4-Channel Enhanced High-Performance Digital Isolator

Features

- 150-Mbps Data Rate
- 5-kV RMS Isolation Rating (WSOP)
- ±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 (TPT774xF) and High (TPT774x)
- Wide Temperature Range: −40°C to +125°C
- SOP16, QSOP16, and WSOP16 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)
  - 5000-V_{RMS} (WSOP16), 3750-V_{RMS} (SOP16, QSOP16) Isolation Rating per UL 1577
  - CQC Certification per GB 4943.1
  - CSA, TUV, and CB Certifications

Applications

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

Description

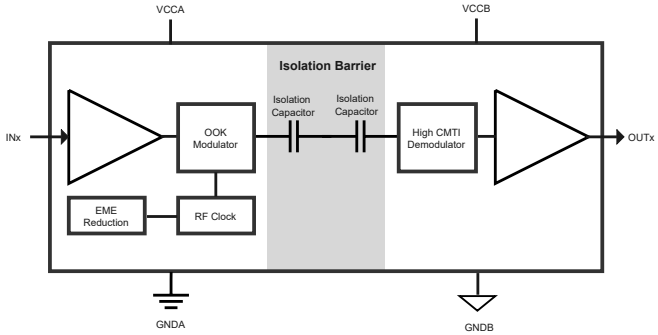
The TPT774x devices are high-performance, 4-channel digital isolators with 5000-V_{RMS} (WSOP16), and 3750-V_{RMS} (SOP16, QSOP16) isolation ratings per UL 1577. These devices are also to be certified by VDE, UL, CSA, TUV, CQC, and CB.

The TPT774x 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 TPT7740 device has four channels in the same direction while the TPT7741 device has three channels in the forward direction and one channel in the opposite direction. The TPT7742 device has two channels in the forward direction and two channels in the opposite direction. In the event of input power or signal loss, the 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 TPT774x devices have been significantly enhanced through innovative circuit design and optimized structure.

The TPT774x family is available in SOP16, QSOP16, and WSOP16 packages, and is characterized from −40°C to +125°C.

Functional Block Diagram



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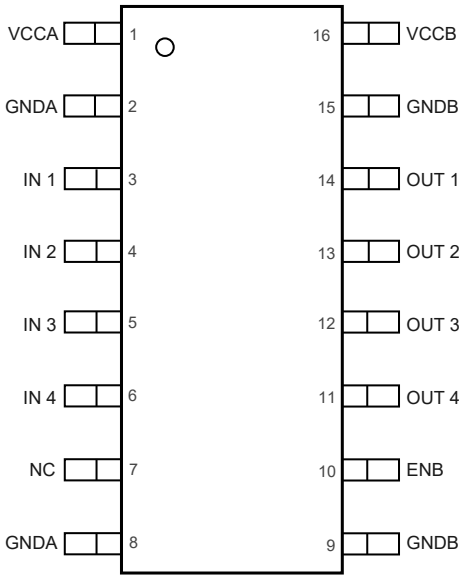
Revision History

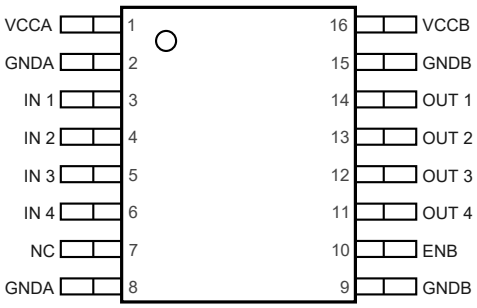
Date	Revision	Notes
2021-08-02	Rev.Pre.0	Initial Version
2022-03-20	Rev.A.0	Released Version
2023-08-15	Rev.A.1	Update supply current characteristics

