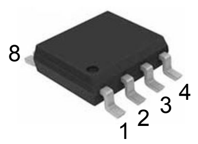
HIGH SPEED CAN TRANSCEIVER

DESCRIPTION

The ***STComponet*** STC1050 is the interface between the Controller Area Network (CAN) protocol controller and the physical bus. The STC1050 provides differential transmit capability to the bus and differential receive capability to the bus and differential receive capability to the CAN controller.

The STC1050 is a high speed CAN transceiver that has much lower Electro-Magnetic Emission (EMI) due to optimal matching of the output signal CANH and CANL.



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FEATURES

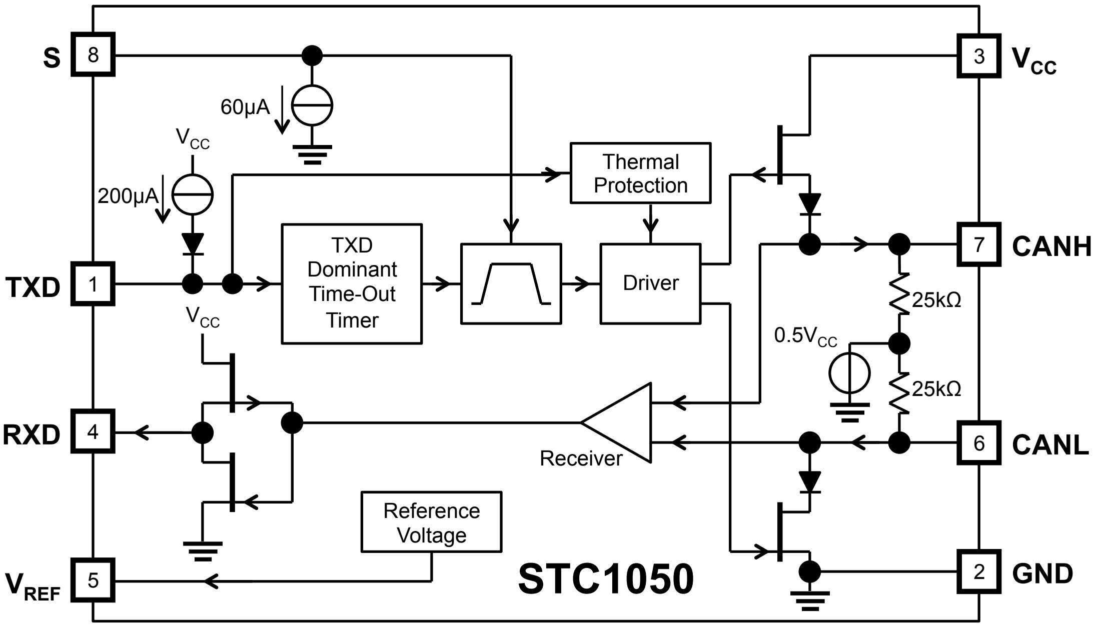
- Fully Compatible with the ISO 11898 Standard
- High Speed (Up to 1MBaud)
- Very Low Electro-Magnetic Emission (EME)
- Differential Receiver with Wide Common-Mode Range for Electro-Magnetic Immunity (EMI)
- An Unpowered Node Doesn't Disturb the Bus Lines
- Input Levels Compatible with 3.3V and 5.0V Devices
- At Least 110 Nodes can be Connected
- Short-Circuit Proof to Battery and to Ground
- Thermally Protected

DEVICE SUMMARY

Ordering Code	Package Material	Package Type	Shipping	Marking[1]
STC1050B	Lead Free	SOP-8	Taping reel	1050 STC YM
STC1050BG	Halogen Free			

Note 1: **Y**: Year code.
M: Month code.

INTERNAL SCHEMATIC DIAGRAM



PIN DESCRIPTION

PIN	SYMBOL	FUNCTION DESCRIPTION
1	TXD	Transmit data input; Reads in data from the CAN controller to the bus line drivers.
2	GND	Ground.
3	V_{CC}	Supply voltage.
4	RXD	Receive data output; Reads out data from the bus lines to the CAN controller.
5	V_{REF}	Reference voltage output.
6	CANL	Low-level CAN bus line.
7	CANH	High-level CAN bus line.
8	S	Select input for high-speed mode or silent mode.

