

1. Description

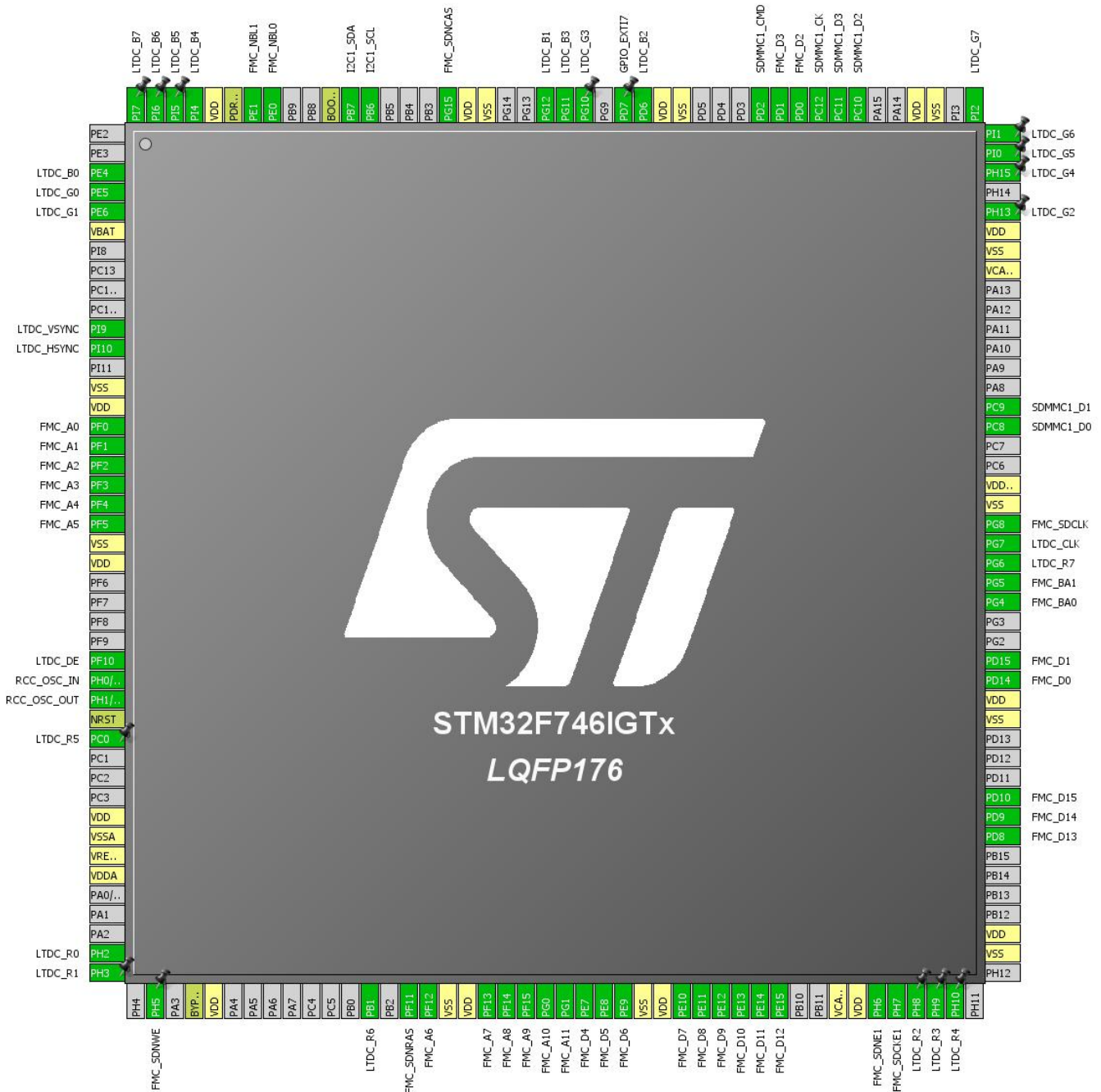
1.1. Project

Project Name	746IG_FMC_LTDC_DMA2d
Board Name	746IG_FMC_LTDC_DMA2d
Generated with:	STM32CubeMX 4.22.0
Date	07/31/2017

1.2. MCU

MCU Series	STM32F7
MCU Line	STM32F7x6
MCU name	STM32F746IGTx
MCU Package	LQFP176
MCU Pin number	176

