

# FMUN2211T Thru FMUN2241T

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## FMUN2211T Thru FMUN2241T

NPN Silicon Epitaxial Planar  
Digital Transistor

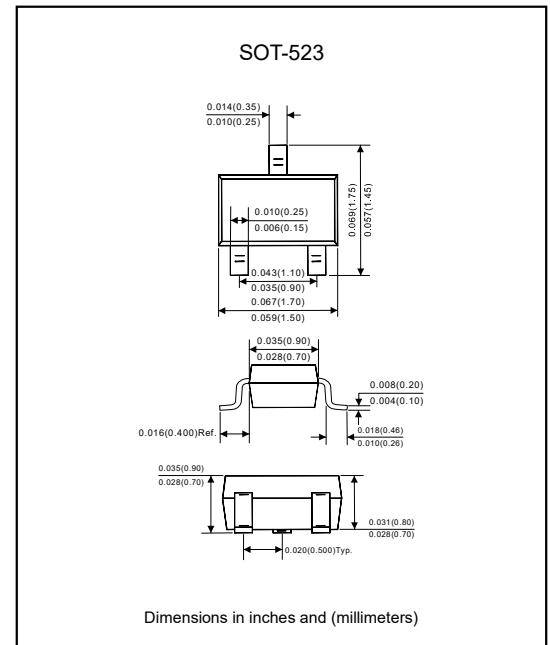
## Features

- Epitaxial planar die construction.
- For switching and interface circuit and drive circuit applications.
- Lead-free parts meet RoHS requirements.
- Suffix "-H" indicates Halogen-free part, ex.FMUN2211T-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.

## Package outline

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

| Parameter                    | Symbol    | Value       | Unit             |
|------------------------------|-----------|-------------|------------------|
| Collector to Base voltage    | $V_{CBO}$ | 50          | V                |
| Collector to Emitter Voltage | $V_{CEO}$ | 50          | V                |
| Collector current            | $I_C$     | 100         | mA               |
| Total power dissipation      | $P_{tot}$ | 200         | mW               |
| Junction temperature         | $T_J$     | 150         | $^\circ\text{C}$ |
| Storage temperature          | $T_{STG}$ | -55 to +150 | $^\circ\text{C}$ |

