

Engine Control System (G4KJ : THETA II 2.4L GDI) (1)

SD313-9

PCM Terminal Information

105	104	103	102	101	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85
84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43
42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	6	5
74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	4	3
57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	2	1
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24		
23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7		

CHG-AG

PIN	COLOR	DESCRIPTION	PIN	COLOR	DESCRIPTION	PIN	COLOR	DESCRIPTION
1	G	IGN CYL.2(W/O IMMO. & Smart Key)	36	-	-	72	-	-
		IGN CYL.3(With IMMO. or Smart Key)	37	-	-	73	B	[A/T] Output Speed Signal
2	L/R	[A/T] ATM Solenoid (LP_VFS)	38	-	-	74	L	[A/T] Up Shift
3	Y	[A/T] ATM Solenoid (T/CON_VFS)	39	Br	Rail Pressure Sensor Ground	75	L/W	TPS. 2 Signal
4	G	[A/T] ATM Solenoid (35R_VFS)	40	-	-	76	G/W	APS. 2 Signal
5	W	ETC Output (+)	41	-	-	77	Y/O	APS. 1 Signal
6	R	ETC Output (-)	42	-	-	78	Br	Power Steering Pressure Sensor Ground
7	L	[A/T] Position Switch Code S1	43	-	-			
8	Br	[A/T] Position Switch Code S2	44	B	[A/T] Ground	79	-	-
9	R	[A/T] Position Switch Code S3	45	B	[A/T] Ground	80	Br	APT Sensor Ground
10	G	[A/T] Position Switch Code S4	46	B	[A/T] Shift Lock Solenoid	81	-	-
11	-	-	47	-	-	82	L	MAP Sensor
12	W	APT, RPS, PSPS Sensor Supply	48	L/W	[A/T] Oil TEMP. Sensor (-)	83	R	O2 Sensor (Up) V_IP
13	-	-	49	-	-	84	Gr	O2 Sensor (Up) V_G
14	W	O2 Sensor (DOWN) Signal	50	-	-	85	L	IGN CYL.1(W/O IMMO. or Smart Key)
15	-	-	51	-	-			IGN CYL.4(With IMMO. or Smart Key)
16	-	-	52	Y	[A/T] Select Switch	86	O	[A/T] ATM Solenoid (V_SOL1)
17	-	-	53	-	-	87	P	[A/T] ATM Solenoid (V_SOL2)
18	-	-	54	B	TPS Ground	88	P	[A/T] Memory Power
19	-	-	55	L	APS. 2 Ground	89	-	-
20	-	-	56	W	APS. 1 Ground	90	L/O	[A/T] Output Speed Supply
21	-	-	57	L	IMMO. Data Line	91	R/B	[A/T] Input Speed Supply
22	P	IGN CYL.4(W/O IMMO. or Smart Key)	58	-	-	92	-	-
		IGN CYL.1(With IMMO. or Smart Key)	59	G	IAT. Sensor	93	-	-
23	W	[A/T] ATM Solenoid (UD_VFS)	60	G	Rail Pressure Sensor Signal	94	Gr	[A/T] Input Speed Signal
24	B	[A/T] ATM Solenoid (26_VFS)	61	B	MAP & TIA. Sensor Ground	95	G/O	[A/T] Down Shift
25	O	[A/T] ATM Solenoid (OD_VFS)	62	L/O	ECT Ground	96	P/B	TPS. 1 Signal
26	-	-	63	W	ECT Signal	97	P	APS. 2 Supply
27	-	-	64	W	IGN CYL.3(W/O IMMO. or Smart Key)	98	G	APS. 1 Supply
28	-	-			IGN CYL.2(With IMMO. or Smart Key)	99	P	Power Steering Pressure Sensor Signal
29	-	-	65	L	[A/T] SS_B			
30	-	-	66	Gr	[A/T] SS_A	100	-	-
31	-	-	67	P	[A/T] Memory Power	101	Gr/B	APT Sensor Signal
32	-	-	68	-	-	102	-	-
33	Y	TPS Supply	69	G/W	[A/T] Oil TEMP. Sensor (+)	103	L/O	MAP Sensor Supply
34	-	-	70	-	-	104	G	O2 Sensor (Up) V_RC
35	P/B	O2 Sensor (DOWN) Ground	71	-	-	105	P	O2 Sensor (Up) V_N

