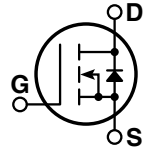


Super Junction MOSFET



- Ultra low $R_{DS(ON)}$
- Ultra Low Gate Charge, Q_g
- Popular SOT-227 Package
- Low Miller Capacitance
- Avalanche Energy Rated
- N-Channel Enhancement Mode



Unless stated otherwise, Microsemi discrete MOSFETs contain a single MOSFET die. This device is made with two parallel MOSFET die. It is intended for switch-mode operation. It is not suitable for linear mode operation.

MAXIMUM RATINGS

All Ratings: $T_C = 25^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	APT31N80JC3	UNIT
V_{DSS}	Drain-Source Voltage	800	Volts
I_D	Continuous Drain Current @ $T_C = 25^\circ\text{C}$	31	Amps
I_{DM}	Pulsed Drain Current ^①	93	
V_{GS}	Gate-Source Voltage Continuous	± 20	Volts
V_{GSM}	Gate-Source Voltage Transient	± 30	
P_D	Total Power Dissipation @ $T_C = 25^\circ\text{C}$	833	Watts
	Linear Derating Factor	6.67	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to 150	$^\circ\text{C}$
T_L	Lead Temperature: 0.063" from Case for 10 Sec.	300	
dv/dt	Drain-Source Voltage slope ($V_{DS} = 640\text{V}$, $I_D = 31\text{A}$, $T_J = 125^\circ\text{C}$)	50	V/ns
I_{AR}	Repetitive Avalanche Current ^⑦	17	Amps
E_{AR}	Repetitive Avalanche Energy ^⑦	0.5	mJ
E_{AS}	Single Pulse Avalanche Energy ^④	670	

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
BV_{DSS}	Drain-Source Breakdown Voltage ($V_{GS} = 0\text{V}$, $I_D = 500\mu\text{A}$)	800			Volts
$R_{DS(on)}$	Drain-Source On-State Resistance ^② ($V_{GS} = 10\text{V}$, $I_D = 22\text{A}$)		0.125	0.145	Ohms
I_{DSS}	Zero Gate Voltage Drain Current ($V_{DS} = 800\text{V}$, $V_{GS} = 0\text{V}$)		0.5	25	μA
	Zero Gate Voltage Drain Current ($V_{DS} = 800\text{V}$, $V_{GS} = 0\text{V}$, $T_J = 150^\circ\text{C}$)			250	
I_{GSS}	Gate-Source Leakage Current ($V_{GS} = \pm 20\text{V}$, $V_{DS} = 0\text{V}$)			± 200	nA
$V_{GS(th)}$	Gate Threshold Voltage ($V_{DS} = V_{GS}$, $I_D = 2\text{mA}$)	2.10	3	3.9	Volts

 **CAUTION:** These Devices are Sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

Microsemi Website - <http://www.microsemi.com>

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DYNAMIC CHARACTERISTICS

APT31N80JC3

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{iss}	Input Capacitance	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1\text{ MHz}$		4510		pF
C_{oss}	Output Capacitance			2050		
C_{rss}	Reverse Transfer Capacitance			110		
Q_g	Total Gate Charge ③	$V_{GS} = 10V$ $V_{DD} = 400V$ $I_D = 31A @ 25^\circ C$		180	355	nC
Q_{gs}	Gate-Source Charge			22		
Q_{gd}	Gate-Drain ("Miller") Charge			90		
$t_{d(on)}$	Turn-on Delay Time	RESISTIVE SWITCHING $V_{GS} = 10V$ $V_{DD} = 400V$ $I_D = 31A @ 125^\circ C$ $R_G = 2.5\Omega$		25		ns
t_r	Rise Time			15		
$t_{d(off)}$	Turn-off Delay Time			70	80	
t_f	Fall Time			6	9	
E_{on}	Turn-on Switching Energy ⑥	INDUCTIVE SWITCHING @ 25^\circ C $V_{DD} = 533V, V_{GS} = 15V$ $I_D = 31A, R_G = 5\Omega$		615		μJ
E_{off}	Turn-off Switching Energy			530		
E_{on}	Turn-on Switching Energy ⑥	INDUCTIVE SWITCHING @ 125^\circ C $V_{DD} = 533V, V_{GS} = 15V$ $I_D = 31A, R_G = 5\Omega$		1025		
E_{off}	Turn-off Switching Energy			580		

