# Atmel

# **APPLICATION NOTE**

Atmel AT04389: Connecting SAMD20E to the AT86RF233 Transceiver

#### Atmel SAMD20

#### **Description**

This application note describes a method to connect an Atmel<sup>®</sup> ATSAMD20E microcontroller to an Atmel AT86RF233 IEEE<sup>®</sup> 802.15.4 Wireless Transceiver. The 32-pin SAM D20E is gaining popularity as a baseband processor for wireless applications. The current development platform uses the 64-pin SAM D20J on the ATSAMD20-XPRO and RF233-XPRO extender board. This combination is supported in Atmel Studio 6. To translate firmware written for the 64-pin platform to a 32-pin target product several layers of signal mapping; such as the 64-pin to 32-pin conversion and header I/O constraints, have to be reconciled. This paper offers a solution that matches the target product topology to the legacy development platform as closely as possible.

#### **Features**

- Essential Hardware Connections
- Development Platform Compatibility
- 64-Pin to 32-Pin Mapping
- Signal Map Spreadsheet
- Example Schematic

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## 1. Description

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This application note describes a method to connect an Atmel ATSAMD20E to an AT86RF233 IEEE 802.15.4 Wireless Transceiver. The 32-pin SAM D20E is gaining popularity as a baseband processor for wireless applications. The current development platform uses the 64-pin SAM D20J on the ATSAMD20-XPRO and RF233-XPRO extender board. This combination is supported in Atmel Studio 6. To translate firmware written for the 64-pin platform to a 32-pin target product several layers of signal mapping; such as the 64-pin to 32-pin conversion and header I/O constraints, have to be reconciled. This paper offers a solution that matches the target product topology to the legacy development platform as closely as possible.

## 2. Signal\_map.xlsx Spreadsheet

The spreadsheet and schematics included with the application note show the basic connections that should be made between the SAMD20E and the RF233. This is a starting point for new work. Designers can use the remaining I/O and features on the D20E as needed for their derivative projects.

The following section describes the column grouping of the signal\_map.xlsx spreadsheet. The column group on the left *SAM D20J XPRO (64 Pin)* is the starting point. This column is the 64-pin SAMD20J signal definitions. Each level of interconnect is shown in a column group. Each signal is shown in a single row. The signals cascade from left-to-right starting with the 64-pin SAMD20J to the final connections on the 32-pin SAMD20E target product. As the signals cascade across the spreadsheet some drop off because of various interface constraints and the matrix becomes sparsely populated.

The SAMD20 processor uses SERCOM ports and MUX modes to on-board sub-systems to the "PA" ports and I/O pins. Table "PORT Function Multiplexing" of the SAMD20 datasheet [1] explains the different permutations and connections possible for various SAMD20-package options. This paper is focused on the 64-pin D20J and the 32-pin D20E. Some of the SECOM ports, such as SERCOM4, are not available on the smaller 32-pin package. This forces the UART migration from SERCOM4 to SERCOM3 on the target product. Additionally the PIN locations are re-organized for the smaller package.

The next column group in the mapping, *XPRO-EX2*, is the Xplained PRO EXT2 header. The designers of the Xplained PRO EK family have chosen a limited set of I/O that provides a uniform interface across a broad line of products. These choices limit the signals available and mandate certain combinations. For example signals like RESETN and SWD programming interface are not included in this interface. These need to be defined ad-hoc on the target product.

Firmware developers using Studio 6 will want to use the REB-233 XPRO Extender card to add the radio transceiver to the SAMD20 CPU. There is a column group for this card too, *REB-233 XPRO*. This card has some interesting features like ID\_PROM and UART that are not on the basic target product. These signals are abandoned at this level.

For reference the next column group, *AT86RF233*, shows the low-level connections to the AT86RF233. All the connections on the RF233, including the segregated analog and digital power domains, are shown to give a complete picture of the transceiver implementation.

Toward the right edge of the spreadsheet is the 32-pin SAMD20 column group, SAM D20E (32 Pin). This shows the SAMD20 connections and signal names. The SPI interface and several of the control I/O signals have passing straight through the mapping matrix and are connected to the legacy PA Ports. Some new signals, such as TRX\_RESET are established using the remaining GPIO on the 32-pin SAMD20E.

The final column group, *LOCAL\_BUS*, identifies the net names used on the example schematic. Additionally the signals are labeled by functional group and their change status. LEGACY status indicates no change; the D20E signals match the legacy D20J signals. CHANGED status indicates the function has been moved and must be accounted for in the HAL layer of software. REMOVED status means the signal did not complete the translation through the matrix or was removed to simplify the basic design.

