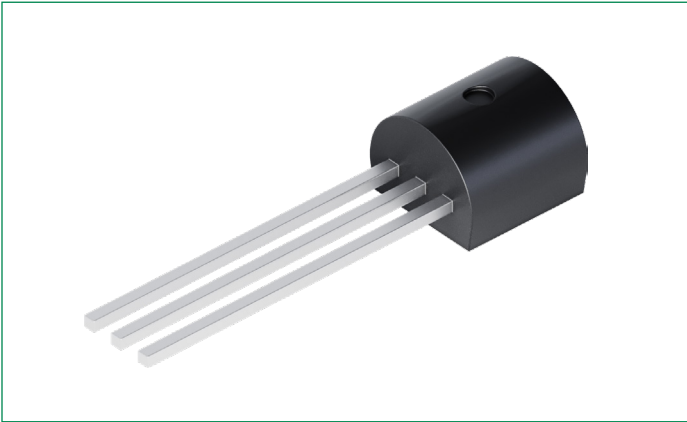


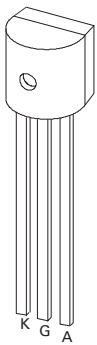
# S8X5ECs EV Series

## 0.5 A Sensitive SCRs

HF RoHS

### Pinout Diagram

TO-92



**A:** Anode; **K:** Cathode; **G:** Gate

### Description

The S8X5ECs series offers a high static  $dv/dt$  with a low turn off ( $t_q$ ) time. It is specifically designed for Ground Fault Circuit Interrupter (GFCI), Arc-Fault Circuit Interrupter (AFCI), Residual Current Device (RCD), and Residual Current Circuit Breaker with Overload Protection (RCBO) applications. All SCR junctions are glass-passivated to ensure long term reliability and parametric stability.

### Features

- RoHS compliant and halogen-free
- Through-hole package
- Blocking voltage ( $V_{DRM} / V_{RRM}$ ) capability up to 800 V
- Surge current capability < 20 A
- Sensitive gate for direct microprocessor interface
- High  $dv/dt$  noise immunity
- Improved turn-off time ( $t_q$ )
- Non-repetitive direct surge peak off-state voltage ( $V_{DSM}$ ) up to 1150 V
- Non-repetitive reverse surge peak off-state voltage ( $V_{RSM}$ ) up to 900 V

### Applications

- Ground Fault Circuit Interrupter (GFCI) applications
- Arc-Fault Circuit Interrupter (AFCI) applications
- Residual Current Device (RCD) applications
- Residual Current Circuit Breaker with Overload Protection (RCBO) applications

### Product Summary

Characteristic	Value	Unit
$I_{T(RMS)}$	0.5	A
$V_{DRM} / V_{RRM}$	800	V
$V_{DSM} (t_p = 50 \mu s)$	1150	V
$V_{RSM} (t_p = 50 \mu s)$	900	V
$I_{GT}$	5 to 450	$\mu A$

## Maximum Ratings

Symbol	Characteristics	Conditions		Value	Units	
$I_{T(RMS)}$	On-state RMS Current	Full sine wave	$T_C = 85^\circ\text{C}$	0.5	A	
$I_{T(AV)}$	Average On-state Current	$T_C = 85^\circ\text{C}$		0.3	A	
$I_{TSM}$	Non-repetitive Surge Peak On-state Current	Half-sine wave	$f = 50\text{ Hz}$	$T_{vj}$ initial = $25^\circ\text{C}$	10	A
			$f = 60\text{ Hz}$		12	
$I^2t$	$I^2t$ Value for Fusing	$t_p = 10\text{ ms}$	$f = 50\text{ Hz}$	0.5	$\text{A}^2\text{s}$	
$di/dt$	Critical Rate of Rise of On-state Current	$I_G = 10\text{ mA}$	$T_{vj} = 125^\circ\text{C}$	80	$\text{A}/\mu\text{s}$	
$I_{GM}$	Peak Gate Current	$t_p = 20\ \mu\text{s}$	$T_{vj} = 125^\circ\text{C}$	0.5	A	
$P_{G(AV)}$	Average Gate Power Dissipation	$T_{vj} = 125^\circ\text{C}$		0.2	W	
$T_{stg}$	Storage Temperature Range	-		-40 to 150	$^\circ\text{C}$	
$T_{vj}$	Virtual Junction Temperature Range	-		-40 to 125	$^\circ\text{C}$	

