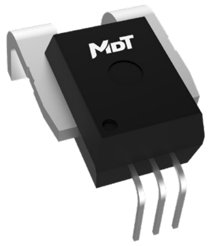
TMR7302-E

Integrated Current Sensor

Description

TMR7302-E is based on the open loop integrated current sensor for measuring DC, AC, pulsed current and arbitrary waveform current with galvanic isolation and its internal temperature compensation circuitry provides excellent performance under different ambient temperature ranges.



Features and Benefits

- Open loop principle
- High accuracy
- Small size, simple structure
- Excellent temperature stability
- RoHS & REACH compliant

Applications

- Power supplies for welding application
- Inverter and variable frequency drives (VFD)
- DC motor drive
- Overcurrent protection

Selection Guide

Model	Supply Voltage	Primary Current Measuring Range	Sensitivity
TMR7302-050E/PFF3BB	3.3 V	±50 A	26.4 mV/A
TMR7302-100E/PFF3BB	3.3 V	±100 A	13.2 mV/A
TMR7302-150E/PFF3BB	3.3 V	±150 A	8.8 mV/A
TMR7302-200E/PFF3BB	3.3 V	±200 A	6.6 mV/A
TMR7302-250E/PFF3BB	3.3 V	±250 A	5.28 mV/A
TMR7302-050E/PFF5BB	5 V	±50 A	40 mV/A
TMR7302-100E/PFF5BB	5 V	±100 A	20 mV/A
TMR7302-150E/PFF5BB	5 V	±150 A	13.33 mV/A
TMR7302-200E/PFF5BB	5 V	±200 A	10 mV/A
TMR7302-250E/PFF5BB	5 V	±250 A	8 mV/A

Insulation and Environmental Characteristics

Parameters	Symbol	Typical	Unit
Supply Voltage (absolute maximum)	V_{CC}	7	V
Dielectric Strength	V_D	4.8	kV(50Hz, 1min)
Creepage Distance	d_{CP}	7.25	mm
Clearance	d_{CL}	7.25	mm
ESD Performance (HBM)	V_{ESD}	4	kV
Ambient Operating Temperature	T_A	-40 to +125	°C
Ambient Storage Temperature	T_{STG}	-40 to +125	°C
Maximum Junction Temperature	$T_{J(MAX)}$	165	°C

Catalogue

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1. TMR7302-XXXE/PFF3BB Specifications

T_A = 25 °C, V_{CC} = 3.3 V, R_L = 10 kΩ, unless otherwise noted

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
General Electrical Data						
Primary Current Measuring Range	I_{PM}	TMR7302-050E/PFF3BB	-50	-	50	A
		TMR7302-100E/PFF3BB	-100	-	100	
		TMR7302-150E/PFF3BB	-150	-	150	
		TMR7302-200E/PFF3BB	-200	-	200	
		TMR7302-250E/PFF3BB	-250	-	250	
Sensitivity	S	TMR7302-050E/PFF3BB	-	26.4	-	mV/A
		TMR7302-100E/PFF3BB	-	13.2	-	
		TMR7302-150E/PFF3BB	-	8.8	-	
		TMR7302-200E/PFF3BB	-	6.6	-	
		TMR7302-250E/PFF3BB	-	5.28	-	
Supply Voltage	V_{CC}	±5 %	3.1	3.3	3.5	V
Offset Voltage	V_{OFF}	I_P = 0	-	1.65	-	V
Output Voltage	V_{OUT}	$I_P = I_{PM(min)}$ to $I_{PM(max)}$	--	1.65 + I_P × S	-	V
Output Saturation Voltage	V_{SATL}	-	0.2	-	-	V
	V_{SATH}	-	-	-	V_{CC}-0.2	V
Current Consumption	I_C	I_P = 0	-	6.3	7.5	mA
Power ON Time	t_{PO}	V_{CC} ≥ 2.5 V	-	40	-	ms
Primary Conductor Input Resistance	R_{IN}	T_A = 25 °C	-	0.1	-	mΩ
Output Impedance	R_{OUT}	-	-	2	5	Ω
Load Resistance	R_L	-	1	10	-	kΩ
Load Capacitance	C_L	-	-	-	10	nF
Rise Time	t_{rise}	I_P = 50 A (100 A/μs)	-	10	-	μs
Delay Time	t_D	I_P = 50 A (100 A/μs)	-	1	-	μs
Response Time	t_R	I_P = 50 A (100 A/μs)	-	10	-	μs
Bandwidth	BW	Small signal -3 dB	-	50	-	kHz
Noise	V_N	T_A = 25 °C, BW = 10 kHz	-	20	-	mV_{PP}
Static Performance Data						
Accuracy	X_G	T_A = 25 °C, $I_P = I_{PM(min)}$ to $I_{PM(max)}$	-2	±1	2	% $I_{PM(max)}$
		T_A = -40 °C to +125 °C, $I_P = I_{PM(min)}$ to $I_{PM(max)}$	-3.5	±2	3.5	
Linearity	ε_L	$I_P = I_{PM(min)}$ to $I_{PM(max)}$	-	0.5	1	% $I_{PM(max)}$
Sensitivity Error	ε_S	T_A = 25 °C, $I_P = I_{PM(min)}$ to $I_{PM(max)}$	-1	-	1	%
		T_A = -40 °C to +125 °C, $I_P = I_{PM(min)}$ to $I_{PM(max)}$	-1.5	-	1.5	
Offset Error	V_{OE}	T_A = 25 °C, I_P = 0	-10	-	10	mV
		T_A = -40 °C to +125 °C, I_P = 0	-25	-	25	
Hysteresis	V_{OH}	$I_P = I_{PM(min)}$ or $I_{PM(max)}$ → 0	-	±5	-	mV

