# ±15 kV IEC ESD High-speed CAN FD transceiver

## Features

- Meet ISO11898 Standard
- Support CAN FD and data rates up to 5 Mbps
- Typical Loop Delay: 110 ns
- 5 V power supply, 3.0 V ~ 5.5 V IO interface
- Receiver Common Mode Input Voltage: ±30 V
- Bus Fault Protection: ±42 V
- Up to 110 Nodes in CAN network
- Junction Temperatures from −40°C to 150°C
- Latch-Up performance exceeds 500 mA
- BUS pin ESD Protection：
  - ±15 kV IEC-Contact ESD
  - ±15 kV Human-Body Model
  - ±1.5 kV Charged-Device Model

## Applications

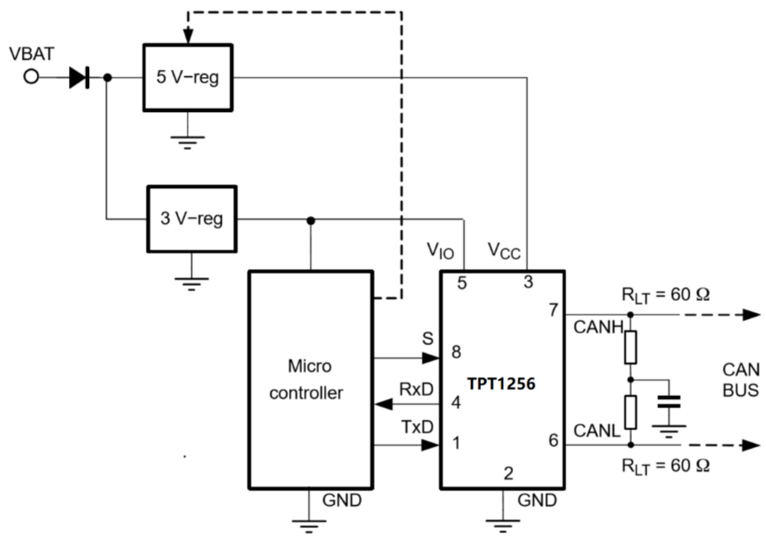
- All devices support highly loaded CAN networks
- Field Industrial Automation, Sensors and Drive Systems
- Building, Security Control Systems
- Energy Storage systems
- Telecom Base Station Status and Control

## Description

The TPT125x device is a CAN transceiver which meets the ISO11898 High-speed CAN (Controller Area Network) physical layer standard. The device is designed to use in CAN FD networks up to 5 Mbps, and to enhance timing margin and higher data rates in long and high-loading networks. As 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. TPT1256 has a secondary power supply input for I/O level shifting the input pin thresholds and RXD output level, and the device comes with silent mode which is also commonly referred as listen-only mode, and it includes many protection features to enhance device and network robustness.

TPT125x is available in SOP-8 and DFN3X3-8L package, and characterized from –40°C to +125°C.

## Typical Application Circuit



## Product Family Table

| Order Number | VCC (V) | VIO (V) | BUS Protection (V) | Package |
|---|---|---|---|---|
| TPT1255-SO1R | 5.0 | NC | ±42 | SOP-8 |
| TPT1256-SO1R | 5.0 | 3.3, or 5 | ±42 | SOP-8 |
| TPT1255-DF6R | 5.0 | NC | ±42 | DFN3X3-8L |
| TPT1256-DF6R | 5.0 | 3.3, or 5 | ±42 | DFN3X3-8L |

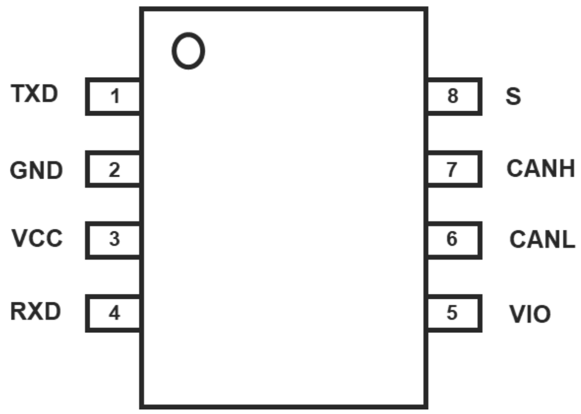
# Table of Contents

## Revision History

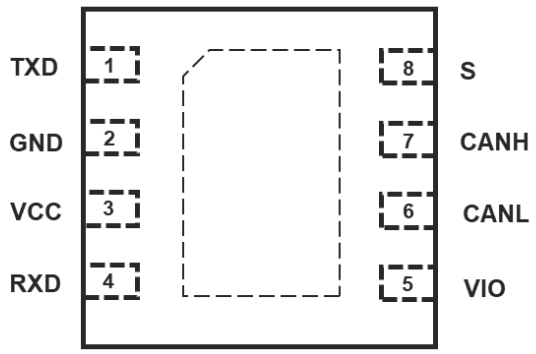
| Date | Revision | Notes |
|---|---|---|
| 2021-06-18 | Rev.Pre.0 | Initial Version |
| 2021-10-15 | Rev.Pre.1 | Update electrical parameter |
| 2021-11-12 | Rev.Pre.2 | Update VIH, VIL and VOH,VOL of TPT1255 |
| 2021-11-16 | Rev.Pre.3 | Update application circuit of TPT1255 and TPT1256 |
| 2021-12-23 | Rev.Pre.4 | Update ESD data |
| 2022-04-06 | Rev.Pre.5 | Update the Test conditions of $I_{CC}$, $V_{O(DOM)}$, $I_{OS(SS\_DOM)}$ |
| 2022-04-26 | Rev.A.0 | Release version |
| 2022-05-26 | Rev.A.1 | Update the notes of Order Information |
| 2022-06-17 | Rev.A.2 | Update the DFN package POD, tape and reel Information of the DFN |
| 2022-08-05 | Rev.A.3 | Update the description of TPT1256 pin VIO |
| 2022-12-26 | Rev.A.4 | Update the description of TPT1256 pin VIO |

