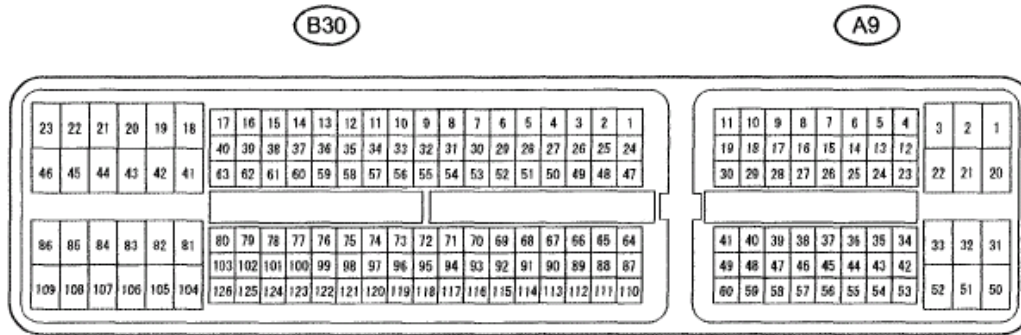


## 2008 Toyota RAV4

2008 ENGINE PERFORMANCE Engine Control System (2AZ-FE) - RAV4

### TERMINALS OF ECM



A107881E05

**Fig. 10: Identifying ECM Terminals**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### HINT:

The standard normal voltage between each pair of ECM terminals is shown in the table below. The appropriate conditions for checking each pair of terminals are also indicated. The result of checks should be compared with the standard normal voltage for that pair of terminals, displayed in the Specified Condition column. The illustration above can be used as a reference to identify the ECM terminal locations.

#### VOLTAGE SPECIFICATION

Symbols (Terminal No.)	Wiring Colors	Terminal Descriptions	Conditions	Specified Conditions
BATT (A9-20) - E1 (B30-104)	W - BR	Battery (for measuring battery voltage and for ECM memory)	Always	9 to 14 V
+BM (A9-3) - E1 (B30-104)	LG - BR	Power source of throttle actuator	Always	9 to 14 V
IGSW (A9-28) - E1 (B30-104)	B - BR	Ignition switch	Ignition switch ON	9 to 14 V
+B (A9-2) - E1 (B30-104)	B - BR	Power source of ECM	Ignition switch ON	9 to 14 V
+B2 (A9-1) - E1 (B30-104)	B - BR	Power source of ECM	Ignition switch ON	9 to 14 V
OC1+ (B30-100) - OC1- (B30- 123)	BR-L	Camshaft timing oil control valve (OCV)	Idling	Pulse generation (see 1 waveform 1)
MREL (A9-44) - E1 (B30-104)	O - BR	EFI relay	Ignition switch ON	9 to 14 V
VG (B30-118) - E2G (B30-116)	R - LG	Mass air flow meter	Idling, Shift lever position P or N, A/C switch OFF	0.5 to 3.0 V
THA (B30-65) -			Idling, Intake air	

