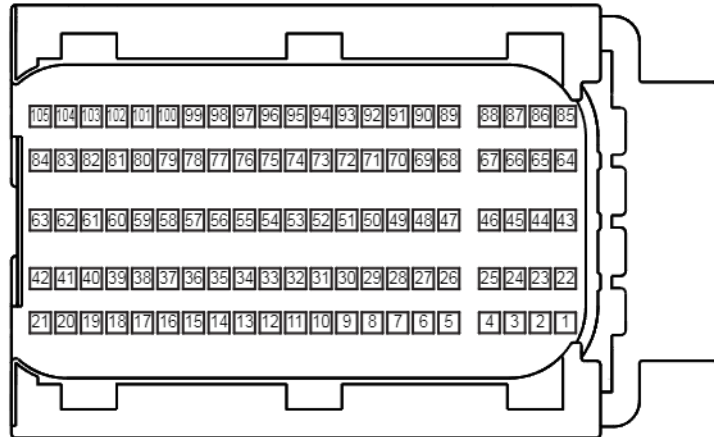


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Engine Control System (G6DF : LAMBDA II 3.3L MPI) (2)

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PCM Terminal Information



C300-A

PIN	COLOR	DESCRIPTION	PIN	COLOR	DESCRIPTION	PIN	COLOR	DESCRIPTION	PIN	COLOR	DESCRIPTION	PIN	COLOR	DESCRIPTION	PIN	COLOR	DESCRIPTION
1	Y	[With IMMO.] Ignition Coil #5	19	W	MAP Sensor IAT Signal	37	-	-	55	Gr	CPS #1 (IN/EX) Ground	73	L	[A/T] Input Speed Power	90	-	-
	G	[W/O IMMO.] Ignition Coil #2	20	R	CPS #2 (EX) Signal	38	W	TPS 2 Signal	56	Br	CPS #2 (IN/EX) Ground	74	W	[A/T] Select Switch	91	-	-
2	O	[A/T] SOL Power 2	21	-	-	39	-	-	57	Br	TPS Ground	75	G	CKP Low	92	-	-
3	Y	[A/T] VFS_OD & LR	22	R	[With IMMO.] Ignition Coil #4	40	W	OTS Signal	58	B	Shield Ground	76	-	-	93	Gr	[A/T] Input Speed Signal
4	P	[A/T] VFS_UD		W	[W/O IMMO.] Ignition Coil #1	41	P	CPS #1 (EX) Signal	59	-	-	77	W	Knock Sensor #2 High	94	W/B	[A/T] Output Speed Power
5	-	-	23	G	[A/T] SOL Power 1	42	Gr	TPS Power	60	-	-	78	G	Knock Sensor #1 High	95	L/B	[A/T] Oil Temp. Sensor (+)
6	R	[A/T] SS_B	24	G	[A/T] VFS_3SR	43	L	[With IMMO.] Ignition Coil #6	61	Gr	ECTS Ground	79	W	Oxygen Sensor #1 (Intake) (V/G)	96	W	CKP High
7	O	[A/T] SS_A	25	Y/B	[A/T] VFS_LINE		B	[W/O IMMO.] Ignition Coil #3	62	-	-	80	Gr	Oxygen Sensor #1 (Intake) (R/C)	97	-	-
8	-	-	26	-	-	44	Br	[A/T] VFS_T/CON	63	B	OTS Ground	81	Br	Oxygen Sensor #1 (Exhaust) (Low)	98	G	Knock Sensor #2 Low
9	-	-	27	-	-	45	B	[A/T] Ground	64	B	[With IMMO.] Ignition Coil #3	82	Gr	Oxygen Sensor #2 (Exhaust) (High)	99	W	Knock Sensor #1 Low
10	Gr	[A/T] Position Switch 'S4'	28	-	-	46	B	[A/T] Ground		L	[W/O IMMO.] Ignition Coil #6	83	Y	Oxygen Sensor #2 (Intake) (V/G)	100	W	Oxygen Sensor #1 (Exhaust) (High)
11	G/B	[A/T] Position Switch 'S1'	29	-	-	47	-	-	65	Gr	[A/T] VFS_26B	84	G/B	Oxygen Sensor #2 (Intake) (R/C)	101	Br	Oxygen Sensor #1 (Intake) (V/N)
12	P	CPS #1 (EX) Power	30	G	[A/T] Position Switch 'S3'	48	-	-	66	O	[A/T] Memory Power	85	G	[With IMMO.] Ignition Coil #2	102	L	Oxygen Sensor #1 (Intake) (I/P)
13	-	-	31	Br	[A/T] Position Switch 'S2'	49	W	[A/T] Oil Temp. Sensor (-)	67	-	-		Y	[W/O IMMO.] Ignition Coil #5	103	Br	Oxygen Sensor #2 (Exhaust) (Low)
14	P	MAP Sensor Power	32	Gr	[A/T] Up Shift	50	-	-	68	L	ETC Motor (-)	86	W	[With IMMO.] Ignition Coil #1	104	B	Oxygen Sensor #2 (Intake) (V/N)
15	P	CPS #2 (IN/EX) Power	33	-	-	51	P	[A/T] Down Shift	69	-	-		R	[W/O IMMO.] Ignition Coil #4	105	W	Oxygen Sensor #2 (Intake) (I/P)
16	O	MAP Sensor Signal	34	-	-	52	B	MAP Sensor Ground	70	-	-	87	O	[A/T] Memory Power			
17	G	TPS 1 Signal	35	G	CPS #2 (IN) Signal	53	-	-	71	-	-	88	-	-			
18	B	ECTS Signal	36	G	CPS #1 (IN) Signal	54	P	CPS #1 (IN) Power	72	G	[A/T] Output Speed Signal	89	W/B	ETC Motor (+)			

※ [A/T] : See Automatic Transaxle Control System (SD450)

