

# FMOS1012T-Q1

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# FMOS1012T-Q1

**20V, 0.63A N-Channel MOSFET**

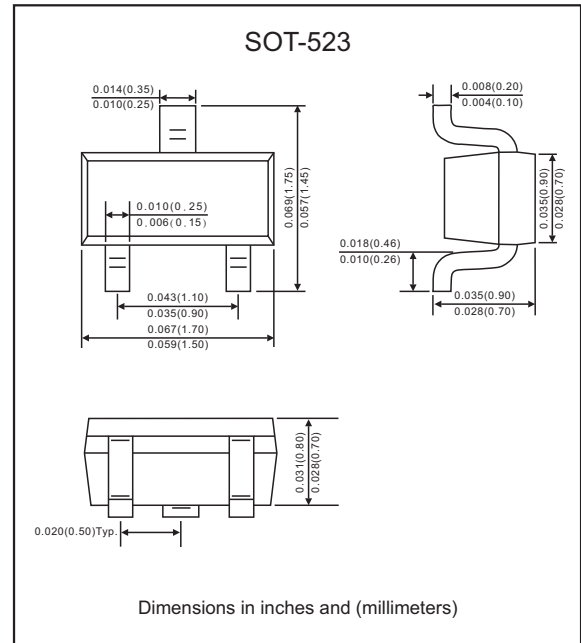
## Features

- Low On-Resistance.
- Low gate threshold voltage.
- Low input capacitance.
- Fast switching speed.
- Low input / output leakage.
- ESD protected up to 2KV.
- Lead-free parts meet RoHS requirements.
- Qualified to AEC-Q101 standards for high reliability.
- Suffix "-H" indicates Halogen-free part, ex.FMOS1012T-Q1-H.

## Mechanical data

- Epoxy:UL94-V0 rated flame retardant
- Case : Molded plastic, SOT-523
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Mounting Position : Any
- Weight : Approximated 0.003 gram

## Package outline



## Maximum ratings (At $T_A=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter                              | Symbol          | Ratings     | Unit                 |
|----------------------------------------|-----------------|-------------|----------------------|
| Drain-source voltage                   | $V_{DS}$        | 20          | V                    |
| Gate-source voltage                    | $V_{GS}$        | $\pm 6$     | V                    |
| Continuous drain Current               | $I_D$           | 0.63        | A                    |
| Pulsed drain current                   | $I_{DM}$        | 6           | A                    |
| Power dissipation                      | $P_D$           | 0.28        | W                    |
| Operating Junction temperature range   | $T_j$           | +150        | $^{\circ}\text{C}$   |
| Storage temperature range              | $T_{STG}$       | -55 to +150 | $^{\circ}\text{C}$   |
| Thermal resistance Junction to ambient | $R_{\theta JA}$ | 452         | $^{\circ}\text{C/W}$ |

Notes : 1.Device mounted on FR-4 PCB.  
2. No purposefully added lead.

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**Electrical characteristics** (At  $T_A=25^\circ\text{C}$  unless otherwise noted)

