

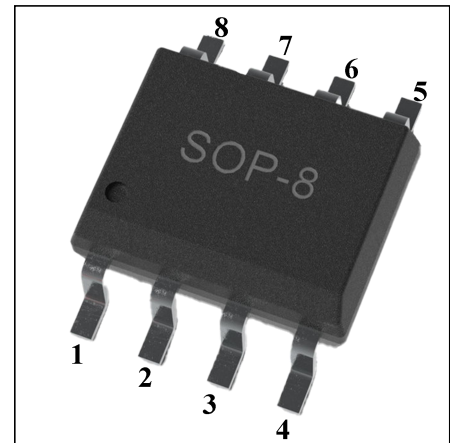
## Description

The TN13P40PA uses advanced trench technology and design to provide excellent  $R_{DS(on)}$  with low gate charge. It can be used in a wide variety of applications.

## P-Channel Enhancement Mode Power MOSFET

## General Features

- $V_{DS} = -40V, I_D = -13A$   
 $R_{DS(on)} < 15m\Omega @ V_{GS} = -10V$   
 $R_{DS(on)} < 18m\Omega @ V_{GS} = -4.5V$
- High density cell design for ultra low  $R_{DS(on)}$
- Fully characterized avalanche voltage and current



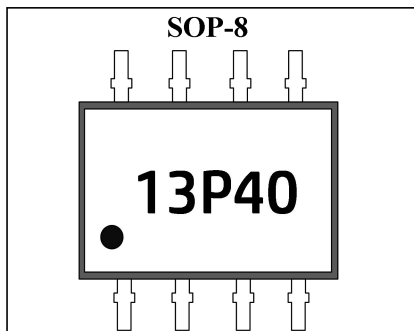
## Mechanical Characteristics

- Package: SOP-8
- Packaging: Tape and Reel per EIA 481
- RoHS Compliant
- Marking : Making Code

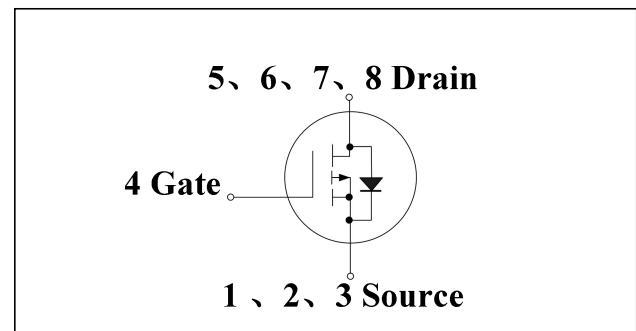
## Applications

- Power switching application
- Hard switched and high frequency circuits
- DC-DC converter

## Marking : Making Code



## Schematic Diagram



## Absolute Maximum Rating (Ratings at 25 °C ambient temperature unless otherwise specified.)

Parameter	Symbols	Value	Unit
Drain-Source Voltage	$-V_{DS}$	40	V
Gate-Source Voltage	$-V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$-I_D$	13	A
Drain Current-Continuous (TC=100°C)	$I_D (100^\circ C)$	9	A
Drain Current-Pulsed Note1	$-I_{DM}$	50	A
Junction Temperature	$P_D$	2.5	W
Maximum Power Dissipation	$T_J$	150	°C
Storage Temperature Range	$T_{STG}$	-55 to +150	°C

## Thermal Characteristics

Thermal Resistance, Junction-to-Ambient Note2	$R_{\theta JA}$	50	$^{\circ}\text{C/W}$
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Electrical Characteristics( $T_c=25^{\circ}\text{C}$  Unless otherwise specified)

