Revision History

1  V3.4 (09-Nov-2016)
   • Bluetooth Smart changed to Bluetooth low energy as per Bluetooth SIG directive.
   • Language and title capitalization changed to US English.
   • Back page:
     • Definition for datasheet status Final clarified.
     • Disclaimer updated with trademarks statement.
     • RoHS statement updated.

2  V3.3 (08-Jun-2016)
   • DA14580 qualified to Bluetooth Specification 4.2. Datasheet title and document content changed accordingly.
   • Section 4.7.2 (Wake-up timer), p.14: Added minimum pulse width of 2 sleep clock cycles for wake-up via GPIO.
   • Table 127 (SPI_CTRL_REG), p.95: Definition of SPI_MINT corrected:
     • ICU changed to Interrupt Controller.
     • Note on shared interrupts (SPI_INT and AD_INT) removed: not applicable.
   • Table 257 (Absolute maximum ratings), p.141: Maximum value of V_PIN(LIM)(VDCDC_RF) changed from min(2,VBAT_RF+0.2) to min(3.3,VBAT_RF+0.2).
   • Table 258 (Recommended operating conditions), p.142: Maximum value of V_PIN(VDCDC_RF) changed from 2 V to 3.3 V.
   • Table 273 (RCX Oscillator: Timing characteristics), p.150: Added parameters ΔT_A/Δt(RCX)100ms, ΔT_A/Δt(RCX)4s:

<table>
<thead>
<tr>
<th>ΔT_A/Δt(RCX)100ms</th>
<th>ambient temperature gradient</th>
<th>buck mode only; connection interval 100 ms</th>
<th>0.66 °C/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔT_A/Δt(RCX)4s</td>
<td>ambient temperature gradient</td>
<td>buck mode only; connection interval 4 s</td>
<td>0.33 °C/s</td>
</tr>
</tbody>
</table>

   • Figure 15 (WLSCSP34 Package Outline Drawing), p.154: drawing updated to Rev F (Min and Max values added to body size).

3  V3.2 (18-Dec-2015)
   • Table 1 (Pin Description), p.8:
     • Programming voltage on pin VPP corrected to 6.7 V ± 0.1 V.
   • Ordering information moved to new section 3 (p.9):
     • Table 2: Ordering information (samples).
     • Table 3: Ordering information (production).
     • Table 4: Ordering information (preprogrammed OTP); previously in separate Addendum document.
   • Figure 14 (p.157): Package outline drawing of QFN40 updated.
   • Table 222 (P01_PADPWR_CTRL_REG), p.130:
     • Notes 3 and 4 updated with limited output current capability in Boost mode.
   • Table 223 (P2_PADPWR_CTRL_REG), p.130:
     • Note 5 updated with limited output current capability in Boost mode.
   • Table 224 (P3_PADPWR_CTRL_REG), p.131:
     • Note 6 updated with limited output current capability in Boost mode.
   • Table 267 (Digital Input/Output: DC characteristics), p.145:
• Note 17 added for $V_{OH}(V_{BAT3V})$: In Boost mode the output source current is limited to $I_{out} = -250 \mu A$.
• Note 18 added for $V_{OL}(V_{BAT3V})$: In Boost mode the output sink current is limited to $I_{out} = 250 \mu A$.
• Template updated to new branding guidelines.
• Back page: Contact information updated.

