Isolated CAN Transceiver with Flexible Data Rate

Features

- Meet ISO11898 Standard
- Support CAN FD and Data Rates up to 5 Mbps
- Typical Loop Delay: 110 ns
- 5-V Power Supply, 2.25-V to 5.5-V IO Interface
- Receiver Common-Mode Input Voltage: ±30 V
- Bus Fault Protection: ±42 V
- Up to 5-kV RMS Isolation Rating (WSOP)
- ±200-kV/μs typ Static CMTI, ±150-kV/μs typ Dynamic CMTI
- Junction Temperatures from −40°C to 150°C
- SMP8 and Wide-SOP (WSOP8, WSOP16)
- BUS pin ESD Protection (between Bus pins and GNDB)
  - ±15-kV IEC 61000-4-2 Contact Discharge
- Safety-Related Certifications:
  - VDE Certification according to DIN VDE V 0884-17 (IEC60747-17)
  - 5000-V_{RMS} (WSOP16, WSOP8), 3750-V_{RMS} (SMP8) Isolation Rating per UL 1577
  - CQC Certification per GB 4943.1
  - CSA, TUV, and CB Certifications

Applications

- Industrial Automation
- Motor Control
- Solar Inverters
- Battery Charging and Management

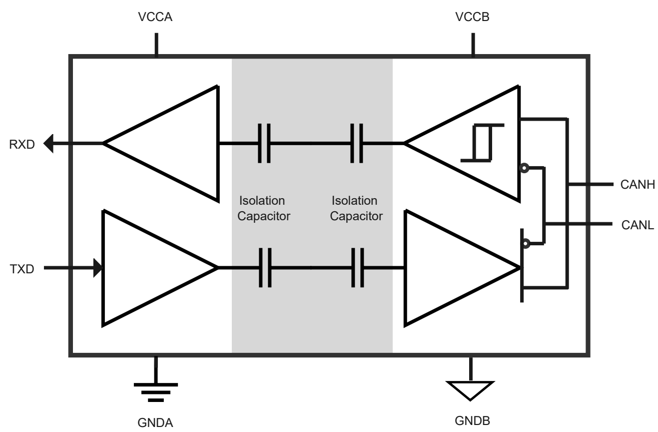
Description

The TPT710xx device is an isolated CAN transceiver that meets the ISO11898 High-speed CAN (Controller Area Network) physical layer standard. The device is designed to be applied in CAN FD networks up to 5 Mbps and to enhance timing margin and higher data rates in long and high-loading 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 range. The VCCA is the power supply input for RXD and TXD I/O pins which support a wide range from 2.25 V to 5.5 V. The 2nd power supply VCCB of CAN BUS side which supports the range from 4.5 V to 5.5 V.

The devices integrate high-performance digital isolators with 5000 VRMS (WSOP8, WSOP16 packages), 3750 VRMS (SMP8 package), and isolation ratings per UL 1577. These devices are also to be certified by VDE, UL, CSA, and CQC.

TPT710xx family is available in WSOP8, WSOP16, and SMP8 packages, and is characterized from −40°C to +125°C.

Functional Block Diagram



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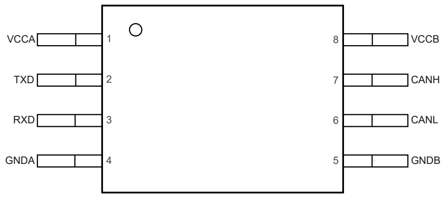
Revision History

Date	Revision	Notes
2022-02-07	Rev.Pre.0	Preliminary version.
2022-11-01	Rev.A.0	Released version.
2022-12-21	Rev.A.1	Updated Order Information.
2022-12-27	Rev.A.2	Updated EC table.

Pin Configuration and Functions

TPT71044
WSOP8
Top View



TPT71044
WSOP16
Top View

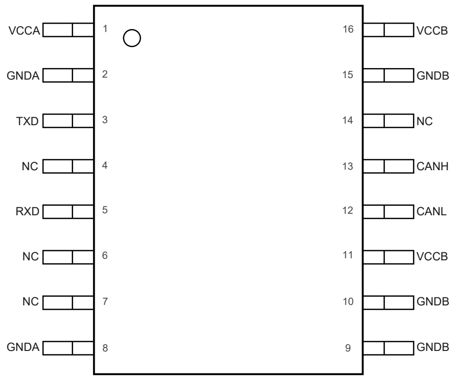
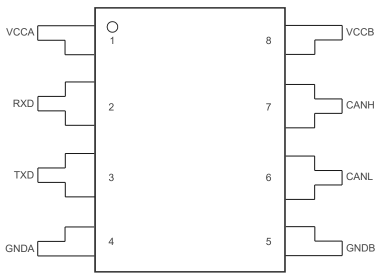


Table 1. Pin Functions: TPT71044

Pin No.		Pin Name	I/O	Description
WSOP8	WSOP16			
TPT7104x	TPT7104x			
1	1	VCCA	−	Power supply, VCCA
2	3	TXD	I	Input, CAN transmit data in
3	5	RXD	O	Output, CAN receive data out
4	2, 8	GNDA	−	Ground connection for VCCA
5	9, 10,15	GNDB	−	Ground connection for VCCB
6	12	CANL	IO	Low level CAN bus input/output line
7	13	CANH	IO	High level CAN bus input/output line
8	11,16	VCCB	−	Power supply, VCCB
−	4, 6, 7, 14	NC	−	No Connect

TPT71050
SMP8
Top View



TPT71050
WSOP16
Top View

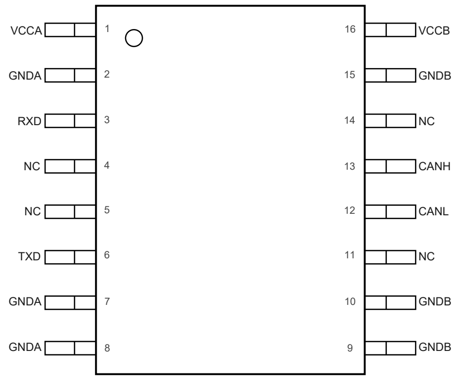


Table 2. Pin Functions: TPT71050

Pin No.		Pin Name	I/O	Description
WSOP8	WSOP16			
TPT71050	TPT71050			
1	1	VCCA	−	Power supply, VCCA
2	3	RXD	O	Output, CAN receive data out
3	5	TXD	I	Input, CAN transmit data in
4	2, 8	GNDA	−	Ground connection for VCCA
5	9, 10,15	GNDB	−	Ground connection for VCCB
6	12	CANL	IO	Low level CAN bus input/output line
7	13	CANH	IO	High level CAN bus input/output line
8	16	VCCB	−	Power supply, VCCB
−	4, 6, 7, 11, 14	NC	−	No Connect

Specifications

Absolute Maximum Ratings (1)

Parameter		Min	Max	Unit
V_{CC}	Supply Voltage, V_{CCA}, V_{CCB} (2)	−0.5	6	V
I_O	Output Current	−15	15	mA
T_J	Operating Virtual Junction Temperature	-	150	°C
T_{stg}	Storage Temperature	−65	150	°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

Parameter		Condition	Minimum Level	Unit
IEC	IEC-61000-4-2, Contact Discharge	Bus pin to GNDB	±15	kV
	IEC-61000-4-2, Air-Gap Discharge	Bus pin to GNDB	±15	kV
HBM	HBM, per ANSI/ESDA/JEDEC JS-001 (1)	Bus pin to GNDB	±15	kV
		All pins except bus Pin	±6	kV
CDM	CDM, per ANSI/ESDA/JEDEC JS-002 (2)	All pins	±1.5	kV
LU	Latch up, per JESD78	All pins	±600	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

Parameter		Min	Typ	Max	Unit
V_{CCB}	Supply Voltage, V_{CCB}	4.5		5.5	V
V_{CCA}	Supply Voltage, V_{CCA}	2.25		5.5	V
V_{IH}	High-level Input Voltage (data input)	2		V_{CC}	V
V_{IL}	Low-level Input Voltage (data input)	0		0.8	V
f_{data}	Data Rate (1)	0		5	Mbps
T_A	Operating Ambient Temperature	−40	25	125	°C

(1) 5 Mbps is the maximum specified data rate, although higher data rates are possible.

