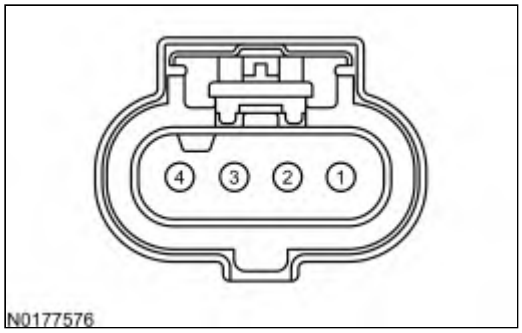
DC: Mass Airflow (MAF) Sensor

This pinpoint test is intended to diagnose the following:

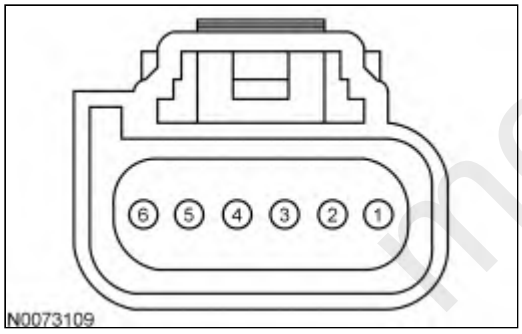
- mass airflow (MAF) sensor (12B579)
- harness circuits: IAT, GND, MAF, MAFRTN, SIGRTN and VPWR
- PCM (12A650)

Mass Airflow/Intake Air Temperature (MAF/IAT) Sensor Connector

A

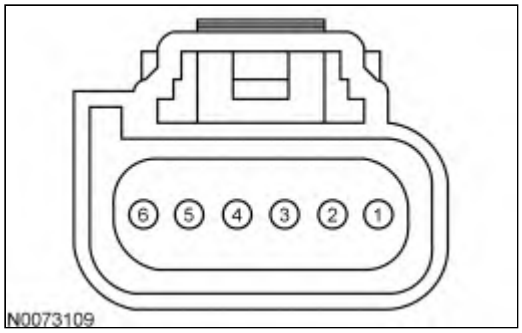


B



Vehicle	Connector	Pin	Circuit
F-Series Super Duty, Motorhome / Stripped Chassis / Step Van	A	3 1	SIGRTN MAF
All other vehicles	B	4 5 3	SIGRTN MAF VPWR

Mass Air Flow Bank 2, Sensor 1/Intake Air Temperature Bank 2, Sensor 1 (MAF21/IAT21) Sensor Connector



Pin	Circuit
4	SIGRTN (Signal Return)
5	MAF21 (Mass Air Flow Bank 2, Sensor 1)
3	VPWR (Vehicle Power)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to Section 6, Reference Values.

Vehicle	Connector	Pin	Circuit
E-Series	198 PIN	B54 B54 B73	SIGRTN MAFRTN MAF
EcoSport	198 PIN	B9 B9 B8	SIGRTN MAFRTN MAF
F-Series Super Duty, Motorhome / Stripped Chassis / Step Van	306 PIN	B58 B58 T39	SIGRTN MAFRTN MAF
Ford GT	198 PIN	B9 E32 E27 B8	SIGRTN SIGRTN MAF21 MAF
Mustang 5.0L	306 PIN	B58 B36	SIGRTN MAF
Transit Connect 2.0L	198 PIN	B89 B90	SIGRTN MAF
All other vehicles	198 PIN	B54 B73	SIGRTN MAF

DC1 VERIFY THE TYPE OF MAF SENSOR
Does the MAF/IAT sensor harness connector have 4 circuits?

Yes	GO to DC15.
No	GO to DC2.

DC2 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)
Are DTCs P0101, P0102, P0103, P0104, or P1100 present?

Yes	GO to DC3.
No	For symptoms without DTCs, GO to DC3. For all others, RETURN to Section 3, Symptom Charts for further direction.

DC3 CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS, AND DAMAGE

Note: *Visually inspect the vehicle for aftermarket accessories and performance modifications (exhaust system, turbocharger, performance chip). Refer to Section 1 Engine Control (EC) System, Modifications to OBD Vehicles.*

- Ignition OFF.
- Check the intake air system (air cleaner, housing, and tubes) for restrictions.
- Check for broken or loose air outlet tube clamps, cracks or holes in the air outlet tube.
- Check for worn gaskets between the MAF/IAT sensor and the air cleaner assembly.
- Check that the MAF/IAT sensor connector is seated correctly.
- Check the throttle body bore for sludge.
- Check the positive crankcase ventilation (PCV) system for leaks and restrictions.

Is a concern present?

Yes	REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.
No	GO to DC4.

DC4 CHECK FOR VOLTAGE AT THE SENSOR

- MAF/IAT Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-)
VPWR	Ground

Is the voltage greater than 10.5 V?