## 3. Example Schematic

The two-page schematic shows the circuitry commonly used for RF233 wireless systems. RF signal chain components such as antenna, pi matching network, balun and local oscillator are shown. The essentials for the SAMD20 baseband CPU are also shown: CPU, programming header, UART test interface and power filtering. Developers can connect additional circuitry to the unused GPIO as needed. Additional suggestions include AT24MAC602 ID-PROM for network credential storage, pushbutton and LED for wireless network binding stimulus and indication.

Note: The SAMD20 on the target product can be programmed using a jumper cable from the Xplained PRO USB interface.

The AT86RF233 datasheet [2] suggests segregating analog and digital power domains to prevent common inductance coupling of EMI. The component R4 is a virtual mnemonic device used to separate the two signals in the CAD tool. In layout this short would be implemented by connection AGND and DGND together at transceiver (Pin U3.33 the 'thermal-pad'.)

## 4. Conclusion

The spreadsheet and schematic give a detailed example of the SAMD20E to RF233 interface. This will give Atmel developers a head start. Projects using this connection set should readily adapt to firmware developed in Atmel Studio 6 using the ATSAMD20-XPRO. Following this application note, and using the recommended basic features, will give Atmel developers a smooth path to production.

### 5. References

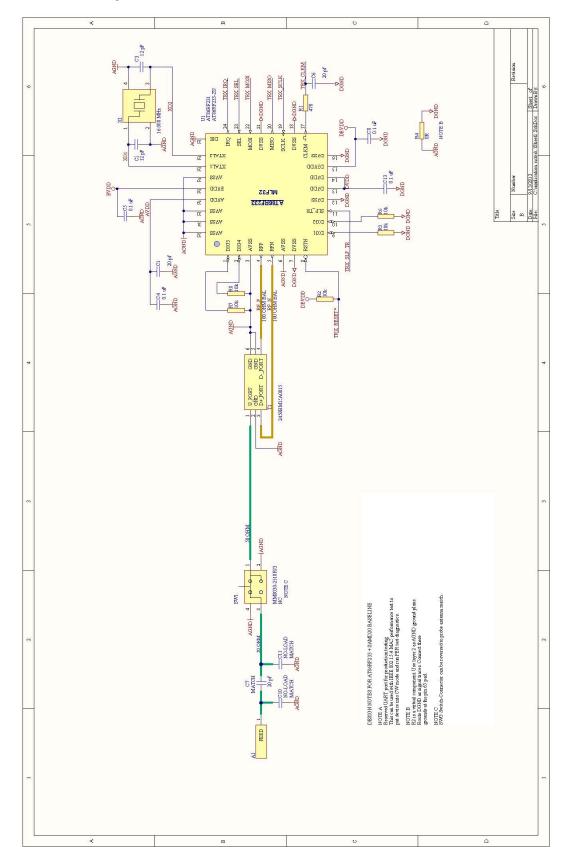
- [1]. Atmel 42129 SAMD20 Datasheet
- [2]. Atmel 8351 AT86RF233 Datasheet
- [3]. Atmel 42102 SAM D20 Xplained Pro User Guide
- [4]. A09-1873 SAMD20 XPRO Schematic (internal doc)
- [5]. A08-1669 RFA233=XPRO Schematic (internal doc)



