GENESYS™

GH1kW

RELIABILITY

DATA

DWG: IA882-57-01		
APPD	CHK	DWG
31/05/20	31.05.2020	Michael Goldsberg 31/05/2020

TDK-LAMBDA

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The above data is typical value. As all units have nearly the same characteristics, the data to be considered as ability value.

M.T.B.F.

Calculation based on parts stress reliability projection of Telcordia (Bellcore)
"Reliability Prediction Procedure for Electronic Equipment" Document number TR-322,Issue5)
Individual failure λss is calculated from electrical stress and temperature rise of each device.

$$MTBF = \frac{1}{\lambda_{equip}} = \frac{1}{\pi_E \sum_{i=1}^{m} N_i \cdot \lambda_{SSi}} \times 10^9 \quad \text{(hours)}$$

$$\lambda_{SSi} = \lambda_{Gi} \cdot \pi_{Qi} \cdot \pi_{Si} \cdot \pi_{Ti}$$

λ equip	:	Total Equipment failure rate (FITs = Failures in10^9 hours)
λ Gi	:	Generic failure rate for the *i* th device
π Qi	:	Quality factor for the *i* th device
π Si	:	Stress factor for the *i* th device
π Ti	:	Temperature factor for the *i* th device
m	:	Number of different device types
Ni	:	Quantity of *i* th device type
π E	:	Equipment environmental factor

Conditions:

Ta=25°C
Gf - Ground,Fixed,Uncontrolled

M.T.B.F. = 665651 (HOURS)

2.COMPONENT DERATING

GH1kW SERIES

Calculation method

(1) Conditions

Input:	Nominal
Output:	Vout - 100%, Iout - 100%
Ambient temperature:	50°C
Mounting Method:	Standard Mounting

(2) Semiconductors

Compared with maximum junction temperature and actual one which is calculated on case temperature, power dissipation and thermal impedance.

(3) IC, Resistors, Capacitors, etc.

Ambient temperature, operating conditions and power dissipation are within derating criteria.

(4) Calculation method of thermal impedance:

$$\Theta_{j-a} = \frac{Tj(\max) - Ta}{Pc(\max)} \qquad \Theta_{j-c} = \frac{Tj(\max) - Tc}{Pc(\max)} \qquad \Theta_{j-l} = \frac{Tj(\max) - Tl}{Pc(\max)}$$

Tc: Case Temperature at Start Point of Derating; 25°C in General

Ta: Ambient Temperature at Start Point of Derating; 25°C in General

$Pc(\max)$: Maximum Power Dissipation

$Tj(\max)$: Maximum Junction temperature

$\Theta_{j\text{-}c}$: Thermal Impedance between Junction and Case

$\Theta_{j\text{-}a}$: Thermal Impedance between Junction and Air

$\Theta_{j\text{-}l}$: Thermal Impedance between Junction and Lead

Load = 100% Ta=50°C **INPUT1P**

D1	Tjmax=	150	°C	qj-c =	1.0	°C/W	Pmax =	---	W
D25XB60-7000	Pd =	5.4	W	DTc =	52.2	°C	Tc =	102.2	°C
SHINDENGEN	Tj = Tc + (q j-c x Pd) =>			Tj =	107.6	°C	D.F. =	71.7	%
A4	Tjmax=	150	°C	qj-c =	39.5	°C/W	Pmax =	---	W
TPS54202DDCR	Pd =	0.31	W	DTc =	8.7	°C	Tc =	58.7	°C
TI	Tj = Tc + (q j-c x Pd) =>			Tj =	70.9	°C	D.F. =	47.3	%
A5	Tjmax=	150	°C	qj-c =	39.5	°C/W	Pmax =	---	W
TPS54202DDCR	Pd =	0.03	W	DTc =	8.7	°C	Tc =	58.7	°C
TI	Tj = Tc + (q j-c x Pd) =>			Tj =	59.9	°C	D.F. =	39.9	%
A6	Tjmax=	150	°C	qj-c =	3.0	°C/W	Pmax =	---	W
MIP2E5DMY	Pd =	1.85	W	DTc =	8.8	°C	Tc =	58.8	°C
PANASONIC	Tj = Tc + (q j-c x Pd) =>			Tj =	64.4	°C	D.F. =	42.9	%
A7	Tjmax=	125	°C	qj-c =	100	°C/W	Pmax =	---	W
TPS560200DBVR	Pd =	0.1	W	DTc =	8.7	°C	Tc =	58.7	°C
TI	Tj = Tc + (q j-c x Pd) =>			Tj =	68.7	°C	D.F. =	55.0	%