2. TMR7302-XXXE/PFF5BB Specifications

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
General Electrical Data						
Primary Current Measuring Range	I_{PM}	TMR7302-050E/PFF5BB	-50	-	50	A
		TMR7302-100E/PFF5BB	-100	-	100	
		TMR7302-150E/PFF5BB	-150	-	150	
		TMR7302-200E/PFF5BB	-200	-	200	
		TMR7302-250E/PFF5BB	-250	-	250	
Sensitivity	S	TMR7302-050E/PFF5BB	-	40	-	mV/A
		TMR7302-100E/PFF5BB	-	20	-	
		TMR7302-150E/PFF5BB	-	13.33	-	
		TMR7302-200E/PFF5BB	-	10	-	
		TMR7302-250E/PFF5BB	-	8	-	
Supply Voltage	V_{CC}	±5 %	4.75	5	5.25	V
Offset Voltage	V_{OFF}	$I_P = 0$	-	2.5	-	V
Output Voltage	V_{OUT}	$I_P = I_{PM(min)}$ to $I_{PM(max)}$	-	2.5 + $I_P \times S$	-	V
Output Saturation Voltage	V_{SATL}	-	0.2	-	-	V
	V_{SATH}	-	-	-	V_{CC}-0.2	V
Current Consumption	I_C	$I_P = 0$	-	6.3	7.5	mA
Power ON Time	t_{PO}	$V_{CC} \geq 2.5$ V	-	40	-	ms
Primary Conductor Input Resistance	R_{IN}	T_A = 25 °C	-	0.1	-	mΩ
Output Impedance	R_{OUT}	-	-	2	5	Ω
Load Resistance	R_L	-	1	10	-	kΩ
Load Capacitance	C_L	-	-	-	10	nF
Rise Time	t_{rise}	I_P = 50 A (100 A/µs)	-	10	-	µs
Delay Time	t_D	I_P = 50 A (100 A/µs)	-	1	-	µs
Response Time	t_R	I_P = 50 A (100 A/µs)	-	10	-	µs
Bandwidth	BW	Small signal -3 dB	-	50	-	kHz
Noise	V_N	T_A = 25 °C, BW = 10 kHz	-	20	-	mV_{PP}
Static Performance Data						
Accuracy	X_G	T_A = 25 °C, $I_P = I_{PM(min)}$ to $I_{PM(max)}$	-2	±1	2	% $I_{PM(max)}$
		T_A = -40 °C to +125 °C, $I_P = I_{PM(min)}$ to $I_{PM(max)}$	-3.5	±2	3.5	
Linearity	ε_L	$I_P = I_{PM(min)}$ to $I_{PM(max)}$	-	0.3	0.5	% $I_{PM(max)}$
Sensitivity Error	ε_S	T_A = 25 °C, $I_P = I_{PM(min)}$ to $I_{PM(max)}$	-1	-	1	%
		T_A = -40 °C to +125 °C, $I_P = I_{PM(min)}$ to $I_{PM(max)}$	-1.5	-	1.5	
Offset Error	V_{OE}	T_A = 25 °C, $I_P = 0$	-10	-	10	mV
		T_A = -40 °C to +125 °C, $I_P = 0$	-25	-	25	
Hysteresis	V_{OH}	$I_P = I_{PM(min)}$ or $I_{PM(max)} \rightarrow 0$	-	±5	-	mV

