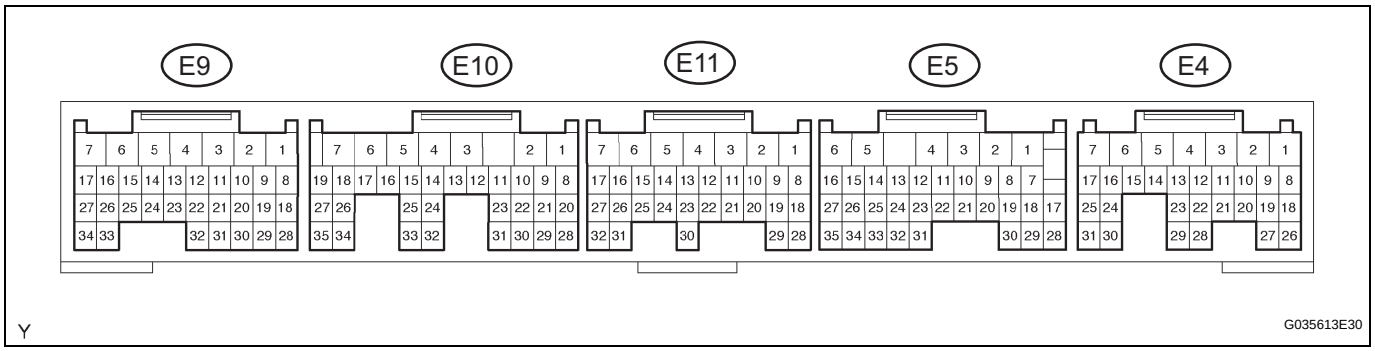
TERMINALS OF ECM

1. SFI SYSTEM



ES

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

Symbols (Terminal No.)	Wiring Colors	Terminal Descriptions	Conditions	Specified Condition
+B (E4-1) - E1 (E11-1)	B-R - BR	Power source of ECM	Ignition switch ON	9 to 14 V
+B2 (E4-2) - E1 (E11-1)	B-R - BR	Power source of ECM	Ignition switch ON	9 to 14 V
BATT (E4-3) - E1 (E11-1)	B-W - BR	Battery (for measuring the battery voltage and for the ECM memory)	Always	9 to 14 V
VPMP (E4-5) - E1 (E11-1)	W - BR	Vent valve operation signal (built into pump module)	Ignition switch ON	9 to 14 V
MPMP (E4-6) - E1 (E11-1)	G - BR	Vacuum pump operation signal (built into pump module)	Vacuum pump OFF	0 to 3 V
MPMP (E4-6) - E1 (E11-1)	G - BR	Vacuum pump operation signal (built into pump module)	Vacuum pump ON	9 to 14 V
+BM (E4-7) - E1 (E11-1)	R - BR	Power source of ETCS throttle motor	Always	9 to 14 V
MREL (E4-8) - E1 (E11-1)	B-W - BR	EFI relay operation signal	Ignition switch ON	9 to 14 V
IGSW (E4-9) - E1 (E11-1)	B-O - BR	Ignition switch signal	Ignition switch ON	9 to 14 V
FC (E4-10) - E1 (E11-1)	V-G - BR	C/OPEN relay operation signal (fuel pump control)	Ignition switch ON	9 to 14 V
STP (E4-15) - E1 (E11-1)	G-W - BR	Stop light switch signal	Brake pedal depressed	7.5 to 14 V
STP (E4-15) - E1 (E11-1)	G-W - BR	Stop light switch signal	Brake pedal released	Below 1.5 V
ST1- (E4-16) - E1 (E11-1)	LG-R - BR	Stop light switch signal (opposite to STP terminal)	Ignition switch ON, Brake pedal depressed	Below 1.5 V
ST1- (E4-16) - E1 (E11-1)	LG-R - BR	Stop light switch signal (opposite to STP terminal)	Ignition switch ON, Brake pedal released	7.5 to 14 V
VPA (E4-18) - EPA (E4-20)	L-Y - R-B	Accelerator pedal position sensor signal (for engine control)	Ignition switch ON, Accelerator pedal fully released	0.5 to 1.1 V