| Parameter                         | Conditions                                                            | Symbol       | Min. | Typ.  | Max.      | Unit     |
|-----------------------------------|-----------------------------------------------------------------------|--------------|------|-------|-----------|----------|
| Off characteristics               |                                                                       |              |      |       |           |          |
| Drain-source breakdown voltage    | $V_{GS}=0V, I_D=250\mu A$                                             | $BV_{DSS}$   | 20   |       |           | V        |
| Drain-source leakage current      | $V_{DS}=20V, V_{GS}=0V$                                               | $I_{DSS}$    |      |       | 100       | nA       |
| Gate-source leakage current       | $V_{DS}=0V, V_{GS}=\pm 4.5V$                                          | $I_{GSS}$    |      |       | $\pm 1.0$ | $\mu A$  |
| Gate threshold voltage            | $V_{DS}=V_{GS}, I_D=250\mu A$                                         | $V_{GS(TH)}$ | 0.5  |       | 1.0       | V        |
| Static drain-source on-resistance | $V_{GS}=4.5V, I_D=600mA$                                              | $R_{DS(ON)}$ |      | 0.3   | 0.4       | $\Omega$ |
|                                   | $V_{GS}=2.5V, I_D=500mA$                                              |              |      | 0.4   | 0.5       |          |
|                                   | $V_{GS}=1.8V, I_D=350mA$                                              |              |      | 0.5   | 0.7       |          |
| Forward transfer admittance       | $V_{DS}=10V, I_D=400mA$                                               | $ Y_{fs} $   | 1.4  |       |           | S        |
| Diode forward voltage             | $I_S=150mA, V_{GS}=0V$                                                | $V_{SD}$     |      | 0.7   | 1.2       | V        |
| Dynamic characteristics           |                                                                       |              |      |       |           |          |
| Input capacitance                 | $V_{DS}=16V, V_{GS}=0V, f=1MHz$                                       | $C_{iss}$    |      | 60.67 |           | pF       |
| Output capacitance                |                                                                       | $C_{oss}$    |      | 9.68  |           |          |
| Reverse transfer capacitance      |                                                                       | $C_{rss}$    |      | 5.37  |           |          |
| Total gate charge                 | $V_{GS}=4.5V, V_{DS}=10V, I_D=250mA$                                  | $Q_g$        |      | 736.6 |           | pC       |
| Gate-source charge                |                                                                       | $Q_{gs}$     |      | 93.6  |           |          |
| Gate-drain charge                 |                                                                       | $Q_{gd}$     |      | 116.6 |           |          |
| Switching characteristics         |                                                                       |              |      |       |           |          |
| Turn-on delay time                | $V_{GEN}=4.5V, V_{DD}=10V$<br>$I_D=200mA, R_G=10\Omega, R_L=47\Omega$ | $t_{d(on)}$  |      | 5.1   |           | ns       |
| Turn-on rise time                 |                                                                       | $t_r$        |      | 7.4   |           |          |
| Turn-off delay time               |                                                                       | $t_{d(off)}$ |      | 26.7  |           |          |
| Turn-off fall time                |                                                                       | $t_f$        |      | 12.3  |           |          |

Notes : 4. Short duration pulse test used to minimize self-heating effect.

