

Cypress Semiconductor Product Qualification Report

QTP# 013806 VERSION 1.1
November, 2002

MoBL2™ and Micropower-Low Power Asynchronous SRAM

R7LD-1.8 Technology, Fab4

CY62135CV18LL

128K x 16

CY62136CV18LL

Static RAM

CY62137CV18LL

MoBL, MoBL2 and more battery life are trademark of Cypress Semiconductor

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PRODUCT QUALIFICATION HISTORY

| Qual Report | Description of Qualification Purpose | Date Comp |
|--------------------|---|------------------|
| 012411 | New Technology R7LD-1.8 / New Device, 8Meg, MoBL Static RAM CY62157CV18LL | Jun 01 |
| 013806 | New Device, 2Meg, MoBL Static RAM CY62137CV18LL and Metal options | Sep 01 |

Cypress products are manufactured using qualified processes. The technology qualification for this product is referenced above and must be considered to get a complete and thorough evaluation of the reliability of the product.

| PRODUCT DESCRIPTION (for qualification) | |
|--|---|
| Qualification Purpose: Qualify New CY62137CV18LL and Metal options in Technology R7LD-1.8, Fab 4 | |
| Marketing Part #: | CY62135CV18LL, CY62136CV18LL , CY62137CV18LL |
| Device Description: | 1.65V – 1.95V, Industrial and commercial available in Wafer Die Sales and 48-ball FBGA package. |
| Cypress Division: | Cypress Semiconductor Corporation –Memory Product Division (MPD) |
| Overall Die (or Mask) REV Level (pre-requisite for qualification): | Rev. B |
| What ID markings on Die: | 7C62335C |

| TECHNOLOGY/FAB PROCESS DESCRIPTION – R7LD-1.8 | | | |
|--|--|--------------------|---|
| Number of Metal Layers: | 2 | Metal Composition: | Metal 1: 100Å Ti / 300Å TiN / 4,000Å Al / 300Å TiW Metal 2: 8,000Å TiAl / 300Å TiN |
| Passivation Type and Materials: | 1000Å TEOS / 9000Å Nitride | | |
| Free Phosphorus contents in top glass layer(%): | 0% | | |
| Number of Transistors in Device | 12.5 million | | |
| Number of Gates in Device | 1.375 million | | |
| Generic Process Technology/Design Rule (μ-drawn): | CMOS, Double Metal /0.16 μm | | |
| Gate Oxide Material/Thickness (MOS): | SiO ₂ . 32Å | | |
| Name/Location of Die Fab (prime) Facility: | Cypress Semiconductor -- Bloomington, MN | | |
| Die Fab Line ID/Wafer Process ID: | Fab4/R7LD-1.8 | | |

PACKAGE AVAILABILITY

| PACKAGE | ASSEMBLY SITE FACILITY |
|----------------|-------------------------------|
| 48-ball FBGA | TAIWN-G, CSPI-R |

Note: Package Qualification details upon request

| MAJOR PACKAGE INFORMATION USED IN THIS QUALIFICATION | |
|---|---|
| Package Designation: | BA48 |
| Package Outline, Type, or Name: | 48-ball Fine Pitch Ball Grid Array (FBGA) |
| Mold Compound Name/Manufacturer: | PLASKON SMT-B-1 |
| Mold Compound Flammability Rating: | V-O per UL94 |
| Oxygen Rating Index: | > 28 % |
| Substrate Material: | BT Resin |
| Lead Finish, Composition / Thickness: | Solder Ball, 63%Sn, 37%Pb |
| Die Backside Preparation Method/Metallization: | N/A |
| Die Separation Method: | Wafer Saw |
| Die Attach Supplier: | Ablestik |
| Die Attach Material: | Ablestik 8355F |
| Die Attach Method: | Epoxy |
| Bond Diagram Designation: | 10-04040 |
| Wire Bond Method: | Thermosonic |
| Wire Material/Size: | Au, 1.0um |
| Thermal Resistance Theta JA °C/W: | 86.18°C/W |
| Package Cross Section Yes/No: | N/A |
| Assembly Process Flow: | 49-41010 |
| Name/Location of Assembly (prime) facility: | ASE Taiwan |

| ELECTRICAL TEST / FINISH DESCRIPTION | |
|---|------------|
| Test Location: | ASE Taiwan |
| Fault Coverage: | 100 % |