Yes	GO to DC5.
No	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DC5 CHECK FOR AN OPEN

Note: *Only measure the circuits that apply to the vehicle being diagnosed.*

- Ignition OFF.
- MAF/IAT Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-)
GND	Ground

- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
MAF	MAF
MAFRTN	MAFRTN

Are the resistances less than 5 ohms?

Yes	GO to DC6.
No	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DC6 CHECK FOR A SHORT TO GROUND

- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-)
MAF	Ground

Is the resistance greater than 10K ohms?

Yes	GO to DC7.
No	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DC7 CHECK FOR A SHORT TO VOLTAGE

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

(+) MAF/IAT Sensor Connector, Harness Side	(-)
MAF	Ground

Is any voltage present?

Yes	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.
No	GO to DC8.

DC8 INTERMITTENT CHECK

- Ignition OFF.
- PCM connector connected.
- MAF/IAT Sensor connector connected.
- Ignition ON, engine running.

- Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle. Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle.
- If the idle is not stable, refer to Section 3, No Diagnostic Trouble Codes (DTCs) Present Symptom Chart Index.
- Access the PCM and monitor the MAF (VOLT) PID.
- Lightly tap on the MAF/IAT sensor and wiggle the harness connector to simulate road shock.

Does the MAF PID go below 0.3 volt or above 4.7 volts?

Yes	CLEAN the MAF/IAT sensor using CRC Mass Air Flow Sensor Cleaner 05110 or equivalent. RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM). REPEAT the self-test. If the concern is still present, INSTALL a new MAF/IAT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM). REPEAT the self-test.
No	GO to DC9.

DC9 CHECK THE INTAKE AIR SYSTEM FOR LEAKS

NOTICE: Pressure above 241 kPa (35 psi) can cause damage to system components. Regulate the shop air to 137.9 kPa (20 psi) before connecting to the system.

- Ignition OFF.
- Connect the Evaporative Emission Leak Detector With On Board Nitrogen Generator 218-522C or equivalent to the intake air system.
- Fill the intake air system with smoke.
- Check the intake air system for leaks.

Are any leaks or restrictions present?

Yes	REPAIR the leaks or restrictions. Clear the PCM DTCs. REPEAT the self-test.
No	GO to DC10.

DC10 CHECK THE MAF PID

- Access the PCM and monitor the RPM (RPM) PID.
- Access the PCM and monitor the MAF (VOLT) PID.
- Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle. Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle.

Is the voltage less than 0.3 V?

Yes	CLEAN the MAF/IAT sensor using CRC Mass Air Flow Sensor Cleaner 05110 or equivalent. RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM). REPEAT the self-test. If the concern is still present, INSTALL a new MAF/IAT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM). REPEAT the self-test.
No	GO to DC11.

DC11 CHECK THE MAF CIRCUIT VOLTAGE CYCLING INTEGRITY

- Ignition ON, engine OFF.
- Access the PCM and monitor the MAF (VOLT) PID.

- Connect a 5 amp fused jumper wire between the following:

Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side
MAF	VPWR

- Connect a 5 amp fused jumper wire between the following:

Point A MAF/IAT Sensor Connector, Harness Side	Point B
MAFRTN	Ground

- Record the PID reading while both jumpers are installed.
- Remove the VPWR jumper while observing the MAF V PID.

Does the MAF PID change from greater than 4.50 volts to less than 0.20 volt when the VPWR jumper is removed?

Yes	CLEAN the MAF/IAT sensor using CRC Mass Air Flow Sensor Cleaner 05110 or equivalent. RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM). REPEAT the self-test. If the concern is still present, INSTALL a new MAF/IAT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM). REPEAT the self-test.
No	GO to DC12.

DC12 CHECK THE FUNCTIONALITY OF THE MAF SENSOR

Note: *A MAF PID value of less than 0.35 volt may indicate an incorrectly installed air cleaner or a leak in the air inlet system.*

- Ignition ON, engine running.
- Allow the engine to stabilize at the correct operating temperature.
- Access the PCM and monitor the MAF (VOLT) PID.

Is the MAF PID at idle and NEUTRAL between 0.35 volt and 1.3 volts?

Yes	GO to DC14.
No	GO to DC13.

DC13 CHECK TO ISOLATE THE MAF SENSOR FROM A LEAN DRIVEABILITY OCCURRENCE

Note: *On some vehicles, a fuel system DTC may be generated without a noticeable driveability concern with the MAF sensor disconnected.*

- Ignition OFF.
- MAF/IAT Sensor connector disconnected.
- Ignition ON, engine running.
- Drive the vehicle on the road.

Is the lack of power, spark knock/detonation, buck/jerk or hesitation/surge on acceleration driveability symptom gone?

Yes	CLEAN the MAF/IAT sensor using CRC Mass Air Flow Sensor Cleaner 05110 or equivalent. RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM).

	REPEAT the self-test. If the concern is still present, INSTALL a new MAF/IAT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM). REPEAT the self-test.
No	GO to DC14.

DC14 VERIFY THE DTC
Are DTCs P0171, P0172, P0174, P0175, P2195, P2196, P2197, or P2198 present?

