TMR7304

Board Mount Precision Current Sensor

Description

TMR7304 is a close loop current sensor for accurate measurement of DC, AC, pulsed current and arbitrary waveform current with galvanic isolation between primary and secondary circuits.

TMR7304-B

TMR7304-C

Features and Benefits

- High accuracy
- Excellent linearity
- Low temperature coefficient
- Fast response time
- Galvanic isolation
- RoHS & REACH compliant

Applications

- Solar inverter
- Direct-current dynamo
- Uninterruptible power supplies (UPS)
- Switched model power supplies (SMPS)
- Variable frequency drive (VFD)

TMR7304-D

TMR7304-E

Selection Guide

Part Number	Primary Nominal Current	Primary Current Measuring Range	Part Number	Primary Nominal Current	Primary Current Measuring Range
TMR7304-0060B	6 A	±20 A	TMR7304-0060C	6 A	±20 A
TMR7304-0150B	15 A	±51 A	TMR7304-0150C	15 A	±51 A
TMR7304-0250B	25 A	±85 A	TMR7304-0250C	25 A	±85 A
TMR7304-0500B	50 A	±150 A	TMR7304-0500C	50 A	±150 A
TMR7304-0060D	6 A	±20 A	TMR7304-0250D	25 A	±85 A
TMR7304-0150D	15 A	±51 A	TMR7304-0500D	50 A	±150 A
TMR7304-0750E	75 A	±180 A			

Insulation and Environmental Characteristics

Parameters	Symbol	Typ.	Unit
Dielectric Strength	V_D	4.2	kV(50 Hz, 1 min)
Insulation Resistance	R_{IS}	1000	MΩ
Creepage Distance	d_{CP}	7.2	mm
Clearance	d_{CL}	7.2	mm
Ambient Operating Temperature	T_A	-40 to +85	°C
Ambient Storage Temperature	T_{STG}	-50 to +105	°C
Mass	m	12	g

Catalogue

1. TMR7304-B Specifications

T_A = +25 °C, V_{CC} = 5 V, R_L = 10 kΩ, unless otherwise noted

Parameter	Symbol	Condition		Min.	Typ.	Max.	Unit
General Electrical Data							
Primary Nominal Current	I_{PN}	TMR7304-0060B		-	6	-	A
		TMR7304-0150B		-	15	-	
		TMR7304-0250B		-	25	-	
		TMR7304-0500B		-	50	-	
Primary Current Measuring Range	I_{PM}	TMR7304-0060B		-20	-	20	A
		TMR7304-0150B		-51	-	51	
		TMR7304-0250B		-85	-	85	
		TMR7304-0500B		-150	-	150	
Sensitivity	S	I_P = 0 to ±I_{PN}	TMR7304-0060B	-	104.2	-	mV/A
			TMR7304-0150B	-	41.67	-	
			TMR7304-0250B	-	25	-	
			TMR7304-0500B	-	12.5	-	
Supply Voltage	V_{CC}	±5 %		-	5	-	V
Offset Voltage	V_{OFF}	-		2.490	2.5	2.510	V
Output Voltage	V_{OUT}	I_P = 0 to ±I_{PM}		-	V_{OFF} + S × I_P	-	V
Current Consumption	I_C	I_P = 0		-	12	-	mA
Static Performance Data							
Accuracy	X_G	T_A = 25 °C, I_P = 0 to ±I_{PN}		-	±0.8	-	% I_{PN}
		T_A = 85 °C, I_P = 0 to ±I_{PN}	TMR7304-0060B	-	1.4	-	
			TMR7304-0150B	-	1.2	-	
			TMR7304-0250B	-	1.15	-	
			TMR7304-0500B	-	1.1	-	
Linearity Error	ε_L	I_P = 0 to ±I_{PN}		-	±0.3	-	% I_{PN}
Symmetry	ε_{SYM}	T_A = -40 °C to +85 °C, I_P = 0 to ±I_{PN}		99	100	101	%
Dynamic Performance Data							
Response Time	t_R	di/dt > 50 A/μs, 10% to 90% of I_{PN}		-	1	-	μs
Bandwidth	BW	-3 dB		DC	300	-	kHz

2. TMR7304-C Specifications

T_A = +25 °C, V_{CC} = 5 V, R_L = 10 kΩ, unless otherwise noted

Parameter	Symbol	Condition		Min.	Typ.	Max.	Unit
General Electrical Data							
Primary Nominal Current	I_{PN}	TMR7304-0060C		-	6	-	A
		TMR7304-0150C		-	15	-	
		TMR7304-0250C		-	25	-	
		TMR7304-0500C		-	50	-	
Primary Current Measuring Range	I_{PM}	TMR7304-0060C		-20	-	20	A
		TMR7304-0150C		-51	-	51	
		TMR7304-0250C		-85	-	85	
		TMR7304-0500C		-150	-	150	
Sensitivity	S	I_P = 0 to ±I_{PN}	TMR7304-0060C	-	104.2	-	mV/A
			TMR7304-0150C	-	41.67	-	
			TMR7304-0250C	-	25	-	
			TMR7304-0500C	-	12.5	-	
Supply Voltage	V_{CC}	±5 %		-	5	-	V
Reference Output Voltage	V_{REF}	-		2.490	2.5	2.510	V
Offset Voltage	V_{OFF}	-		-	2.5	-	V
Output Voltage	V_{OUT}	I_P = 0 to ±I_{PM}		-	V_{OFF} + S × I_P	-	V
Current Consumption	I_C	I_P = 0		-	12	-	mA
Static Performance Data							
Accuracy	X_G	T_A = 25 °C, I_P = 0 to ±I_{PN}		-	±0.8	-	% I_{PN}
		T_A = 85 °C, I_P = 0 to ±I_{PN}	TMR7304-0060C	-	1.4	-	
			TMR7304-0150C	-	1.2	-	
			TMR7304-0250C	-	1.15	-	
			TMR7304-0500C	-	1.1	-	
Linearity Error	ε_L	I_P = 0 to ±I_{PN}		-	±0.3	-	% I_{PN}
Symmetry	ε_{SYM}	T_A = -40 °C to +85 °C, I_P = 0 to ±I_{PN}		99	100	101	%
Offset Error	V_{OE}	T_A = +25 °C, I_P = 0		-5	-	5	mV
Dynamic Performance Data							
Response Time	t_R	di/dt > 50 A/μs, 10% to 90% of I_{PN}		-	1	-	μs
Bandwidth	BW	-3 dB		DC	300	-	kHz