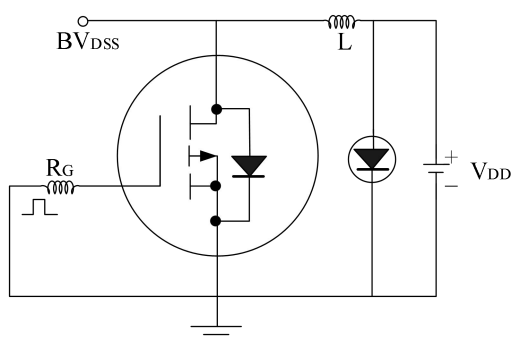
Parameter	Symbols	Test Condition	Min.	Typ.	Max.	Unit
Static Characteristics						
Drain-Source Breakdown Voltage	$-V_{(BR)DSS}$	$V_{GS}=0V, I_D=-250\mu A$	40	--	--	V
Zero Gate Voltage Drain Current	$-I_{DSS}$	$V_{DS}=-40V, V_{GS}=0V$	--	--	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	--	--	$\pm 100$	$\mu A$
Gate Threshold Voltage <sup>Note3</sup>	$-V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	1.3	2.0	2.5	V
Drain-Source On-Resistance <sup>Note3</sup>	$R_{DS(ON)}$	$V_{GS}=-10V, I_D=-12A$	--	12	15	m $\Omega$
Forward Transconductance <sup>Note4</sup>	$g_{FS}$	$V_{DS}=-15V, I_D=-10A$	35	--	--	S
Dynamic Characteristics						
Input Capacitance	$C_{iss}$	$V_{DS}=-20V, V_{GS}=0V, f=1MHz$	--	2800	--	pF
Output Capacitance	$C_{oss}$		--	320	--	pF
Reverse Transfer Capacitance	$C_{rss}$		--	220	--	pF
Total Gate Charge	$Q_g$	$V_{DS}=-20V, I_D=-12A, V_{GS}=-10V$	--	40	--	nC
Gate-Source Charge	$Q_{gs}$		--	6	--	nC
Gate-Drain Charge	$Q_{gd}$		--	12	--	nC
Switching Characteristics						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-20V, R_L=2\Omega, V_{GS}=-10V, R_{GEN}=6\Omega$	--	11	--	nS
Turn-on Rise Time	$t_r$		--	79	--	nS
Turn-off Delay Time	$t_{d(off)}$		--	89	--	nS
Turn-off Fall Time	$t_f$		--	35	--	nS
Source-Drain Diode Characteristics						
Diode Forward Voltage <sup>Note3</sup>	$-V_{SD}$	$V_{GS}=0V, I_S=12A$	--	--	-1.2	V
Diode Forward Current <sup>Note2</sup>	$-I_S$	--	--	--	13	A

Notes:

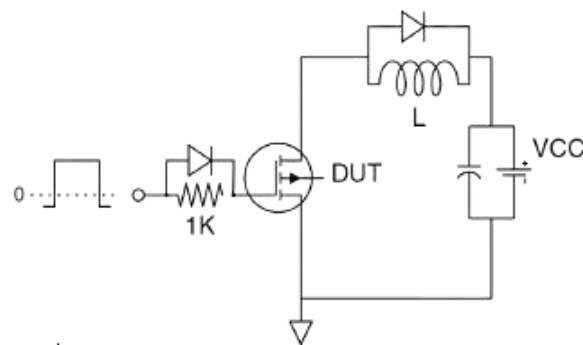
- Repetitive Rating: Pulse width limited by maximum junction temperature.
- Surface Mounted on FR4 Board,  $t \leq 10$  sec.
- Pulse Test: Pulse width  $\leq 300 \mu s$ , duty cycle  $\leq 2\%$ .