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
I_S	Continuous Source Current (Body Diode)			31	Amps
I_{SM}	Pulsed Source Current ① (Body Diode)			93	
V_{SD}	Diode Forward Voltage ② ($V_{GS} = 0V, I_S = -31A$)		1	1.2	Volts
t_{rr}	Reverse Recovery Time ($I_S = -31A, di_S/dt = 100A/\mu s, V_R = 400V$)		855		ns
Q_{rr}	Reverse Recovery Charge ($I_S = -31A, di_S/dt = 100A/\mu s, V_R = 400V$)		30		μC
dv/dt	Peak Diode Recovery dv/dt ⑤			6	V/ns

THERMAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			0.37	$^\circ C/W$
$R_{\theta JA}$	Junction to Ambient			62	

① Repetitive Rating: Pulse width limited by maximum junction temperature

② Pulse Test: Pulse width < 380 μs , Duty Cycle < 2%

③ See MIL-STD-750 Method 3471

④ Starting $T_j = +25^\circ C$, $L = 115.92mH$, $R_G = 25\Omega$, Peak $I_L = 3.4A$

⑤ $I_S = -31A$ $di_S/dt = 100A/\mu s$ $v_R = 480V$ $T_j = 125^\circ C$

⑥ Eon includes diode reverse recovery. See figures 18, 20.

⑦ Repetitive avalanche causes additional power losses that can be calculated as $P_{AV} = E_{AR} \cdot f$

Microsemi reserves the right to change, without notice, the specifications and information contained herein.