Pin Configuration and Functions

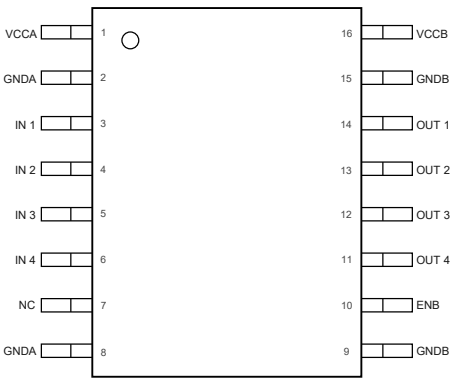
TPT7740
SOP16
Top View



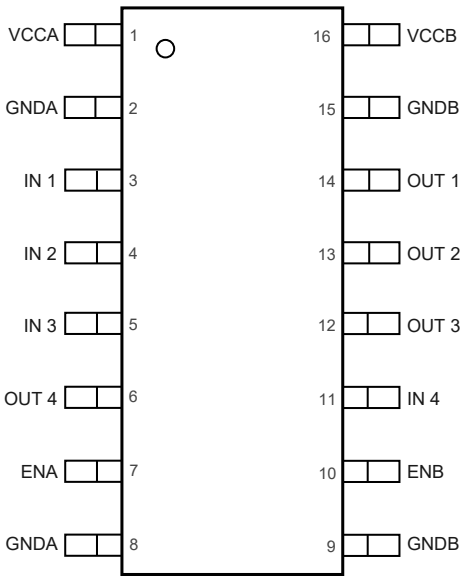
TPT7740
QSOP16
Top View



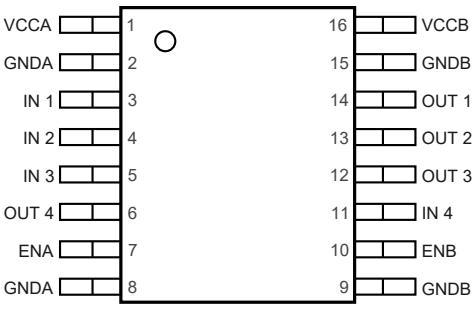
TPT7740
WSOP16
Top View



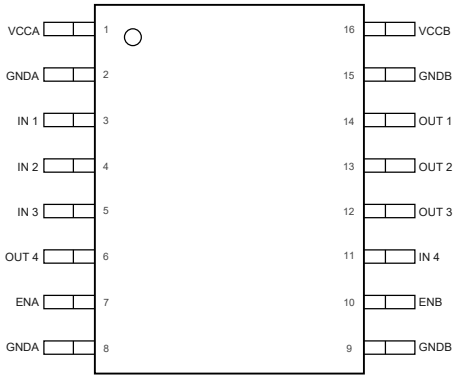
TPT7741
SOP16
Top View



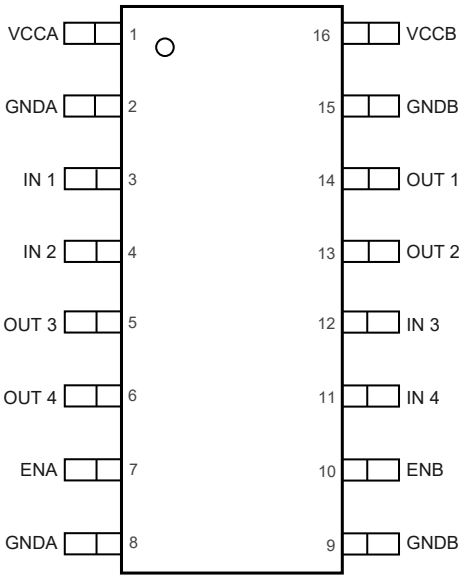
TPT7741
QSOP16
Top View



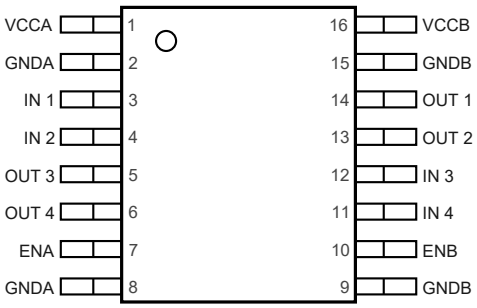
TPT7741
WSOP16
Top View



TPT7742
SOP16
Top View



TPT7742
QSOP16
Top View



TPT7742
WSOP16
Top View

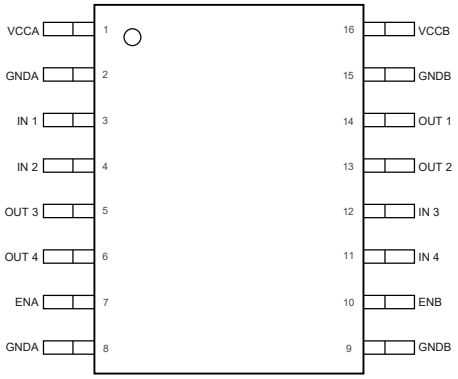


Table 1. Pin Functions: TPT774x

Pin			Name	I/O	Description
TPT7740	TPT7741	TPT7742			
1	1	1	VCCA	−	Power supply, VCCA
2	2	2	GNDA	−	Ground connection for VCCA
3	3	3	IN1	I	Input, channel 1
4	4	4	IN2	I	Input, channel 2
5	5	12	IN3	I	Input, channel 3
6	11	11	IN4	I	Input, channel 4
7	-	-	NC		
-	7	7	ENA	I	Side A enable pin
8	8	8	GNDA	−	Ground connection for VCCA
9	9	9	GNDB	−	Ground connection for VCCB
10	10	10	ENB	I	Side B enable pin
11	6	6	OUT4	O	Output, channel 4
12	12	5	OUT3	O	Output, channel 3
13	13	13	OUT2	O	Output, channel 2
14	14	14	OUT1	O	Output, channel 1
15	15	15	GNDB	−	Ground connection for VCCB
16	16	16	VCCB	−	Power supply, VCCB

(1) ENA: Side A OUTx enable when ENA = high or open, and in high-impedance state when ENA is low.
(2) ENB: Side B OUTx enable when ENB = high or open, and in high-impedance state when ENB is low.

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 INx, OUTx, ENx	−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.
(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	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 data rate tested in lab, although higher data rates are possible.

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
SOP16	79	31	°C/W
QSOP16	112	58	°C/W
WSOP16	93	52	°C/W

Insulation Specifications

Parameter		Conditions	Value			Unit
			SOP16	QSOP16	WSOP16	
CLR	External clearance	Shortest terminal-to-terminal distance through air	> 4.0	> 4.0	> 8.0	mm
CPG	External creepage	Shortest terminal-to-terminal distance across the package surface	> 4.0	> 4.0	> 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	0.45	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-III	I-IV	
		For Rated Mains Voltage ≤ 600 V_{RMS}	I-II	I-II	I-IV	
		For Rated Mains Voltage ≤ 1000 V_{RMS}	I	I	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	637	1414	V_{PK}
V_{IOWM}	Maximum working isolation voltage	AC voltage; TDDB Test	450	450	1000	V_{RMS}
		DC voltage	637	637	1414	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	5300	7070	V_{PK}

Parameter		Conditions	Value			Unit
			SOP16	QSOP16	WSOP16	
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	5980	6500	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 × 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	3750	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 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, QSOP) VIORM= 637 VIOSM= 5980	(WSOP)Single protection, 5000Vrms (SOP, QSOP)Single protection, 3750Vrms	6400Vrms reinforced insulation (WSOP), 800Vrms maximum work voltage. 4000Vrms basic insulation (SOP, QSOP), 400V rms maximum work voltage.	Reinforced insulation (WSOP), Altitude<=5000m,800V rms maximum work voltage. Basic insulation (SOP, QSOP), Altitude<=5000m,400V rms maximum work voltage.	400Vrms basic insulation (SOP, QSOP) 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, QSOP), Altitude<=5000m,400V rms maximum work voltage.
Certificate No. 40054570	Report Reference E524241	Customer Number：2332359	Certificate No. CQC22001332218 CQC22001332219 CQC22001356662	Master contract: 302375	Ref. Certif. No. CN57659 CN56354 CN56355

