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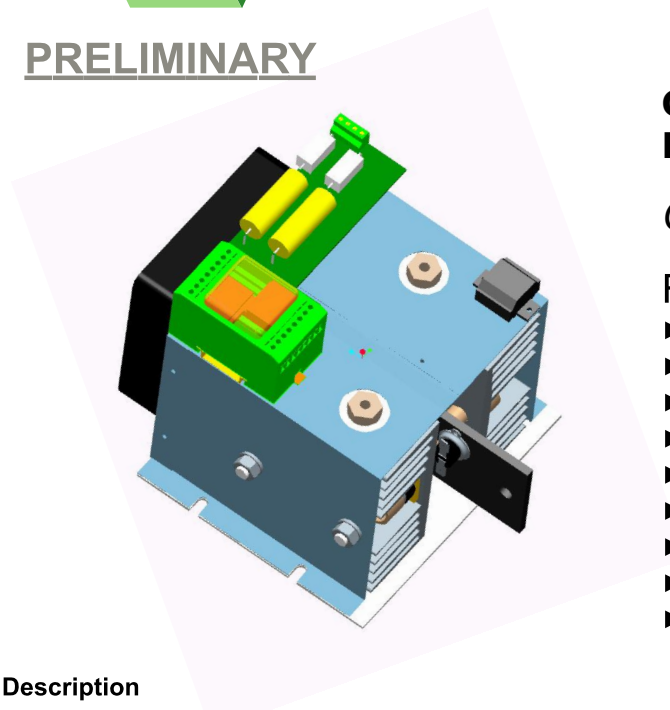
PRELIMINARY



GEM_013, _015, _017, _019 FAMILY

Green Power Easy Module®

Features:

- ► Electrically insulated metal frame
- ► 2500 V_{RMS} Insulation
- ► High reliability
- ► Modular approach
- ► Broad choice of circuit configurations
- ► Fully customizable
- ► Cost effective solution
- ► Suitable for heavy duty applications
- ► Line voltage range up to 500V_{RMS}

Description

This new family of high power modules brings to the high power applications the same compactness, ease of use and scalability of the lower power semiconductor modules. In addition to these typical features (i.e. standard dimensions, electrical insulation, various circuit types, etc.) the new *Green Power Easy Module* (**GEM)** family includes many features that simplify their adoption allowing the end users to focus on their core business. These features include:

• embedded air cooling system (heatsink and fan)
• optimised snubber circuits
• pulse transformer modules
• ducted heat flow.

The GEM family can be used for most of the converter cicuits like single and three phase bridges, AC-switches, motor brakes, double wye rectifiers, current source inverters, etc.. Their application range covers all low and high line voltage applications (up to 690V_{RMS}) such as: electroplating, motor drive, induction heating, welding, temperature control, electrolysis, UPS, etc.

Maximum Ratings

Parameters	GEM_013	GEM_015	GEM_017	GEM_019		Conditions	Units
$I_{T(AV)}$	130	150	170	195		180° cond., half sine, T_A=40°C	A
$I_{T(RMS)}$	290	330	370	440		as AC-switch, T_A=40°C	A
I_{TSM}	5.5	7	8.5	15		50Hz, T_J=$T_{J(MAX)}$, V_R=0V	kA
I_{TSM}	5.8	7.4	8.95	15.9		60Hz, T_J=$T_{J(MAX)}$, V_R=0V	kA
I^2t	151	245	361	1125		50Hz, T_J=$T_{J(MAX)}$, V_R=0V	kA^2s
I^2t	137.6	223.3	329	1025		60Hz, T_J=$T_{J(MAX)}$, V_R=0V	kA^2s
V_{RRM} V_{DRM}	up to 1600	up to 400	up to 1600	up to 400		T_J=$T_{J(MAX)}$	V
$T_{J(MAX)}$	125	125	125	125			°C

Voltage Ratings

Part Number	Voltage Code	V_{RRM} V_{DRM} maximum repetitive reverse and off–state blocking voltage V	I_{DRM} I_{RRM} max @125°C mA	$V_{L(RMS)}$ maximum suggested line RMS voltage V
GEM_015 GEM_019	04	400	50	110
GEM_013 GEM_017	12 16	1200 1600	50	400 500

