DALLAS
SEMICONDUCTOR

DS211
4 Driver/5 Receiver RS–232 Serial Port

FEATURES

● Compatible with MAX211

● 5V Operation

● 28–pin SOIC or SSOP package

● Complete PC serial port plus one additional receiver

● Operate from Single +5V power

● Meets all EIA–232E and V.28

● Uses small capacitors: 0.1 μF

● Optional industrial temperature range available (–40°C to +85°C)

ORDERING INFORMATION
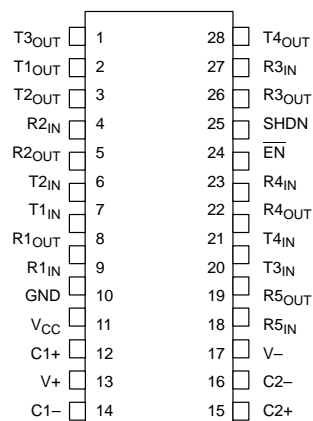DS211S   28–pin SOIC
DS211E   28–pin SSOP

DESCRIPTION
The DS211 is a 4 Driver/5 Receiver RS–232 Serial Port that generates RS–232 voltage levels from a single +5 volt power supply. Additional ±12 volt supplies are not needed since the DS211 uses on–board charge pumps to convert the +5 volt supply to ±10 volts. The DS211 is fully compliant with EIA RS–232E and V.28/V.24 stan- dards. Driver slew rates and data rates are guaranteed up to 116 kbits/sec. The DS211 operates with only 0.1 μF charge pump capacitors.

OPERATION
The diagram in Figure 1 shows the main elements of the DS211. The following paragraphs describe the function of each pin.

PIN ASSIGNMENT

Pin			Pin	
$T3_{OUT}$	1		28	$T4_{OUT}$
$T1_{OUT}$	2		27	$R3_{IN}$
$T2_{OUT}$	3		26	$R3_{OUT}$
$R2_{IN}$	4		25	SHDN
$R2_{OUT}$	5		24	$\overline{EN}$
$T2_{IN}$	6		23	$R4_{IN}$
$T1_{IN}$	7		22	$R4_{OUT}$
$R1_{OUT}$	8		21	$T4_{IN}$
$R1_{IN}$	9		20	$T3_{IN}$
GND	10		19	$R5_{OUT}$
V_{CC}	11		18	$R5_{IN}$
C1+	12		17	V–
V+	13		16	C2–
C1–	14		15	C2+

28–PIN SOIC/SSOP

PIN DESCRIPTION
V_{CC}	–	+5 Volt Supply
GND	–	Ground
V+	–	Positive Supply Output Driver
V–	–	Negative Supply Output Driver
$T1–4_{IN}$	–	RS–232 Driver Inputs
$T1–4_{OUT}$	–	RS–232 Driver Outputs
$R1–5_{IN}$	–	Receiver Inputs
$R1–5_{OUT}$	–	Receiver Outputs
C1+, C1–	–	Capacitor 1 Connections
C2+, C2–	–	Capacitor 2 Connections
SHDN	–	Shutdown Input
$\overline{EN}$	–	Receiver Enable Input