Safety Limiting Values

Parameter	Conditions (1)	Min	Typ	Max	Unit
Safety Supply Current	$R_{\theta JA}$ = 79°C/W, V_I = 5 V, T_J = 150°C, T_A = 25°C (SOP16)	-	-	316.4	mA
	$R_{\theta JA}$ = 112°C/W, V_I = 5 V, T_J = 150°C, T_A = 25°C (QSOP16)	-	-	223.2	
	$R_{\theta JA}$ = 93°C/W, V_I = 5 V, T_J = 150°C, T_A = 25°C (WSOP16)	-	-	268.8	
Safety Total Power	$R_{\theta JA}$ = 79°C/W, T_J = 150°C, T_A = 25°C (SOP16)	-	-	1582.2	mW
	$R_{\theta JA}$ = 112°C/W, T_J = 150°C, T_A = 25°C (QSOP16)	-	-	1116.0	
	$R_{\theta JA}$ = 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, INx	2.0	-	-	V
V_{IL}	Logic Input Low Voltage	Input signal, INx	-	-	0.8	V
V_{IT+}	Rising Input Threshold Voltage	Input signal, INx	-	1.6	2	V
V_{IT-}	Falling Input Threshold Voltage	Input signal, INx	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 INx(1)	-	2.5	10	μA
I_{IL}	Low-Level Input Current	V_{IL} = 0 V at INx(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 OUTx	V_{CCB} – 0.4	V_{CCB} – 0.2	-	V
		V_{CCB} = 3.3 V ± 10%, I_{OH} = –2 mA; Test OUTx	V_{CCB} – 0.3	V_{CCB} – 0.15	-	
		V_{CCB} = 2.5 V ± 10%, I_{OH} = –1 mA; Test OUTx	V_{CCB} – 0.2	V_{CCB} – 0.1	-	
V_{OL}	Low-Level Output Voltage	V_{CCB} = 5 V ± 10%, I_{OL} = 4 mA; Test OUTx	-	0.2	0.4	V
		V_{CCB} = 3.3 V ± 10%, I_{OL} = 2 mA; Test OUTx	-	0.15	0.3	
		V_{CCB} = 2.5 V ± 10%, I_{OL} = 1 mA; Test OUTx	-	0.1	0.2	
CMTI	Common-Mode Transient Immunity	Static CMTI	150	200	-	kV/μs
		Dynamic CMTI	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	22	ns
t_{PHL}	Propagation delay time		-	12	22	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 (1)(2)	Same direction channels	-	-	2.5	ns
$t_{sk(PP)}$	Channel-to-channel output skew time (1)(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
t_{PHZ}	Disable propagation delay, high-to-high impedance output	C_L= 15pF ， R_L= 1K	-	20	40	ns
t_{PLZ}	Disable propagation delay, low-to-high impedance output	C_L= 15pF ， R_L= 1K	-	18	40	ns
t_{PZH}	Enable propagation delay, high impedance-to-high output	C_L= 15pF ， R_L= 1K	-	10.4	40	ns
t_{PZL}	Enable propagation delay, high impedance-to-low output	C_L= 15pF ， R_L= 1K	-	8.6	40	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 V_{CC} goes below 1.7 V	-	30	80	ns
t_{SU}	Setup time		-	28	80	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
TPT7740							
Supply current - DC signal	V_I = 0 V(TPT774xF) V_I = VCC_I(TPT774x)		I_{CCA}	-	1.8	2.8	mA
			I_{CCB}	-	3.5	7.2	
	V_I = VCC_I(TPT774xF) V_I = 0 V(TPT774x)		I_{CCA}	-	9.5	24.3	
			I_{CCB}	-	3.9	6.5	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}	-	7.8	13.1	
			I_{CCB}	-	4.6	6.9	
		10 Mbps	I_{CCA}	-	8.0	11.1	
			I_{CCB}	-	6.6	10.3	
		100 Mbps	I_{CCA} (1)	-	10.6	14.7	
			I_{CCB} (1)	-	24.1	33.4	
TPT7741							
Supply current - DC signal	V_I = 0 V(TPT774xF) V_I = VCC_I(TPT774x)		I_{CCA}	-	2.4	4.1	mA
			I_{CCB}	-	4.3	6.7	
	V_I = VCC_I(TPT774xF) V_I = 0 V(TPT774x)		I_{CCA}	-	12.0	16.2	
			I_{CCB}	-	7.0	10.0	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}	-	7.3	10.2	
			I_{CCB}	-	5.9	8.8	
		10 Mbps	I_{CCA}	-	8.9	11.0	
			I_{CCB}	-	7.9	10.5	
		100 Mbps	I_{CCA} (1)	-	11.9	15.2	
			I_{CCB} (1)	-	22	24.4	
TPT7742							
Supply current - DC signal	V_I = 0 V(TPT774xF) V_I = VCC_I(TPT774x)		I_{CCA}, I_{CCB}	-	3.2	5.5	mA
	V_I = VCC_I(TPT774xF) V_I = 0 V(TPT774x)		I_{CCA}, I_{CCB}	-	9.7	13.4	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}, I_{CCB}	-	6.4	9.4	
		10 Mbps	I_{CCA}, I_{CCB}	-	7.6	11.0	
		100 Mbps	I_{CCA}, I_{CCB} (1)	-	16.7	23.1	

(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	22	ns
t_{PHL}	Propagation delay time		-	12.2	22	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 (1)(2)	Same direction channels	-	-	2.5	ns
$t_{sk(PP)}$	Channel-to-channel output skew time (1)(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
t_{PHZ}	Disable propagation delay, high-to-high impedance output	C_L= 15 pF , R_L= 1 K	-	20	40	ns
t_{PLZ}	Disable propagation delay, low-to-high impedance output	C_L= 15 pF , R_L= 1 K	-	18.5	40	ns
t_{PZH}	Enable propagation delay, high impedance-to-high output	C_L= 15 pF , R_L= 1 K	-	14.9	40	ns
t_{PZL}	Enable propagation delay, high impedance-to-low output	C_L= 15 pF , R_L= 1 K	-	13.5	40	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 V_{CC} goes below 1.7 V.	-	30	80	ns
t_{SU}	Setup time		-	28	80	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 − 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
TPT7740							
Supply current - DC signal	V_I = 0 V(TPT774xF) V_I = VCC_I(TPT774x)		I_{CCA}	-	1.5	2.7	mA
			I_{CCB}	-	3.1	7.2	
	V_I = VCC_I(TPT774xF) V_I = 0 V(TPT774x)		I_{CCA}	-	8.7	24.1	
			I_{CCB}	-	3.4	6.5	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}	-	7.8	13.1	
			I_{CCB}	-	4.4	6.5	
		10 Mbps	I_{CCA}	-	8.1	11.0	
			I_{CCB}	-	5.6	8.0	
		100 Mbps	I_{CCA} (1)	-	9.6	14.3	
			I_{CCB} (1)	-	16.6	23.0	
TPT7741							
Supply current - DC signal	V_I = 0 V(TPT774xF) V_I = VCC_I(TPT774x)		I_{CCA}	-	2.7	4.1	mA
			I_{CCB}	-	4.3	6.6	
	V_I = VCC_I(TPT774xF) V_I = 0 V(TPT774x)		I_{CCA}	-	12.0	16.0	
			I_{CCB}	-	6.9	9.8	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}	-	7.2	10.1	
			I_{CCB}	-	5.7	8.7	
		10 Mbps	I_{CCA}	-	8.4	10.5	
			I_{CCB}	-	7.1	9.8	
		100 Mbps	I_{CCA} (1)	-	10.7	15.1	
			I_{CCB} (1)	-	15.4	21.3	
TPT7742							
Supply current - DC signal	V_I = 0 V(TPT774xF) V_I = VCC_I(TPT774x)		I_{CCA}, I_{CCB}	-	3.2	5.4	mA
	V_I = VCC_I(TPT774xF) V_I = 0 V(TPT774x)		I_{CCA}, I_{CCB}	-	9.1	12.75	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}, I_{CCB}	-	6.3	9.3	
		10 Mbps	I_{CCA}, I_{CCB}	-	7.0	11.0	
		100 Mbps	I_{CCA}, I_{CCB} (1)	-	13.1	18.1	