2. Pinout Configuration



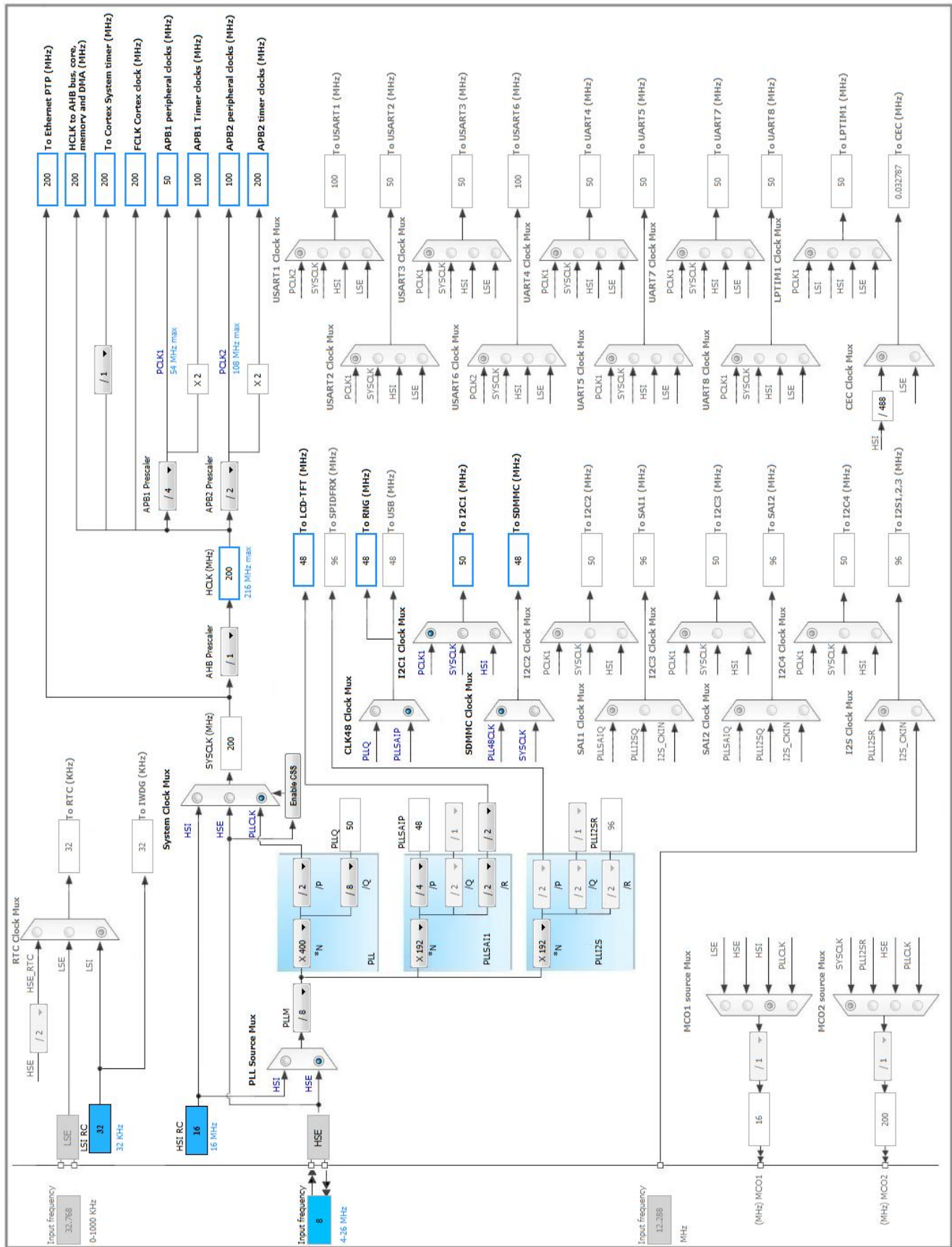
3. Pins Configuration

Pin Number LQFP176	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
3	PE4	I/O	LTDC_B0	
4	PE5	I/O	LTDC_G0	
5	PE6	I/O	LTDC_G1	
6	VBAT	Power		
11	PI9	I/O	LTDC_VSYNC	
12	PI10	I/O	LTDC_HSYNC	
14	VSS	Power		
15	VDD	Power		
16	PF0	I/O	FMC_A0	
17	PF1	I/O	FMC_A1	
18	PF2	I/O	FMC_A2	
19	PF3	I/O	FMC_A3	
20	PF4	I/O	FMC_A4	
21	PF5	I/O	FMC_A5	
22	VSS	Power		
23	VDD	Power		
28	PF10	I/O	LTDC_DE	
29	PH0/OSC_IN	I/O	RCC_OSC_IN	
30	PH1/OSC_OUT	I/O	RCC_OSC_OUT	
31	NRST	Reset		
32	PC0	I/O	LTDC_R5	
36	VDD	Power		
37	VSSA	Power		
38	VREF+	Power		
39	VDDA	Power		
43	PH2	I/O	LTDC_R0	
44	PH3	I/O	LTDC_R1	
46	PH5	I/O	FMC_SDNWE	
48	BYPASS_REG	Reset		
49	VDD	Power		
57	PB1	I/O	LTDC_R6	
59	PF11	I/O	FMC_SDNRAS	
60	PF12	I/O	FMC_A6	
61	VSS	Power		
62	VDD	Power		
63	PF13	I/O	FMC_A7	

Pin Number LQFP176	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
64	PF14	I/O	FMC_A8	
65	PF15	I/O	FMC_A9	
66	PG0	I/O	FMC_A10	
67	PG1	I/O	FMC_A11	
68	PE7	I/O	FMC_D4	
69	PE8	I/O	FMC_D5	
70	PE9	I/O	FMC_D6	
71	VSS	Power		
72	VDD	Power		
73	PE10	I/O	FMC_D7	
74	PE11	I/O	FMC_D8	
75	PE12	I/O	FMC_D9	
76	PE13	I/O	FMC_D10	
77	PE14	I/O	FMC_D11	
78	PE15	I/O	FMC_D12	
81	VCAP_1	Power		
82	VDD	Power		
83	PH6	I/O	FMC_SDNE1	
