GENESYS™ 2.7/3.4kW

RELIABILITY DATA

APPD	CHK	DWG
22/08/19	ASAF. A 22/08/19	PAVEL G. 22/08/19

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-332,Issue3)
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:

Input: 1-Phase
Ta=25°C
Gf - Ground,Fixed,Uncontrolled

M.T.B.F. = 205335 (HOURS)

Conditions:

Input: 3-Phase
Ta=25°C
Gf - Ground,Fixed,Uncontrolled

M.T.B.F. = 197213 (HOURS)

2.COMPONENT DERATING

G+ 3.4kW SERIES

Calculation method

(1) Conditions

Input:	Nominal
Output:	Vout - 100%, Iout - 100%
Ambient temperature:	40°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

Θ_{j-c}: Thermal Impedance between Junction and Case

Θ_{j-a}: Thermal Impedance between Junction and Air

Θ_{j-l}: Thermal Impedance between Junction and Lead

Load = 100% Ta=40°C **INPUT1P**

D1	Tjmax=	150	°C	qj-c =	1.0	°C/W	Pmax =	---	W
D25XB60-7000	Pd =	18.1	W	DTc =	47.4	°C	Tc =	87.4	°C
SHINDENGEN	Tj = Tc + (q j-c x Pd) =>			Tj =	105.5	°C	D.F. =	70.3	%
D2	Tjmax=	150	°C	qj-c =	1.0	°C/W	Pmax =	---	W
D25XB60-7000	Pd =	18.1	W	DTc =	54.6	°C	Tc =	94.6	°C
SHINDENGEN	Tj = Tc + (q j-c x Pd) =>			Tj =	112.7	°C	D.F. =	75.1	%
A4	Tjmax=	125	°C	qj-c =	1.2	°C/W	Pmax =	---	W
TPS54202DDCR	Pd =	12	W	DTc =	15.2	°C	Tc =	55.2	°C
TI	Tj = Tc + (q j-c x Pd) =>			Tj =	69.6	°C	D.F. =	55.7	%
A5	Tjmax=	125	°C	qj-c =	1.2	°C/W	Pmax =	---	W
TPS54202DDCR	Pd =	8.50	W	DTc =	24.6	°C	Tc =	64.6	°C
TI	Tj = Tc + (q j-c x Pd) =>			Tj =	74.8	°C	D.F. =	59.8	%
A6	Tjmax=	150	°C	qj-c =	3.0	°C/W	Pmax =	---	W
MIP2E5DMY	Pd =	1.85	W	DTc =	18.2	°C	Tc =	58.2	°C
PANASONIC	Tj = Tc + (q j-c x Pd) =>			Tj =	63.8	°C	D.F. =	42.5	%
A7	Tjmax=	150	°C	qj-c =	29.2	°C/W	Pmax =	---	W
TPS560200DBVR	Pd =	1.15	W	DTc =	24.0	°C	Tc =	64.0	°C
TI	Tj = Tc + (q j-c x Pd) =>			Tj =	97.6	°C	D.F. =	65.1	%

Load = 100% Ta=40°C **PFC1P**

Q3	Tjmax=	150	°C	qj-c =	0.463	°C/W	Pmax =	270.0	W
TK39N60W,S1VF	Pd =	9.12	W	DTc =	67.8	°C	Tc =	107.8	°C
Toshiba	Tj = Tc + (q j-c x Pd) =>			Tj =	112.0	°C	D.F. =	74.7	%
Q4	Tjmax=	150	°C	qj-c =	0.463	°C/W	Pmax =	270.0	W
TK39N60W,S1VF	Pd =	9.12	W	DTc =	51.8	°C	Tc =	91.8	°C
Toshiba	Tj = Tc + (q j-c x Pd) =>			Tj =	96.0	°C	D.F. =	64.0	%
Q7	Tjmax=	150	°C	qj-c =	0.463	°C/W	Pmax =	270.0	W
TK39N60W,S1VF	Pd =	9.12	W	DTc =	45.0	°C	Tc =	85.0	°C
Toshiba	Tj = Tc + (q j-c x Pd) =>			Tj =	89.2	°C	D.F. =	59.5	%
Q8	Tjmax=	150	°C	qj-c =	0.463	°C/W	Pmax =	270.0	W
TK39N60W,S1VF	Pd =	9.12	W	DTc =	43.4	°C	Tc =	83.4	°C
Toshiba	Tj = Tc + (q j-c x Pd) =>			Tj =	87.6	°C	D.F. =	58.4	%
D2	Tjmax=	175	°C	qj-c =	1.7	°C/W	Pmax =	89.0	W
IDH10G65C5	Pd =	4.89	W	DTc =	28.4	°C	Tc =	68.4	°C
INFINEON	Tj = Tc + (q j-c x Pd) =>			Tj =	76.7	°C	D.F. =	43.8	%
D3	Tjmax=	175	°C	qj-c =	1.7	°C/W	Pmax =	89.0	W
IDH10G65C5	Pd =	4.89	W	DTc =	30.0	°C	Tc =	70.0	°C
INFINEON	Tj = Tc + (q j-c x Pd) =>			Tj =	78.3	°C	D.F. =	44.8	%
D5	Tjmax=	175	°C	qj-c =	1.7	°C/W	Pmax =	89.0	W
IDH10G65C5	Pd =	4.89	W	DTc =	36.4	°C	Tc =	76.4	°C
INFINEON	Tj = Tc + (q j-c x Pd) =>			Tj =	84.7	°C	D.F. =	48.4	%
D6	Tjmax=	175	°C	qj-c =	1.7	°C/W	Pmax =	89.0	W
IDH10G65C5	Pd =	4.89	W	DTc =	35.3	°C	Tc =	75.3	°C
INFINEON	Tj = Tc + (q j-c x Pd) =>			Tj =	83.6	°C	D.F. =	47.8	%