RELIABILITY TESTS PERFORMED PER SPECIFICATION REQUIREMENT

| Stress/Test | Test Condition (Temp/Bias) | Result P/F |
|--|---|---------------|
| High Temperature Operating Life Early Failure Rate | 1) QTP #013806 Dynamic Operating Condition, Vcc Max = 2.07V, 125°C 2) QTP #012411 Dynamic Operating Condition, Vcc Max = 2.75V, 125°C | P |
| High Temperature Operating Life Latent Failure Rate | 1) QTP #012411 Dynamic Operating Condition, Vcc Max=2.07V, 150°C | P |
| High Temperature Steady State Life | 1) QTP # QTP #012411 Static Operating Condition, Vcc Max=1.98V, 150°C | P |
| High Accelerated Saturation Test (HAST) | 1) QTP #012411 130°C, 2.75V,85%RH Precondition: JESD22 Moisture Sensitivity MSL 3 192 Hrs, 30C/60%RH+3IR-Reflow, 235°C+5, 0°C | P |
| Temperature Cycle | 1) QTP #013806, QTP #012411 MIL-STD-883C, Method 1010, Condition C, -65°C to 150°C Precondition: JESD22 Moisture Sensitivity MSL 3 192 Hrs, 30C/60%RH+3IR-Reflow, 235°C+5, 0°C | P |
| Pressure Cooker | 1) QTP #013806, QTP #012411 121°C, 100%RH Precondition: JESD22 Moisture Sensitivity MSL 3 192 Hrs, 30C/60%RH+3IR-Reflow, 235°C+5, 0°C | P |
| High Temperature Storage | 1) QTP #012411 150°C ± 5°C no bias | P |
| Electrostatic Discharge Human Body Model (ESD-HBM) | 1) QTP #013806, QTP #012411 2,200V MIL-STD-883, Method 3015.7 | P |
| Electrostatic Discharge Charge Device Model (ESD-CDM) | 1) QTP #013806, QTP #012411 500V Cypress Spec. 25-00020 | P |
| Age Bond Strength | 1) QTP #012411 200C, 4HRS MIL-STD-883, Method 883-2011 | P |

RELIABILITY TESTS PERFORMED PER SPECIFICATION REQUIREMENT

| Stress/Test | Test Condition (Temp/Bias) | Result P/F |
|--------------------------------|---|-----------------------|
| SEM X-Section | 1) QTP #012411 MIL-STD-883, Method 883-2018-2 / Cypress Spec. 22-00009 | P |
| Low Temperature Operating Life | 1) QTP #012411 -30C, 3.25V, 8MHZ | P |
| Acoustic Microscopy, MSL 3 | 1) QTP #012411 Cypress Spec. 25-00104 | P |
| Current Density | 1) QTP #012411 Cypress Spec 22-00029 | P |
| Static Latchup | 1) QTP #013806, QTP #012411 125C, 6.5V, \pm 300mA In accordance with JEDEC 17. Cypress Spec. 01-00081 | P |

RELIABILITY FAILURE RATE SUMMARY

| Stress/Test | Device Tested/ Device Hours | # Fails | Activation Energy | Thermal AF ⁴ | Failure Rate |
|--|--------------------------------|------------|----------------------|----------------------------|--------------|
| High Temperature Operating Life Early Failure Rate ¹ | 6,039 | 0 | N/A | N/A | 0 PPM |
| High Temperature Operating Life ^{1,2} Long Term Failure Rate | 488,000 DHRs | 1 | 0.7 | 170 | 24 FIT |

¹ A production burn-in of 12 Hrs at 125°C, 2.75V is required for the product.

² Assuming an ambient temperature of 55°C and a junction temperature rise of 15°C.

³ Chi-squared 60% estimations used to calculate the failure rate..

⁴ Thermal Acceleration Factor is calculated from the Arrhenius equation

$$AF = \exp \left[\frac{E_A}{k} \left[\frac{1}{T_2} - \frac{1}{T_1} \right] \right]$$

where:

E_A =The Activation Energy of the defect mechanism.

k = Boltzmann's constant = 8.62x10⁻⁵ eV/Kelvin.

T₁ is the junction temperature of the device under stress and T₂ is the junction temperature of the device at use conditions.

