

# DIAGNOSIS SYSTEM

## DESCRIPTION

The engine and ECT ECU contains a built-in, self-diagnosis system which detects troubles within the engine signal network and flashes the "CHECK" engine warning light in the combination meter.

By analyzing various signals as shown in the later table (See page [FI-26](#)) the Electronic Control Unit (ECU) detects system malfunctions which are related to the various operating parameter sensors or to the actuator.

In the normal mode, the self-diagnosis system monitors 18 (California specification vehicles) or 16 (Other than California specification vehicles) items, indicated by code Nos. 11, 12, 13, 14, 16, 21, 22, 24, 25, 26, 27, 31, 32, 41, 42, 52, 53 and 71 (California specification vehicles) or 11, 12, 13, 14, 16, 21, 22, 24, 25, 26, 31, 32, 41, 42, 52, and 53 (Other than California specification vehicles) as shown in [FI-26](#). A "CHECK" engine warning light on the instrument panel informs the driver that a malfunction has been detected. The light goes off automatically when the malfunction has been cleared. Once the malfunction is cleared, the "CHECK" engine warning light on the instrument panel will go off but the diagnostic code(s) remains stored in the ECU memory (except for code Nos. 16, 43, 51 and 53). The ECU stores the failure until the diagnosis system is cleared by removing the EFI fuse with the ignition switch OFF.

The diagnostic code can be read by the number of blinks of the "CHECK" engine warning light when TE1 and E1 terminals on the check connector are connected. When 2 or more codes are indicated, the lowest number (code) will appear first. However, no other code will appear along with code No. 11.

In the test mode, 14 (California specification vehicles) or 12 (Other than California specification vehicles) items, indicated by 'code Nos. 13, 21, 22, 24, 25, 26, 27, 31, 32, 41, 42, 43, 51 and 71 (California specification vehicles) or 13, 21, 22, 24, 25, 26, 31, 32, 41, 42, 43 and 51 (Other than California specification vehicles) as shown in [FI-26](#) are monitored. If a malfunction is detected in any one of the systems indicated by code Nos. 13, 21, 22, 24, 25, 26, 27, 31, 32, 41, 43, and 71 (California specification vehicles) or 13, 21, 22, 24, 25, 26, 31, 32, 41 and 43 (Other than California specification vehicles), the ECU lights the "CHECK" engine warning light to warn the technician that malfunction has been detected. In this case, TE2 and E1 terminals on the TOYOTA DIAGNOSTIC COMMUNICATION LINK (TDCL) should be connected as shown later. (See page [FI-24](#))

In the test mode, even if the malfunction is corrected, the malfunction is stored in the ECU memory while the ignition switch remains on (except code Nos. 43, 51 and 53). Also, when a malfunction occurs for the 12 (California specification vehicles) or 10 (Other than California specification vehicles) conditions from code Nos. 13, 21, 22, 24, 25, 26, 27, 31, 32, 41, 43, and 71 (California specification vehicles) or 13, 21, 22, 24, 25, 26, 31, 32, 41 and 43 (Other than California specification vehicles) the "CHECK" engine warning light remains on. However, once the ignition switch is turned OFF, the ECU erases all of the malfunctions in the memory.

The diagnostic mode (normal or test) and the output of the "CHECK" engine warning light can be selected by connecting the TE1, TE2 and E1 terminals on the check connector or TDCL, as shown later.

In the ECU, a test mode function has been added to the functions of the self-diagnosis system of the normal mode for the purpose of detecting malfunctions such as poor contact which are difficult to detect in the normal mode. This function fills up the self-diagnosis system. The test mode can be implemented by the technician following the appropriate procedures of check terminal connection and operation described later. (See page FI-28)

