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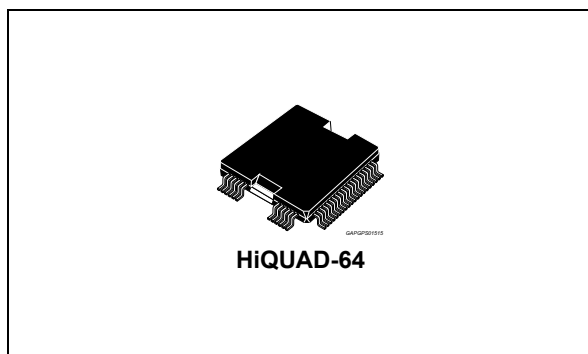
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Multifunction IC for engine management system

Datasheet - production data



Features

- 5 V logic regulator
- 3.3 V logic regulator
- 5 V tracking sensor supply
- Smart reset function
- Power latch with Secure Engine Off (SEO) functionality, to safely complete driver switch off procedure
- Flying wheel interface function (VRS) with adaptive time and amplitude control
- Protected low-side relay driver
 - OUT13 to 18, MRD
- Protected low-side (injector drivers)
 - OUT1 to 4
- Protected low-side (high current)
 - OUT5, 6, 7

- Protected low-side (low current)
 - OUT19, 20
- IGBT pre-drivers (IGN1 to 4)
- External MOS pre-drivers (OUT8 to 9)
- Configurable power stages CPS
 - Stepper motor driver/ high-side - low-side (OUT21 to 28)
- Thermal warning and shutdown
- Serial interface
 - Micro Second Channel interface (MSC)
 - ISO9141 interface (K-Line)
- High speed CAN transceiver
- Dedicated pin VDDIO to select the voltage level of digital output used for serial communication
- VDA 2.0 compliance with 3 level Watchdog
- Package: HiQUAD-64

Description

The L9779WD is an integrated circuit designed for automotive environment and implemented in BCD6S technology.

It is conceived to provide all basic functions for standard engine management control units.

It is assembled in the HiQUAD-64 power package.

Table 1. Device summary

Order code	Package	Packing
L9779WD	HiQUAD-64	Tray
L9779WD-TR	HiQUAD-64	Tape and Reel

Contents

- 1 Detailed features description 9**
- 2 Block diagram 12**
- 3 Pins description 13**
- 4 Application schematic 17**
- 5 Absolute maximum ratings 18**
 - 5.1 ESD protection 19
 - 5.2 Latch-up test 20
 - 5.3 Temperature ranges and thermal data 20
 - 5.4 Operating range 20
 - 5.4.1 Low battery 20
 - 5.4.2 Normal battery 20
 - 5.4.3 High battery 20
 - 5.4.4 Load dump 20
- 6 Functional description 21**
 - 6.1 Ignition switch, main relay, battery pin 21
 - 6.2 Power-up/down management unit 22
 - 6.2.1 Power-up sequence 22
 - 6.2.2 Power-down sequence 24
 - 6.3 VDD_IO function 31
 - 6.3.1 Description of VDD_IO function and IC pin 31
 - 6.4 Smart reset circuit 32
 - 6.4.1 Smart reset circuit functionality description 32
 - 6.4.2 VDD5_UV detection modes 37
 - 6.5 Thermal shut down 38
 - 6.6 Voltage regulators 39
 - 6.7 Charge pump 45
 - 6.8 Main relay driver 49
 - 6.8.1 Main relay driver functionality description 49

6.8.2	MRD scenarios	50
6.9	Low-side switch function (LSa, LSb, LSd)	55
6.9.1	LSa function OUT 1 to 5 (Injectors)	55
6.9.2	LSb function OUT6, 7 (O2 heater)	58
6.9.3	LSc function OUT19, 20 (low current drivers)	60
6.9.4	LSd function OUT13 to 18 (relay drivers)	62
6.10	LSa, LSb, LSc, LSd diagnosis	67
6.11	Ignition pre-drivers (IGN1 to 4)	69
6.11.1	Ignition pre-drivers functionality description	70
6.11.2	Ignition pre-driver diagnosis	71
6.12	External MOSFET gate pre-drivers	73
6.12.1	External MOSFET gate pre-drivers diagnosis	75
6.13	Configurable power stages (CPS) (OUT21 to 28)	76
6.13.1	Configurable power stages functionality description	76
6.13.2	Diagnosis of configurable power stages (CPS)	80
6.13.3	Diagnosis of CPS [OUT21 to OUT28] when configured as H-bridges	81
6.13.4	Diagnosis of CPS [OUT21 to OUT28] when configured as single power stages	85
6.14	ISO serial line (K-LINE)	92
6.14.1	ISO serial line (K-LINE) functionality description	92
6.15	CAN transceiver	95
6.15.1	CAN transceiver functionality description	95
6.16	Flying wheel interface function	100
6.16.1	Flying wheel interface functionality description	100
6.16.2	Auto-adaptative sensor filter	101
6.16.3	Application circuits	106
6.16.4	Diagnosis test	108
6.17	Monitoring module (watchdog)	110
6.17.1	WDA - Watchdog (algorithmic)	110
6.17.2	Monitoring module - WDA Functionality	111
6.17.3	Watchdog related MSC commands	120
6.17.4	Watchdog related MSC registers	121
	MSC_RESPTIME	121
	WDA_RESPTIME	122
	REQULO	122
	REQUHI	123
	RST_AB1_CNT	124

6.17.5	MicroSecond Channel activity watchdog	125
6.18	Serial interface	127
6.18.1	MSC interface	127
6.18.2	Commands	135
6.18.3	Registers (Upstream blocks)	142
	STEP_CNT_H	143
	STEP_CNT_L	144
	IDENT_REG	144
	CONFIG_REG1	145
	CONFIG_REG2	146
	CONFIG_REG3	147
	CONFIG_REG4	148
	CONFIG_REG5	149
	CONFIG_REG6	150
	CONFIG_REG7	152
	CONFIG_REG10 (CPS Configuration register)	153
	DIA_REG[1:5]	153
	DIA_REG6	156
	DIA_REG7	157
	DIA_REG8	158
	DIA_REG9	159
	DIA_REG10	160
	DIA_REG11	161
	DIA_REG12	162
	CONTR_REG1	163
	CONTR_REG2	164
	CONTR_REG3	165
	CONTR_REG4	166
7	Package information	167
7.1	HiQUAD-64 package information	167
8	Revision history	169

List of tables

Table 1.	Device summary	1
Table 2.	Pins description	13
Table 3.	Absolute maximum ratings	18
Table 4.	ESD protection	19
Table 5.	Temperature ranges and thermal data	20
Table 6.	Operating range	20
Table 7.	KEY_ON pin electrical characteristics	30
Table 8.	VDD_IO electrical characteristics	31
Table 9.	Internal reset	33
Table 10.	RST pin external components required	35
Table 11.	RST pin electrical characteristics	36
Table 12.	Temperature information	38
Table 13.	Voltage regulators external components required	40
Table 14.	VB Power supply electrical characteristics	42
Table 15.	Linear 5 V regulator electrical characteristics	43
Table 16.	Linear 3.3 V regulator electrical characteristics	46
Table 17.	5V tracking sensor supply electrical characteristics	48
Table 18.	Main relay driver electrical characteristics	50
Table 19.	LSa electrical characteristics	55
Table 20.	LSa diagnosis electrical characteristics	57
Table 21.	LSa diagnosis electrical characteristics (OUT 5)	57
Table 22.	LSb electrical characteristics	58
Table 23.	LSb diagnosis electrical characteristics	59
Table 24.	LSc electrical characteristics	60
Table 25.	LSc diagnosis electrical characteristics	61
Table 26.	LSd electrical characteristics	62
Table 27.	LSd diagnosis electrical characteristics	63
Table 28.	Fault encoding condition	68
Table 29.	Ignition pre-drivers electrical characteristics	70
Table 30.	External MOSFET gate pre-drivers	74
Table 31.	Configuration of the stepper motor	77
Table 32.	H-bridge1 configurable power stages OUT [21 to 24]	78
Table 33.	H-bridge2 configurable power stages OUT [25 to 28]	79
Table 34.	Stepper configuration electrical characteristics	84
Table 35.	Electrical and diagnosis characteristics of [OUT22], [OUT24], [OUT27], [OUT28] when configured as single power stages	87
Table 36.	Electrical characteristics of [OUT22], [OUT24], [OUT27], [OUT28] when configured as single power stages connected in parallel (For information only)	88
Table 37.	Electrical characteristics of [OUT21], [OUT23], [OUT25], [OUT26] when configured as single power stages	89
Table 38.	Diagnosis characteristic of [OUT21], [OUT23], [OUT25], [OUT26] when configured as single power stages	89
Table 39.	CPS table single mode parallelism	90
Table 40.	CPS table combined mode parallelism	90
Table 41.	ISO serial line (K-LINE) functionality electrical characteristics	92
Table 42.	CAN transceiver electrical characteristics	96
Table 43.	CAN transceiver timing characteristics	98
Table 44.	Pick voltage detector precision	102