4 V3.1 (January 29, 2015)
• General description partly rephrased.
• Features (p.1):
  • Corrected nominal package size for WLCSP34 package.
  • Package added: KGD (wafer, dice).
• Ordering information (p.5):
  • Reformatted into separate tables for samples and production orders.
  • Table 1 (samples):
    • Discontinued: DA14580-01UN6 (WLCSP34 samples in waffle pack).
    • Replacement: DA14580-01UNA (WLCSP34 samples on mini-reel).
  • Table 2 (production):
    • Added: DA14580-01W04 (KGD, wafer)
    • Added: DA14580-01WC4 (KGD, dice)
• Section 3.7.1 (p.13):
  • Section title changed to ‘General purpose timers’.
  • Timer 0: formulas for output frequency, duty cycle and interrupt time reformatted.
  • Timer 2:
    • Input clock frequency: corrected from 16 MHz (fixed) to $sys_{clk}/N$ with $N = 1, 2, 4$ or 8 and $sys_{clk} = 16$ MHz or 32 kHz. Formula reformatted.
    • Output frequency: formula reformatted.
• Section 3.9 (Power management), p.15:
  • Feature ‘On/off control’ removed. Not supported for normal operation.
  • Minimum voltage for Buck mode operation changed from 2.2 V to 2.35 V.
  • Figures 8 and 10 updated accordingly.
• Order of sections ‘Registers’ and ‘Specifications’ reversed.
• Section 4 (Registers):
  • Table 32 (CLK_AMBA_REG), p.31: descriptions of fields PCLK_DIV and HCLK_DIV rephrased.
  • Tables 240, 241 and 242 (Px_PADPWR_CTRL_REG), p.134: Note added:
    “For buck mode the output must be powered by the 3V rail, for boost mode by the 1V rail.”
• Section 5 (Specifications), p.142:
  • Definition of MIN/MAX specifications rephrased.
  • Default measurement conditions added.
  • Table 281 (Recommended operating conditions), p.145:
    • $V_{BAT}(V_{BAT3V})_{NO\_OTP}$: parameter removed. $V_{BAT}(V_{BAT3V})$ also applies when OTP is not programmed.
  • Table 282 (DC characteristics), p.145 and 146:
    • Max value added for: $I_{BAT}(DP\_SLP)_\_BOOST\_8kB$, $I_{BAT}(EXT\_SLP)_\_BOOST\_50kB$, $I_{BAT}(ACT\_RX)_\_BOOST$, $I_{BAT}(ACT\_TX)_\_BOOST$, $I_{BAT}(DP\_SLP)_\_BUCK\_8kB$, $I_{BAT}(EXT\_SLP)_\_BUCK\_50kB$, $I_{BAT}(ACT\_RX)_\_BUCK$, $I_{BAT}(ACT\_TX)_\_BUCK$. 
• Supply voltage condition removed for: I_{BAT(DP_SLP)_BUCK_1kB}, I_{BAT(DP_SLP)_BUCK_2kB}, I_{BAT(DP_SLP)_BUCK_8kB}, I_{BAT(ACT_RX)_BOOST}, I_{BAT(ACT_TX)_BOOST}, I_{BAT(ACT_RX)_BUCK}, I_{BAT(ACT_TX)_BUCK}. Default measurement conditions apply.

• Table 295 (Radio: AC characteristics), p.151: Note 15 (reference to AN-B-017) removed.

5 V3.0 (September 25, 2014)

5.1 CRITICAL CHANGES
• Product status changed to Production, datasheet status changed to Final.
• Section 4 (Specifications), p.17: added MIN/MAX definitions and reference diagrams for Boost and Buck mode (Figures 11 and 12).
• Table 3 (Absolute maximum ratings), p.19:
  - V_{PIN(LIM)(default)}: condition text corrected, maximum value changed from 3.6 V to min(3.6, V_{BAT_RF}+0.2) V.
  - V_{BAT(LIM)_VBAT1V}: minimum value changed from 0.9 V to -0.1 V.
  - V_{BAT(LIM)_VBAT3V}: minimum value changed from 1.8 V to -0.1 V.
  - V_{PIN(LIM)(1V2)}: minimum value changed from 0 V to -0.2 V, maximum value changed from 1.2 V to min(1.2, V_{BAT_RF}+0.2) V.
  - Added parameter V_{PIN(VDCDC_RF)} with minimum value -0.2 V, maximum value min(2, V_{BAT_RF}+0.2) V.
  - Added parameter V_{PIN(VDCDC_RF)} with minimum value -0.2 V, maximum value min(1.5, V_{BAT_RF}+0.2) V.
  - V_{ESD(MM)(WLCSP34)}: maximum value changed from 175 V to 200 V.
• Table 4 (Recommended operating conditions), p.20:
  - V_{PP}: specification changed from 6.55 V, 6.8 V, 7.05 V (Min, Typ, Max) to 6.6 V, 6.7 V, 6.8 V (Min, Typ, Max); added condition T_{J} \leq 50 ^{\circ}C.
  - V_{BAT(VBAT3V)}: also applies to pin V_{BAT_RF}, conditions updated accordingly.
  - Added parameter V_{BAT(VBAT3V)_NO OTP} with minimum value 1.8 V, maximum value 3.3 V and condition ‘OTP not programmed’.
  - V_{PIN(default)}: maximum value changed from 3.3 V to min(3.3, V_{BAT_RF}+0.2).
  - Added parameter V_{PIN(VDCDC_RF)} with minimum value 0 V, maximum value 2 V.
  - Note 2: added text ‘Trim values programmed in the OTP as well as the application image, should be copied into RAM while V_{BAT3V} >= 2.5 V’.
• Table 6 (Timing characteristics), p.22:
  - Added Note 3 to typical values of t_{STA(BOOST)} and t_{STA(BUCK)}: ‘Worst-case value under Normal Operating Conditions’.
• Table 7 (16 MHz Crystal Oscillator: Recommended operating conditions), p.22:
  - \Delta f_{XTAL(16M)}: Min/Max values changed from -15/+15 ppm to -20/+20 ppm. Added Note 4: ‘Using the internal varicaps a wide range of crystals can be trimmed to the required tolerance.’
  - Added parameter \Delta f_{XTAL(16M)_UNT} with Min/Max values -40/+40 ppm, condition ‘untrimmed’ and Note 5: ‘Maximum allowed frequency tolerance for compensation by the internal varicap trimming mechanism.’

