SOLID STATE OPTRONICS



SMJ1360

2 Form C
60V / 7Ω
MOSFET Output Solid State Relay

Description

The SMJ1360 is a 2 Form C relay in one compact 16 pin SOIC package. It is designed to replace electro-mechanical relays in general purpose switching applications. Input control is configured for 2 Form C functionality and provides for “break before make” switching. Each output pole has a low resistance of 7Ω (TYP) as well as low output capacitance (8pF @ 25V).

The SMJ1360 comes standard in a compact 16 pin SOIC package making it ideal for high-density board applications.

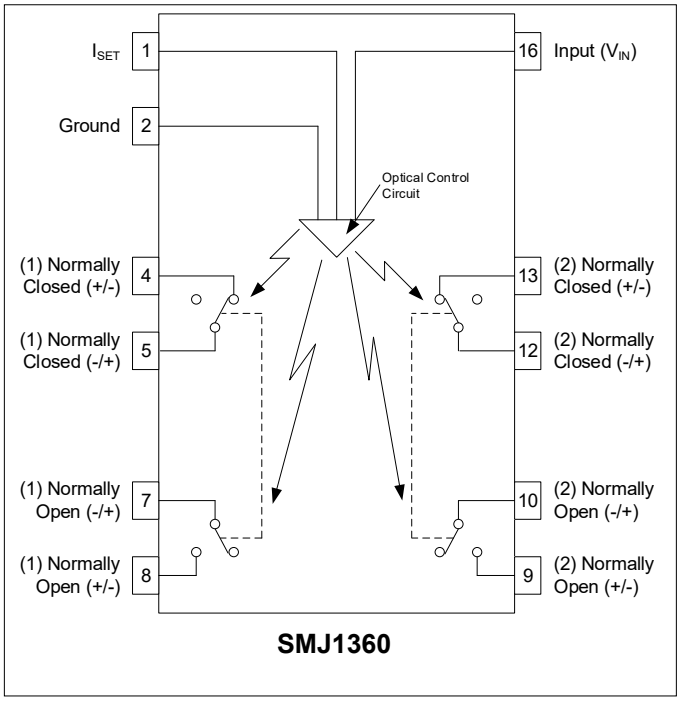
Features

- Low On Resistance (7Ω TYP)
- Low Output Capacitance (8pF TYP @ 25V)
- 250mA Maximum Continuous Load Current
- Isolation Voltage (400V_{RMS})
- 2 Form C with Break Before Make Switching (Functionality provided by control circuity)
- Long Life / High Reliability
- RoHS / Pb-Free / REACH Compliant

Applications

- EMR Replacement
- Automatic Test Equipment
- Data Acquisition
- Medical Equipment
- Battery Monitoring
- Safety Systems

Schematic Diagram



SMJ1360

Absolute Maximum Ratings

The values indicated are absolute stress ratings. Functional operation of the device is not implied at these or any conditions in excess of those defined in electrical characteristics section of this document. Exposure to absolute Maximum Ratings may cause permanent damage to the device and may adversely affect reliability.

Storage Temperature .....-55 to +125°C
Operating Temperature .....-40 to +85°C
Continuous Input Current.....40mA
Transient Input Current 400mA
Reverse Input Control Voltage 5V
Input Power Dissipation.....40mW
Output Power Dissipation 600mW
Solder Temperature – Wave (10sec).....260°C
Solder Temperature – IR Reflow (10sec).....260°C

Ordering Information

Part Number	Description
SMJ1360	16 pin SOIC, (45/Tube)
SMJ1360-TR	16 pin SOIC, Tape and Reel (1000/Reel)

NOTES: Suffixes listed above are not included in marking on device for part number identification