## Pin Configuration and Functions – TPT1256

TPT1256L1-SO1R
SOP8



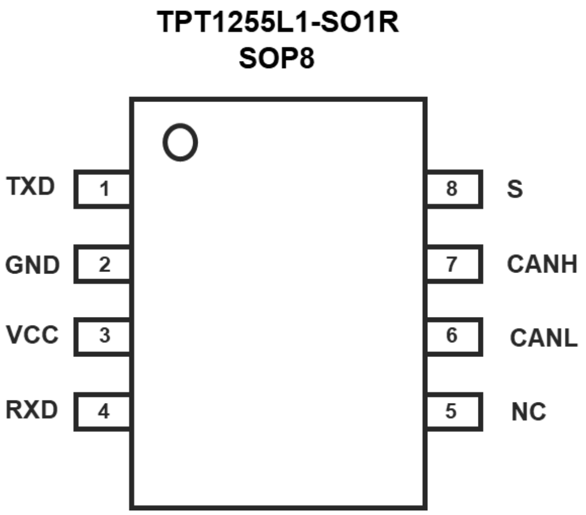

TPT1256L1-DF6R
DFN3X3-8L

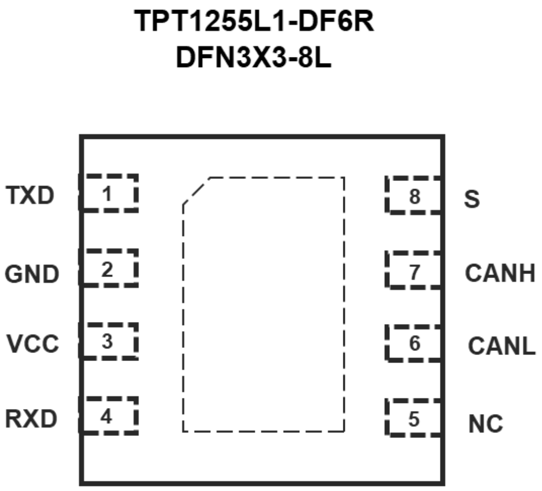



## TPT1256 Pin Functions

| Pin | | I/O | Description |
|---|---|---|---|
| No. | Name | | |
| 1 | TXD | I | CAN transmit data input |
| 2 | GND | GND | Ground |
| 3 | VCC | POWER | Transceiver 5V supply voltage |
| 4 | RXD | O | CAN receive data output |
| 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 | S | I | Silent Mode control input (active high) |

## Pin Configuration and Functions – TPT1255




### TPT1255 Pin Functions

| Pin | | I/O | Description |
|---|---|---|---|
| No. | Name | | |
| 1 | TXD | I | CAN transmit data input |
| 2 | GND | GND | Ground |
| 3 | VCC | POWER | Transceiver 5V supply voltage |
| 4 | RXD | O | CAN receive data output |
| 5 | NC | - | Not Connection |
| 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 | S | I | Silent 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(Logic_Input) | Logic input terminal voltage range (TXD, S) | −0.3 | 7 | V |
| V(Logic_Output) | Logic output terminal voltage range (RXD) | −0.3 | 7 | V |
| IO(RXD) | RXD (Receiver) output current | −8 | 8 | mA |
| $T_J$ | Maximum junction temperature | −40 | 150 | °C |
| $T_{stg}$ | Storage temperature range | −65 | 150 | °C |

**Note:** 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.

(1) This data was taken with the JEDEC low effective thermal conductivity test board.

(2) 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 | ±15 | kV |
| | IEC Air-Gap Discharge | IEC-61000-4-2, Bus Pin | ±15 | kV |
| HBM | Human Body Model ESD | ANSI/ESDA/JEDEC JS-001, Bus Pin | ±15 | kV |
| | | ANSI/ESDA/JEDEC JS-001, All Pin Except Bus Pin | ±6 | kV |
| CDM | Charged Device Model ESD | ANSI/ESDA/JEDEC JS-002, All Pin | ±1.5 | kV |
| LU | Latch Up | LU, per JESD78, All Pin | ±500 | mA |

(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.

## Recommended Operating Conditions

| Symbol | Description | Min | Max | Unit |
|---|---|---|---|---|
| $V_{IO}$ | Input/output voltage TXD, RXD,S of TPT1256 | 3.0 | 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 |
|---|---|---|---|
| 8-Pin SOIC | 148 | 48 | °C/W |
| 8-Pin DFN3x3 | 52 | 23 | °C/W |

## Power Consumption

| Parameter | | Test Condition | Value | Unit |
|---|---|---|---|---|
| $P_D$ | Average power dissipation (Dominant mode) | VCC = 5V, VIO = 3.3V, Ta = 25°C, RL = 60 Ω, S at 0 V, Input to TXD at 250 kHz, CL_RXD = 15 pF. Typical CAN operating conditions at 500 kbps with 25% transmission rate | 63 | mW |
| | | VCC = 5.5V, VIO = 3.6V, Ta = 125°C, RL = 50 Ω, S at 0 V, Input to TXD at 0.5MHz, CL_RXD = 15 pF. Typical high load CAN operating conditions at 1 Mbps with 50% transmission rate and loaded network. | 154 | mW |

## Electrical Characteristics

$V_{CC}$ = 4.5 V to 5.5 V, $V_{IO}$ = 3.0 V to 5.5 V, $T_A$ = −40°C to 125°C, unless otherwise noted.

