4-Channel Reinforced High-Performance Digital Isolator

Features

- Data Rate: up to 100 Mbps
- Wide Supply Range: 2.25 V to 5.5 V
- Wide Temperature Range: −40°C to +125°C
- Low Power Consumption: Typical 1.6 mA per Channel at 1 Mbps
- Low Propagation Delay: Typical 13 ns at 5 V Supply
- CMTI: Typical ±200 kV/μs (Static), ±150 kV/μs (Dynamic)
- Standout Transient Isolation Voltage: 12000 V_{PK} for WWSOP, 9191 V_{PK} for WSOP (100% Production)
- Standout Surge Immunity: 12000 V_{PK}
- Over 30-year Projected Lifetime under Working Voltage of 2000 V_{RMS} for WWSOP, 1500 V_{RMS} for WSOP
- Wide Creepage and Clearance: Nominal 16.0 mm for WWSOP, 9.5 mm for WSOP, 5.2 mm for SOP and QSOP
- Robust Electromagnetic Compatibility (EMC)
- Low Emissions, CISPR32 Class B Qualified
- System-level ESD and EFT Immunity
- Default Output High (TPT764x) and Low (TPT764xF)
- Wide Package Range: WSOP16, WWSOP16, SOP16, QSOP16
- Safety-related Certifications:
  - Reinforced Isolation according to DIN VDE V 0884-17 (IEC 60747-17)
  - Isolation for 1 minute per UL 1577: 8000 V_{RMS} (WWSOP16), 6500 V_{RMS} (WSOP16), 3750 V_{RMS} (SOP16, QSOP16)
  - CQC Certification per GB 4943.1
  - CSA, TUV, and CB Certifications

Applications

- Solar Inverters
- Wind Power Generation
- Energy Storage
- Power System
- DC Charger
- Isolated Interface and General-purpose Isolation

Description

The TPT764x devices are high-performance, 4-channel digital isolators with 8000 V_{RMS} (WWSOP16), 6500 V_{RMS} (WSOP16), and 3750 V_{RMS} (SOP16, QSOP16) isolation ratings per UL 1577. These devices are also certified by VDE, CSA, TUV, CQC, and CB.

The TPT764x 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 TPT7640 device has four channels in forward direction. The TPT7641 device has three channels in forward direction and one channel in reverse direction. The TPT7642 device has two channels in forward direction and two channels in reverse 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.

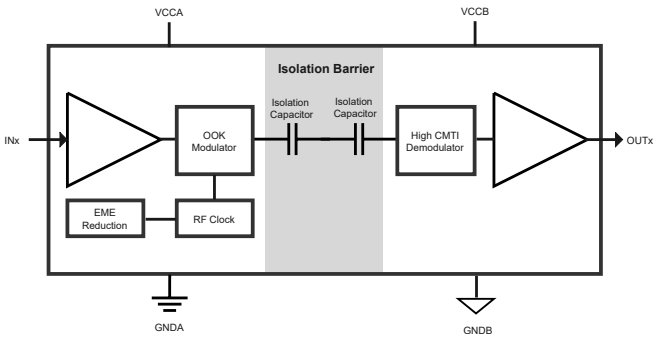
The common mode transient immunity (CMTI) and electromagnetic compatibility of the TPT764x devices have been significantly enhanced through innovative circuit design and optimized structure.

The TPT764x family is available in SOP16, QSOP16, WSOP16, and WWSOP16 packages, and is characterized from −40°C to +125°C.

Part Number	Package (1)	Body Size (Nominal)
TPT764x TPT764xF	SOP16	9.90 mm × 3.90 mm
	QSOP16	4.90 mm × 3.90 mm
	WSOP16	10.30 mm × 7.50 mm
	WWSOP16	10.30 mm × 14.00 mm

(1) For all available packages, see Order Information at the end of the datasheet.

Functional Block Diagram



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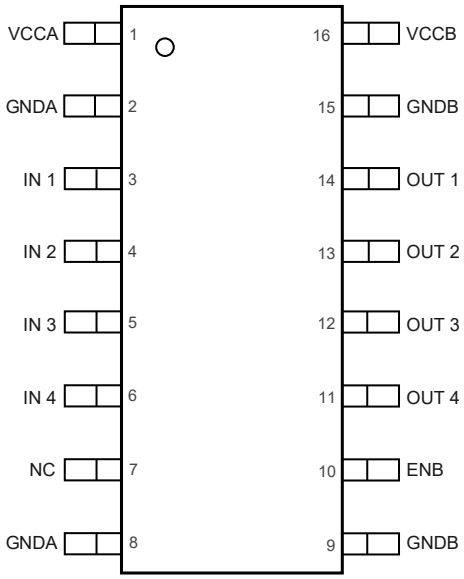
Revision History

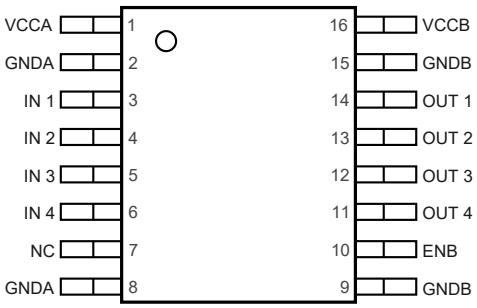
Date	Revision	Notes
2025-08-30	Rev.A.0	Released version.

