SEMiX405GARL07E3

SEMiX® 5

Trench IGBT Modules

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Features

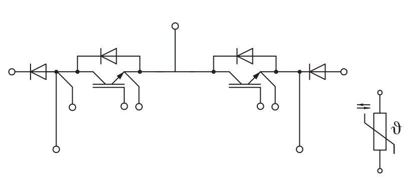
- Solderless assembling solution with PressFIT signal pins and screw power terminals
- IGBT Trench Gate Technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Reliable mechanical design with injection moulded terminals and reliable internal connections
- UL recognized file no. E63532
- NTC temperature sensor inside

Typical Applications*

- UPS
- 3 Level Inverters

Remarks

- Case temperature limited to T_C=125° max.
- Product reliability results are valid for T_{jop}=150°C
- Dynamic data are estimated
- For storage and case temperature with TIM see document “TP(HALA P8) SEMiX 5p”



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Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
IGBT				
V_{CES}	T_j = 25 °C		650	V
I_C	T_j = 175 °C	T_c = 25 °C	457	A
		T_c = 80 °C	343	A
I_{Cnom}			400	A
I_{CRM}			1200	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 360 V V_{GE} ≤ 15 V V_{CES} ≤ 650 V	T_j = 150 °C	6	µs
T_j			-40 ... 175	°C
Inverse diode				
V_{RRM}	T_j = 25 °C		650	V
I_F	T_j = 175 °C	T_c = 25 °C	86	A
		T_c = 80 °C	64	A
I_{Fnom}			50	A
I_{FRM}			100	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		550	A
T_j			-40 ... 175	°C
Freewheeling diode				
V_{RRM}	T_j = 25 °C		650	V
I_F	T_j = 175 °C	T_c = 25 °C	484	A
		T_c = 80 °C	353	A
I_{Fnom}			400	A
I_{FRM}			800	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		2646	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$			450	A
T_{stg}	module without TIM		-40 ... 125	°C
V_{isol}	AC sinus 50Hz, t = 1 min		4000	V

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
IGBT						
$V_{CE(sat)}$	I_C = 400 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.45	1.90	V
		T_j = 150 °C		1.70	2.10	V
V_{CE0}	chiplevel	T_j = 25 °C		0.90	1.00	V
		T_j = 150 °C		0.82	0.90	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		1.38	2.3	mΩ
		T_j = 150 °C		2.2	3.0	mΩ
$V_{GE(th)}$	V_{GE}=V_{CE}, I_C = 6.4 mA		5.1	5.8	6.4	V
I_{CES}	V_{GE} = 0 V V_{CE} = 650 V	T_j = 25 °C		0.12	0.3	mA
		T_j = 150 °C		-		mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		24.7		nF
C_{oes}		f = 1 MHz		1.54		nF
C_{res}		f = 1 MHz		0.73		nF
Q_G	V_{GE} = - 15 V...+ 15 V			5139		nC
R_{Gint}	T_j = 25 °C			1.0		Ω

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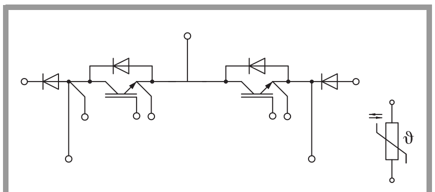

