DESCRIPTION

MAX487ESA is an RS-485/RS-422 transceiver powered by+5.0V and equipped with ± 16kV ESD protection. The entire series has a hot swappable function, which can eliminate transient fault signals on the bus when powered on or hot plugged in.

The MAX487ESA has a low swing rate driver that can reduce EMI and reflections caused by improper terminal matching cables, achieving error free data transmission of up to 500kbps. MAX487ESA is used for half duplex communication.

The receiver of MAX487ESA has 1/8 unit load input impedance and can be connected to up to 256 transceivers on the bus.

MAX487ESA adopts 8-pin DIP and 8-pin SOP packaging.

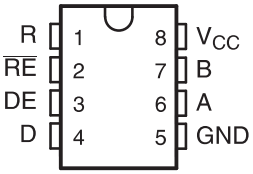
ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) 6V
Control Input Voltage -0.3V to 6V
Driver Input Voltage (DI) -0.3V to 6V

Driver Output Voltage (A, B) -7V to +12V
Receiver Input Voltage (A, B) -7V to +12V
Receiver Output Voltage (RO) -0.3V to (VCC + 0.3V)

Continuous Power Dissipation (T_A= +70°C)
8-Pin SO (derate 5.88mW/°C above +70°C) 500mW
Operating Temperature Ranges 0°C to +70°C
Storage Temperature Range -65°C to +150°C
Lead Temperature (soldering, 10sec) +300°C

PIN CONFIGURATION



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FEATURES

- Low power shutdown mode
- DE and $\overline{RE}$ adopt a hot swappable input structure
- Up to 256 transceivers with swing are allowed to be mounted on the bus
- Rate limiting function helps achieve error free data transmission
- I/O port adopts enhanced ESD protection (± 16kV IEC 61000-4-2 model)

APPLICATIONS

- RS-422/RS-485 communication
- Digital electricity and water meters, industrial control
- Industrial embedded computers and peripherals, security monitoring systems
- Routers and switches, instruments and meters, level conversion
- EMI sensitive transceiver applications

DCELECTRICAL CHARACTERISTICS

(V_{CC} = 5V ±0.25, T_A = T_{MIN} to T_{MAX}, unless otherwise noted,T_A= 25°C)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
No-Load Supply Current	I_{CC}	$\overline{RE}$ = 0V or V_{CC}	DE = V_{CC}		530		μA
			DE = 0V		475		
Supply Current in Shutdown	I_{SHDN}	DE = 0V, $\overline{RE}$ = V_{CC}			0.5	10	μA
Driver Short-Circuit Current, V_O = High	I_{OSD1}	-7V ≤ V_O ≤12V				250	mA
Driver Short-Circuit Current, V_O = Low	I_{OSD2}	-7V ≤ V_O ≤12V		-250			mA
Receiver Short-Circuit Current	I_{OSR}	0V ≤ V_O ≤ V_{CC}		7		95	mA
ESD Protection		A, B, Y and Z pins, tested using Human Body Model			±16		kV
Driver Input to Output	t_{PLH}	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 50pF				1000	ns
	t_{PHL}					1000	
Driver Output Skew to Output	t_{SKEW}	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 50pF				±140	ns
Driver Rise or Fall Time	t_R, t_F	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF				900	ns
Driver Enable to Output High	t_{ZH}	C_L = 100pF, S3 closed				2500	ns
Driver Enable to Output Low	t_{ZL}	C_L = 100pF, S2 closed				2500	ns
Driver Disable Time from Low	t_{LZ}	C_L = 15pF, S2 closed				100	ns
Driver Disable Time from High	t_{HZ}	C_L = 15pF, S3 closed				100	ns
Receiver Input to Output	t_{PLH}, t_{PHL}	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF		20	60	200	ns
| t_{PLH} - t_{PHL} | Differential Receiver Skew	t_{SKD}	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF				±30	ns
Receiver Enable to Output Low	t_{ZL}	C_{RL} = 15pF, S1 closed			20	50	ns
Receiver Enable to Output High	t_{ZH}	C_{RL} = 15pF, S2 closed			20	50	ns
Receiver Disable Time from Low	t_{LZ}	C_{RL} = 15pF, S1 closed			20	50	ns
Receiver Disable Time from High	t_{HZ}	C_{RL} = 15pF, S2 closed			20	50	ns
Maximum Data Rate	f_{MAX}				500		kbps
Time to Shutdown	t_{SHDN}	MAX481E (Note 5)		50		700	ns
Receiver Enable from Shutdown to Output High	$t_{ZH(SHDN)}$	C_L = 15pF, S2 closed				5500	ns
Receiver Enable from Shutdown to Output Low	$t_{ZL(SHDN)}$	C_L = 15pF, S1 closed				5500	ns