FUNCTIONAL DIAGRAM OF DS211 Figure 1
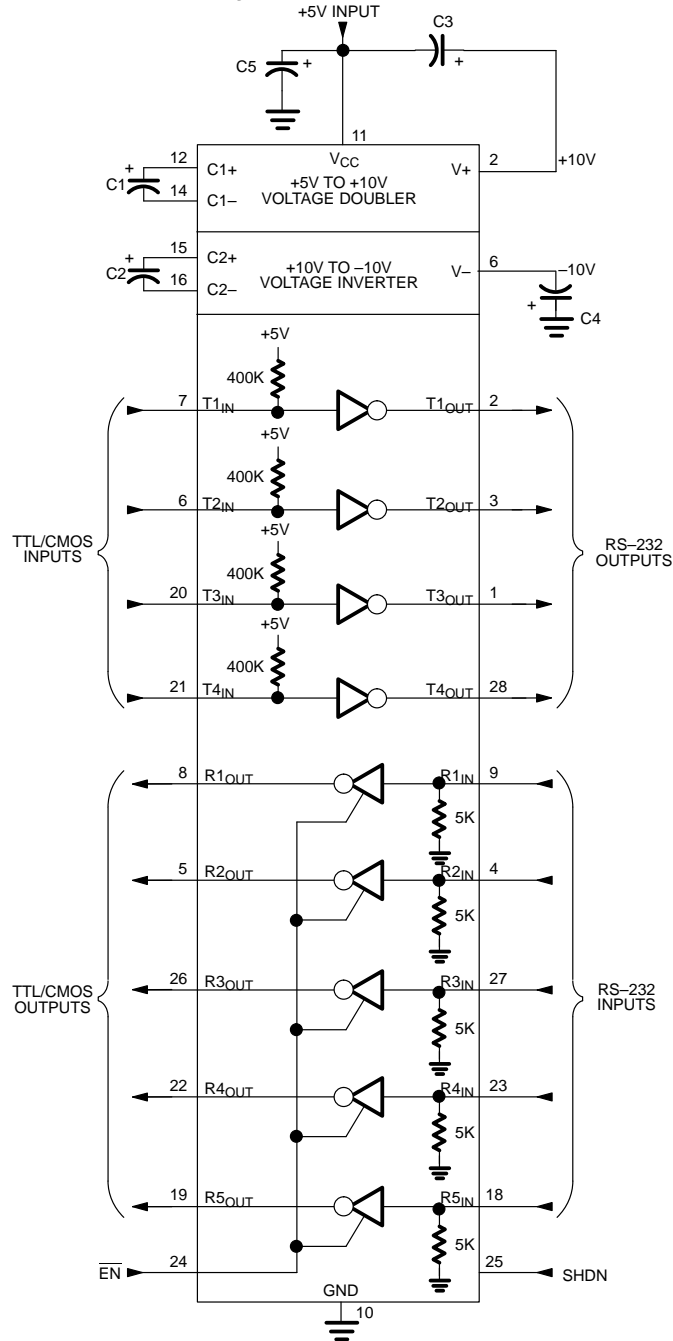
NOTE: C5 is a recommended decoupling capacitor which is the same value as C1, C2, C3, and C4.

PIN DESCRIPTIONS

V_{CC}, GND: DC power is provided to the device on these pins. V_{CC} is the +5 volt input.

V+: Positive supply output (RS–232). V+ requires an external storage charge capacitor of at least 0.1 µF. A larger capacitor (up to 10 µF) can be used to reduce supply ripple.

V–: Negative supply output (RS–232). V– requires an external storage capacitor of at least 0.1 µF. A larger capacitor (up to 10 µF) can be used to reduce supply ripple.

T1–4$_{IN}$: Standard TTL/CMOS inputs for the RS–232 drivers. The inputs of unused drivers can be left unconnected since each input has a 400 kΩ pull–up resistor.

T1–4$_{OUT}$: Driver outputs at RS–232 levels. Driver output swing meets RS–232 levels for loads up to 3 kΩ. These driver outputs provide current necessary to meet RS–232 levels for loads up to 2500 pF.

R1–5$_{IN}$: Receiver inputs. These inputs accept RS–232 level signals (±25 volts) into a protected 5 kΩ terminat-

ing resistor. Each receiver provides 0.5V hysteresis (typical) for noise immunity.

R1–5$_{OUT}$: Receiver outputs at TTL/CMOS levels.

C1+, C1–, C2+, C2–: Charge pump capacitor inputs. These pins require two external capacitors (0.1 µF minimum, 10 µF maximum and should be the same size as C3 and C4). Capacitor 1 is connected between C1+ and C1–. Capacitor 2 is connected between C2+ and C2–.

SHDN: Active high shutdown input. When placed in shutdown mode, the internal charge pumps are turned off, V+ is pulled to V_{CC} and V– is pulled to ground. The transmitter outputs are disabled and the receiver inputs are put into a high impedance state.

$\overline{EN}$: Active low enable input. The $\overline{EN}$ pin is used to place the receiver outputs into a high impedance state so that the receivers can be placed directly on a three–state bus. This pin has no effect on the charge pumps or RS–232 drivers.