Pin Configuration and Functions

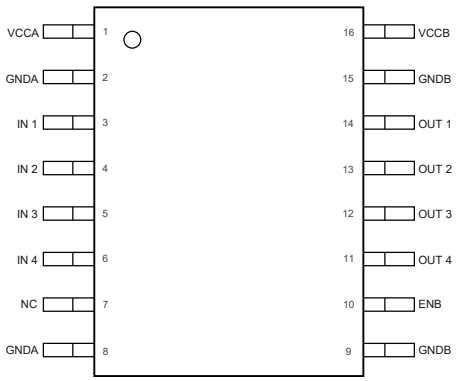
TPT7640 / TPT7640F
SOP16
Top View



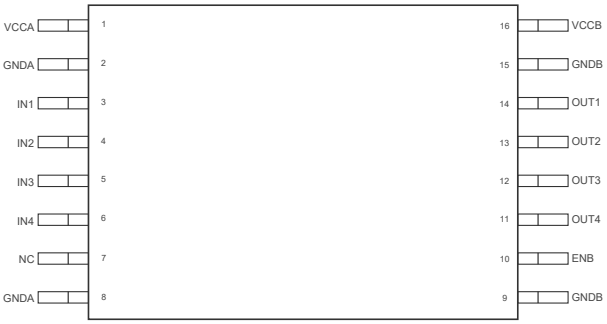
TPT7640 / TPT7640F
QSOP16
Top View



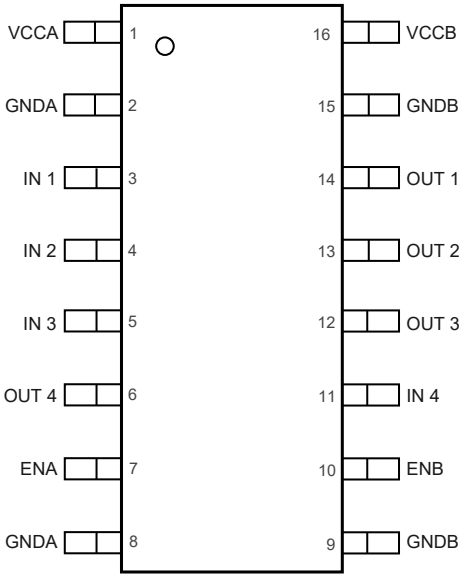
TPT7640 / TPT7640F
WSOP16
Top View



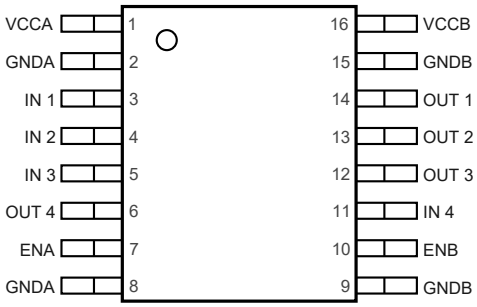
TPT7640 / TPT7640F
WWSOP16
Top View



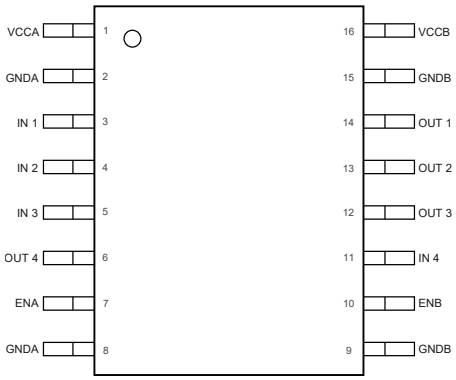
TPT7641 / TPT7641F
SOP16
Top View



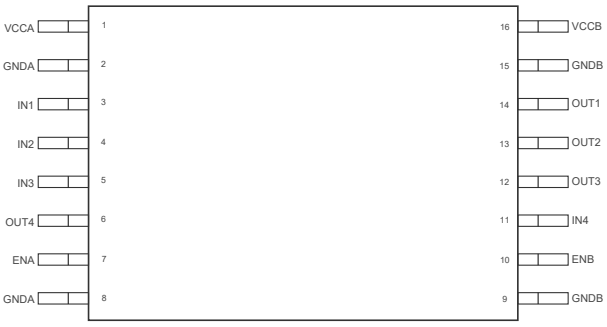
TPT7641 / TPT7641F
QSOP16
Top View



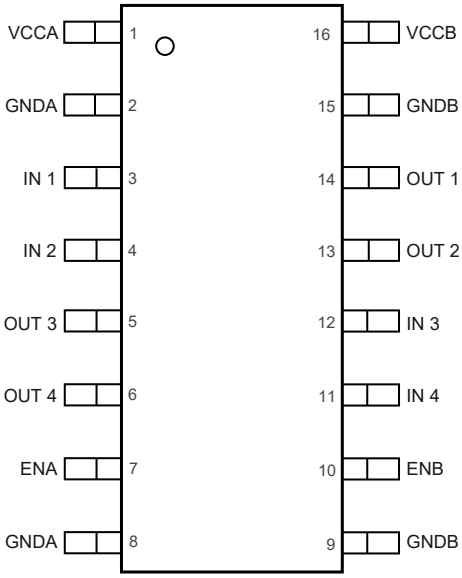
TPT7641 / TPT7641F
WSOP16
Top View



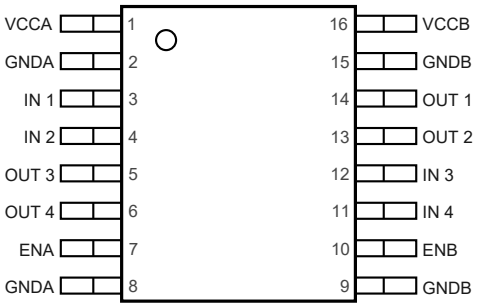
TPT7641 / TPT7641F
WWSOP16
Top View



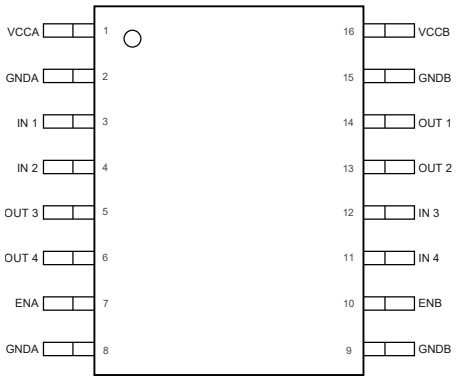
TPT7642 / TPT7642F
SOP16
Top View



TPT7642 / TPT7642F
QSOP16
Top View



TPT7642 / TPT7642F
WSOP16
Top View



TPT7642 / TPT7642F
WWSOP16
Top View

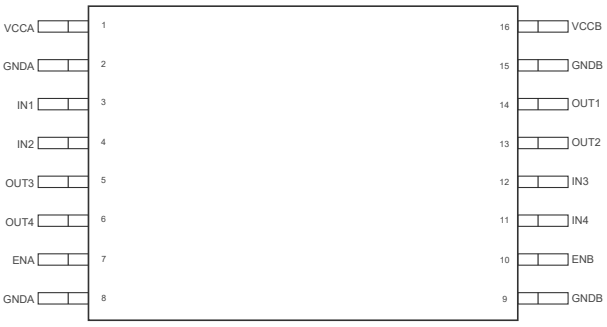


Table 1. Pin Functions: TPT764x

Pin			Name	I/O	Description
TPT7640 TPT7640F	TPT7641 TPT7641F	TPT7642 TPT7642F			
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	-	Not Connected
-	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 are enabled when ENA is high or open, and in high-impedance state when ENA is low.
(2) ENB: Side-B OUTx are enabled when ENB is 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.

ESD, Electrostatic Discharge Protection

Parameter		Condition	Value	Unit
HBM	HBM, per ANSI/ ESDA/ JEDEC JS-001/ ANSI/ ESD STM5.5.1 (1)	All Pins	±8	kV
CDM	CDM, per ANSI/ ESDA/ JEDEC JS-002 (2)	All Pins	±2	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_{CCX}	Supply Voltage, V_{CCA}, V_{CCB}		2.25	-	5.5	V
$V_{CC(UVLO+)}$	UVLO threshold when the supply voltage is rising (1)		-	2	2.22	V
$V_{CC(UVLO-)}$	UVLO threshold when the supply voltage is falling (1)		1.8	1.9	-	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)		0.7 * V_{CC}	-	V_{CC}	V
V_{IL}	Low-level Input Voltage (Data Input)		0	-	0.3 * V_{CC}	V

Parameter		Min	Typ	Max	Unit
f_{data}	Data Rate (2)	0	-	100	Mbps
T_A	Operating Ambient Temperature	−40	25	125	°C

(1) $V_{CC(UVLO+)}$, $V_{CC(UVLO+)}$, $V_{HYS(UVLO)}$ are same to V_{CCA} and V_{CCB};
(2) 100 Mbps is the data rate tested in the lab, although higher data rates are possible.

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
SOP16	58.79	27.28	°C/W
QSOP16	76.74	35.60	°C/W
WSOP16	59.09	22.58	°C/W
WWSOP16	50.24	18.77	°C/W

Insulation Specifications

Parameter		Test Conditions	Value				Unit
			SOP16	QSOP16	WSOP16	WWSOP16	
IEC 60664-1							
CLR	External clearance (1)	Shortest terminal-to-terminal distance through air, nominal	5.2	5.2	9.5	16.0	mm
CPG	External creepage (1)	Shortest terminal-to-terminal distance across the package surface, nominal	5.2	5.2	9.5	16.0	mm
DTI	Distance through the insulation	Minimum internal gap (internal clearance)	> 22	> 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	0.8	mm
CTI	Comparative tracking index	IEC 60112	> 600	> 600	> 600	> 600	V
	Material group	According to IEC 60664-1	I	I	I	I	
	Overvoltage category per IEC 60664-1	Rated mains voltage ≤ 150 V_{RMS}	I-IV	I-IV	I-IV	I-IV	
		Rated mains voltage ≤ 300 V_{RMS}	I-III	I-III	I-IV	I-IV	
		Rated mains voltage ≤ 600 V_{RMS}	I-II	I-II	I-IV	I-IV	
		Rated mains voltage ≤ 1000 V_{RMS}	I	I	I-III	I-IV	
DIN EN IEC 60747-17 (VDE 0884-17) (2)							
V_{IORM}	Maximum repetitive peak isolation voltage	AC voltage (bipolar)	707	707	2121	2828	V_{PK}

Parameter		Test Conditions	Value				Unit
			SOP16	QSOP16	WSOP16	WWSOP16	
V_{IOWM}	Maximum working isolation voltage	AC voltage; Time dependent dielectric breakdown (TDDB) Test	500	500	1500	2000	V_{RMS}
		DC voltage	707	707	2121	2828	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	9191	12000	V_{PK}
V_{IMP}	Maximum impulse voltage (3)	Tested in air, 1.2/50 μs waveform per IEC 62368-1	8000	8000	9000	9000	V_{PK}
V_{IOSM}	Maximum surge isolation voltage (4)	$V_{IOSM} \geq 1.3 \times V_{IMP}$; tested in oil (qualification test), 1.2/50 μs waveform per IEC 62368-1	12000	12000	12000	12000	V_{PK}
q_{pd}	Apparent charge (5)	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	≤ 5	≤ 5	≤ 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	≤ 5	≤ 5	≤ 5	
		Method b: At routine test (100% production); $V_{ini} = 1.2 \times V_{IOTM}$, t_{ini} = 1 s; $V_{pd(m)} = 1.875 \times V_{IORM}$, t_m = 1 s (method b1) or $V_{pd(m)} = V_{ini}$, $t_m = t_{ini}$ (method b2)	≤ 5	≤ 5	≤ 5	≤ 5	
C_{IO}	Barrier capacitance, input to output (6)	V_{IO} = 0.4 × sin (2πft), f = 1 MHz	~0.5	~0.5	~0.5	~0.5	pF
R_{IO}	Isolation resistance, input to output (6)	V_{IO} = 500 V, T_A = 25°C	> 10^{12}	> 10^{12}	> 10^{12}	> 10^{12}	Ω
		V_{IO} = 500 V, 100°C ≤ T_A ≤ 125°C	> 10^{11}	> 10^{11}	> 10^{11}	> 10^{11}	Ω
		V_{IO} = 500 V at T_S = 150°C	> 10^9	> 10^9	> 10^9	> 10^9	Ω
	Pollution degree		2	2	2	2	
	Climatic category		-40/125/21	-40/125/21	-40/125/21	-40/125/21	
UL 1577							
V_{ISO}	Withstand isolation voltage	$V_{TEST} = V_{ISO}$, t = 60 s (qualification); $V_{TEST} = 1.2 \times V_{ISO}$, t = 1 s (100% production)	3750	3750	6500	8000	V_{RMS}