84	PH7	I/O	FMC_SDCKE1	
85	PH8	I/O	LTDC_R2	
86	PH9	I/O	LTDC_R3	
87	PH10	I/O	LTDC_R4	
90	VSS	Power		
91	VDD	Power		
96	PD8	I/O	FMC_D13	
97	PD9	I/O	FMC_D14	
98	PD10	I/O	FMC_D15	
102	VSS	Power		
103	VDD	Power		
104	PD14	I/O	FMC_D0	
105	PD15	I/O	FMC_D1	
108	PG4	I/O	FMC_BA0	
109	PG5	I/O	FMC_BA1	
110	PG6	I/O	LTDC_R7	
111	PG7	I/O	LTDC_CLK	
112	PG8	I/O	FMC_SDCLK	
113	VSS	Power		
114	VDDUSB	Power		
117	PC8	I/O	SDMMC1_D0	

Pin Number LQFP176	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
118	PC9	I/O	SDMMC1_D1	
125	VCAP_2	Power		
126	VSS	Power		
127	VDD	Power		
128	PH13	I/O	LTDC_G2	
130	PH15	I/O	LTDC_G4	
131	PI0	I/O	LTDC_G5	
132	PI1	I/O	LTDC_G6	
133	PI2	I/O	LTDC_G7	
135	VSS	Power		
136	VDD	Power		
139	PC10	I/O	SDMMC1_D2	
140	PC11	I/O	SDMMC1_D3	
141	PC12	I/O	SDMMC1_CK	
142	PD0	I/O	FMC_D2	
143	PD1	I/O	FMC_D3	
144	PD2	I/O	SDMMC1_CMD	
148	VSS	Power		
149	VDD	Power		
150	PD6	I/O	LTDC_B2	
151	PD7	I/O	GPIO_EXTI7	
153	PG10	I/O	LTDC_G3	
154	PG11	I/O	LTDC_B3	
155	PG12	I/O	LTDC_B1	
158	VSS	Power		
159	VDD	Power		
160	PG15	I/O	FMC_SDNCAS	
164	PB6	I/O	I2C1_SCL	
165	PB7	I/O	I2C1_SDA	
166	BOOT0	Boot		
169	PE0	I/O	FMC_NBL0	
170	PE1	I/O	FMC_NBL1	
171	PDR_ON	Reset		
172	VDD	Power		
173	PI4	I/O	LTDC_B4	
174	PI5	I/O	LTDC_B5	
175	PI6	I/O	LTDC_B6	
176	PI7	I/O	LTDC_B7	