## Electrical Characteristics ( $T_{vj} = 25^\circ\text{C}$ , unless otherwise specified)

Symbol	Characteristics	Conditions	S8X5ECS			S8X5ECS2			Units
			Min.	Typ.	Max.	Min.	Typ.	Max.	
$I_{GT}$	DC Gate Trigger Current	$V_D = 6\text{ V}, R_L = 100\ \Omega$	20	-	-	20	-	-	$\mu\text{A}$
			-	-	100	-	-	50	
$V_{GT}$	DC Gate Trigger Voltage	$V_D = 6\text{ V}, R_L = 100\ \Omega$	-	-	0.8	-	-	0.8	V
$V_{GRM}$	Peak Reverse Gate Voltage	$I_{RG} = 10\ \mu\text{A}$	8	-	-	8	-	-	V
$V_{GD}$	Gate Non-trigger Voltage	$V_D = \frac{1}{2}V_{DRM}, R_{GK} = 1\text{ k}\Omega, T_{vj} = 125^\circ\text{C}$	0.2	-	-	0.2	-	-	V
$I_H$	Holding Current	$R_{GK} = 1\text{ k}\Omega$ , Initial current = 20 mA	-	-	3	-	-	3	mA
$dv/dt_{(cr)}$	Critical Rate-of-rise of Off-stage Voltage	$T_{vj} = 125^\circ\text{C}, V_D = \frac{2}{3}V_{DRM}$ , Exp. Waveform, $R_{GK} = 1\text{ k}\Omega$	40	-	-	40	-	-	$\text{V}/\mu\text{s}$
$t_q$	Turn-off Time	$I_T = 0.5\text{ A}$	-	-	35	-	-	35	$\mu\text{s}$
$t_{gt}$	Turn-on Time	$I_G = 10\text{ mA}, P_W = 15\ \mu\text{s}, I_T = 1.6\text{ A}_{pk}$	-	2.3	-	-	2.3	-	$\mu\text{s}$

## Static Characteristics ( $T_{vj} = 25^\circ\text{C}$ , unless otherwise specified)

Symbol	Characteristics	Conditions	Maximum Value	Units
$V_{TM}$	Peak On-state Voltage	0.5 A device, $I_{TM} = 4\text{ A}, t_p = 380\ \mu\text{s}$	1.8	V
$V_{T0}$	Threshold Voltage	-	1.03	V
$r_T$	Slope Resistance	-	106	$\text{m}\Omega$
$I_{DRM}/I_{RRM}$	Repetitive Peak Off-state Current	$T_{vj} = 25^\circ\text{C}$	3	$\mu\text{A}$
		$T_{vj} = 125^\circ\text{C}$	500	

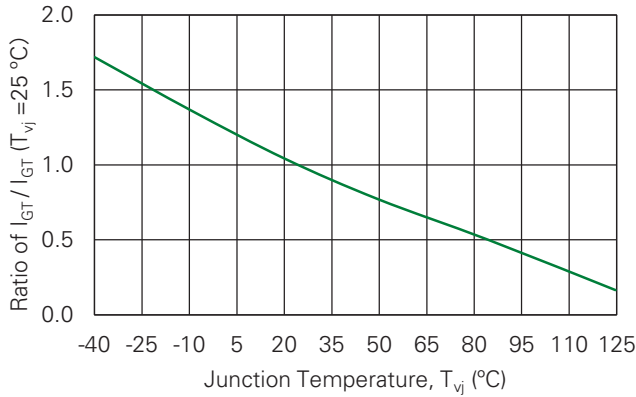
## Thermal Characteristics

Symbol	Characteristics	Conditions	Value	Units
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (AC)	$I_T = 0.8\text{ A}_{(RMS)}$ <sup>1</sup>	35	$\text{K}/\text{W}$
$R_{th(j-a)}$	Thermal Resistance, Junction to Ambient	$I_T = 0.8\text{ A}_{(RMS)}$ <sup>1</sup>	150	$\text{K}/\text{W}$