3. Typical Output Characteristics

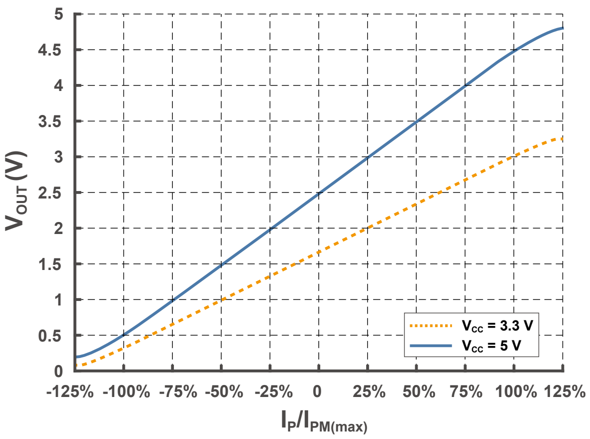


Figure 1. Output voltage vs primary current

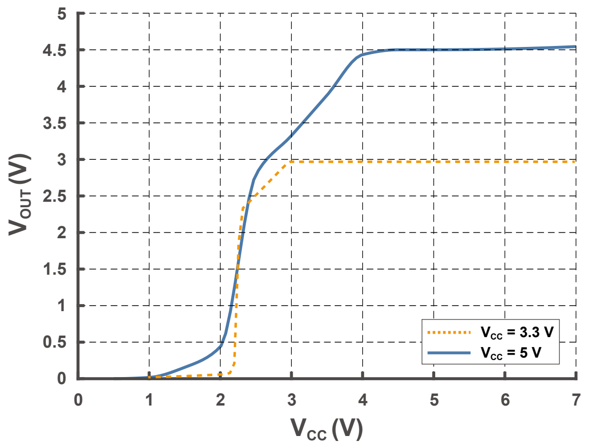


Figure 2. Output voltage vs supply voltage (@$I_P = I_{PN}$)

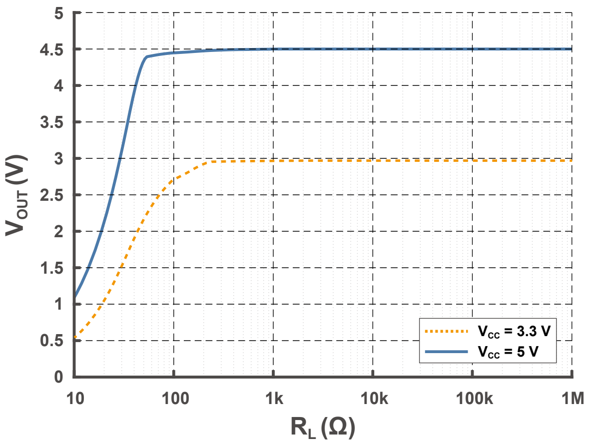


Figure 3. Output voltage vs load resistance (@$I_P = I_{PN}$)

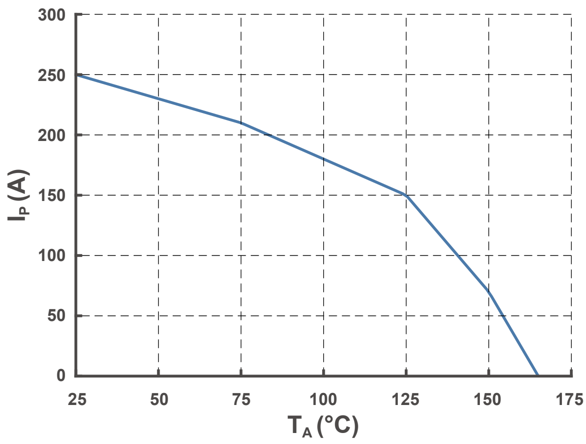


Figure 4. Maximum continuous current (DC)

4. Parameters Definition and Formula

1) Accuracy

$$X_G = \max_{I_p \in [I_{PM(min)},\, I_{PM(max)}]} \left(\frac{V_{OUT} - (I_P \times S + V_{OFF})}{I_{PM(max)} \times S} \times 100\% \right)$$

I_P stands for primary current, $I_{PM(max)}$、$I_{PM(min)}$ stands for the maximum and minimum values within primary current measuring range, V_{OUT} stands for current sensor output voltage at given primary current, S stands for sensitivity, V_{OFF} stands for offset voltage.

2) Sensitivity

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

$V_{OUT}(@\,I_{PM(max)})$、$V_{OUT}(@\,I_{PM(min)})$ stand for the voltage output at $I_{PM(max)}$、$I_{PM(min)}$ respectively.