ABSOLUTE MAXIMUM RATINGS (2)

T_A = 25°C, All voltages are referenced to GND, positive currents flow into the IC, unless otherwise specified.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Supply Voltage	V_{CC}		-0.3	+5.25	V
TXD Pin DC Voltage	V_{TXD}		-0.3	V_{CC} + 0.3	V
RXD Pin DC Voltage	V_{RXD}		-0.3	V_{CC} + 0.3	V
V_{REF} Pin DC Voltage	V_{REF}		-0.3	V_{CC} + 0.3	V
Pin S DC Voltage	V_S		-0.3	V_{CC} + 0.3	V
CANH Pin DC Voltage	V_{CANH}	0V < V_{CC} < 5.25V, no time limit	-27	+40	V
CANL Pin DC Voltage	V_{CANH}	0V < V_{CC} < 5.25V, no time limit	-27	+40	V
CANH and CANL Pins Transient Voltage	V_{TRT}	Time = 1μs	-55	+55	V
		According to ISO 7637	-200	+200	V
ESD Human Body Model (3)	HBM	CANH & CANL pins	-4000	+4000	V
		Other pins	-2000	+2000	V
Machine Model (4)	MM		-200	+200	V
Virtual Junction Temperature (5)	T_{VJ}		-40	+150	°C
Operating Ambient Temperature	T_{amb}		-40	+125	°C
Storage Temperature	T_{stg}		-55	+150	°C

Note 2: Absolute Maximum Ratings are stress ratings only and functional device operation is not implied. The device could be permanently damaged beyond absolute maximum ratings.
Note 3: Equivalent to discharging a 100pF capacitor via a 1.5kΩ series resistor.
Note 4: Equivalent to discharging a 200pF capacitor via a 0.75μH series inductor and a 10Ω series resistor.
Note 5: Junction temperature in accordance with IEC 60747-1. An alternative definition of T_{VJ} is: $T_{VJ} = T_{amb} + P \times R_{th(VJ-amb)}$, where $R_{th(VJ-amb)}$ is a fixed value to be used for the calculating of T_{VJ}. The rating for T_{VJ} limits the allowable combinations of power dissipation (P) and ambient temperature (T_{amb}).

ELECTRICAL CHARACTERISTICS [6]

V_{CC} = 4.75V ~ 5.25V, T_{VJ} = -40°C ~ +150°C, and R_L = 60Ω unless otherwise noted. All voltages are referenced to GND; positive currents flow into the IC.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{CC} Supply Pin						
Supply Current	I_{CC}	Recessive; V_{TXD} = V_{CC}	2.5	5	13	mA
		Dominant; V_{TXD} = 0V	25	50	75	mA
Transmit Data Input (TXD) Pin						
High Level Input Voltage	V_{IH}		2		V_{CC}+0.3	V
Low Level Input Voltage	V_{IL}		-0.3		+0.8	V
High Level Input Current	I_{IH}	V_{TXD} = V_{CC}	-5	0	+5	μA
Low Level Input Current	I_{IL}	V_{TXD} = 0V	-100	-200	-300	μA
Input Capacitance	C_i	Not tested		5	10	pF
Mode Select Input (S) Pin						
High Level Input Voltage	V_{IH}	Silent mode	2		V_{CC}+0.3	V
Low Level Input Voltage	V_{IL}	High-speed mode	-0.3		+0.8	V
High Level Input Current	I_{IH}	V_S = V_{CC}	30	60	100	μA
Low Level Input Current	I_{IL}	V_S = 0V	-30	0	30	μA
Receive Data Output (RXD) Pin						
High Level Output Current	I_{OH}	V_{RXD} = 0.7V_{CC}	-2	-6	-15	mA
Low Level Output Current	I_{OL}	V_{RXD} = 0.45V	2	8.5	20	mA
Reference Voltage Output (V_{REF}) Pin						
Reference Output Voltage	V_{REF}	-50μA < I_{VREF} < +50μA	0.45V_{CC}	0.5V_{CC}	0.55V_{CC}	V
Bus Lines (CANH & CANL) Pins						
CANH Recessive Bus Voltage	$V_{O(reces)(CANH)}$	V_{TXD} = V_{CC}, no load	2	2.5	3	V
CANL Recessive Bus Voltage	$V_{O(reces)(CANL)}$	V_{TXD} = V_{CC}, no load	2	2.5	3	V
CANH Recessive Output Current	$I_{O(reces)(CANH)}$	-27V < V_{CANH} & V_{CANL} < +32V 0V < V_{CC} < 5.25V	-2.0		+2.5	mA
CANL Recessive Output Current	$I_{O(reces)(CANL)}$		-2.0		+2.5	mA