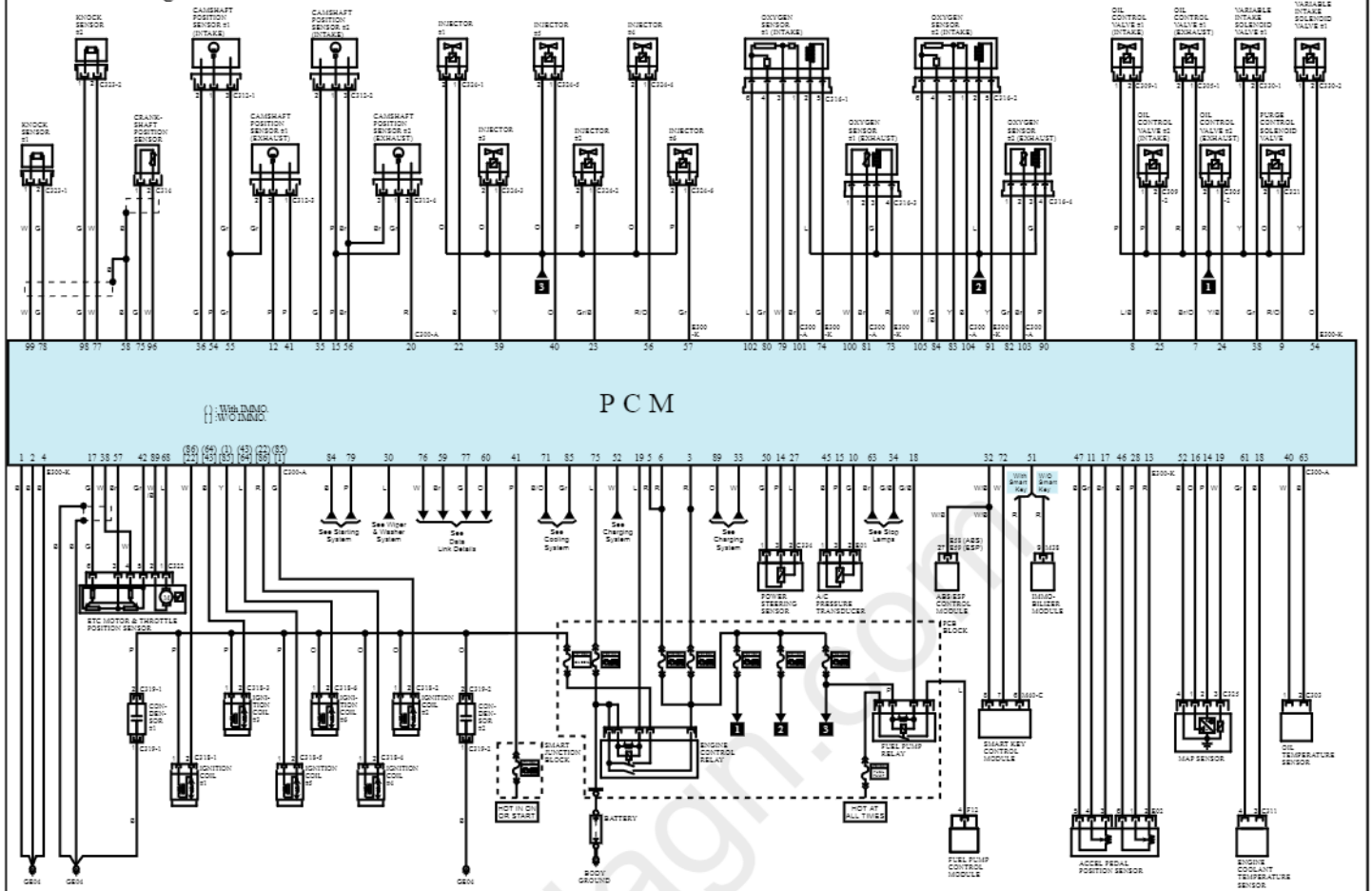
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Engine Control System (G6DF : LAMBDA II 3.3L MPI)

(3)

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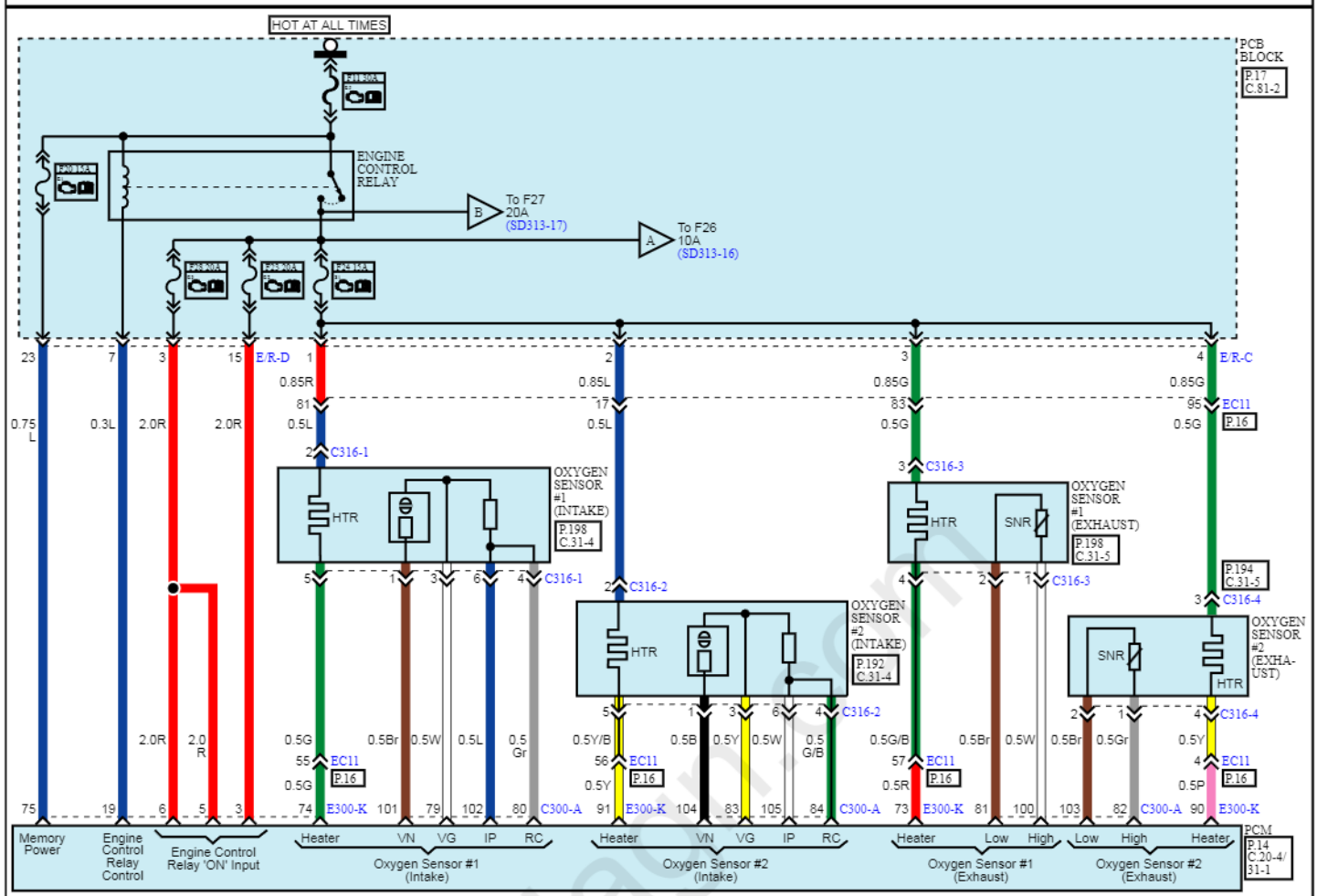
Full Circuit Diagrams



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Engine Control System (G6DF : LAMBDA II 3.3L MPI) (4)

