## Features

- Meet the ISO 11898-2:2016 and SAE J2284-1 to SAE J2284-5 Physical Layer Standards
- Support CAN FD and Data Rates up to 5 Mbps
- Short propagation delay times and fast loop times
- 5 V power supply, I/O voltage range supports 2.8V to 5.5V MCU interface
- Very low current standby mode with bus wake-up capability
- Ideal passive behavior to CAN bus when unpowered
- Common-Mode Input Voltage: ±30 V
- Protection feature：
  - Bus Fault protection: ±42V
  - VCC and VIO(V variants only) undervoltage protection
  - TXD dominant time-out function and Bus-dominant time-out function
  - Thermal shutdown protection
- Available in SOP8 package and leadless DFN3X3 package
- Qualified for Automotive Applications with AEC-Q100 Reliability Test

## Applications

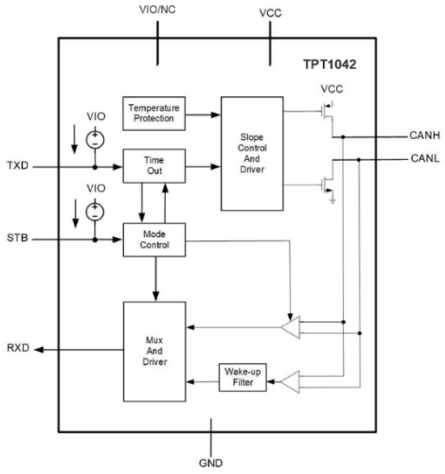
- All Devices Supporting Highly Loaded CAN Networks
- Automotive and Transportation
  - Body Electronics / Lighting
  - Power Train / Chassis
  - Infotainment / Cluster
  - ADAS / Safety

## Description

The TPT1044V is a CAN transceiver that meets the ISO11898 high-speed CAN (Controller Area Network) physical layer standard. The device is designed in CAN FD networks up to 5 Mbps and enhances timing margin and higher data rates in long and highly loaded networks. As the design, the device features cross-wire, overvoltage and loss of ground protection from −42 V to +42 V, overtemperature shutdown, and a −30 V to +30 V common-mode input Voltage range. The TPT1044V has a secondary power supply input for I/O level shifting the input pin thresholds and RXD output level. This family has low current standby mode with CAN BUS waked up capability. Additionally, all devices include many protection features to enhance the device and network robustness.

The TPT1044V are available in SOP-8 and DFN3X3-8L packages and is characterized from −40°C to +125°C.

## Functional Block Diagram



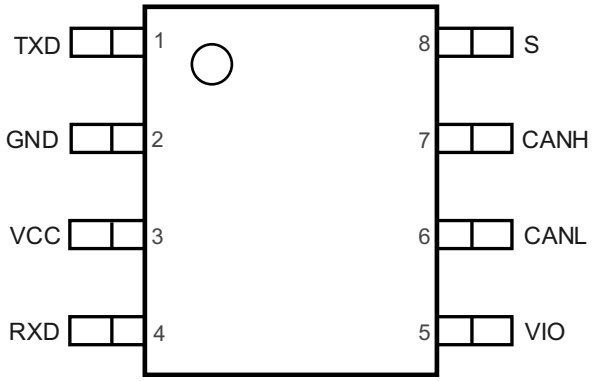
# Table of Contents

## Revision History

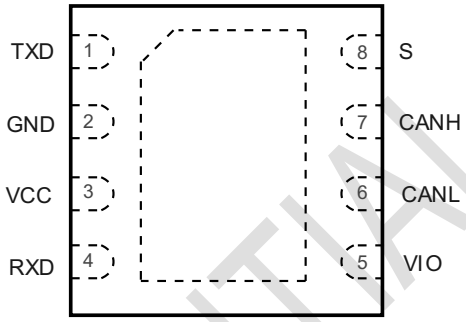
| Date | Revision | Notes |
|---|---|---|
| 2022-11-20 | Pre.A.0 | Released Version |

## Pin Configuration and Function

TPT1044V
SOP8
Top View



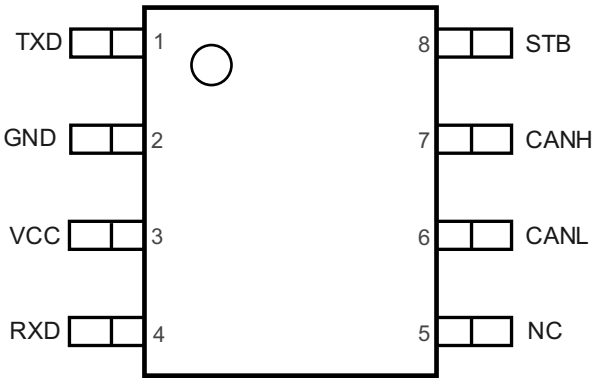

TPT1044V
DFN3x3-8
Top View



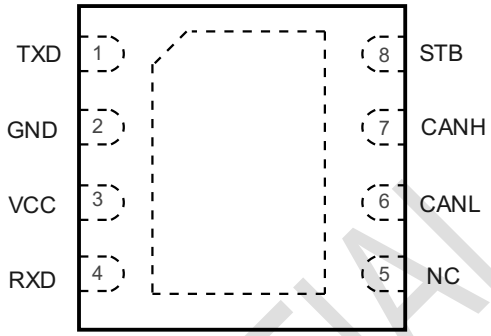

### Pin Functions

| Pin | | I/O | Description |
|---|---|---|---|
| No. | Name | | |
| 1 | TXD | I | CAN transmit data input<br>(LOW for dominant and HIGH for recessive bus states) |
| 2 | GND | GND | Ground |
| 3 | VCC | POWER | Transceiver 5 V supply voltage |
| 4 | RXD | O | CAN receive data output<br>(LOW for dominant and HIGH for recessive bus states) |
| 5 | VIO | POWER | Transceiver I/O level shifting supply voltage |
| 6 | CANL | BUS I/O | Low level CAN bus input/output line |
| 7 | CANH | BUS I/O | High level CAN bus Input/output line |
| 8 | STB | I | Standby Mode control input (active high) |

