钛地半导体
Tudi Semiconductor

Product Specification

TUDI-TJA1042

High-speed CAN transceiver with Standby mode

网址 www.sztdbdt.com

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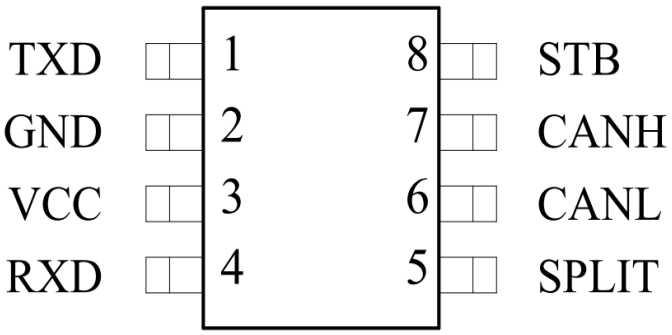
semiconductor device manufacturer

- Design
- research and development
- production
- and sales

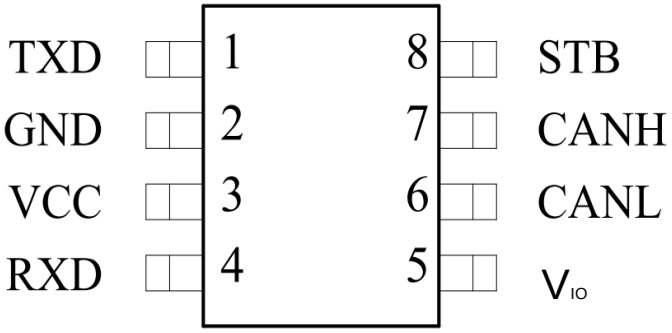
Revison V1.1

Features

- Fully ISO 11898-2:2016, SAE J2284-1 to SAE J2284-5 and SAE J1939-14 compliant
- Timing guaranteed for data rates up to 5 Mbit/s in the CAN FD fast phase
- Suitable for 12 V and 24 V systems
- Low Electromagnetic Emission (EME) and high Electromagnetic Immunity (EMI), according to proposed EMC Standards IEC 62228-3 and SAE J2962-2
- Variants with a V_{IO} pin allow for direct interfacing with 3.3 V to 5 V microcontrollers
- SPLIT voltage output on TJA1042T for stabilizing the recessive bus level .
- Dark green product (halogen free and Restriction of Hazardous Substances (RoHS) compliant)



TJA1042T/1 Pin Diagram



TJA1042T/3 Pin Diagram

Applications

- automotive electronics

Description

The TJA1042 high-speed CAN transceiver provides an interface between a Controller Area Network (CAN) protocol controller and the physical two-wire CAN bus. The transceiver is designed for high-speed CAN applications in the automotive industry, providing the differential transmit and receive capability to (a microcontroller with) a CAN protocol controller.
It offers improved ElectroMagnetic Compatibility (EMC) and ElectroStatic Discharge (ESD) performance, and also features:

- Ideal passive behavior to the CAN bus when the supply voltage is off
- A very low-current Standby mode with bus wake-up capability
- Variants with a VIO pin can be interfaced directly with microcontrollers with supply voltages from 3.3 V to 5 V.

The TJA1042 implements the CAN physical layer as defined in ISO 11898-2:2016 and SAE J2284-1 to SAE J2284-5. This implementation enables reliable communication in the CAN FD fast phase at data rates up to 5 Mbit/s.
These features make the TJA1042 an excellent choice for all types of HS-CAN networks, in nodes that require a low-power mode with wake-up capability via the CAN bus.