## Rating and characteristic curves (FMOS1012T-Q1)

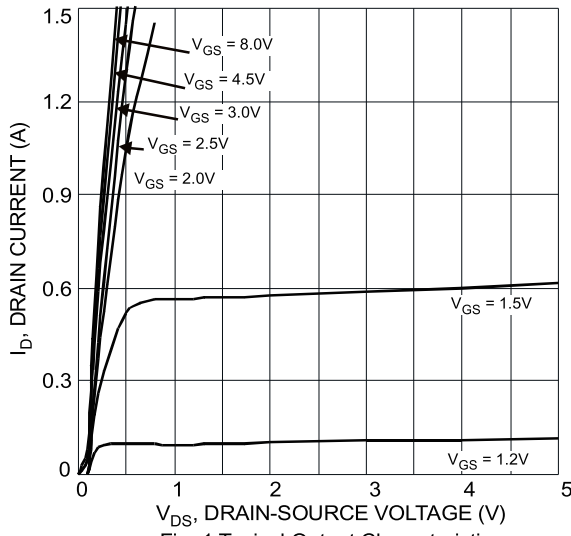


Fig. 1 Typical Output Characteristics

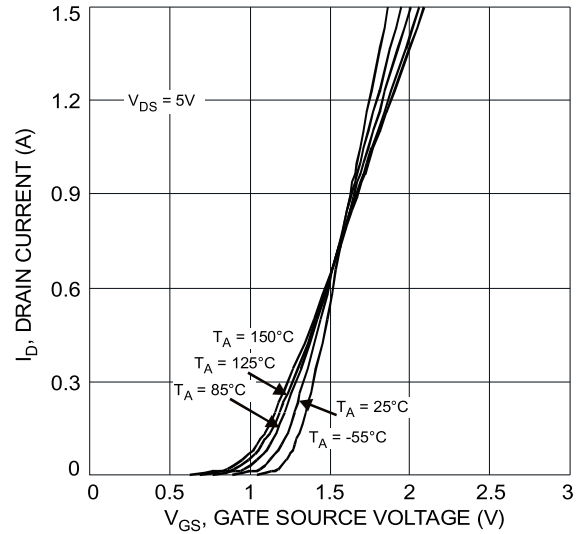


Fig. 2 Typical Transfer Characteristics

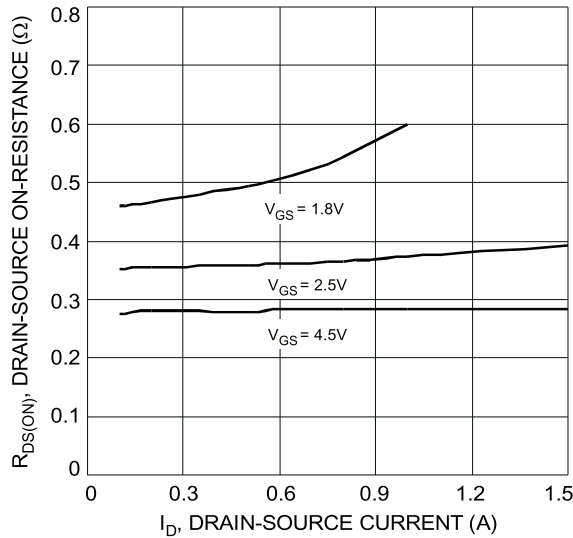


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

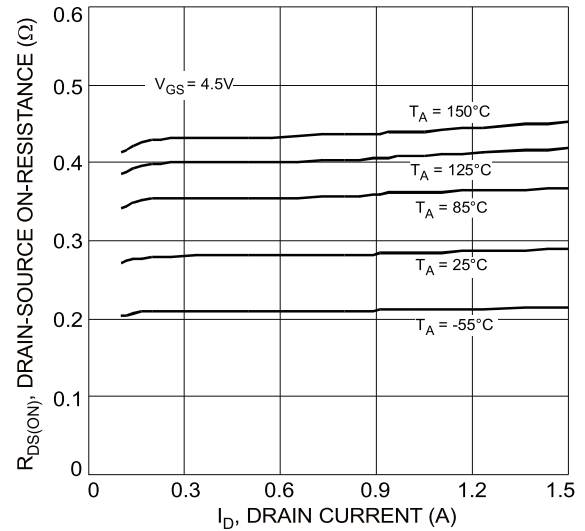
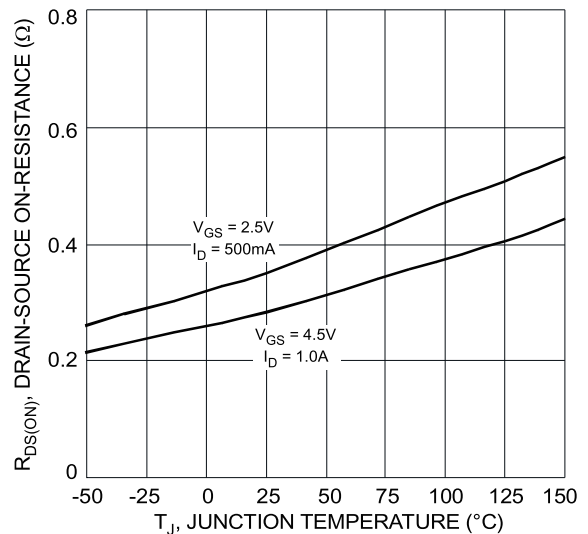
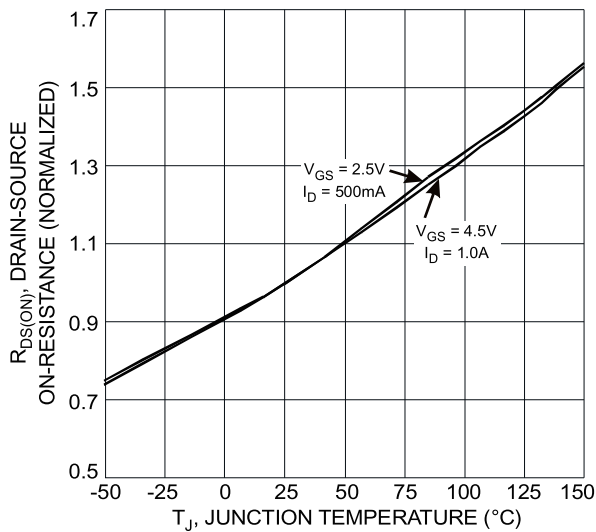


