

Libraries

Name	Process	Form Factor
RGO_TSMC16_18V18_FFC_20C_ONFI_4_1	FFC	Staggered CUP
RGO_TSMC12_18V18_FFC_LL_20C_ONFI_4_1	FFC_LL	Staggered CUP

Summary

The ONFI 4.1 library provides the combo driver / receiver cells, the ODT / driver impedance calibration cell, and the voltage reference cell to support both single-ended and differential ONFI 4.1 signaling. This library also meets the requirements for ONFI 3.0 & Toggle 2.0 signaling. Also included is a full complement of power, spacer, and adapter cells to assemble a complete pad ring by abutment. An included rail splitter allows isolated ONFI domains to be placed in the same pad ring with other power domains while maintaining continuous VDD/VSS in the pad ring for robust ESD protection.

The ONFI 4.1 I/O library supports all impedance modes defined in the ONFI 4.1 specification and features fast and precise calibration, low power consumption, area-efficient design, and easy integration into the physical layer (PHY).

These libraries are offered at both 16nm and a 12nm shrink. They are available in a staggered CUP wire bond implementation with a flip chip option.

ESD Protection:

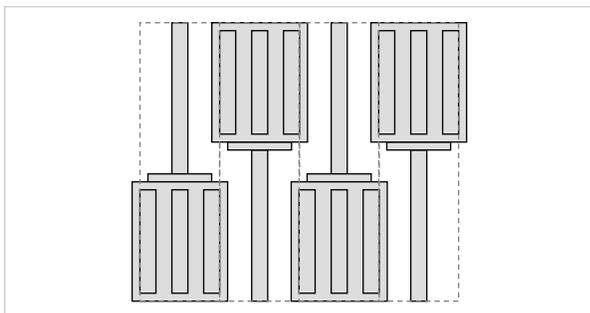
- JEDEC compliant
 - 2KV ESD Human Body Model (HBM)
 - 500 V ESD Charge Device Model (CDM)

Latch-up Immunity:

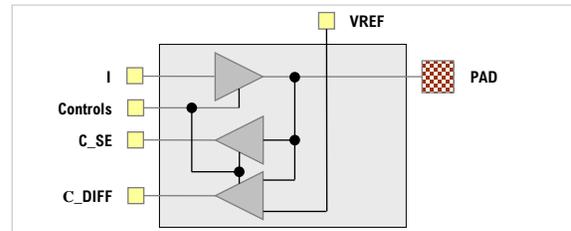
- JEDEC compliant
 - Tested to I-Test criteria of $\pm 100\text{mA}$ @ 125°C

Cell Size & Form Factor

Staggered (pad-limited) – $22.08\mu\text{m} \times 358.8\mu\text{m}$



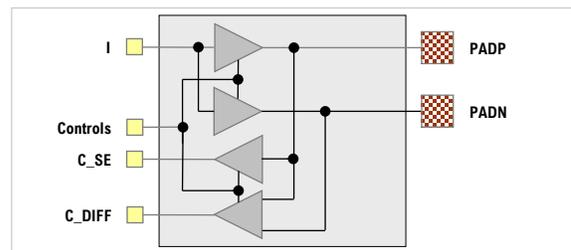
ONP_BI_SDS_1218V_SCB: Single-Ended Driver



ONFI Single-Ended Driver / Receiver Features:

- Driver – user-selectable on-die termination and programmable drive strength with ODT / Z_o calibration and programmable “off” state control.
 - $ODT R_{it} = 30\Omega / 50\Omega / 75\Omega / 100\Omega / 150\Omega$
 - $Z_{OUT} = 18\Omega / 25\Omega / 35\Omega / 50\Omega$
 - Off state – Z / pull-up / pull-down / bus keeper
- Receiver – single-ended and pseudo-differential outputs
- Powered by 1.2V / 1.8V I/O and 0.8V core supplies
- Maximum operating frequency – 400 MHz

ONP_CL_SDS_1218V_SCB: Differential Driver



ONFI Differential Clock Driver / Receiver Features:

- Driver – user-selectable on-die termination and programmable drive strength with ODT / Z_o calibration and programmable “off” state control.
 - $ODT R_{it} = 30\Omega / 50\Omega / 75\Omega / 100\Omega / 150\Omega$
 - $Z_{OUT} = 18\Omega / 25\Omega / 35\Omega / 50\Omega$
 - Off state – Z / pull-up / pull-down / bus keeper
- Receiver – single-ended and true differential outputs
- Powered by 1.2V / 1.8V I/O and 0.8V core supplies
- Maximum operating frequency – 400 MHz