Thermal Information

Package Type	$θ_{JA}$	$θ_{JC}$	Unit
WSOP8	85	43	°C/W
WSOP16	75	41	°C/W
SMP8	74	65	°C/W

Insulation Specifications

Parameter		Conditions	Value			Unit
			SMP8	WSOP8	WSOP16	
CLR	External clearance	Shortest terminal-to-terminal distance through air	> 6.5	> 8.0	> 8.0	mm
CPG	External creepage	Shortest terminal-to-terminal distance across the package surface	> 6.5	> 8.0	> 8.0	mm
DTI	Distance through the insulation	Minimum internal gap (internal clearance)	> 22	> 22	> 22	μm
DTC	Distance through the Molding compound	Minimum internal distance across the conductors inside the package	0.45	0.8	0.8	mm
CTI	Comparative tracking index		> 600	> 600	> 600	V
	Material group		I	I	I	
	Over-voltage category	For Rated Mains Voltage ≤ 150 V_{RMS}	I-IV	I-IV	I-IV	
		For Rated Mains Voltage ≤ 300 V_{RMS}	I-III	I-IV	I-IV	
		For Rated Mains Voltage ≤ 600 V_{RMS}	I-II	I-IV	I-IV	
		For Rated Mains Voltage ≤ 1000 V_{RMS}	I	I-III	I-III	
	Climatic category		40/125/21	40/125/21	40/125/21	
	Pollution degree		2	2	2	
DIN V VDE V 0884-17 (1)(2)						
V_{IORM}	Maximum repetitive isolation voltage	AC voltage	637	1414	1414	V_{PK}
V_{IOWM}	Maximum working isolation voltage	AC voltage; TDDB Test	450	1000	1000	V_{RMS}
		DC voltage	637	1414	1414	V_{DC}
V_{IOTM}	Maximum transient isolation voltage	V_{TEST}= V_{IOTM}, t = 60 s (qualification); V_{TEST}= 1.2 x V_{IOTM}, t = 1 s (100% production)	5300	7070	7070	V_{PK}
V_{IOSM}	Maximum surge isolation voltage(3)	Test method per IEC 62368-1, 1.2/50 μs waveform, V_{TEST}= 1.3 × V_{IOSM}(qualification)	5980	6500	6500	V_{PK}

Parameter		Conditions	Value			Unit
			SMP8	WSOP8	WSOP16	
q_{pd}	Apparent charge	Method a, After Input/Output safety test subgroup 2/3, V_{ini}= V_{IOTM}, t_{ini}= 60 s; $V_{pd(m)}$ = 1.2 × V_{IORM}, t_m= 10 s	≤ 5	≤ 5	≤ 5	pC
		Method a, After environmental tests subgroup 1, V_{ini}= V_{IOTM}, t_{ini}= 60 s; $V_{pd(m)}$ = 1.6 × V_{IORM}, t_m= 10 s	≤ 5	≤ 5	≤ 5	
		Method b1; At routine test (100% production) and preconditioning (type test), V_{ini}= 1.2 x V_{IOTM}, t_{ini}= 1 s; $V_{pd(m)}$= 1.875 × V_{IORM}, t_m = 1 s	≤ 5	≤ 5	≤ 5	
C_{IO}	Isolation capacitance	V_{IO}= 0.4 × sin (2πft), f = 1 MHz	~0.5	~0.5	~0.5	pF
R_{IO}	Isolation resistance	V_{IO}= 500 V, T A= 25°C	> 10^{12}	> 10^{12}	> 10^{12}	Ω
		V_{IO}= 500 V, 100°C ≤ T A≤ 125°C	> 10^{11}	> 10^{11}	> 10^{11}	Ω
		V_{IO}= 500 V at T S= 150°C	> 10^9	> 10^9	> 10^9	Ω
UL 1577						
V_{ISO}	Withstanding isolation voltage	V_{TEST}= V_{ISO}, t = 60 s(qualification); V_{TEST}= 1.2 × V_{ISO}, t = 1 s (100% production)	3750	5000	5000	V_{RMS}

(1) All pins on each side of the barrier are tied together creating a two-terminal device.
(2) This coupler is suitable for safe electrical insulation only within the safety operating ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.
(3) Testing must be carried out in oil.

Safety-Related Certifications

VDE	UL	TUV	CQC	CSA	CB
Certified according to DIN EN IEC 60747-17 (VDE 0884-17)	Certified according to UL 1577 and CSA Component Acceptance Service No. 5A	Certified according to EN IEC 62368-1 and EN IEC 61010-1	Certified according to GB 4943.1	Certified CSA C22.2 No. 62368-1 and CAN/CSA-C22.2 No. 60601-1	Certified according to EN IEC 62368-1
Basic insulation (WSOP) VIORM = 1414 VIOSM = 6500 (SOP, QSOP) VIORM = 637 VIOSM = 5980	(WSOP) Single protection, 5000 Vrms (SOP, QSOP) Single protection, 3750 Vrms	6400 Vrms reinforced insulation (WSOP), 800 Vrms maximum work voltage. 4000 Vrms basic insulation (SOP, QSOP), 400 V rms maximum work voltage.	Reinforced insulation (WSOP), Altitude<=5000m, 800-V rms maximum work voltage. Basic insulation (SOP, QSOP), Altitude<=5000m, 400-V rms maximum work voltage.	400-Vrms basic insulation (SOP, QSOP) and 600-V rms reinforced insulation (WSOP) working voltage per CSA C22.2 No. 62368-1:19 3rd, IEC 62368-1:2018 Ed. 3(in pollution degree 2, material group I) 2 MOPP (Means of Patient Protection) insulation requirements for 250Vrms and 1 MOPP insulation requirements for 500Vrms (WSOP) in CAN/CSA-C22.2 No. 60601-1:14, IEC 60601-1:2005 + AMD1:2012. 1 MOPP (Means of Patient Protection) insulation requirements for 250Vrms (SOP, QSOP) in CAN/ CSA-C22.2 No. 60601-1:14, IEC 60601-1:2005 + AMD1:2012	Reinforced insulation (WSOP), Altitude<=5000m,800-V rms maximum work voltage. Basic insulation (SOP, QSOP), Altitude<=5000m,400-V rms maximum work voltage
Certificate No. 40054570	Report Reference E524241	AK 50560071 0001	Certificate No. CQC22001356658	Master contract: 302375	Ref. Certif. No. CN57658

VDE	UL	TUV	CQC	CSA	CB
		AK 50560072 0001			

Safety Limiting Values

Parameter	Conditions [1]	Min	Typ	Max	Unit
Safety Supply Current	$R_{θJA}$ = 74°C/W, V_I = 5 V, T_J = 150°C, T_A = 25°C (SMP8)			337.8	mA
	$R_{θJA}$ = 85°C/W, V_I = 5 V, T_J = 150°C, T_A = 25°C (WSOP8)			294.1	
	$R_{θJA}$ = 75°C/W, V_I = 5 V, T_J = 150°C, T_A = 25°C (WSOP16)			333.3	
Safety Total Power	$R_{θJA}$ = 74°C/W, T_J = 150°C, T_A = 25°C (SMP8)			1689.1	mW
	$R_{θJA}$ = 85°C/W, T_J = 150°C, T_A = 25°C (WSOP8)			1470.5	
	$R_{θJA}$= 75°C/W, T_J = 150°C, T_A = 25°C (WSOP16)			1666.6	
Maximum Safety Temperature				150	°C

(1) The assumed junction-to-air thermal resistance in the Thermal Information is that of a device installed on a high-K test board for leaded surface-mount packages.

