

DL: Cylinder Head Temperature (CHT) Sensor

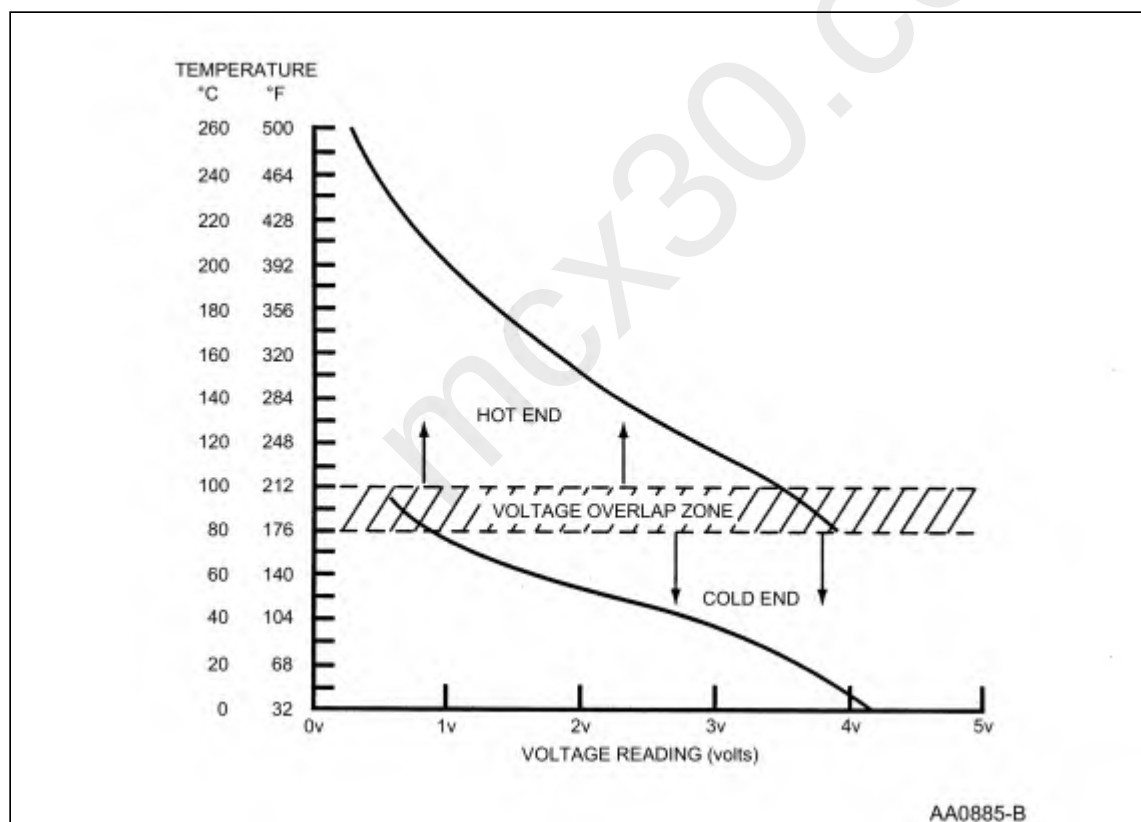
Note: On a typical vehicle, the CHT sensor is located in the cylinder head and the CHT2 sensor is located in the exhaust manifold.

This pinpoint test is intended to diagnose the following:

- cylinder head temperature (CHT) sensor (6G004)
- cylinder head temperature 2 (CHT2) sensor (6G004)
- harness circuits: CHT, CHT2, and SIGRTN
- 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 value 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 expected values.

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



Cylinder Head Temperature (CHT) And CHT2 Sensor Expected Values

Temperature		CHT Sensor Values		
°C	°F	Cold End (volts)	Hot End (volts)	Resistance (K ohms)
-40	-40	4.89	-	965.808

Temperature		CHT Sensor Values		
°C	°F	Cold End (volts)	Hot End (volts)	Resistance (K ohms)
-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