TPT1044
SOP8
Top View




TPT1044
DFN3x3-8
Top View




## Pin Functions

| Pin | | I/O | Description |
|---|---|---|---|
| No. | Name | | |
| 1 | TXD | Input | CAN transmit data input<br>(LOW for dominant and HIGH for recessive bus states) |
| 2 | GND | GND | Ground |
| 3 | VCC | Power | Transceiver 5 V supply voltage |
| 4 | RXD | Output | CAN receive data output<br>(LOW for dominant and HIGH for recessive bus states) |
| 5 | NC | – | Not Connected |
| 6 | CANL | Bus I/O | Low level CAN bus input/output line |
| 7 | CANH | Bus I/O | High level CAN bus input/output line |
| 8 | STB | Input | Standby Mode control input (active high) |

# Specifications

## Absolute Maximum Ratings

| Parameter | | Min | Max | Unit |
|---|---|---|---|---|
| $V_{CC}$ | 5-V Bus supply voltage range | −0.3 | 7 | V |
| $V_{IO}$ | I/O Level-shifting voltage range | −0.3 | 7 | V |
| $V_{BUS}$ | CAN Bus I/O voltage range (CANH, CANL) | −42 | 42 | V |
| $V_{BUS\_DIFF}$ | Differential voltage of CAN Bus, CANH - CANL | −42 | 42 | V |
| $V_{LOGIC}$ | Logic input and output terminal voltage range (TXD, STB, RXD) | −0.3 | 7 | V |
| $I_{O\_RXD}$ | RXD (Receiver) output current | −8 | 8 | mA |
| $T_J$ | Maximum junction temperature | −40 | 150 | °C |
| $T_{STG}$ | Storage temperature range | −65 | 150 | °C |
| $T_{OTP}$ | Shutdown junction temperature | | 170 | °C |

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.
(2) This data was taken with the JEDEC low effective thermal conductivity test board.
(3) This data was taken with the JEDEC standard multilayer test boards.

## ESD, Electrostatic Discharge Protection

| Symbol | Parameter | Condition | Minimum Level | Unit |
|---|---|---|---|---|
| IEC | IEC Contact Discharge | IEC-61000-4-2, Bus Pin | ±2 | kV |
| HBM | Human Body Model ESD | ANSI/ESDA/JEDEC JS-001, CAN Bus Pin | ±8 | kV |
| | | ANSI/ESDA/JEDEC JS-001, All Pin | ±7 | kV |
| CDM | Charged Device Model ESD | ANSI/ESDA/JEDEC JS-002, All Pin | ±1.5 | kV |
| LU | Latch up | Latch up per JESD78, All Pin (3) | ±500 | mA |
| $V_{tran}$ | ISO7637-2 transients per IEC 62228-3, CANH, CANL | Pulse 1 | -100 | V |
| | | Pulse 2a | 75 | V |
| | | Pulse 3a | -150 | V |
| | | Pulse 3b | 100 | V |

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.
(3) Test at the temperature of 25℃.

## Recommended Operating Conditions

| Parameter | | Min | Max | Unit |
|---|---|---|---|---|
| $V_{I/O}$ | Input/Output Voltage | 2.8 | 5.5 | V |
| $V_{CC}$ | Power Supply | 4.5 | 5.5 | V |
| $I_{OH(RXD)}$ | RXD Terminal HIGH Level Output Current | −2 | | mA |
| $I_{OL(RXD)}$ | RXD Terminal LOW Level Output Current | | 2 | mA |
| $T_A$ | Operating Ambient Temperature | −40 | 125 | °C |

## Thermal Information

| Package Type | $\theta_{JA}$ | $\theta_{JC}$ | Unit |
|---|---|---|---|
| SOP8 | 118 | 48 | °C/W |
| DFN3x3-8 | 51 | 23 | °C/W |