Pin description

Symbol	Pin	Type1	Description
TXD	1	1	transmit data input
GND	2	G	ground supply
Vcc	3	P	supply voltage
RXD	4	O	receive data output;reads out data from the bus lines
SPLIT	5	O	common-mode stabilization output;TJA1042T variants only
V_{IO}	5	P	supply voltage for I/O level adapter;TJA1042T/3 variants only
CANL	6	AIO	LOW-level CAN bus line
CANH	7	AIO	HIGH-level CAN bus line
STB	8	1	Standby mode control input

Block diagram

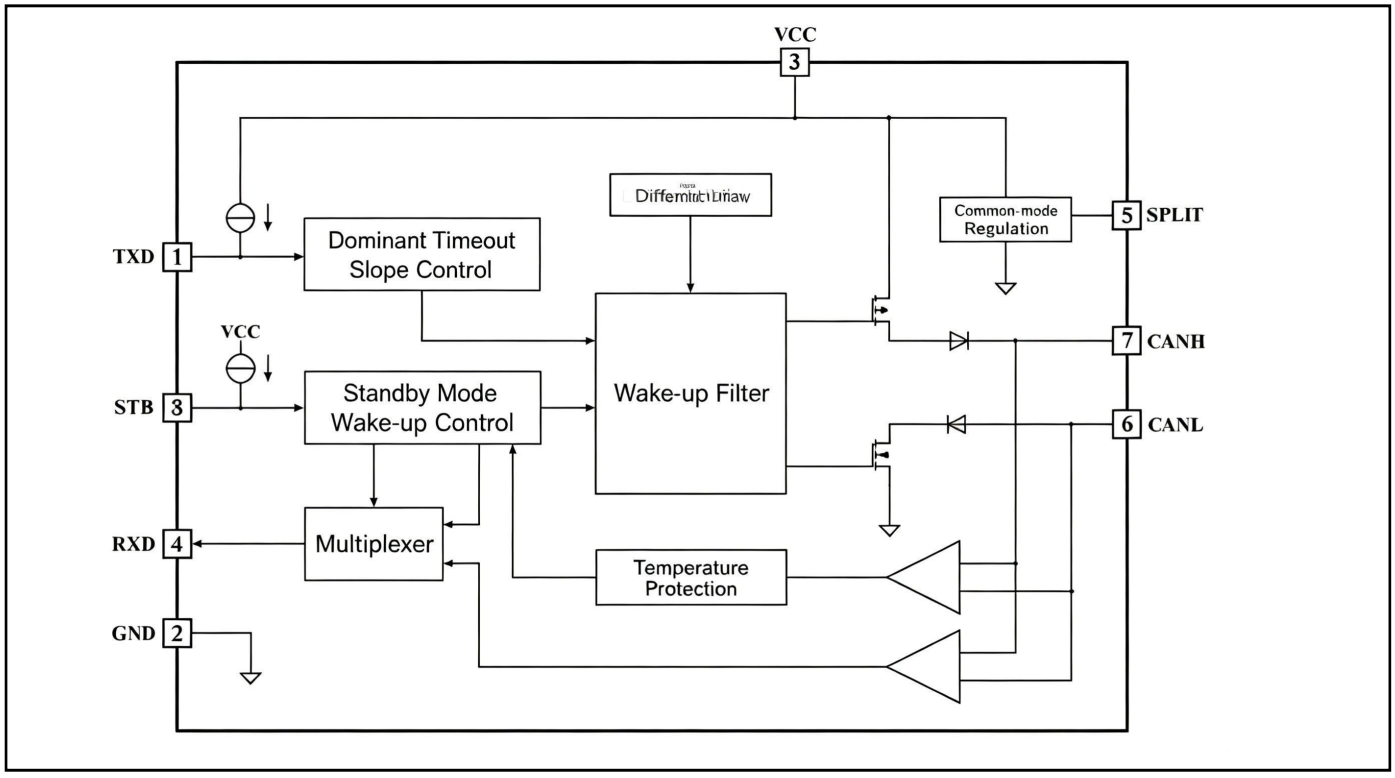


Figure 1 Functional Block Diagram

Typical Application Circuit Diagram

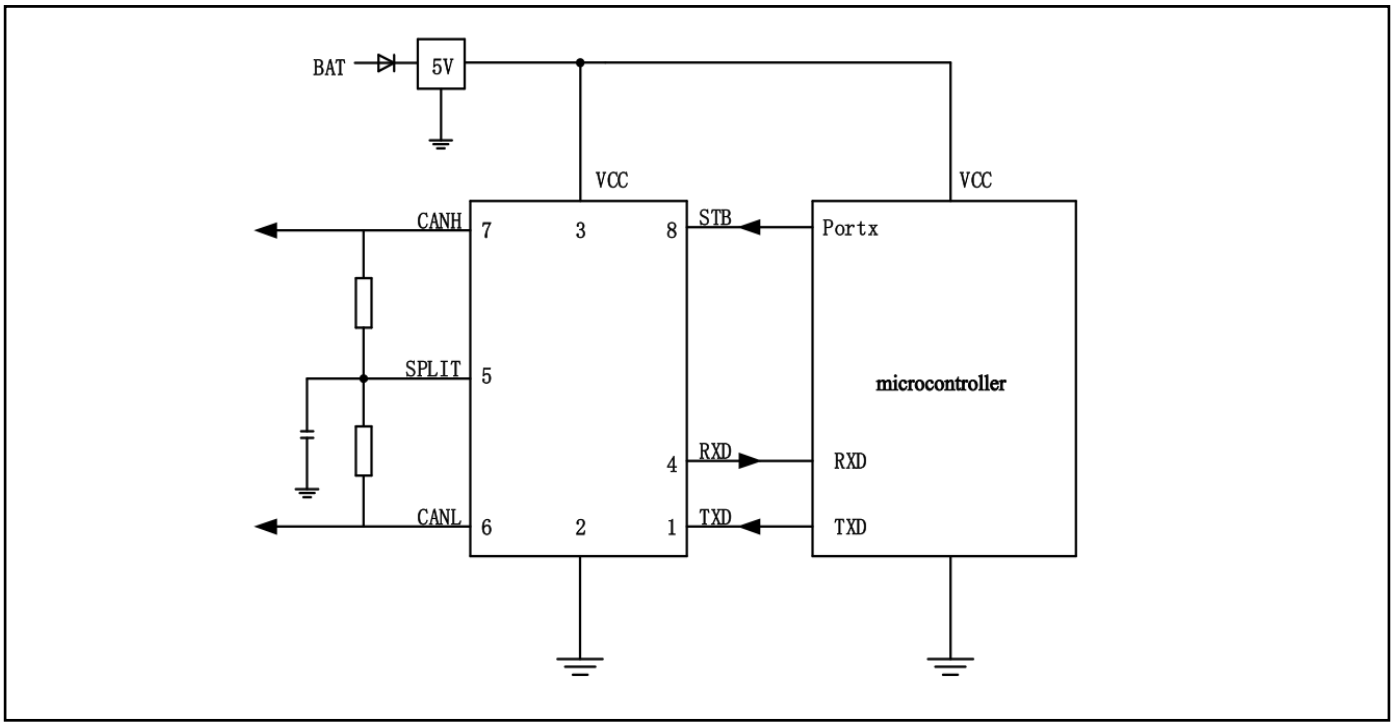


Figure 2 Typical Applications of a 5V Microcontroller

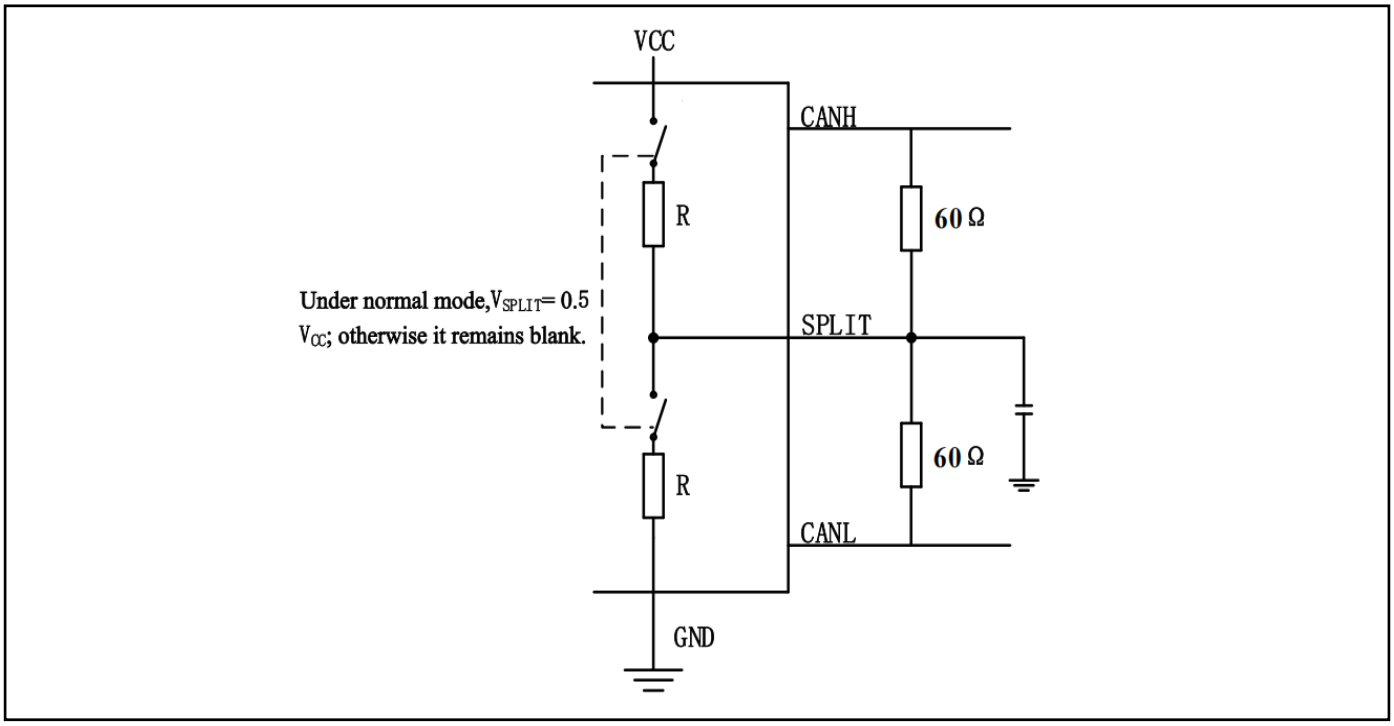


Figure 3 Common-Mode Voltage Regulation Application

Maximum rated value(unless otherwise specified,T_A=25°C