SWITCHING CHARACTERISTICS

(V_{CC} = 5.0V ±5% , T_A = 25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Input to Output	t_{PLH}	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 50pF			1000	ns
	t_{PHL}				1000	
Driver Output Skew to Output	t_{SKEW}	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 50pF			±140	ns
Driver Rise or Fall Time	t_R, t_F	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF			900	ns
Driver Enable to Output High	t_{ZH}	C_L = 100pF, S3 closed			2500	ns
Driver Enable to Output Low	t_{ZL}	C_L = 100pF, S2 closed			2500	ns
Driver Disable Time from Low	t_{LZ}	C_L = 15pF, S2 closed			100	ns
Driver Disable Time from High	t_{HZ}	C_L = 15pF, S3 closed			100	ns
Receiver Input to Output	t_{PLH}, t_{PHL}	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF	20	60	200	ns
$\lvert t_{PLH} - t_{PHL} \rvert$ Differential Receiver Skew	t_{SKD}	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF			±30	ns
Receiver Enable to Output Low	t_{ZL}	C_{RL} = 15pF, S1 closed		20	50	ns
Receiver Enable to Output High	t_{ZH}	C_{RL} = 15pF, S2 closed		20	50	ns
Receiver Disable Time from Low	t_{LZ}	C_{RL} = 15pF, S1 closed		20	50	ns
Receiver Disable Time from High	t_{HZ}	C_{RL} = 15pF, S2 closed		20	50	ns
Maximum Data Rate	f_{MAX}			500		kbps
Time to Shutdown	t_{SHDN}	MAX481E (Note 5)	50		700	ns
Receiver Enable from Shutdown to Output High	$t_{ZH(SHDN)}$	C_L = 15pF, S2 closed			5500	ns
Receiver Enable from Shutdown to Output Low	$t_{ZL(SHDN)}$	C_L = 15pF, S1 closed			5500	ns

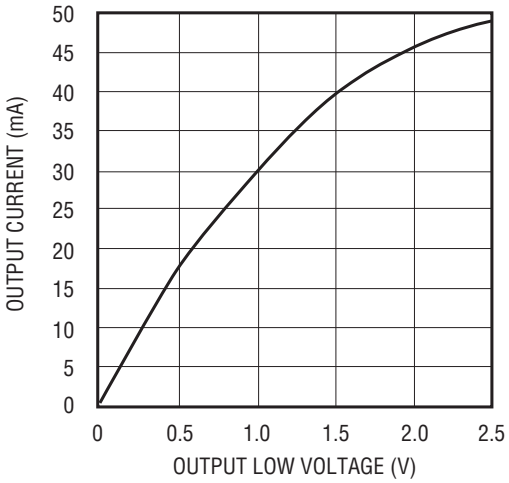
TABLEOF OPERATION

Transmission					Receipt			
Inputs			Outputs X		Inputs			Outputs
RE	DE	DI	A	B	RE	DE	A-B	RO
X	1	1	1	0	0	X	≥+0.2V	1
X	1	0	0	1	0	X	≤-0.2V	0
0	0	X	Z	Z	0	1	Inputs open	1
1	0	X	Z	Z	1	0	X	Z