MDX_FNG         MDX_FNG         REFCOND         REFCOND <t< th=""><th>Dotation         Rest, MeD, and N         Rest, MeD, and N</th><th>SAR</th><th></th><th></th><th></th><th>XPRO-EX2</th><th>REB-233 XPRO</th><th>3 XPRO</th><th>AT</th><th>AT86RF233</th><th>SAM D</th><th></th><th></th><th>LDCAL_BUS</th><th></th></t<>	Dotation         Rest, MeD, and N	SAR				XPRO-EX2	REB-233 XPRO	3 XPRO	AT	AT86RF233	SAM D			LDCAL_BUS	
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U12.38 OND OTHER NOTICE CONTRACT ON CONTRA	U13.28         GNU         Destructione         Destructione <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>U3.10</td><td>GND</td><td>DGND</td><td>POWER</td><td></td></t<>										U3.10	GND	DGND	POWER	
U0:2.28 000000 U0:2.28 00000 MRS U103 MSS U113	U0:2.20         000000           U0:2.20         000000           U0:2.20         000000           U0:2.20         000000           RFN         U103           RFN         U103           RFN         U104           RFN         U103           RFN         U104           RFN         U103           RFN         U104           RFN         U104           RFN         U103           RFN         U104           RFN         U103           RFN         U104           RFN         U103           RFN         U104           RFN         U105           RFN         U104           RFN         U105           RFN         U104           RFN         U105           RFN         D0000           D0000         U111           RFN         D0000           D111         RFN           RFN         D0000           D112         RFN           RFN         D112           RFN         D112           RFN         D128           RFN														
15.23 V00000 V000 U133 V000 DF4 V103 D5400 D540 D540 D540 D540 D540 D540 D54	Interface         Interface <t< td=""><td>+</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>U3.28</td><td>GND</td><td>DGND</td><td>POWER</td><td></td></t<>	+									U3.28	GND	DGND	POWER	
DIG4     U102     U103     DIG4       RFP     U103     U103     DIG4       RFN     U104     RFN     U103       RFN     U104     RFN     U104       RFN     U104     RFN     DIG4       RFN     U104     RFN     U104       RFN     U104     RFN     DIG40       RFN     U104     RFN     DIG40       RFN     U104     RFN     DIG40       RFN     U107     U103     RFN       RFN     U106     RFN     DIG40       RFN     U107     U103     RFN       RFN     U107     U103     RFN       RFN     U107     U103     RFN       RFN     U113     DIG40     DIG40       DNDD     U113     DIG40     DIG40       DND     U128     RAD0     DIG40       ANDD     U128     RAD0     DIG40       ANDD     U128     RAD0     DIG40       ANDD     U128	Diest     U103     U103     Diest     U103       RFP     U103     RFP     U103     Diest       RFP     U103     RFP     Diest     Diest       NSS     U103     NSS     U103     Diest       NSS     U113     Diest     Diest     Diest       DNDD     U114     Diest     Diest     Diest       DNDD     U113     Diest     Diest     Diest       NNDD     U123     Diest     Diest       DND     U123 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>00 511</td><td>NDDDPF</td><td>VDDCDEE</td><td></td><td></td></t<>										00 511	NDDDPF	VDDCDEE		
Ult:33         VDIN         DEVDIN           0164         U102         U133         VDIN           RFP         U103         RFP         U103         R410           RFN         U103         RFP         U103         R410           RFN         U103         RFP         U103         R410           RFN         U104         RFP         R710         D000           RFN         U103         RFP         R710         D000           RFN         U103         RFP         RFP         R410           RFN         U103         R711         D000         D011           RFN         U113         D000         D111         D000           DV000         U114         D126         D000         D011           DV000         U114         D126         D000         D011           DV000         U113         D000         D011         D000           DV000         U113         D012         D012         D010           DV000         U112         D128         D010         D010           RV00         U128         RV00         U128         RV00           RV00         U128	1054         U102         U333         VDBN           RFN         U103         RFN         U103         RFN           RFN         U103         RFN         U103         RFN         D0104           RFN         U103         RFN         D0104         RFN         D0104           DSSS         U113         D0105         U113         D0105         D0104           RFN         U103         NSS         U113         D0105         D0104           RFN         U113         RND         U113         D0103         D0113	2									67.00				
Miss         U100         DGI0           1033         PAD         DGI0           1044         U103         PULLDOWN           1055         U103         PULLDOWN           1055         U103         PULLDOWN           1055         U103         PULLDOWN           1055         U103         PULLDOWN           1050         U113         PULLDOWN           1050         U113         PULLDOWN           1050         U113         PULLDOWN           1050         U113         PULLDONN           1050         U113         PULLDONN           1050         U113         PULLDONN <t< td=""><td>Image: Description of the state of</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>U3.30</td><td>VDDIN</td><td>DEVDD</td><td>POWER</td><td></td></t<>	Image: Description of the state of										U3.30	VDDIN	DEVDD	POWER	