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Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
$t_{d(on)}$	V_{CC} = 300 V	T_j = 150 °C		220		ns
t_r	I_C = 400 A	T_j = 150 °C		220		ns
E_{on}	V_{GE} = +15/-15 V	T_j = 150 °C		27.91		mJ
$t_{d(off)}$	$R_{G\,on}$ = 10 Ω $R_{G\,off}$ = 10 Ω	T_j = 150 °C		1120		ns
t_f	di/dt_{on} = 2038 A/µs	T_j = 150 °C		103		ns
E_{off}	di/dt_{off} = 3960 A/µs du/dt = 3052 V/µs	T_j = 150 °C		27.89		mJ
$R_{th(j-c)}$	per IGBT				0.14	K/W
$R_{th(c-s)}$	per IGBT (λgrease=0.81 W/mK, thickness 50-100µm)			0.06		K/W
Inverse diode						
$V_F = V_{EC}$	I_F = 50 A V_{GE} = 0 V	T_j = 25 °C		1.37	1.73	V
	chiplevel	T_j = 150 °C		1.35	1.72	V
V_{F0}	chiplevel	T_j = 25 °C		1.04	1.24	V
		T_j = 150 °C		0.85	0.99	V
r_F	chiplevel	T_j = 25 °C		6.7	9.8	mΩ
		T_j = 150 °C		10	15	mΩ
I_{RRM}	I_F = 50 A	T_j = 150 °C		-		A
Q_{rr}		T_j = 150 °C		-		µC
E_{rr}	V_{CC} = 300 V	T_j = 150 °C		-		mJ
$R_{th(j-c)}$	per diode				0.81	K/W
$R_{th(c-s)}$	per diode (λgrease=0.81 W/mK, thickness 50-100µm)			0.082		K/W
Freewheeling diode						
$V_F = V_{EC}$	I_F = 400 A V_{GE} = 0 V	T_j = 25 °C		1.39	1.75	V
	chiplevel	T_j = 150 °C		1.38	1.76	V
V_{F0}	chiplevel	T_j = 25 °C		1.04	1.236	V
		T_j = 150 °C		0.85	0.99	V
r_F	chiplevel	T_j = 25 °C		0.88	1.30	mΩ
		T_j = 150 °C		1.32	1.93	mΩ
I_{RRM}	I_F = 400 A	T_j = 150 °C		188.2		A
Q_{rr}	di/dt_{off} = 2038 A/µs	T_j = 150 °C		37		µC
E_{rr}	V_{CC} = 300 V	T_j = 150 °C		6.27		mJ
$R_{th(j-c)}$	per diode				0.17	K/W
$R_{th(c-s)}$	per diode (λgrease=0.81 W/mK, thickness 50-100µm)			0.069		K/W

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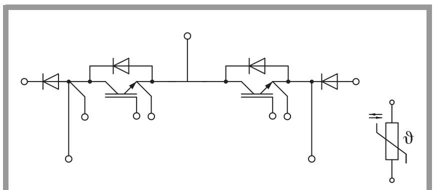

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Module						
L_{CE}				30		nH
$R_{CC'+EE'}$	measured per switch	T_C = 25 °C		0.8		mΩ
		T_C = 125 °C		1.1		mΩ
$Rth_{(c-s)1}$	calculated without thermal coupling			0.017		K/W
M_s	to heat sink (M5)		3		6	Nm
M_t		to terminals (M6)	3		6	Nm
						Nm
w				398		g
Temperature Sensor						
R_{100}	T_c=100°C (R_{25}=5 kΩ)			493 ± 5%		Ω
$B_{100/125}$	$R_{(T)}=R_{100}exp[B_{100/125}(1/T-1/T_{100})]$; T[K];			3550 ±2%		K

