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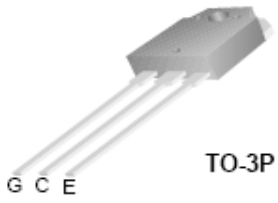
Silicon FS Trench IGBT

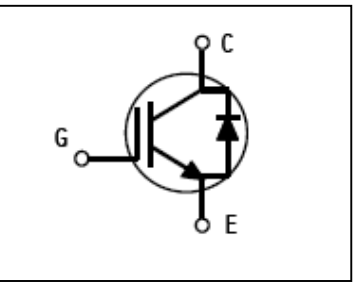
BT40T60 ANFU

General Description：

Using HUAJING's proprietary trench design and advanced Field Stop (FS) technology, offering superior conduction and switching performances.

V_{CES}	600	V
I_C	40	A
P_{tot} （T_C=25℃）	280	W
$V_{CE(sat)}$	1.9	V





Features：

- FS Trench Technology, Positive temperature coefficient
- Low saturation voltage: $V_{CE(sat)}$, typ= 1.9V
  @ I_C = 40A and T_C = 25°C
- RoHS Compliant

Applications：

- Welding
- Solar Inverter
- UPS

Absolute Maximum Ratings（Tj= 25℃ unless otherwise specified）：

Symbol	Parameter	Rating	Units
V_{CES}	Collector-Emitter Voltage	600	V
V_{GES}	Gate- Emitter Voltage	±20	V
I_C	Collector Current@TC=25℃	80	A
	Collector Current @TC = 100 °C	40	A
I_{CM} [a1]	Pulsed Collector Current@TC=25℃	120	A
I_F	Diode Continuous Forward Current @T_C = 100 °C	20	A
I_{FM}	Diode Maximum Forward Current	100	A
P_D	Power Dissipation @ T_C = 25°C	280	W
	Power Dissipation @T_C = 100 °C	110	W
	Power Dissipation @T_A = 25 °C	3.125	W
T_J, T_{stg}	Operating Junction and Storage Temperature Range	-55 to +150	℃
T_L	Maximum Temperature for Soldering	270	℃

[a1]: Repetitive rating; pulse width limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction to case for IGBT	--	0.446	℃/W
$R_{\theta JC}$	Thermal Resistance, Junction to case for Diode	--	1.25	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	--	40	℃/W

Electrical Characteristics of the IGBT（T_j= 25℃ unless otherwise specified）:

OFF Characteristics						
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	V_{GE}=0V,I_{CE}=250uA	600	--	--	V
I_{CES}	Collector-Emitter Leakage Current	V_{GE} =0V V_{CE}= 600V	--	--	1.0	mA
$I_{GES(F)}$	Gate to Emitter Forward Leakage	V_{GE} =+20V	--	--	+250	nA
$I_{GES(R)}$	Gate to Source Reverse Leakage	V_{GE} =-20V	--	--	-250	nA
ON Characteristics						
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=40A,V_{GE}=15V	--	1.9	2.4	V
$V_{GE(th)}$	Gate Threshold Voltage	I_C=1mA,V_{CE}=V_{GE}	4.0	5.7	7.0	V
Pulse width tp≤300μs,δ≤2%						
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE}=30V,V_{GE}=0V f=1MHz	--	3070	--	pF
C_{oes}	Output Capacitance		--	123	--	
C_{res}	Reverse Transfer Capacitance		--	80	--	
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	V_{CE}=400V,I_C=40A V_{GE}=15V, R_g=10Ω Inductive Load， Tj=25℃	--	42	--	ns
t_r	Rise Time		--	50	--	
$t_{d(off)}$	Turn-Off Delay Time		--	207	--	
t_f	Fall Time		--	53	--	
E_{on}	Turn-On Switching Loss		--	1.6	--	mJ
E_{off}	Turn-Off Switching Loss		--	0.82	--	
E_{ts}	Total Switching Loss		--	2.42	--	
Q_g	Total Gate Charge	V_{CE}=400V,I_C=40A V_{GE}=15V	--	165	--	nC
Q_{ge}	Gate to Emitter Charge		--	15	--	
Q_{gc}	Gate to Collector Charge		--	96	--	