3) Offset Error

$$V_{OE} = V_{OUT(@I_P = 0)} - V_{OFF}$$

4) Linearity

$$\varepsilon_L = \max_{I_p \in [I_{PM(min)},\, I_{PM(max)}]} \left(\frac{\left| V_{OUT} - (I_P \times \overline{S} + V_{OFF} + \overline{V_{OE}}) \right|}{I_{PM(max)} \times S} \times 100\% \right)$$

$\overline{S}$、$\overline{V_{OE}}$ stand for the average values of the sensitivity and offset error.

5) Hysteresis

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

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

5. Dimensions

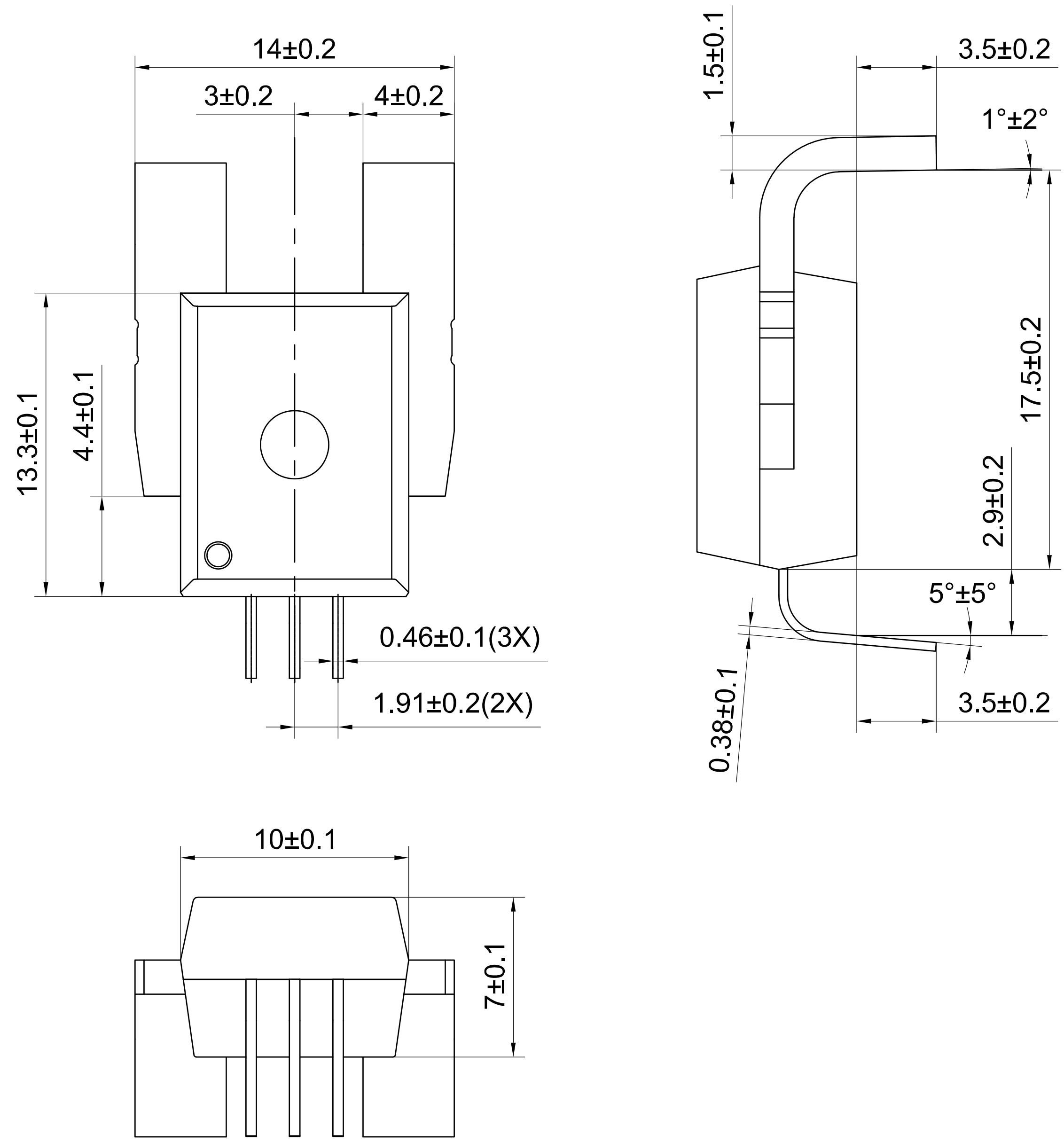
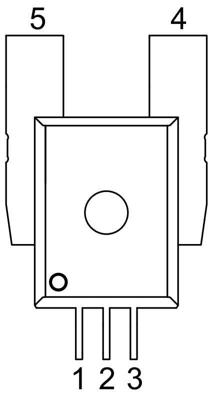