(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 (1)(2)	Same direction channels	-	-	2.5	ns
$t_{sk(PP)}$	Channel-to-channel output skew time (1)(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
t_{PHZ}	Disable propagation delay, high-to-high impedance output	C_L= 15 pF , R_L= 1 K	-	24.5	40	ns
t_{PLZ}	Disable propagation delay, low-to-high impedance output	C_L= 15 pF , R_L= 1 K	-	21.5	40	ns
t_{PZH}	Enable propagation delay, high impedance-to-high output	C_L= 15 pF , R_L= 1 K	-	20	40	ns
t_{PZL}	Enable propagation delay, high impedance-to-low output	C_L= 15 pF , R_L= 1 K	-	17.7	40	ns
Jitter	Eye jitter p-p (1)	f_{data} = 100 Mbps	-	350	-	ps
t_{DO}	Default output delay time from input power loss	Measured from the time V_{CC} goes below 1.7 V.	-	30	80	ns
t_{SU}	Setup time		-	28	80	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 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
TPT7740							
Supply current - DC signal	V_I = 0 V(TPT774xF) V_I = VCC_I(TPT774x)		I_{CCA}	-	1.4	2.7	mA
			I_{CCB}	-	3.1	7.1	
	V_I = VCC_I(TPT774xF) V_I = 0 V(TPT774x)		I_{CCA}	-	8.4	18.0	
			I_{CCB}	-	3.2	6.5	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}	-	7.7	13.1	
			I_{CCB}	-	4.5	6.5	
		10 Mbps	I_{CCA}	-	8.1	10.2	
			I_{CCB}	-	5.4	8.0	
		100 Mbps	I_{CCA} (1)	-	10.1	14.0	
			I_{CCB} (1)	-	13.1	18.1	
TPT7741							
Supply current - DC signal	V_I = 0 V(TPT774xF) V_I = VCC_I(TPT774x)		I_{CCA}	-	2.7	4.0	mA
			I_{CCB}	-	4.3	6.5	
	V_I = VCC_I(TPT774xF) V_I = 0 V(TPT774x)		I_{CCA}	-	11.9	15.7	
			I_{CCB}	-	6.9	9.6	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}	-	7.2	10.0	
			I_{CCB}	-	5.7	8.2	
		10 Mbps	I_{CCA}	-	8.2	10.5	
			I_{CCB}	-	6.8	9.1	
		100 Mbps	I_{CCA} (1)	-	10.9	15.0	
			I_{CCB} (1)	-	13.4	18.6	
TPT7742							
Supply current - DC signal	V_I = 0 V(TPT774xF) V_I = VCC_I(TPT774x)		I_{CCA}, I_{CCB}	-	3.2	5.3	mA
	V_I = VCC_I(TPT774xF) V_I = 0 V(TPT774x)		I_{CCA}, I_{CCB}	-	8.3	12.5	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}, I_{CCB}	-	6.3	9.1	
		10 Mbps	I_{CCA}, I_{CCB}	-	6.8	9.75	
		100 Mbps	I_{CCA}, I_{CCB} (1)	-	11.3	15.6	