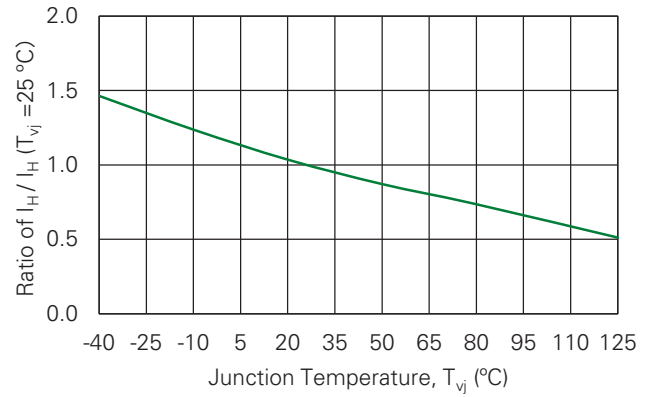
Note 1: 60 Hz AC resistive load condition, 100% conduction

**Characteristic Curves**

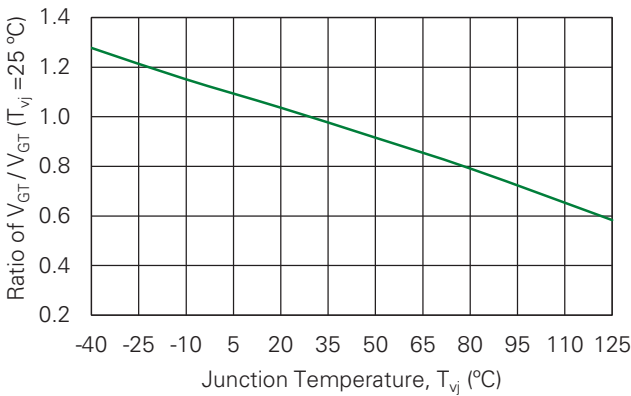
**Fig. 1. Normalized DC Gate Trigger Current for all Quadrants vs. Junction Temperature**



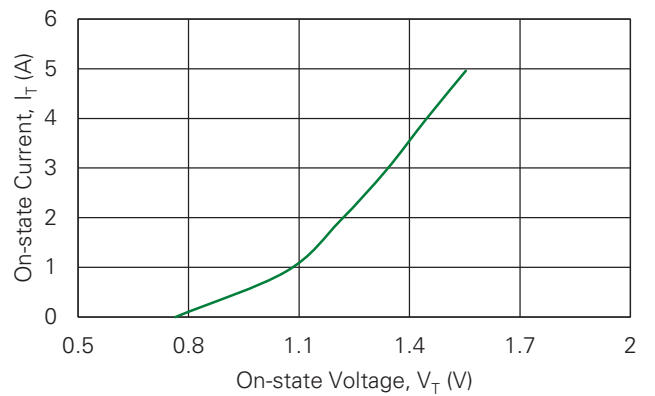
**Fig. 2. Normalized DC Holding Current vs. Junction Temperature**



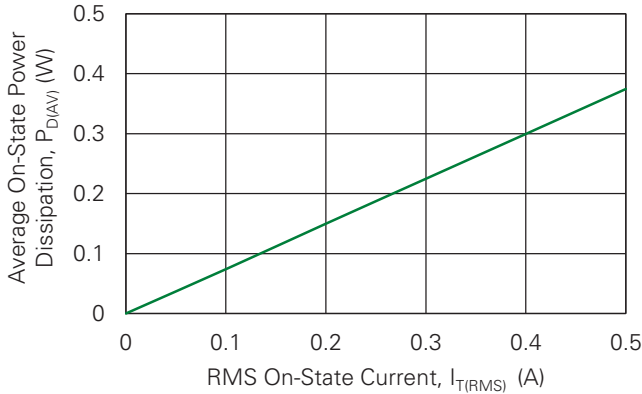
**Fig. 3. Normalized DC Gate Trigger Voltage vs. Junction Temperature**