Voltage Ratings

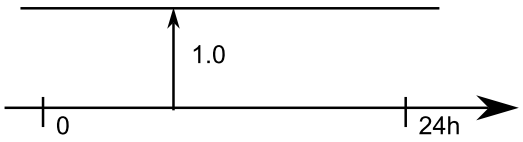
Parameters	GEM_013	GEM_015	GEM_017	GEM_019		Conditions	Units
$V_{T(TO)}$ - Threshold voltage	1	0.85	0.9	0.87		$T_J=T_{JMAX}$	V
r_t - Slope resistance	0.8	0.5	0.65	0.238		$T_J=T_{JMAX}$	mΩ
I_H - Maximum holding current	600	300	600	600		T_J=25°C	mA
I_L - Typical latching current	1000	600	1000	1000		T_J=25°C	mA
P_{MAX} - Maximum power losses						T_A=40°C	W

Triggering Characteristics

Parameters	GEM_013	GEM_015	GEM_017	GEM_019		Conditions	Units
V_{GT} - Gate trigger voltage	3.5	3	3	3.5		T_J=25°C, V_D=5V	V
I_{GT} - Gate trigger current	150	150	200	190		T_J=25°C, V_D=5V	mA
P_{GM} - Peak gate power	10	10	10	10		Pulse width= 100µs	W
$P_{G(AV)}$ - Avg. gate power dissip.	2	2	2	2			W
I_{FGM} - Peak gate current	3	3	3	3			A
V_{FGM} - Peak gate voltage (fwd.)	20	30	20	20			V
VRGM - Peak gate voltage (rev.)	5	5	5	5			V

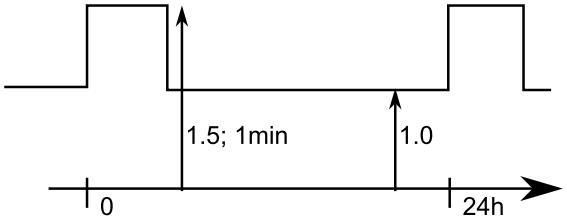
Switching Characteristics

Parameters	GEM_013	GEM_015	GEM_017	GEM_019		Conditions	Units
di/dt - Crit. rate of rise of on-state current	200	200	200	200		$T_J=T_{JMAX}$	A/µs
dv/dt - Crit. rate of rise of off-state voltage	500	500	500	500		$T_J=T_{JMAX}$	V/µs
t_q - Turn-off time	200	200	200	200		$T_J=T_{JMAX}$, I_T=1000A, di/dt=20A/µs, V_R=50V, V_D=67%V_{DRM}, dV/dt=20V/µs	µs



Maximum IEC class 1 currents for typical circuit types

Circuit Type	GEM_013	GEM_015	GEM_017	GEM_019		Conditions	Units
AC switch	610	680	740	770		dealy angle=0, T_A=40°C	A
Center Tap	549	612	666	693		dealy angle=0, T_A=40°C	A
Two pulse bridge	549	612	666	693		dealy angle=0, T_A=40°C	A
Six pulse bridge	770	880	960	1000		dealy angle=0, T_A=40°C	A
Double star with I.P. transformer		885		1180		dealy angle=0, T_A=40°C	A



Maximum IEC class 2 currents for typical circuit types

Circuit Type	GEM_013	GEM_015	GEM_017	GEM_019		Conditions	Units
AC switch	215	247	275	327		dealy angle=0, T_A=40°C	A
Center Tap	193	223	248	294		dealy angle=0, T_A=40°C	A
Two pulse bridge	193	223	248	294		dealy angle=0, T_A=40°C	A
Six pulse bridge	276	320	353	427		dealy angle=0, T_A=40°C	A
Double star with I.P. transformer		646		861		dealy angle=0, T_A=40°C	A

Mechanical Characteristics

Parameters	GEM_013	GEM_015	GEM_017	GEM_019		Conditions	Units
T_J - Junction operating temp.	125	125	125	125			°C
T_{STG} - Storage temperature	-40 -	-40 - +70	-40 - +70	-40 - +70			°C
R_{thJA} - Maximum thermal resistance junction to ambient	0.495	0.52	0.42	0.42		DC operation	°C/W
T Mounting torque ± 10% GEM to panel	7	7	7	7		M6 mounting screws	Nm
T Mounting torque ± 10% Busbar to GEM	14	14	14	14		M8 mounting screws	Nm
wt - approximate weight	3.5	3.5	3.5	3.5		without options	kg

Green Power Solutions

GEM_013, _015, _017, _019 FAMILY

Ordering Information

OPTIONS

GEM	T	013	-	12	-	V	F	0	L	P	C	0	2
	①	②		③		④	⑤	⑥	⑦	⑧	⑨	⑩	⑪

① Circuit configuration

② GEM average current / 10

③ GEM bloking voltage/ 100

④ 0= No Fan; V= With 230V fan; W= With 115V fan

⑤ 0= No fuse; F= With fuse protection

⑥ 0= No standard busbars available for this module please contact factory in case of specific need