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SMJ1360 /TR
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Electrical Characteristics, T_A = 25°C (unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Input Specifications						
Control Voltage	V_{CC}	4.5	-	16	V	-
Input Control Low Level	$V_{In(Low)}$	-	-	0.5	V	-
Input Control High Level[1]	$V_{In(High)}$	-	Pull-up to Vcc	-	V	-
Control Current[2]	I_F	-	2	-	mA	-
V_{In} Driver Transition Time	-	-	-	5	µS	-
Output Specifications (Same for both NO and NC poles)						
Blocking Voltage	V_B	60	-	-	V	-
Continuous Load Current	I_O	-	-	250	mA	-
On Resistance	R_{ON}	-	7	10	Ω	I_O=200mA
Leakage Current	I_{Oleak}	-	-	100	nA	V_O=60V
Output Capacitance	C_{OUT}	-	26	-	pF	V_O=0, f=1MHz
		-	8	-		V_O=25, f=1MHz
Coupled Specifications						
Turn-On Time	T_{ON}	-	1	3	mS	-
Turn-Off Time	T_{OFF}	-	0.05	-	mS	-
Input to Output Capacitance	C_S	-	0.6	-	pF	V=0, f=1MHz
Contact Transient Ratio	-	2,000	7,000	0	V/µS	dV = 50V
Isolation Specifications						
Isolation Voltage	V_{ISO}	400	-	-	V_{RMS}	RH ≤ 50%, t=1min
Input-Output Resistance	R_{I-O}	-	10^{12}	-	Ω	RH ≤ 50%, V_{I-O} = 500V_{DC}

NOTES:

1. Input Control High Level is controlled by the pull-up resistor (R_P) to V_{CC}. For more details, reference the Connection Diagram found on page 4

2. Control Current is referred to as "I_{SET}" in the connection diagram found on page 4. Reference Note 4 found there for more details

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SMJ1360 Performance & Characteristics Plots, T_A = 25°C (unless otherwise specified)

Figure 1: *Typical On-Resistance Distribution* (N = 100, T_a = 25ºC)

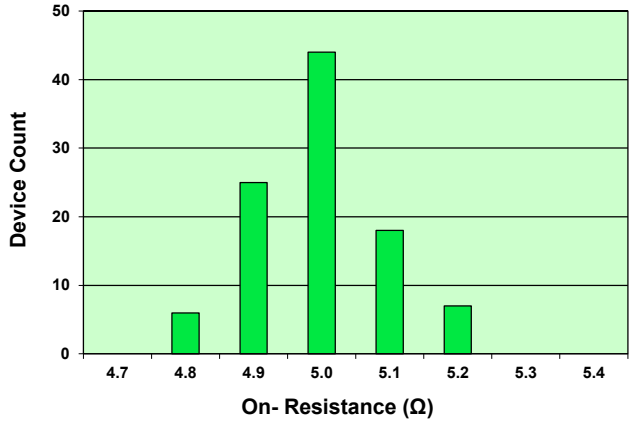


Figure 2: *Typical Blocking Voltage Distribution* (N = 100, Ta = 25ºC)

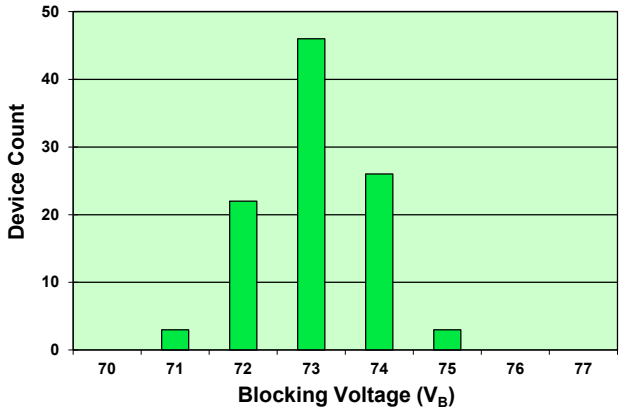


Figure 3: *Typical Output Leakage Current Distribution* (N = 100, T_a = 25ºC)

