

# MMDT3946

Rev.E Oct.-2021



| A | 2016-3     |   |                               |  |  |
|---|------------|---|-------------------------------|--|--|
| B | 2019-4-12  |   | RθJA=625<br>SOT363-6L SOT-363 |  |  |
| C | 2019-4-20  |   |                               |  |  |
| D | 2020-11-10 |   |                               |  |  |
| E | 2021-7     | 4 |                               |  |  |

## / Descriptions

SOT-363 PNP+NPN Silicon PNP and NPN transistor in a SOT-363 Plastic Package.

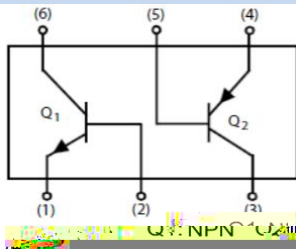
## / Features

$h_{FE}$   $V_{CE(sat)}$   
High DC Current Gain, Low Collector to Emitter Saturation Voltage, HF Product.

## / Applications

General purpose amplifier and switching.

## / Equivalent Circuit



## / Pinning



PIN 1 4 Emitter PIN 2 5 Base PIN 3 6 Collector

## / $h_{FE}$ Classifications & Marking

See Marking Instructions.

/ Absolute Maximum Ratings( $T_a=25^\circ\text{C}$ ) (NPN)

| Parameter                              | Symbol          | Rating  | Unit               |
|----------------------------------------|-----------------|---------|--------------------|
| Collector to Base Voltage              | $V_{CBO}$       | 60      | V                  |
| Collector to Emitter Voltage           | $V_{CEO}$       | 40      | V                  |
| Emitter to Base Voltage                | $V_{EBO}$       | 6.0     | V                  |
| Collector Current                      | $I_C$           | 200     | mA                 |
| Collector Power Dissipation            | $P_C$           | 200     | mW                 |
|                                        | $*P_C$          | 350     | mW                 |
| Thermal Resistance Junction to Ambient | $R_{\theta JA}$ | 625     | $^\circ\text{C/W}$ |
| Junction Temperature                   | $T_j$           | 150     | $^\circ\text{C}$   |
| Storage Temperature Range              | $T_{stg}$       | -55~150 | $^\circ\text{C}$   |

/ Absolute Maximum Ratings( $T_a=25^\circ\text{C}$ ) (PNP)

| Parameter                              | Symbol          | Rating  | Unit               |
|----------------------------------------|-----------------|---------|--------------------|
| Collector to Base Voltage              | $V_{CBO}$       | -40     | V                  |
| Collector to Emitter Voltage           | $V_{CEO}$       | -40     | V                  |
| Emitter to Base Voltage                | $V_{EBO}$       | -5.0    | V                  |
| Collector Current                      | $I_C$           | -200    | mA                 |
| Collector Power Dissipation            | $P_C$           | 300     | mW                 |
| Thermal Resistance Junction to Ambient | $R_{\theta JA}$ | 625     | $^\circ\text{C/W}$ |
| Junction Temperature                   | $T_j$           | 150     | $^\circ\text{C}$   |
| Storage Temperature Range              | $T_{stg}$       | -55~150 | $^\circ\text{C}$   |