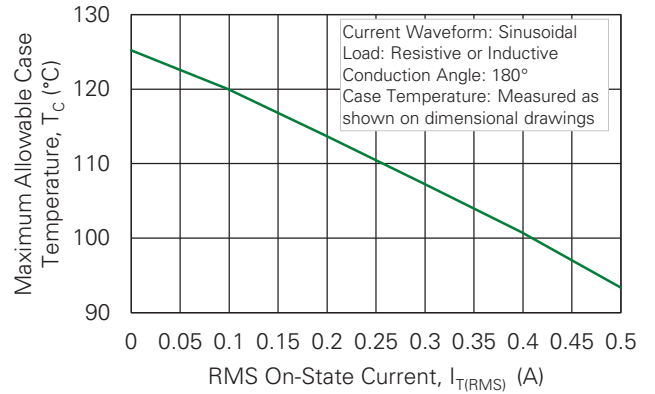
**Fig. 4. Typical On-state Current vs. On-state Voltage**



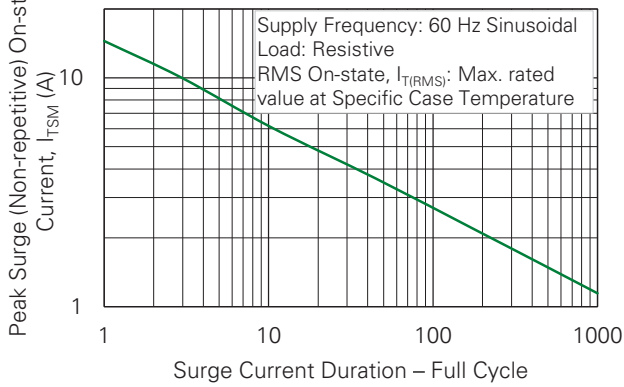
**Fig. 5. Typical Power Dissipation vs. RMS On-state Current**



**Fig. 6. Maximum Allowable Case Temperature vs. On-state Current**



**Fig. 7. Surge Peak On-state Current vs. Number of Cycles**

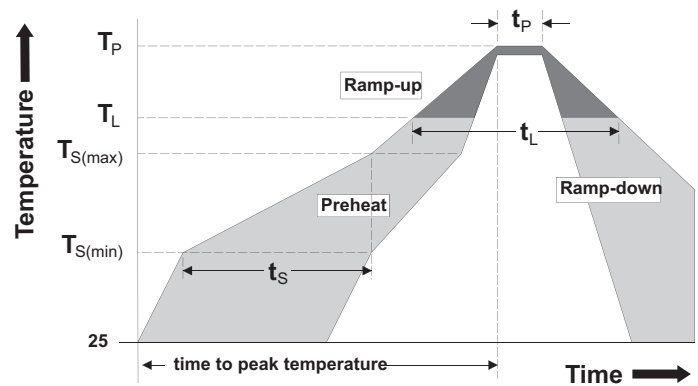


Notes:

1. Gate control may be lost during and immediately following surge current interval.
2. Overload may not be repeated until junction temperature has returned to steady-state rated value.

**Soldering Parameters**

Characteristic		Value
Reflow Condition		Pb – Free assembly
Pre-heat	Temperature Min ( $T_{s(min)}$ )	150°C
	Temperature Max ( $T_{s(max)}$ )	200°C
	Time (min to max) ( $t_s$ )	60 – 180 secs
Average ramp up rate (Liquidus Temp)( $T_L$ ) to peak		5°C/second max
$T_{s(max)}$ to $T_L$ - Ramp-up Rate		5°C/second max
Reflow	Temperature ( $T_L$ ) (Liquidus)	217°C
	Time ( $t_L$ )	60 – 150 seconds
Peak Temperature ( $T_p$ )		260 <sup>+0/-5</sup> °C
Time within 5°C of actual peak Temperature ( $t_p$ )		20 – 40 seconds
Ramp-down Rate		5°C/second max
Time 25°C to peak Temperature ( $T_p$ )		8 minutes max
Do Not Exceed		280°C



**Environmental Specifications**

Test	Specifications and Conditions
AC Blocking	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 125 °C for 1008 hours
Temperature Cycling	MIL-STD-750, M-1051, 1000 cycles; -55 °C to +150 °C; 15-min dwell-time
Temperature/Humidity	EIA / JEDEC, JESD22-A101, 1008 hours; 320 V - DC: 85 °C; 85 % relative humidity
UHASt	JESD22-A118, 96 hours, 130 °C, 85 %RH
High-temperature Storage	MIL-STD-750, M-1031, 1008 hours; 150 °C
Low-temperature Storage	1008 hours; -40 °C
Resistance to Solder Heat	MIL-STD-750: Method 2031
Solderability	ANSI/J-STD-002: category 3, Test A
Lead Bend	MIL-STD-750, M-2036 Cond E