Table 45.	Hysteresis threshold precision	102
Table 46.	MSC command possible configuration of different option of VRS function.	104
Table 47.	VRs typical characteristics	106
Table 48.	Diagnosis test electrical characteristics	108
Table 49.	WDA_INT electrical characteristics.	110
Table 50.	Error counter	114
Table 51.	State for <INIT_WDR> = 1	115
Table 52.	Reset-behaviour of <WDA_INT>, AB1 and <WD_RST>	116
Table 53.	Expected responses	117
Table 54.	Reset behaviour	117
Table 55.	RD_DATA8	120
Table 56.	WR_RESP	120
Table 57.	WR_RESPTIME	120
Table 58.	MicroSecond Channel activity watchdog	125
Table 59.	Content of a command frame (transmitted LSB first)	129
Table 60.	Content of a data frame (transmitted LSB first)	130
Table 61.	Timing characteristics	132
Table 62.	Time electrical characteristics.	133
Table 63.	Commands	135
Table 64.	RD_DATA1, 2, 3, 4, 5, 6, 7 and 8	136
Table 65.	WR_CONFIG1, 2, 3, 4, 5, 6, 7, WR_RESP, WR_RESPTIME	137
Table 66.	Lock, unlock	137
Table 67.	SW_RST	138
Table 68.	Start, Stop	138
Table 69.	MRD_REACT	139
Table 70.	RD_SINGLE	139
Table 71.	Register through the command data field	139
Table 72.	Association between the registers and the "4 bit address field.	140
Table 73.	Registers.	142
Table 74.	CONFIG_REG6 power off source	151
Table 75.	HiQUAD-64 package mechanical data	168
Table 76.	Document revision history	169

List of figures

Figure 1.	Block diagram	12
Figure 2.	Pins connection diagram (top view)	13
Figure 3.	Application schematic	17
Figure 4.	Configuration supplied by VB	21
Figure 5.	Power-up/down management unit	22
Figure 6.	Non-permanent supply power-up sequence	22
Figure 7.	Permanent supply power-up sequence	23
Figure 8.	Power-down sequence without power latch mode	26
Figure 9.	Power-down sequence without power latch mode and PSOFF = 1	27
Figure 10.	Power-down sequence with power latch mode	28
Figure 11.	Power-down sequence with power latch mode and KEY_ON toggle	29
Figure 12.	KEY_ON voltage vs. status diagram	30
Figure 13.	Smart reset circuit	32
Figure 14.	RST pin as a function of VDD5 (if CONFIG_REG6 bit3 = Low)	36
Figure 15.	Structure regulators diagram	39
Figure 16.	Graphic representation of the calculation method	40
Figure 17.	Circuit and PCB layout suggested	41
Figure 18.	VB overvoltage diagram	43
Figure 19.	VDD5 overvoltage diagram	45
Figure 20.	VDD5 vs battery: ramp-up diagram	46
Figure 21.	VDD5 vs battery (ramp-down diagram)	46
Figure 22.	Main relay driver controlled by L9779WD	49
Figure 23.	Scenario 1a: Standard on/off MRD driver with NO power latch mode bit PSOFF = 0	50
Figure 24.	Scenario 1b: Standard on/off MRD driver with NO power latch mode bit PSOFF = 1	51
Figure 25.	Scenario 2: Standard on/off MRD driver with power latch mode bit PSOFF = 0	51
Figure 26.	Scenario 3a: Deglitch concept on KEY_ON at start-up	51
Figure 27.	Scenario 3b: Deglitch concept on KEY_ON during ON phase	52
Figure 28.	Scenario 4: Non standard on, KEY_ON removed before VB present	52
Figure 29.	Scenario 5: MRD overcurrent without VB	52
Figure 30.	Scenario 6: permanent MRD overcurrent with VB POR restart	53
Figure 31.	Scenario 7 (temporary MRD overcurrent with VB POR restart)	53
Figure 32.	Scenario 8 (temporary MRD overcurrent with VB μ C commands restart)	54
Figure 33.	LSa function OUT 1 to 5 (Injectors)	55
Figure 34.	LSb function OUT6, 7 (O2 heater)	58
Figure 35.	LSc function OUT19, 20 (low current drivers)	60
Figure 36.	LSd function OUT13 to 18 (relay drivers)	62
Figure 37.	Behavior of OUT13, 14, 21, 25 with VB = VB_LV for a time shorter than Thold and with a valid ON condition	64
Figure 38.	Behavior of OUT13, 14, 21, 25 with VB = VB_LV for a time longer than Thold and with a valid ON condition	65
Figure 39.	Behavior of OUT13, 14, 21, 25 with VB that drops lower than POR threshold during cranking	66
Figure 40.	LSx diagnosis circuit	68
Figure 41.	Fault encoding condition diagram	68
Figure 42.	LSx ON/OFF slew rate control diagram	69
Figure 43.	Ignition-pre drivers (IGN1 to 4) circuit	69
Figure 44.	Ignition-pre drivers (IGN1 to 4) diagram	71
Figure 45.	External MOSFET gate pre-drivers circuit	73

Figure 46.	Stepper motor operation diagram	78
Figure 47.	Configurable power stages OUT [21 to 24] can be configured to create the H-bridge1 . . .	79
Figure 48.	Configurable power stages OUT [25 to 28] can be configured to create the H-bridge2 . . .	79
Figure 49.	Stepper counter diagram	80
Figure 50.	Stepper motor driver “off” diagnosis time diagram	82
Figure 51.	Stepper motor driver diagnosis I-V relationship diagram	82
Figure 52.	Open load detection during “on” phase	83
Figure 53.	Open load detection during “on” phase	83
Figure 54.	Short to GND detection during “on” phase	84
Figure 55.	Short to VB & open load diagram	86
Figure 56.	ISO serial line (K-LINE) circuit	92
Figure 57.	ISO serial line switching waveform	94
Figure 58.	ISO serial line: short circuit protection	94
Figure 59.	CAN transceiver diagram	95
Figure 60.	CAN transceiver switching waveforms	99
Figure 61.	CAN transceiver test circuit	99
Figure 62.	Flying wheel interface circuit.	100
Figure 63.	Auto adaptative hysteresis diagram	101
Figure 64.	VRS interface block diagram	102
Figure 65.	Auto-adaptive time filter (rising edge)	103
Figure 66.	Adaptive filter function when the MSC bit are 00 or 01.	104
Figure 67.	Adaptive Filter Function when the MSC bit is 10 or 11	105
Figure 68.	Variable reluctance sensor	106
Figure 69.	VRs typical characteristics	106
Figure 70.	Hall effect sensor configuration 1	107
Figure 71.	Hall effect sensor configuration 2	107
Figure 72.	Diagnosis test diagram	108
Figure 73.	WDA block diagram	111
Figure 74.	Monitoring cycle diagram	112
Figure 75.	4-bit Markov chain diagram	113
Figure 76.	MicroSecond Channel activity watch dog diagram	126
Figure 77.	Communication diagram between μ C and L9779WD	128
Figure 78.	Command frame diagram	129
Figure 79.	Data frame diagram	130
Figure 80.	Upstream communication diagram	131
Figure 81.	Timing diagram	131
Figure 82.	Time circuit	132
Figure 83.	Cycle time diagram	133
Figure 84.	HiQUAD-64 package outline.	167