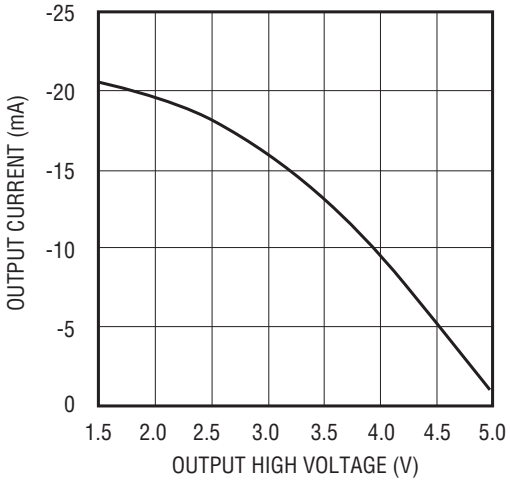
X-Any level
Z-High resistance

TYPICAL CHARACTERISTICS

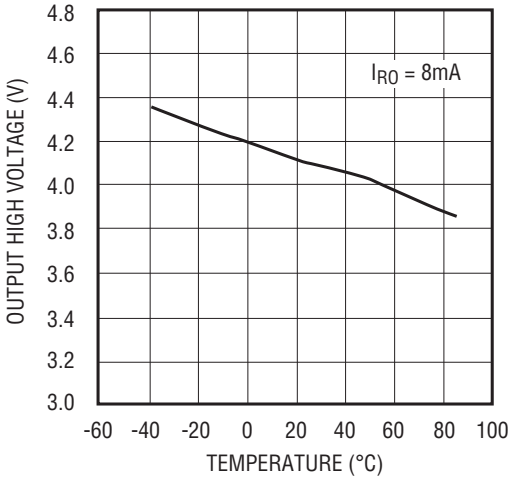
OUTPUT CURRENT vs.
RECEIVER OUTPUT LOW VOLTAGE



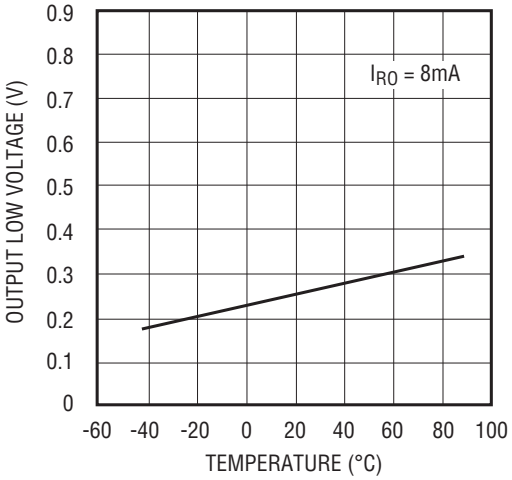
OUTPUT CURRENT vs.
RECEIVER OUTPUT HIGH VOLTAGE



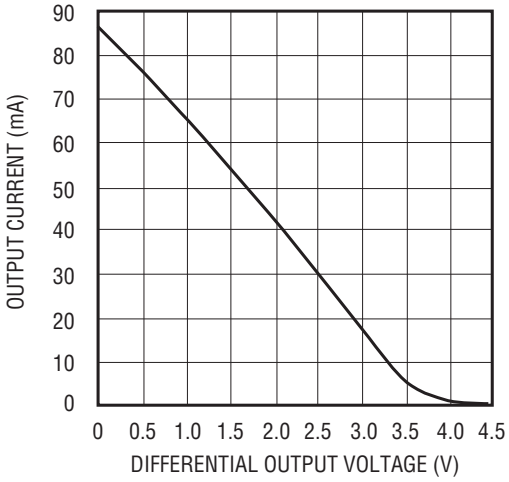
RECEIVER OUTPUT LOW VOLTAGE
vs. TEMPERATURE