## Test Circuit

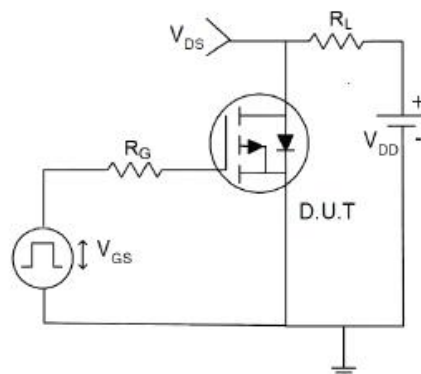
- EAS Test Circuit



- Gate Charge Test Circuit



- Switch Time Test Circuit



## Typical Characteristics Curves

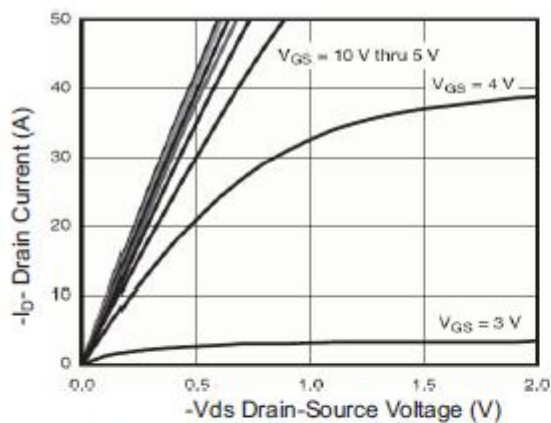


Figure 1 Output Characteristics

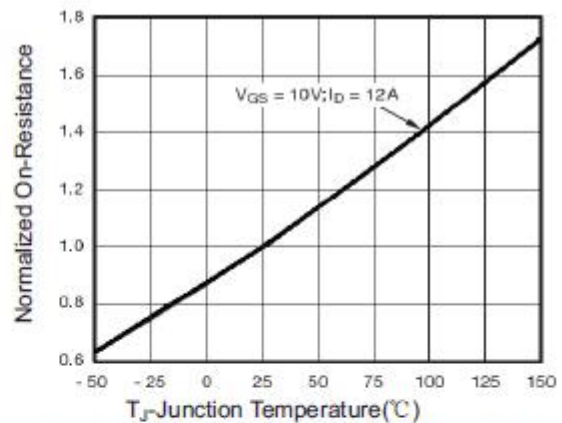


Figure 4  $R_{DS(on)}$ -Junction Temperature