Cylinder Head Temperature 2 (CHT2) Sensor Connector

A



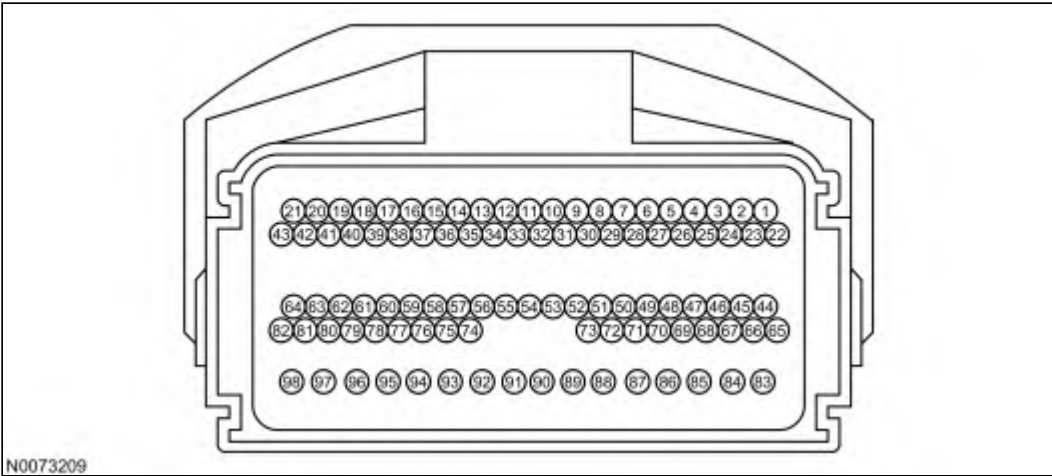
B



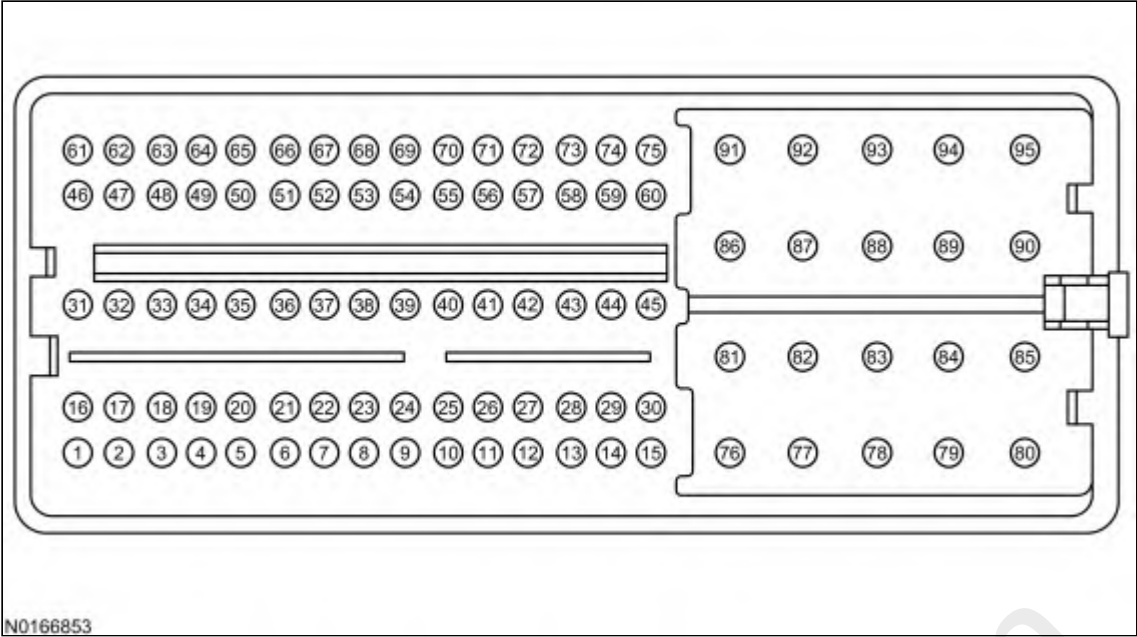
Vehicle	Connector	Pin	Circuit
F-150	A	2 1	SIGRTN CHT2
Transit Connect	B	2 1	SIGRTN CHT2