3. TMR7304-D Specifications

T_A = +25 °C, V_{CC} = 5 V, R_L = 10 kΩ, unless otherwise noted

Parameter	Symbol	Condition		Min.	Typ.	Max.	Unit
General Electrical Data							
Primary Nominal Current	I_{PN}	TMR7304-0060D		-	6	-	A
		TMR7304-0150D		-	15	-	
		TMR7304-0250D		-	25	-	
		TMR7304-0500D		-	50	-	
Primary Current Measuring Range	I_{PM}	TMR7304-0060D		-20	-	20	A
		TMR7304-0150D		-51	-	51	
		TMR7304-0250D		-85	-	85	
		TMR7304-0500D		-150	-	150	
Sensitivity	S	I_P = 0 to ±I_{PN}	TMR7304-0060D	-	104.2	-	mV/A
			TMR7304-0150D	-	41.67	-	
			TMR7304-0250D	-	25	-	
			TMR7304-0500D	-	12.5	-	
Supply Voltage	V_{CC}	±5 %		-	5	-	V
Reference Output Voltage	V_{REF}	-		2.490	2.5	2.510	V
Offset Voltage	V_{OFF}	-		-	2.5	-	V
Output Voltage	V_{OUT}	I_P = 0 to ±I_{PM}		-	V_{OFF} + S × I_P	-	V
Current Consumption	I_C	I_P = 0		-	12	-	mA
Static Performance Data							
Accuracy	X_G	T_A = 25 °C, I_P = 0 to ±I_{PN}		-	±0.8	-	% I_{PN}
		T_A = 85 °C, I_P = 0 to ±I_{PN}	TMR7304-0060D	-	1.4	-	
			TMR7304-0150D	-	1.2	-	
			TMR7304-0250D	-	1.15	-	
			TMR7304-0500D	-	1.1	-	
Linearity Error	ε_L	I_P = 0 to ±I_{PN}		-	±0.3	-	% I_{PN}
Symmetry	ε_{SYM}	T_A = -40 °C to +85 °C, I_P = 0 to ±I_{PN}		99	100	101	%
Offset Error	V_{OE}	T_A = +25 °C, I_P = 0		-5	-	5	mV
Dynamic Performance Data							
Response Time	t_R	di/dt > 50 A/μs, 10% to 90% of I_{PN}		-	1	-	μs
Bandwidth	BW	-3 dB		DC	300	-	kHz

4. TMR7304-E Specifications

T_A = +25 °C, V_{CC} = 5 V, R_L = 10 kΩ, unless otherwise noted

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
General Electrical Data						
Primary Nominal Current	I_{PN}	TMR7304-0750E	-	75	-	A
Primary Current Measuring Range	I_{PM}	TMR7304-0750E	-180	-	180	A
Sensitivity	S	I_P = 0 to ±I_{PN}	-	6.25	-	mV/A
Supply Voltage	V_{CC}	±5 %	-	5	-	V
Reference Output Voltage	V_{REF}	-	2.490	2.5	2.510	V
Offset Voltage	V_{OFF}	-	-	2.5	-	V
Output Voltage	V_{OUT}	I_P = 0 to ±I_{PM}	-	V_{OFF} + S × I_P	-	V
Current Consumption	I_C	I_P = 0	-	12	-	mA
Static Performance Data						
Accuracy	X_G	T_A = 25 °C, I_P = 0 to ±I_{PN}	-	±0.8	-	% I_{PN}
		T_A = 85 °C, I_P = 0 to ±I_{PN}	-	1.1	-	
Linearity Error	ε_L	I_P = 0 to ±I_{PN}	-	±0.3	-	% I_{PN}
Symmetry	ε_{SYM}	T_A = -40 °C to +85 °C, I_P = 0 to ±I_{PN}	99	100	101	%
Offset Error	V_{OE}	T_A = +25 °C, I_P = 0	-5	-	5	mV
Dynamic Performance Data						
Response Time	t_R	di/dt > 50 A/μs, 10% to 90% of I_{PN}	-	1	-	μs
Bandwidth	BW	-3 dB	DC	300	-	kHz

