

# REALTEK

## RTS5169

**USB 2.0 SD/MMC/MS/MSPRO/xD-Picture  
& Smart Card / SIM Card Reader**

## DATASHEET

**Rev 1.2  
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## **USING THIS DOCUMENT**

This document is intended for the hardware and software engineer’s general information on the Realtek RTS5169 USB2.0 card reader.

Though every effort has been made to ensure that this document is current and accurate, more information may have become available subsequent to the production of this guide. In that event, please contact your Realtek representative for additional information that may help in the development process.

## **REVISION HISTORY**

| Revision | Release Date | Summary                                                                                                    |
|----------|--------------|------------------------------------------------------------------------------------------------------------|
| 0.9      | 2007/05/2    |                                                                                                            |
| 0.91     | 2007/5/11    | Add MS/MSPRO information                                                                                   |
| 0.92     | 2007/05/14   | Add Smart Card information                                                                                 |
| 1.0      | 2008/6/12    | Modify electrical characteristic                                                                           |
| 1.1      | 2008/12/25   | 1. Change the Part No. of Ordering information to RTS5169-VEC-GR<br>2. Support pure Smart Card Reader mode |
| 1.2      | 2009/4/30    | Support xD-Picture card                                                                                    |

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## 1. General Description

The RTS5169 is a high performance USB 2.0 compliant card-reader that supports SD/MMC cards, MS/MSPRO cards, xD-Picture cards and Smart Card/SIM cards. RTS5169 integrates USB 2.0 transceiver, MCU, DC-DC regulators and memory card access unit into a single chip. The supported SD/MMC series memory cards are Secure Digital <sup>TM</sup> (SD), Multi-Media Card <sup>TM</sup> (MMC), MicroSD, SDHC, MiniSD, RS-MMC, Mobile-MMC and MMC-Micro. The supported MS/MSPRO series memory cards are Memory Stick <sup>TM</sup> (MS), Memory Stick Pro <sup>TM</sup> (MS-Pro) and M2. The supported xD-Picture series memory cards are Type M, Type M+ and Type H.

Smart Card reader will be a must to the personal computers and Notebooks in the near future. The RTS5169 is an innovation that integrates the traditional flash memory card reader with smart card reader into one USB device. This integration can support the end user to access memory cards and smart card at the same time, which brings the end users great facility and reduces the BOM cost greatly.

SIM Card Reader with SIM editor AP can easily help users to backup/restore the phonebook of SIM Card to/from the PC. This integration can support users to access MicroSD and SIM at the same time.