CHG-BG

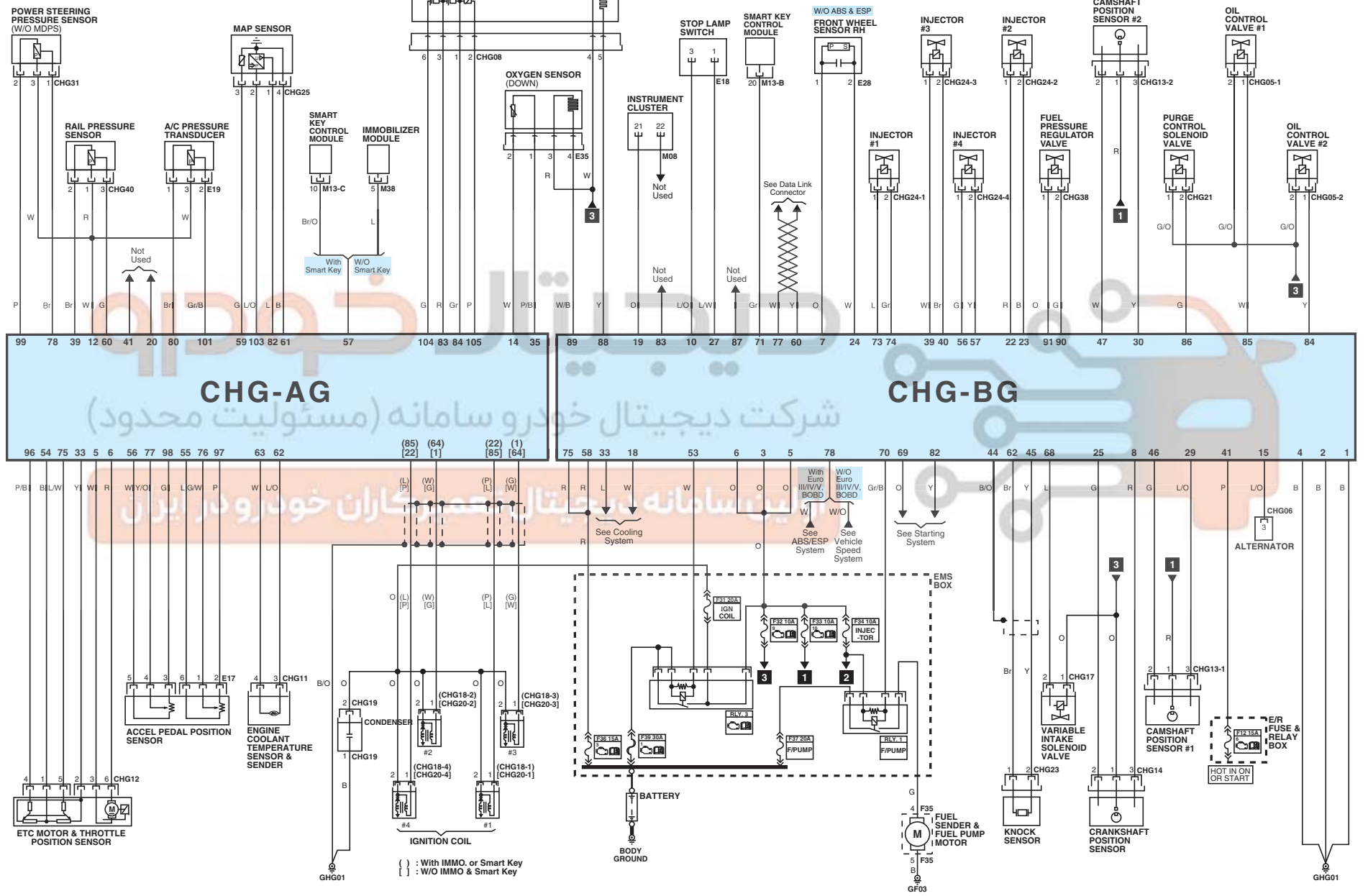
PIN	COLOR	DESCRIPTION	PIN	COLOR	DESCRIPTION	PIN	COLOR	DESCRIPTION
1	B	Ground	34	-	-	69	O	Start Relay Control
2	B	Ground	35	-	-	70	Gr/B	Fuel Pump Relay Control
3	O	Engine ControlRelay 'ON' Input	36	-	-	71	Gr	Engine RPM Signal
			37	-	-	72	-	-
4	B	Ground	38	-	-	73	L	Injector #1 (High) Control
5	O	Engine ControlRelay 'ON' Input	39	W	Injector #3 (High) Control	74	Gr	Injector #1 (Low) Control
			40	Br	Injector #3 (Low) Control	75	R	Memory Power
6	O	Engine ControlRelay 'ON' Input	41	P	On/Start Input	76	-	-
			42	-	-	77	W	C-CAN High
7	O	Wheel Speed (+)	43	-	-	78	Br	Vehicle Speed Input
8	R	CKP Signal	44	B/O	Knock Sensor Shield	79	-	-
9	-	-	45	Y	Knock Sensor Ground	80	-	-
10	L/O	Brake Test Switch	46	G	CMP #1 Ground	81	-	-
11	-	-	47	W	CMP #2 Ground	82	Y	Start Motor Control Switch
12	-	-	48	-	-	83	-	-
13	-	-	49	-	-	84	Y	CVVT(Exhaust)
14	-	-	50	-	-	85	W	CVVT(Intake)
15	L/O	Alternator (FR)	51	-	-	86	G	PCSV Control
16	-	-	52	-	-	87	-	-
17	-	-	53	W	Engine Control Relay Control	88	Y	O2 Sensor (Up) Heater
18	W	C/Fan Relay (High) Control				89	W/B	O2 Sensor (Down) Heater
19	O	IMMO. IND.	54	-	-	90	G	Fuel Pressure Regulator Valve (High)
20	-	-	55	-	-			
21	-	-	56	G	Injector #4 (High) Control	91	O	Fuel Pressure Regulator Valve (Low)
22	R	Injector #2 (High) Control	57	Y	Injector #4 (Low) Control			
23	B	Injector #2 (Low) Control	58	R	Memory Power			
24	W	Wheel Speed (-)	59	-	-			
25	L/O	CKP Ground	60	Y	C-CAN Low			
26	-	-	61	-	-			
27	L/W	Brake Light Switch	62	Br	Knock Sensor Interface			
28	-	-	63	W	Clutch Switch			
29	L/O	CMP #1 Signal	64	-	-			
30	Y	CMP #2 Signal	65	-	-			
31	-	-	66	-	-			
32	-	-	67	-	-			
33	L	C/Fan Relay (Low) Control	68	L	VIS Control			

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

Engine Control System (G4KJ : THETA II 2.4L GDI) (2)