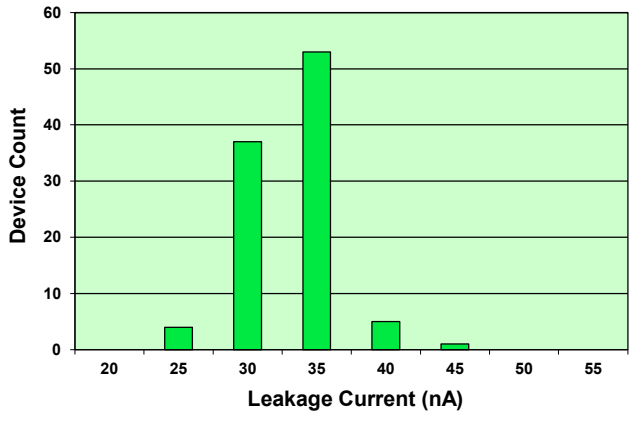
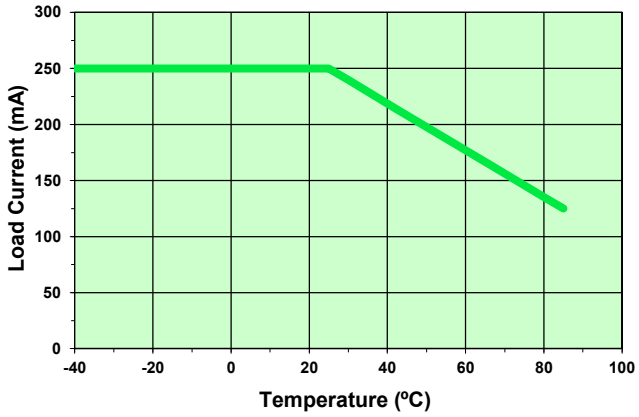
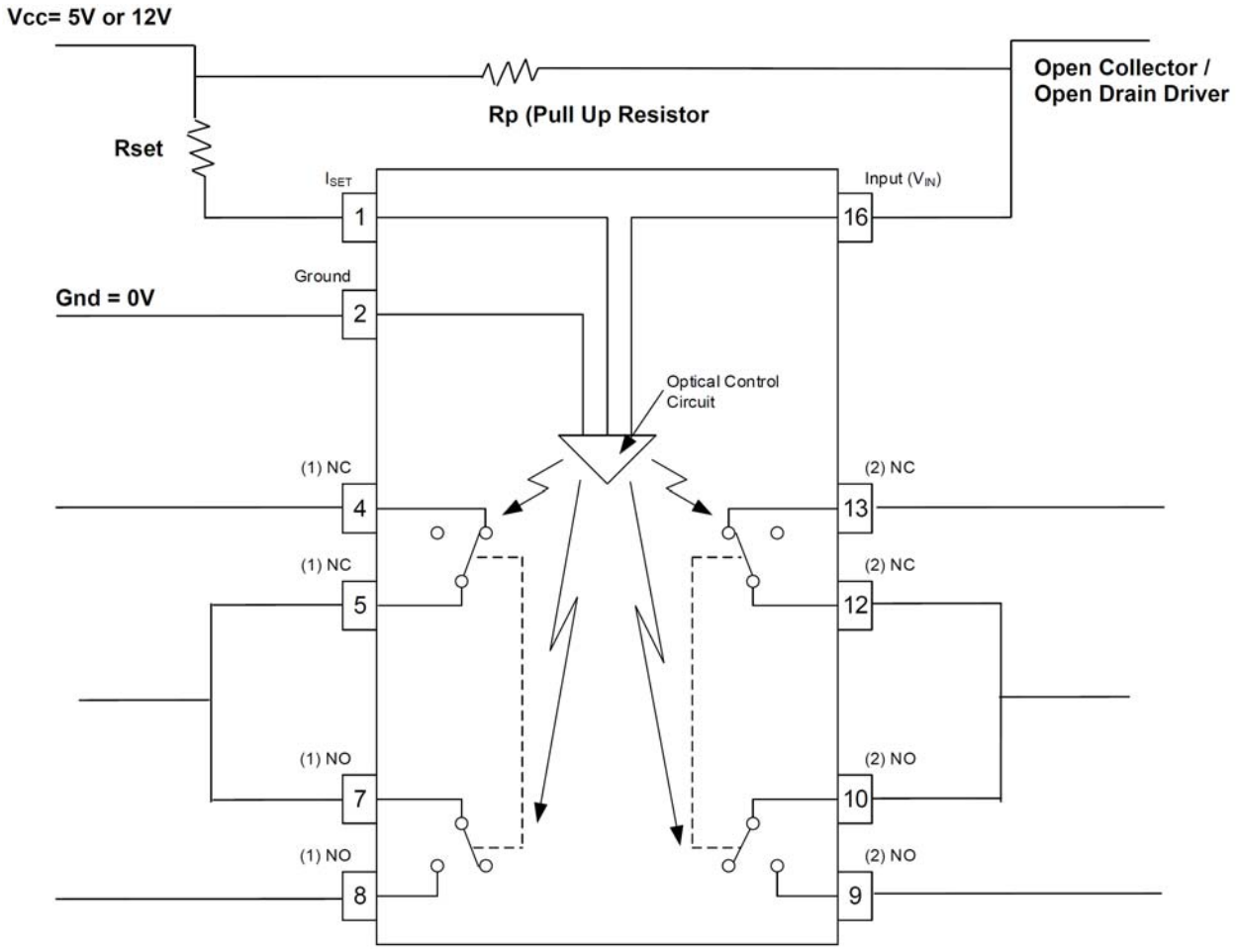


