OVERVIEW

The **LC-063 / Kimat External Watchdog Timer (EXT WDT) v2.0** module provides a reliable external signal to allow most microcontroller (MCU) boards including Arduino boards to reset whenever a software or hardware malfunction halts the microcontroller. This module simplifies external WDT implementation by providing the necessary hardware in a small package with standard 2.54mm headers.

While some microcontrollers already feature an internal watchdog timer, this module is 100% independent of the operation of the target microcontroller being monitored ensuring that the safety circuit operates regardless of internal microcontroller issues. Having an external WDT solution also eliminates all the issues related to the implementation of an internal watchdog timer.

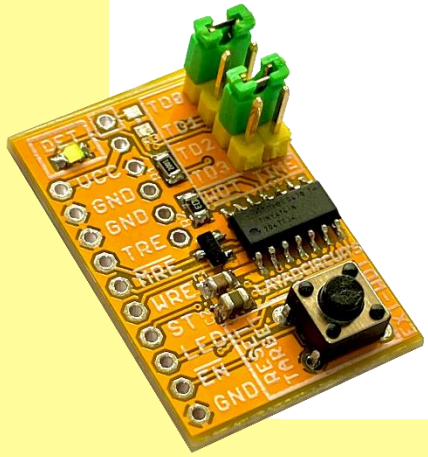

Figure 1 Kimat External WDT

The module follows typical WDT implementation plus other important features. The module accepts a simple digital strobe signal that is made to toggle between HIGH and LOW. This signal comes from any available GPIO from the target microcontroller. The signal is then used by the module to determine if the target is working normally. Whenever the strobe signal does not change state within the selected WDT timeout period, the target's reset pin is pulled low causing a hard reset on the target and promoting immediate recovery.

The module has a built-in LED (DET) that blinks every time the strobe signal, coming from the target, changes state between HIGH and LOW. The module features a selectable WDT timeout via the onboard micro jumpers.

It also has a physical button that may be used to manually trigger a reset on the target. A digital control pin labeled EN is also provided to allow the target microcontroller to temporarily disable the WDT function of the module should there be a need

FEATURES

- No external components required
- Minimum of one output from the target
- 11 user – selectable watchdog timeout periods
- Enable/Disable via EN pin
- 3.3V/5V operating voltage
- Current consumption of less than 100mA
- On board target reset button
- Strobe signal detection LED indicator
- Arduino compatible, Standard 2.54mm headers

PIN FUNCTIONS

The module has a 10 pin 2.54mm pitched main header with the following functions.

Pin Label	Function/Operation/Remarks
VCC	Accepts input power source with +3.3Vdc to +5Vdc that can supply at least 100mA.
GND	Ground.
TRE	Connects to the target's reset pin. This open-drain output of the module pulls

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	the targets reset pin to ground causing a hard reset on the target.
MRE	Module reset. Pulling this low will reset the module. The External WDT has around 10ms bootup time after the is module reset
WRE	Reserved. Do not use.
ST	Strobe input pin. Connects to the digital strobe signal from the target MCU. To ensure each rising or falling edge is detected, keep the state changes at a minimum of 1 microsecond interval.
LED	Connected internally to the DET LED signal. This is normally not used by the target.
EN	Enable/Disable pin. This internally pulled up input enables or disables the watchdog timer functions of the module. When signal is high or left open, the WDT functions normally. When signal is pulled low, the WDT will not function. The DET LED blinks fast to indicate that the watchdog timer is disabled. Connect this pin to a free output pin on the target if disabling/enabling is required. Care should be taken when disabling the module as this removes the protection function of the module. Unless pulled to low by the target, the EN pin is always HIGH due to the internal pull-up. Leave this pin unconnected if the module is to be left operational at all times.
TD0 - TD3	WDT Timeout. User selectable watchdog timeout. Watchdog timeout is selected using the two provided micro jumpers.

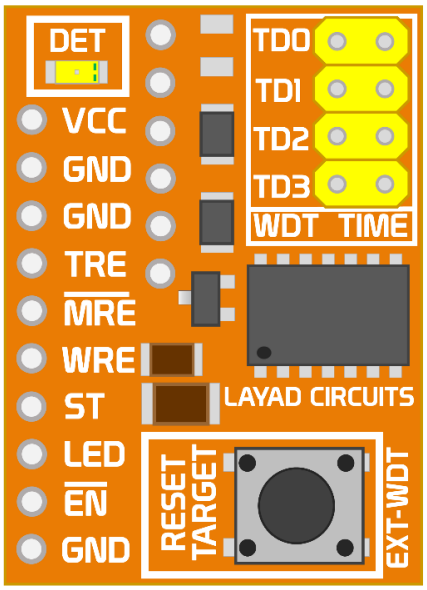

Figure 2: Top view showing pin labels

WDT TIMEOUT SELECTION

The user can pre-select the watchdog timeout period by installing either one, two or none of the micro jumpers on the WDT TIME header. This timeout is the time within which the module must receive a falling or rising edge on the strobe pin to keep the TRE pin high. If the strobe signal does not change within this period, the TRE pin is pulled LOW, and hence generating a reset on the target. Refer to the diagrams below for the micro jumper position and its corresponding timeout.