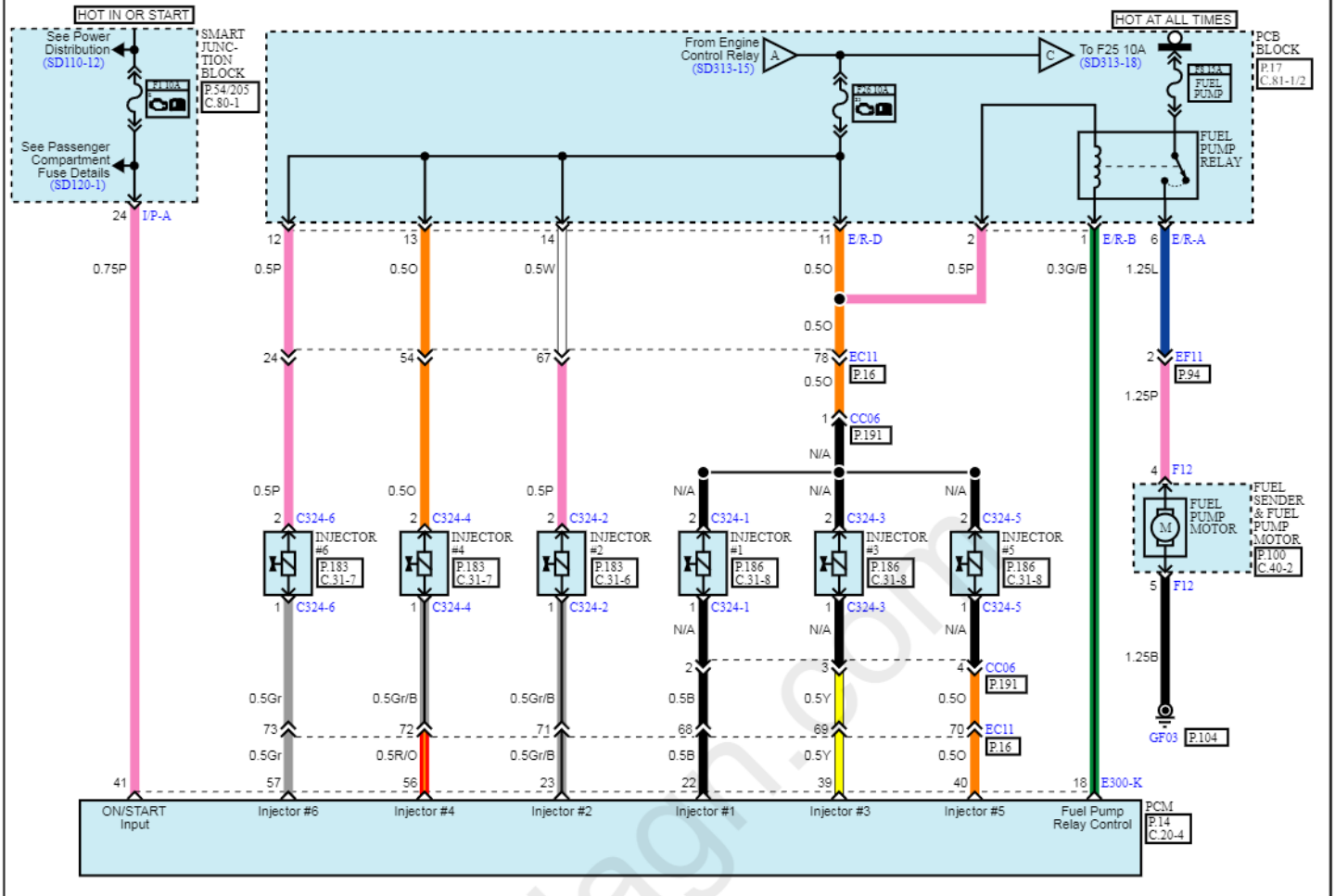
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Engine Control System (G6DF : LAMBDA II 3.3L MPI) (5)

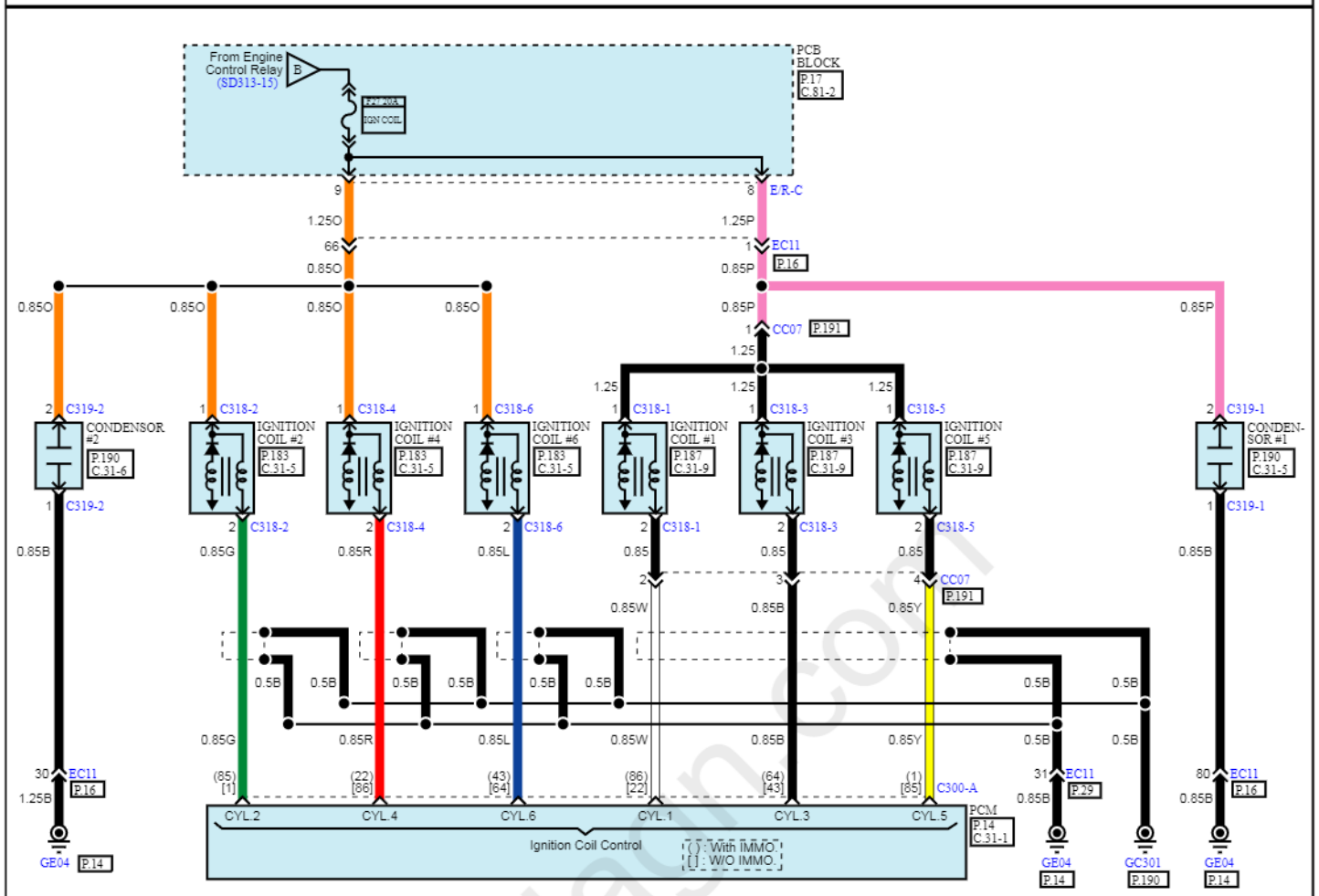
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Engine Control System (G6DF : LAMBDA II 3.3L MPI) (6)