## "CHECK" ENGINE WARNING LIGHT CHECK

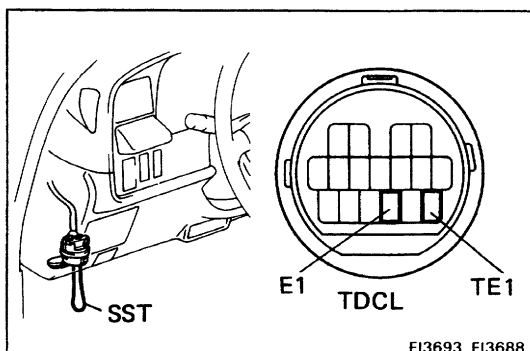
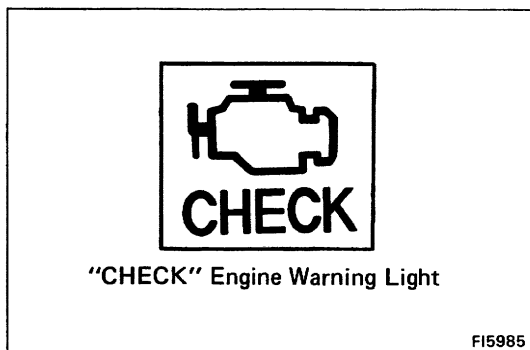
1. The "CHECK" engine warning light will come on when the ignition switch is placed at ON and the engine is not running.
2. When the engine is started, the "CHECK" engine warning light should go off.  
If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.

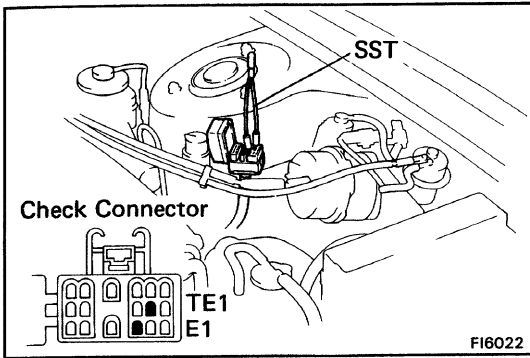
## OUTPUT OF DIAGNOSTIC CODES (Normal mode)

To obtain an output of diagnostic codes, proceed as follows:

1. Initial conditions
  - (a) Battery voltage 11 V or more
  - (b) Throttle valve fully closed (throttle position sensor IDL points closed)
  - (c) Transmission in neutral range
  - (d) Accessories switched OFF
  - (e) Engine at normal operating temperature
2. Turn the ignition switch ON. Do not start the engine.
3. Using SST, connect terminals TE1 and E1 of the TOYOTA DIAGNOSTIC COMMUNICATION LINK (TDCL).

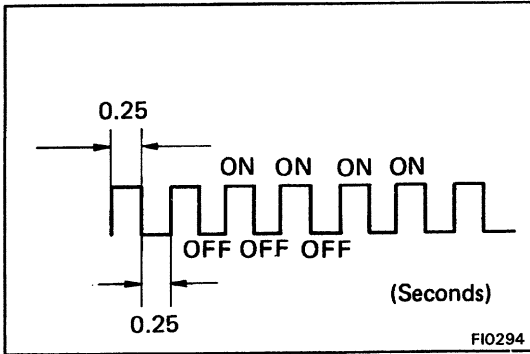
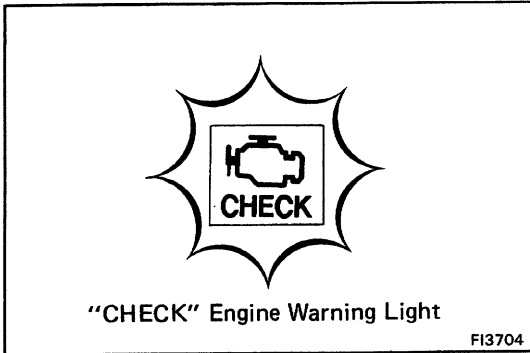
SST 09843-18020





HINT: Even if check connector terminals TE1 and E1 are connected, the diagnostic code can be output.

4. Read the diagnostic code as indicated by the number of flashes of the "CHECK" engine warning light.



Diagnostic Code (See page FI-26)

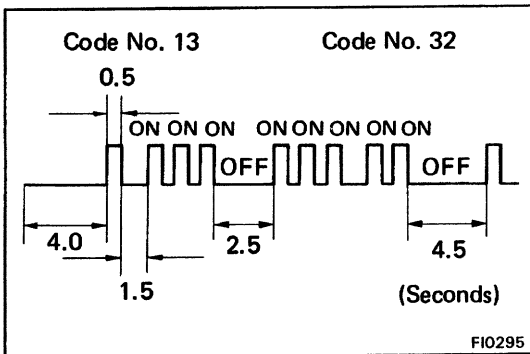
- (a) Normal System Operation (no malfunction)

- The light will alternately blink ON and OFF at 0.25 second intervals.