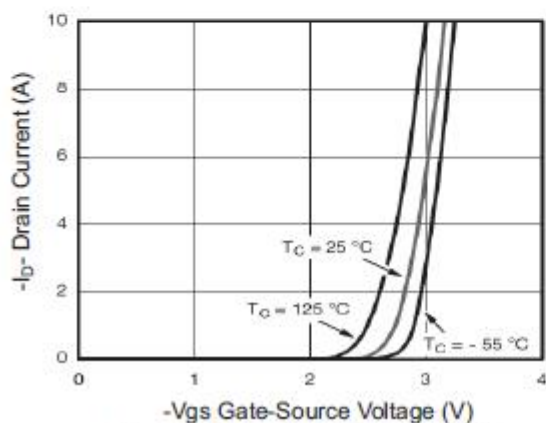


Figure 2 Transfer Characteristics

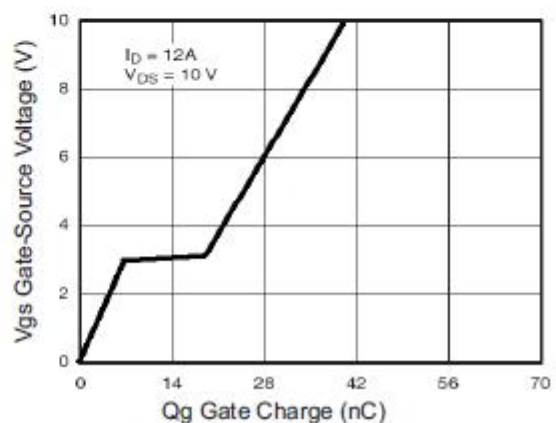


Figure 5 Gate Charge

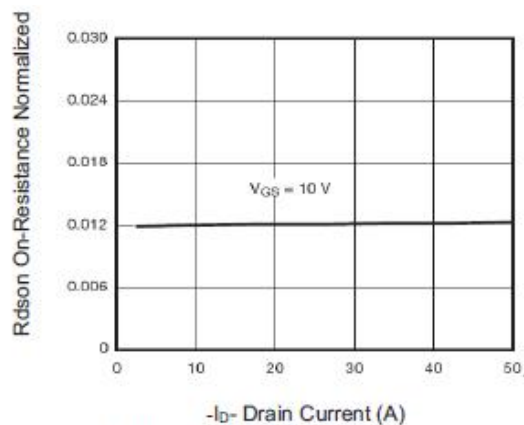


Figure 3 Rdson- Drain Current

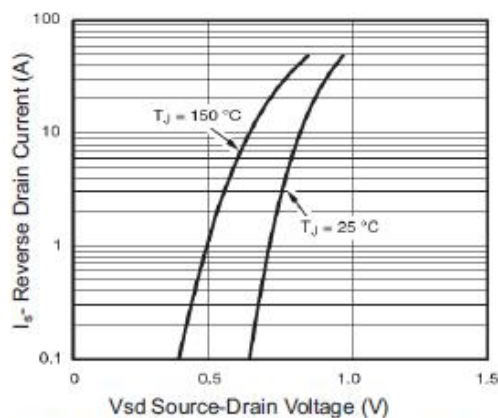


Figure 6 Source- Drain Diode Forward

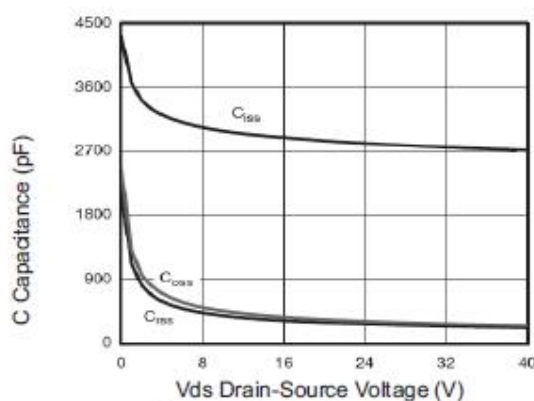