1 Detailed features description

- Package
 - HiQUAD-64
- 5 V logic regulator
 - 5 V precision voltage regulator ($\pm 2\%$) with external NMOS
 - Max current regulated: 400 mA
 - Charge pump capacitor at pin CP is used to drive the gate of the external NMOS transistor
- 3.3 V logic regulator
 - 3.3 V precision voltage regulator ($\pm 2\%$) with over-current protection
 - Max current regulated: 100 mA
- 5 V tracking sensor supply
 - 2 x 5 V tracking sensor supply with protection and diagnosis on MSC
 - Short-circuit to Vbat/GND fully protected
 - Max current regulated: 2 x 100 mA
- VDD_IO supply
 - All the digital output is supplied by external VDD_IO through VDD_IO pin
- Smart reset
 - Main Reset monitoring VB_UV Logic voltage management and safety control
- Watch dog
 - Main reset management 5 V voltage monitoring safety output disable
 - MicroSecond Channel activity watch dog
 - MSC controllable query and answer watch dog compliant with VDA2.0 level 3 (enabled by default)
- Power latch
 - L9779WD is switched on by KEY_ON signal and switched off by logic OR of KEY_ON signal and MicroSecond Channel bit
- Secure engine off mode (default) switches off the drivers in the following order:
 - OUT1 through to OUT4 in 225 ms (typical)
 - OUT13 and OUT14 in 600 ms (typical)
- Flying wheel interface function (VRS)
 - The VRS is the interface between the microprocessor and the magnetic pick-up or variable reluctance sensor that collects the information coming from the flying wheel
 - Adaptive filtering on amplitude and timing adapts better the device response to VRS input switching
- Protected low-side driver
 - LSa (OUT1 to 5)
 - 4 Ch. serial IN via MicroSecond Channel, $R_{dson} = 0.72 \text{ Ohm @ } 150 \text{ }^\circ\text{C}$, $V_{cl} = 58 \text{ V } \pm 5$, $I_{max} = 2.2 \text{ A}$;
 - 1 Ch. serial IN via MicroSecond Channel, $R_{dson} = 0.72 \text{ Ohm @ } 150 \text{ }^\circ\text{C}$, $V_{cl} = 58 \text{ V } \pm 5$, $I_{max} = 3 \text{ A}$;

- LSb (OUT6, 7)
2 Ch. serial IN via MicroSecond Channel, $R_{dson} = 0.47 \text{ Ohm @ } 150^{\circ}\text{C}$, $V_{cl} = 45 \text{ V } \pm 5$, $I_{max} = 5 \text{ A}$
- LSc (OUT19, 20)
2 Ch serial IN via MicroSecond Channel, $I_{max} = 50 \text{ mA}$
Full diagnosis on MicroSecond Channel (2 bit for each channel) and voltage slew rate control.
When an over current fault occurs, the driver switch off with faster slew rate in order to reduce the power dissipation.
- Protected low side relay driver (OUT13 to 18, MRD)
 - LSD
6 Ch. serial IN via MicroSecond Channel, $R_{dson} = 1.5 \text{ Ohm @ } 150^{\circ}\text{C}$, $V_{cl} = 48 \text{ V}$, $I_{max} = 600 \text{ mA}$ (2 of them with low battery voltage function);
1 main relay driver $R_{dson} = 2.4 \text{ Ohm @ } 150^{\circ}\text{C}$, $V_{cl} = 48 \text{ V}$, $I_{max} = 600 \text{ mA}$
With full diagnosis on MicroSecond Channel (2 bit for each channel) and voltage slew-rate control.
When an over current fault occurs, the driver switch off with faster slew rate in order to reduce the power dissipation.
- Ignition pre-drivers (IGN1 to 4)
 - 4 x ignition pre-drivers with full diagnostic.
- External MOS pre-drivers (OUT8 to 9)
 - 2 x MOS pre-drivers with sense of the external drain voltage to perform the diagnostic:
Open load in OFF state
Shorted load in ON state with programmable threshold voltage and programmable filter time via MSC
- Configurable power stages CPS: stepper motor driver/ high-side - low-side (OUT21 to 28)
1 x Stepper motor driver designed for a double winding coil motor, used for engine idle speed control.
The bridge driver is made by 4 independent high-side drivers and 4 independent low-side drivers:
 - 4 high-side driver, $R_{dson} = 1.5 \text{ Ohm}$, $I_{max} = 600 \text{ mA}$
 - 4 low-side driver, $R_{dson} = 1.5 \text{ Ohm}$, $I_{max} = 600 \text{ mA}$
 The 4 high-side drivers and the 4 low-side drivers can be controlled independently
The low-side drivers could be connected in parallel (in pairs): OUT22 with OUT24 and OUT27 with OUT28.
Low-side and high-side drivers implement voltage SR control to minimize emission.
Two high-side drivers have the low battery voltage function.
- Thermal shutdown
 - 1 x Thermal shutdown ($T_j > 175^{\circ}\text{C} = T_{sd}$) if $T_j > T_{sd}$: VTRK1, 2 are turned off.
 - 1 x Thermal shutdown ($T_j > 175^{\circ}\text{C} = T_{sd}$) if $T_j > T_{sd}$: OUT1 to 10, OUT13 to 20, OUT21 to 28, IGN1 to 4 are turned off.
 - 1 x Thermal shutdown ($T_j > 175^{\circ}\text{C} = T_{sd}$) if $T_j > T_{sd}$: MRD is turned off (if battery present).

- 1 x Thermal Shutdown ($T_j > 175\text{ °C} = T_{sd}$) if $T_j > T_{sd}$: V3V3 is turned off.