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{CC}$ | Normal mode (dominant) | TXD = 0 V, $R_L$ = 60 Ω, $C_L$ = open, $R_{CM}$ = open, S = 0 V | | 50 | 70 | mA |
| | | TXD = 0 V, $R_L$ = 50 Ω, $C_L$ = open, $R_{CM}$ = open, S = 0 V | | 52 | 80 | mA |
| | Normal mode (dominant – bus fault) | TXD = 0 V, S = 0 V, CANH = CANL = -3 /+18V, $R_L$ = open, $C_L$ = open, $R_{CM}$ = open | | 73 | 150 | mA |
| | Normal mode (recessive) | TXD = $V_{IO}$, $R_L$ = 50 Ω, $C_L$ = open, $R_{CM}$ = open, S = 0 V | | 1.2 | 2.5 | mA |
| | Silent mode | TXD = $V_{IO}$, $R_L$ = 50 Ω, $C_L$ = open, $R_{CM}$ = open, S = VCC | | 1.2 | 2.5 | mA |
| $I_{IO}$ | Normal and Silent modes | RXD Floating, TXD = S = 0 or $V_{IO}$ | | 73 | 200 | μA |
| $UV_{VCC}$ | Rising undervoltage detection on $V_{CC}$ for protected mode | | | 4.0 | 4.4 | V |
| | Falling undervoltage detection on $V_{CC}$ for protected mode | | 3.6 | 3.9 | 4.2 | |
| $V_{HYS(UVVCC)}$ | Hysteresis voltage on $U_{VVCC}$ (1) | | | 200 | | mV |
| $UV_{VIO}$ | Undervoltage detection on $V_{IO}$ for protected mode | $V_{IH}$ and $V_{IL}$ | 1.3 | | 2.75 | V |
| $V_{HYS(UVVIO)}$ | Hysteresis voltage on $U_{VVIO}$ for protected mode (1) | | | 150 | | mV |
| **Pin-S (mode select input)** | | | | | | |
| $V_{IH}$ | High-level input voltage | TPT1256 | 0.7 x $V_{IO}$ | | | V |
| | | TPT1255 | 2 | | | |
| $V_{IL}$ | Low-level input voltage | TPT1256 | | | 0.3 x $V_{IO}$ | |
| | | TPT1255 | | | 0.8 | |
| $I_{IH}$ | High-level input leakage current | S = $V_{CC}$ or $V_{IO}$ = 5.5 V | | | 30 | μA |
| $I_{IL}$ | Low-level input leakage current | S = 0 V, $V_{CC}$ = $V_{IO}$ = 5.5 V | −1 | 0 | 1 | |
| $I_{lkg(OFF)}$ | Unpowered leakage current | S = 5.5 V, $V_{CC}$ = $V_{IO}$ = 0 V | −1 | 0 | 1 | |
| **Pin-TXD (CAN transmit data input)** | | | | | | |
| $V_{IH}$ | High-level input voltage | TPT1256 | 0.7 x $V_{IO}$ | | | V |
| | | TPT1255 | 2 | | | |
| $V_{IL}$ | Low-level input voltage | TPT1256 | | | 0.3 x $V_{IO}$ | |
| | | TPT1255 | | | 0.8 | |
| $I_{IH}$ | High-level input leakage current | S = $V_{CC}$ or $V_{IO}$ = 5.5 V | −2.5 | 0 | 1 | μA |
| $I_{IL}$ | Low-level input leakage current | S = 0 V, $V_{CC}$ = $V_{IO}$ = 5.5 V | −100 | −63 | −7 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| $I_{lkg(OFF)}$ | Unpowered leakage current | TXD = 5.5 V, $V_{CC}$ = $V_{IO}$ = 0 V | −1 | 0 | 1 | |
| $C_I$ | Input capacitance (1) | | | 5 | | pF |

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

## Electrical Characteristics (Continued)

$V_{CC}$ = 4.5 V to 5.5 V, $V_{IO}$ = 3.0 V to 5.5 V, $T_A$ = –40°C to 125°C, unless otherwise noted.

| Symbol | Parameter | | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Pin- RXD (CAN Receive data output)** | | | | | | | |
| $V_{OH}$ | High-level output voltage | | TPT1256, $I_O$ = −2 mA | 0.8 × $V_{IO}$ | | | V |
| | | | TPT1255, $I_O$ = −2 mA | 4 | 4.6 | | |
| $V_{OL}$ | Low-level output voltage | | TPT1256, $I_O$ = +2 mA | | | 0.2 x $V_{IO}$ | |
| | | | TPT1255, $I_O$ = +2 mA | | 0.2 | 0.4 | |
| $I_{lkg (OFF)}$ | Unpowered leakage current | | RXD = 5.5 V, $V_{CC}$ = 0 V, $V_{IO}$ = 0 V | −1 | 0 | 1 | μA |
| **Driver electrical characteristics** | | | | | | | |
| $V_{O(DOM)}$ | Bus output voltage (dominant) | CANH | TXD = 0 V, S = 0 V, 45 Ω ≤ $R_L$ ≤ 65 Ω, $C_L$ = open, $R_{CM}$ = open | 2.75 | | 4.5 | V |
| | | CANL | | 0.5 | | 2.25 | V |
| $V_{O(REC)}$ | Bus output voltage (recessive) | CANH CANL | TXD = $V_{CC}$, $V_{IO}$ = $V_{CC}$, S = $V_{CC}$ or 0 V(2), $R_L$ = open (no load), $R_{CM}$ = open | 2 | 0.5 x $V_{CC}$ | 3 | V |
| $V_{OD(DOM)}$ | Differential output voltage (dominant) | CANH CANL | TXD = 0 V, S = 0 V, 45 Ω ≤ $R_L$ < 50 Ω, $C_L$ = open, $R_{CM}$ = open | 1.4 | | 3 | V |
| | | | TXD = 0 V, S = 0 V, 50 Ω ≤ $R_L$ ≤ 65 Ω, $C_L$ = open, $R_{CM}$ = open | 1.5 | | 3 | V |
| | | | TXD = 0 V, S =0 V, $R_L$ = 2240 Ω, $C_L$ = open, RCM = open, $V_{CC}$ = 4.5 V~5.25 V | 1.5 | | 5 | V |
| $V_{OD(REC)}$ | $V_{OD(REC)}$ | $V_{OD(REC)}$ | TXD = $V_{CC}$, S = 0 V, $R_L$ = 60 Ω, $C_L$ = open, $R_{CM}$ = open | −120 | | 12 | mV |
| | | | TXD = $V_{CC}$, S = 0 V, $R_L$ = open (no load), $C_L$ = open, $R_{CM}$ = open | −50 | | 50 | mV |
| $V_{SYM}$ | Transient symmetry (dominant or recessive), ($V_{O(CANH)}$ + $V_{O(CANL)}$) / $V_{CC}$ (1) | | S at 0 V, $R_{term}$= 60 Ω, $C_{split}$ = 4.7 nF, $C_L$ = open, $R_{CM}$ = open, $T_{XD}$ = 250 kHz, 1 MHz | | 1.0 | | V/V |
| $V_{SYM\_DC}$ | DC Output symmetry (dominant or recessive), ($V_{CC}$ – $V_{O(CANH)}$ – $V_{O(CANL)}$) (1) | | S = 0 V, $R_L$ = 60 Ω, $C_L$ = open, $R_{CM}$ = open | −0.4 | | 0.4 | V |
| $I_{OS(SS\_DOM)}$ | Short-circuit steady-state output current, dominant | | S at 0 V, $V_{CANH}$ = −5 V to 40 V, CANL = open, TXD = 0 V | −100 | | | mA |
| | | | S at 0 V, $V_{CANL}$ = −5 V to 40 V, CANH = open, TXD = 0 V | | | 100 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| $I_{OS(SS\_REC)}$ | Short-circuit steady-state output current, recessive | −27 V ≤ $V_{BUS}$ ≤ 32 V, Where $V_{BUS}$ = CANH = CANL, TXD = $V_{CC}$ | −5 | | 5 | mA |

(1). Test data based on bench test and design simulation, Vsym = 0.9 ~ 1.1 V/V at 250 kbps

## Electrical Characteristics (Continued)

$V_{CC}$ = 4.5 V to 5.5 V, $V_{IO}$ = 3.0 V to 5.5 V, $T_A$ = –40°C to 125°C, unless otherwise noted.