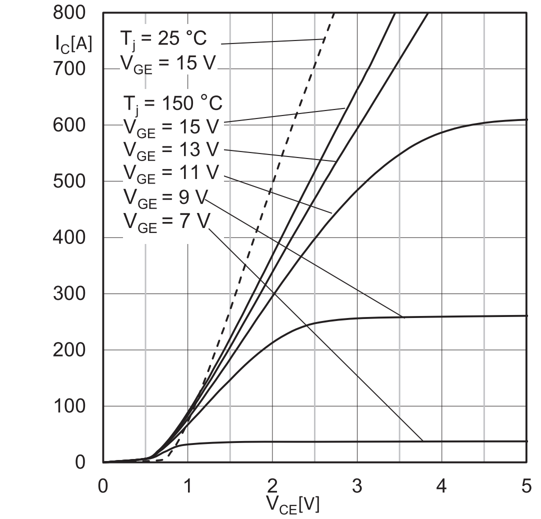


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

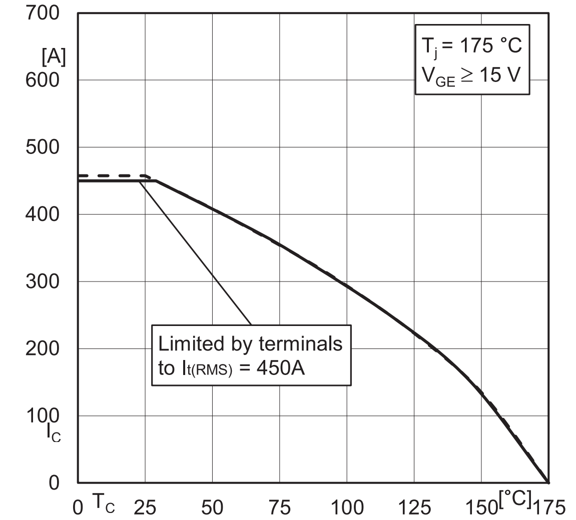


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

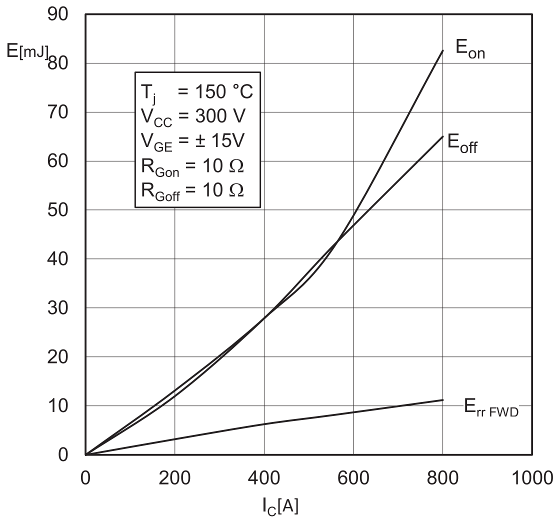


Fig. 3: Typ. turn-on /-off energy = f (I_C)

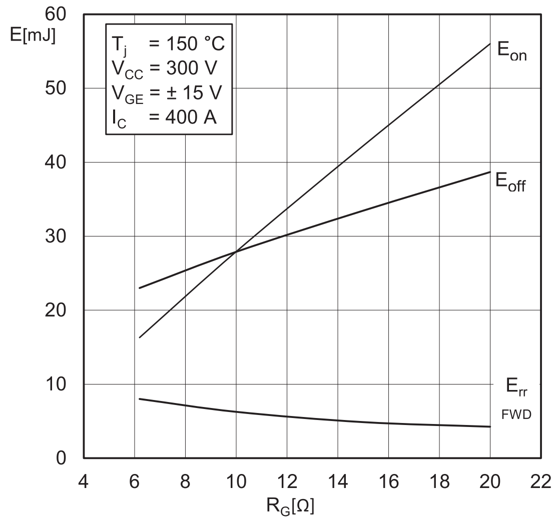


Fig. 4: Typ. turn-on /-off energy = f (R_G)

