

TLB6-A1TDM



Residual
Current
Device

DIMENSIONS:



From
1.931 x 1.339 x 0.679"
(49.05 x 34 x 17.25mm)

IEC 62752 (IC-CPD)

IEC 62955 (RDC-PD)

3000A SURGE

General specifications

Part number	Input voltage	DC residual current	AC residual current	Rated current	Static power dissipation
TLB6-A1TDM	5VDC	6mA	30mA	40A	0.25W

Note: Add K for enhanced magnetic shielding version

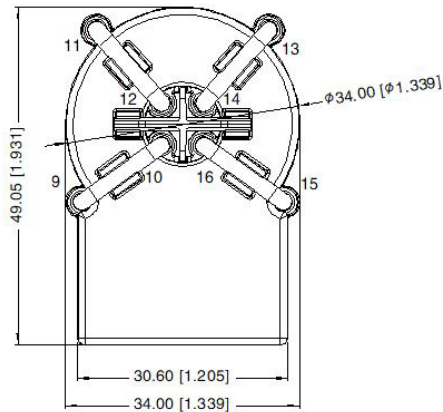
Electrical specifications

Parameter	Symbol	Min	Typical	Max	Unit
Rated residual DC operating current	$I_{\Delta NDC}$		6		mA
Rated residual AC operating current	$I_{\Delta NAC}$		30		mA
Range of remaining DC operating current	$I_{\Delta NDC-RANGE}$	3		6	mA
Range of remaining AC operating current	$I_{\Delta NAC-RANGE}$	15		30	mA
Maximum residual current measurement range	$I_{\Delta RANGE}$		±300		mA
Input voltage	V_{CC}	4.85	5	5.15	V
Static operating current			30	45	mA
Rated current	I_p		32	40	A

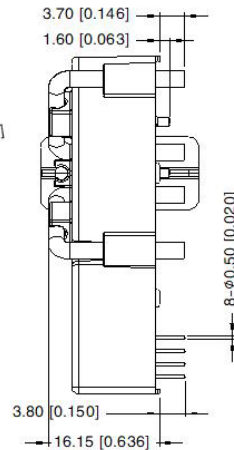
Mechanical

THIRD ANGLE PROJECTION 

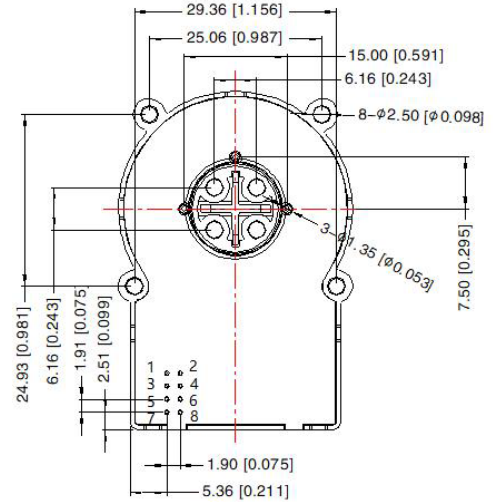
Front View



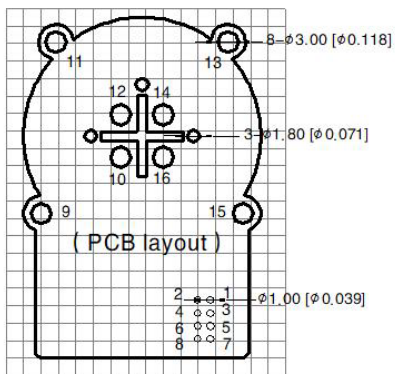
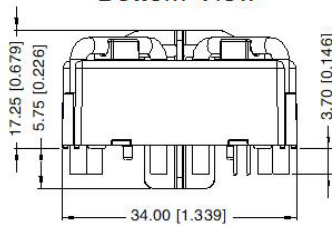
Right View



Rear View



Bottom View



Note: Grid 2.54*2.54mm

Notes

1. All dimensions shown in mm [Inch]
2. Pin tolerance: $\pm 0.10 [\pm 0.004]$
3. General tolerance $\pm 0.50 [\pm 0.020]$
4. Grid 2.54*2.54

Pin-Out

Pin	Function
1	Error
2	Calibrate
3	DC trigger out
4	AC trigger out
5	GND
6	Vcc
7	PWM out
8	NC
9-16	Primary winding