5. Typical Output Characteristics

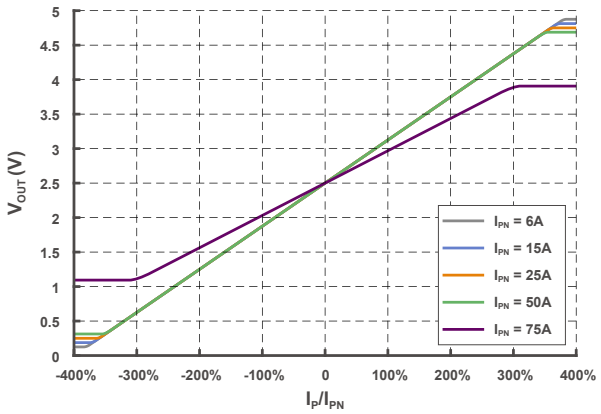

Figure 1. Output Voltage vs Primary Current

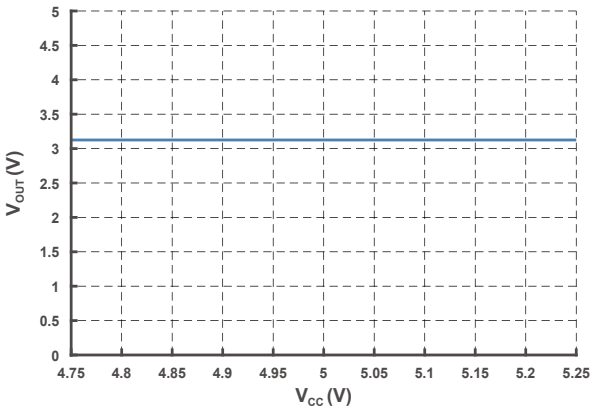

Figure 2. Output Voltage vs Supply Voltage (@I_P = I_{PN})

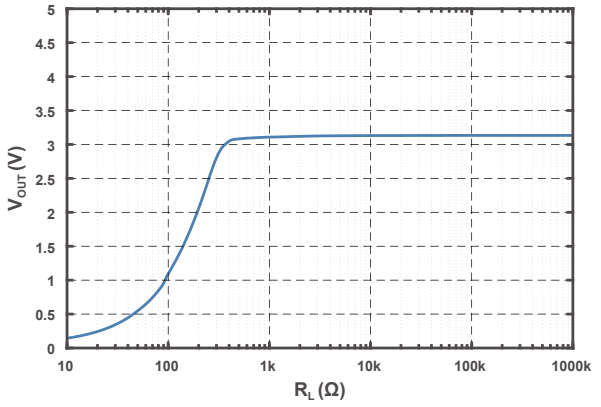

Figure 3. Output Voltage vs Load Resistance (@I_P = I_{PN})

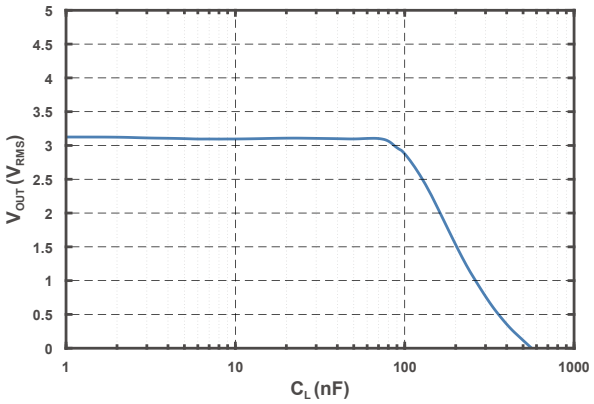

Figure 4. Output Voltage vs Load Capacitance (@I_P = I_{PN})