## FMUN2211T Thru FMUN2241T

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

| Parameter                           | Conditions                                               | Device    | Symbol        | Min | Typ | Max  | Unit |
|-------------------------------------|----------------------------------------------------------|-----------|---------------|-----|-----|------|------|
| Collector-Base breakdown voltage    | $I_C=10\mu\text{A}$                                      |           | $V_{(BR)CBO}$ | 50  |     |      | V    |
| Collector-Emitter breakdown voltage | $I_C=2\text{mA}$                                         |           | $V_{(BR)CEO}$ | 50  |     |      | V    |
| Collector-base cut-off current      | $V_{CB}=50\text{V}$                                      |           | $I_{CBO}$     |     |     | 100  | nA   |
| Collector-emitter cut-off current   | $V_{CE}=50\text{V}$                                      |           | $I_{CEO}$     |     |     | 500  | nA   |
| Emitter cut-off current             | $V_{CB}=6\text{V}$                                       | FMUN2211T | $I_{EBO}$     |     |     | 0.5  | mA   |
|                                     |                                                          | FMUN2212T |               |     |     | 0.2  |      |
|                                     |                                                          | FMUN2213T |               |     |     | 0.1  |      |
|                                     |                                                          | FMUN2214T |               |     |     | 0.2  |      |
|                                     |                                                          | FMUN2215T |               |     |     | 0.9  |      |
|                                     |                                                          | FMUN2216T |               |     |     | 1.9  |      |
|                                     |                                                          | FMUN2230T |               |     |     | 4.3  |      |
|                                     |                                                          | FMUN2231T |               |     |     | 2.3  |      |
|                                     |                                                          | FMUN2232T |               |     |     | 1.5  |      |
|                                     |                                                          | FMUN2233T |               |     |     | 0.18 |      |
|                                     |                                                          | FMUN2234T |               |     |     | 0.13 |      |
|                                     |                                                          | FMUN2235T |               |     |     | 0.2  |      |
|                                     |                                                          | FMUN2238T |               |     |     | 4    |      |
|                                     |                                                          | FMUN2241T |               |     |     | 0.1  |      |
| Output voltage (on)                 | $V_{CC}=5\text{V}, V_B=2.5\text{V}, R_L=1\text{K}\Omega$ | FMUN2211T | $V_{OL}$      |     |     | 0.2  | V    |
|                                     |                                                          | FMUN2212T |               |     |     |      |      |
|                                     |                                                          | FMUN2214T |               |     |     |      |      |
|                                     |                                                          | FMUN2215T |               |     |     |      |      |
|                                     |                                                          | FMUN2216T |               |     |     |      |      |
|                                     |                                                          | FMUN2230T |               |     |     |      |      |
|                                     |                                                          | FMUN2231T |               |     |     |      |      |
|                                     |                                                          | FMUN2232T |               |     |     |      |      |
|                                     |                                                          | FMUN2233T |               |     |     |      |      |
|                                     |                                                          | FMUN2234T |               |     |     |      |      |
|                                     |                                                          | FMUN2235T |               |     |     |      |      |
|                                     |                                                          | FMUN2238T |               |     |     |      |      |
|                                     | $V_{CC}=5\text{V}, V_B=3.5\text{V}, R_L=1\text{K}\Omega$ | FMUN2213T |               |     |     | 0.2  |      |
|                                     | $V_{CC}=5\text{V}, V_B=5\text{V}, R_L=1\text{K}\Omega$   | FMUN2241T |               |     |     | 0.2  |      |