## 2008 Toyota RAV4

2008 ENGINE PERFORMANCE Engine Control System (2AZ-FE) - RAV4

ETHA (B30-88)	W - BR	Intake air temperature sensor	temperature 20°C (68°F)	0.5 to 3.4 V
THW (B30-97) - ETHW (B30-96)	GR - BR	Engine coolant temperature sensor	Idling, Engine coolant temperature 80°C (176°F)	0.2 to 1.0 V
VCTA (B30-67) - ETA (B30-91)	Y - BR	Power source of throttle position sensor (specific voltage)	Ignition switch ON	4.5 to 5.5 V
VTA1 (B30-115) - ETA (B30-91)	G - BR	Throttle position sensor (for engine control)	Ignition switch ON, Throttle valve fully closed	0.5 to 1.1 V
			Ignition switch ON, Throttle valve fully open	3.3 to 4.9 V
VTA2 (B30-114) - ETA (B30-91)	L - BR	Throttle position sensor (for sensor malfunction detection)	Ignition switch ON, Throttle valve fully closed	2.1 to 3.1 V
			Ignition switch ON, Throttle valve fully open	4.6 to 5.0 V
VPA (A9-55) - EPA (A9-59)	W - Y	Accelerator pedal position sensor (for engine control)	Ignition switch ON, Accelerator pedal released	0.5 to 1.1 V
			Ignition switch ON, Accelerator pedal fully depressed	2.6 to 4.5 V
VPA2 (A9-56) - EPA2 (A9-60)	R - O	Accelerator pedal position sensor (for sensor malfunctioning detection)	Ignition switch ON, Accelerator pedal released	1.2 to 2.0 V
			Ignition switch ON, Accelerator pedal fully depressed	3.4 to 5.0 V
VCPA (A9-57) - EPA (A9-59)	B - Y	Power source of accelerator pedal position sensor (for VPA)	Ignition switch ON	4.5 to 5.5 V
VCP2 (A9-58) - EPA2 (A9-60)	L - O	Power source of accelerator pedal position sensor (for VPA2)	Ignition switch ON	4.5 to 5.5 V
HA1A (B30-109) - E04 (B30-46)	L - W-B	A/F sensor heater	Idling	Below 3.0 V
			Ignition switch ON	9 to 14 V
A1A+ (B30-112) - E1 (B30-104)	G - BR	A/F sensor	Ignition switch ON	3.3 V*
A1A- (B30-113) - E1 (B30-104)	R - BR	A/F sensor	Ignition switch ON	3.0 V*
HT1B (B30-47) - E03 (B30-86)	R - W-B	Heated oxygen sensor heater	Idling	Below 3.0 V
			Ignition switch ON	9 to 14 V
OX1B (B30-64) - EX1B (B30-87)	B - BR	Heated oxygen sensor	Engine speed maintained at 2,500 rpm for 2 minutes after warming up sensor	Pulse generation (see 2 waveform 2)
#10 (B30-108) - E01 (B30-45)	L - W-B		Ignition switch ON	9 to 14 V
#20 (B30-107) -				

## 2008 Toyota RAV4

2008 ENGINE PERFORMANCE Engine Control System (2AZ-FE) - RAV4

E01 (B30-45) #30 (B30-106) - E01 (B30-45) #40 (B30-105) - E01 (B30-45)	G - W-B B - W-B W - W-B	Injector	Idling	Pulse generation (see 3 waveform 3)
KNK1 (B30-110) - EKNK (B30-111)	B-W	Knock sensor	Engine speed maintained at 4,000 after warming up engine	Pulse generation (see 4 waveform 4)
G2+ (B30-99) - G2- (B30-98)	L - Y	Camshaft position sensor	Idling	Pulse generation (see 5 waveform 5)
NE+ (B30-122) - NE- (B30-121)	W - B	Crankshaft position sensor	Idling	Pulse generation (see 5 waveform 5)
IGT1 (B30-85) - E1 (B30-104) IGT2 (B30-84) - E1 (B30-104) IGT3 (B30-83) - E1 (B30-104) IGT4 (B30-82) - E1 (B30-104)	R - BR P - BR G - BR L - BR	Ignition coil (ignition signal)	Idling	Pulse generation (see 6 waveform 6)
IGF1 (B30-81) - E1 (B30-104)	W - BR	Ignition coil (ignition confirmation signal)	Ignition switch ON	4.5 to 5.5 V
			Idling	Pulse generation (see 6 waveform 6)
PRG (B30-49) - E1 (B30-104)	G - BR	Purge VSV	Ignition switch ON	9 to 14 V
			Idling	Pulse generation (see 7 waveform 7)
SPD (A9-8) - E1 (B30-104)	V - BR	Speed signal from combination meter	Driving at 20 km/h (12 mph)	Pulse generation (see 8 waveform 8)
STA (A9-48) - E1 (B30-104)	LG - BR	Starter signal	Cranking	5.5 V or more
STAR (B30-52) - E1 (B30-104)	W - BR	Starter relay control	Ignition switch ON	Below 1.5 V
			Cranking	6.0 V or more
STP (A9-36) - E1 (B30-104)	L - BR	Stop light switch	Brake pedal depressed	7.5 to 14 V
			Brake pedal released	Below 1.5 V
ST1- (A9-35) - E1 (B30-104)	GR - BR	Stop light switch (opposite to STP terminal)	Ignition switch ON, Brake pedal depressed	Below 1.5 V
			Ignition switch ON, Brake pedal released	7.5 to 14 V
M+ (B30-42) - ME01 (B30-43)	B-W-B	Throttle actuator	Idling with warm engine	Pulse generation (see 9 waveform 9)
M- (B30-41) - ME01 (B30-43)	W - W-B	Throttle actuator	Idling with warm engine	Pulse generation (see 10 waveform 10)
FC (A9-7) - E1	W - BR	Fuel pump control	Ignition switch ON	9 to 14 V