## Electrical Characteristics

$V_{CC}$ = 4.5 V to 5.5 V, $V_{IO}$ = 2.8 V to 5.5 V, $R_L$ = 60 Ω, $T_A$ = −40°C to 125°C, unless otherwise noted.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Pin $V_{CC}$, (Power supply)** | | | | | | |
| $V_{CC}$ | Supply Voltage | | 4.5 | | 5.5 | V |
| $V_{UV\_VCC}$ | Rising undervoltage detection on $V_{CC}$ for protected mode | | - | 4.1 | 4.5 | V |
| | Falling undervoltage detection on $V_{CC}$ for protected mode | | 3.6 | 3.9 | - | V |
| $V_{HYS\_UVVCC}$ | Hysteresis voltage on $UV_{VCC}$(1) | | - | 200 | - | mV |
| $I_{CC}$ | Standby mode supply current | 1044V, device with the "V" suffix, Standby Mode, $V_{TXD}$ = $V_{CC}$, RL = 60 Ω, $C_L$ = open, $V_{STB}$ = $V_{CC}$ | - | 3.5 | 5 | μA |
| | | 1044, device without the "V" suffix, Standby Mode, $V_{TXD}$ = $V_{IO}$, RL = 60 Ω, $C_L$ = open, $V_{STB}$ = $V_{IO}$ | - | 10 | 20 | μA |
| | Normal mode supply current | Recessive, $V_{TXD}$ = $V_{CC}$, $R_L$ = 50 Ω, $C_L$ = open, $V_{STB}$ = 0 V | 0.5 | 1.3 | 5 | mA |
| | | Dominant, $V_{TXD}$ = 0 V, $R_L$ = 60 Ω, $C_L$ = open, $V_{STB}$ = 0 V | 20 | 50 | 80 | mA |
| | | Dominant bus fault, short circuit on bus lines, $V_{TXD}$ = $V_{STB}$ = 0 V, -25V < ($V_{CANH}$ = $V_{CANL}$) < +25V, $R_L$ = $C_L$ = open | 2 | 60 | 110 | mA |
| **PIN $V_{IO}$, (I/O Level Adapter Supply)(2)** | | | | | | |
| $V_{IO}$ | Supply voltage on $V_{IO}$ pin | | 2.8 | - | 5.5 | V |
| $V_{UV\_VIO}$ | Rising undervoltage detection on $V_{IO}$ for protected mode | | - | 2.0 | 2.7 | V |
| | Falling undervoltage detection on $V_{IO}$ for protected mode | | 1.3 | 1.9 | - | V |
| $V_{HYS\_UVVIO}$ | Hysteresis voltage on $UV_{VIO}$ for protected mode | | - | 100 | - | mV |
| $I_{IO}$ | Standby mode supply current on pin $V_{IO}$ | Standby Mode, RXD Floating, $V_{TXD}$ = $V_{STB}$ = $V_{IO}$ | 5 | 10 | 14 | μA |
| | Normal mode supply current on pin $V_{IO}$ | Recessive, $V_{STB}$ = 0 V, $V_{TXD}$ = $V_{IO}$ | - | 15 | 30 | μA |
| | | Dominant, $V_{STB}$ = 0 V, $V_{TXD}$ = 0 V | - | 200 | 600 | μA |
| **Pin STB, (Standby Mode Control Input)** | | | | | | |
| $V_{IH}$ | High level input voltage | | 0.7 x $V_{IO}$ | - | $V_{IO}$ + 0.3 | V |
| $V_{IL}$ | Low level input voltage | | -0.3 | - | 0.3 x $V_{IO}$ | V |
| $I_{IH}$ | High level input current | $V_{STB}$ = $V_{CC}$ = $V_{IO}$ = 5.5 V | −2 | 0 | 2 | μA |
| $I_{IL}$ | Low level input current | $V_{STB}$ = 0 V, $V_{CC}$ = $V_{IO}$ = 5.5 V | −20 | -11 | -2 | μA |

| | | | | | | |
|---|---|---|---|---|---|---|
| $I_{lkg(OFF)}$ | Unpowered leakage current | $V_{STB}$ = 5.5 V, $V_{CC}$ = $V_{IO}$ = 0 V | −1 | 0 | 1 | uA |
| **Pin TXD, (CAN Transmit Data Input)** | | | | | | |
| $V_{IH}$ | High level input voltage | | 0.7 x $V_{IO}$ | - | $V_{IO}$ + 0.3 | V |
| $V_{IL}$ | Low level input voltage | | -0.3 | - | 0.3 x $V_{IO}$ | V |
| $I_{IH}$ | High level input current | $V_{TXD}$ = $V_{CC}$ = $V_{IO}$ = 5.5V | −2 | 0 | 2 | μA |
| $I_{IL}$ | Low level input current | $V_{TXD}$=0V, $V_{CC}$ = $V_{IO}$ = 5.5V | −250 | −160 | −30 | μA |
| $I_{LKG\_OFF}$ | Unpowered leakage current | $V_{TXD}$ = 5.5V, $V_{CC}$ = $V_{IO}$ = 5.5V | −1 | 0 | 1 | μA |
| $C_I$ | Input capacitance (1) | | - | 5 | - | pF |

(1) Test data based on bench test and design simulation.

(2) Typical data is based on bench test by LRC meter E4980AL.