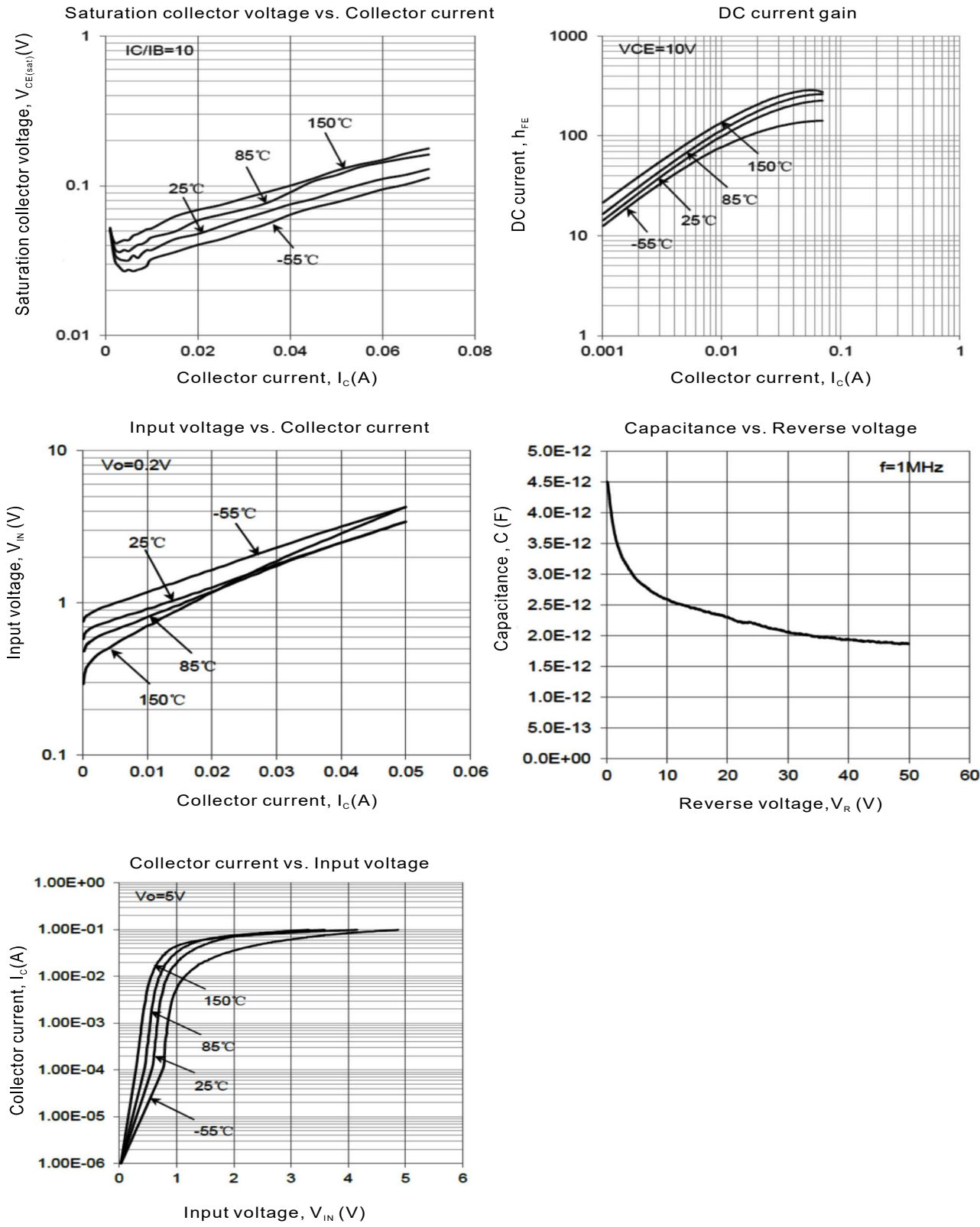
## FMUN2211T Thru FMUN2241T

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

| Parameter                            | Conditions                            | Device    | Symbol        | Min | Typ | Max  | Unit |  |
|--------------------------------------|---------------------------------------|-----------|---------------|-----|-----|------|------|--|
| DC current gain                      | $V_{CE}=10V, I_C=5mA$                 | FMUN2211T | $h_{FE}$      | 35  |     |      |      |  |
|                                      |                                       | FMUN2212T |               | 60  |     |      |      |  |
|                                      |                                       | FMUN2213T |               | 80  |     |      |      |  |
|                                      |                                       | FMUN2214T |               | 80  |     |      |      |  |
|                                      |                                       | FMUN2215T |               | 160 |     |      |      |  |
|                                      |                                       | FMUN2216T |               | 160 |     |      |      |  |
|                                      |                                       | FMUN2230T |               | 3   |     |      |      |  |
|                                      |                                       | FMUN2231T |               | 8   |     |      |      |  |
|                                      |                                       | FMUN2232T |               | 15  |     |      |      |  |
|                                      |                                       | FMUN2233T |               | 80  |     |      |      |  |
|                                      |                                       | FMUN2234T |               | 80  |     |      |      |  |
|                                      |                                       | FMUN2235T |               | 80  |     |      |      |  |
|                                      |                                       | FMUN2238T |               | 160 |     |      |      |  |
|                                      |                                       | FMUN2241T |               | 160 |     |      |      |  |