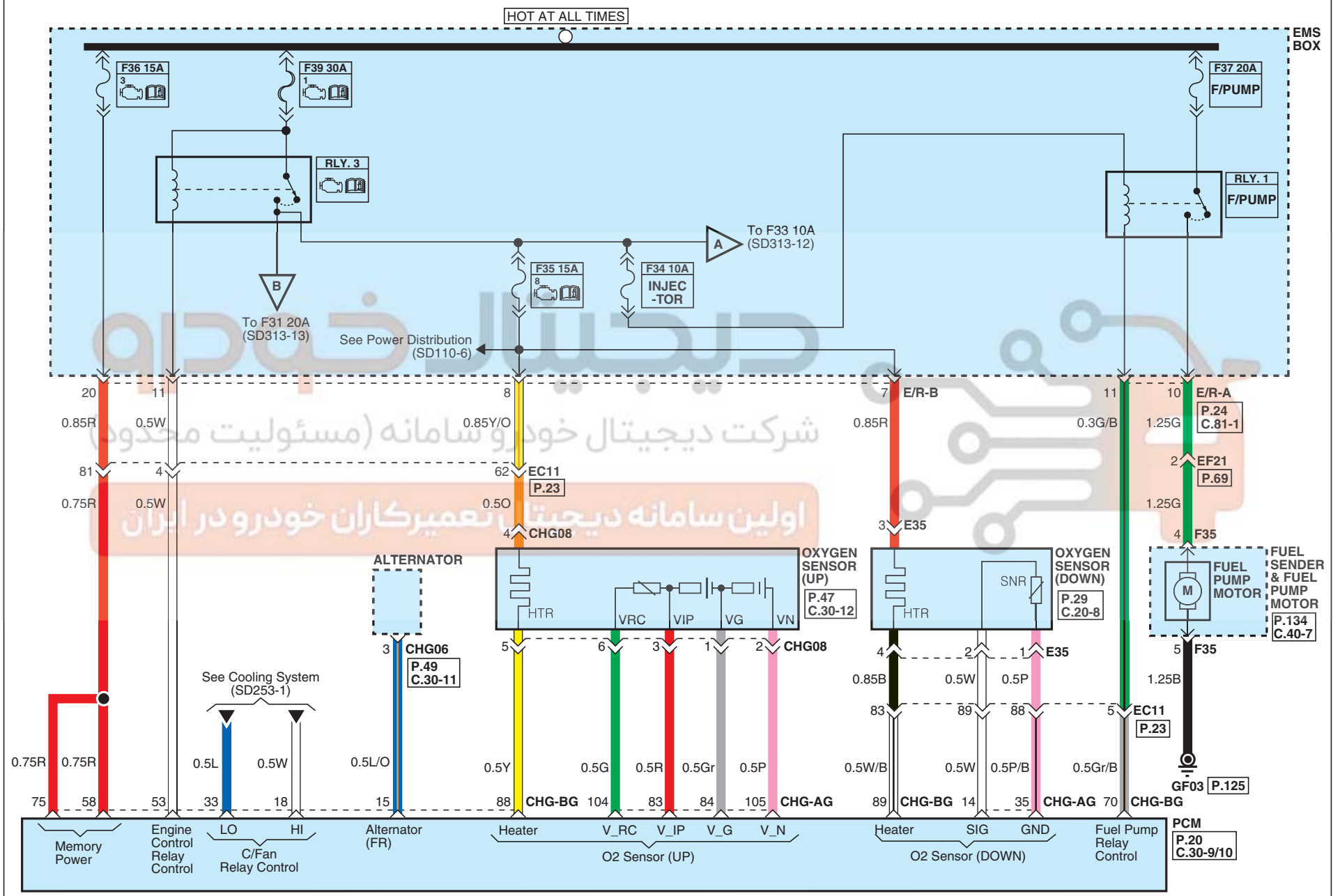
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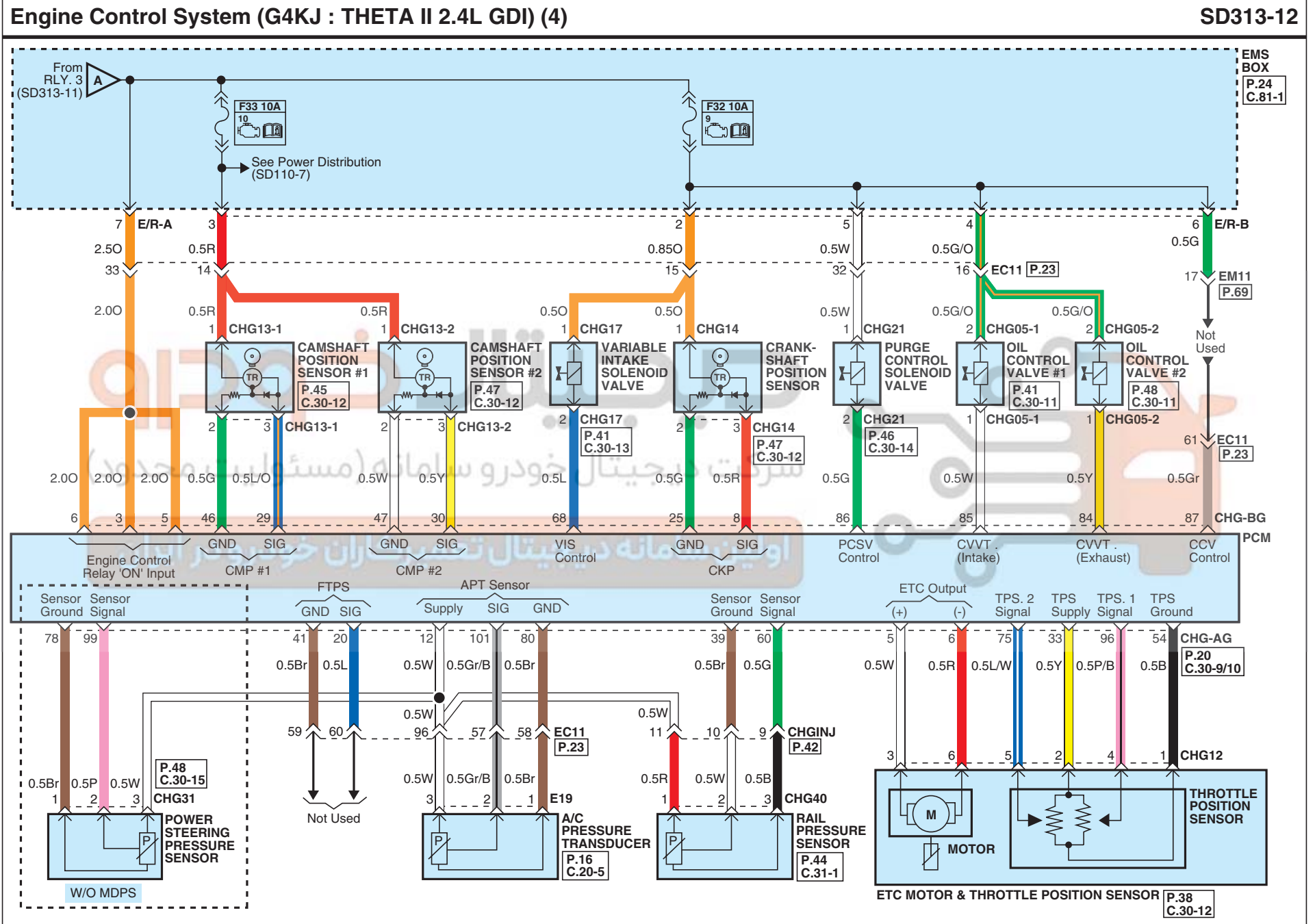
Full Circuit Diagrams



Engine Control System (G4KJ : THETA II 2.4L GDI) (3)