Symbols (Terminal No.)	Wiring Colors	Terminal Descriptions	Conditions	Specified Condition
VPA (E4-18) - EPA (E4-20)	L-Y - R-B	Accelerator pedal position sensor signal (for engine control)	Ignition switch ON, Accelerator pedal fully depressed	2.6 to 4.5 V
VPA2 (E4-19) - EPA2 (E4-21)	W-R - LG	Accelerator pedal position sensor signal (for sensor malfunction detection)	Ignition switch ON, Accelerator pedal fully released	1.2 to 2.0 V
VPA2 (E4-19) - EPA2 (E4-21)	W-R - LG	Accelerator pedal position sensor signal (for sensor malfunction detection)	Ignition switch ON, Accelerator pedal fully depressed	3.4 to 5.0 V
EPA (E4-20) - VPA (E4-18)	R-B - L-Y	Accelerator pedal position sensor signal (for engine control)	Ignition switch ON, Accelerator pedal fully released	0.5 to 1.1 V
EPA (E4-20) - VPA (E4-18)	R-B - L-Y	Accelerator pedal position sensor signal (for engine control)	Ignition switch ON, Accelerator pedal fully depressed	2.6 to 4.5 V
EPA2 (E4-21) - VPA2 (E4-19)	LG - W-R	Accelerator pedal position sensor signal (for sensor malfunction detection)	Ignition switch ON, Accelerator pedal fully released	1.2 to 2.0 V
EPA2 (E4-21) - VPA2 (E4-19)	LG - W-R	Accelerator pedal position sensor signal (for sensor malfunction detection)	Ignition switch ON, Accelerator pedal fully depressed	3.4 to 5.0 V
PPMP (E4-22) - E2 (E9-28)	B - BR	Pressure sensor signal (built into pump module)	Ignition switch ON	3 to 3.6 V
TC (E4-23) - E1 (E11-1)	P-B - BR	Terminal TC of DLC3	Ignition switch ON	9 to 14 V
VCPA (E4-26) - EPA (E4-20)	GR-R - R-B	Power source of accelerator pedal position sensor (for VPA)	Ignition switch ON	4.5 to 5.0 V
VCP2 (E4-27) - EPA2 (E4-21)	B-R - LG	Power source of accelerator pedal position sensor (for VPA2)	Ignition switch ON	4.5 to 5.0 V
TACH (E5-1) - E1 (E11-1)	B-O - BR	Engine speed signal (for combination meter)	Idling	Pulse generation (see waveform 11)
SPD (E5-8) - E1 (E11-1)	V-W - BR	Vehicle speed signal from combination meter	Ignition switch ON, driving wheel rotated slowly	Pulse generation (see waveform 8)
W (E5-30) - E1 (E11-1)	B-Y - BR	Malfunction Indicator Lamp (MIL) operation signal	Ignition switch ON	Below 3.0 V
W (E5-30) - E1 (E11-1)	B-Y - BR	Malfunction Indicator Lamp (MIL) operation signal	Idling	9 to 14 V
CANH (E5-33) - CANL (E5-34)	B - W	CAN communication circuit	Ignition switch off	54 to 69 Ω
CANL (E5-34) - CANH (E5-33)	W - B	CAN communication circuit	Ignition switch off	54 to 69 Ω
E1 (E11-1) - Body ground	BR - -	Earth (ground) circuit of ECM	Always	Below 1 V
#10 (E11-2) - E01 (E9-7) #20 (E11-3) - E01 (E9-7) #30 (E11-4) - E01 (E9-7) #40 (E11-5) - E01 (E9-7) #50 (E11-6) - E01 (E9-7) #60 (E11-7) - E01 (E9-7)	L - W-B R - W-B B - W-B W - W-B B-W - W-B G - W-B	Fuel injector operation signal	Ignition switch ON	9 to 14 V
#10 (E11-2) - E01 (E9-7) #20 (E11-3) - E01 (E9-7) #30 (E11-4) - E01 (E9-7) #40 (E11-5) - E01 (E9-7) #50 (E11-6) - E01 (E9-7) #60 (E11-7) - E01 (E9-7)	L - W-B R - W-B B - W-B W - W-B B-W - W-B G - W-B	Fuel injector operation signal	Idling	Pulse generation (see waveform 3)
PSW (E11-10) - E1 (E11-1)	R-W - BR	P/S pressure switch signal	Ignition switch ON	9 to 14 V

