2-Channel Enhanced High-Reliability Digital Isolator

Features

- 100-Mbps Data Rate
- 3.75-kV RMS Isolation Rating
- ±200-kV/μs typ static CMTI, ±150-kV/μs typ dynamic CMTI
- Low Power Consumption, typ 3 mA/ch @1 Mbps
- Low Propagation Delay: 12 ns Typical
- Default Output Low (TPT772xFE) and High (TPT772xE)
- Wide Temperature Range: −40°C to +125°C
- SOP8 package
- Robust Electromagnetic Compatibility (EMC)
  - Low Emissions
  - System-Level ESD, EFT, and Surge Immunity
- Safety-Related Certifications:
  - VDE Certification according to DIN VDE V 0884-17(IEC60747-17)
  - 3750-V_{RMS} (SOP8) Isolation Rating per UL 1577
  - CQC Certification per GB 4943.1
  - CAS, TUV, and CB certifications

Applications

- Industrial Automation
- Motor Control
- Power Supplies
- Isolated Interface and General-Purpose Isolation

Description

The TPT772xE devices are high-performance, dual-channel enhanced digital isolators with 3750-V_{RMS} (SOP8) isolation ratings per UL 1577. These devices have also been certified by VDE, UL, CSA, TUV, CQC, and CB.

The TPT772xE devices provide high reliability and high performance at low power consumption with isolating digital input and output. Each isolation signal channel is separated by a double capacitive silicon dioxide insulation barrier. The TPT7720 device has both channels in the same direction while the TPT7721 and TPT7722 devices have both channels in the opposite direction. In the event of input power or signal loss, the fail-safe default output is low for devices with the suffix F and high for devices without the suffix F.

The common mode transient immunity (CMTI) and electromagnetic compatibility of the TPT772xE devices have been significantly enhanced through innovative circuit design and optimized structure.

The TPT772xE family is available in SOP8 packages, and is characterized from −40°C to +125°C.

Function block diagram

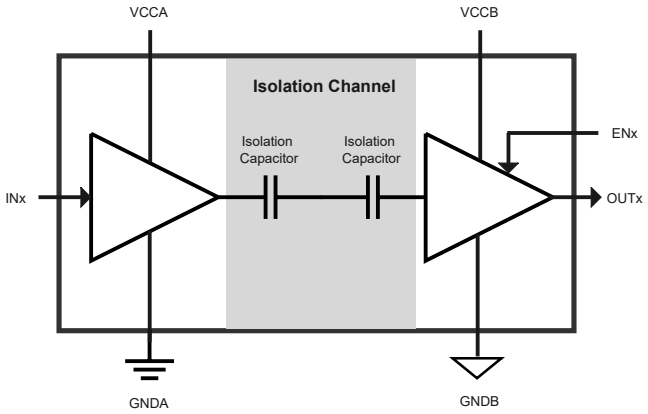


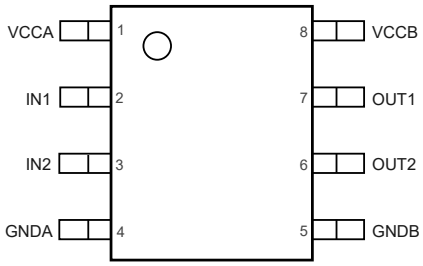
Table of Contents

Revision History

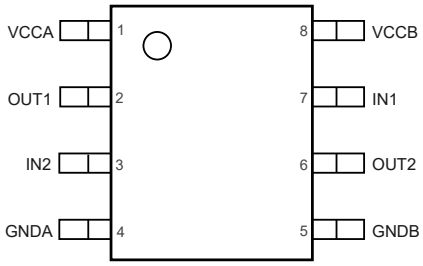
Date	Revision	Notes
2020-05-05	Rev.Pre.0	Initial Version
2021-12-30	Rev.A.0	Released version

Pin Configuration and Functions

TPT7720E
SOP8
Top View



TPT7721E
SOP8
Top View



TPT7722E
SOP8
Top View

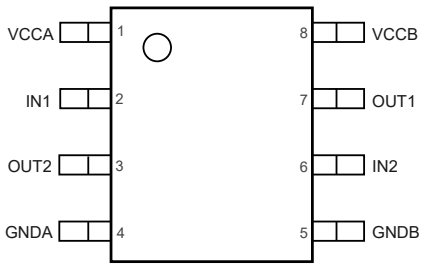


Table 1. Pin Functions: TPT772xE

Pin			Name	I/O	Description
SOP8					
TPT7720	TPT7721	TPT7722			
1	1	1	VCCA	−	Power supply, VCCA
2	7	2	IN1	I	Input, channel 1
3	3	6	IN2	I	Input, channel 2
4	4	4	GNDA	−	Ground connection for VCCA
5	5	5	GNDB	−	Ground connection for VCCB
6	6	3	OUT2	O	Output, channel 2
7	2	7	OUT1	O	Output, channel 1
8	8	8	VCCB	−	Power supply, VCCB
−	−	−	NC	−	No Connect

Specifications

Absolute Maximum Ratings (1)

Parameter		Min	Max	Unit
V_{CC}	Supply Voltage, V_{CCA}, V_{CCB}	−0.5	6	V
V_{IO}	Voltage at IN1, IN2, OUT1, OUT2	−0.5	V_{CC} + 0.5	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.

