Embedded systems course
Display specification

The device has an alphanumeric display with **18** lines. Each line can display **12** characters.

The display content is stored in an internal, 216 bytes long, buffer in which each byte is a representation of a single character on the screen.

The software set the device's buffer by supplying the device with a pointer to a buffer in memory which the device can copy using DMA to its internal buffer.

The rows are saved continuously in memory starting from the top row. For example, the first byte in the buffer represents the top-left character, the second byte represents the top-second-from-the-left byte, and the first left character of the second row will immediately follow the top-right character.

The display interface registers base address is **0x1F0**.

The following registers are supported:

Address	Symbol	Name
0x1F0	DBUF	Display data buffer register
0x1F1	DCMD	Display command register
0x1F2	DIER	Display interrupt enable register
0x1F3	DICR	Display interrupt cause register

DBUF - Display data buffer register

Bit	Type	Default Value	Description
31:0	RW	0	First address of a data buffer to be copied to the displayed internal buffer. The encoding of each byte in the buffer is as follows: Bits 0-6 – the character encoding is according to GSM 7 bit default alphabet. For the supported subset of the alphabet, see later in this document. Bit 7 – "Selected" bit – 0 if unselected, 1 if selected. When a character is selected its background and foreground colors will be inverted.

DCMD - Display command register

Bit	Type	Default Value	Description
31:1		0	Reserved
0	RWS	0	Software setting this bit to 1 starts the DMA-copy from the address supplied in DBUF to the display's internal buffer. This bit remains set until the DMA completes, and automatically cleared by the hardware. At the same time the display is refreshed to display the new data. Writing to this bit while it is already set has no effect.

DIER - Display interrupt enable register

Bit	Type	Default Value	Description
31:1		0	Reserved
0	RW	0	Enable DMA completion interrupt Setting this bit will cause the device to assert IRQ15 while bit 0 of DICR is set.

DICR - Display interrupt cause register

Bit	Type	Default Value	Description
31:1		0	Reserved
0	RWC	0	This bit is set to 1 when the DMA cycle completes, and remains asserted until cleared by software writing a 1 or hardware reset.

Supported 7-bit alphabet characters

The 7 bit default alphabet is specified by GSM 03.38.

Only the following subset is supported by the LCD display.

Hex	Dec	Character name	Character
0x00	0	COMMERCIAL AT	@
0x01	1	Not supported	
0x02	2	DOLLAR SIGN	$
0x03	3	Not supported	
0x04	4	Not supported	
0x05	5	Not supported	
0x06	6	Not supported	
0x07	7	Not supported	
0x08	8	Not supported	
0x09	9	Not supported	
0x0A	10	Not supported	
0x0B	11	Not supported	
0x0C	12	Not supported	
0x0D	13	Not supported	
0x0E	14	Not supported	
0x0F	15	Not supported	
0x10	16	Not supported	
0x11	17	LOW LINE	_
0x12	18	Not supported	
0x13	19	Not supported	
0x14	20	Not supported	
0x15	21	Not supported	
0x16	22	Not supported	
0x17	23	Not supported	
0x18	24	Not supported	
0x19	25	Not supported	
0x1A	26	Not supported	
0x1B	27	Not supported	
0x1C	28	Not supported	
0x1D	29	Not supported	
0x1E	30	Not supported	
0x1F	31	Not supported	
0x20	32	SPACE	
0x21	33	EXCLAMATION MARK	!
0x22	34	QUOTATION MARK	"
0x23	35	NUMBER SIGN	#
0x24	36	Not supported	
0x25	37	PERCENT SIGN	%
0x26	38	AMPERSAND	&
0x27	39	APOSTROPHE	'
0x28	40	LEFT PARENTHESIS	(
0x29	41	RIGHT PARENTHESIS	)
0x2A	42	ASTERISK	*
0x2B	43	PLUS SIGN	+
0x2C	44	COMMA	,
0x2D	45	HYPHEN-MINUS	-
0x2E	46	FULL STOP	.
0x2F	47	SOLIDUS (SLASH)	/
0x30	48	DIGIT ZERO	0
0x31	49	DIGIT ONE	1
0x32	50	DIGIT TWO	2

