



TN138NSA

Product Summary

- $V_{DS}= 60V, I_D= 0.3A$
- $R_{DS(on)} < 2.5\Omega @V_{GS}= 10V$
- $R_{DS(on)} < 3.0\Omega @V_{GS}= 4.5V$

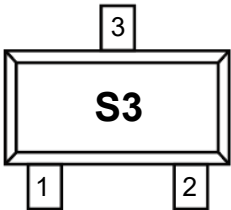
Features

- Advanced Trench Technology
- ESD Protected(HBM) Up To 2KV
- RoHS and Reach Compliant
- Halogen and Antimony Free
- Moisture Sensitivity Level 1

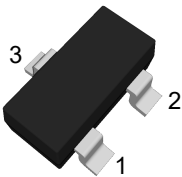
Application

- Solid-State Relays
- Batterty Operated Systems
- Direct Logic-Level Interface: TTL/CMOS

Marking Code



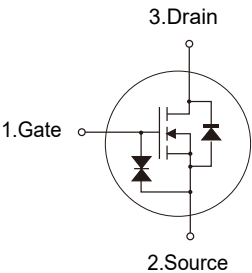
SOT-23



(Top View)

Pin	Description
1	Gate
2	Source
3	Drain

Schematic Diagram



Absolute Maximum Ratings

(Ta=25°C unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous	I_D	0.3	A
Maximum Power Dissipation	P_D	0.35	W
Junction Temperature	T_J	150	°C
Storage Temperature Range	T_{STG}	-55 to +150	°C

