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ETRI

Korea Lunar Exploration Program

DTN

SBC Part Stress Analysis

Date: 15 Oct. 2018

Doc. No: KPLO-D1-554-032
Issue: 1.0
Total page: 17

Superseding   <u>Revised</u>

Prepared By:

_____
June-Tae Park   Date
DTN Payload Engineer, Lumir

Reviewed By:

_____
Chang-Soo Lee   Date
DTN Product Assurance, Lumir

_____
Dae-Soo Oh   Date
DTN Project Manager, Lumir

Approval Signature:

_____
Cheol-Oh Jeong   Date
DTN Product Assurance, ETRI

_____
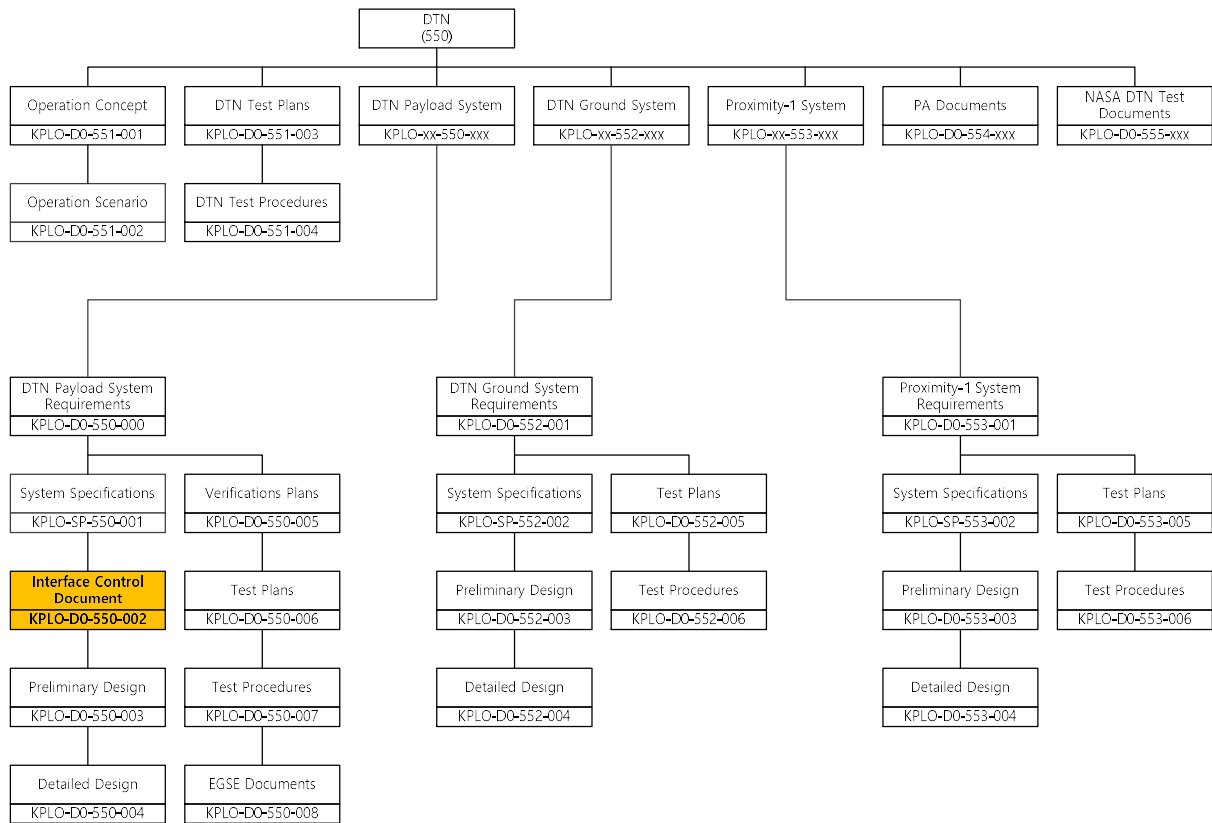Jin-Ho Jo   Date
DTN Project Leader, ETRI

Original CDMO Release_____

Revision History

Version	Author(s)	Date	Description
D-00	Myeong-Ho Yang	2016. 10. 07	Draft
P-00	Myeong-Ho Yang	2016. 11. 23	PSA Table add
P-01	Jae-Won Jang	2017. 11. 27	Doc Number & Form Change
1.0	June-Tae Park	2018. 10. 15	Final