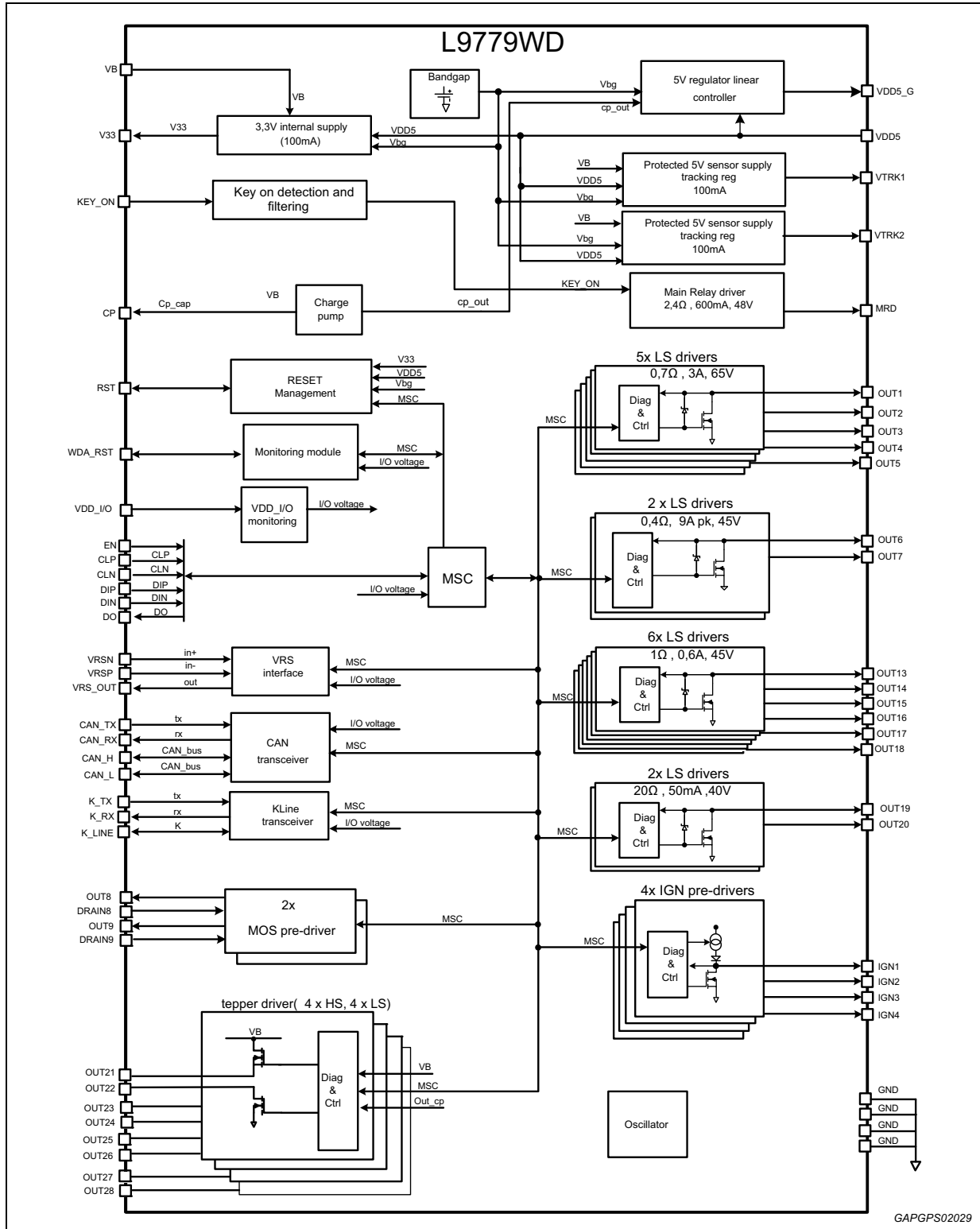
There are 5 temperature sensors for OT2 (OUT1..10, OUT13...20, OUT21...28, IGN1...4 are turned off) in different Layout position, they are logically “AND” in case of thermal shutdown.

- ISO9141 interface
 - ISO9141 serial interface (K-Line)
- CAN transceiver

The CAN bus transceiver allows the connection of the microcontroller, with CAN controller unit, to a high speed CAN bus with transmission rates up to 1Mbit/s for exchange of data with other ECUs.

2 Block diagram

Figure 1. Block diagram



3 Pins description

Figure 2. Pins connection diagram (top view)

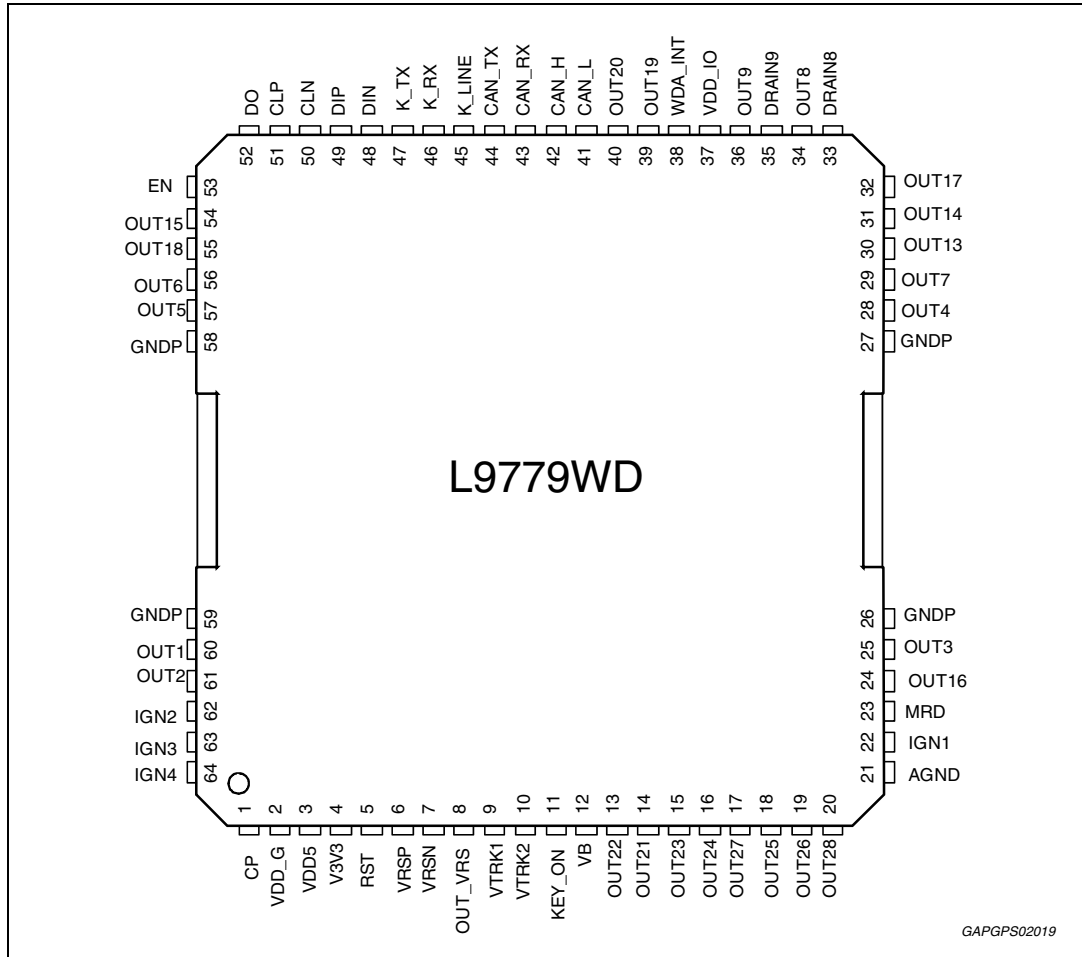


Table 2. Pins description

Pin#	Name	Function	Type	Polarization/note
Supply block				
12	VB	Battery supply	Power supply polarization	-
3	VDD5	5 V output voltage regulator	Power logic output supply	-
2	VDD_G	5 V regulator ext MOS gate	Analog output	-
11	KEY_ON	Key signal	Analog Input	Internal pull down resistor
4	V3V3	3.3 V output voltage regulator	Power logic output supply	-
1	CP	Charge pump	Analog Input	-
9	VTRK1	Sensor1 tracking supply 5V	Sensor supply output	-

Table 2. Pins description (continued)

Pin#	Name	Function	Type	Polarization/note
10	VTRK2	Sensor1 tracking supply 5V	Sensor supply output	-
5	RST	Reset input/output for μ P	Output: push-pull DGT input	Open drain
37	VDD_IO	External supply	Power input	-
38	WDA_INT	WDA Interrupt Signal	Output: open drain DGT input	-
VRS				
7	VRSN	Negative VRS input	Analog input	1.65 V internal polarization
6	VRSP	Positive VRS input	Analog input	1.65 V internal polarization
8	OUT_VRS	Digital VRS output	DGT output	Push-pull
CAN				
44	CAN_TX	Can transceiver input (from TX μ P)	DGT input	-
43	CAN_RX	Can transceiver output (to RX μ P)	DGT output	-
42	CAN_H	Bi-dir protected CAN_H wire	Analog input/output	-
41	CAN_L	Bi-dir protected CAN_L wire	Analog input/output	-
ISO9141				
47	K_TX	ISO9141 logical input	DGT input	Internal pull-up resistor
45	K_LINE	Bi-dir protected K-line wire	Analog input/output	Open drain
46	K_RX	ISO9141 logical output	DGT output	Push-pull
Low side drivers				
60	OUT1	Output low-side 1 for R, L load (Injector)	Power output	Open drain
61	OUT2	Output low-side 2 for R, L load (Injector)	Power output	Open drain
25	OUT3	Output low-side 3 for R, L load (Injector)	Power output	Open drain
28	OUT4	Output low-side 4 for R, L load (Injector)	Power output	Open drain
26	PGND	Power GND	PGND	-
27	PGND	Power GND	PGND	-
57	OUT5	Output low-side 5 for R, L load (high current)	Power output	Open drain
56	OUT6	Output low-side 6 for R, L load (heater)	Power output	Open drain
29	OUT7	Output low-side 7 for R, L load (heater)	Power output	Open drain