Yes	GO to Section 4, Diagnostic Trouble Code (DTC) Charts and Descriptions.
No	RETURN to Section 3, Symptom Charts for further direction.

DC15 PRELIMINARY DIAGNOSIS
Are DTCs P00BC, P00BD, P00BE, P00BF, P010C, P010D, P010E, P010F, P0102, P0103 or P0104 present?

Yes	GO to DC16.
No	For symptoms without DTCs, GO to DC16. For all others, RETURN to Section 3, Symptom Charts for further direction.

DC16 CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS, AND DAMAGE

- Ignition OFF.
- Check the intake air system (air cleaner, housing, and tubes) for restrictions.
- Check for broken or loose air outlet tube clamps, cracks or holes in the air outlet tube.
- Check for worn gaskets between the MAF/IAT sensor and the air cleaner assembly.
- Check that the MAF/IAT sensor connector is seated correctly.
- Check that the MAF21/IAT21 sensor connector is seated correctly.
- Check the throttle body bore for sludge.
- Check the crankcase ventilation system for leaks and restrictions.

Is a concern present?

Yes	REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.
No	GO to DC17.

DC17 CHECK THE VPWR TO THE MAF/IAT SENSOR

Note: *For EcoSport 2.0L, the MAF/IAT sensor VPWR is supplied by the fuel pump control module relay. When the ignition is in the KOEO position, the fuel pump stays on for about 5 seconds. It may be necessary to cycle the ignition from ON, to OFF, and back to the ON position, to continue testing.*

- For DTCs P00BE, P00BF, P010C, P010D, or P010E,
- MAF21/IAT21 Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) MAF21/IAT21 Sensor Connector, Harness Side	(-)
VPWR - Pin 3	Ground

- For all others,
- MAF/IAT Sensor connector disconnected.

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

(+) MAF/IAT Sensor Connector, Harness Side	(-)
VPWR	Ground

Is the voltage greater than 10.5 V?

Yes	GO to DC18.
No	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DC18 CHECK THE MAF HARNESS FOR A OPEN

- Ignition OFF.
- PCM connector disconnected.
- For DTCs P00BE, P00BF, P010C, P010D, or P010E,
- MAF21/IAT21 Sensor connector disconnected.
- Measure the resistance between:

(+) MAF21/IAT21 Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
MAF21 - Pin 5	MAF21
SIGRTN - Pin 4	SIGRTN

- For all others,
- MAF/IAT Sensor connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
MAF	MAF
SIGRTN	SIGRTN

Are the resistances less than 5 ohms?

Yes	GO to DC19.
No	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DC19 CHECK THE MAF SIGNAL CIRCUIT FOR A SHORT

- For DTCs P00BE, P00BF, P010C, P010D, or P010E,
- Measure the resistance between:

(+) MAF21/IAT21 Sensor Connector, Harness Side	(-)
MAF21 - Pin 5	Ground

- For all others,

- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-)
MAF	Ground

Is the resistance greater than 10K ohms?

Yes	GO to DC20.
No	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DC20 CHECK FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For DTCs P00BE, P00BF, P010C, P010D, or P010E,
- Measure the voltage between:

(+) MAF21/IAT21 Sensor Connector, Harness Side	(-)
MAF21 - Pin 5	Ground

- For all others,
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-)
MAF	Ground

Is any voltage present?

Yes	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.
No	For DTCs P00BE, P00BF, P010C, P010D, or P010E, INSTALL a new MAF21/IAT21 sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. Clear the PCM DTCs. REPEAT the self-test. For all others, GO to DC21.

DC21 CHECK FOR AN INTERMITTENT CONCERN

- Ignition OFF.
- PCM connector connected.
- MAF/IAT Sensor connector connected.
- Ignition ON, engine running.
- Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle. Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle.
- If the idle is not stable, refer to Section 3, No Diagnostic Trouble Codes (DTCs) Present Symptom Chart Index.
- Access the PCM and monitor the MAF_HZ (FREQ) PID.
- Lightly tap on the MAF sensor and wiggle the harness connector to simulate road shock.

Does the MAF PID reading change?

Yes	CLEAN the MAF/IAT sensor using CRC Mass Air Flow Sensor Cleaner 05110 or equivalent.

	RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM). REPEAT the self-test. If the concern is still present, INSTALL a new MAF/IAT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM). REPEAT the self-test.
No	GO to DC22.

DC22 CHECK THE MAF/IAT HARNESS FOR INTERMITTENT CONCERNS

- Access the PCM and monitor the MAF_HZ (FREQ) PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness working from the sensor to the PCM.

Does the MAF PID reading change?

Yes	REPAIR the harness as necessary. Clear the PCM DTCs. REPEAT the self-test.
No	CLEAN the MAF/IAT sensor using CRC Mass Air Flow Sensor Cleaner 05110 or equivalent. RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM). REPEAT the self-test. If the concern is still present, INSTALL a new MAF/IAT sensor. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM). REPEAT the self-test.