



## Characteristics

Parameter	Rating	Units
Output Voltage	20	V
Output Rise Time	5	ns
Output Fall Time	5	ns

## Features

- CMOS Technology
- TTL/CMOS Compatible Inputs
- Low Switching Noise
- 5nS Typical True / Complement Output Skew
- 5nS Typical Output Rise and Fall Times
- Up to 20V Output Voltage
- Output High Voltage Programmable Via  $V_{OPT}$
- Output Low Voltage Programmable Via  $V_{EE}$

## Applications

- Digital Control of Analog Circuits
- Level Shifting and Amplification
- Circuit Applications Requiring Complementary Signal Generation with Low Skew
- Bias Control for PIN Diode Drivers in a Microwave Switch

## Description

The MX856 and MX857 are high speed, single-channel level shifters with complementary output drivers. The MX856 features a 5.0V  $V_{CC}$  positive supply, and the MX857 features a 3.3V  $V_{CC}$  positive supply.

The input buffers accept digital TTL or CMOS level signals, amplifies them to the  $V_{CC}$  and GND supply rails, and generates complementary outputs. The translator level shifts these output signals by amplifying them to the  $V_{CC}$  and  $V_{EE}$  supply rails.

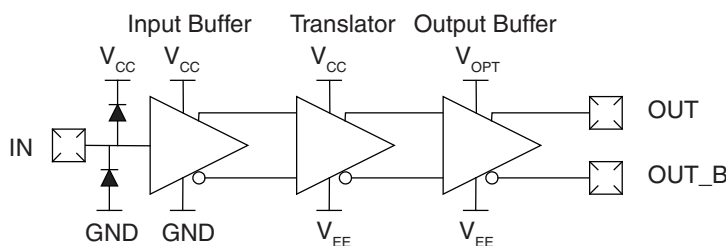
The output drivers then buffer the signals to  $V_{OPT}$  and  $V_{EE}$ .  $V_{OPT}$  may be set within the range of  $V_{CC}$  and GND. The output drivers also adjust the complementary signals for minimized skew error.

The MX856 and MX857 are designed to operate over a temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ , and are available in an 8-lead SOIC package.

## Ordering Information

Part	Description
MX856B	8-Lead SOIC (100/Tube)
MX856BTR	8-Lead SOIC, Tape&Reel (1000/Reel)
MX857B	8-Lead SOIC (100/Tube)
MX857BTR	8-Lead SOIC, Tape&Reel (1000/Reel)

## Functional Block Diagram

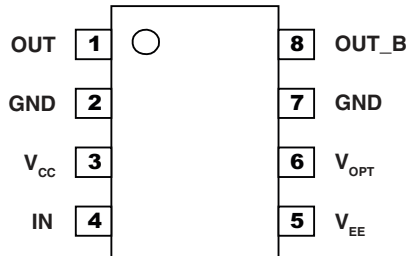


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## 1 Specifications

### 1.1 Package Pinout



### 1.2 Pin Description

Pin#	Name	Description
1	OUT	Output Driver
2	GND	Ground
3	V <sub>CC</sub>	Positive Supply for Input Buffer
4	IN	Input Buffer
5	V <sub>EE</sub>	Negative Supply for Output Driver
6	V <sub>OPT</sub>	Positive Supply for Output Driver
7	GND	Ground
8	OUT_B	Complementary Output Driver

### 1.3 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units
Positive DC Supply Voltage	V <sub>CC</sub>	-0.4	6	V
Negative DC Supply Voltage	V <sub>EE</sub>	-17	0.4	V
Output Positive DC Supply Voltage	V <sub>OPT</sub>	-	6	V
Output Positive to Negative Supply Voltage	V <sub>OPT</sub> -V <sub>EE</sub>	-0.4	20	V
Positive to Negative Supply Voltage	V <sub>CC</sub> -V <sub>EE</sub>	-0.4	14	V
Positive to Output Supply Voltage	V <sub>CC</sub> -V <sub>OPT</sub>	-0.4	V <sub>CC</sub> +0.4	V
DC Input Voltage	V <sub>IN</sub>	-0.4	V <sub>CC</sub> +0.4	V
DC Input Current	I <sub>IN</sub>	-10	10	μA
Operating Temperature	T <sub>A</sub>	-40	85	°C
Storage Temperature	T <sub>STG</sub>	-65	150	°C
ESD Sensitivity (Human Body Model)	ESD	1.0	-	kV