(1) Creepage and clearance requirements should be applied according to the specific equipment isolation standards of an application. Care should be taken to maintain the creepage and clearance distance of a board design to ensure that the mounting pads of the isolator on the printed-circuit board do not reduce this distance. Creepage and clearance on a printed-circuit board become equal in certain cases. Techniques such as inserting grooves, ribs, or both on a printed circuit board are used to help increase these specifications.

(2) This coupler is suitable for safe electrical insulation only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.
(3) Testing is carried out in air to determine the surge immunity of the package.
(4) Testing is carried out in oil to determine the intrinsic surge immunity of the isolation barrier.
(5) Apparent charge is an electrical discharge caused by a partial discharge (pd).
(6) All pins on each side of the barrier are tied together creating a two-pin device.

Safety-Related Certifications

VDE	UL	TUV	CQC	CSA	CB
Plan to certify according to DIN EN IEC 60747-17 (VDE 0884-17)	Plan to certify according to UL 1577 Component Recognition Program	Plan to certify according to EN 61010-1 and EN 62368-1	Plan to certify according to GB 4943.1	Plan to certify according to IEC 62368-1, IEC 61010-1 and IEC 60601	Plan to certify according to EN IEC 62368-1
Certificate planned	Certificate planned	Certificate planned	Certificate planned	Certificate planned	Certificate planned

Safety Limiting Values

Safety limiting (1) intends to minimize potential damage to the isolation barrier upon failure of input or output circuitry.

Parameter		Conditions	Min	Typ	Max	Unit
I_S	Safety Supply Current	$R_{\theta JA}$ = 58.79 °C/W, V_I = 5 V, T_J = 150 °C, T_A = 25 °C (SOP16)	-	-	425.24	mA
		$R_{\theta JA}$ = 76.74 °C/W, V_I = 5 V, T_J = 150 °C, T_A = 25 °C (QSOP16)	-	-	325.78	
		$R_{\theta JA}$ = 59.09 °C/W, V_I = 5 V, T_J = 150 °C, T_A = 25 °C (WSOP16)	-	-	423.08	
		$R_{\theta JA}$ = 50.24 °C/W, V_I = 5 V, T_J = 150 °C, T_A = 25 °C (WWSOP16)	-	-	497.61	
P_S	Safety Total Power	$R_{\theta JA}$ = 58.79 °C/W, T_J = 150 °C, T_A = 25 °C (SOP16)	-	-	2126.21	mW
		$R_{\theta JA}$ = 76.74 °C/W, T_J = 150 °C, T_A = 25 °C (QSOP16)	-	-	1628.88	
		$R_{\theta JA}$ = 59.09 °C/W, T_J = 150 °C, T_A = 25 °C (WSOP16)	-	-	2115.42	
		$R_{\theta JA}$ = 50.24 °C/W, T_J = 150 °C, T_A = 25 °C (WWSOP16)	-	-	2488.06	
T_S	Maximum Safety Temperature		-	-	150	°C

(1) The maximum safety temperature, T_S, has the same value as the maximum junction temperature, T_J, specified for the device. The I_S and P_S parameters represent the safety current and safety power respectively. The maximum limits of I_S and P_S must not be exceeded. These limits vary with the ambient temperature, T_A.

The junction-to-air thermal resistance, $R_{\theta JA}$, in the table is that of a device installed on a high-K test board for leaded surface-mount packages. Use these equations to calculate the value for each parameter:

$T_J = T_A + R_{\theta JA} \times P$, where P is the power dissipated in the device.

$T_{J(max)} = T_S = T_A + R_{\theta JA} \times P_S$, where $T_{J(max)}$ is the maximum allowed junction temperature.

$P_S = I_S \times V_I$, where V_I is the maximum input voltage.

Electrical Characteristics

All test conditions: V_{CCA} = V_{CCB} = 2.25 V to 5.5 V, T_A = −40°C to +125°C. Typical values are at V_{CC} = 3.3 V, T_A = +25°C, unless otherwise noted.

Parameter		Conditions	Min	Typ	Max	Unit
V_{IT+}	Rising Input Threshold Voltage	Input signal, INx	-	0.52 * V_{CCI} (1)	0.7 * V_{CCI}	V
V_{IT-}	Falling Input Threshold Voltage	Input signal, INx	0.3 * V_{CCI}	0.38 * V_{CCI}	-	V
V_{HYS}	Input Threshold Voltage Hysteresis		-	0.14 * V_{CCI}	-	V
I_{IH}	High-level Input Current	V_{IH} = V_{CCI} at INx			20	μA
I_{IL}	Low-level Input Current	V_{IL} = 0 V at INx	−20			μA
V_{OH}	High-level Output Voltage	V_{CCO} (1) = 5 V ± 10%, I_{OH} = −4 mA; Test OUTx	V_{CCO} – 0.4	V_{CCO} – 0.2	-	V
		V_{CCO} = 3.3 V ± 10%, I_{OH} = –2 mA; Test OUTx	V_{CCO} – 0.2	V_{CCO} – 0.11	-	
		V_{CCO} = 2.5 V ± 10%, I_{OH} = –1 mA; Test OUTx	V_{CCO} – 0.1	V_{CCO} – 0.07	-	
V_{OL}	Low-level Output Voltage	V_{CCO} = 5 V ± 10%, I_{OL} = 4 mA; Test OUTx	-	0.17	0.4	V
		V_{CCO} = 3.3 V ± 10%, I_{OL} = 2 mA; Test OUTx	-	0.1	0.2	
		V_{CCO} = 2.5 V ± 10%, I_{OL} = 1 mA; Test OUTx	-	0.05	0.1	
CMTI	Common-mode Transient Immunity	Static CMTI	-	200	-	kV/μs
		Dynamic CMTI	-	150	-	kV/μs
C_i	Input Capacitance (2)		-	2.8	-	pF

(1) V_{CCI} = Input-side V_{CC}; V_{CCO} = Output-side V_{CC}
(2) Provided by bench test and design simulation.

Timing Specifications − 5 V Supply

All test conditions: V_{CCA} = V_{CCB} = 5 V ± 10%, T_A = −40°C to +125°C. Typical values are at 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		-	-	100	Mbps
t_{PLH}	Propagation delay time, low-to-high		8	13	24	ns
t_{PHL}	Propagation delay time, high-to-low		8	13	24	ns
PWD	Pulse width distortion (1) $\lvert t_{PHL} - t_{PLH} \rvert$		-	0.5	7	ns
$t_{sk(CC)}$	Channel-to-channel output skew time (1)(2)	Same direction channels	-	3.8	6	ns
$t_{sk(PP)}$	Part-to-part output skew time (1)(2)	Same direction channels	-	-	6	ns
t_r	Output signal rise time (1)		-	1.6	10	ns
t_f	Output signal fall time (1)		-	1.3	10	ns
t_{PHZ}	Disable propagation delay, high-to-high impedance output	C_L= 15 pF, R_L= 1 kΩ	-	8	30	ns
t_{PLZ}	Disable propagation delay, low-to-high impedance output	C_L= 15 pF, R_L= 1 kΩ	-	7	30	ns
t_{PZH}	Enable propagation delay, high impedance-to-high output	C_L= 15 pF, R_L= 1 kΩ	-	7	30	ns
t_{PZL}	Enable propagation delay, high impedance-to-low output	C_L= 15 pF, R_L= 1 kΩ	-	7	30	ns
t_{DO}	Default output delay time from input power loss	Measured from the time V_{CC} goes below 1.7 V	-	34	80	ns
t_{SU}	Setup time		1	35	80	μs