Revision/Change Records			
Version	Date	Revision/Change Description	Pages
D-00	2016. 10. 07	Draft	All
P-00	2016. 11. 23	PSA Table add	11~14
P-01	2017. 11. 27	Doc Number & Form Change	All
1.0	2018. 10. 15	Final	All

Documents Tree

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                                  DTN
                                 (550)
   ┌──────────┬──────────┬─────────┼──────────┬──────────┬──────────┐
Operation    DTN Test    DTN Payload   DTN Ground   Proximity-1    PA Documents   NASA DTN Test
Concept      Plans       System        System       System                        Documents
KPLO-D0-     KPLO-D0-    KPLO-xx-      KPLO-xx-     KPLO-xx-       KPLO-D0-       KPLO-D0-
551-001      551-003     550-xxx       552-xxx      553-xxx        554-xxx        555-xxx

Operation    DTN Test
Scenario     Procedures
KPLO-D0-     KPLO-D0-
551-002      551-004

DTN Payload System          DTN Ground System        Proximity-1 System
Requirements                Requirements             Requirements
KPLO-D0-550-000             KPLO-D0-552-001          KPLO-D0-553-001

System          Verifications   System          Test Plans    System          Test Plans
Specifications  Plans           Specifications   KPLO-D0-      Specifications   KPLO-D0-
KPLO-SP-        KPLO-D0-        KPLO-SP-         552-005       KPLO-SP-         553-005
550-001         550-005         552-002                        553-002

Interface       Test Plans      Preliminary      Test          Preliminary      Test
Control         KPLO-D0-        Design           Procedures    Design           Procedures
Document        550-006         KPLO-D0-         KPLO-D0-      KPLO-D0-         KPLO-D0-
KPLO-D0-                        552-003          552-006       553-003          553-006
550-002

Preliminary     Test            Detailed                       Detailed
Design          Procedures      Design                         Design
KPLO-D0-        KPLO-D0-        KPLO-D0-                       KPLO-D0-
550-003         550-007         552-004                        553-004

Detailed        EGSE
Design          Documents
KPLO-D0-        KPLO-D0-
550-004         550-008
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1 INTRODUCTION

1.1 SCOPE

This document summarizes Part Stress Analysis for the Single Board Computer (SBC) to be developed for the DTN. Part Stress analysis procedures and documentation shall be performed in accordance with ECSS-Q-ST-30-11C.

1.2 DTN Overview

The mission of DTN is to validate DTN communication protocols by space-link testing through KPLO. So DTN operations are focused on testing the DTN protocols using KPLO space-links.

2 DOCUMENTS

2.1 APPLICABLE DOCUMENTS

	Document No.	Title
AD-1	KPLO-D0-210-003	User Requirements Document (KARI)
AD-2	KPLO-D0-524-008	User Requirements Document (ETRI)

2.2 REFERENCE DOCUMENTS

	Document No.	Title
RD-1	MIL-STD-461E	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
RD-2	MIL-STD-462D	Measurements of Electromagnetic Interference Characteristics
RD-3	ECSS-E-ST-10-06C	Space engineering Technical Requirements specification
RD-4	ECSS-Q-60-11A	Derating and End of Life parameter drifts-EEE Components
RD-5	MIL-HDBK-217	Reliability Prediction for Electronic Equipment
RD-6	ECSS-Q-ST-30-11C	Derating – EEE Components
RD-7	MIL-STD-975 M	NASA Standard Electrical, Electronics and Electromechanical Parts List

3 ACRONYMS AND ABBREVIATIONS

AMS	Asynchronous Message Service
AOS	Advanced Orbiting System
BP	Bundle Protocol
BSS	Bundle Streaming Service
CCSDS	Consultative Committee for Space Data Systems
CFDP	CCSDS File Delivery Protocol
DCC	DTN Control Center
DTN	Delay(Disruption) Tolerant Network
DTNPL	DTN Payload
IP	Internet Protocol
KPLO	Korea Pathfinder Lunar Orbiter
LCM	Lander Communication Model
LTP	Liklider Transmission Protocol
M&C	Monitor & Control
RCM	Rover Communication Model
SLE	Space Link Extension
TBC	To Be Confirmed
TBD	To Be Defined
TCP	Transmission Control Protocol
UDP	User Datagram Protocol

