



ST6G3244ME

Level translator for SD, SDIO, mini SD, and micro SD Cards
with internal I/O supply and ± 15 kV ESD protection

Features

- Supports 60 MHz clock rate
- Supports DDR mode for SD Card™
- Compliant with
 - SD Specification Part 1 Physical Layer Specification 3.00 (SDR12, SDR25, DDR50)
 - SD Specification Part 1 Physical Layer Specification 2.00
- Bi-directional with direction control pin
- Balanced propagation delays: $t_{PLH} \approx t_{PHL}$
- LDO power-down support. When the LDO is powered down, V_{CCB} is pulled to GND via the 130 Ω resistor. When $V_{CCB} = 0$ V, there is no additional leakage seen on V_{CCA} .
- EMI filtering and signal conditioning
- Supports both 1.8 V and 2.9 V data translation on card side
- Integrated LDO to supply 1.8 V or 2.9 V power for B-side I/Os (pin-selectable); can be used also externally
- Integrated pull-up and pull-down resistors on B-side
- Operating voltage range
 - $V_{CCA} = 1.62$ V to 1.98 V
 - $V_{BAT} = 3.0$ V to 5.0 V
- Latch-up performance exceeds 100 mA (JEDEC Standard 78)
- ESD protection for card side (B-port, CD and WP pins)
 - ± 8 kV contact discharge (IEC61000-4-2)
 - ± 15 kV air-gap discharge (IEC61000-4-2)
- ESD protection for host side (A-side)
 - ± 2 kV HBM (JEDEC 22-A114)
 - ± 200 V MM (JEDEC 22-A115)



- Operating temperature range -40 °C to $+85$ °C
- Space-saving Flip Chip 25 package (2 x 2 x 0.605 mm, 0.4 mm bump pitch)
- RoHS compliant, lead-free soldering capable

Applications

- Mobile phones, smartphones
- PDAs
- Cameras
- SD Card readers
- Any device with SD memory card

Table 1. Device summary

Order code	Package	Packing	Package topmark
ST6G3244MEBJR	Flip Chip 25 2 x 2 x 0.605 mm, 0.4 mm bump pitch	Tape and reel (5000 parts per reel)	VKH, VKV

Contents

1	Description	5
2	Functional description	6
3	Maximum ratings	10
4	DC and AC parameters	11
5	Passive integration and low-pass EMI filter	12
6	Data transmission	14
6.1	Test circuit from host to SD Card	16
6.2	Test circuit from SD Card to host	16
6.3	Measurement of t_{SKEW} (SD Card to host) from rising edge CLK.h	17
6.4	Measurement of $t_{\text{SKEW.f}}$ (read mode) from rising edge CLK.h	18
7	Low drop-out voltage regulator	19
8	SD Card specification compliance	21
9	Package mechanical data	22
10	Tape and reel information	25
11	Revision history	26

List of tables

Table 1.	Device summary	1
Table 2.	Signal names	6
Table 3.	Direction control	7
Table 4.	Absolute maximum ratings	10
Table 5.	Recommended operating conditions	11
Table 6.	Current levels under recommended operating conditions ($T_A = -40\text{ }^\circ\text{C}$ to $85\text{ }^\circ\text{C}$)	11
Table 7.	Components	13
Table 8.	EMI filter attenuation	13
Table 9.	DC voltage levels on host CPU side ($T_A = -40\text{ }^\circ\text{C}$ to $85\text{ }^\circ\text{C}$)	14
Table 10.	DC voltage levels on SD Card side ($T_A = -40\text{ }^\circ\text{C}$ to $85\text{ }^\circ\text{C}$)	14
Table 11.	Leakage and short-circuit currents	14
Table 12.	AC characteristics ($T_A = -40\text{ }^\circ\text{C}$ to $85\text{ }^\circ\text{C}$)	15
Table 13.	V_{CCB} selection (B-side power supply voltage), EN pin control	19
Table 14.	LDO static parameters ($V_{EN} = V_{CCA}$ unless otherwise specified)	20
Table 15.	LDO dynamic parameters ($V_{EN} = V_{CCA}$ unless otherwise specified)	20
Table 16.	Package mechanical data for Flip Chip 25 (2 mm x 2 mm x 0.605 mm, 0.4 mm pitch)	23
Table 17.	Revision history	26

List of figures

Figure 1.	Pin connections	6
Figure 2.	Block diagram	8
Figure 3.	Typical application diagram	9
Figure 4.	Circuit diagram of ST6G3244ME (without LDO).	12
Figure 5.	Symbol definitions of t_{PLH} , t_{PHL} , t_r and t_f for AC characteristics	15
Figure 6.	Test circuit from host to SD Card	16
Figure 7.	Test circuit from SD Card to host	16
Figure 8.	Example of measurement of t_{SKEW} (SD Card to host) from rising edge CLK.h	17
Figure 9.	Example of measurement of t_{SKEW} for read mode from rising edge CLK.h	18
Figure 10.	Low drop-out voltage regulator	19
Figure 11.	Package outline for Flip Chip 25 (2 mm x 2 mm x 0.605 mm, 0.4 mm pitch)	23
Figure 12.	Footprint recommendation for Flip Chip 25 (2 mm x 2 mm x 0.605 mm, 0.4 mm pitch)	24
Figure 13.	Pin 1 orientation in tape	25

1 Description

The ST6G3244ME is a dual supply, low voltage 6-bit bi-directional CMOS level translator for SD, mini SD and micro SD Cards. Designed for use as an interface between baseband and memory cards, it achieves high speed operation while maintaining CMOS low-power dissipation.

The A-port is designed to track V_{CCA} . The internal LDO is powered by V_{BAT} and provides a power supply of either 1.8 V or 2.9 V to the B-side I/Os (programmed by the SEL pin). The B-port is designed to track V_{CCB} . The V_{CCB} voltage can be also used externally. When $V_{CCB} = 0$ V, there is no additional leakage seen on V_{CCA} . All outputs are push-pull type.

This device is intended for two-way asynchronous communication between data buses. The direction of data transmission is determined by CMD.dir, DAT0.dir and DAT123.dir inputs.

All inputs are equipped with protection circuits against electrostatic discharge, giving them ± 2 kV (on A-side) and ± 15 kV (on B-side, CD and WP) ESD and transient excess voltage immunity.

2 Functional description

Figure 1. Pin connections

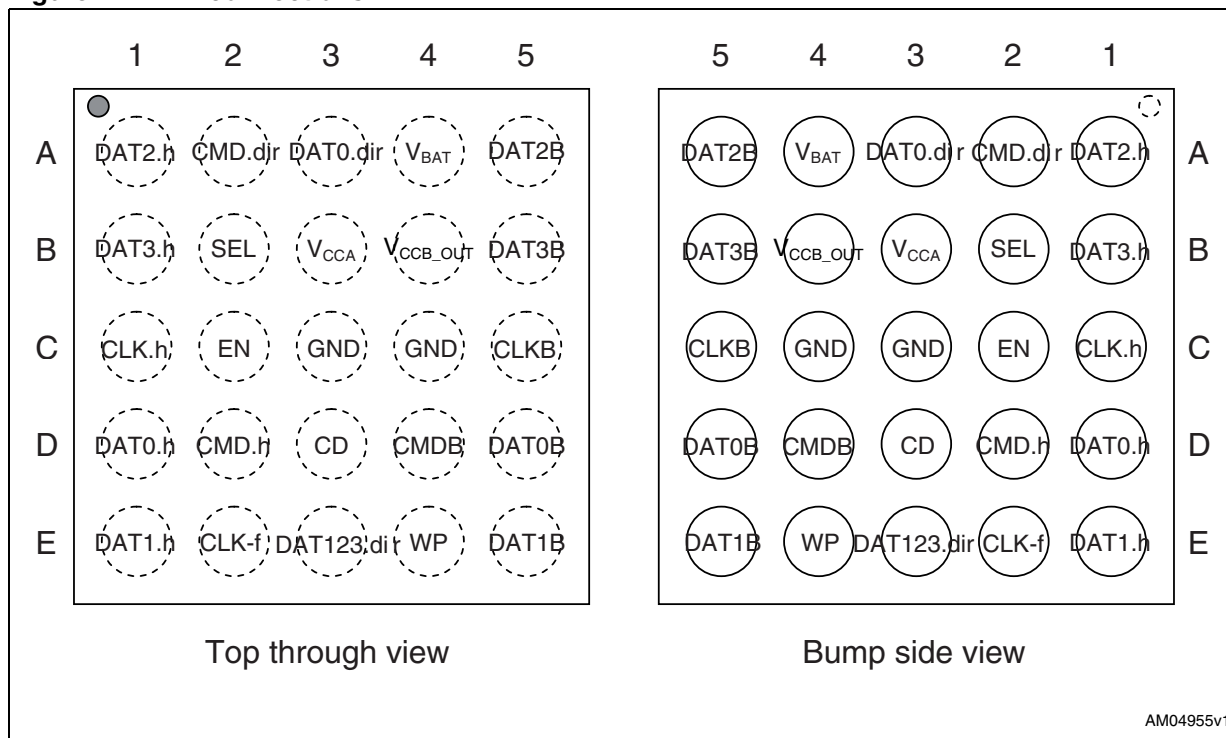


Table 2. Signal names (1)