- (b) Malfunction Code Indication

- In the event of a malfunction, the light will blink every 0.5 seconds. The first number of blinks will equal the first digit of a 2-digit diagnostic code and, after a 1.5 second pause, the 2nd number of blinks will equal the 2nd. If there are two or more codes, there will be a 2.5 second pause between each code.
- After all the codes have been output, there will be a 4.5 second pause and they will all be repeated as long as the terminals TE1 and E1 of the TDCL or check connector are connected.

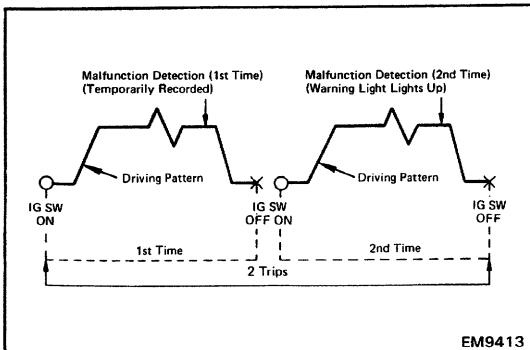
HINT: In the event of a number of trouble codes, indication will begin from the smaller value and continue to the larger.



- (c) (2 trip detection logic)

Diagnostic codes 25, 26, 27 and 71 use "2 trip detection logic". With this logic, when a malfunction is first detected, the malfunction is temporarily stored in the ECU memory. If the same case is detected again during the second drive test, this second detection causes the "CHECK" Engine Warning Light to light up.

The 2 trip repeats the same mode a 2nd time. (However, the ignition switch must be turned OFF between the 1st time and 2nd time.) In the Test Mode, the "CHECK" Engine Warning Light lights up the 1st time a malfunction is detected.



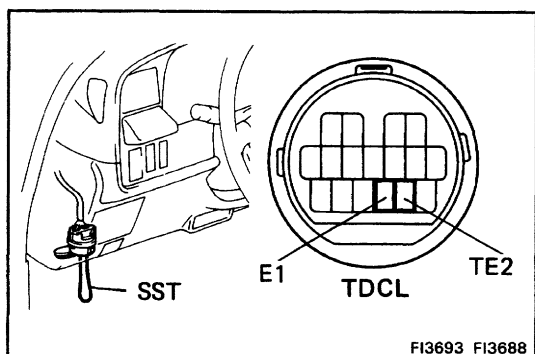
5. After the diagnosis check, remove SST.  
SST 09843-18020

## (Test mode)

To obtain an output of diagnostic codes, proceed as follows:

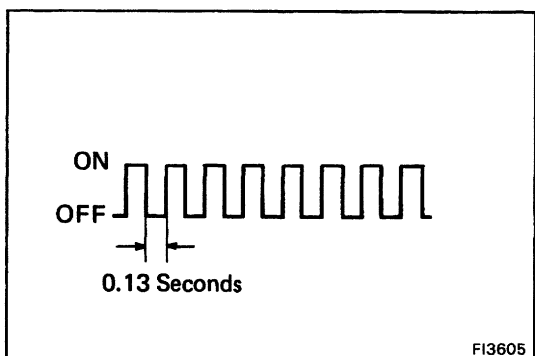
### 1. Initial conditions

- (a) Battery voltage 11 volts or more
- (b) Throttle valve fully closed (throttle position sensor IDL points closed)
- (c) Transmission in neutral range
- (d) Accessories switched OFF



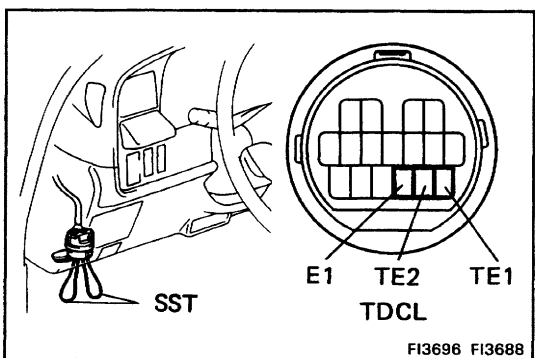
2. First, using SST, connect terminals TE2 and E1 of the TDCL, then turn the ignition switch on to begin the diagnosis in the test mode.

