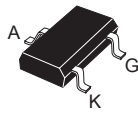
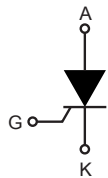


## 0.8 A sensitive gate SCR thyristor in SOT23-3L



SOT23-3L



### Features

- On-state rms current, 0.8 A sensitive
- Repetitive peak off-state voltage, 600 V
- Non-repetitive surge peak off-state voltage, 750 V
- Narrow sensitive gate current range [30 to 150]  $\mu\text{A}$
- Compact SOT23-3L package:
  - Creepage distance of 1.1 mm
  - 9 mm<sup>2</sup> footprint

### Applications

- Ground-fault circuit interrupter (GFI)
- Arc-fault circuit interrupter (AFCI)
- Overvoltage crowbar protection in power supplies
- Capacitive ignition circuits
- Low consumption triggering switches

### Description

Thanks to highly sensitive triggering levels, X0115ML SCR thyristor is suitable for all applications where available gate current is limited. The X0115ML offers a high blocking voltage of 600 V, and a surge peak voltage of 750 V, ideal for applications like ground fault circuit interrupter (GFCI) and arc fault circuit interrupters (AFCI).

The SOT23-3L package provides the smallest SCR footprint while keeping 1.1 mm creepage distance, guaranteeing 120 V functional insulation (UL-840) at level 2 pollution degree without extra certification.

Product status link	
<a href="#">X0115ML</a>	
Product summary	
$I_{T(RMS)}$	0.8 A
$V_{DRM}/V_{RRM}$	600 V
$V_{DSM}/V_{RSM}$	750 V
$I_{GT}$	[30-150] $\mu\text{A}$

# 1 Characteristics

**Table 1. Absolute maximum ratings (limiting values)**

Symbol	Parameters		Value	Unit	
$I_{T(RMS)}$	On-state RMS current (180° conduction angle)		0.8	A	
$I_{T(AV)}$	Average on-state current (180° conduction angle)				
$I_{TSM}$	Non repetitive surge peak on-state current ( $T_j$ initial = 25 °C)	$t_p = 8.3$ ms	7.6	A	
		$t_p = 10$ ms			
	One surge every 500 ms, 50 surges	$t_p = 8.3$ ms	$T_{AMB} = 105$ °C		5
$I^2t$	$I^2t$ value for fusing	$t_p = 10$ ms	$T_j = 25$ °C	0.25	A <sup>2</sup> s
$di/dt$	Critical rate of rise of on-state current $I_G = 2 \times I_{GT}$ , $t_r \leq 100$ ns	$f = 60$ Hz	$T_j = 25$ °C	75	A/ $\mu$ s
$V_{DRM} / V_{RRM}$	Repetitive peak off-state voltage		$T_j = 125$ °C	600	V
$V_{DSM} / V_{RSM}$	Non repetitive surge peak off-state voltage	$t_p = 10$ ms	$T_j = 25$ °C	750	V
$I_{GM}$	Peak forward gate current	$t_p = 20$ $\mu$ s	$T_j = 125$ °C	1.2	A
$P_{G(AV)}$	Average gate power dissipation		$T_j = 125$ °C	0.2	W
$T_{stg}$	Storage junction temperature range			-40 to +150	°C
$T_j$	Operating junction temperature range			-40 to +125	°C

**Table 2. Electrical characteristics ( $T_j = 25$  °C, unless otherwise specified)**

Symbol	Parameters	Value		Unit
		Min.	Max.	
$I_{GT}$	$V_D = 12$ V, $R_L = 33$ $\Omega$	30	150	$\mu$ A
$V_{GT}$		0.8		V
$V_{GD}$	$V_D = V_{DRM}$ , $R_L = 3.3$ k $\Omega$ , $R_{GK} = 1$ k $\Omega$ , $T_j = 125$ °C	0.2		V
$V_{RG}$	$I_{RG} = 10$ $\mu$ A	5		V
$I_H$	$I_T = 50$ mA, gate open, $R_{GK} = 1$ k $\Omega$	5		mA
$I_L$	$I_G = 1.2 I_{GT}$ , $R_{GK} = 1$ k $\Omega$	6		mA
$dV/dt$	$V_D = 67\%$ $V_{DRM}$ , gate open, $R_{GK} = 1$ k $\Omega$ , $T_j = 125$ °C	80		V/ $\mu$ s