| Output voltage (off)                 | $V_{CC}=5V, V_B=0.5V, R_L=1K\Omega$   |           | $V_{OH}$      | 4.9 |     |      | V    |  |
|                                      | $V_{CC}=5V, V_B=0.05V, R_L=1K\Omega$  | FMUN2230T |               | 4.9 |     |      |      |  |
|                                      | $V_{CC}=5V, V_B=0.25V, R_L=1K\Omega$  | FMUN2215T |               | 4.9 |     |      |      |  |
|                                      |                                       | FMUN2216T |               |     |     |      |      |  |
|                                      |                                       | FMUN2233T |               |     |     |      |      |  |
|                                      |                                       | FMUN2238T |               |     |     |      |      |  |
| Collector-Emitter saturation voltage | $I_C=10\text{ mA}, I_B=0.3\text{ mA}$ |           | $V_{(CE)sat}$ |     |     | 0.25 | V    |  |
|                                      | $I_C=10\text{ mA}, I_B=5\text{ mA}$   | FMUN2230T |               |     |     | 0.25 |      |  |
|                                      |                                       | FMUN2231T |               |     |     |      |      |  |
|                                      | $I_C=10\text{ mA}, I_B=1\text{ mA}$   | FMUN2215T |               |     |     | 0.25 |      |  |
|                                      |                                       | FMUN2216T |               |     |     |      |      |  |
|                                      |                                       | FMUN2232T |               |     |     |      |      |  |
|                                      |                                       | FMUN2233T |               |     |     |      |      |  |
|                                      |                                       | FMUN2234T |               |     |     |      |      |  |
|                                      |                                       | FMUN2235T |               |     |     |      |      |  |
|                                      |                                       | FMUN2238T |               |     |     |      |      |  |

