















































































**General RF Conditions**

| Parameter | Description                                 | Min  | Typ | Max  | Units | Notes |
|-----------|---|------|-----|------|-------|-------|
| F_op      | Operating frequency                         | 2400 | –   | 2525 | MHz   |       |
| Fstep     | RF channel frequency programming resolution |      | 1   |      | MHz   |       |
| XTAL      | Crystal frequency                           | –    | 16  | –    | MHz   |       |
| Df2avg    | Frequency deviation @ 2 Mbps                | –    | 290 | –    | kHz   |       |
| Df1avg    | Frequency deviation @ 250 kbps              | –    | 155 | –    | kHz   |       |
| Ts        | Air data rate                               | 250  | –   | 2000 | kbps  |       |

**Transmitter Operation**

| Parameter    | Description  | Min | Typ  | Max  | Units | Notes   |
|--------------|--|-----|------|------|-------|---------|
| Pavh0        | Maximum output power                                 | –   | 0    | +4   | dBm   | Note 19 |
| Pop_acc      | RF power control accuracy                            | –   | –    | ±4   | dB    |         |
| BW_20dB_2M   | 20dB bandwidth with modulated carrier (2 Mbps)       | –   | 1800 | 2300 | kHz   |         |
| BW_20dB_250K | 20dB bandwidth with modulated carrier (250 kbps)     | –   | 900  | 1000 | kHz   |         |
| IBS_2        | 1st adjacent channel transmit power 2 MHz (2 Mbps)   | –   | –20  | –    | dBc   |         |
| IBS_3        | 2nd adjacent channel transmit power 4 MHz (2 Mbps)   | –   | –50  | –    | dBc   |         |
| IBS_2        | 1st adjacent channel transmit power 1 MHz (250 kbps) | –   | –30  | –    | dBc   |         |
| IBS_3        | 2nd adjacent channel transmit power 2 MHz (250 kbps) | –   | –45  | –    | dBc   |         |

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**Note**

19. Antenna load impedance = 70 + j75 Ω.

**Receiver Operation**

| Parameter    | Description                                       | Min | Typ | Max | Units | Notes   |
|--------------|---|-----|-----|-----|-------|---------|
| Rxmax-sig    | Maximum received signal power at < 0.1% BER       | –   | 0   | –   | dBm   |         |
| RxSbase      | Sensitivity (0.1%BER) @ 2 Mbps                    | –   | –82 | –   | dBm   |         |
| RxSbase      | Sensitivity (0.1%BER) @ 250 kbps                  | –   | –93 | –   | dBm   |         |
| CI_cochannel | C/I Co-channel (2 Mbps)                           | –   | 11  | –   | dBc   | Note 20 |
| CI_1         | Adjacent channel selectivity C/I 2 MHz (2 Mbps)   | –   | 4   | –   | dBc   | Note 20 |
| CI_2         | Adjacent channel selectivity C/I 4 MHz (2 Mbps)   | –   | –26 | –   | dBc   | Note 20 |
| CI_3         | Adjacent channel selectivity C/I 6 MHz (2 Mbps)   | –   | –32 | –   | dBc   | Note 20 |
| CI_image     | C/I image (2 Mbps)                                |     | –25 |     | dBc   | Note 20 |
| CI_cochannel | C/I Co-channel (250 kbps)                         |     | 7   |     | dBc   | Note 20 |
| CI_1         | Adjacent channel selectivity C/I 1 MHz (250 kbps) | –   | 4   | –   | dBc   | Note 20 |
| CI_2         | Adjacent channel selectivity C/I 2 MHz (250 kbps) | –   | –17 | –   | dBc   | Note 20 |
| CI_3         | Adjacent channel selectivity C/I 3 MHz (250 kbps) | –   | –35 | –   | dBc   | Note 20 |
| CI_image     | C/I image (250 kbps)                              |     | –25 |     | dBc   | Note 20 |

