

# CG51/CE51 SERIES

## 3V, 0.50 MICRON HIGH PERFORMANCE/LOW POWER CMOS GATE ARRAYS

### DESCRIPTION

The Fujitsu CG51/CE51 is a series of ultra high performance CMOS gate arrays. The CG51 is a high density Sea-of-Gates array for applications requiring high levels of integration or low power. The CE51 is a high performance embedded gate array family offering full support of diffused high speed RAMS, ROMS and embedded megafunctions. The CE51 series offers density and performance approaching that achievable with standard cell solutions with the time-to-market advantage of a gate array.

True 3V products, the CG51/CE51 feature very low power (1.2 microwatt/Mhz) and both 3.3V and 5.0V compatible I/Os. These advanced product families are targeted at users who are seeking very high performance or very high levels of integration. Potential end-user applications include computers, supercomputers, workstations, graphic terminals, telecom networking, and signal processing.

### FEATURES

- 0.5 Micron Drawn Channel Length
- Triple layer metal
- 3.3V  $\pm$  0.3V supply voltage
- Chanelless, Sea-of-gates Architecture
- Internal gate delay of 210ps, F/O = 2, L = 1mm
- Low power consumption: 1.2 microwatt/gate/Mhz
- Maximum toggle frequency: 600Mhz
- High speed I/Os: PCML (PECL), LVTC
- Supports 3.3V and 5.0V I/O
- RAM compiler supports Single/Dual/Triple port RAM
- Supports JTAG boundary scan, full and partial scan
- Phase Locked Loop for interchip clock skew control
- Clock net for optimized on-chip clock skew control
- Advanced packaging options include QFP, PGA, BGA, and MCM
- High drive capability: 2, 4, 8, 12, or 24mA
- Supports all major third party EDA tools including: Cadence, Mentor, Synopsys



Fujitsu Microelectronics, Inc.'s CE51654  
647,000 Available Gate .5 Micron Embedded  
Array, Containing 28 Embedded Macro Cells

### PRODUCT SUMMARY

Device Name	Available Gates	Number of Pads	Metal Wiring
CG51754	753,768	496	3LM
CG51654	647,948	456	3LM
CG51484	477,632	400	3LM
CG51364	363,084	352	3LM
CG51284	277,380	304	3LM
CG51214	214,760	272	3LM
CG51164	160,140	240	3LM
CG51114	113,520	208	3LM
CG51343	34,272	120	3LM

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### DC CHARACTERISTICS

Measuring conditions:  $V_{DD} = 3.3V \pm 0.3V, V_{SS} = 0V, T_j = -0$  to  $100^\circ C$

Parameter	Symbol	Test Conditions		Requirements			Unit	
				Min.	Typ.	Max.		
Supply current <sup>2</sup>	$I_{DDs}$	Standby mode <sup>1</sup>	CG51343 to CG51214	-1.0	-	1.0	mA	
			CG51284 to CG51484	-2.0	-	2.0		
			CG51654 to CG51754	-3.0	-	3.0		
High-level input voltage <sup>3</sup>	$V_{IH}$	CMOS level	Normal cell	$V_{DD} \times 0.7$	-	$V_{DD}$	V	
			Schmitt trigger cell	$V_{DD} \times 0.8$	-	$V_{DD}$		
		TTL level	Normal cell	2.2	-	$V_{DD}$		
Low-level input voltage <sup>3</sup>	$V_{IL}$	CMOS level	Normal cell	$V_{SS}$	-	$V_{DD} \times 0.2$	V	
			Schmitt trigger cell	$V_{SS}$	-	$V_{DD} \times 0.2$		
		TTL level	Normal cell	$V_{SS}$	-	0.8		
High-level output voltage	$V_{OH}$	$I_{OH} = -2, -4, -8, -12, -18$		$V_{DD} - 0.4$	-	$V_{DD}$	V	
Low-level output voltage	$V_{OL}$	$I_{OL} = 2, 4, 8, 12, 18$		$V_{SS}$	0	0.4	V	
Input leakage current (Tri-state pin input) <sup>4</sup>	$I_{LI}$	$V_I = 0V$ to $V_{DD}$		-10	-	10	$\mu A$	
	$I_{LZ}$			-10	-	10		
Input pull-up/pull-down resistor <sup>5</sup>	$R_P$	Pull-up $V_I = V_{DDI}$ Pull-down $V_I = 0V$		20	50	140	$k\Omega$	
Output Short-circuit current <sup>6</sup>	$I_O$	Type	Condition	$V_O = V_{DD}$		$V_O = 0V$		mA
		Output buffer	Low power $I_{OL} = 2mA$	-20	+20			
			Normal $I_{OL} = 4mA$	-40	+40			
			Power $I_{OL} = 8mA$	-80	+80			
			High power $I_{OL} = 12mA$	-120	+120			
			Very high power $I_{OL} = 24mA$	-180	+180			