Table 2. Pins description (continued)

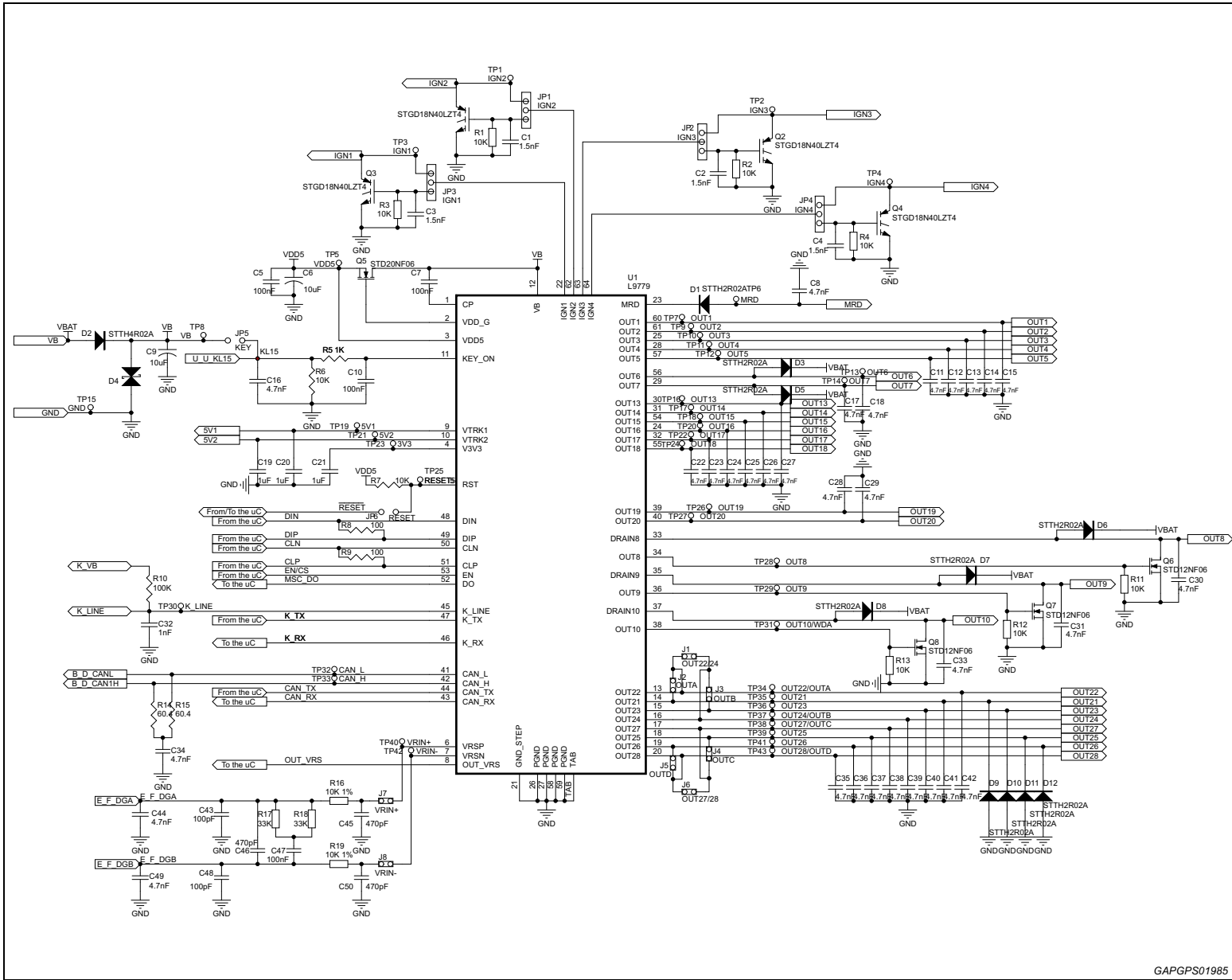
Pin#	Name	Function	Type	Polarization/note
30	OUT13	Output low-side 13 for relay (low. bat.)	Power output	Open drain
31	OUT14	Output low-side 14 for relay (low. bat.)	Power output	Open drain
54	OUT15	output low-side 15 for relay	Power output	Open drain
24	OUT16	Output low-side 16 for relay	Power output	Open drain
32	OUT17	Output low-side 17 for relay	Power output	Open drain
55	OUT18	Output low-side 18 for relay	Power output	Open drain
58	PGND	Power GND	PGND	-
59	PGND	Power GND	PGND	-
Ignition pre-driver				
22	IGN1	Output ignition driver 1	Power output	-
62	IGN2	Output ignition driver 2	Power output	-
63	IGN3	Output ignition driver 3	Power output	-
64	IGN4	Output ignition driver 4	Power output	-
21	GND_STEP	Analog GND	AGND	-
Main relay driver				
23	MRD	Main relay driver	Power output	Open drain
Low current drivers (50 mA)				
39	OUT19	Output low-side 19	Power Output	Open drain
40	OUT20	Output low-side 20	Power Output	Open drain
Ext MOS pre-driver				
33	DRAIN8	Ext. drain voltage sense for OUT8	Input	-
34	OUT8	Gate driver for ext MOS OUT8	Power output	-
35	DRAIN9	Ext. Drain voltage sense for OUT9	Input	-
36	OUT9	Gate driver for ext MOS OUT9	Power output	-
MSC interface				
51	CLP	Clock positive for differential interface	DGT Input	-
50	CLN	Clock negative for differential interface	DGT Input	-
49	DIP	Downstream data positive for differential interface	DGT Input	-
48	DIN	Downstream data negative for differential interface	DGT Input	-
53	EN	Enable pin	DGT Input	-

Table 2. Pins description (continued)

Pin#	Name	Function	Type	Polarization/note
52	DO	Upstream data push-pull output	DGT Output	-
Configurable power stage: Stepper motor driver / low-side, high-side drivers				
14	OUT21	Output high-side 21 / stepper (low. bat.)	Power output	Open drain
13	OUT22	Output low-side 22/ stepper	Power output	Open drain
15	OUT23	Output high-side 23 / stepper	Power output	Open drain
16	OUT24	Output low-side 24 / stepper	Power output	Open drain
18	OUT25	Output high-side 25 / stepper (low. bat.)	Power output	Open drain
19	OUT26	Output high-side 26 / stepper	Power output	Open drain
17	OUT27	Output low-side 27/ stepper	Power output	Open drain
20	OUT28	Output low-side 28 / stepper	Power output	Open drain

Note: *OUT11 and OUT12 are not valid.*

All the powers GND are connected to the package slug, so it is mandatory to connect the slug to GND.