⑦ 0= No anti-parallel busbar; L= anti-parallel busbar;

⑧ 0= No pulse transformer; P=With pulse transformer**

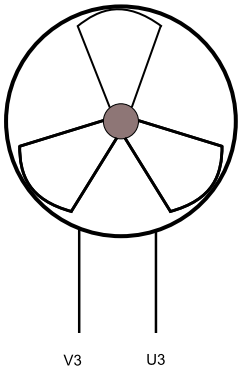
⑨ 0= No cooling alarm; C= With cooling alarm

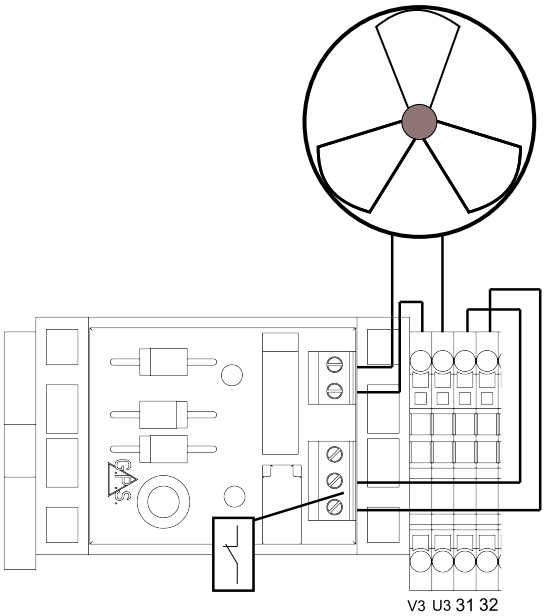
⑩ 0= No device short alarm available for this module

⑪ 0= No snubber, 1= One snubber, 2= Two snubbers

** Pulse transformer GT001(dual) or GT0002(single) depending on the circuit configuration for pulse transformer charateristics see dtheir respective datashheet

Fan circuit without C option	Fan circuit with C option



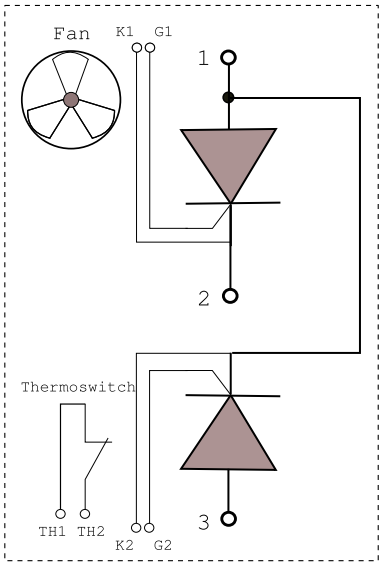


- U3, V3: 230V supply
- 31, 32 fault switch

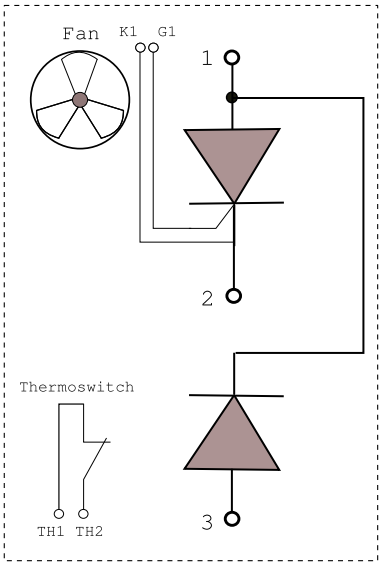
Document GEM10T001 **PRELIMINARY**

Circuit Configurations

GEMT...



GEMH...