Electrical Characteristics

All test conditions: V_{CCA} = 2.25 V ~ 5.5 V, V_{CCB} = 4.5 V ~ 5.5 V, T_A = −40°C to 125°C. Typical value is in V_{CCA} = 3.3 V, V_{CCB} = 5 V, T_A = +25°C., unless otherwise noted.

Parameter		Test Conditions	Min	Typ	Max	Unit
Power Supply						
I_{CCA}	Supply Current Side A	Bus dominant, V_{CCA}= 2.25 V to 5.5 V, TXD = 0 V		2.3	8	mA
		Bus recessive, V_{CCA}= 2.25 V to 5.5 V, TXD = V_{CCA}		1.3	4.1	mA
		V_{CCA}= 4.5 to 5.5 V, TXD= 1Mbps 50% duty square wave		2.0	7.6	mA
		V_{CCA} = 4.5 to 5.5 V, TXD= 5Mbps 50% duty square wave		2.0	9	mA
I_{CCB}	Supply Current Side B	Bus dominant, TXD = 0 V, R_L= 60 Ω		10	80	mA
		Bus recessive, TXD = V_{CCA}, R_L = 60 Ω		1	6	mA
		V_{CCB}= 4.5 to 5.5 V, TXD= 1 Mbps 50% duty square wave		10	50	mA
		V_{CCB}= 4.5 to 5.5 V, TXD= 5 Mbps 50% duty square wave		10	60	mA
UV_{VCCA}	Rising under Voltage Detection, Side A			2	2.2	V
UV_{VCCA}	Falling under Voltage Detection, Side A		1.7	1.85		V
$V_{HYS(UVCCA)}$	Hysteresis Voltage on V_{CCA}Undervoltage Lock-out(1)			150		mV
UV_{VCCB}	Rising under Voltage Detection, side B			4.2	4.4	V
UV_{VCCB}	Falling under Voltage Detection, side B		3.5	4.0		V
$V_{HYS(UVCCB)}$	Hysteresis Voltage on V_{CCB}Undervoltage Lock-out(1)			200		mV
TXD Terminal						
V_{IH}	High Level Input Voltage		2		Vcc	V
V_{IL}	Low Level Input Voltage		0		0.8	V
I_{IH}	High Level Input Leakage Current	TXD = V_{CCA}			5	uA
I_{IL}	Low Level Input Leakage Current	TXD = 0 V	−20			uA

Parameter		Test Conditions	Min	Typ	Max	Unit
C_I	Input Capacitance[1]	V_{IN}= 0.4 x sin(2 x π x 1E+6 x t) + 2.5 V, V_{CCA}= 5 V		5		pF
$V_{OH} - V_{CCA}$	High Level Output Voltage	I_O = −4 mA for 4.5 V ≤ V_{CCA} ≤ 5.5 V	−0.4			V
		I_O = −2 mA for 3.0 V ≤ V_{CCA} ≤ 3.6 V	−0.2			V
		I_O = −1 mA for 2.25 V ≤ V_{CCA} ≤ 2.75 V	−0.1			V
V_{OL}	Low Level Output Voltage	I_O = 4 mA for 4.5 V ≤ V_{CCA} ≤ 5.5 V			0.4	V
		I_O = 2 mA for 3.0 V ≤ V_{CCA} ≤ 3.6 V			0.2	V
		I_O = 1 mA for 2.25 V ≤ V_{CCA} ≤ 2.75 V			0.1	V
Driver Electrical Characteristics						
$V_{O(DOM)}$	Bus Output Voltage (Dominant), CANH	TXD = 0 V, 50 Ω ≤ R_L ≤ 65 Ω, C_L = open	2.75		4.5	V
	Bus Output Voltage (Dominant), CANL	TXD = 0 V, 50 Ω ≤ R_L ≤ 65 Ω, C_L = open	0.5		2.25	V
$V_{O(REC)}$	Bus Output Voltage (recessive), CANH and CANL	TXD = V_{CCA}, R_L = open	2.0	0.5 x V_{CCB}	3.0	V

(1) Provided by bench test and design simulation

Electrical Characteristics - DC Specification

All test conditions: V_{CCA} = 2.25 V ~ 5.5 V, V_{CCB} = 4.5 V ~ 5.5 V, T_A = −40°C to 125°C. Typical value is in V_{CCA} = 3.3 V, V_{CCB} = 5 V, T_A = +25°C, unless otherwise noted.

Parameter		Test Conditions	Min	Typ	Max	Unit
Power Supply						
$V_{OD(DOM)}$	Differential Output Voltage, CANH − CANL (dominant)	TXD = 0 V, 45 Ω ≤ R_L ≤ 50 Ω, C_L = open	1.4		3.0	V
		TXD = 0 V, 50 Ω ≤ R_L ≤ 65 Ω, C_L = open	1.5		3.0	V
		TXD = 0 V, R_L = 2240 Ω, C_L = open, V_{CCB} = 4.5 V ~ 5.25 V	1.5		5.0	V
$V_{OD(REC)}$	Differential Output Voltage, CANH-CANL (recessive)	TXD = V_{CCA}, R_L = 60 Ω, C_L = open	-120		30	mV
		TXD = V_{CCA}, R_L = open, C_L = open	-50		50	mV
V_{SYM_DC}	DC Output Symmetry (V_{CCB} − $V_{O(CANH)}$ − $V_{O(CANL)}$)	R_L = 60 Ω, C_L = open, TXD = V_{CCA} or 0 V	−400		400	mV
$I_{SO(SS\_DOM)}$	Short Circuit Current Steady State Output Current, dominant	V_{CANH} = −5 V to 40 V, CANL = open, TXD = 0 V	−100			mA
		V_{CANL} = −5 V to 40 V, CANH = open, TXD = 0 V			100	mA
$I_{SO(SS\_REC)}$	Short Circuit Current Steady State Output Current, recessive	−27 V ≤ V_{BUS} ≤ 32 V, V_{BUS} = CANH = CANL, TXD = V_{CCA}	−5.0		5.0	mA
Receiver Electrical Characteristics						
VIT	Differential Input Threshold Voltage	|V_{CM}| ≤ 20 V	500		900	mV
		20 V ≤ |V_{CM}| ≤ 30 V	400		1000	
VHYS	Hysteresis Voltage for differential input threshold (1)			120		mV
VCM	Input Common Mode Range		−30		30	V
$I_{OFF(LKG)}$	Power-off Bus Input Leakage Current	CANH = CANL = 5 V, V_{CCB} to GND via 0 Ω and 47 kΩ resistor			4.8	uA
C_I	Input capacitance to ground (CANH or CANL) (1)	TXD = V_{CCA}		24.0	30	pF
C_{ID}	Differential Input Capacitance (CANH – CANL) (1)	TXD = V_{CCA}		12.0	15	pF
R_{ID}	Differential Input Resistance	TXD = V_{CCA}; −30 V ≤ V_{CM} ≤ +30 V	25		80	kΩ
R_{IN}	Input Resistance (CANH or CANL)	TXD = V_{CCA}; −30 V ≤ V_{CM} ≤ +30 V	15		40	kΩ