GAPGPS01985

Figure 3. Application schematic

4 Application schematic

5 Absolute maximum ratings

Warning: Maximum ratings are absolute ratings: exceeding any of these values may cause permanent damage to the integrated circuit

Table 3. Absolute maximum ratings

Pin	Parameter	Condition	Value	Unit
VB	DC supply battery power voltage (Vb)	Also without external components	-0.3 to +40	V
V3V3	DC logic supply voltage	-	-0.3 to VDD5, when V3V3 = VDD5 = max+19V	V
VTRK1,2	DC sensors supply voltage	-	-2 to +40	V
VDD_G	-	-	-0.3 to VDD5, when VDDG = VDD5 = max+19	V
VDD5	Voltage pin	-	-0.3 to 19	V
CP	-	-	-0.3 to 40 Max ABS = +40 V when VB = 40 V	V
KEY_ON	-	Protected with external component (R = 1 kΩ plus a diode, refer to Figure 4) for negative pulse (isopulse 1)	-1.2 to +40	V
RST	-	-	-0.3 to +19	V
VRSP	-	Max current to be limited with external resistors (see Section 6.16.3: Application circuits on page 106)	-20 to +20	mA
VRSM	-	Max current to be limited with external resistors (see Section 6.16.3: Application circuits on page 106)	-20 to +20	mA
MRD	-	-	-0.3 to +40	V
OUT1-5	Low-side output	-	-1 to +53	V
OUT6-7	Low-side output	-	-1 to +40	V
OUT8-9	-	-	-0.3 to 40	V
VDD_IO	DC logic output supply voltage	-	-0.3 to 19	V
DRAIN8-9	-	-	-1 to 60	V
WDA_INT	-	-	-0.3 to 19	V

Table 3. Absolute maximum ratings (continued)

Pin	Parameter	Condition	Value	Unit
OUT13-18	Low-side output	-	-1 to +40	V
OUT19-20	Low-side output	-	-1 to +40	
IGNx	-	-	-1 to 19	V
OUT21, 23, 25, 26	High-side output	With external diode vs ground for negative voltage	-1.0 to VB (-2.0 dynamically for a short time)	V
OUT22, 24, 27, 28	Low-side output	-	-1 to 41	V
DIP,DIN	-	-	-0.3 to +19	V
DO, CAN_RX,K_RX, OUT_VRS	-	-	-0.3 to VDD_IO, when DO = VDD_IO = max+19V	V
EN	-	-	-0.3 to +19	V
CLP,CLN	-	-	-0.3 to +19	V
CAN_TX	-	-	-0.3 to +19	V
CAN_H, CAN_L	-	-	-18 to 40 ⁽¹⁾	V
K_TX	-	-	-0.3 to +19	V
K_LINE	-	-	-18 to 40	V

1. In case of negative voltage is applied on CAN_H or CAN_L the voltage slew rate must be <10 V/μs.

5.1 ESD protection

Table 4. ESD protection

Item	Condition	Min	Max	Unit
All pins	Electro static discharge voltage "Charged-device-model – CDM" all pin ⁽¹⁾	-500	+500	V
All pins	Electro static discharge voltage "Charged-device-model – CDM" corner pin (1,20,21,32,33,52,53,64)	-750	+750	V
All pins	ESD voltage HBM respect to GND	-1.5	+1.5	KV
Pins to connector ⁽²⁾	ESD voltage HBM respect to GND	-4	+4	KV

1. All pins are OK at ±500 V except VTRK1, VTRK2, VB, CP, HIGHSIDE21-23-25-26. [1, 9, 10, 12, 14, 15, 18 e 19]. Pins 1, 9, 10, 12, 14, 15, 18 e 19 passed ±350 V

2. Pins to connector are: LSa, LSb, LSc, LSd, DRAIN1-3, IGNx,VTRK1-2, CAN_H, CAN_L, K_LINE, OUT22, 24, 27, 28. (60, 61, 24, 25, 28, 29, 30, 31, 32, 39, 40, 54, 55, 56, 57, 22, 62, 63, 64, 9, 10, 42, 41, 45, 13, 16, 17, 20, 33, 35).

Test circuit according to HBM (EIA/JESD22-A114-B) and CDM (EIA/JESD22-C101-C).

5.2 Latch-up test

According to JEDEC 78 class 2 level A.

5.3 Temperature ranges and thermal data

Table 5. Temperature ranges and thermal data

Symbol	Parameter	Min	Max	Unit
T _{amb}	Operating temperature	-40	125	°C
T _j	Continuative operative junction temperature	-40	150	°C
T _{stg}	Storage temperature	-40	150	°C
R _{thj-case}	Thermal resistance junction-to-case	-	1	°C/W
R _{thj-amb}	Thermal resistance junction-to-ambient ⁽¹⁾	-	16	°C/W
T _s	Lead temperature during soldering (for a time = 10 s max)	-	260	°C

1. With 2S2P+vias PCB.

5.4 Operating range

Table 6. Operating range

Pins symbol	Battery voltage range	Junction temperature condition	Note
VB	4.15 V < Vb < 6 V	-40 < Tj < 40	Low battery
	6 V < Vb = 18 V	-40 < Tj < 150	Normal battery
	18 V < Vb = 28 V	-40 < Tj < 40	High battery
	28 < Vb = 40 V, t _{rise} = 10ms, T _{pulse} = 400 ms.	-40 < Tj < 40	Load dump

5.4.1 Low battery

All the functions are guaranteed with degraded parameters. The voltage regulators follow VB in RDSon mode with drop-out depending on load current. V3V3 regulator works as expected assuming VDD5 > 4 V.

5.4.2 Normal battery

All the functions and the parameters are guaranteed by testing coverage.

5.4.3 High battery

All the functions are guaranteed with degraded parameters.

5.4.4 Load dump

The device is switched-off if load dump exceeds battery overvoltage threshold for a time longer than filter time.

6 Functional description

6.1 Ignition switch, main relay, battery pin

The system has an ignition switch pin KEY_ON and a pin VB for battery behind the main relay connected at pin MRD.

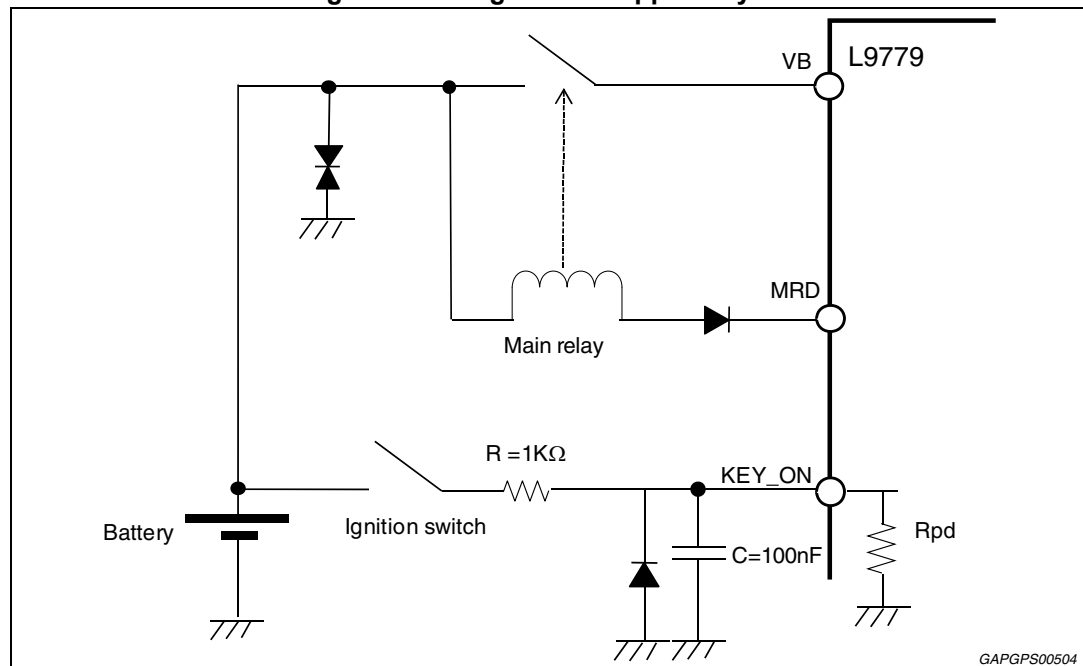
L9779WD can also support the configuration where it is permanently supplied by VB; in this case the MRD output can be used to connect the loads to VB.