Fig. 4 Typical Drain-Source On-Resistance vs. Drain Current and Temperature



## Rating and characteristic curves (FMOS1012T-Q1)

Fig. 5 On-Resistance Variation with Temperature

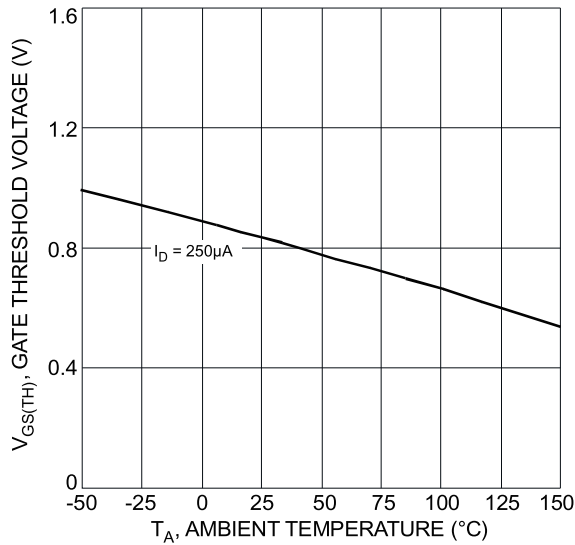


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

Fig. 6 On-Resistance Variation with Temperature

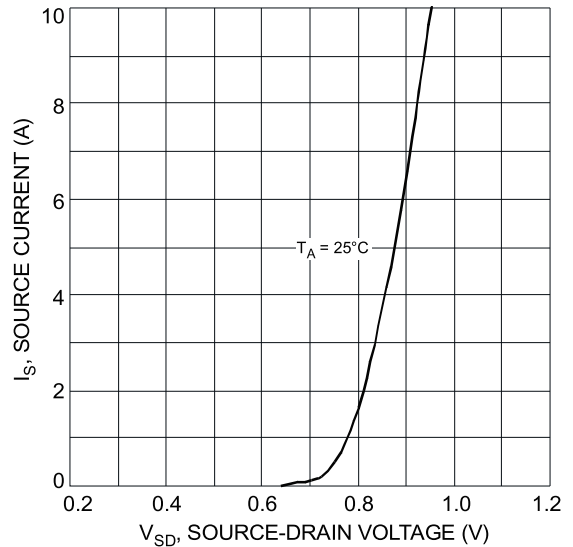


Fig. 8 Diode Forward Voltage vs. Current

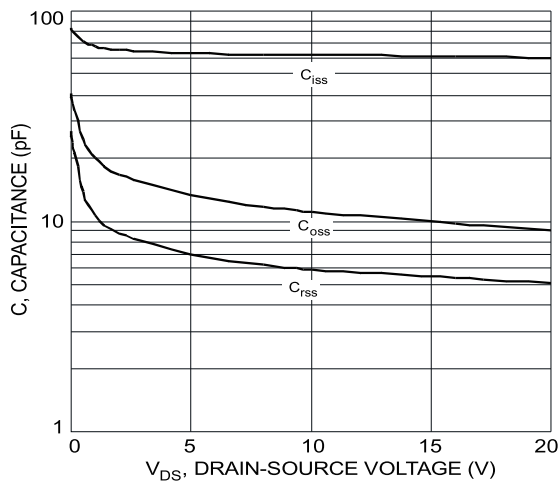


Fig. 9 Typical Capacitance

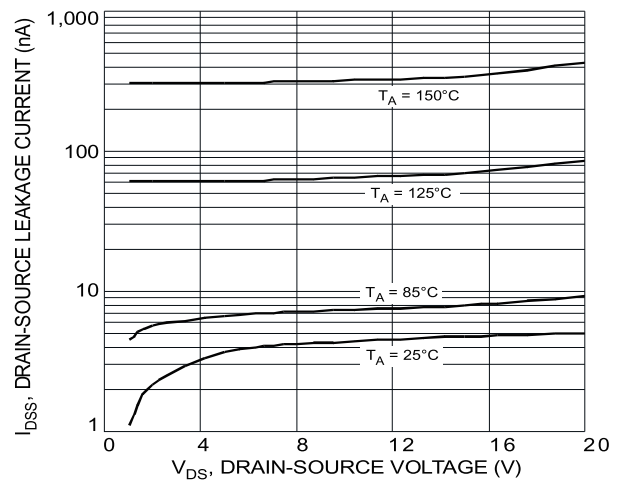


Fig. 10 Typical Drain-Source Leakage Current vs. Drain-Source Voltage

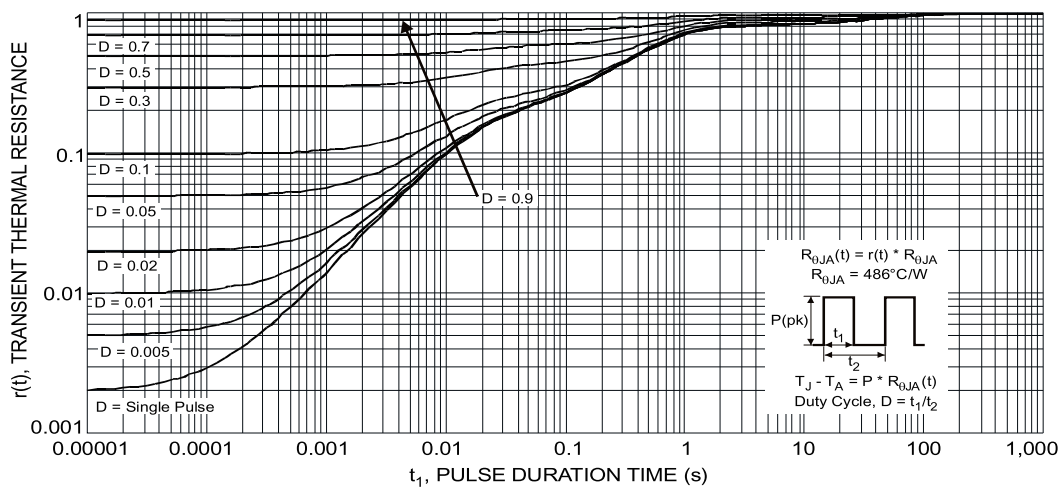
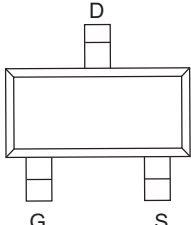
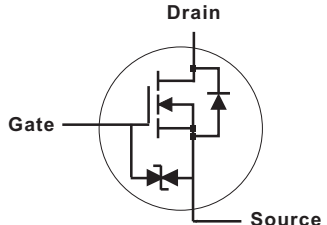


Fig. 11 Transient Thermal Response

## FMOS1012T-Q1

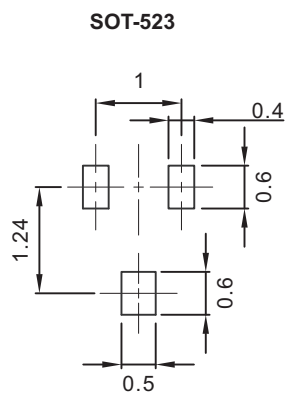
## Pinning information

| Pin                                    | Simplified outline                                                                | Symbol                                                                              |
|----------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| PinD Drain<br>PinG Gate<br>PinS Source |  |  |

## Marking

| Type number  | Marking code |
|--------------|--------------|
| FMOS1012T-Q1 | NA1,C        |