4. Clock Tree Configuration



5. IPs and Middleware Configuration

5.1. CRC

mode: Activated

5.1.1. Parameter Settings:

Basic Parameters:

Default Polynomial State	Enable
Default Init Value State	Enable

Advanced Parameters:

Input Data Inversion Mode	None
Output Data Inversion Mode	Disable
Input Data Format	Bytes

5.2. DMA2D

mode: Activated

5.2.1. Parameter Settings:

Basic Parameters:

Transfer Mode	Memory to Memory
Color Mode	ARGB8888
Output Offset	0

Foreground layer Configuration:

DMA2D Input Color Mode	ARGB8888
DMA2D ALPHA MODE	Replace original alpha channel *
Input Alpha	0
Input Offset	0
DMA2D ALPHA Inversion	Regular Alpha
DMA2D Red and Blue swap	Regular mode (RGB or ARGB)

5.3. FMC

SDRAM 1

Clock and chip enable: SDCKE1+SDNE1

Internal bank number: 4 banks

Address: 12 bits

Data: 16 bits

Byte enable: 16-bit byte enable

5.3.1. SDRAM 1:

SDRAM control:

Bank	SDRAM bank 2
Number of column address bits	8 bits
Number of row address bits	12 bits
CAS latency	3 memory clock cycles *
Write protection	Disabled
SDRAM common clock	2 HCLK clock cycles *
SDRAM common burst read	Enabled *
SDRAM common read pipe delay	0 HCLK clock cycle

SDRAM timing in memory clock cycles:

Load mode register to active delay	2 *
Exit self-refresh delay	7 *
Self-refresh time	4 *
SDRAM common row cycle delay	6 *
Write recovery time	2 *
SDRAM common row precharge delay	2 *
Row to column delay	2 *

5.4. I2C1

I2C: I2C

5.4.1. Parameter Settings:

Timing configuration:

I2C Speed Mode	Standard Mode
I2C Speed Frequency (KHz)	100
Rise Time (ns)	700 *

Fall Time (ns)	100 *
Coefficient of Digital Filter	0
Analog Filter	Enabled
Timing	0xA0401116 *

Slave Features:

Clock No Stretch Mode	Disabled
General Call Address Detection	Disabled
Primary Address Length selection	7-bit
Dual Address Acknowledged	Disabled
Primary slave address	0x70 *

5.5. LTDC

Display Type: RGB888 (24 bits)

5.5.1. Parameter Settings:

Synchronization for Width:

Horizontal Synchronization Width	40 *
Horizontal Back Porch	65 *
Active Width	800 *
Horizontal Front Porch	32 *
HSync Width	39
Accumulated Horizontal Back Porch Width	104
Accumulated Active Width	904
Total Width	936

Synchronization for Height:

Vertical Synchronization Height	20 *
Vertical Back Porch	32 *
Active Height	480
Vertical Front Porch	16 *
VSyn Height	19
Accumulated Vertical Back Porch Height	51
Accumulated Active Height	531
Total Height	547

Signal Polarity:

Horizontal Synchronization Polarity	Active Low
Vertical Synchronization Polarity	Active Low
Data Enable Polarity	Active Low

Pixel Clock Polarity Normal Input

BackGround Color:

Red 0
Green 0
Blue 0

5.5.2. Layer Settings:

BackGround Color:

Layer 0 - Blue 0
Layer 0 - Green 0
Layer 0 - Red 0

Number of Layers:

Number of Layers 1 layer *

Windows Position:

Layer 0 - Window Horizontal Start 0
Layer 0 - Window Horizontal Stop 800 *
Layer 0 - Window Vertical Start 0
Layer 0 - Window Vertical Stop 480 *

Pixel Parameters:

Layer 0 - Pixel Format RGB565 *

Blending:

Layer 0 - Alpha constant for blending 255 *
Layer 0 - Default Alpha value 0
Layer 0 - Blending Factor1 Alpha constant x Pixel Alpha *
Layer 0 - Blending Factor2 Alpha constant x Pixel Alpha *

Frame Buffer:

Layer 0 - Color Frame Buffer Start Address 0xD0200000 *
Layer 0 - Color Frame Buffer Line Length (Image Width) 800 *
Layer 0 - Color Frame Buffer Number of Lines (Image Height) 480 *