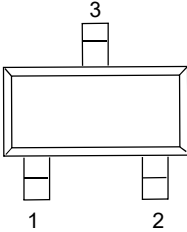
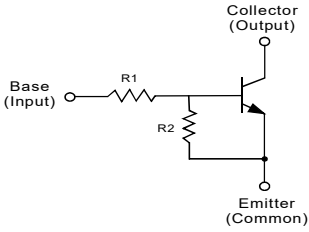
FMUN2211T Thru FMUN2241T

Typical characteristics



## FMUN2211T Thru FMUN2241T

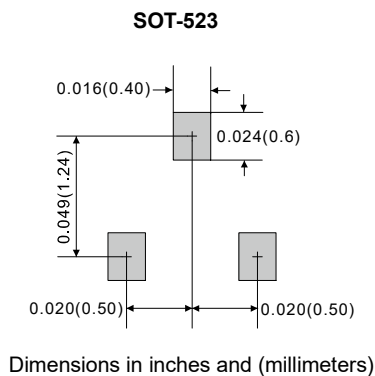
## Pinning information

| Pin                                         | Simplified outline                                                                | Symbol                                                                              |
|---------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Pin1 Base<br>Pin2 Emitter<br>Pin3 Collector |  |  |

## Device marking and resistor values and ordering information

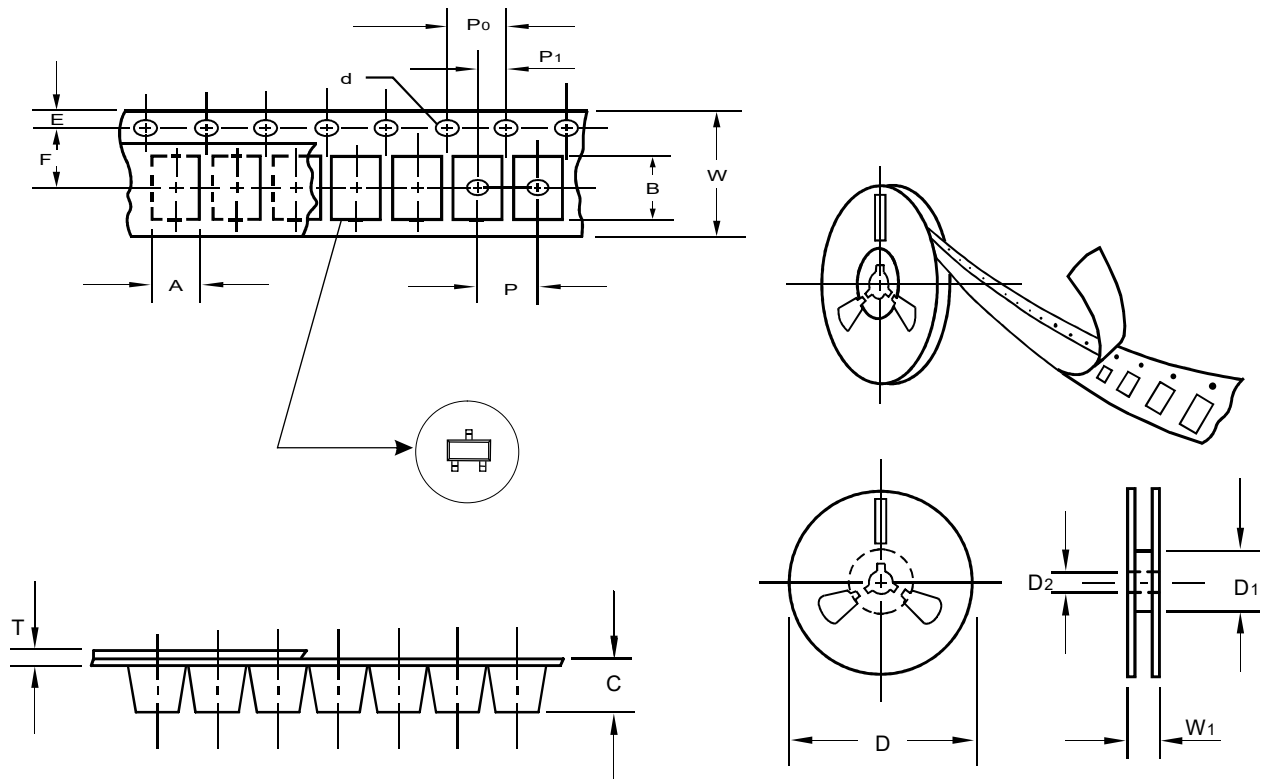
| Device    | Marking | Input resistor $R_1$ (K $\Omega$ ) |        |      | $R_2$ (K $\Omega$ ) | Resistor ratio $R_1 / R_2$ |        |       |
|-----------|---------|------------------------------------|--------|------|---------------------|----------------------------|--------|-------|
|           |         | Min                                | Normal | Max  |                     | Min                        | Normal | Max   |
| FMUN2211T | A8A     | 7                                  | 10     | 13   | 10                  | 0.8                        | 10     | 1.2   |
| FMUN2212T | A8B     | 15.4                               | 22     | 28.6 | 22                  | 0.8                        | 22     | 1.2   |
| FMUN2213T | A8C     | 32.9                               | 47     | 61.1 | 47                  | 0.8                        | 47     | 1.2   |
| FMUN2214T | A8D     | 7                                  | 10     | 13   | 47                  | 0.17                       | 47     | 0.25  |
| FMUN2215T | A8E     | 7                                  | 10     | 13   | —                   | —                          | —      | —     |
| FMUN2216T | A8F     | 3.3                                | 4.7    | 6.1  | —                   | —                          | —      | —     |
| FMUN2230T | A8G     | 0.7                                | 1      | 1.3  | 1                   | 0.8                        | 1      | 1.2   |
| FMUN2231T | A8H     | 1.5                                | 2.2    | 2.9  | 2.2                 | 0.8                        | 2.2    | 1.2   |
| FMUN2232T | A8I     | 3.3                                | 4.7    | 6.1  | 4.7                 | 0.8                        | 4.7    | 1.2   |
| FMUN2233T | A8J     | 3.3                                | 4.7    | 6.1  | 47                  | 0.055                      | 47     | 0.185 |
| FMUN2234T | A8K     | 15.4                               | 22     | 28.6 | 47                  | 0.38                       | 47     | 0.56  |
| FMUN2235T | A8M     | 1.54                               | 2.2    | 2.86 | 47                  | 0.038                      | 47     | 0.056 |
| FMUN2238T | A8L     | 1.54                               | 2.2    | 2.88 | —                   | —                          | —      | —     |
| FMUN2241T | A8N     | 70                                 | 100    | 130  | —                   | —                          | —      | —     |