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Vcc	supply voltage		4.5	-	5.5	V
V_{IO}	supply voltage on pin Vio		2.8	-	5.5	V
$V_{uvd(VCC)}$	undervoltage detection voltage on pin Vcc		3.5	-	4.5	V
$V_{uvd(VIO)}$	undervoltage detection voltage on pin VIO		1.3	2.0	2.7	V
Icc	supply current	Standby mode	-	10	15	μA
		Normal mode;bus recessive	2.5	5	10	mA
		Normal mode;bus dominant	20	45	70	mA
I_{IO}	supply current on pin Vio	Standby mode;VTXD =V_{IO}	5	-	14	μA
		Normal mode				
		recessive;V_{TXD} =V_{IO}	15	80	200	μA
		dominant;V_{TXD}=0V	-	350	1000	μA
V_{ESD}	electrostatic discharge voltage	IEC 61000-4-2 at pins CANH and CANL	-8	-	+8	kV
V_{CANH}	voltage on pin CANH		-58	-	+58	V
V_{CANL}	voltage on pin CANL		-58	-	+58	V
Tvj	virtual junction temperature		-40	-	+150	℃

NOTE:

1. Equivalent to a 100pF capacitor discharging through a 1.5 kΩ resistor.
2. Equivalent to a 200pF capacitor discharging through a 0.75μH inductor and a 10Ω resistor.
3. According to the junction temperature of "IEC-6077-1", another definition of T_{VJ} is: T_{VJ}= T_{amb} P*$R_{th(VJ-amb)}$, where $R_{th(VJ-amb)}$ is a fixed used to calculate T_{VJ}, and the rated value of T_{VJ} limits the allowable combination of power dissipation (P) and ambient temperature (T_{amb}).
4. If the operating conditions the device exceed the maximum ratings mentioned above, permanent damage may be caused to the device. The above parameters are only the maximum values of the operating conditions, and we do not recommend the device outside this specification range. If the device operates under absolute maximum limit conditions for a long time, its stability may be affected.