DIG4     U102     U00       RFP     U103     WVS5       NVS5     U103     RFN       NVS5     U113     RFN       NVD0     U113     RVD0       NVD0     U113     RVD0       NVD0     U123     RVD0	Dist         U103         Dutto           ANSS         U103         ANSS         U103           ANSS         U103         ANSS         U103         ANN           ANSS         U104         ANSS         U103         ANN           ANSS         U103         ANN         U103         ANN           ANSS         U104         ANN         ANN         ANN           ANSS         U107         ANN         ANN         ANN           ANSS         U103         ANN         ANN         ANN           ANN         ANN         U103         ANN         ANN           ANN         U104         ANN         ANN         ANN           ANN         U113         ANN         ANN         ANN           ANN         U114         ANN         ANN         ANN           ANN         U113         ANN         ANN         ANN           ANN         U113         ANN         ANN         ANN           ANN         ANN         ANN         ANN         ANN           ANN         U113         ANN         ANN         ANN           ANN         ANN         ANN         ANN <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>112 22</td> <td>000</td> <td><b>UNDU</b></td> <td>DOM/CD</td> <td></td>										112 22	000	<b>UNDU</b>	DOM/CD	
DIG4     U102       ANSS     U103       RFN     U104       RFN     U103       RFN     U104       RFN     U105       RFN     U106       RFN     U106       RFN     U107       NSS     U107       DSS     U113       DSS     U114       DSS     U113       DSS     U113       DSS     U114       DSS     U113       DSS     U113       DSS     U114       DSS     U113       DSS     U113       DSS     U113       DSS     U128       DSS     U28	DIG4         U102           RFP         U103           RFP         U104           RFN         U105           RFN         U106           RFN         U106           RFN         U106           RFN         U107           RFN         U106           RFN         U107           RFN         U106           RFN         U107           RFN         U107           RFN         U106           RFN         U107           RFN         U106           RFN         U107           RFN         U107           RFN         U107           RFN         U108           RFN         U107           RFN         U108           RFN         U108           RFN         D000           U113         D000           D114         U128           RFN         D000           D113         D113           RND         U128           RND         U128           RND         U128           RND         U128           RND         U128								10-10-10	1.0000	00.00	Š			
AVSS         U103         AGNU           RFP         U104         RFN         U103           RFN         U105         RFN         U104           RFN         U105         RFN         U105           RFN         U105         RFN         U105           RFN         U106         RFN         U107           RFN         U107         RVSS         U107           RFN         U113         RVDD         U113           RFN         U113         RVDD         U114           RFN         U113         RVDD         U114           RFN         U113         RVDD         U113           RFND         U113         RVDD         U114           RFND         U126         RVDD         RVDD           RFND         U128         RVDD         U128           RVDD         U128<	ANS         U103         RFP         U104         RFP         RFP         U104         RFP         R010         R011         RFP         R010         R011         RFP         R010         R010         R011         R010         R011         R010	<u></u>							DIG4	U1.02			PULL DOWN	TRX	
RFD         U100         RFD         U101           RFN         U106         RFN         U106         RFN           RNSS         U112         U106         RFN         U106         RFN           RNSS         U113         U106         U113         DOUD         DOUD           DNDD         U113         U113         DOUD         DOUD         DOUD           DNSS         U114         DOUD         DOUD         DOUD         DOUD           DNSS         U113         DOUD         U114         DOUD         DOUD           DNSS         U113         DOUD         DOUD         DOUD         DOUD           DNSS         U113         DOUD         DOUD         DOUD         DOUD           DNSS         U113         DOUD         DOUD         DOUD         DOUD           DNSS         U128         U128         DOUD         DOUD         DOUD           DNSS         U128         U128         DOUD         DOUD         DOUD           ANDD         U128         N128         DOUD         DOUD         DOUD           ANDD         U128         N128         N128         ANDD         N128	FFP         U100         FFP         U100           RFN         U106         RFN         U106         RFN           RFN         U106         NSS         U106         RFN           RFN         U106         NSS         U106         RFN           RFN         U106         NSS         U107         RCND           NSS         U113         NU00         U114         RFN           NSS         U116         NSS         U116         RFND           NSS         U118         NSS         U118         RCND           NSS         U118         NSS         U118         RVDD           NSS         U118         NSS         U118         RVDD           NSS         U118         NSS         U128         NOD           NSS         U128         NSS         U128         NOD           NSS         U128         NOD         U128         NOD           NOD         U128         NOD         U128         NOD           NOD         U128         NOD         U128         NOD           NOD         U128         NOD         NOD         NOD           NOD         U1								AVCC	111 03			AGND	a divide	