At pin KEY_ON there is an external diode for reverse battery protection. An internal Pull-down resistor is provided on the KEY_ON pin. The external components to be connected to KEY pin are shown in the below schematic.

Internal functions and regulators are supplied by VB; only some basic functions required for startup are supplied from KEY_ON as described below. Reverse protection for pin VB is done by the main relay. Transient negative voltage at VB may be limited by an external diode if necessary. There is no integrated reverse protection at pin VB.

The pin connected to the battery line can bear the ISO 7637/1 noise pulses without any damage. The VB voltage must be externally limited to +40 V and -0.3 V (with external components as in [Figure 4](#)). It is suggested the use of a transil.

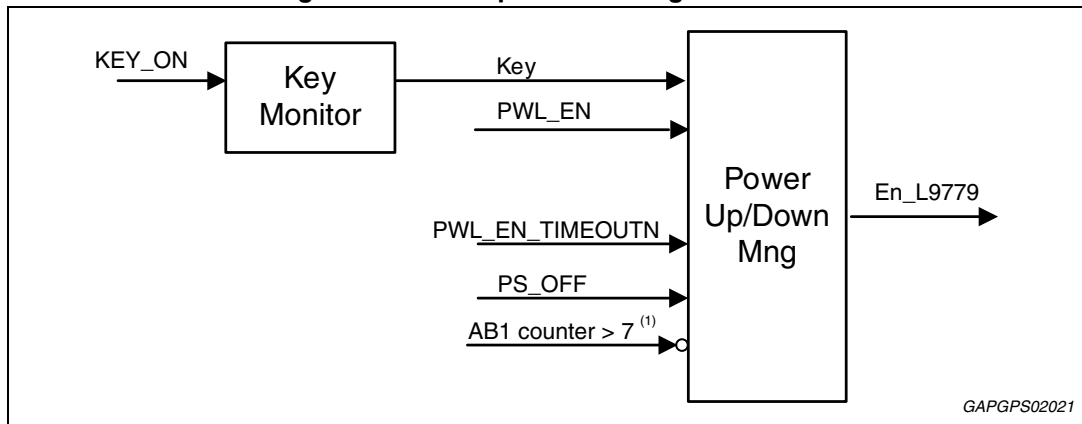
Figure 4. Configuration supplied by VB



1. The external components connected to KEY_ON pin are mandatory in order to protect the device from ISO 7637 pulses.

6.2 Power-up/down management unit

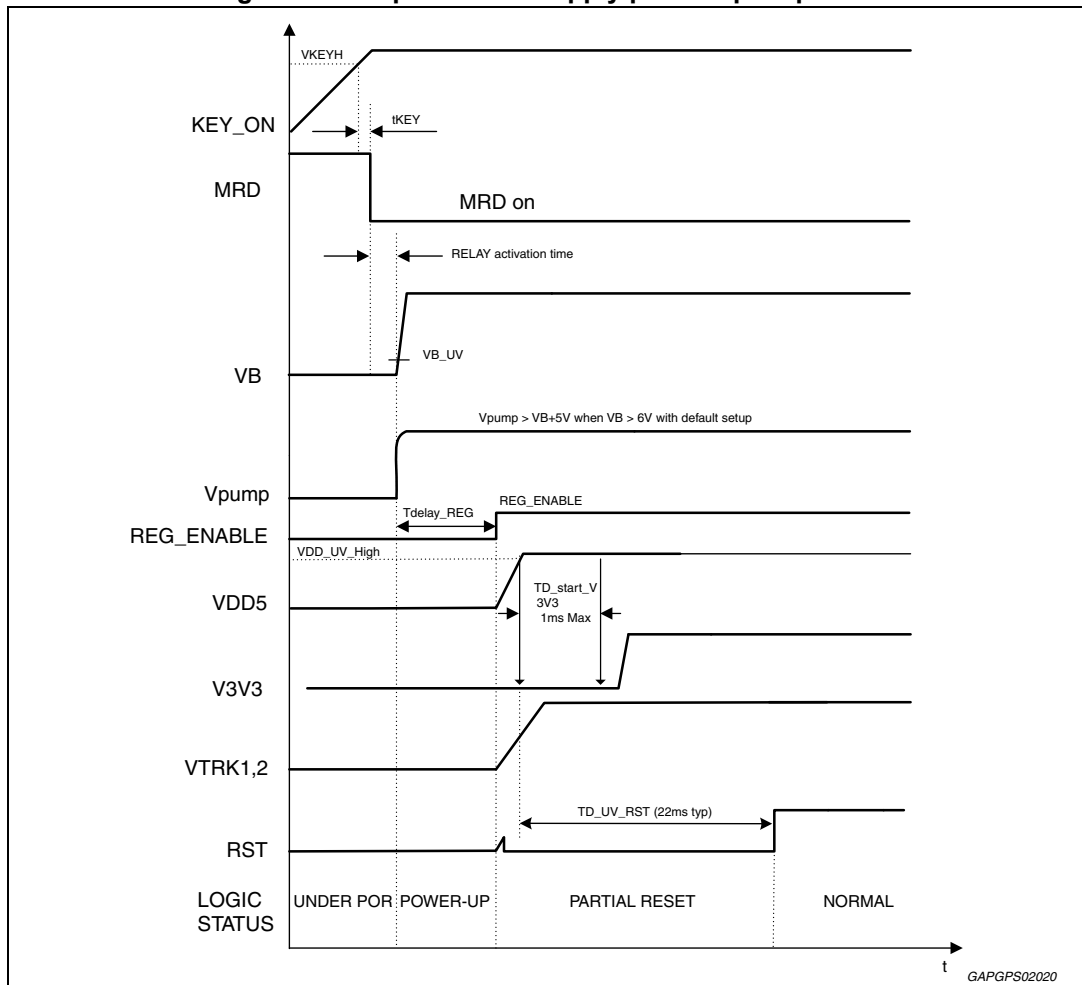
Figure 5. Power-up/down management unit



1. AB1 counter function defined at WDA [Section 6.17.1](#).

6.2.1 Power-up sequence

Figure 6. Non-permanent supply power-up sequence



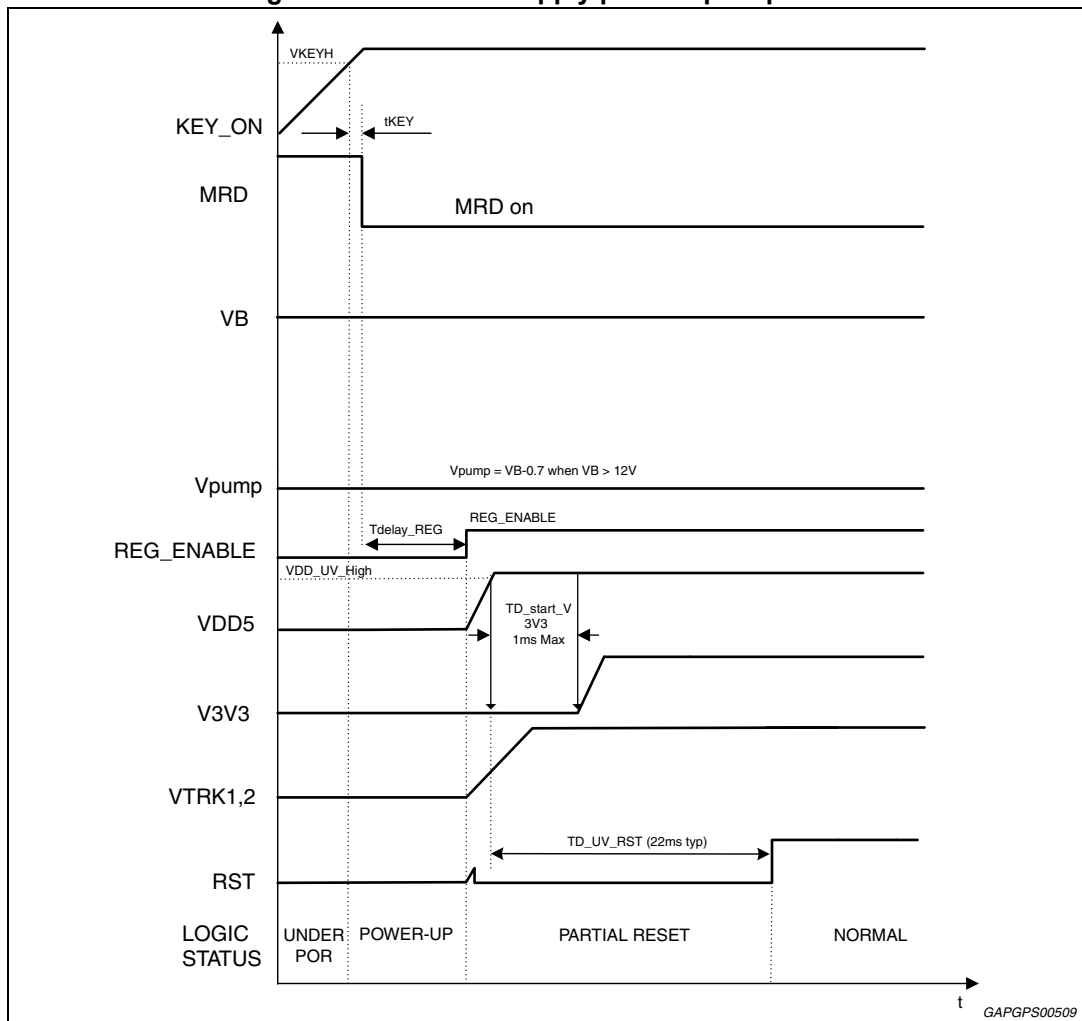
When the KEY_ON reaches a sufficient high voltage VKEYH, after a minimum deglitch filter time T_KEY the system is switched on. First of all the main relay driver is switched on, so the main relay connects VB pin to battery.

Control current into pin KEY_ON is sufficient for basic functions such as filtering time, control the main relay output stage, internal oscillator and internal bias currents.

When the voltage at VB exceeds the under voltage-detection threshold for VB (VB_UV_H) the internal biasing circuits are activated.

VDD5 regulator is activated Tdelay_REG seconds later. After VDD5 exceeds the VDD_UV threshold and with typ. 1.0 ms delay, the V3V3 is activated also. The sensor supplies VTRK1, 2 are turned on together with VDD5.

Figure 7. Permanent supply power-up sequence



In case VB is always connected, when the KEY_ON voltage exceeds VKEYH the internal biasing circuits are activated.

VDD5 regulator is activated Tdelay_REG seconds after the tKEY filter time has expired.

VDD5 regulator is activated $T_{\text{delay_REG}}$ seconds later. After VDD5 exceeds the VDD_UV threshold and with typ. 1.0 ms delay, the V3V3 is activated also. The sensor supplies VTRK1, 2 are turned on together with VDD5.

6.2.2 Power-down sequence

The system is switched off according to the status of KEY_ON, VB and power latch mode bit PWL_EN_N set by the μC , according to:

$$\text{En_L9779} = [(\text{!PWL_EN_N AND PWL_EN_TIMEOUTN}) \text{ OR KEY_ON}] \text{ AND VB_UVN.}$$

The KEY_ON is the status of KEY_ON pin after deglitch filter time.

En_L9779 represents the enable signals used by different blocks.

The system will be switched off after a minimum deglitch filter time if the voltage at pin KEY_ON is below VKEYL and if power latch mode is not active i.e. PWL_EN_N=1.

Otherwise, if the power latch mode is active PWL_EN_N=0, nothing happens until the power latch mode has finished by the μC writing PWL_EN_N=1.

However L9779WD will wait for a maximum time-out time PWL_TIMEOUT for PWL_EN_N de-assertion after which the system will be forced to switch off. PWL_TIMEOUT can be enabled and configured by 3 bit PWL_TIMEOUT_CONF.

For TNL description see Smart reset circuit description.

The status of KEY_ON can be read through the bit KEY_ON_STATUS. After t_{KEY} filter time the status of KEY_ON can be read through the bit KEY_ON_FLT also.