## 2008 Toyota RAV4

2008 ENGINE PERFORMANCE Engine Control System (2AZ-FE) - RAV4

(B30-104)			Idling	Below 1.5 V
W (A9-24) - E1 (B30-104)	R - BR	MIL	Ignition switch ON	Below 1.5 V
			Idling	9 to 14 V
TC (A9-27) - E1 (B30-104)	G - BR	Terminal TC of DLC3	Ignition switch ON	9 to 14 V
TACH (A9-15) - E1 (B30-104)	GR - BR	Engine speed	Idling	Pulse generation (see 11 waveform 11)
VPMP (A9-42) - E1 (B30-104)	W - BR	Vent valve (built into canister pump module)	Ignition switch ON	9 to 14 V
MPMP (A9-34) - E1 (B30-104)	B - BR	Leak detection pump (built into canister pump module)	Leak detection pump OFF	Below 3 V
			Leak detection pump ON	9 to 14 V
VCPP (B30-70) - EPPM (B30- 94)	Y - BR	Power source for canister pressure sensor (specific voltage)	Ignition switch ON	4.5 to 5.5 V
PPMP (B30-71) - EPPM (B30- 94)	V - BR	Canister pressure sensor (built into canister pump module)	Ignition switch ON	3 to 3.6 V
ELS1 (A9-31) - E1 (B30-104)	O - BR	Electric load	Taillight switch ON	7.5 to 14 V
			Taillight switch OFF	Below 1.5 V
ELS3 (A9-33) - E1 (B30-104)	G - BR	Electric load	Defogger switch ON	7.5 to 14 V
			Defogger switch OFF	Below 1.5 V
FANL (A9-21) - E1 (B30-104)	R - BR	Fan No. 1 relay	Ignition switch ON	9 to 14 V
			Idling with A/C ON, or high engine coolant temperature	Below 1.5 V
FANH (A9-22) - E1 (B30-104)	W - BR	Fan No. 2 relay	Idling with high engine coolant temperature	Below 1.5 V
ALT (B30-50) - E1 (B30-104)	B - BR	<a href="#">Generator</a>	Ignition switch ON	9 to 14 V
CANH (A9-41) - E1 (B30-104)	Y - BR	CAN communication line	Ignition switch ON	Pulse generation (see 12 waveform 12)
CANL (A9-49) - E1 (B30-104)	W - BR	CAN communication line	Ignition switch ON	Pulse generation (see 13 waveform 13)
VCIB (B30-69) - EIB (B30-92)	R - BR	Battery current sensor	Ignition switch ON	4.5 to 5.5 V
IB (B30-68) - EIB (B30-92)	B - BR	Battery current sensor	Ignition switch ON	0.5 to 2.5 V
THB (B30-120) - EIB (B30-92)	LG - BR	Battery temperature sensor	Ignition switch ON, Battery temperature -30 to 80°C (-22 to 176°F)	0.5 to 4.5 V
RLO (B30-51) -	GR - BR	<a href="#">Generator</a>	After engine warmed up, during charging control,	Pulse generation (see 14 waveform)

