

ESP430CE1A, active energy measurement test conditions and accuracy, $T_A = 25^\circ\text{C}$ (See Note 1)

- $f_{\text{ACLK}} = 32,768 \text{ Hz}$ (watch crystal)
- $f_{\text{MCLK}} = 4.194\text{MHz}$ (FLL+)
- $f_{\text{SD16}} = f_{\text{MCLK}}/4 = 1.049\text{MHz}$
- Single point calibration at $I = 10 \text{ A}$, $\text{PF} = 0.5$ lagging
- Measurements according to IEC1036
- Input conditions (unless otherwise noted):
 $I_B = 6 \text{ A}$, $I_{\text{MAX}} = n * I_B = 60 \text{ A}$, $n = 10$, $V_N = 230 \text{ V}$, $f_{\text{MAINS}} = 50 \text{ Hz}$

PARAMETER	TEST CONDITIONS	V_{CC}	MIN	TYP	MAX	UNIT
Maximum error	$I = 0.05 * I_B$, $V = V_N$, $\text{PF} = 1.0$	3 V				%
	$I = 0.1 * I_B$ to I_{MAX} , $V = V_N$, $\text{PF} = 1.0$					
	$I = 0.1 * I_B$, $V = V_N$, $\text{PF} = 0.5$ lagging					
	$I = 0.2 * I_B$ to I_{MAX} , $V = V_N$, $\text{PF} = 0.5$ lagging					
	$I = 0.1 * I_B$, $V = V_N$, $\text{PF} = 0.8$ leading					
	$I = 0.2 * I_B$ to I_{MAX} , $V = V_N$, $\text{PF} = 0.8$ leading					
	$I = 0.2 * I_B$ to I_{MAX} , $V = V_N$, $\text{PF} = 0.25$ lagging					
	V1 SD16GAINx = 1 I1 SD16GAINx = 1 See Figure 14: $R1 = 0\Omega$, $R_B = 12.4\Omega$					

- Input conditions (unless otherwise noted):
 $I_B = 10 \text{ A}$, $I_{\text{MAX}} = n * I_B = 60 \text{ A}$, $n = 6$, $V_N = 230 \text{ V}$, $f_{\text{MAINS}} = 50 \text{ Hz}$

PARAMETER	TEST CONDITIONS	V_{CC}	MIN	TYP	MAX	UNIT
Maximum error	$I = 0.05 * I_B$, $V = V_N$, $\text{PF} = 1.0$	3 V				%
	$I = 0.1 * I_B$ to I_{MAX} , $V = V_N$, $\text{PF} = 1.0$					
	$I = 0.1 * I_B$, $V = V_N$, $\text{PF} = 0.5$ lagging					
	$I = 0.2 * I_B$ to I_{MAX} , $V = V_N$, $\text{PF} = 0.5$ lagging					
	$I = 0.1 * I_B$, $V = V_N$, $\text{PF} = 0.8$ leading					
	$I = 0.2 * I_B$ to I_{MAX} , $V = V_N$, $\text{PF} = 0.8$ leading					
	$I = 0.2 * I_B$ to I_{MAX} , $V = V_N$, $\text{PF} = 0.25$ lagging					
	V1 SD16GAINx = 1 I1 SD16GAINx = 32					

- NOTES: 1. Measurements performed using complete hardware solution. Error shown contain temperature dependencies of all components including the MSP430FE42xA, crystal, and discrete components.
2. I1 SD16GAIN x = 1,4: CT part number = T60404-E4624-X101 (Vacuumschmelze)
 I1 SD16GAINx = 8: shunt part number = A-H2-R005-F1-K2-0.1 (Isabellenhütte Heusler GmbH KG)
 I1 SD16GAINx = 32: shunt part number = BVO-M-R0002-5.0 (Isabellenhütte Heusler GmbH KG)

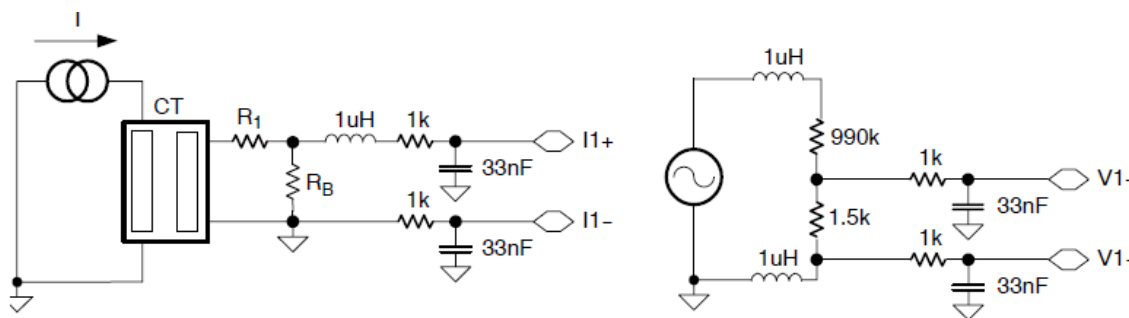


Figure 14. Energy Measurement Test Circuitry (SD16GAINx = 1)