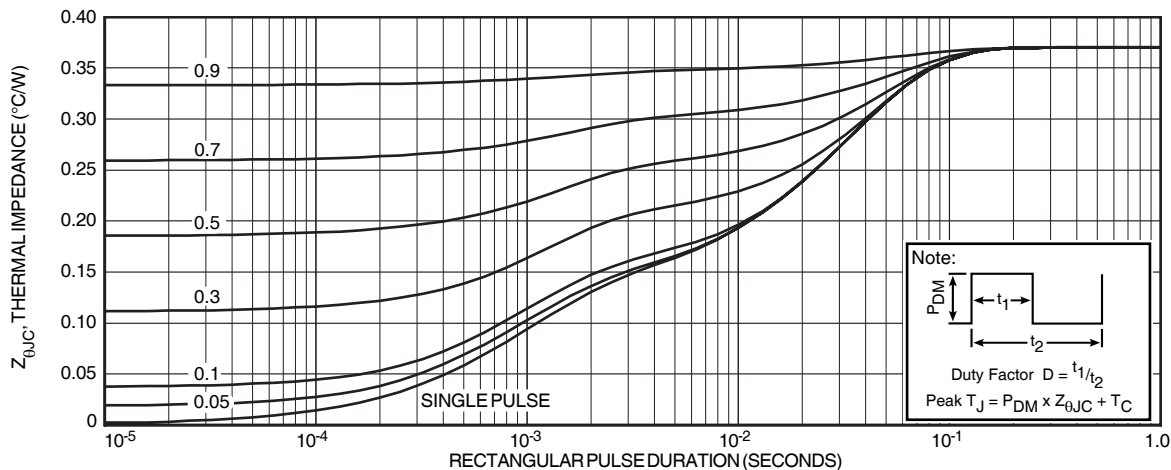


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

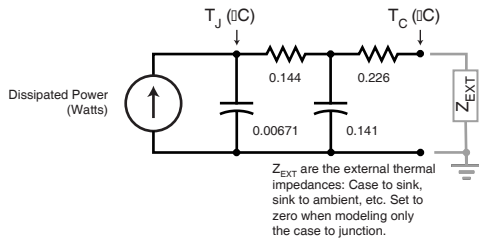


FIGURE 2, TRANSIENT THERMAL IMPEDANCE MODEL

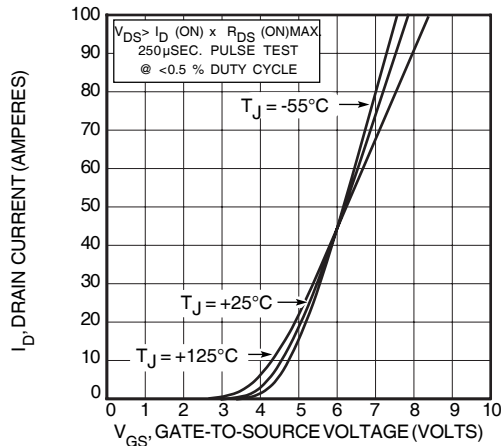


FIGURE 4, TRANSFER CHARACTERISTICS

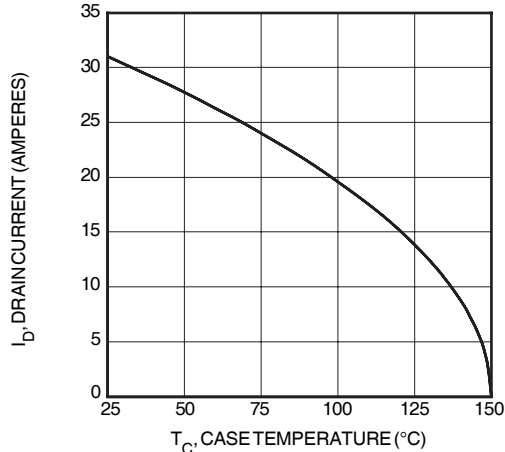


FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

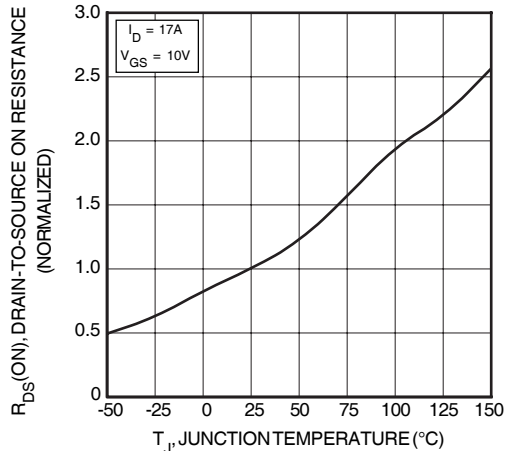


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