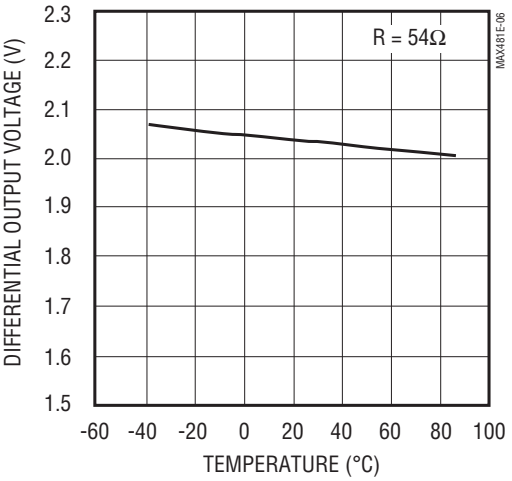
RECEIVER OUTPUT LOW VOLTAGE
vs. TEMPERATURE



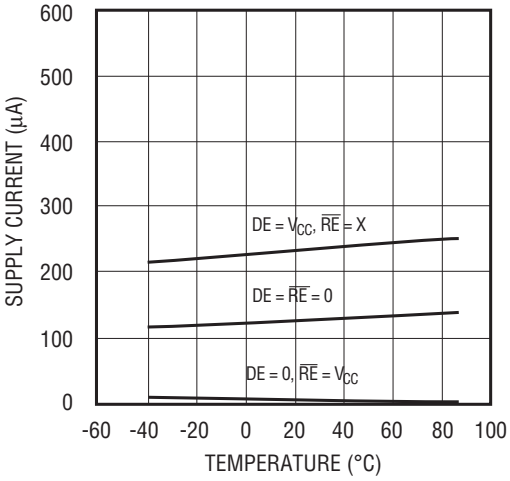
DRIVER OUTPUT CURRENT vs.
DIFFERENTIAL OUTPUT VOLTAGE



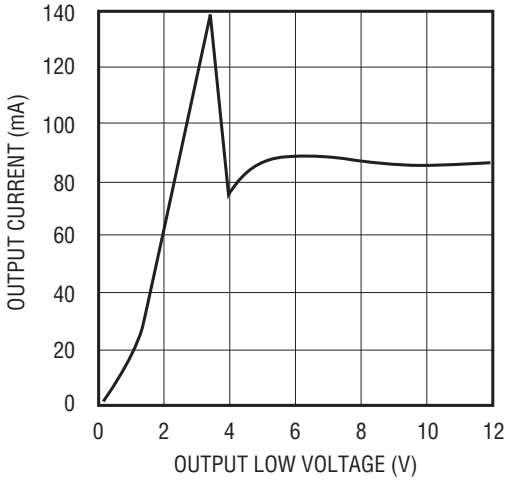
DRIVER DIFFERENTIAL OUTPUT
VOLTAGE vs. TEMPERATURE



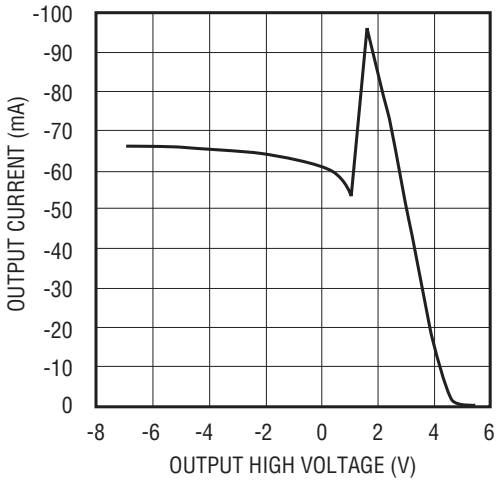
SHUTDOWN CURRENT
vs. TEMPERATURE



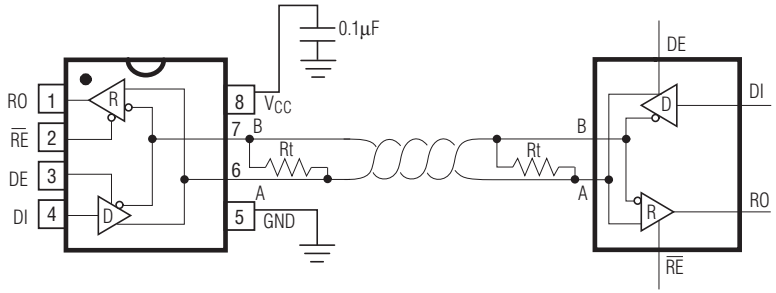
OUTPUT CURRENT vs.
DRIVER OUTPUT LOW VOLTAGE