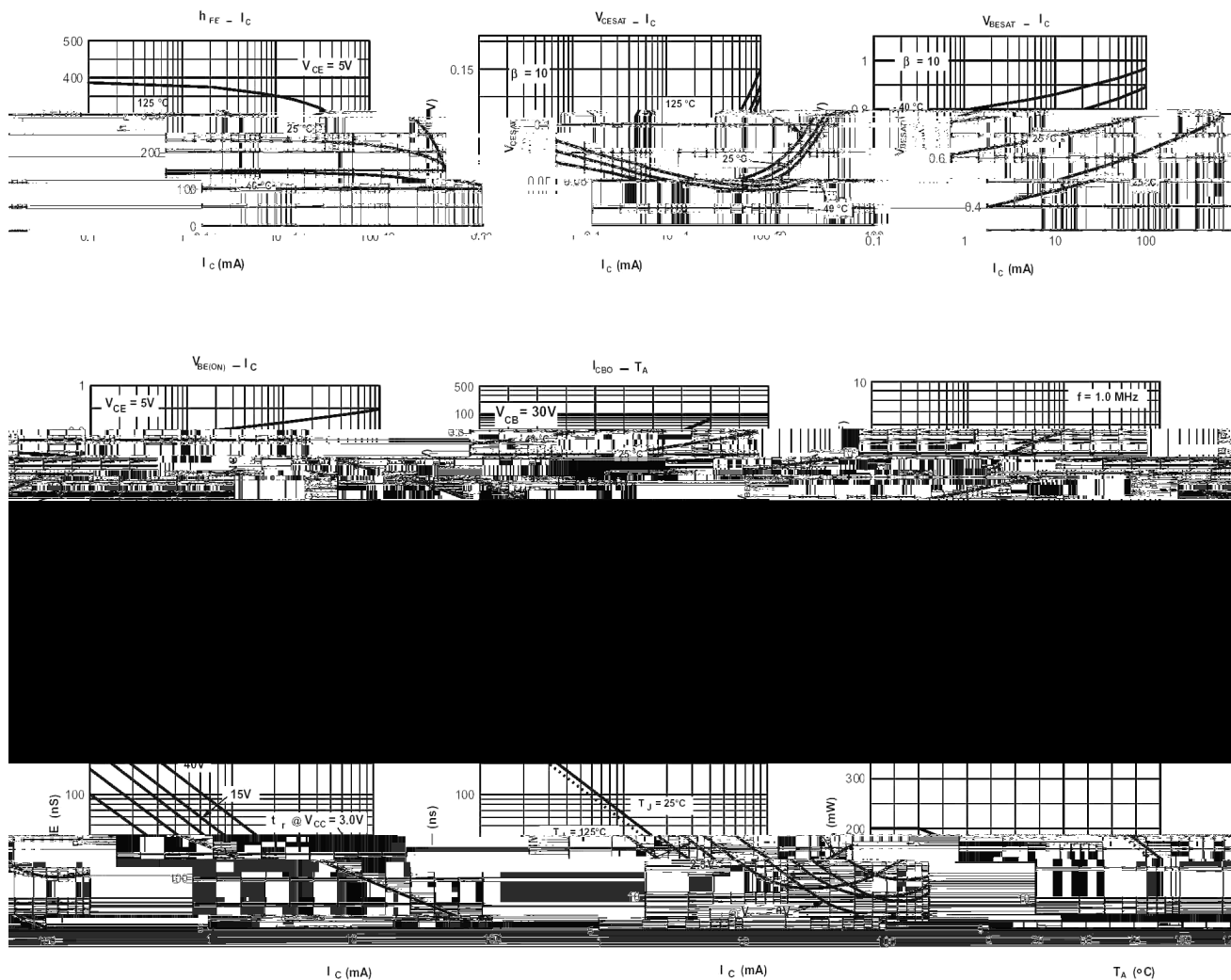
**/ Electrical Characteristics(Ta=25 ) (NPN)**

| Parameter                              | Symbol           | Test Conditions                                          | Min  | Typ | Max  | Unit    |
|----------------------------------------|------------------|----------------------------------------------------------|------|-----|------|---------|
| Collector to Base Breakdown Voltage    | $V_{CBO}$        | $I_C=10\mu A$ $I_E=0$                                    | 60   |     |      | V       |
| Collector to Emitter Breakdown Voltage | $V_{CEO}$        | $I_C=1.0mA$ $I_B=0$                                      | 40   |     |      | V       |
| Emitter to Base Breakdown Voltage      | $V_{EBO}$        | $I_E=10\mu A$ $I_C=0$                                    | 6.0  |     |      | V       |
| Collector Cut-Off Current              | $I_{CBO}$        | $V_{CB}=30V$ $I_E=0$                                     |      |     | 0.05 | $\mu A$ |
| Emitter Cut-Off Current                | $I_{EBO}$        | $V_{EB}=3.0V$ $I_C=0$                                    |      |     | 0.05 | $\mu A$ |
| DC Current Gain                        | $h_{FE(1)}$      | $V_{CE}=1.0V$ $I_C=10mA$                                 | 100  |     | 300  |         |
|                                        | $h_{FE(2)}$      | $V_{CE}=1.0V$ $I_C=100mA$                                | 30   |     |      |         |
|                                        | $h_{FE(3)}$      | $V_{CE}=1.0V$ $I_C=50mA$                                 | 60   |     |      |         |
|                                        | $h_{FE(4)}$      | $V_{CE}=1.0V$ $I_C=1.0mA$                                | 70   |     |      |         |
|                                        | $h_{FE(5)}$      | $V_{CE}=1.0V$ $I_C=0.1mA$                                | 40   |     |      |         |
| Collector-Emitter Saturation Voltage   | $V_{CE(sat)(1)}$ | $I_C=10mA$ $I_B=1.0mA$                                   |      |     | 0.2  | V       |
|                                        | $V_{CE(sat)(2)}$ | $I_C=50mA$ $I_B=5.0mA$                                   |      |     | 0.3  | V       |
| Base-Emitter Saturation Voltage        | $V_{BE(sat)(1)}$ | $I_C=10mA$ $I_B=1.0mA$                                   | 0.65 |     | 0.85 | V       |
|                                        | $V_{BE(sat)(2)}$ | $I_C=50mA$ $I_B=5.0mA$                                   |      |     | 0.95 | V       |
| Transition Frequency                   | $f_T$            | $V_{CE}=20V$ $I_C=10mA$<br>$f=100MHz$                    | 300  |     |      | MHz     |
| Output Capacitance                     | $C_{ob}$         | $V_{CB}=5.0V$ $f=1.0MHz$                                 |      |     | 4.0  | pF      |
| Storage Time                           | $t_{stg}$        | $V_{CC}=3.0V$ $I_C=10mA$<br>$I_{B1}=-I_{B2}=1.0mA$       |      |     | 200  | ns      |
| Fall Time                              | $t_f$            | $V_{CC}=3.0V$ $I_C=10mA$<br>$I_{B1}=-I_{B2}=1.0mA$       |      |     | 50   | ns      |
| Delay Time                             | $t_d$            | $V_{CC}=3.0V$ $V_{BE}=0.5V$<br>$I_C=10mA$ $I_{B1}=1.0mA$ |      |     | 35   | ns      |
| Rise Time                              | $t_r$            | $V_{CC}=3.0V$ $V_{BE}=0.5V$<br>$I_C=10mA$ $I_{B1}=1.0mA$ |      |     | 35   | ns      |
| Input Capacitance                      | $C_{ib}$         | $V_{EB}=0.5V$ $f=1.0MHz$                                 |      |     | 8.0  | pF      |