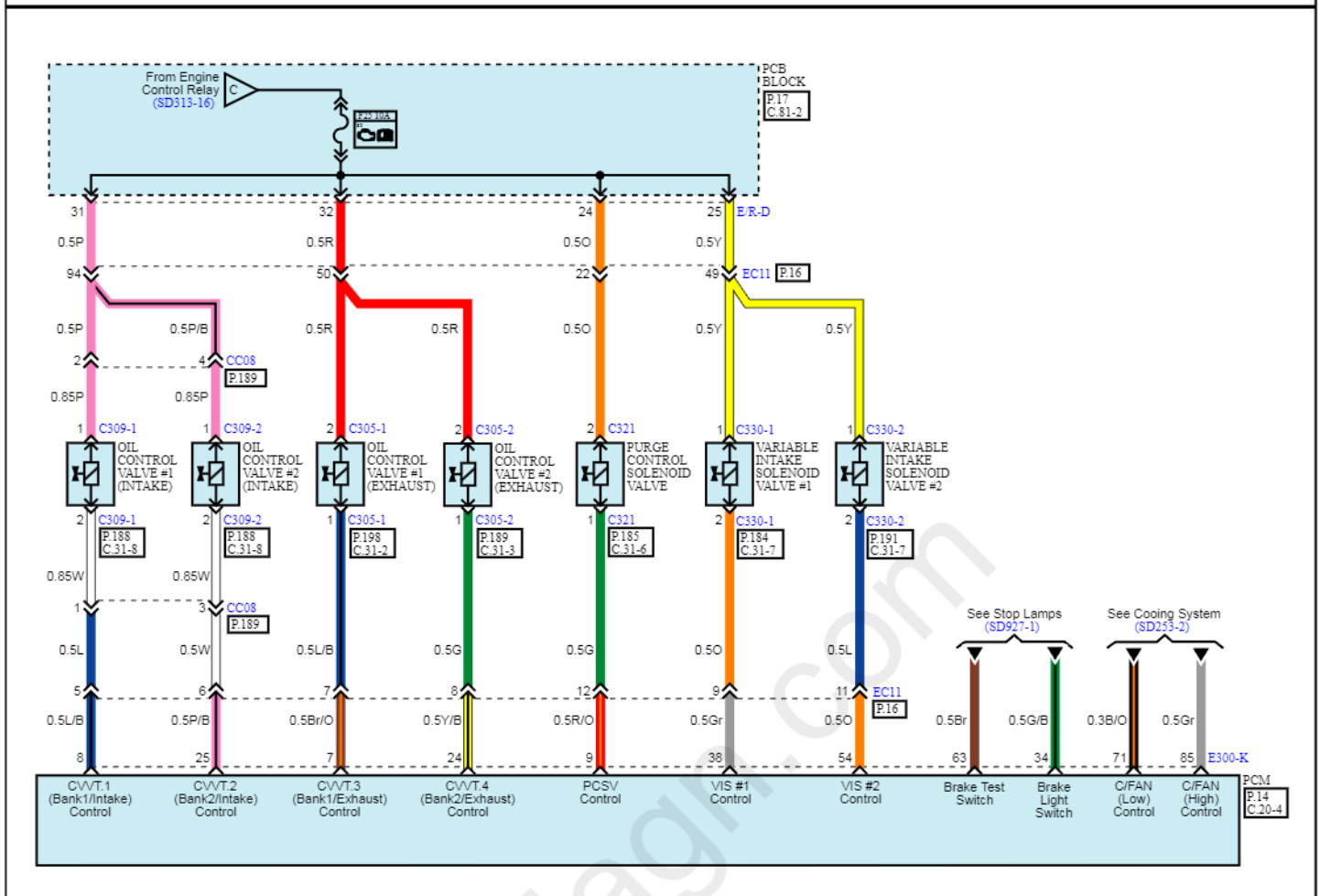
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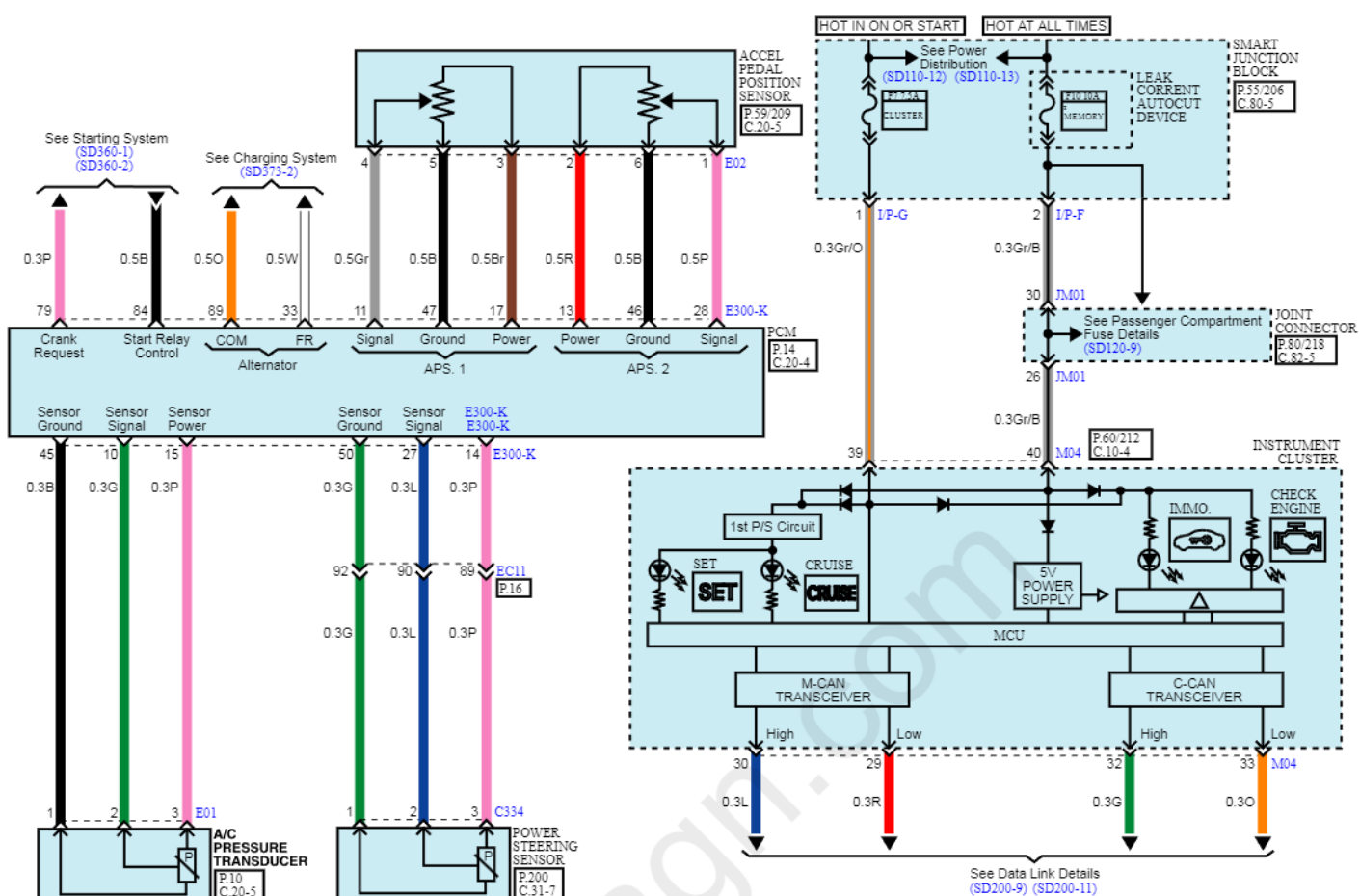
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Engine Control System (G6DF : LAMBDA II 3.3L MPI) (7)