ESD, Electrostatic Discharge Protection

Parameter	Condition	Value	Unit
HBM, per ANSI/ESDA/JEDEC JS-001/ANSI/ESD STM5.5.1 (1)	All Pin	8	kV
CDM, per ANSI/ESDA/JEDEC JS-002 (2)	All Pin	2	kV
Latch up, per JESD78	All Pin	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_{CCX}	Supply Voltage, V_{CCA}, V_{CCB} (1)		2.25	-	5.5	V
$V_{CC(UVLO+)}$	UVLO threshold when supply voltage is rising (2)		-	2	2.25	V
$V_{CC(UVLO+)}$	UVLO threshold when supply voltage is falling (2)		1.7	1.85	-	V
$V_{HYS(UVLO)}$	Supply Voltage UVLO Hysteresis		60	150	-	mV
I_{OH}	High-Level Output Current	V_{CCB} = 5 V	−4	-	-	mA
		V_{CCB} = 3.3 V	−2	-	-	mA
		V_{CCB} = 2.5 V	−1	-	-	mA
I_{OL}	High-Level Output Current	V_{CCB} = 5 V	-	-	4	mA
		V_{CCB} = 3.3 V	-	-	2	mA
		V_{CCB} = 2.5 V	-	-	1	mA
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 (3)		0	-	150	Mbps
T_A	Operating Ambient Temperature		−40	25	125	°C

(1) V_{CCA} is input side V_{CC}; V_{CCB} is output side V_{CC};

(2) $V_{CC(UVLO+)}$, $V_{CC(UVLO+)}$, $V_{HYS(UVLO)}$ are same to V_{CCA} and V_{CCB};
(3) 150 Mbps is the maximum specified data rate, although higher data rates are possible.

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
SOP8	130	48	°C/W

Insulation Specifications

Parameter		Conditions	Value	Unit
			SOP8	
CLR	External clearance	Shortest terminal-to-terminal distance through air	> 4.0	mm
CPG	External creepage	Shortest terminal-to-terminal distance across the package surface	> 4.0	mm
DTI	Distance through the insulation	Minimum internal gap (internal clearance)	> 22	μm
DTC	Distance through the Molding compound	Minimum internal distance across the conductors inside the package	0.45	mm
CTI	Comparative tracking index	DIN EN 60112 (VDE 0303-11); IEC 60112; UL 746A	> 600	V
	Material group	According to IEC 60664-1	I	
	Over-voltage category	For Rated Mains Voltage ≤ 150 V_{RMS}	I-IV	
		For Rated Mains Voltage ≤ 300 V_{RMS}	I-III	
		For Rated Mains Voltage ≤ 600 V_{RMS}	I-II	
		For Rated Mains Voltage ≤ 1000 V_{RMS}	I	
	Climatic category		40/125/21	
	Pollution degree		2	
DIN V VDE V 0884-17 (1)(2)				
V_{IORM}	Maximum repetitive isolation voltage	AC voltage	637	V_{PK}
V_{IOWM}	Maximum working isolation voltage	AC voltage; TDDB Test	450	V_{RMS}
		DC voltage	637	V_{DC}
V_{IOTM}	Maximum transient isolation voltage	$V_{TEST} = V_{IOTM}$, t = 60 s (qualification); $V_{TEST} = 1.2 \times V_{IOTM}$, t = 1 s (100% production)	5300	V_{PK}
V_{IOSM}	Maximum surge isolation voltage(3)	Test method per IEC 62368-1, 1.2/50 μs waveform, $V_{TEST} = 1.3 \times V_{IOSM}$ (qualification)	5980	V_{PK}
q_{pd}	Apparent charge	Method a, After Input/Output safety test subgroup 2/3, $V_{ini} = V_{IOTM}$, t_{ini} = 60 s; $V_{pd(m)} = 1.2 \times V_{IORM}$, t_m = 10 s	≤ 5	pC
		Method a, After environmental tests subgroup 1, $V_{ini} = V_{IOTM}$, t_{ini} = 60 s; $V_{pd(m)} = 1.6 \times V_{IORM}$, t_m = 10 s	≤ 5	

Parameter		Conditions	Value	Unit
			SOP8	
		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	
C_{IO}	Isolation capacitance	V_{IO} = 0.4 × sin (2πft), f = 1 MHz	~0.5	pF
R_{IO}	Isolation resistance	V_{IO} = 500 V, T A= 25°C	> 10^{12}	Ω
		V_{IO} = 500 V, 100°C ≤ T A≤ 125°C	> 10^{11}	Ω
		V_{IO} = 500 V at T S= 150°C	> 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	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 VDE V 0884-17	Certified according to UL 1577 and CSA Component Acceptance Notice 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) VIORM= 637 VIOSM= 5500	(WSOP)Single protection, 5000Vrms (SOP)Single protection, 3750Vrms	5000Vrms reinforced insulation (WSOP), 800Vrms maximum work voltage. 3750Vrms basic insulation (SOP), 400V rms maximum work voltage.	Reinforced insulation (WSOP), Altitude<=5000m,800V rms maximum work voltage. Basic insulation (SOP), Altitude<=5000m,400V rms maximum work voltage.	400Vrms basic insulation (SOP) and 600V 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 (WSOP) in CAN/CSA-C22.2 No. 60601-1:14, IEC 60601-1:2005 + AMD1:2012	Reinforced insulation (WSOP), Altitude<=5000m,800V rms maximum work voltage. Basic insulation (SOP), Altitude<=5000m,400V rms maximum work voltage.
Certificate No. 40054570	Report Reference E524241	Registration No. AK 50524505 0001 AK 50524506 0001 AK 50550847 0001 AK 50550849 0001	Certificate No. CQC21001303701 CQC22001332218 CQC22001332219	Master contract: 302375	Ref. Certif. No. CN54369 CN56354 CN56355

Safety Limiting Values

Parameter	Conditions (1)	Min	Typ	Max	Unit
Safety Supply Current	$R_{\theta JA}$ = 130°C/W, V_I = 5 V, T_J = 150°C, T_A = 25°C (SOP8)	-	-	192.3	mA
	$R_{\theta JA}$ = 85°C/W, V_I = 5 V, T_J = 150°C, T_A = 25°C (WSOP8)	-	-	294.1	
	$R_{\theta JA}$ = 93°C/W, V_I = 5 V, T_J = 150°C, T_A = 25°C (WSOP16)	-	-	268.8	
Safety Total Power	$R_{\theta JA}$ = 130°C/W, T_J = 150°C, T_A = 25°C (SOP8)	-	-	961.5	mW
	$R_{\theta JA}$ = 85°C/W, T_J = 150°C, T_A = 25°C (WSOP8)	-	-	1470.5	
	$R_{\theta JA}$ = 93°C/W, T_J = 150°C, T_A = 25°C (WSOP16)	-	-	1344	
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 condition is at V_{CCA} = V_{CCB} = 2.25 V to 5.5 V, T_A = −40°C to +125°C, Typical value is in V_{CC} = 3.3 V, T_A = +25°C, unless otherwise noted.