Load = 100% Ta=50°C **PFC**

Q3	Tjmax=	150	°C	qj-c =	0.5	°C/W	Pmax =	270.0	W
TK39N60W,S1VF	Pd =	5.22	W	DTc =	29.3	°C	Tc =	79.3	°C
Toshiba	Tj = Tc + (q j-c x Pd) =>			Tj =	81.7	°C	D.F. =	54.5	%
Q4	Tjmax=	150	°C	qj-c =	0.5	°C/W	Pmax =	270.0	W
TK39N60W,S1VF	Pd =	5.22	W	DTc =	29.3	°C	Tc =	79.3	°C
Toshiba	Tj = Tc + (q j-c x Pd) =>			Tj =	81.7	°C	D.F. =	54.5	%
D3	Tjmax=	175	°C	qj-c =	1.7	°C/W	Pmax =	89.0	W
IDH10G65C5	Pd =	4.6	W	DTc =	41.0	°C	Tc =	91.0	°C
INFINEON	Tj = Tc + (q j-c x Pd) =>			Tj =	98.8	°C	D.F. =	56.4	%

Load = 100% Ta=50°C **DC/DC 10V**

Q1	Tjmax=	150	°C	qj-c =	0.57	°C/W	Pmax =	220.0	W
FMW30N60S1HF	Pd =	13.2	W	DTc =	28.5	°C	Tc =	78.5	°C
Fuji	Tj = Tc + (q j-c x Pd) =>			Tj =	86.0	°C	D.F. =	57.3	%
Q2	Tjmax=	150	°C	qj-c =	0.57	°C/W	Pmax =	220.0	W
FMW30N60S1HF	Pd =	13.2	W	DTc =	28.5	°C	Tc =	78.5	°C
Fuji	Tj = Tc + (q j-c x Pd) =>			Tj =	86.0	°C	D.F. =	57.3	%
Q23~Q27	Tjmax=	175	°C	qj-c =	0.9	°C/W	Pmax =	167.0	W
IPP023N04N G	Pd =	0.65	W	DTc =	19.7	°C	Tc =	69.7	°C
Infineon	Tj = Tc + (q j-c x Pd) =>			Tj =	70.3	°C	D.F. =	40.2	%

Load = 100% Ta=50°C **DC/DC 150V**

Q1	Tjmax=	150	°C	qj-c =	0.57	°C/W	Pmax =	220.0	W
FMW30N60S1HF	Pd =	13.2	W	DTc =	27.9	°C	Tc =	77.9	°C
Fuji	Tj = Tc + (q j-c x Pd) =>			Tj =	85.4	°C	D.F. =	56.9	%
Q2	Tjmax=	150	°C	qj-c =	0.57	°C/W	Pmax =	220.0	W
FMW30N60S1HF	Pd =	13.2	W	DTc =	27.9	°C	Tc =	77.9	°C
Fuji	Tj = Tc + (q j-c x Pd) =>			Tj =	85.4	°C	D.F. =	56.9	%
D31~D36	Tjmax=	150	°C	qj-c =	3.5	°C/W	Pmax =	---	W
YG911S3R	Pd =	3.5	W	DTc =	29.6	°C	Tc =	79.6	°C
Fuji	Tj = Tc + (q j-c x Pd) =>			Tj =	91.9	°C	D.F. =	61.2	%

Load = 100% Ta=50°C **DC/DC 600V**

Q1	Tjmax=	150	°C	qj-c =	0.57	°C/W	Pmax =	220.0	W
FMW30N60S1HF	Pd =	13.4	W	DTc =	27.9	°C	Tc =	77.9	°C
Fuji	Tj = Tc + (q j-c x Pd) =>			Tj =	85.5	°C	D.F. =	57.0	%
Q2	Tjmax=	150	°C	qj-c =	0.57	°C/W	Pmax =	220.0	W
FMW30N60S1HF	Pd =	11.2	W	DTc =	27.9	°C	Tc =	77.9	°C
Fuji	Tj = Tc + (q j-c x Pd) =>			Tj =	84.3	°C	D.F. =	56.2	%
D31~D36	Tjmax=	175	°C	qj-c =	2.0	°C/W	Pmax =	---	W
IDH02SG120	Pd =	3.41	W	DTc =	29.6	°C	Tc =	79.6	°C
Infineon	Tj = Tc + (q j-c x Pd) =>			Tj =	86.4	°C	D.F. =	49.4	%

3.Main Components Temperature Rise

GH10-100

Location No.		Parts Name	ΔT Temperature Rise (°C)
			Standard Mounting
DC-DC	A3	Gate Driver	30.4
	C8	EL. Capacitor	23.3
	R99	Shunt Resistor	31.3
	Q2	Buck Mosfet	28.5
	Q27	Mosfet Rectifier	20.2
PFC	L1	Choke	52.4
	D3	Diode	48.0
	Q3	Mosfet	34.4
	C24	E-Cap	9.6
OUTPUT FILTER	C1	E-Cap	22.9
INPUT	D1	Bridge	53.8
	RL1	Relay	22.0
	A6	Top-Switch	7.9
	T1	Transformer	12.4
	C28	E-Cap	4.3
	C45	E-Cap	10.6
	C66	E-Cap	6.3
	C76	E-Cap	9.9
Conditions:			
Standard Mounting			
Input Voltage		85V~265V	
Output Voltage		10V	
Output Current		100A	

3.Main Components Temperature Rise

GH150-7

Location No.		Parts Name	ΔT Temperature Rise (°C)
			Standard Mounting
DC-DC	Q2	Buck Mosfet	30.6
	D32	Diode Rectifier	33.0
	R99	Shunt Resistor	23.9
	C5	E-Cap	22.5
OUTPUT FILTER	C15	E-Cap	69.8
Conditions:			
Standard Mounting			
Ta		50°C	
Input Voltage		85V~265V	
Output Voltage		150V	
Output Current		7A	

3.Main Components Temperature Rise

GH600-1.7

Location No.		Parts Name	ΔT Temperature Rise (°C)
			Standard Mounting
DC-DC	Q2	Buck Mosfet	26.4
	D32	Diode Rectifier	22.3
	R99	Shunt Resistor	18.5
	C5	E-Cap	18.7
OUTPUT FILTER	C15	E-Cap	21.1
Conditions:			
Standard Mounting			
Ta		50°C	
Input Voltage		85V~265V	
Output Voltage		600V	
Output Current		1.7A	

4.ELECTROLYTIC CAPACITORS LIFE TIME ESTIMATION

MODEL	COMPUTED LIFE (year) at Tambient		
	30°C	40°C	50°C
G10V-170A	15	15	7.6
G60V-28A	15	15	7.6
G150V-11.2A	15	15	7.6
G600V-2.8A	15	15	7.6

FORMULA $L = Lo \times 2^{\frac{105-Tc}{10}}$ (years)

L : Elec.capacitor computed life (24 hours per day,365 days operation)

Lo : Guarantee life for Elec.capacitor

Tc : Case temperature of Elec.capacitor

Standard Mounting	
Input Voltage	Nom.
Output Voltage	100%
Output Current	100%

5. ABNORMAL TEST

INPUT 1P

Condition: Ta:25°C Input:230VAC Vout:100% Iout:100%

No.	Test Position		Failure		Study result (prediction of the phenomena)																
	Location No.	Test Point	Short	Open	Fire	Sligth Smoke	Smoke	Burst	Smell	Red Hot	Damaged	Fuse Open	OVP	OCP	OTP	AC FAIL	No Output	No Change	PS functional after AC recycle	Others	Note
1	A4	2-3	●								●						●				Input-A4
2	A5	2-3	●								●						●				Input-A5
3	A6	1-2	●														●		●		Display stopped working
4		1		●													●		●		Display stopped working
5		2-3	●									●					●				Input-F3
6		2		●													●		●		Display stopped working
7		3-1	●								●	●					●				Input-F3;ZD4;A6
8		3		●													●		●		Display stopped working
9	A7	3-4	●								●						●			●	Input-A7,Internal Error
10	C28		●														●		●		Display stopped working
11				●														●			
12	C50	thermal:A5,L4	●														●		●	●	Internal Error. Input-A5&L4-35°C
13				●														●			
14	C70	thermal:A8,L6	●																	●	Fan`s stopped working*
15				●														●			
16	D1	4		●													●		●		
17	D7	A-C	●								●						●				Input-A5
18		A		●														●			
19	D9	A-C	●														●		●	●	Internal Error
20		A		●														●			
21	D14	A-C	●														●		●		Display stopped working
22	D17	A-C	●														●		●		Display stopped working
23		A		●														●			

Condition: Ta:25°C Input:230VAC Vout:100% Iout:100%

No.	Test Position		Failure		Study result (prediction of the phenomena)																	
	Location No.	Test Point	Short	Open	Fire	Sligth Smoke	Smoke	Burst	Smell	Red Hot	Damaged	Fuse Open	OVP	OCP	OTP	AC FAIL	No Output	No Change	PS functional after AC recycle	Others	Note
1	C20;24;25		●									●					●				Input F1, F2
2				●														●			
3	D3	A-C	●								●	●					●				Input F1, F2;PFC Q4
4		A		●							●	●					●				Input F1, F2;PFC Q3
5	L1		●														●		●	●	Input Relay Clicking
6				●													●		●	●	Display shows: V - 0 and I - 0
7	Q1	B-E	●															●			
8		B		●							●	●					●				Input F1, F2;PFC Q3
9		K-E	●								●						●			●	Display shows: V - 0 and I - 0 ;PFC R13
10		E		●							●	●					●				Input F1, F2;PFC Q3
11		K-B	●														●		●	●	Display shows: V - 0 and I - 0
12		K		●							●	●						●			Input F2;PFC Q4
13	Q2	B-E	●															●			
14		B		●							●	●					●				After 2 min. Input F1, F2;PFC Q3
15		K-E	●								●									●	PFC R13 (P.S. continued to work)
16		E		●							●	●					●				Input F1, F2;PFC Q4
17		K-B	●								●	●					●				Input F1, F2;PFC Q4
18		K		●														●			
19	Q3	G-S	●								●						●			●	Output 4min. Not stable;PFC R13
20		G		●							●	●					●				Input F1, F2;PFC Q3
21		D-S	●									●					●				Input F1, F2
22		S		●																●	PFC Q4 temp enlarge from 42°C to 46°C
23		D-G	●								●	●					●				Input F1, F2;PFC Q3
24		D		●																●	PFC Q4 temp enlarge from 42°C to 46°C

Condition: Ta:25°C Input:230VAC Vout:100% Iout:100%

No.	Test Position		Failure		Study result (prediction of the phenomena)																	
	Location No.	Test Point	Short	Open	Fire	Sligth Smoke	Smoke	Burst	Smell	Red Hot	Damaged	Fuse Open	OVP	OCP	OTP	AC FAIL	No Output	No Change	PS functional after AC recycle	Others	Note
1	C8		●						●		●	●					●				A1, Q2, Q6~Q10, D11, D13, D14, ZD1, R6, R39, R40, R41, R42
2				●														●			
3	C17		●								●	●					●				PFC3P200 - D1; Input3P200 - F1, F3
4				●														●			
5	L3		●															●			
6				●													●		●		
7	Q1	G-S	●																●	●	Q2 temp enlarge from 57°C to 76°C
8		G		●									●				●		●		
9		D-S	●										●				●		●		
10		S		●															●	●	Q2 temp enlarge from 57°C to 76°C
11		D-G	●										●				●		●		
12		D		●															●	●	Q2 temp enlarge from 57°C to 76°C
13	Q5	G-S	●																●	●	Vo go down to 6V; Mode CV change to CC
14		G		●					●		●	●					●				A1, Q6, Q5, C12, C14, C20, Q1, D1, R2, ZD1, R5
15		D-S	●						●		●	●					●				A1, Q6, Q5, Q1, D1, R1, R2, ZD1, R5
16		S		●															●	●	Vo go down to 6V; Mode CV change to CC
17		D-G	●						●		●	●					●				A1, Q5, Q6, Q4, Q1, D1, D6, D8, R1, R2, ZD1, R5, R27, R28,
18		D		●															●	●	Vo go down to 6V; Mode CV change to CC
19	Q23	G-S	●															●			
20		G		●														●			
21		D-S	●						●		●	●					●				A1, Q25, Q5~Q7, Q9, Q1, D1, D6, R2, ZD1, R5, R27, R30, R39
22		S		●														●			
23		D-G	●						●		●	●					●				A1, Q22, Q23, Q25, Q5~Q7, Q9, Q1, D1, D6, R2, ZD1, R5, R27, R30, R39, R84
24		D		●														●			
25	T3	1-2	●						●		●	●					●				A1, Q5, Q9, Q10, Q7, C12, C14, C20, Q1, D1, D6, R2, ZD1, R5, R39
26		1		●													●		●		
27		A-C	●								●						●				A1, Q17, Q25, Q1, Q2, Q5~Q7, Q9, D1, D6, ZD1, R5, R6, R27, R30, R39
28		A		●															●	●	Vo go down to 6V
29		B-C	●								●						●				A1, Q17, Q25, Q1, Q2, Q5~Q7, Q9, D1, D6, ZD1, R5, R6, R27, R30, R39
30		B		●															●	●	Vo go down to 6V