(1) Provided by bench test and design simulation.
(2) $t_{sk(CC)}$ is the skew of delay time between different channels of a single device, while $t_{sk(PP)}$ is the skew of delay time between 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 conditions: V_{CCA} = V_{CCB} = 5 V ± 10%, T_A = −40°C to +125°C. Typical values are at 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
TPT7642							
Supply current - DC signal	V_I = 0 V (TPT7642F) V_I = VCC_I (TPT7642)		I_{CCA}	-	1.7	2.8	mA
			I_{CCB}	-	1.7	2.8	
	V_I = VCC_I (TPT7642F) V_I = 0 V (TPT7642)		I_{CCA}	-	4.3	6	
			I_{CCB}	-	4.3	6	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}	-	3.2	4.7	
			I_{CCB}	-	3.2	4.7	
		10 Mbps	I_{CCA}	-	4.4	5.9	
			I_{CCB}	-	4.4	5.9	
		100 Mbps	I_{CCA} (1)	-	12.0	-	
			I_{CCB} (1)	-	12.0	-	

(1) Provided by bench test and design simulation.

Timing Specifications − 3.3 V Supply

All test conditions: V_{CCA} = V_{CCB} = 3.3 V ± 10%, T_A = −40°C to +125°C. Typical values are at 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		-	-	100	Mbps
t_{PLH}	Propagation delay time, low-to-high		8	18	24	ns
t_{PHL}	Propagation delay time, high-to-low		8	17	24	ns
PWD	Pulse width distortion (1) $\lvert t_{PHL} - t_{PLH} \rvert$		-	0.8	5	ns
$t_{sk(CC)}$	Channel-to-channel output skew time (1)(2)	Same direction channels	-	-	2.5	ns
$t_{sk(PP)}$	Part-to-part output skew time (1)(2)	Same direction channels	-	-	4.5	ns
t_r	Output signal rise time (1)		-	2	4	ns
t_f	Output signal fall time (1)		-	2	4	ns
t_{PHZ}	Disable propagation delay, high-to-high impedance output	C_L= 15 pF, R_L= 1 kΩ	-	10	30	ns
t_{PLZ}	Disable propagation delay, low-to-high impedance output	C_L= 15 pF, R_L= 1 kΩ	-	10	30	ns
t_{PZH}	Enable propagation delay, high impedance-to-high output	C_L= 15 pF, R_L= 1 kΩ	-	10	30	ns
t_{PZL}	Enable propagation delay, high impedance-to-low output	C_L= 15 pF, R_L= 1 kΩ	-	10	30	ns
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	μs

(1) Provided by bench test and design simulation.

(2) $t_{sk(CC)}$ is the skew of delay time between different channels of a single device, while $t_{sk(PP)}$ is the skew of delay time between 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 conditions: V_{CCA} = V_{CCB} = 3.3 V ± 10%, T_A = −40°C to +125°C. Typical values are at 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
TPT7642							
Supply current - DC signal	V_I = 0 V (TPT7642F) V_I = VCC_I (TPT7642)		I_{CCA}	-	1.7	2.6	mA
			I_{CCB}	-	1.7	2.6	
	V_I = VCC_I (TPT7642F) V_I = 0 V (TPT7642)		I_{CCA}	-	4.3	5.8	
			I_{CCB}	-	4.3	5.8	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}	-	3.0	4.4	
			I_{CCB}	-	3.0	4.4	
		10 Mbps	I_{CCA}	-	3.8	5.2	
			I_{CCB}	-	3.8	5.2	
		100 Mbps	I_{CCA} (1)	-	8.7	-	
			I_{CCB} (1)	-	8.7	-	

(1) Provided by bench test and design simulation.

Timing Specifications − 2.5 V Supply

All test conditions: V_{CCA} = V_{CCB} = 2.5 V ± 10%, T_A = −40°C to +125°C. Typical values are at 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		-	-	100	Mbps
t_{PLH}	Propagation delay time, low-to-high		8	15	24	ns
t_{PHL}	Propagation delay time, high-to-low		8	15	24	ns
PWD	Pulse width distortion (1) $\lvert t_{PHL} - t_{PLH} \rvert$		-	0.6	7	ns
$t_{sk(CC)}$	Channel-to-channel output skew time (1)(2)	Same direction channels	-	3	6	ns
$t_{sk(PP)}$	Part-to-part output skew time (1)(2)	Same direction channels	-	-	6	ns
t_r	Output signal rise time (1)		-	2.3	10	ns
t_f	Output signal fall time (1)		-	1.5	10	ns
t_{PHZ}	Disable propagation delay, high-to-high impedance output	C_L= 15 pF ， R_L= 1 kΩ	1	12	30	ns
t_{PLZ}	Disable propagation delay, low-to-high impedance output	C_L= 15 pF ， R_L= 1 kΩ	1	14	30	ns
t_{PZH}	Enable propagation delay, high impedance-to-high output	C_L= 15 pF ， R_L= 1 kΩ	1	12	30	ns
t_{PZL}	Enable propagation delay, high impedance-to-low output	C_L= 15 pF ， R_L= 1 kΩ	1	12	30	ns
t_{DO}	Default output delay time from input power loss	Measured from the time V_{CC} goes below 1.7 V.	-	29	80	ns
t_{SU}	Setup time		1	35	80	μs

(1) Provided by bench test and design simulation.

(2) $t_{sk(CC)}$ is the skew of delay time between different channels of a single device, while $t_{sk(PP)}$ is the skew of delay time between 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 conditions: V_{CCA} = V_{CCB} = 2.5 V ± 10%, T_A = −40°C to +125°C. Typical values are at 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
TPT7642							
Supply current - DC signal	V_I = 0 V (TPT7642F) V_I = VCC_I (TPT7642)		I_{CCA}	-	1.7	2.5	mA
			I_{CCB}	-	1.7	2.5	
	V_I = VCC_I (TPT7642F) V_I = 0 V (TPT7642)		I_{CCA}	-	4.2	5.7	
			I_{CCB}	-	4.2	5.7	
Supply current - AC signal	All channels switching with square wave clock input; C_L = 15 pF	1 Mbps	I_{CCA}	-	3.0	4.3	
			I_{CCB}	-	3.0	4.3	
		10 Mbps	I_{CCA}	-	3.5	5	
			I_{CCB}	-	3.5	5	
		100 Mbps	I_{CCA} (1)	-	7.4	-	
			I_{CCB} (1)	-	7.4	-	

(1) Provided by bench test and design simulation.