Recommended operating conditions

Symbol	Description	Min	Nom	Max	Units
V _{VDD}	Core supply voltage	0.72	0.80	0.88	V
T _J	Junction temperature	-40	25	125	°C
V _{PAD}	Voltage at PAD	-0.3V		V _{DVDD} +0.3V	V
V _{DVDD}	I/O supply voltage	1.62	1.8	1.98	V
V _{IH(DC)}	Input High (DC)	0.7 * V _{DVDD}		V _{DVDD} + 0.3	V
V _{IL(DC)}	Input Low (DC)	V _{DVSS} - 0.3		0.3 * V _{DVDD}	V
V _{IH(AC)}	Input High (AC)	0.8 * V _{DVDD}		V _{DVDD} + 0.3	V
V _{IL(AC)}	Input Low (AC)	V _{DVSS} - 0.3		0.2 * V _{DVDD}	V
V _{DVDD}	I/O supply voltage	1.62	1.8	1.98	V
V _{IH(DC)}	Input High (DC)	V _{REF} +.125		V _{DVDD} + 0.3	V
V _{IL(DC)}	Input Low (DC)	V _{DVSS} - 0.3		V _{REF} -.125	V
V _{IH(AC)}	Input High (AC)	V _{REF} +.250			V
V _{IL(AC)}	Input Low (AC)			V _{REF} -.125	V
V _{DVDD}	I/O supply voltage	1.14	1.2	1.26	V
V _{IH(DC)}	Input High (DC)	V _{REF} +.100		V _{DVDD} + 0.3	V
V _{IL(DC)}	Input Low (DC)	V _{DVSS} - 0.3		V _{REF} -.100	V
V _{IH(AC)}	Input High (AC)	V _{REF} +.150			V
V _{IL(AC)}	Input Low (AC)			V _{REF} -.150	V

Characterization Corners (16nm)

Model	LPE Type	VDD=0.8V	DVDD	Temp
FFGNP	Cbest_CCbest_T	+10%		-40°C
FFGNP	Cbest_CCbest_T	+10%		0°C
FFGNP	Cbest_CCbest_T	+10%		125°C
FFG	Ctypical	+10%	See table below for DVDD voltage ranges.	125°C
TT	Ctypical	nominal		25°C
TT	Ctypical	nominal		85°C
SSGNP	Cworst_CCworst_T	-10%		-40°C
SSGNP	Cworst_CCworst_T	-10%		0°C
SSGNP	Cworst_CCworst_T	-10%		125°C

Characterization Corners (12nm)

Model	LPE Type	VDD=0.8V	DVDD	Temp
FF	Cbest_CCbest	+10%		-40°C
FF	Cbest_CCbest	+10%		0°C
FF	Cbest_CCbest	+10%		125°C
FFG	Ctypical	+10%	See table below for DVDD voltage ranges.	125°C
TT	Ctypical	nominal		25°C
TT	Ctypical	nominal		85°C
SS	Cworst_CCworst	-10%		-40°C
SS	Cworst_CCworst	-10%		0°C
SS	Cworst_CCworst	-10%		125°C

Library Characterization DVDD Voltage Ranges

Nominal DVDD		FF	TT	SS	Units
1.8	NV-DDR & NV-DDR2	1.95	1.8V	1.7	V
1.2	NV-DDR3	1.26	1.2	1.14	V

Cell summary

Name	Description
ONP_BI_SDS_1218V_SCB *	ONFI Single-Ended Driver/Receiver
ONP_CL_SDS_1218V_SCB *	ONFI Differential Clock Driver/Receiver
ONP_SP_CAL_1218V *	Calibration cell
ONP_RE_000_1218V *	Voltage Reference (VREF).
PVP_VD_PDO_1218V *	I/O V _{DD} (DVDD) with POC
PVP_VD_RDO_1218V *	I/O V _{DD} (DVDD)
PVP_VS_RDO_1218V *	I/O V _{SS} (DVSS)
PVP_VS_DRC_1218V *	I/O V _{SS} (DVSS is shorted to VSS)
PVP_VD_RCD_0918V *	Core V _{DD} (VDD)
PVP_VS_RCD_0918V *	Core V _{SS} (VSS)
PVP_VS_DRC_0918V *	Core V _{SS} (DVSS is shorted to VSS)
SVP_CO_000_1218V	Corner cell – rail splitter
SVP_CO_001_1218V	Corner cell - continous
SVP_SP_001_1218V	1µm spacer cell
SVP_SP_005_1218V *	5µm spacer cell
SVP_SP_020_1218V *	20µm spacer cell
SPP_RS_005_1218V	Rail splitter cell
SPP_SP_CAP_1218V	Core decoupling cap cell

* Vertical-only and horizontal-only orientations

Staggered CUP Cells

CUP_TSMC16_44X80_IN	44µm X 80µm Inner
CUP_TSMC16_44X80_OUT	44µm X 80µm Outer
CUP_TSMC16_FC	Flip chip with top metal port
CUP_TSMC16_FC_NRV	Flip chip without RV vias

© 2011-2018 Aragio Solutions. All rights reserved.

Information in this document is subject to change without notice. Aragio Solutions may have patents, patent applications, trademarks, copyrights or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from Aragio, the furnishing of this document does not give you any license to the patents, trademarks, copyrights, or other intellectual property.

Published by:

Aragio Solutions
 2201 K Avenue
 Section B Suite 200
 Plano, TX 75074-5918
 Phone: (972) 516-0999
 Fax: (972) 516-0998
 Web: <http://www.aragio.com/>

While every precaution has been taken in the preparation of this book, the publisher assumes no responsibility for errors or omissions, or for damages resulting from the use of the information contained herein. This document may be reproduced and distributed in whole, in any medium, physical or electronic, under the terms of a license or nondisclosure agreement with Aragio.

Printed in the United States of America