8.5 Programming

8.5.1 PMBus Command Support

The device features an SMBus interface that allows the use of PMBus commands to set warn levels, error masks, and get telemetry on V_{IN}, V_{OUT}, I_{IN}, V_{AUX}, and P_{IN}. The supported PMBus commands are shown in Table 2.

Table 2. Supported PMBus Commands

CODE	NAME	FUNCTION	R/W	NUMBER OF DATA BYTES	DEFAULT VALUE
01h	OPERATION	Retrieves or stores the operation status	R/W	1	80h
03h	CLEAR_FAULTS	Clears the status registers and re-arms the black box registers for updating	Send byte	0	
19h	CAPABILITY	Retrieves the device capability	R	1	B0h
43h	VOUT_UV_WARN_LIMIT	Retrieves or stores output undervoltage warn limit threshold	R/W	2	0000h
4Fh	OT_FAULT_LIMIT	Retrieves or stores over temperature fault limit threshold	R/W	2	0FFFh (256°C)
51h	OT_WARN_LIMIT	Retrieves or stores over temperature warn limit threshold	R/W	2	0FFFh (256°C)
57h	VIN_OV_WARN_LIMIT	Retrieves or stores input overvoltage warn limit threshold	R/W	2	0FFFh
58h	VIN_UV_WARN_LIMIT	Retrieves or stores input undervoltage warn limit threshold	R/W	2	0000h
5Dh	IIN_OC_WARN_LIMIT	Retrieves or stores input current warn limit threshold (mirror at D3h)	R/W	2	0FFFh
78h	STATUS_BYTE	Retrieves information about the parts operating status	R	1	01h
79h	STATUS_WORD	Retrieves information about the parts operating status	R	2	0801h
7Ah	STATUS_VOUT	Retrieves information about output voltage status	R	1	00h
7Ch	STATUS_INPUT	Retrieves information about input status	R	1	10h
7Dh	STATUS_TEMPERATURE	Retrieves information about temperature status	R	1	00h
7Eh	STATUS_CML	Retrieves information about communications status	R	1	00h
7Fh	STATUS_OTHER	Retrieves other status information	R	1	00h
80h	STATUS_MFR_SPECIFIC	Retrieves information about circuit breaker and MOSFET shorted status	R	1	10h
86h	READ_EIN	Retrieves energy meter measurement	R	6	00h 00h 00h 00h 00h 00h
88h	READ_VIN	Retrieves input voltage measurement	R	2	0000h
89h	READ_IIN	Retrieves input current measurement (Mirrors at D1h)	R	2	0000h
8Bh	READ_VOUT	Retrieves output voltage measurement	R	2	0000h
8Dh	READ_TEMPERATURE_1	Retrieves temperature measurement	R	2	0190h
97h	READ_PIN	Retrieves averaged input power measurement (mirror at DFh).	R	2	0000h
99h	MFR_ID	Retrieves manufacturer ID in ASCII characters (TI)	R	3	54h 49h 0h
9Ah	MFR_MODEL	Retrieves part number in ASCII characters. (LM5066I)	R	8	4Ch 4Dh 35h 30h 36h 36h 49h 0h
9Bh	MFR_REVISION	Retrieves part revision letter or number in ASCII (for example, AA)	R	2	41h 41h
D0h	MFR_SPECIFIC_00 READ_VAUX	Retrieves auxiliary voltage measurement	R	2	0000h
D1h	MFR_SPECIFIC_01 MFR_READ_IIN	Retrieves input current measurement (Mirror at 89h)	R	2	0000h
D2h	MFR_SPECIFIC_02 MFR_READ_PIN	Retrieves input power measurement	R	2	0000h
D3h	MFR_SPECIFIC_03 MFR_IIN_OC_WARN_LIMIT	Retrieves or stores input current limit warn threshold (Mirror at 5Dh)	R/W	2	0FFFh

Programming (continued)

Table 2. Supported PMBus Commands (continued)

CODE	NAME	FUNCTION	R/W	NUMBER OF DATA BYTES	DEFAULT VALUE
D4h	MFR_SPECIFIC_04 MFR_PIN_OP_WARN_LIMIT	Retrieves or stores input power limit warn threshold	R/W	2	0FFFh
D5h	MFR_SPECIFIC_05 READ_PIN_PEAK	Retrieves measured peak input power measurement	R	2	0000h
D6h	MFR_SPECIFIC_06 CLEAR_PIN_PEAK	Resets the contents of the peak input power register to 0	Send byte	0	
D7h	MFR_SPECIFIC_07 GATE_MASK	Allows the user to disable MOSFET gate shutdown for various fault conditions	R/W	1	0000h
D8h	MFR_SPECIFIC_08 ALERT_MASK	Retrieves or stores user $\overline{\text{SMBA}}$ fault mask	R/W	2	FD04h
D9h	MFR_SPECIFIC_09 DEVICE_SETUP	Retrieves or stores information about number of retry attempts	R/W	1	0000h
DAh	MFR_SPECIFIC_10 BLOCK_READ	Retrieves most recent diagnostic and telemetry information in a single transaction	R	12	0880h 0000h 0000h 0000h 0000h 0000h
DBh	MFR_SPECIFIC_11 SAMPLES_FOR_AVG	Exponent value AVGN for number of samples to be averaged (N = 2^{AVGN}), range = 00h to 0Ch	R/W	1	08h
DCh	MFR_SPECIFIC_12 READ_AVG_VIN	Retrieves averaged input voltage measurement	R	2	0000h
DDh	MFR_SPECIFIC_13 READ_AVG_VOUT	Retrieves averaged output voltage measurement	R	2	0000h
DEh	MFR_SPECIFIC_14 READ_AVG_IIN	Retrieves averaged input current measurement	R	2	0000h
DFh	MFR_SPECIFIC_15 READ_AVG_PIN	Retrieves averaged input power measurement	R	2	0000h
E0h	MFR_SPECIFIC_16 BLACK_BOX_READ	Captures diagnostic and telemetry information, which are latched when the first $\overline{\text{SMBA}}$ event occurs after faults are cleared	R	12	0880h 0000h 0000h 0000h 0000h 0000h
E1h	MFR_SPECIFIC_17 DIAGNOSTIC_WORD_READ	Manufacturer-specific parallel of the STATUS_WORD to convey all FAULT/WARN data in a single transaction	R	2	0880h
E2h	MFR_SPECIFIC_18 AVG_BLOCK_READ	Retrieves most recent average telemetry and diagnostic information in a single transaction	R	12	0880h 0000h 0000h 0000h 0000h 0000h

8.5.2 Standard PMBus Commands

8.5.2.1 OPERATION (01h)

The OPERATION command is a standard PMBus command that controls the MOSFET switch. This command can be used to switch the MOSFET on and off under host control. It is also used to re-enable the MOSFET after a fault triggered shutdown. Writing an OFF command, followed by an ON command, clears all faults and re-enables the device. Writing only an ON after a fault-triggered shutdown does not clear the fault registers or re-enable the device. The OPERATION command is issued with the write byte protocol.