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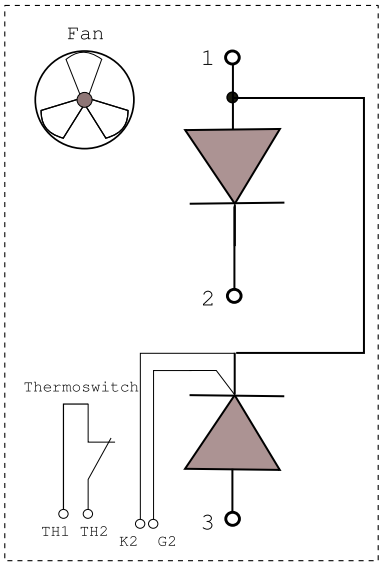
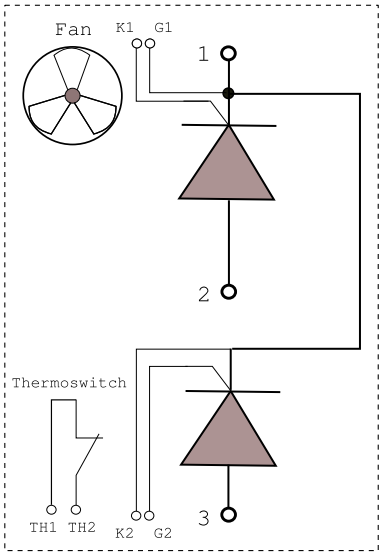
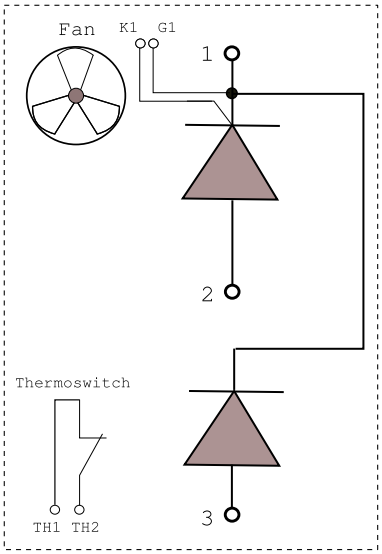


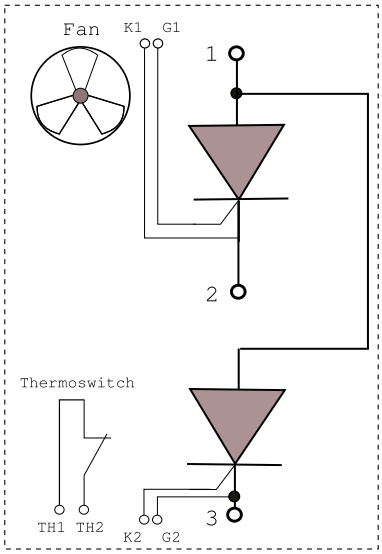
GEMU...



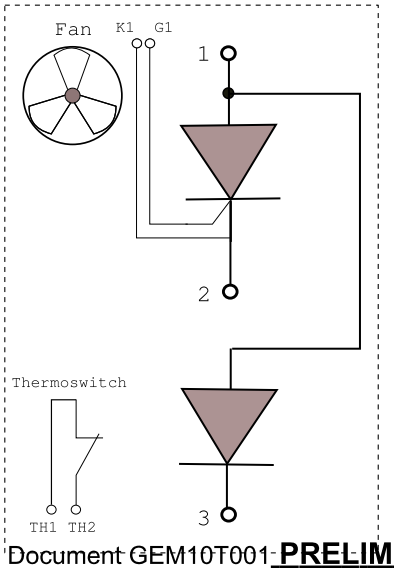
GEMK...



GEMV...



GEMN...



Cooling unit characteristics

Supply voltage:	230V
Supply freq.:	50-60 Hz
Supply current:	0.67 A
Noise:	61dB

Thermoswitch characteristics

Contact type:	normally closed
Switch temp.:	90°C
Insulation:	2500 V_{DC}

Maximum Output Current vs. Ambient temperature Curves

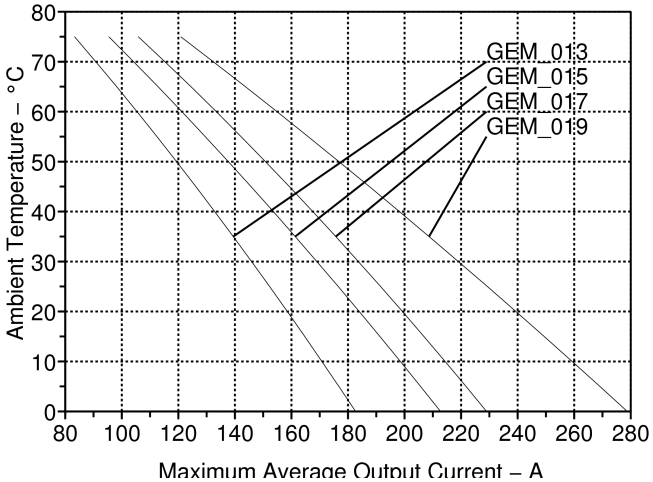


Fig.1: Maximum module output vs. ambient temperature half sine 180° conduction.