**Table 3. Static characteristics**

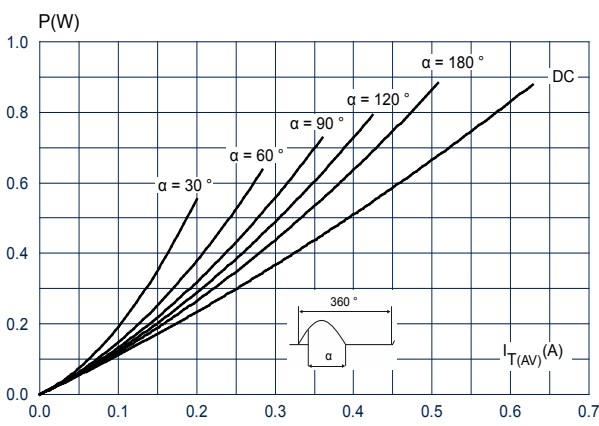
Symbol	Test conditions		Value		Unit	
$V_{TM}$	$I_{TM} = 1.6$ A, $t_p = 380$ $\mu$ s	$T_j = 25$ °C	Max.	1.7	V	
$V_{TO}$	Threshold on-state voltage		$T_j = 125$ °C	Max.	1.06	V
$R_d$	Dynamic resistance		$T_j = 125$ °C	Max.	540	m $\Omega$
$I_{DRM} / I_{RRM}$	$V_T = V_{DRM}$ , $V_T = V_{RRM}$ , $R_{GK} = 1$ k $\Omega$	$T_j = 25$ °C	Max.	1	$\mu$ A	
		$T_j = 125$ °C		150	$\mu$ A	

**Table 4. Thermal resistance**

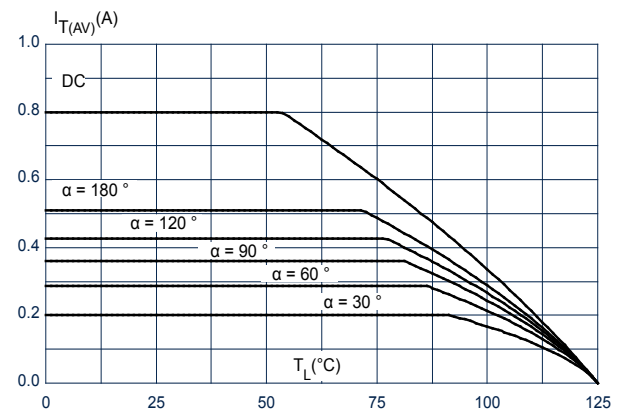
Symbol	Parameters	Value	Unit
$R_{th(j-l)}$	Junction to lead (DC)	Typ. 60	°C/W
$R_{th(j-a)}$	Junction to ambient (DC) for 5 cm <sup>2</sup> copper surface	Typ. 400	

## 1.1 Characteristics (curves)

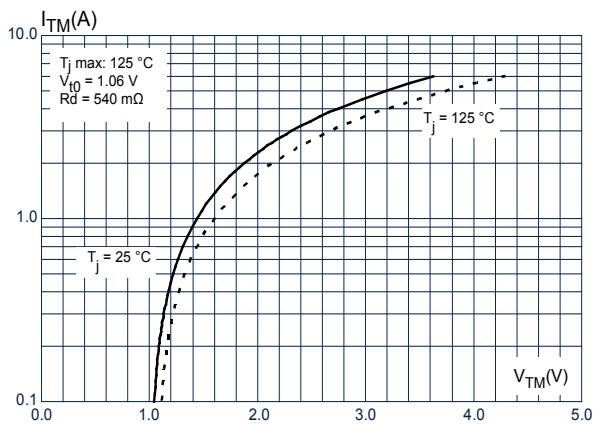
**Figure 1. Maximum average power dissipation versus average on-state current**