Thermal Characteristics

Thermal Resistance,Junction-to-Ambient ^{Note1}	$R_{\theta JA}$	357	°C/W
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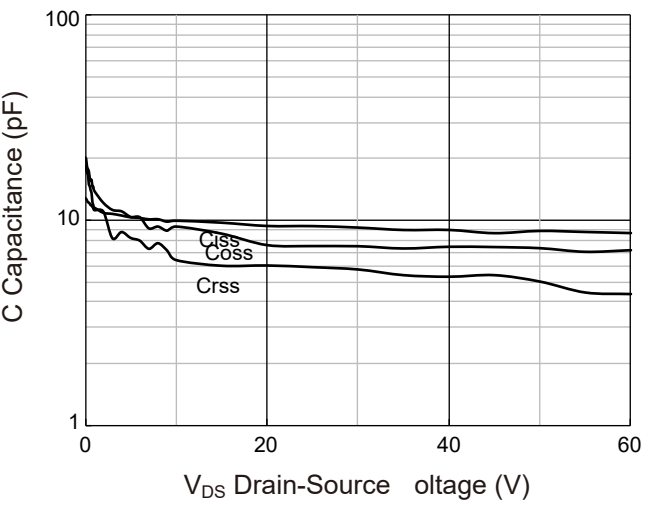
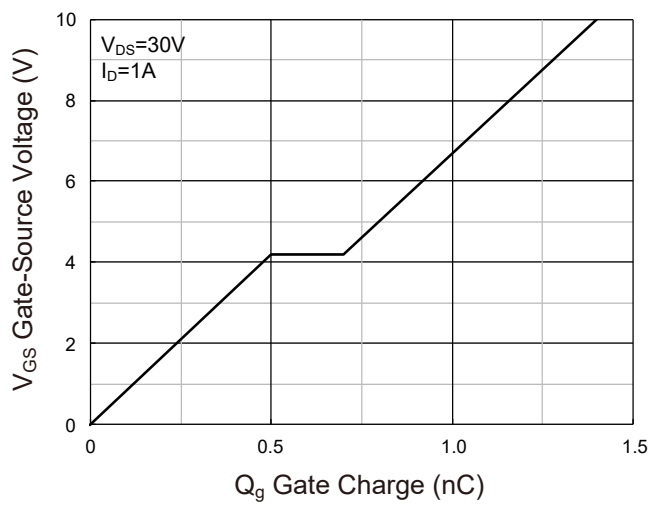
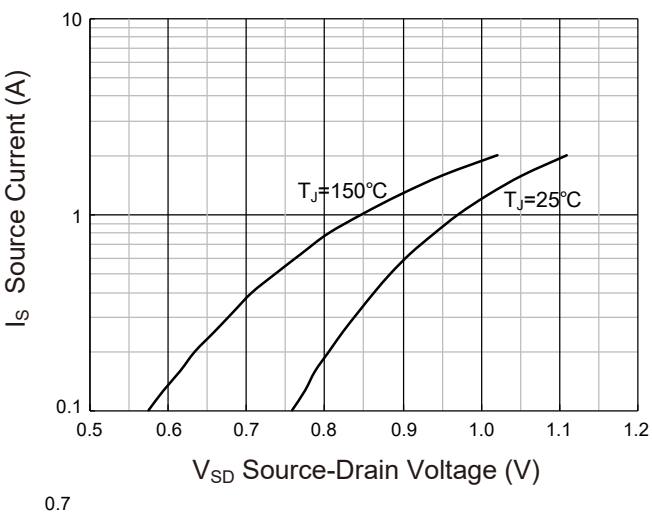
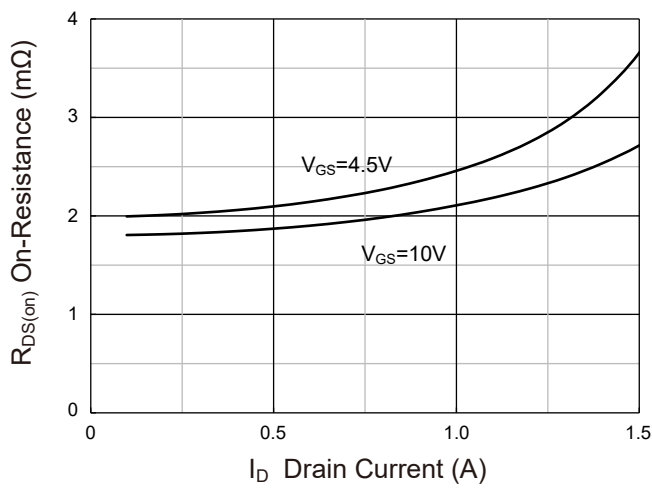
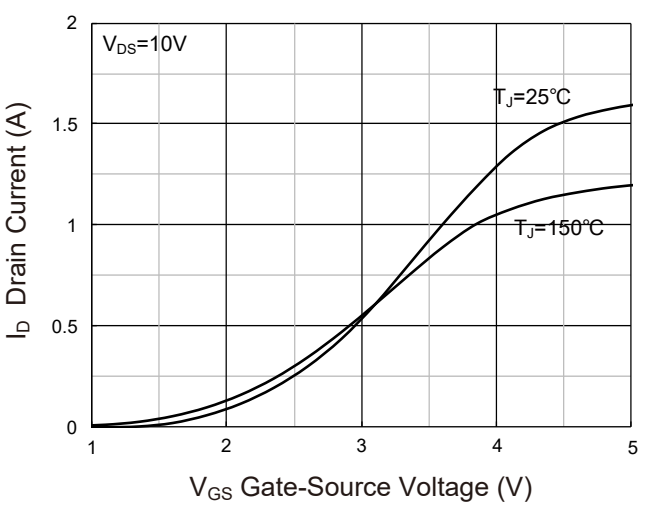
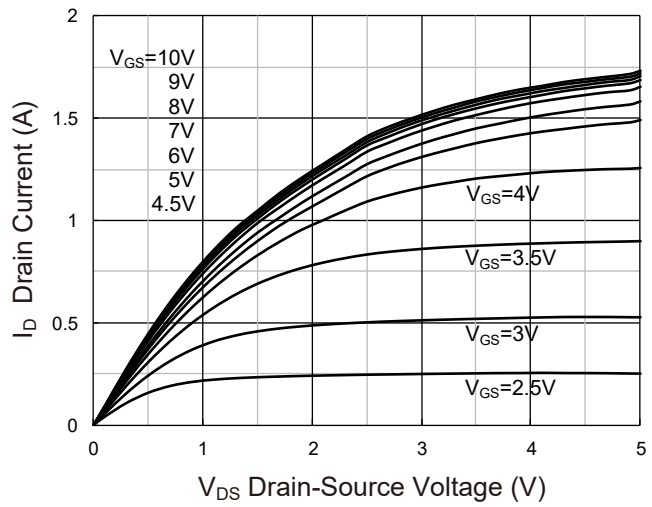
Electrical Characteristics