Parameter		Test Conditions	Min	Typ	Max	Unit
$R_{IN(M)}$	Input Resistance Matching: (1 − $R_{IN(CANH)}/R_{IN(CANL)}$) x 100%	$V_{CANH} = V_{CANL}$ = 5 V	−2.0		2.0	%
Thermal Shutdown						
T_{TSD}	Thermal Shutdown Temperature (1)			170		°C
T_{TSD_HYST}	Thermal Shutdown Hysteresis (1)			5		°C

(1) Provided by bench test and design simulation.

Switching Characteristics

All test conditions: V_{CCA} = 2.25 V ~ 5.5 V, V_{CCB} = 4.5 V ~ 5.5 V, T_A = −40°C to 125°C. Typical value is in V_{CCA} = 3.3 V, V_{CCB} = 5 V, T_A = +25°C., unless otherwise noted.

Parameter		Conditions	Min	Typ	Max	Units
Switching Characteristics						
$t_{PROP(LOOP1)}$	Total loop delay, driver input TXD to receiver RXD, recessive to dominant	R_L = 60 Ω, C_L = 100 pF, $C_{L(RXD)}$ = 15 pF; input rise/fall time (10% to 90%) on TXD < 5 ns; 2.25 V ≤ V_{CCA} ≤ 5.5 V	80	110	200	ns
$t_{PROP(LOOP2)}$	Total loop delay, driver input TXD to receiver RXD, dominant to recessive	R_L = 60 Ω, C_L = 100 pF, $C_{L(RXD)}$ = 15 pF; input rise/fall time (10% to 90%) on TXD < 5 ns; 2.25 V ≤ V_{CCA} ≤ 5.5 V	80	120	200	ns
$t_{UV\_RE\_ENABLE}$	Re-enable time after undervoltage event	Time for device to return to normal operation from V_{CCA} or V_{CCB} under voltage event		30	50	μs
Static CMTI	Static Common mode transient immunity (1)	V_{CM} = 1200 V_{PK}	150	200		kV/μs
Dynamic CMTI	Dynamic Common mode transient immunity (1)	V_{CM} = 1200 V_{PK}	100	150		kV/μs
Driver Switching Characteristics						
t_{pHR}	Propagation delay time, HIGH TXD to driver recessive	R_L = 60 Ω and C_L = 100 pF; input rise/fall time (10% to 90%) on TXD < 5 ns		65	120	ns
t_{pLD}	Propagation delay time, LOW TXD to driver dominant			55	120	
$t_{sk(p)}$	Pulse skew ($\|t_{pHR} - t_{pLD}\|$) (1)			12	30	
t_R	Differential output signal rise time (1)			40		
t_F	Differential output signal fall time (1)			40		
V_{SYM}	Output symmetry (dominant or recessive) ($V_{O(CANH)}$ + $V_{O(CANL)}$) / V_{CCB}	R_{TERM} = 60 Ω, C_{SPLIT} = 4.7 nF, C_L = open, R_L = open, TXD = 250 kHz, 1 MHz	0.9		1.1	V/V
t_{TXD_DTO}	Dominant time out	R_L = 60 Ω and C_L = open	1.2		3.8	Ms
Receiver Switching Characteristics						
t_{pRH}	Propagation delay time, bus recessive input to RXD high output	$C_{L(RXD)}$ = 15 pF		60	120	ns
t_{pDL}	Propagation delay time, bus dominant input to RXD low output			55	120	ns
t_R	Output signal rise time (RXD) (1)			1	4	ns

Parameter		Conditions	Min	Typ	Max	Units
t_F	Output signal fall time (RXD) (1)			1	4	ns
CAN FD Timing parameters						
$t_{BIT(BUS)}$	Bit time on CAN bus output pins with $t_{BIT(TXD)}$ = 500 ns	R_L = 60 Ω, C_L = 100 pF, $C_{L(RXD)}$ = 15 pF; input rise/fall time (10% to 90%) on TXD < 5 ns	435		530	ns
	Bit time on CAN bus output pins with $t_{BIT(TXD)}$ = 200 ns	R_L = 60 Ω, C_L = 100 pF, $C_{L(RXD)}$ = 15 pF; input rise/fall time (10% to 90%) on TXD < 5 ns	155		210	ns
$t_{BIT(RXD)}$	Bit time on RXD output pins with $t_{BIT(TXD)}$ = 500 ns	R_L = 60 Ω, C_L = 100 pF, $C_{L(RXD)}$ = 15 pF; input rise/fall time (10% to 90%) on TXD < 5 ns	400		550	ns
	Bit time on RXD output pins with $t_{BIT(TXD)}$ = 200 ns	R_L = 60 Ω, C_L = 100 pF, $C_{L(RXD)}$ = 15 pF; input rise/fall time (10% to 90%) on TXD < 5 ns	120		220	ns
Δt_{REC}	Receiver timing symmetry with $t_{BIT(TXD)}$ = 500 ns	R_L = 60 Ω, C_L = 100 pF, $C_{L(RXD)}$ = 15 pF; input rise/fall time (10% to 90%) on TXD < 5 ns; $\Delta t_{REC} = t_{BIT(RXD)} - t_{BIT(BUS)}$	−65.0		40	ns
	Receiver timing symmetry with $t_{BIT(TXD)}$ = 200 ns	R_L = 60 Ω, C_L = 100 pF, $C_{L(RXD)}$ = 15 pF; input rise/fall time (10% to 90%) on TXD < 5 ns; $\Delta t_{REC} = t_{BIT(RXD)} - t_{BIT(BUS)}$	−45.0		15	ns

(1) Provided by bench test and design simulation.