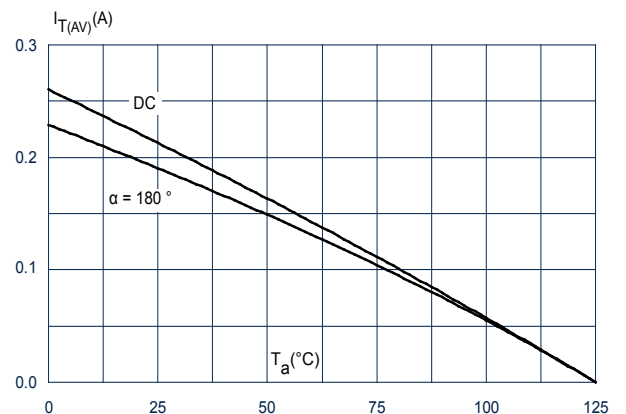
**Figure 2. Average and DC on-state current versus lead temperature**



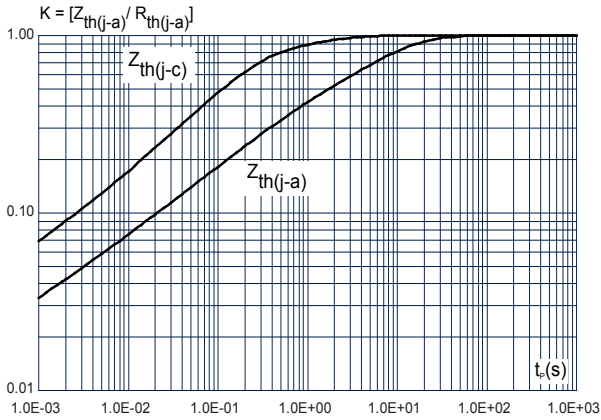
**Figure 3. On-state characteristics (maximum values)**



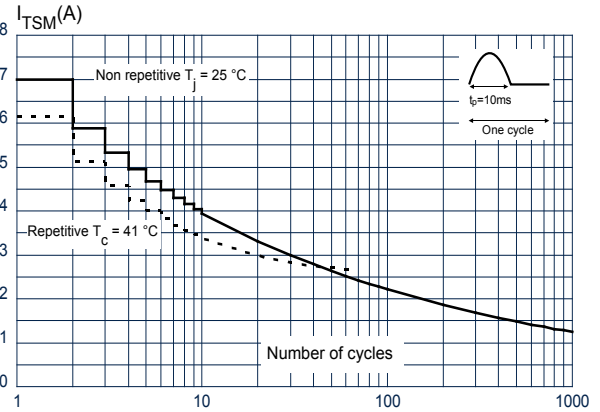
**Figure 4. Average and D.C. on-state current versus ambient temperature**



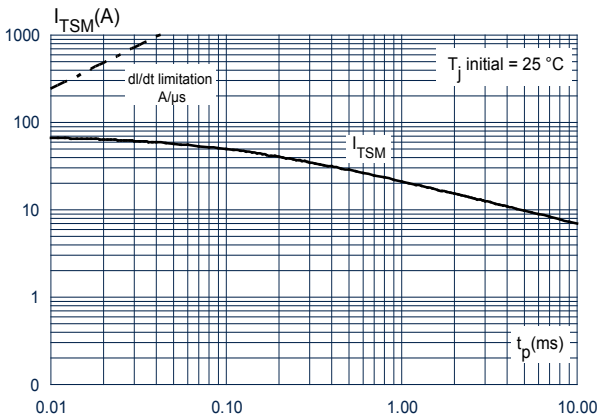
**Figure 5. Relative variation of thermal impedance junction to case and junction to ambient versus pulse duration**



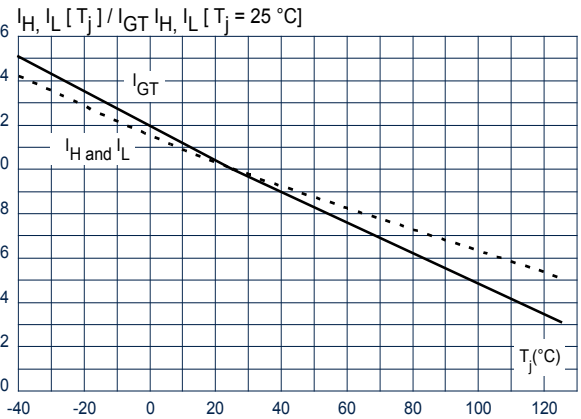
**Figure 6. Surge peak on-state current versus number of cycles**