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HINT: To confirm that the test mode is operating, check that the "CHECK" engine light flashes when the ignition switch is turned ON.

3. Start the engine and drive the vehicle at a speed of 10 km/h or higher.
4. Simulate the conditions of the malfunction described by the customer.



5. Using SST, connect terminals TE1 and E1 of the TDCL. SST 09843-18020

6. Read the diagnostic code as indicated by the number of flashes of the "CHECK" engine warning light.

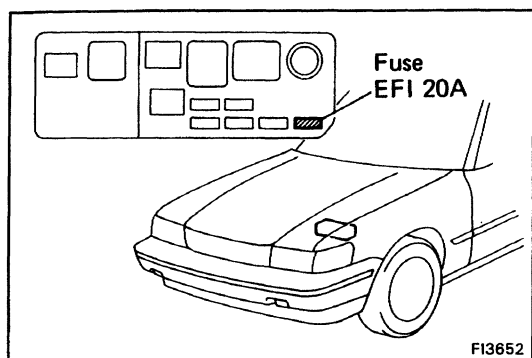
(See page [FI-26](#))

7. After the diagnosis check, remove SST.

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HINT:

- The test mode will not start if terminals TE2 and E1 are connected after the ignition switch is turned on.
- The starter signal and vehicle speed signal will be diagnosed by the ECU as malfunctions, and code Nos. 42, and 43 will be output, if the operation in 3 above is not performed.



## CANCELLING DIAGNOSTIC CODE

1. After repair of the trouble area, the diagnostic code retained in memory by the engine and ECT ECU must be cancelled out by removing the EFI fuse (20 A) for 10 seconds or more, depending on ambient temperature (the lower the temperature, the longer the fuse must be left out) with the ignition switch OFF.

### HINT:

- Cancellation can also be done by removing the battery negative (-) terminal, but in this case, other memory systems (clock, etc. ) will also be cancelled out.
- If the diagnostic code is not cancelled out, it will be retained by the ECU and appear along with a new code in the event of future trouble.
- If it is necessary to work on engine components requiring removal of the battery terminal, a check must first be made to see if a diagnostic code has been recorded.


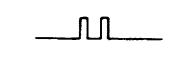

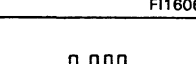

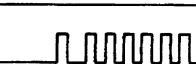

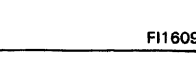
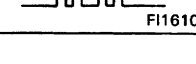
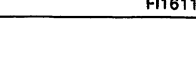

2. After cancellation, road test the vehicle to check that a normal code is now read on the "CHECK" engine warning light.

If the same diagnostic code appears, it indicates that the trouble area has not been repaired thoroughly.







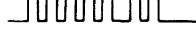
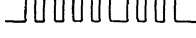

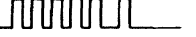
## DIAGNOSIS INDICATION

1. When 2 or more codes are indicated, the lowest number (code) will appear first.
2. All detected diagnostic codes, except code Nos. 16, 43, 51 and 53, will be retained in memory by the ECU from the time of detection until cancellation.
3. Once the malfunction is cleared, the "CHECK" engine warning light on the instrument panel will go off but the diagnostic code(s) remains stored in ECU memory (except for code Nos. 15, 43, 51 and 53).