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Receiver electrical characteristics** | | | | | | |
| $V_{CM}$ | Common mode range, normal mode | S = 0 or $V_{CC}$ or $V_{IO}$ | −30 | | +30 | V |
| $V_{IT+}$ | Positive-going input threshold voltage, all modes | S = 0 or $V_{CC}$ or $V_{IO}$, −20 V ≤ $V_{CM}$ ≤ +20 V | | | 900 | mV |
| $V_{IT-}$ | Negative-going input threshold voltage, all modes | | 500 | | | |
| $V_{IT+}$ | Positive-going input threshold voltage, all modes | S = 0 or $V_{CC}$ or $V_{IO}$, −30 V ≤ $V_{CM}$ ≤ +30 V | | | 1000 | mV |
| $V_{IT-}$ | Negative-going input threshold voltage, all modes | | 400 | | | |
| $V_{HYS}$ | Hysteresis voltage ($V_{IT+}$ − $V_{IT-}$) (1) | S = 0 or $V_{CC}$ or $V_{IO}$ | | 120 | | mV |
| $I_{lkg(IOFF)}$ | Power-off (unpowered) bus input leakage current | CANH = CANL = 5 V, $V_{CC}$ = $V_{IO}$ = 0 V | | | 3 | μA |
| $C_I$ | Input capacitance to ground (CANH or CANL) (1) | | | 25 | | pF |
| $C_{ID}$ | Differential input capacitance (1) | | | 2 | | pF |
| $R_{ID}$ | Differential input resistance | TXD = $V_{CC}$ = $V_{IO}$ = 5 V, S = 0 V, −30 V ≤ $V_{CM}$ ≤ +30 V | 30 | | 80 | kΩ |
| $R_{IN}$ | Input resistance (CANH or CANL) | | 15 | | 40 | kΩ |
| $R_{IN(M)}$ | Input resistance matching: [1 − $R_{IN(CANH)}$ / $R_{IN(CANL)}$] × 100% | $V_{CANH}$ = $V_{CANL}$ = 5 V | −1% | | +1% | |

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

## AC Timing Requirements

$V_{CC}$ = 4.5 V to 5.5 V, $V_{IO}$ = 3.0 V to 5.5 V, $T_A$ = −40°C to 125°C, unless otherwise noted.

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **DEVICE SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{PROP(LOOP1)}$ | Total loop delay, driver input (TXD) to receiver output (RXD), recessive to dominant | S = 0 V, $R_L$ = 60 Ω, $C_L$ = 100 pF, $C_{L(RXD)}$ = 15 pF | | 100 | 160 | ns |
| $t_{PROP(LOOP2)}$ | Total loop delay, driver input (TXD) to receiver output (RXD), dominant to recessive | | | 110 | 175 | |
| $t_{MODE}$ | Mode change time, from Normal to Silent or from Silent to Normal | | | 0.15 | 10 | μs |
| **DRIVER SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{pHR}$ | Propagation delay time, high TXD to driver recessive (dominant to recessive) (1) | S = 0 V, $R_L$ = 60 Ω, $C_L$ = 100 pF, $R_{CM}$ = open | | 70 | | ns |
| $t_{pLD}$ | Propagation delay time, low TXD to driver dominant (recessive to dominant) (1) | | | 40 | | |
| $t_{sk(p)}$ | Pulse skew ($\|t_{pHR} - t_{pLD}\|$) (1) | | | 20 | | |
| $t_R$ | Differential output signal rise time (1) | | | 27 | | |
| $t_F$ | Differential output signal fall time (1) | | | 35 | | |
| $t_{TXD\_DTO}$ | Dominant timeout | S = 0 V, $R_L$ = 60 Ω, $C_L$ = open | 1.2 | | 3.8 | ms |
| **RECEIVER SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{pRH}$ | Propagation delay time, bus recessive input to high output (Dominant to Recessive) (1) | S = 0 V, $C_{L(RXD)}$ = 15 pF | | 76 | | ns |
| $t_{pDL}$ | Propagation delay time, bus dominant input to low output (Recessive to Dominant) (1) | | | 59 | | |
| $t_R$ | RXD Output signal rise time (1) | | | 12 | | |
| $t_F$ | RXD Output signal fall time (1) | | | 7 | | |
| **FD Timing Parameters** | | | | | | |
| $t_{BIT(BUS)}$ | Bit time on CAN bus output pins with $t_{BIT(TXD)}$ = 500 ns, all devices | S = 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, G device variants only | | 155 | | 210 | |
| $t_{BIT(RXD)}$ | Bit time on RXD output pins with $t_{BIT(TXD)}$ = 500 ns, all devices | | 400 | | 550 | |
| | Bit time on RXD output pins with $t_{BIT(TXD)}$ = 200 ns, G device variants only | | 120 | | 220 | |
| $\Delta t_{REC}$ | Receiver timing symmetry with $t_{BIT(TXD)}$ = 500 ns, all devices | | −65 | | 40 | |
| | Receiver timing symmetry with $t_{BIT(TXD)}$ = 200 ns, G device variants only | | −45 | | 15 | |

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

# Detailed Description

## Overview

The TPT125x device is a CAN transceiver which meets the ISO11898 High-speed CAN (Controller Area Network) physical layer standard. The device is designed to use in CAN FD networks up to 5 Mbps, and enhanced timing margin and higher data rates in long and high-loading networks. As design, the device features cross-wire, overvoltage and loss of ground protection from −42 V to +42 V, overtemperature shutdown, a −30V to +30V common-mode range. TPT1256 have a secondary power supply input for I/O level shifting the input pin thresholds and RXD output level, and the pin5 of TPT1255 is NC. The devices come with silent mode which is also commonly referred to as listen-only mode, and it includes many protection features to enhance device and network robustness.