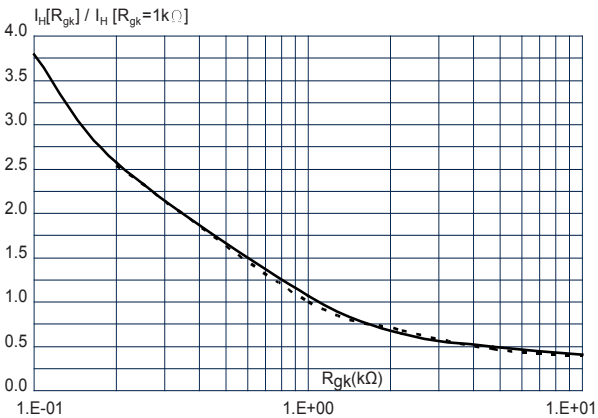
**Figure 7. Non repetitive surge peak on-state current for a sinusoidal pulse with width  $t_p < 10$  ms**



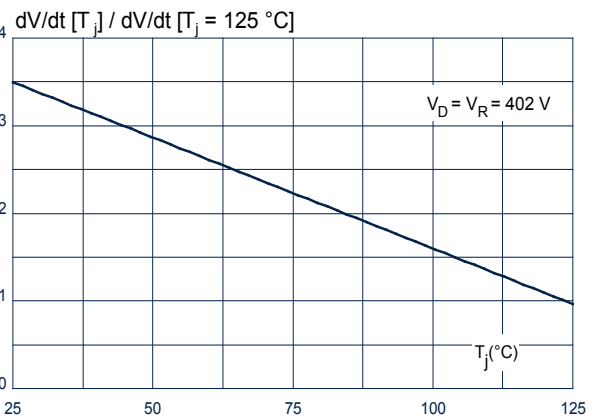
**Figure 8. Relative variation of gate trigger current, holding current and latching current versus junction temperature (typical values)**



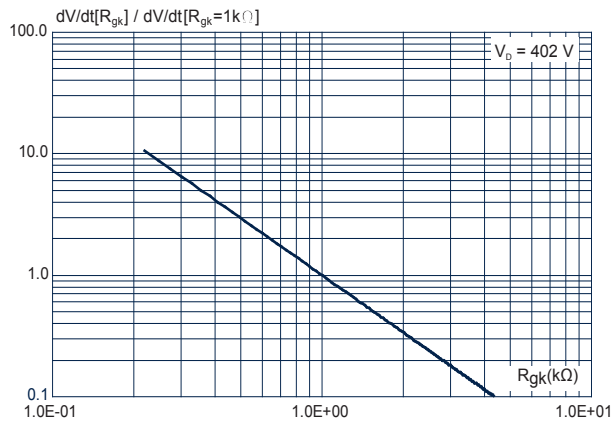
**Figure 9. Relative variation of holding current versus gate-cathode resistance (typical values)**



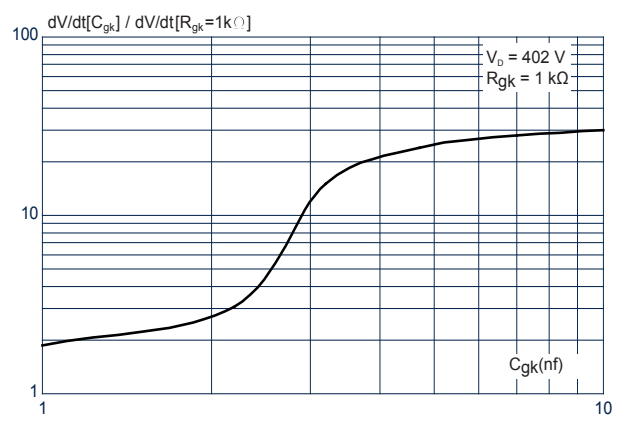
**Figure 10. Relative variation of static dV/dt immunity versus junction temperature**