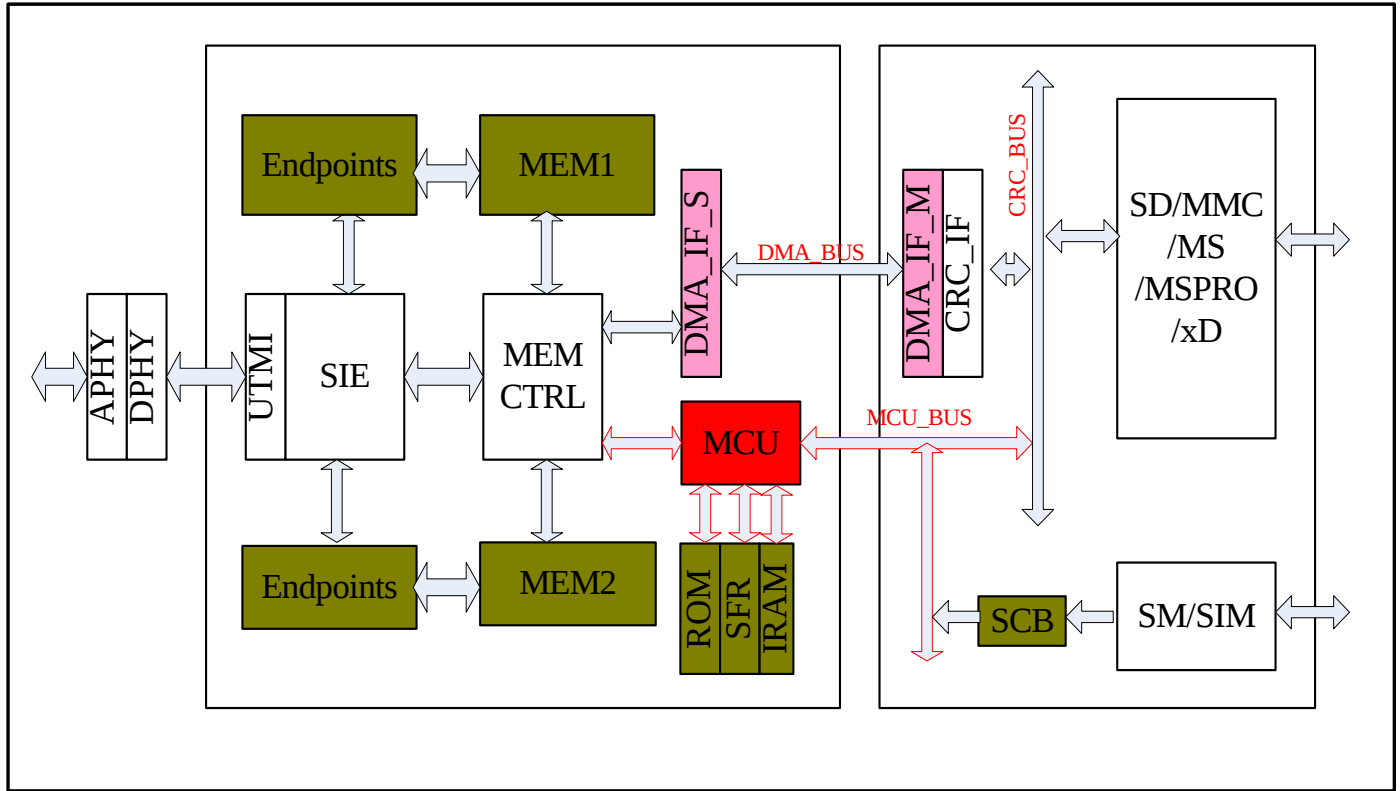
The RTS5169 integrates 5V-to-3.3V, 5V-to-3V and 3.3V-to-1.8V regulators, MOSFET switches, and could dramatically reduce the system BOM cost.