Pin name	Bump	Type	Side	Description
V _{CCA}	B3	Input	A	Host side positive power supply (1.8 V)
V _{CCB_OUT}	B4	Output	B	Internal supply voltage decoupling, V _{CCB} LDO output
V _{BAT}	A4	Input	A	Battery power supply (3.0 - 5.0 V)
GND	C4	Ground	-	Ground
GND	C3	Ground	-	Ground
EN	C2	Input	A	Enable, active-high
SEL	B2	Input	A	V _{CCB} selection (B-side supply voltage, 1.8 V/2.9 V)
CMD.dir	A2	Input	A	Command direction control
CMD.h	D2	I/O	A	Host side command
CLK.h	C1	Input	A	Host side clock input
CLK-f	E2	Output	A	Clock feedback to host
DAT0.dir	A3	Input	A	DAT0 direction control
DAT0.h	D1	I/O	A	Host side data input/output
DAT123.dir	E3	Input	A	DAT1, DAT2, DAT3 direction control
DAT1.h	E1	I/O	A	Host side data input/output

Table 2. Signal names (continued)⁽¹⁾

Pin name	Bump	Type	Side	Description
DAT2.h	A1	I/O	A	Host side data input/output
DAT3.h	B1	I/O	A	Host side data input/output
WP	E4	Input to CPU	A	Write protect
CD	D3	Input to CPU	A	Card detect
CMDB	D4	I/O	B	Card side command
CLKB	C5	Output	B	Card side clock output
DAT0B	D5	I/O	B	Card side data input/output
DAT1B	E5	I/O	B	Card side data input/output
DAT2B	A5	I/O	B	Card side data input/output
DAT3B	B5	I/O	B	Card side data input/output

1. Collective names are used for groups of pins in the datasheet:

*.dir = CMD.dir, DAT0.dir, DAT123.dir

*.h = CMD.h, CLK.h, DAT0.h, DAT1.h, DAT2.h, DAT3.h

*B = CMDB, CLKB, DAT0B, DAT1B, DAT2B, DAT3B

V_{IA} = all A-side input pins.

Table 3. Direction control

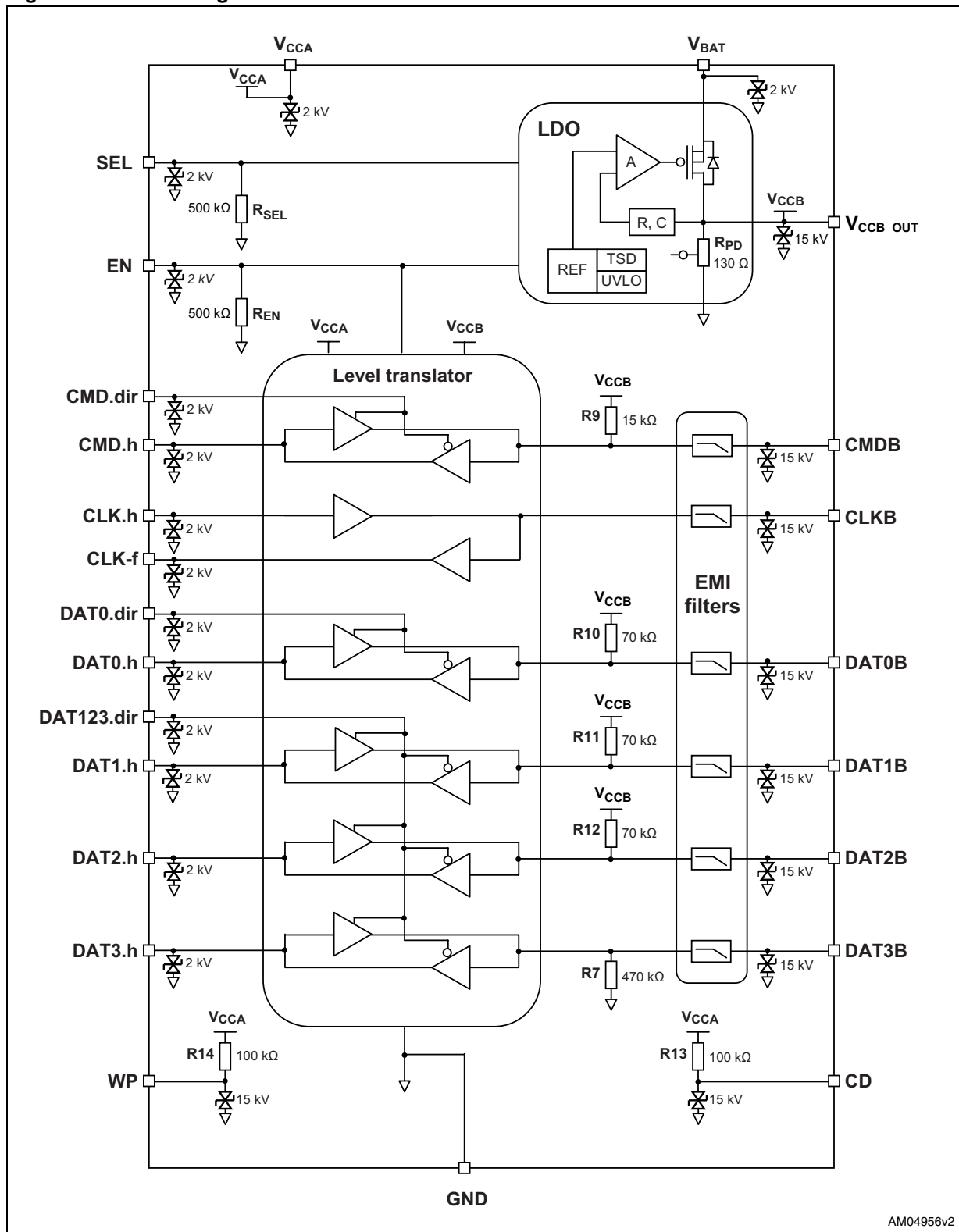
EN	Command signals			Direction of A-side signals ⁽¹⁾					Direction of B-side signals ⁽¹⁾							
	CMD.dir	DAT0.dir	DAT123.dir	CMD.h	CLK.h	CLK-f	DAT0.h	DAT1.h	DAT2.h	DAT3.h	CMDB	CLKB	DAT0B	DAT1.B	DAT2.B	DAT3.B
H	H	X	X	IN	IN	OUT	X	X			OUT	OUT	X	X		
H	L	X	X	OUT	IN	OUT	X	X			IN	OUT	X	X		
H	X	H	X	X	IN	OUT	IN	X			X	OUT	OUT		X	
H	X	L	X	X	IN	OUT	OUT	X			X	OUT	IN		X	
H	X	X	H	X	IN	OUT	X	IN			X	OUT	X		OUT	
H	X	X	L	X	IN	OUT	X	OUT			X	OUT	X		IN	
L	X	X	X	X	X	Z	X	X			(2)	Z	(2)		(2)	

1. When the direction of the A-side signal is INPUT, the host CPU WRITES to the SD Card (i.e. the direction of the B-side signal is OUTPUT).
When the direction of the A-side signal is OUTPUT, the host CPU READS the SD Card (i.e. the direction of the B-side signal is INPUT).

