Slew-Rate Selection Switch

Slew-Rate Selection Switch

The MAX3812 output has a selectable slew-rate in order to achieve compliance to SMPTE 259M/344M and SMPTE 292M. Output slew rate is selected with the SD/$\overline{HD}$ input (Figure 4). The SD/$\overline{HD}$ pin must be set high for SMPTE 259M/344M standards and low for SMPTE 292M standards.

Differential Data Outputs

The MAX3812 differential data outputs are current-mode logic, CML (Figure 5). Each side of the differential output will drive 800mV$_{P-P}$ into a doubly terminated 75Ω transmission line (R$_{SET}$ = 750Ω).

The cable driver output must have a source impedance of 75Ω and a return loss of at least 15dB between 5MHz and 1.485GHz to comply with the SMPTE 259M, SMPTE 344M, and SMPTE 292M standards. In order to meet the return loss specification, the output network shown in the *Typical Application Circuit* is recommended.

The value of the output inductor is typically 6.8nH, but the value will vary depending on PC board layout. If the outputs are AC-coupled, a minimum capacitor value of 4.7µF should be used to accommodate SMPTE pathological test signals.

When measuring output return loss, it is necessary to take the measurement for both a logic-high and logic-low state. This is due to the output capacitance being slightly dependent on the logic state. See the Output Return Loss graph in the *Typical Operating Characterisitics*.

Output Voltage Swing Control

The external R$_{SET}$ resistor connected between V$_{CC}$ and the RSET pin controls the output voltage swing (Figure 5). Typically the output voltage swing is set to 800mV$_{P-P}$ using a value of 750Ω. For output voltage swings other than 800mV$_{P-P}$, see the graph Output Voltage Swing vs. R$_{SET}$ given in the *Typical Operating Characteristics*. Using R$_{SET}$ values below 500Ω is not recommended.

The R$_{SET}$ resistor should be placed as close as possible to the RSET pin and the capacitance at this node should be minimized.

Applications Information

Layout Considerations

Use controlled-impedance transmission lines to interface with the MAX3812 high-speed inputs and outputs. Power-supply decoupling capacitors should be placed as close as possible to the V$_{CC}$ connections. To support a 75Ω transmission-line environment at the outputs, it is necessary to minimize the parasitic capacitance by removing the PC board ground plane from under the output pins and output components. Transmission line stubs associated with BNC connectors should be minimized. Edge-mount BNC connectors are recommended.