## Suggested solder pad layout

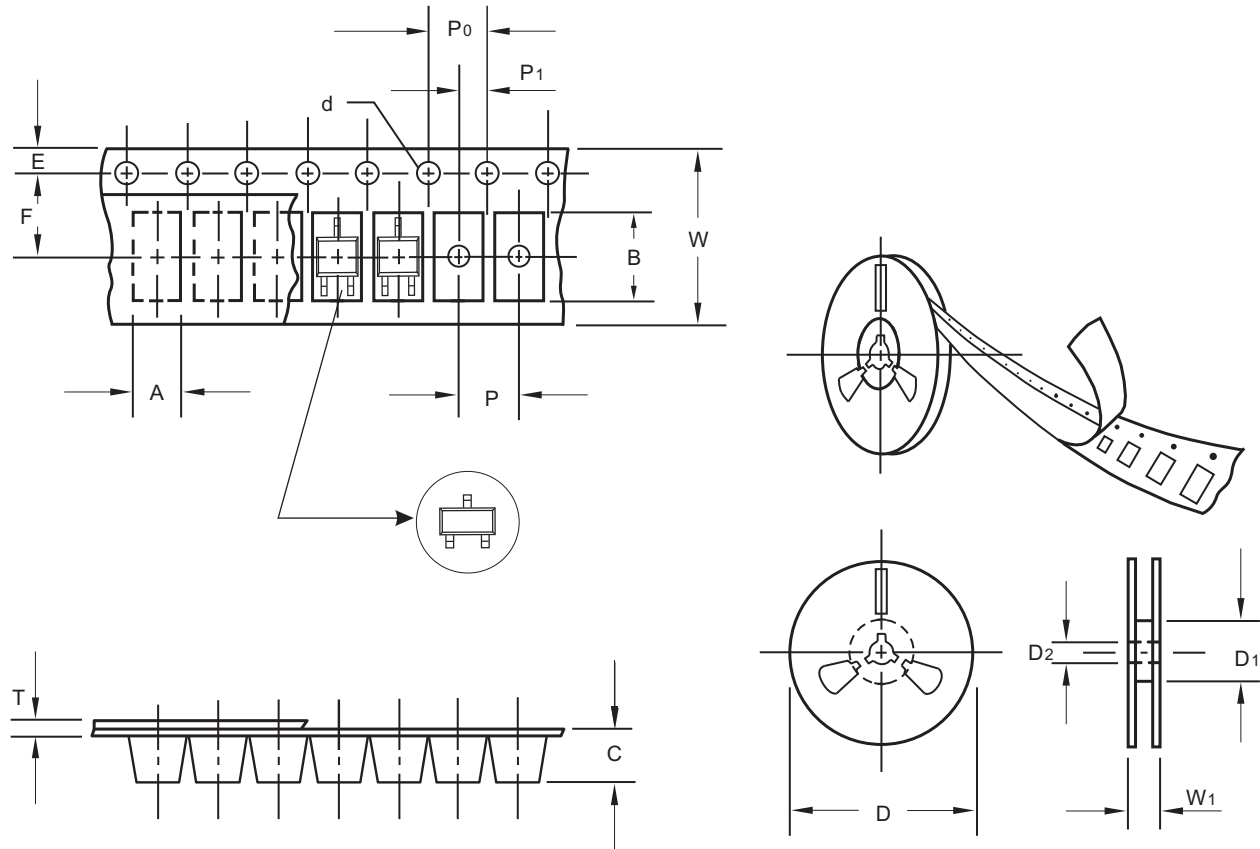


## Note:

1. Control ling dimension: in millimeters.
2. General tolerance:  $\pm 0.05\text{mm}$ .
3. The pad layout is for reference purposes only.

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## Packing information



unit:mm

| Item                      | Symbol | Tolerance | SOT-523 |
|---------------------------|--------|-----------|---------|
| Carrier width             | A      | 0.1       | 1.85    |
| Carrier length            | B      | 0.1       | 1.85    |
| Carrier depth             | C      | 0.1       | 0.875   |
| Sprocket hole             | d      | 0.1       | 1.50    |
| 13" Reel outside diameter | D      | 2.0       | -       |
| 13" Reel inner diameter   | D1     | min       | -       |
| 7" Reel outside diameter  | D      | 2.0       | 178.00  |
| 7" Reel inner diameter    | D1     | min       | 54.40   |
| Feed hole diameter        | D2     | 0.5       | 13.00   |
| Sprocket hole position    | E      | 0.1       | 1.75    |
| Punch hole position       | F      | 0.1       | 3.50    |
| Punch hole pitch          | P      | 0.1       | 4.00    |
| Sprocket hole pitch       | P0     | 0.1       | 4.00    |
| Embossment center         | P1     | 0.1       | 2.00    |
| Overall tape thickness    | T      | 0.1       | 0.23    |
| Tape width                | W      | 0.3       | 8.00    |
| Reel width                | W1     | 1.0       | 12.30   |

Note: Devices are packed in accordance with EIA standard RS-481-A and specifications listed above.