Electrical Characteristics of the DIODE（T_j= 25℃ unless otherwise specified）:

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=20A	--	1.8	2.6	V
t_{rr}	Reverse Recovery Time	I_F=20A di/dt=200A/uS	--	80	--	ns
I_{rrm}	Reverse Recovery Current		--	6	--	A
Q_{rr}	Reverse Recovery Charge		--	240	--	nC
Pulse width t tp≤300μs,δ≤2%						

Typical Performance Characteristics

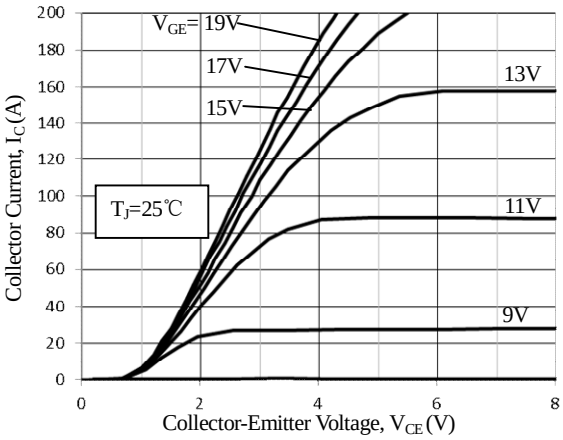


Figure 1.Output Characteristics

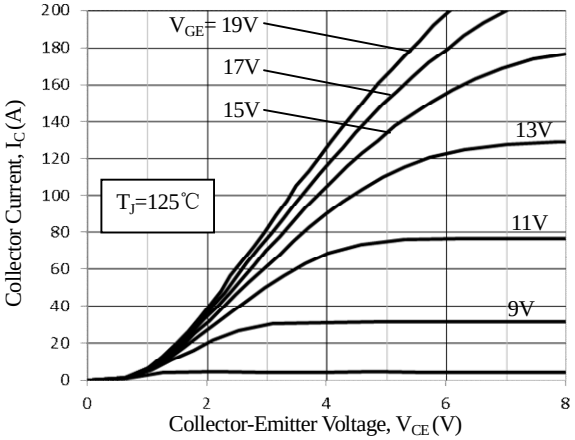


Figure 2.Output Characteristics

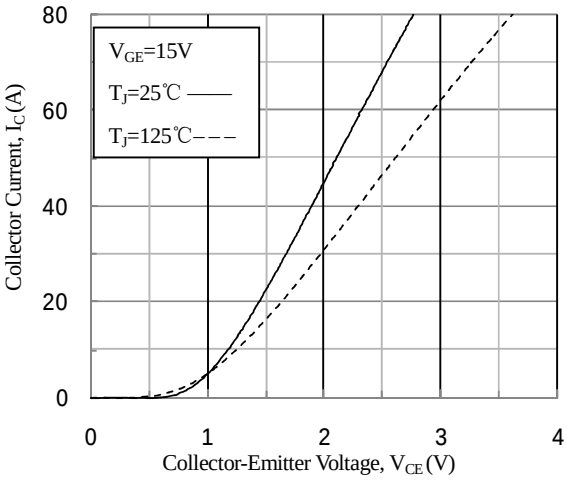


Figure 3.Saturation Voltage Characteristics

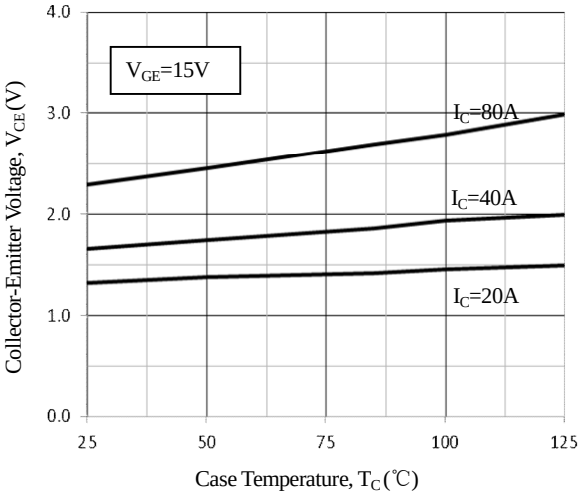