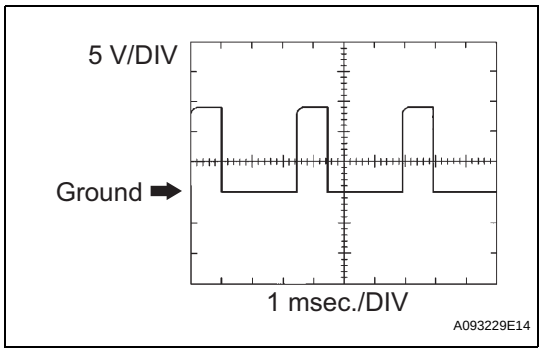
Symbols (Terminal No.)	Wiring Colors	Terminal Descriptions	Conditions	Specified Condition
STAR (NSW) (E10-8) - E1 (E11-1)	B-Y - BR	Park/Neutral position switch signal	Ignition switch ON, Shift lever position P or N	9 to 14 V
STAR (NSW) (E10-8) - E1 (E11-1)	B-Y - BR	Park/Neutral position switch signal	Ignition switch ON, Shift lever position other than P or N	9 to 14 V
STA (E11-11) - E1 (E11-1)	B-L - BR	Starter relay operation signal	Cranking	9 to 14 V
OC2- (E11-14) - OC2+ (E11-15)	G-B - L-R	Camshaft timing Oil Control Valve (OCV) operation signal (Intake side)	Ignition switch ON	Pulse generation (see waveform 1)
OE2+ (E11-27) - OE2- (E11-32)	W - G-R	Camshaft timing Oil Control Valve (OCV) operation signal (Intake side)	Ignition switch ON	Pulse generation (see waveform 1)
OC1- (E11-16) - OC1+ (E11-17)	G-R - G-W	Camshaft timing Oil Control Valve (OCV) operation signal (Intake side)	Ignition switch ON	Pulse generation (see waveform 1)
OE1+ (E11-26) - OE1- (E11-31)	G - R	Camshaft timing Oil Control Valve (OCV) operation signal (Intake side)	Ignition switch ON	Pulse generation (see waveform 1)
VV2+ (E11-18) - VV2- (E11-28)	V - G	Variable Valve Timing (VVT) sensor signal (Intake side)	Idling	Pulse generation (see waveform 5)
VV1+ (E11-19) - VV1- (E11-29)	B-W - L-Y	Variable Valve Timing (VVT) sensor signal (Intake side)	Idling	Pulse generation (see waveform 5)
NE- (E11-20) - NE+ (E11-21)	B - W	Crankshaft position sensor signal	Idling	Pulse generation (see waveform 5)
NE+ (E11-21) - NE- (E11-20)	W - B	Crankshaft position sensor signal	Idling	Pulse generation (see waveform 5)
EV2- (E11-22) - EV2+ (E11-23)	R - P	Variable Valve Timing (VVT) sensor signal (Exhaust side)	Idling	Pulse generation (see waveform 5)
EV2+ (E11-23) - EV2- (E11-22)	P - R	Variable Valve Timing (VVT) sensor signal (Exhaust side)	Idling	Pulse generation (see waveform 5)
EV1- (E11-24) - EV1+ (E11-25)	L-W - B-W	Variable Valve Timing (VVT) sensor signal (Exhaust side)	Idling	Pulse generation (see waveform 5)
EV1+ (E11-25) - EV1- (E11-24)	B-W - L-W	Variable Valve Timing (VVT) sensor signal (Exhaust side)	Idling	Pulse generation (see waveform 5)
VV2- (E11-28) - VV2+ (E11-18)	G - V	Variable Valve Timing (VVT) sensor signal (Intake side)	Idling	Pulse generation (see waveform 5)
VV1- (E11-29) - VV1+ (E11-19)	L-Y - B-W	Variable Valve Timing (VVT) sensor signal (Intake side)	Idling	Pulse generation (see waveform 5)
HT1B (E9-1) - E1 (E11-1) HT2B (E10-5) - E1 (E11-1)	L - BR W-L - BR	Heated oxygen sensor heater operation signal	Idling	Below 3.0 V
HT1B (E9-1) - E1 (E11-1) HT2B (E10-5) - E1 (E11-1)	L - BR W-L - BR	Heated oxygen sensor heater operation signal	Ignition switch ON	9 to 14 V
ACM (E9-3) - E1 (E11-1)	Y-G - BR	VSV for active control mount system operation signal	Ignition switch ON	9 to 14 V
M- (E9-4) - ME01 (E10-3)	W - W-B	Throttle drive motor operation signal (negative terminal)	Idling with warm engine	Pulse generation (see waveform 10)