Absolute maximum electrical ratings are at 25°C

*Absolute maximum ratings are stress ratings. Stresses in excess of these ratings can cause permanent damage to the device. Functional operation of the device at conditions beyond those indicated in the operational sections of this data sheet is not implied.*

### 1.4 MX856: Guaranteed Operating Range

Parameter	Symbol	Min	Max	Units
Positive DC Supply Voltage	$V_{CC}$	3	5.5	V
Negative DC Supply Voltage	$V_{EE}$	-15	-4.5	V
Output Positive DC Supply Voltage	$V_{OPT}$	0	5.5	V
Output Positive to Negative Supply Voltage	$V_{OPT}-V_{EE}$	7.5	20	V
Positive to Negative Supply Voltage	$V_{CC}-V_{EE}$	7.5	20	V
Positive to Output Supply Voltage	$V_{CC}-V_{OPT}$	0	$V_{CC}$	V
Operating Temperature	$T_A$	-40	85	°C
Input Rise and Fall Time	$T_R, T_F$	0	500	ns

### 1.5 MX857: Guaranteed Operating Range

Parameter	Symbol	Min	Max	Units
Positive DC Supply Voltage	$V_{CC}$	3	3.6	V
Negative DC Supply Voltage	$V_{EE}$	-17	-4.5	V
Output Positive DC Supply Voltage	$V_{OPT}$	0	3.6	V
Output Positive to Negative Supply Voltage	$V_{OPT}-V_{EE}$	7.5	20	V
Positive to Negative Supply Voltage	$V_{CC}-V_{EE}$	7.5	20	V
Positive to Output Supply Voltage	$V_{CC}-V_{OPT}$	0	$V_{CC}$	V
Operating Temperature	$T_A$	-40	85	°C
Input Rise and Fall Time	$T_R, T_F$	0	500	ns

### 1.6 DC Electrical Characteristics

Over guaranteed operating range.

Parameter	Conditions	Symbol	Min	Typ	Max	Units
Input High Voltage	-	$V_{IH}$	2	-	-	V
Input Low Voltage	-	$V_{IL}$	-	-	0.8	V
Output High Voltage ( $I_{OH}=1mA$ )	-	$V_{OH}$	$V_{OPT}-0.1$	-	-	V
Output Low Voltage ( $I_{OL}=1mA$ )	-	$V_{OL}$	-	-	$V_{EE}+0.1$	V
Input Current ( $V_{IN}=0.0$ to $V_{CC}$ )	-	$I_{IN}$	-10	-	10	μA
Supply Current ( $V_{IN}=0$ or $V_{CC}$ )	$V_{CC}=3.3V$	$I_{CC}$	-	<1	-	μA
	$V_{CC}=5V$		-	<1	-	
Supply Current ( $V_{IN}=0$ or $V_{CC}$ )	$V_{CC}=3.3V$	$I_{EE}$	-	<1	-	
	$V_{CC}=5V$		-	<1	-	
Supply Current ( $V_{IN}=0$ or $V_{CC}$ )	$V_{CC}=3.3V$	$I_{OPT}$	-	<1	-	
	$V_{CC}=5V$		-	<1	-	