(3) Only device with V suffix (TPT1044V) have a $V_{IO}$ Pin, device without V suffix TPT1044 $V_{IO}$ connoted to $V_{CC}$ internally.

| Symbol | Parameter | | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Pin RXD, (CAN Receive Data Output)** | | | | | | | |
| $I_{OH}$ | High level output current | | $V_{RXD}$ = $V_{IO}$ - 0.4 V | −8 | -6 | −1 | mA |
| $I_{OL}$ | Low level output current | | $V_{RXD}$ = 0.4 V, bus dominant | 2 | 5 | 12 | mA |
| $I_{LKG\_OFF}$ | Unpowered leakage current | | $V_{RXD}$ = 5.5 V, $V_{CC}$ = $V_{IO}$ = 0 V | −1 | 0 | 1 | μA |
| **Pins CANH and CANL, (CAN Bus Lines)** | | | | | | | |
| $V_{O\_DOM}$ | Dominant bus output voltage | CANH | $V_{TXD}$ = 0 V, $V_{STB}$ = 0 V, 50 Ω ≤ $R_L$ ≤ 65 Ω, $C_L$ = open, t < $t_{to(dom)TXD}$ | 2.75 | 3.5 | 4.5 | V |
| | | CANL | | 0.5 | 1.5 | 2.25 | V |
| $V_{SYM\_DC}$ | DC output symmetry (dominant or recessive) ($V_{CC}$ – $V_{O(CANH)}$ – $V_{O(CANL)}$) | | $V_{STB}$ = 0 V, $R_L$ = 60 Ω, $C_L$ = open, | −0.4 | - | 0.84 | V |
| $V_{SYM}$ | Transient symmetry (dominant or recessive) ($V_{O(CANH)}$ + $V_{O(CANL)}$) / $V_{CC}$ (1) | | $V_{STB}$ = 0 V, $R_L$ = 60 Ω, $C_{SPLIT}$ = 4.7 nF, $C_L$ = open, $T_{XD}$ = 250 kHz, 1 MHz | 0.9 | 1.0 | 1.1 | V/V |
| $V_{OD\_DOM}$ | Differential output voltage (dominant) | | Normal mode, t < $t_{to(dom)TXD}$, $V_{TXD}$ = 0 V, $V_{STB}$ = 0 V, 45 Ω ≤ $R_L$ < 50 Ω, $C_L$ = open | 1.4 | - | 3 | V |
| | | | Normal mode, t < $t_{to(dom)TXD}$, $V_{TXD}$ = 0 V, $V_{STB}$ = 0 V, 50 Ω ≤ $R_L$ ≤ 65 Ω, $C_L$ = open | 1.5 | - | 3 | V |
| | | | Normal mode, t < $t_{to(dom)TXD}$, $V_{TXD}$ = 0 V, $V_{STB}$ = 0 V, 65 Ω ≤ $R_L$ ≤ 70 Ω, $C_L$ = open | 1.5 | - | 3.3 | V |
| | | | Normal mode, t < $t_{to(dom)TXD}$, $V_{TXD}$ = 0 V, $V_{STB}$ = 0 V, $R_L$ = 2240 Ω, $C_L$ = open | 1.5 | - | 5 | V |
| $V_{OD\_REC}$ | Differential output voltage (recessive) | | Normal mode, $V_{TXD}$ = $V_{CC}$, $V_{STB}$ = 0 V, no load | −50 | - | 50 | mV |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Standby mode, $V_{TXD}$ = $V_{STB}$ = $V_{CC}$, no load | −150 | - | 150 | mV |
| $V_{O\_REC}$ | Recessive bus output voltage | Normal mode, $V_{TXD}$ = $V_{IO}$ = $V_{CC}$, $V_{STB}$ = 0 V, no load | 2 | 0.5 x VCC | 3 | V |
| | | Standby mode, $V_{TXD}$ = $V_{STB}$ = $V_{IO}$ = $V_{CC}$, no load | -0.1 | - | 0.1 | V |
| $V_{CM}$ | Common mode range | $V_{STB}$ = 0 or $V_{CC}$ or $V_{IO}$ | −30 | - | 30 | V |
| $V_{TH\_RX\_DIF}$ | Differential receiver threshold voltage | Normal mode, $V_{STB}$ = 0 V, -30V ≤$V_{CANH}$ / $V_{CANL}$ ≤ 30V | 0.5 | 0.7 | 0.9 | V |
| | | Standby mode, $V_{STB}$ = $V_{IO}$, -30V ≤$V_{CANH}$ / $V_{CANL}$ ≤ 30V | 0.4 | 0.7 | 1.15 | V |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $V_{REC\_RX}$ | Receiver recessive voltage, Normal mode | | -30V ≤$V_{CANH}$ / $V_{CANL}$ ≤ 30V | -4 | - | 0.5 | V |
| | Receiver recessive voltage, Standby mode | | | -4 | - | 0.4 | V |
| $V_{DOM\_RX}$ | Receiver dominant voltage, Normal Mode | | -30V ≤$V_{CANH}$ / $V_{CANL}$ ≤ 30V | 0.9 | - | 9 | V |
| | Receiver dominant voltage, Standby Mode | | | 1.15 | - | 9 | V |
| $V_{HYS\_RX\_DIF}$ | Differential receiver hysteresis voltage | | Normal mode, -30V ≤$V_{CANH}$ / $V_{CANL}$ ≤ 30V | 50 | 120 | 200 | mV |
| | | | Standby mode, -30V ≤$V_{CANH}$ / $V_{CANL}$ ≤ 30V | 20 | 70 | 120 | mV |
| $I_{O\_SC\_DOM}$ | Dominant short-circuit output current | CANH | $V_{STB}$ = 0 V, $V_{CANH}$ = −15 V to 15 V, CANL = open, $V_{TXD}$ = 0 V | −125 | - | - | mA |
| | | CANL | $V_{STB}$ = 0 V, $V_{CANL}$ = −15 V to 15 V, CANH = open, $V_{TXD}$ = 0 V | - | - | 125 | mA |
| $I_{O\_SC\_RCE}$ | Recessive short-circuit output current | | −27 V ≤$V_{CANH}$ / $V_{CANL}$ ≤ 32 V, $V_{TXD}$ = $V_{CC}$, normal modes | −5 | - | 5 | mA |
| $I_{LKG\_IOFF}$ | Power-off (unpowered) bus input leakage current | | $V_{CC}$=$V_{IO}$=0V or $V_{CC}$=$V_{IO}$ shorted to ground via 47kΩ, $V_{CANH}$=$V_{CANL}$=5V | −5 | - | 5 | μA |
| $R_{IN}$ | Input Resistance (CANH or CANL) | | $V_{TXD}$ = $V_{CC}$ = $V_{IO}$ = 5 V, $V_{STB}$ = 0 V, −30 V ≤ $V_{CM}$ ≤ +30 V | 10 | 23 | 30 | kΩ |
| $R_{IN\_M}$ | Input Resistance Matching: [1 − $R_{IN(CANH)}$ / $R_{IN(CANL)}$] × 100% | | $V_{TXD}$=$V_{CC}$=$V_{IO}$=5V, $V_{STB}$=0V, $V_{CANH}$ = $V_{CANL}$=5V, | −2 | - | +2 | % |
| $R_{ID}$ | Differential Input Resistance | | $V_{TXD}$ = $V_{CC}$ = $V_{IO}$ = 5 V, $V_{STB}$ = 0 V, −30 V ≤ $V_{CM}$ ≤ +30 V | 30 | 47 | 60 | kΩ |
| $C_I$ | Input Capacitance to Ground (CANH or CANL) (1) (2) | | | - | 20 | - | pF |
| $C_{ID}$ | Differential Input | | | - | 10 | - | pF |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Capacitance (1) (2) | | | | | |