2. Level of the B-side signals when EN = L is defined by the internal resistors as listed in [Table 7](#).

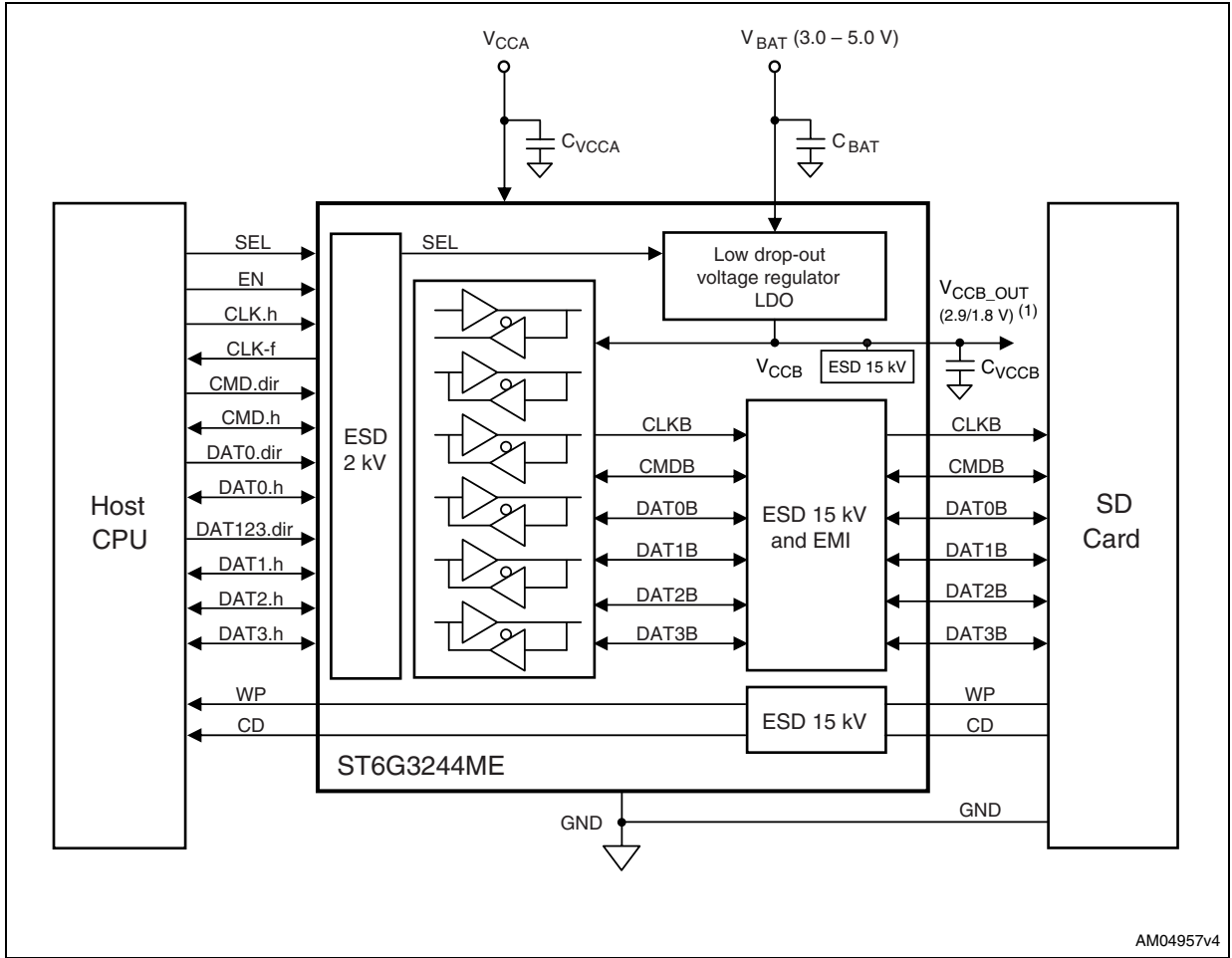
Note: *During application design it has to be considered that the level shifter device needs some time to change the direction after a change of the .dir signal level. Valid data on the input of the corresponding channel can then start after a turn-around time, see the t_{TA} specification in [Table 12](#).*

Figure 2. Block diagram



AM04956v2

Figure 3. Typical application diagram



1. Can be used externally, however, note that it follows V_{CCB} value that is switched between 2.9 and 1.8 V by the SEL pin.

3 Maximum ratings

Stressing the device above the rating listed in [Table 4: Absolute maximum ratings](#) may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in [Table 5: Recommended operating conditions](#) of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Table 4. Absolute maximum ratings

Symbol	Parameter		Value	Unit	
T _{JMAX}	Maximum junction temperature		150	°C	
R _{TH(J-A)} ⁽¹⁾	Thermal resistance from junction to ambient (board: epoxy FR4, e _(CU) = 40 μm, 4 layers)		64	°C/W	
P _{DMAX}	Maximum power dissipation: $P_{DMAX} = (T_{JMAX} - T_{AMAX})/R_{TH(J-A)}$		1	W	
T _{STG}	Storage temperature range		-55 to 150	°C	
V _{CCA}	Power supply		-0.3 to 4.6	V	
V _{BAT}	Battery power supply		-0.3 to 5.5	V	
V _{IO}	CMDB, CLKB, DAT0B, DAT1B, DAT2B, DAT3B		-0.3 to V _{CCB} + 0.3	V	
	V _{CCA} , SEL, EN		-0.3 to 4.6		
	CMD.dir, CMD.h, CLK.h, CLK-f, DAT0.dir, DAT0.h, DAT123.dir, DAT1.h, DAT2.h, DAT3.h, WP, CD		-0.3 to V _{CCA} + 0.3		
ESD	A-side (host CPU), all pins: V _{CCA} , EN, SEL, DAT123.dir, CMD.dir, CMD.h, CLK.h, CLK-f, DAT0.dir, DAT0.h, DAT1.h, DAT2.h, DAT3.h, V _{BAT}	HBM	JEDEC 22-A114	±2	kV
		MM	JEDEC 22-A115	±200	V
	B-side (SD Card), external pins: CMDB, CLKB, DAT0B, DAT1B, DAT2B, DAT3B, WP, CD, V _{CCB_OUT}	Air discharge	IEC61000-4-2	±15	kV
		Contact discharge	IEC61000-4-2	±8	kV

1. The thermal resistance depends on the printed circuit board layout. To dissipate the heat efficiently away from the Flip-Chip bumps, it is recommended to make the copper planes as large as possible and consider using thermal vias.

4 DC and AC parameters

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _{CCA}	Power supply		1.62	1.8	1.98	V
V _{BAT}	Battery power supply		3.0		5.0	V
C _{BAT}	External battery capacitance	Ceramic capacitor	1.0	2.2	2.8	μF
C _{VCCA}	V _{CCA} decoupling capacitor	Ceramic capacitor	0.1			μF
C _{VCCB}	Internal supply voltage (V _{CCB}) decoupling capacitor	Ceramic capacitor	1.0	2.2	2.8	μF
T _A	Ambient operating temperature		-40	25	85	°C
T _J	Junction operating temperature		-40	25	125	°C
P _D	Maximum power dissipation	$P_D = (T_J - T_A)/R_{TH(J-A)}$			625	mW
V _{IO_B}	I/O voltage on external pins (without WP and CD) - B-side	CMDB, CLKB, DAT0B, DAT1B, DAT2B, DAT3B	0		V _{CCB}	V
V _{IO_A}	I/O voltage on internal pins (includes WP and CD) - A-side	EN, SEL, WP, CD, DAT123.dir, CMD.dir, CMD.h, CLK.h, CLK-f, DAT0.dir, DAT0.h, DAT1.h, DAT2.h, DAT3.h	0		V _{CCA}	V

Table 6. Current levels under recommended operating conditions (T_A = -40 °C to 85 °C)

Symbol	Parameter	Test conditions ⁽¹⁾	Min.	Typ.	Max.	Unit
I _{Q_OFF}	Quiescent current consumption I _{CCA_OFF}	V _{EN} = 0.4 V, V _{BAT} = 3.4 V, V _{CCA} = 1.98 V *.dir, *B = 0 V, WP = CD = V _{CCA}			1	μA
	Quiescent current consumption I _{BAT_OFF}	All other pins floating			1	μA
I _{Q_ON}	Quiescent current consumption (Ground pin current) I _{BAT} + I _{CCA}	*.dir = 0 V, V _{BAT} = 3.4 V V _{EN} = V _{CCA} = V _{CLK.h} = 1.98 V All other pins floating	I _{OUT} = 100 μA		150 ⁽²⁾	μA
			I _{OUT} = 50 mA		250 ⁽²⁾	
I _{CCA_ON}	Quiescent current on V _{CCA}	V _{EN} = V _{CCA} = 1.92 V, V _{BAT} = 3.4 V, *.dir = V _{CCA} , V _{IA} = *.h = V _{CCA}		3	10	μA

- Collective names for groups of pins:
*.dir = CMD.dir, DAT0.dir, DAT123.dir
*.h = CMD.h, CLK.h, DAT0.h, DAT1.h, DAT2.h, DAT3.h
*B = CMDB, CLKB, DAT0B, DAT1B, DAT2B, DAT3B
V_{IA} = all A-side input pins.