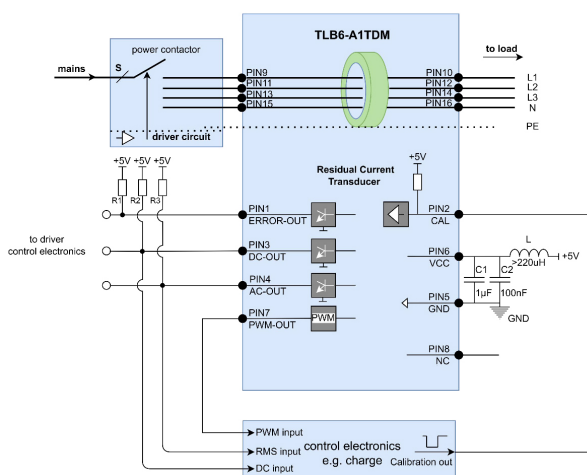
Pin out description

PIN	ID	Description
1	Error out	Error output pin, when the pin is in the high impedance, it indicates that the system is faulty. At this time, the DC-OUT pin and the AC-OUT pin are also in the high impedance. If the system is normal, the pin is low level
2	CAL	Calibration pin, when the pin inputs a low voltage of >40ms and <1.2s in duration, the product performs a calibration
3	DC-out	DC action pin. Under the condition that the system is fault-free, the pin is low level when the DC residual current is less than 6mA; otherwise, the pin is high impedance. In addition, when the AC-OUT pin is in a high impedance, the pin is also set to a high impedance. See "Output pin truth table".
4	AC-out	AC action pin. Under the condition that the system is fault-free, the pin is low level when the AC residual current is less than 30mA; otherwise, the pin is high impedance.
5	GND	Ground
6	VCC	The product is powered by VCC, which requires a capacitor of 100nF and 1uF in parallel at the input end.
7	PWM-out	Duty ratio output pin. Output a square wave signal with 8kHz frequency, and the duty ratio varies with the input current by 3.3% per mA
8	NC	Not connected

Truth table

Pin	DC out	AC out	Error out	Operating State
$V_{CAL IL}$	Low level	Low level	Low level	System normal
	High impedance	Low level	Low level	$I_{ANDC} > 6mA$
	High impedance	High impedance	Low level	$I_{ANAC} > 30mA$
	High impedance	High impedance	High impedance	Error system fault

Application notes



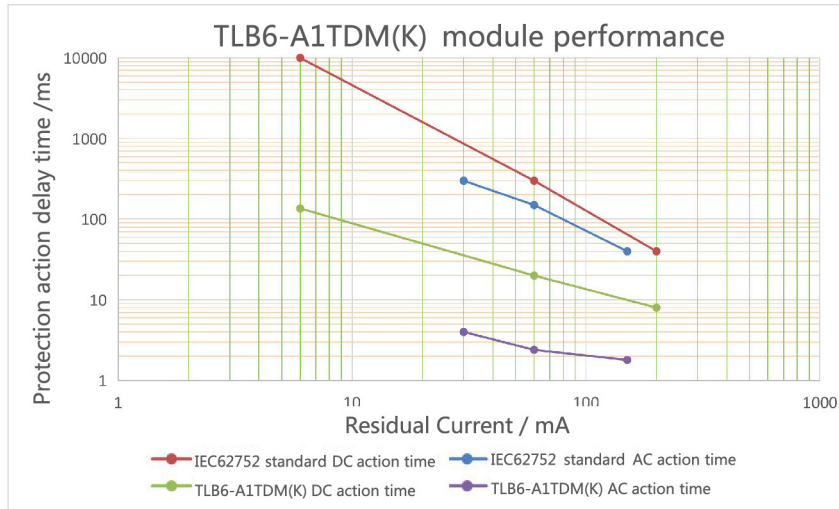
NOTES

- Two capacitors 1uF/16V and 100nF/16V need to be provided at VCC and GND for energy storage and decoupling. The value of inductance L is greater than 220μH.
- DC action pin DC-OUT, AC action pin AC-OUT and duty ratio output pin PWM-OUT are usually connected to a microcontroller or to a power circuit to control back-end circuit breaker action
- The ERROR output pin ERROR-OUT, DC action pin DC-OUT, and AC action pin AC-OUT need to be connected to pull-up resistors R1, R2 and R3 respectively. 10 kΩ is recommended for pull-up resistors
- Calibration pin CAL is generally controlled by a microcontroller. See "Pin out description" for details