Table 3. Recognized OPERATION Command Values

VALUE	MEANING	DEFAULT
80h	Switch ON	80h
00h	Switch OFF	N/A

8.5.2.2 CLEAR_FAULTS (03h)

The CLEAR_FAULTS command is a standard PMBus command that resets all stored warning and fault flags and the SMBA signal. If a fault or warning condition still exists when the CLEAR_FAULTS command is issued, the SMBA signal may not clear or re-asserts almost immediately. Issuing a CLEAR_FAULTS command does not cause the MOSFET to switch back on in the event of a fault turnoff; that must be done by issuing an OPERATION command after the fault condition is cleared. This command uses the PMBus send byte protocol.

8.5.2.3 CAPABILITY (19h)

The CAPABILITY command is a standard PMBus command that returns information about the PMBus functions supported by the LM5066I. This command is read with the PMBus read byte protocol.

Table 4. CAPABILITY Register

VALUE	MEANING	DEFAULT
B0h	Supports packet error check, 400 Kb/s, supports SMBus alert	B0h

8.5.2.4 VOUT_UV_WARN_LIMIT (43h)

The VOUT_UV_WARN_LIMIT command is a standard PMBus command that allows configuring or reading the threshold for the VOUT undervoltage warning detection. Reading and writing to this register should use the coefficients shown in Table 47. Accesses to this command should use the PMBus read or write word protocol. If the measured value of VOUT falls below the value in this register, VOUT UV warn flags are set and the SMBA signal is asserted.

Table 5. VOUT_UV_WARN_LIMIT Register

VALUE	MEANING	DEFAULT
0001h to 0FFFh	VOUT undervoltage warning detection threshold	0000h (disabled)
0000h	VOUT undervoltage warning disabled	N/A

8.5.2.5 OT_FAULT_LIMIT (4Fh)

The OT_FAULT_LIMIT command is a standard PMBus command that allows configuring or reading the threshold for the overtemperature fault detection. Reading and writing to this register should use the coefficients shown in Table 47. Accesses to this command should use the PMBus read or write word protocol. If the measured temperature exceeds this value, an overtemperature fault is triggered and the MOSFET is switched off, OT FAULT flags set, and the SMBA signal asserted. After the measured temperature falls below the value in this register, the MOSFET may be switched back on with the OPERATION command. A single temperature measurement is an average of 16 round-robin cycles; therefore, the minimum temperature fault detection time is 16 ms.

Table 6. OT_FAULT_LIMIT Register

VALUE	MEANING	DEFAULT
0000h to 0FFEh	Over-temperature fault threshold value	0FFFh (256°C)
0FFFh	Over-temperature fault detection disabled	N/A

8.5.2.6 OT_WARN_LIMIT (51h)

The OT_WARN_LIMIT command is a standard PMBus command that allows configuring or reading the threshold for the over-temperature warning detection. Reading and writing to this register should use the coefficients shown in Table 47. Accesses to this command should use the PMBus read or write word protocol. If the measured temperature exceeds this value, an over-temperature warning is triggered and the OT WARN flags set in the respective registers and the SMBA signal asserted. A single temperature measurement is an average of 16 round-robin cycles; therefore, the minimum temperature warn detection time is 16 ms.

Table 7. OT_WARN_LIMIT Register

VALUE	MEANING	DEFAULT
0000h to 0FFEh	Over-temperature warn threshold value	0FFFh (256°C)
0FFFh	Over-temperature warn detection disabled	N/A

8.5.2.7 VIN_OV_WARN_LIMIT (57h)

The VIN_OV_WARN_LIMIT command is a standard PMBus command that allows configuring or reading the threshold for the VIN overvoltage warning detection. Reading and writing to this register should use the coefficients shown in Table 47. Accesses to this command should use the PMBus read or write word protocol. If the measured value of VIN rises above the value in this register, VIN OV warn flags are set in the respective registers and the SMBA signal is asserted.

Table 8. VIN_OV_WARN_LIMIT Register

VALUE	MEANING	DEFAULT
0h to 0FFEh	VIN overvoltage warning detection threshold	0FFFh (disabled)
0FFFh	VIN overvoltage warning disabled	N/A

8.5.2.8 VIN_UV_WARN_LIMIT (58h)

The VIN_UV_WARN_LIMIT command is a standard PMBus command that allows configuring or reading the threshold for the VIN undervoltage warning detection. Reading and writing to this register should use the coefficients shown in Table 47. Accesses to this command should use the PMBus read or write word protocol. If the measured value of VIN falls below the value in this register, VIN UV warn flags are set in the respective register, and the SMBA signal is asserted.

Table 9. VIN_UV_WARN_LIMIT Register

VALUE	MEANING	DEFAULT
1h to 0FFFh	VIN undervoltage warning detection threshold	0000h (disabled)
0000h	VIN undervoltage warning disabled	N/A

8.5.2.9 STATUS_BYTE (78h)

The STATUS BYTE is a standard PMBus command that returns the value of a number of flags indicating the state of the LM5066I. Accesses to this command should use the PMBus read byte protocol. To clear bits in this register, the underlying fault should be removed on the system and a CLEAR_FAULTS command issued.

Table 10. STATUS_BYTE Definitions

BIT	NAME	MEANING	DEFAULT
7	BUSY	Not supported, always 0	0
6	OFF	This bit is asserted if the MOSFET is not switched on for any reason.	0
5	VOUT OV	Not supported, always 0	0
4	IOUT OC	Not supported, always 0	0
3	VIN UV fault	A VIN undervoltage fault has occurred	0
2	TEMPERATURE	A temperature fault or warning has occurred	0
1	CML	A communication fault has occurred	0
0	None of the above	A fault or warning not listed in bits [7:1] has occurred	1

8.5.2.10 STATUS_WORD (79h)

The STATUS_WORD command is a standard PMBus command that returns the value of a number of flags indicating the state of the LM5066I. Accesses to this command should use the PMBus read word protocol. To clear bits in this register, the underlying fault should be removed and a CLEAR _FAULTS command issued. The INPUT and VIN UV flags default to 1 on startup; however, they are cleared to 0 after the first time the input voltage exceeds the resistor-programmed UVLO threshold.

Table 11. STATUS_WORD Definitions

BIT	NAME	MEANING	DEFAULT
15	VOUT	An output voltage fault or warning has occurred	0
14	IOUT/POUT	Not supported, always 0	0
13	INPUT	An input voltage or current fault has occurred	0
12	FET FAIL	FET is shorted	0
11	$\overline{\text{POWER GOOD}}$	The Power Good signal has been negated	1
10	FANS	Not supported, always 0	0
9	CB_Fault	Circuit breaker fault triggered	0
8	UNKNOWN	Not supported, always 0	0
7	BUSY	Not supported, always 0	0
6	OFF	This bit is asserted if the MOSFET is not switched on for any reason.	0
5	VOUT OV	Not supported, always 0	0
4	IOUT OC	Not supported, always 0	0
3	VIN UV	A VIN undervoltage fault has occurred	0
2	TEMPERATURE	A temperature fault or warning has occurred	0
1	CML	A communication fault has occurred	0
0	None of the above	A fault or warning not listed in bits [7:1] has occurred	1

8.5.2.11 STATUS_VOUT (7Ah)

The STATUS_VOUT command is a standard PMBus command that returns the value of the VOUT UV warn flag. Accesses to this command should use the PMBus read byte protocol. To clear bits in this register, the underlying fault should be cleared and a CLEAR_FAULTS command issued.