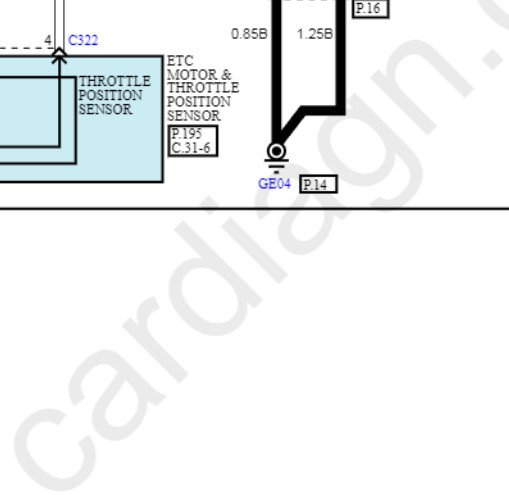
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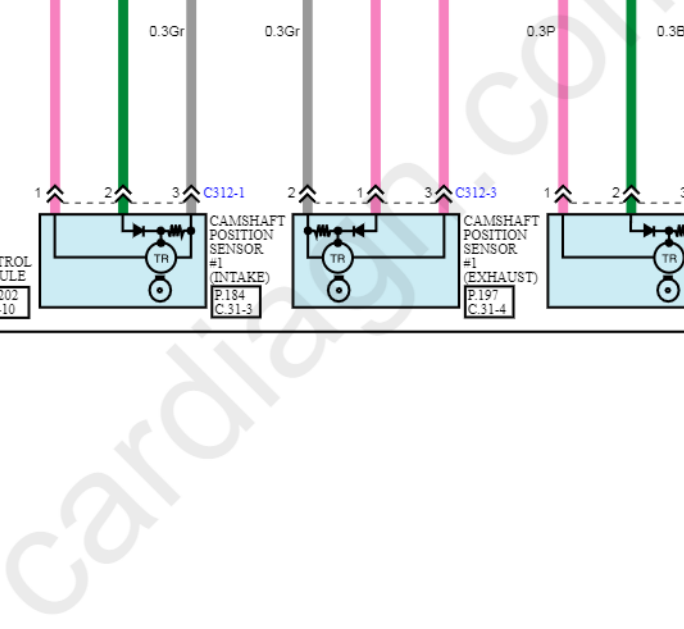
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SD313-21



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Engine Control System (G6DF : LAMBDA II 3.3L MPI)

Service Tips (2)

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
25	[A/T] Line pressure control solenoid valve (LINE_VFS)	-	Output	0V/Battery voltage level 9V < Battery voltage level <1.6V
26	-	-	-	-
28	-	-	-	-
29	-	-	-	-
30	[A/T] Inhibitor switch signal "S3"	ON	Input	Battery voltage level
		OFF		9V < Battery voltage level <1.6V
31	[A/T] Inhibitor switch signal "S2"	ON	Input	9V < Battery voltage level <1.6V
		OFF		0V(GND)
32	[A/T] Sports mode up switch	Up ON	Input	0V/Battery voltage level
		Other		9V < Battery voltage level <1.6V
33	-	-	-	-
34	-	-	-	-
35	Camshaft Position Sensor (CMPS) [Bank 2/Intake] signal input	Idle	Pulse	High: 3.2 ~ Vcc Low: Max. 0.7V 0<FREQUENCY< 350Hz
36	Camshaft Position Sensor (CMPS) [Bank 1/Intake] signal input	Idle		High: 3.2 ~ Vcc Low: Max. 0.7V 0<FREQUENCY< 350Hz
37	-	-		-
38	Throttle Position Sensor (TPS) 2 signal input	C.T	Analog	3.8 ~ 4.7V
		W.O.T		0.25 ~ 0.9V
39	-	-	-	-
40	CVT Oil Temperature Sensor (OTS) signal input	Idle	Analog	0.5 ~ 4.5V
41	Camshaft Position Sensor (CMPS) [Bank 1/Exhaust] signal input	Idle	Pulse	High: 3.2 ~ Vcc Low: Max. 0.7V 0<FREQUENCY< 350Hz
42	Sensor power (+5V)	IG OFF		Max. 0.5V
		IG ON		4.9 ~ 5.1V
43	Ignition Coil (Cylinder #6) control output [With Immo./Smart key]	Idle	Pulse	1st Voltage : 300 - 400V
	Ignition Coil (Cylinder #3) control output [W/O Immo./Smart key]			ON Voltage : Max. 2.2V
44	[A/T] Torque converter control solenoid valve (T/CON_VFS)	-	Output	0V/Battery voltage level 9V < Battery voltage level <1.6V
45	[A/T] ECM ground	-	Ground	0V
46	[A/T] ECM ground	-	Ground	0V
48	-	-	-	-
49	[A/T] Oil temperature sensor (-)	-	Ground	0V
50	-	-	-	-
51	[A/T] Sports mode down switch	Down ON	Input	0V/Battery voltage level
		Other		9V < Battery voltage level <1.6V
52	Sensor ground	Idle	DC voltage	Max. 50mV
53	-	-	-	-
54	Sensor power (+5V)	IG OFF	DC	Max. 0.5V
		IG ON		4.75 ~ 5.25V
55	Sensor ground	Idle	DC	Max. 50mV
56	Sensor ground	Idle	DC	Max. 50mV
57	Sensor ground	Idle	DC	Max. 50mV
58	Sensor Shield	Idle	DC	Max. 0.1V
59	-	-	-	-
60	-	-	-	-
61	Sensor ground	Idle	DC voltage	Max. 50mV
62	-	-	-	-
63	Sensor ground	Idle	DC	Max. 50mV
64	Ignition Coil (Cylinder #3) control output [With Immo./Smart key]	Idle	Pulse	1st Voltage : 300 - 400V
	Ignition Coil (Cylinder #6) control output [W/O Immo./Smart key]			ON Voltage : Max. 2.2V

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Engine Control System (G6DF : LAMBDA II 3.3L MPI)

Service Tips (3)

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
65	[A/T] 26 brake control solenoid valve (26B_VFS)	-	Output	0V/Battery voltage level 9V < Battery voltage level < 16V
66	[A/T] Battery power (B+)	Always (Without Ignition key)	DC voltage	Battery Voltage
67	-	-	Current	Below 1.0mA
68	ETC Motor [-] control output	Idle	Pulse	HI: Battery Voltage LO: Max. 1.0V
69	-	-	-	-
70	-	-	-	-
71	-	-	-	-
72	[A/T] Output speed sensor power	ON OFF	Power	0V/1.5V
73	[A/T] Input speed sensor power	ON OFF	Power	0V/1.5V
74	[A/T] Sports mode select switch	Sport mode Other	Input	0V/Battery voltage level 9V < Battery voltage level < 16V
75	Crankshaft Position Sensor (CKPS) [Low] signal input	Idle	SINE Wave	Min. 1.0V
76	-	-	-	-
77	Knock Sensor (KS) [Bank 2] [High] signal input	Knocking Normal	Variable Frequency	-0.3 ~ 0.3V 0V
78	Knock Sensor (KS) [Bank 1] [High] signal input	Knocking Normal	Variable Frequency	-0.3 ~ 0.3V 0V
79	VS-/IP- (Common Ground for VS, IP)	Idle	Analog	Reference for V_IP, V_N
80	Rc (Compensative Resistance)	Idle	Analog	Rc-Rc/Rp < ±0.1V
81	Sensor ground	Idle	DC	Max. 0.1V
82	Heated Oxygen Sensor (HO2S) [Bank 2/Sensor 2] signal input	RICH LEAN	Analog	Min. 0.8V Max. 0.1V
83	VS-/IP- (Common Ground for VS, IP)	Idle	Analog	Reference for V_IP, V_N
84	Rc (Compensative Resistance)	Idle	Analog	Rc-Rc/Rp < ±0.1V
85	Ignition Coil (Cylinder #2) control output [With Immo./Smart key]	Idle	Pulse	1st Voltage : 300 - 400V ON Voltage : Max. 2.2V
86	Ignition Coil (Cylinder #5) control output [W/O Immo./Smart key]	Idle	Pulse	1st Voltage : 300 - 400V ON Voltage : Max. 2.2V
87	[A/T] Battery power (B+)	Always (Without Ignition key)	DC voltage Current	Battery Voltage Below 1.0mA
88	-	-	-	-
89	ETC Motor [+] control output	Idle	Pulse	HI: Battery Voltage LO: Max. 1.0V
90	-	-	-	-
91	-	-	-	-
92	-	-	-	-
93	[A/T] Input speed sensor signal	Rotate	Pulse	Maximum frequency : 9 kHz Minimum frequency : > 0 Hz
94	[A/T] Output speed sensor signal	Rotate	Pulse	Minimum high pulse : ≥ 25 μs Minimum low pulse : ≥ 25 μs
95	[A/T] Oil temperature sensor (+)	-	Input	5V
96	Crankshaft Position Sensor (CKPS) [High] signal input	Idle	SINE Wave	Min. 1.0V
97	-	-	-	-
98	Knock Sensor (KS) [Bank 2] [Low] signal input	Knocking Normal	Variable Frequency	-0.3 ~ 0.3V 0V