Figure 7 Capacitance vs Vds

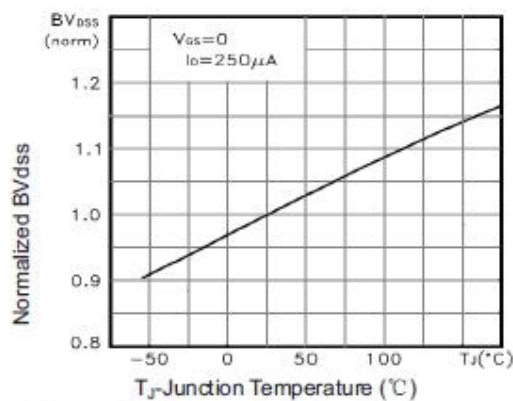


Figure 9 BVdss vs Junction Temperature

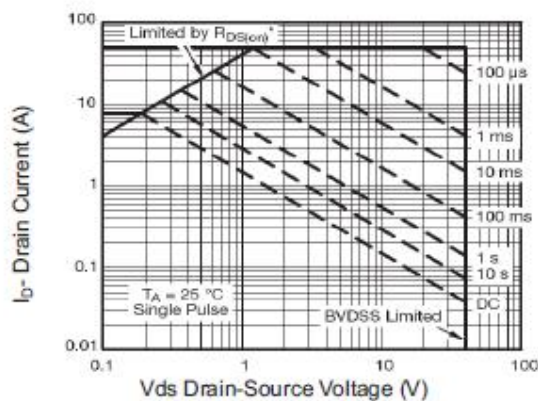


Figure 8 Safe Operation Area

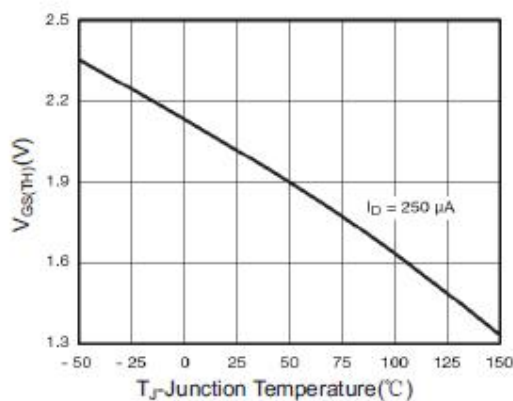
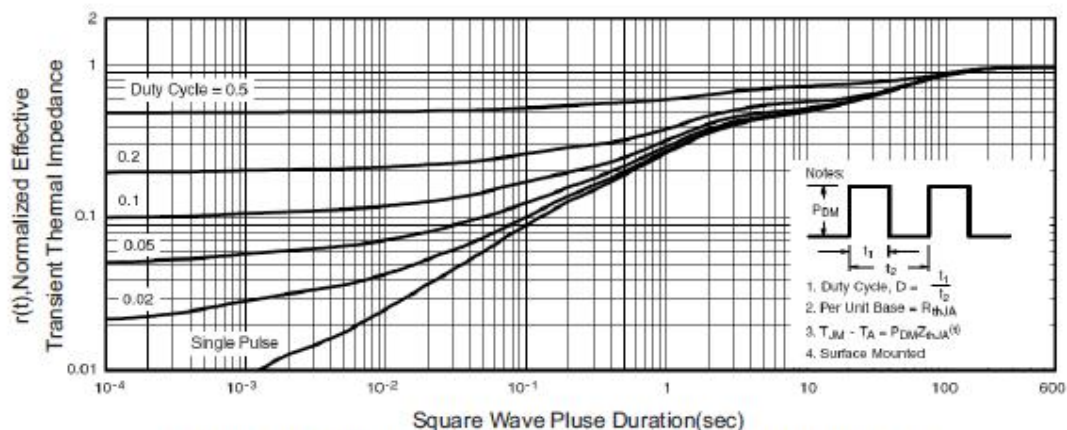
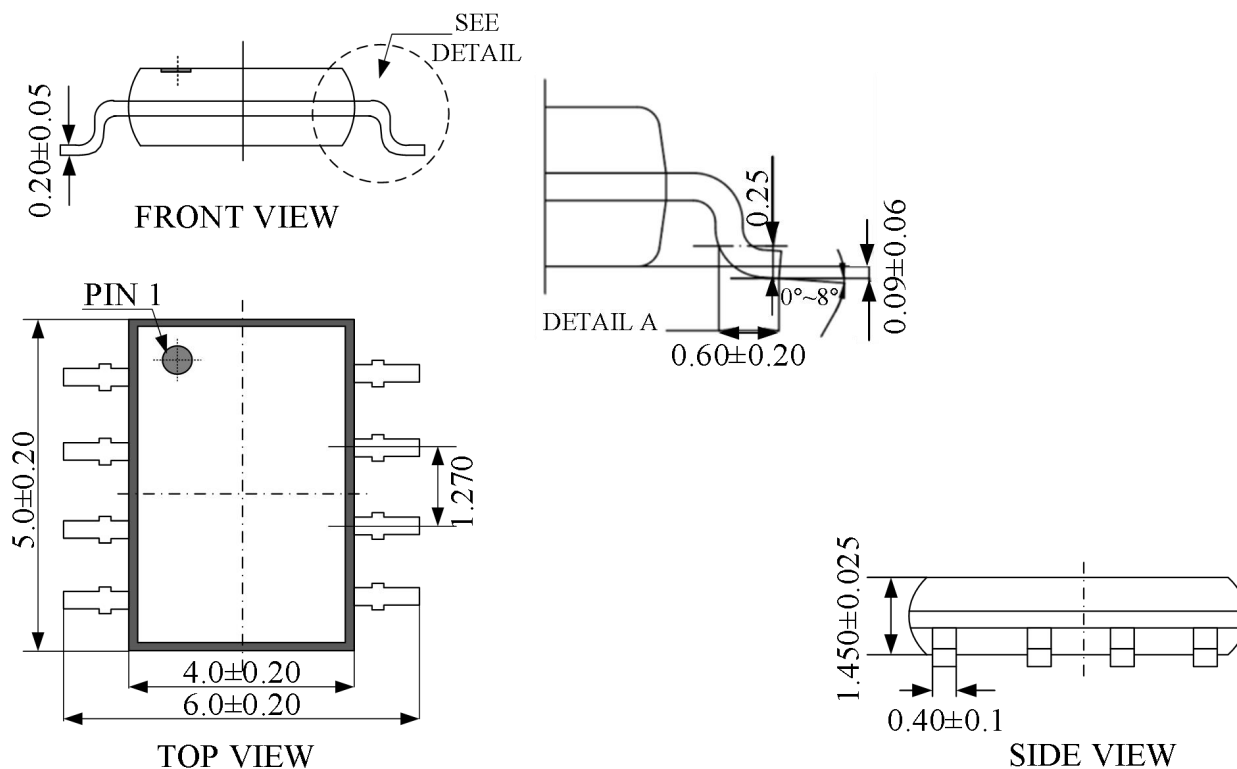
Figure 10  $V_{GS(th)}$  vs Junction Temperature