OUTPUT CURRENT vs.
DRIVER OUTPUT HIGH VOLTAGE



Typical Operating Circuit



Applications Information

The MAX487ESA is low-power transceivers for RS-485 and RS-422 communications. These “E” versions of the MAX487ESA provide extra protection against ESD. These devices eliminate the need for transient suppres-sor diodes and the associated high capacitance loading.

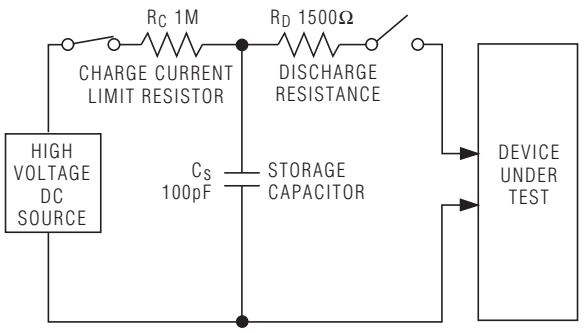
The MAX487E is specified for data rates up to 250kbps. The MAX487ESA is half-duplex. In addition, driver-enable (DE) and receiver-enable (RE) pins are included on the MAX487ESA. When disabled,the driver and receiver outputs are high impedance.

±15kV ESD Protection

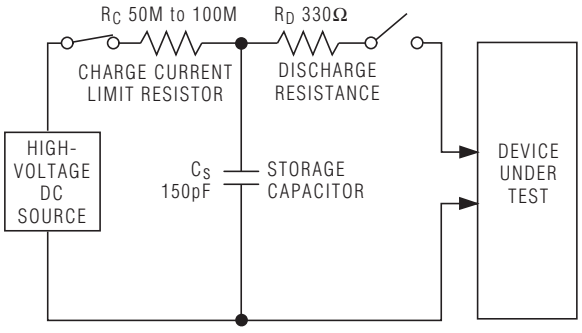
ESD-protection structures are incorporated on all pins to protect against electro-static discharges encountered during handling and assembly. The driver outputs and receiver inputs have extra protection against static electricity. Developed state-of-the-art structures to protect these pins against ESD of ±15kV without damage. The ESD structures withstand high ESD in all states: normal operation, shutdown, and powered down. After an ESD event, MAX487ESA keep working without latchup.ESD protection can be tested in various ways; the transmitter outputs and receiver inputs of this product family are characterized for protection to ±15kV using the Human Body Model.

Other ESD test methodologies include IEC10004-2 con- tact discharge and IEC1000-4-2 air-gap discharge (formerly IEC801-2).

Human Body ESD Test Model



IEC1000-4-2 ESD Test Model



Reduced EMI and Reflections

The MAX487ESA is slew-rate limited, minimizing EMI and reducing reflections caused by improperly terminated cables.