Reliability Test Data

QTP #: 013806

| <i>Device</i> | <i>Fab Lot #</i> | <i>Assy Lot #</i> | <i>Ass Loc</i> | <i>Duration</i> | <i>Samp</i> | <i>Rej</i> | <i>Failure Mechanism</i> |
|---|------------------|-------------------|----------------|-----------------|-------------|------------|--------------------------|
| STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE (125C, 2.07V, Vcc Max) | | | | | | | |
| CY62137CV18LL (7C62337B) | 41125681 | 610125199 | TAIWN-G | 96 | 1607 | 0 | |
| STRESS: ESD-CHARGE DEVICE MODEL (500V) | | | | | | | |
| CY62137CV18LL (7C62337B) | 4038574 | 610047321 | TAIWN-G | COMP | 9 | 0 | |
| STRESS: ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015 (2,200V) | | | | | | | |
| CY62137CV18LL (7C62337B) | 4038574 | 610047321 | TAIWN-G | COMP | 9 | 0 | |
| STRESS: STATIC LATCH-UP TESTING (125C, 6.5V, +/-300mA) | | | | | | | |
| CY62137CV18LL (7C62337B) | 4038574 | 610047321 | TAIWN-G | COMP | 3 | 0 | |
| STRESS: PRESSURE COOKER TEST (121C, 100%RH), PRE COND 192 HR 30C/60%RH, MSL3) | | | | | | | |
| CY62137CV18LL (7C62337B) | 4111527 | 610116217Q | TAIWN-G | 168 | 48 | 0 | |
| STRESS: TC COND. C -65C TO 150C, PRECONDITION 192 HRS 30C/60%RH (MSL3) | | | | | | | |
| CY62137CV18LL (7C62337B) | 4038574 | 610047321 | TAIWN-G | 500 | 47 | 0 | |
| CY62137CV18LL (7C62337B) | 4038574 | 610047321 | TAIWN-G | 1500 | 47 | 0 | |
| CY62137CV18LL (7C62337B) | 4038574 | 610047321 | TAIWN-G | 2000 | 45 | 0 | |

Reliability Test Data

QTP #: 012411

| Device | Fab Lot # | Assy Lot # | Ass Loc | Duration | Samp | Rej | Failure Mechanism |
|--|-----------|-------------|---------|----------|------|-----|--------------------|
| STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-EARLY FAILURE RATE (125C, 2.75V, Vcc Max) | | | | | | | |
| CY62157CV18LL (7C623571C) | 4108785 | 610112193 | CSPI-R | 96 | 1596 | 0 | |
| CY62157CV18LL (7C62357C) | 4110220 | 610114276L2 | CSPI-R | 96 | 1246 | 0 | |
| CY62157CV18LL (7C62357C) | 4039754 | 610100977L1 | CSPI-R | 96 | 800 | 0 | |
| CY62157CV18LL (7C62357C) | 4039754 | 610100977L1 | CSPI-R | 96 | 791 | 0 | |
| STRESS: HIGH TEMP DYNAMIC OPERATING LIFE-LATENT FAILURE RATE (150C, 2.07V, Vcc Max) | | | | | | | |
| CY62157CV18LL (7C623571C) | 4107546 | 610112215 | CSPI-R | 96 | 390 | 0 | |
| CY62157CV18LL (7C623571C) | 4107546 | 610112215 | CSPI-R | 168 | 390 | 0 | |
| CY62157CV18LL (7C623571C) | 4107546 | 610112215 | CSPI-R | 500 | 389 | 1 | SINGLE BIT FAILURE |
| CY62157CV18LL (7C623571C) | 4108785 | 610112193 | CSPI-R | 96 | 389 | 0 | |
| CY62157CV18LL (7C623571C) | 4108785 | 610112193 | CSPI-R | 168 | 388 | 0 | |
| CY62157CV18LL (7C623571C) | 4108785 | 610112193 | CSPI-R | 500 | 388 | 0 | |
| CY62157CV18LL (7C623571C) | 4048795 | 610103046 | CSPI-R | 96 | 200 | 0 | |
| CY62157CV18LL (7C623571C) | 4048795 | 610103046 | CSPI-R | 168 | 199 | 0 | |
| CY62157CV18LL (7C623571C) | 4048795 | 610103046 | CSPI-R | 500 | 199 | 0 | |
| STRESS: ESD-CHARGE DEVICE MODEL (500V) | | | | | | | |
| CY62157CV18LL (7C623571C) | 4107546 | 610112305 | CSPI-R | COMP | 9 | 0 | |
| CY62157CV18LL (7C623571C) | 4108785 | 610112193 | CSPI-R | COMP | 9 | 0 | |
| CY62157CV18LL (7C62357C) | 4028521 | 340000332 | CSPI-R | COMP | 9 | 0 | |
| STRESS: ESD-HUMAN BODY CIRCUIT PER MIL STD 883, METHOD 3015 (2,200V) | | | | | | | |
| CY62157CV18LL (7C623571C) | 4107546 | 610112305 | CSPI-R | COMP | 9 | 0 | |
| CY62157CV18LL (7C623571C) | 4108785 | 610112193 | CSPI-R | COMP | 9 | 0 | |
| CY62157CV18LL (7C62357C) | 4028521 | 340000332 | CSPI-R | COMP | 9 | 0 | |
| STRESS: STATIC LATCH-UP TESTING (125C, 6.5V, +/300mA) | | | | | | | |
| CY62157CV18LL (7C623571C) | 4107546 | 610112305 | CSPI-R | COMP | 3 | 0 | |
| CY62157CV18LL (7C623571C) | 4108785 | 610112193 | CSPI-R | COMP | 3 | 0 | |
| CY62157CV18LL (7C62357C) | 4028521 | 340000332 | CSPI-R | COMP | 3 | 0 | |
| STRESS: ACOUSTIC-MSL3 | | | | | | | |
| CY62157CV18LL (7C623571C) | 4107546 | 610112460 | CSPI-R | COMP | 15 | 0 | |
| CY62157CV18LL (7C623571C) | 4107546 | 610112461 | CSPI-R | COMP | 15 | 0 | |
| CY62157CV18LL (7C623571C) | 4107546 | 610112462 | CSPI-R | COMP | 15 | 0 | |