Figure 4: *Maximum Load Current vs. Temperature*



SMJ1360 Recommended Output Connections and Components



Notes

1) SSO recommends a Pull Up Resistor (Rp) value of 10kΩ or less
2) NO (Normally Open) contacts between pins 7&8 and 9&10 are defined as OPEN when the Open Collector is open and pin 16 is pulled up with the Pull Up Resistor (Rp). These contacts will CLOSE when the Open Collector driver pulls pin 16 to ground (below 0.5V). The NC (Normally Closed) contacts between pins 4&5 and 12&13 operate in an inverse manner
3) The Open Collector Transition Time should be less than 5μS for proper performance
4) I_{SET} (Control Current as found in Parameters on Page 2) is used to set the internal photo drive current. SSO recommends an Iset value of 2mA for optimal device performance. Rset can be calculated for Vcc of either 5V or 12V. Assume a voltage drop of 2.1V for the Optical Control Circuit and Rset values for a 2mA Iset become:

Rset (@5Vcc)	=	(Vcc-Vopticalcircuit) / (target Iset)	Rset (@12Vcc)	=	(Vcc-Vopticalcircuit) / (target Iset)
	=	(5V-2.1V) / (0.002A)		=	(12V-2.1V) / (0.002A)
	=	2.9 / 0.002		=	9.9 / 0.002
Rset (@5Vcc)	**=**	**1450 ohms**	**Rset (@12Vcc)**	**=**	**4950 ohms**

The above calculations are for power supplies with acceptable tolerances of ±10%. If tolerances go beyond this range calculate Rset values based on the lowest voltage in the tolerance range

5) The same V_{CC} value should be used for both R_{set} (as calculated above) and the pull-up resistor (R_P) used with V_{IN} (pin 16) discussed in Note 1
6) Pins 5&7 and similarly pins 10&12 can be connected externally forming a common point, in effect the common point of the Form C relay

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SMJ1360 Solder Temperature Profile Recommendations

(1) *Infrared Reflow:*

Refer to the following figure as an example of an optimal temperature profile for single occurrence infrared reflow. Soldering process should not exceed temperature or time limits expressed herein. Surface temperature of device package should not exceed 250ºC:

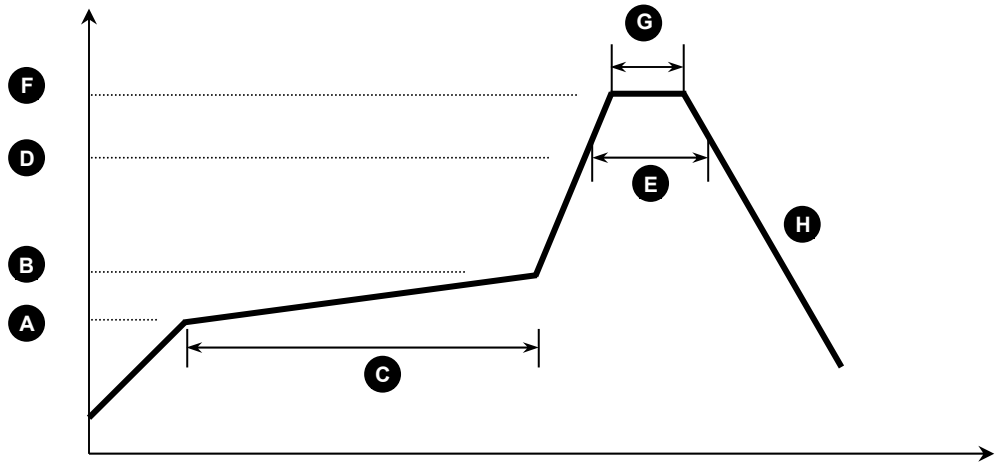


Figure 1

Process Step	Description	Parameter
A	Preheat Start Temperature (ºC)	150ºC
B	Preheat Finish Temperature (ºC)	180ºC
C	Preheat Time (s)	90 - 120s
D	Melting Temperature (ºC)	230ºC
E	Time above Melting Temperature (s)	30s
F	Peak Temperature, at Terminal (ºC)	260ºC
G	Dwell Time at Peak Temperature (s)	10s
H	Cool-down (ºC/s)	<6ºC/s

(2) *Wave Solder:*

Maximum Temperature: 260ºC (at terminal)
Maximum Time: 10s
Pre-heating: 100 - 150ºC (30 - 90s)
Single Occurrence

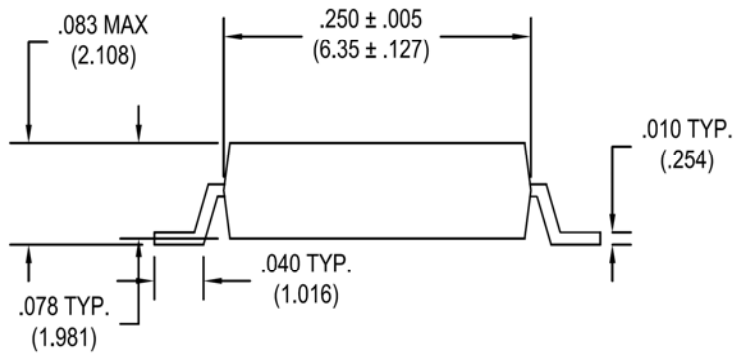
(3) *Hand Solder:*

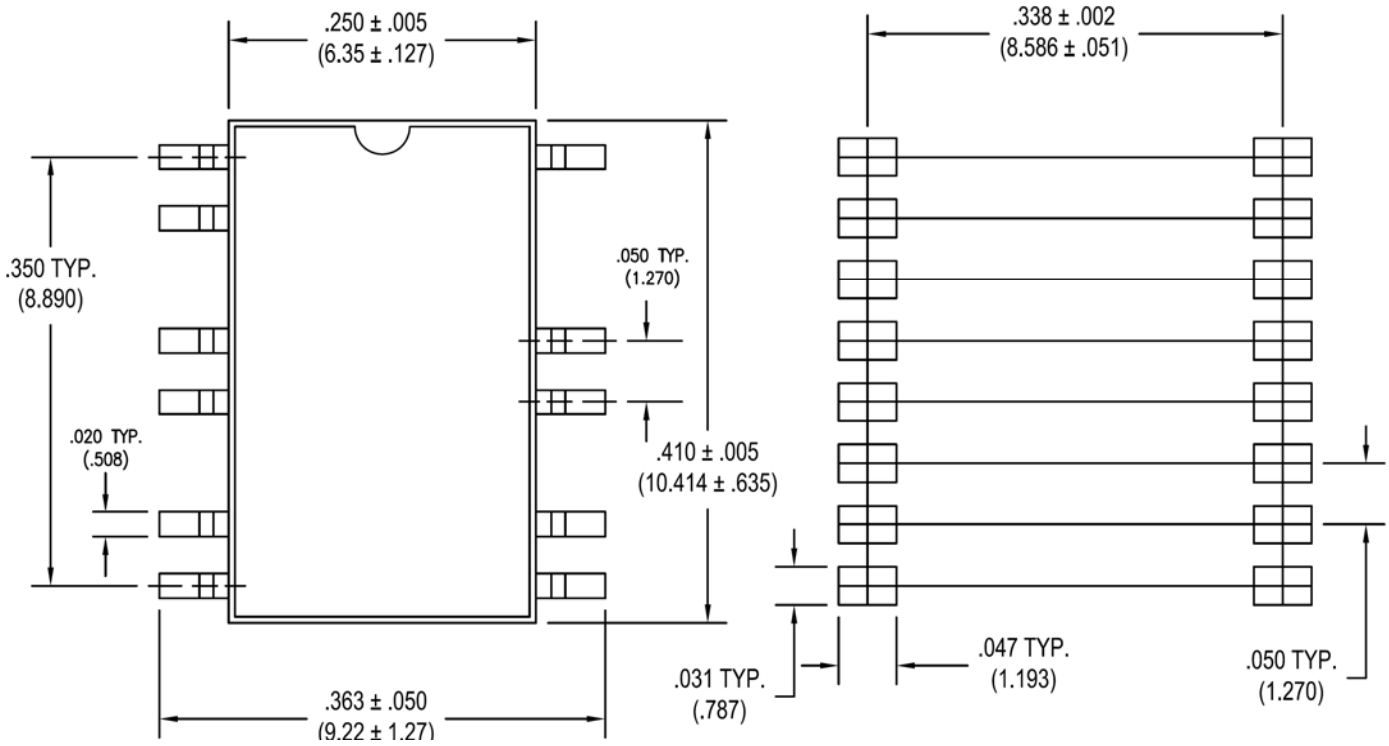
Maximum Temperature: 350ºC (at tip of soldering iron)
Maximum Time: 3s
Single Occurrence