CONTROL PIN CONFIGURATIONS Table 1

SHDN	$\overline{EN}$	OPERATION	TRANSMITTERS (T1–T5)	RECEIVERS (R1–R5)
0	0	Normal Operation	All Active	All Active
0	1	Normal Operation	All Active	All High–Z
1	X	Shutdown	All High–Z	All High–Z

X = Don't Care

DUAL CHARGE PUMP CONVERTERS

The DS211 has a two stage on–board charge pump circuit that is used to generate ±10 volts from a single +5 volt supply. In the first stage, capacitor C1 doubles the +5V supply to +10 volts which is then stored on capacitor C3. The second stage uses capacitor C2 to invert the +10V potential to –10V. This charge is then stored on capacitor C4. The ±10 volt supplies allow the DS211 to provide the necessary output levels for RS–232 communication. The DS211 will operate with charge pump capacitors as low as 0.1 μF. Larger capacitors (up to 10 μF) can be used to reduce supply ripple.

The shutdown feature of the DS211 should not be used in applications where an external +12 volt power supply is connected to V+ (instead of using the internal charge pump to generate the RS–232 voltage level) because V+ is internally connected to V_{CC} when in shutdown mode. When the DS211 is used in this type of application, the SHDN pin must be permanently tied to ground and capacitor C1 must be removed.

RS–232 DRIVERS

The four RS–232 drivers are powered by the internal ±10 volt supplies generated by the on–board charge pump. The driver inputs are both TTL and CMOS compatible. Each input has an internal 400 kΩ pull–up resistor so that unused transmitter inputs can be left unconnected. The open circuit output voltage swing is from (V+ – 0.6) to V– volts. Worst case conditions for EIA–232E/V.28 of ±5 volt driving a 3 kΩ load and 2500 pF are met at maximum operating temperature and V_{CC} equal to 4.5 volts. Typical voltage swings of ±8 volts occur when loaded with a nominal 5 kΩ RS–232 receiver. As required by EIA–232E and V.28 specifications, the slew rate at the output is limited to less than 30 volts/μs. Typical slew rates are 20 volts/μs unloaded and 12 volts/μs with 3 kΩ and 2500 pF load. These slew rates allow for bit rates of over 116 kbits/s. Driver outputs maintain high impedance when power is off.

RS–232 RECEIVERS

The five receivers conform fully to the RS–232E specifications. The input impedance is typically 5 kΩ and can withstand up to ±25 volts with or without V_{CC} applied. The input switching thresholds are within the ±3 volt limit of RS–232E specification with an input threshold low of 0.8 volts and an input threshold high of 2.4 volts. The receivers have 0.5 volts of hysteresis (typical) to improve noise rejection. The TTL/CMOS compatible outputs of the receivers will be low whenever the RS–232 input is greater than 2.4 volts. The receiver output will be high when the input is floating or driven between +0.8 volts and –25 volts.

ABSOLUTE MAXIMUM RATINGS*

V_{CC}	−0.3V to +7.0V
V+	(V_{CC}−0.3V) to +14V
V−	+0.3V to −14V

Input Voltages
T_{IN}	−0.3V to (V_{CC}+0.3V)
R_{IN}	±30V

Output Voltages
T_{OUT}	(V+ + 0.3V) to (V− − 0.3V)
R_{OUT}	−0.3V to (V_{CC} + 0.3V)
Short Circuit Duration, T_{OUT}	Continuous

* This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

RECOMMENDED DC OPERATING CONDITIONS (0°C to 70°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Operating Supply Voltage	V_{CC}	4.5		5.5	V	1
Logic 1 Input	V_{IH}	−0.3		+0.8	V	1
Logic 0 Input	V_{IL}	2.2		V_{CC}+0.3	V	1