V_{CC} = 4.75V ~ 5.25V, T_{VJ} = -40°C ~ +150°C, and R_L = 60Ω unless otherwise noted. All voltages are referenced to GND; positive currents flow into the IC.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Bus Lines (CANH & CANL) Pins						
CANH Dominant Output Voltage	$V_{O(dom)(CANH)}$	V_{TXD} = 0V	2.8		4.5	V
CANL Dominant Output Voltage	$V_{O(dom)(CANL)}$	V_{TXD} = 0V	0.5		2.0	V
Differential Bus Input Voltage ($V_{CANH} – V_{CANL}$)	$V_{i(dif)(bus)}$	Dominant, V_{TXD} = 0V, 42.5Ω < R_L < 60Ω	1.5		3	V
		Recessive, V_{TXD} = V_{CC}, no load	-50	0	+50	mV
CANH Short-Circuit Output Current	$I_{O(SC)(CANH)}$	V_{CANH} = 0V, V_{TXD} = 0V	-35		-95	mA
CANL Short-Circuit Output Current	$I_{O(SC)(CANL)}$	V_{CANL} = 36V, V_{TXD} = 0V	35		150	mA
Differential Recessive Threshold Voltage (7)	$V_{i(dif)(th)}$	-12V < V_{CANL} & V_{CANH} < +12V	0.5	0.7	0.9	V
Differential Receiver Input Voltage Hysteresis (7)	$V_{i(dif)(hys)}$	-12V < V_{CANL} & V_{CANH} < +12V	100		200	mV
CANH Input Leakage Current	$I_{LI(CANH)}$	V_{CC} = 0V, V_{CANH} = 5V			500	μA
CANL Input Leakage Current	$I_{LI(CANH)}$	V_{CC} = 0V, V_{CANL} = 5V			500	μA
Common-Mode Input Resistance	$R_{i(cm)}$	CANH and CANL pins	15	25	50	kΩ
Common-Mode Input Resistance Matching	$R_{i(cm)(m)}$	V_{CANH} = V_{CANL}	-3	0	+3	%
Differential Input Resistance	$R_{i(dif)}$		25	50	100	kΩ
CANH & CANL Input Capacitance	$C_{i(cm)}$	V_{TXD} = V_{CC}, not tested			20	pF
Differential Input Capacitance	$C_{i(dif)}$	V_{TXD} = V_{CC}, not tested			10	pF
Timing Characteristics (8)						
Delay TXD to Bus Active	$t_{d(TXD-BUSon)}$	V_S = 0V	25		150	ns
Delay TXD to Bus Inactive	$t_{d(TXD-BUSoff)}$		25		150	ns
Delay Bus Active to RXD	$t_{d(BUSon-RXD)}$		20		100	ns
Delay Bus Inactive to RXD	$t_{d(BUSoff-RXD)}$		20		100	ns
Thermal Shutdown						
Shutdown Junction Temperature	$T_{J(sd)}$		155	165	180	°C

Note 6: All parameters are guaranteed in the virtual junction temperature range by design, but only 100% tested at 25°C ambient temperature for final tested.
Note 7: See the *Figure 2*.
Note 8: See the *Figure 3* and *Figure 4*.

