

Year = 2011  
Model = Mustang  
Engine = 5.0L  
VIN =  
IDS Version = Not Available

## Cylinder Head Temperature (CHT) Sensor

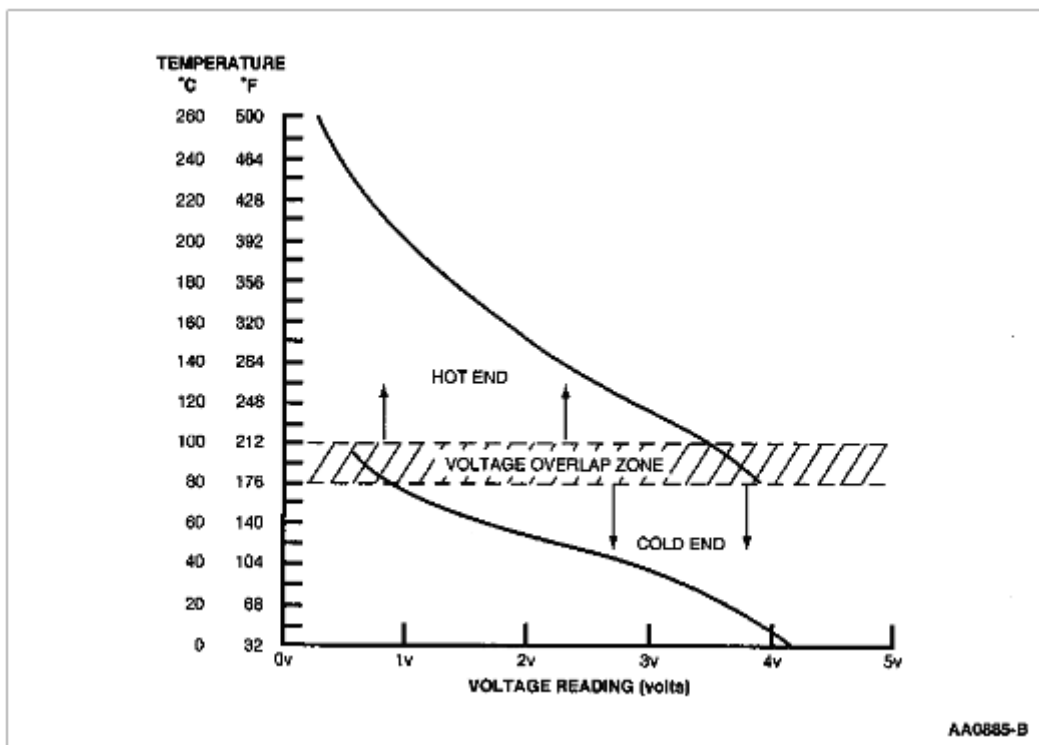
This pinpoint test is intended to diagnose the following:

- CHT sensor (6G004)
- harness circuits: CHT , VREF , and SIGRTN
- powertrain control module ( PCM) (12A650)

On applications that do not use an engine coolant temperature (ECT) sensor, the CHT sensor is used to determine the engine coolant temperature. To cover the entire temperature range of both the CHT and ECT sensors, the PCM has a dual switching resistor circuit on the CHT input. A graph showing the temperature switching from the COLD END line to the HOT END line, with increasing temperature and back with decreasing temperature is included. Note the temperature to voltage overlap zone.

Within this zone it is possible to have either a COLD END or HOT END voltage at the same temperature. For example, at 90°C (194°F) the voltage could read either 0.60 volt or 3.71 volts. Refer to the table for the temperature to voltage expected values.

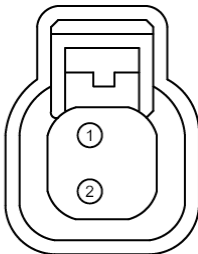
Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.