MAXIM

MAX3812
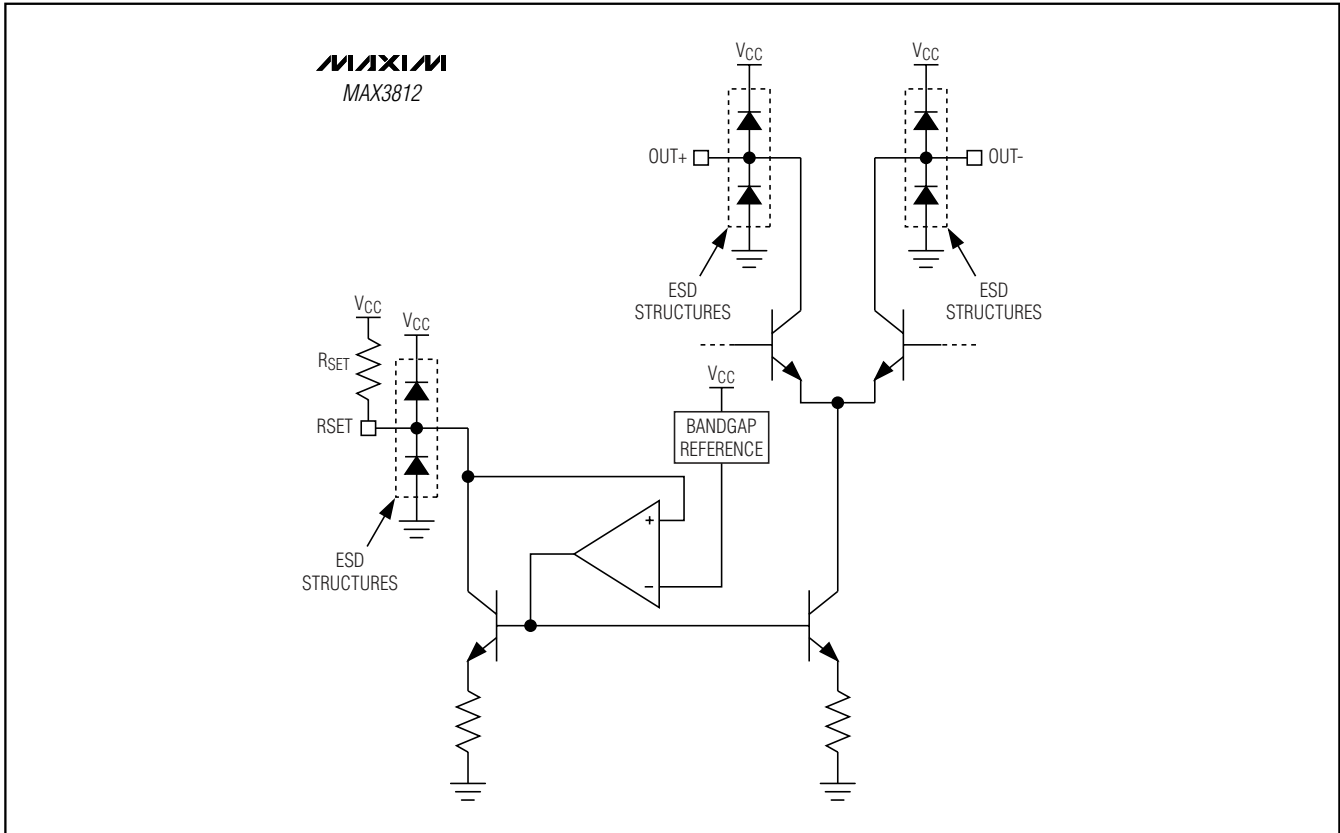
Figure 5. Differential Output and Biasing Circuit

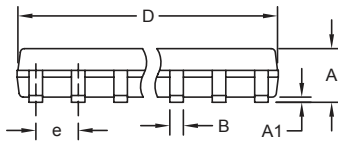## Chip Information

TRANSISTOR COUNT: 926
PROCESS: SiGe Bipolar
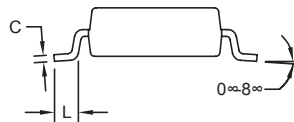
MAX3812

Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

SOICN.EPS

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
e	0.050 BSC		1.27 BSC	
E	0.150	0.157	3.80	4.00
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27

VARIATIONS:

DIM	INCHES		MILLIMETERS		N	MS012
	MIN	MAX	MIN	MAX		
D	0.189	0.197	4.80	5.00	8	AA
D	0.337	0.344	8.55	8.75	14	AB
D	0.386	0.394	9.80	10.00	16	AC
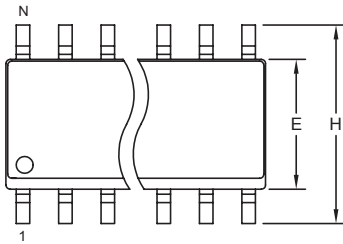
TOP VIEW

FRONT VIEW

SIDE VIEW

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm (.006").
3. LEADS TO BE COPLANAR WITHIN 0.10mm (.004").
4. CONTROLLING DIMENSION: MILLIMETERS.
5. MEETS JEDEC MS012.
6. N = NUMBER OF PINS.

DALLAS SEMICONDUCTOR **MAXIM**

PROPRIETARY INFORMATION

TITLE:
PACKAGE OUTLINE, .150" SOIC

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0041	B	1⁄1