Parameter		Conditions	Min	Typ	Max	Unit
Input Electrical Specifications						
V_{IH}	Logic Input High Voltage	Input signal, IN1, IN2	2.0	-	-	V
V_{IL}	Logic Input Low Voltage	Input signal, IN1, IN2	-	-	0.8	V
V_{IT+}	Rising Input Threshold Voltage	Input signal, IN1, IN2	-	1.6	2	V
V_{IT-}	Falling Input Threshold Voltage	Input signal, IN1, IN2	0.8	1.2	-	V
V_{HYS}	Input Threshold Voltage Hysteresis		-	0.4	-	V
I_{IH}	High-Level Input Current	V_{IH} = V_{CCA} at IN1, IN2 (1)	-	2.5	10	μA
I_{IL}	Low-Level Input Current	V_{IL} = 0 V at IN1, IN2 (1)	−10	−2.5	-	μA
I_{OH}	High-Level Output Current	V_{CCB} = 5 V ± 10%	−4	-	-	mA
		V_{CCB} = 3.3 V ± 10%	−2	-	-	
		V_{CCB} = 2.5 V ± 10%	−1	-	-	
I_{OL}	Low-Level Output Current	V_{CCB} = 5 V ± 10%	-	-	4	mA
		V_{CCB} = 3.3 V ± 10%	-	-	2	
		V_{CCB} = 2.5 V ± 10%	-	-	1	
V_{OH}	High-Level Output Voltage	V_{CCB}= 5 V ± 10%, I_{OH} = −4 mA; Test OUT1, OUT2, Figure 9	V_{CCB} – 0.4	V_{CCB} – 0.2	-	V
		V_{CCB} = 3.3 V ± 10%, I_{OH} = –2 mA; Test OUT1, OUT2, Figure 9	V_{CCB} – 0.3	V_{CCB} – 0.15	-	
		V_{CCB} = 2.5 V ± 10%, I_{OH} = –1 mA; Test OUT1, OUT2, Figure 9	V_{CCB} – 0.2	V_{CCB} – 0.1	-	
V_{OL}	Low-Level Output Voltage	V_{CCB} = 5 V ± 10%, I_{OL} = 4 mA; Test OUT1, OUT2, Figure 9	-	0.2	0.4	V
		V_{CCB} = 3.3 V ± 10%, I_{OL} = 2 mA; Test OUT1, OUT2, Figure 9	-	0.15	0.3	
		V_{CCB} = 2.5 V ± 10%, I_{OL} = 1 mA; Test OUT1, OUT2, Figure 9	-	0.1	0.2	
CMTI	Common-Mode Transient Immunity	Static CMTI, See Figure 11	150	200	-	kV/μs
		Dynamic CMTI, See Figure 11	100	150	-	kV/μs
C_i	Input Capacitance (1)		-	2	-	pF

(1) Provided by bench test and design simulation

Timing Specifications − 5-V Supply

All test condition is at V_{CCA} = V_{CCB} = 5 V ± 10%, T_A = −40°C to +125°C. Typical value is in V_{CC} = 5 V, T_A = +25°C, C_L = 15 pF to GND, unless otherwise noted.

Parameter		Conditions	Min	Typ	Max	Unit
f_{data}	Translation Data Rate		-	-	150	Mpbs
t_{PLH}	Propagation Delay Time		-	11.5	20	ns
t_{PHL}	Propagation Delay Time		-	12	20	ns
PWD	Pulse Width Distortion (1) $\lvert t_{PHL} - t_{PLH} \rvert$		-	0.5	5	ns
$t_{sk(CC)}$	Channel-to-Channel Output Skew Time (2)	Same direction channels	-	-	2.5	ns
$t_{sk(PP)}$	Channel-to-Channel Output Skew Time (2)	Same direction channels	-	-	4.5	ns
t_r	Output Signal Rise Time (1)		-	0.7	4	ns
t_f	Output Signal Fall Time (1)		-	0.7	4	ns
Jitter	Eye Jitter p-p (1)	f_{data} = 100 Mbps	-	340	-	ps
t_{DO}	Default Output Delay Time from Input Power Loss	Measured from the time VCC goes below 1.7 V	-	30	52	ns
t_{su}	Setup Time		-	28	60	us
t_{ie}	Time Interval Error (1)	2^{16}− 1 PRBS data at 100 Mbps (1)	-	2.4	-	ns

(1) Provided by bench test and design simulation.
(2) $t_{sk(CC)}$ & $t_{sk(PP)}$ is the shew of delay time between the different channels of a single device or different devices switching in the same direction while operating at identical supply voltages, temperature, input signals, and loads.

Supply Current Characteristics − 5-V Supply

All test condition is at V_{CCA} = V_{CCB} = 5 V ± 10%, T_A = −40°C to +125°C. Typical value is in V_{CC} = 5 V, T_A = +25°C, C_L = 15 pF to GND, unless otherwise noted.

Parameter	Description		Supply Current	Min	Typ	Max	Unit
TPT7720							
Supply current - DC signal	V_I= 0 V (TPT7720F), V_I = VCC_I (TPT7720)		I_{CCA}	-	0.95	1.5	mA
			I_{CCB}	-	2.4	4.4	
	V_I = VCC_I (TPT7720F), V_I = 0 V (TPT7720)		I_{CCA}	-	8.2	10.9	
			I_{CCB}	-	2.1	3.8	
Supply current - AC signal	All channels switching with square wave clock input; C_L= 15 pF	1 Mbps	I_{CCA}	-	4.4	5.9	
			I_{CCB}	-	2.4	4.3	
		10 Mbps	I_{CCA}	-	4.6	6	
			I_{CCB}	-	3.7	6.2	
		100 Mbps	I_{CCA}	-	6.3	8.4	
			I_{CCB}	-	16.4	22	
TPT7721							
Supply current - DC signal	V_I = 0 V (TPT7721F), V_I = VCC_I (TPT7721)		I_{CCA}, I_{CCB}	-	1.9	2.9	mA
	V_I = VCC_I (TPT7721F), V_I = 0 V (TPT7721)		I_{CCA}, I_{CCB}	-	5.2	7.5	
Supply current - AC signal	All channels switching with square wave clock input; C_L= 15 pF	1 Mbps	I_{CCA}, I_{CCB}	-	3.6	5.5	
		10 Mbps	I_{CCA}, I_{CCB}	-	4.3	6.6	
		100 Mbps	I_{CCA}, I_{CCB}	-	11.6	19	
TPT7722							
Supply current - DC signal	V_I = 0 V (TPT7722F), V_I = VCC_I (TPT7722)		I_{CCA}, I_{CCB}	-	1.9	2.9	mA
	V_I = VCC_I (TPT7722F), V_I = 0 V (TPT7722)		I_{CCA}, I_{CCB}	-	5.2	7.5	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}, I_{CCB}	-	3.6	5.5	
		10 Mbps	I_{CCA}, I_{CCB}	-	4.3	6.6	
		100 Mbps	I_{CCA}, I_{CCB}	-	11.6	19	