### 1.7 ESD Warning

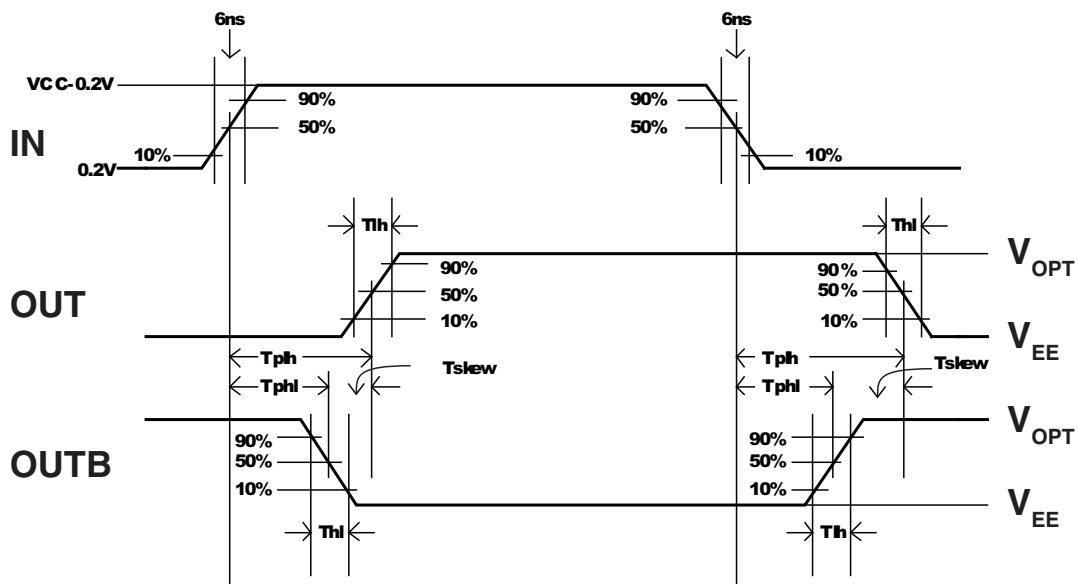
ESD (electrostatic discharge) sensitive device. Electrostatic charges can readily accumulate on test equipment and the human body in excess of 4000 Volts. This energy can discharge without detection. Although the MX856 / MX857 feature proprietary ESD

protection circuitry, permanent damage may be sustained if subjected to high energy electrostatic discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

### 1.8 AC Electrical Characteristics

$V_{CC}=V_{OPT}=3.3V$ ,  $V_{EE}=-16.75V$  or  $-4.5V$ , input rise and fall times 6ns,  $V_{IN}=3.1V$ ,  $V_{IL}=0.2V$ ,  $T_A=-40^{\circ}C$  to  $+85^{\circ}C$   
 $V_{CC}=V_{OPT}=5V$ ,  $V_{EE}=-15V$  or  $-4.5V$ , input rise and fall times 6ns,  $V_{IN}=4.8V$ ,  $V_{IL}=0.2V$ ,  $T_A=-40^{\circ}C$  to  $+85^{\circ}C$

Parameter	Conditions	Symbol	Min	Typ	Max	Units
Propogation Delay (Low to High Input)	$V_{CC}=3.5V$	$T_{PLH}$	-	22	29	ns
	$V_{CC}=5.0V$		-	24	29	
Propogation Delay (High to Low Input)	$V_{CC}=3.5V$	$T_{PHL}$	-	20	29	
	$V_{CC}=5.0V$		-	20	29	
Output Rise Time ( $C_{LD}=10pF$ )	$V_{CC}=3.5V$	$T_{TLH}$	-	5	9	
	$V_{CC}=5.0V$		-	4	9	
Output Fall Time ( $C_{LD}=10pF$ )	$V_{CC}=3.5V$	$T_{THL}$	-	5	8	
	$V_{CC}=5.0V$		-	4	8	
Delay Skew (Output A to Output B)	$V_{CC}=3.5V$	$T_{SKEW}$	-	5	10	
	$V_{CC}=5.0V$		-	5	10	
Input Capacitance	-	$C_{IN}$	-	-	15	pF



## 2 Manufacturing Information

### 2.1 Moisture Sensitivity



All plastic encapsulated semiconductor packages are susceptible to moisture ingress. Clare classified all of its plastic encapsulated devices for moisture sensitivity according to the latest version of the joint industry standard, **IPC/JEDEC J-STD-020**, in force at the time of product evaluation. We test all of our products to the maximum conditions set forth in the standard, and guarantee proper operation of our devices when handled according to the limitations and information in that standard as well as to any limitations set forth in the information or standards referenced below.

Failure to adhere to the warnings or limitations as established by the listed specifications could result in reduced product performance, reduction of operable life, and/or reduction of overall reliability.

This product carries a **Moisture Sensitivity Level (MSL) rating** as shown below, and should be handled according to the requirements of the latest version of the joint industry standard **IPC/JEDEC J-STD-033**.

Device	Moisture Sensitivity Level (MSL) Rating
MX856B / MX857B	MSL 1

### 2.2 ESD Sensitivity



This product is **ESD Sensitive**, and should be handled according to the industry standard **JESD-625**.