- Guaranteed by design.

5 Passive integration and low-pass EMI filter

Figure 4. Circuit diagram of ST6G3244ME (without LDO)

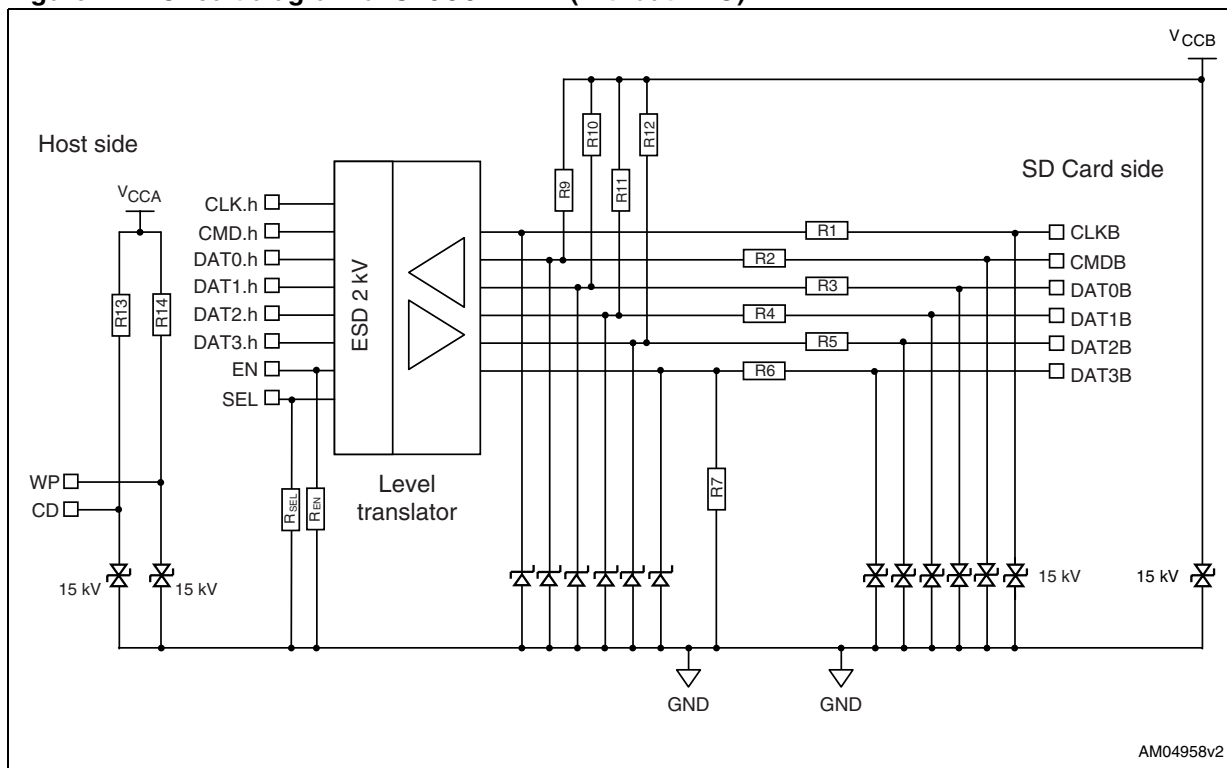


Table 7. Components

Symbol	Parameter	Test conditions ⁽¹⁾	Min.	Typ.	Max.	Unit
C _{IN-A}	Input capacitance for A-side	V _{BAT} = 3.4 V, *.dir = V _{EN} = V _{CCA} f = 1 MHz, V _{DC} = 0 V ± 30 mV, V _{AC} = 30 mV		5	10	pF
C _{IN-B}	Input capacitance for B-side	V _{BAT} = 3.4 V, *.dir = 0 V, V _{EN} = V _{CCA} f = 1 MHz, V _{DC} = 0 V ± 30 mV, V _{AC} = 30 mV		24	28	pF
R1, R2, R3, R4, R5, R6 ⁽²⁾	EMIF resistors	T _J = 25 °C	32	40	48	Ω
R10, R11, R12	DAT0B, DAT1B, DAT2B pull-up resistors	T _J = 25 °C	49	70	91	kΩ
R9	CMDB pull-up resistor	T _J = 25 °C	10.5	15	19.5	kΩ
R7	DAT3B pull-down resistor	T _J = 25 °C	329	470	611	kΩ
R13	CD pull-up resistor	T _J = 25 °C	70	100	130	kΩ
R14	WP pull-up resistor	T _J = 25 °C	70	100	130	kΩ
R _{PD}	LDO resistor	T _J = 25 °C	90	130	170	Ω
R _{EN}	EN pull-down resistor	T _J = 25 °C		500		kΩ
R _{SEL}	SEL pull-down resistor	T _J = 25 °C		500		kΩ

1. See [Note 1 on page 7](#) for definition of collective names of pins, for example *.dir.
2. These values are guaranteed by design and statistical process control.

Table 8. EMI filter attenuation

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
IL _{0-200M}	Filter attenuation ⁽¹⁾	Frequency range: 0 Hz to 200 MHz	6	-	-	dB
IL _{401-800M}		Frequency range: 401 MHz to 800 MHz	10	-	-	
IL _{801-2500M}		Frequency range: 801 MHz to 2.5 GHz	20	-	-	
IL _{2600-6000M}		Frequency range: 2.6 GHz to 6 GHz	30	-	-	

1. Guaranteed by design.

6 Data transmission

All values in the tables below are guaranteed across the operating temperature and voltage range unless otherwise specified.

Table 9. DC voltage levels on host CPU side ($T_A = -40\text{ °C}$ to 85 °C)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_{IHA}	High level input voltage		$0.65 V_{CCA}$	V_{CCA}		V
V_{ILA}	Low level input voltage			0	$0.35 V_{CCA}$	V
V_{OHA}	High level output voltage	$I_{OH} = -6\text{ mA}$, $V_{CCA} = 1.62\text{ V}$	$V_{CCA} - 0.45$	V_{CCA}		V
V_{OLA}	Low level output voltage	$I_{OL} = 7\text{ mA}$, $V_{CCA} = 1.62\text{ V}$		0	0.45	V

Table 10. DC voltage levels on SD Card side ($T_A = -40\text{ °C}$ to 85 °C)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_{IHB}	High level input voltage		$0.7 V_{CCB}$	V_{CCB}		V
V_{ILB}	Low level input voltage			0	$0.3 V_{CCB}$	V
V_{OHB}	High level output voltage	$I_{OH} = -4\text{ mA}$	$0.8 V_{CCB}$	V_{CCB}		V
V_{OLB}	Low level output voltage	$I_{OL} = 4\text{ mA}$		0	$0.2 V_{CCB}$	V

Table 11. Leakage and short-circuit currents

Symbol	Parameter	Test condition ⁽¹⁾	Min.	Typ.	Max.	Unit
I_{LH}	Leakage current on host side pins	$V_{SEL} = 0\text{ V}$, $V_{EN} = *.dir = V_{CCA} = 1.98\text{ V}$ $V_{IA} = V_{CCA}$ or 0 V , $V_{BAT} = 3.4\text{ V}$			5	μA
I_{LSD}	Leakage current on SD Card side pins	$V_{SEL} = 0\text{ V}$, $V_{BAT} = 3.4\text{ V}$, $V_{CLK.h} = V_{CCA}$ $V_{CMD} = V_{DAT0} = V_{DAT1} = V_{DAT2} = V_{CCB}$ $V_{DAT3} = *.dir = 0\text{ V}$			5	μA
I_{SCH}	Short-circuit current on host side pins	SD Card input = H, host = 0 V SD Card input = 0 V , host = $V_{CCA} = 1.8\text{ V}$ $*.dir = 0\text{ V}$, $V_{BAT} = 3.4\text{ V}$, $T_J = 25\text{ °C}$		25		mA
I_{SCSD}	Short-circuit current on SD Card side pins	Host input = H, SD Card = 0 V Host input = L, SD Card = $V_{CCB} = 2.9\text{ V}$, $T_J = 25\text{ °C}$, $*.dir = V_{CCA} = 1.8\text{ V}$, $V_{BAT} = 3.4\text{ V}$	25		70	mA
		Host input = H, SD Card = 0 V Host input = L, SD Card = $V_{CCB} = 1.8\text{ V}$, $T_J = 25\text{ °C}$, $*.dir = V_{CCA} = 1.8\text{ V}$, $V_{BAT} = 3.4\text{ V}$	25		70	

1. Collective names for groups of pins:
 $*.dir$ = CMD.dir, DAT0.dir, DAT123.dir
 $*.h$ = CMD.h, CLK.h, DAT0.h, DAT1.h, DAT2.h, DAT3.h
 $*B$ = CMDB, CLKB, DAT0B, DAT1B, DAT2B, DAT3B
 V_{IA} = all A-side input pins.