## Functional Block Diagram

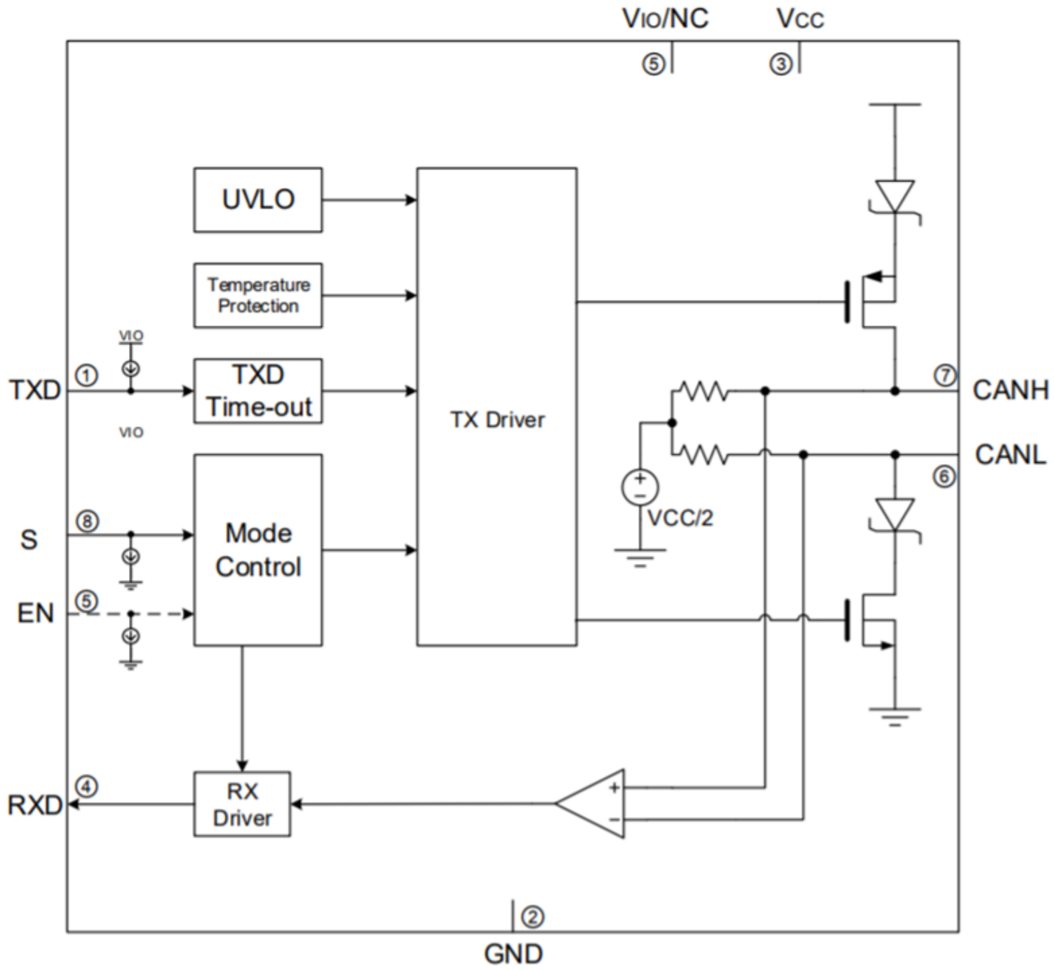



**Figure 1 Functional Block Diagram**

## Feature Description

### Under-voltage Lockout (UVLO)

The TPT1256 uses an under-voltage lockout circuit to keep the device in shutdown mode until the supply voltage is higher than UVLO threshold.

### Over Temperature Protection (OTP)

The TPT125x integrates Foldback circuit and over-temperature protection to prevent device from over-heated and damage. When the junction temperature is higher than $T_{OTP}$, 150°C, a current thermal Foldback circuit starts to work and decrease the device output charge current gradually with $T_J$ rise. If $T_J$ still rises and reaches 180°C, the device will shut down charging loop until $T_J$ drops below 100°C.

### Driver Function Table

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

### Receiver Function Table

| Device Mode | CAN Differential Inputs $V_{ID} = V_{CANH} - V_{CANL}$ | BUS State | RXD Terminal |
|---|---|---|---|
| Normal or Silent | $V_{ID} \geq V_{IT+(MAX)}$ | 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 S 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 are optimized in a way that guarantees the lowest possible Electro Magnetic Emission (EME).

### Silent mode

A HIGH level on pin S selects Silent mode. In Silent mode the transmitter is disabled, releasing the bus pins to recessive state. All other IC functions, including the receiver, continue to operate as in Normal mode, just like listen-only mode. Silent mode can be used to prevent a faulty CAN controller from disrupting all network communications.