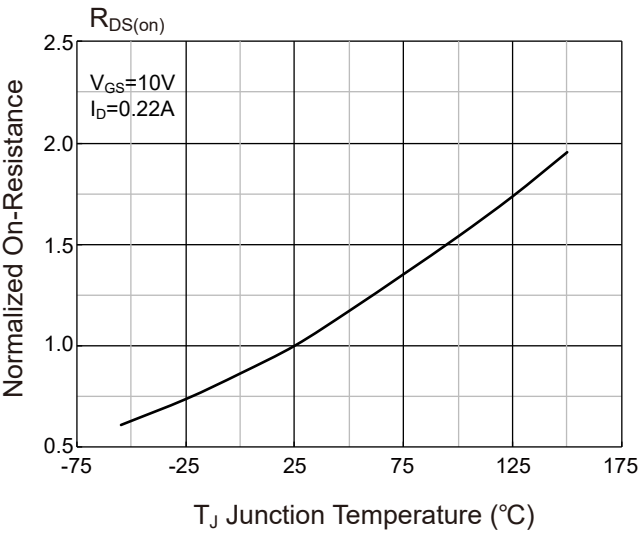
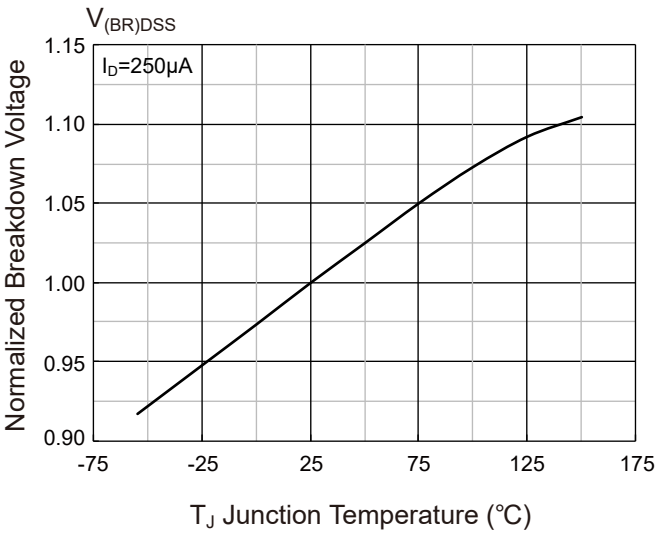
(Ta=25°C unless otherwise specified)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static Characteristics						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=250\mu A$	60	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=60V, V_{GS}=0V$	--	--	1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	--	--	± 10	μA
Gate Threshold Voltage ^{Note2}	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	0.6	1.1	1.6	V
Drain-Source On-Resistance ^{Note2}	$R_{DS(on)}$	$V_{GS}=10V, I_D=0.22A$	--	1.8	2.5	Ω
		$V_{GS}=4.5V, I_D=0.22A$	--	2	3	Ω
Forward Transconductance ^{Note2}	g_{FS}	$V_{DS}=5V, I_D=0.22A$	--	0.38	--	S
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{DS}=25V, V_{GS}=0V, f=1MHz$	--	9	--	pF
Output Capacitance	C_{oss}		--	7.5	--	pF
Reverse Transfer Capacitance	C_{rss}		--	5.8	--	pF
Total Gate Charge	Q_g	$V_{DS}=30V, I_D=1A,$ $V_{GS}=10V$	--	1.4	--	nC
Gate-Source Charge	Q_{gs}		--	0.5	--	nC
Gate-Drain Charge	Q_{gd}		--	0.2	--	nC
Switching Characteristics						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=30V, I_D=1A,$ $V_{GS}=10V, R_{GEN}=2.3\Omega$	--	4	--	nS
Turn-on Rise Time	t_r		--	19	--	nS
Turn-off Delay Time	$t_{d(off)}$		--	9	--	nS
Turn-off Fall Time	t_f		--	25	--	nS
Source-Drain Diode Characteristics						
Diode Forward Voltage ^{Note2}	V_{SD}	$V_{GS}=0V, I_S=0.3A$	--	--	1.2	V
Diode Forward Current ^{Note1}	I_S		--	--	0.3	A