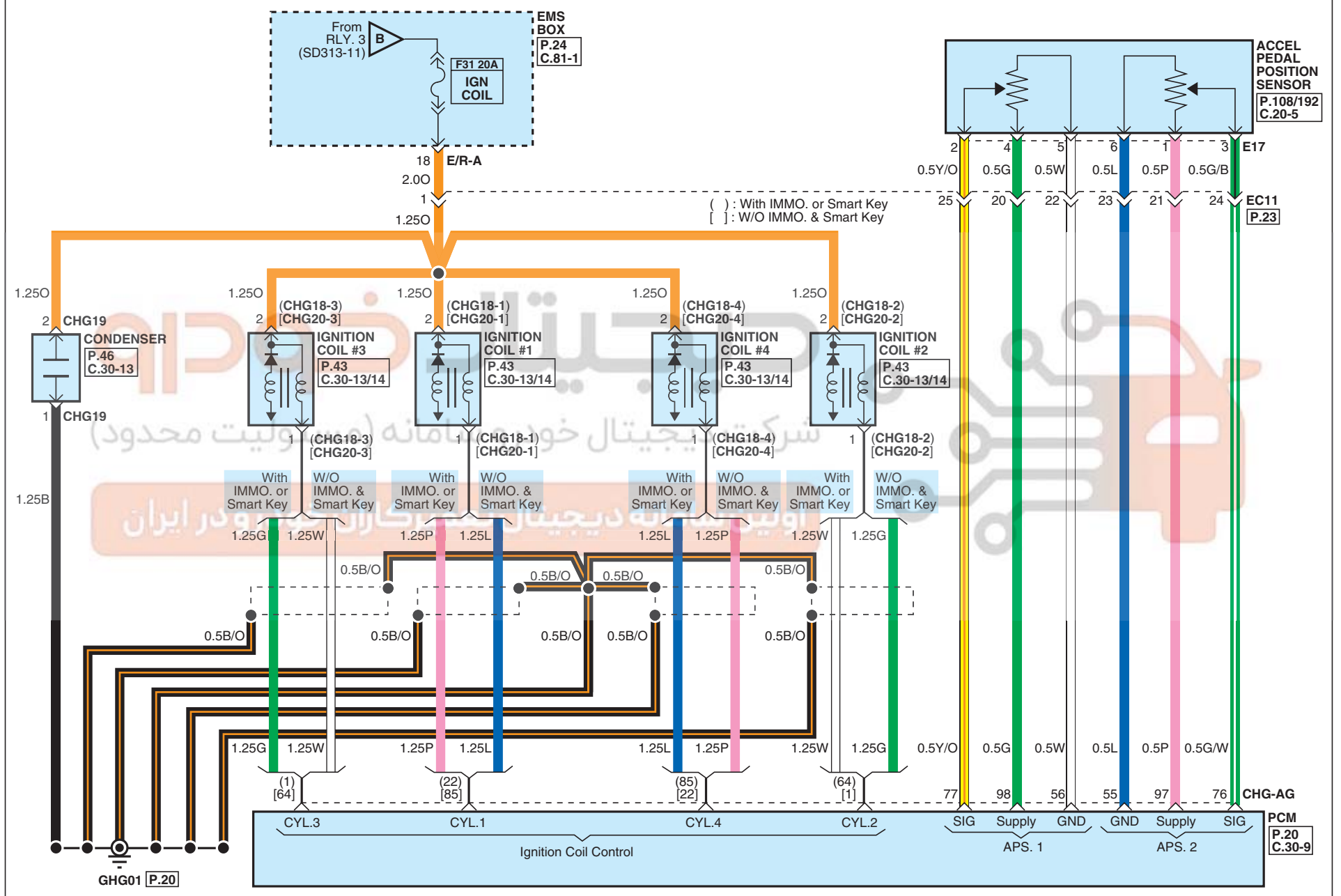
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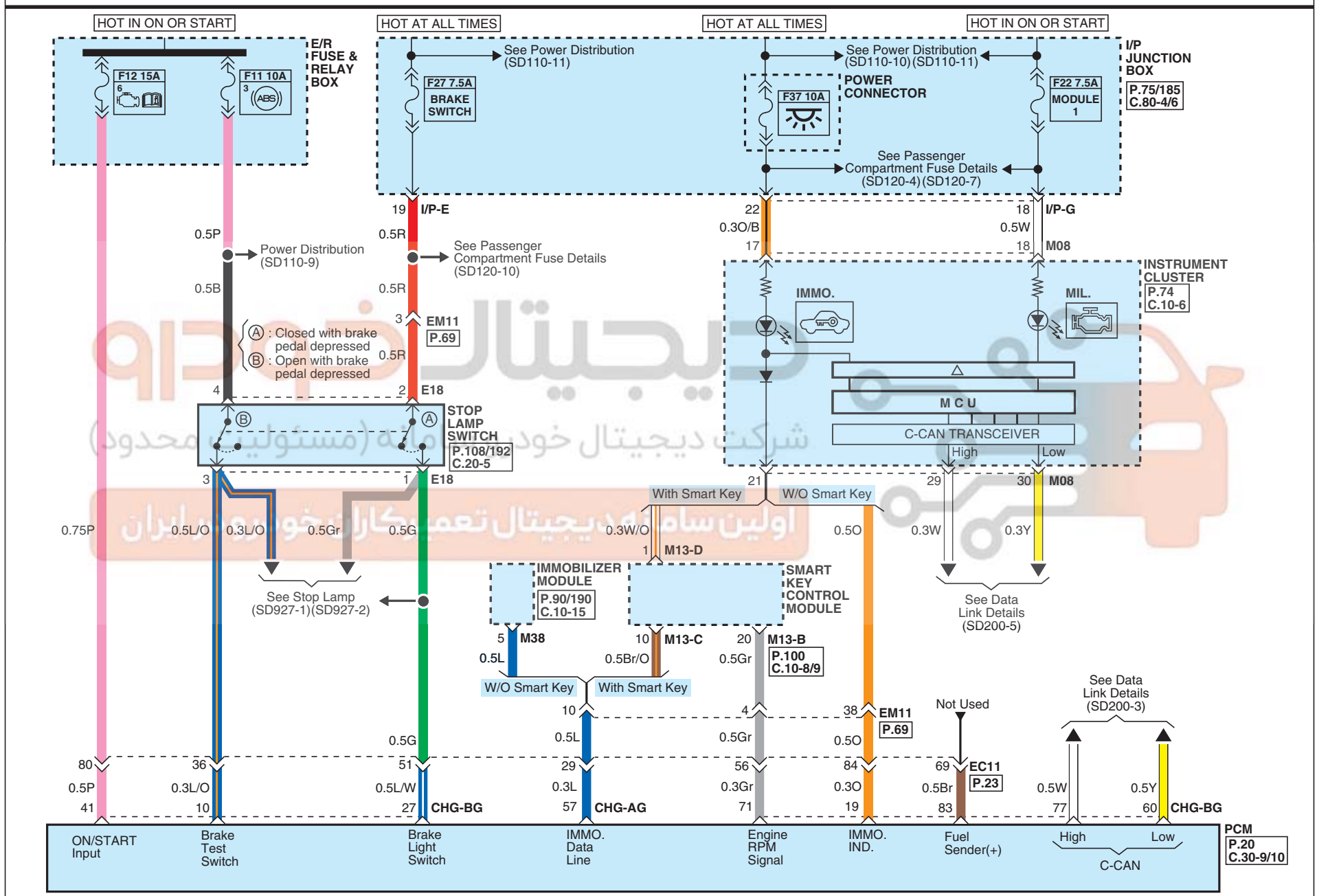
Engine Control System (G4KJ : THETA II 2.4L GDI) (5)