Test Circuits and Waveforms

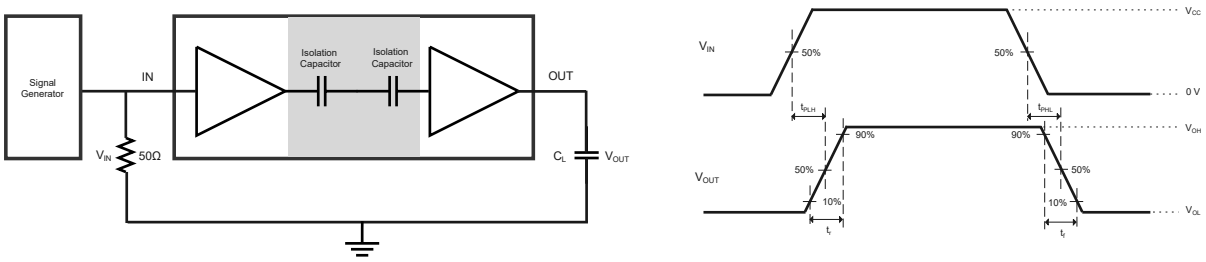


Figure 1. Switching Characteristics Test Circuit and Waveforms

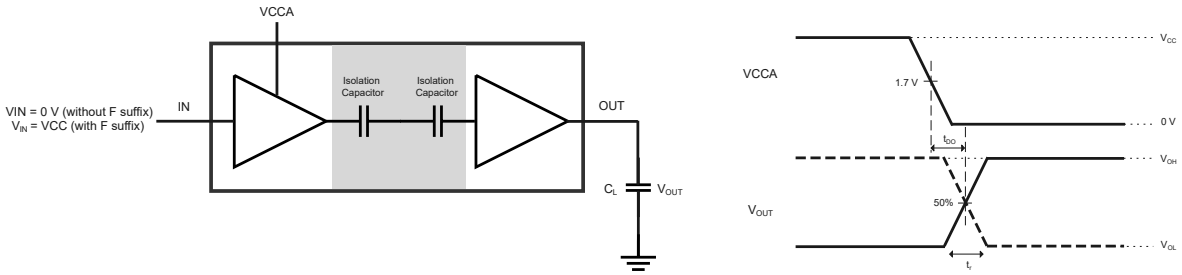


Figure 2. Default Output Delay Time Test Circuit and Voltage Waveforms

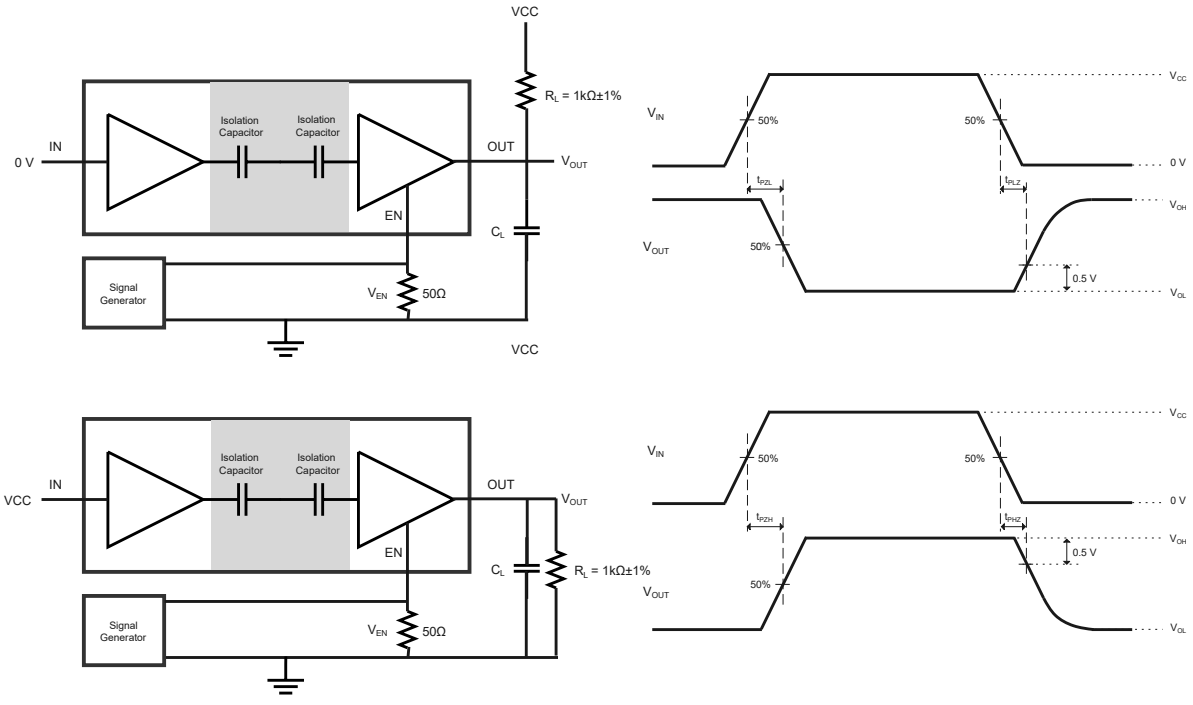


Figure 3. Enable/Disable Propagation Delay Test Circuit and Waveforms

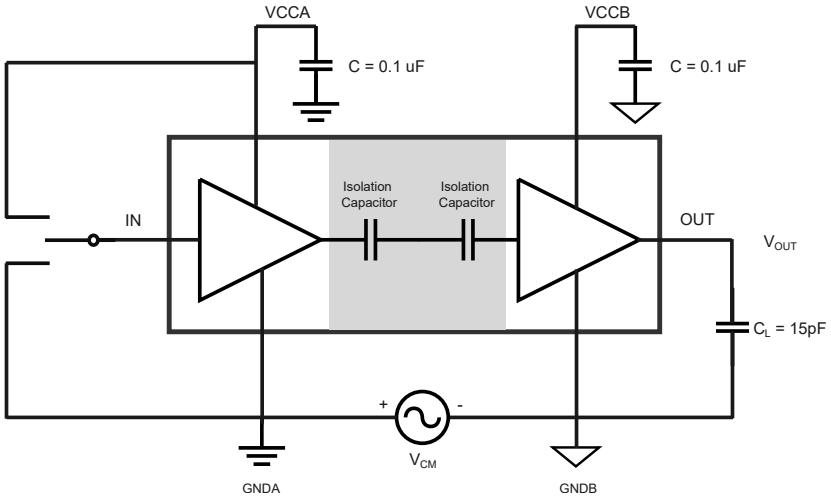


Figure 4. Common-Mode Transient Immunity Test Circuit

Detailed Description

Overview

The TPT764x device utilizes an ON-OFF Keying (OOK) modulation circuit to transmit the digital data through the isolation barrier. The transmitter sends an HF carrier to represent the digital state One and sends no signal to represent the digital state Zero. Once the modulated signal passes through the barrier, the receiver demodulates the signal following the process of signal conditioning and brings the output via a buffer stage. If the EN pin is at a Low level, the output goes to the high-impedance state. The device also utilizes advanced circuit design to maximize the CMTI performance and minimize the radiated emissions due to the HF carrier and IO buffer switching. The block diagram below shows a functional block diagram of a typical channel.

Functional Block Diagram

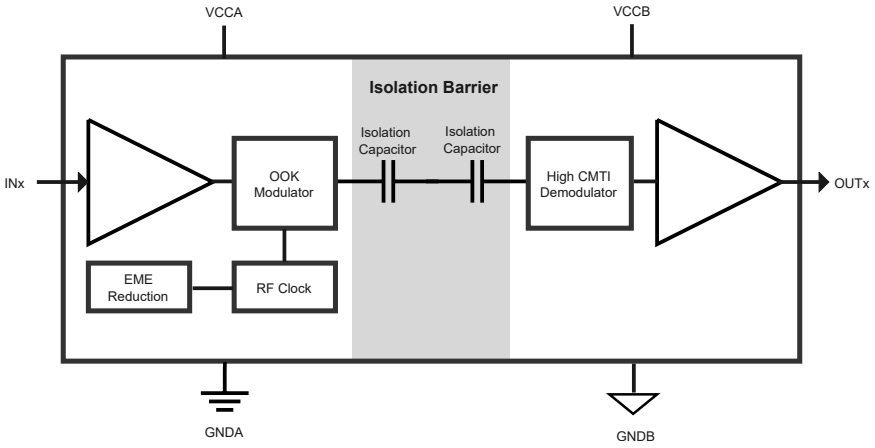


Figure 5. Block Diagram of Digital Capacitive Isolator

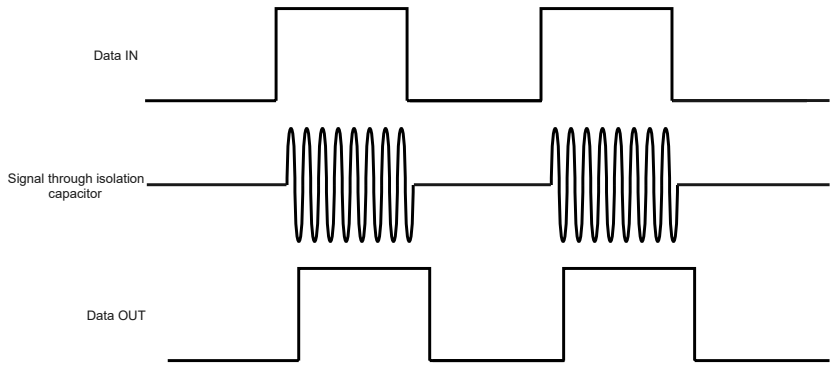


Figure 6. On-Off Keying (OOK) based Modulation Scheme

Feature Description

The TPT764x device is available in three-channel configurations and two default output state options to enable a variety of application uses. The table below lists the device features of the TPT764x device.