Condition: Ta:25°C Input:230VAC Vout:100% Iout:100%

No.	Test Position		Failure		Study result (prediction of the phenomena)																	
	Location No.	Test Point	Short	Open	Fire	Sligth Smoke	Smoke	Burst	Smell	Red Hot	Damaged	Fuse Open	OVP	OCP	OTP	AC FAIL	No Output	No Change	PS functional after AC recycle	Others	Note
1	C4		●										●				●				
2				●														●			
3	C7		●										●				●				
4				●														●			
5	C16		●								●	●					●				PFC3P200 - D1; Input3P200 - F1, F3
6				●														●			
7	D22	A-C	●															●			
8		A		●														●			
9	D32	A-C	●						●		●						●				A1, Q1, Q8, Q9, Q10, Q14, Q15, D1, D35, D13, D11, ZD1, R1, R5, R39, R40 PFC3P200 - Q1
10		A		●							●									●	R63~R66, R68, R71, R66, R69; Vo go down to 360V; Mode CV change to CC
11	L3	8.9-10,11	●															●			
12		8,9		●													●		●		
13		5,4-3,2	●															●			
14		5,4		●													●		●		
15	Q1	G-S	●																●	●	Q2 temp enlarge from 57°C to 76°C
16		G		●									●				●		●		
17		D-S	●										●				●		●		
18		S		●															●	●	Q2 temp enlarge from 57°C to 76°C
19		D-G	●										●				●		●		
20		D		●															●	●	Q2 temp enlarge from 57°C to 76°C
21	Q5	G-S	●																●	●	Vo go down to 360V; Mode CV change to CC
22		G		●					●		●						●				A1, Q6, Q5, C12, Q1, D1, R2, ZD1, R5
23		D-S	●						●		●						●				A1, Q6, Q5, Q1, D1, R1, R2, ZD1, R5
24		S		●															●	●	Vo go down to 360V; Mode CV change to CC
25		D-G	●						●		●						●				A1, R149, Q5, Q6, Q3, Q1, D1, D6, D8, R1, R2, ZD1, R5, R27, R28
26		D		●															●	●	Vo go down to 360V; Mode CV change to CC
27	T3	1-2	●						●		●	●					●				A1, C11, C12, Q1, Q9, Q10, D1, ZD1, R1, R5, R39, R40 PFC3P200 - D1; Input3P200 - F1, F3
28		1		●													●		●		
29		A-B	●						●		●	●					●				A1,C11, C12, Q1, Q9, Q10, D1, ZD1, R1, R5, R39, R40 PFC3P200 - D1; Input3P200 - F1, F3
30		A		●															●	●	Vo go down to 360V
31		C-B	●						●		●						●				A1, C11, C12, Q1, Q9, Q10, D1, ZD1, R1, R5, R39, R40 PFC3P200 - D1; Input3P200 - F1, F3
32		C		●															●	●	Vo go down to 360V