Table 12. STATUS_VOUT Definitions

BIT	NAME	MEANING	DEFAULT
7	VOUT OV fault	Not supported, always 0	0
6	VOUT OV warn	Not supported, always 0	0
5	VOUT UV warn	A VOUT undervoltage warning has occurred	0
4	VOUT UV fault	Not supported, always 0	0
3	VOUT max	Not supported, always 0	0
2	TON max fault	Not supported, always 0	0
1	TOFF max fault	Not supported, always 0	0
0	VOUT tracking error	Not supported, always 0	0

8.5.2.12 STATUS_INPUT (7Ch)

The STATUS_INPUT command is a standard PMBus command that returns the value of a number of flags related to input voltage, current, and power. Accesses to this command should use the PMBus read byte protocol. To clear bits in this register, the underlying fault should be cleared and a CLEAR_FAULTS command issued. The VIN UV warn flag defaults to 1 on startup; however, it is cleared to 0 after the first time the input voltage increases above the resistor-programmed UVLO threshold.

Table 13. STATUS_INPUT Definitions

BIT	NAME	MEANING	DEFAULT
7	VIN OV fault	A VIN overvoltage fault has occurred	0
6	VIN OV warn	A VIN overvoltage warning has occurred	0
5	VIN UV warn	A VIN undervoltage warning has occurred	1
4	VIN UV fault	A VIN undervoltage fault has occurred	0
3	Insufficient voltage	Not supported, always 0	0
2	IIN OC fault	An IIN overcurrent fault has occurred	0
1	IIN OC warn	An IIN overcurrent warning has occurred	0
0	PIN OP warn	A PIN overpower warning has occurred	0

8.5.2.13 STATUS_TEMPERATURE (7dh)

The STATUS_TEMPERATURE is a standard PMBus command that returns the value of the of a number of flags related to the temperature telemetry value. Accesses to this command should use the PMBus read byte protocol. To clear bits in this register, the underlying fault should be cleared and a CLEAR_FAULTS command issued.

Table 14. STATUS_TEMPERATURE Definitions

BIT	NAME	MEANING	DEFAULT
7	Overtemp fault	An overtemperature fault has occurred	0
6	Overtemp warn	An overtemperature warning has occurred	0
5	Undertemp warn	Not supported, always 0	0
4	Undertemp fault	Not supported, always 0	0
3	Reserved	Not supported, always 0	0
2	Reserved	Not supported, always 0	0
1	Reserved	Not supported, always 0	0
0	Reserved	Not supported, always 0	0

8.5.2.14 STATUS_CML (7Eh)

The STATUS_CML is a standard PMBus command that returns the value of a number of flags related to communication faults. Accesses to this command should use the PMBus read byte protocol. To clear bits in this register, a CLEAR_FAULTS command should be issued.

Table 15. STATUS_CML Definitions

BIT	NAME	DEFAULT
7	Invalid or unsupported command received	0
6	Invalid or unsupported data received	0
5	Packet error check failed	0
4	Not supported, always 0	0
3	Not supported, always 0	0
2	Reserved, always 0	0
1	Miscellaneous communications fault has occurred	0
0	Not supported, always 0	0

8.5.2.15 STATUS_OTHER (7Fh)

Table 16. STATUS_OTHER Definitions

BIT	NAME	DEFAULT
7	Reserved: Always 0	0
6	Reserved: Always 0	0
5	CB Fault	0

Table 16. STATUS_OTHER Definitions (continued)

BIT	NAME	DEFAULT
4	Not supported, always 0	0
3	Not supported, always 0	0
2	Not supported, always 0	0
1	Not supported, always 0	0
0	Not supported, always 0	0

8.5.2.16 STATUS_MFR_SPECIFIC (80h)

The STATUS_MFR_SPECIFIC command is a standard PMBus command that contains manufacturer specific status information. Accesses to this command should use the PMBus read byte protocol. To clear bits in this register, the underlying fault should be removed and a CLEAR_FAULTS command should be issued.

Table 17. STATUS_MFR_SPECIFIC Definitions

BIT	MEANING	DEFAULT
7	Circuit breaker fault	0
6	External MOSFET shorted fault	0
5	Not supported, always 0	0
4	Defaults loaded	1
3	Not supported, always 0	0
2	Not supported, always 0	0
1	Not supported, always 0	0
0	Not supported, always 0	0

8.5.2.17 READ_EIN (86h)

The READ_EIN command is a standard PMBus command that returns information the host can use to calculate average input power consumption. Accesses to this command should use the PMBus block read protocol. The information provided by this command is independent of any device-specific averaging period. Six data bytes are returned by this command. The first two bytes are the two's complement signed output of an accumulator that continuously sums samples of the instantaneous input power. The accumulator value is the summation of the instantaneous power measurement. These two data bytes are formatted in the DIRECT format. The next data byte is a rollover count for the accumulator. This byte is an unsigned integer that indicates the number of times the accumulator has rolled over from its maximum positive unsigned integer (7FFFh) to 0. The last three data bytes are a 24-bit unsigned integer that counts the number of samples of the instantaneous input power. This value also rolls over periodically from its maximum positive value to 0. It is up to the host to keep track of the sample count and account for the rollovers.

The combination of the accumulator and the roller count may overflow after a period of several seconds. Similarly, the sample count value overflows, but this event only occurs once every few hours.

To convert the data obtained from two separate READ_EIN commands into average power, first convert the accumulator and rollover count to an unsigned integer (see Equation 1).

$$\text{Accumulator\_23} = (\text{rollover\_count} << 15) + \text{accumulator} \quad (1)$$

Note that the overflow of this variable needs to be monitored and properly accounted for. Data from the previous calculation, along with the sample count values from the corresponding register access, can be used to get the unscaled average power:

$$\frac{\text{Accumulator\_23 [n]} - \text{Accumulator\_23 [n} - 1]}{\text{Sample\_count [n]} - \text{Sample\_count [n} - 1]}$$

where

- Accumulator_23 [n] = Overflow corrected, 23-bit accumulator data from this read
- Sample_count [n] = Sample count data from this read
- Accumulator_23 [n – 1] = Overflow corrected, 23-bit accumulator data from previous read
- Sample_count [n – 1] = Sample count data from previous read

- Unscaled average power is now in the same units as the data from the READ_PIN command. Coefficients from Table 47 are used to convert the unscaled average power to Watts. (2)

Table 18. READ_EIN Definition

BYTE	MEANING	DEFAULT
0	Number of bytes	6
1	Power accumulator low byte	0
2	Power accumulator high byte	0
3	Power accumulator rollover count	0
4	Sample count low byte	0
5	Sample count mid byte	0
6	Sample count high byte	0

8.5.2.18 READ_VIN (88h)

The READ_VIN command is a0 standard PMBus command that returns the 12-bit measured value of the input voltage. Reading this register should use the coefficients shown in Table 47. Accesses to this command should use the P0MBus read word protocol. This value is also used internally for the VIN overvoltage and undervoltage warning detection.