TEST INFORMATION AND CIRCUIT

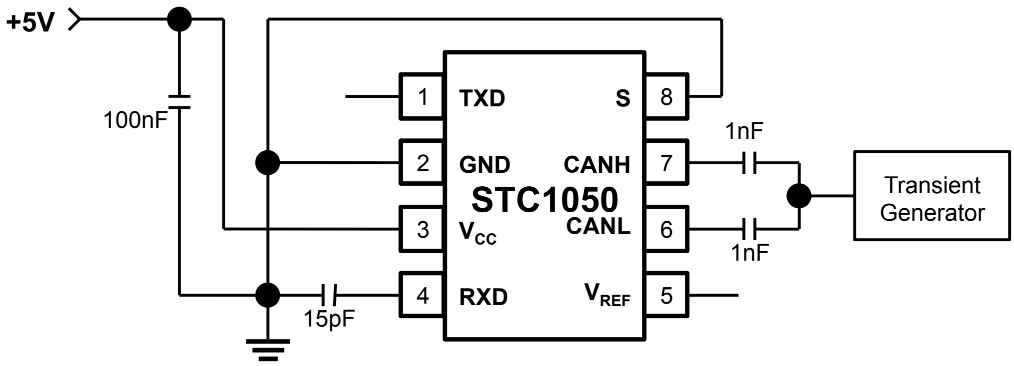


Figure 1: Automotive Transients Test Circuit

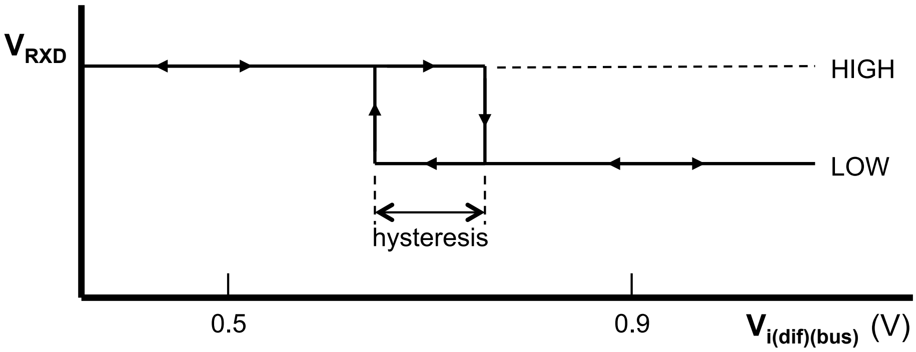


Figure 2: Hysteresis of the Receiver

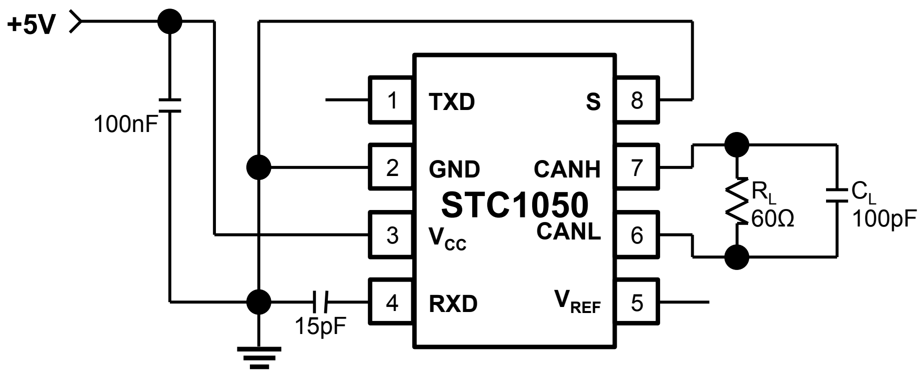


Figure 3: Test Circuit for Timing Characteristics

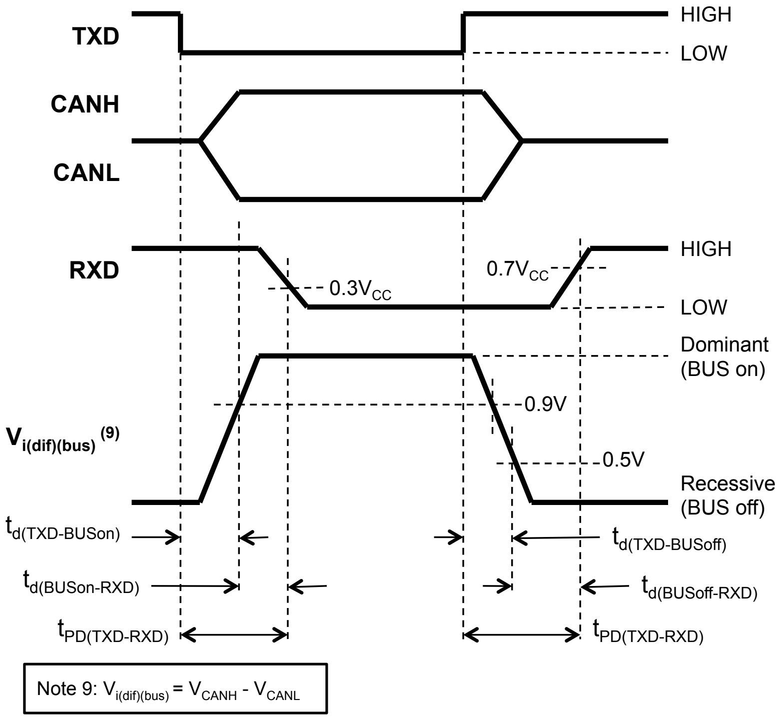


Figure 4: Timing Diagram

FUNCTIONAL DESCRIPTION

The STC1050 is the interface between the CAN protocol controller and the physical bus. It is primarily intended for high-speed automotive applications using baud rates from 40 kbaud up to 1 Mbaud. It is fully compatible to the ISO 11898 standard.