DC ELECTRICAL CHARACTERISTICS (0°C to 70°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Power Supply Current (No Load)	I_{CC1}		11	20	mA	
Power Supply Current (3 kΩ Load All Outputs)	I_{CC2}		22		mA	
Shutdown Supply Current (t_A=25°C)	I_{CCS}		1	10	μA	
Shutdown Supply Current (t_A=0°C to 70°C)	I_{CCS}		2	50	μA	
Shutdown Supply Current (t_A=0°C to 85°C)	I_{CCS}		2	50	μA	
SHDN Leakage Current	I_{SHDN}			±1	μA	
RS–232 Transmitters						
Output Voltage Swing	V_{ORS}	±5	±8		V	2
Maximum Data Rate	f_D	116	200		kbits/s	
Logic Pullup/Input Current (SHDN=0)	I_{PU}		15	200	μA	3
Logic Pullup/Input Current (SHDN=V_{CC})	I_{PU}		±0.01	±1	μA	3
Output Leakage Current (SHDN=V_{CC})	I_{OUT}		±0.01	±10	μA	4
Transmitter Output Resistance	R_{OUT}	300	10M		Ω	5
Output Short–Circuit Current	I_{TSC}		±10	±60	mA	6

DC ELECTRICAL CHARACTERISTICS (continued) (0°C to 70°C)

RS–232 Receivers						
RS–232 Input Voltage Operating Range	V_{IR}	±25	±30		V	
RS–232 Input Threshold Low	V_{RTL}	0.8	1.3		V	
RS–232 Input Threshold High	V_{RTH}		1.8	2.4	V	
RS–232 Input Hysteresis	V_{HY}	0.2	0.5	1	V	
RS–232 Input Resistance	R_{IN}	3	5	7	kΩ	
TTL/CMOS Output Voltage Low	V_{ROL}		0.2	0.4	V	7
TTL/CMOS Output Voltage High	V_{ROH}	3.5	V_{CC}–0.2		V	8
TTL/CMOS Output Short Circuit Current (V_{OUT}=GND)	I_{RSC}	−2	−10		mA	
TTL/CMOS Output Short Circuit Current (V_{OUT}=V_{CC})	I_{RSC}	10	30		mA	
TTL/CMOS Output Leakage Current	I_{ROUT}		±0.05	±10	µA	9

AC ELECTRICAL CHARACTERISTICS (0°C to 70°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Transition Slew Rate	t_{SR}	6	12	30	V/µs	10
Transmitter Propagation Delay TTL to RS–232	t_{PHLT} t_{PLHT}		1.3 1.5	3.5 3.5	µs µs	
Receiver Propagation Delay RS–232 to TTL	t_{PHLR} t_{PLHR}		0.5 0.6	1 1	µs µs	
Transmitter + to – Propagation Delay Difference	t_{PHLT} −t_{PLHT}		300		ns	
Receiver + to – Propagation Delay Difference	t_{PHLR} −t_{PLHR}		100		ns	
Receiver Output Enable Time	t_{ER}		125	500	ns	
Receiver Output Disable Time	t_{DR}		160	500	ns	
Transmitter Output Enable Time	t_{ET}		250		µs	11
Transmitter Output Disable Time	t_{DT}		600		µs	11

NOTES:

1. All voltages are referenced to ground.

2. All transmitter outputs loaded with 3 kΩ to ground.

3. T_{IN} = 0

4. V_{CC} = 5.5V and V_{OUT} = ±15V or V_{CC} = 0V and V_{OUT} = ±15V

5. V_{CC} = V+ = V− = 0V; V_{OUT} = ±2V .

6. $V_{OUT} = 0V$.

7. $I_{OUT} = 3.2$ mA.

8. $I_{OUT} = -1.0$ mA.

9. $\overline{EN} = 0V$ and/or SHDN = V_{CC}; $V_{CC} \geq V_{OUT} \geq 0V$

10. $C_L = 50$ pF $- 2500$ pF; RL = 3 kΩ $-$ 7 kΩ; $V_{CC} = 5V$; TA = 25°C.