RFP         U104           RFN         U106           NVSS         U107           NVSS         U107           NVSS         U107           NVSS         U107           NVSS         U107           NVSS         U113           NVSS         U114           NVSS         U113           NVDD         U114           NVSS         U113           NVSS         U114           NVSS         U113           NVSS         U113           NVSS         U124           NVSS         U125           NVSS         U126           NVSS         U127           NVSS         U128           NVSS         U127           NVSS         U128           NVSS         U128           NVDD         U128           NVD         U128           NVD	RFP         U104           RFN         U104           RFN         U104           ASS         U107           DNSS         U111           DNDD         U114           DNSS         U114           DNSS         U118           DNSS         U118           DNSS         U127           DNSS         U128           DNDD         U128           ANDD									20:10					
RFN         U106           AVSS         U107           AVSS         U107           AVSS         U117           AVSS         U117           AVDD         U113           AVDD         U113           AVDD         U113           AVDD         U113           AVDD         U113           AVDD         U114           AVDD         U113           AVDD         U114           AVDD         U113           AVDD         U114           AVDD         U114           AVDD         U113           AVDD         U114           AVDD         U113           AVDD         U128           AVD	RFN         U105           ANSS         U107           ANSS         U107           ANSS         U113           ANSS         U114           ANSS         U113           ANSS         U114           ANSS         U113           ANSS         U114           ANSS         U113           ANSS         U121           ANSS         U123           ANDD         U123           ANDD <td>_</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>RFP</td> <td>U1.04</td> <td></td> <td></td> <td>RF P</td> <td>TRX</td> <td></td>	_							RFP	U1.04			RF P	TRX	
NWS         U100           NVDD         U113           NVDD         U113           NVDD         U113           NVDD         U114           NVDD         U113           NVDD         U114           NVDD         U113           NVDD         U114           NVDD         U114           NVSS         U113           NVSS         U114           NVSS         U113           NVSS         U113           NVSS         U113           NVSS         U113           NVSS         U121           NVSS         U123           NVSS <td>With State         With St</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>111 06</td> <td></td> <td></td> <td></td> <td>YOT</td> <td></td>	With State         With St									111 06				YOT	
AMD MULTING MU	MVSS         U1005         MVSID         MVDD           NVSD         U1112         NVDD         NVDD           NVDD         U1114         NVDD         NVDD           NVDD         U1116         NVDD         NVDD           NVSS         U1128         NVD         NVDD           NVSS         U1128         NVD         NVD           NVSS         U1128         NVD         NVD           NVSS         U1128         NVD         NVD           NVSS         U1128         NVD         NVD           NVDD         U1128         NVD         NVD									20:00					
DVSs         U1.07         DSND         DU1.13         DSND         DVDD         DSND	DVSS     U1.07       DVSS     U1.12       DVDD     U1.13       DVDD     U1.13       DVDD     U1.14       DVDD     U1.15       DVDD     U1.16       DVDD     U1.17       DVDD     U1.18       DVDD     U1.26       DVSS     U1.17       DVSS     U1.18       DVSS     U1.18       DVDD     U1.26       AVDD     U1.28       A								AVSS	U1.06			AGND	POWER	
0.955     0.113       0.000     0.114       0.000     0.114       0.000     0.114       0.000     0.114       0.000     0.114       0.000     0.114       0.000     0.114       0.000     0.114       0.000     0.114       0.000     0.114       0.000     0.114       0.000     0.114       0.000     0.116       0.000     0.112       0.000     0.123       0.000     0.126       0.000     0.128       0.000	Dydding         Dydding <t< td=""><td>6</td><td></td><td></td><td></td><td></td><td></td><td></td><td>2010C</td><td>111 07</td><td></td><td></td><td><b>UNDU</b></td><td></td><td></td></t<>	6							2010C	111 07			<b>UNDU</b>		