Load = 100% Ta=40°C **DC/DC 10V**

Q1	Tjmax=	150	°C	qj-c =	0.57	°C/W	Pmax =	220.0	W
FMW30N60S1HF	Pd =	13.15	W	DTc =	36.0	°C	Tc =	76.0	°C
Fuji	Tj = Tc + (q j-c x Pd) =>			Tj =	83.5	°C	D.F. =	55.7	%
Q2	Tjmax=	150	°C	qj-c =	0.57	°C/W	Pmax =	220.0	W
FMW30N60S1HF	Pd =	13.15	W	DTc =	46.3	°C	Tc =	86.3	°C
Fuji	Tj = Tc + (q j-c x Pd) =>			Tj =	93.8	°C	D.F. =	62.5	%
Q5	Tjmax=	150	°C	qj-c =	0.96	°C/W	Pmax =	130.0	W
FMV40N60S1	Pd =	5.41	W	DTc =	51.5	°C	Tc =	91.5	°C
Fuji	Tj = Tc + (q j-c x Pd) =>			Tj =	96.7	°C	D.F. =	64.5	%
Q6	Tjmax=	150	°C	qj-c =	0.96	°C/W	Pmax =	130.0	W
FMV40N60S1	Pd =	5.39	W	DTc =	36.4	°C	Tc =	76.4	°C
Fuji	Tj = Tc + (q j-c x Pd) =>			Tj =	81.6	°C	D.F. =	54.4	%
Q9	Tjmax=	150	°C	qj-c =	0.96	°C/W	Pmax =	130.0	W
FMV40N60S1	Pd =	5.58	W	DTc =	49.0	°C	Tc =	89.0	°C
Fuji	Tj = Tc + (q j-c x Pd) =>			Tj =	94.4	°C	D.F. =	62.9	%
Q10	Tjmax=	150	°C	qj-c =	0.96	°C/W	Pmax =	130.0	W
FMV40N60S1	Pd =	6.64	W	DTc =	46.5	°C	Tc =	86.5	°C
Fuji	Tj = Tc + (q j-c x Pd) =>			Tj =	92.9	°C	D.F. =	61.9	%
Q17,Q19,Q21	Tjmax=	175	°C	qj-c =	0.9	°C/W	Pmax =	167.0	W
IPP023N04N G	Pd =	0.65	W	DTc =	46.7	°C	Tc =	86.7	°C
Infineon	Tj = Tc + (q j-c x Pd) =>			Tj =	87.3	°C	D.F. =	49.9	%
Q23~Q27	Tjmax=	175	°C	qj-c =	0.9	°C/W	Pmax =	167.0	W
IPP023N04N G	Pd =	0.65	W	DTc =	40.7	°C	Tc =	80.7	°C
Infineon	Tj = Tc + (q j-c x Pd) =>			Tj =	81.3	°C	D.F. =	46.4	%
D4	Tjmax=	175	°C	qj-c =	1.7	°C/W	Pmax =	---	W
IDH10G65C5	Pd =	2.6	W	DTc =	34.8	°C	Tc =	74.8	°C
Infineon	Tj = Tc + (q j-c x Pd) =>			Tj =	79.2	°C	D.F. =	45.3	%