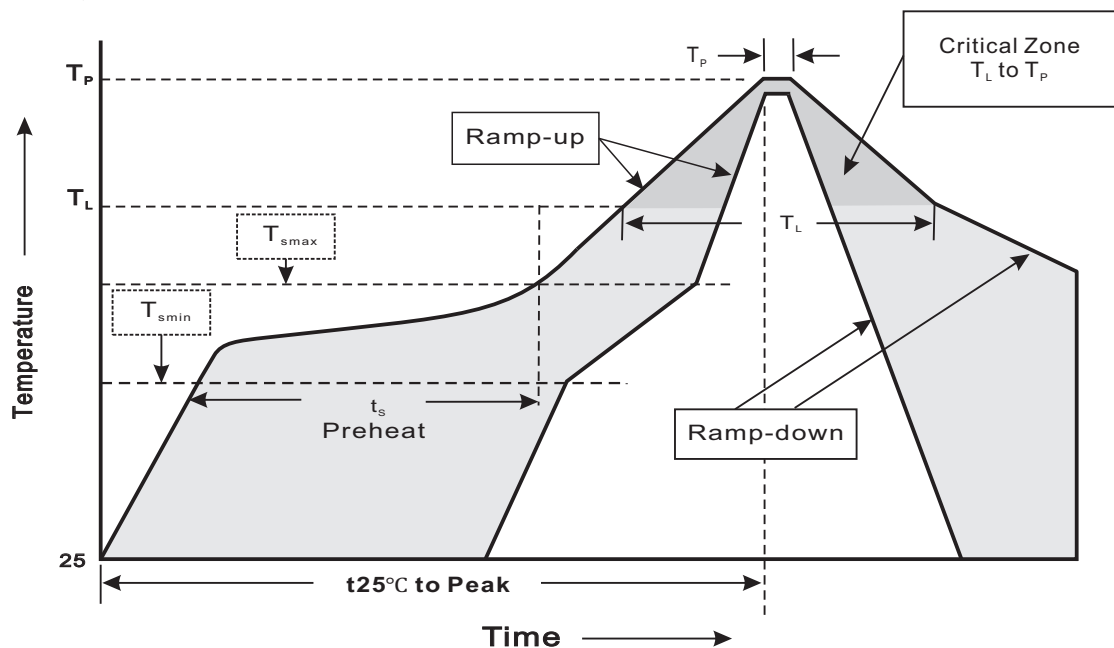
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## Reel packing

| PACKAGE | REEL SIZE | REEL (pcs) | COMPONENT SPACING (m/m) | BOX (pcs) | INNER BOX (m/m) | REEL DIA, (m/m) | CARTON SIZE (m/m) | CARTON (pcs) | APPROX. GROSS WEIGHT (kg) |
|---------|-----------|------------|-------------------------|-----------|-----------------|-----------------|-------------------|--------------|---------------------------|
| SOT-523 | 7"        | 3,000      | 4.0                     | 30,000    | 183*123*183     | 178             | 382*257*387       | 240,000      | 11.6                      |

## Suggested thermal profiles for soldering processes

- 1.Storage environment : Temperature=5°C~40°C Humidity=55%±25%
- 2.Reflow soldering of surface-mount devices



## 3.Reflow soldering

| Profile feature                                                                                               | Soldering Condition           |
|---------------------------------------------------------------------------------------------------------------|-------------------------------|
| Average ramp-up rate ( $T_L$ to $T_p$ )                                                                       | < 3°C/sec                     |
| Preheat<br>-Temperature Min ( $T_{smin}$ )<br>-Temperature Max ( $T_{smax}$ )<br>-Time (min to max) ( $t_s$ ) | 150°C<br>200°C<br>60 ~ 120sec |
| $T_{smax}$ to $T_L$<br>-Ramp-up rate                                                                          | < 3°C/sec                     |
| Time maintained above:<br>-Temperature ( $T_L$ )<br>-Time( $T_L$ )                                            | 217°C<br>60 ~ 260 sec         |
| Peak Temperature( $T_p$ )                                                                                     | 255°C -0/+5°C                 |
| Time within 5°C of actual peak Temperature( $T_p$ )                                                           | 10 ~ 30sec                    |
| Ramp-down rate                                                                                                | < 6°C/sec                     |
| Time 25°C to peak temperature                                                                                 | < 6 minutes                   |