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

Test Circuits and Waveforms

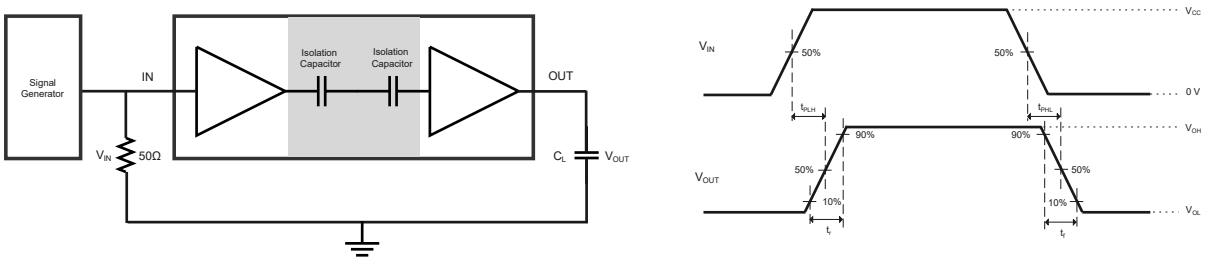


Figure 1. Swtiching Characteristics Test circuit and Waveforms

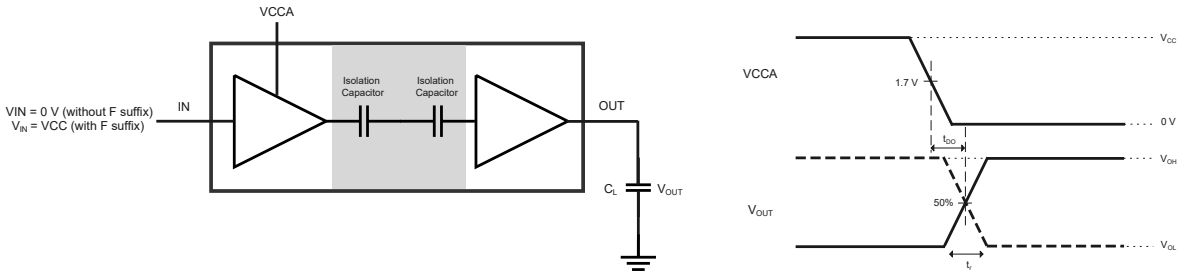


Figure 2. Default Output Delay Time Test Circuit and Voltage Waveforms

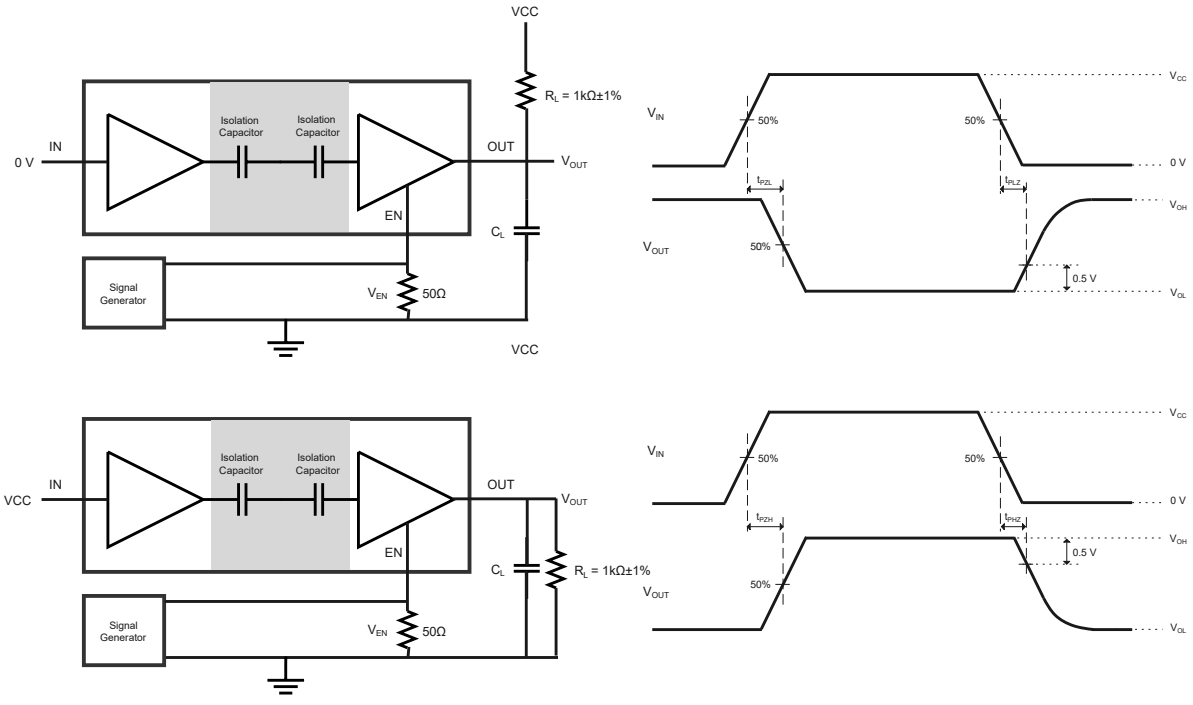


Figure 3. Enable/Disable propagation delay Test circuit and Waveforms

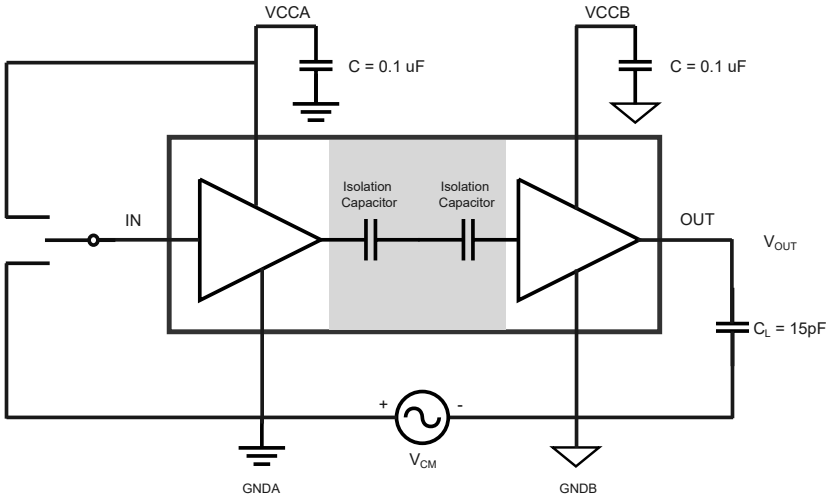


Figure 4. Common-Mode Transient Immunity Test Circuit

Detailed Description

Overview

The TPT774x 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

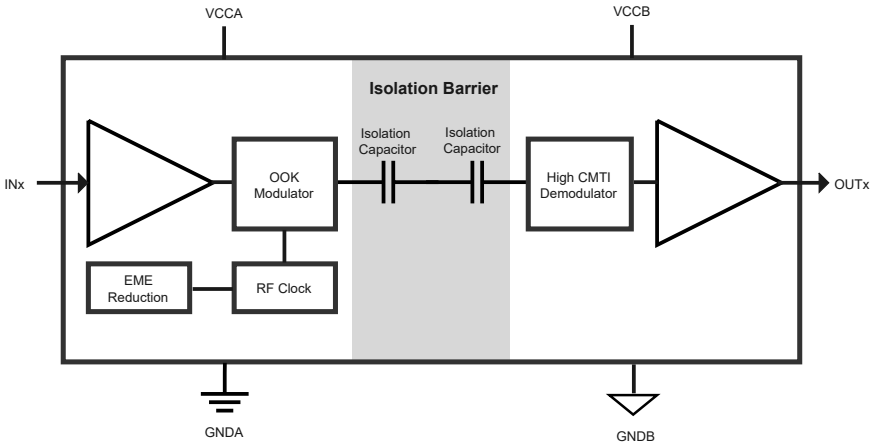


Figure 5. Block Diagram of Digital Capacitive Isolator

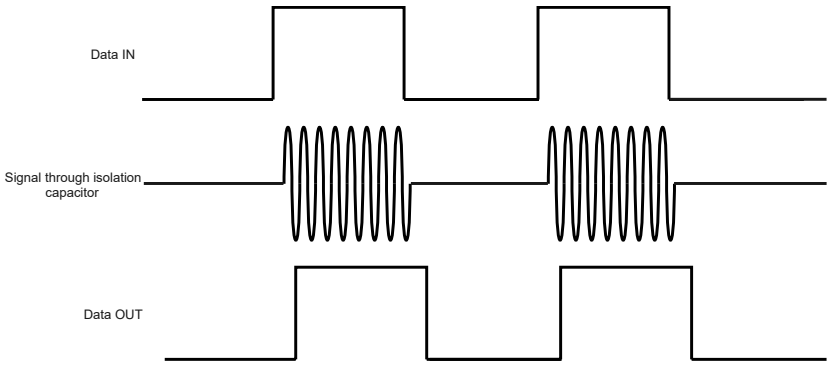


Figure 6. On-Off Keying (OOK) based Modulation Scheme

Feature Description

The TPT774x 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 TPT774x devices.