**Physical Specifications**

Characteristic	Value
Terminal Finish	100% Matte Tin-plated
Body Material	UL Recognized compound meeting flammability rating V-0
Lead Material	Copper Alloy

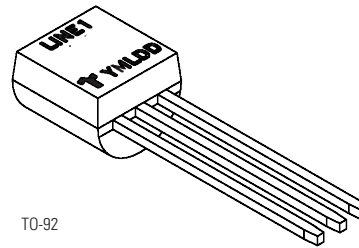
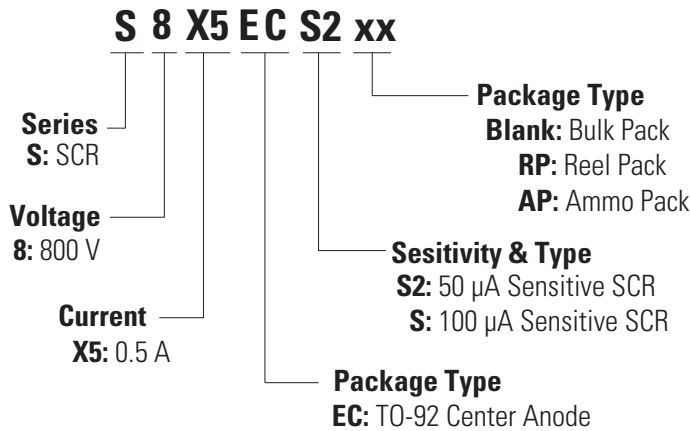
**Design Considerations**

Careful selection of the correct component for the application's operating parameters and environment will go a long way toward extending the operating life of the Thyristor. Good design practice should limit the maximum continuous current through the main terminals to 75% of the component rating. Other ways to ensure long life for a power discrete semiconductor are proper heat sinking and selection of voltage ratings for worst case conditions. Overheating, overvoltage (including dv/dt), and surge currents are the main killers of semiconductors. Correct mounting, soldering, and forming of the leads also help protect against component damage.

### Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
S8X5ECS	S8X5ECS	0.217 g	Bulk	2500
S8X5ECSR	S8X5ECS	0.217 g	Tape & Reel	2000
S8X5ECSAP	S8X5ECS	0.217 g	Ammo Pack	2000
S8X5ECS2	S8X5ECS2	0.217 g	Bulk	2500
S8X5ECS2RP	S8X5ECS2	0.217 g	Tape & Reel	2000
S8X5ECS2AP	S8X5ECS2	0.217 g	Ammo Pack	2000

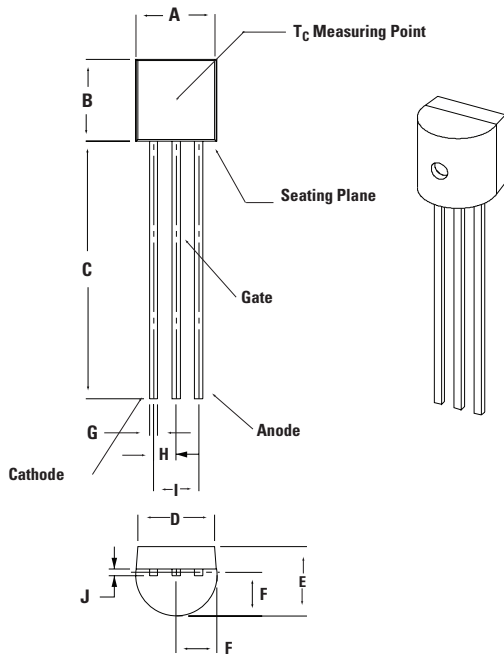
### Part Numbering and Marking



Line1 = Littelfuse Part Number  
Y = Last Digit of Calendar Year  
M = Letter Month Code (A-L for Jan-Dec)  
L = Location Code  
DD = Calendar Date