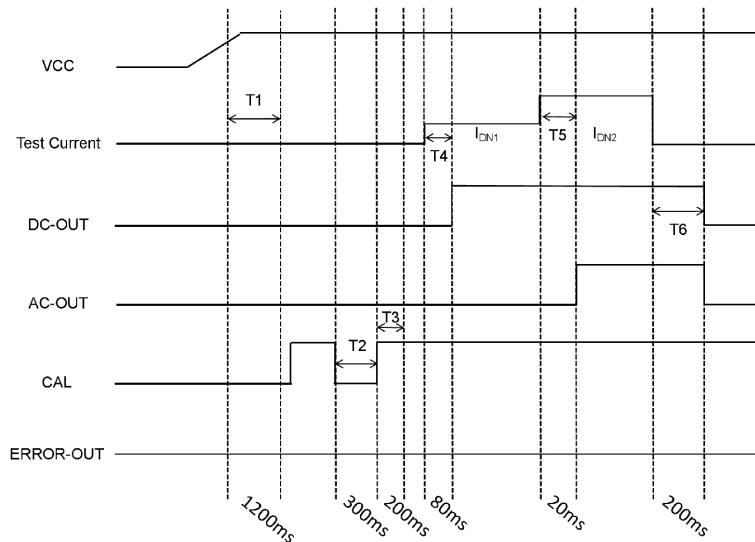
Performance characteristic

Parameter	Symbol	Residual current waveform	Min	Typical	Max	Unit	
Residual operating current	$I_{\Delta NDC50}$	Frequency 50Hz AC	15	22.5	30	mA RMS	
	$I_{\Delta NDC1000}$	Frequency 1000Hz AC		300		mA RMS	
	$I_{\Delta NA0}$	0 Angle pulsating DC	11	15	30	mA RMS	
	$I_{\Delta NA90}$	90 Angle pulsating DC	10	15	30	mA RMS	
	$I_{\Delta NA135}$	135 Angle pulsating DC	10	15	35	mA RMS	
	$I_{\Delta NS-DC}$	Smooth DC	3	4.5	6	mA RMS	
	$I_{\Delta N2-PDC}$	Two phase rectification DC	3.5	5	7	mA RMS	
	$I_{\Delta N3-PDC}$	Three phase rectification DC	3.1	4.5	6.2	mA RMS	
	$I_{\Delta IC-CPD}$	IP-CPD current	18	28	38	mA RMS	
Response time	$T_{\Delta NAC50@30mA}$	RMS 30mA Frequency 50Hz AC		55	70	mS	
	$T_{\Delta NAC50@60mA}$	RMS 60mA Frequency 50Hz AC		30	35	mS	
	$T_{\Delta NAC50@150mA}$	RMS 150mA Frequency 50Hz AC		15	20	mS	
	$T_{\Delta NA0@42mA}$	RMS 42mA 0 Angle pulsating DC		38	50	mS	
	$T_{\Delta NA0@84mA}$	RMS 84mA 0 Angle pulsating DC		30	40	mS	
	$T_{\Delta NA0@210mA}$	RMS 210mA 0 Angle pulsating DC		25	35	mS	
	$T_{\Delta NA0@42mA+S-DC@6mA}$	RMS 42mA 0 Angle pulsating DC + 6mA smooth DC		38	50	mS	
	$T_{\Delta NA0@84mA+S-DC@6mA}$	RMS 84mA 0 Angle pulsating DC + 6mA smooth DC		30	40	mS	
	$T_{\Delta NA0@210mA+S-DC@6mA}$	RMS 210mA 0 Angle pulsating DC + 6mA smooth DC		25	35	mS	
	$T_{\Delta NA90@42mA}$	RMS 42mA 90 Angle pulsating DC		38	50	mS	
	$T_{\Delta NA90@84mA}$	RMS 84mA 90 Angle pulsating DC		30	40	mS	
	$T_{\Delta NA90@210mA}$	RMS 210mA 90 Angle pulsating DC		25	35	mS	
	$T_{\Delta NA90@42mA+S-DC@6mA}$	RMS 42mA 90 Angle pulsating +6mA smooth DC		38	50	mS	
	$T_{\Delta NA90@84mA+S-DC@6mA}$	RMS 84mA 90 Angle pulsating +6mA smooth DC		30	40	mS	
	$T_{\Delta NA90@210mA+S-DC@6mA}$	RMS 210mA 90 Angle pulsating +6mA smooth DC		25	35	mS	
	$T_{\Delta NA135@42mA}$	RMS 42mA 135 Angle pulsating		38	50	mS	
	$T_{\Delta NA135@84mA}$	RMS 84mA 135 Angle pulsating		30	40	mS	
	$T_{\Delta NA135@210mA}$	RMS 210mA 135 Angle pulsating		25	35	mS	
	$T_{\Delta NA135@42mA+S-DC@6mA}$	RMS 42mA 135 Angle pulsating +6mA smooth DC		38	50	mS	
	$T_{\Delta NA135@84mA+S-DC@6mA}$	RMS 84mA 135 Angle pulsating +6mA smooth DC		30	40	mS	
	$T_{\Delta NA135@210mA+S-DC@6mA}$	RMS 210mA 135 Angle pulsating +6mA smooth DC		25	35	mS	
	$T_{\Delta NS-DC@6mA}$	6mA smooth DC			120	200	mS
	$T_{\Delta NS-DC@60mA}$	60mA smooth DC			25	30	mS
	$T_{\Delta NS-DC@300mA}$	300mA smooth DC			25	30	mS
	$T_{\Delta N2PDC@6mA}$	RMS 6mA two phase rectification DC			120	200	mS
	$T_{\Delta N2PDC@60mA}$	RMS 60mA two phase rectification DC			25	30	mS
	$T_{\Delta N2PDC@300mA}$	RMS 300mA two phase rectification DC			25	35	mS
	$T_{\Delta N3PDC@6mA}$	RMS 6mA three phase rectification DC			120	200	mS
	$T_{\Delta N3PDC@60mA}$	RMS 60mA three phase rectification DC			25	30	mS
	$T_{\Delta N3PDC@300mA}$	RMS 300mA three phase rectification DC			25	30	mS
	$T_{\Delta NF@210mA}$	RMS 210mA composite current			15	25	mS
	$T_{\Delta IC-CPD@210mA}$	RMS 210mA IP-CPD current			15	25	mS