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Engine Control System (G6DF : LAMBDA II 3.3L MPI)

Service Tips (4)

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
99	Knock Sensor (KS) [Bank 1] [Low] signal input	Knocking	Variable	-0.3 ~ 0.3V
		Normal	Frequency	0V
100	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] signal input	RICH	Analog	Min. 0.8V
		LEAN		Max. 0.1V
101	VS+ (NERNST Cell Voltage)	Idle	Analog	Normal : 450±50mV
				Rich : Max. Normal+150mV
				Lean : Min Normal-150mV
102	Rc/Rp (Pumping Cell Voltage)	Idle	Analog	Normal : 450±50mV
				Rich : Max. Normal+150mV
				Lean : Min Normal-150mV
103	Sensor ground	Idle	DC	Max. 0.1V
104	VS+ (NERNST Cell Voltage)	Idle	Analog	Normal : 450±50mV
				Rich : Max. Normal+150mV
				Lean : Min Normal-150mV
105	Rc/Rp (Pumping Cell Voltage)	Idle	Analog	Normal : 450±50mV
				Rich : Max. Normal+150mV
				Lean : Min Normal-150mV

• Connector [E300-K]

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
1	ECM ground	Idle	DC	-0.3 ~ 0.5V
2	ECM ground	Idle	DC	-0.3 ~ 0.5V
3	Battery power (B+)	IG OFF	DC	Max. 0.5V
		IG ON		Battery Voltage
4	ECM ground	Idle	DC	-0.3 ~ 0.5V
5	Battery power (B+)	IG OFF	DC	Max. 0.5V
		IG ON		Battery Voltage
6	Battery power (B+)	IG OFF	DC	Max. 0.5V
		IG ON		Battery Voltage

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
7	CVT Oil Control Valve (OCV) [Bank 1/Exhaust] control output	Idle	Pulse	Hi: Battery Voltage
				LO: Max. 1.0V
8	CVT Oil Control Valve (OCV) [Bank 1/Intake] control output	Idle	Pulse	Hi: Battery Voltage
				LO: Max. 1.0V
9	Purge Control Solenoid Valve (PCSV) control output	Inactive	Pulse	Battery Voltage
		Active		Max. 1.0V
10	A/C Pressure Transducer (APT) signal input	A/C ON	DC	Max. 4.8V
11	Accelerator Position Sensor (APS) 1 signal input	C.T	Analog	0.3 ~ 0.9V
		W.O.T		4.0 ~ 4.8V
12	-	-	-	-
13	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
14	Sensor power (+5V)	IG OFF	DC	Max. 0.5V
		IG ON		4.9 ~ 5.1V
15	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
16	-	-	-	-
17	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.7 ~ 5.3V
18	Fuel Pump Relay control output	Relay OFF	DC voltage	Battery Voltage
		Relay ON		Max. 1.0V
19	Main Relay control output	Relay OFF	DC voltage	Battery Voltage
		Relay ON		Max. 1.0V
20	-	-	-	-
21	-	-	-	-
22	Injector (Cylinder #1) control output	Idle	Pulse	Hi: Battery Voltage
				LO: Max. 1.0V
23	Injector (Cylinder #2) control output	Idle	Pulse	Hi: Battery Voltage
				LO: Max. 1.0V

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Engine Control System (G6DF : LAMBDA II 3.3L MPI)

Service Tips (5)

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
24	CVT Oil Control Valve (OCV) [Bank 2/Exhaust] control output	Idle	Pulse	Hi: Battery Voltage LO: Max. 1.0V
25	CVT Oil Control Valve (OCV) [Bank 2/Intake] control output	Idle	Pulse	Hi: Battery Voltage LO: Max. 1.0V
26	-	-	-	-
27	Power Steering Pressure Sensor (PSPS) signal input	Handling	Analog	0.3 ~ 4.53V
28	Accelerator Position Sensor (APS) 2 signal input	C.T	Analog	0.3 ~ 0.9V
		W.O.T		1.5 ~ 3.0V
29	-	-	-	-
30	Electrical load [Wiper] signal input	-	-	-
31	-	-	-	-
32	Vehicle speed signal input	Vehicle Running	Pulse	High: Battery Voltage Low: Max. 0.5V 0.7(1kph)<FREQUENCY 44<DUTY<56%
33	Alternator (FR) signal output	Idle	Pulse	Hi: Battery Voltage LO: Max. 1.0V
34	Brake Switch [Light] signal input	Brake OFF	DC voltage	Max. 1.0V
		Brake ON		Battery Voltage
35	-	-	-	-
37	-	-	-	-
38	Variable Intake Solenoid (VIS) Valve 1 control output	Idle	Pulse	Hi: Battery Voltage LO: Max. 1.0V
39	Injector (Cylinder #3) control output	Idle	Pulse	Hi: Battery Voltage LO: Max. 1.0V
40	Injector (Cylinder #5) control output	Idle	Pulse	Hi: Battery Voltage LO: Max. 1.0V
41	Battery power (B+)	IG OFF	DC voltage	Max. 0.5V
		IG ON		Battery Voltage
42	-	-	-	-
44	-	-	-	-
45	Sensor ground	Idle	DC voltage	Max. 50mV
46	Sensor ground	Idle	DC voltage	Max. 50mV
47	Sensor ground	Idle	DC voltage	Max. 50mV
48	-	-	-	-
49	-	-	-	-
50	Sensor ground	Idle	DC voltage	Max. 50mV
51	Immobilizer communication line	After IG.ON Communication	Pulse	High: Min. 8.5V(at 14V) Low: Max. 3.5V(at 14V)
52	LIN (Local Interconnect Network) Serial Bus Line	Recessive Dominant	Pulse	High: Min. Vbatt X 60% Low: Max. Vbatt X 40%
53	-	-	-	-
54	Variable Intake Solenoid (VIS) Valve 2 control output	Idle	Pulse	Hi: Battery Voltage LO: Max. 1.0V
55	-	-	-	-
56	Injector (Cylinder #4) control output	Idle	Pulse	Hi: Battery Voltage LO: Max. 1.0V
57	Injector (Cylinder #6) control output	Idle	Pulse	Hi: Battery Voltage LO: Max. 1.0V
58	-	-	-	-
59	CCP-CAN [Low]	Recessive Dominant	DC voltage	2.0 ~ 3.0V 2.75 ~ 4.5V
60	C-CAN [Low]	Recessive Dominant	DC voltage	2.0 ~ 3.0V 2.75 ~ 4.5V
61	-	-	-	-
62	-	-	-	-
63	Brake Switch [Test] signal input	Brake OFF Brake ON	DC voltage	Battery Voltage Max. 0.5V
64	-	-	-	-

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Engine Control System (G6DF : LAMBDA II 3.3L MPI)

Service Tips (6)