## AC Timing Characteristics

$V_{CC}$ = 4.5 V to 5.5 V, $V_{IO}$ = 2.8 V to 5.5 V, $R_L$ = 60 Ω, $T_A$ = −40°C to 125°C, unless otherwise noted.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Transceiver Switching Characteristics** | | | | | | |
| $t_{pLD}$ | Propagation delay time, low TXD to driver dominant (recessive to dominant) (1) | Normal mode, $V_{STB}$ = 0 V, $R_L$ = 60 Ω, $C_L$ = 100 pF | - | 60 | 100 | ns |
| $t_{pHR}$ | Propagation delay time, high TXD to driver recessive (dominant to recessive) (1) | | - | 60 | 100 | ns |
| $t_{SK\_P}$ | Pulse Skew ($\lvert t_{pHR} - t_{pLD} \rvert$) (1) | | - | 10 | 35 | ns |
| $t_R$ | Differential Output Signal Rise Time (1) | | - | 45 | - | ns |
| $t_F$ | Differential Output Signal Fall Time (1) | | - | 45 | - | ns |
| $t_{PROP\_TXDL-RXDL}$ | Total loop delay, driver input (TXD) low to receiver output (RXD) low, recessive to dominant(1) | Normal mode, $V_{STB}$ = 0 V, $R_L$ = 60 Ω, $C_L$ = 100 pF, $C_{L(RXD)}$ = 15 pF, | - | 110 | 220 | ns |
| $t_{PROP\_TXDH-RXDH}$ | Total loop delay, driver input (TXD) high to receiver output (RXD) high, dominant to recessive(1) | | - | 140 | 220 | ns |
| $t_{pRH}$ | Propagation Delay Time, Bus Recessive Input to RXD High Output (Dominant to Recessive) (1) | $V_{STB}$ = 0 V, $C_{L(RXD)}$ = 15 pF | - | 90 | 120 | ns |
| $t_{pDL}$ | Propagation Delay Time, Bus Dominant Input to RXD Low Output (Recessive to Dominant) (1) | | - | 90 | 120 | ns |
| $t_{R\_R}$ | RXD Output Signal Rise Time (1) | | - | 20 | - | ns |
| $t_{R\_F}$ | RXD Output Signal Fall Time (1) | | - | 20 | - | ns |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **FD Timing Parameters** | | | | | | |
| $t_{BIT\_BUS}$ | Bit time on CAN bus output pins with $t_{BIT(TXD)}$ = 500 ns | $V_{STB}$ = 0 V, $R_L$ = 60 Ω, $C_L$ = 100 pF, $C_{L(RXD)}$ = 15 pF, $\Delta t_{REC} = t_{BIT(RXD)} - t_{BIT(BUS)}$ | 435 | - | 530 | ns |
| | Bit time on CAN bus output pins with $t_{BIT(TXD)}$ = 200 ns | | 155 | - | 210 | ns |
| $t_{BIT\_RXD}$ | Bit time on RXD output pins with $t_{BIT(TXD)}$ = 500 ns | | 400 | - | 550 | ns |
| | Bit time on RXD output pins with $t_{BIT(TXD)}$ = 200 ns | | 120 | - | 220 | ns |
| $\Delta t_{REC}$ | Receiver timing symmetry with $t_{BIT(TXD)}$ = 500 ns | | −65 | - | 40 | ns |
| | Receiver timing symmetry with $t_{BIT(TXD)}$ = 200 ns | | −45 | - | 15 | ns |
| **Device Timing Parameters** | | | | | | |
| $t_{TXD\_DTO}$ | TXD dominant time-out time | normal mode, $V_{STB}$ = 0 V, $R_L$ = 60 Ω, $C_L$ = open, $V_{TXD}$ = 0V | 0.3 | 2 | 5 | ms |
| $t_{BUS\_DTO}$ | Bus dominant time-out time (1) | Standby mode | 0.3 | 2 | 5 | ms |
| $t_{BUS\_WAKE\_FILTER}$ | Bus wake-up filter time | Standby mode | 0.5 | 1.5 | 5 | μs |
| $t_{dMODE}$ | Standby to normal mode delay time (1) | | 3 | 8 | 15 | μs |