Reliability Test Data

QTP #: 012411

| <i>Device</i> | <i>Fab Lot #</i> | <i>Assy Lot #</i> | <i>Ass Loc</i> | <i>Duration</i> | <i>Samp</i> | <i>Rej</i> | <i>Failure Mechanism</i> |
|---|------------------|-------------------|----------------|-----------------|-------------|------------|--------------------------|
| STRESS: AGE BOND STRENGTH | | | | | | | |
| CY62157CV18LL (7C623571C) | 4107546 | 610112215 | CSPI-R | COMP | 15 | 0 | |
| CY62157CV18LL (7C62357C) | 4111455 | 610114268 | CSPI-R | COMP | 15 | 0 | |
| CY62157CV18LL (7C62357C) | 4110220 | 610114276L2 | CSPI-R | COMP | 15 | 0 | |
| STRESS: HIGH TEMPERATURE STORAGE, PLASTIC, 150C | | | | | | | |
| CY62157CV18LL (7C62357C) | 4039638 | 610046995 | CSPI-R | 500 | 48 | 0 | |
| CY62157CV18LL (7C62357C) | 4039638 | 610046995 | CSPI-R | 1000 | 48 | 0 | |
| STRESS: HIGH TEMP STEADY STATE LIFE TEST (150C, 1.98V, Vcc MAX) | | | | | | | |
| CY62157CV18LL (7C62357C) | 4039638 | 610046995 | CSPI-R | 168 | 77 | 0 | |
| CY62157CV18LL (7C62357C) | 4039638 | 610046995 | CSPI-R | 336 | 76 | 1 | POLYSILICON PROTRUSION |
| STRESS: PRESSURE COOKER TEST (121C, 100%RH), PRE COND 192 HR 30C/60%RH | | | | | | | |
| CY62157CV18LL (7C623571C) | 4107546 | 610112305 | CSPI-R | 168 | 54 | 0 | |
| CY62157CV18LL (7C623571C) | 4108785 | 610112193 | CSPI-R | 168 | 47 | 0 | |
| CY62157CV18LL (7C62357C) | 4111455 | 610114268L4 | CSPI-R | 168 | 45 | 0 | |
| STRESS: HI-ACCEL SATURATION TEST (130C, 85%RH, 1.98V), PRE COND 192 HR 30C/60%RH | | | | | | | |
| CY62157CV18LL (7C62357C) | 4039638 | 610046995 | CSPI-R | 128 | 45 | 0 | |
| CY62157CV18LL (7C623571C) | 4107546 | 610112215 | CSPI-R | 128 | 50 | 0 | |
| CY62157CV18LL (7C623571C) | 4108785 | 610112193 | CSPI-R | 128 | 50 | 0 | |
| STRESS: TC COND. C -65C TO 150C, PRECONDITION 192 HRS 30C/60%RH (MSL3) | | | | | | | |
| CY62157CV18LL (7C62357C) | 4039638 | 610046995 | CSPI-R | 300 | 46 | 0 | |
| CY62157CV18LL (7C623571C) | 4107546 | 610112215 | CSPI-R | 300 | 102 | 0 | |
| CY62157CV18LL (7C62357C) | 4039638 | 610046995 | CSPI-R | 300 | 47 | 0 | |
| STRESS: LOW TEMPERATURE OPERATING LIFE (-30C, 3.25V) | | | | | | | |
| CY62157CV18LL (7C62357C) | 4039638 | 610046995 | CSPI-R | 500 | 44 | 1 | POLYSILICON PROTRUSION |