**Crystal Specification**

| Parameter | Description                               | Min | Typ   | Max | Units | Notes       |
|-----------|---|-----|-------|-----|-------|-------------|
| XTAL      | Crystal Frequency                         | –   | 16    | –   | MHz   |             |
| XTAL_PPM  | Tolerance                                 | –   | +/-60 | –   | ppm   |             |
| Co        | Equivalent parallel capacitance ( $C_0$ ) | –   | 1.5   | 7.0 | pF    |             |
| Ls        | Equivalent serial inductance ( $L_S$ )    | –   | 30    | –   | mH    | Note 21, 22 |
| Cl        | Load capacitance ( $C_L$ )                | 8   | 12    | 16  | pF    |             |
| ESR       | Equivalent Series resistance (ESR)        | –   | –     | 100 | Ohm   |             |

**Notes**

20. C/I test conditions: Interfering signal has same modulation scheme as CYRF9935. Measured using -67 dBm input power for the wanted signal.

21. Crystal oscillator startup time is proportional to crystal equivalent serial inductance. Larger equivalent serial inductance will cause longer startup time. 1.5 ms stable time when CYRF9935 switches from sleep mode to Idle-I mode is set using equivalent serial inductance of maximum 30 mH.

22. Small crystal oscillator physical outline may increase equivalent serial inductance.

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**DC Characteristics**

| Parameter       | Description                                  | Min                   | Typ | Max                   | Units | Notes |
|-----------------|--|-----------------------|-----|-----------------------|-------|-------|
| V <sub>IH</sub> | HIGH level input voltage (V <sub>IH</sub> )  | 0.7 × V <sub>IN</sub> | –   | V <sub>IN</sub>       | V     |       |
| V <sub>IL</sub> | LOW level input voltage (V <sub>IL</sub> )   | V <sub>SS</sub>       | –   | 0.3 × V <sub>IN</sub> | V     |       |
| V <sub>OH</sub> | HIGH level output voltage (V <sub>OH</sub> ) | V <sub>IN</sub> – 0.3 | –   | V <sub>IN</sub>       | V     |       |
| V <sub>OL</sub> | LOW level output voltage (V <sub>OL</sub> )  | –                     | –   | 0.3                   | V     |       |

**Power-On Reset**

| Parameter | Description        | Min | Typical | Max | Units | Notes   |
|-----------|--------------------|-----|---------|-----|-------|---------|
| PS_IPEAK  | Power ramp up time | –   | –       | 100 | ms    | Note 23 |
| Trpw      | Power on reset     | –   | –       | 50  | ms    | Note 24 |