Low-Power Shutdown Mode

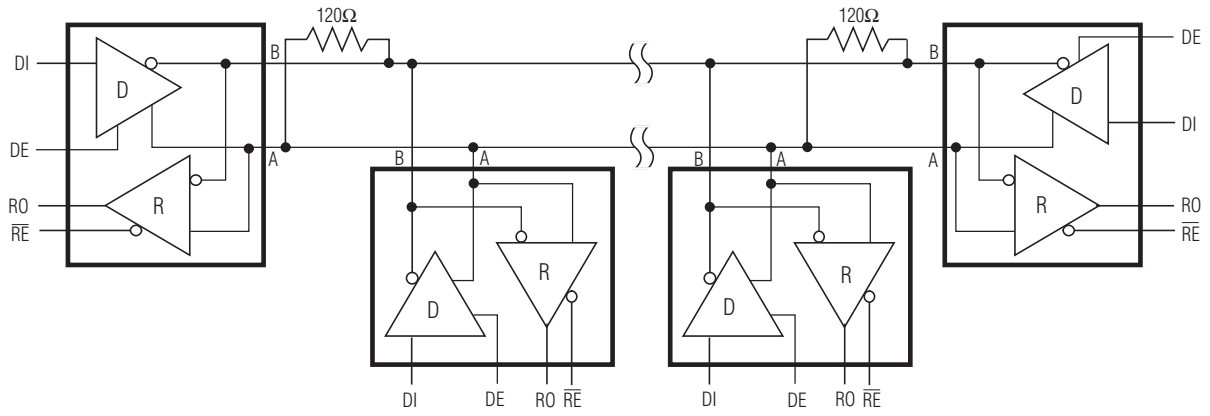
A low-power shutdown mode is initiated by bringing both $\overline{RE}$ high and DE low. The devices will not shut down unless both the driver and receiver are disabled. In shutdown, the devices typically draw only 0.5µA of supply current. $\overline{RE}$ and DE may be driven simultaneously; the parts are guaranteed not to enter shutdown if $\overline{RE}$ is high and DE is low for less than 50ns. If the inputs are in this state for at least 600ns, the parts are guaranteed to enter shutdown.

For the MAX487ESA, the tZH and tZL enable times assume the part was not in the low-power shutdown state . The tZH(SHDN) and tZL(SHDN) enable times assume the parts were shut down.

Typical Applications

The MAX487ESA transceivers are designed for bidirectional data communications on multipoint bus transmission lines. To minimize reflections, the line should be terminated at both ends in its characteristic impedance, and stub lengths off the main line should be kept as short as possi-ble. The slew-rate-limited MAX487ESA are more tolerant of imperfect termination.

Typical Half-Duplex RS-485 Network



PACKAGE OUTLINE DIMENSIONS

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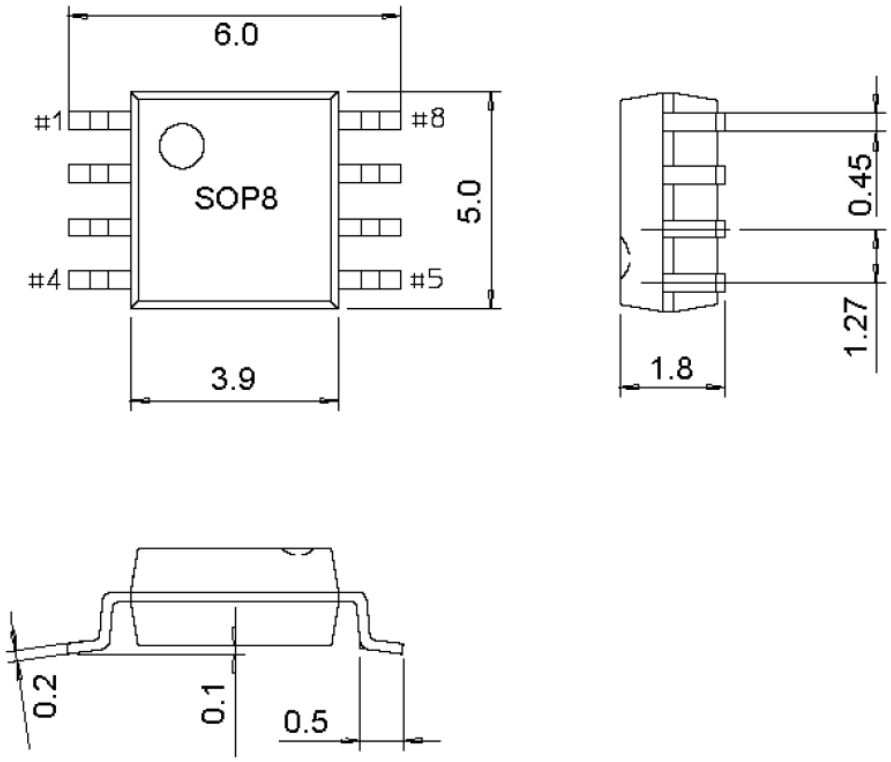

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