Figure 5. Dimension (unit: mm, tolerances for unmarked scales ±1 mm)

6. Pin Configuration and Wiring Diagram



Pin Number	Name	Function
1	V_{CC}	Power supply
2	GND	Ground
3	V_{OUT}	Voltage output
4	I_P+	Primary current (forward)
5	I_P-	Primary current (reverse)

Figure 6. Pin configuration

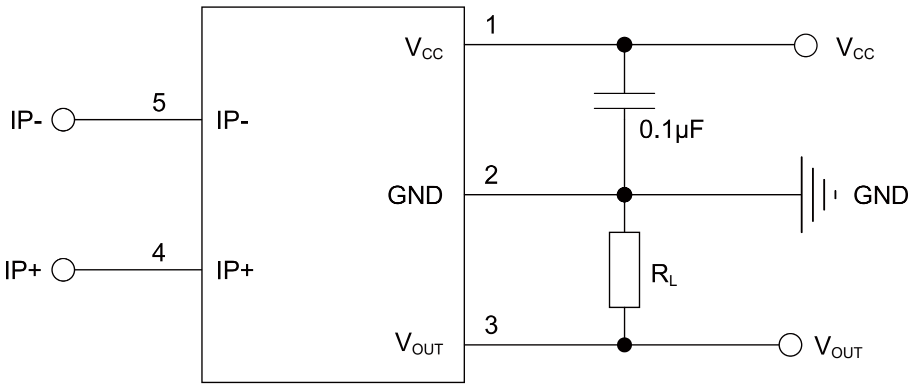


Figure 7. Wiring diagram

7. Remarks

1. Improper connection may result in permanent damage of the sensor.

2. Bandwidth can be adjusted by adding low pass filter (LPF) between V_{OUT} and GND.

3. Sensor is customizable upon request.

8. Recommended PCB Layout

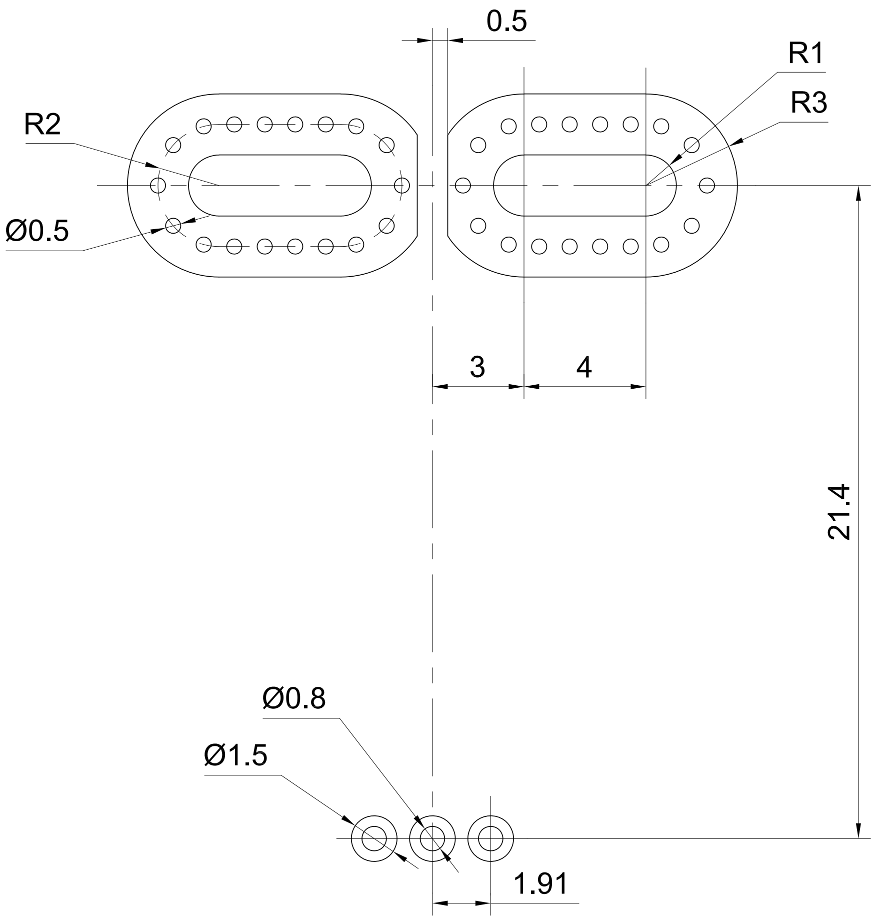


Figure 8. PCB layout

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