#### NOTES:

1. When  $V_{IH} = V_{DD}$  and  $V_{IL} = V_{SS}$ , memory is in the standby mode.
2. If an input buffer with pull-up/pull-down resistor is used, the supply current may not be assured depending on the circuit configuration.
3. 5V interface is only for CMOS level.
4. If an input buffer with pull-up/pull-down resistor is used, the input leakage current may exceed the above value.
5. Either a buffer without a resistor or with a pull-up/pull-down resistor can be selected from the input and bidirectional buffers.
6. Maximum supply current at the short-circuit of output and  $V_{DD}$  or  $V_{SS}$ .

## ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Requirements	Unit
Supply voltage	$V_{DDE}$	(External) $V_{SS}^* -0.5$ to 6.0	V
	$V_{DDI}$	(Internal) $V_{SS}^* -0.5$ to 4.0	
Input voltage	$V_I$	$V_{SS}^* -0.5$ to $V_{DD} +0.5$	V
Output voltage	$V_O$	$V_{SS}^* -0.5$ to $V_{DD} +0.5$	V
Storage ambient temperature	$T_{ST}$	Plastic $-55$ to $+125$	°C
		Ceramic $-65$ to $+150$	
Supply pin current	$I_D$	For one $V_{DD}$ pin	90
		For one $V_{SS}$ pin	90
Output current	$I_O$	Low power-type output buffer $I_{OL} = 2$ mA	$\pm 14$
		Normal-type output buffer $I_{OL} = 4$ mA	$\pm 14$
		Power-type output buffer $I_{OL} = 8$ mA	$\pm 14$
		High-power type output buffer $I_{OL} = 12$ mA	$\pm 21$
		Very high-power type of output buffer $I_{OL} = 24$ mA	$\pm 58$

\*  $V_{SS} = 0V$ 

## RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Requirements			Unit	
		Min.	Typ.	Max.		
Supply voltage	$V_{DDE}$	3.0	3.3	3.6	V	
	$V_{DDI}$	3.0	3.3	4.6		
High-level input voltage	$V_{IH}$	CMOS level	$V_{DD} \times 0.7$	–	$V_{DDI}$	V
		TTL level	2.2	–	$V_{DDI}$	
Low-level input voltage	$V_{IL}$	CMOS level	$V_{SS}^*$	–	$V_{DDI} \times 0.2$	V
		TTL level	$V_{SS}^*$	–	0.8	
Junction temperature	$T_j$	0	–	100	°C	

\*  $V_{SS} = 0V$

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### THIRD PARTY EDA TOOL SUPPORTED

Fujitsu supports a third party environment allowing an ASIC designer the widest possible range of design options. Both the CG51 gate array and CE51 embedded array product families are fully supported by Fujitsu's ASIC design kits, running on leading workstations and provides a seamless link from leading third party ASIC design flows to Fujitsu's

ASIC back end environment. These kits provide an easy environment for design entry, design rule checking. They also provide a complete pre- and post-layout timing back annotating capabilities. The following leading third party tools are supported.

Cadence:	Verilog-XL
Mentor:	Design Architect 8.2, Autologic I, QuickSim II
Motive:	Motive 4.2 (Static Timing Analyzer)
Sunrise Systems:	ATPG 2.1
Synopsys:	Design Analyzer 3.2a, VSS

**PACKAGE OPTIONS**

In addition to offering plastic and ceramic versions of industry standard packages such as PQFPs and PGAs, Fujitsu also offers an impressive array of advanced packaging technology. Our long experience with high speed logic and thermal management has led us to develop some of the most advanced packaging available anywhere. From cost