Part Number	Max Data rate	Channel Direction	Default Output State	Package	Rating Isolation
TPT7740	150 Mbps	4 Forward, 0 Reverse	High	WSOP16	5000 V_{RMS} / 7070 V_{PK}
				QSOP16	3750 V_{RMS} / 5300 V_{PK}
				SOP16	3750 V_{RMS} / 5300 V_{PK}
TPT7740F	150 Mbps	4 Forward, 0 Reverse	Low	WSOP16	5000 V_{RMS} / 7070 V_{PK}
				QSOP16	3750 V_{RMS} / 5300 V_{PK}
				SOP16	3750 V_{RMS} / 5300 V_{PK}
TPT7741	150 Mbps	3 Forward, 1 Reverse	High	WSOP16	5000 V_{RMS} / 7070 V_{PK}
				QSOP16	3750 V_{RMS} / 5300 V_{PK}
				SOP16	3750 V_{RMS} / 5300 V_{PK}
TPT7741F	150 Mbps	3 Forward, 1 Reverse	Low	WSOP16	5000 V_{RMS} / 7070 V_{PK}
				QSOP16	3750 V_{RMS} / 5300 V_{PK}
				SOP16	3750 V_{RMS} / 5300 V_{PK}
TPT7742	150 Mbps	2 Forward, 2 Reverse	High	WSOP16	5000 V_{RMS} / 7070 V_{PK}
				QSOP16	3750 V_{RMS} / 5300 V_{PK}
				SOP16	3750 V_{RMS} / 5300 V_{PK}
TPT7742F	150 Mbps	2 Forward, 2 Reverse	Low	WSOP16	5000 V_{RMS} / 7070 V_{PK}
				QSOP16	3750 V_{RMS} / 5300 V_{PK}
				SOP16	3750 V_{RMS} / 5300 V_{PK}

Device Functional Modes

The below table lists the functional modes for the TPT774x devices.

VCC_I	VCC_O	Input (INx)	Enable (ENA, ENB)	Output (OUTx)	Comments
Power up	Power up	High	High or Open	High	Normal Operation.
		Low	High or Open	Low	
		Open	High or Open	Default	Default mode. The default is High for TPT774x and Low for TPT774xF.
X	Power up	X	Low	Z	Disabled output is high impedence.
Power down	Power up	X	High or Open	Default	Default mode. When VCC_I is unpowered, the default is High for TPT774x and Low for TPT774xF.
X	Power down	X	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);
(2) X = Irrelevant; Z = High impedence
(3) 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 TPT774x typical application. The two external bypass capacitors need to be close to the VCC power pin. The maximum distance is 2 mm.

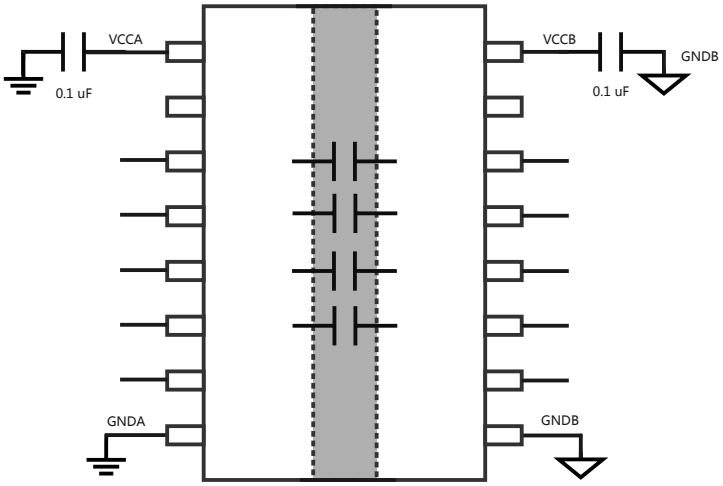
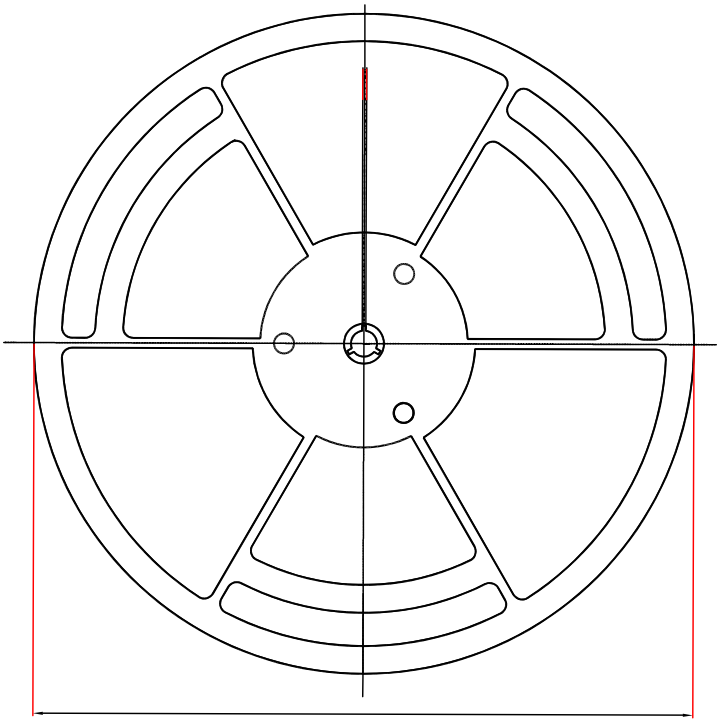
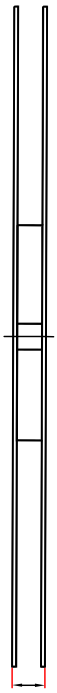
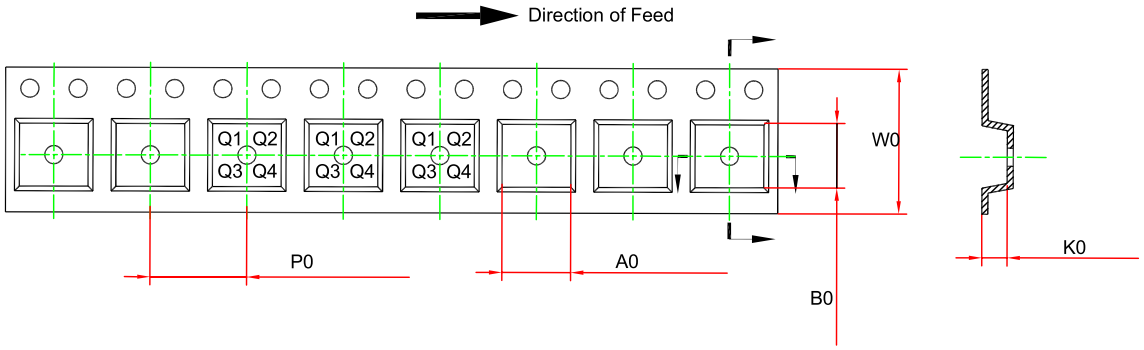


Figure 7. Typical Application

Tape and Reel Information







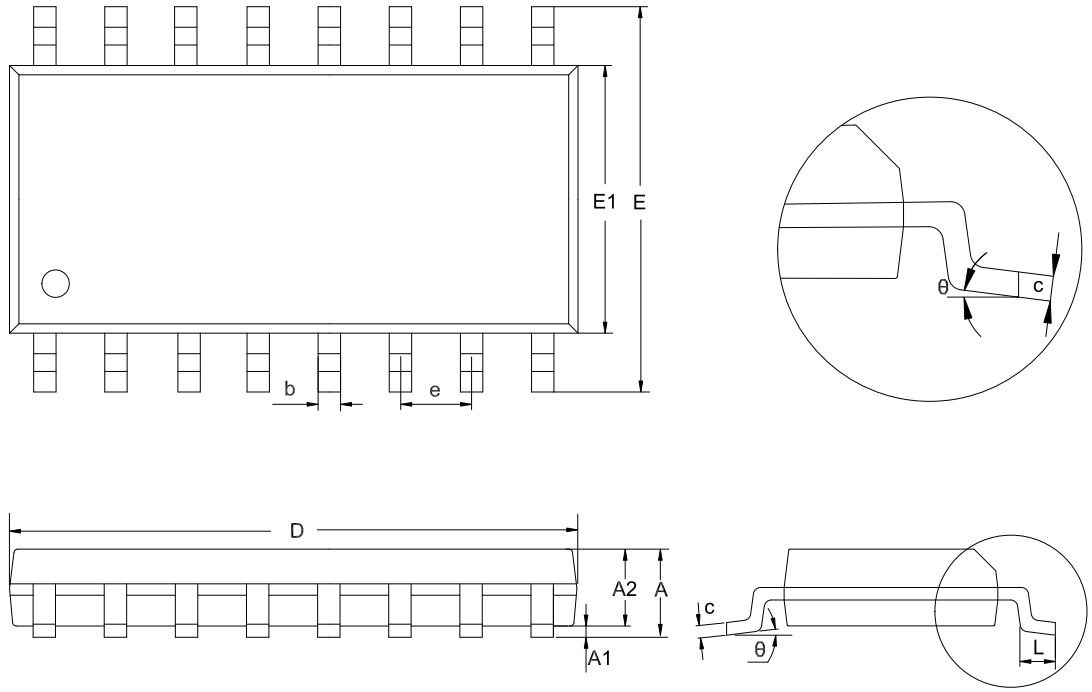
Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPT7740-SO3R	SOP16	330	21.6	6.7	10.4	2.1	8.0	16.0	Q1
TPT7740F-SO3R	SOP16	330	21.6	6.7	10.4	2.1	8.0	16.0	Q1
TPT7741-SO3R	SOP16	330	21.6	6.7	10.4	2.1	8.0	16.0	Q1
TPT7741F-SO3R	SOP16	330	21.6	6.7	10.4	2.1	8.0	16.0	Q1
TPT7742-SO3R	SOP16	330	21.6	6.7	10.4	2.1	8.0	16.0	Q1
TPT7742F-SO3R	SOP16	330	21.6	6.7	10.4	2.1	8.0	16.0	Q1
TPT7740-SSAR	QSOP16	330	17.6	6.4	5.4	2.1	8.0	12.0	Q1

Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPT7740F- SSAR	QSOP16	330	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPT7741- SSAR	QSOP16	330	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPT7741F- SSAR	QSOP16	330	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPT7742- SSAR	QSOP16	330	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPT7742F- SSAR	QSOP16	330	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPT7740-SOBR	WSOP16	330	22.4	10.9	10.8	3.0	12.0	16.0	Q1
TPT7740F-SOBR	WSOP16	330	22.4	10.9	10.8	3.0	12.0	16.0	Q1
TPT7741-SOBR	WSOP16	330	22.4	10.9	10.8	3.0	12.0	16.0	Q1
TPT7741F-SOBR	WSOP16	330	22.4	10.9	10.8	3.0	12.0	16.0	Q1
TPT7742-SOBR	WSOP16	330	22.4	10.9	10.8	3.0	12.0	16.0	Q1
TPT7742F-SOBR	WSOP16	330	22.4	10.9	10.8	3.0	12.0	16.0	Q1

Package Outline Dimensions

SOP16

Package Outline Dimensions SO3(SOP-16-A)



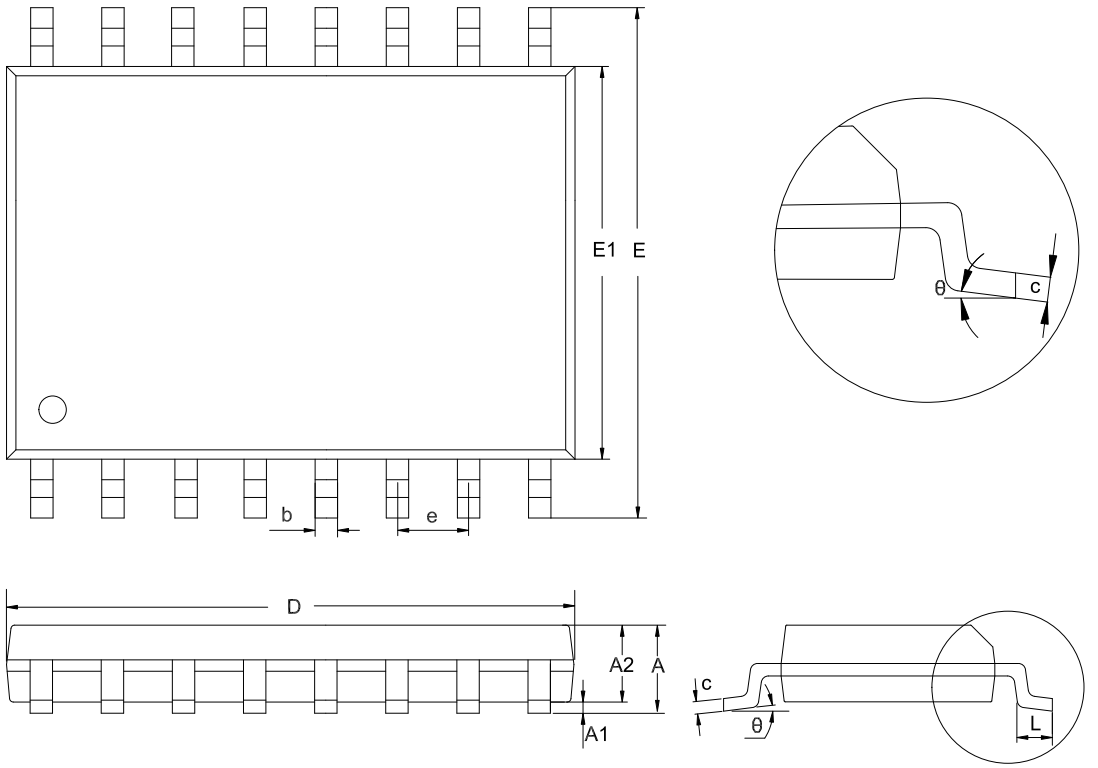
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.050	0.250	0.002	0.010
A2	1.300	1.600	0.051	0.063
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	9.800	10.000	0.386	0.394
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	1.270 BSC		0.050 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.