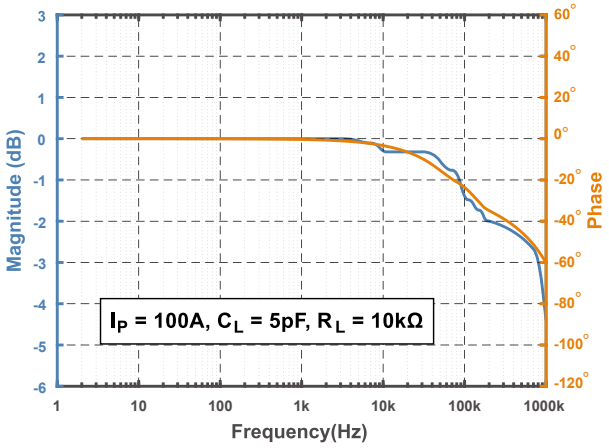

Figure 5. Bode Plot

6. Typical Temperature Characteristics

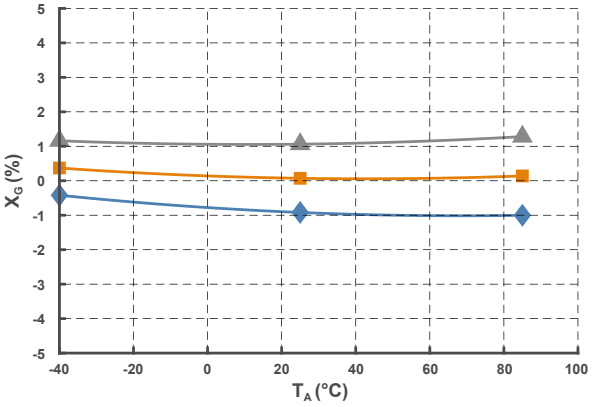

Figure 6. Accuracy

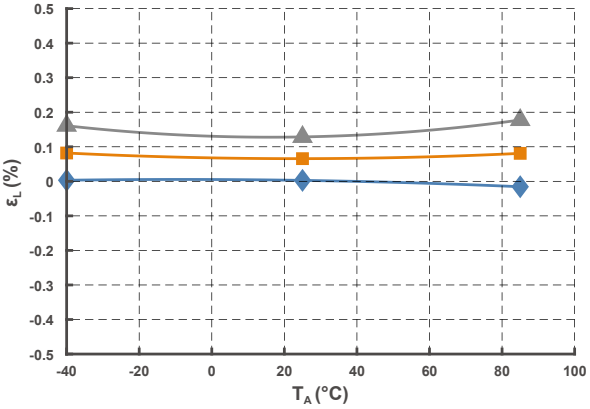

Figure 7. Linearity Error

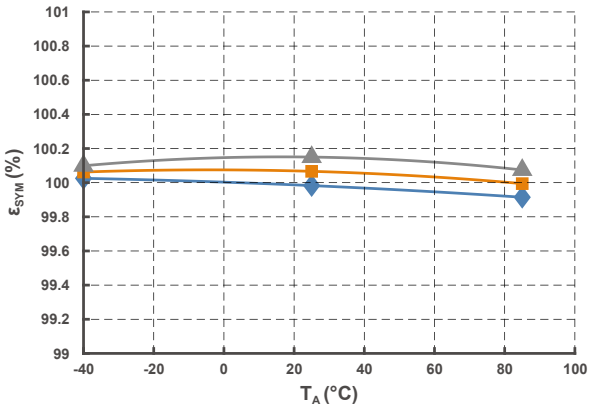

Figure 8. Symmetry

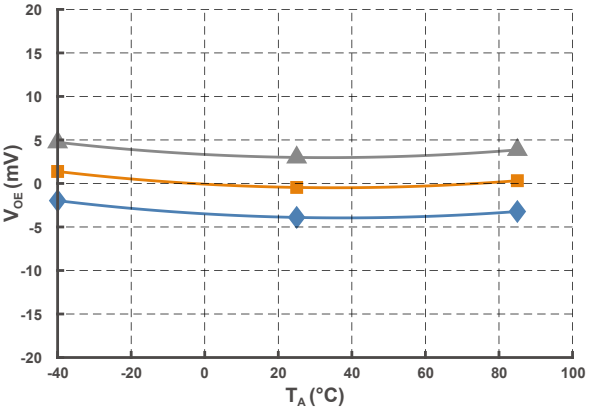

Figure 9. Offset Error

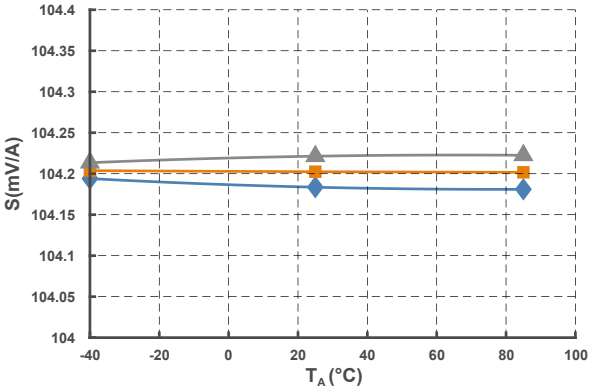

Figure 10. Sensitivity (@I_{PN} = 6 A)

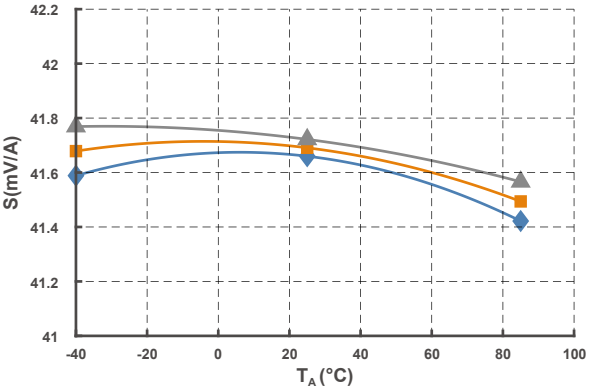

Figure 11. Sensitivity (@I_{PN} = 15 A)

Typical Temperature Characteristics

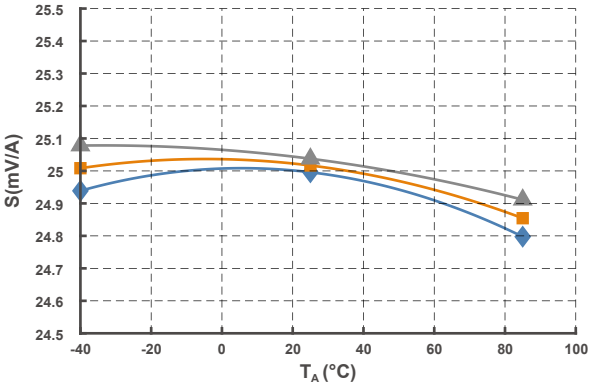

Figure 12. Sensitivity (@I_{PN} = 25 A)

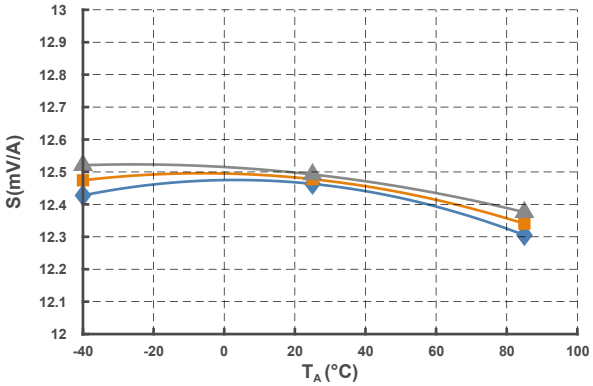

Figure 13. Sensitivity (@I_{PN} = 50 A)

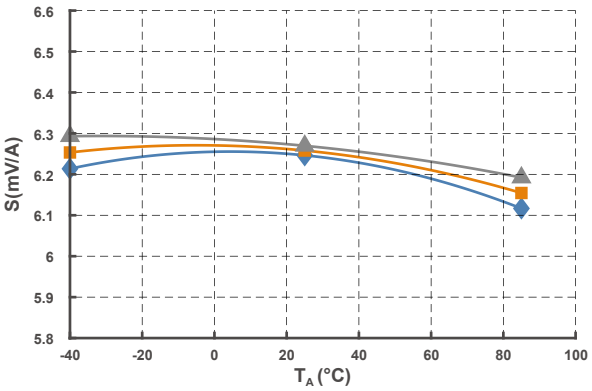

Figure 14. Sensitivity (@I_{PN} = 75 A)