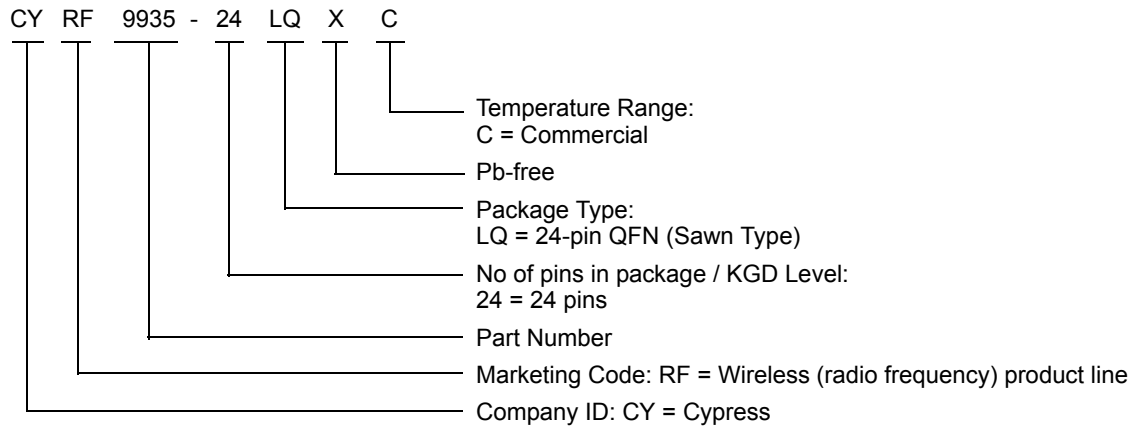
**Notes**

23. Power ramp up from 0 V to 1.9 V.  
 24. From V<sub>CC</sub> = 1.9 V to reset finished.

**Ordering Information**

| Ordering Code   | Package                           | Temperature Range | Comments  |
|-----------------|-----------------------------------|-------------------|---|
| CYRF9935-24LQXC | 24-pin (4 × 4 × 0.55 mm) Sawn QFN | Commercial        | This part is not recommended for new designs (NRND) |

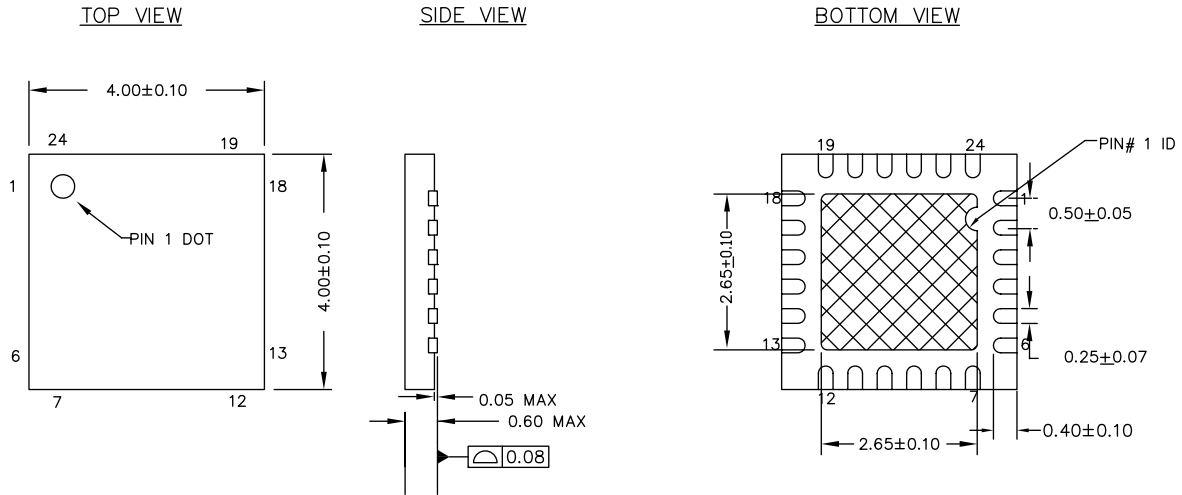
**Ordering Code Definitions**




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Packaging Information

Figure 12. 24-pin QFN (4 × 4 × 0.55 mm) LQ24A 2.65 × 2.65 E-Pad (Sawn) Package Outline, 001-13937



NOTES :

1.  HATCH IS SOLDERABLE EXPOSED METAL.
2. REFERENCE JEDEC # MO-248
3. PACKAGE WEIGHT :  $29 \pm 3$  mg
4. ALL DIMENSIONS ARE IN MILLIMETERS

001-13937 \*F

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## Acronyms

Table 38. Acronyms Used in this Document

| Acronym | Description                     |
|---------|---------------------------------|
| AACK    | Auto-Acknowledge                |
| AAWD    | Auto ACK Wait Delay             |
| ACK     | Acknowledge                     |
| ARSC    | Auto Resend Count               |
| DPL     | Dynamic Payload                 |
| ESR     | Equivalent Series Resistance    |
| FIFO    | First In First Out              |
| I/O     | Input/Output                    |
| LSB     | Least Significant Bit           |
| MCU     | Microcontroller Unit            |
| MISO    | Master In Slave Out             |
| MSB     | Most Significant Bit            |
| NRND    | Not recommended for new designs |
| PLL     | Phased Locked Loop              |
| QFN     | Quad Flat No-lead               |
| RF      | Radio Frequency                 |
| RSD     | Resend Delay                    |
| R/W     | Read/Write                      |
| RX      | Receive                         |
| RXer    | Receiver                        |
| SCK     | Serial Clock                    |
| SPI     | Serial Peripheral Interface     |
| TX      | Transmit                        |
| TXer    | Transmitter                     |
| VoRF    | Voice over Radio Frequency      |