## Suggested solder pad layout



## FMUN2211T Thru FMUN2241T

## 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       | 0.90    |
| Sprocket hole             | d      | 0.1       | 1.5     |
| 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       | 60.00   |
| 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       | 9.50    |

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

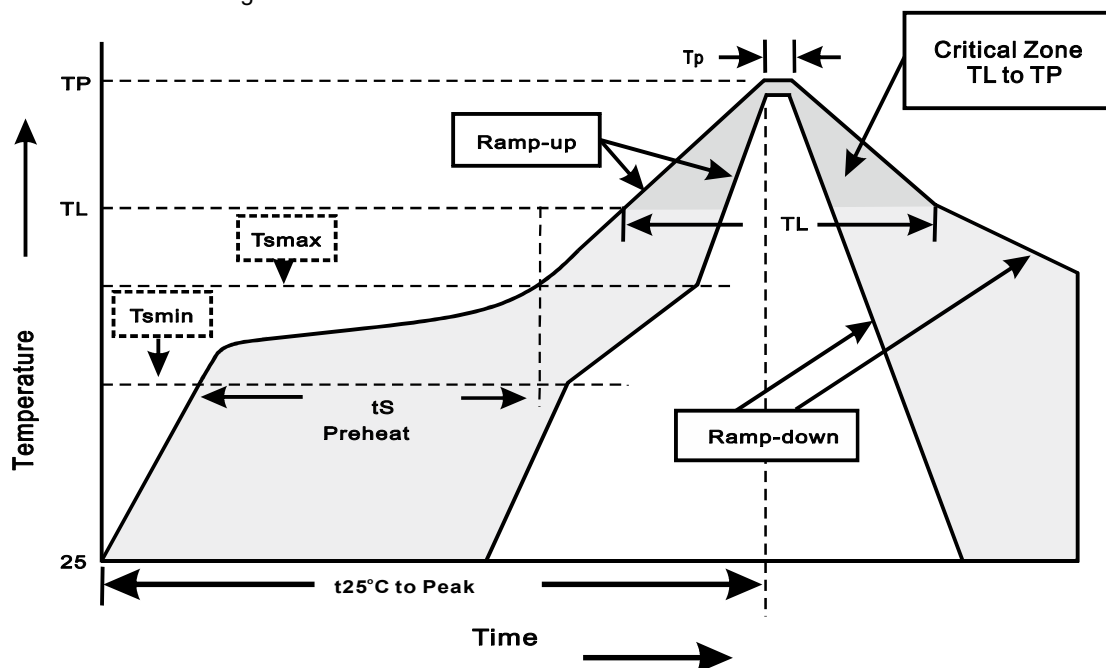
## FMUN2211T Thru FMUN2241T

## 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) |
|---------|-----------|------------|-------------------------|-----------|-----------------|-----------------|-------------------|--------------|
| SOT-523 | 7"        | 3,000      | 4.0                     | 30,000    | 183*183*123     | 178             | 382*262*387       | 240,000      |

## 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 $T_P$ )                                                                    | $< 3^\circ\text{C/sec}$     |
| 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-upRate                                                                       | $< 3^\circ\text{C/sec}$     |
| Time maintained above:<br>-Temperature( $T_L$ )<br>-Time( $t_L$ )                                         | 217°C<br>60~260sec          |
| Peak Temperature( $T_P$ )                                                                                 | 255°C-0/+5°C                |
| Time within 5°C of actual Peak Temperature( $t_p$ )                                                       | 10~30sec                    |
| Ramp-down Rate                                                                                            | $< 6^\circ\text{C/sec}$     |
| Time 25°C to Peak Temperature                                                                             | $< 6\text{ minutes}$        |