# DIAGNOSTIC CODES

Code No.	Number of blinks "CHECK" Engine Warning Light	System	"CHECK" *1 Engine Warning Light		Diagnosis	Trouble Area	*2 Memory	See page
			Normal Mode	Test Mode				
-	 FI1401	Normal	-	-	Output when no other code is recorded.	-	-	-
11	 FI1605	ECU (+ By	OFF	N.A.	Momentary interruption in power supply to ECU.	<ul style="list-style-type: none"> <li>• Open or short in ignition switch circuit</li> <li>• Ignition switch</li> <li>• Main relay circuit</li> <li>• Main relay</li> <li>• ECU</li> </ul>	○	FI-34
12	 FI1606	RPM Signal	ON	N.A.	No G or N E signal is input to ECU for 2 secs. or more after STA turns ON.	<ul style="list-style-type: none"> <li>• Open or short in NE, G circuit</li> <li>• Distributor</li> <li>• Open or short in STA circuit</li> <li>• ECU</li> </ul>	○	IG-4 FI-41
13	 FI1607	RPM Signal	ON	ON	NE signal is not input to ECU for 50 msec. or more when engine speed is 1000 rpm or more.	<ul style="list-style-type: none"> <li>• Open or short in NE circuit</li> <li>• Distributor</li> <li>• ECU</li> </ul>	○	IG-4
14	 FI1608	Ignition Signal	ON	N.A.	IGF signal from igniter is not input to ECU for 6 - 8 consecutive ignition.	<ul style="list-style-type: none"> <li>• Open or short in IGF or IGT circuit from igniter to ECU</li> <li>• Igniter</li> <li>• ECU</li> </ul>	○	FI-42
16	 FI3600	ECT Control Signal	ON	N.A.	Normal signal is not output from ECU CPU.	<ul style="list-style-type: none"> <li>• ECU</li> </ul>	×	-
21	 FI1609	Main Oxygen Sensor Signal	ON	ON	At normal driving speed (below 60 mph and engine speed is above 2000 rpm), amplitude of oxygen sensor signal (OX) is reduced to between 0.35 - 0.70 V continuously for 60 secs. or more.	<ul style="list-style-type: none"> <li>• Open or short in oxygen sensor circuit</li> <li>• Oxygen sensor</li> <li>• ECU</li> </ul>	○	FI-46
22	 FI1610	Water Temp. Sensor Signal	ON	ON	Open or short in water temp. sensor circuit for 500 msec. or more. (THW)	<ul style="list-style-type: none"> <li>• Open or short in water temp. sensor circuit</li> <li>• Water temp. sensor</li> <li>• ECU</li> </ul>	○	FI-40
24	 FI1611	Intake Air Temp. Sensor Signal	*3 ON	ON	Open or short in intake air temp. sensor circuit for 500 msec. or more. (THA)	<ul style="list-style-type: none"> <li>• Open or short in intake air temp. circuit</li> <li>• Intake air temp. sensor</li> <li>• ECU</li> </ul>	○	FI-39
25	 FI2562	Air-Fuel Ratio Lean Malfunction	ON	ON	(1) Oxygen sensor output is less than 0.45 V for at least 120 secs. when oxygen sensor is warmed up tracing at 2000 rpm). - only for code 25 *4	<ul style="list-style-type: none"> <li>• Engine ground bolt loose</li> <li>• Open in E1 circuit</li> <li>• Open in injector circuit</li> <li>• Fuel line pressure (Injector blockage, etc.)</li> <li>• Open or short in oxygen sensor circuit</li> <li>• Oxygen sensor</li> <li>• Ignition system</li> <li>• Water temp. sensor</li> <li>• Air flow meter (air intake)</li> <li>• ECU</li> </ul>	○	FI-38 FI-46
26	 FI2563	Air-Fuel Ratio Rich Malfunction	ON	ON	(2) When the oxygen sensor feedback frequency is abnormally high during feedback condition. *4 (3) When marked variation is detected in engine revolutions for each cylinder during idle switch on and feedback condition. *6 (2 trip detection logic) (1)-(3)	<ul style="list-style-type: none"> <li>• Engine ground bolt loose</li> <li>• Open in E1 circuit</li> <li>• Short in injector circuit</li> <li>• Fuel line pressure (Injector leakage, etc.)</li> <li>• Open or short in cold start injector circuit</li> <li>• Cold start injector</li> <li>• Open or short in oxygen sensor circuit</li> <li>• Oxygen sensor</li> <li>• Water temp. sensor</li> <li>• Air flow meter</li> <li>• Compression pressure</li> <li>• ECU</li> </ul>	○	