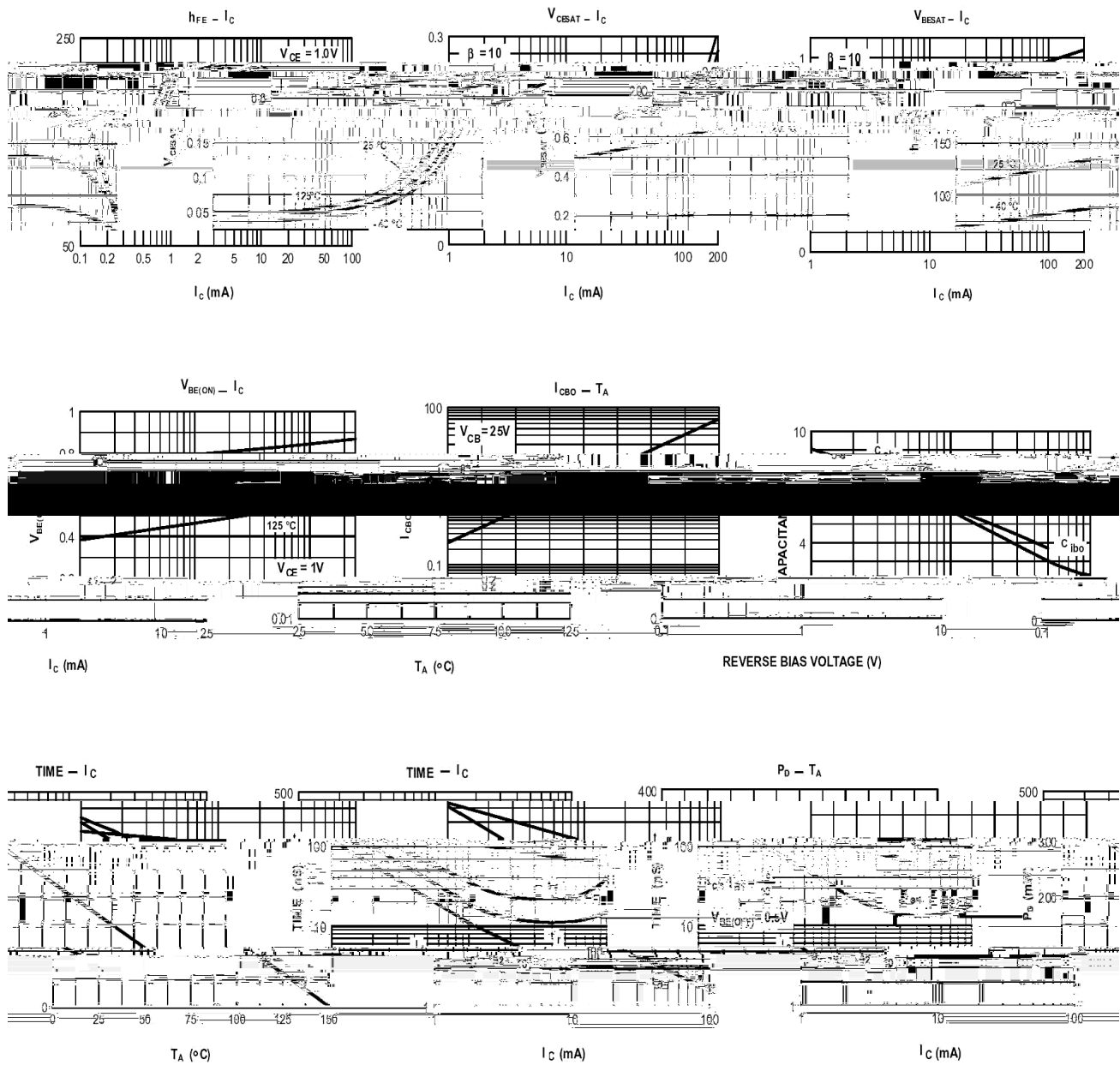
## / Electrical Characteristics(Ta=25 ) (PNP)