5.6. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

5.6.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Flash Latency(WS)	6 WS (7 CPU cycle)

RCC Parameters:

HSI Calibration Value	16
TIM Prescaler Selection	Disabled
HSE Startup Timeout Value (ms)	100
LSE Startup Timeout Value (ms)	5000

Power Parameters:

Power Over Drive	Enabled
Power Regulator Voltage Scale	Power Regulator Voltage Scale 1

5.7. RNG

mode: Activated

5.8. SDMMC1

Mode: SD 4 bits Wide bus

5.8.1. Parameter Settings:

SDMMC parameters:

SDMMCCLK clock divide factor	0
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5.9. SYS

Timebase Source: TIM14

5.10. TIM6

mode: Activated

5.10.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	10000 *
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Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	200 *
auto-reload preload	Disable
Trigger Output (TRGO) Parameters:	
Trigger Event Selection	Enable (CNT_EN) *

5.11. FATFS

mode: SD Card

5.11.1. Set Defines:

Version:

FATFS version	R0.11
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Function Parameters:

FS_READONLY (Read-only mode)	Disabled
FS_MINIMIZE (Minimization level)	Disabled
USE_STRFUNC (String functions)	Enabled with LF -> CRLF conversion
USE_FIND (Find functions)	Disabled
USE_MKFS (Make filesystem function)	Enabled
USE_FASTSEEK (Fast seek function)	Enabled
USE_LABEL (Volume label functions)	Disabled
USE_FORWARD (Forward function)	Disabled

Locale and Namespace Parameters:

CODE_PAGE (Code page on target)	Multilingual Latin 1 (OEM)
USE_LFN (Use Long Filename)	Disabled
MAX_LFN (Max Long Filename)	255
LFN_UNICODE (Enable Unicode)	ANSI/OEM
STRF_ENCODE (Character encoding)	UTF-8
FS_RPATH (Relative Path)	Disabled

Physical Drive Parameters:

VOLUMES (Logical drives)	1
MAX_SS (Maximum Sector Size)	4096 *
MIN_SS (Minimum Sector Size)	512
MULTI_PARTITION (Volume partitions feature)	Disabled
USE_TRIM (Erase feature)	Disabled
FS_NOFSINFO (Force full FAT scan)	0

System Parameters:

FS_TINY (Tiny mode)	Disabled
FS_NORTC (Timestamp feature)	Dynamic timestamp

NORTC_YEAR (Year for timestamp)	2015
NORTC_MON (Month for timestamp)	6
NORTC_MDAY (Day for timestamp)	4
WORD_ACCESS (Platform dependent access option)	Byte access
FS_REENTRANT (Re-Entrancy)	Disabled
FS_TIMEOUT (Timeout ticks)	1000
SYNC_t (O/S sync object)	osSemaphoreId
FS_LOCK (Number of files opened simultaneously)	2

5.11.2. IPs instances:

SDIO/SDMMC:

SDMMC instance	SDMMC1
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* User modified value

6. System Configuration

6.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
FMC	PF0	FMC_A0	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PF1	FMC_A1	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PF2	FMC_A2	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PF3	FMC_A3	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PF4	FMC_A4	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PF5	FMC_A5	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PH5	FMC_SDNWE	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PF11	FMC_SDNRAS	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PF12	FMC_A6	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PF13	FMC_A7	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PF14	FMC_A8	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PF15	FMC_A9	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PG0	FMC_A10	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PG1	FMC_A11	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PE7	FMC_D4	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PE8	FMC_D5	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PE9	FMC_D6	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PE10	FMC_D7	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PE11	FMC_D8	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PE12	FMC_D9	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PE13	FMC_D10	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PE14	FMC_D11	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PE15	FMC_D12	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PH6	FMC_SDNE1	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PH7	FMC_SDCKE1	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PD8	FMC_D13	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PD9	FMC_D14	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PD10	FMC_D15	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PD14	FMC_D0	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PD15	FMC_D1	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PG4	FMC_BA0	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PG5	FMC_BA1	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PG8	FMC_SDCLK	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PD0	FMC_D2	Alternate Function Push Pull	No pull-up and no pull-down	Very High	