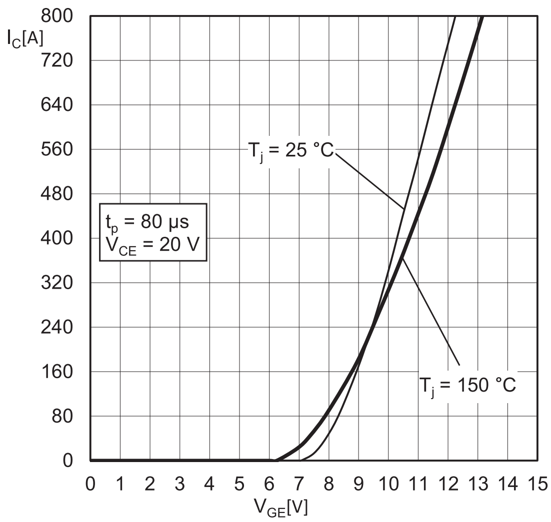


Fig. 5: Typ. transfer characteristic

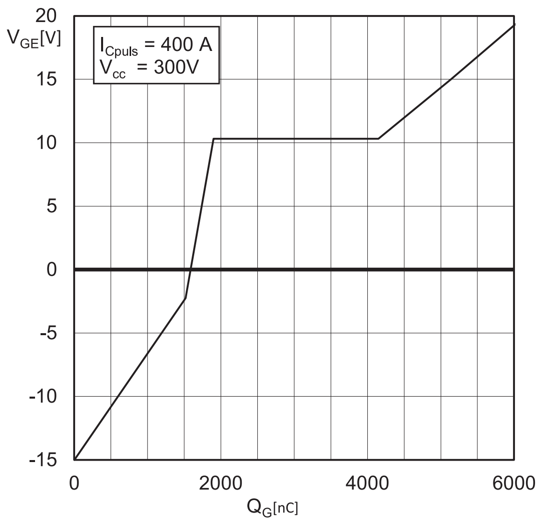


Fig. 6: Typ. gate charge characteristic

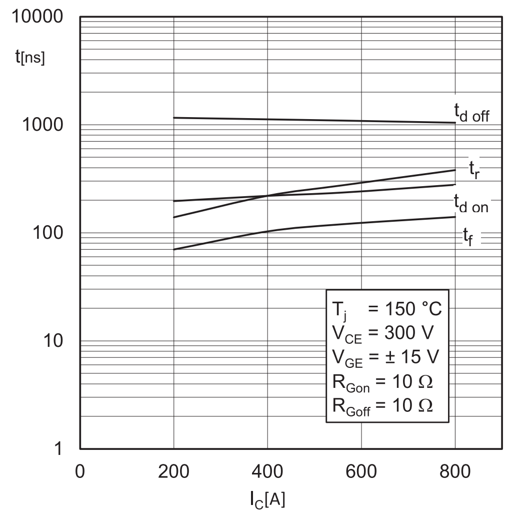


Fig. 7: Typ. switching times vs. I_C

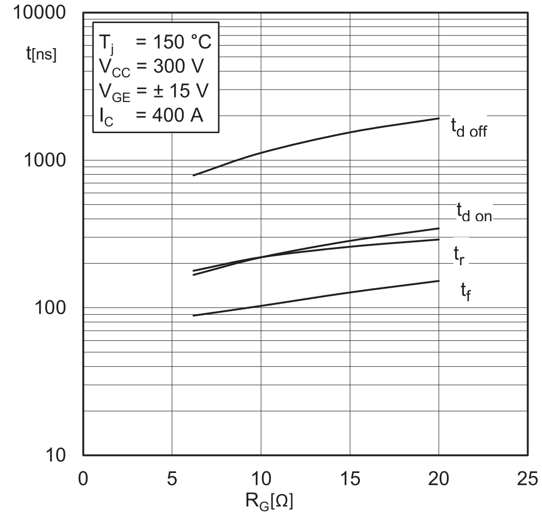


Fig. 8: Typ. switching times vs. gate resistor R_G

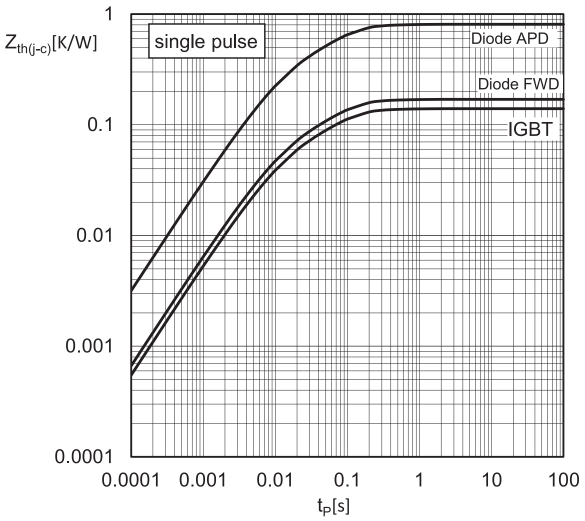