DVSS         U1.12         DOND           DVDD         U1.13         DOND           DVDD         U1.14         DEVDD           DVSS         U1.14         DEVDD           DVSS         U1.16         DEVDD           DVSS         U1.16         DEVDD           DVSS         U1.16         DEVDD           DVSS         U1.18         DOND           DVSS         U1.21         DOND           DVSS         U1.23         DOND           DVSS         U1.23         DOND           ANDD         U1.23         XO1           ANDD         U1.23         ANDD	DVSS         U1.12         DV0D         U1.13         DV0D           DVDD         U1.14         DVDD         U1.13         DVDD           DVDD         U1.16         DVDD         U1.13         DVDD           DVDS         U1.16         DVDD         DVDD         DVDD           DVDD         U1.16         DVDD         DVDD         DVDD           DVSS         U1.16         DVSS         U1.16         DOND           DVSS         U1.18         DVDD         DVDD         DVDD           DVSS         U1.18         DVD         DVDD         DVDD           DVSS         U1.18         DVD         DVDD         DVDD           DVSS         U1.18         DVD         DVD         DVD           DVSS         U1.26         XTAL         U1.26         XO1           AVDD         U1.28         AVDD         U1.28         AVDD           AVDD         U1.28         AVDD         AVD	2													
DVDD         U113         DVDD           DVDD         U1145         DVDD           DVDD         U1145         DVDD           DVSS         U1145         DOND           DVSS         U1145         DOND           DVSS         U116         DOND           DVSS         U116         DOND           DVSS         U118         DOND           DVSS         U121         DOND           DVSS         U121         DOND           DVSS         U126         XTALL           DVSS         U127         DOND           DVSS         U128         XOO           AVDD         U128         XOO           AVDD         U128         XOO           AVDD         U128         XOO           AVDD         U128         AVDD           AVDD         U128         AVDD	DVDD         U1.13         DVDD         U1.13         DVDD           DVDD         U1.14         DVDD         U1.14         DVDD           DVDS         U1.16         DVDD         U1.14         DVDD           DVSS         U1.16         DVSS         U1.16         DVDD           DVSS         U1.16         DVSS         U1.16         DVDD           DVSS         U1.16         DVSS         U1.17         DVD           DVSS         U1.17         DVSS         U1.27         DOND           DVSS         U1.12         DVSS         U1.12         DOND           DVSS         U1.12         AVSS         U1.12         XO1           AVDD         U1.28         AVSS         U1.27         XO1           AVDD         U1.28         AVDD         U1.28         AVDD	**							DVSS	U1.12			DGND	POWER	
DDD     U111       DEVDD     U116       DVSS     U116       DVSS     U116       DVSS     U111       DVSS     U112       DVSS     U121       DVSS     U121       DVSS     U121       DVSS     U121       DVSS     U121       DVDD     U123       ANDD     U128       ANDD     U138       ANDD     U138       ANDD     U138       ANDD     U138       ANDD     U138	DEVDD         U115         DVDD         U116         DVDD           DEVDD         U116         U116         DVDD         DVDD           DVSS         U1118         DSND         U116         DSND           DVSS         U1118         DSND         U116         DSND           DVSS         U1118         DSND         U117         DSND           DVSS         U125         U126         DSND         DSND           DVSS         U126         U127         DSND         DSND           DVDD         U128         NYDD         U127         DSND           ANDD         U128         NYDD         U128         NYDD           ANDD         U128         NYDD         U128         NYDD           ANDD         U128         NYDD         U138         NYDD           ANDD         U138         NYDD         U138         NYDD           ANDD         U138         NYDD         NYDD         NYDD           ANDD         U138         NYDD         NYDD         NYDD									111 12				DOM/FB	
DVDD         U1.14         DEVDD           DSS         U1.16         DEVDD           DSS         U1.18         DEVDD           DSS         U1.21         DEVDD           DSS         U1.21         DEVDD           DSS         U1.21         DEVDD           DSS         U1.23         EDD         U1.26           AVDD         U1.28         XC1         XC1           AVDD         U1.28         ACND         U1.28           AVDD         U1.29         AVDD         U1.28           AVDD         U1.29         AVDD         U1.30           AVDD         U1.30         AVDD         AVDD	DVDD         U1.14         DEVDD         U1.14         DEVDD           DSS         U1.16         DEVDD         DEVDD         DEVDD           DSS         U1.16         DEVD         DEVDD         DEVDD           DSS         U1.16         DEVD         DEVD         DEVDD           DSS         U1.16         DEVD         DEVD         DEVD           DSS         U1.16         DEVD         DEVD         DEVD           DSS         U1.21         U1.26         DEVD         DEVD           DSS         U1.26         XTAL2         U1.26         XC1           AUSS         U1.27         MSS         U1.27         XC2         XC1           AUDD         U1.28         AUDD         U1.28         AUDD         U1.28         AUDD           AUDD         U1.28         AUDD         U1.28         AUDD	<u> </u>								2:-0					