Electrical characteristics

Unless otherwise specified, all typical values are measured under the conditions of T_A=25℃, V_{CC}=5V, T_{VJ}= -40~50℃, and R_L=60Ω. All voltages are referenced to ground, and the positive current direction is flowing into the IC.

Parameter declaration	Symbol	Test condition	Least value	Representative value	Crest value	Unit
Current Characteristics						
Dominant power supply current	$I_{cc(dom)}$	Normal mode:Dominant V_{TxD}=0V	30	50	70	mA
Implicit power supply current	$I_{cCreces)}$	Normal mode,recessive V_{TxD}=Vcc	2.5	5	10	mA
Standby power current	$I_{cc(stb)}$	Standby mode	5	10	20	μA
Short-circuit output current at pin CANH	$I_{o(CANH)(sc)}$	Normal mode V_{TXD}=0V,V_{CANH}=0V	-40	-70	-95	mA
Short-circuit output current at pin CANL	$I_{o(CANL)(sc)}$	Normal mode V_{TXD}=0V,V_{CANL}=40V	40	70	100	mA
Standby pin high-level input current	$I_{sTB(H)}$	V_{STB}=Vcc	—	0	—	μA
Standby pin low-level input current	$I_{sTB(L)}$	V_{STB}=0V	-1	-4	-10	μA
TXD Pin High-Level Input Current	$I_{TXD(H)}$	V_{TXD}=Vcc	-5	0	5	μA
Pin TXD low-level input current	$I_{TXD(L)}$	Normal mode:V_{TXD}=0V	-100	-200	-300	μA
Pin RXD high-level output current	$I_{RXDCH)}$	Normal mode V_{RXD}=Vcc-0.4V	-0.1	-0.4	-1	mA
Pin RXD low-level output current	$I_{RXD(L)}$	V_{RXD}=0.4V	2	6	12	mA
Implicit output current	$I_{o(reces)}$	-27V<VCAN<32V	-2.5	—	2.5	mA
CANH,CANL leakage current	$I_{leak(CAN)}$	Vcc=0V V_{CANH}=V_{CANL}=5V	-5	0	5	μA
SPLIT Pin Leakage Current	$\|I_L\|$	Standby mode -22V<V_{sPLIT}<35V	—	0	5	μA
Input Threshold Voltage						
High-level input voltage for the standby pin	$V_{STB(H)}$		2	—	Vcc+0.3	V
Standby pin low-level input voltage	$V_{STB(L)}$		-0.3	—	0.8	V
Pin TXD high-level input voltage	$V_{TXD(H)}$		2	—	Vcc+0.3	V
Pin TXD low-level input voltage	$V_{TXD(L)}$		-0.3	—	0.8	V
Differential receiver threshold voltage	$V_{dif(th)}$	Normal mode -12V<VCAN<12V	0.5	0.7	0.9	V
Differential receiver threshold hysteresis	$V_{ifhys)}$		50	70	100	mV
Standby mode differential receiver threshold voltage	$V_{dif(th)(stb)}$	Standby mode-12V<VCAN<12V	0.4	0.7	1.15	V
Output voltage						
Pin CANH dominant output voltage	$V_{O(CANH)(dom)}$	V_{TXD}=0V 45Ω<R_L<65Ω	3	3.6	4.25	V
Pin CANL output voltage (dominant)	$V_{O(CANL)(dom)}$		0.5	1.4	1.75	V
Differential bus explicit output voltage	$V_{O(dif)(dom)}$		1.5	—	3	V
Dominant output voltage matching	$V_{O(dom)(m)}$	Vcc-Vo(CANH))(dom) -Vo(CANL)(dom)	-100	0	150	mV
Implicit bus output voltage	$V_{O(reces)}$	Normal mode V_{TXD}=Vcc,no load	2	0.5Vcc	3	V
Differential bus implicit output voltage	$V_{O(dif)(reces)}$		-50	—	50	mV
Standby Mode Bus Output Voltage	$V_{O(stb)}$	Standby mode,no load	-0.1	0	0.1	V
Pin RXD high-level output voltage	$V_{RXD(H)}$	Standby mode I_{rxD}=-100μA	Vcc-1.1	Vcc-0.7	Vcc-0.4	V
Pin SPLIT Output Voltage	V_{sPLIT}	Normal mode -500μA<IsPLIT<500μA	0.3Vcc	0.5Vcc	0.7Vcc	V