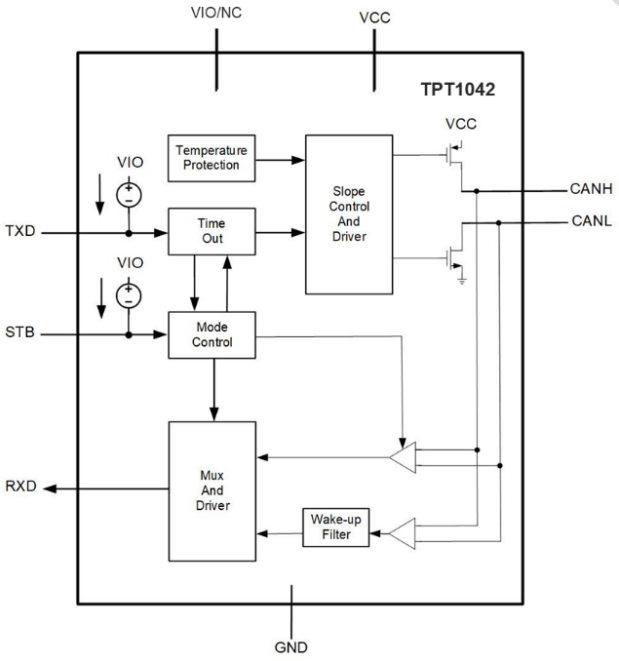
(1) Test data based on bench test and design simulation

# Detailed Description

## Overview

The TPT1044 is a CAN transceiver that meets the ISO11898 High-speed CAN (Controller Area Network) physical layer standard. The device is designed in CAN FD networks up to 5 Mbps, and enhances timing margin and higher data rates in long and highly-loaded networks. As the design, the device features cross-wire, overvoltage and loss of ground protection from −42 V to +42 V, overtemperature shutdown, a −30 V to +30 V common-mode range. The TPT1044 has a secondary power supply input for I/O level shifting the input pin thresholds and RXD output level, and the device comes with standby mode which is also waked up from CAN BUS, and it includes many protection features to enhance the device and network robustness.

## Functional Block Diagram




## Feature Description

**Table 1 Driver Function Table**

| Device | Inputs | | Outputs | | Driven BUS State |
|---|---|---|---|---|---|
| | STB | TXD | CANH | CANL | |
| All Devices | L or open | L | H | L | Dominant |
| | | H or Open | Z | Z | Recessive |
| | H | X | Z | Z | Recessive |

**Table 2 Receiver Function Table**

| Device Mode | CAN Differential Inputs $V_{ID} = V_{CANH} - V_{CANL}$ | Bus State | RXD Terminal |
|---|---|---|---|
| Normal or Standby | $V_{ID} \geq V_{IT+(MAX)}$ | Dominant | L |
| | $V_{IT-(MIN)} < V_{ID} < V_{IT+(MAX)}$ | Indeterminate | Indeterminate |
| | $V_{ID} \leq V_{IT-(MIN)}$ | Recessive | H |
| | Open ($V_{ID} \approx 0$ V) | Open | H |

### Normal Mode

A LOW level on pin STB selects Normal mode. In this mode, the transceiver will transmit and receive data via the bus lines CANH and CANL. The differential receiver converts the analog data on the bus lines into digital data which is output to pin RXD. The slopes of the output signals on the bus lines are controlled internally and optimized to guarantee the lowest possible Electro Magnetic Emission (EME).

### Standby Mode

Activate low power Standby mode by setting STB terminal high. In this mode the bus transmitter will not send data, nor will the normal mode receiver accept data as the bus lines are biased to ground minimizing the system supply current. Only the low-power receiver will be actively monitoring the bus for activity. RXD indicates a valid wake-up event after a wake-up pattern (WUP) has been detected on the Bus. The low-power receiver is powered using only the VIO pin. This allows $V_{CC}$ to be removed reducing power consumption further.

The bus lines are biased to ground in Standby mode to minimize the required system supply current. The low-power receiver is supplied by $V_{IO}$ and is capable of detecting CAN bus activity even if $V_{IO}$ is the only supply voltage available to the transceiver.

### Time-out Function in TXD Dominant Mode

When the TXD pin is set to LOW, the timer of 'TXD dominant time-out' is started. If the LOW state on TXD persists for longer than $t_{TXD\_DTO}$, the transmitter is disabled and the bus lines are in recessive state. This function prevents a hardware and/or software application failure from driving the bus lines to a permanent dominant state which will block all network communications. The TXD dominant time-out timer is reset as TXD is pulled to HIGH. The TXD dominant time-out time also defines the data rate should be faster than 10 kbit/s.