Note: 1. Surface Mounted on FR4 Board, $t \leq 10$ sec.2. Pulse Test: Pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$.

Typical Characteristic Curves

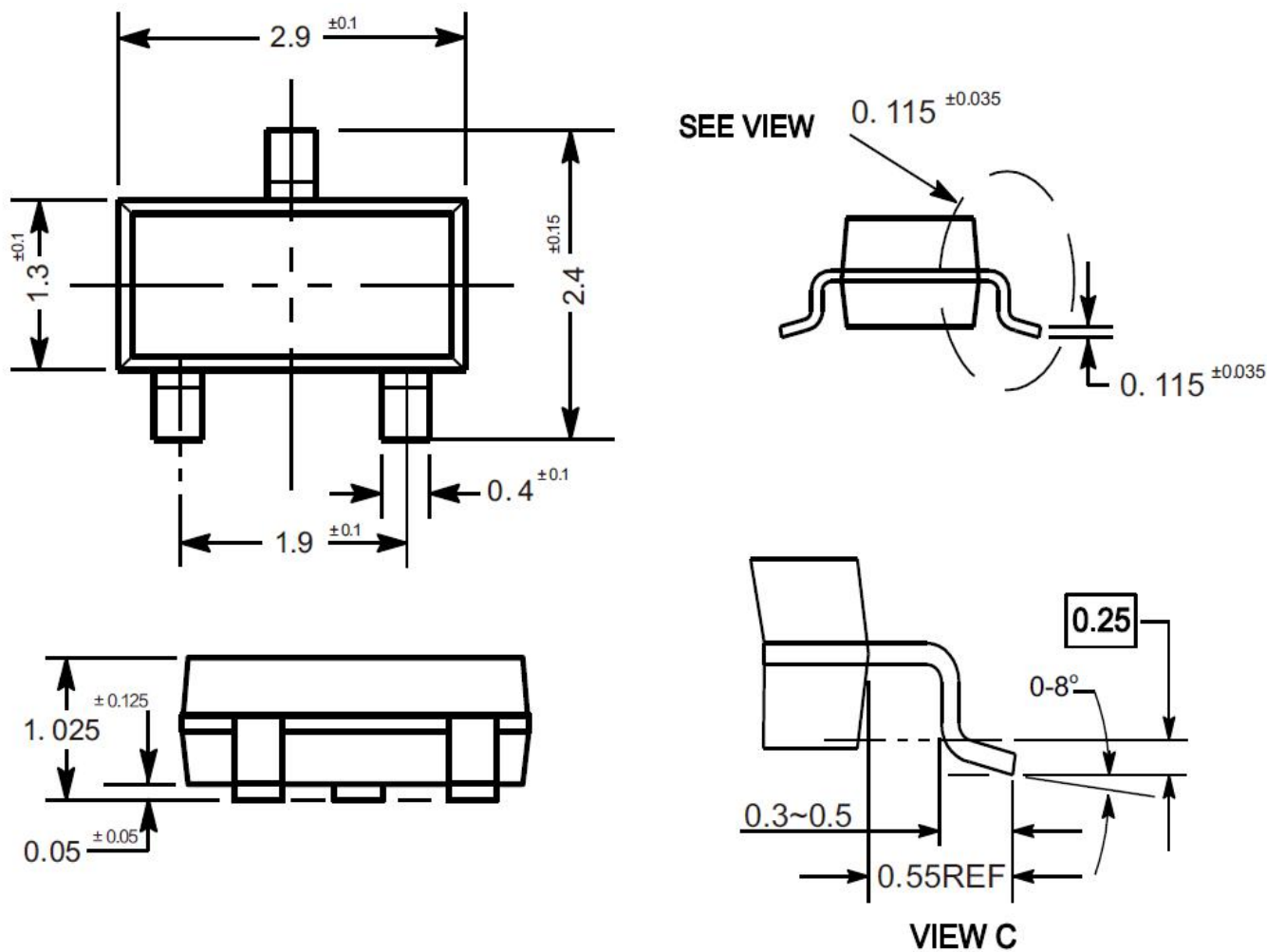




Package Outline

SOT-23

Dimensions in mm

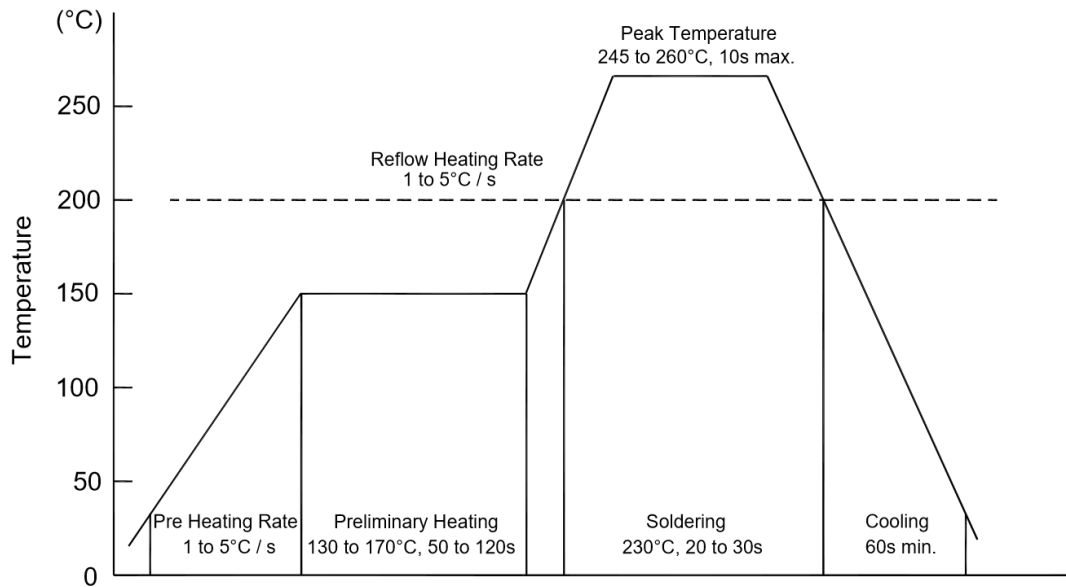


Ordering Information