Table 19. 0READ_VIN Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	Measured va0lue for VIN	0000h

8.5.2.19 READ_IIN (89h)

The READ_IIN command is a standard PMBus command that returns the 12-bit measured value of the input current. Reading this register should use the coefficients shown in Table 47. Accesses to this command should use the PMBus read word protocol. This value is also mirrored at (D1h).

Table 20. READ_IIN Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	Measured value for IIN	0000h

8.5.2.20 READ_VOUT (8Bh)

The READ_VOUT command is a standard PMBus command that returns the 12-bit measured value of the output voltage. Reading this register should use the coefficients shown in Table 47. Accesses to this command should use the PMBus read word protocol. This value is also used internally for the VOUT undervoltage warning detection.

Table 21. READ_VOUT Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	Measured value for VOUT	0000h

8.5.2.21 READ_TEMPERATURE_1 (8Dh)

The READ_TEMPERATURE_1 command is a standard PMBus command that returns the signed value of the temperature measured by the external temperature sense diode. Reading this register should use the coefficients shown in Table 47. Accesses to this command should use the PMBus read word protocol. This value is also used internally for the overtemperature fault and warning detection. This data has a range of –256°C to 255°C after the coefficients are applied.

Table 22. READ_TEMPERATURE_1 Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	Measured value for TEMPERATURE	0000h

8.5.2.22 READ_PIN (97h)

The READ_PIN command is a standard PMBus command that returns the 12-bit measured value of the input power. Reading this register should use the coefficients shown in Table 47. Accesses to this command should use the PMBus read word protocol. This value is also mirrored at (D5h).

Table 23. READ_PIN Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	Measured value for PIN	0000h

8.5.2.23 MFR_ID (99h)

The MFR_ID command is a standard PMBus command that returns the identification of the manufacturer. To read the MFR_ID, use the PMBus block read protocol.

Table 24. MFR_ID Register

BYTE	NAME	VALUE
0	Number of bytes	03h
1	MFR ID-1	54h ‘T’
2	MFR ID-2	29h ‘I’
3	MFR ID-3	00h

8.5.2.24 MFR_MODEL (9Ah)

The MFR_MODEL command is a standard PMBus command that returns the part number of the chip. To read the MFR_MODEL, use the PMBus block read protocol.

Table 25. MFR_MODEL Register

BYTE	NAME	VALUE
0	Number of bytes	08h
1	MFR ID-1	4Ch ‘L’
2	MFR ID-2	4Dh ‘M’
3	MFR ID-3	35h ‘5’
4	MFR ID-4	30h ‘0’
5	MFR ID-5	36h ‘6’
6	MFR ID-6	36h ‘6’
7	MFR ID-7	49h 'I'
8	MFR ID-8	00h

8.5.2.25 MFR_REVISION (9Bh)

The MFR_REVISION command is a standard PMBus command that returns the revision level of the part. To read the MFR_REVISION, use the PMBus block read protocol.

Table 26. MFR_REVISION Register

BYTE	NAME	VALUE
0	Number of bytes	02h
1	MFR ID-1	41h ‘A’
2	MFR ID-2	41h ‘A’

8.5.3 Manufacturer Specific PMBus Commands

8.5.3.1 MFR_SPECIFIC_00: READ_VAUX (D0h)

The READ_VAUX command reports the 12-bit ADC measured auxiliary voltage. Voltages greater than or equal to 2.97 V to ground are reported at plus full scale (0FFFh). Voltages less than or equal to 0 V referenced to ground are reported as 0 (0000h). To read data from the READ_VAUX command, use the PMBus read word protocol.

Table 27. READ_VAUX Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	Measured value for VAUX input	0000h

8.5.3.2 MFR_SPECIFIC_01: MFR_READ_IIN (D1h)

The MFR_READ_IIN command reports the 12-bit ADC measured current sense voltage. To read data from the MFR_READ_IIN command, use the PMBus read word protocol. Reading this register should use the coefficients shown in Table 47. See the section *Reading and Writing Telemetry Data and Warning Thresholds* to calculate the values to use.

Table 28. MFR_READ_IIN Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	Measured value for input current sense voltage	0000h

8.5.3.3 MFR_SPECIFIC_02: MFR_READ_PIN (D2h)

The MFR_READ_PIN command reports the upper 12 bits of the VIN × IIN product as measured by the 12-bit ADC. To read data from the MFR_READ_PIN command, use the PMBus read word protocol. Reading this register should use the coefficients shown in Table 47. See the section *Reading and Writing Telemetry Data and Warning Thresholds* to calculate the values to use.

Table 29. MFR_READ_PIN Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	VALUE for input current x input voltage	0000h

8.5.3.4 MFR_SPECIFIC_03: MFR_IN_OC_WARN_LIMIT (D3h)

The MFR_IIN_OC_WARN_LIMIT PMBus command sets the input overcurrent warning threshold. In the event that the input current rises above the value set in this register, the IIN overcurrent flags are set in the respective registers and the SMBA is asserted. To access the MFR_IIN_OC_WARN_LIMIT register, use the PMBus read/write word protocol. Reading and writing to this register should use the coefficients shown in Table 47.

Table 30. MFR_IIN_OC_WARN_LIMIT Register

VALUE	MEANING	DEFAULT
0000h to 0FFEh	Value for input overcurrent warn limit	0FFFh
0FFFh	Input overcurrent warning disabled	N/A

8.5.3.5 MFR_SPECIFIC_04: MFR_PIN_OP_WARN_LIMIT (D4h)

The MFR_PIN_OP_WARN_LIMIT PMBus command sets the input over-power warning threshold. In the event that the input power rises above the value set in this register, the PIN over-power flags are set in the respective registers and the SMBA is asserted. To access the MFR_PIN_OP_WARN_LIMIT register, use the PMBus read/write word protocol. Reading and writing to this register should use the coefficients shown in Table 47.

Table 31. MFR_PIN_OPWARN_LIMIT Register

VALUE	MEANING	DEFAULT
0000h to 0FFEh	Value for input over power warn limit	0FFFh

Table 31. MFR_PIN_OPWARN_LIMIT Register (continued)

VALUE	MEANING	DEFAULT
0FFFh	Input over power warning disabled	N/A

8.5.3.6 MFR_SPECIFIC_05: READ_PIN_PEAK (D5h)

The READ_PIN_PEAK command reports the maximum input power measured since a power-on reset or the last CLEAR_PIN_PEAK command. To access the READ_PIN_PEAK command, use the PMBus read word protocol. Use the coefficients shown in Table 47.

Table 32. READ_PIN_PEAK Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	Maximum value for input current × input voltage since reset or last clear	0000h

8.5.3.7 MFR_SPECIFIC_06: CLEAR_PIN_PEAK (D6h)

The CLEAR_PIN_PEAK command clears the PIN PEAK register. This command uses the PMBus send byte protocol.

8.5.3.8 MFR_SPECIFIC_07: GATE_MASK (D7h)

The GATE_MASK register allows the hardware to prevent fault conditions from switching off the MOSFET. When the bit is high, the corresponding FAULT has no control over the MOSFET gate. All status registers are still updated (STATUS, DIAGNOSTIC) and $\overline{\text{SMBA}}$ is still asserted. This register is accessed with the PMBus read/write byte protocol.

