

**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

**General Description**

The MX856 and MX857 are high speed single channel level shifters with complimentary 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 complimentary 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 as die in wafer form, die in waaffle pack, 8 lead SOIC package, and SOIC on Tape and Reel.

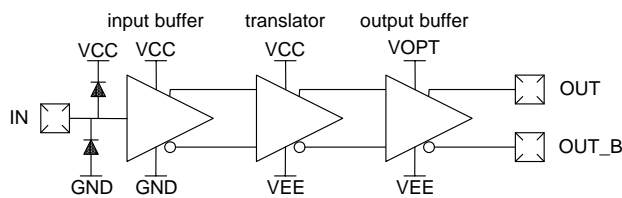
**Ordering Information – MX856**

Part No.	Description
19202	MX856 Die / Wafer Form
19201	MX856 Die / Waffle Pack
19200-00	MX856 8 Lead SOIC
19241-00	MX856 SOIC on Tape & Reel

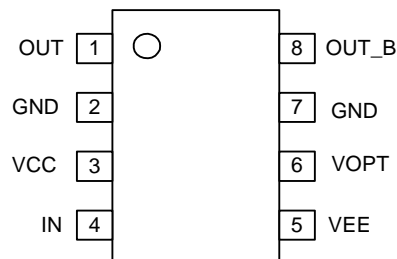
**Ordering Information – MX857**

Part No.	Description
19302	MX857 Die / Wafer Form
19301	MX857 Die / Waffle Pack
19300-00	MX857 8 Lead SOIC
19341-00	MX857 SOIC on Tape & Reel

**Functional Block Diagram**



**8 Lead SOIC Configuration**



### Absolute Maximum Ratings

SYMBOL	PARAMETER	MIN	MAX	UNITS
V <sub>CC</sub>	Positive DC Supply Voltage	-0.4	+6.0	V
V <sub>EE</sub>	Negative DC Supply Voltage	-17.0	+0.4	V
V <sub>OPT</sub>	Output Positive DC Supply Voltage		+6.0	V
V <sub>OPT</sub> - V <sub>EE</sub>	Output Positive to Negative Supply Voltage	-0.4	+20.0	V
V <sub>CC</sub> - V <sub>EE</sub>	Positive to Negative Supply Voltage	-0.4	+14.0	V
V <sub>CC</sub> - V <sub>OPT</sub>	Positive to Output Supply Voltage	-0.4	V <sub>CC</sub> +0.4	V
V <sub>IN</sub>	DC Input Voltage	-0.4	V <sub>CC</sub> +0.4	V
I <sub>IN</sub>	DC Input Current	-10	+10	μA
T <sub>A</sub>	Ambient Operating Temperature	-40	+85	°C
T <sub>STG</sub>	Storage Temperature	-65	+150	°C
ESD	ESD sensitivity (human body model)	1.0		kV

*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 these or any other conditions beyond those indicated in the operational sections of this data sheet is not implied. Exposure of the device to the absolute maximum ratings for an extended period may degrade the device and affect its reliability.*

### Guaranteed Operating Range

MX856 5.0V version

SYMBOL	PARAMETER	MIN	MAX	UNITS
V <sub>CC</sub>	Positive DC Supply Voltage	3.0	5.5	V
V <sub>EE</sub>	Negative DC Supply Voltage	-15.0	-4.5	V
V <sub>OPT</sub>	Output Positive DC Supply Voltage	0.0	5.5	V
V <sub>OPT</sub> - V <sub>EE</sub>	Output Positive to Negative Supply Voltage	7.5	20.0	V
V <sub>CC</sub> - V <sub>EE</sub>	Positive to Negative Supply Voltage	7.5	20.0	V
V <sub>CC</sub> - V <sub>OPT</sub>	Positive to Output Supply Voltage	0.0	V <sub>CC</sub>	V
T <sub>A</sub>	Ambient Operating Temperature	-40	+85	°C
T <sub>R</sub> , T <sub>F</sub>	Input Rise and Fall Time	0.0	500	nS

MX857B 3.3V version

SYMBOL	PARAMETER	MIN	MAX	UNITS
V <sub>CC</sub>	Positive DC Supply Voltage	3.0	3.6	V
V <sub>EE</sub>	Negative DC Supply Voltage	-17.0	-4.5	V
V <sub>OPT</sub>	Output Positive DC Supply Voltage	0.0	3.6	V
V <sub>OPT</sub> - V <sub>EE</sub>	Output Positive to Negative Supply Voltage	7.5	20.0	V
V <sub>CC</sub> - V <sub>EE</sub>	Positive to Negative Supply Voltage	7.5	20.0	V
V <sub>CC</sub> - V <sub>OPT</sub>	Positive to Output Supply Voltage	0.0	V <sub>CC</sub>	V
T <sub>A</sub>	Ambient Operating Temperature	-40	+85	°C
T <sub>R</sub> , T <sub>F</sub>	Input Rise and Fall Time	0.0	500	nS