Device	Package	Shipping
TN138NSA	SOT-23	3,000PCS/Reel&7inches

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

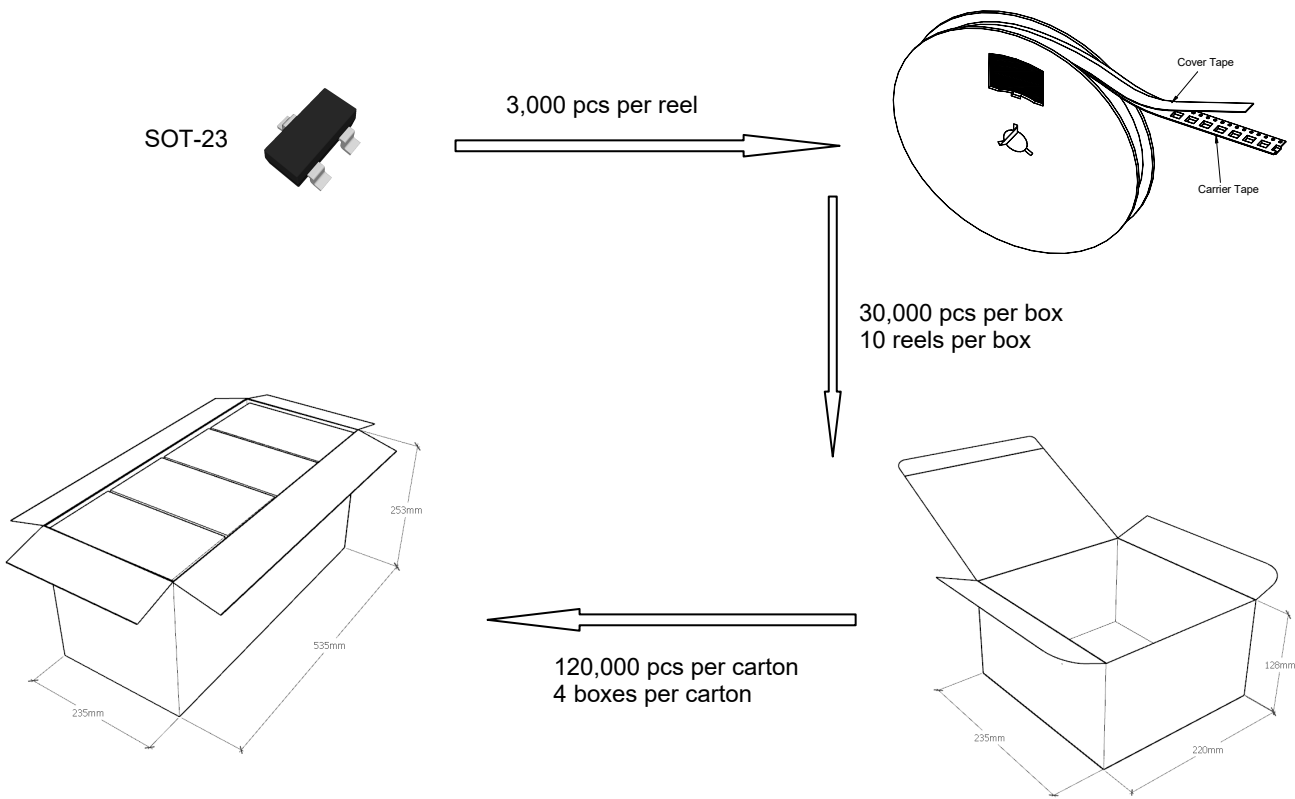
- Temperature: 300°C
- Time: 3s max.
- Times: one time

◆ Storage conditions

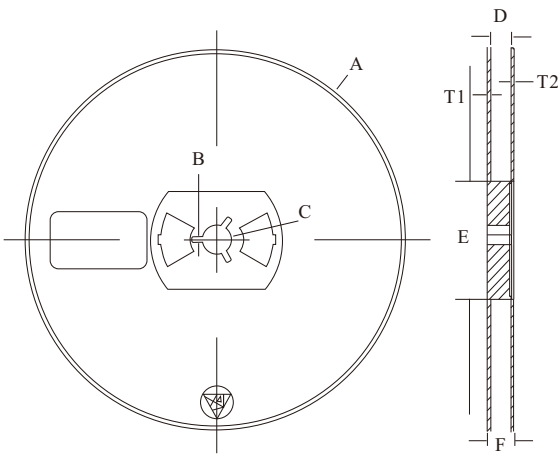
- **Temperature**
5 to 40°C
- **Humidity**
30 to 80% RH
- **Recommended period**
One year after manufacturing

Package Specifications

- The method of packaging



◆ Embossed tape and reel data



Symbol	Value (unit: mm)
A	Ø 177.8±1
B	2.7±0.2
C	Ø 13.5±0.2
E	Ø 54.5±0.2
F	12.3±0.3
D	9.6+2/-0.3
T1	1.0±0.2
T2	1.2±0.2

Reel (7")