## 2. Features

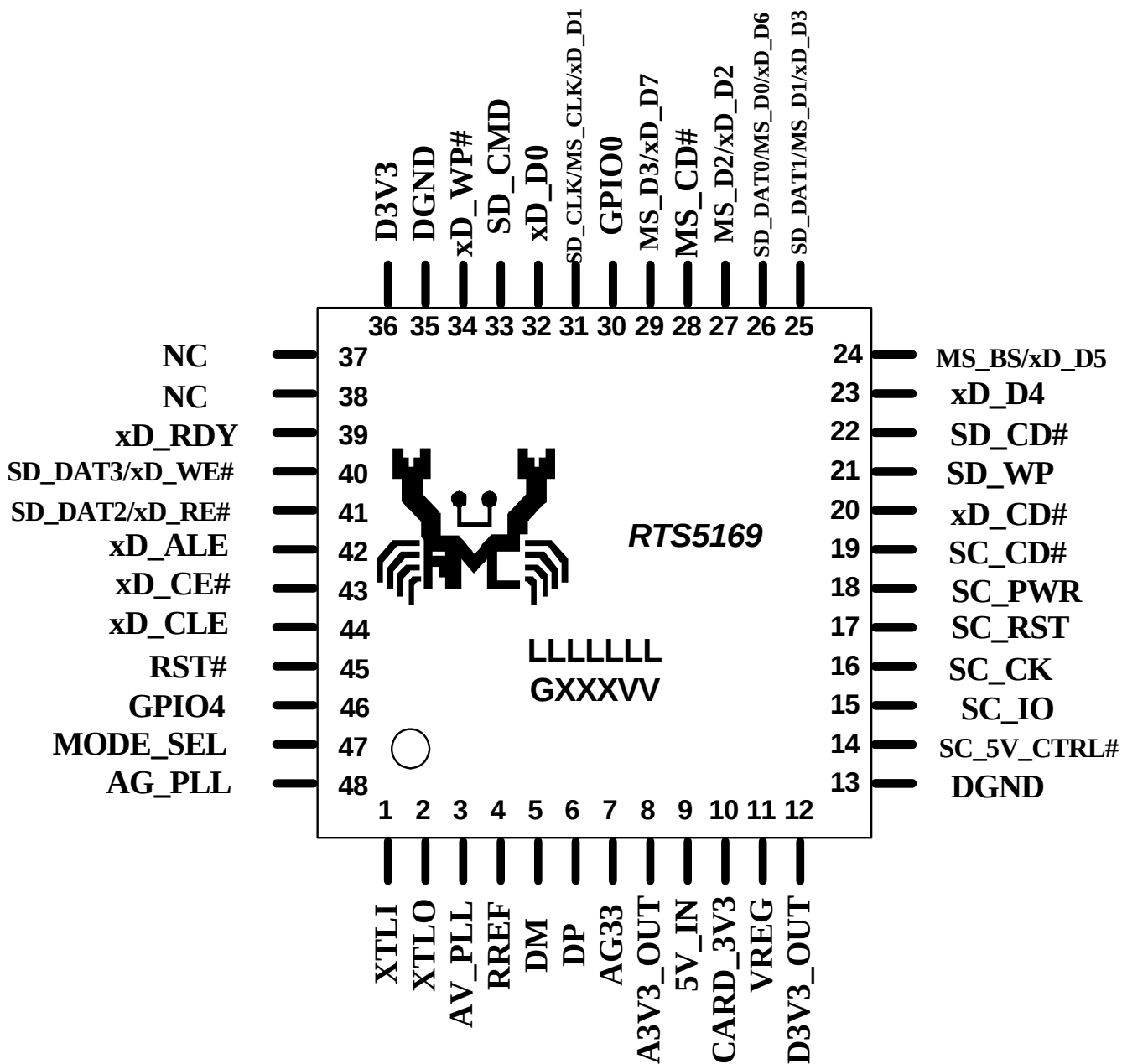
- Compliant with USB Specification 2.0 Full-Speed and High-Speed transfer mode.
- Compliant with USB Mass Storage Class Bulk only Transport Specification Rev. 1.0
- Compliant with USB CCID Transport Specification Rev1.1
- Support USB bus power operation
- Support several endpoints:
  - Control endpoint
  - Mass Storage Bulk Out endpoint
  - Mass Storage Bulk IN endpoint
  - CCID Interrupt IN endpoint
  - CCID Bulk Out endpoint
  - CCID Bulk IN endpoint
- Supports the following memory card interfaces:
  - Secure Digital <sup>TM</sup> (SD), MultiMediaCard <sup>TM</sup> (MMC), Mini-SD, Micro-SD (T-flash), RS-MMC, Mobile-MMC and MMC-micro
  - Memory Stick <sup>TM</sup> (MS), Memory Stick PRO <sup>TM</sup> (MS-PRO), MS Duo, MS-PRO Duo and Micro-MS (M2)
- Supports hardware CRC (Cyclic Redundancy Check) function
- Supports SD version **2.0**
- Support MMC version **4.2**
- Supports MS-PRO **v1.02**
- Supports MS **v1.43**
- Supports xD-Picture **v1.2**
- Integrated Fast 8051 microprocessor

- Support the following Asynchronous and synchronous smart cards interface
  - Based on ISO7816 implementation, T=0 and T=1 asynchronous card,
  - EMV2000 (EMV 4.1) compatible
  - Support PC Smart Card industry standard: PC/SC1.0; PC/SC 2.0
  - Support 2-wire, 3-wire or I2C Interface synchronous card
    - Atmel: AT88sc1608, AT88sc153
    - Atmel: AT24c128, AT24c256
    - ST: M14C16, M14C04
    - Siemens 2-wire link protocol: sle4432/42
    - Siemens serial 3-wire bus: sle4418/28
  - Configurable hardware auto error detection
  - Card Voltage: 5V, 3V, 1.8V
- Support CCID Linux driver working on Kernel 2.4.x and 2.6.x
  - ✓ Redhat: Fedora Core (1 ~ 6), Redhat 9, Redhat Enterprise Edition (3, 4)
  - ✓ Novell: SuSE 10, SuSE 10.1, Open SUSE 10.2
  - ✓ Ubuntu: Ubuntu 6.06, Ubuntu 6.10
  - ✓ Mandriva: Mandrake 10.2, Mandriva 2006, Mandriva 2007
  - ✓ Debian: Debian 3.1
- 12MHz crystal oscillator with integrated PLL
- On chip 5V to 3.3V regulator
- On chip 5V to 3V regulator
- On chip 3.3V to 1.8V regulator
- On chip MOSFET components for direct power control of memory card
- Supports Spread Spectrum Clock (SSC) for SD/MMC and MS/MSPRO to reduce EMI effect
- Support pure Smart Card Reader mode
- 48 pins LQFP package capability for one-LUN Memory Card Reader and SIM Card

### 3. Block Diagram



## 4. Pin Assignments



## 5. Pin Descriptions

### 5.1 USB Transceiver

| Name | Type | I/O Type | Pin No. | Definition                                        |
|------|------|----------|---------|---------------------------------------------------|
| DP   | I/O  | I/O-U    | 6       | USB D+ signal                                     |
| DM   | I/O  | I/O-U    | 5       | USB D- signal                                     |
| RREF | N/A  | I/O-U    | 4       | Connect external resistor (6.25K $\pm$ 1%) to GND |
|      |      |          |         | Total: 3 Pins                                     |

### 5.2 System Interface

| Name     | Type | I/O Type | Pin No. | Definition                                                                  |
|----------|------|----------|---------|-----------------------------------------------------------------------------|
| XTLI     | I    | CLK      | 1       | Crystal oscillator input (12 MHz). Also can be used as external clock input |
| XTLO     | O    | CLK      | 2       | Crystal oscillator output (12Mhz)                                           |
| RST#     | I    | IOSH     | 45      | System reset                                                                |
| MODE_SEL | I    | I        | 47      | Used for Mode Selection                                                     |
| GPIO0    | I/O  | IOH      | 30      | General purpose input/output                                                |
| GPIO4    | I/O  | IOH      | 46      | General purpose input/output                                                |
|          |      |          |         | Total: 6 Pins                                                               |

### 5.3 Secure Digital & MultiMedia Card Interface

| Name         | Type | I/O Type | Pin No.         | Definition                                  |
|--------------|------|----------|-----------------|---------------------------------------------|
| SD_DAT [3:0] | I/O  | IOH      | 40,41,<br>25,26 | SD/MMC Data Signals                         |
| SD_CMD       | I/O  | IOH      | 33              | Serial protocol command and response signal |
| SD_CLK       | O    | O        | 31              | Serial protocol clock signal                |
| SD_WP        | I    | I        | 21              | Write Protect switch signal                 |
| SD_CD#       | I    | IH       | 22              | SD/MMC Card Detect                          |
|              |      |          |                 | Total: 8 Pins                               |

## 5.4 Memory Stick & Memory Stick Pro Card Interface

| Name       | Type | I/O Type | Pin No.         | Definition            |
|------------|------|----------|-----------------|-----------------------|
| MS_CD#     | I    | IH       | 28              | MS/MSPRO Card Detect  |
| MS_BS      | O    | O        | 24              | Bus State signal      |
| MS_D [3:0] | I/O  | IOL      | 29,27,<br>25,26 | MS/MSPRO Data signals |
| MS_CLK     | O    | O        | 31              | Serial Clock signal   |
|            |      |          |                 | Total: 7 Pins         |

## 5.5 Smart Card & SIM Card Interface

| Name       | Type | I/O Type | Pin No. | Definition                               |
|------------|------|----------|---------|------------------------------------------|
| SC_CK      | O    | O        | 16      | Smart Card Clock                         |
| SC_IO      | I/O  | IOL      | 15      | Smart Card Data I/O signal               |
| SC_5V_CTRL | O    | O        | 14      | Power Control signal for external MOSFET |
| SC_RST     | O    | O        | 17      | Smart Card Reset signal                  |
| SC_CD#     | I    | IH       | 19      | Smart Card Detect                        |
|            |      |          |         | Total: 5 Pins                            |

## 5.6 xD-Picture Card Interface

| Name       | Type | I/O Type | Pin No.                             | Definition               |
|------------|------|----------|-------------------------------------|--------------------------|
| xD_CD#     | I    | IH       | 20                                  | xD-Picture Card Detect   |
| xD_D [7:0] | I/O  | IOL      | 29,26,24<br>,23,25,<br>27,31,<br>32 | xD-Picture Data signals  |
| xD_ALE     | O    | O        | 42                                  | Address Latch Enable     |
| xD_CE#     | O    | O        | 43                                  | Card Enable              |
| xD_CLE     | O    | O        | 44                                  | Command Latch Enable     |
| xD_RE#     | O    | O        | 41                                  | Read Enable              |
| xD_WE#     | O    | O        | 40                                  | Write Enable             |
| xD_RDY     | I    | I        | 39                                  | Ready/Busy Signal        |
| xD_WP#     | I    | IH       | 34                                  | Electrical Write Protect |
|            |      |          |                                     | Total: 16 Pins           |

## 5.7 Power & Ground

| Name     | Type  | I/O Type | Pin No. | Definition                                                                                                                        |
|----------|-------|----------|---------|-----------------------------------------------------------------------------------------------------------------------------------|
| AG_PLL   | Power | Ground   | 48      | Analog PLL Ground                                                                                                                 |
| AV_PLL   | Power | Power    | 3       | Power for PLL                                                                                                                     |
| AG33     | Power | Ground   | 7       | Analog ground                                                                                                                     |
| A3V3_OUT | Power | Power    | 8       | Analog 3.3V output from internal regulator                                                                                        |
| 5V_IN    | Power | Power    | 9       | 5V Input                                                                                                                          |
| CARD_3V3 | Power | Power    | 10      | Power to SD/MMC and MS/MSPRO Card                                                                                                 |
| VREG     | Power | Power    | 11      | Regulated supply voltage from internal regulator; supplies internal digital circuits. An external capacitance should be connected |
| D3V3_OUT | Power | Power    | 12      | Digital 3.3V output from internal regulator                                                                                       |
| DGND     | Power | Ground   | 13,35   | Digital Ground                                                                                                                    |
| SC_PWR   | Power | Power    | 18      | Power to Smart Card                                                                                                               |
| D3V3     | Power | Power    | 36      | Digital 3.3V Power                                                                                                                |
|          |       |          |         | Total: 12 Pins                                                                                                                    |

## 5.8 I/O Type Description

| I/O Type | Description                            |
|----------|----------------------------------------|
| O        | Output                                 |
| I        | Input                                  |
| IH       | Input with internal pull-high          |
| IL       | Input with internal pull-down          |
| IO       | Input / Output                         |
| IOL      | Input / Output with internal pull-down |
| IOH      | Input / Output with internal pull-up   |
| IOSH     | Input / Output with Schmitt trigger    |
| IO-U     | USB related IO                         |
| CLK      | Clock related IO                       |

## 6. Card Power Switch

RTS5169 integrates all regulators and MOSFET components to supply and switch power for cards.

### 1. The maximum range of the MOSFET output current

- SD/MMC card: 200mA
- SIM card: 60mA
- MS/MSPRO card: 220mA

### 2. The maximum range of the 5V regulator is 550mA

## 7. Electrical Characteristics

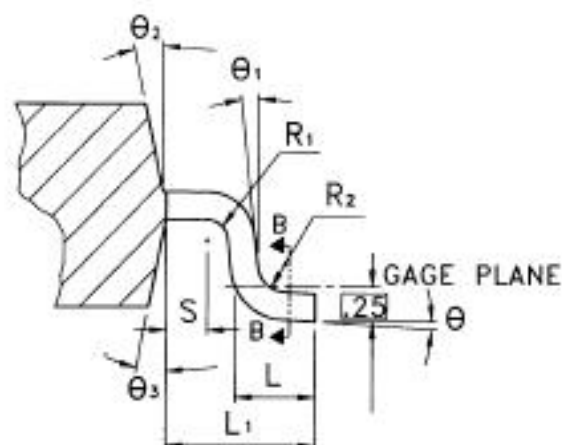
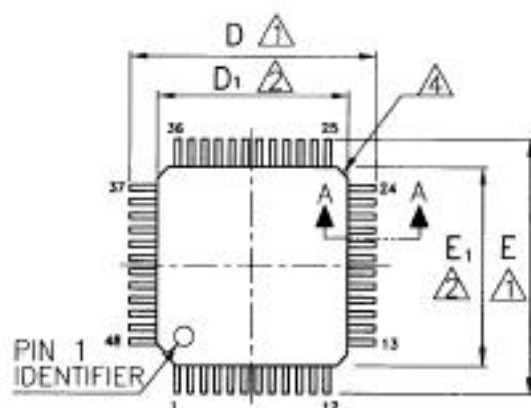
### 7.1 Absolute Maximum Ratings

| Parameter               | Rating                                    |
|-------------------------|-------------------------------------------|
| Supply Voltage          | −0.5V to +5.5V electrical characteristics |
| Operating Temperature   | 0°C to +70°C                              |
| Latchup Current         | 200mA                                     |
| Electrostatic Discharge | 4kV                                       |

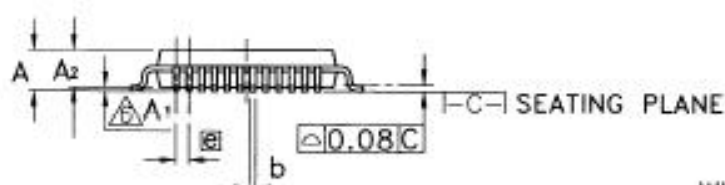
### 7.2 DC Characteristics

| Symbol           | Description           | Conditions                    | Min. | Typ. | Max. | Unit |
|------------------|-----------------------|-------------------------------|------|------|------|------|
| V <sub>DD</sub>  | Supply Voltage        |                               | 4.5  | 5    | 5.5  | V    |
| V <sub>IH</sub>  | Input Voltage High    |                               | 2    |      |      | V    |
| V <sub>IL</sub>  | Input Voltage Low     |                               |      |      | 0.8  | V    |
| V <sub>OH</sub>  | Output Voltage High   |                               | 3    |      |      | V    |
| V <sub>OL</sub>  | Output Voltage Low    |                               |      |      | 0.4  | V    |
| C <sub>in</sub>  | Input Pin Capacitance |                               |      |      | 10   | pF   |
| I <sub>DD</sub>  | Supply Current        | 8051 is running @ 24MHz       |      | 73   |      | mA   |
| I <sub>SUS</sub> | Suspend Current       | D+ 1.5KΩ resistor is included |      | 365  |      | uA   |