## 2008 Toyota RAV4

2008 ENGINE PERFORMANCE Engine Control System (2AZ-FE) - RAV4

E1 (B30-104)			vehicle driven at constant speed	14)
RLO (B30-51) - E1 (B30-104)	GR - BR	<a href="#">Generator</a>	After engine warmed up, during charging control, vehicle accelerated	Pulse generation (see 15 waveform 15)
RLO (B30-51) - E1 (B30-104)	GR - BR	<a href="#">Generator</a>	After engine warmed up, during charging control, vehicle decelerated	Pulse generation (see 16 waveform 16)

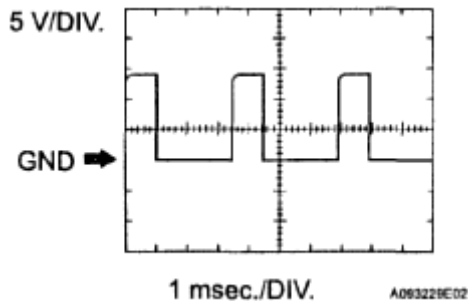
**HINT:**  
\*: The ECM terminal voltage is constant regardless of the output voltage from the sensor.

### 1. WAVEFORM 1

#### Camshaft timing oil control valve (OCV)

#### WAVEFORM REFERENCE (WAVEFORM 1)

ECM Terminal Names	Between OC1+ and OC1-
Tester Ranges	5 V/DIV., 1 msec./DIV.
Conditions	Idling



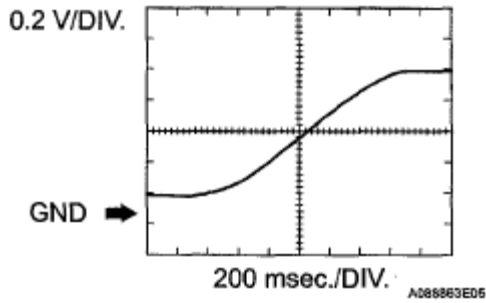
**Fig. 11: Waveform Graph (Waveform 1)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 2. WAVEFORM 2

#### Heated oxygen sensor

#### WAVEFORM REFERENCE (WAVEFORM 2)

ECM Terminal Names	Between OX1B and EX1B
Tester Ranges	0.2 V/DIV., 200 msec./DIV.
Conditions	Engine speed maintained at 2,500 rpm for 2 minutes after warming up sensor



**Fig. 12: Waveform Graph (Waveform 2)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

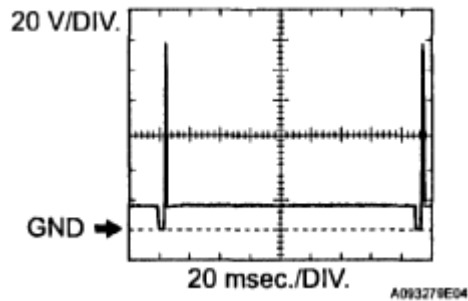
In DATA LIST, item O2S B1 S2 shows the ECM input values from the heated oxygen sensor.

**3. WAVEFORM 3**

**Injector No. 1 (to No. 4) injection signal**

**WAVEFORM REFERENCE (WAVEFORM 3)**

ECM Terminal Names	Between #10 (to #40) and E01
Tester Ranges	20 V/DIV., 20 msec./DIV.
Conditions	Idling



**Fig. 13: Waveform Graph (Waveform 3)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

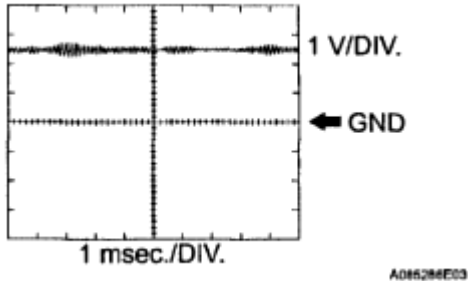
The wavelength becomes shorter as the engine rpm increases.