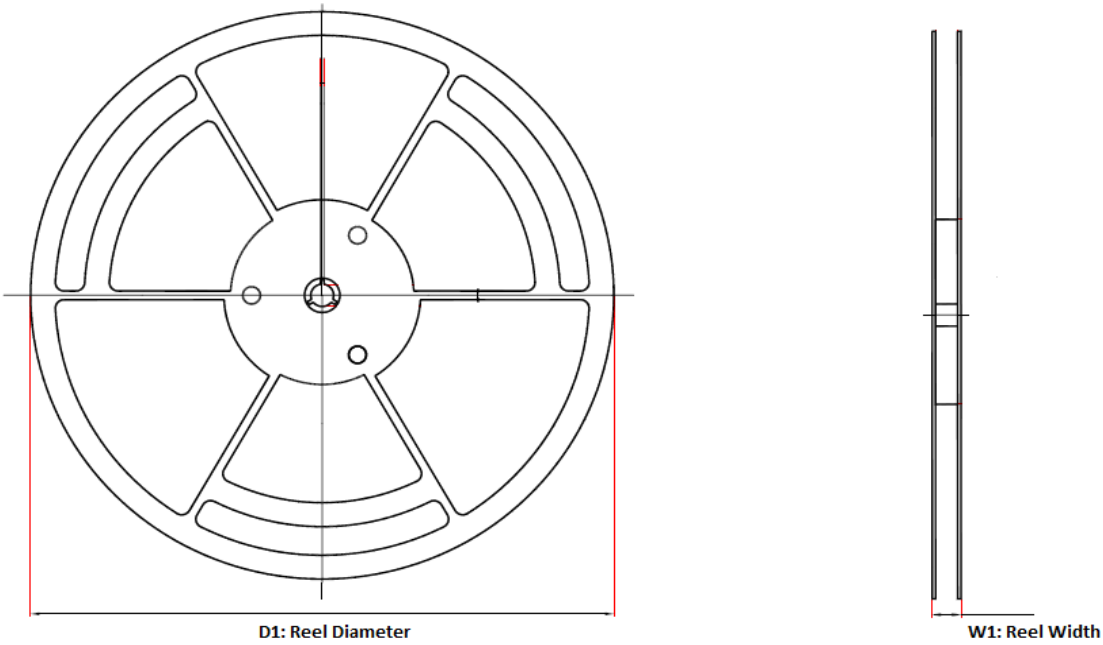
### Time-out Function in Bus Dominant Mode

In Standby mode, the timer of 'bus dominant time-out' is started when the CAN bus changes from recessive to dominant state. If the dominant state on the bus persists for longer than the $t_{BUS\_DTO}$ bus, the RXD pin is reset to HIGH. If a bus short-circuits or a failure in one of the other nodes on the network, this function prevents a clamped dominant bus from generating a permanent wake-up request. The bus dominant time-out timer is reset when the CAN bus changes from a dominant to recessive state.

### Overtemperature Protection

The output drivers are protected against overtemperature conditions. If the virtual junction temperature exceeds the shutdown junction temperature, $T_{OTP}$, the output drivers will be disabled until the virtual junction temperature falls below $T_{OTP}$ and TXD becomes recessive again. Including the TXD condition ensures that output driver oscillation due to temperature drift is avoided.

## Tape and Reel Information

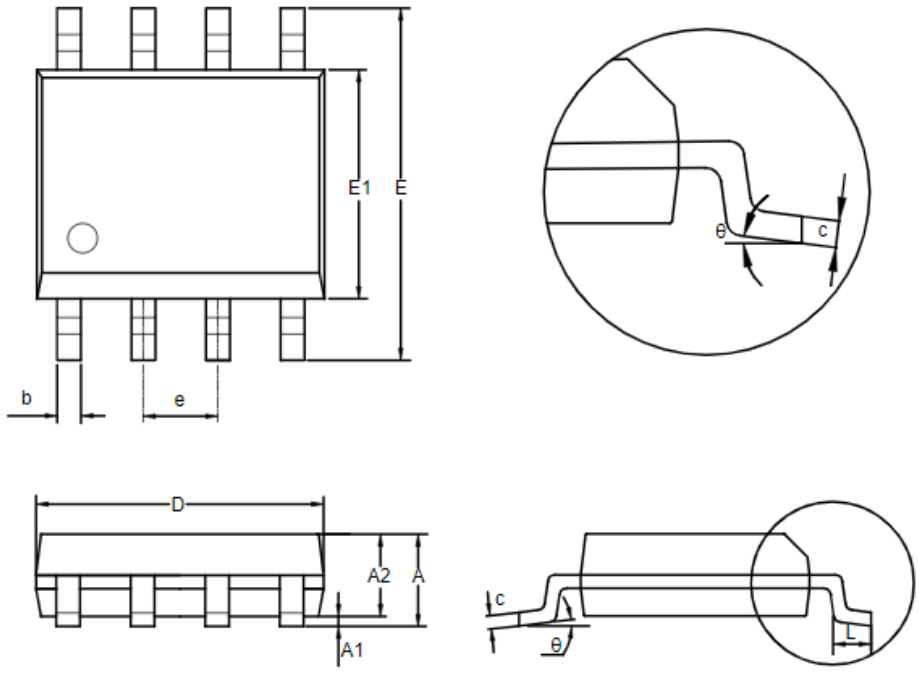



| Order Number | Package | D1 (mm) | A0 (mm) | K0 (mm) | W0 (mm) | W1 (mm) | B0 (mm) | P0 (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|
| TPT1044V-SO1R-S | SOP8 | 330.0 | 6.4 | 2.1 | 12.0 | 17.6 | 5.4 | 8.0 | Q1 |
| TPT1044V-DF6R-S | DFN3x3-8 | 330.0 | 3.3 | 1.1 | 12.0 | 17.6 | 3.3 | 8.0 | Q1 |
| TPT1044-SO1R-S | SOP8 | 330.0 | 6.4 | 2.1 | 12.0 | 17.6 | 5.4 | 8.0 | Q1 |
| TPT1044-DF6R-S | DFN3x3-8 | 330.0 | 3.3 | 1.1 | 12.0 | 17.6 | 3.3 | 8.0 | Q1 |