Figure 5. Symbol definitions of t_{PLH} , t_{PHL} , t_r and t_f for AC characteristics

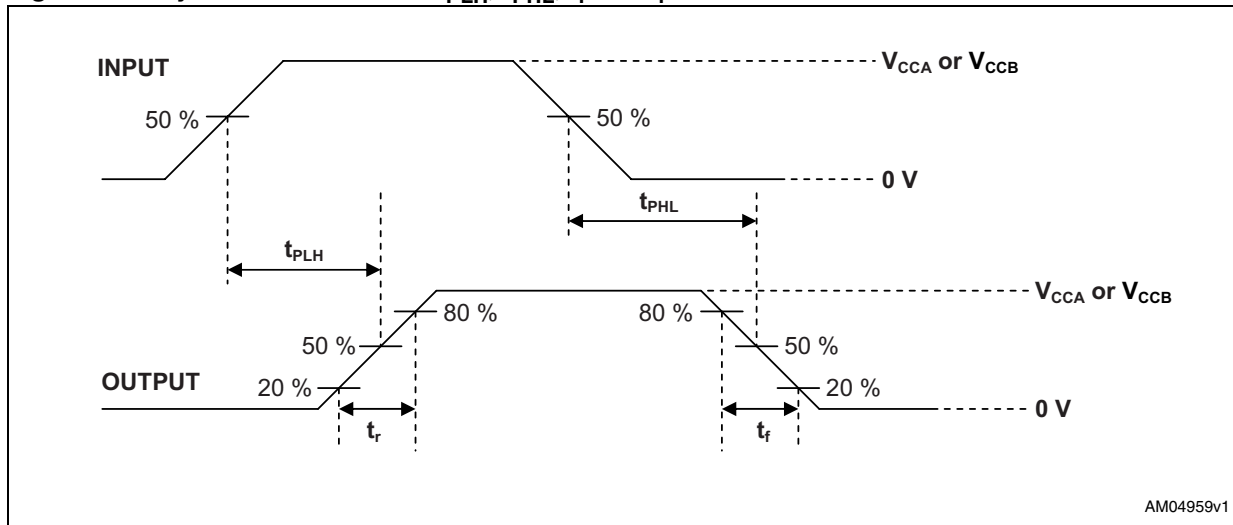


Table 12. AC characteristics ($T_A = -40\text{ }^\circ\text{C}$ to $85\text{ }^\circ\text{C}$)

Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
t_{PHL}	Propagation delay HL from host to SD	See Section 6.1	$V_{CCB} = 1.8\text{ V}$		3.2	7	ns
			$V_{CCB} = 2.9\text{ V}$		3.2	5	
t_{PLH}	Propagation delay LH from host to SD	See Section 6.1	$V_{CCB} = 1.8\text{ V}$		3.2	7	ns
			$V_{CCB} = 2.9\text{ V}$		3.2	5	
t_{PHL}	Propagation delay HL from SD to host	See Section 6.2	$V_{CCB} = 1.8\text{ V}$		3.0	7	ns
			$V_{CCB} = 2.9\text{ V}$		2.8	5	
t_{PLH}	Propagation delay LH from SD to host	See Section 6.2	$V_{CCB} = 1.8\text{ V}$		3.0	7	ns
			$V_{CCB} = 2.9\text{ V}$		2.8	5	
t_r	Rise time from host to SD	See Section 6.1	$V_{CCB} = 1.8\text{ V}$		2.0	4	ns
			$V_{CCB} = 2.9\text{ V}$		2.0	4	
	Rise time from SD to host	See Section 6.2	$V_{CCB} = 1.8\text{ V}$		2.0	4	
			$V_{CCB} = 2.9\text{ V}$		2.0	4	
t_f	Fall time from host to SD	See Section 6.1	$V_{CCB} = 1.8\text{ V}$		2.0	4	ns
			$V_{CCB} = 2.9\text{ V}$		2.0	4	
	Fall time from SD to host	See Section 6.2	$V_{CCB} = 1.8\text{ V}$		2.0	4	
			$V_{CCB} = 2.9\text{ V}$		2.0	4	
t_{TA}	Turn-around time (direction switch response, for all channels) ⁽¹⁾		$V_{CCB} = 1.8\text{ V}$ or 2.9 V , $C_L = 15\text{ pF}$		7.5	12	ns
t_{SKEW}	Delay differences from host to SD	See Section 6.1	See Section 6.3	-0.5	0	0.5	ns
$t_{CH2CH-SKEW}$	Channel-to-channel skew			-0.5	0	0.5	ns
$t_{SKEW.f}$	CLK-f to CMD, DAT delay (valid for PCB trace lengths from 20 mm to 100 mm)	See Section 6.2	See Section 6.4	0.3		1.2	ns
t_{P_CLKF}	Propagation delay from CLK feedback	See Section 6.2	$V_{CCB} = 1.8\text{ V}$		5.7	13.5	ns
			$V_{CCB} = 2.9\text{ V}$		5.5	9.5	

Table 12. AC characteristics ($T_A = -40\text{ }^\circ\text{C}$ to $85\text{ }^\circ\text{C}$) (continued)

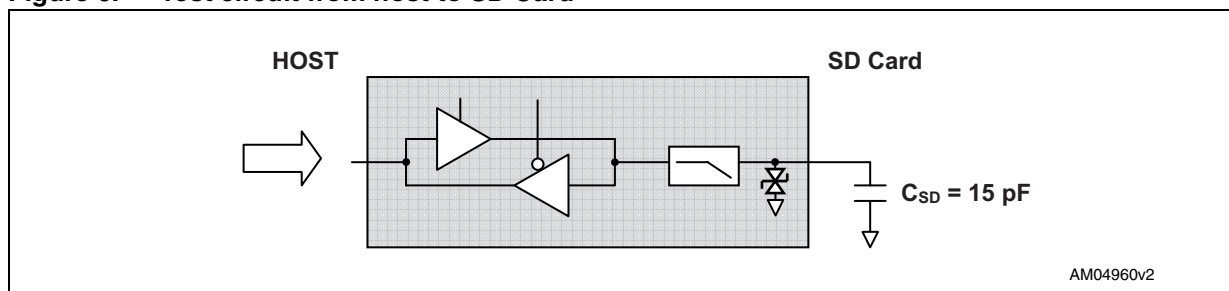
Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
t_{r_CLKF}	Rise time for CLK feedback	See Section 6.2	$V_{CCB} = 1.8\text{ V}$		1.0	3	ns
			$V_{CCB} = 2.9\text{ V}$		1.0	3	
t_{f_CLKF}	Fall time for CLK feedback	See Section 6.2	$V_{CCB} = 1.8\text{ V}$		1.0	3	ns
			$V_{CCB} = 2.9\text{ V}$		1.0	3	
f_{MAX}	Clock rate					60	MHz
	Data rate					120	Mbps

1. The time after the .dir signal transition that the device needs to switch direction, after that it is ready to accept valid data on the switched input.

6.1 Test circuit from host to SD Card

The test circuit from the host to the SD Card is shown in [Figure 6](#). Timings are measured for the whole line cell (translator + EMI + ESD) on an external load $C_{SD} = 15\text{ pF}$ (board capacitance 5 pF + SD Card capacitance 10 pF).