**4. WAVEFORM 4**

**Knock sensor**

**WAVEFORM REFERENCE (WAVEFORM 4)**

ECM Terminal Names	Between KNK1 and EKNK
Tester Ranges	1 V/DIV., 1 msec./DIV.
Conditions	Engine speed maintained at 4,000 rpm after warming up engine



**Fig. 14: Waveform Graph (Waveform 4)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

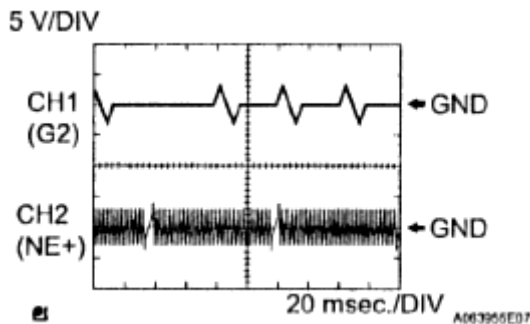
- The wavelength becomes shorter as the engine rpm increases.
- The waveforms and amplitudes displayed differ slightly depending on the vehicle.

**5. WAVEFORM 5**

**Crankshaft position sensor and Camshaft position sensor**

**WAVEFORM REFERENCE (WAVEFORM 5)**

ECM Terminal Names	CH1: Between G2+ and G2- CH2: Between NE+ and NE-
Tester Ranges	5 V/DIV., 20 msec./DIV.
Conditions	Idling



**Fig. 15: Waveform Graph (Waveform 5)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

The wavelength becomes shorter as the engine rpm increases.

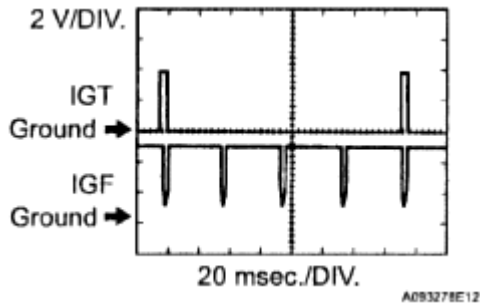


6. WAVEFORM 6

Igniter IGT signal (from ECM to igniter) and Igniter IGF signal (from igniter to ECM)

WAVEFORM REFERENCE (WAVEFORM 6)

ECM Terminal Names	Between IGT (1 to 4) and E1 Between IGF1 and E1
Tester Ranges	2 V/DIV., 20 msec./DIV.
Conditions	Idling



**Fig. 16: Waveform Graph (Waveform 6)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

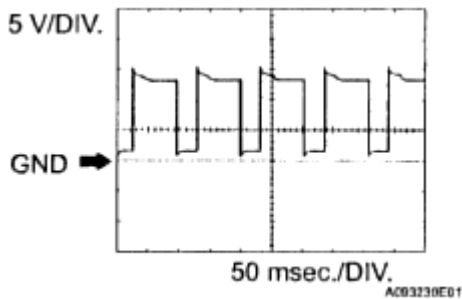
The wavelength becomes shorter as the engine rpm increases.

7. WAVEFORM 7

Purge VSV

WAVEFORM REFERENCE (WAVEFORM 7)

ECM Terminal Names	Between PRG and E1
Tester Ranges	5 V/DIV., 50 msec./DIV.
Conditions	Idling



**Fig. 17: Waveform Graph (Waveform 7)**



Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

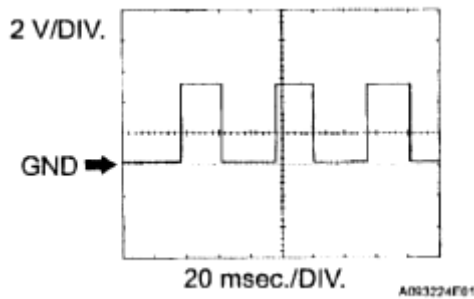
If the waveform is not similar to the illustration, check the waveform again after idling for 10 minutes or more.