CAUTION

Inhibiting the MOSFET switch off in response to overcurrent or circuit breaker fault conditions will likely result in the destruction of the MOSFET. This functionality must be used with great care and supervision.

Table 33. MFR_SPECIFIC_07 Gate Mask Definitions

BIT	NAME	DEFAULT
7	Not used, always 0	0
6	Not used, always 0	0
5	VIN UV FAULT	0
4	VIN OV FAULT	0
3	IIN/PFET FAULT	0
2	OVERTEMP FAULT	0
1	Not used, always 0	0
0	CIRCUIT BREAKER FAULT	0

The IIN/PFET fault refers to the input current fault and the MOSFET power dissipation fault. There is no input power fault detection, only input power warning detection.

8.5.3.9 MFR_SPECIFIC_08: ALERT_MASK (D8h)

The ALERT_MASK command is used to mask the $\overline{\text{SMBA}}$ when a specific fault or warning has occurred. Each bit corresponds to one of the 14 different analog and digital faults or warnings that would normally result in an $\overline{\text{SMBA}}$ being asserted. When the corresponding bit is high, that condition does not cause the $\overline{\text{SMBA}}$ to be asserted. If that condition occurs, the registers where that condition is captured is still updated (STATUS registers, DIAGNOSTIC_WORD) and the external MOSFET gate control is still active (VIN_OV_FAULT, VIN_UV_FAULT, IIN/PFET_FAULT, CB_FAULT, OT_FAULT). This register is accessed with the PMBus read/write word protocol. The VIN UNDERVOLTAGE FAULT flag defaults to 1 on startup; however, it clears to 0 after the first time the input voltage increases above the resistor-programmed UVLO threshold.

Table 34. ALERT_MASK Definitions

BIT	NAME	DEFAULT
15	VOUT UNDERVOLTAGE WARN	1
14	IIN LIMIT warn	1
13	VIN UNDERVOLTAGE WARN	1
12	VIN OVERVOLTAGE WARN	1
11	$\overline{\text{POWER GOOD}}$	1
10	OVERTEMP WARN	1
9	Not used	0
8	OVERPOWER LIMIT WARN	1
7	Not used	0
6	EXT_MOSFET_SHORTED	0
5	VIN UNDERVOLTAGE FAULT	1
4	VIN OVERVOLTAGE FAULT	0
3	IIN/PFET FAULT	0
2	OVERTEMPERATURE FAULT	0
1	CML FAULT (communications fault)	0
0	CIRCUIT BREAKER FAULT	0

8.5.3.10 MFR_SPECIFIC_09: DEVICE_SETUP (D9h)

The DEVICE_SETUP command can be used to override pin settings to define operation of the LM5066I under host control. This command is accessed with the PMBus read/write byte protocol.

Table 35. DEVICE_SETUP Byte Format

BIT	NAME	MEANING
7:5	Retry setting	111 = Unlimited retries 110 = Retry 16 times 101 = Retry 8 times 100 = Retry 4 times 011 = Retry 2 times 010 = Retry 1 time 001 = No retries 000 = Pin configured retries
4	Current limit setting	0 = High setting (50 mV) 1 = Low setting (26 mV)
3	CB/CL ratio	0 = Low setting (1.9x) 1 = High setting (3.9x)
2	Current limit configuration	0 = Use pin settings 1 = Use SMBus settings
1	Unused	
0	Unused	

To configure the current limit setting with this register, it is necessary to set the current limit configuration bit (2) to 1 to enable the register to control the current limit function and the current limit setting bit (4) to select the desired setting. If the current limit configuration bit is not set, the pin setting is used. The circuit breaker to current limit ratio value is set by the CB / CL ratio bit (3). Note that if the current limit configuration is changed, the samples for the telemetry averaging function are not reset. TI recommends to allow a full averaging update period with the new current limit configuration before processing the averaged data.

Note that the current limit configuration affects the coefficients used for the current and power measurements and warning registers.

8.5.3.11 MFR_SPECIFIC_10: BLOCK_READ (DAh)

The BLOCK_READ command concatenates the DIAGNOSTIC_WORD with input and output telemetry information (IIN, VOUT, VIN, PIN) as well as TEMPERATURE to capture all of the operating information of the LM5066I in a single SMBus transaction. The block is 12-bytes long with telemetry information being sent out in the same manner as if an individual READ_XXX command had been issued (shown in Table 36). The contents of the block read register are updated every clock cycle (85 ns) as long as the SMBus interface is idle. BLOCK_READ also specifies that the VIN, VOUT, IIN and PIN measurements are all time-aligned. If separate commands are used, individual samples may not be time-aligned because of the delay necessary for the communication protocol.

The block read command is read through the PMBus block read protocol.

Table 36. BLOCK_READ Register Format

Byte Count (Always 12)	(1 Byte)
DIAGNOSTIC_WORD	(1 word)
IIN_BLOCK	(1 word)
VOUT_BLOCK	(1 word)
VIN_BLOCK	(1 word)
PIN_BLOCK	(1 word)
TEMP_BLOCK	(1 word)

8.5.3.12 MFR_SPECIFIC_11: SAMPLES_FOR_AVG (DBh)

The SAMPLES_FOR_AVG command is a manufacturer-specific command for setting the number of samples used in computing the average values for IIN, VIN, VOUT, and PIN. The decimal equivalent of the AVGN nibble is the power of 2 samples, (for example, AVGN = 12 equates to N = 4096 samples used in computing the average). The LM5066I supports average numbers of 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, and 4096. The SAMPLES_FOR_AVG number applies to average values of IIN, VIN, VOUT, and PIN simultaneously. The LM5066I uses simple averaging. This is accomplished by summing consecutive results up to the number programmed, then dividing by the number of samples. Averaging is calculated according to the following sequence:

$$Y = (X_{(N)} + X_{(N-1)} + ... + X_{(0)}) / N \quad (3)$$

When the averaging has reached the end of a sequence (for example, 4096 samples are averaged), then a whole new sequence begins that requires the same number of samples (in this example, 4096) to be taken before the new average is ready.

Table 37. SAMPLES_FOR_AVG Register

AVGN (b)	N = 2^{AVGN}	Averaging / Register Update Period (ms)
0000b	1	1
0001b	2	2
0010b	4	4
0011b	8	8
0100b	16	16
0101b	32	32
0110b	64	64
0111b	128	128
1000b	256	256
1001b	512	512
1010b	1024	1024
1011b	2048	2048
1100b	4096	4096

Note that a change in the SAMPLES_FOR_AVG register is not reflected in the average telemetry measurements until the present averaging interval has completed. The default setting for AVGN is 1000b, or 08h.

The SAMPLES_FOR_AVG register is accessed with the PMBus read/write byte protocol.

Table 38. SAMPLES_FOR_AVG Register

VALUE	MEANING	DEFAULT
00h to 0Ch	Exponent (AVGN) for number of samples to average over	00h

8.5.3.13 MFR_SPECIFIC_12: READ_AVG_VIN (DCh)

The READ_AVG_VIN command reports the 12-bit ADC measured input average voltage. If the data is not ready, the returned value is the previous averaged data. However, if there is no previously averaged data, the default value (0000h) is returned. This data is read with the PMBus read word protocol. This register should use the coefficients shown in Table 47.