## Typical Characteristics

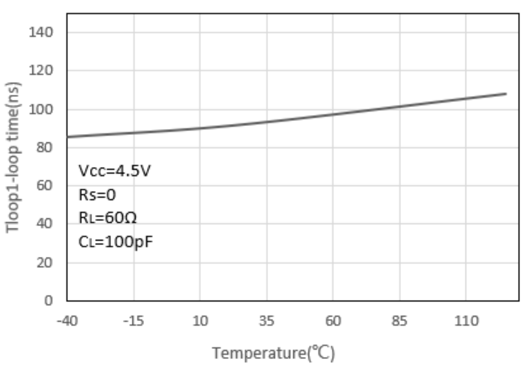



**Figure1.Recessive to Dominant Loop Delay Vs Temperature**

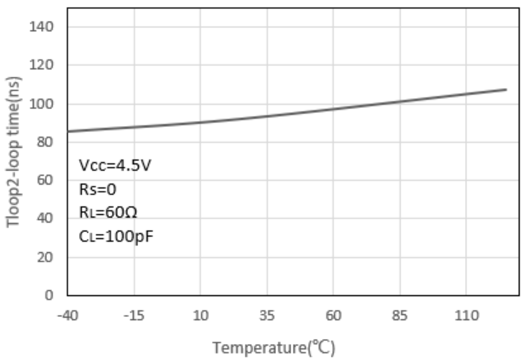



**Figure2. Dominant to Recessive Loop Delay Vs Temperature**

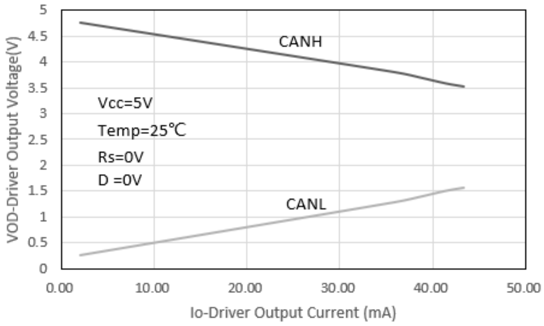



**Figure3.Driver Output Voltage Vs Output Current**

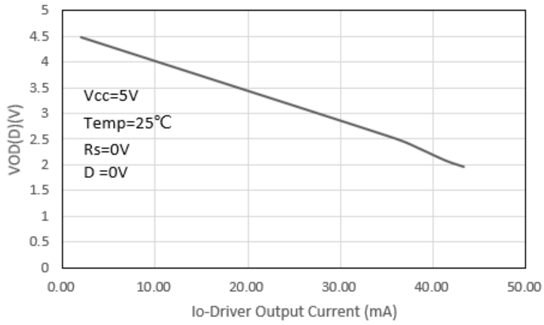



**Figure4. Driver Differential Output Voltage Vs Output Current**

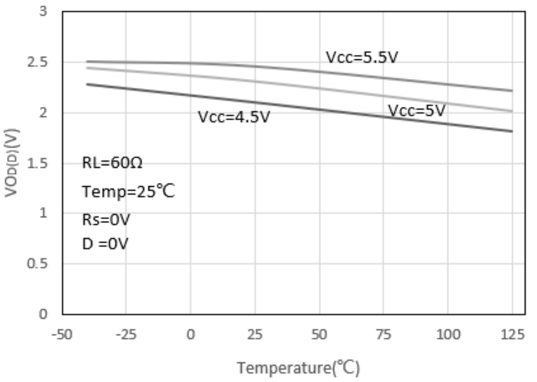



**Figure5. Driver Differential Output Voltage Vs Temperature**

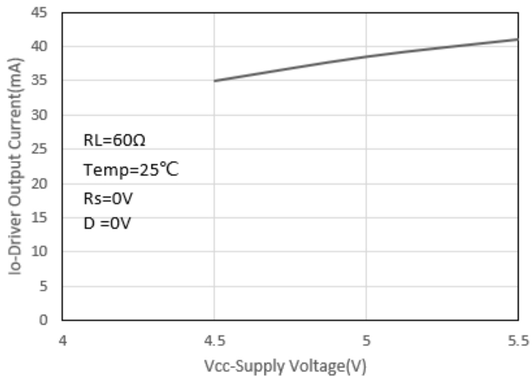



**Figure6. Driver Output Current Vs Supply Voltage**

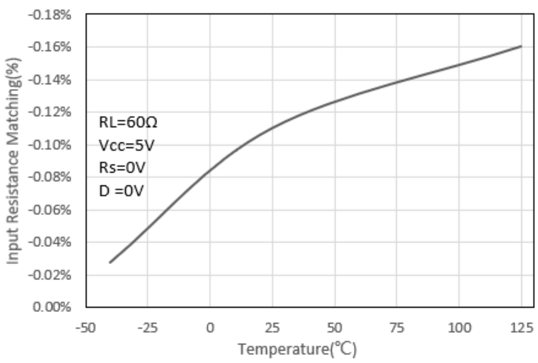



**Figure7. Input Resistance Matching Vs Temperature**

## Application and Implementation

| NOTE |
|---|
| Information in the following applications sections is not part of the 3PEAK's component specification and 3PEAK does not warrant its accuracy or completeness. 3PEAK's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality. |

### Application Information

The TPT1256 device is a CAN transceiver to support CAN FD function up to 5 Mbps, with BUS protection voltage from –42 V to +42 V, overtemperature shutdown, a −30 V to +30 V common-mode range. The VIO of TPT1256 can support the voltage level of TXD and RXD from 3.3 V to 5.0 V, and pin5 of TPT1255 is NC which means it can only support 5V I/O voltage.

The following sections show a typical application of the TPT1256 and TPT1255.

### Typical Application

Figure 2 shows the typical application schematic of the TPT1256.

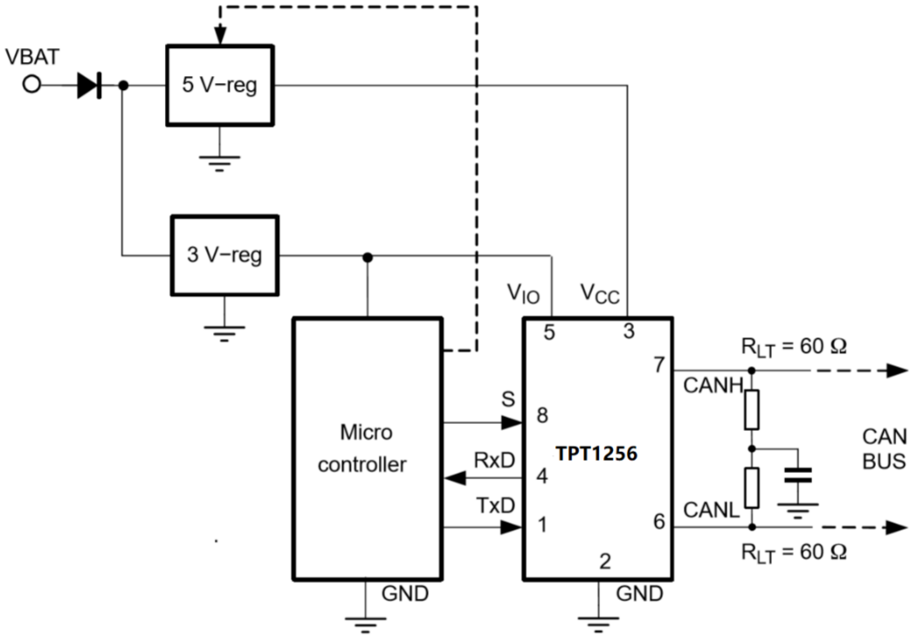



**Figure 2 TPT1256 Typical Application Circuit**

Figure 2 shows the typical application schematic of the TPT1255.