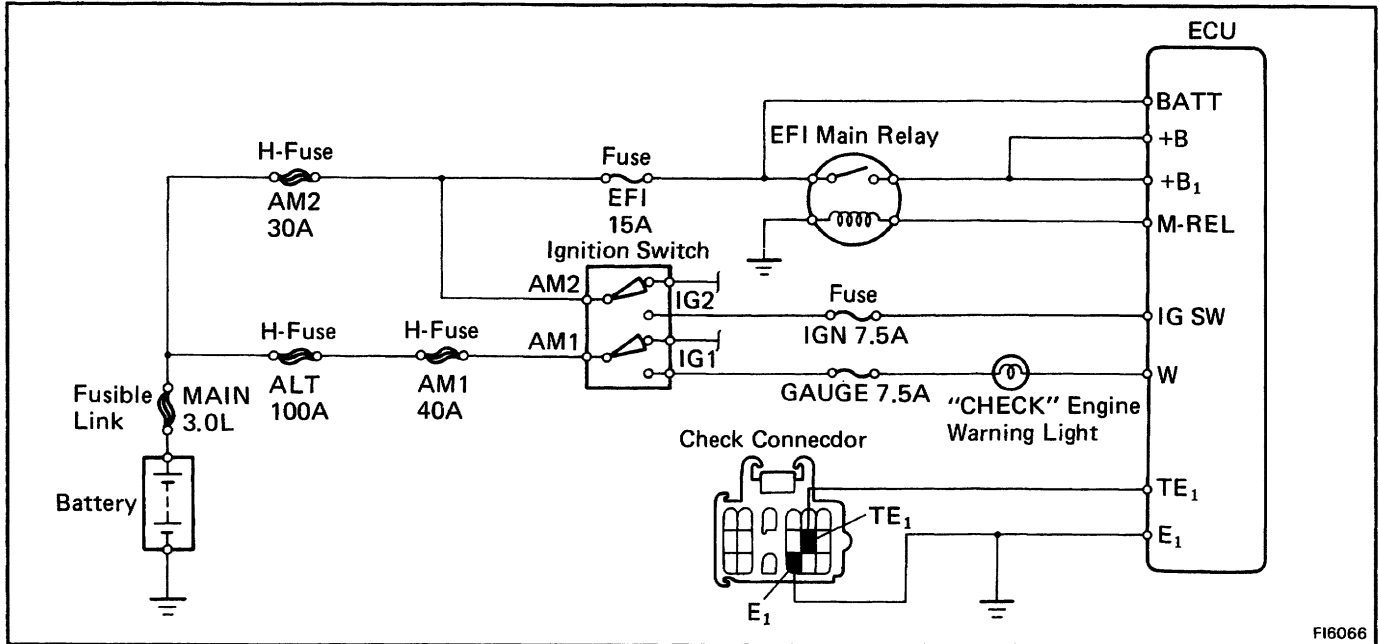
# DIAGNOSTIC CODES (Cont'd)