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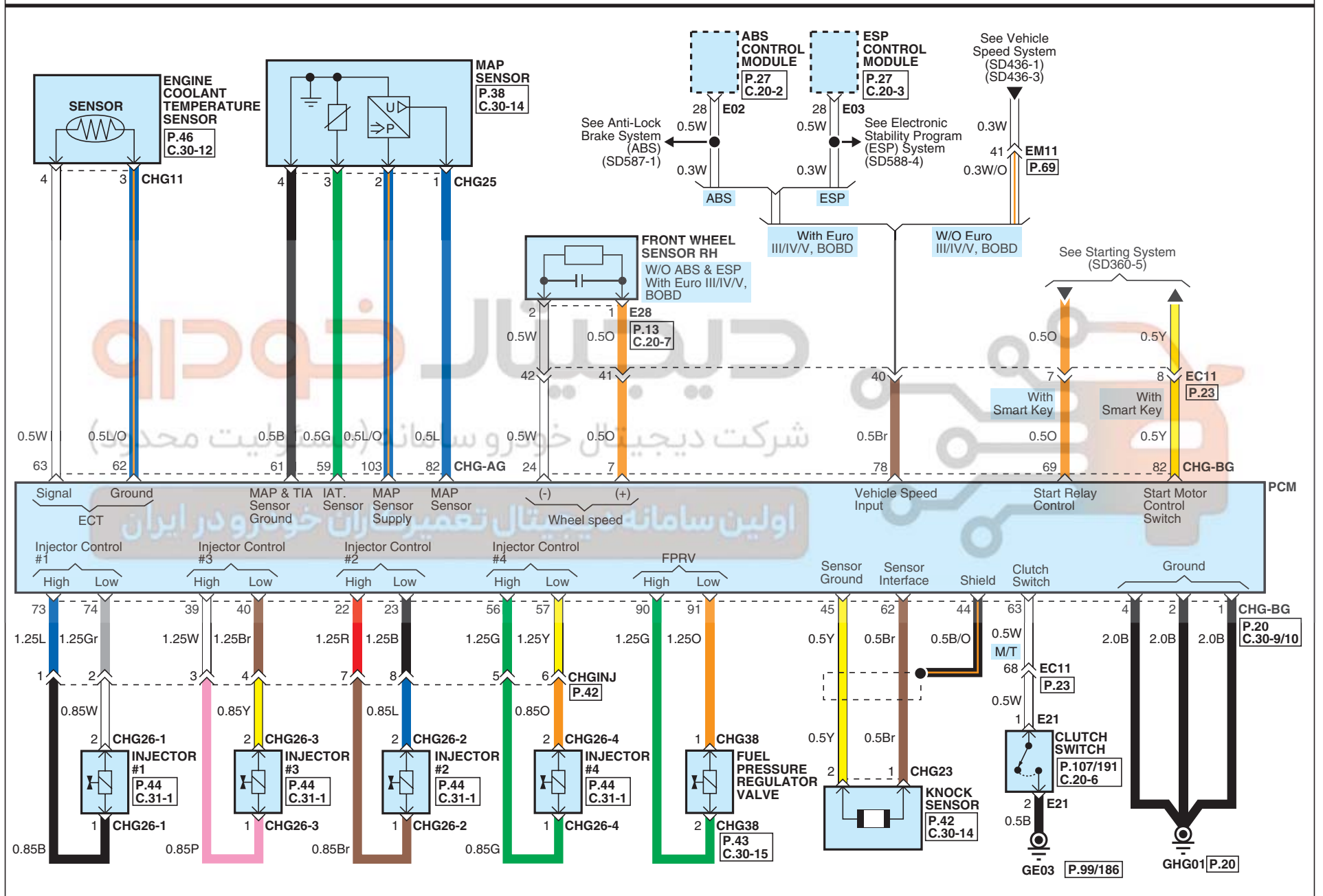
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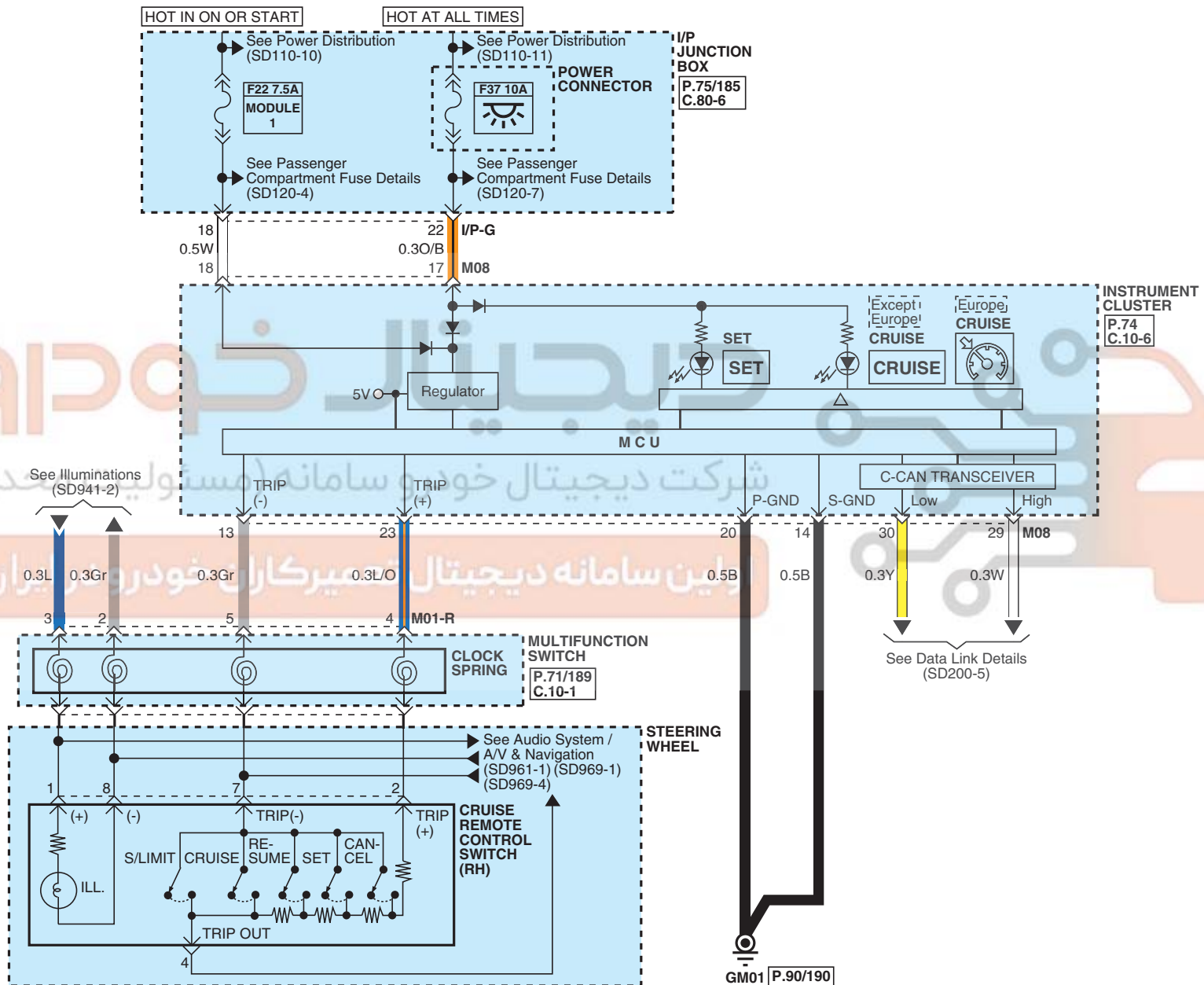
Engine Control System (G4KJ : THETA II 2.4L GDI) (7)