SMJ1360 Package Dimensions

16 PIN SOIC

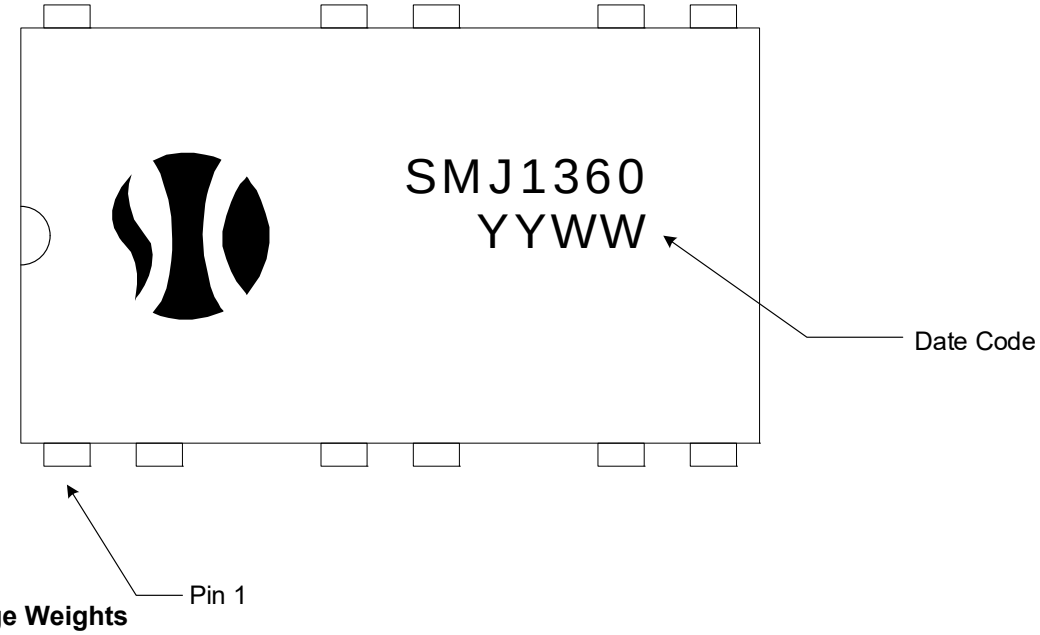
Note: *All dimensions in inches ["] with millimeters in parenthesis ()*





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SMJ1360 Package Marking



SMJ1360 Package Weights

Device	Single Unit	Full Tube (45pcs)	Full Pouch (10 tubes)	Full Reel (1000pcs)
SMJ1360	0.35	33	350	-
SMJ1360-TR	0.35	-	-	850

Note: *All weights above are in GRAMS, and include packaging materials where applicable*

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