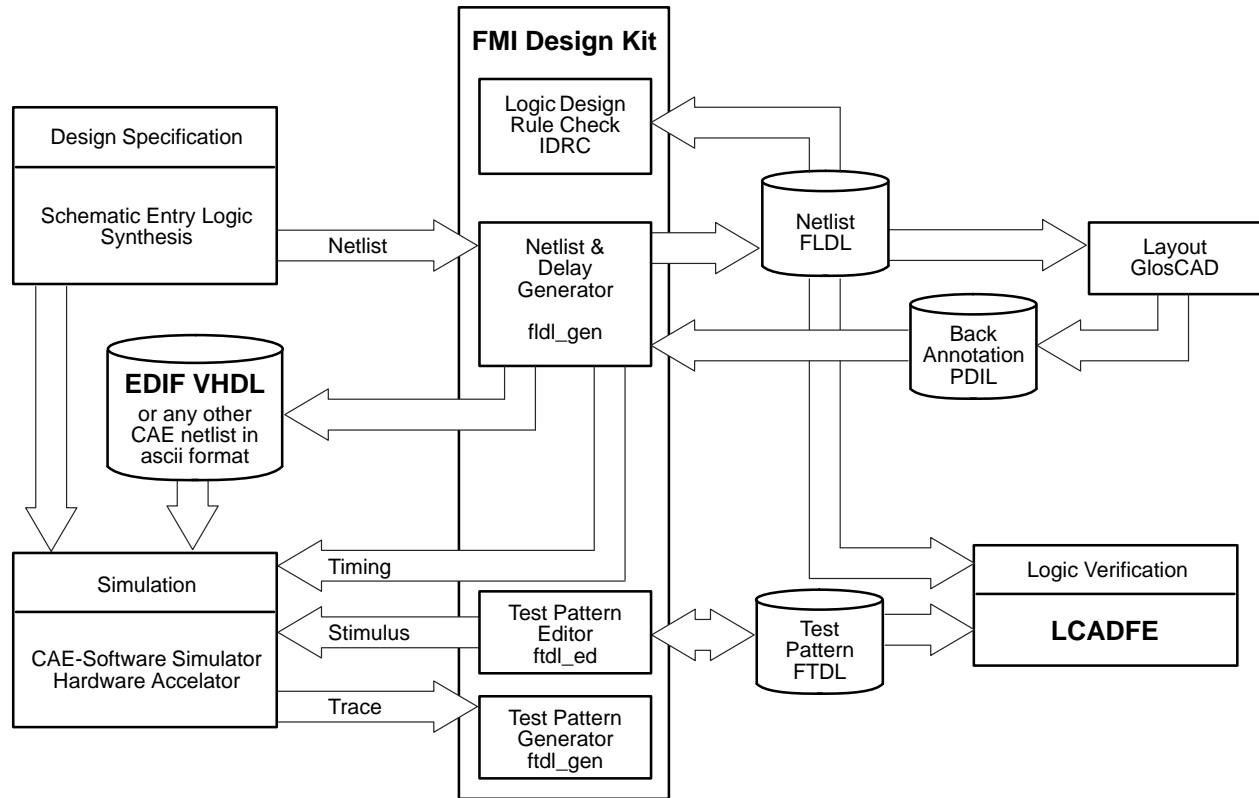
effective, single chip packages to sophisticated multichip modules, Fujitsu has a packaging option to suit your requirements. Whether you need a 208 PQFP, the newest in high I/O count surface mounted Ball Grid Array (BGA) packages or full custom packaging we can deliver the optimal solution.

**Packaging Options**

	343	114	164	214	284	364	484	654	754
<b>Quad Flat Package (1.0, 0.8, 0.65 mm pin pitch)</b>									
100	P								
120	P								C
160		P,C	P,C	P,C	P,C	P,C	P,C	P,C	
<b>Shrink Quad Flat Package (0.5 mm pin pitch)</b>									
80	P								
100	P								
120	P								
144		P	P	P	P				
176		P,C	P,C	P,C	P,C	P,C			
208		P,C	P,C	P,C	P,C	P,C	P,C	P,C	
240			P,C	P,C	P,C	P,C	P,C	P,C	
256				C	P,C	P,C	P,C	P,C	
304					C1	C1	C	C	C
<b>Fine Pitch Flat Package (0.4 mm pin pitch)</b>									
304						C	C	C	C
<b>Pin Grid Array Package</b>									
256					C	C	C	C	C
299					C	C	C	C	C
321						C	C	C	C
361							C	C	C
401						C	C	C	C
<b>Ball Grid Array (BGA)</b>									
256			P	P	P				
352					P	P	P		
416								P1	P1
576									P1