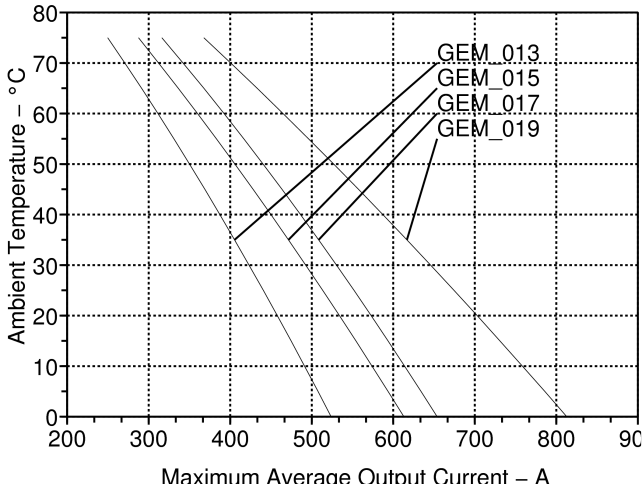


Fig.2: Maximum output vs. ambient temperature for three phase bridge circuit.

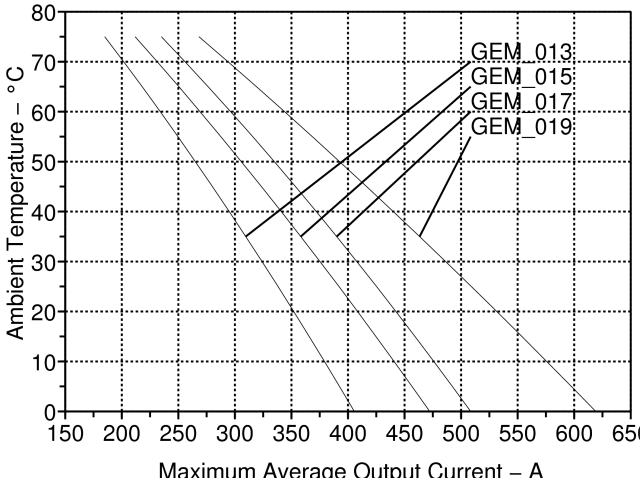


Fig.3: Maximum output vs. ambient temperature for AC-switch circuit.

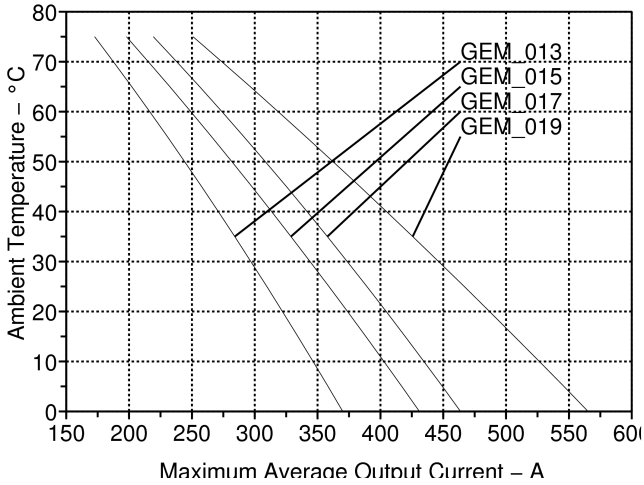
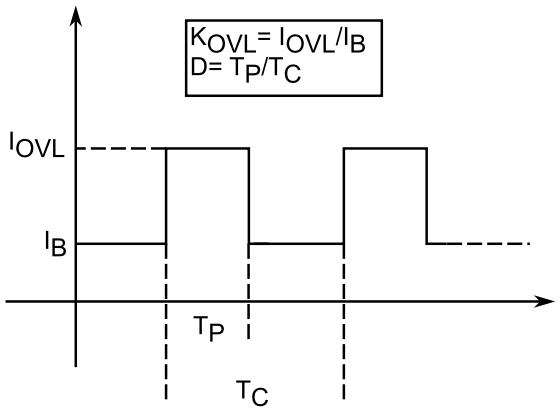


Fig.4: Maximum output vs. ambient temperature for two pulse bridge and center tap circuit.

Six Pulse Bridge Connection Overload Capability Curves
I_{OUT_DC} vs. Duty Cycle with K_{OVL}=1.5



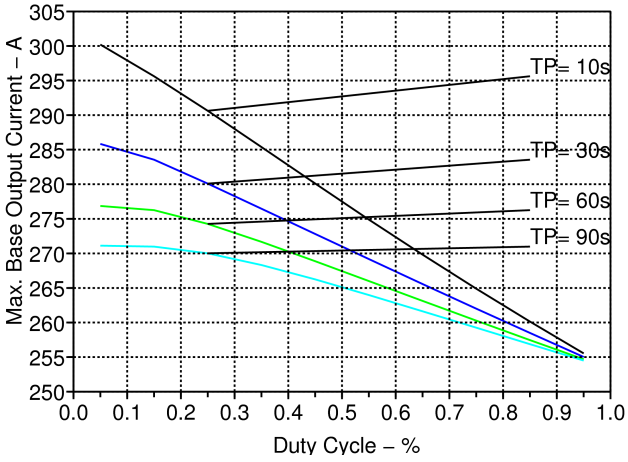


Fig.5: Overload capability curves for GEM_013 (T_A = 40°C).