**DC Characteristics - Over Guaranteed Operating Range**

SYMBOL	PARAMETER	MIN	TYP	MAX	Units
V <sub>IH</sub>	Input HIGH Voltage	2.0			V
V <sub>IL</sub>	Input LOW Voltage			0.8	V
V <sub>OH</sub>	Output HIGH Voltage (I <sub>OH</sub> =-1mA)	V <sub>OPT</sub> - 0.1			V
V <sub>OL</sub>	Output LOW Voltage (I <sub>OL</sub> =1mA)			V <sub>EE</sub> + 0.1	V
I <sub>IN</sub>	Input Current (V <sub>IN</sub> =0.0 to V <sub>CC</sub> )	-10		+10	uA
I <sub>CC</sub>	Supply Current (V <sub>IN</sub> =0.0 or V <sub>CC</sub> )	V <sub>CC</sub> = 3.3V	<1.0		uA
		V <sub>CC</sub> = 5.0V	<1.0		uA
I <sub>EE</sub>	Supply Current (V <sub>IN</sub> =0.0 or V <sub>CC</sub> )	V <sub>CC</sub> = 3.3V	<1.0		uA
		V <sub>CC</sub> = 5.0V	<1.0		uA
I <sub>OPT</sub>	Supply Current (V <sub>IN</sub> =0.0 or V <sub>CC</sub> )	V <sub>CC</sub> = 3.3V	<1.0		uA
		V <sub>CC</sub> = 5.0V	<1.0		uA

**ESD Warning**

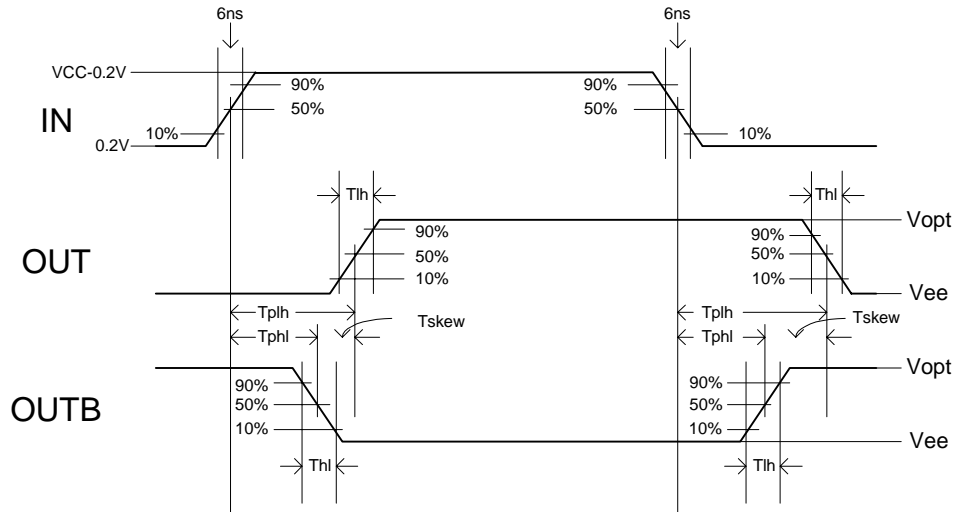
ESD (electrostatic discharge) sensitive device. Electrostatic charges can readily accumulate on test equipment and the human body in excess of 4000 Volts. This energy can discharge without detection. Although the MX856 / MX857 feature proprietary ESD protection circuitry, permanent damage may be sustained if subjected to high energy electrostatic discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

### AC Characteristics

$V_{CC}=V_{OPT}=3.3V$ ,  $V_{EE}=-16.7V$  or  $-4.5V$ , Input rise and fall time 6ns,  $V_{IH}=3.1$ ,  $V_{IL}=0.2V$ ,  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$   
 $V_{CC}=V_{OPT}=5.0V$ ,  $V_{EE}=-15.0V$  or  $-4.5V$ , Input rise and fall time 6ns,  $V_{IH}=4.8$ ,  $V_{IL}=0.2V$ ,  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$