## CYLINDER HEAD TEMPERATURE SENSOR EXPECTED VALUES

Temperature		CHT Sensor Values		
°C	°F	Cold End (volts)	Hot End (volts)	Resistance (K ohms)
-40	-40	4.89	-	965.808
-30	-22	4.81	-	513.019
-20	-4	4.67	-	283.664
-10	14	4.45	-	162.584
0	32	4.14	-	96.255
10	50	3.73	-	59.175
20	68	3.26	-	37.387
30	86	2.74	-	24.215
40	104	2.23	-	16.043
50	122	1.76	-	10.85
60	140	1.36	-	7.487
70	158	1.04	-	5.268
80	176	0.79	3.99	3.775
85	185	0.69	3.86	3.215
90	194	0.60	3.71	2.75
95	203	0.53	3.56	2.361
100	212	0.46	3.41	2.034
110	230	-	3.07	1.523
120	248	-	2.74	1.155
130	266	-	2.41	0.8866
140	284	-	2.10	0.6891
150	302	-	1.81	0.5417
160	320	-	1.55	0.4301
170	338	-	1.33	0.3449
180	356	-	1.13	0.2791
190	374	-	0.96	0.2278
200	392	-	0.82	0.1875
210	410	-	0.70	0.155
220	428	-	0.60	0.130
230	446	-	0.51	0.109
240	464	-	0.44	0.092
250	482	-	0.35	0.078
260	500	-	0.33	0.067

## CHT Sensor Connector

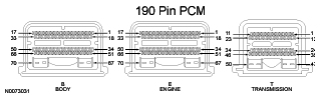


N0073112

Harness Side

Circuit	Pin
CHT (Cylinder Head Temperature)	1
SIGRTN (Signal Return)	2

## PCM Connector - For PCM connector views or reference values, refer to Section 6.



### Harness Side

Circuit	Pin
CHT (Cylinder Head Temperature)	E30
VREF (Reference Voltage)	E20
SIGRTN (Signal Return)	E32

### DL1 : CHECK FOR DIAGNOSTIC TROUBLE CODES ( DTCS)

- Are DTCs P0116, P0119, P0125, P0128, P1285, P1288, P1289, P128A, P1290, or P1299 present?

Yes	No
For DTC P1288, Go to DL2. For KOEO and KOER DTCs P1289 or P1290, Go to DL8. For continuous memory DTCs P0119, P1289, P128A, or P1290, Go to DL15. For KOEO or continuous memory DTC P1299, Go to DL21. For continuous memory DTCs P0125 or P0128, Go to DL22. For continuous memory DTC P0116, Go to DL24. For DTC P1285, Go to DL18.	For temperature warning indicator lamp or gauge (applications with CHT sensor only) symptom, Go to DL29. For all others, GO to Section 4, Diagnostic Trouble Code (DTC) Charts and Descriptions.

temperature.

- Check the vehicle coolant level.
- **Is the cooling system OK?**

Yes	No
Go to DL3.	REFER to the Workshop Manual Section 303-03, Engine Cooling, for loss of coolant diagnosis. Clear the PCM DTCs. REPEAT the self-test.

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#### DL3 : CHECK IF THE VEHICLE ENGINE STARTS

- Attempt to start the engine.
- **Does the engine start and run normally?**

Yes	No
Go to DL6.	Go to DL4.

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#### DL4 : CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: Refer to the chart at the beginning of this test for the resistance specifications

- Ignition OFF.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+)	(-)
CHT Sensor Connector, Component Side	CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
Go to DL5.	INSTALL a new CHT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. Clear the PCM DTCs. REPEAT the self-test.

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The concern is elsewhere. RETURN to Section 3, No Diagnostic Trouble Codes (DTCs) Present Symptom Chart Index, for further direction.

Go to DL12.

#### DL6 : CHECK THE CHT SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Carry out the PCM self-test.
- **Is DTC P1288 present?**

Yes	No
Go to DL7.	The engine temperature was not stabilized. REPAIR any other DTCs as necessary.

#### DL7 : CHECK THE RESISTANCE OF THE CHT SENSOR

NOTE: Refer to the chart at the beginning of this test for the resistance specifications

- The vehicle must be at normal operating temperature
- Ignition OFF.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+)	(-)
CHT Sensor Connector, Component Side	CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
Go to DL31.	INSTALL a new CHT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. Clear the PCM DTCs. REPEAT the self-test.

#### DL8 : DTCs P1289 or P1290: ACCESS THE CHT PID AND CHECK THE VOLTAGE

- Ignition ON, engine OFF.
- Access the PCM and monitor the CHT (VOLT) PID.
- **Is the voltage less than 0.2 V?**

Yes	No
Go to DL9.	Go to DL10.