SD313-15



Engine Control System (G4KJ : THETA II 2.4L GDI) (8)

SD313-16



Engine Control System (G4KJ : THETA II 2.4L GDI)

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 [CHG-AG]

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
1	Ignition Coil (Cylinder #2) control output [Without Immobilizer]	Engine	Pulse	Vpeak = 360 ~ 440V
	Ignition Coil (Cylinder #3) control output [With Immobilizer]	Running		125<Frequency<1,000Hz (333Hz at idle)
2	[A/T] Line pressure control solenoid valve (LINE_VFS)	-	Output	0V/Battery voltage level 9V < Battery voltage level < 16V
3	[A/T] Torque converter control solenoid valve (T/CON_VFS)	-	Output	0V/Battery voltage level
				9V < Battery voltage level < 16V
4	[A/T] 35R clutch control solenoid valve (35R/C_VFS)	-	Output	0V/Battery voltage level
				9V < Battery voltage level < 16V
5	ETC Motor [+] control output	Engine Running	Pulse	High: Battery Voltage Low: Max.1.0V
6	ETC Motor [-] control output	Engine Running	Pulse	High: Battery Voltage Low: Max.1.0V
7	[A/T] Inhibitor switch signal "S1"	High	Input	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
8	[A/T] Inhibitor switch signal "S2"	High	Input	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
9	[A/T] Inhibitor switch signal "S3"	High	Input	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
10	[A/T] Inhibitor switch signal "S4"	High	Input	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
12	Sensor power (+5V)	IG OFF	DC	Max. 0.5V
		IG ON		4.75 ~ 5.25V
14	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] signal input	Idle	DC	Rich : 0.6 ~ 1.0V
				Lean : Max 0.4V
20	Fuel Tank Pressure Sensor (FTPS) signal input	Idle	Analog	-0.3 ~ 5.2V
22	Ignition Coil (Cylinder #4) control output [Without Immobilizer]	Engine Running	Pulse	Vpeak = 360 ~ 440V
	Ignition Coil (Cylinder #1) control output [With Immobilizer]			125<Frequency<1,000Hz (333Hz at idle)
23	[A/T] Underdrive brake control solenoid valve (UD/B_VFS)	-	Output	0V/Battery voltage level
				9V < Battery voltage level < 16V
24	[A/T] 26 brake control solenoid valve (26/B_VFS)	-	Output	0V/Battery voltage level
				9V < Battery voltage level < 16V
25	[A/T] Overdrive clutch control solenoid valve (OD/C_VFS)	-	Output	0V/Battery voltage level
				9V < Battery voltage level < 16V
33	Sensor power (+5V)	IG OFF	DC	Max. 0.5V
		IG ON		4.75 ~ 5.25V
35	Sensor ground	Idle	DC	-0.3 ~ 0.5V
39	Rail Pressure Sensor (RPS) signal input	Idle	Analog	-0.3 ~ 5.2V
41	Sensor ground	Idle	DC	-0.3 ~ 0.5V
43	Shield	Idle	DC	-0.3 ~ 0.5V
44	[A/T] Ground (Power 1)	-	Ground	0V

Engine Control System (G4KJ : THETA II 2.4L GDI)

Service Tips (2)

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
45	[A/T] Ground (Power 2)	-	Ground	0V
46	[A/T] Shift lock solenoid	High	Output	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
48	[A/T] Oil temperature sensor (-)	-	Ground	0V
52	[A/T] Sports mode select switch	Sport mode	Input	0V/Battery voltage level
		Other		9V < Battery voltage level < 16V
54	Sensor ground	Idle	DC	-0.3 ~ 0.5V
55	Sensor ground	Idle	DC	-0.3 ~ 0.5V
56	Sensor ground	Idle	DC	-0.3 ~ 0.5V
57	Immobilizer communication line	-	-	-
59	Intake Air Temperature Sensor (IATS) signal input	Idle	Analog	0 ~ 5.0V (2.55V at Idle)
		Idle		DC
60	Sensor ground	Idle	DC	-0.3 ~ 0.5V
61	Sensor ground	Idle	DC	-0.3 ~ 0.5V
62	Sensor ground	Idle	DC	-0.3 ~ 0.5V
63	Engine Coolant Temperature Sensor (ECTS) signal input	Idle	Analog	0.5 ~ 4.5V (1.02V at Idle)
		Idle		DC
64	Ignition Coil (Cylinder #3) control output [Without Immobilizer]	Engine	Pulse	Vpeak = 360 ~ 440V
	Ignition Coil (Cylinder #2) control output [With Immobilizer]	Running		125<Frequency<1,000Hz (333Hz at idle)
65	[A/T] ON/OFF solenoid valve B(SS-B)	High	Output	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
66	[A/T] ON/OFF solenoid valve A (SS-A)	High	Output	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
67	[A/T] Battery power (B+)	ON	Power	0V/Battery voltage level
		OFF		9V < Battery voltage level < 16V
69	[A/T] Oil temperature sensor (+)	ON	Input	0V/3.3V
		OFF		
72	-	-	-	-

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
73	[A/T] Output speed sensor signal	High	Input	0.7V/1.4V
		Low		
74	[A/T] Sports mode up switch	Up ON	Input	0V/Battery voltage level
		Other		9V < Battery voltage level < 16V
75	Throttle Position Sensor (TPS) 2 signal input	C.T	Analog	4.2 ~ 5.0V
		W.O.T		3.3 ~ 3.8V
76	Accelerator Position Sensor (APS) 2 signal input	C.T	Analog	Max. 1.0V
		W.O.T		1.5 ~ 3.0V
77	Accelerator Position Sensor (APS) 1 signal input	C.T	Analog	Max. 1.0V
		W.O.T		Min. 4.0V
78	Power Steering Pressure Sensor Ground	-	-	-
80	Sensor ground	Idle	DC	-0.3 ~ 0.5V
82	Manifold Absolute Pressure Sensor (MAPS) signal input	Idle	Analog	0.8 ~ 1.6V (1.37V at Idle)
		Idle		DC
83	Rc/Rp (Pump Cell Voltage)	Idle	Analog	Normal: 450±50 mV Rich: Max. Normal+150 mV Lean: Min. Normal-150 mV
84	VS-/IP- (Common Ground for VS, IP)	Idle	Analog	Reference for V_IP, V_N
85	Ignition Coil (Cylinder #1) control output [Without Immobilizer]	Engine	Pulse	Vpeak = 360 ~ 440V
	Ignition Coil (Cylinder #4) control output [With Immobilizer]	Running		125<Frequency<1,000Hz (333Hz at idle)
86	[A/T] Solenoid supply power 1	ON	Power	0V/Battery voltage level
		OFF		9V < Battery voltage level < 16V
87	[A/T] Solenoid supply power 2	ON	Power	0V/Battery voltage level
		OFF		9V < Battery voltage level < 16V
88	[A/T] Battery power (B+)	ON	Power	0V/Battery voltage level
		OFF		9V < Battery voltage level < 16V
90	[A/T] Output speed sensor power	ON	Power	0V/7.5V
		OFF		