Figure 11 Normalized Maximum Transient Thermal Impedance

## Outline Drawing – SOP-8(Dimensions in mm)

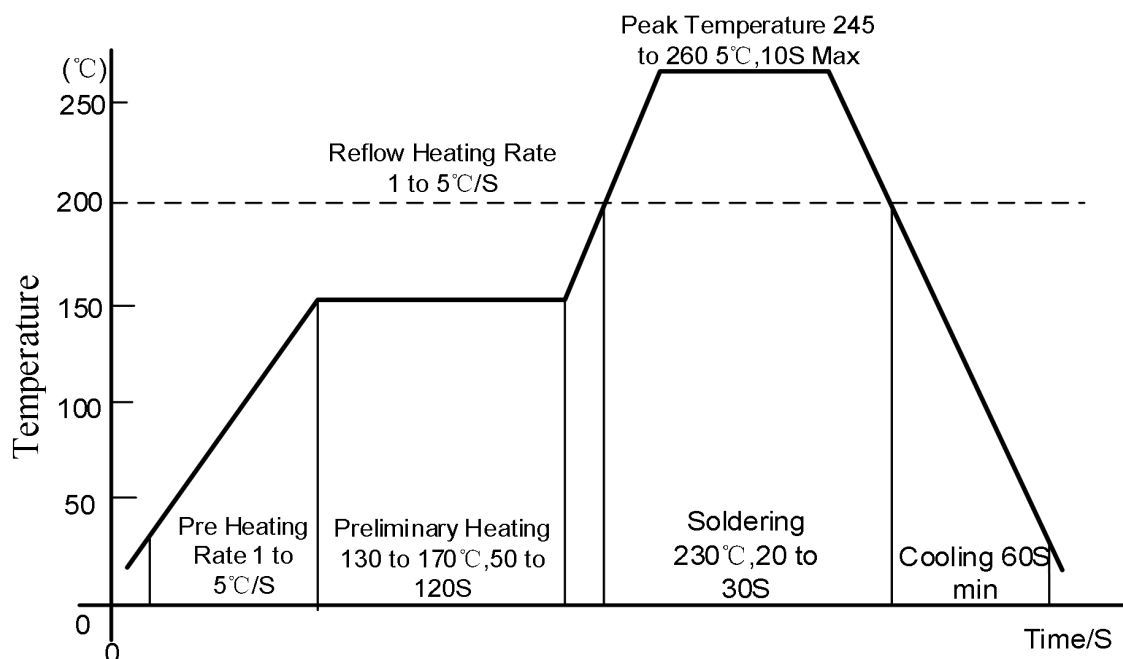


## Package Information

Package Type	Description	Quantity (pcs)	Standard
SOP-8	Reel -13" tape	4000	EIA-481

## Conditions of Soldering and Storage

- Recommended condition of reflow soldering



Recommended peak temperature is over 245° C. If peak temperature is below 245° C, you may adjust the following parameters:

●Time length of peak temperature (longer)
●Time length of soldering (longer)
●Thickness of solder paste (thicker)