## Package Outline Dimensions

### SO1R(SOP-8)

Package Outline Dimensions SO1(SOP-8-A)



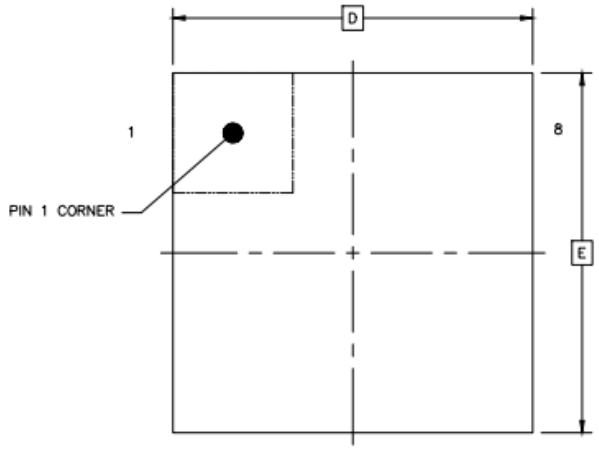

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.050 | 0.250 | 0.002 | 0.010 |
| A2 | 1.250 | 1.550 | 0.049 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.007 | 0.010 |
| D | 4.700 | 5.100 | 0.185 | 0.201 |
| E | 5.800 | 6.200 | 0.228 | 0.244 |
| E1 | 3.800 | 4.000 | 0.150 | 0.157 |
| e | 1.270 BSC | | 0.050 BSC | |
| L | 0.400 | 1.000 | 0.016 | 0.039 |
| θ | 0 | 8° | 0 | 8° |

NOTES

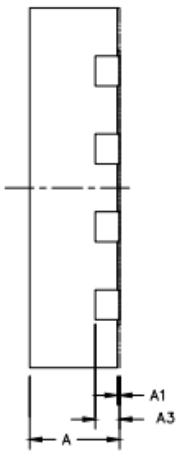
1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

## DF6R (DFN3X3-8L)

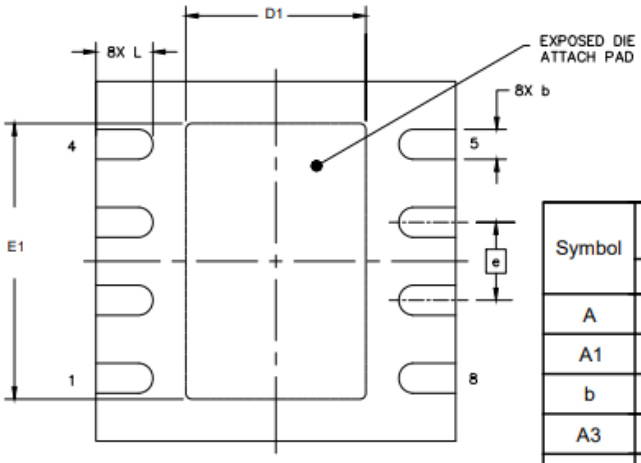
### Package Outline Dimensions DF6(DFN3X3-8-A)




TOP VIEW




SIDE VIEW




BOTTOM VIEW

NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.700 | 0.800 | 0.028 | 0.031 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| b | 0.200 | 0.330 | 0.008 | 0.013 |
| A3 | 0.150 | 0.250 | 0.006 | 0.010 |
| D | 2.900 | 3.100 | 0.114 | 0.122 |
| D1 | 1.400 | 1.600 | 0.055 | 0.063 |
| E | 2.900 | 3.100 | 0.114 | 0.122 |
| E1 | 2.200 | 2.400 | 0.087 | 0.094 |
| e | 0.650 BSC | | 0.026 BSC | |
| L | 0.250 | 0.575 | 0.010 | 0.023 |

## Order Information

| Order Number | Operating Temperature Range | Package | Marking Information | MSL | Transport Media, Quantity | Eco Plan |
|---|---|---|---|---|---|---|
| TPT1044V-SO1R-S | −40 to 125°C | SOP8 | 1044V | MSL3 | Tape and Reel, 4000 | Green |
| TPT1044V-DF6R-S | −40 to 125°C | DFN3x3-8 | 1044V | MSL3 | Tape and Reel, 4000 | Green |
| TPT1044-SO1R-S (1) | −40 to 125°C | SOP-8 | T1044 | MSL3 | Tape and Reel, 4000 | Green |
| TPT1044-DF6R-S (1) | −40 to 125°C | DFN3x3-8 | T1044 | MSL3 | Tape and Reel, 4000 | Green |

(1) Future product, contact 3PEAK factory for more information and sample

(2) Green: 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

(3) MSL will be updated depending on the qualification report.