4 Part Stress Analysis

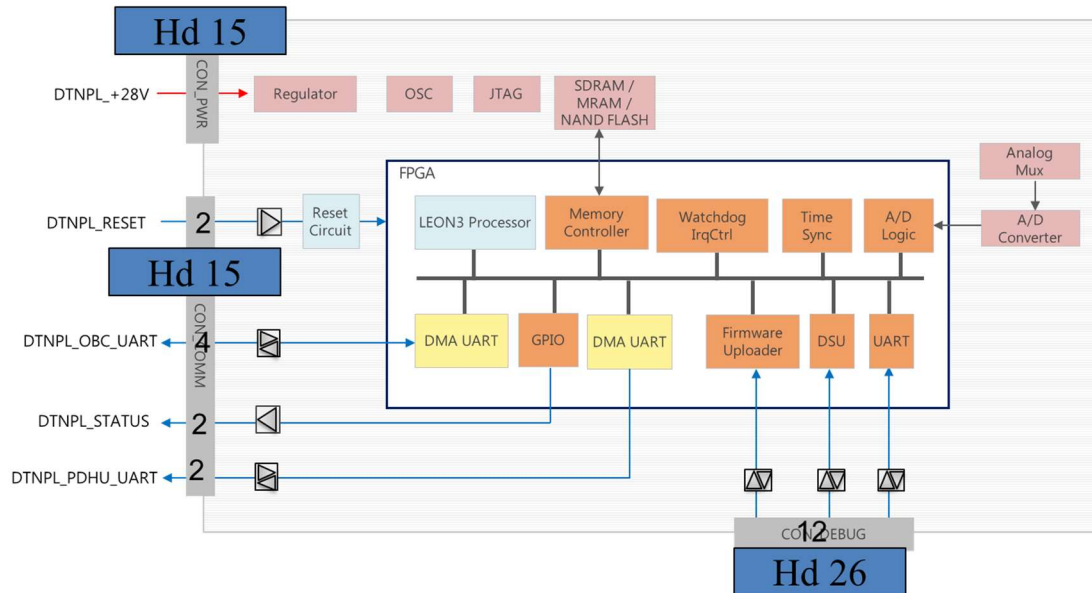The Configuration of SBC (Single Board Computer) is shown as below (Figure 4-1)

Figure 4-1 SBC Configuration

4.1 Derating Parameters

Derating requirements are provided in the clause 6 for each component family.

For each category, parameters to be derated are identified. The main parameters to be derated are:

    (i) Junction or case temperature

    (ii) Power (rating, dissipation)

    (iii) Voltage

    (iv) Current

The parameters to be derated depend on component type.

A stress balancing concept offers flexibility between one stress versus another(voltage and temperature). In some cases, e.g. resistors, derating has a direct impact on component performance.