- Ignition ON, engine OFF.
- Access the PCM and monitor the CHT (VOLT) PID.
- **Is the voltage greater than 4.6 V?**

Yes	No
INSTALL a new CHT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. Clear the PCM DTCs. REPEAT the self-test.	Go to DL14.

#### DL10 : CHECK THE CHT CIRCUIT FOR A SHORT TO VOLTAGE

- CHT Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+)	(-)
CHT Sensor Connector, Harness Side	
CHT - Pin 1	Ground

- **Is the voltage greater than 5.5 V?**

Yes	No
REPAIR the short circuit.CHECK the CHT sensor for damage. Go to DL11.	Go to DL11.

#### DL11 : CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: Refer to the chart at the beginning of this test for the resistance specifications

- Ignition OFF.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+)	(-)
CHT Sensor Connector, Component Side	CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
Go to DL12.	INSTALL a new CHT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. Clear the PCM DTCs. REPEAT the self-test.

(+)	(-)
CHT Sensor Connector, Harness Side	PCM Connector, Harness Side
CHT - Pin 1	CHT - Pin E30
SIGRTN - Pin 2	SIGRTN - Pin E32

- Are the resistances less than 5 Ohm?

Yes	No
Go to DL13.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

#### DL13 : CHECK THE SENSOR SIGNAL FOR A SHORT TO VREF

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+)	(-)
PCM Connector, Harness Side	PCM Connector, Harness Side
CHT - Pin E30	VREF - Pin E20

- Is the resistance greater than 10 kOhm?

Yes	No
Go to DL31.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

#### DL14 : CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+)	(-)
PCM Connector, Harness Side	PCM Connector, Harness Side
CHT - Pin E30	SIGRTN - Pin E32

- Measure the resistance between:

(+)	(-)
PCM Connector, Harness Side	12 Volt Vehicle Battery
CHT - Pin E30	Negative terminal

- Is the resistance greater than 10 kOhm?

Yes	No
Go to DL31.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

- Access the PCM and monitor the CHT (VOLT) PID.
- While observing the PID, carry out the following:
  - tap on the sensor to simulate road shock
  - wiggle the sensor connector
- **Is there a large change in the voltage reading?**

Yes	No
DISCONNECT and INSPECT the connector. If OK, INSTALL a new CHT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. Clear the PCM DTCs. REPEAT the self-test.	Go to DL16.

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#### DL16 : CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the CHT (VOLT) PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM
- **Is there a large change in the voltage reading?**

Yes	No
ISOLATE the concern. REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	Go to DL17.

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#### DL17 : CHECK THE PCM AND VEHICLE HARNESS CONNECTORS

- PCM connector disconnected.
- CHT Sensor connector disconnected.
- **Are the connectors and terminals OK?**

Yes	No
Go to DL31.	REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.

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- internal or external coolant leaks
- blockage of the radiator
- cooling fan operation

- **Is the cooling system OK?**

Yes	No
Go to DL19.	REFER to the Workshop Manual Section 303-03, Engine Cooling, for loss of coolant diagnosis. Clear the PCM DTCs. REPEAT the self-test.

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#### **DL19 : CHECK THE OPERATION OF THE CYLINDER HEAD TEMPERATURE SENSOR**

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Carry out the PCM self-test.
- **Is DTC P1285 present?**

Yes	No
Go to DL20.	An engine overheat temperature was not detected. REPAIR any other DTCs as necessary.

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#### **DL20 : CHECK THE RESISTANCE OF THE CHT SENSOR**

NOTE: Refer to the chart at the beginning of this test for the resistance specifications

- The vehicle must be at normal operating temperature
- Ignition OFF.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+)	(-)
CHT Sensor Connector, Component Side	CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
Go to DL31.	INSTALL a new CHT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. Clear the PCM DTCs. REPEAT the self-test.

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additional DTC description information.