### 2.3 Reflow Profile

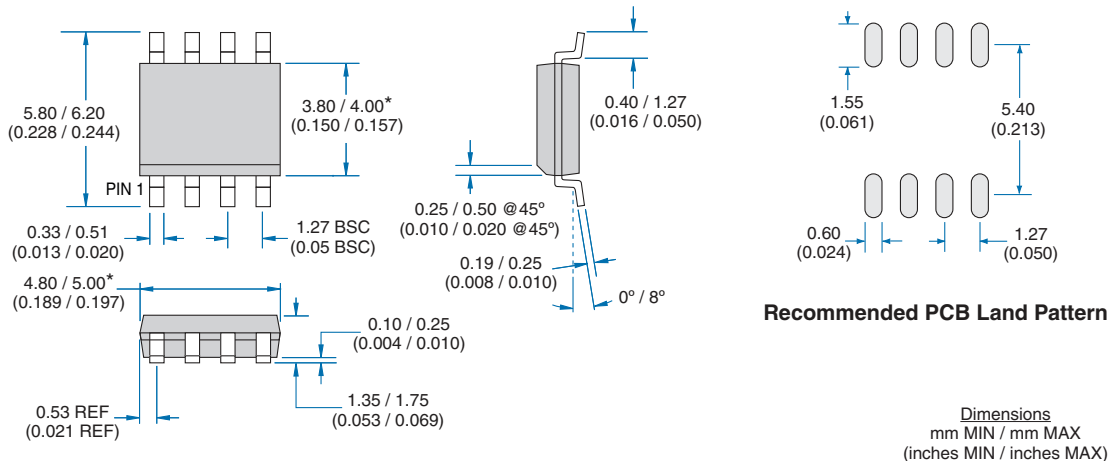
This product has a maximum body temperature and time rating as shown below. All other guidelines of **J-STD-020** must be observed.

Device	Maximum Temperature x Time
MX856B / MX857B	260°C for 30 seconds



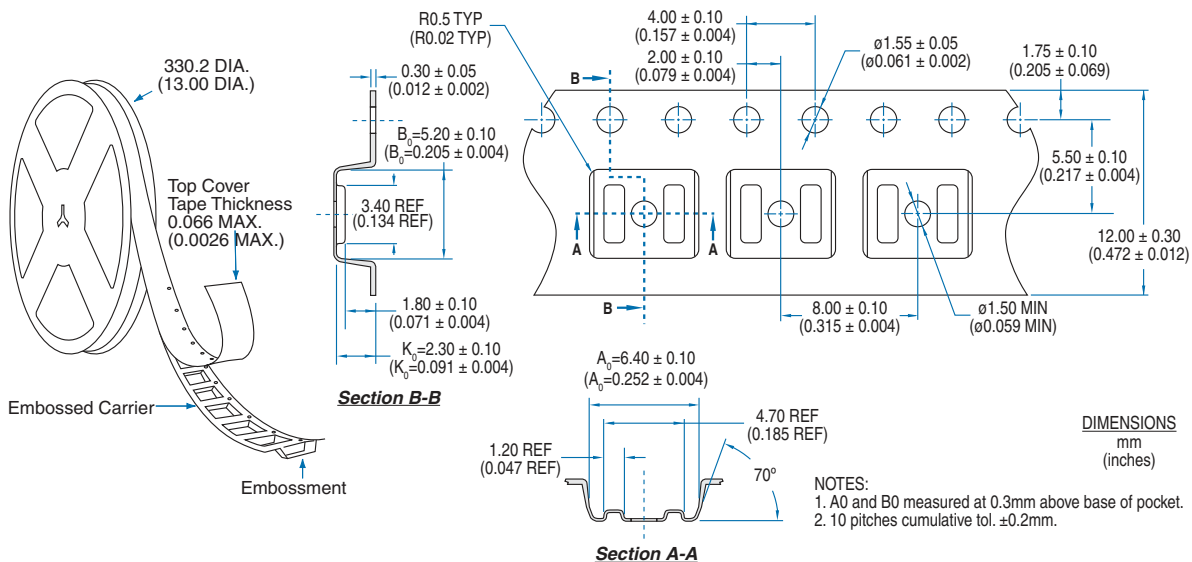
### 2.4 Mechanical Dimensions

#### 2.4.1 8-Lead SOIC Package



- NOTES: (Unless otherwise specified)
1. Controlling dimensions: millimeters.
  2. Dimensions (\*) do not include mold protrusions.
  3. Molded package shall conform to JEDEC standard configuration MS-012 variation AA.

#### 2.4.2 Tape & Reel Dimensions



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Specification: DS-MX856/MX857-20110729  
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7/29/2011