0x33	51	DIGIT THREE	3
0x34	52	DIGIT FOUR	4
0x35	53	DIGIT FIVE	5
0x36	54	DIGIT SIX	6
0x37	55	DIGIT SEVEN	7
0x38	56	DIGIT EIGHT	8
0x39	57	DIGIT NINE	9
0x3A	58	COLON	:
0x3B	59	SEMICOLON	;
0x3C	60	LESS-THAN SIGN	<
0x3D	61	EQUALS SIGN	=
0x3E	62	GREATER-THAN SIGN	>
0x3F	63	QUESTION MARK	?
0x40	64	Not supported	
0x41	65	LATIN CAPITAL LETTER A	A
0x42	66	LATIN CAPITAL LETTER B	B
0x43	67	LATIN CAPITAL LETTER C	C
0x44	68	LATIN CAPITAL LETTER D	D
0x45	69	LATIN CAPITAL LETTER E	E
0x46	70	LATIN CAPITAL LETTER F	F
0x47	71	LATIN CAPITAL LETTER G	G
0x48	72	LATIN	H
		CAPITAL LETTER H	
0x49	73	LATIN CAPITAL LETTER I	I
0x4A	74	LATIN CAPITAL LETTER J	J
0x4B	75	LATIN CAPITAL LETTER K	K
0x4C	76	LATIN CAPITAL LETTER L	L
0x4D	77	LATIN CAPITAL LETTER M	M
0x4E	78	LATIN CAPITAL LETTER N	N
0x4F	79	LATIN CAPITAL LETTER O	O
0x50	80	LATIN CAPITAL LETTER P	P
0x51	81	LATIN CAPITAL LETTER Q	Q
0x52	82	LATIN CAPITAL LETTER R	R
0x53	83	LATIN CAPITAL LETTER S	S
0x54	84	LATIN CAPITAL LETTER T	T
0x55	85	LATIN CAPITAL LETTER U	U

0x56	86	LATIN CAPITAL LETTER V	V
0x57	87	LATIN CAPITAL LETTER W	W
0x58	88	LATIN CAPITAL LETTER X	X
0x59	89	LATIN CAPITAL LETTER Y	Y
0x5A	90	LATIN CAPITAL LETTER Z	Z
0x5B	91	Not supported	
0x5C	92	Not supported	
0x5D	93	Not supported	
0x5E	94	Not supported	
0x5F	95	Not supported	
0x60	96	Not supported	
0x61	97	LATIN SMALL LETTER A	a
0x62	98	LATIN SMALL LETTER B	b
0x63	99	LATIN SMALL LETTER C	c
0x64	100	LATIN SMALL LETTER D	d
0x65	101	LATIN SMALL LETTER E	e
0x66	102	LATIN SMALL LETTER F	f
0x67	103	LATIN SMALL LETTER G	g
0x68	104	LATIN SMALL LETTER H	h
0x69	105	LATIN SMALL LETTER I	i
0x6A	106	LATIN SMALL	j
		LETTER J	
0x6B	107	LATIN SMALL LETTER K	k
0x6C	108	LATIN SMALL LETTER L	l
0x6D	109	LATIN SMALL LETTER M	m
0x6E	110	LATIN SMALL LETTER N	n
0x6F	111	LATIN SMALL LETTER O	o
0x70	112	LATIN SMALL LETTER P	p
0x71	113	LATIN SMALL LETTER Q	q
0x72	114	LATIN SMALL LETTER R	r
0x73	115	LATIN SMALL LETTER S	s
0x74	116	LATIN SMALL LETTER T	t
0x75	117	LATIN SMALL LETTER U	u
0x76	118	LATIN SMALL LETTER V	v
0x77	119	LATIN SMALL LETTER W	w
0x78	120	LATIN SMALL LETTER X	x
0x79	121	LATIN SMALL LETTER Y	y
0x7A	122	LATIN SMALL LETTER Z	z
0x7B	123	Not supported	
0x7C	124	Not supported	
0x7D	125	Not supported	
0x7E	126	Not supported	
0x7F	127	Not supported	