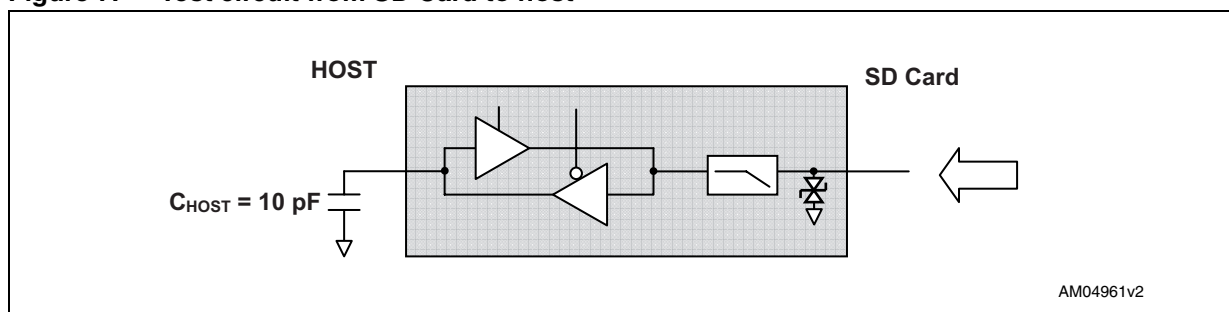
Figure 6. Test circuit from host to SD Card



6.2 Test circuit from SD Card to host

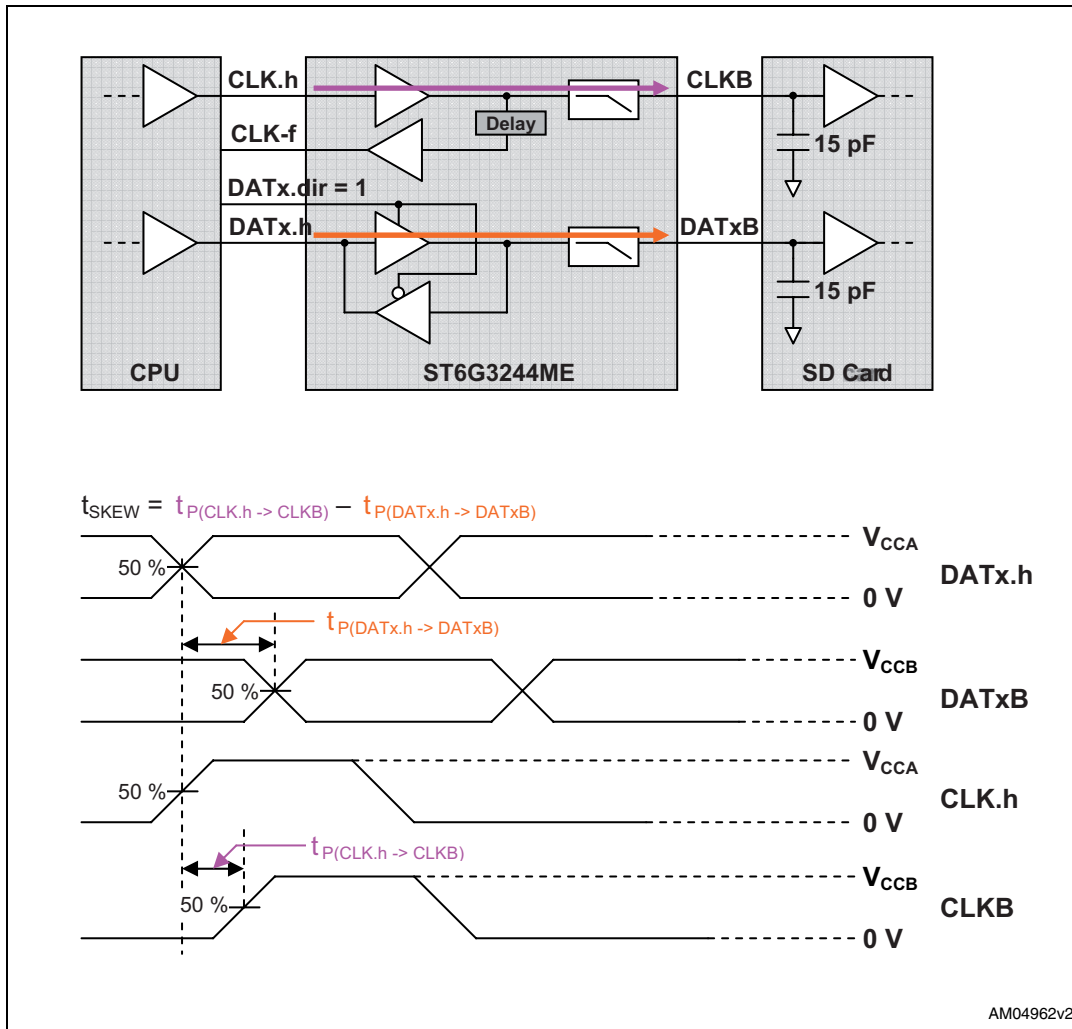
The test circuit from the SD Card to the host is shown in [Figure 7](#). Timings are measured for the whole line cell (translator + EMI + ESD) on an external load $C_{HOST} = 10\text{ pF}$ (board capacitance + host capacitance).

Figure 7. Test circuit from SD Card to host



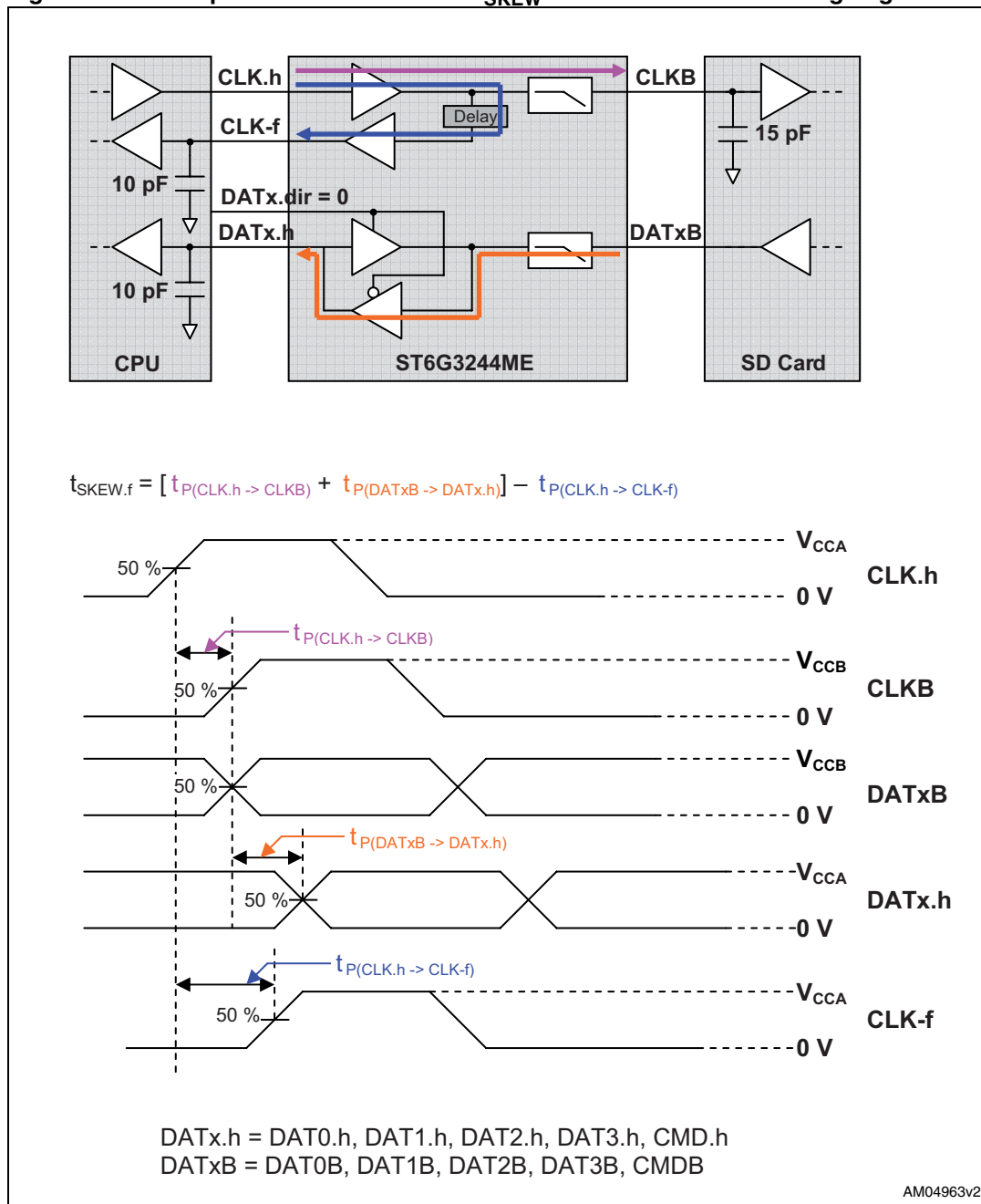
6.3 Measurement of t_{SKEW} (SD Card to host) from rising edge CLK.h