●Conditions of hand soldering

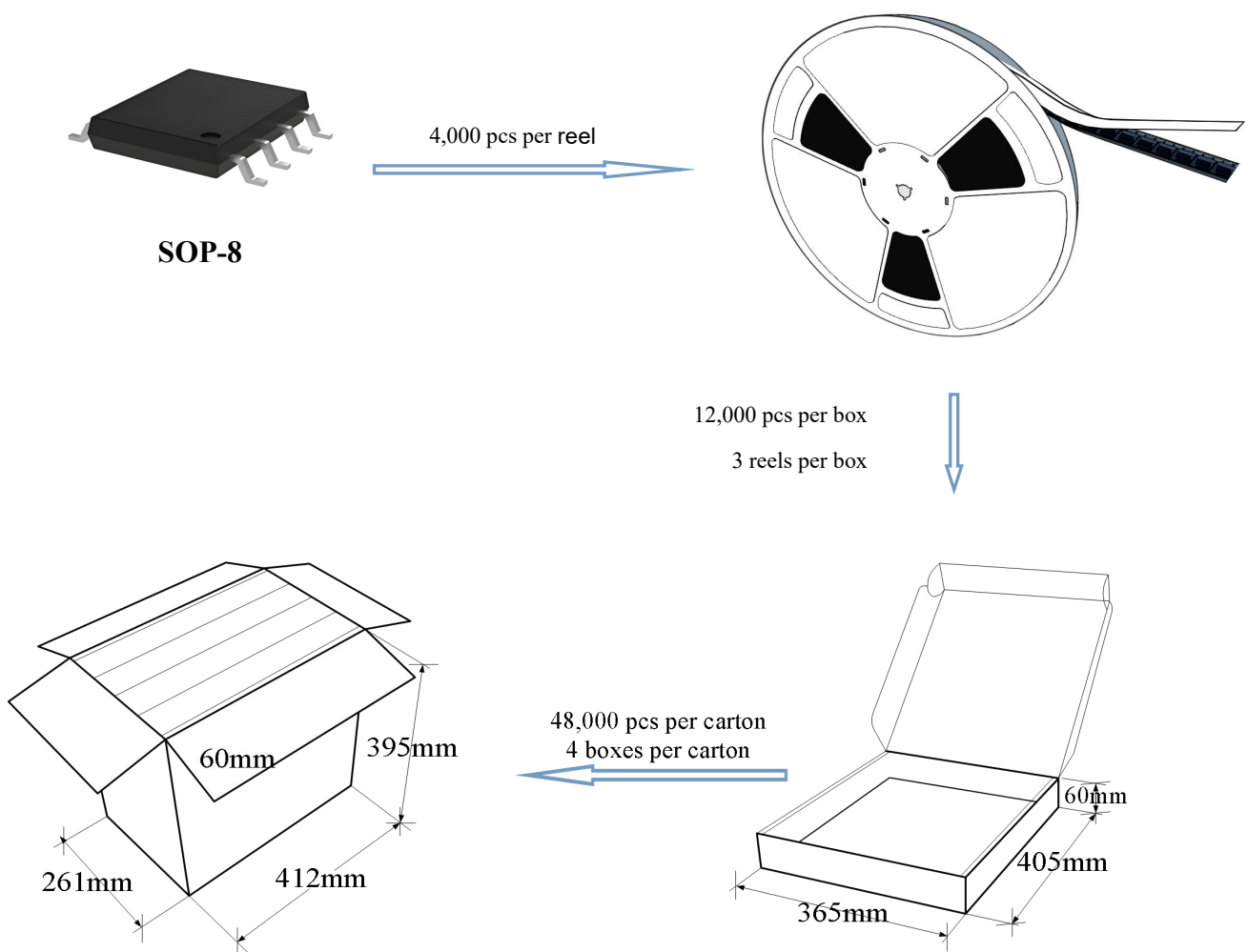
●Temperature: 300°C
●Time: 3s max
●Times: one time