ES

Symbols (Terminal No.)	Wiring Colors	Terminal Descriptions	Conditions	Specified Condition
M+ (E9-5) - ME01 (E10-3)	B - W-B	Throttle drive motor operation signal (positive terminal)	Idling with warm engine	Pluse generation (see waveform 9)
E02 (E9-6) - Body ground	W-B - -	Earth (ground) circuit of ECM	Always	Below 1 V
E01 (E9-7) - Body ground	W-B - -	Earth (ground) circuit of ECM	Always	Below 1 V
IGT1 (E9-8) - E1 (E11-1) IGT2 (E9-9) - E1 (E11-1) IGT3 (E9-10) - E1 (E11-1) IGT4 (E9-11) - E1 (E11-1) IGT5 (E9-12) - E1 (E11-1) IGT6 (E9-13) - E1 (E11-1)	R-L - BR P - BR Y-B - BR L-Y - BR G-Y - BR L-R - BR	Ignition coil with igniter (ignition signal)	Idling	Pulse generation (see waveform 6)
GE01 (E9-17) - E1 (E11-1)	- - BR	Shielded earth (ground) circuit of throttle drive motor	Always	Below 1 V
OX1B (E9-18) - E2 (E9-28) OX2B (E10-33) - E2 (E9-28)	W - BR B - BR	Heated oxygen sensor signal	With engine speed at 2500 rpm for 2 minutes after warming up	Pulse generation (see waveform 2)
VTA2 (E9-19) - E2 (E9-28)	B-R - BR	Throttle position sensor signal (for sensor malfunction detection)	Ignition switch ON, Accelerator pedal fully released	2.1 to 3.1 V
VTA2 (E9-19) - E2 (E9-28)	B-R - BR	Throttle position sensor signal (for sensor malfunction detection)	Ignition switch ON, Accelerator pedal fully depressed	4.5 to 5.0 V
VTA1 (E9-20) - E2 (E9-28)	LG - BR	Throttle position sensor signal (for engine control)	Ignition switch ON, Throttle valve fully closed	0.5 to 1.2 V
VTA1 (E9-20) - E2 (E9-28)	LG - BR	Throttle position sensor signal (for engine control)	Ignition switch ON, Throttle valve fully open	3.2 to 4.8 V
THW (E9-21) - E2 (E9-28)	G-B - BR	Engine coolant temperature sensor signal	Idling, Engine coolant temperature 80°C (176°F)	0.2 to 1.0 V
THA (E9-22) - E2 (E9-28)	L-B - BR	Intake air temperature sensor signal	Idling, Intake air temperature 20°C (68°F)	0.5 to 3.4 V
VC (E9-23) - E2 (E9-28)	Y - BR	Power source of sensors (specific voltage)	Ignition switch ON	4.5 to 5.0 V
IGF1 (E9-24) - E1 (E11-1)	W-R - BR	Ignition coil with igniter (ignition confirmation signal)	Ignition switch ON	4.5 to 5.0 V
IGF1 (E9-24) - E1 (E11-1)	W-R - BR	Ignition coil with igniter (ignition confirmation signal)	Idling	Pulse generation (see waveform 6)
AICV (E9-27) - E1 (E11-1)	W - BR	VSV for Air intake control system operation signal	Ignition switch ON	9 to 14 V
E2 (E9-28) - E1 (E11-1)	BR - BR	Earth (ground) circuit of sensors for ETCS	Always	Below 1 V
E2G (E9-29) - E1 (E11-1)	L-W - BR	Earth (ground) circuit of sensor for mass air flow meter	Always	Below 1 V
VG (E9-30) - E2G (E9-29)	R - L-W	Mass Air Flow (MAF) meter signal	Idling, Shift lever position P or N, A/C switch OFF	0.5 to 3.0 V
ACIS (E9-33) - E1 (E11-1)	R-Y - BR	VSV for ACIS (Acoustic Control Induction System) operation signal	Ignition switch ON	9 to 14 V
PRG (E9-34) - E1 (E11-1)	G - BR	Purge VSV for EVAP system operation signal	Ignition switch ON	9 to 14 V
PRG (E9-34) - E1 (E11-1)	G - BR	Purge VSV for EVAP system operation signal	Idling	Pulse generation (see waveform 7)
HA2A (E10-1) - E05 (E10-6)	Y - W-B	A/F sensor heater operation signal	Idling	Below 3.0 V