## Document Conventions

### Units of Measure

Table 39. Units of Measure

| Symbol | Unit of Measure   |
|--------|-------------------|
| °C     | degree Celsius    |
| dBm    | decibel-milliwatt |
| GHz    | gigahertz         |
| kHz    | kilohertz         |
| MHz    | megahertz         |
| MΩ     | megaohm           |
| μA     | microampere       |
| μF     | microfarad        |
| mA     | milliampere       |
| mH     | millihenry        |
| mm     | millimeter        |
| ms     | millisecond       |
| mW     | milliwatt         |
| nA     | nanoampere        |
| nH     | nanoHenry         |
| ns     | nanosecond        |
| Ω      | ohm               |
| %      | percent           |
| ppm    | parts per million |
| pF     | picofarad         |
| V      | volt              |

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| Revision  | ECN No. | Orig. of Change | Submission Date | Description of Change  |
| **  | 4184206 | DEJO            | 11/08/2013      | New data sheet.  |
| *A  | 4202840 | DEJO            | 11/26/2013      | <p>Updated <a href="#">Pin Descriptions</a>:<br/>Added Note 3 and referred the same note in pins 7, 12 and 18.</p> <p>Updated <a href="#">Power Management</a>:<br/>Updated <a href="#">Figure 2</a>.<br/>Updated <a href="#">Table 8</a>:<br/>Updated Condition corresponding to Path 1 and also added one more condition.<br/>Updated Condition corresponding to Path 3.<br/>Replaced CE with Mode in Condition corresponding to Path 8-9.<br/>Added details corresponding to Path 15.<br/>Added a Note below the table.<br/>Updated <a href="#">Sleep Mode</a>:<br/>Updated description.</p>  |
| *B  | 4220889 | ANKC            | 12/15/2013      | <p>Updated <a href="#">Block Diagram</a>.</p> <p>Updated <a href="#">Pin Descriptions</a>:<br/>Updated Note 3 (Removed “of 3.3 V”).</p> <p>Updated <a href="#">Functional Overview</a>:<br/>Updated <a href="#">Interrupt</a>:<br/>Updated <a href="#">Table 1</a> (Replaced “TX_MT” with “TX_MAX_ARSC”).<br/>Updated <a href="#">RF Pins</a>:<br/>Updated description.<br/>Updated <a href="#">RF Channel</a>:<br/>Updated description.<br/>Updated <a href="#">Transmit Power control</a>:<br/>Updated <a href="#">Table 4</a> (Replaced “Address” with “Indirect Register Address”).<br/>Updated <a href="#">RSSI Operation</a>:<br/>Updated description.</p> <p>Updated <a href="#">Power Management</a>:<br/>Updated <a href="#">Figure 2</a>.<br/>Updated <a href="#">Table 8</a> (Updated “Path” column, replaced “Undefined” with “Reset”).<br/>Updated <a href="#">Idle-I Mode</a>:<br/>Updated description.<br/>Updated <a href="#">Sleep Mode</a>:<br/>Updated description.<br/>Updated <a href="#">Transmit Mode</a>:<br/>Updated description.</p> <p>Updated <a href="#">SPI Command</a>:<br/>Updated <a href="#">SPI Timing</a>:<br/>Updated <a href="#">Figure 10</a>.<br/>Updated <a href="#">Table 22</a>:<br/>Removed <math>T_{cd}</math>, <math>T_{cdz}</math> parameters and their details.<br/>Replaced “CSN” with “SPI_nSS”.<br/>Updated “Symbol” column.<br/>Updated <a href="#">SPI Command for TX FIFO Access</a>:<br/>Updated <a href="#">Table 31</a> (Updated details of Byte 2).</p> <p>Updated <a href="#">Absolute Maximum Ratings</a>:<br/>Included “Parameter” column and renamed the existing “Parameter” column as “Description”.<br/>Replaced “VCC” with “VIN”.<br/>Replaced “VSS” with “GND”.</p> |

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| *B (Cont.)  | 4220889 | ANKC            | 12/15/2013      | <p>Updated <a href="#">Operating Range</a>:<br/>Included "Parameter" column and renamed the existing "Parameter" column as "Description".<br/>Replaced "VCC" with "VIN".</p> <p>Updated <a href="#">Electrical Specifications</a>:<br/>Updated <a href="#">Power Consumption</a>:<br/>Included "Parameter" column and renamed the existing "Item" column as "Description".</p> <p>Updated <a href="#">General RF Conditions</a>:<br/>Included "Parameter" column and renamed the existing "Item" column as "Description".<br/>Changed maximum value of "Operating frequency" from 2480 to 2525.<br/>Removed "Non-overlapping channel spacing (2 Mbps)", "Non-overlapping channel spacing (250 kbps)" and their details.</p> <p>Updated <a href="#">Transmitter Operation</a>:<br/>Included "Parameter" column and renamed the existing "Item" column as "Description".<br/>Removed "RF power control range" and its details.</p> <p>Updated <a href="#">Receiver Operation</a>:<br/>Included "Parameter" column and renamed the existing "Item" column as "Description".<br/>Removed "Sensitivity degradation @ LNA low gain mode" and its details.</p> <p>Updated <a href="#">Crystal Specification</a>:<br/>Included "Parameter" column and renamed the existing "Item" column as "Description".</p> <p>Updated <a href="#">DC Characteristics</a>:<br/>Included "Parameter" column and renamed the existing "Item" column as "Description".<br/>Replaced "VCC" with "VIN".</p> <p>Updated <a href="#">Power-On Reset</a>:<br/>Included "Parameter" column and renamed the existing "Item" column as "Description".</p> |
| *C  | 4341593 | ANKC            | 04/15/2014      | <p>Changed status from Preliminary to Final.</p> <p>Updated <a href="#">Key Features</a>.</p> <p>Updated <a href="#">Pin Configuration</a>:<br/>Updated <a href="#">Figure 1</a>.</p> <p>Updated <a href="#">Pin Descriptions</a>.</p> <p>Updated <a href="#">Functional Overview</a>:<br/>Removed Clock frequency measurement.</p> <p>Updated <a href="#">RF Pins</a>:<br/>Updated description.</p> <p>Updated <a href="#">Transmit Power control</a>:<br/>Updated description.</p> <p>Updated <a href="#">Table 5</a>.<br/>Updated <a href="#">RSSI Operation</a>:<br/>Updated description.<br/>Updated <a href="#">Table 7</a>.</p> <p>Updated <a href="#">Power Management</a>:<br/>Updated description.<br/>Updated <a href="#">Table 8</a>.<br/>Updated <a href="#">Sleep Mode</a>:<br/>Updated description.</p> <p>Updated <a href="#">Transmit Mode</a>:<br/>Updated description.</p> <p>Updated <a href="#">Receive Mode</a>:<br/>Updated description.</p>   |

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|---|---------|-----------------|-----------------|---|
| Revision  | ECN No. | Orig. of Change | Submission Date | Description of Change   |
| *C (cont.)  | 4341593 | ANKC            | 04/15/2014      | <p>Updated <a href="#">Baseband Engine</a>:<br/> Updated <a href="#">Packet Format</a>:<br/> Updated <a href="#">Preamble</a>:<br/> Updated description.<br/> Updated <a href="#">Address</a>:<br/> Updated description.<br/> Updated <a href="#">Packet Control Word</a>:<br/> Updated <a href="#">Payload Length</a>:<br/> Updated description.<br/> Updated <a href="#">CRC</a>:<br/> Updated description.<br/> Updated <a href="#">Auto-Retransmit Mode</a>:<br/> Updated <a href="#">Table 18</a>.<br/> Updated <a href="#">Table 19</a>.<br/> Updated <a href="#">Timing Diagram of Auto-Retransmit Mode</a>:<br/> Updated <a href="#">Figure 4</a>.<br/> Updated <a href="#">Data Packet Loss</a>:<br/> Updated description.<br/> Updated <a href="#">ACK Packet Loss</a>:<br/> Updated description.</p> <p>Renamed "FIFO Handle and Control" as <a href="#">FIFO Control</a>.<br/> Updated <a href="#">Overview</a>:<br/> Updated description.<br/> Updated <a href="#">TX FIFO Access</a>:<br/> Updated description.<br/> Updated <a href="#">Table 23</a>.</p> <p>Updated <a href="#">SPI Command</a>:<br/> Updated <a href="#">SPI Timing</a>:<br/> Updated <a href="#">Table 24</a>.<br/> Updated <a href="#">Command List</a>:<br/> Updated <a href="#">Table 25</a>:<br/> Updated details in "Description" column for R_REGISTER, W_REGISTER, R_RX_PAYLOAD, W_TX_PAYLOAD, W_ACK_PAYLOAD, and REUSE_TX_PAYLOAD commands.<br/> Added Notes 7, 8, and 6.<br/> Referred Notes 7, 6 in "Command Word" of W_TX_PAYLOAD commands.<br/> Referred Notes 8, 6 in "Command Word" of W_ACK_PAYLOAD command.<br/> Updated <a href="#">SPI Command for Register Read and Write</a>:<br/> Updated description.<br/> Updated <a href="#">SPI Command for RX FIFO Access</a>:<br/> Updated Note 9 referred in <a href="#">Table 29</a>.<br/> Updated <a href="#">SPI Command for TX FIFO Access</a>:<br/> Updated <a href="#">Table 33</a>.</p> <p>Updated <a href="#">Register Sets</a>:<br/> Updated details in "Description" column for 0x03 address.<br/> Updated details in "Description" column for 0x05 address.<br/> Updated details in "Description" column for 0x08 address.<br/> Updated details in "Bit", "Reset Value", "Description" columns for 0x21 address.<br/> Updated details in "Description" column for 0x3C address.</p> <p>Updated <a href="#">Application Circuit</a>:<br/> Updated <a href="#">Figure 11</a>.<br/> Updated <a href="#">Table 37</a>.</p> |