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PD1	FMC_D3	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PG15	FMC_SDNCAS	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PE0	FMC_NBL0	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PE1	FMC_NBL1	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
I2C1	PB6	I2C1_SCL	Alternate Function Open Drain	Pull-up	Very High *	
	PB7	I2C1_SDA	Alternate Function Open Drain	Pull-up	Very High *	
LTDC	PE4	LTDC_B0	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PE5	LTDC_G0	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PE6	LTDC_G1	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PI9	LTDC_VSYNC	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PI10	LTDC_HSYNC	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PF10	LTDC_DE	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PC0	LTDC_R5	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PH2	LTDC_R0	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PH3	LTDC_R1	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PB1	LTDC_R6	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PH8	LTDC_R2	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PH9	LTDC_R3	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PH10	LTDC_R4	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PG6	LTDC_R7	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PG7	LTDC_CLK	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PH13	LTDC_G2	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PH15	LTDC_G4	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PI0	LTDC_G5	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PI1	LTDC_G6	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PI2	LTDC_G7	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PD6	LTDC_B2	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PG10	LTDC_G3	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PG11	LTDC_B3	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PG12	LTDC_B1	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PI4	LTDC_B4	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PI5	LTDC_B5	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PI6	LTDC_B6	Alternate Function Push Pull	No pull-up and no pull-down	High *	

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PI7	LTDC_B7	Alternate Function Push Pull	No pull-up and no pull-down	High *	
RCC	PH0/OSC_IN	RCC_OSC_IN	n/a	n/a	n/a	
	PH1/OSC_OUT	RCC_OSC_OUT	n/a	n/a	n/a	
SDMMC1	PC8	SDMMC1_D0	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PC9	SDMMC1_D1	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PC10	SDMMC1_D2	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PC11	SDMMC1_D3	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PC12	SDMMC1_CK	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PD2	SDMMC1_CMD	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
GPIO	PD7	GPIO_EXTI7	External Interrupt Mode with Rising edge trigger detection	Pull-up *	n/a	

6.2. DMA configuration

DMA request	Stream	Direction	Priority
MENTOMEM	DMA2_Stream0	Memory To Memory	High *

MENTOMEM: DMA2_Stream0 DMA request Settings:

Mode: Normal
Use fifo: **Enable ***
FIFO Threshold: Full
Src Memory Increment: **Enable ***
Dst Memory Increment: **Enable ***
Src Memory Data Width: **Word ***
Dst Memory Data Width: **Word ***
Src Memory Burst Size: Single
Dst Memory Burst Size: Single

6.3. NVIC configuration

Interrupt Table	Enable	Preenmption Priority	SubPriority
Non maskable interrupt	true	0	0
Hard fault interrupt	true	0	0
Memory management fault	true	0	0
Pre-fetch fault, memory access fault	true	0	0
Undefined instruction or illegal state	true	0	0
System service call via SWI instruction	true	0	0
Debug monitor	true	0	0
Pendable request for system service	true	0	0
System tick timer	true	0	0
TIM8 trigger and commutation interrupts and TIM14 global interrupt	true	0	0
TIM6 global interrupt, DAC1 and DAC2 underrun error interrupts	true	5	0
LTDC global interrupt	true	0	0
DMA2D global interrupt	true	0	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
EXTI line[9:5] interrupts	unused		
I2C1 event interrupt	unused		
I2C1 error interrupt	unused		
FMC global interrupt	unused		
SDMMC1 global interrupt	unused		
DMA2 stream0 global interrupt	unused		
HASH and RNG global interrupts	unused		
FPU global interrupt	unused		
LTDC global error interrupt	unused		

* User modified value

7. Power Consumption Calculator report

7.1. Microcontroller Selection

Series	STM32F7
Line	STM32F7x6
MCU	STM32F746IGTx
Datasheet	027590_Rev4

7.2. Parameter Selection

Temperature	25
Vdd	3.3

8. Software Project

8.1. Project Settings

Name	Value
Project Name	746IG_FMC_LTDC_DMA2d
Project Folder	H:\746IG_my\746IG_FMC_LTDC_DMA2D_SDIO_I2C_TIMER_1
Toolchain / IDE	MDK-ARM V5
Firmware Package Name and Version	STM32Cube FW_F7 V1.7.0

8.2. Code Generation Settings

Name	Value
STM32Cube Firmware Library Package	Copy all used libraries into the project folder
Generate peripheral initialization as a pair of '.c/.h' files	Yes
Backup previously generated files when re-generating	No
Delete previously generated files when not re-generated	Yes
Set all free pins as analog (to optimize the power consumption)	No