A current-limiting circuit protects the transmitter output stage from damage caused by accidential short-circuit to either positive or negative supply voltage, although power dissipation increases during this fault condition.

A thermal protection circuit protects the STC1050 from damage by switching off the transmitter if the junction temperature exceeds a value of approximately 165°C. Because the transmitter dissipates most of the power, the power dissipation and temperature of the IC is reduced. All other IC functions continue to operate. The transmitter off-state resets when TXD pin goes HIGH. The thermal protection circuit is particularly needed when a bus line short-circuits.

The pins CANH and CANL are protected from automotive electrical transients. Control pin S allows two operating modes to be selected: high-speed mode or silent mode.

The high-speed mode is the normal operating mode and is selected by connecting pin S to ground. It is recommended that pin S is connected to ground.

In the silent mode, the transmitter is disabled. All other IC functions continue to operate. The silent mode is selected by connecting pin S to V_{CC}.

TYPICAL APPLICATION CIRCUIT

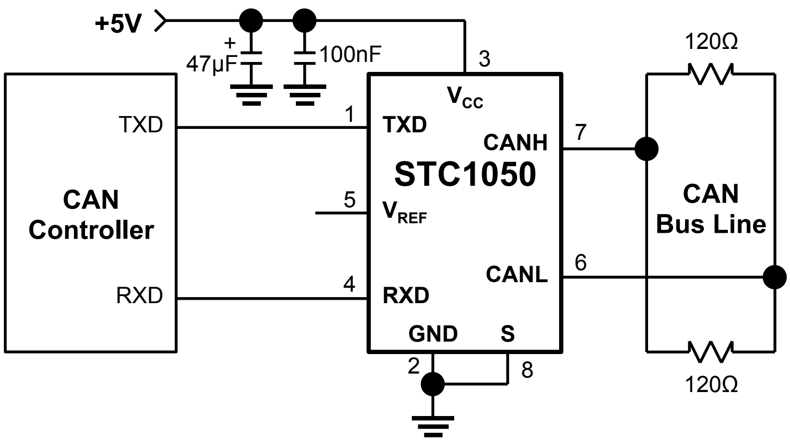


Figure 5: Typical Application for STC1050

PACKAGE DIMENSION

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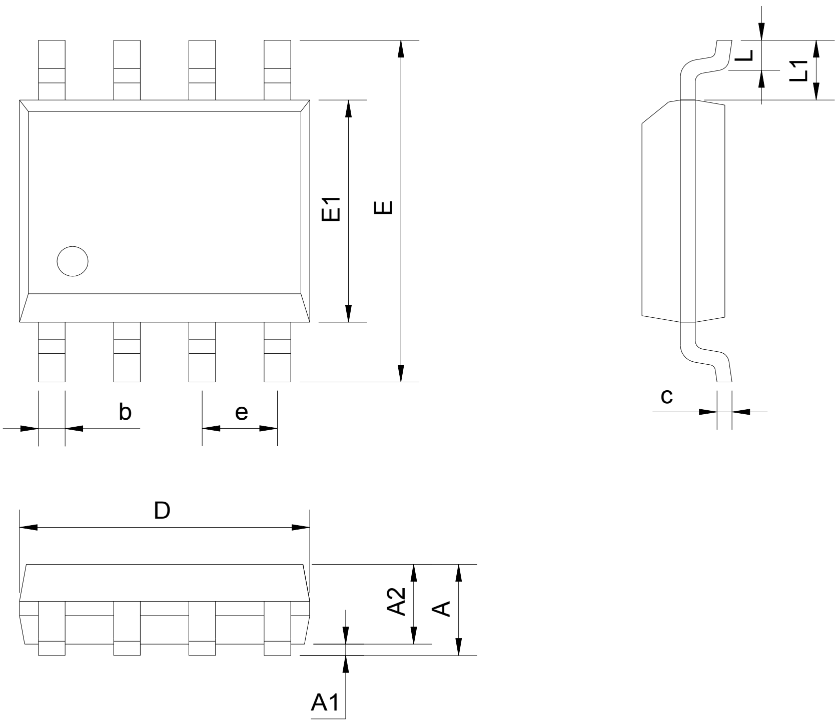

SYMBOL	Dimensions in Millimeters		Dimensions in Inches	
	MIN	MAX	MIN	MAX
A		1.750		0.069
A1	0.050	0.230	0.002	0.090
A2	1.300	1.500	0.051	0.059
b	0.350	0.450	0.014	0.018
c	0.180	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
E1	3.700	4.100	0.146	0.161
E	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	0.800	0.016	0.031