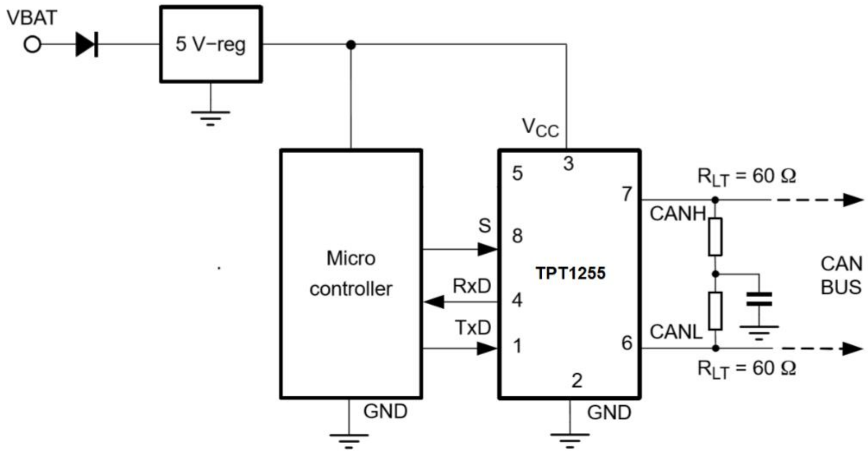



**Figure 3 TPT1255 Typical Application Circuit**

## Power Dissipation and Thermal Consideration

During normal operation, junction temperature limitation is 150°C. When junction temperature exceeds 150°C, the charge current decreases with the temperature value. Using Equation 2 and Equation 3 to calculate the power dissipation and estimate the junction temperature.

The maximum power dissipation can be calculated using Equation 2.

$$P_D = (V_{IN} - V_{BAT}) \times I_{BAT} = \frac{T_{J,max} - T_A}{\theta_{JA}} \quad (2)$$

Where,

$T_{J,max}$ is the junction temperature limitation, 150°C,

$T_A$ is the ambient temperature, $\theta_{JA}$ is the junction-to-ambient thermal resistance (See Thermal Information).

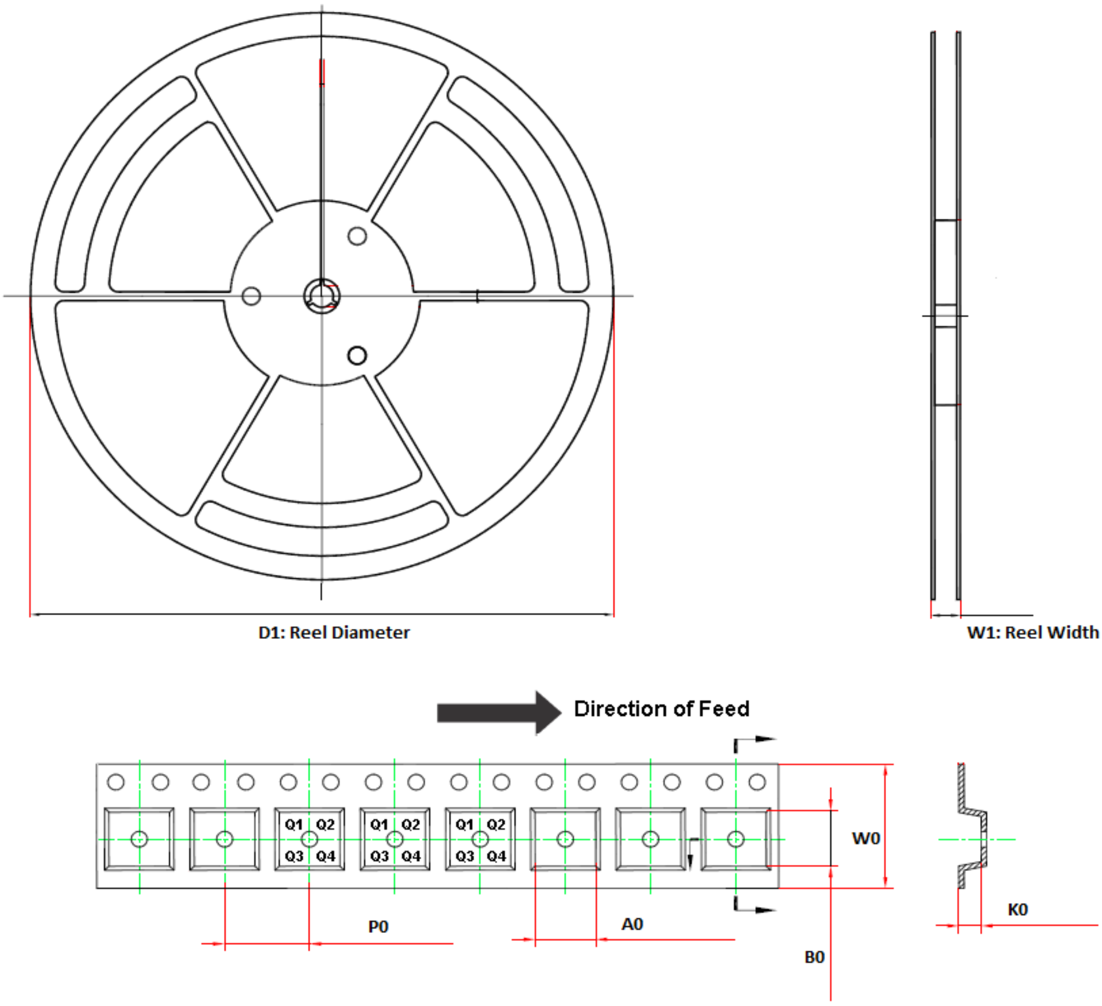
Solve Equation 2, the constant charge current value is calculated in Equation 3.

$$I_{BAT} = \frac{150°C - T_A}{(V_{IN} - V_{BAT}) \times \theta_{JA}} \quad (3)$$

## Power Consumption

| Parameter | | Test Condition | Value | Unit |
|---|---|---|---|---|
| $P_D$ | Average power dissipation (Dominant mode) | VCC = 5V, VIO = 3.3V, Ta = 25°C, RL = 60 Ω, S at 0 V, Input to TXD at 250 kHz, CL_RXD = 15 pF. Typical CAN operating conditions at 500 kbps with 25% transmission rate | 63 | mW |
| | | VCC = 5.5V, VIO = 3.6V, Ta = 125°C, RL = 50 Ω, S at 0 V, Input to TXD at 0.5MHz, CL_RXD = 15 pF. Typical high load CAN operating conditions at 1 Mbps with 50% transmission rate and loaded network. | 154 | mW |