Figure 4.Saturation Voltage –T_C Characteristics

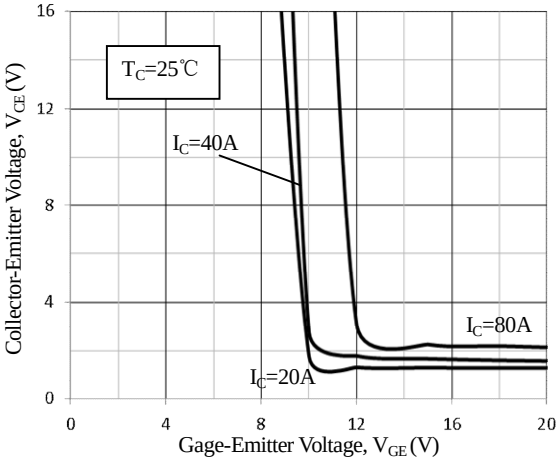


Figure 5.$V_{CE(sat)}$— V_{GE} Characteristics

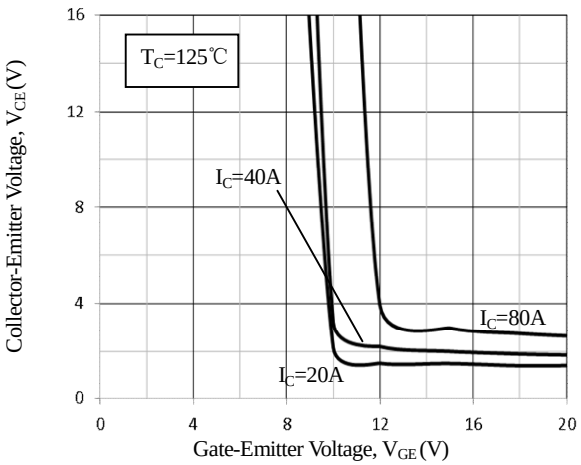


Figure 6.$V_{CE(sat)}$— V_{GE} Characteristics

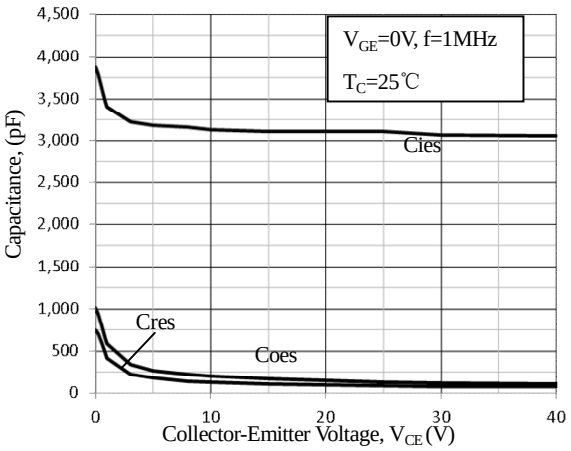


Figure 7.Capacitance Characteristics

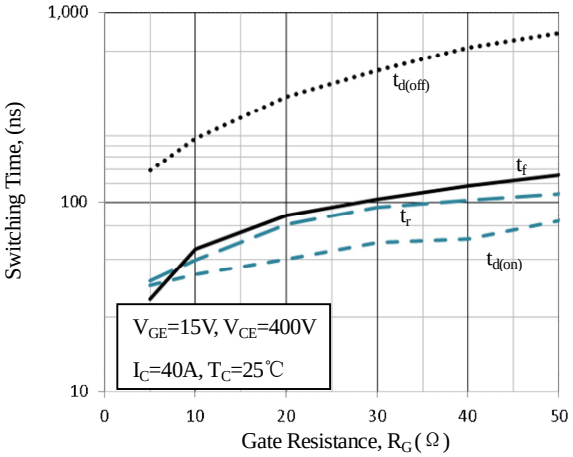


Figure 8.Switching Time-R_G Characteristics

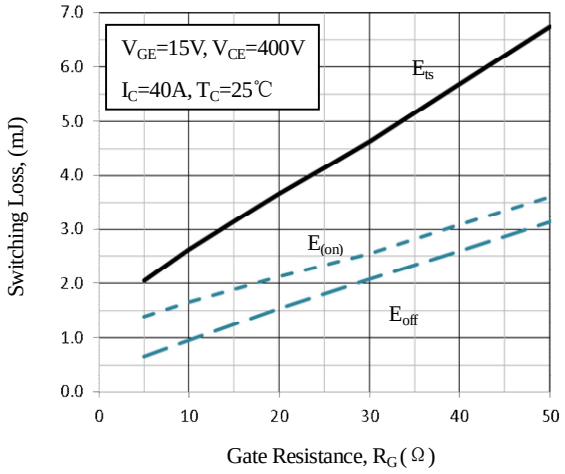


Figure 9.Switching Loss-R_G Characteristics

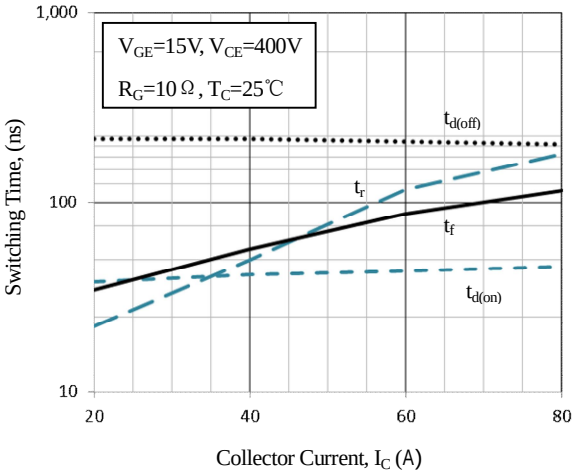


Figure 10.Switching Time-I_C Characteristics

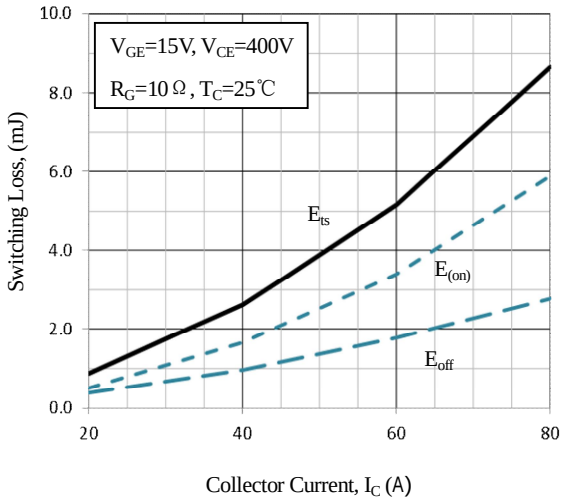