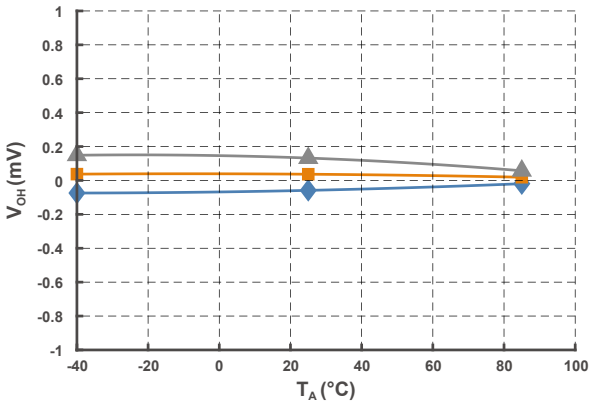

Figure 15. Hysteresis

7. Parameters Definition And Formula

1) Output Voltage

$$V_{OUT} = V_{OFF} + S \times I_P$$

V_{OUT} stands for current sensor output voltage at given primary current, V_{OFF} stands for offset voltage, S stands for sensitivity, I_P stands for primary current.

2) Accuracy

$$X_G = \underset{I_P \in [-I_{PN}, I_{PN}]}{MAX} \left(\frac{(V_{OUT} - V_{REF}) - (S \times I_P)}{S \times I_{PN}} \times 100\% \right)$$

I_{PN} stands for nominal primary current

3) Sensitivity

$$S = \frac{V_{OUT(@\, I_{PN})} - V_{OUT(@\, -I_{PN})}}{2 \times I_{PN}}$$

$V_{OUT(@\, I_{PN})}$ and $V_{OUT(@-I_{PN})}$ stand for the current output at I_{PN} and $-I_{PN}$ respectively.

4) Linearity

$$\varepsilon_L = \underset{I_P \in [-I_{PN}, I_{PN}]}{MAX} \left(\frac{(V_{OUT} - V_{REF}) - (\bar{V}_{OE} + \bar{S} \times I_P)}{S \times I_{PN}} \times 100\% \right)$$

$\bar{S}$ and $\bar{V}_{OE}$ stand for the average values of the sensitivity and electric offset.

5) Symmetry

$$\varepsilon_{SYM} = \left| \frac{V_{OUT(@\, I_{PN})} - \bar{V}_{OFF}}{V_{OUT(@\, -I_{PN})} - \bar{V}_{OFF}} \right| \times 100\%$$

6) Hysteresis

$$V_{OH} = MAX\ \Delta H$$

ΔH is the maximum residual output current between full scale positive and negative nominal current.

7) Offset Voltage

$$V_{OE} = V_{OUT(@\, I_P = 0)} - V_{REF}$$

8. Application Information

Electrical Connection

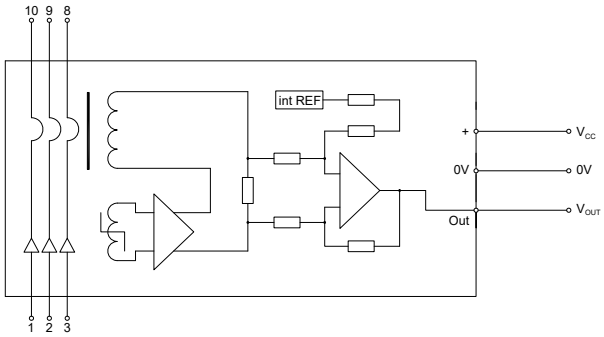

Figure 16. TMR7304-B Electrical Connection

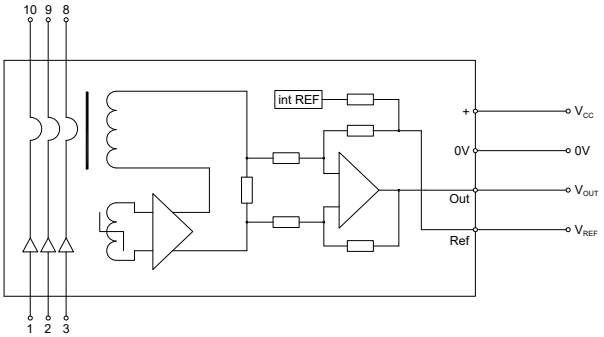

Figure 17. TMR7304-C Electrical Connection

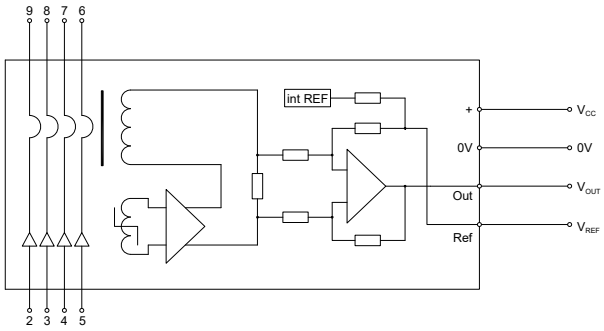

Figure 18. TMR7304-D Electrical Connection

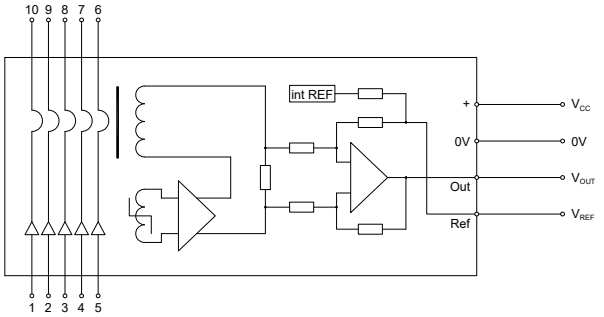

Figure 19. TMR7304-E Electrical Connection

Remarks

1. V_{OUT} is positive when the primary current (I_P) is in the same direction as the arrow indication on the label and vice versa.
2. Improper connection may result in permanent damage of the sensor.
3. Excessive capacitive load may result in distortion of output signals when measuring high frequency primary signal. Please refer to Output Voltage vs Load Capacitance Curve.
4. Wave soldering profile max temperature should be set no higher than 260 °C for 10 s.
5. Sensor is customizable upon request.