3.Main Components Temperature Rise

G10-340

Location No.		Parts Name	ΔT Temperature Rise (°C)
			Standard Mounting
DC-DC	T3 IN	Transformer	78.5
	T3 Case	Transformer	46.9
	Q17	Mosfet	46.7
	Q6	Mosfet	41.3
	Q2	Mosfet	54.5
	D4	Diode	34.8
	Q25	Mosfet	40.7
	L3 IN	Choke	58.8
	L3 Core	Choke	39.3
	C8	E-Cap	43.0
	C17	E-Cap	26.9
	R100	Shunt	50.4
PFC1P	L1	Choke	47.7
	D5	Diode	36.4
	Q4	Mosfet	51.8
	C21	E-Cap	16.5
OUTPUT FILTER	C3	E-Cap	42.7
	C44	E-Cap	43.4
	L1 Core	Choke	33.6
INPUT1P	D2	Bridge	54.6
	RL1	Relay	23.4
	A6	Top-Switch	18.2
	T1 IN1	Transformer	26.1
	T1 IN2	Transformer	28.8
	C30	E-Cap	11.2
	C44	E-Cap	19.0
	C66	E-Cap	14.6
	C68	E-Cap	19.0

Conditions:

Standard Mounting	
Ta	40°C
Input Voltage	170V~265V
Output Voltage	10V
Output Current	340A

4.ELECTROLYTIC CAPACITORS LIFE TIME ESTIMATION

MODEL	COMPUTED LIFE (year) at Tambient		
	30°C	40°C	50°C
G10V-340A	13.5	6.8	3.4
G600V-5.6A	15	14	7

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.VIBRATION TEST

MODEL: G10-340 1P200

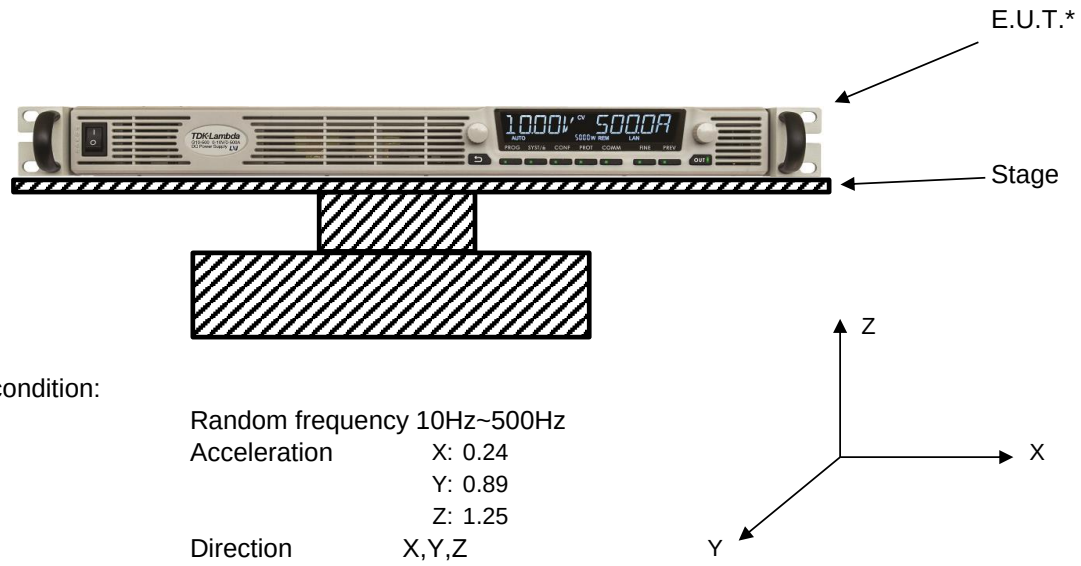
(1) Vibration test class

Frequency variable endurance test

(2) Equipment used

Name	Manufaturer	Model
Vibration Test System	Ling Dynamic Systems	V875
Isotron Accelerometer	Endevco	256-100
Precision Barometer	LUFT Mess-und Regeltechnik GmbH	DFD-K-26701
Isotron Accelerometer	Dytran Instruments Inc.	3256A2
Temp&Humidity Meter	Mad Electronics	HTC-1
Vibration Controller	Unholtz-Dickie	Apex SL

(3) Testing method



Test condition:

Random frequency 10Hz~500Hz
Acceleration X: 0.24
Y: 0.89
Z: 1.25
Direction X,Y,Z
Test time 1H.each

*E.U.T. is fixed to vibrator surface by mounting straps

(4)Test Result (OK) NG

Vin=230Vac; Iout=340A

Check item	Vout (V)	Ripple(mVp-p)	E.U.T.state
Directions \Initial	9.989	40	O.K.
X	9.963	40.3	O.K.
Y	9.997	36.4	O.K.
Z	9.996	37.9	O.K.