4.2 SBC Part Stress Analysis Table

4.2.1 Integrated Circuits

No.	Designator	Family	Group	Family Code	Group Code	Name	Part Number	Supply Voltage				Temperature			Complete	Remark
								Requirement Derating	Rated Value (V)	Applied Value (V)	Applied Rating (%)	Requirement Derating (℃)	Tj max (℃)	Applied Tj (℃)		
1	N/A	Integrated Circuits	Programmable Array Logic	08	30	FPGA	RT4G150-CG1657B	±5%	1.2	1.20004	4.76%	95	135	60	O	
2	N/A	Integrated Circuits	Programmable Array Logic	08	30	FPGA	RT4G150-CG1657B	±5%	3.3	3.30004	4.76%	95	135	60	O	
3	N/A	Integrated Circuits	Memory others	08	29	NAND Flash	3DFN32G08VS4704IB	±5%	3.3	3.30004	4.76%	110	150	60	O	
4	N/A	Integrated Circuits	Memory DRAM	08	21	SDRAM	3DSD2G40VS5493IB	±5%	3.3	3.30004	4.76%	110	150	60	O	
5	N/A	Integrated Circuits	Memory others	08	29	MRAM	3DMR64M08VS4476IB	±5%	3.3	3.30004	4.76%	110	150	60	O	
6	N/A	Integrated Circuits	Linear analog to digital converter	08	61	ADC	AD1671-703D	±5%	5	5.00004	4.76%	110	150	60	O	
7	N/A	Integrated Circuits	Linear line driver	08	55	RS422 Driver	HX422DGVF	±5%	3.3	3.30004	4.76%	110	175	60	O	
8	N/A	Integrated Circuits	Linear line receiver	08	56	RS422 Receiver	HX422RGVF	±5%	3.3	3.30004	4.76%	110	175	60	O	
9	N/A	Integrated Circuits	Linear line driver	08	55	LVDS Driver	HXLVDSDGVF	±5%	3.3	3.30004	4.76%	110	175	60	O	
10	N/A	Integrated Circuits	Linear line receiver	08	56	LVDS Receiver	HXLVDSRGVF	±5%	3.3	3.30004	4.76%	110	175	60	O	
11	N/A	Integrated Circuits	Linear multiplexer	08	60	Multiplexer	HS-1840ARH-8	±5%	15	15.00004	4.76%	110	175	60	O	
12	N/A	Integrated Circuits	Linear switching regulator	08	54	Switching regulator	MSK5063RHG	90%	60	28	46.666667%	110	150	60	O	
13	N/A	Integrated Circuits	Linear voltage regulator	08	53	Voltage regulator	MSK5984RHD	90%	16.5	5	30.303030%	110	150	60	O	
14	N/A	Integrated Circuits	Linear voltage regulator	08	53	Voltage regulator	MSK5984RHD	90%	16.5	5	30.303030%	110	150	60	O	

4.2.2 Transistors FET

No.	Designator	Family	Group	Family code	Group code	Part Number	Drain to source vloatge (Vds)				Gate to source voltage (Vgs)				Drain Current (Ids, mA)				Power dissipation				Tj max (℃)	Applied Tj (℃)	Board Temp	Remark	Complete
							Requirement Derating	Rated Value	Applied Value	Applied Rating	Requirement Derating	Rated Value	Applied Value	Applied Rating	Requirement Derating	Rated Value	Applied Value	Applied Rating	Requirement Derating	Rated Value	Applied Value	Applied Rating					
1	N/A	Transistors	Low power, NPN-<2W	12	01	JANS2N2222AUB	75%	50	3.3	6.60%	75%	6	2	33.33%	75%	800	3	0.38%	65%	0.5	0.01	2.00%	200	110			O