Symbols (Terminal No.)	Wiring Colors	Terminal Descriptions	Conditions	Specified Condition
HA2A (E10-1) - E05 (E10-6)	Y - W-B	A/F sensor heater operation signal	Ignition switch ON	9 to 14 V
HA1A (E10-2) - E04 (E10-7)	B-W - W-B	A/F sensor heater operation signal	Idling	Below 3.0 V
HA1A (E10-2) - E04 (E10-7)	B-W - W-B	A/F sensor heater operation signal	Ignition switch ON	9 to 14 V
ME01 (E10-3) - E1 (E11-1)	W-B - BR	Earth (ground) circuit of ECM	Always	Below 1 V
E03 (E10-4) - E1 (E11-1)	W-B - BR	Earth (ground) circuit of ECM	Always	Below 1 V
HT2B (E10-5) - E1 (E11-1) HT1B (E9-1) - E1 (E11-1)	W-L - BR L - BR	Heated oxygen sensor heater operation signal	Idling	Below 3.0 V
HT2B (E10-5) - E1 (E11-1) HT1B (E9-1) - E1 (E11-1)	W-L - BR L - BR	Heated oxygen sensor heater operation signal	Ignition switch ON	9 to 14 V
E05 (E10-6) - E1 (E11-1)	W-B - BR	Earth (ground) circuit of ECM	Always	Below 1 V
E04 (E10-7) - E1 (E11-1)	W-B - BR	Earth (ground) circuit of ECM	Always	Below 1 V
EKN2 (E10-20) - KNK2 (E10-21)	G - R	Earth (ground) circuit of knock sensor	With engine speed at 4000 rpm after warming up	Pulse generation (see waveform 4)
KNK2 (E10-21) - EKN2 (E10-20)	R - G	Knock sensor signal	With engine speed at 4000 rpm after warming up	Pulse generation (see waveform 4)
A1A+ (E10-22) - E1 (E11-1)	BR - BR	A/F sensor signal	Ignition switch ON	3.3 V*1
A1A+ (E10-22) - E1 (E11-1)	BR - BR	A/F sensor signal	Ignition switch ON	3.0 V*1
A2A+ (E10-23) - E1 (E11-1)	P - BR	A/F sensor signal	Ignition switch ON	3.3 V*1
A2A+ (E10-23) - E1 (E11-1)	P - BR	A/F sensor signal	Ignition switch ON	3.0 V*1
EKNK (E10-28) - KNK1 (E10-29)	W - B	Earth (ground) circuit of knock sensor	With engine speed at 4000 rpm after warming up	Pulse generation (see waveform 4)
KNK1 (E10-29) - EKNK (E10-28)	B - W	Knock sensor signal	With engine speed at 4000 rpm after warming up	Pulse generation (see waveform 4)
A1A- (E10-30) - E1 (E11-1)	Y - BR	A/F sensor	Ignition switch ON	3.3 V*1
A1A- (E10-30) - E1 (E11-1)	Y - BR	A/F sensor	Ignition switch ON	3.0 V*1
A2A- (E10-31) - E1 (E11-1)	L - BR	A/F sensor	Ignition switch ON	3.3 V*1
A2A- (E10-31) - E1 (E11-1)	L - BR	A/F sensor	Ignition switch ON	3.0 V*1
OX2B (E10-33) - E2 (E9-28) OX1B (E9-18) - E2 (E9-28)	B - BR W - BR	Heated oxygen sensor signal	With engine speed at 2500 rpm for 2 minutes after warming up	Pulse generation (see waveform 2)