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| Revision  | ECN No. | Orig. of Change | Submission Date | Description of Change   |
| *C (cont.)  | 4341593 | ANKC            | 04/15/2014      | <p>Updated <a href="#">Electrical Specifications</a>:<br/> Updated <a href="#">Power Consumption</a>:<br/> Updated typical value of Idd_idle2 parameter.<br/> Updated description of Idd_tx6, Idd_tx12, Idd_tx18 parameters.<br/> Updated <a href="#">General RF Conditions</a>:<br/> Updated minimum value of F_op parameter.<br/> Updated typical value of Df2avg parameter.<br/> Updated typical value of Df1avg parameter.<br/> Updated <a href="#">Transmitter Operation</a>:<br/> Updated maximum value of BW_20dB_2M parameter.<br/> Updated <a href="#">Receiver Operation</a>:<br/> Updated Note 20 referred in Notes column.</p>  |
| *D  | 4529727 | DEJO            | 10/28/2014      | <p>Updated <a href="#">Functional Overview</a>:<br/> Updated <a href="#">RF Channel</a>:<br/> Updated <a href="#">Table 2</a>:<br/> Replaced “126” with “125” in “Channel Number (Decimal)” column.<br/> Updated <a href="#">Transmit Power control</a>:<br/> Updated <a href="#">Table 4</a>:<br/> Replaced “address” with “register” in “Description” column.</p> <p>Updated <a href="#">Baseband Engine</a>:<br/> Updated <a href="#">Packet Control Word</a>:<br/> Updated <a href="#">PID</a>:<br/> Updated description.<br/> Updated <a href="#">NOACK</a>:<br/> Updated description.<br/> Updated <a href="#">Auto-Retransmit Mode</a>:<br/> Updated description.<br/> Updated <a href="#">Table 18</a>:<br/> Replaced “AA” with “Auto-ACK” in “Description” column corresponding to “0x05” address.</p> <p>Updated <a href="#">SPI Command</a>:<br/> Updated <a href="#">Command List</a>:<br/> Updated <a href="#">Table 25</a>:<br/> Added Note 5 and referred the same note in “00AAAAAA” and “01AAAAAA” in “Command Word” column.<br/> Updated <a href="#">SPI Command for TX FIFO Access</a>:<br/> Updated <a href="#">Table 33</a>:<br/> Removed row corresponding to “Byte 3–34”.</p> <p>Updated <a href="#">Register Sets</a>:<br/> Updated details in “Description” column for bit 1 of 0x01 address.<br/> Replaced “AA” with “Auto-ACK” in “Description” column for 0x05 address.<br/> Replaced “PIPI” with “PIPE” in “Description” column for 0x13, 0x14, and 0x15 addresses.<br/> Updated <a href="#">Indirect Registers</a>:<br/> Updated <a href="#">Table 36</a>:<br/> Updated details in “Description” column for bit 6:0 of 0x00 address.<br/> Removed row corresponding to 0x0B address.</p> <p>Completing Sunset Review.</p> |

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| *E  | 4616502 | DEJO            | 01/21/2015      | <p>Updated <a href="#">Functional Overview</a>:<br/> Updated <a href="#">Interrupt</a>:<br/> Updated <a href="#">Table 1</a>:<br/> Updated details in “Description” column for TX_DS Interrupt source.<br/> Updated details in “Description” column for TX_FIFO Interrupt source.</p> <p>Updated <a href="#">FIFO Control</a>:<br/> Updated <a href="#">TX FIFO Access</a>:<br/> Updated <a href="#">Table 22</a>:<br/> Updated details in “Description” column for 0x01 address.<br/> Updated details in “Description” column for 0x28 address.</p> <p>Updated <a href="#">SPI Command</a>:<br/> Updated <a href="#">SPI Status in Command Phase</a>:<br/> Updated description.<br/> Added <a href="#">Table 26</a>.<br/> Updated <a href="#">SPI Command for RX FIFO Access</a>:<br/> Updated description.<br/> Added <a href="#">Table 30</a>.<br/> Updated <a href="#">SPI Command for TX FIFO Access</a>:<br/> Updated description.<br/> Updated <a href="#">Table 31</a>:<br/> Updated Note 13 referred in <a href="#">Table 31</a>.<br/> Updated <a href="#">Table 33</a>:<br/> Updated Note 13 referred in <a href="#">Table 33</a>.<br/> Added <a href="#">Table 34</a>.</p> <p>Updated <a href="#">Register Sets</a>:<br/> Updated details in “Description” column for bit 1 of 0x01 address.</p> |
| *F  | 5216464 | UTSV            | 04/11/2016      | <p>Updated <a href="#">Ordering Information</a>:<br/> No change in part numbers.<br/> Added a column “Comments” and added “This part is not recommended for new designs (NRND)” in the column.<br/> Updated to new template.</p>  |
| *G  | 5731626 | SGUP            | 05/09/2017      | <p>Added watermark “Not recommended for new designs” across the document.<br/> Updated to new template.</p>   |

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