	100ms	10 sec
TD0	MICRO JUMPER	MICRO JUMPER
TD1		
TD2		MICRO JUMPER
TD3		

	1 sec	15 sec
TD0		MICRO JUMPER
TD1	MICRO JUMPER	MICRO JUMPER
TD2		
TD3		

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	2 sec	30 sec
TD0		
TD1		MICRO JUMPER
TD2	MICRO JUMPER	
TD3		MICRO JUMPER

	5 sec	60 sec
TD0		
TD1		MICRO JUMPER
TD2		MICRO JUMPER
TD3	JUMPER WIRE	

	8 sec	120 sec
TD0	MICRO JUMPER	
TD1		
TD2		MICRO JUMPER
TD3	MICRO JUMPER	MICRO JUMPER

In cases where no jumpers are installed, the WDT will choose a timeout of 180 seconds or 3 minutes.

	180 sec
TD0	
TD1	
TD2	
TD3	

STROBE MONITORING DELAY

After the target microcontroller is reset by the module, it will automatically prompt the External WDT to enter a 2.5 seconds delay to accommodate bootup time of the target. The watchdog monitoring features are only enabled after this delay.

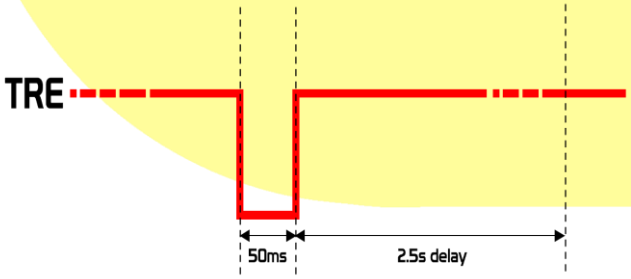

Figure 3: Shows the 2.5 seconds delay implemented after the TRE pin is pulled low for 50ms by the module. During the 2.5 seconds delay, no watchdog functions are enabled to allow the target to fully boot up.

Note: An Arduino UNO has an average bootup time of 1.8 seconds after reset.

For boards that require more than 2.5 seconds to boot up, select the timeout periods that are longer than 2.5 seconds. This ensures that whenever a reset is generated by the EXT WDT by pulling the TRE low, the target has sufficient time to boot up and start generating the strobe signals.

EXAMPLE APPLICATION

The LC-063 / Kimat External Watchdog Timer (EXT WDT) ensures continuous run time of the target microcontroller. If target microcontroller fails to properly execute code due to any reason, the strobe signal may not change and hence, the LC-063 module will trigger a reset on the target by pulling the reset pin of the target Arduino/Saleng Uno board via the TRE pin.

WIRING

The VCC of the Kimat External WDT is sourced from the Saleng Uno/Arduino Uno's 5V pin. The Saleng Uno is powered using the DC jack with a supply range of 6 to 9v or powered via the USB port. The pin connections of the Saleng UNO with Kimat External WDT are as follow:

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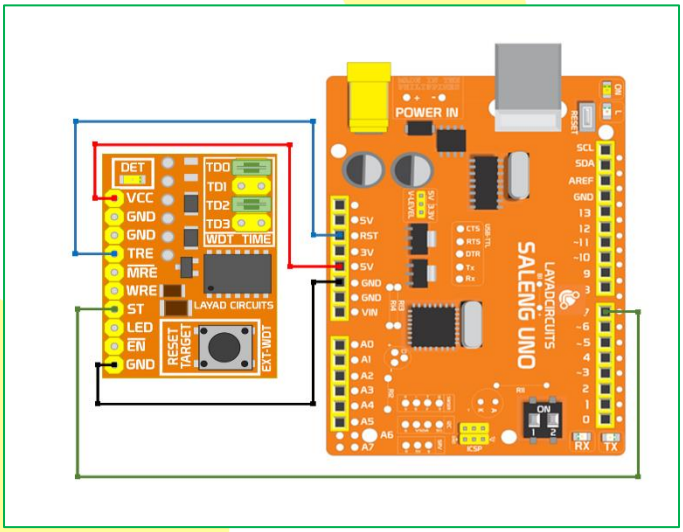

Figure 4: Saleng UNO (Arduino UNO) connected to Kimat External WDT with a 10 seconds WDT timeout

In the example code, the strobe signals are toggled every 1000 milliseconds hard delay. In actual implementations, this may not be the case. The target needs to simply toggle the strobe signal at an interval of at least 1 microsecond gap to ensure its detection. A typical application would insert the strobe state changes at the top of the application code and another somewhere at the middle of the code.

EXAMPLE CODE

```
// This sketch uses pin 7 to generate strobe pulses every 1 secs
// Arduino uno has an average 1.8s bootup time and the WDT has 2.5s delay to compensate for it
// This uses the built-in LED as an indicator for the pulses generated

void setup(){
  Serial.begin (9600);                          //choose the baud rate, default set as 9600
  pinMode (7, OUTPUT);                          //set pin 7 to send pulses to ST
  pinMode (LED_BUILTIN, OUTPUT);                //pulse indicator
  Serial.println("LAYAD CIRCUIT SAMPLE CODE");  //shows up on serial monitor every reset
}

void loop() {
  digitalWrite (7, HIGH);                       //toggle/change the strobe signal
  digitalWrite (LED_BUILTIN, HIGH);             //turn the LED on
  delay (1000);                                 //wait for a second to ensure 1uS interval

  //the rest of the code go here

  digitalWrite (7, LOW);                        //toggle/change the strobe signal
  digitalWrite (LED_BUILTIN, LOW);              //turn the LED off
  delay (1000);                               // wait for a second to ensure 1uS interval

    //the rest of the code go here
}
```


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