## Tape and Reel Information

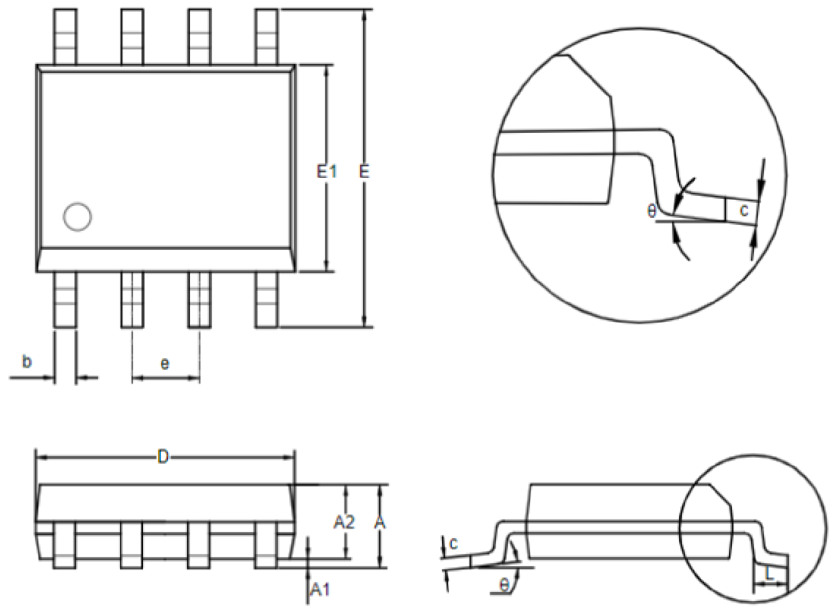



| Order Number | Package | D1 (mm) | W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | W0 (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|
| TPT1255-SO1R | 8-Pin SOP | 330.0 | 17.6 | 6.4 | 5.4 | 2.1 | 8.0 | 12.0 | Q1 |
| TPT1256-SO1R | 8-Pin SOP | 330.0 | 17.6 | 6.4 | 5.4 | 2.1 | 8.0 | 12.0 | Q1 |
| TPT1255-DF6R | DFN3X3-8L | 330.0 | 17.6 | 3.3 | 3.3 | 1.1 | 8.0 | 12.0 | Q1 |
| TPT1256-DF6R | DFN3X3-8L | 330.0 | 17.6 | 3.3 | 3.3 | 1.1 | 8.0 | 12.0 | 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° |

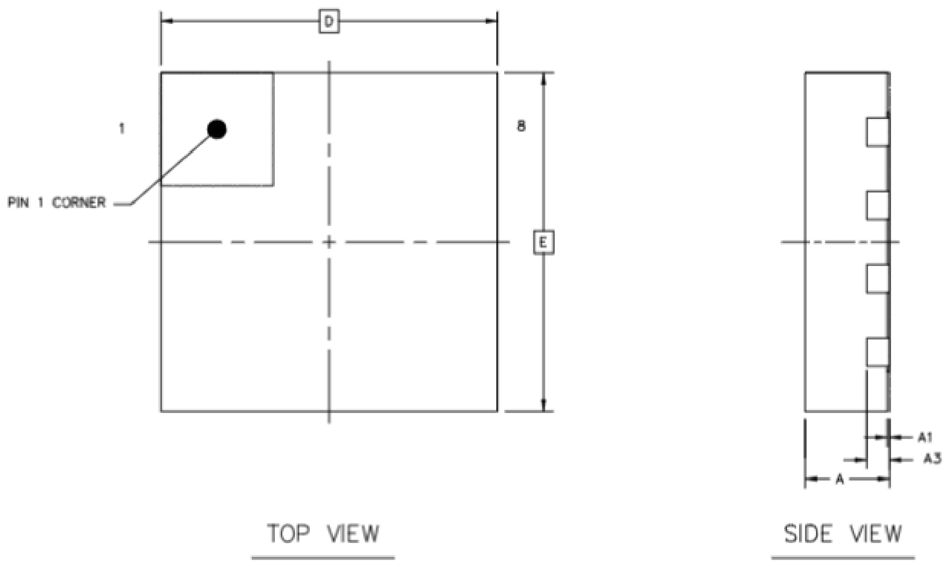
NOTES

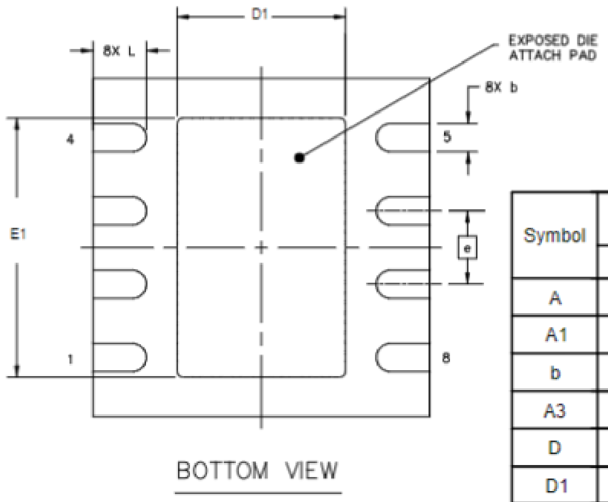
1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

## Package Outline Dimensions (Continued)

### DF6R (DFN3x3-8L)

Package Outline Dimensions DF6(DFN3X3-8-A)




| 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 |

NOTES

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

## Order Information

| Order Number | Operating Temperature Range | Package | Marking Information | MSL | Transport Media, Quantity | Eco Plan |
|---|---|---|---|---|---|---|
| TPT1255-SO1R | -40 to 125°C | 8-Pin SOP | T1255 | MSL3 | Tape and Reel, 4000 | Green |
| TPT1256-SO1R | -40 to 125°C | 8-Pin SOP | T1256 | MSL3 | Tape and Reel, 4000 | Green |
| TPT1255-DF6R | -40 to 125°C | 8-Pin DFN | 1255 | MSL3 | Tape and Reel, 4000 | Green |
| TPT1256-DF6R | -40 to 125°C | 8-Pin DFN | 1256 | MSL3 | Tape and Reel, 4000 | Green |

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