Test Circuits and Waveforms

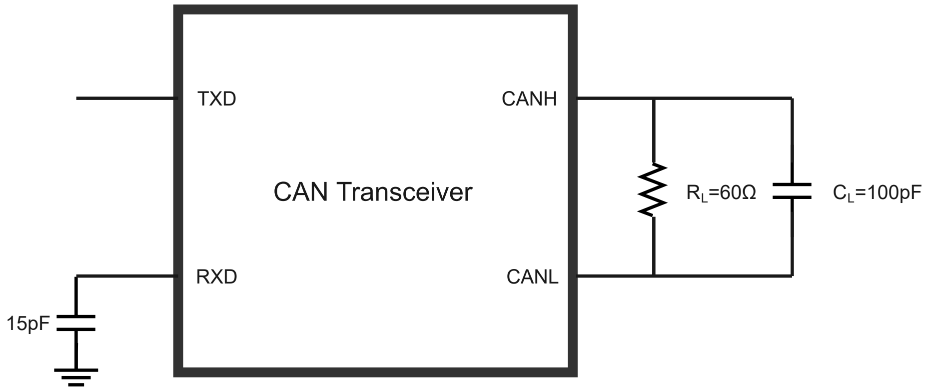


Figure 1. CAN Transceiver Timing Parameter Test Circuit

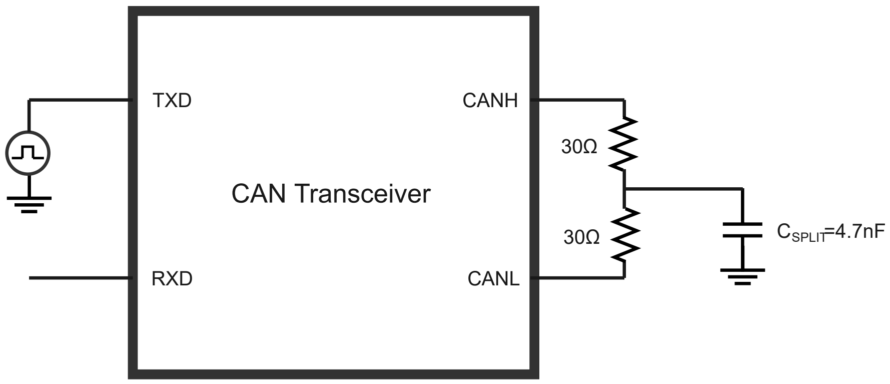


Figure 2. CAN Transceiver Driver Symmetry Test Circuit

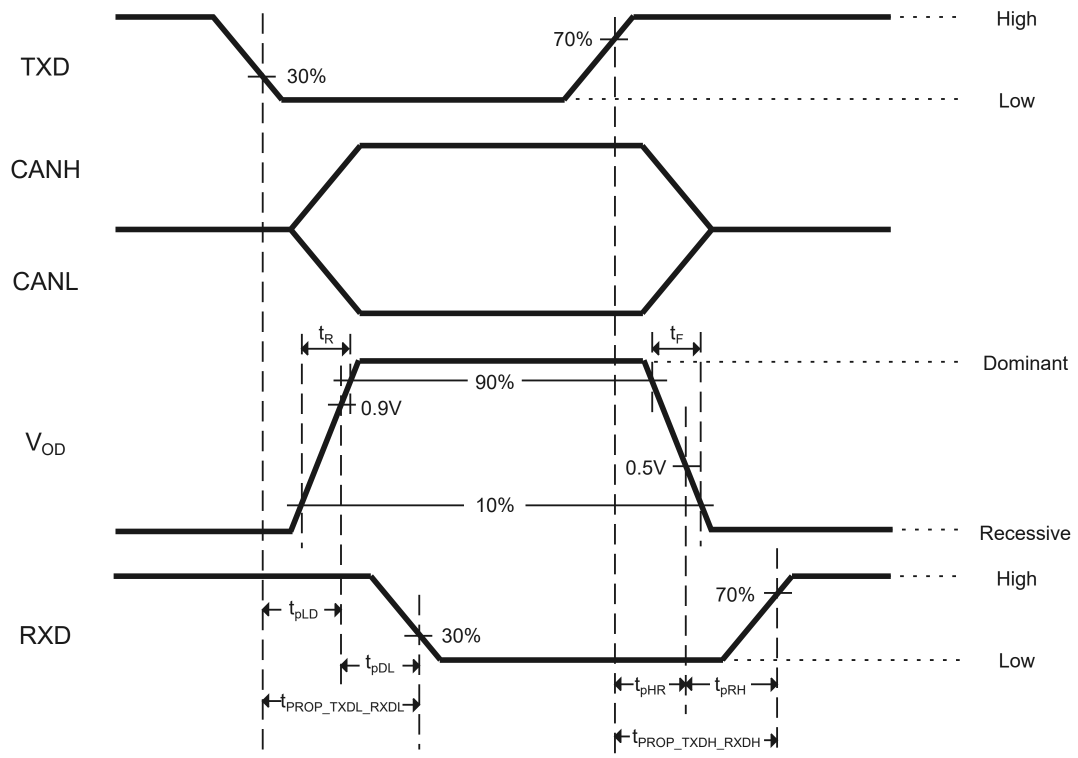


Figure 3. CAN Transceiver Timing Diagram

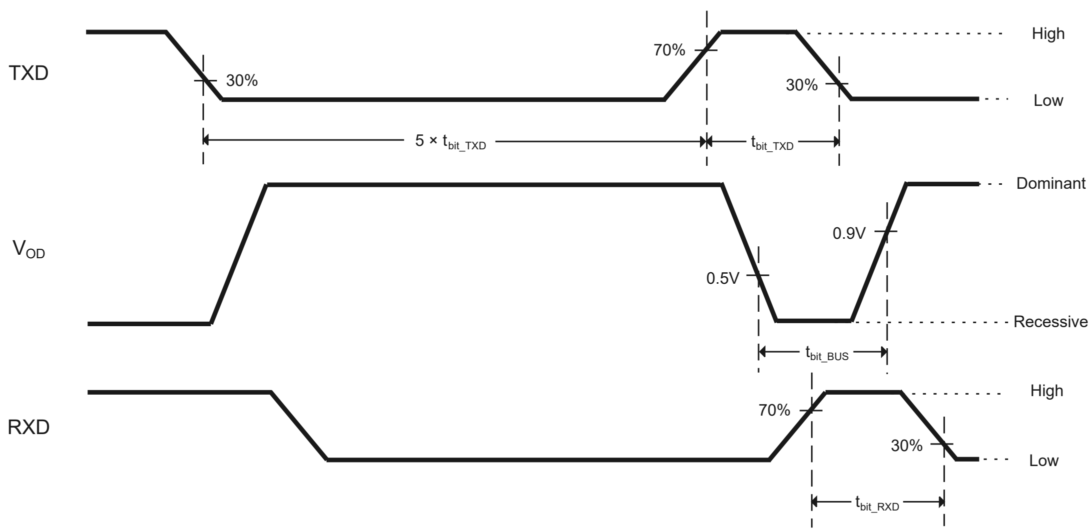


Figure 4. CAN FD Timing Parameter Diagram

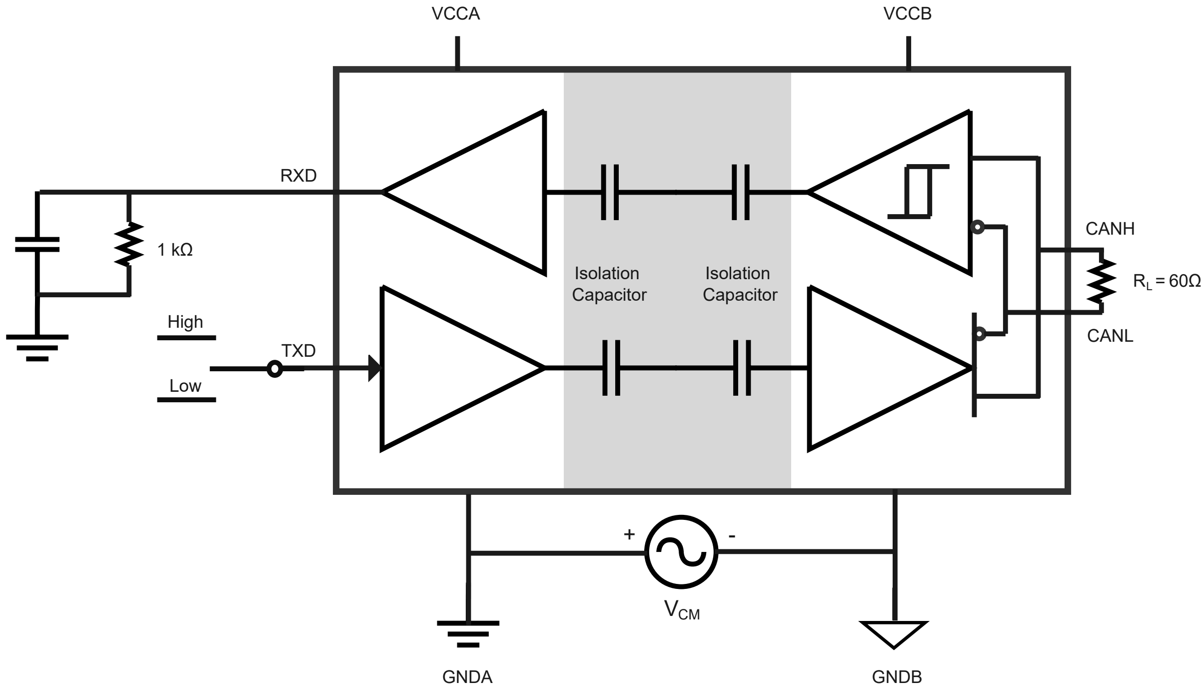


Figure 5. Common-Mode Transient Immunity Test Circuit

Detailed Description

Overview

The TPT71044 and TPT71050 devices are isolated CAN transceivers that meet the ISO11898 High-speed CAN (Controller Area Network) physical layer standard. The device utilize an ON-OFF Keying (OOK) modulation circuit to transmit the digital data through the isolation barrier. The transmitter sends a RF carrier to represent digital state one and sends no signal to represent the digital state zero. The devices also utilize advanced circuit design to maximise CMTI performance and minimise radiated emissions. The devices are designed to be applied in CAN FD networks up to 5 Mbps, and to enhance timing margin and higher data rates in long and high-loading 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 VCCA is the power supply input for RXD and TXD I/O pins which support a wide range from 2.25 V to 5.5 V. The 2nd power supply VCCB of CAN BUS side supports a range from 4.5 V to 5.5 V. The difference between TPT71050 and TPT71044 is the TXD and RXD pin position.