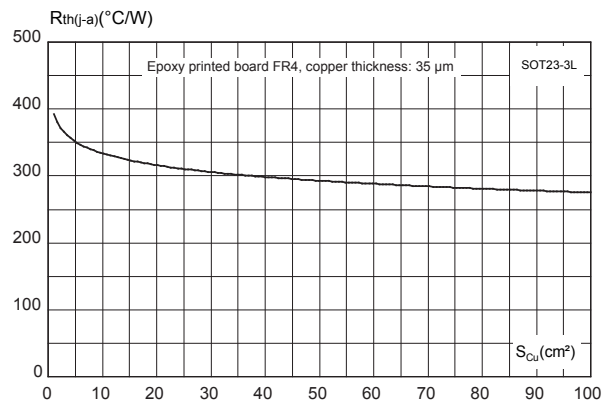
**Figure 11. Relative variation of dV/dt immunity versus gate-cathode resistance (typical values)**



**Figure 12. Relative variation of dV/dt immunity versus gate-cathode capacitance (typical values)**



**Figure 13. Typical thermal resistance junction to ambient versus copper surface under anode (epoxy FR4,  $e_{Cu} = 35\mu m$ , SOT-23-3L)**



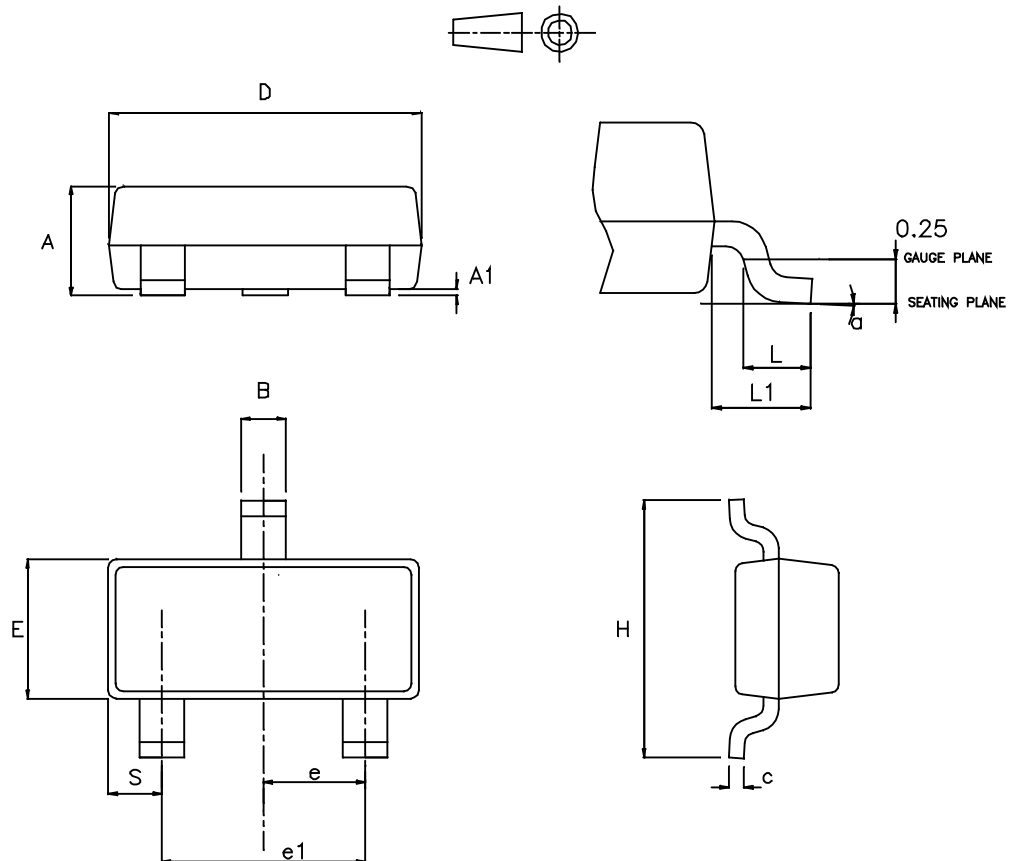
## 2 Package information

In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

### 2.1 SOT23-3L package information

- Lead-free package
- Halogen free molding resin
- Epoxy meets UL94, V0

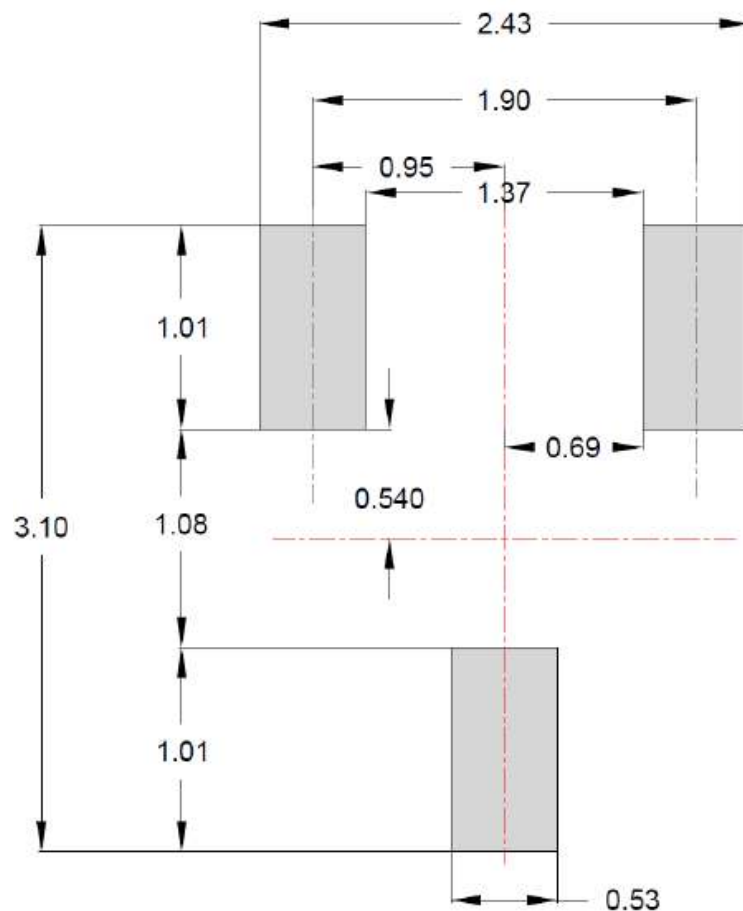
**Figure 14. SOT23-3L package outline**



**Table 5. SOT23-3L package mechanical data**

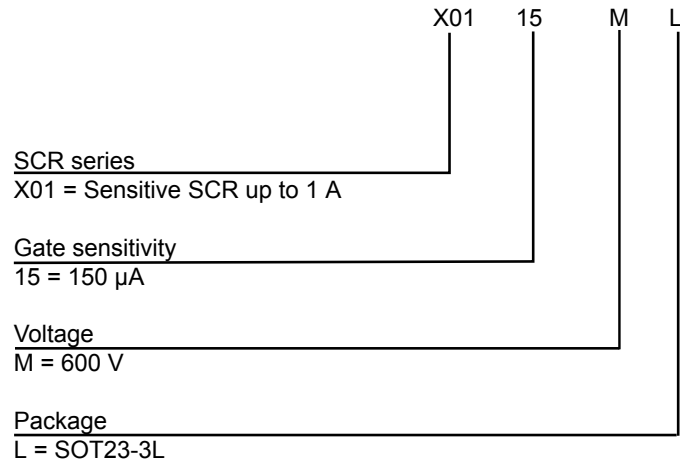
Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.89		1.25	0.035		0.0493
A1	0		0.15	0		0.006
B	0.30		0.51	0.0118		0.0201
C	0.085		0.20	0.0033		0.0079
D	2.75		3.04	0.1082		0.1197
E	1.20		1.75	0.0472		0.0689
e	0.85	0.95	1.05	0.0334	0.0374	0.0414
e1	1.70	1.90	2.10	0.0669	0.0748	0.0827
H	2.10		3.00	0.0826		0.1182
L	0.25		0.61	0.0098		0.0241
L1		0.55			0.0217	
S	0.35		0.65	0.0137		0.0256
a	0°		8°	0°		8°

**Figure 15. Footprint recommendations, dimensions in mm**



### 3 Ordering information

**Figure 16. Ordering information scheme**



**Table 6. Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
X0115ML	X1M	SOT23-3L	0.01 mg	3000	Tape and reel



## Revision history

**Table 7. Document revision history**

Date	Revision	Changes
16-Jul-2021	1	First issue.
10-Dec-2021	2	Updated <a href="#">Table 1</a> and <a href="#">Figure 6</a> .
28-Jan-2022	3	Updated <a href="#">Table 2</a> .

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