NOTES: 1 : Under Development  
 C: Ceramic Package  
 P: Plastic Package

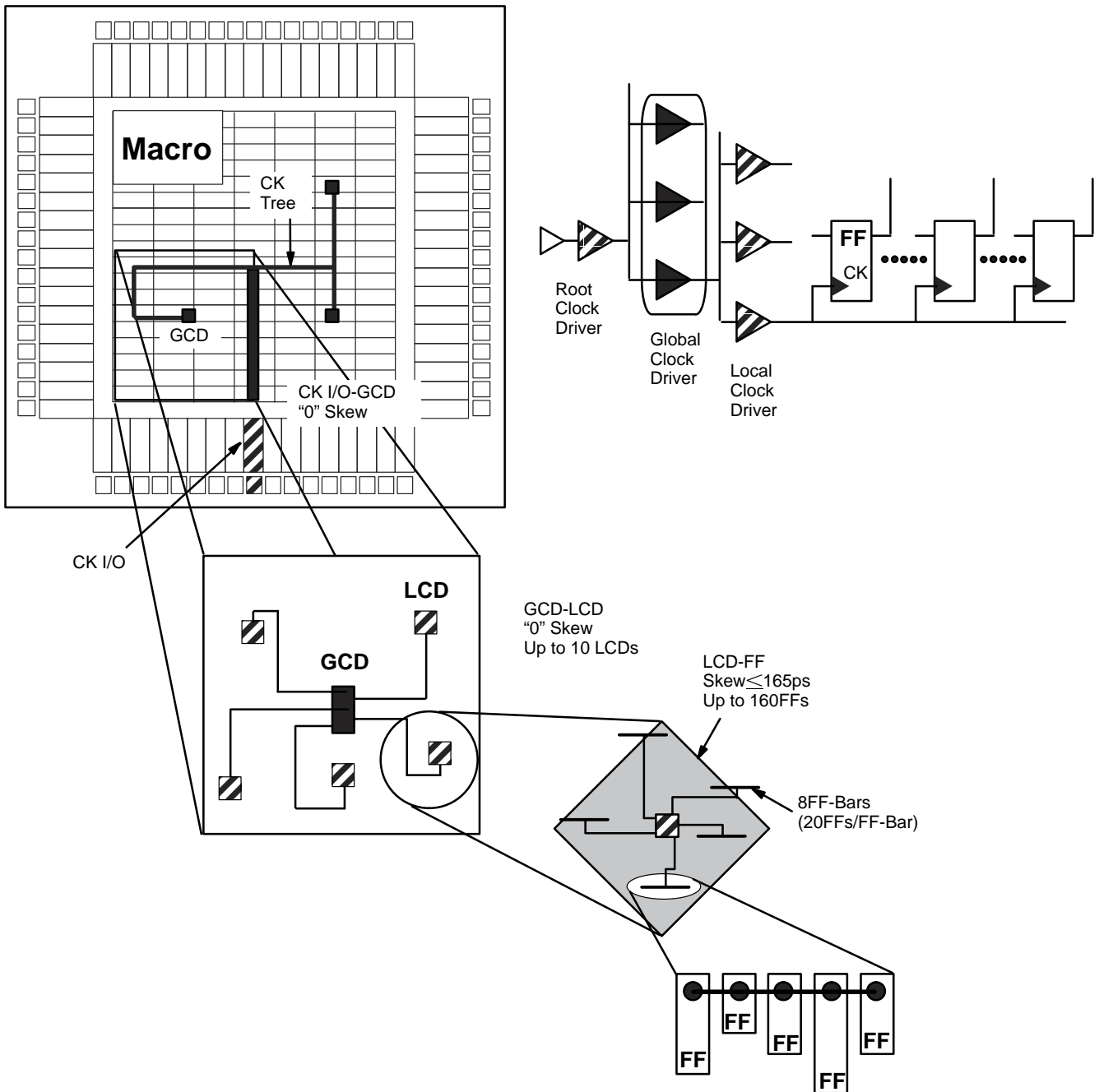
# FRONT-END DESIGN FLOW



## CLOCK SKEW CONTROL

To maximize performance in high speed, high density arrays, a designer must maintain tight clock skew control. In addition to an available PLL to manage interchip clock skew, Fujitsu's clock driven design methodology (CDDM) offers accurate on chip clock skew control. CDDM offers accurate RC extraction

of clock tree parameters, interactive clock tree implementation, simplifies trade-offs between clock tree delay and clock skew, early verification of potential design hold time errors and race conditions.



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This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.



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