(1) Provided by bench test and design simulation.
(2) VCC_I is the VCC of V_I.

Timing Specifications − 3.3-V Supply

All test condition is at V_{CCA} = V_{CCB} = 3.3 V ± 10%, T_A = −40°C to +125°C. Typical value is in V_{CC} = 3.3 V, T_A = +25°C, C_L = 15 pF to GND, unless otherwise noted.

Parameter		Conditions	Min	Typ	Max	Unit
f_{data}	Translation data rate		-	-	150	Mpbs
t_{PLH}	Propagation delay time		-	12.5	20	ns
t_{PHL}	Propagation delay time		-	12.2	20	ns
PWD	Pulse width distortion (1) $\lvert t_{PHL} - t_{PLH} \rvert$		-	0.3	5	ns
$t_{sk(CC)}$	Channel-to-channel output skew time (2)	Same direction channels	-	-	2.5	ns
$t_{sk(PP)}$	Channel-to-channel output skew time (2)	Same direction channels	-	-	4.5	ns
t_r	Output signal rise time (1)		-	0.7	4	ns
t_f	Output signal fall time (1)		-	0.7	4	ns
Jitter	Eye jitter p-p (1)	f_{data} = 100 Mbps	-	800	-	ps
t_{DO}	Default output delay time from input power loss	Measured from the time VCC goes below 1.7 V	-	30	52	ns
t_{su}	Setup time		-	28	60	μs
t_{ie}	Time interval error (1)	2^{16} − 1 PRBS data at 100 Mbps	-	2.4	-	ns

(1) Provided by bench test and design simulation.
(2) $t_{sk(CC)}$ & $t_{sk(PP)}$ is the shew of delay time between the different channels of a single device or different devices switching in the same direction while operating at identical supply voltages, temperature, input signals, and loads.

Supply Current Characteristics − 3.3-V Supply

All test condition is at V_{CCA} = V_{CCB} = 3.3 V ± 10%, T_A = −40°C to +125°C. Typical value is in V_{CC} = 3.3 V, T_A = +25°C, C_L = 15 pF to GND, unless otherwise noted.

Parameter	Description		Supply Current	Min	Typ	Max	Unit
TPT7720							
Supply current - DC signal	V_I = 0 V (TPT7720F), V_I = VCC_I (TPT7720)		I_{CCA}	-	0.92	1.51	mA
			I_{CCB}	-	2.4	4.4	
	V_I = VCC_I (TPT7720F), V_I = 0 V (TPT7720)		I_{CCA}	-	8.2	10.8	
			I_{CCB}	-	2.1	4	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}	-	4.3	6.4	
			I_{CCB}	-	2.3	4.3	
		10 Mbps	I_{CCA}	-	4.4	6.5	
			I_{CCB}	-	3.2	6.2	
		100 Mbps	I_{CCA}	-	5.5	8.2	
			I_{CCB}	-	11	18	
TPT7721							
Supply current - DC signal	V_I = 0 V (TPT7721F), V_I = VCC_I (TPT7721)		I_{CCA}, I_{CCB}	-	1.9	2.9	mA
	V_I = VCC_I (TPT7721F), V_I = 0 V (TPT7721)		I_{CCA}, I_{CCB}	-	5.2	7.5	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}, I_{CCB}	-	3.5	5.1	
		10 Mbps	I_{CCA}, I_{CCB}	-	3.9	5.8	
		100 Mbps	I_{CCA}, I_{CCB}	-	8.6	15.5	
TPT7722							
Supply current - DC signal	V_I = 0 V (TPT7722F), V_I= VCC_I (TPT7722)		I_{CCA}, I_{CCB}	-	1.9	2.9	mA
	V_I = VCC_I (TPT7722F), V_I = 0 V (TPT7722)		I_{CCA}, I_{CCB}	-	5.2	7.5	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}, I_{CCB}	-	3.5	5	
		10 Mbps	I_{CCA}, I_{CCB}	-	3.9	5.5	
		100 Mbps	I_{CCA}, I_{CCB}	-	8.6	15.5	

(1) Provided by bench test and design simulation.
(2) VCC_I is the VCC of V_I.

Timing Specifications − 2.5-V Supply

All test condition is at V_{CCA} = V_{CCB} = 2.5 V ± 10%, T_A = −40°C to +125°C. Typical value is in V_{CC} = 2.5 V, T_A = +25°C, C_L = 15 pF to GND, unless otherwise noted.