5.2 NON CRITICAL CHANGES
• Figure 2 and Figure 3 (system diagrams for Boost mode and Buck Mode) moved from section 1 (Block diagram) to section 4 (Specifications) and renamed to Figure 11 and Figure 12.
• Figures 8 and 9 (Supply overview), p.15 and p.16: component values removed.
• Figure 11 (System diagram: Boost mode) updated, p.17:
  - Pin RST not connected
  - Pin VDCDCA renamed to VDCDC_RF
- Pin VBATA renamed to VBAT_RF
  - C8 = 1 μF (was: 100 nF)
  - C9 = 1 μF (was: NP)
- Figure 12 (System diagram: Buck mode) updated, p.18:
  - Pin RST not connected
  - Pin VDCDCA renamed to VDCDC_RF
  - Pin VBATA renamed to VBAT_RF
  - C8 = 1 μF (was: 100 nF)
  - Added C9 = 1 μF on pin VBAT_RF
  - 32.768 kHz XTAL oscillator optional
- Table 4 (Recommended operating conditions), p.20:
  - \( V_{BAT}(V_{BAT3V}) \) and \( V_{BAT}(V_{BAT3V})_{NO\_OTP} \): reference to Note 19 moved from Conditions to Min column.
- Table 5 (DC characteristics), p.20 and p.21:
  - \( I_{BAT}(DP\_SLP)_{BOOST\_1kB} \) and \( I_{BAT}(DP\_SLP)_{BOOST\_2kB} \): condition changed from 'Typical boost-application' to 'Boost configuration'.
  - \( I_{BAT}(DP\_SLP)_{BUCK\_1kB} \) and \( I_{BAT}(DP\_SLP)_{BUCK\_2kB} \): condition changed from 'Typical buck-application' to 'Buck configuration'.
- Table 17 (Radio: DC characteristics), p.25:
  - Note 11: text ' \( V_{BAT3V} = 3 \text{ V} \) ' appended.
- Section 5 (Registers), p.29: added references to ARM Cortex-M0 documentation.
- Table 56 (TRIM_CTRL_REG), p.47: Note 22 added: 'The period duration of 250 us is derived by dividing the RC16M clock signal by 4000. Consequently, the period duration may vary over temperature.'.
- Table 59 (CLK_RCX20K_REG), p.48: oscillator name 'RCX32K' corrected to 'RCX'.
- Table 85 (UART_MCR_REG), p.56: description of bit UART_AFCE clarified, reference to section “Auto Flow Control” removed (internal design document).
- Table 111 (UART_SRTS_REG), p.79: description of bit UART_SHADOW_REQUEST_TO_SEND clarified.
- Table 125 (UART2_MCR_REG), p.85: description of bit UART_AFCE clarified, reference to section “Auto Flow Control” removed (internal design document).
- Table 151 (UART2_SRTS_REG), p.108: description of bit UART_SHADOW_REQUEST_TO_SEND clarified.
- Back page: contact information updated.