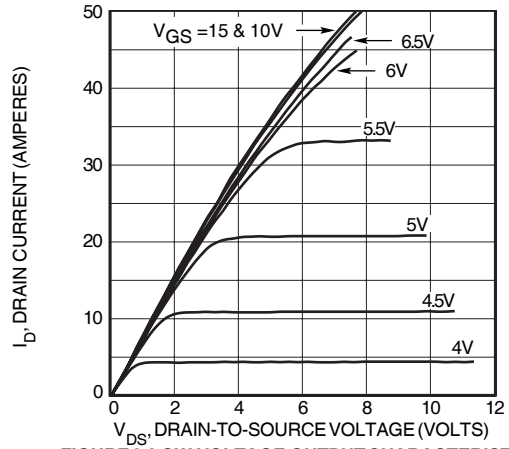


FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS

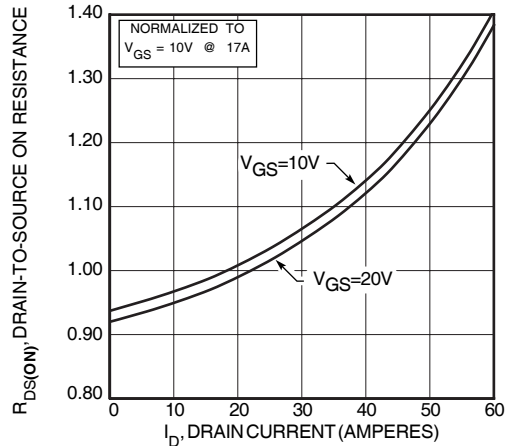


FIGURE 5, $R_{DS(ON)}$ vs DRAIN CURRENT

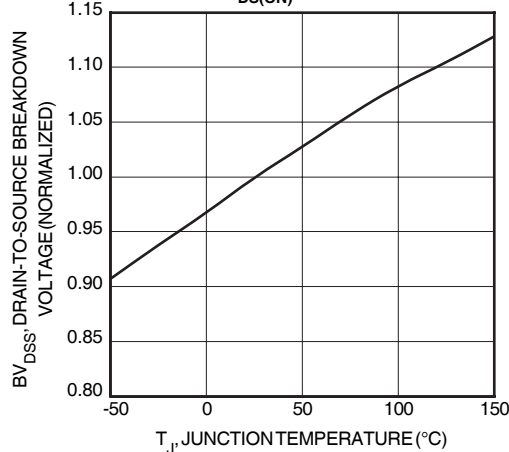


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

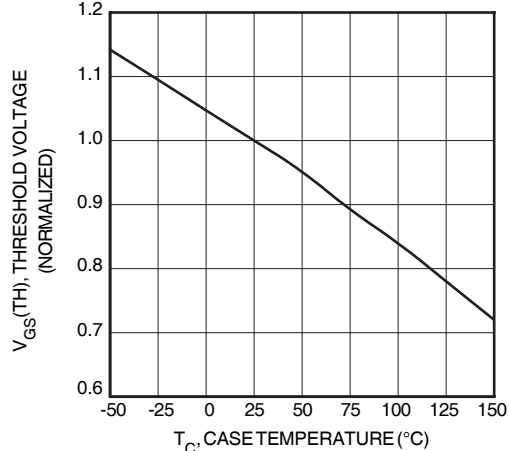


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

I_D , DRAIN CURRENT (AMPERES)