Code No.	Number of blinks "CHECK" Engine Warning Light	System	"CHECK"*1 Engine Warning Light		Diagnosis	Trouble Area	*2 Memory	See page
			Normal Mode	Test Mode				
27*s	 FI3294	Sub-Oxygen Sensor Signal	ON	ON	When sub-oxygen sensor is warmed up and full acceleration continued for 2 seconds, output of main oxygen sensor is 0.45 V or more (rich) and output of sub-oxygen sensor is 4.45 V or less (lean). (OX2) *6 (2 trip detection logic)	<ul style="list-style-type: none"> <li>Short or open in suboxygen sensor circuit</li> <li>Sub-oxygen sensor</li> <li>ECU</li> </ul>	○	FI-45
31	 FI1612	Air Flow Meter Signal	ON	ON	At idling, open or short detected continuously for 500 msec. or more in air flow meter circuit. <ul style="list-style-type: none"> <li>Open - VC</li> <li>Short - VC-E2</li> </ul>	<ul style="list-style-type: none"> <li>Open or short in air flow meter circuit</li> </ul>	○	FI-37
32	 FI1613	Air Flow Meter Signal	ON	ON	Open or short detected continuously for 500 msec. or more in air flow meter circuit. <ul style="list-style-type: none"> <li>Open - E2</li> <li>Short - VS-VC</li> </ul>	<ul style="list-style-type: none"> <li>Air flow meter</li> <li>ECU</li> </ul>	○	FI-37
41	 FI1614	Throttle Position Sensor Signal	ON*3	ON	Open or short detected in throttle position sensor signal (VTA) for 500 msec. or more. IDL contact is ON and VTA output exceeds 1.5 V.	<ul style="list-style-type: none"> <li>Open or short in throttle position sensor circuit</li> <li>Throttle position sensor</li> <li>ECU</li> </ul>	○	FI-35
42	 FI1615	Vehicle Speed Sensor Signal	OFF	OFF	SPD signal is not input to ECU for at least 8 seconds during high load driving with engine speed between 2500 rpm and 6000 rpm.	<ul style="list-style-type: none"> <li>Open or short in vehicle speed sensor circuit</li> <li>Vehicle speed sensor</li> <li>ECU</li> </ul>	○	-
43	 FI1616	Starter Signal	N.A.	ON	Starter signal (STA) is not input to ECU even once until engine reaches 800 rpm or more when cranking.	<ul style="list-style-type: none"> <li>Open or short in starter signal circuit</li> <li>Open or short in IG SW or main relay circuit</li> <li>ECU</li> </ul>	○	FI-41
52	 FI1618	Knock Sensor Signal	ON	N.A.	With engine speed between 1600 rpm and 5200 rpm, signal from knock sensor is not input to ECU for 12 revolutions. (KNK)	<ul style="list-style-type: none"> <li>Open or short in knock sensor circuit</li> <li>Knock sensor (looseness, etc.)</li> <li>ECU</li> </ul>	○	-
53	 FI1619	Knock Control Signal	ON	N.A.	Engine speed is between 650 rpm and 5200 rpm and engine control computer (for knock control) malfunction is detected.	<ul style="list-style-type: none"> <li>ECU</li> </ul>	×	-
71*s	 FI2622	EGR System Malfunction	ON	ON	EGR gas temp. sensor signal (THG) is below 700C (158°F) after driving for 60 seconds in EGR operation range. *6 (2 trip detection logic)	<ul style="list-style-type: none"> <li>Open in EGR gas temp. sensor circuit</li> <li>Open in VSV circuit for EGR</li> <li>EGR vacuum hose disconnected, valve stuck</li> <li>Clogged in EGR gas passage</li> <li>ECU</li> </ul>	○	FI-47
51	 FI1617	Switch Condition Signal	N.A.	OFF	Displayed when A/C is ON, IDL contact OFF or shift position in "R", "D", "2", or "1" ranges with the check terminals E1 and TE1 connected.	<ul style="list-style-type: none"> <li>A/C switch system</li> <li>Throttle position sensor IDL circuit</li> <li>Neutral start switch circuit</li> <li>Accelerator pedal, cable</li> <li>ECU</li> </ul>	×	FI-35 FI-45

REMARKS:

- \*1: "ON" displayed in the diagnosis mode column indicates that the "CHECK" Engine Warning Light is lighted up when a malfunction is detected. "OFF" indicates that the "CHECK" does not light up during malfunction diagnosis, even if a malfunction is detected. "N.A." indicates that the item is not included in malfunction diagnosis.
- \*2: "0" in the memory column indicates that a diagnostic code is recorded in the ECU memory when a malfunction occurs. "x" indicates that a diagnostic code is not recorded in the ECU memory even if a malfunction occurs. Accordingly, output of diagnostic results in normal or test mode is performed with the IG SW ON.
- \*3: The "CHECK" Engine Warning Light comes on if malfunction occurs only for California specification vehicles.
- \*4: No. (2) and (3) in the diagnostic contents of codes No.25 and 26 apply to California specification vehicles only, while (1) applies to all models.
- \*5: Codes 27 and 71 are used only for California specification vehicles.
- \*6: "2" trip detection logic" (See page FI-23)

# INSPECTION OF DIAGNOSIS CIRCUIT



FI6066