QSOP16

Package Outline Dimensions SSA(QSOP-16-A)



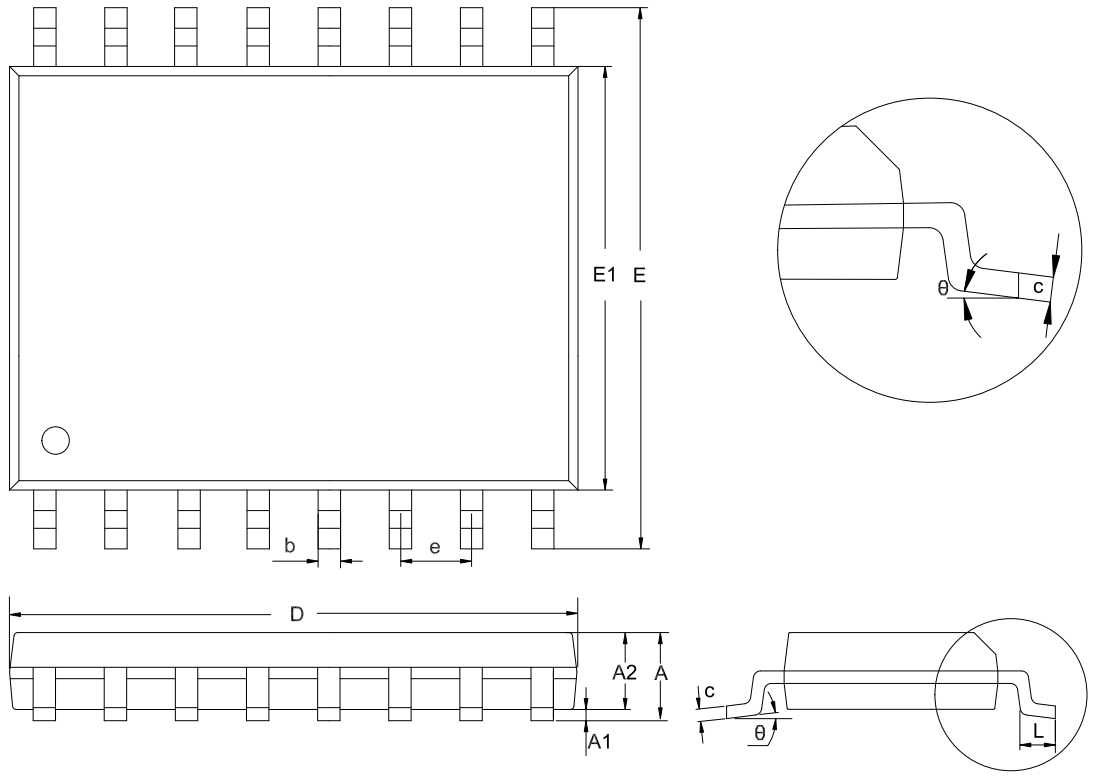
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.050	0.250	0.002	0.010
A2	1.300	1.500	0.051	0.059
b	0.230	0.310	0.009	0.012
c	0.170	0.250	0.007	0.010
D	4.800	5.000	0.189	0.197
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	0.635 BSC		0.025 BSC	
L	0.400	0.800	0.016	0.031
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.

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPT7740-SO3R	−40 to 125°C	16-Pin SOP	T7740	MSL3	Tape and Reel, 2500	Green
TPT7740F-SO3R	−40 to 125°C	16-Pin SOP	7740F	MSL3	Tape and Reel, 2500	Green
TPT7741-SO3R	−40 to 125°C	16-Pin SOP	T7741	MSL3	Tape and Reel, 2500	Green
TPT7741F-SO3R	−40 to 125°C	16-Pin SOP	7741F	MSL3	Tape and Reel, 2500	Green
TPT7742-SO3R	−40 to 125°C	16-Pin SOP	T7742	MSL3	Tape and Reel, 2500	Green
TPT7742F-SO3R	−40 to 125°C	16-Pin SOP	7742F	MSL3	Tape and Reel, 2500	Green
TPT7740-SSAR	−40 to 125°C	16-Pin QSOP	T7740	MSL3	Tape and Reel, 4000	Green
TPT7740F-SSAR	−40 to 125°C	16-Pin QSOP	7740F	MSL3	Tape and Reel, 4000	Green
TPT7741-SSAR	−40 to 125°C	16-Pin QSOP	T7741	MSL3	Tape and Reel, 4000	Green
TPT7741F-SSAR	−40 to 125°C	16-Pin QSOP	7741F	MSL3	Tape and Reel, 4000	Green
TPT7742-SSAR	−40 to 125°C	16-Pin QSOP	T7742	MSL3	Tape and Reel, 4000	Green
TPT7742F-SSAR	−40 to 125°C	16-Pin QSOP	7742F	MSL3	Tape and Reel, 4000	Green
TPT7740-SOBR	−40 to 125°C	16-Pin WSOP	T7740	MSL3	Tape and Reel, 1500	Green
TPT7740F-SOBR	−40 to 125°C	16-Pin WSOP	7740F	MSL3	Tape and Reel, 1500	Green
TPT7741-SOBR	−40 to 125°C	16-Pin WSOP	T7741	MSL3	Tape and Reel, 1500	Green
TPT7741F-SOBR	−40 to 125°C	16-Pin WSOP	7741F	MSL3	Tape and Reel, 1500	Green
TPT7742-SOBR	−40 to 125°C	16-Pin WSOP	T7742	MSL3	Tape and Reel, 1500	Green
TPT7742F-SOBR	−40 to 125°C	16-Pin WSOP	7742F	MSL3	Tape and Reel, 1500	Green

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

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