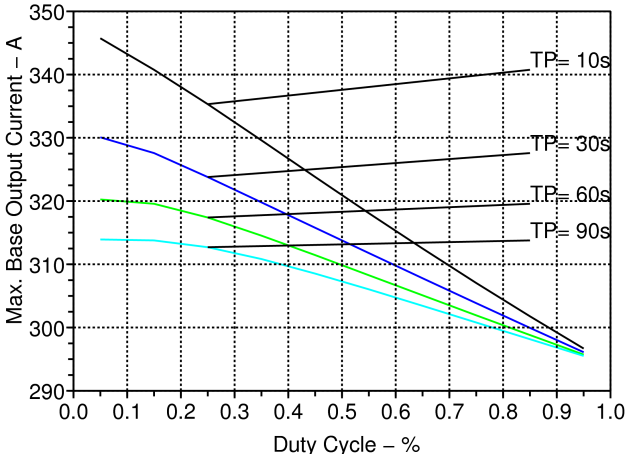


Fig.6: Overload capability curves for GEM_015 (T_A = 40°C).

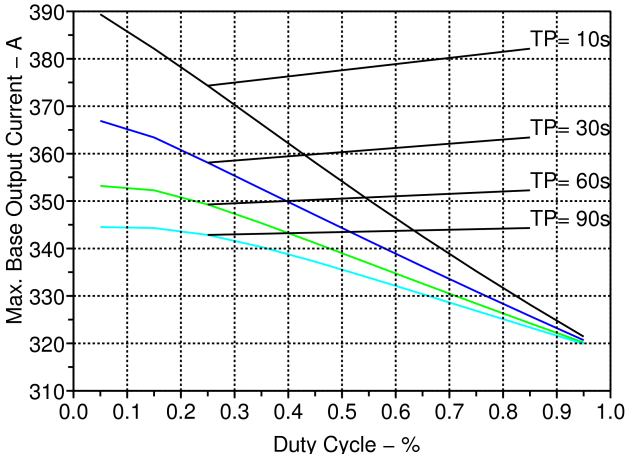


Fig.7: Overload capability curves for GEM_017 (T_A = 40°C).

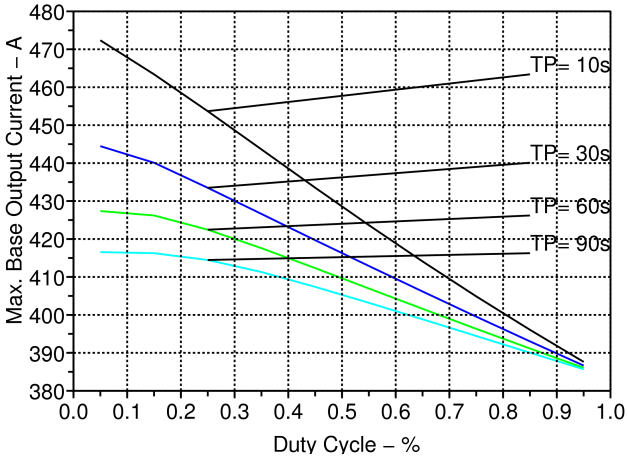
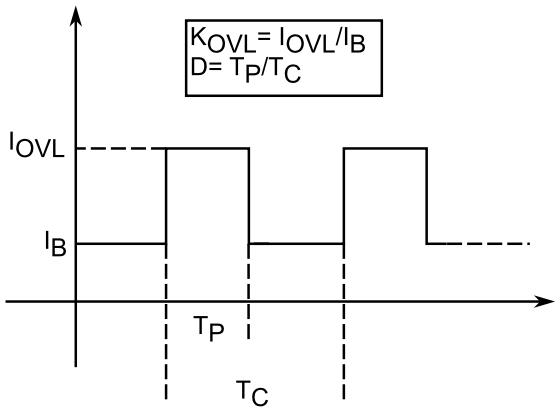


Fig.8: Overload capability curves for GEM_019 (T_A = 40°C).