Electrical characteristics (Continue)

Unless otherwise specified, all typical values are measured under the conditions of T_A=25℃, V_{CC}=5V, T_{VJ}= -40~50℃, and R_L=60Ω. All voltages are referenced to ground, and the positive current direction is flowing into the IC.

Parameter declaration	Symbol	Test condition	Least value	Representative value	Crest value	Unit
Transfer characteristic						
TXD-induced explicit delay in the bus communication	$t_{a(TXD-BUSon)}$	Normal mode	25	70	110	ns
Bus visibility to RXD latency	$t_{a(BUSon-RXD)}$		15	65	115	ns
TXD to bus implicit latency	$t_{a(TXD-BUSoff)}$		10	50	95	ns
Bus latency to RXD delay	$t_{d(BUSoff-RXD)}$		35	100	160	ns
Transmission delay from TXD to RXD	$t_{PD(TXD-RXD)}$	V_{STB}=0V	40	—	255	ns
Bus Wake Time	t_{BUS}	Standby mode	0.75	1.75	5	μs
Defencive function						
Enabling time from standby mode to normal mode	$t_{a(stb-norm)}$		5	7.5	10	μs
TXD Dominant Timeout	$t_{dom(TXD)}$	V_{TXD}=0V	300	600	1000	μs
Turn-off junction temperature	$T_{j(sd)}$		155	165	180	℃
Input resistance						
Common-mode input impedance	R_{icm}	Normal/Standby Mode	15	25	35	kΩ
Common-mode input impedance matching	$R_{icm)(m)}$	V_{CANH}=V_{CANL}	-3	0	3	%
Differential input impedance	$R_{i(dif)}$	Normal/Standby Mode	25	50	75	kΩ
Input capacitance						
TXD Pin Input Capacitor	$C_{i(TXD)}$		—	5	10	pF
Common-mode input capacitance	$C_{i(cm)}$	V_{TXD}=Vcc	—	—	20	pF
Differential input capacitor	$C_{i(dif)}$		—	—	10	pF

Functional Description

Work Pattern

The TJA1042 has two operating modes, which can be selected via the STB pin. Table 1 provides detailed descriptions of these operating modes.

Pattern	Pin STB	Pin RXD	
		Low	Gao
Normal mode	Low	Bus Visibility	Bus Implicitity
Standby mode	Gao	Wake request detected	No wake-up request detected

The STB control pin allows selection of two operating modes: normal mode and standby mode. Normal mode is selected by connecting pin STB to ground. Both the CAN driver and receiver operate fully normally, and CAN communication proceeds bidirectionally. t_{BUS} Standby mode can be selected by setting the STB to a high level. Both the CAN driver and receiver are turned off to reduce system power consumption. The high level on pin STB activates the low-power receiver and wake-up filter; when the low-power differential comparator detects an explicit bus level exceeding , pin RXD transitions to a low level.

Common-Mode Voltage Regulation Function

The SPLIT pin provides a 0.5VCC DC voltage regulator. It is only connected in normal mode. In standby mode, the SPL pin is floating. By connecting the SPLIT pin to the midpoint of the terminal load, the recessive common-mode voltage is stabilized. Due to the presence of unpowered transce on the bus, they have significant leakage current between the bus and ground, making the recessive bus voltage < $0.5V_{CC}$. The common-mode voltage regulation function will this recessive voltage to $0.5V_{CC}$. Therefore, no step will be generated on the common-mode signal when starting transmission, thereby ensuring the electromagnetic emission (EME).