- Check the engine coolant level
- **Is the engine coolant fill level correct?**

Yes	No
REFER to the Workshop Manual Section 303-03, Engine Cooling, to diagnose the engine overheating condition. Clear the PCM DTCs. REPEAT the self-test.	REFER to the Workshop Manual Section 303-03, Engine Cooling, to diagnose the loss of coolant. Clear the PCM DTCs. REPEAT the self-test.

#### DL22 : Self-Test DTCs P0125 or P0128: CHECK THE ENGINE COOLANT LEVEL



**WARNING:** To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.

NOTE: DTC P0125 or P0128 indicates the engine coolant temperature has not achieved the required engine operation temperature level, since start-up within a specified amount of time.

- Check the engine coolant level
- **Is the engine coolant fill level correct?**

Yes	No
Go to DL23.	REFER to the Workshop Manual Section 303-03, Engine Cooling, to diagnose the loss of coolant. Clear the PCM DTCs. REPEAT the self-test.

#### DL23 : CHECK THE SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Access the PCM and monitor the CHT (TEMP) PID.
- **Is the temperature greater than 171 F?**

Yes	No
The test is complete. Clear the PCM DTCs. REPEAT the self-test.	REFER to the Workshop Manual Section 303-03, Engine Cooling, to diagnose the engine not reaching normal operating temperature. Clear the PCM DTCs. REPEAT the self-test.

- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- Refer to the chart at the beginning of this test for the resistance specifications
- **Is the resistance within specification?**

<b>Yes</b>	<b>No</b>
Go to DL25.	INSTALL a new CHT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. Clear the PCM DTCs. REPEAT the self-test.

### DL25 : DTC P0116: CHECK THE RESISTANCE OF THE CHT SENSOR

NOTE: Verify the engine is at operating temperature before taking the CHT reading.

- CHT Sensor connector connected.
- Run the engine until the engine temperature stabilizes.
- Ignition OFF.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- Refer to the chart at the beginning of this test for the resistance specifications
- **Is the resistance within specification?**

<b>Yes</b>	<b>No</b>
The concern is not present at this time. CARRY OUT the OBD drive cycle to determine if fuel, HO2S, catalyst and misfire monitors can be executed. REFER to Section 2, On Board Diagnostic (OBD) Drive Cycle. REPEAT the PCM self-test if necessary.	INSTALL a new CHT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. Clear the PCM DTCs. REPEAT the self-test.

**DL27 : CHECK FOR CHT DTCS**

- Carry out the PCM self-test.
- **Are DTCs P1285, P1288, P1289 or P1299 present?**

Yes	No
DISREGARD the engine oil temperature (EOT) DTC at this time. ADDRESS the next DTC. GO to Section 4, Diagnostic Trouble Code (DTC) Charts and Descriptions.	Go to DL28.

**DL28 : ROAD TEST THE VEHICLE AND MONITOR FOR ENGINE OVER TEMPERATURE**

- Access the freeze frame data (if available) and record the DTC conditions.
- Access the PCM and monitor the CHT (TEMP) PID.
- Test drive the vehicle and allow the engine to reach normal operating temperature.
- Observe CHT PID
- **Does the engine overheat?**

Yes	No
REFER to the Workshop Manual Section 303-03, Engine Cooling to diagnose the overheat symptom. Clear the PCM DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time.

**DL29 : ENGINE TEMPERATURE WARNING INDICATOR LAMP ON OR TEMPERATURE GAUGE INDICATES HOT, BUT ENGINE IS NOT OVERHEATING**

NOTE: The PCM self-test must be carried out prior to entering this pinpoint test.

- **Was the PCM self-test carried out prior to entering this pinpoint test?**

Yes	No
Go to DL30.	The concern is elsewhere. RETURN to Section 3, Powertrain Control Module (PCM) Quick Test for further direction.

**gauge return to the normal zone with the PCM disconnected?**

Yes	No
REFER to the Workshop Manual Section 303-03, Engine Cooling to diagnose the overheat symptom. Clear the PCM DTCs. REPEAT the self-test.	REFER to the Workshop Manual Section 413-01, Instrumentation, Message Center, and Warning Chimes to diagnose the incorrect temperature gauge. Clear the PCM DTCs. REPEAT the self-test.

**DL31 : CHECK FOR CORRECT PCM OPERATION**

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test.
- Verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM), Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.