9. Dimensions

Dimension for TMR7304-B Series

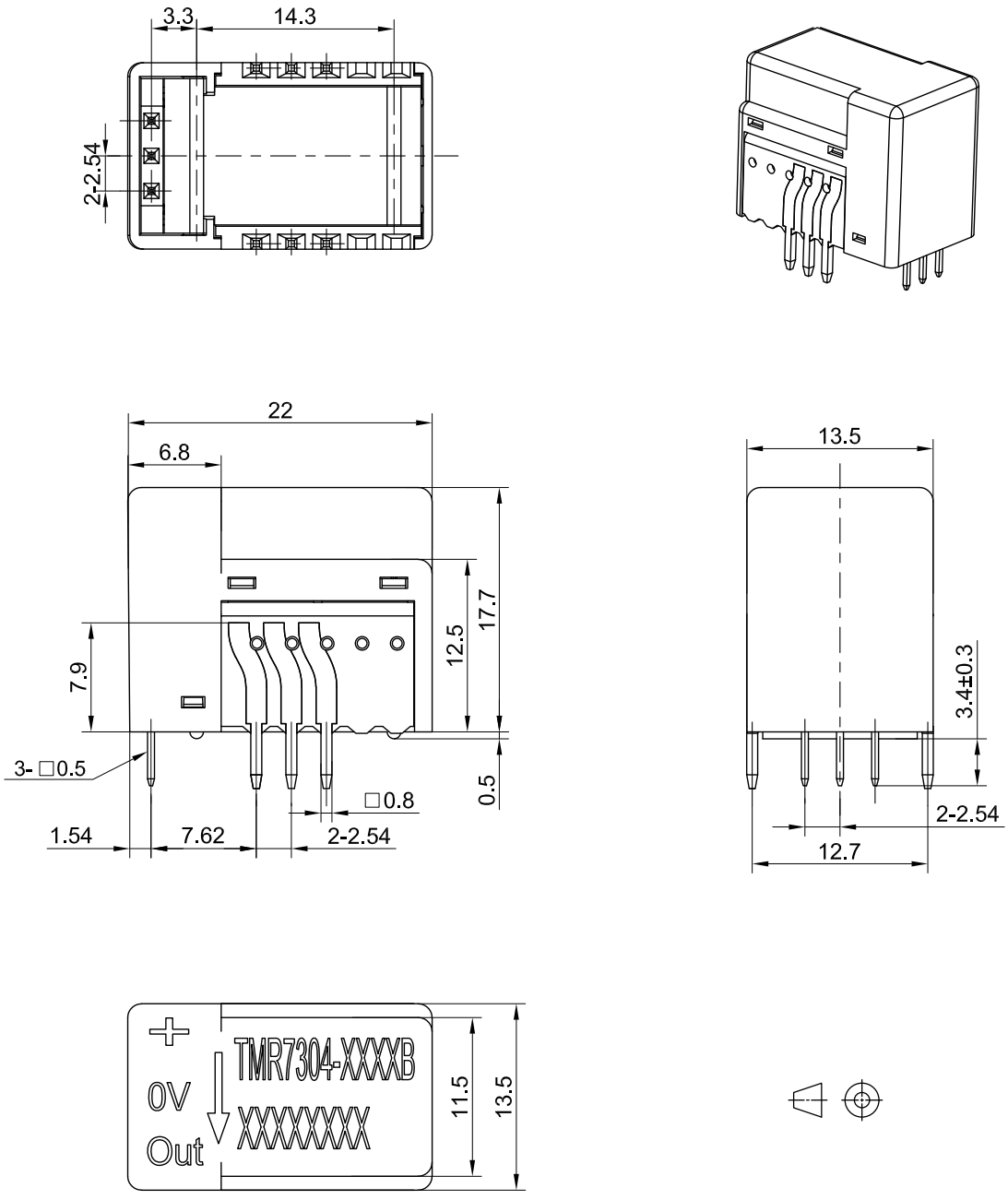

Figure 20. Dimension for TMR7304-B (unit: mm, tolerances for unmarked scales ±1 mm)