Fig. 9: Transient thermal impedance

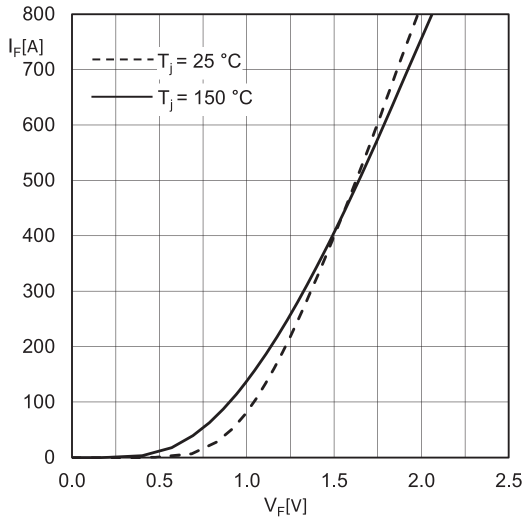


Fig.10: Typ. FWD diode forward characteristic, incl. $R_{CC'+EE'}$

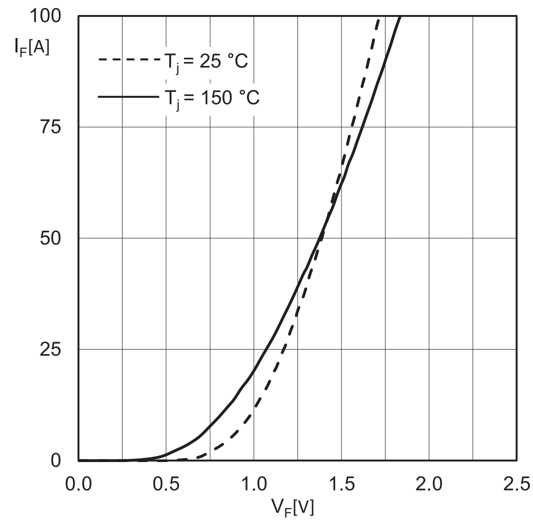


Fig. 11: Typ. inv. diode forward charact., incl. $R_{CC'+EE'}$

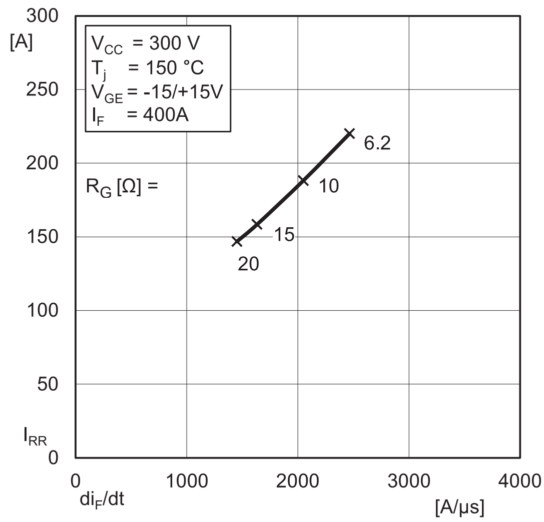
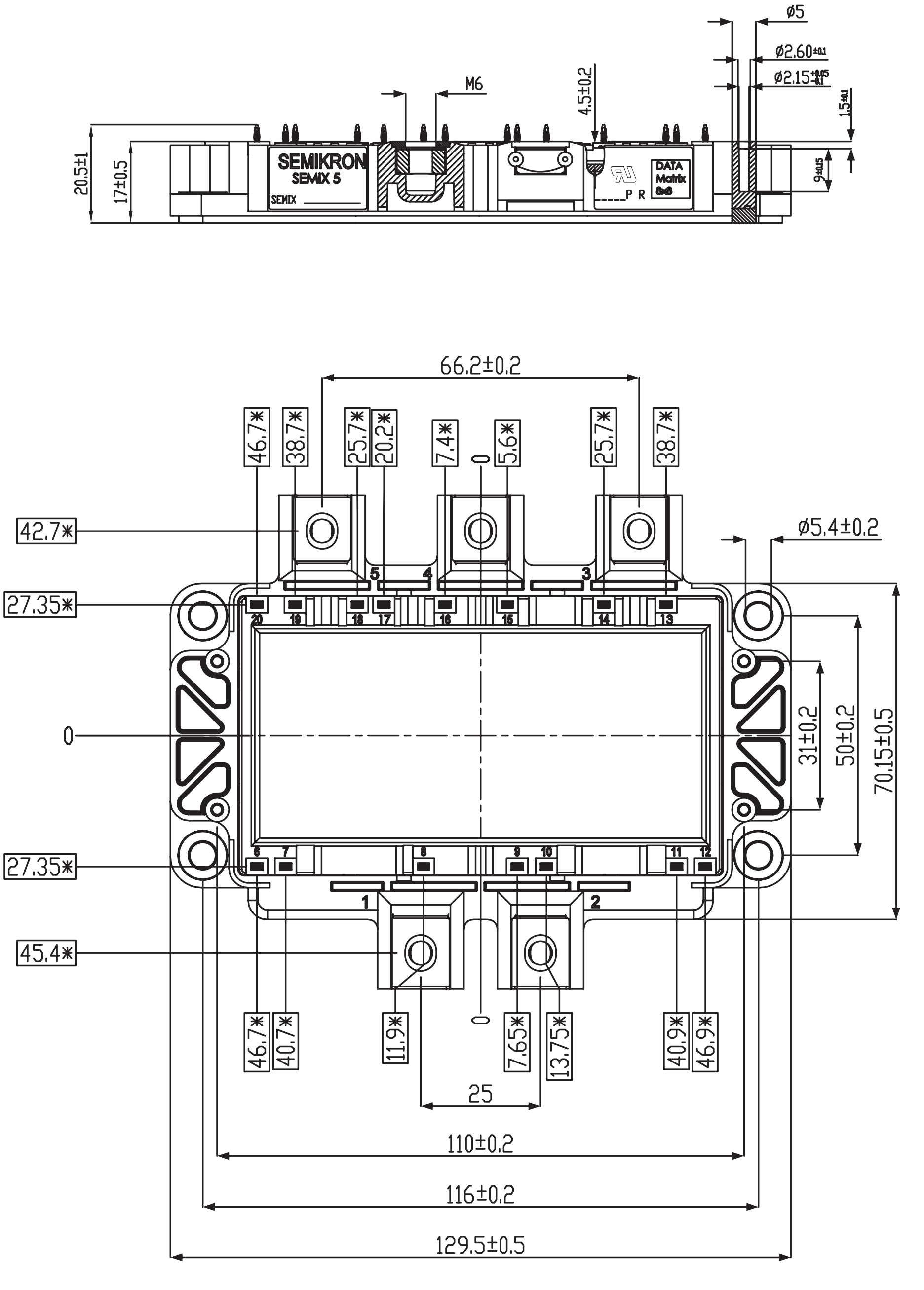


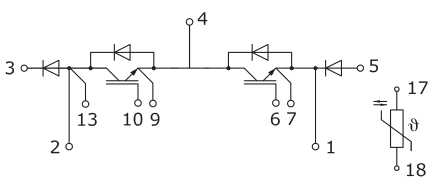
Fig. 12: Typ. CAL Diode FWD peak reverse recovery current



* = All dimensions with tolerance of ⌖ Ø 0.4

For technical details please refer to SEMiX(R)5 Mounting Instruction

SEMiX5p



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This is an electrostatic discharge sensitive device (ESDS) according to international standard IEC 61340.

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