High Performance Safety Controller – HY-TTC 540

**General Description**

HY-TTC 540 is a high-end electronic control solution for the off-highway industry satisfying all upcoming needs: The core of the controller is the very powerful TMS570 CPU designed for use in demanding safety-critical automotive and transportation applications. The HY-TTC 540 fulfills safety requirements up to SIL 2 (IEC 61508) / PL d (ISO 13849).

The HY-TTC 540 is part of a complete and compatible product family and is protected by a compact, automotive-style housing suited to mobile applications.

**Specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECU Dimensions</td>
<td>231.3 x 204.9 x 38.8 mm</td>
</tr>
<tr>
<td>Dimensions for minimum connector release clearance</td>
<td>315.3 x 204.9 x 38.8 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>1200 g</td>
</tr>
<tr>
<td>Connector</td>
<td>154 pins</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40 to +85 °C</td>
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<tr>
<td>Operating Altitude</td>
<td>0 to 4000 m</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>8 to 32 V</td>
</tr>
<tr>
<td>Peak Supply Voltage</td>
<td>45 V&lt;sub&gt;Nmax&lt;/sub&gt;</td>
</tr>
<tr>
<td>Supply Current at 12/24V</td>
<td>400/200 mA&lt;sub&gt;Nmax&lt;/sub&gt;</td>
</tr>
<tr>
<td>Standby Current</td>
<td>&lt;1 mA&lt;sub&gt;Nmax&lt;/sub&gt;</td>
</tr>
<tr>
<td>Total Load Current</td>
<td>50 A&lt;sub&gt;Nmax&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

**Standards**

- Functional safety: IEC 61508 SIL2, EN ISO 13849 PL d
- CE-Mark: 2014/30/EU, 2006/42/EC
- E-Mark: ECE-R10 Rev.4
- EMC: EN 13309, ISO 14982, CISPR 25
- ESD: ISO 10605
- Electrical: ISO 16750-2, ISO 7637-2, 3
- Ingress Protection: EN 60529 IP67, ISO 20653 IP6k9k
- Climatic: ISO 16750-4
- Mechanical: ISO 16750-3

**Features**

**CPU core**
- 32-Bit TI TMS570, ARM cortex-R4F based
- Dual-core lockstep CPU and memory protection for safety-relevant applications
- 180 MHz, 298 DMIPS, Floating-Point Unit
- 3 MB flash, 256 kB int. RAM
- 2 MB ext. RAM, 64 kB ext. EEPROM
- Safety Companion CPU

**Interfaces**
- 4 x CAN 50 kbit/s up to 1 Mbit/s
- 4 x CAN bus termination configurable via connector pins
- 28 x PWM OUT or digital OUT, up to 4 A, high side, with high side current-measurement
- 8 x digital OUT up to 4 A, high side, overload and open load detection, current sense alternative use as LED control OUT or analog IN 0 – 32 V, with configurable pull-up/down
- 8 x digital OUT up to 4 A, low side, current sense, overload and open load detection, alternative use as analog IN, 0 – 32 V
- Wiring option to use up to 8 of the digital OUT, high side and 8 digital OUT, low side, as full H-bridge for motor control

**Outputs**
- 8 x analog IN 12 bit, 0 - 5 V, 0 - 25 mA, 0 - 100 kOhm
- 8 x analog IN 12 bit, 0 - 5 V, 0 - 10 V, 0 - 25 mA
- 8 x analog IN 12 bit, 0 - 5 V, 0 - 32 V, 0 - 25 mA
- 6 x digital timer IN (0.1 Hz - 20 kHz), encoder supporting digital voltage sensors with configurable pull-up/down, digital (7/14 mA) current loop speed-sensor alternative use as analog IN 12 bit, 0 – 32 V
- 6 x digital timer IN (0.1 Hz - 20 kHz), encoder supporting digital voltage sensors with configurable pull-up/down, alternative use as analog IN 12 bit, 0 – 32 V
- 8 x digital timer IN (0.1 Hz - 10 kHz) with pull-up
- 8 x analog IN 12 bit, 0 – 32 V
- K15 and wake up

**Multi-purpose I/O’s**
- 8 x configurable as
  - PVG OUT, 10 - 90% of BAT+ or voltage OUT, 0 - 100% of BAT+ or
  - digital OUT up to 4 A high side or
  - LED control OUT or
  - analog IN 12 bit, 0 - 32 V

**Sensor supply**
- 2 x sensor supply, 5 V, max. 500 mA
- 1 x sensor supply, 5 - 10 V, max. 2.5 W, configurable by SW in 1 V steps

All I/Os and interfaces are protected against short circuit to GND and BAT+ and can be configured by software.

Board temperature, sensor supply and supply voltage are monitored by software.

Inputs and Outputs can also be used as digital Input.

Two independent shut-off groups for PWM output stages.

Details to the standards can be found in the System-Manual.

Software
- C Programming Environment (extended with SAFERTOS<sup>®</sup> integration)
- CODESYS<sup>®</sup> Safety SIL 2 including support for CANopen<sup>®</sup> Safety Master
- CODESYS<sup>®</sup> V3 including support for CANopen<sup>®</sup> Master

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Block Diagram

**RAM:** 2 MB

**EEROM:** 64 kB

**TMS 570**

**ARM Cortex**
- Dual-core lockstep
- 32 bit / 180 MHz
- 256 kB RAM
- 3 MB Flash
- Safety Companion

**INTERFACES**

1. K15 Key Switch
2. Sensor supply
   - 5 V / 500 mA
3. Wake-Up
4. Sensor supply
   - 5-10 V
5. analog IN
   - 0-5 V / 0-25 mA / 0-100 kOhm
6. analog IN
   - 0-5 V / 0-10 V / 0-25 mA
7. analog IN
   - 0-5 V / 0-32 V / 0-25 mA
8. digital timer IN
   - 0.1 Hz – 20 kHz or digital timer IN
   - 7/14 mA or analog IN
9. digital timer IN
   - 0.1 Hz – 20 kHz or analog IN
10. digital timer IN
    - 0.1 Hz – 10 kHz with pull-up
11. analog IN
    - 0-32 V
12. Sensor supply
    - 5 V / 500 mA
13. HS PWM OUT
    - up to 4 A with current measurement
14. HS digital OUT
    - up to 4 A with current sense or LED OUT or analog IN
15. PVG OUT or
    - Voltage OUT or
    - HS digital OUT or
    - LED OUT or
    - analog IN
16. analog IN
    - 0-5 V / 0-32 V
17. analog IN
    - 0-5 V / 0-10 V / 0-25 mA
18. analog IN
    - 0-5 V / 0-32 V / 0-25 mA

**Housing and Connector**

Aluminum die-cast housing

154-pin connector

For further information, including price and availability, please contact products@ttcontrol.com

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