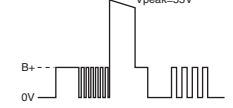
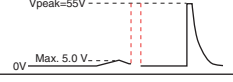
Engine Control System (G4KJ : THETA II 2.4L GDI)

Service Tips (3)

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
91	[A/T] Input speed sensor power	ON	Power	0V/7.5V
		OFF		
94	[A/T] Input speed sensor signal	High	Input	0.7V/1.4V
		Low		
95	[A/T] Sports mode down switch	Down ON	Input	0V/Battery voltage level
		Other		9V < Battery voltage level < 16V
96	Throttle Position Sensor (TPS) 1 signal input	C.T	Analog	0.3 ~ 0.9V
		W.O.T		1.5 ~ 3.0V
97	Sensor power (+5V)	IG OFF	DC	Max. 0.5V
		IG ON		4.75 ~ 5.25V
98	Sensor power (+5V)	IG OFF	DC	Max. 0.5V
		IG ON		4.75 ~ 5.25V
99	Power Steering Pressure Sensor Signal	-	-	-
101	A/C Pressure Transducer (APT) signal input	-	-	-
103	Sensor power (+5V)	IG OFF	DC	Max. 0.5V
		IG ON		4.75 ~ 5.25V
104	Rc (Compensative Resistance)	Idle	Analog	Rc-Rc/Rp < ±0.1V
105	VS+ (NERNST Cell Voltage)	Idle	Analog	Normal: 450±50 mV Rich: Max. Normal+150 mV Lean: Min. Normal-150 mV

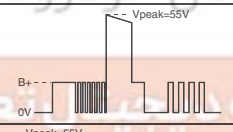
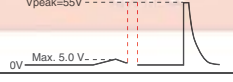
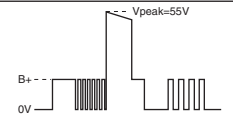
Connector [CHG-BG]

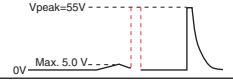
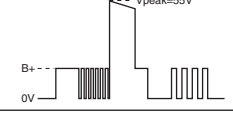
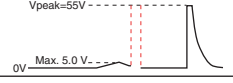
Pin No.	Description	Condition	In/Output Signal	
			Type	Level
1	ECM ground	Idle	DC	-0.3 ~ 0.5V
2	ECM ground	Idle	DC	-0.3 ~ 0.5V
3	Battery power (B+)	IG OFF	DC	Max. 1.0V
		IG ON		Battery Voltage
4	ECM ground	Idle	DC	-0.3 ~ 0.5V

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
5	Battery power (B+)	IG OFF	DC	Max. 1.0V
		IG ON		Battery Voltage
6	Battery power (B+)	IG OFF	DC	Max. 1.0V
		IG ON		Battery Voltage
7	Wheel Speed Sensor (WSS) [A] signal input	-	-	-
8	Crankshaft Position Sensor (CKPS) signal input	Engine Running	Pulse	High : 4.5 ~ 5.5V
				Low : -0.3 ~ 0.5V
10	Brake Switch 2 signal input	Brake OFF	DC	Battery Voltage
		Brake ON		Max. 0.5V
12	-	-	-	-
14	Wiper signal input	-	-	-
15	Electrical load signal input	Lamp OFF	DC	Battery Voltage
		Lamp ON		-0.3 ~ 0.5V
16	Alternator PWM signal output	Idle	Pulse	High: Battery Voltage
				Low: Max. 1.5V
18	Cooling Fan Relay [High] control output	Relay OFF	DC	Battery Voltage
		Relay ON		Max. 1.0V
19	Immobilizer Lamp control output	Lamp OFF	DC	Battery Voltage
		Lamp ON		-0.3 ~ 1.2V
22	Injector (Cylinder #2) [High] control output	Engine Running	PWM	
23	Injector (Cylinder #2) [Low] control output	Engine Running	Pulse	
24	Wheel Speed Sensor (WSS) [B] signal input	-	-	-

Engine Control System (G4KJ : THETA II 2.4L GDI)

Service Tips (4)

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
25	Sensor ground	Idle	DC	-0.3 ~ 0.5V
27	Brake Switch 1 signal input	Brake OFF	DC	Max. 0.5V
		Brake ON		Battery Voltage
29	Camshaft Position Sensor (CMPS) [Bank 1/Intake] signal input	Engine Running	Pulse	High: 4.5 ~ 5.5V
				Low: -0.3 ~ 0.5V
				Frequency: 7Hz (Idle), 25Hz (3,000rpm)
30	Camshaft Position Sensor (CMPS) [Bank 1/Exhaust] signal input	Engine Running	Pulse	High: 4.5 ~ 5.5V
				Low: -0.3 ~ 0.5V
				Frequency: 7Hz (Idle), 25Hz (3,000rpm)
32	LIN communication signal input	-	-	-
33	Cooling Fan Relay [Low] control output	Relay OFF	DC	Battery Voltage
		Relay ON		-0.3 ~ 1.2V
39	Injector (Cylinder #3) [High] control output	Engine Running	PWM	
		Engine Running		Pulse
40	Injector (Cylinder #3) [Low] control output	Engine Running	Pulse	
41	Battery power (B+)	IG OFF	DC	Max. 1.0V
		IG ON		Battery Voltage
44	Sensor shield	Idle	DC	-0.3 ~ 0.5V
45	Sensor ground	Idle	DC	-0.3 ~ 0.5V
46	Sensor ground	Idle	DC	-0.3 ~ 0.5V
47	Sensor ground	Idle	DC	-0.3 ~ 0.5V
53	Main Relay control output	Relay OFF	DC	Battery Voltage
		Relay ON		-0.3 ~ 1.2V
56	Injector (Cylinder #4) [High] control output	Engine Running	PWM	
				Pulse