Table 39. READ_AVG_VIN Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	Average of measured values for input voltage	0000h

8.5.3.14 MFR_SPECIFIC_13: READ_AVG_VOUT (DDh)

The READ_AVG_VOUT command reports the 12-bit ADC measured current sense average voltage. The returned value is the default value (0000h) or previous data when the average data is not ready. This data is read with the PMBus read word protocol. This register should use the coefficients shown in Table 47.

Table 40. READ_AVG_VOUT Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	Average of measured values for output voltage	0000h

8.5.3.15 MFR_SPECIFIC_14: READ_AVG_IIN (DEh)

The READ_AVG_IIN command reports the 12-bit ADC measured current sense average voltage. The returned value is the default value (0000h) or previous data when the average data is not ready. This data is read with the PMBus read word protocol. This register should use the coefficients shown in Table 47.

Table 41. READ_AVG_IIN Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	Average of measured values for current sense voltage	0000h

8.5.3.16 MFR_SPECIFIC_14: READ_AVG_PIN (DFh)

The READ_AVG_PIN command reports the 12-bit ADC measured VIN x IIN product. The returned value is the default value (0000h) or previous data when the average data is not ready. This data is read with the PMBus read word protocol. This register should use the coefficients shown in Table 47.

Table 42. READ_AVG_IIN Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	Average of measured values for current sense voltage	0000h

8.5.3.17 MFR_SPECIFIC_15: READ_AVG_PIN

The READ_AVG_PIN command reports the upper 12-bits of the average VIN × IIN product as measured by the 12-bit ADC. The user can read the default value (0000h) or previous data when the average data is not ready. This data is read with the PMBus read word protocol. This register should use the coefficients shown in Table 47.

Table 43. READ_AVG_PIN Register

VALUE	MEANING	DEFAULT
0000h to 0FFFh	Average of measured value for input voltage x input current sense voltage	0000h

8.5.3.18 MFR_SPECIFIC_16: BLACK_BOX_READ (E0h)

The BLACK BOX READ command retrieves the BLOCK READ data which was latched in at the first assertion of SMBA by the LM5066I. It is re-armed with the CLEAR_FAULTS command. It is the same format as the BLOCK_READ registers, the only difference is that its contents are updated with the SMBA edge rather than the internal clock edge. This command is read with the PMBus block read protocol.

8.5.3.19 MFR_SPECIFIC_17: READ_DIAGNOSTIC_WORD (E1h)

The READ_DIAGNOSTIC_WORD PMBus command reports all of the LM5066I faults and warnings in a single read operation. The standard response to the assertion of the SMBA signal of issuing multiple read requests to various status registers can be replaced by a single word read to the DIAGNOSTIC_WORD register. The READ_DIAGNOSTIC_WORD command should be read with the PMBus read word protocol. The READ_DIAGNOSTIC_WORD is also returned in the BLOCK_READ, BLACK_BOX_READ, and AVG_BLOCK_READ operations. Note that if UVLO is pulled low to shutt OFF the FET, the diagnostic word will return 08E0h.

Table 44. DIAGNOSTIC_WORD Format

BIT	MEANING	DEFAULT
15	VOUT_UNDERVOLTAGE_WARN	0
14	IIN_OP_WARN	0
13	VIN_UNDERVOLTAGE_WARN	0
12	VIN_OVERVOLTAGE_WARN	0
11	POWER GOOD	1
10	OVER_TEMPERATURE_WARN	0
9	TIMER_LATCHED_OFF	0
8	EXT_MOSFET_SHORTED	0
7	CONFIG_PRESET	1
6	DEVICE_OFF	0
5	VIN_UNDERVOLTAGE_FAULT	0
4	VIN_OVERVOLTAGE_FAULT	0
3	IIN_OC/PFET_OP_FAULT	0
2	OVER_TEMPERATURE_FAULT	0
1	CML_FAULT	0
0	CIRCUIT_BREAKER_FAULT	0

8.5.3.20 MFR_SPECIFIC_18: AVG_BLOCK_READ (E2h)

The AVG_BLOCK_READ command concatenates the DIAGNOSTIC_WORD with input and output average telemetry information (IIN, VOUT, VIN, and PIN) and temperature to capture all of the operating information of the part in a single PMBus transaction. The block is 12-bytes long with telemetry information sent out in the same manner as if an individual READ_AVG_XXX command had been issued (shown in Table 45). AVG_BLOCK_READ also specifies that the VIN, VOUT, and IIN measurements are all time-aligned whereas there is a chance they may not be if read with individual PMBus commands. To read data from the AVG_BLOCK_READ command, use the SMBus block read protocol.

Table 45. AVG_BLOCK_READ Register Format

Byte Count (Always 12)	(1 Byte)
DIAGNOSTIC_WORD	(1 word)
AVG_IIN	(1 word)
AVG_VOUT	(1 word)
AVG_VIN	(1 word)
AVG_PIN	(1 word)
TEMPERATURE	(1 word)