Six Pulse Bridge Connection Overload Capability Curves
I_{OUT_DC} vs. Duty Cycle with K_{OVL}=2



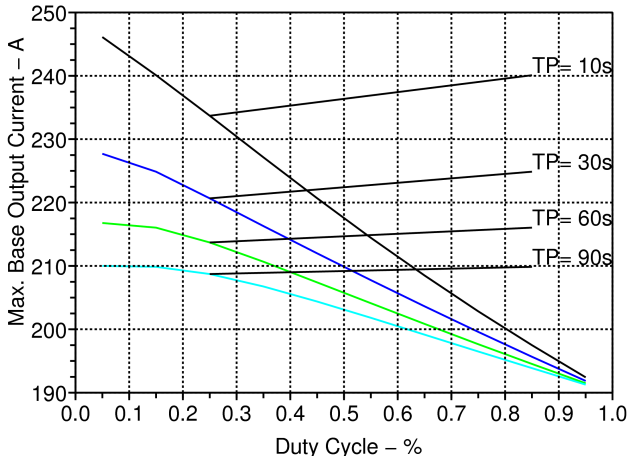


Fig.9: Overload capability curves for GEM_013 (T_A = 40°C).

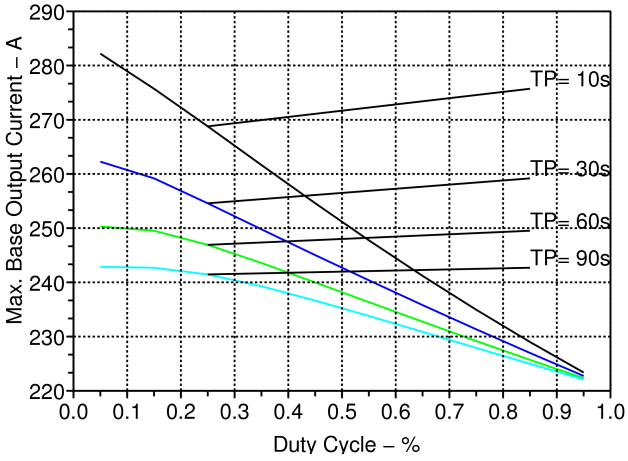


Fig.10: Overload capability curves for GEM_015 (T_A = 40°C).

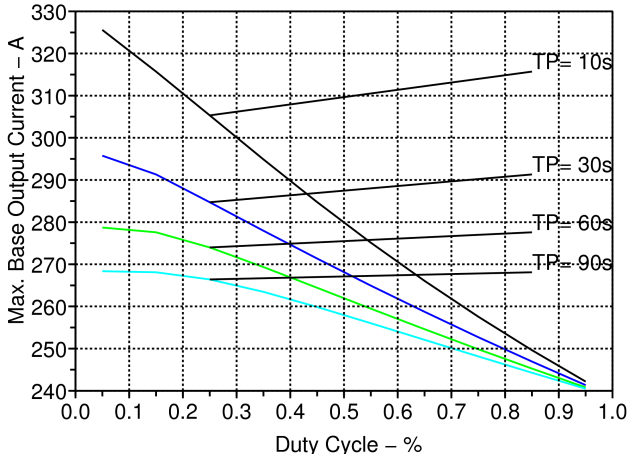


Fig.11: Overload capability curves for GEM_017 (T_A = 40°C).

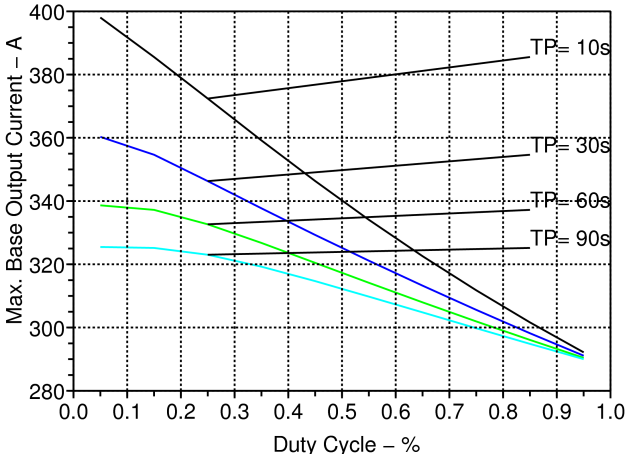
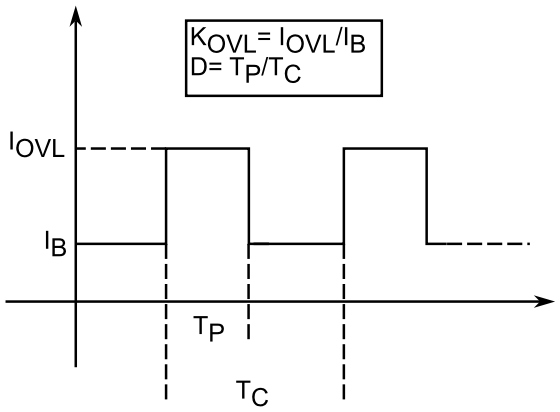


Fig.12: Overload capability curves for GEM_019 (T_A = 40°C).