Graph removed

V_{DS} , DRAIN-TO-SOURCE VOLTAGE (VOLTS)
FIGURE 10, MAXIMUM SAFE OPERATING AREA

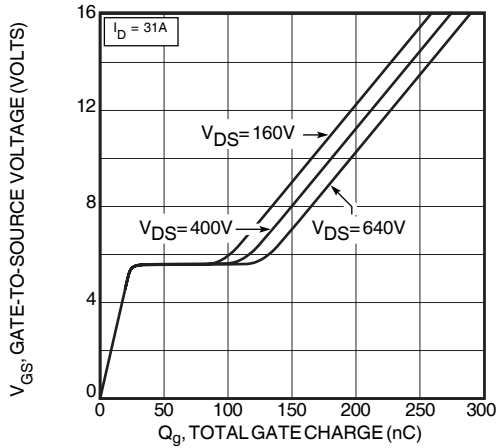


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

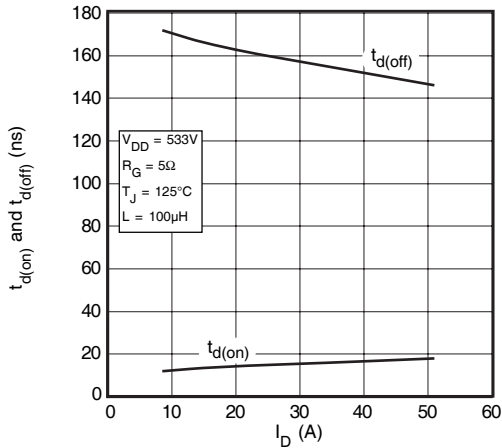


FIGURE 14, DELAY TIMES vs CURRENT

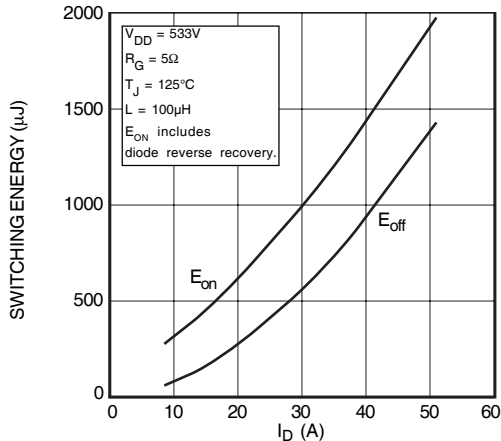


FIGURE 16, SWITCHING ENERGY vs CURRENT

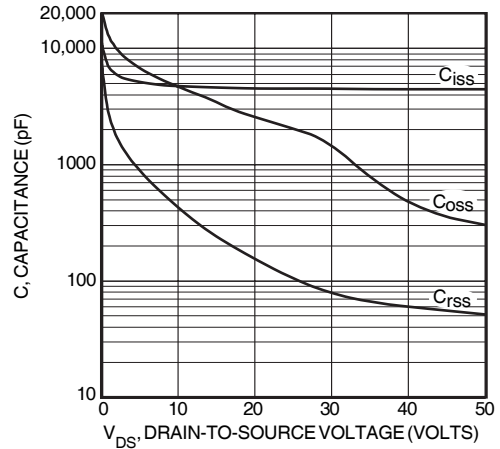


FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

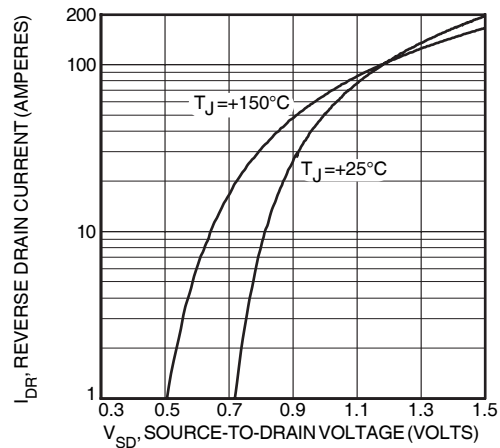


FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE

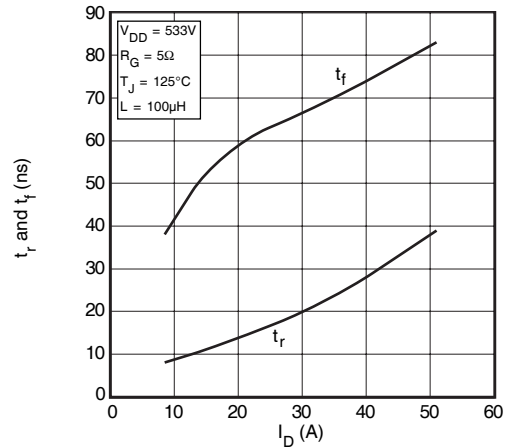