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

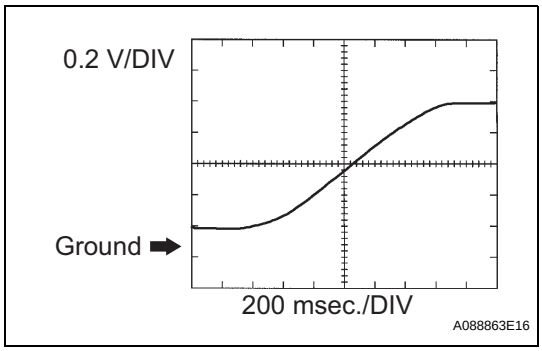


(a) WAVEFORM 1

(1) Camshaft Timing Oil Control Valve (OCV) operation signal

ECM Terminal Names	Between OC1+ and OC1- , OC2+ and OC2- , OE1+ and OE1- , or OE2+ and OE2-
Tester Ranges	5 V/DIV, 1 msec./DIV
Conditions	Idling

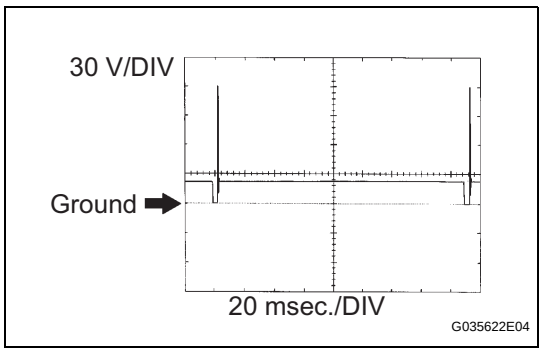
HINT:
The wavelength becomes shorter as the engine rpm increases.



(b) WAVEFORM 2
(1) Heated oxygen sensor signal

ECM Terminal Names	Between OX1B and E2, or OX2B and E2
Tester Ranges	0.2 V/DIV, 200 msec./DIV
Conditions	Engine speed is maintained at 2500 rpm for 2 minutes after sensor is warmed up

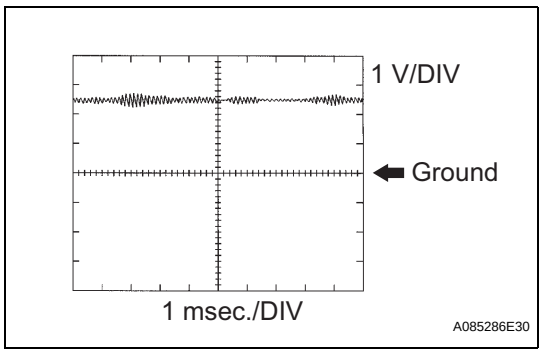
HINT:
In the DATA LIST, item O2S B1S2 shows the ECM input values from the heated oxygen sensor.