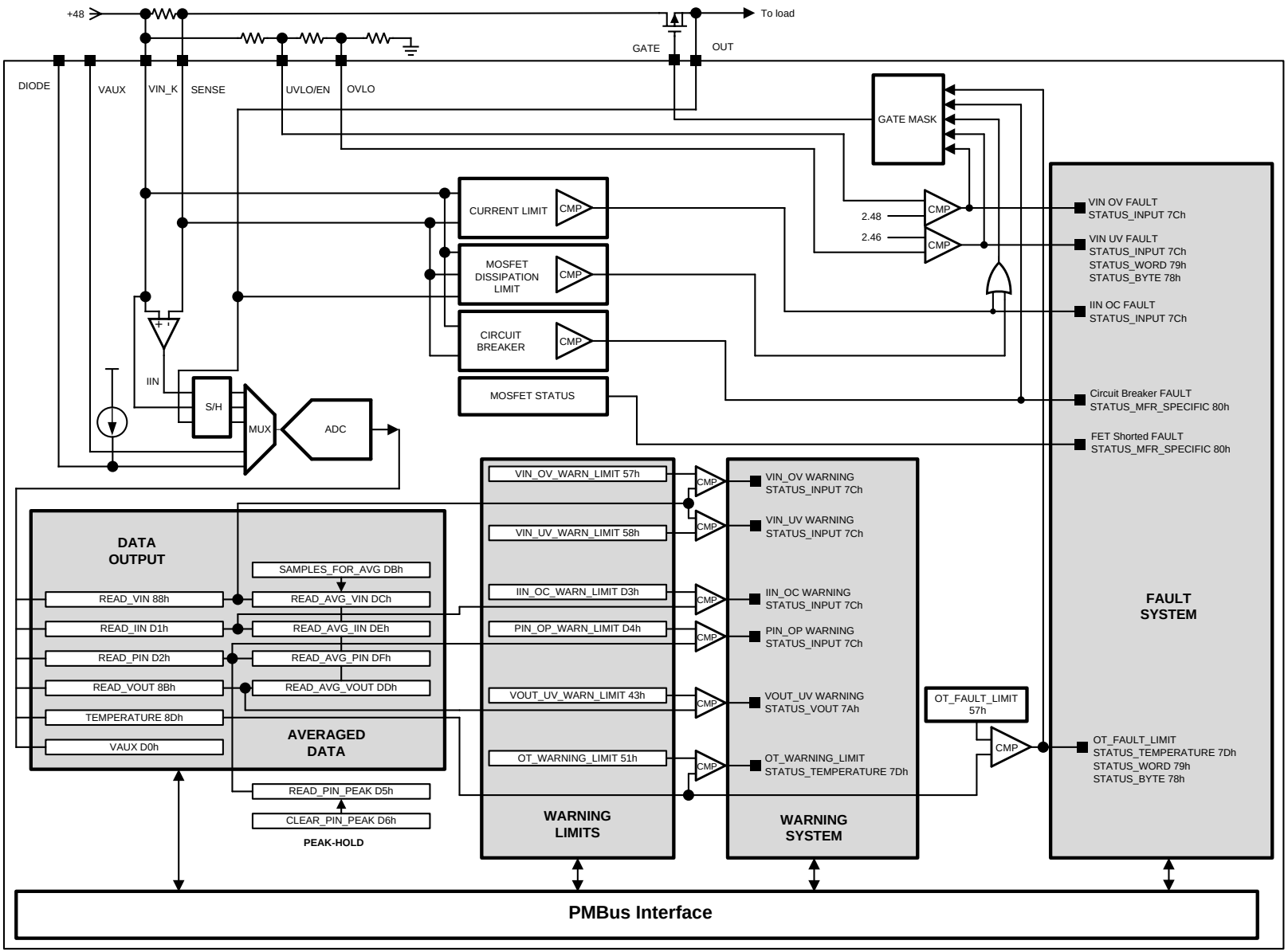

Figure 17. Command / Register and Alert Flow Diagram

8.5.4 Reading and Writing Telemetry Data and Warning Thresholds

All measured telemetry data and user-programmed warning thresholds are communicated in 12-bit two's complement binary numbers read or written in 2-byte increments conforming to the direct format as described in section 8.3.3 of the *PMBus Power System Management Protocol Specification 1.1* (Part II). The organization of the bits in the telemetry or warning word is shown in Table 46, where Bit_11 is the most significant bit (MSB) and Bit_0 is the least significant bit (LSB). The decimal equivalent of all warning and telemetry words are constrained to be within the range of 0 to 4095, with the exception of temperature. The decimal equivalent value of the temperature word ranges from 0 to 65535.

Table 46. Telemetry and Warning Word Format

Byte	B7	B6	B5	B4	B3	B2	B1	B0
1	Bit_7	Bit_6	Bit_5	Bit_4	Bit_3	Bit_2	Bit_1	Bit_0
2	0	0	0	0	Bit_11	Bit_10	Bit_9	Bit_8

Conversion from direct format to real-world dimensions of current, voltage, power, and temperature is accomplished by determining appropriate coefficients as described in section 7.2.1 of the *PMBus Power System Management Protocol Specification 1.1* (Part II). According to this specification, the host system converts the values received into a reading of volts, amperes, watts, or other units using the following relationship:

$$x = \frac{1}{m}\left(Y \times 10^{-R} - b\right) \quad (4)$$

where

- **X** = The calculated real-world value (volts, amps, watt, and so forth)
- **m** = The slope coefficient
- **Y** = A 2-byte two's complement integer received from device
- **b** = The offset, a 2-byte two's complement integer
- **R** = The exponent, a 1-byte two's complement integer

R is only necessary in systems where m is required to be an integer (for example, where m may be stored in a register in an integrated circuit). In those cases, R only needs to be large enough to yield the desired accuracy.

Table 47. Telemetry and Warning Conversion Coefficients

Commands	Condition	Format	Number of Data Bytes	m	b	R	Unit
READ_VIN, READ_AVG_VIN VIN_OV_WARN_LIMIT VIN_UV_WARN_LIMIT		DIRECT	2	4617	–140.0	–2	V
READ_VOUT, READ_AVG_VOUT VOUT_UV_WARN_LIMIT		DIRECT	2	4602	500.0	–2	V
READ_VAUX		DIRECT	2	13774	73.0	–1	V
READ_IIN, READ_AVG_IIN(1) MFR_IIN_OC_WARN_LIMIT	CL = VDD	DIRECT	2	15076	-503.9	–2	A
READ_IN, READ_AVG_IN(1) MFR_IIN_OC_WARN_LIMIT	CL = GND	DIRECT	2	7645	100	–2	A
READ_PIN, READ_AVG_PIN(1), READ_PIN_PEAK MFR_PIN_OP_WARN_LIMIT	CL = VDD	DIRECT	2	1701	–4000	–3	W
READ_PIN, READ_AVG_PIN(1), READ_PIN_PEAK MFR_PIN_OP_WARN_LIMIT	CL = GND	DIRECT	2	860.6	–965	–3	W
READ_TEMPERATURE_1 OT_WARN_LIMIT OT_FAULT_LIMIT		DIRECT	2	16000	0	–3	°C

(1) The coefficients relating to current/power measurements and warning thresholds shown are normalized to a sense resistor (R_S) value of 1 mΩ. In general, the current or power coefficients can be calculated using the relationships shown in Table 48.

Table 48. Current and Power Telemetry and Warning Conversion Coefficients (R_S in mΩ)

Commands	Condition	Format	Number of Data Bytes	m	b	R	Unit
READ_IIN, READ_AVG_IIN(1) MFR_IIN_OC_WARN_LIMIT	CL = VDD	DIRECT	2	15076 × R_S	–503.9	–2	A
READ_IIN, READ_AVG_IIN(1) MFR_IIN_OC_WARN_LIMIT	CL = GND	DIRECT	2	7645 × R_S	100.0	–2	A
READ_PIN, READ_AVG_PIN(1), READ_PIN_PEAK MFR_PIN_OP_WARN_LIMIT	CL = VDD	DIRECT	2	1701 × R_S	–4000	–3	W
READ_PIN, READ_AVG_PIN(1), READ_PIN_PEAK MFR_PIN_OP_WARN_LIMIT	CL = GND	DIRECT	2	860.6 × R_S	–965.0	–3	W

(1) The coefficients relating to current/power measurements and warning thresholds shown are normalized to a sense resistor (R_S) value of 1 mΩ. In general, the current or power coefficients can be calculated using the relationships shown in Table 48.

Take care to adjust the exponent coefficient, R, such that the value of m remains within the range of –32768 to 32767. For example, if a 5-mΩ sense resistor is used, the correct coefficients for the READ_IIN command with CL = VDD would be m = 7553, b = –65, R = –1.

8.5.5 Determining Telemetry Coefficients Empirically With Linear Fit

The coefficients for telemetry measurements and warning thresholds presented in Table 47 are adequate for the majority of applications. Current and power coefficients are dependent on R_{SNS} and must be calculated per application. Table 48 provides the equations necessary for calculating the current and power coefficients for the general case. These were obtained by characterizing multiple units over temperature and are considered optimal. The small signal nature of the current and power measurement makes it more susceptible to PCB parasitics than other telemetry channels. In addition there is some variation in R_{SNS} and the LM5066I itself. This may cause slight variations in the optimum coefficients (m, b, and R) for converting from digital values to real world values (for example, amps and watts). To maximize telemetry accuracy, the coefficients can be calibrated for a given board using empirical methods. This would determine optimum coefficients to cancel out the error from PCB parasitics, R_{SNS} variation, and the variation of LM5066I. It is not considered good practice to take measurements on one board and use the computed coefficients for all units in production, because the R_{SNS} and the LM5066I on a given board are randomly chosen and do not represent a statistical mean. It is recommended to either calibrate all boards individually or to use the recommended coefficients from Table 48.