FIGURE 15, RISE AND FALL TIMES vs CURRENT

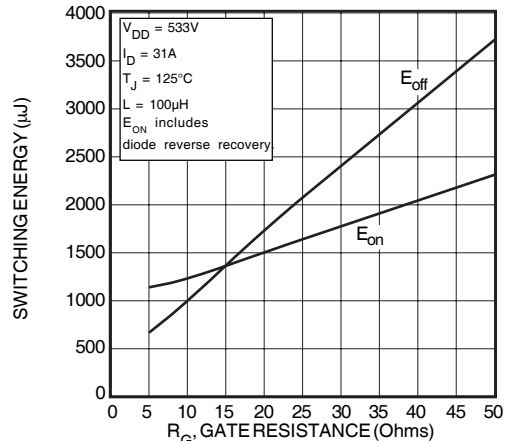


FIGURE 17, SWITCHING ENERGY vs. GATE RESISTANCE

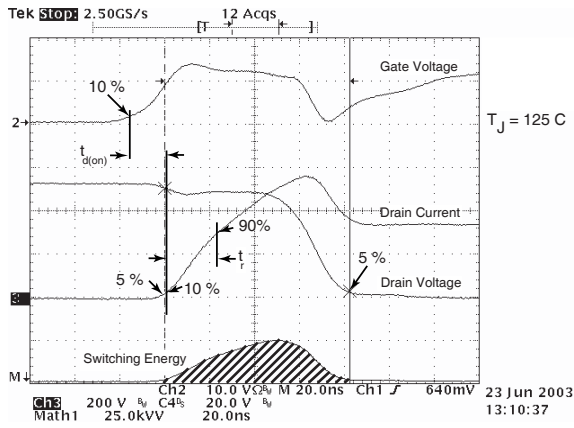


Figure 18, Turn-on Switching Waveforms and Definitions

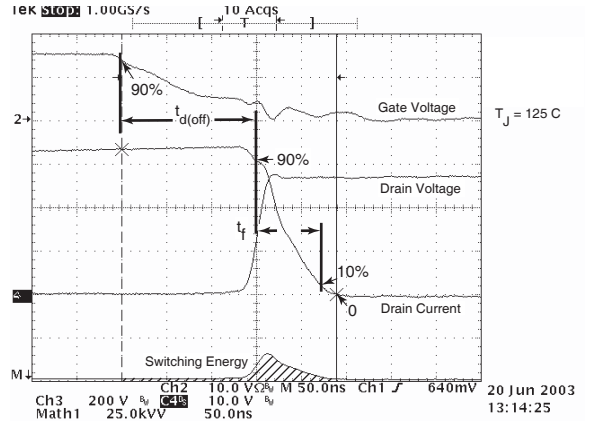


Figure 19, Turn-off Switching Waveforms and Definitions

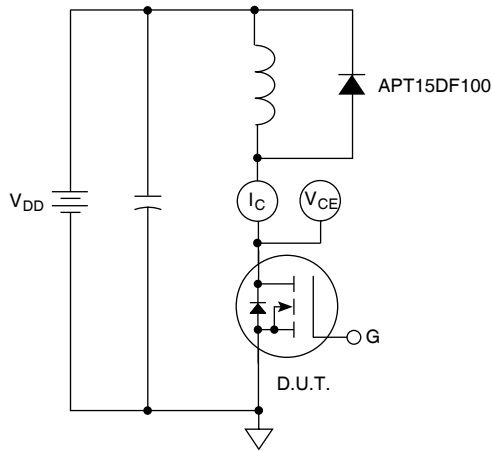
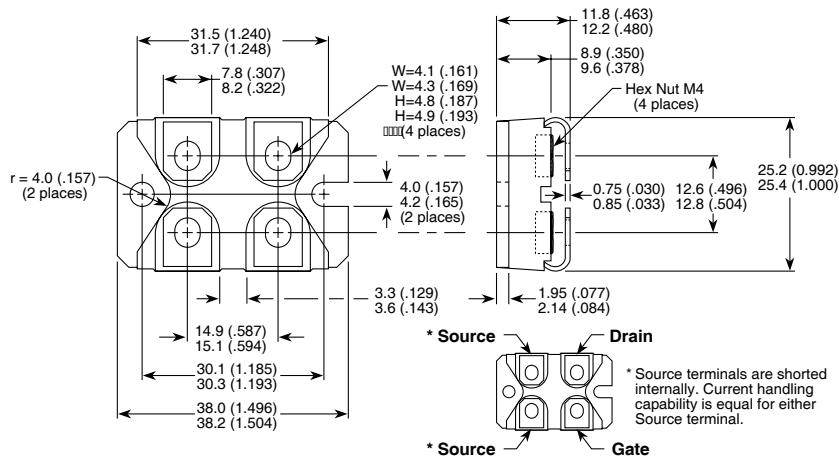


Figure 20, Inductive Switching Test Circuit

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)

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