Timing characteristic

Parameter	Symbol	Min	Typical	Max	Unit
Start up time	T1			1200	mS
CAL signal low level maintenance time	T2	40	300	1200	mS
CAL calibration duration	T3		200		mS
Idn1 Test signal action time ($I_{DN1}=8mA$)	T4		80		mS
Idn2 Test signal action time ($I_{DN2}=40mA$)	T5		20		mS
Trip signal maintenance time	T6		200		mS



Timing application design essentials:

1. After the power supply is fully started, the startup and stabilization time of the module is about 1200ms (T1). During this period, it is recommended that the whole system does not operate.
2. When performing signal calibration, the external signal sets the CAL pin to low level, and the recognition time (T2) of the CAL pin low level is about 300ms. After successful identification, signal calibration is carried out internally. The duration of the calibration was approximately 200ms (T3).
3. External input test current IDN1, delay about 80ms (T4), DC-OUT pin output high impedance (trip signal); Then the test current is increased to IDN2, and after a delay of about 20ms (T5), the DC-OUT pin and AC-OUT pin output high impedance (trip signal).
4. The test current input stops, and after a delay of about 200ms (T6), the DC-OUT pin and AC-OUT pin stop the output trip signal and output low level

Protection and detection specifications

Parameter	Symbol	Min	Typical	Max	Unit
Calibration input low level voltage	V_{CALIL}	0		1	V
Calibration input high level voltage	V_{CALIH}	4		5.15	V
Error output low level voltage	$V_{ERROR-OUT OL}$	0		0.6	V
Error output high level voltage	$V_{ERROR-OUT OH}$			High impedance	
Operating output low level voltage	$V_{DC-OUT/AC-OUT OL}$	0		0.6	V
Operating output high level voltage	$V_{DC-OUT/AC-OUT OH}$			High impedance	
PWM output duty ratio	$S_{PWM-OUT}$	3	3.3	3.6	%/mA
Frequency of PWM	$f_{PWM-OUT}$	7.8	8	8.2	kHz
Error output delay time	$T_{ERROR-OUT}$	150			mS
Calibration input low pulse time limit	T_{CALIL}		40		mS
Calibration input high pulse time limit	T_{CALIH}		1.2		S

General specifications

Parameter	Symbol	Min	Typical	Max	Unit
Operating temperature	T_A	-40		85	°C
Storage temperature	T_s	-40		105	°C
Weight	m		31		g
Weight (K version)	m		37		g
Vibration		0-150Hz, 5g (GB2423.10, IEC60068-2-6)			
Over voltage category		OVC III (IEC61010)			

Isolation specifications

Parameter	Operating conditions	Min	Typical	Max	Unit
Isolation voltage	Primary to secondary 50hz 1min. Leakage current <1mA			4	KVAC
Pulse withstand voltage	1.2/50us		5.5		kV
Insulation resistance	500VDC	1			G Ω

EMC specifications

Parameter	Operating conditions	Specificaitons	Performance
EMI	Conducted and Radiated	CISPR32/EN55032	Level B
EMS	ESD EN61000-4-2	Contact ±4kV, Air ±8kV	B
	RS EN61000-4-3	20V/m	A
	EFT EN61000-4-4	±2kV	B
	Surge current	3000A, 8/20us	B