Parameter		Conditions	Min	Typ	Max	Unit
f_{data}	Translation data rate		-	-	150	Mpbs
t_{PLH}	Propagation delay time		-	13.5	22	ns
t_{PHL}	Propagation delay time		-	12.2	22	ns
PWD	Pulse width distortion (1) $\lvert t_{PHL} - t_{PLH} \rvert$		-	1.3	5	ns
$t_{sk(CC)}$	Channel-to-channel output skew time (2)	Same direction channels	-	-	2.5	ns
$t_{sk(PP)}$	Channel-to-channel output skew time (2)	Same direction channels	-	-	4.5	ns
t_r	Output signal rise time (1)		-	0.7	4	ns
t_f	Output signal fall time (1)		-	0.7	4	ns
Jitter	Eye jitter p-p (1)	f_{data} = 100 Mbps	-	800	-	ps
t_{DO}	Default output delay time from input power loss	Measured from the time VCC goes below 1.7 V	-	30	52	ns
t_{su}	Setup time		-	28	60	μs
t_{ie}	Time interval error (1)	2^{16} − 1 PRBS data at 100 Mbps	-	2.4	-	ns

(1) Provided by bench test and design simulation.
(2) $t_{sk(CC)}$ & $t_{sk(PP)}$ is the shew of delay time between different channels of a single device or different devices switching in the same direction while operating at identical supply voltages, temperature, input signals, and loads.

Supply Current Characteristics − 2.5-V Supply

All test condition is at V_{CCA} = V_{CCB} = 2.5 V ± 10%, T_A = −40°C to +125°C. Typical value is in V_{CC} = 2.5 V, T_A = +25°C, C_L = 15 pF to GND, unless otherwise noted.

Parameter	Description		Supply Current	Min	Typ	Max	Unit
TPT7720							
Supply Current - DC Signal	V_I = 0 V (TPT7720F), V_I = VCC_I (TPT7720)	I_{CCA}		0.9	1.54	2.0	mA
		I_{CCB}		2.4	4.4	4.3	
	V_I = VCC_I (TPT7720F), V_I = 0 V (TPT7720)	I_{CCA}		8.2	10.8	11.8	
		I_{CCB}		2.1	4	4.4	
Supply Current - AC Signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}	-	4.3	5.9	
			I_{CCB}	-	2.3	4.3	
		10 Mbps	I_{CCA}	-	4.3	6.1	
			I_{CCB}	-	3	6.2	
		100 Mbps	I_{CCA}	-	4.6	6.2	
			I_{CCB}	-	8.9	12.5	
TPT7721							
Supply Current - DC Signal	V_I = 0 V (TPT7721F) V_I = VCC_I (TPT7721)		I_{CCA}, I_{CCB}	-	1.9	2.9	mA
	V_I = VCC_I (TPT7721F) V_I = 0 V (TPT7721)		I_{CCA}, I_{CCB}	-	5.2	7.5	
Supply Current - AC Signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA} I_{CCB}	-	3.5	5.1	
		10 Mbps	I_{CCA} I_{CCB}	-	3.8	5.5	
		100 Mbps	I_{CCA} I_{CCB}	-	7	10.5	
TPT7722							
Supply Current - DC Signal	V_I = 0 V (TPT7722F) V_I = VCC_I (TPT7722)		I_{CCA}, I_{CCB}	-	1.9	2.9	mA
	V_I = VCC_I (TPT7722F) V_I = 0 V (TPT7722)		I_{CCA}, I_{CCB}	-	5.2	7.5	
Supply Current - AC Signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}, I_{CCB}	-	3.5	5	
		10 Mbps	I_{CCA}, I_{CCB}	-	3.8	5.5	
		100 Mbps	I_{CCA}, I_{CCB}	-	7	10.5	

(1) Provided by bench test and design simulation.
(2) VCC_I is the VCC of V_I.