11. C1 = C2 = C3 = C4 = 0.1 μF
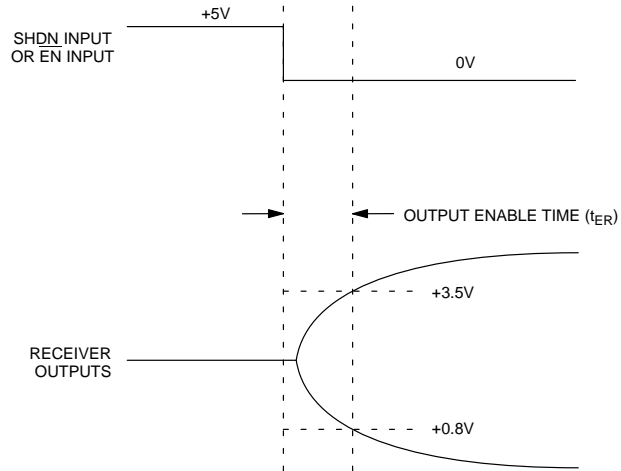
TRANSMITTER PROPAGATION DELAY TIMING Figure 2
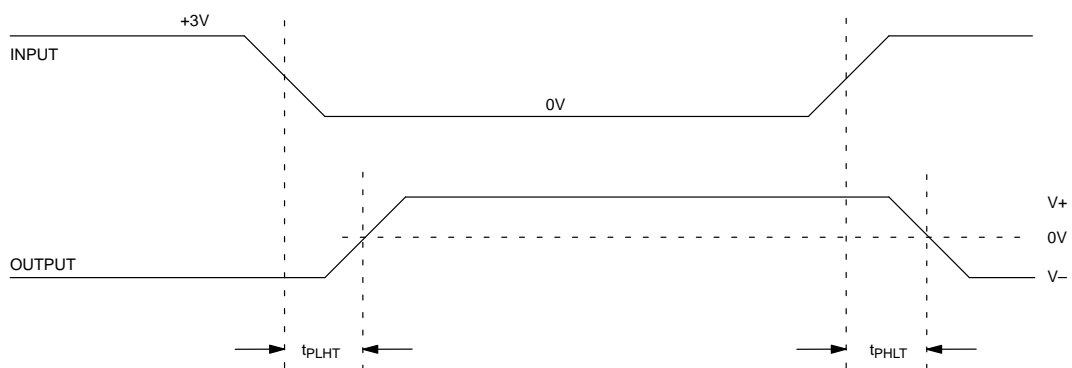
RECEIVER PROPAGATION DELAY TIMING Figure 3
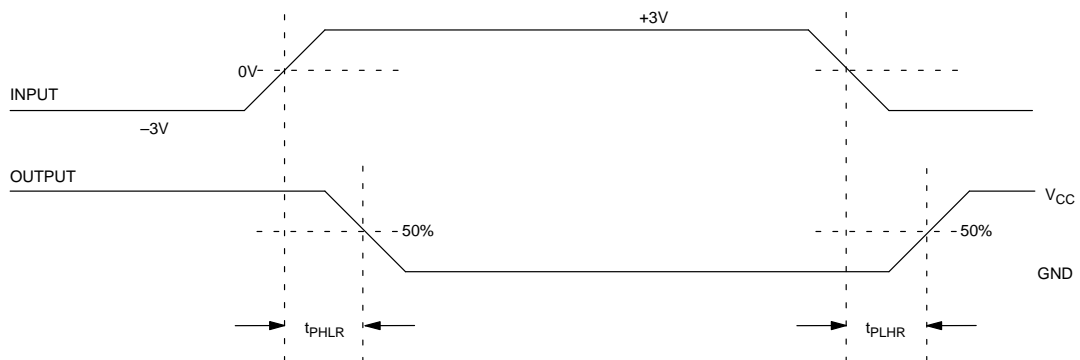
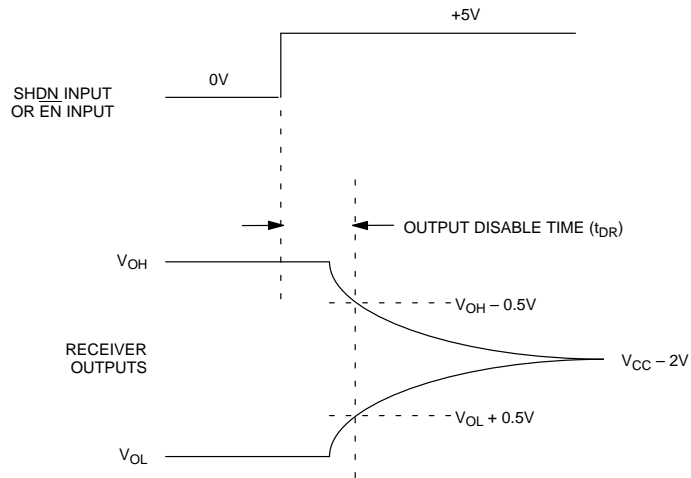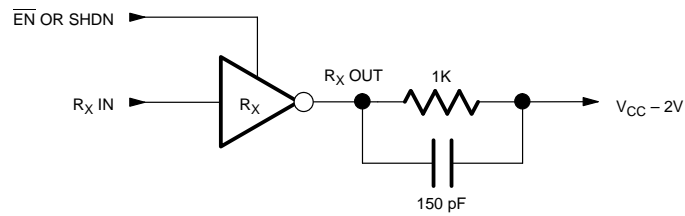**RECEIVER OUTPUT ENABLE AND DISABLE TIMING** Figure 4