8. **WAVEFORM 8**

**Vehicle speed signal**

**WAVEFORM REFERENCE (WAVEFORM 8)**

ECM Terminal Names	Between SPD and E1
Tester Ranges	2 V/DIV., 20 msec./DIV.
Conditions	Driving at 20 km/h (12 mph)



**Fig. 18: Waveform Graph (Waveform 8)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

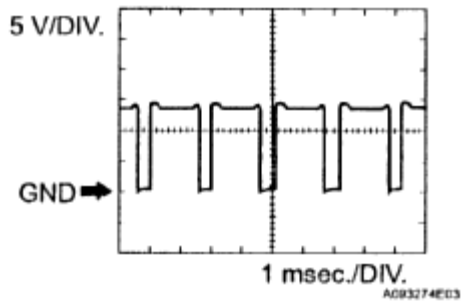
The wavelength becomes shorter as the vehicle speed increases.

9. **WAVEFORM 9**

**Throttle actuator positive terminal**

**WAVEFORM REFERENCE (WAVEFORM 9)**

ECM Terminal Names	Between M+ and ME01
Tester Ranges	5 V/DIV., 1 msec./DIV.
Conditions	Idling with warm engine



**Fig. 19: Waveform Graph (Waveform 9)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

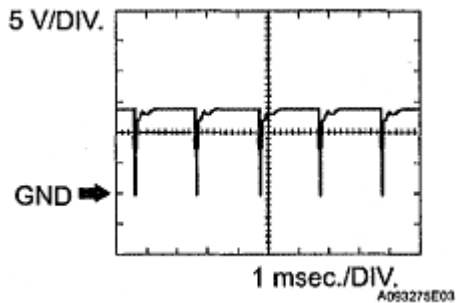
The duty ratio varies depending on the throttle actuator operation.

10. **WAVEFORM 10**

**Throttle actuator negative terminal**

**WAVEFORM REFERENCE (WAVEFORM 10)**

ECM Terminal Names	Between M- and ME01
Tester Ranges	5 V/DIV., 1 msec./DIV.
Conditions	Idling with warm engine



**Fig. 20: Waveform Graph (Waveform 10)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

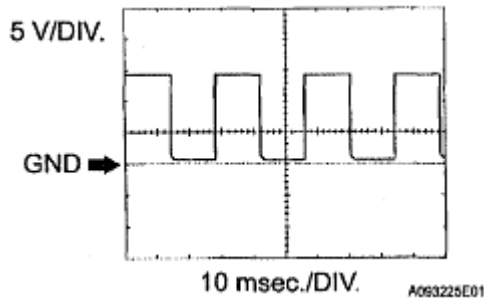
The duty ratio varies depending on the throttle actuator operation.

11. **WAVEFORM 11**

**Engine speed signal**

**WAVEFORM REFERENCE (WAVEFORM 11)**

ECM Terminal Names	Between TACH and E1
Tester Ranges	5 V/DIV., 10 msec./DIV.
Conditions	Idling



**Fig. 21: Waveform Graph (Waveform 11)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

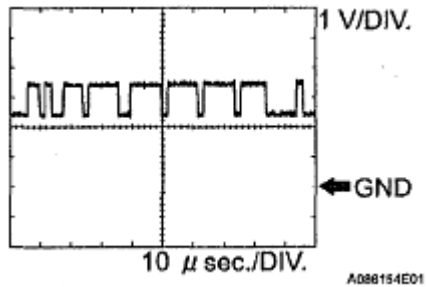
The wavelength becomes shorter as the engine rpm increases.