Test Circuits and Waveforms

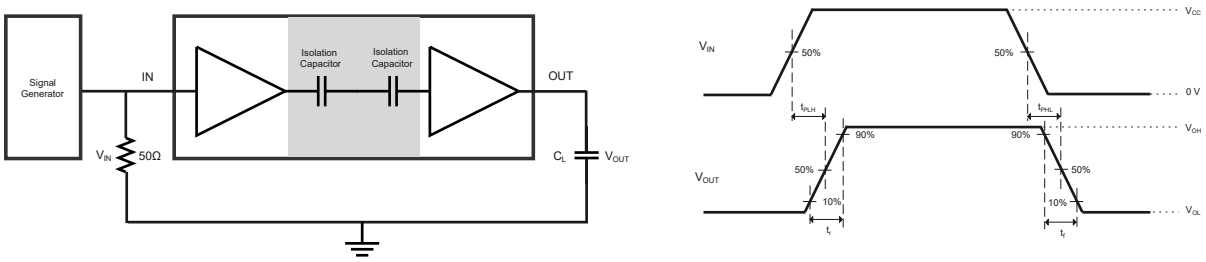


Figure 1. Swtiching Characteristics Test circuit and Waveforms

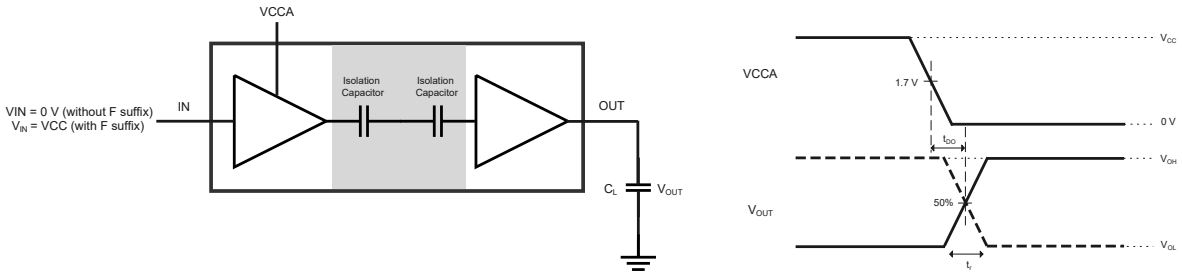


Figure 2. Default Output Delay Time Test Circuit and Voltage Waveforms

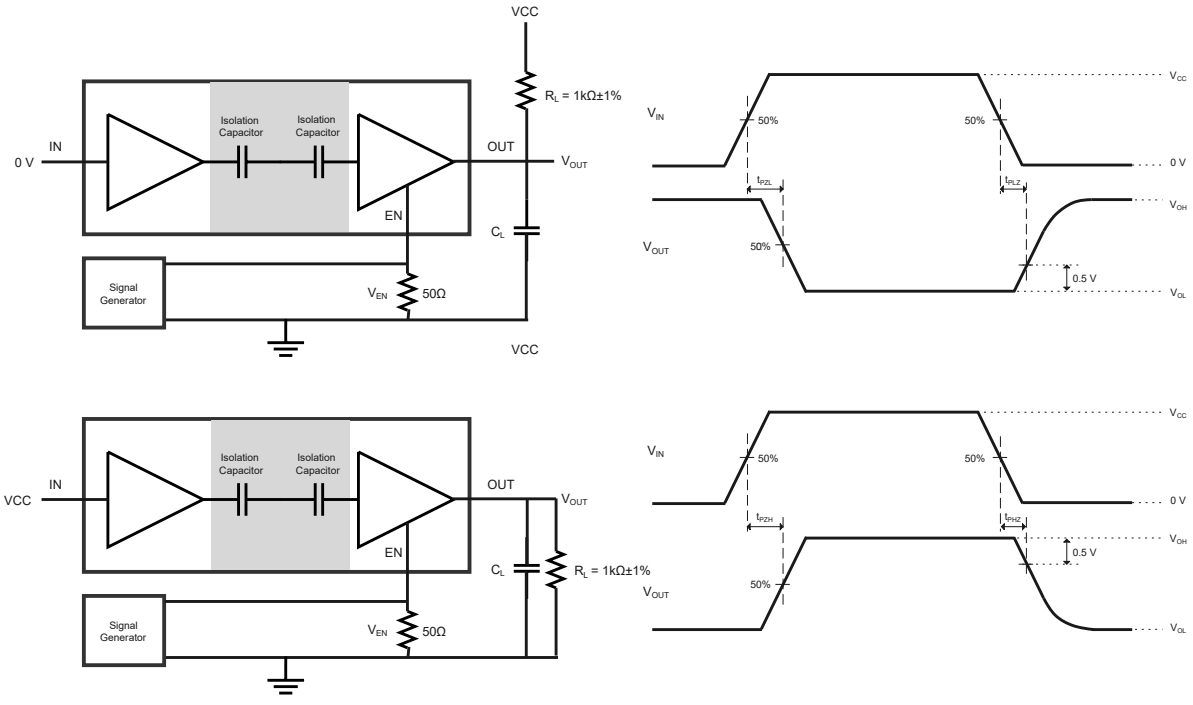


Figure 3. Enable/Disable propagation delay Test circuit and Waveforms

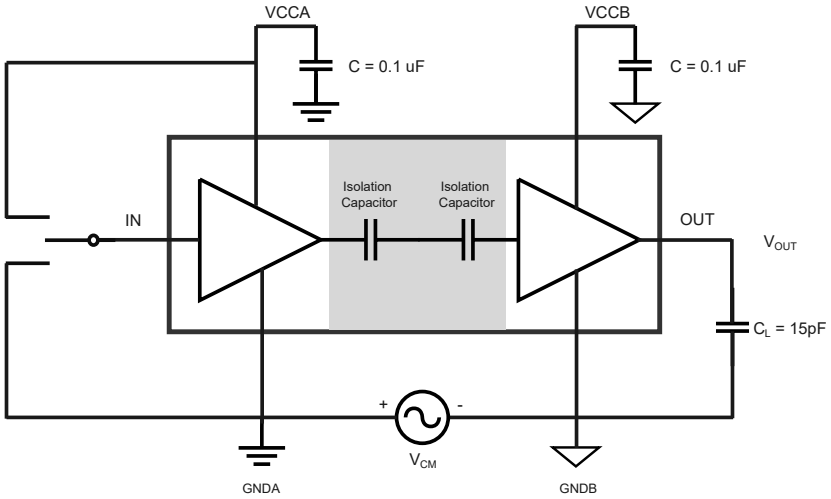


Figure 4. Common-Mode Transient Immunity Test Circuit

Detailed Description

Overview

The TPT772x family 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 block diagram below shows a functional block diagram of a typical channel.