DEVDD         U1.15         DEVDD           DSS         U1.18         DGND           DNSS         U1.18         DGND           DNSS         U1.18         DGND           DNSS         U1.18         DGND           DNSS         U1.21         NSS           DNSS         U1.21         NSS           NNSS         U1.21         NOD           DNSS         U1.23         NOD           ANSS         U1.23         NOD           ANDD         U1.28         NOD	DEVDD         U115         DEVDD           DEVDD         U116         DORUD           DNSS         U1118         DORUD           DNSS         U1118         DORUD           DNSS         U1118         DORUD           DNSS         U125         XTALI         U126           XTALI         U126         XCO         XCO           ANDD         U127         ANDD         U128         XCO           ANDD         U128         XCO         XCO         XCO           ANDD         U128         ANDD         U128         XCO         XCO           ANDD         U128         ANDD         U138         ANDD         XCO         XCO           ANDD         U138         ANDD         U138         ANDD         U138         ANDD         ANDD <td>0</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>DVDD</td> <td>U1.14</td> <td></td> <td></td> <td>DVDD</td> <td>POWER</td> <td></td>	0							DVDD	U1.14			DVDD	POWER	
Diss     U1116     DOND       Diss     U1118     DOND       Diss     U1121     DOND       Diss     U127     NOD       AVSS     U127     NOD       AVDD     U128     NOD       AVDD     U129     AVDD       AVDD     U130     AVDD	Diss     U118     DGND       Diss     U118     DSND       Diss     U121     DSND       Diss     U121     DSND       Diss     U128     XTALI       Diss     U128     XO1       ANS     U128     XO1       AND     U138     XO1       AND     U138     XOD       AND     U138     ANDD	2							DFVDD	U1 15			DFVDD	POWFR	
UVSS 01.18 DSS 01.18 DSS 01.18 DSS 01.18 DSS 01.126 XTAL2 01.26 AVDD 01.28 AVDD 01.28 AV	UVSS 01.18 UVSS 01.18 UVSS 01.18 UVSS 01.18 UV125 XTAL1 01.25 XTAL2 01.25 XTAL2 01.25 XTAL2 01.25 XTAL2 01.25 ANDD 01.28 ANDD 01.28 ANDD 01.28 ANDD 01.28 ANDD 01.38 ANDD 0														
Device Durition Duritio Durition Durition Durition Durition Durition	DVSS     U1.18     DGND       DVSS     U1.21     DGND       DVSS     U1.25     XTAL1       DVSS     U1.26     XO1       AVSS     U1.26     XO2       AVDD     U1.28     AOD       AVDD     U1.28     XO1       AVDD     U1.28     XO1       AVDD     U1.28     XO1       AVDD     U1.30     AVDD	<u>n</u>							2220	U1.16			DGND	FOWER	
DOND DOND XTAL2 U125 XTAL1 U128 XTAL1 U128 XVO1 V128 XVO1 V128 AVDD U128 AVDD U128 AVDD U128 AVDD U130 AVDD U130 AVDD U138 AVDD U138 AVD	DVSS     U1.21     DGND       XTAL2     U1.25     V1.26       XTAL2     U1.26     XO1       XVSS     U1.27     XO2       ANDD     U1.28     XO1       ANDD     U1.29     ANDD       ANDD     U1.29     ANDD       ANDD     U1.33     ANDD								DVSS	U1.18			DGND	POWER	
XTAL2 U125 XTAL2 U126 XTAL2 U126 AVDD U128 XOD U128 XOD U128 XOD U128 XOD U128 AVDD U128 AVDD U138 AVDD	XTAL2     U125     VOID       XTAL2     U126     VOID       AVSS     U127     VOID       AVDD     U128     XOI       AVDD     U129     XOI       AVDD     U138     XOD								20100	11 24			C NOC		
XTAL2 U1.25 XTAL2 U1.26 XTAL1 U1.26 XTAL1 U1.26 AVDD U1.27 AVDD U1.28 AVDD U1.28 AVDD U1.30 AVDD U1	XTAL2     U1.25       XTSL1     U1.25       XTSL1     U1.26       XTS1     U1.26       XTS1     U1.26       AVDD     U1.27       AVDD     U1.28       AVDD     U1.33								0000	01.21			הפועה	Y NUCH	
XTAL1 U126 X01 AVSS U127 X01 AVDD U128 AGND AVDD U128 AVDD U128 AVDD U128 AVDD U128 AVDD U130 AVDD U138 AVDD U138 AVDD U138 AVDD	XTAL1     U1.26     XO1       AVSS     U1.27     AGND       AVDD     U1.28     AGND       AVDD     U1.29     AGND       AVDD     U1.30     AVDD	_							XTAL2	U1.25			X02	0X	
									VTAL 1	ac 11			LOX	UX V	
AVDD U1.28 AVDD U1.28 AVDD U1.28 AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.32 AVDD U1.32	AVDD U128 EVDD U128 AVDD U128 AVDD U128 AVDD U139 AVDD U130 AVDD U133 AVDD U133 AVDD U138 AVDD U138 AVDD U138														
EVDD U1.28 AVDD U1.29 AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.33 AVDD U1.33 AVDD U1.33 AVDD U1.33	EVDD U1.28 AVDD U1.28 AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.33 AVDD U1.33 AVDD U1.33	<u>~</u>							AVSS	U1.27			AGND	POWER	
AVDD U1.29 AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.32 AVDD U1.32 AVDD U1.32	AVDD U1.29 AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.32 AVDD U1.32 AVDD U1.33 AVDD U1.33 AVDD U1.33	4							EVDD	U1.28			EVDD	POWER	
	AVDD 0.1.28 AVDD 0.1.39 AVDD 0.1.30 AVDD 0.1.33 AVDD 0.1.33 AVDD 0.1.33 AVDD 0.1.33 AVDD 0.1.33								0077	00 811					
AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.32 AVDD U1.33	AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.30 AVDD U1.32 AVDD U1.32 AVDD U1.32 AVDD U1.32 AVDD U1.33	0							AVUU	67.FU			AVUU	LOWER	
AVDD U1.30 AVDD U1.32 AVDD U1.33	AVDD U1.30 AVDD U1.30 AVDD U1.32 AVDD U1.32 AVDD U1.32 AVDD U1.32 AVDD U1.32 AVDD U1.33	0							AVDD	U1.30			AVDD	POWER	
	AVDD 01.32 AVDD 01.32 AVDD 01.33 AVDD	-								00 111					
	AVDD U1:32 AVDD U1:32 AVDD U1:33 AVDD									02.10					
	PAD U1.33 AVDD	<u></u>							AVDD	U1.32			AVDD	POWER	
										00 11			AVDD		