Functional Block Diagram

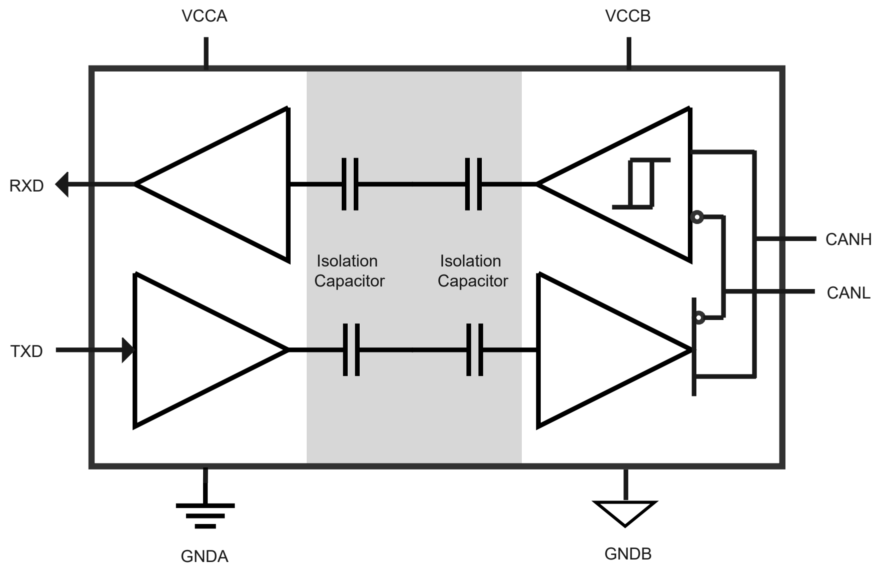


Figure 6. Block Diagram of Digital Capacitive Isolator

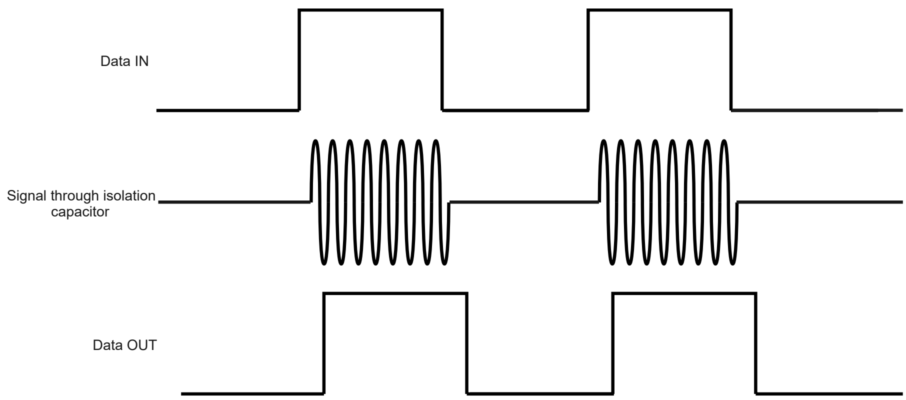


Figure 7. On-Off Keying (OOK) based Modulation Scheme

Feature Description

Under-voltage Lockout (UVLO)

The TPT710xx uses an under-voltage lockout circuit to keep the device in shutdown mode until the supply voltage is higher than the UVLO threshold.

Over Temperature Protection (OTP)

The TPT710xx 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.

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.

Over-Temperature Protection (OTP)

The output drivers are protected against over-temperature 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 to ensures output driver oscillation due to temperature drift is avoided.

Table 3. Driver Function Table

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

Table 4. Receiver Function Table

Device Mode	CAN Differential Inputs $V_{ID} = V_{CANH} - V_{CANL}$	Bus State	RXD Terminal
Normal	$V_{ID} \geq V_{IT+(MAX)}$	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

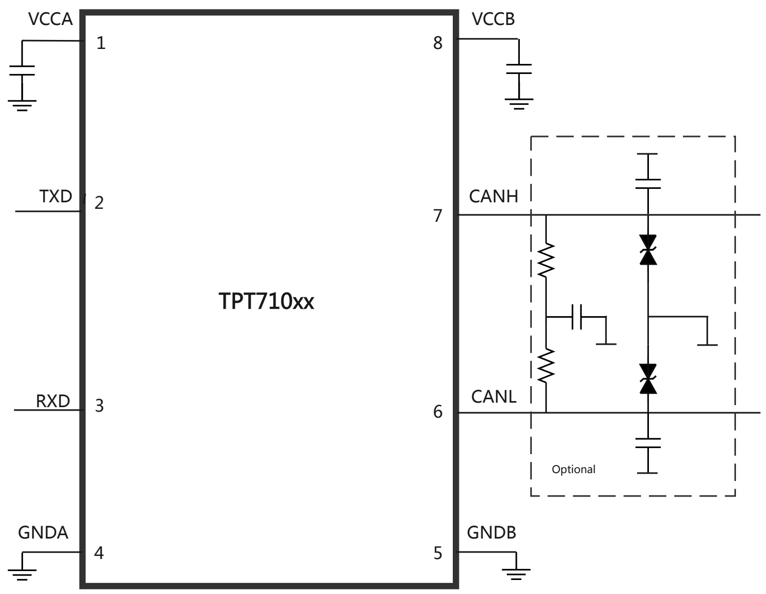
Application and Implementation

> Note
>
> Information in the following application 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.