Powertrain Control Module-E (PCM-E) Connector

A

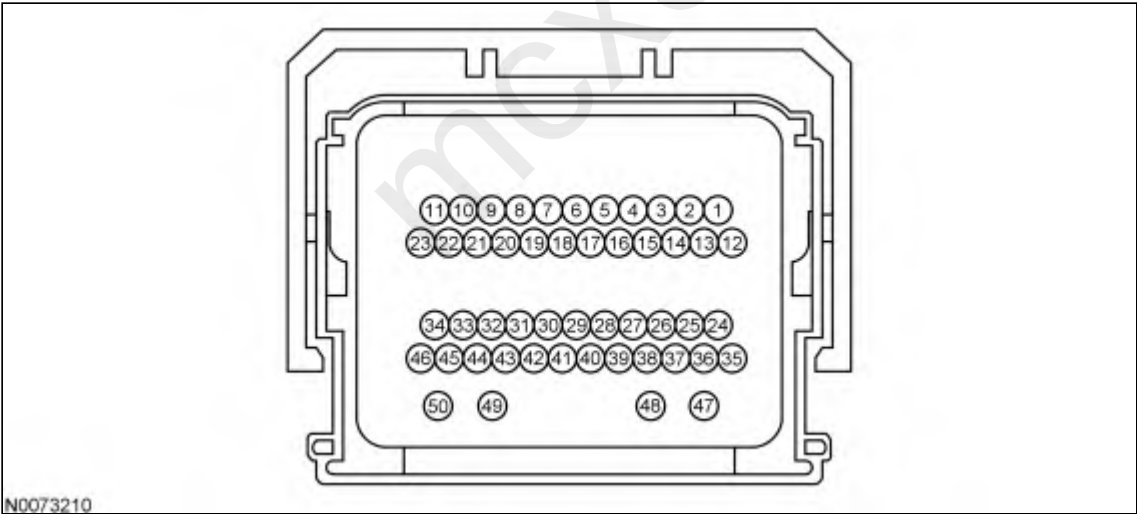


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Vehicle	Connector	Pin	Circuit
F-150	A	4	SIGRTN
Transit Connect	B	60	SIGRTN

Powertrain Control Module-T (PCM-T) Connector



Pin	Circuit
40	CHT2 (Cylinder Head Temperature 2)

DL1 CHECK FOR DTCS

Are DTCs P1022, P1023, P2C3A, or P2C3B present?

Yes	GO to DL2 .
No	RETURN to Section 3, Symptom Charts for further direction.

DL2 CHECK THE RESISTANCE OF THE CHT2 SENSOR WITH THE ENGINE OFF

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

- Ignition OFF.
- CHT2 Sensor connector disconnected.
- Measure the resistance between:

(+) CHT2 Sensor Connector, Component Side	(-) CHT2 Sensor Connector, Component Side
CHT2	SIGRTN

Is the resistance within specification?

Yes	GO to DL3 .
No	INSTALL a new CHT2 sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. CLEAR the DTCs. REPEAT the self-test.

DL3 CHECK FOR AN OPEN CIRCUIT

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

(+) PCM-T Connector, Harness Side	(-) CHT2 Sensor Connector, Harness Side
CHT2 - Pin 40	CHT2

- Measure the resistance between:

(+) PCM-E Connector, Harness Side	(-) CHT2 Sensor Connector, Harness Side
SIGRTN	SIGRTN

Are the resistances less than 5 ohms?

Yes	GO to DL4 .
No	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DL4 CHECK FOR A SHORT TO GROUND

- Measure the resistance between:

(+) CHT2 Sensor Connector, Harness Side	(-)
CHT2	Ground

Are the resistances greater than 10K ohms?

Yes	GO to DL5 .
No	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DL5 CHECK FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- Measure the voltage between:

(+) CHT2 Sensor Connector, Harness Side	(-)
CHT2	Ground

Is any voltage present?

Yes	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.
No	GO to DL6 .

DL6 CHECK THE RESISTANCE OF THE CHT SENSOR

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

- Ignition OFF.
- CHT2 Sensor connector connected.
- PCM-E connector connected.
- PCM-T connector connected.
- Run the engine until the engine temperature stabilizes.
- Ignition OFF.
- CHT2 Sensor connector disconnected.
- Measure the resistance between:

(+) CHT2 Sensor Connector, Component Side	(-) CHT2 Sensor Connector, Component Side
CHT2	SIGRTN

Is the resistance within specification?

Yes	GO to DL7 .
No	INSTALL a new CHT2 sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. CLEAR the DTCs. REPEAT the self-test.

DL7 CHECK THE CHT2 SENSOR

- Ignition ON, engine OFF.

- Measure the voltage between:

(+) CHT2 Sensor Connector, Harness Side	(-) CHT2 Sensor Connector, Harness Side
CHT2	SIGRTN

- Observe the digital multi meter (DMM) for an indication of a concern while shaking, wiggling, and bending the CHT2 circuit between the CHT2 and the PCM. Note that voltage changes suddenly when a concern is detected.

Is a concern present?

Yes	REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.
No	GO to DL8 .

DL8 TEMPERATURE SENSOR CORRELATION

Note: Cold soak the vehicle at ambient temperature for at least 6 hours while not in direct sunlight.

Note: All PID's may not be available on all vehicles.

- Ignition OFF.
- CHT2 Sensor connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the AAT (TEMP), CHT2 (TEMP), ECT (TEMP) and ECT1 (TEMP) PIDs.

Are the PID values within 16.67°C (30°F) of each other?

Yes	Unable to duplicate or identify the concern at this time. GO to Pinpoint Test ZZ .
No	INSTALL a new CHT2 sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls.CLEAR the DTCs. Clear the PCM DTCs. REPEAT the self-test.