●Storage conditions

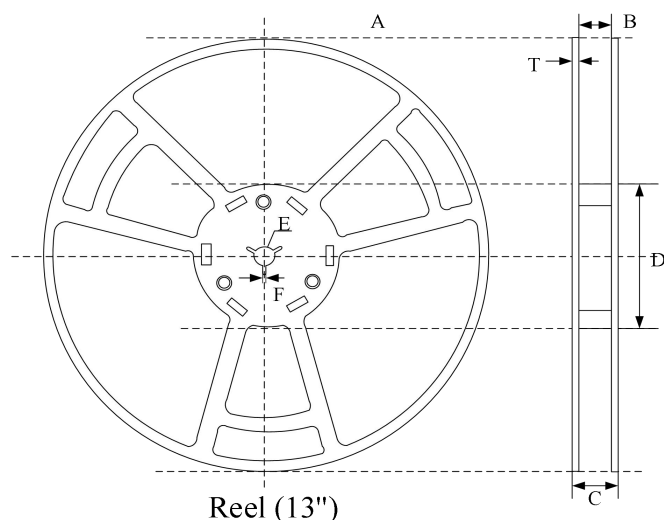
●Temperature: 5 to 40° C
●Humidity: 30 to 80% RH
●Recommended period: One year after manufacturing

## Package Specifications

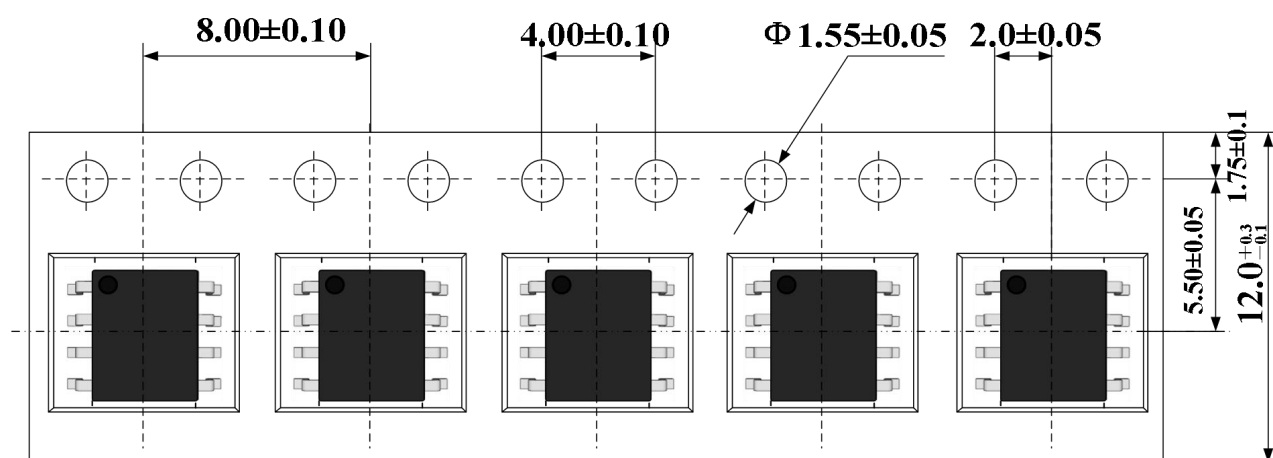
●The method of packaging



## Embossed tape and reel data



Symbol	Value(unit:mm)
A	$\phi 330 \pm 1$
B	$12.7 \pm 0.5$
C	$16.5 \pm 0.3$
D	$\phi 99.5 \pm 0.5$
E	$\phi 13.6 \pm 0.3$
F	$2.8 \pm 0.3$
T	$1.9 \pm 0.2$



## Contact Information

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For additional information, please contact your local Sales Representative.

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## Product Specification Statement

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The product parameters described in the product specification are numerical values, characteristics, and functions obtained through actual testing or theoretical calculations of the product in an independent or ideal state. Due to the complexity of product applications and variations in test conditions and equipment, there may be slight fluctuations in parameter test values. TANI shall not guarantee that the actual performance of the product when installed in the customer's system or equipment will be entirely consistent with the product specification, especially concerning dynamic parameters. It is recommended that users consult with professionals for product selection and system design. Users should also thoroughly validate and assess whether the actual parameters and performance when installed in their respective systems or equipment meet their requirements or expectations. Additionally, users should exercise caution in verifying product compatibility issues, and TANI assumes no responsibility for the application of the product. TANI strives to provide accurate and up-to-date information to the best of our ability. However, due to technical, human, or other reasons, TANI cannot guarantee that the information provided in the product specification is entirely accurate and error-free. TANI shall not be held responsible for any losses or damages resulting from the use or reliance on any information in these product specifications.

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