Part number	Max data rate	Channel direction	Default output state	Package	Rating isolation
TPT7640	100 Mbps	4 forward, 0 reverse	High	SOP16	3750 V_{RMS} / 5300 V_{PK}
				QSOP16	3750 V_{RMS} / 5300 V_{PK}
				WSOP16	6500 V_{RMS} / 9191 V_{PK}
				WWSOP16	8000 V_{RMS} / 12000 V_{PK}
TPT7640F	100 Mbps	4 forward, 0 reverse	Low	SOP16	3750 V_{RMS} / 5300 V_{PK}
				QSOP16	3750 V_{RMS} / 5300 V_{PK}
				WSOP16	6500 V_{RMS} / 9191 V_{PK}
				WWSOP16	8000 V_{RMS} / 12000 V_{PK}
TPT7641	100 Mbps	3 forward, 1 reverse	High	SOP16	3750 V_{RMS} / 5300 V_{PK}
				QSOP16	3750 V_{RMS} / 5300 V_{PK}
				WSOP16	6500 V_{RMS} / 9191 V_{PK}
				WWSOP16	8000 V_{RMS} / 12000 V_{PK}
TPT7641F	100 Mbps	3 forward, 1 reverse	Low	SOP16	3750 V_{RMS} / 5300 V_{PK}
				QSOP16	3750 V_{RMS} / 5300 V_{PK}
				WSOP16	6500 V_{RMS} / 9191 V_{PK}
				WWSOP16	8000 V_{RMS} / 12000 V_{PK}
TPT7642	100 Mbps	2 forward, 2 reverse	High	SOP16	3750 V_{RMS} / 5300 V_{PK}
				QSOP16	3750 V_{RMS} / 5300 V_{PK}
				WSOP16	6500 V_{RMS} / 9191 V_{PK}
				WWSOP16	8000 V_{RMS} / 12000 V_{PK}
TPT7642F	100 Mbps	2 forward, 2 reverse	Low	SOP16	3750 V_{RMS} / 5300 V_{PK}
				QSOP16	3750 V_{RMS} / 5300 V_{PK}
				WSOP16	6500 V_{RMS} / 9191 V_{PK}
				WWSOP16	8000 V_{RMS} / 12000 V_{PK}

Device Functional Modes

The table below lists the functional modes for the TPT764x device.

V_{CCI} (1)	V_{CCO}	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 TPT764x and Low for TPT764xF.
X	Power up	X	Low	Z	Disabled output is in high impedance.
Power down	Power up	X	High or Open	Default	Default mode. When V_{CCI} is unpowered, the default is High for TPT764x and Low for TPT764xF.
X	Power down	X	X	Undetermined	When V_{CCO} is unpowered, a channel output is undetermined (2).

(1) V_{CCI} = Input-side V_{CC}; V_{CCO} = Output-side V_{CC}; Power up means $V_{CC} \geq 2.25$ V; Power down means $V_{CC} \leq 1.7$ V; X = Irrelevant; Z = High impedance

(2) The outputs are in the undetermined state when 1.7 V < V_{CCI} & V_{CCO} < 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

The two external bypass capacitors need to be close to the VCC power pin. The maximum distance is 2 mm.

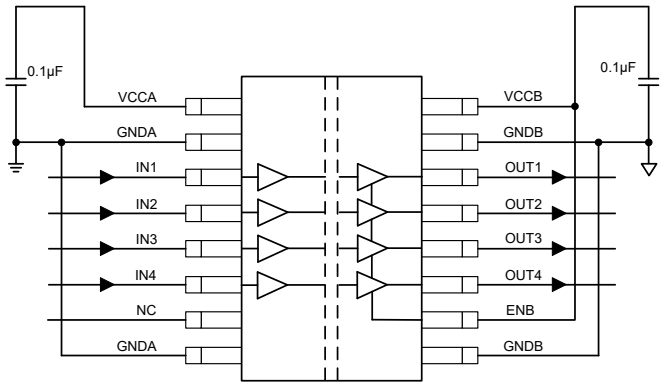


Figure 7. TPT7640/TPT7640F

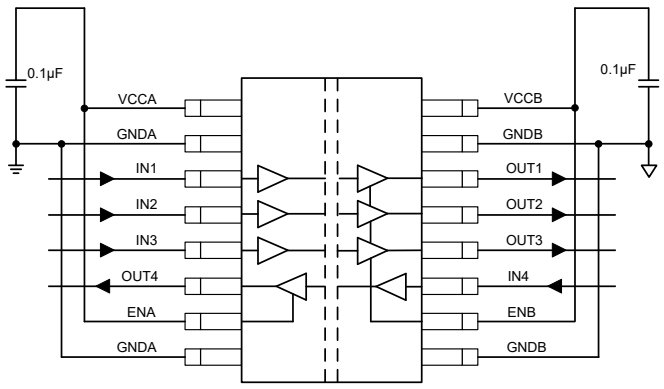


Figure 8. TPT7641/TPT7641F

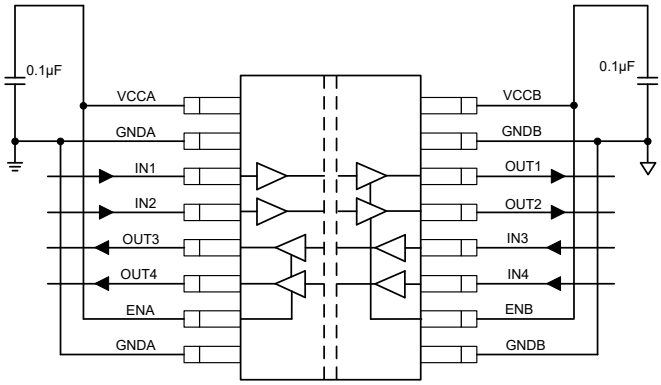
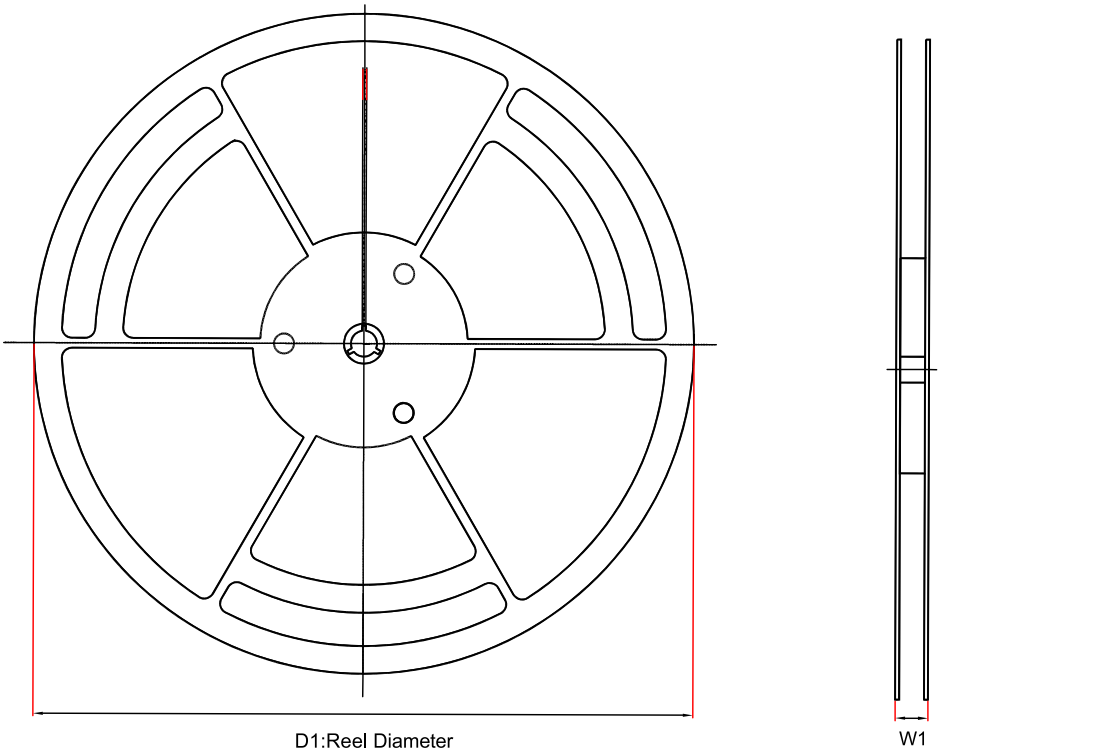