Wake Up Function

In standby mode, the bus is monitored by a low-power differential comparator. Once the low-power differential comparator detects a persistent bus voltage level lasting longer than t_{BUS} , pin RXD becomes low (low-level).

Overheating Detection

The output driver is protected against overheating. If the temperature exceeds 165°C, the output driver will be disabled until the temperature drops below the typical threshold of 165° C and TXD becomes inactive, at which point it resumes operation. Thus, the output driver does not oscillate due to temperature fluctuations.

TXD Explicit Timeout Function

When the TXD pin is continuously held low (level) due to a hardware or software error, the " TXD dominant timeout" timer circuit prevents bus from entering a continuous dominant state (blocking all network communication). This timer is triggered by the falling edge of the TXD pin. If the low level of the TXD lasts longer than the internal timer value (tdom), the transceiver will be disabled, forcing the bus into a recessive state. The timer is reset by the rising edge of the TX pin. The TXD dominant timeout time (tdom) defines the minimum allowed bit rate as 40kBaud.

Failure Protection Function

Pin TXD provides a pull-up to Vcc, keeping it at a low level when not in use. Pin STB provides a pull-up to Vcc; when not used, it puts the transceiver into standby mode. If Vcc is powered down , pins TXD, STB, and RXD remain floating to prevent reverse current flow through them.

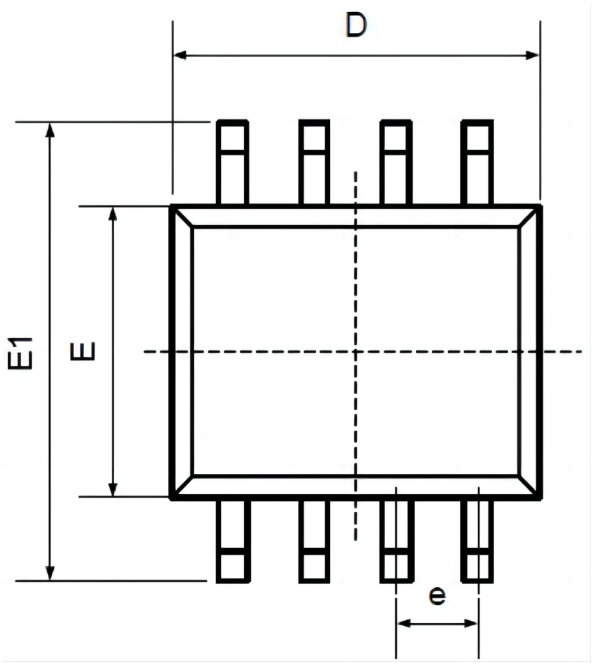
Order information

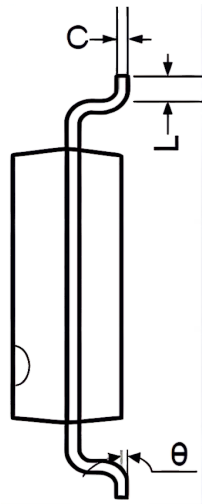
Order Number	Package	Package Quantity	Marking On The park	Temperature
TJA1042T/1J-TUDI	SOP8	Tape,Reel,2500	TD1042T	-40℃ to 150℃
TJA1042T/CM-TUDI	SOP8	Tape,Reel,2500	A42/C	
TJA1042T/3/1J-TUDI	SOP8	Tape,Reel,2500	TDA1042/3	
TJA1042T/3/CM-TUDI	SOP8	Tape,Reel,2500	A42/3C	

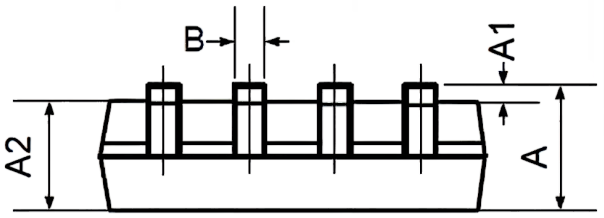
Revision history

Revison Number	Date	Revision	Page
V1.0	2018-9	New	1-11
V1.1	2026-5	Update PDF version， Update making	9

Package SOP8







Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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