SYMBOL	PARAMETER		Typ	Max	UNITS
T <sub>PLH</sub>	Propagation Delay (low to high input)	V <sub>CC</sub> = 3.3V	22	29	nS
		V <sub>CC</sub> = 5.0V	24	29	nS
T <sub>PHL</sub>	Propagation Delay (high to low input)	V <sub>CC</sub> = 3.3V	20	29	nS
		V <sub>CC</sub> = 5.0V	20	29	nS
T <sub>TLH</sub>	Output Rise Time (C <sub>LD</sub> =10pf)	V <sub>CC</sub> = 3.3V	5	9	nS
		V <sub>CC</sub> = 5.0V	4	9	nS
T <sub>THL</sub>	Output Fall Time (C <sub>LD</sub> =10pf)	V <sub>CC</sub> = 3.3V	5	8	nS
		V <sub>CC</sub> = 5.0V	4	8	nS
T <sub>SKREW</sub>	Delay Skew (Output A to Output B)	V <sub>CC</sub> = 3.3V	5	10	nS
		V <sub>CC</sub> = 5.0V	5	10	nS
C <sub>IN</sub>	Input Capacitance			15	pF

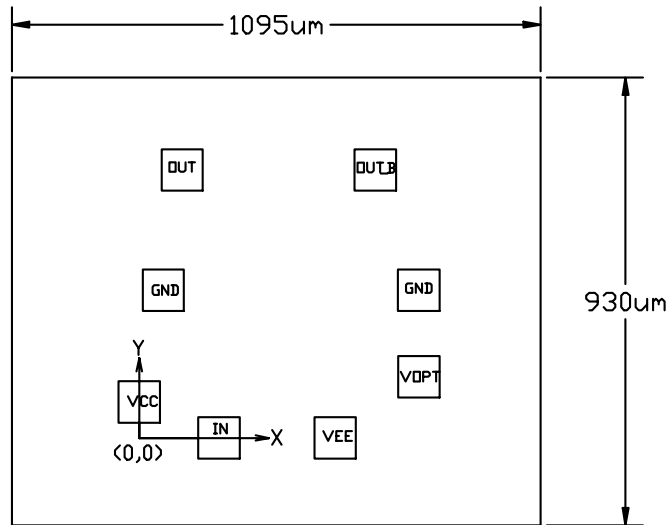
Note: Production Tested at 25°C



**Pad Locations** (in  $\mu\text{m}$ )

PAD NAME	X	Y
OUT	89.1	556.4
OUT_B	489.1	556.4
GND	579.1	306.3
V <sub>OPT</sub>	579.3	126.8
V <sub>EE</sub>	406	0
IN	165.4	0
V <sub>CC</sub>	0	74.3
GND	49.9	306.3

Pad location is the pad center point in microns. The origin of the coordinates is located as shown.

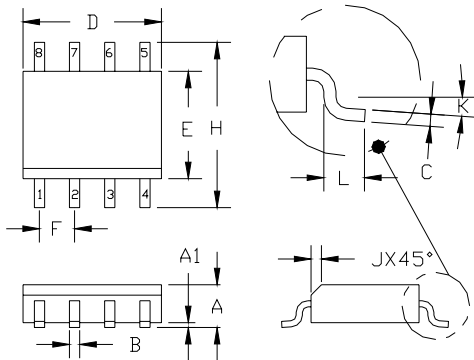


Die Size: 1095  $\mu\text{m}$  X 930  $\mu\text{m}$   
(Not Drawn To Scale)

### 8 Lead SOIC – I/O Assignment

Pin No.	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	Complimentary Output Driver

#### 8-LEAD SOIC



DIM.	DIMENSIONS ①				NOTE
	INCH		MM.		
	MIN.	MAX.	MIN.	MAX.	
A	.0532	.0688	1.35	1.75	----
A1	.0040	.0098	.10	.25	----
B	.013	.020	.33	.51	----
C	.0075	.0098	.19	.25	----
D	.1890	.1968	4.80	5.00	②
E	.1497	.1574	3.80	4.00	②
F	.050	BSC	1.27	BSC	----
H	.2284	.2440	5.80	6.20	----
J	.0099	.0196	.25	.50	----
K	0°	8°	0°	8°	----
L	.016	.050	.40	1.27	----

3. MOLDED PACKAGE SHALL CONFORM TO JEDEC STANDARD CONFIGURATION MS-012 VARIATION AA.

② DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.

① CONTROLLING DIMENSIONS: MILLIMETERS.

NOTES: (UNLESS OTHERWISE SPECIFIED)

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