Figure 11.Switching Loss-I_C Characteristics

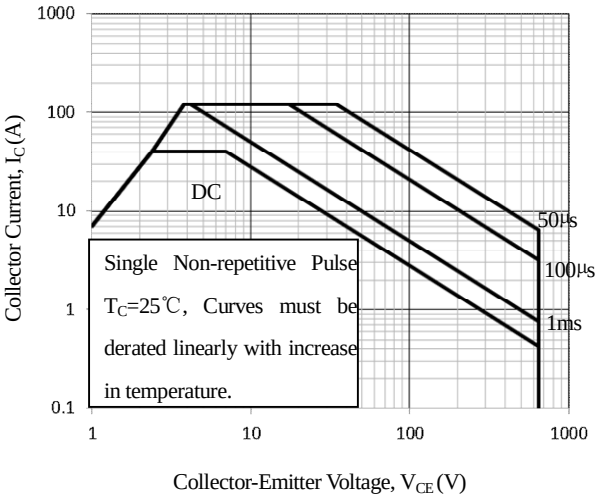


Figure 12.Forward Bias Safe Operating Area

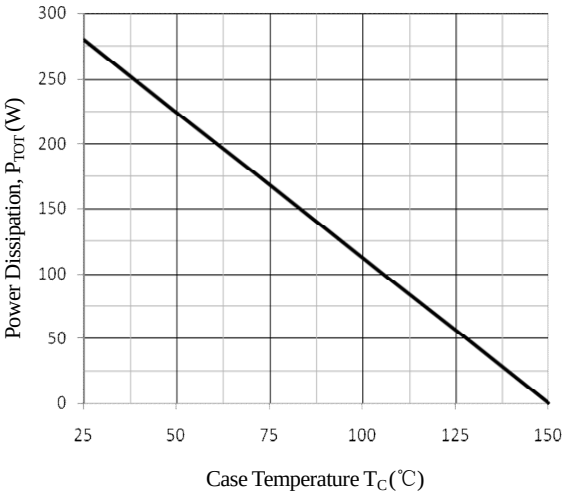


Figure 13.Power Dissipation-T_C Characteristics

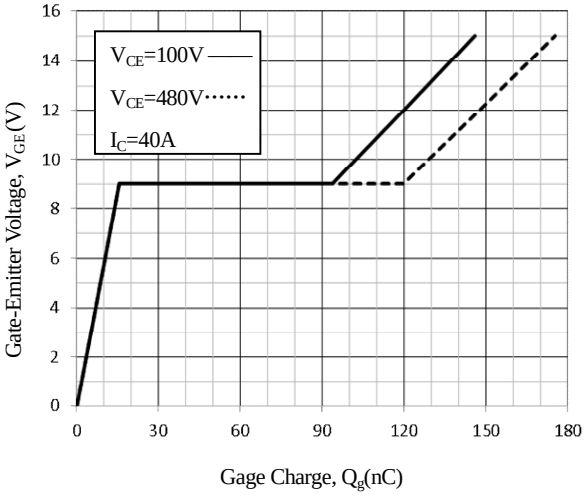


Figure 14.Gage Charge Characteristics

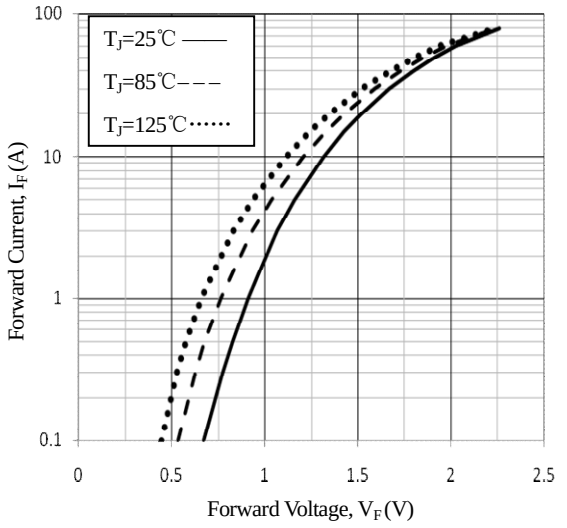


Figure 15.Diode Forward Characteristics

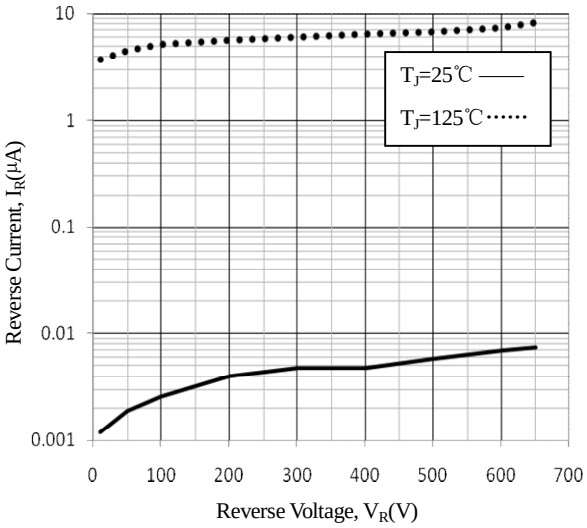


Figure 16. Diode Reverse Characteristics

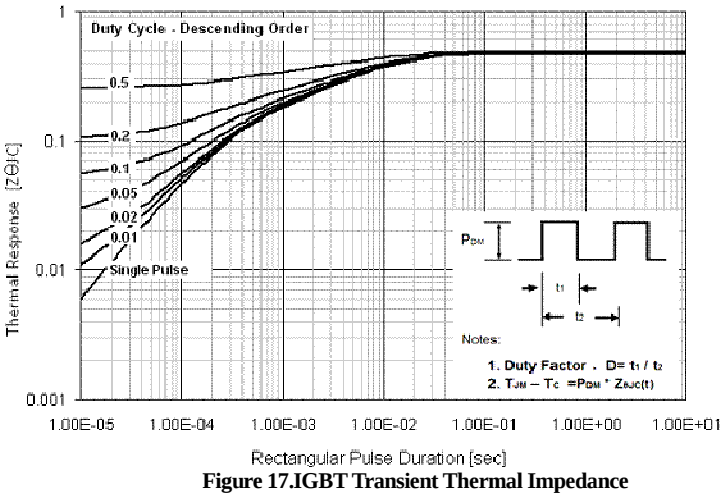
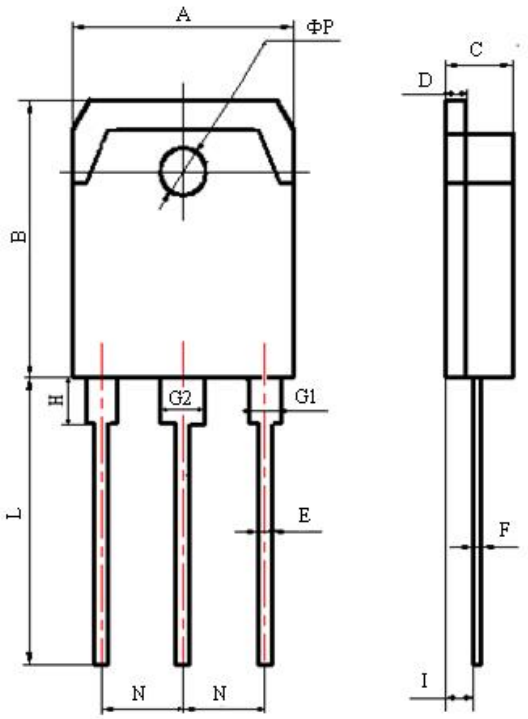


Figure 17.IGBT Transient Thermal Impedance

Package Information：



Items	Values(mm)	