Functional Block Diagram

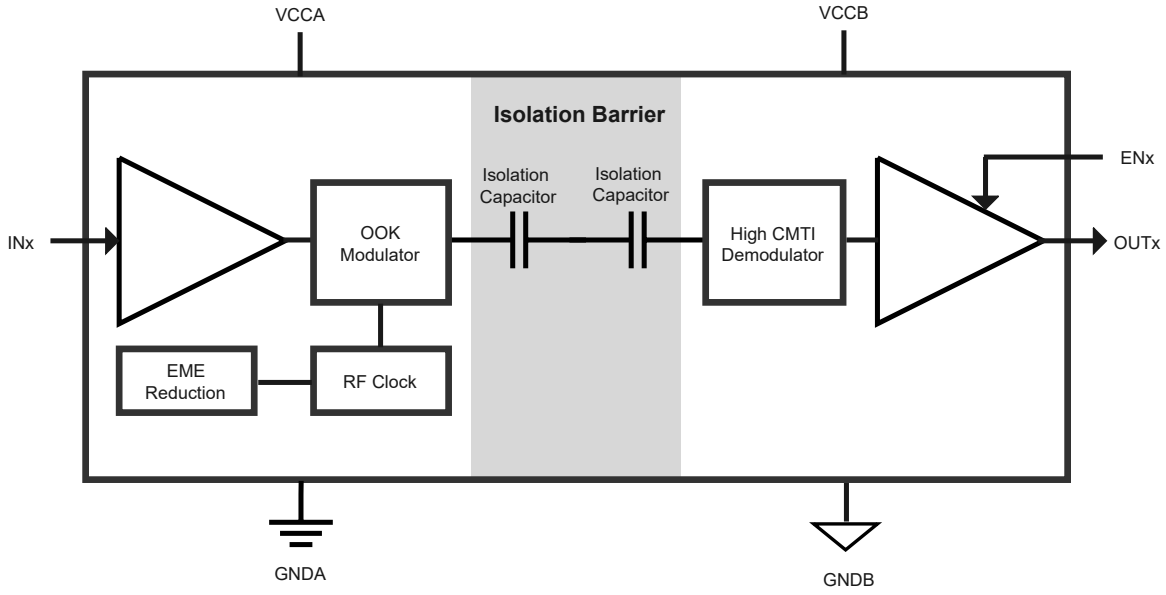


Figure 5. Block diagram of Digital Capacitive isolator

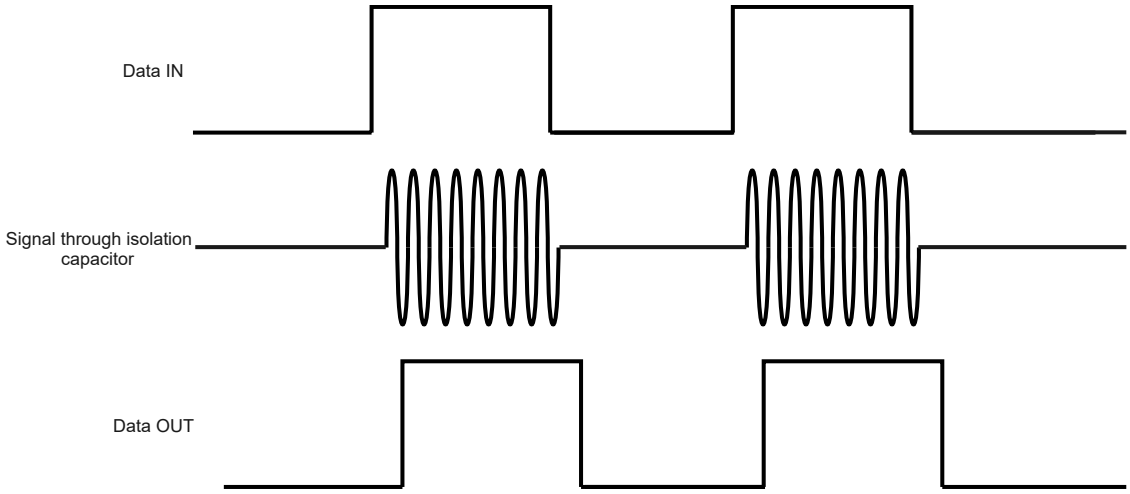


Figure 6. On-Off Keying (OOK) based Modulation Scheme

Feature Description

The TPT772x family of devices is available in two-channel configurations and default output state options to enable a variety of application uses. The table below lists the device features of the TPT772x devices.

Part Number	Max Data Rate	Channel Direction	Default Output State	Package	Rating Isolation
TPT7720E	100 Mbps	2 Forward, 0 Reverse	High	SOP8	3750 V_{RMS}/ 5250 V_{PK}
TPT7720FE	100 Mbps	2 Forward, 0 Reverse	Low	SOP8	3750 V_{RMS}/ 5250 V_{PK}
TPT7721E	100 Mbps	1 Forward, 1 Reverse	High	WSOP8	3750 V_{RMS}/ 5250 V_{PK}
TPT7721FE	100 Mbps	1 Forward, 1 Reverse	Low	WSOP8	3750 V_{RMS}/ 5250 V_{PK}
TPT7722E	100 Mbps	1 Forward, 1 Reverse	High	WSOP8	3750 V_{RMS}/ 5250 V_{PK}
TPT7722FE	100 Mbps	1 Forward, 1 Reverse	Low	WSOP8	3750 V_{RMS}/ 5250 V_{PK}

Device Functional Modes

The table below lists the functional modes for the TPT772x devices.

VCC_I	VCC_O	Input (IN1. IN2)	Output (OUT1, OUT2)	Comments
Power up	Power up	High	High	Normal Operation

VCC_I	VCC_O	Input (IN1. IN2)	Output (OUT1, OUT2)	Comments
		Low	Low	
		Open	Default	Default mode. The default is High for TPT772x and Low for TPT772xF.
Power down	Power up	X	Default	Default mode: When VCC_I is unpowered, the default is High for TPT772x and Low for TPT772xF.
X	Power down	X	Undetermined	When VCC_O is unpowered, a channel output is undetermined.

(1) VCC_I = Input-side V_{CCA}; VCC_O = Output-side V_{CCB}; Powered up (V_{CC} ≥ 2.25 V); Powered down (V_{CC} ≤ 1.7 V); X = Irrelevant

(2) The outputs are in the undetermined state when 1.7 V < VCC_I, VCC_O < 2.25 V.

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.

Typical Application

Figure 7 is the TPT772x typical application. The two external bypass capacitors need to be close to the VCC power pin. The maximum distance is 2 mm.