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
65	-	-	-	-
68	-	-	-	-
70	-	-	-	-
71	Cooling Fan Relay [Low] control output	Relay Off	DC voltage	Battery Voltage
		Relay On		Max. 1.0V
72	Engine speed signal output	Idle	Pulse	Hi: Battery Voltage
				LO: Max. 1.0V
73	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]	Engine Running	PWM	High: Battery Voltage
	Heater control output			Low: Max. 1.15V
				0<DUTY<100%
74	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]	Engine Running	PWM	High: Battery Voltage
	Heater control output			Low: Max. 1.15V
				0<DUTY<100%
75	Battery power (B+)	Always (Without Ignition key)	DC voltage	Battery Voltage
			Current	Below 1.0mA
76	CCP-CAN [High]	Recessive	DC voltage	2.0 ~ 3.0V
		Dominant		2.75 ~ 4.5V
77	C-CAN [High]	Recessive	DC voltage	2.0 ~ 3.0V
		Dominant		2.75 ~ 4.5V
78	-	-	-	-
79	Engine Starter Switch signal input	IG ON	DC voltage	Hi: Battery Voltage
		IG OFF		LO: Max. 1.0V
80	-	-	-	-
82	-	-	-	-
83	-	-	-	-
84	Starter Relay control output	Relay OFF	DC voltage	Battery Voltage
		Relay ON		Max. 1.0V
85	Cooling Fan Relay [High] control output	Relay OFF	DC voltage	Battery Voltage
		Relay ON		Max. 1.1V

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
86	-	-	-	-
88	-	-	-	-
89	Alternator (COM) signal output	Idle	Pulse	High: Min. 4.0V
				Low: Max. 2.0V
90	Heated Oxygen Sensor (HO2S) [Bank 2/Sensor 2]	Engine Running	PWM	High: Battery Voltage
	Heater control output			Low: Max. 1.15V
				0<DUTY<100%
91	Heated Oxygen Sensor (HO2S) [Bank 2/Sensor 1]	Engine Running	PWM	High: Battery Voltage
	Heater control output			Low: Max. 1.15V
				0<DUTY<100%

Knock Sensor

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. Knock Sensor (KS) is installed on the cylinder block and senses engine knocking.

When knocking occurs, the vibration from the cylinder block is applied as pressure to the piezoelectric element. At this time, this sensor transfers the voltage signal higher than the specified value to the PCM and the PCM retards the ignition timing. If the knocking disappears after retarding the ignition timing, the PCM will advance the ignition timing. This sequential control can improve engine power, torque and fuel economy. speed or low speed. PCM stops the operation of compressor when the temperature of refrigerant line is so high or so low irregularly to optimize air conditioning system.

Variable Intake Solenoid Valve (VIS)

Variable intake solenoid (VIS) valve is installed on the intake manifold. The VIS valve controls the vacuum modulator which activates a valve in the intake manifold. The PCM opens or closes this valve according to engine condition.

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Engine Control System (G6DF : LAMBDA II 3.3L MPI)	Service Tips (7)
Manifold Absolute Pressure Sensor (MAPS) Manifold Absolute Pressure Sensor (MAPS) is a speed-density type sensor and is installed on the surge tank. It senses absolute pressure of the surge tank and transfers the analog signal proportional to the pressure to the PCM. By using this signal, the PCM calculates the intake air quantity and engine speed. Intake Air Temperature Sensor (IATS) Intake Air Temperature Sensor (IATS) is included inside Manifold Absolute Pressure Sensor and detects the intake air temperature. To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the temperature. So the PCM uses not only MAPS signal but also IATS signal. This sensor has a Negative Temperature Coefficient (NTC) and its resistance is in inverse proportion to the temperature. Engine Coolant Temperature Sensor (ECTS) The reference +5V is supplied to the ECTS via a resistor in the PCM. That is, the resistor in the PCM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation, the PCM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability. Oil Control Valve (OCV) The PCM controls the Oil Control Valve (OCV), based on the signals output from air flow, throttle position and engine coolant temperature. The CVVT controller regulates the camshaft angle using oil pressure through the OCV.	Ignition Coil Ignition timing is controlled by the electronically controlled ignition module. The standard ignition timing data according to the engine condition are stored in the PCM memory. The engine operating conditions (speed, load, warm-up condition, etc.) are detected by various sensors. The module receives the primary current cut-off signal from the PCM based on such sensor signals and ignition timing data to activate the ignition coil and control the ignition timing. Injector Based on information from various sensors, the PCM can calculate the fuel amount to be injected. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of injection time. The PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM deenergizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak. ETC Motor & Throttle Position Sensor The Electronic Throttle Control (ETC) System consists of a throttle body with an integrated control motor and throttle position sensor (TPS). Instead of the traditional throttle cable, an Accelerator Position Sensor (APS) is used to receive driver input. The PCM uses the APS signal to calculate the target throttle angle, the position of the throttle is then adjusted via PCM control of the ETC motor. The TPS signal is used to provide feedback regarding throttle position to the PCM. Using ETC, precise control over throttle position is possible and the need for external cruise control modules/cables is eliminated.

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Camshaft Position Sensor (CMPS) Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect. The CMPS is installed on engine head cover and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. Crankshaft Position Sensor (CKPS) Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, fuel is not supplied. That is, vehicle can't run without CKPS signal. This sensor is installed on the cylinder block or the transaxle housing and generates alternating current by magnetic flux field which is made by the sensor and the target wheel when engine runs. Oxygen Sensor The sensor detects the oxygen content in the exhaust gas and sends the data to the PCM. A duty control type heater is built into the oxygen sensor. It has the function of heating the sensor tip's temperature to a certain level or higher so that the sensor will operate normally even when the exhaust gas temperature is low. Battery Sensor A battery sensor installed in the battery (-) terminal detects the battery fluid temperature, voltage and current, which are needed by the control system, using the internal elements (silicon diode and shunt resistance) and mapping values, and then sends them to the PCM using the LIN communication line.	Accelerator Pedal Position Sensor (APS) The sensor detects the position of the accelerator pedal being stepping on to determine the driver's intention to accelerate. As fidelity of APS is strongly required, APS is divided into two. One is APS 1, which outputs main signals and the other is APS 2, which monitors APS 1 performance. APS 1 and 2 do not share power supply and ground. Normally, APS 2 output voltage is the half of APS 1 and if the ratio of two signals is out of specified value, error is recognized. Purge Control Solenoid Valve (PCSV) Purge Control Solenoid Valve (PCSV) is a solenoid valve and is installed on the surge tank and controls the passage between the canister and the intake manifold. The evaporative gases gathered in the canister are delivered to the intake manifold when the PCSV is open by PCM control signal. Power Steering Sensor To reduce the required power to manipulate steering wheel, hydraulic pressure is used in power steering system. A load is sensed at steering oil pressure sensor then inputted to PCM as a wheel position signal. Controlling idle speed valve, PCM performs appropriate electric load correction With this signal. A/C Pressure Transducer (APT) A/C pressure transducer (APT) convert the pressure value of high pressure line into voltage value after measure it. By converted voltage value, PCM controls cooling fan by operating it high speed or low speed. PCM stops the operation of compressor when the temperature of refrigerant line is so high or so low irregularly to optimize air conditioning system.