A. Enable Timing

SHDN INPUT
OR EN INPUT
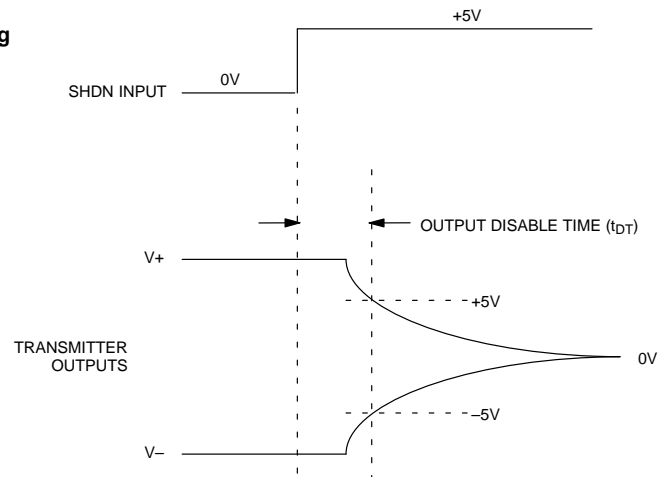
+5V

0V

OUTPUT ENABLE TIME (t_{ER})

RECEIVER
OUTPUTS

+3.5V

+0.8V

B. Disable Timing

+5V

SHDN INPUT
OR EN INPUT

0V

OUTPUT DISABLE TIME (t_{DR})

V_{OH}

$V_{OH} - 0.5V$

RECEIVER
OUTPUTS

$V_{CC} - 2V$

$V_{OL} + 0.5V$

V_{OL}

C. Test Circuit

EN OR SHDN

R_X IN

R_X

R_X OUT

1K

$V_{CC} - 2V$

150 pF

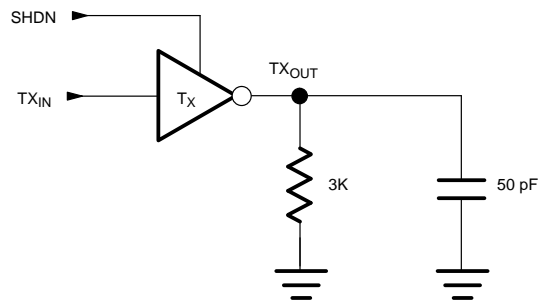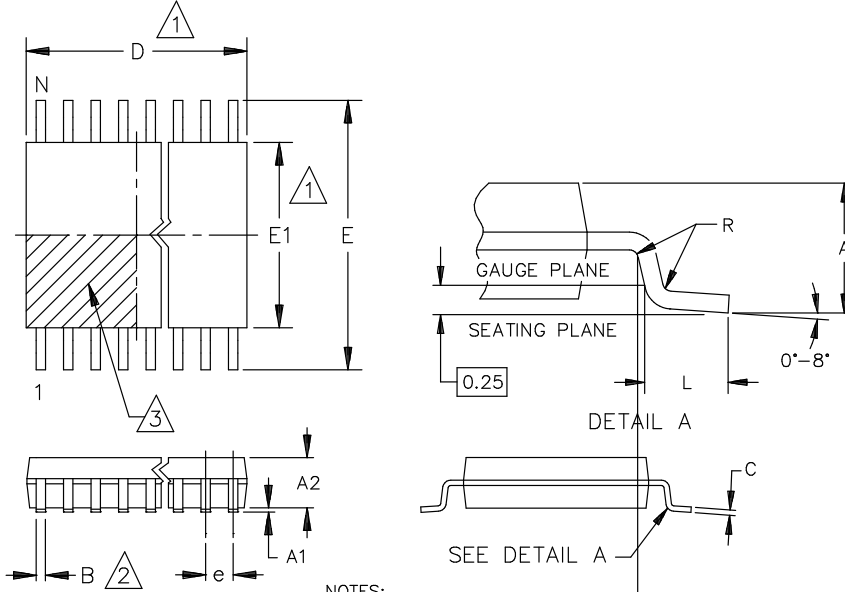## TRANSMITTER OUTPUT ENABLE AND DISABLE TIMING Figure 5