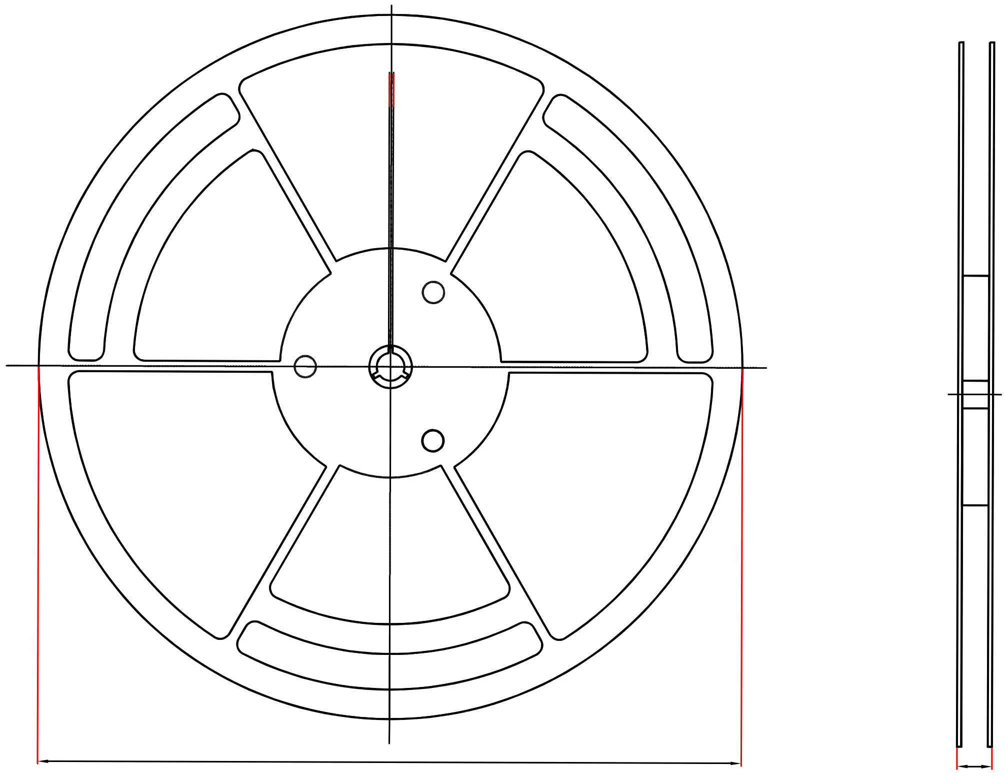
Application Information

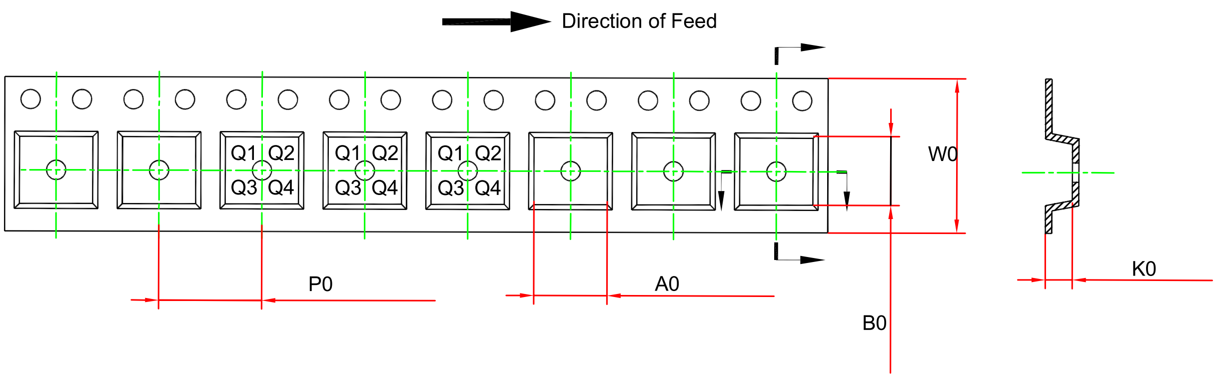
The TPT710xx can be used with other components such as a microcontroller, a transformer driver, and a linear voltage regulator to form a fully isolated CAN interface.

Typical Application



Tape and Reel Information



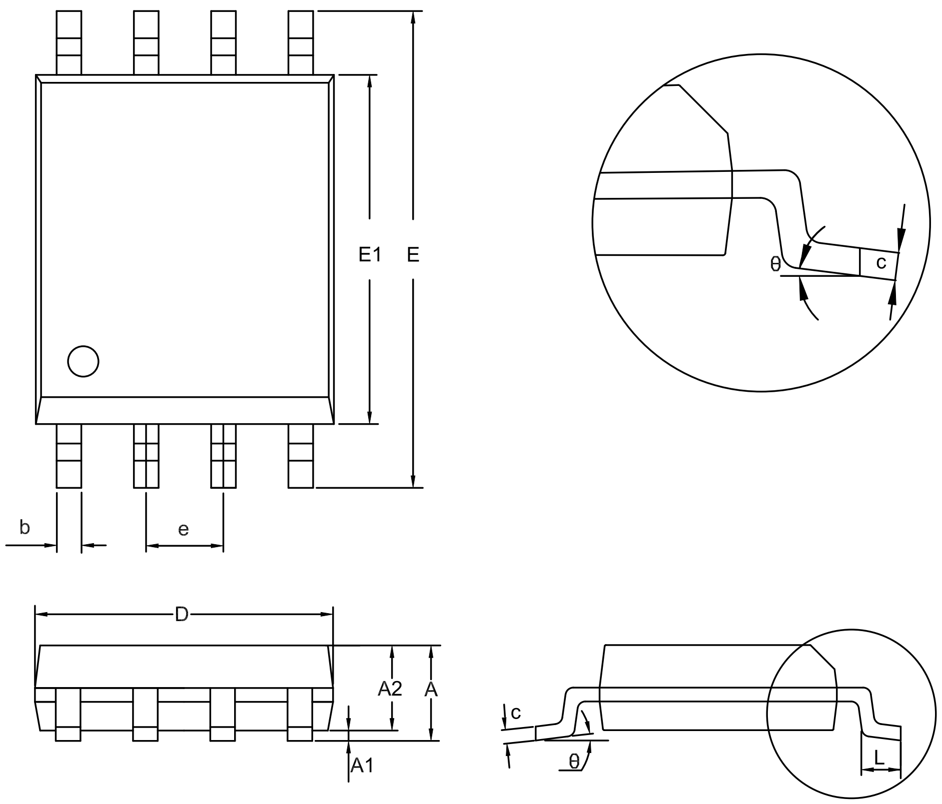


Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPT71050-SOBR	WSOP16	330	22.4	10.9	10.8	3.0	12.0	16.0	Q1
TPT71050-SM1R	SMP8	330	29.0	10.9	9.6	4.3	16.0	24.0	Q1
TPT71044-SOAR	WSOP8	330	21.6	11.95	6.2	3.0	16.0	16.0	Q1
TPT71044-SOBR	WSOP16	330	22.4	10.9	10.8	3.0	12.0	16.0	Q1