4.2.3 Capacitors

No.	Designator	Family	Group	Family Code	Group Code	Name	Part Number	Value(uF)	Voltage				Complete	Remark
									Requirement Derating (@85℃)	Rated Value (V)	Applied Value (V)	Applied Rating (%)		
1	N/A	Capacitors	Ceramic Chip	01	02	Chip, Multiple Layer	CDR31BX180AKSR	18	60%	50	5	10%	O	
2	N/A	Capacitors	Ceramic Chip	01	02	Chip, Multiple Layer	CDR31BX102AKSR	1,000	60%	50	5	10%	O	
3	N/A	Capacitors	Ceramic Chip	01	02	Chip, Multiple Layer	300901107C105KC	1,000,000	60%	50	5	10%	O	
4	N/A	Capacitors	Ceramic Chip	01	02	Chip, Multiple Layer	CDR31BX103AKSR	10,000	60%	50	15	30%	O	
5	N/A	Capacitors	Ceramic Chip	01	02	Chip, Multiple Layer	CDR33BX104AKSR	100,000	60%	50	5	10%	O	
6	N/A	Capacitors	Ceramic Chip	01	02	Chip, Multiple Layer	CDR31BX183AKSR	18,000	60%	50	5	10%	O	
7	N/A	Capacitors	Tantalum solid	01	03	Chip, Tantalum	301200117C227AK	220,000,000	60%	10	5	50%	O	
8	N/A	Capacitors	Tantalum solid	01	03	Chip, Tantalum	301200114C336CK	33,000,000	60%	16	5	31%	O	
9	N/A	Capacitors	Tantalum solid	01	03	Chip, Tantalum	301200117C476DK	47,000,000	60%	20	5	25%	O	
10	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR31BX180AKSR	18	60%	50	5	10%	O	
11	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR31BX102AKSR	1,000	60%	50	5	10%	O	
12	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	300901107C105KC	1,000,000	60%	50	5	10%	O	
13	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR31BX103AKSR	10,000	60%	50	15	30%	O	
14	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR33BX104AKSR	100,000	60%	50	5	10%	O	
15	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR31BX183AKSR	18,000	60%	50	5	10%	O	
16	N/A	Capacitors	Solid, Elec, Tant (CSR)	01	03	Chip, Tantalum	301200117C227AK	220,000,000	60%	10	5	50%	O	
17	N/A	Capacitors	Solid, Elec, Tant (CSR)	01	03	Chip, Tantalum	301200114C336CK	33,000,000	60%	16	5	31%	O	
18	N/A	Capacitors	Solid, Elec, Tant (CSR)	01	03	Chip, Tantalum	301200117C476DK	47,000,000	60%	20	5	25%	O	
19	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR31BX180AKSR	18	60%	50	5	10%	O	
20	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR31BX102AKSR	1,000	60%	50	5	10%	O	
21	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	300901107C105KC	1,000,000	60%	50	5	10%	O	
22	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR31BX103AKSR	10,000	60%	50	15	30%	O	
23	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR33BX104AKSR	100,000	60%	50	5	10%	O	
24	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR31BX183AKSR	18,000	60%	50	5	10%	O	
25	N/A	Capacitors	Solid, Elec, Tant (CSR)	01	03	Chip, Tantalum	301200117C227AK	220,000,000	60%	10	5	50%	O	

26	N/A	Capacitors	Solid, Elec, Tant (CSR)	01	03	Chip, Tantalum	301200114C336CK	33,000,000	60%	16	5	31%	O	
27	N/A	Capacitors	Solid, Elec, Tant (CSR)	01	03	Chip, Tantalum	301200117C476DK	47,000,000	60%	20	5	25%	O	
28	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR31BX180AKSR	18	60%	50	5	10%	O	
29	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR31BX102AKSR	1,000	60%	50	5	10%	O	
30	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	300901107C105KC	1,000,000	60%	50	5	10%	O	
31	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR31BX103AKSR	10,000	60%	50	15	30%	O	
32	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR33BX104AKSR	100,000	60%	50	5	10%	O	
33	N/A	Capacitors	Chip, Ceramic (CDR)	01	02	Chip, Multiple Layer	CDR31BX183AKSR	18,000	60%	50	5	10%	O	
34	N/A	Capacitors	Solid, Elec, Tant (CSR)	01	03	Chip, Tantalum	301200117C227AK	220,000,000	60%	10	5	50%	O	
35	N/A	Capacitors	Solid, Elec, Tant (CSR)	01	03	Chip, Tantalum	301200114C336CK	33,000,000	60%	16	5	31%	O	
36	N/A	Capacitors	Solid, Elec, Tant (CSR)	01	03	Chip, Tantalum	301200117C476DK	47,000,000	60%	20	5	25%	O	

4.2.4 Resistors

No.	Designator	Family	Group	Family Code	Group Code	Part Number	Value(ohms)	Power(W)				Voltage(V)				Remark	Complete
								Requirement Derating (@85℃)	Rated Value (W)	Applied Value (W)	Applied Rating (%)	Requirement Derating	Rated Value (V)	Applied Value (V)	Applied Rating (%)		
1	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
2	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
3	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
4	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
5	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
6	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
7	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
8	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
9	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
10	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
11	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
12	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
13	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
14	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
15	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
16	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
17	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
18	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
19	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
20	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
21	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
22	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
23	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
24	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
25	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O