A. Enable Timing
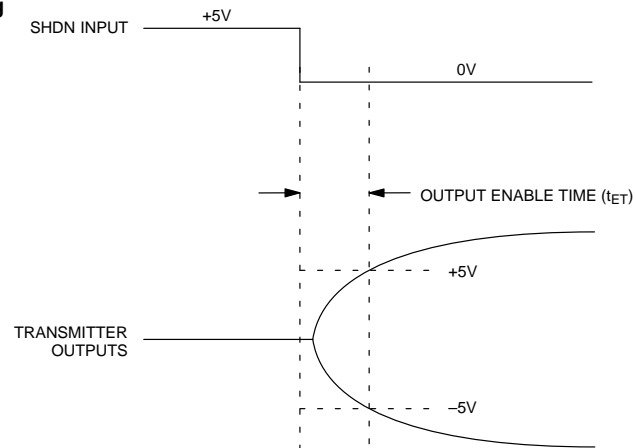
B. Disable Timing

C. Test Circuit

DS211 28–PIN SSOP


NOTES:

1. DIMENSIONS D & E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS, BUT DO INCLUDE MOLD MISMATCH AND ARE MEASURED AT THE PARTING LINE; MOLD FLASH OR PROTRUSION SHALL NOT EXCEED 0.20 MM PER SIDE.

2. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSIONS. DAMBAR PROTRUSION TO BE 0.13 MM TOTAL IN EXCESS OF B AT MAXIMUM MATERIAL CONDITION.

3. VISUAL INDEX FEATURE WITHIN CROSSHATCHED AREA.

DIM	MIN	MAX
A	–	2.00
A1	0.05	0.25
A2	1.65	1.85
B	0.22	0.38
C	0.09	0.21
D	9.90	10.50
E	7.40	8.20
E1	5.00	5.60
e	0.65 BSC	
L	0.55	0.95
R	0.09	–

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DS211 28–PIN SOIC
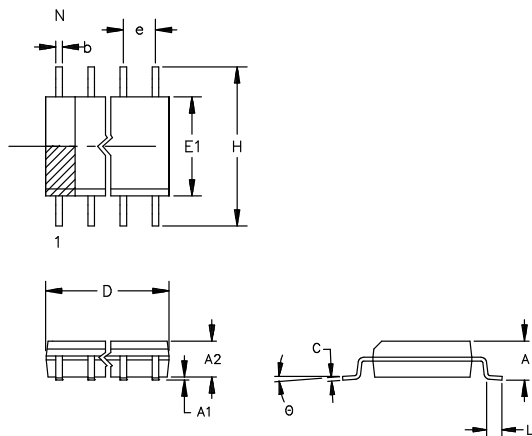
The chamfer on the body is optional. If it is not present, a terminal 1 identifier must be positioned so that 1/2 or more of its area is contained in the hatched zone.

PKG	28-PIN	
DIM	MIN	MAX
A IN. MM	0.094 2.39	0.105 2.67
A1 IN. MM	0.004 0.102	0.012 0.30
A2 IN. MM	0.089 2.26	0.095 2.41
b IN. MM	0.013 0.33	0.020 0.51
C IN MM	0.009 0.229	0.013 0.33
D IN. MM	0.698 17.73	0.712 18.08
e IN. MM	.050 BSC 1.27 BSC	
E1 IN. MM	0.290 7.37	0.300 7.62
H IN MM	0.398 10.11	0.416 10.57
L IN MM	0.016 0.40	0.040 1.02
Θ	0°	8°

56–G4009–001