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
57	Injector (Cylinder #4) [Low] control output	Engine Running	Pulse	
		IG OFF		DC
58	Battery power (B+)	IG OFF	DC	Battery Voltage
		IG ON		Battery Voltage
60	CAN [Low]	Recessive	Pulse	2.0 ~ 3.0V
		Dominant		2.75 ~ 4.5V
62	Knock Sensor (KS) signal input	Knocking	Variable Frequency	-0.3 ~ 0.3V
		Normal		0V
63	Clutch Switch signal input	S/W OFF	DC	Battery Voltage
		S/W ON		-0.3 ~ 0.5V
66	-	-	-	-
68	Variable Intake Solenoid (VIS) Valve control output	Active	DC	Max. 1.0V
		Inactive		Battery Voltage
69	Starter Relay control output	Relay OFF	DC	Battery Voltage
		Relay ON		-0.3 ~ 1.2V
70	Fuel Pump Relay control output	Relay OFF	DC	Battery Voltage
		Relay ON		-0.3 ~ 1.2V
71	Engine speed signal output	Engine Running	Frequency	High: Battery Voltage
				Low: -0.3 ~ 1.0V
				Frequency: 26Hz (Idle), 106Hz (3,000rpm)
73	Injector (Cylinder #1) [High] control output	Engine Running	PWM	
		Engine Running		Pulse
74	Injector (Cylinder #1) [Low] control output	Engine Running	Pulse	
75	Battery power (B+)	IG OFF	DC	Max. 1.0V
		IG ON		Battery Voltage
77	CAN [High]	Recessive	Pulse	2.0 ~ 3.0V
		Dominant		2.75 ~ 4.5V

Engine Control System (G4KJ : THETA II 2.4L GDI)

Service Tips (5)

Pin No.	Description	Condition	In/Output Signal	
			Type	Level
78	Vehicle speed signal input	-	-	-
80	-	-	-	-
82	Starter Control Switch signal input	S/W OFF	DC	-0.3 ~ 0.5V
		S/W ON		Battery Voltage
83	-	-	-	-
84	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust] control output	Idle	Pulse	High : Battery Voltage
				Low : -0.3 ~ 1.0V
				Frequency : 300Hz
85	CVVT Oil Control Valve (OCV) [Bank 1/Intake] control output	Idle	Pulse	High : Battery Voltage
				Low : -0.3 ~ 1.0V
				Frequency : 300Hz
86	Purge Control Solenoid Valve (PCSV) control output	Inactive	Pulse	High : Battery Voltage
				Low : Max. 1.0V
		Active		Vpeak : 42.0 ~ 60.0V
				Frequency : 20Hz
87	Canister Close Valve (CCV) control output	Active Inactive	Pulse	High : Battery Voltage
				Low : Max. 1.0V
				Vpeak : 42.0 ~ 60.0V
88	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] Heater control output	Engine Running	Pulse	High : Battery Voltage
				Low : -0.3 ~ 1.0V
				Frequency : 8 ~ 10Hz
				Duty : 0 ~ 100%
89	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] Heater control output	Engine Running	Pulse	High : Battery Voltage
				Low : -0.3 ~ 1.0V
				Frequency : 8 ~ 10Hz
				Duty : 0 ~ 100%
90	Fuel Pressure Regulator Valve [High] control output	Engine Running	PWM	
91	Fuel Pressure Regulator Valve [Low] control output	Engine Running	Pulse	

• 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) Thermister and its resistance changes in reverse proportion to the temperature.

• Engine Coolant Temperature Sensor (ECTS)

The Engine Coolant Temperature Sensor (ECTS) detects the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. 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.

• 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.

Engine Control System (G4KJ : THETA II 2.4L GDI)

Service Tips (6)

• 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, the engine may stop because of CKPS signal missing.

• Camshaft Position Sensor (CMPS)

The sensor detects a top dead point of cylinder no. 1. It is installed at the end of the camshaft and consists of a hole-type sensor and target wheel.

When the signal detecting unit of a sensor is blocked by a bump of the target wheel, high voltage is generated, while low voltage is generated otherwise.

The PCM recognizes the position of each cylinder using the signal from the camshaft position sensor.

• 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; the need for external cruise control modules/cables is eliminated.

• Accelerator Pedal Position Sensor (APS)

Accelerator Position Sensor (APS) is installed on the accelerator pedal module and detects the rotation angle of the accelerator pedal. The APS is one of the most important sensors in engine control system, so it consists of the two sensors which adapt individual sensor power and ground line. The second sensor monitors the first sensor and its output voltage is half of the first one. If the ratio of the sensor 1 and 2 is out of the range (approximately 1/2), the diagnostic system judges that it is abnormal.

• 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 de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

• Power Steering Pressure 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.

• Purge Control Solenoid Valve (PCSV)

Purge Control Solenoid Valve (PCSV) is installed on the surge tank and controls the passage between the canister and the intake manifold. It is a solenoid valve and is open when the PCM grounds the valve control line. When the passage is open (PCSV ON), fuel vapor stored in the canister is transferred to the intake manifold.

Engine Control System (G4KJ : THETA II 2.4L GDI)**Service Tips (7)**

- **Knock Sensor**

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. When a knock occurs, the sensor produces voltage signal. The PCM retards the ignition timing when knocking occurs. 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.

- **Variable Intake Solenoid Valve (VIS)**

Variable Intake manifold 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.

- **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.

- **Rail Pressure Sensor (RPS)**

The Fuel Pressure Sensor confirms the fuel pressure and returns the signal to the Powertrain Control Module.

According to this signal, PCM control more accurate fuel inject and inject timing. If current fuel pressure different from optimum fuel pressure then fuel pressure is changed by fuel pressure regulator valve.

- **Fuel Pressure Regulator Valve (FPRV)**

Fuel pressure regulator valve is a device that regulates fuel pressure from the PCM control signal according to the engine status.

- **Stop Lamp Switch**

Stop Lamp Switch is mounted on the brake pedal assembly and is used to send the status of the brake pedal to the PCM. There are two separate switches in the switch housing. The Brake Test Switch is normally closed while the Brake Light Switch is normally open.

- **Stop Lamp Relay**

It is used to increasing long-term reliability for stop lamp switch.

- **A/C Pressure Transducer (APT)**

The Air Conditioner Control Module receives air conditioner refrigerants pressure signal from the PCM via CAN communications. The Air Conditioning Pressure Transducer (APT) supplies the A/C line pressure signal to the PCM. The APT signal value is used by the A/C control unit to control engagement of the compressor.

- **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.

- **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.

Engine Control System (G4KJ : THETA II 2.4L GDI)**Service Tips (8)****• Immobilizer IND.**

Immobilizer informs status of system and result of Authentication by blinking of immobilizer lamp on instrument cluster. Through Authentication procedure immobilizer lamp keep lighting up till engine starts. In normal status. Immobilizer lamp lights up Right after ignition "ON". The light goes out after the engine is running. If there's any fault in immobilizer system or in Authentication, lamp blinks after ignition "ON"

• 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.

• 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.

• Data Link Connector

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.