(c) WAVEFORM 3
(1) Fuel injector operation signal

ECM Terminal Names	Between #10 (to 60) and E01
Tester Ranges	30 V/DIV, 20 msec./DIV
Conditions	Idling

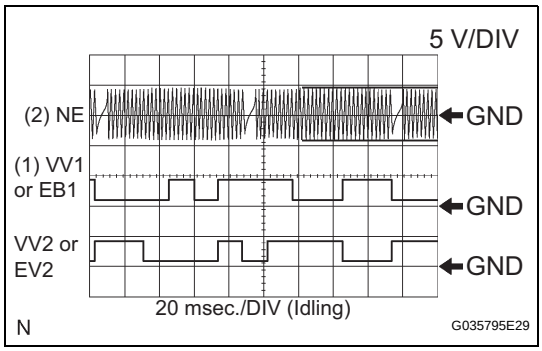
HINT:
The wavelength becomes shorter as the engine rpm increases.



(d) WAVEFORM 4
(1) Knock sensor signal

ECM Terminal Names	Between KNK1 and EKNK, or KNK2 and EKN2
Tester Ranges	0.01 to 10 V/DIV, 0.01 to 10 msec./DIV
Conditions	Engine speed is maintained at 4000 rpm after engine is warmed up

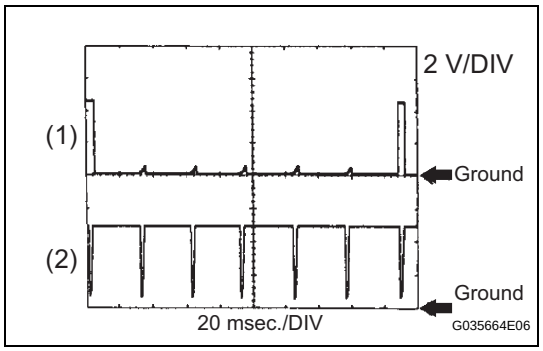
HINT:
- The wavelength becomes shorter as the engine rpm increases.
- The waveforms and amplitudes displayed differ slightly depending on the vehicle.



(e) WAVEFORM 5
(1) Variable Valve Timing (VVT) sensor signal (1)
(2) Crankshaft position sensor signal (2)

ECM Terminal Names	(1) Between VV1+ and VV1- , VV2+ and VV2-, EV1+ and EV1-, or EV2+ and EV2- (2) Between NE+ and NE-
Tester Ranges	5 V/DIV, 20 msec./DIV
Conditions	Idling

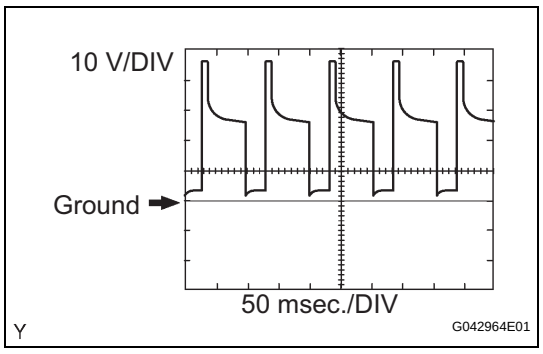
HINT:
The wavelength becomes shorter as the engine rpm increases.