Six Pulse Bridge Connection Overload Capability Curves
I_{OUT_DC} vs. Duty Cycle with K_{OVL}=2.5



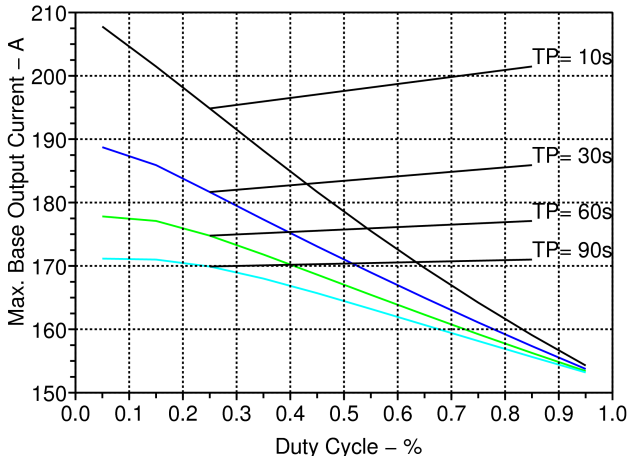


Fig.13: Overload capability curves for GEM_013 (T_A = 40°C).

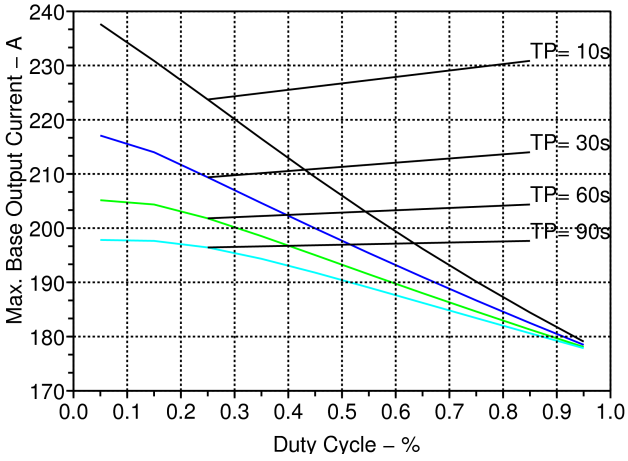


Fig.14: Overload capability curves for GEM_015 (T_A = 40°C).

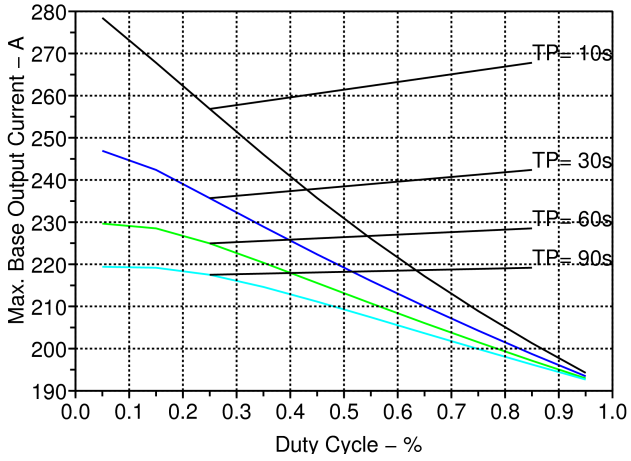


Fig.15: Overload capability curves for GEM_017 (T_A = 40°C).

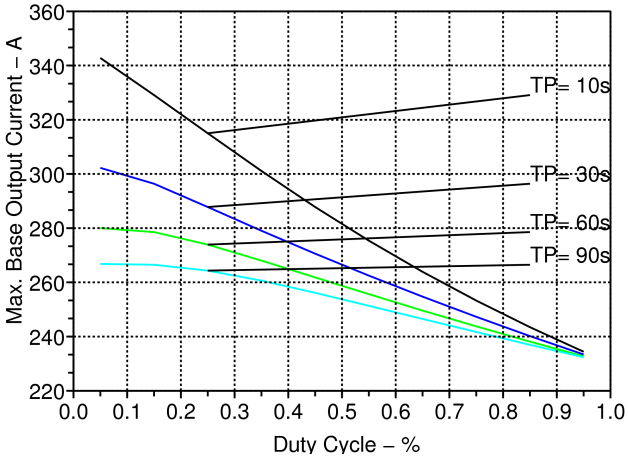


Fig.16: Overload capability curves for GEM_019 (T_A = 40°C).