26	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
27	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
28	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
29	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
30	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
31	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
32	N/A	Resistors	Chip-all	10	9	M32159B12T	0	50%	0.035	0.0075	21.429	80%	40	28	70		O
33	N/A	Resistors	Chip-all	10	9	M55342K06B22D1R	22.1	50%	0.05	0.0075	15	80%	40	28	70		O
34	N/A	Resistors	Chip-all	10	9	M55342K06B22D1R	22.1	50%	0.05	0.0075	15	80%	40	28	70		O
35	N/A	Resistors	Chip-all	10	9	M55342K06B22D1R	22.1	50%	0.05	0.0075	15	80%	40	28	70		O
36	N/A	Resistors	Chip-all	10	9	M55342K06B22D1R	22.1	50%	0.05	0.0075	15	80%	40	28	70		O
37	N/A	Resistors	Chip-all	10	9	M55342K06B22D1R	22.1	50%	0.05	0.0075	15	80%	40	28	70		O
38	N/A	Resistors	Chip-all	10	9	M55342K06B22D1R	22.1	50%	0.05	0.0075	15	80%	40	28	70		O
39	N/A	Resistors	Chip-all	10	9	M55342K06B22D1R	22.1	50%	0.05	0.0075	15	80%	40	28	70		O
40	N/A	Resistors	Chip-all	10	9	M55342K06B22D1R	22.1	50%	0.05	0.0075	15	80%	40	28	70		O
41	N/A	Resistors	Chip-all	10	9	M55342K12B49D9R	49.9	50%	0.035	0.0075	21.429	80%	40	28	70		O
42	N/A	Resistors	Chip-all	10	9	M55342K12B49D9R	49.9	50%	0.035	0.0075	21.429	80%	40	28	70		O
43	N/A	Resistors	Chip-all	10	9	M55342K12B49D9R	49.9	50%	0.035	0.0075	21.429	80%	40	28	70		O
44	N/A	Resistors	Chip-all	10	9	M55342K12B49D9R	49.9	50%	0.035	0.0075	21.429	80%	40	28	70		O
45	N/A	Resistors	Chip-all	10	9	M55342K12B49D9R	49.9	50%	0.035	0.0075	21.429	80%	40	28	70		O
46	N/A	Resistors	Chip-all	10	9	M55342K12B49D9R	49.9	50%	0.035	0.0075	21.429	80%	40	28	70		O
47	N/A	Resistors	Chip-all	10	9	M55342K12B49D9R	49.9	50%	0.035	0.0075	21.429	80%	40	28	70		O
48	N/A	Resistors	Chip-all	10	9	M55342K12B49D9R	49.9	50%	0.035	0.0075	21.429	80%	40	28	70		O
49	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O
50	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O
51	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O
52	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O
53	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O
54	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O