(f) WAVEFORM 6
(1) Igniter IGT signal (from ECM to igniter) (1)
(2) Igniter IGF signal (from igniter to ECM) (2)

ECM Terminal Names	(1) Between IGT (1 to 6) and E1 (2) Between IGF1 and E1
Tester Ranges	2 V/DIV, 20 msec./DIV
Conditions	Idling

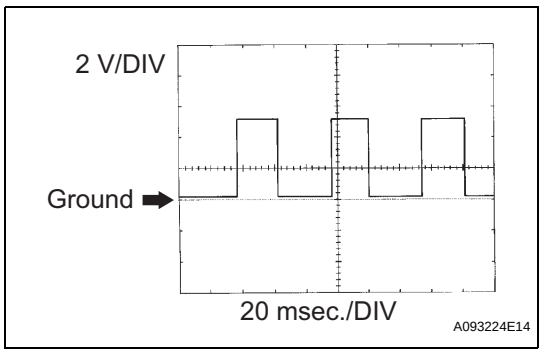
HINT:
The wavelength becomes shorter as the engine rpm increases.



(g) WAVEFORM 7
(1) Purge VSV for EVAP system operation signal

ECM Terminal Names	Between PRG and E1
Tester Ranges	10 V/DIV, 50 msec./DIV
Conditions	Idling

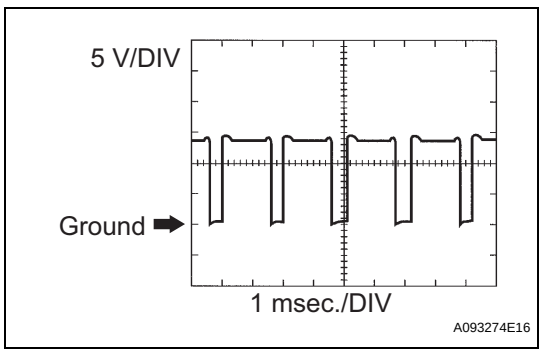
HINT:
If the waveform is not similar to that shown in the illustration, check the waveform again after idling for 10 minutes or more.



(h) WAVEFORM 8
(1) Vehicle speed signal

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

HINT:
- The wavelength becomes shorter as the vehicle speed increases.
- Depending on the vehicle, the output waveform voltage may rise to 12 V if influenced by optionally installed systems.

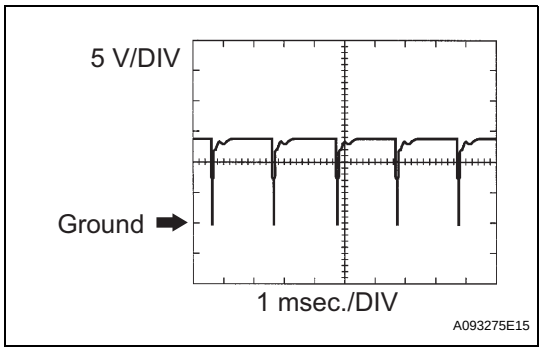


(i) WAVEFORM 9
(1) Throttle drive motor operation signal (positive terminal)

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

HINT:
The duty ratio varies depending on the throttle actuator operation.

ES

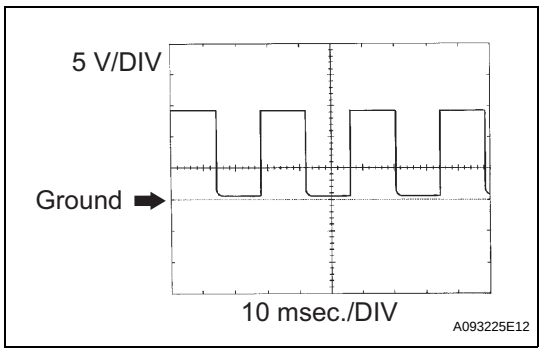


(j) WAVEFORM 10

(1) Throttle drive motor operation signal (negative terminal)

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

HINT:
The duty ratio varies depending on the throttle actuator operation.



(k) WAVEFORM 11

(1) Engine speed signal

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

HINT:
The wavelength becomes shorter as the engine rpm increases.

ES