## 8. Mechanical Dimensions

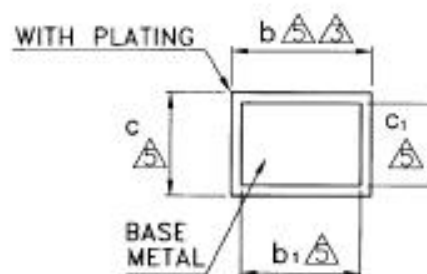


SECTION A-A



**NOTE :**

- △ TO BE DETERMINED AT SEATING PLANE  $\square\square$ .
- △ DIMENSIONS  $D_1$  AND  $E_1$  DO NOT INCLUDE MOLD PROTRUSION.  $D_1$  AND  $E_1$  ARE MAXIMUM PLASTIC BODY SIZE DIMENSIONS INCLUDING MOLD MISMATCH.
- △ DIMENSION  $b$  DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR CAN NOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.
- △ EXACT SHAPE OF EACH CORNER IS OPTIONAL.
- △ THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 mm AND 0.25 mm FROM THE LEAD TIP.
- △  $A_1$  IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT OF THE PACKAGE BODY.
- 7. CONTROLLING DIMENSION : MILLIMETER.
- 8. REFERENCE DOCUMENT : JEDEC MS-026 , BBC.



SECTION B-B

| Symbol         | Dimension in mm |      |      | Dimension in inch |       |       |
|----------------|-----------------|------|------|-------------------|-------|-------|
|                | Min             | Nom  | Max  | Min               | Nom   | Max   |
| A              | —               | —    | 1.60 | —                 | —     | 0.063 |
| A <sub>1</sub> | 0.05            | —    | 0.15 | 0.002             | —     | 0.006 |
| A <sub>2</sub> | 1.35            | 1.40 | 1.45 | 0.053             | 0.055 | 0.057 |
| b              | 0.17            | 0.22 | 0.27 | 0.007             | 0.009 | 0.011 |
| b <sub>1</sub> | 0.17            | 0.20 | 0.23 | 0.007             | 0.008 | 0.009 |
| c              | 0.09            | —    | 0.20 | 0.004             | —     | 0.008 |
| c <sub>1</sub> | 0.09            | —    | 0.16 | 0.004             | —     | 0.006 |
| D              | 9.00 BSC        |      |      | 0.354 BSC         |       |       |
| D <sub>1</sub> | 7.00 BSC        |      |      | 0.276 BSC         |       |       |
| E              | 9.00 BSC        |      |      | 0.354 BSC         |       |       |
| E <sub>1</sub> | 7.00 BSC        |      |      | 0.276 BSC         |       |       |
| ⌀              | 0.50 BSC        |      |      | 0.020 BSC         |       |       |
| L              | 0.45            | 0.60 | 0.75 | 0.018             | 0.024 | 0.030 |
| L <sub>1</sub> | 1.00 REF        |      |      | 0.039 REF         |       |       |
| R <sub>1</sub> | 0.08            | —    | —    | 0.003             | —     | —     |
| R <sub>2</sub> | 0.08            | —    | 0.20 | 0.003             | —     | 0.008 |
| S              | 0.20            | —    | —    | 0.008             | —     | —     |
| θ              | 0°              | 3.5° | 7°   | 0°                | 3.5°  | 7°    |
| θ <sub>1</sub> | 0°              | —    | —    | 0°                | —     | —     |
| θ <sub>2</sub> | 12°TYP          |      |      | 12°TYP            |       |       |
| θ <sub>3</sub> | 12°TYP          |      |      | 12°TYP            |       |       |

## 9. Ordering Information

| Part Number    | Description                  | Status    |
|----------------|------------------------------|-----------|
| RTS5169-VEC-GR | LQFP-48 with 'Green' package | Available |
|                |                              |           |

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