The optimal current coefficients for a specific board can be determined using the following method:

1. While the LM5066I is in normal operation, measure the voltage across the sense resistor using Kelvin test points and a high accuracy DVM while controlling the load current. Record the integer value returned by the READ_AVG_IIN command (with the SAMPLES_FOR_AVG set to a value greater than 0) for two or more voltages across the sense resistor. For best results, the individual READ_AVG_IIN measurements should span nearly the full-scale range of the current (for example, voltage across R_{SNS} of 5 and 20 mV).
2. Convert the measured voltages to currents by dividing them by the value of R_{SNS}. For best accuracy, the value of R_{SNS} should be measured. Table 49 assumes a sense resistor value of 5 mΩ.

Table 49. Measurements for Linear Fit Determination of Current Coefficients

Measured Voltage Across R_S (V)	Measured Current (A)	READ_AVG_IIN (Integer Value)
0.005	1	568
0.01	2	1108
0.02	4	2185

3. Using the spreadsheet (or a math program) determine the slope and the y-intercept of the data returned by the READ_AVG_IIN command versus the measured current. For the data shown in Table 47:
   - READ_AVG_IN value = slope × (Measured Current) + (y-intercept)
   - Slope = 538.9
   - Y-intercept = 29.5
4. To determine the **m** coefficient, simply shift the decimal point of the calculated slope to arrive at integer with a suitable number of significant digits for accuracy (typically 4) while staying with the range of –32768 to 32767. This shift in the decimal point equates to the **R** coefficient. For the slope value shown in the previous

step, the decimal point would be shifted to the right once hence **R** = –1.

5. After the **R** coefficient has been determined, the **b** coefficient is found by multiplying the y-intercept by 10^{-R}. In this case the value of **b** = 295.
   - Calculated current coefficients:
   - **m** = 5389
   - **b** = 295
   - **R** = –1

$$x = \frac{1}{m}\left(Y \times 10^{-R} - b\right)$$

where

- **X =** The calculated real-world value (volts, amps, watts, temperature)
- **m** = The slope coefficient, is the 2-byte, two's complement integer
- **Y** = A 2-byte two's complement integer received from device
- **b** = The offset, a 2-byte two's complement integer
- **R** = The exponent, a 1-byte two's complement integer (5)

This procedure can be repeated to determine the coefficients of any telemetry channel simply by substituting measured current for some other parameter (for example, power or voltage).

8.5.6 Writing Telemetry Data

There are several locations that require writing data if their optional usage is desired. Use the same coefficients previously calculated for your application, and apply them using this method as prescribed by the PMBus revision section 7.2.2 *Sending a Value*

$$Y = \left(mX + b\right) \times 10^{R}$$

where

- **X** = The calculated real-world value (volts, amps, watts, temperature)
- **m** = The slope coefficient is the 2-byte, two's complement integer
- **Y** = A 2-byte two's complement integer received from device
- **b** = The offset, a 2-byte two's complement integer
- **R** = The exponent, a 1-byte two's complement integer (6)

8.5.7 PMBus Address Lines (ADR0, ADR1, ADR2)

The three address lines are to be set high (connect to VDD), low (connect to GND), or open to select one of 27 addresses for communicating with the LM5066I. Table 50 depicts 7-bit addresses (eighth bit is read/write bit).

Table 50. Device Addressing

ADR2	ADR1	ADR0	DECODED ADDRESS
Z	Z	Z	40h
Z	Z	0	41h
Z	Z	1	42h
Z	0	Z	43h
Z	0	0	44h
Z	0	1	45h
Z	1	Z	46h
Z	1	0	47h
Z	1	1	10h
0	Z	Z	11h
0	Z	0	12h
0	Z	1	13h
0	0	Z	14h

Table 50. Device Addressing (continued)

ADR2	ADR1	ADR0	DECODED ADDRESS
0	0	0	15h
0	0	1	16h
0	1	Z	17h
0	1	0	50h
0	1	1	51h
1	Z	Z	52h
1	Z	0	53h
1	Z	1	54h
1	0	Z	55h
1	0	0	56h
1	0	1	57h
1	1	Z	58h
1	1	0	59h
1	1	1	5Ah

8.5.8 $\overline{\text{SMBA}}$ Response

The $\overline{\text{SMBA}}$ effectively has two masks:

- The alert mask register at D8h
- The ARA automatic mask.

The ARA automatic mask is a mask that is set in response to a successful ARA read. An ARA read operation returns the PMBus address of the lowest addressed part on the bus that has its $\overline{\text{SMBA}}$ asserted. A successful ARA read means that this part was the one that returned its address. When a part responds to the ARA read, it releases the $\overline{\text{SMBA}}$ signal. When the last part on the bus that has an $\overline{\text{SMBA}}$ set has successfully reported its address, the $\overline{\text{SMBA}}$ signal de-asserts.

The way that the LM5066I releases the $\overline{\text{SMBA}}$ signal is by setting the ARA automatic mask bit for all fault conditions present at the time of the ARA read. All status registers will still the fault condition, but it does not generate a $\overline{\text{SMBA}}$ on that fault again until the ARA automatic mask is cleared by the host issuing a CLEAR_FAULTS command to this part. This should be done as a routine part of servicing an $\overline{\text{SMBA}}$ condition on a part, even if the ARA read is not done. Figure 18 depicts a schematic version of this flow.

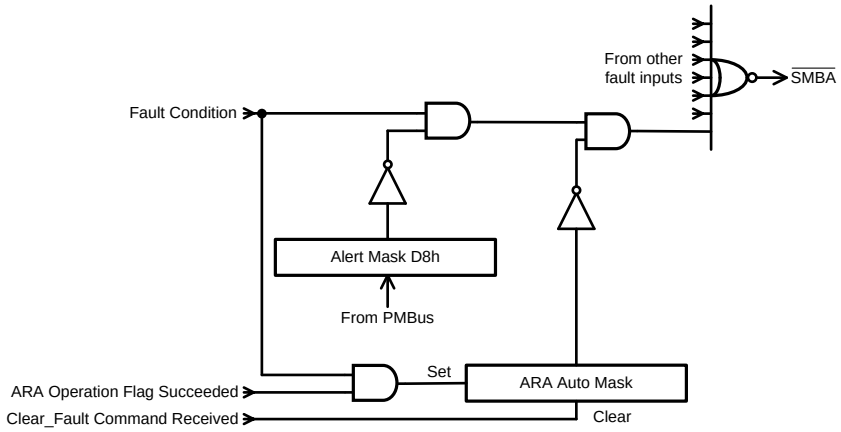

Figure 18. Typical Flow Schematic for $\overline{\text{SMBA}}$ Fault