ESP430CE1A (I1 SD16GAINx = 1) typical characteristics (see Note A)

MEASUREMENT ERROR AS % OF READING
($T_A = 25^\circ\text{C}$)

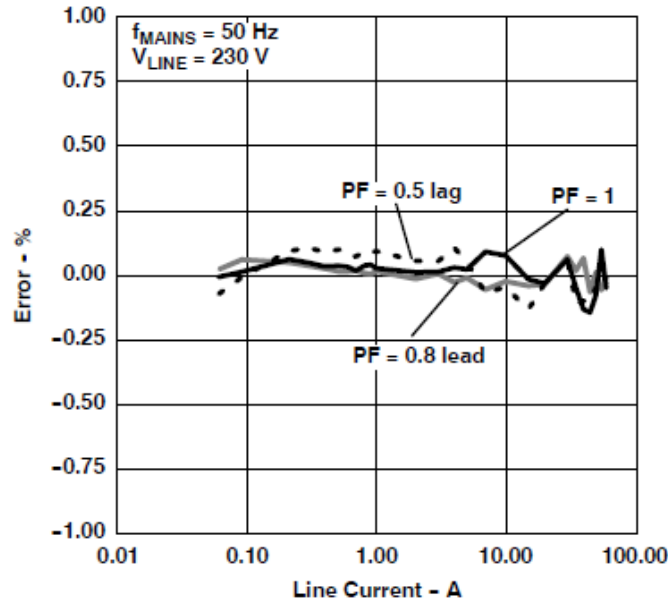


Figure 15

MEASUREMENT ERROR AS % OF READING
($T_A = -40^\circ\text{C}$)

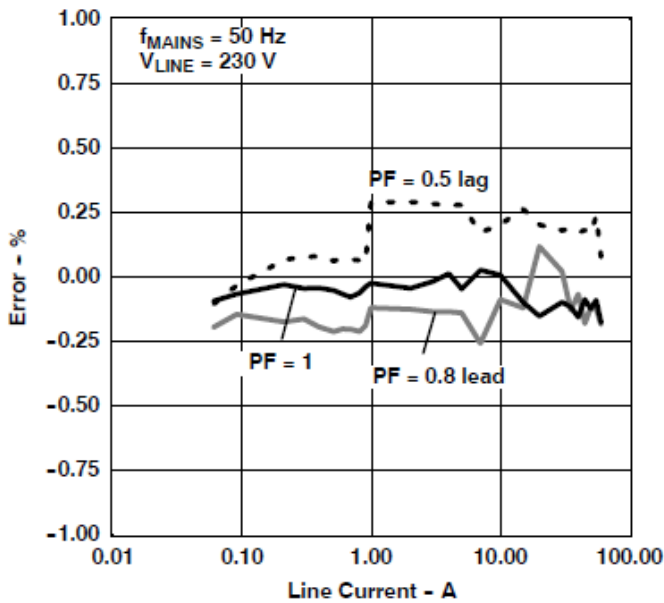


Figure 16

MEASUREMENT ERROR AS % OF READING
($T_A = 85^\circ\text{C}$)

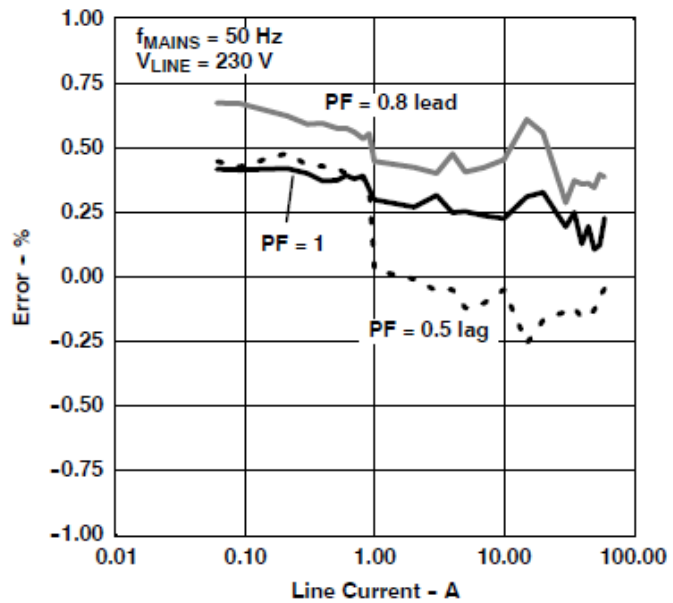


Figure 17

NOTE A. Results corrected for typical phase error of CT used (-40°C to 25°C : -0.7° ; 25°C to 85°C : $+0.5^\circ$).
See Figure 14 for test circuitry: CT part number = T60404-E4624-X101 (Vacuumschmelze), $R_1 = 0 \Omega$, $R_B = 12.4 \Omega$.

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