Figure 8. Example of measurement of t_{SKEW} (SD Card to host) from rising edge CLK.h



6.4 Measurement of $t_{SKEW.f}$ (read mode) from rising edge CLK.h

Figure 9. Example of measurement of t_{SKEW} for read mode from rising edge CLK.h



7 Low drop-out voltage regulator

Figure 10. Low drop-out voltage regulator

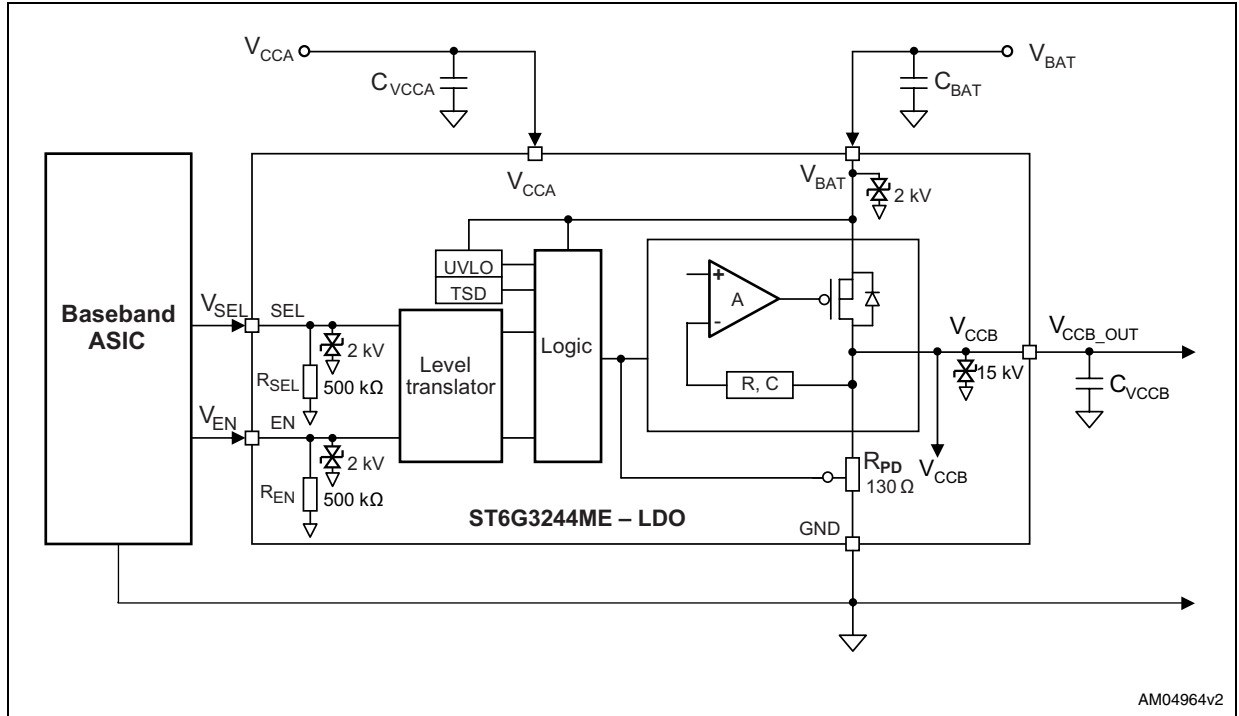


Table 13. V_{CCB} selection (B-side power supply voltage), EN pin control

EN	SEL	V _{CCB} ⁽¹⁾ (V)
0	x	0 ⁽²⁾
1	0	2.9
1	1	1.8

- V_{CCB} is an internal B-side I/O power supply, tied to the V_{CCB_OUT} pin for external decoupling capacitor. V_{CCB} supply voltage can also be used externally.
- Pulled down to GND by R_{PD}. When V_{CCB} = 0 V, no additional leakage is seen on V_{CCA}.

Table 14. LDO static parameters ($V_{EN} = V_{CCA}$ unless otherwise specified)

Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
V_{CCB_OUT}	Regulated output voltage (V_{CCB})	$V_{BAT} = 3$ to 5 V, $SEL = 0$ $I_{OUT} = 0.1$ to 50 mA, $T_J = -40$ to 125 °C		2.75	2.90	3.05	V
		$V_{BAT} = 3$ to 5 V, $SEL = 1$ $I_{OUT} = 0.1$ to 50 mA, $T_J = -40$ to 125 °C		1.71	1.8	1.89	
V_{DO}	Drop-out voltage	V_{CCB_OUT} (nom) – 100 mV $T_J = -40$ to 85 °C $SEL = 0$	$I_{OUT} = 50$ mA		25	40	mV
I_{OUT}	V_{CCB_OUT} output current					50	mA
TSD	Thermal shutdown temperature	$V_{BAT} = 3.4$ V	Shutdown (temp. ↑)		150		°C
			Reset (temp. ↓)		130		
			Hysteresis		20		
UVLO	Undervoltage lockout	$T_J = -40$ to 125 °C	Shutdown ($V_{BAT} \downarrow$)	2.3	2.5	2.7	V
			Reset ($V_{BAT} \uparrow$)	2.35	2.55	2.75	V
			Hysteresis		50		mV

Note: Level translator deactivated, *.dir = 0, CLK.h = V_{CCA} , all other pins floating.

Table 15. LDO dynamic parameters ($V_{EN} = V_{CCA}$ unless otherwise specified)

Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
PSRR	Power supply rejection ratio	$V_{BAT} = 3.4$ V $I_{OUT} = 50$ mA $T_J = 25$ °C $C_{VCCB} = 2.2$ μF, ESR = 5 mΩ	f = 1 kHz		40		dB
			f = 10 kHz		30		
t_{START}	Settling time	$V_{CCB_OUT} \uparrow$ 95% nom., $V_{BAT} = 5$ V, $I_{OUT} = 50$ mA, $T_J = -40$ °C to 125 °C, $C_{VCCB} = 1$ μF, enable L → H, $SEL = 0$			30	100	μs
		$V_{CCB_OUT} \uparrow$ 95% nom., $V_{BAT} = 5$ V, $I_{OUT} = 50$ mA, $T_J = -40$ °C to 125 °C, $C_{VCCB} = 1$ μF, enable L → H, $SEL = 1$			30	100	
t_{STOP}	Discharge time	$V_{CCB_OUT} \downarrow$ 10% nom., $V_{BAT} = 3.4$ V, $I_{OUT} = 1$ mA, $T_J = 25$ °C, $C_{VCCB} = 1$ μF, enable H → L, $SEL = 0$			0.6	1	ms
		$V_{CCB_OUT} \downarrow$ 10% nom., $V_{BAT} = 3.4$ V, $I_{OUT} = 1$ mA, $T_J = 25$ °C, $C_{VCCB} = 1$ μF, enable H → L, $SEL = 1$			0.6	1	

8 SD Card specification compliance

The ST6G3244ME is designed to be compliant with SD Card specifications. The reference standards used include:

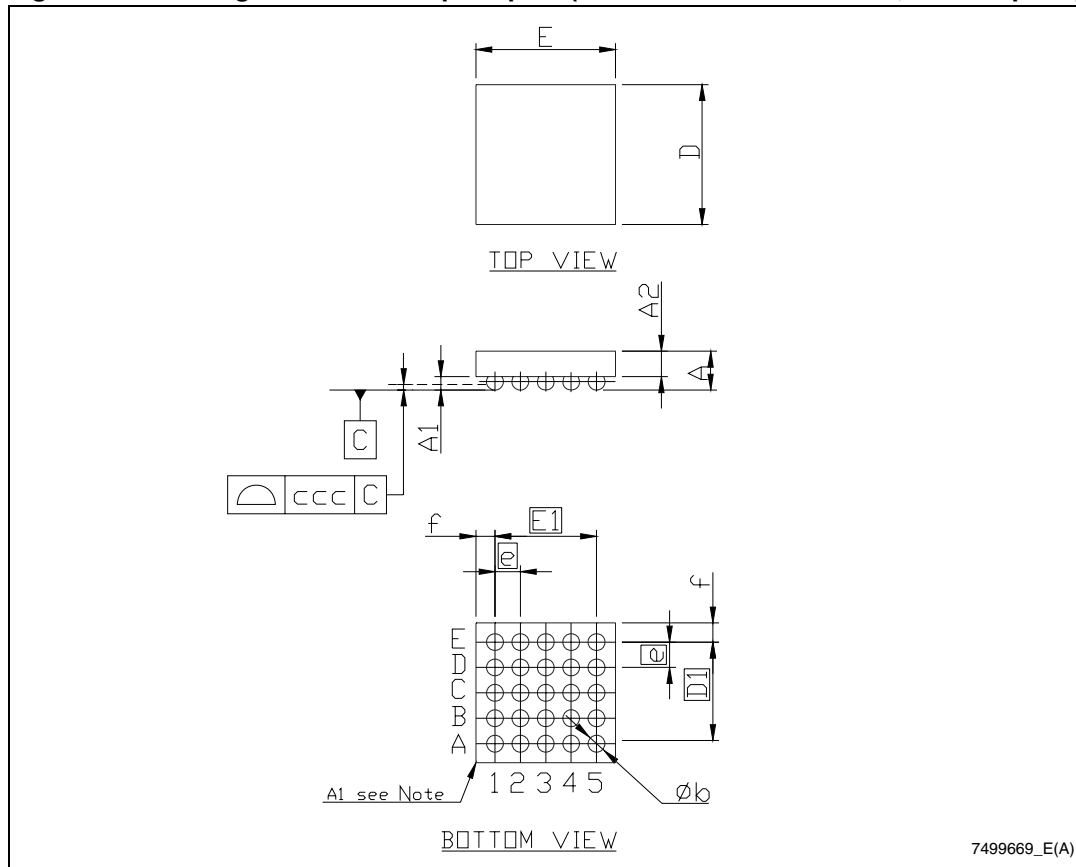
- SD Card Specification v3.00 (SDR12, SDR25, DDR50)
- SD Card Specification v2.00

The clock and data channels are designed to meet a 60 MHz clock rate and 120 Mbps data rate respectively to support both SDR and DDR modes.

9 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com. ECOPACK[®] is an ST trademark.

Figure 11. Package outline for Flip Chip 25 (2 mm x 2 mm x 0.605 mm, 0.4 mm pitch)



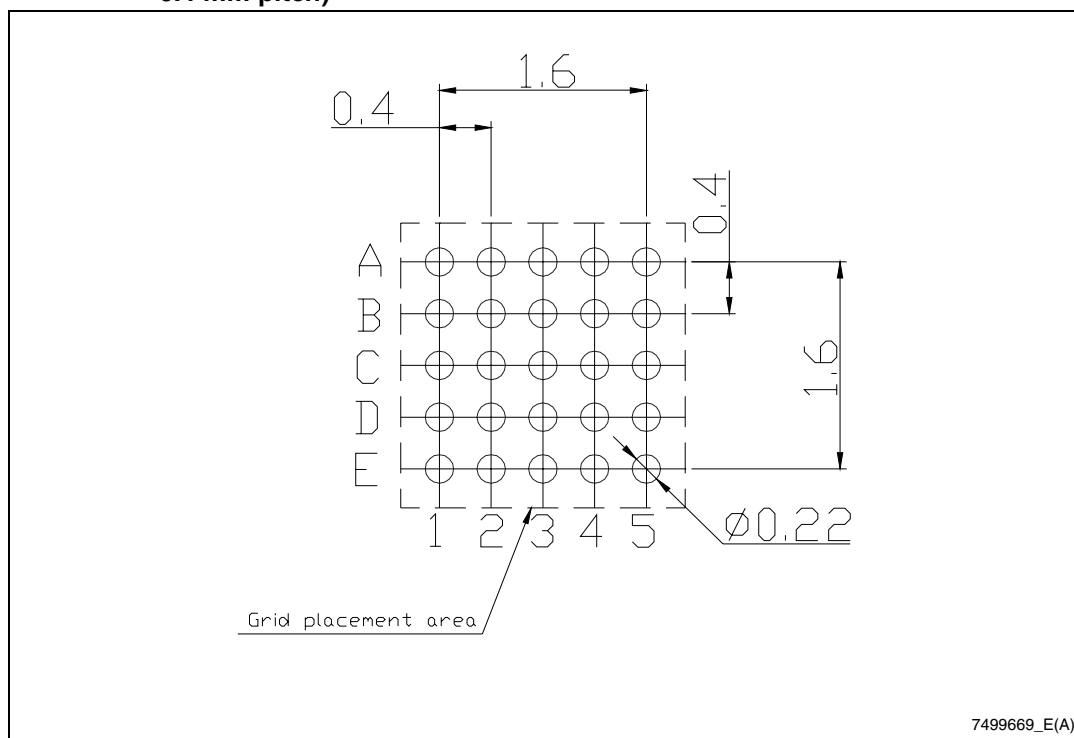
7499669_E(A)

Note: The terminal A1 is on the top side of the package identified by a circular dot - typically 0.5 mm in diameter.

Table 16. Package mechanical data for Flip Chip 25 (2 mm x 2 mm x 0.605 mm, 0.4 mm pitch)

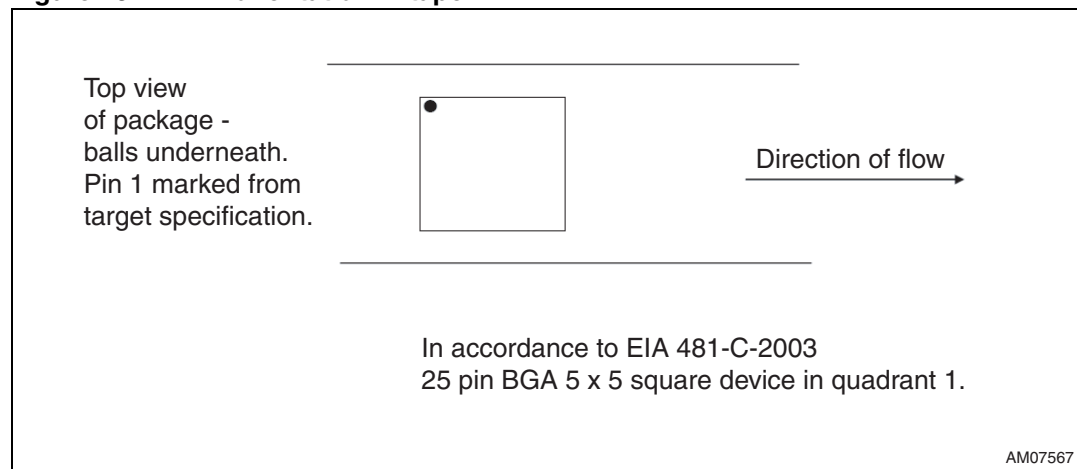
Symbol	Millimeters		
	Min.	Typ.	Max.
A	0.560	0.605	0.650
A1	0.180	0.205	0.230
A2	0.380	0.400	0.420
b	0.230	0.255	0.280
D	1.985	2.00	2.015
D1	1.59	1.60	1.61
E	1.985	2.00	2.015
E1	1.59	1.60	1.61
e	0.36	0.40	0.44
f	0.190	0.200	0.210
ccc			0.05

Figure 12. Footprint recommendation for Flip Chip 25 (2 mm x 2 mm x 0.605 mm, 0.4 mm pitch)



10 Tape and reel information

Figure 13. Pin 1 orientation in tape



11 Revision history

Table 17. Document revision history

Date	Revision	Changes
25-Aug-2011	1	Initial release.
08-Nov-2011	2	Removed label "custom data", updated Features , Applications , Table 1 updated and moved from <i>Section 11 Package marking</i> on page 26 to page 1, updated Section 1: Description , Section 2: Functional description , Table 2 , Table 3 to Table 7 , Table 10 to Table 12 , Table 14 , Figure 8 , Figure 9 , Figure 13 , removed <i>Section 11 Package marking</i> , minor text corrections throughout document.

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY TWO AUTHORIZED ST REPRESENTATIVES, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2011 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com