Dimension for TMR7304-C Series

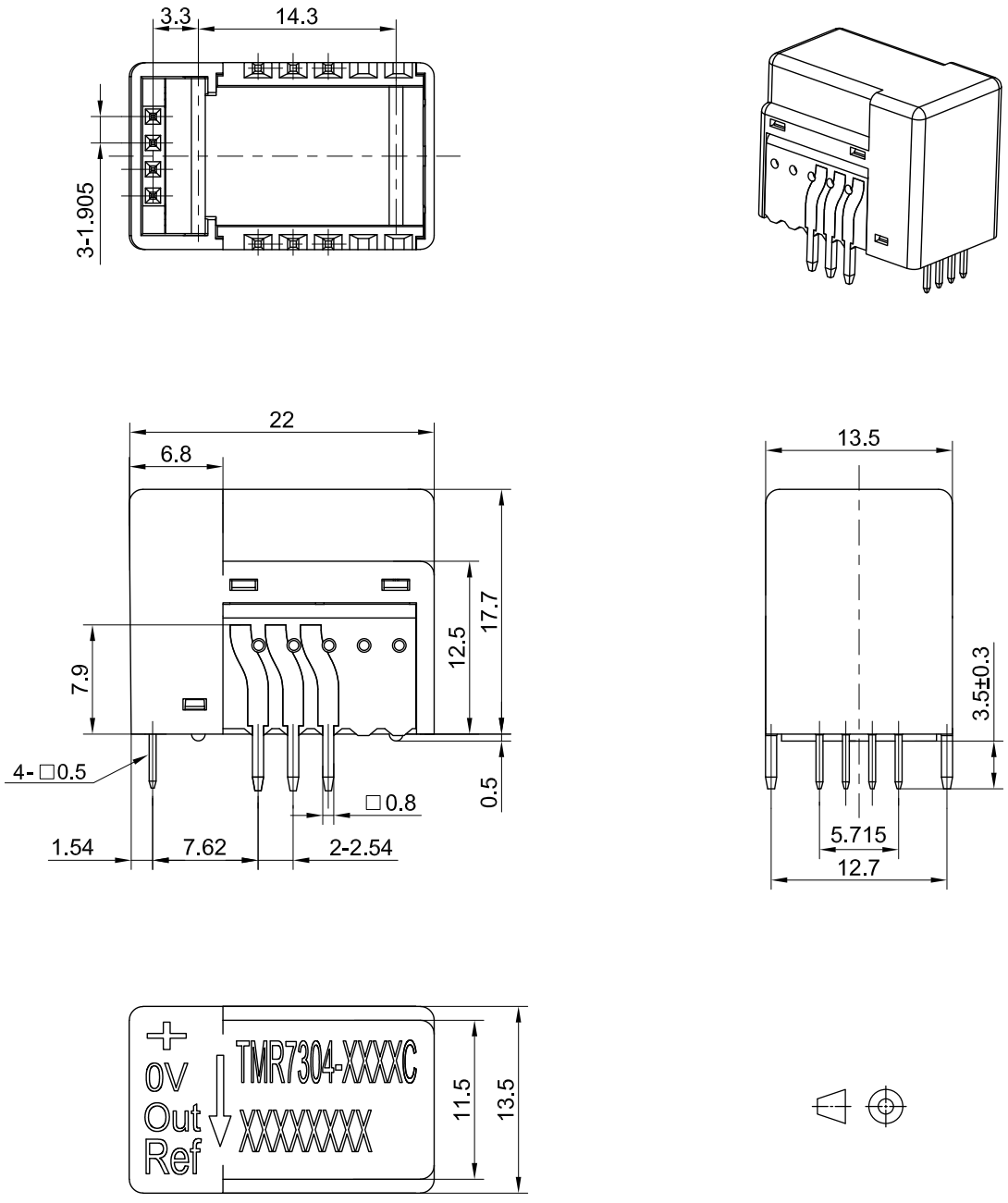

Figure 21. Dimension for TMR7304-C (unit: mm, tolerances for unmarked scales ±1 mm)