All the supply outputs shall be switched-off simultaneously. If the supplied devices have particular sequencing requirements, external diodes or clamping devices will be used.

During power down, whether the regulators are switched off at the same time as the main relay output or not is decided via the <PSOFF> bit.

- <PSOFF>='0' (default): simultaneous switching-off the regulators with the main-relay driver MRD
- <PSOFF>='1': regulators remain active when the main relay driver MRD will be switched off

With this function it is possible to detect a stuck main relay. If conditions to switch off are satisfied when <PSOFF>='1', the MRD is switched off while the voltage regulators continue to operate as long as no under voltage is detected at VB. The RST pin is not asserted till VDD_UV. The μC measures the time passed since shutdown. If a certain time is exceeded, then a stuck main relay is detected and this fault is stored in the μC (not in the L9779WD). After this the μC turns off the voltage regulators by setting the bit <PSOFF> to '0' (reset state). With a stuck main relay the voltage at pin VB remains present at battery level with a current consumption of I_{Leak} .

Secure Engine Off function is that the engine can be directly switched off by the key-switch via a hardware path and without the help or interference of software or μC .

Whenever the KEY_ON signal goes low the output stages mentioned in the following pages are disabled.

In no power latch/no SEO mode the key-switch has direct shut-off access to the injector stages (OUT1-4 in L9779) and to the starter relay drivers (OUT13 and OUT14).

An additional feature for the starter delay drivers is that the starters are only shut-off after the time delay THOLD if the SEO condition is still active. To satisfy the Secure Engine Switch off THOLD time, we need to activate the drivers OUT1-4 at least for 225 ms and the OUT 13/14 at least for 600 ms when the Key is ON, the Watch DOG Algorithm [Watchdog influence [Section 6.17.2](#)] is served and the PWL is enabled after the power on.

The KEY_ON, WDA and "OUT 13/ 14 Switch ON" events for 13 and 14 channels or the KEY_ON, WDA [Watchdog influence [Section 6.17.2](#)] and "OUT_1-4 Switch ON" events for 1 to 4 channels are "anded" by the internal SEO filter in order to guarantee the THOLD switch off time after the KEY OFF. Example: If the Key is not maintained in ON state for at least 225 ms for driver 1 to 4 and 600 ms for drivers 13/14, the SEO hold time will not be granted and the drivers are switched off immediately at next Key turn OFF. The same behaviour will happen if the WDA [Watchdog influence [Section 6.17.2](#)] is not served ($EC \geq 4$) for 225 ms and 600ms when Key is in ON state after the POWER ON.

The ignition stages are not affected by the SEO signal. This is different from the WDA signal which additionally switches off the ignition stages.

To avoid misunderstandings one must be aware that the SEO function has nothing to do with the WDA function and is not a part of the WDA module. The SEO function is related to the key switch, not to the WDA function. The SEO function adds an additional safety procedure for switching off.

Other functions than the injector stages and the starter relay drivers are not affected or influenced by the SEO signal.

With the falling edge of KEY_ON a timer is started which disables the mentioned power stages after 200 ms to 250 ms (typ. 225 ms). The timer is clocked by an internal oscillator. The timer does not depend on any μC clock or function. The μC still has control on switching on/off drivers during SEO time. This function is configured by CONFIG_REG6 register. After a SEO event, KEY should be stay ON for at least 600ms so to allow a further SEO event delay.