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• Oil Temperature Sensor (OTS) The Continuously Variable Valve Timing (CVVT) system uses engine oil pressure to change the camshaft timing according to engine operating conditions. Engine oil viscosity changes according to engine temperature. The Oil Temperature Sensor (OTS) signal along with coolant and intake air temperature is used by the PCM to compensate for changes in oil viscosity when commanding the Oil Control Valve (OCV). The OTS measures the engine oil temperature before the engine oil flows through the OCV. • Stop Lamp Switch The PCM uses the brake signal to detect functional defects in the ETC system. To diagnose the brake switch, two signals (brake alarm switch and brake inspection switch) are used. These two signals send opposite values depending on the brake operation. If the brake is not stepped on, the brake inspection switch sends the power voltage value while the brake alarm switch sends a 0V value. On the other hand, if the brake is stepped on, the opposite values are output. • Cruise Remote Control Switch Cruise control is a system that automatically controls the speed of a motor vehicle. The system takes over the throttle of the car to maintain a steady speed as set by the driver. Cruise control system will not operate below a minimum speed of 40km/h. 1. Cruise Switch (ON/OFF) : cruise control system is engaged by pressing the "ON/OFF" push button. 2. Resume Switch : increase the vehicle speed. 3. Set Switch : reduce the vehicle speed. 4. Cancel Switch : cruise control speed canceled by this switch.	• Check Engine IND. The Check Engine IND is lighted when there is a problem with the various sensors used by the electronic engine control system or exhaust gas control, or when an oil leak in the fuel supply system (fuel tank, fuel filter connector, fuel line, etc.) or a water leak in the evaporated gas control system (canister and connected hoses) is detected. When the Check Engine IND is lighted, the error code is saved in the PCM and the error code memorized by the PCM is not erased even when the engine is turned off. • Immobilizer IND. Immobilizer informs status of system and result of Authentication by blinking of immobilizer lamp on instrument cluster. [With Smart Key System] When the smart key is in the vehicle, if the ENGINE START/STOP button is in the ACC or ON position, the indicator will illuminate for approximately 30 seconds to indicate that you are able to start the engine. However, when the smart key is not in the vehicle, if the ENGINE START/STOP button is pressed, the indicator will blink for a few seconds to indicate that you are not able to start the engine. When the smart key battery is weak, if the ENGINE START/STOP button is pressed, the indicator blinks, you are not able to start the engine. However, you are able to start the engine by pressing the ENGINE START/STOP button directly with the smart key. Also, if the smart key system related parts have a problem, the indicator will blink. [Without Smart Key System] This indicator illuminates when the immobilizer key is inserted and turned to the ON position to start the engine. At this time, you can start the engine. The indicator goes out after approximately 30 seconds. If there's any fault in immobilizer system or in Authentication, lamp blinks after ignition "ON"

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Service Tips (10)

• Cruise IND.

1. Cruise indicator (CRUISE) : The indicator light illuminates when the cruise control system is enabled. The cruise indicator light in the instrument cluster is illuminated when the cruise control ON-OFF button on the steering wheel is pushed. The indicator light turns off when the cruise control ON-OFF button is pushed again.
2. Cruise set indicator (SET) : The indicator light illuminates when the cruise function switch (SET- or RES+) is ON. The cruise SET indicator light in the instrument cluster is illuminated when the cruise control switch (SET- or RES+) is pushed. The cruise SET indicator light does not illuminate when the cruise control switch (CANCEL) is pushed or the system is disengaged.

• Fuel Pump Relay

The PCM provides ground to one side of the coil in the fuel pump relay to control the fuel pump relay. The other side of the fuel pump relay coil is connected to fuel pump relay, which activates when the ignition switch is ON. The PCM monitors the control circuit between the fuel pump relay and the PCM. When the ignition switch is turned ON, the PCM energizes the fuel pump relay, which sends power to the fuel pump.

• Vehicle Speed Signal

Information about vehicle speed is sends to PCM. Then the PCM uses this information to control the fuel injection, ignition timing, transaxle shift scheduling and torque converter clutch scheduling.

• Self Diagnosis

The PCM exchanges signals with the engine control system's components (sensors and actuators) continuously or discretely. If an abnormal signal is generated for a certain period, the PCM acknowledges it as a problem and saves the error code in the memory. It then sends the problem signal to the data link connector output terminal. The error code is backed up by the battery so that it is not erased even when the ignition switch is turned off. However, it is erased when the battery terminal or the PCM connector is separated.

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Service Tips (1)

Circuit Description

The components (sensors, actuators, PCM, injector, etc.) of an engine control module wait in standby when the ignition switch is turned on. The engine is started when the ignition switch is started and exchanges signals with the engine control components (sensor and actuator) continuously or discretely to control fuel injection. It adjusts the injector operation time based on the ratio of the cylinder intake air flow and the air-to-fuel ratio in order to improve the fuel economy, reduce the amount of exhaust gas, and increase the engine's performance. The roles and functions of each component are described below.

PCM Terminal Input/ Output signal

• Connector [C300-A]

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
1	Ignition Coil (Cylinder #5) control output [With Immo/Smart key]	Idle	Pulse	1st Voltage : 300 - 400V
	Ignition Coil (Cylinder #2) control output [W/O Immo/Smart key]			ON Voltage : Max. 2.2V
2	[A/T] TCM Input power 2 (For solenoid)	-	Power	Battery voltage level 9V < Battery voltage level <16V
3	[A/T] Overdrive clutch control solenoid valve (OD/C_VFS)	-	Output	0V/Battery voltage level 9V < Battery voltage level <16V
4	[A/T] Underdrive brake control solenoid valve (UD/B_VFS)	-	Output	0V/Battery voltage level 9V < Battery voltage level <16V
5	-	-	-	-
6	[A/T] ON/OFF solenoid valve B (SS-B)	-	Output	0V/Battery voltage level 9V < Battery voltage level <16V
7	[A/T] ON/OFF solenoid valve A (SS-A)	-	Output	0V/Battery voltage level 9V < Battery voltage level <16V
8	-	-	-	-
9	-	-	-	-

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
10	[A/T] Inhibitor switch signal "S4"	ON	Input	9V < Battery voltage level <16V
		OFF		0V(GND)
11	[A/T] Inhibitor switch signal "S1"	ON	Input	9V < Battery voltage level <16V
		OFF		0V(GND)
12	Sensor power (+5V)	IG OFF	DC	Max. 0.5V
		IG ON		4.9 ~ 5.1V
13	-	-	-	-
14	Sensor power (+5V)	IG OFF	DC	Max. 0.5V
		IG ON		4.9 ~ 5.1V
15	Sensor power (+5V)	IG OFF	DC	Max. 0.5V
		IG ON		4.9 ~ 5.1V
16	Manifold Absolute Pressure Sensor (MAPS) signal input	IG ON	Analog	3.9 ~ 4.9V
		Idle		0.8 ~ 1.6V
17	Throttle Position Sensor (TPS) 1 signal input	C.T	Analog	0.25 ~ 0.9V
		W.O.T		3.8 ~ 4.7V
18	Engine Coolant Temperature Sensor (ECTS) signal input	Idle	Analog	0.5 ~ 4.5V
19	Intake Air Temperature Sensor (IATS) signal input	Idle	Analog	3.2V (-40)E
				0.2 ~ 4.8V
20	Camshaft Position Sensor (CMPS) [Bank 2/Exhaust] signal input	Idle	Pulse	High: 3.2 ~ Vcc
				Low: Max. 0.7V
				0<FREQUENCY< 350Hz
22	Ignition Coil (Cylinder #4) control output [With Immo/Smart key]	Idle	Pulse	1st Voltage : 300 - 400V
	Ignition Coil (Cylinder #1) control output [W/O Immo/Smart key]			ON Voltage : Max. 2.2V
23	[A/T] TCM Input power 1 (For solenoid)	-	Power	Battery voltage level 9V < Battery voltage level <16V
				0V/Battery voltage level
24	[A/T] 35R clutch control solenoid valve (35R/C_VFS)	-	Output	0V/Battery voltage level
				9V < Battery voltage level <16V