12. **WAVEFORM 12**

**CAN communication signal**

**WAVEFORM REFERENCE (WAVEFORM 12)**

ECM Terminal Names	Between CANH and E1
Tester Ranges	1 V/DIV., 10 $\mu$ sec./DIV.
Conditions	Engine stops and ignition switch ON



**Fig. 22: Waveform Graph (Waveform 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

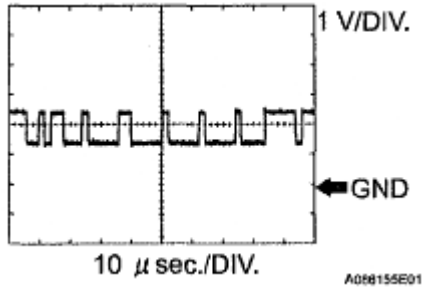
The waveform varies depending on the CAN communication signal.

13. **WAVEFORM 13**

**CAN communication signal**

**WAVEFORM REFERENCE (WAVEFORM 13)**

ECM Terminal Names	Between CANL and E1
Tester Ranges	1V/DIV., 10 μsec/DIV.
Conditions	Engine stops and ignition switch ON



**Fig. 23: Waveform Graph (Waveform 13)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

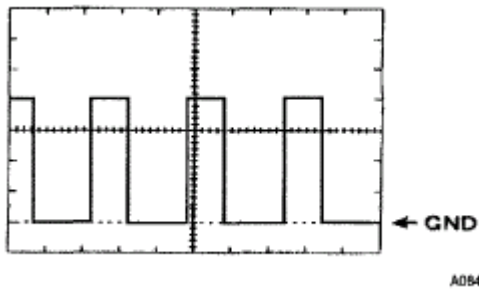
The waveform varies depending on the CAN communication signal.

14. **WAVEFORM 14**

**Generator**

**WAVEFORM REFERENCE (WAVEFORM 14)**

ECM Terminal Names	Between RLO and E1
Tester Ranges	2 V/DIV., 50 msec./DIV.
Conditions	After engine warmed up, during charging control, vehicle driven at constant speed



**Fig. 24: Waveform Graph (Waveform 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

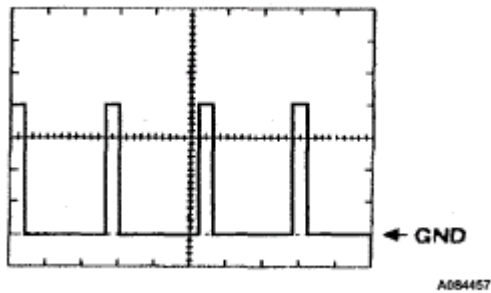
A constant value is not output, as the duty ratio varies depending on the electrical load and battery condition.

15. **WAVEFORM 15**

Generator

**WAVEFORM REFERENCE (WAVEFORM 15)**

ECM Terminal Names	Between RLO and E1
Tester Ranges	2 V/DIV., 50 msec./DIV.
Conditions	After engine warmed up, during charging control, vehicle accelerated



**Fig. 25: Waveform Graph (Waveform 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

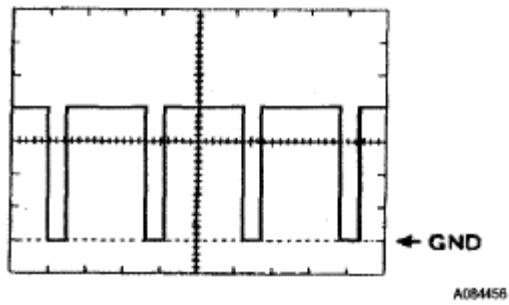
A constant value is not output, as the duty ratio varies depending on the electrical load and battery condition.

16. **WAVEFORM 16**

Generator

**WAVEFORM REFERENCE (WAVEFORM 16)**

ECM Terminal Names	Between RLO and E1
Tester Ranges	2 V/DIV., 50 msec./DIV.
Conditions	After engine warmed up, during charging control, vehicle decelerated



**Fig. 26: Waveform Graph (Waveform 16)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

A constant value is not output, as the duty ratio varies depending on the electrical load and battery condition.