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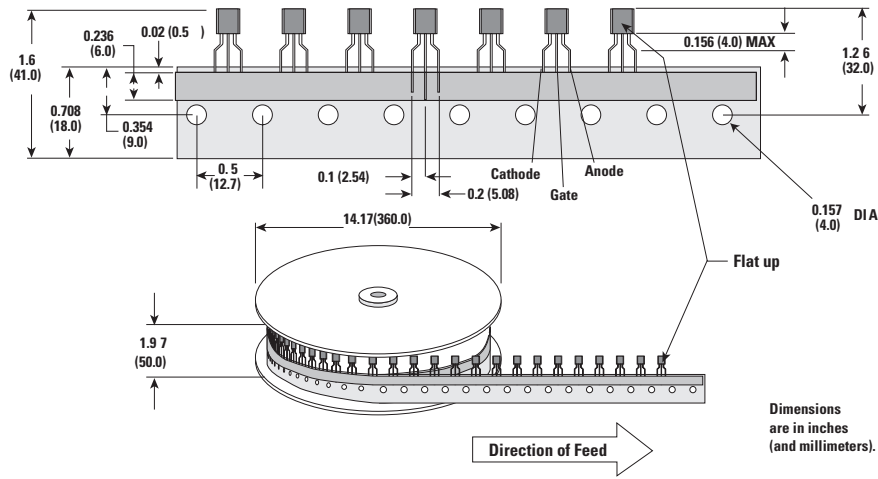
### Package Dimensions TO-92



Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.450	5.200	0.175	0.205
B	4.320	5.330	0.170	0.210
C	12.70	–	0.500	–
D	3.430	–	0.135	–
E	3.180	4.190	0.125	0.165
F	2.040	2.660	0.080	0.105
G	0.407	0.533	0.016	0.021
H	1.150	1.390	0.045	0.055
I	2.420	2.660	0.095	0.105
J	0.380	0.500	0.015	0.020

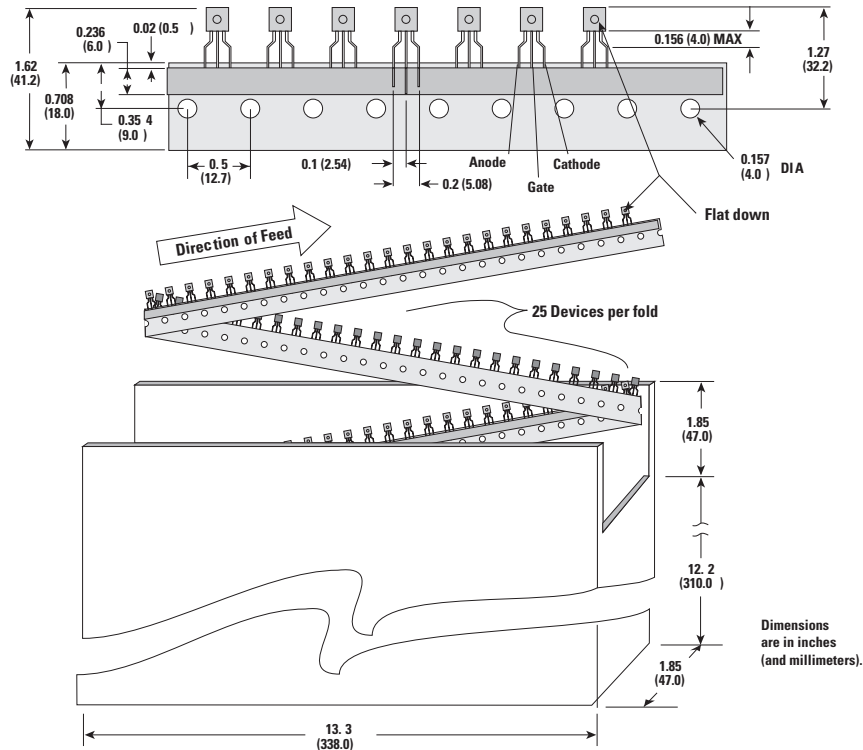
### TO-92 (3-lead) Reel Pack (RP) Radial Leaded Specifications

Meets all EIA-468-C Standards



### TO-92 (3-lead) Ammo Pack (AP) Radial Leaded Specifications

Meets all EIA-468-C Standards



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Part of:

