

<b>V<sub>DSS</sub> , -60V</b> <b>R<sub>DS(ON)</sub> , 170mΩ (max.) @ V<sub>GS</sub>=-10V</b> <b>R<sub>DS(ON)</sub> , 215mΩ (max.) @ V<sub>GS</sub>=-4.5V</b> <b>I<sub>D</sub> , -4.9A</b>	<b>SOP-8</b>	

Description	Features
<p>The SG60P48S uses advanced Trench technology and designs to provide excellent R<sub>DS(ON)</sub> with low gate charge. This device is suitable for use in PWM, load switching and general purpose applications.</p>	<ul style="list-style-type: none"> <li>• Low On-Resistance</li> <li>• Low Input Capacitance</li> <li>• Low Miller Charge</li> <li>• Pb-free lead plating; RoHS compliant</li> </ul>
	<b>Applications</b> <ul style="list-style-type: none"> <li>• Motor / Body Load Control</li> <li>• Automotive Systems</li> <li>• Load Switch</li> <li>• DC-DC converters and Off-line UPS</li> </ul>

## Ordering Information

Ordering Code	RoHS Status	Package	Package Code	Packing	Quantity
SG60P48S	Halogen-Free	SOP-8	S	Tape & Reel	3,000

## Absolute Maximum Ratings (T<sub>A</sub>=25°C unless otherwise noted)

Parameter		Symbol	Value	Unit
Drain-Source Voltage		V <sub>DS</sub>	-60	V
Gate-Source Voltage		V <sub>GS</sub>	±20	V
Drain Current-Continuous	T <sub>A</sub> =25°C	I <sub>D</sub>	-4.9	A
	T <sub>A</sub> =75°C		-3.1	A
Drain Current-Pulsed <sup>Note 1</sup>		I <sub>DM</sub>	-23	A
Maximum Power Dissipation	T <sub>A</sub> =25°C	P <sub>D</sub>	1.5	W
	T <sub>A</sub> =75°C		0.9	W
Operating Junction Temperature Range		T <sub>J</sub> T <sub>STG</sub>	-55 to +150	°C

## Thermal Resistance Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Maximum Junction-to-Ambient <sup>Note 2</sup>	R <sub>θJA</sub>	Steady State	-	-	85	°C/W
Maximum Junction-to-Case	R <sub>θJC</sub>	Steady State	-	-	32	°C/W

**Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)**

OFF CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA	-60	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-48V, V <sub>GS</sub> =0V	-	-	-1	μA
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA

ON CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA	-1	-	-2.5	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>DS</sub> =-2A	-	-	170	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>DS</sub> =-1A	-	-	215	mΩ
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> =-5V, I <sub>DS</sub> =-3A	-	8.5	-	S

DYNAMIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V, f=1MHz	-	409	-	pF
Output Capacitance	C <sub>oss</sub>		-	27	-	
Reverse Transfer Capacitance	C <sub>rss</sub>		-	26	-	

SWITCHING CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Turn-On Delay Time	T <sub>d(on)</sub>	V <sub>DS</sub> =-15V, I <sub>DS</sub> =-1A, V <sub>GS</sub> =-10V, R <sub>GEN</sub> =3Ω	-	4.4	-	ns
Rise Time	t <sub>r</sub>		-	19.8	-	
Turn-Off Delay Time	T <sub>d(off)</sub>		-	63.0	-	
Fall Time	t <sub>f</sub>		-	27.5	-	
Total Gate Charge at 10V	Q <sub>g</sub>	V <sub>DS</sub> =-48V, I <sub>DS</sub> =-3A, V <sub>GS</sub> =-4.5V	-	4.1	-	nC
Gate to Source Gate Charge	Q <sub>gs</sub>		-	1.7	-	
Gate to Drain "Miller" Charge	Q <sub>gd</sub>		-	1.6	-	

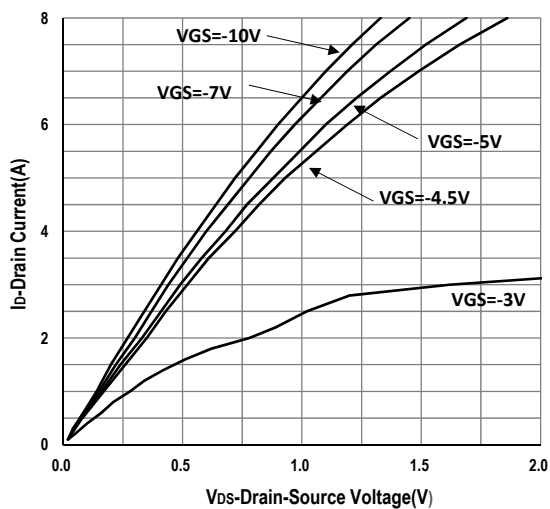
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =-1A	-	-	-1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	V <sub>DS</sub> =-48V, I <sub>F</sub> =-3A, dI/dt=100A/μs	-	10.2	-	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>		-	5.1	-	nC

**Notes:**

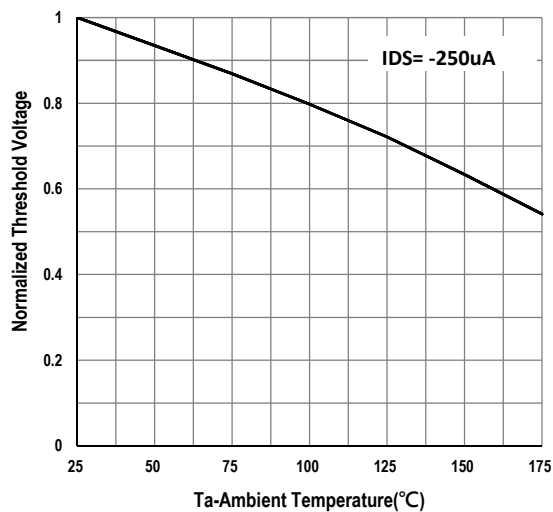
- Pulse Test: Pulse Width ≤ 10ms, Duty Cycle ≤ 1%.
- R<sub>θJA</sub> is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R<sub>θJC</sub> is guaranteed by design while R<sub>θCA</sub> is determined by the user's board design. R<sub>θJA</sub> shown below for single device operation on FR-4 in still air.

## Typical Operating Characteristics

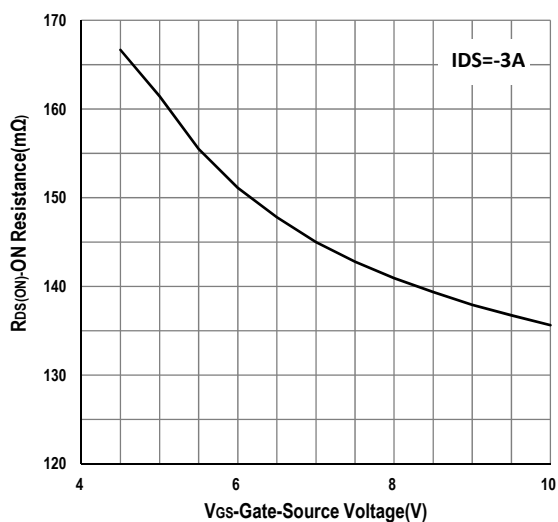
Output Characteristics



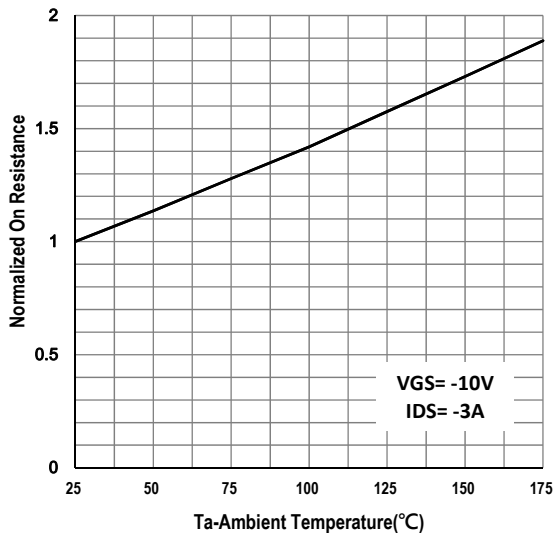
Gate Threshold Voltage



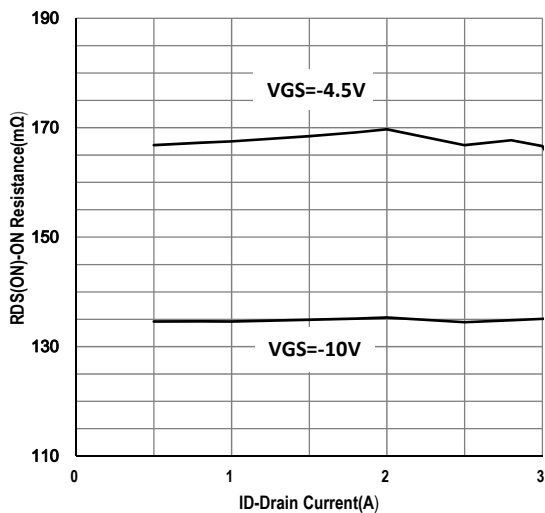
Gate-Source On Resistance



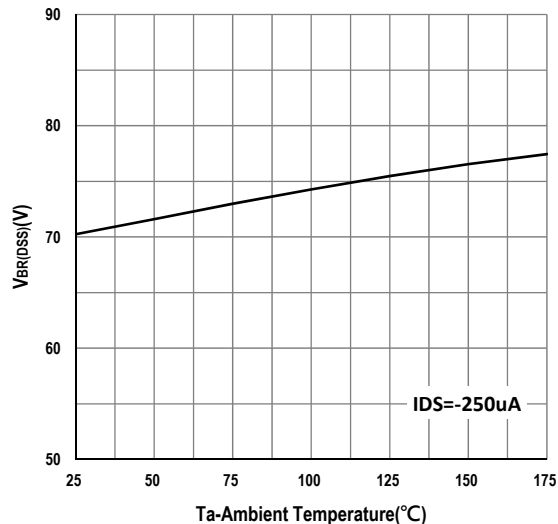
Drain-Source On Resistance



Drain-Source On Resistance

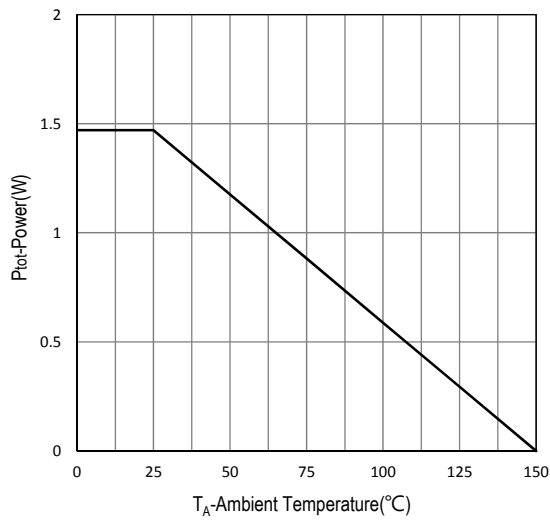


Drain-source Breakdown Voltage

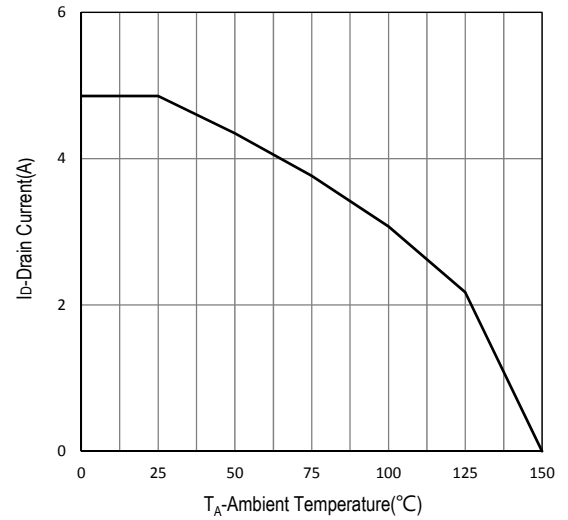


## Typical Operating Characteristics (Cont.)

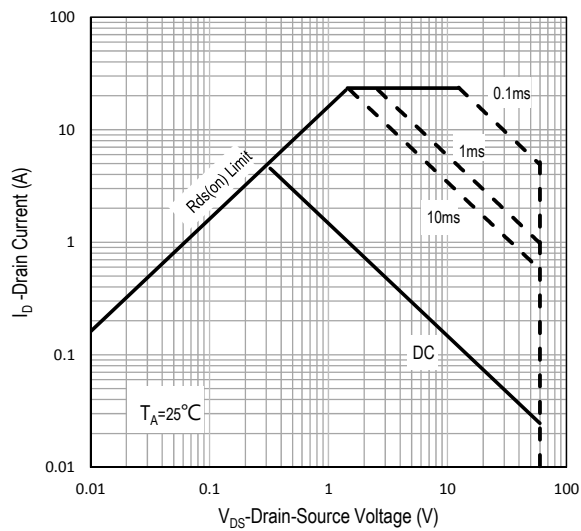
**Power Dissipation**



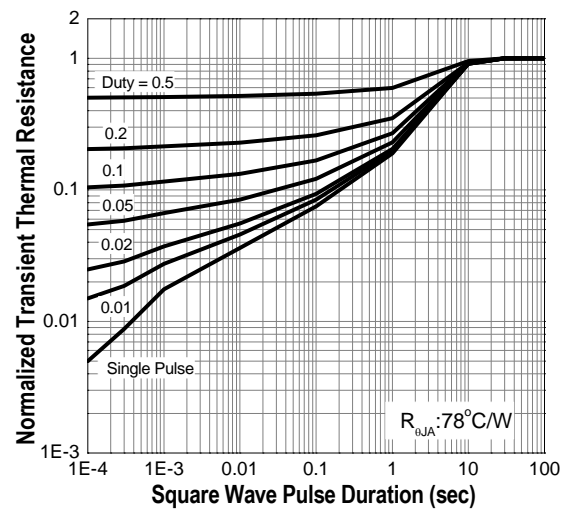
**Drain Current**



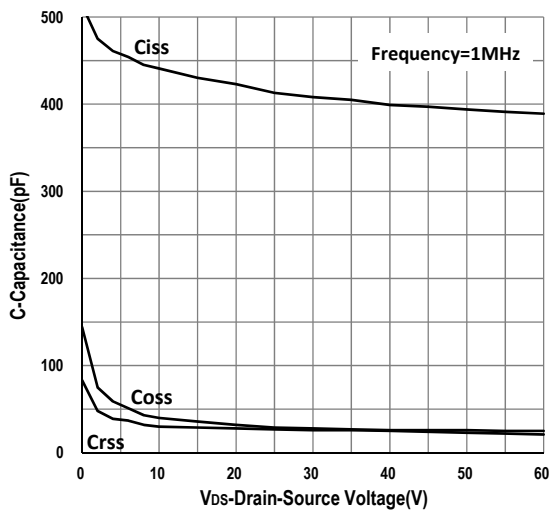
**Safe Operation Area**



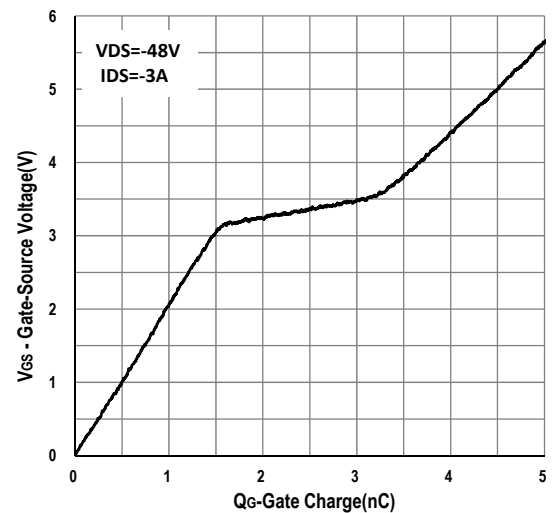
**Transient Thermal Impedance**




**Capacitance**



**Gate Charge**

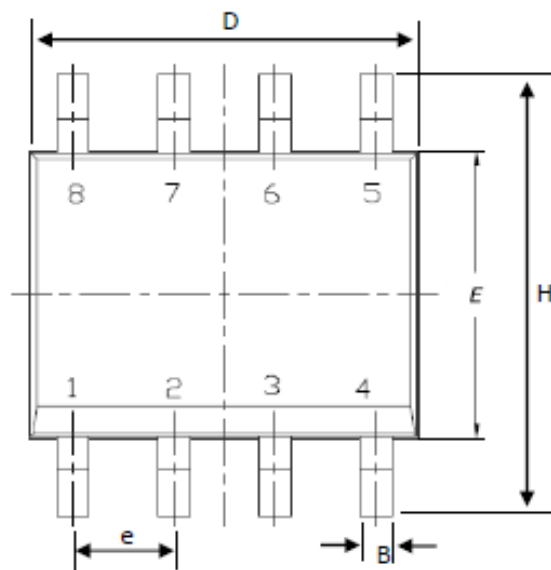


## Marking Information

SOP-8 (S)	Marking Rule
<p>Laser Marking</p>  <p>Diagram</p>	<p><u>Line 1</u> : Device Name SG60P48S</p> <p><u>Line 2</u> : Date Code YYMMXXX</p> <p>YY : Year Code MM : Month Code XXX : Serial Number</p>

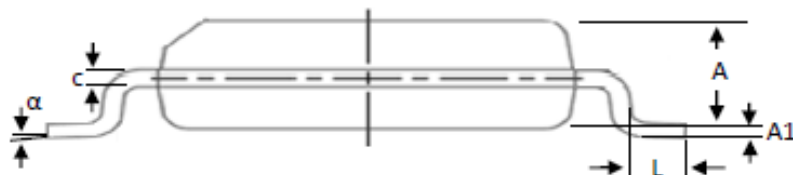
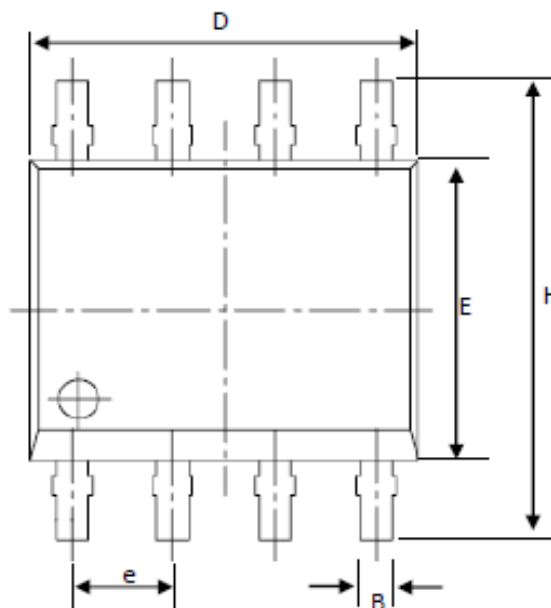
## Package of Dimension

G-TYPE



Symbol	Min	Nor	Max
A	1.35	1.55	1.75
A1	0.10	0.18	0.25
B	0.31	0.41	0.51
c	0.17	0.21	0.25
D	4.80	4.90	5.00
E	3.80	3.90	4.00
e	1.27	1.27	1.27
H	5.80	6.00	6.20
L	0.40	0.84	1.27
$\alpha$	0.00	4.00	8.00

B-TYPE

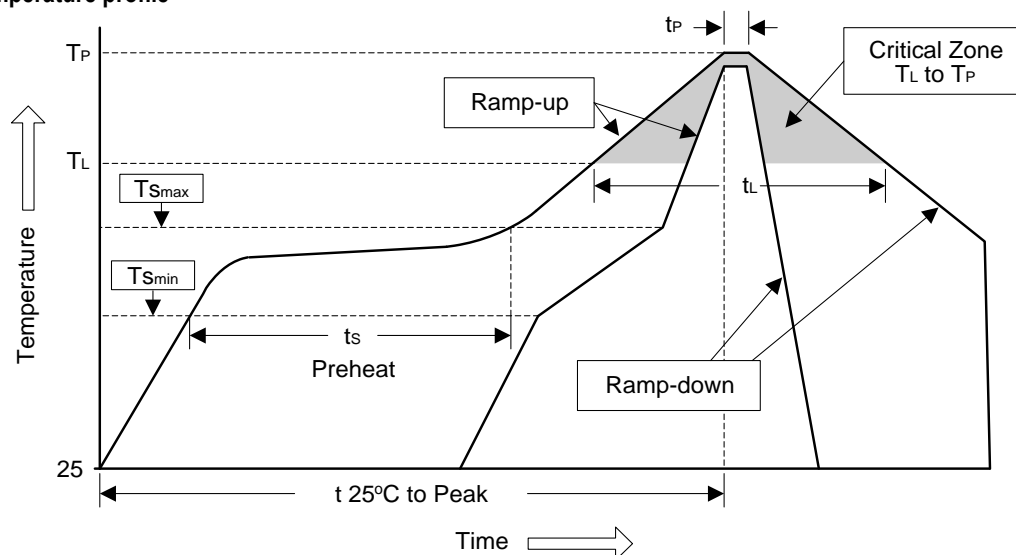


1. All dimension are in millimeters.
2. Dimension does not include burrs and mold flash/protrusions.

## Soldering Methods for Silicongear's Products

1. Storage environment: Temperature=10°C to 35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate ( $T_L$ to $T_P$ )	<3°C/sec	<3°C/sec
Preheat		
- Temperature Min ( $T_{Smin}$ )	100°C	150°C
- Temperature Max ( $T_{Smax}$ )	150°C	200°C
- Time (min to max) ( $t_s$ )	60 to 120 sec	60 to 180 sec
$T_{Smax}$ to $T_L$		
- Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above:		
- Temperature ( $T_L$ )	183°C	217°C
- Time ( $t_L$ )	60 to 150 sec	60 to 150 sec
Peak Temperature ( $T_P$ )	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature ( $t_P$ )	10 to 30 sec	20 to 40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

### 3. Flow (wave) soldering (solder dipping)

Products	Peak Temperature	Dipping Time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec

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