Figure 9. TPT7642/TPT7642F

Tape and Reel Information

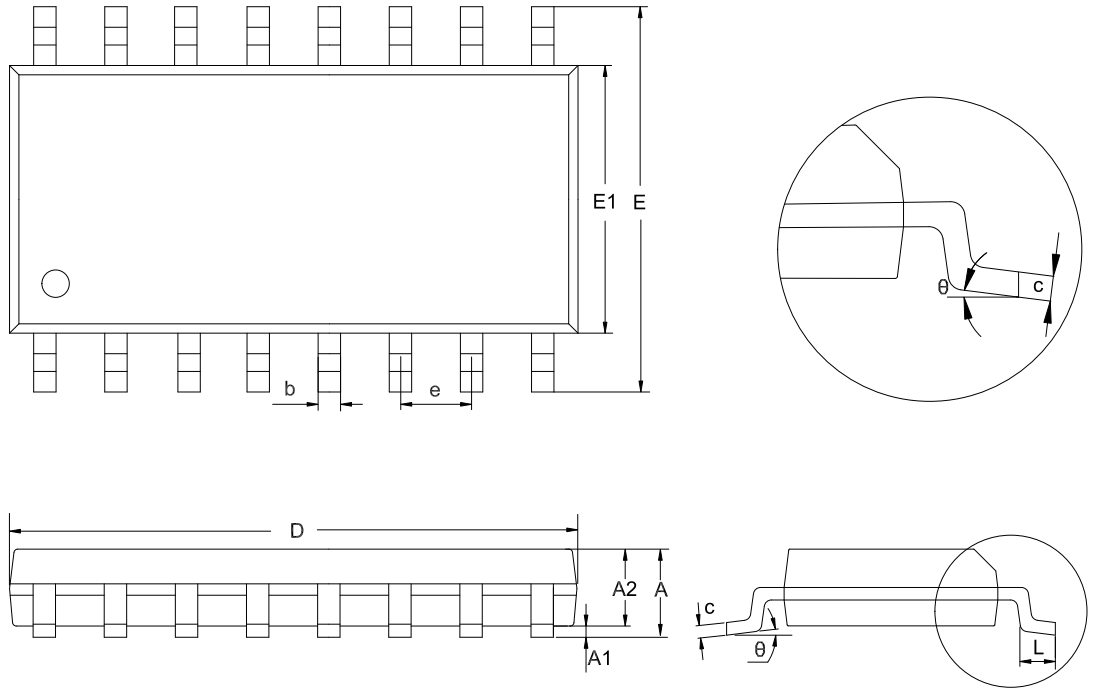


Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPT7640-SO3R	SOP16	330	21.6	6.6	10.4	2.1	8.0	16.0	Q1
TPT7640F-SO3R	SOP16	330	21.6	6.6	10.4	2.1	8.0	16.0	Q1
TPT7641-SO3R	SOP16	330	21.6	6.6	10.4	2.1	8.0	16.0	Q1
TPT7641F-SO3R	SOP16	330	21.6	6.6	10.4	2.1	8.0	16.0	Q1
TPT7642-SO3R	SOP16	330	21.6	6.6	10.4	2.1	8.0	16.0	Q1
TPT7642F-SO3R	SOP16	330	21.6	6.6	10.4	2.1	8.0	16.0	Q1
TPT7640-SSAR	QSOP16	330	17.6	6.5	5.4	2.0	8.0	12.0	Q1
TPT7640F- SSAR	QSOP16	330	17.6	6.5	5.4	2.0	8.0	12.0	Q1
TPT7641- SSAR	QSOP16	330	17.6	6.5	5.4	2.0	8.0	12.0	Q1
TPT7641F- SSAR	QSOP16	330	17.6	6.5	5.4	2.0	8.0	12.0	Q1
TPT7642- SSAR	QSOP16	330	17.6	6.5	5.4	2.0	8.0	12.0	Q1
TPT7642F- SSAR	QSOP16	330	17.6	6.5	5.4	2.0	8.0	12.0	Q1
TPT7640-SOBR	WSOP16	330	21.6	10.9	10.8	3.1	12.0	16.0	Q1
TPT7640F-SOBR	WSOP16	330	21.6	10.9	10.8	3.1	12.0	16.0	Q1
TPT7641-SOBR	WSOP16	330	21.6	10.9	10.8	3.1	12.0	16.0	Q1
TPT7641F-SOBR	WSOP16	330	21.6	10.9	10.8	3.1	12.0	16.0	Q1
TPT7642-SOBR	WSOP16	330	21.6	10.9	10.8	3.1	12.0	16.0	Q1
TPT7642F-SOBR	WSOP16	330	21.6	10.9	10.8	3.1	12.0	16.0	Q1
TPT7640-SOFR	WWSOP16	330	29.0	17.6	10.8	3.0	20.0	24.0	Q1
TPT7640F-SOFR	WWSOP16	330	29.0	17.6	10.8	3.0	20.0	24.0	Q1
TPT7641-SOFR	WWSOP16	330	29.0	17.6	10.8	3.0	20.0	24.0	Q1
TPT7641F-SOFR	WWSOP16	330	29.0	17.6	10.8	3.0	20.0	24.0	Q1
TPT7642-SOFR	WWSOP16	330	29.0	17.6	10.8	3.0	20.0	24.0	Q1
TPT7642F-SOFR	WWSOP16	330	29.0	17.6	10.8	3.0	20.0	24.0	Q1

Package Outline Dimensions

SOP16

Package Outline Dimensions SO3(SOP-16-A)



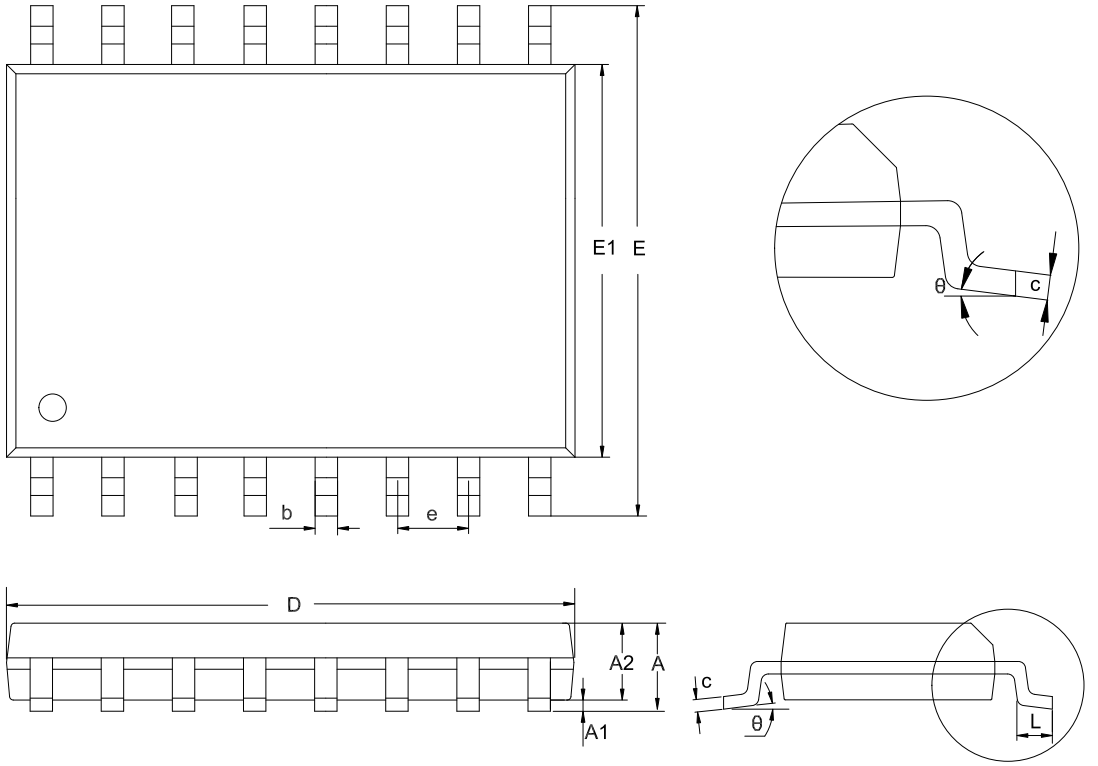
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.050	0.250	0.002	0.010
A2	1.300	1.600	0.051	0.063
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	9.800	10.000	0.386	0.394
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	1.270 BSC		0.050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