# Appendix A. Signal Map Spreadsheet

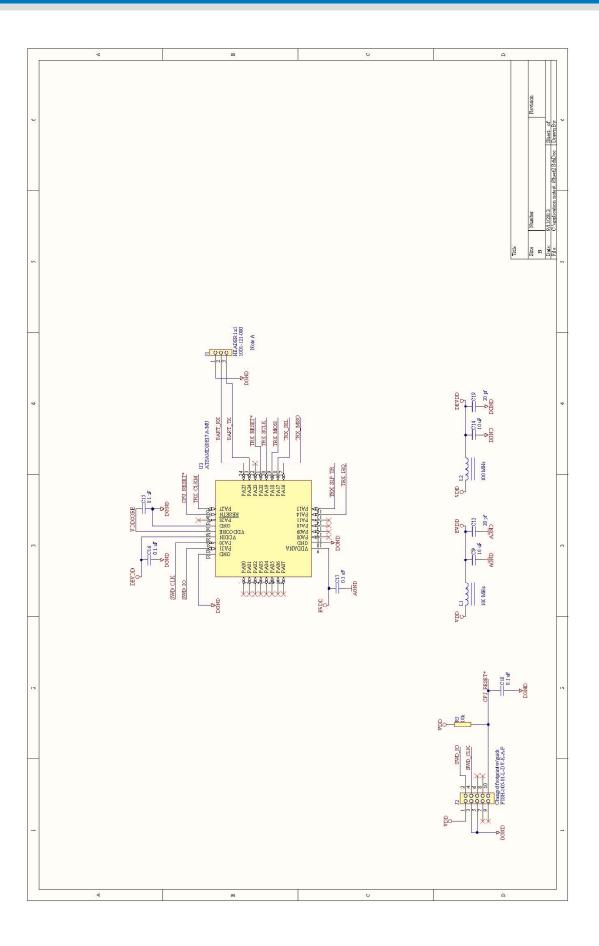




Appendix B. Example Schematic



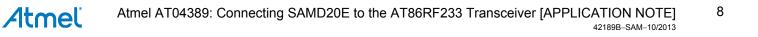
6



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Doc. Rev.	Date	Comments
42189B	10/2013	The document title has changed from "SAMD20E to Wireless Connections" to "Connecting SAMD20E to the AT86RF233 Transceiver"
42189A	09/2013	Initial document release

## Appendix C. Revision History



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