Dimension for TMR7304-D Series

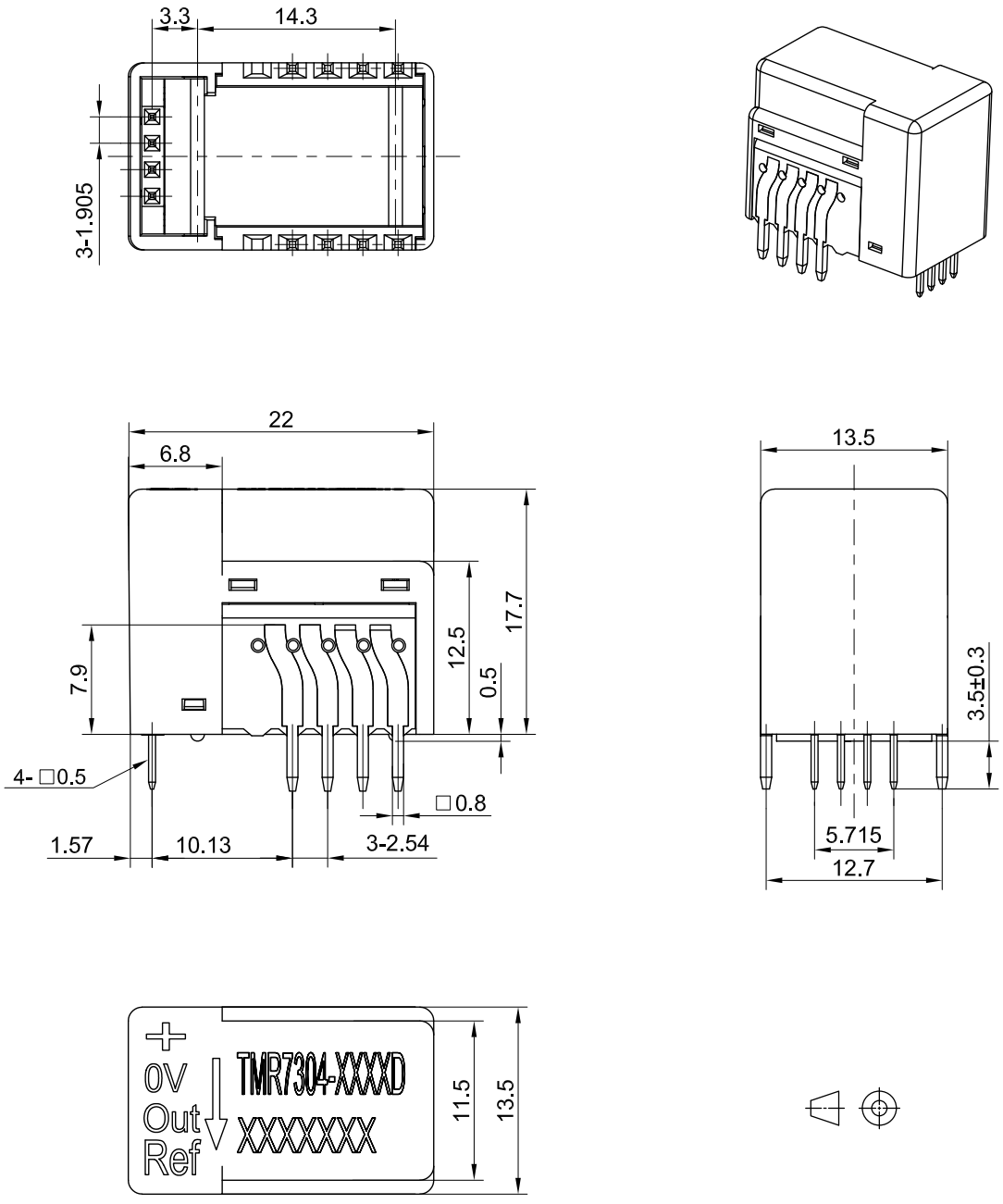

Figure 22. Dimension for TMR7304-D (unit: mm, tolerances for unmarked scales ±1 mm)

Dimension for TMR7304-E

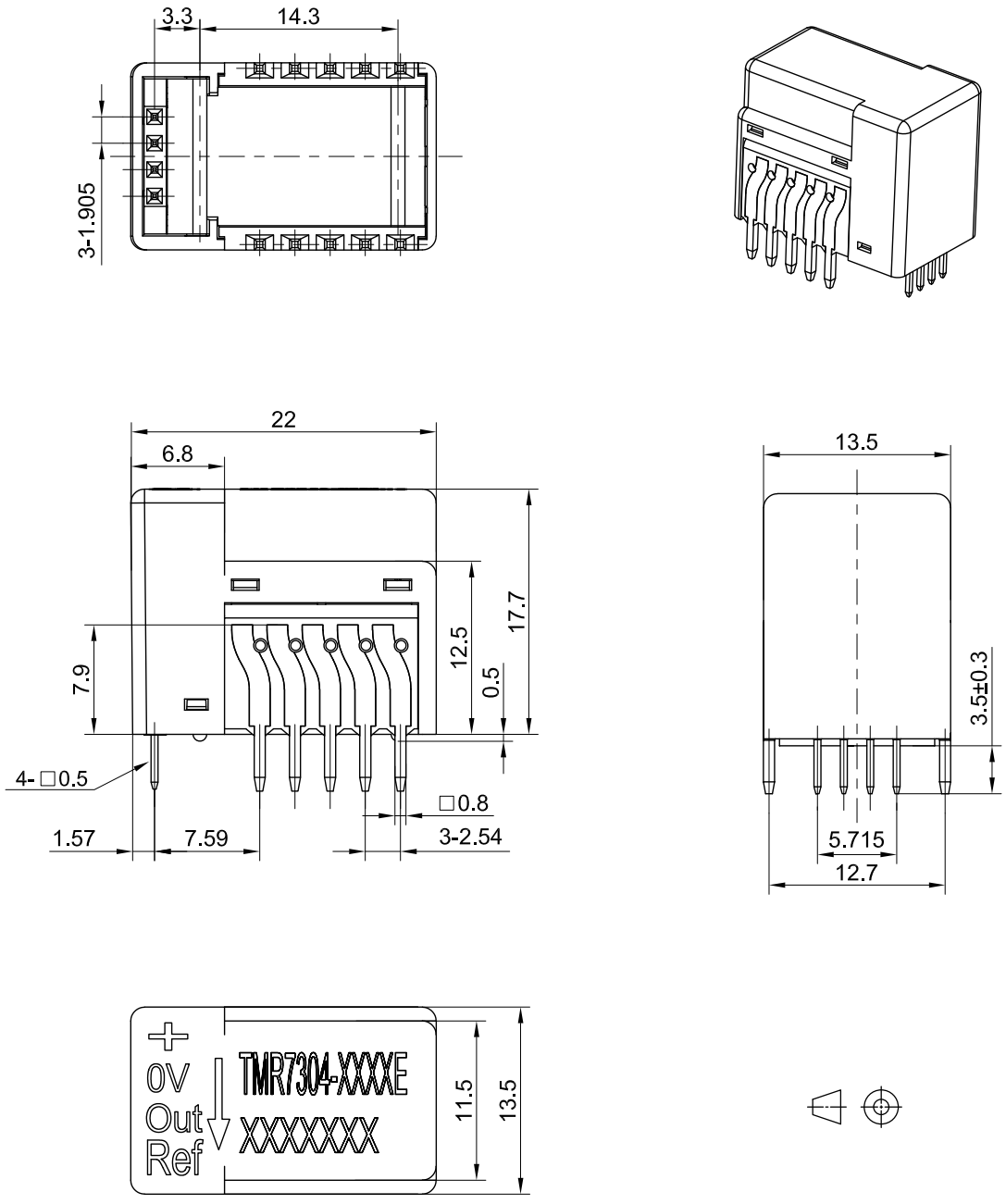

Figure 23. Dimension for TMR7304-E (unit: mm, tolerances for unmarked scales ±1 mm)

Recycling

The product(s) in this document need to be handed over to a qualified solid waste management services company for recycling in accordance with relevant regulations on waste classification after the end of the product(s) life.

MULTIDIMENSION
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