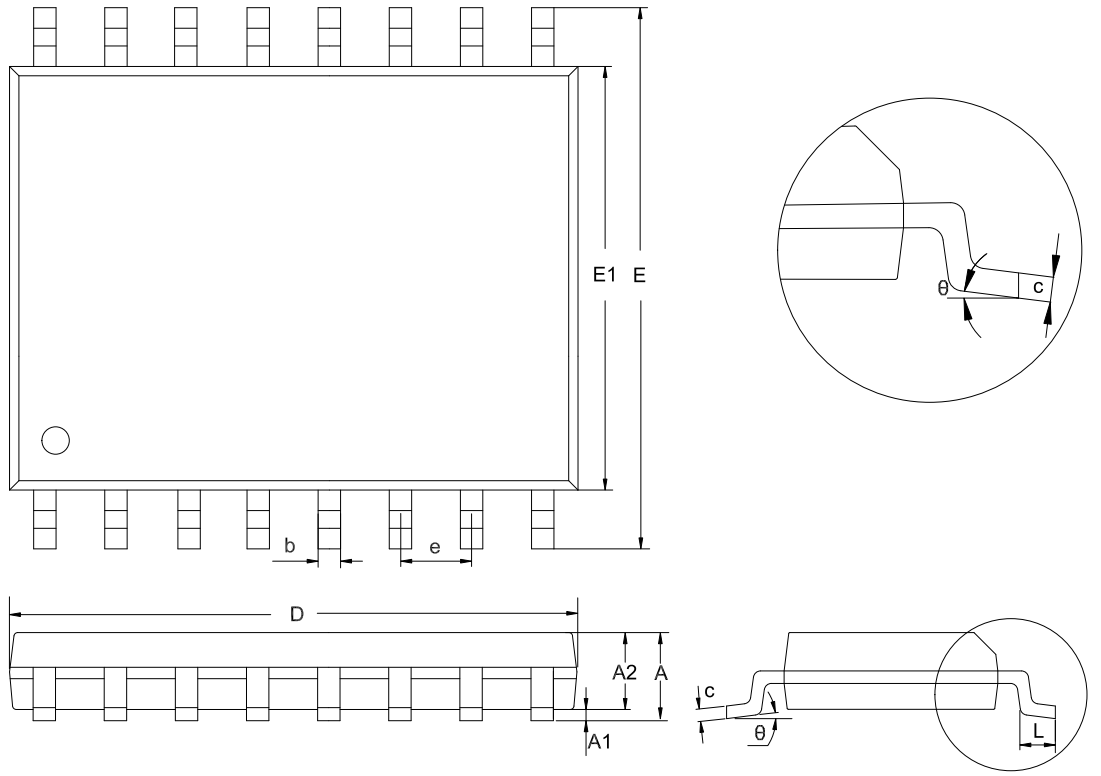
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.050	0.250	0.002	0.010
A2	1.300	1.500	0.051	0.059
b	0.230	0.310	0.009	0.012
c	0.170	0.250	0.007	0.010
D	4.800	5.000	0.189	0.197
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	0.635 BSC		0.025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



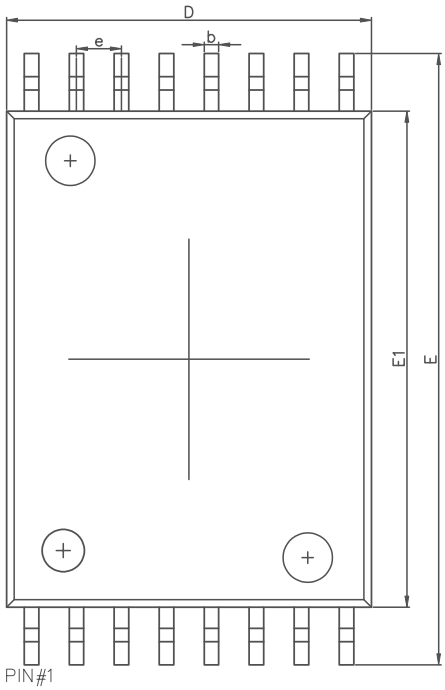
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	2.350	2.650	0.093	0.104
A1	0.100	0.300	0.004	0.012
A2	2.250	2.350	0.089	0.093
b	0.350	0.450	0.014	0.018
c	0.200	0.290	0.008	0.011
D	10.100	10.500	0.398	0.413
E	10.100	10.600	0.398	0.417
E1	7.300	7.700	0.287	0.303
e	1.270 BSC	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

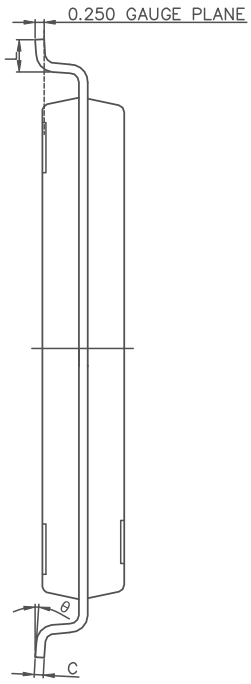
NOTES

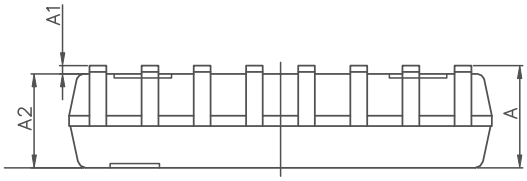
1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

WWSOP16

Package Outline Dimensions SOF(WWSOP-16-A)







Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	---	2.650	---	0.104
A1	0.100	0.300	0.004	0.012
A2	2.236	2.336	0.088	0.092
b	0.310	0.510	0.012	0.020
c	0.220	0.280	0.009	0.011
D	10.200	10.400	0.402	0.409
E	17.100	17.400	0.673	0.685
E1	13.900	14.100	0.547	0.555
e	1.270 BSC		0.050 BSC	
L	0.600	1.100	0.024	0.043
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	MSL	Transport Media, Quantity	Eco Plan
TPT7640-SO3R	−40 to 125°C	SOP16	T7640	MSL3	Tape and Reel, 2500	Green
TPT7640F-SO3R	−40 to 125°C	SOP16	7640F	MSL3	Tape and Reel, 2500	Green
TPT7641-SO3R	−40 to 125°C	SOP16	T7641	MSL3	Tape and Reel, 2500	Green
TPT7641F-SO3R	−40 to 125°C	SOP16	7641F	MSL3	Tape and Reel, 2500	Green
TPT7642-SO3R	−40 to 125°C	SOP16	T7642	MSL3	Tape and Reel, 2500	Green
TPT7642F-SO3R	−40 to 125°C	SOP16	7642F	MSL3	Tape and Reel, 2500	Green
TPT7640-SSAR (1)	−40 to 125°C	QSOP16	T7640	MSL3	Tape and Reel, 4000	Green
TPT7640F-SSAR (1)	−40 to 125°C	QSOP16	7640F	MSL3	Tape and Reel, 4000	Green
TPT7641-SSAR	−40 to 125°C	QSOP16	T7641	MSL3	Tape and Reel, 4000	Green
TPT7641F-SSAR	−40 to 125°C	QSOP16	7641F	MSL3	Tape and Reel, 4000	Green
TPT7642-SSAR	−40 to 125°C	QSOP16	T7642	MSL3	Tape and Reel, 4000	Green
TPT7642F-SSAR	−40 to 125°C	QSOP16	7642F	MSL3	Tape and Reel, 4000	Green
TPT7640-SOBR	−40 to 125°C	WSOP16	T7640	MSL3	Tape and Reel, 1500	Green
TPT7640F-SOBR	−40 to 125°C	WSOP16	7640F	MSL3	Tape and Reel, 1500	Green
TPT7641-SOBR	−40 to 125°C	WSOP16	T7641	MSL3	Tape and Reel, 1500	Green
TPT7641F-SOBR	−40 to 125°C	WSOP16	7641F	MSL3	Tape and Reel, 1500	Green
TPT7642-SOBR	−40 to 125°C	WSOP16	T7642	MSL3	Tape and Reel, 1500	Green
TPT7642F-SOBR	−40 to 125°C	WSOP16	7642F	MSL3	Tape and Reel, 1500	Green
TPT7640-SOFR	−40 to 125°C	WWSOP16	T7640	MSL3	Tape and Reel, 1000	Green
TPT7640F-SOFR	−40 to 125°C	WWSOP16	7640F	MSL3	Tape and Reel, 1000	Green

Order Number	Operating Temperature Range	Package	Marking	MSL	Transport Media, Quantity	Eco Plan
TPT7641-SOFR	−40 to 125°C	WWSOP16	T7641	MSL3	Tape and Reel, 1000	Green
TPT7641F-SOFR	−40 to 125°C	WWSOP16	7641F	MSL3	Tape and Reel, 1000	Green
TPT7642-SOFR	−40 to 125°C	WWSOP16	T7642	MSL3	Tape and Reel, 1000	Green
TPT7642F-SOFR	−40 to 125°C	WWSOP16	7642F	MSL3	Tape and Reel, 1000	Green

(1) For future products, contact the 3PEAK factory for more information and samples.

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

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