55	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O
56	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O
57	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O
58	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O
59	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O
60	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O
61	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O
62	N/A	Resistors	Chip-all	10	9	M55342K12B100DR	100	50%	0.05	0.0075	15	80%	40	28	70		O
63	N/A	Resistors	Chip-all	10	9	M55342K12B121DR	121	50%	0.035	0.0075	21.429	80%	40	28	70		O
64	N/A	Resistors	Chip-all	10	9	M55342K12B121DR	121	50%	0.035	0.0075	21.429	80%	40	28	70		O
65	N/A	Resistors	Chip-all	10	9	M55342K12B140DR	140	50%	0.05	0.0075	15	80%	40	28	70		O
66	N/A	Resistors	Chip-all	10	9	M55342K12B140DR	140	50%	0.05	0.0075	15	80%	40	28	70		O
67	N/A	Resistors	Chip-all	10	9	M55342K12B140DR	140	50%	0.05	0.0075	15	80%	40	28	70		O
68	N/A	Resistors	Chip-all	10	9	M55342K12B140DR	140	50%	0.05	0.0075	15	80%	40	28	70		O
69	N/A	Resistors	Chip-all	10	9	M55342K12B402DR	402	50%	0.035	0.0075	21.429	80%	40	28	70		O
70	N/A	Resistors	Chip-all	10	9	M55342K12B402DR	402	50%	0.035	0.0075	21.429	80%	40	28	70		O
71	N/A	Resistors	Chip-all	10	9	M55342K12B402DR	402	50%	0.035	0.0075	21.429	80%	40	28	70		O
72	N/A	Resistors	Chip-all	10	9	M55342K12B402DR	402	50%	0.035	0.0075	21.429	80%	40	28	70		O
73	N/A	Resistors	Chip-all	10	9	M55342K12B402DR	402	50%	0.035	0.0075	21.429	80%	40	28	70		O
74	N/A	Resistors	Chip-all	10	9	M55342K12B402DR	402	50%	0.035	0.0075	21.429	80%	40	28	70		O
75	N/A	Resistors	Chip-all	10	9	M55342K12B402DR	402	50%	0.035	0.0075	21.429	80%	40	28	70		O
76	N/A	Resistors	Chip-all	10	9	M55342K12B402DR	402	50%	0.035	0.0075	21.429	80%	40	28	70		O
77	N/A	Resistors	Chip-all	10	9	M55342K12B1E00R	1K	50%	0.05	0.0075	15	80%	40	28	70		O
78	N/A	Resistors	Chip-all	10	9	M55342K12B1E00R	1K	50%	0.05	0.0075	15	80%	40	28	70		O
79	N/A	Resistors	Chip-all	10	9	M55342K12B1E00R	1K	50%	0.05	0.0075	15	80%	40	28	70		O
80	N/A	Resistors	Chip-all	10	9	M55342K12B1E00R	1K	50%	0.05	0.0075	15	80%	40	28	70		O
81	N/A	Resistors	Chip-all	10	9	M55342K12B1E00R	1K	50%	0.05	0.0075	15	80%	40	28	70		O
82	N/A	Resistors	Chip-all	10	9	M55342K12B1E00R	1K	50%	0.05	0.0075	15	80%	40	28	70		O
83	N/A	Resistors	Chip-all	10	9	M55342K12B1E00R	1K	50%	0.05	0.0075	15	80%	40	28	70		O
84	N/A	Resistors	Chip-all	10	9	M55342K12B1E00R	1K	50%	0.05	0.0075	15	80%	40	28	70		O
85	N/A	Resistors	Chip-all	10	9	M55342K12B1E00R	1K	50%	0.05	0.0075	15	80%	40	28	70		O

86	N/A	Resistors	Chip-all	10	9	M55342K12B3E48R	3.48K	50%	0.035	0.0075	21.429	80%	40	28	70		O
87	N/A	Resistors	Chip-all	10	9	M55342K12B3E48R	3.48K	50%	0.035	0.0075	21.429	80%	40	28	70		O
88	N/A	Resistors	Chip-all	10	9	M55342K12B3E48R	3.48K	50%	0.035	0.0075	21.429	80%	40	28	70		O
89	N/A	Resistors	Chip-all	10	9	M55342K12B3E48R	3.48K	50%	0.035	0.0075	21.429	80%	40	28	70		O
90	N/A	Resistors	Chip-all	10	9	M55342K12B3E48R	3.48K	50%	0.035	0.0075	21.429	80%	40	28	70		O
91	N/A	Resistors	Chip-all	10	9	M55342K12B3E48R	3.48K	50%	0.035	0.0075	21.429	80%	40	28	70		O
92	N/A	Resistors	Chip-all	10	9	M55342K12B3E48R	3.48K	50%	0.035	0.0075	21.429	80%	40	28	70		O
93	N/A	Resistors	Chip-all	10	9	M55342K12B3E48R	3.48K	50%	0.035	0.0075	21.429	80%	40	28	70		O
94	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
95	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
96	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
97	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
98	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
99	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
100	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
101	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
102	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
103	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
104	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
105	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
106	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
107	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
108	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
109	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
110	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
111	N/A	Resistors	Chip-all	10	9	M55342K12B50D0R	4.75K	50%	0.05	0.0075	15	80%	40	28	70		O
112	N/A	Resistors	Chip-all	10	9	M55342K11B1E00R	1K	50%	0.05	0.0075	15	80%	40	28	70		O
113	N/A	Resistors	Chip-all	10	9	M55342K11B1E00R	1K	50%	0.05	0.0075	15	80%	40	28	70		O
114	N/A	Resistors	Chip-all	10	9	M55342K11B1E00R	1K	50%	0.05	0.0075	15	80%	40	28	70		O
115	N/A	Resistors	Chip-all	10	9	M55342K11B1E00R	1K	50%	0.05	0.0075	15	80%	40	28	70		O