	MIN	MAX
A	15.00	16.00
B	19.20	20.60
C	4.60	5.00
D	1.40	1.60
E	0.90	1.10
F	0.50	0.70
G1	2.00	2.20
G2	3.00	3.20
H	3.00	3.70
I	1.20	1.70
	2.70	2.90
L*	19.00	21.00
N	5.25	5.65
ΦP	3.10	3.30

*：adjustable

TO-3P(N) Package

The name and content of poisonous and harmful material in products

	Hazardous Substance									
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE	DIBP	DEHP	DBP	BBP
Limit	≤0.1%	≤0.1%	≤ 0.01%	≤0.1%	≤0.1%	≤0.1%	≤0.1%	≤0.1%	≤0.1%	≤0.1%
Lead Frame	○	○	○	○	○	○	○	○	○	○
Molding	○	○	○	○	○	○	○	○	○	○
Chip	○	○	○	○	○	○	○	○	○	○
Wire Bonding	○	○	○	○	○	○	○	○	○	○
Solder	×	○	○	○	○	○	○	○	○	○
Note	○：Means the hazardous material is under the criterion of 2011/65/EU. ×：Means the hazardous material exceeds the criterion of 2011/65/EU. The plumbum element of solder exist in products presently, but within the allowed range of Eurogroup's RoHS.									

Warnings

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. It is suggested to be used under 80 percent of the maximum ratings of the device.
2. When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
3. IGBTs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. This publication is made by Huajing Microelectronics and subject to regular change without notice.

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