Package Outline Dimensions

WSOP8-B

Package Outline Dimensions SOA(WSOP-8-B)



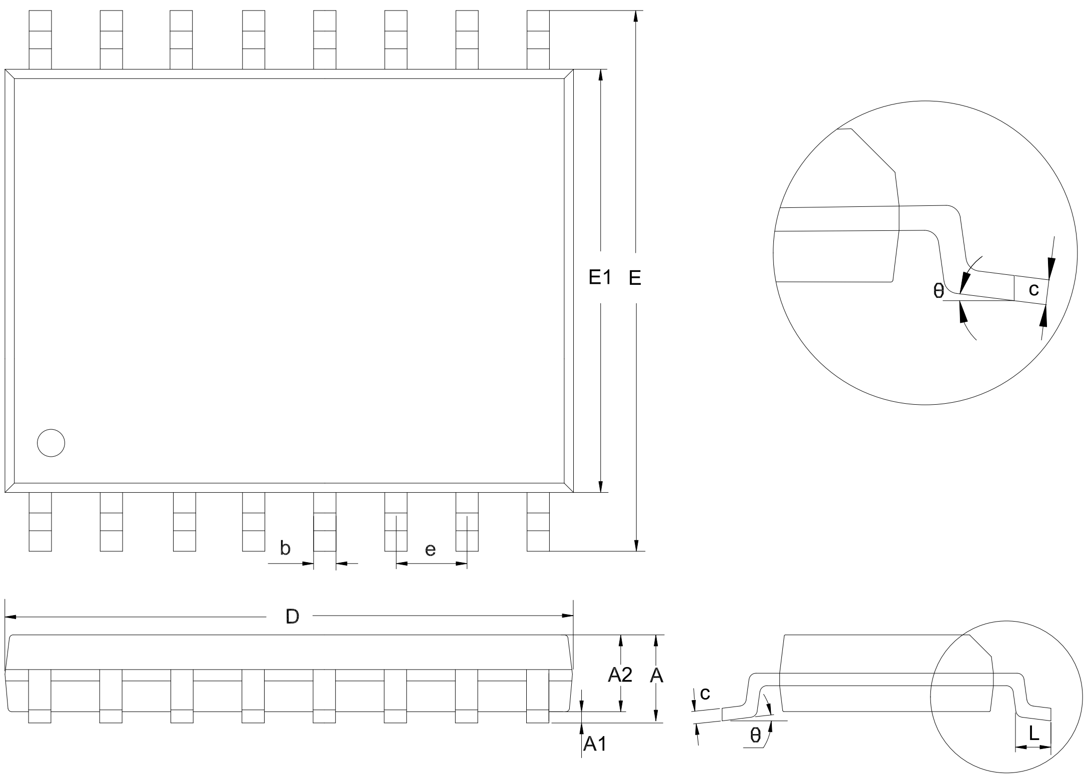
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	2.350	2.650	0.093	0.104
A1	0.100	0.300	0.004	0.012
A2	2.250	2.350	0.089	0.093
b	0.310	0.510	0.012	0.020
c	0.150	0.300	0.006	0.012
D	5.750	5.950	0.226	0.234
E	11.250	11.750	0.443	0.463
E1	7.400	7.600	0.291	0.299
e	1.270 BSC		0.050 BSC	
L	0.500	1.000	0.020	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.

WSOP16

Package Outline Dimensions SOB(WSOP-16-A)



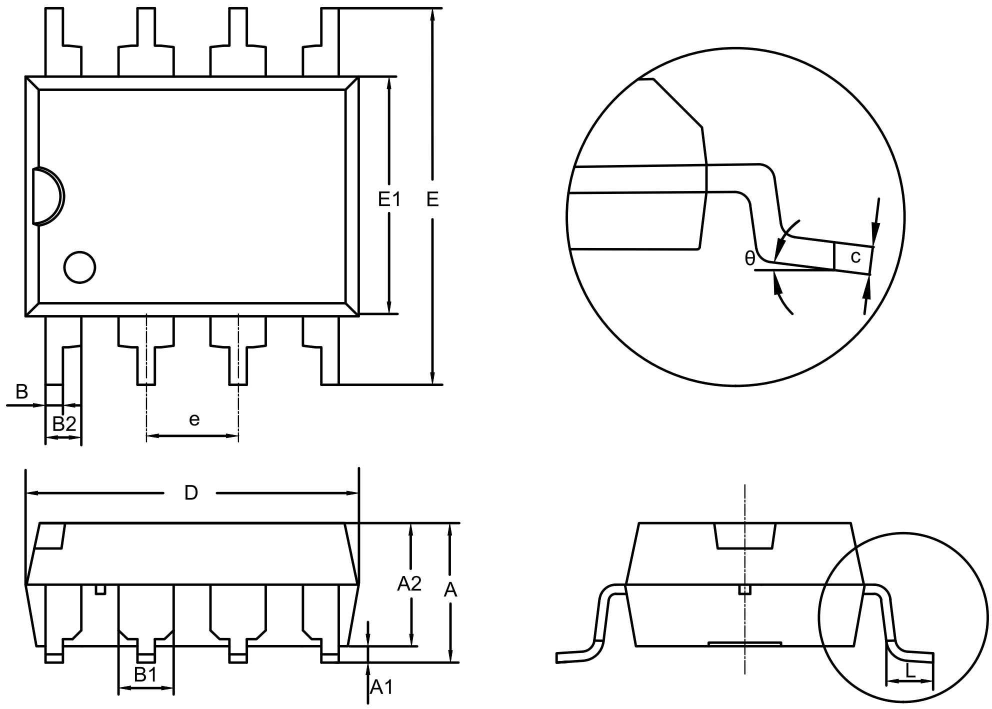
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	2.350	2.650	0.093	0.104
A1	0.100	0.300	0.004	0.012
A2	2.250	2.350	0.089	0.093
b	0.350	0.450	0.014	0.018
c	0.200	0.290	0.008	0.011
D	10.100	10.500	0.398	0.413
E	10.100	10.600	0.398	0.417
E1	7.300	7.700	0.287	0.303
e	1.270 BSC		0.050 BSC	
L	0.500	0.850	0.020	0.033
θ	0	8°	0	8°

NOTES

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

SMP-8

Package Outline Dimensions SM1(SMP-8-A)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	3.674	4.026	0.145	0.159
A1	0.350	0.550	0.014	0.022
A2	3.324	3.476	0.131	0.137
B1	1.464	1.584	0.058	0.062
B2	0.930	1.050	0.037	0.041
B	0.420	0.540	0.017	0.021
c	0.204	0.304	0.008	0.012
D	9.100	9.300	0.358	0.366
E	10.100	10.700	0.398	0.421
E1	6.370	6.870	0.251	0.270
e	2.540 BSC		0.100 BSC	
L	1.150	1.450	0.045	0.057
θ	0	8°	0	8°

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
TPT71050-SM1R	−40 to 125°C	SMP8	71050	MSL3	Tape and Reel, 800	Green
TPT71050-SOBR	−40 to 125°C	WSOP16	71050	MSL3	Tape and Reel, 1500	Green
TPT71044-SOAR	−40 to 125°C	WSOP8	71044	MSL3	Tape and Reel, 1000	Green
TPT71044-SOBR	−40 to 125°C	WSOP16	71044	MSL3	Tape and Reel, 1500	Green

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

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