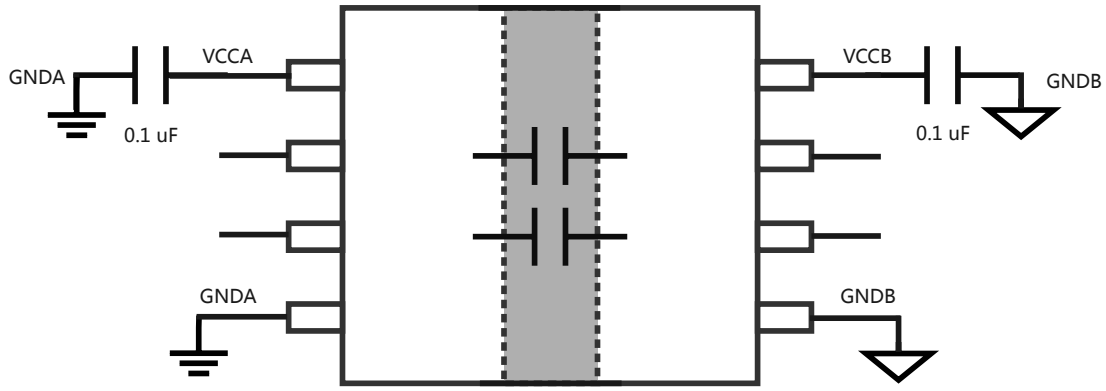
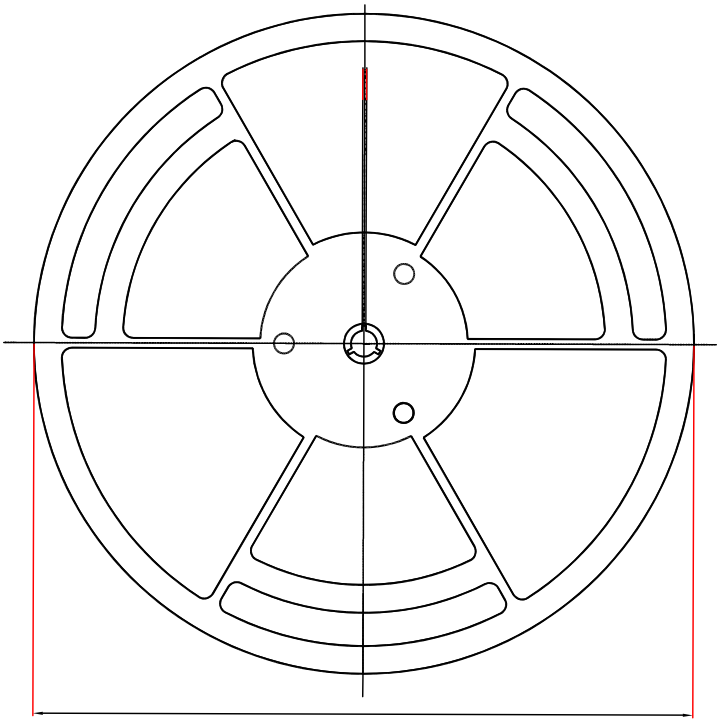
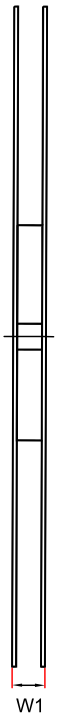
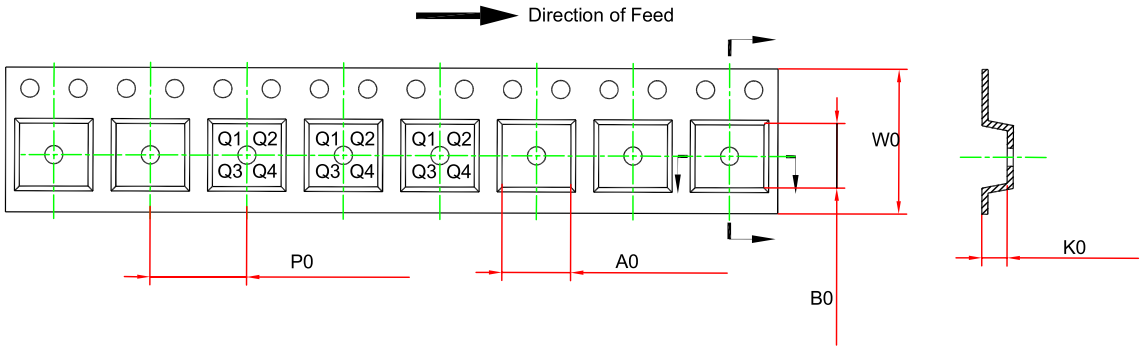


Figure 7. Typical Application

Tape and Reel Information





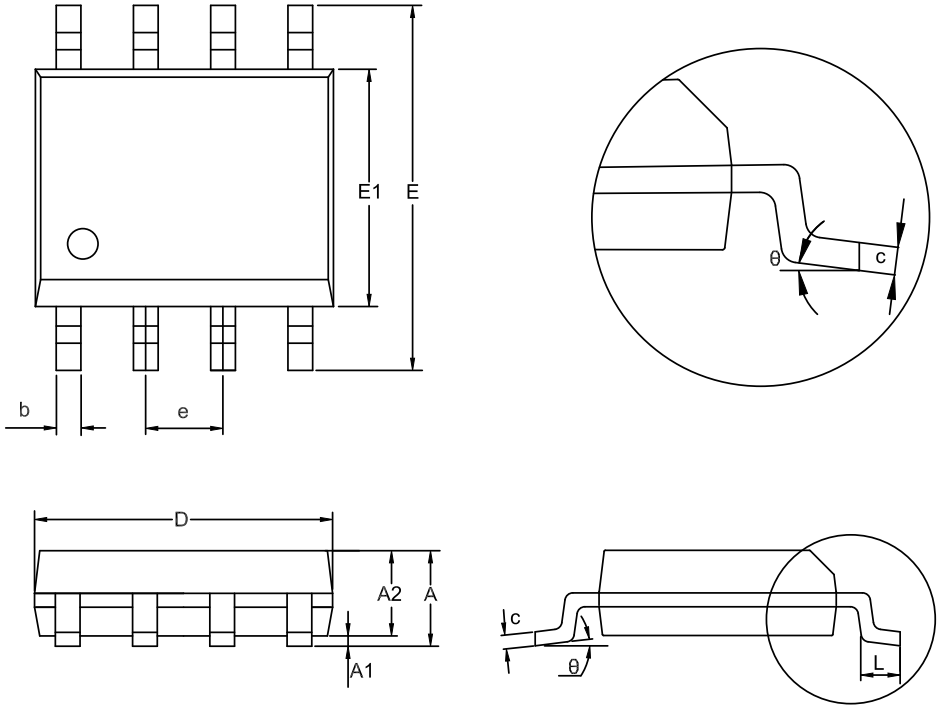


Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPT7720E-SO1R	SOP8	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPT7720FE-SO1R	SOP8	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPT7721E-SO1R	SOP8	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPT7721FE-SO1R	SOP8	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPT7722E-SO1R	SOP8	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPT7722FE-SO1R	SOP8	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1

Package Outline Dimensions

SOP8

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.

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPT7720E-SO1R	−40 to 125°C	SOP8	7720E	MSL3	Tape and Reel, 4000	Green
TPT7720FE-SO1R	−40 to 125°C	SOP8	720FE	MSL3	Tape and Reel, 4000	Green
TPT7721E-SO1R	−40 to 125°C	SOP8	7721E	MSL3	Tape and Reel, 4000	Green
TPT7721FE-SO1R	−40 to 125°C	SOP8	721FE	MSL3	Tape and Reel, 4000	Green
TPT7722E-SO1R	−40 to 125°C	SOP8	7722E	MSL3	Tape and Reel, 4000	Green
TPT7722FE-SO1R	−40 to 125°C	SOP8	722FE	MSL3	Tape and Reel, 4000	Green

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

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