| Parameter                              | Symbol            | Test Conditions                                              | Min   | Typ | Max   | Unit    |
|----------------------------------------|-------------------|--------------------------------------------------------------|-------|-----|-------|---------|
| Collector to Base Breakdown Voltage    | $V_{CBO}$         | $I_C=-10\mu A$ $I_E=0$                                       | -40   |     |       | V       |
| Collector to Emitter Breakdown Voltage | $V_{CEO}$         | $I_C=-1.0mA$ $I_B=0$                                         | -40   |     |       | V       |
| Emitter to Base Breakdown Voltage      | $V_{EBO}$         | $I_E=-10\mu A$ $I_C=0$                                       | -5.0  |     |       | V       |
| Collector Cut-Off Current              | $I_{CBO}$         | $V_{CB}=-30V$ $I_E=0$                                        |       |     | -0.05 | $\mu A$ |
| Emitter Cut-Off Current                | $I_{EBO}$         | $V_{EB}=-3.0V$ $I_C=0$                                       |       |     | -0.05 | $\mu A$ |
| DC Current Gain                        | $h_{FE(1)}$       | $V_{CE}=-1.0V$ $I_C=-10mA$                                   | 100   |     | 300   |         |
|                                        | $h_{FE(2)}$       | $V_{CE}=-1.0V$ $I_C=-100mA$                                  | 30    |     |       |         |
|                                        | $h_{FE(3)}$       | $V_{CE}=-1.0V$ $I_C=-50mA$                                   | 60    |     |       |         |
|                                        | $h_{FE(4)}$       | $V_{CE}=-1.0V$ $I_C=-1.0mA$                                  | 80    |     |       |         |
|                                        | $h_{FE(5)}$       | $V_{CE}=-1.0V$ $I_C=-0.1mA$                                  | 60    |     |       |         |
| Collector-Emitter Saturation voltage   | $V_{CE(sat) (1)}$ | $I_C=-10mA$ $I_B=-1.0mA$                                     |       |     | -0.25 | V       |
|                                        | $V_{CE(sat) (2)}$ | $I_C=-50mA$ $I_B=-5.0mA$                                     |       |     | -0.4  | V       |
| Base-Emitter Saturation Voltage        | $V_{BE(sat) (1)}$ | $I_C=-10mA$ $I_B=-1.0mA$                                     | -0.65 |     | -0.85 | V       |
|                                        | $V_{BE(sat) (2)}$ | $I_C=-50mA$ $I_B=-5.0mA$                                     |       |     | -0.95 | V       |
| Transition Frequency                   | $f_T$             | $V_{CE}=-20V$ $I_C=-10mA$<br>$f=100MHz$                      | 250   |     |       | MHz     |
| Output Capacitance                     | $C_{ob}$          | $V_{CB}=-5.0V$ $f=1.0MHz$                                    |       |     | 4.5   | pF      |
| Storage Time                           | $t_{stg}$         | $V_{CC}=-3.0V$ $I_C=-10mA$<br>$I_{B1}=-I_{B2}=-1.0mA$        |       |     | 225   | ns      |
| Fall Time                              | $t_f$             | $V_{CC}=-3.0V$ $I_C=-10mA$<br>$I_{B1}=-I_{B2}=-1.0mA$        |       |     | 75    | ns      |
| Delay Time                             | $t_d$             | $V_{CC}=-3.0V$ $V_{BE}=-0.5V$<br>$I_C=-10mA$ $I_{B1}=-1.0mA$ |       |     | 35    | ns      |
| Rise Time                              | $t_r$             | $V_{CC}=-3.0V$ $V_{BE}=-0.5V$<br>$I_C=-10mA$ $I_{B1}=-1.0mA$ |       |     | 35    | ns      |
| Input Capacitance                      | $C_{ib}$          | $V_{EB}=-0.5V$ $f=1.0MHz$                                    |       |     | 10    | pF      |

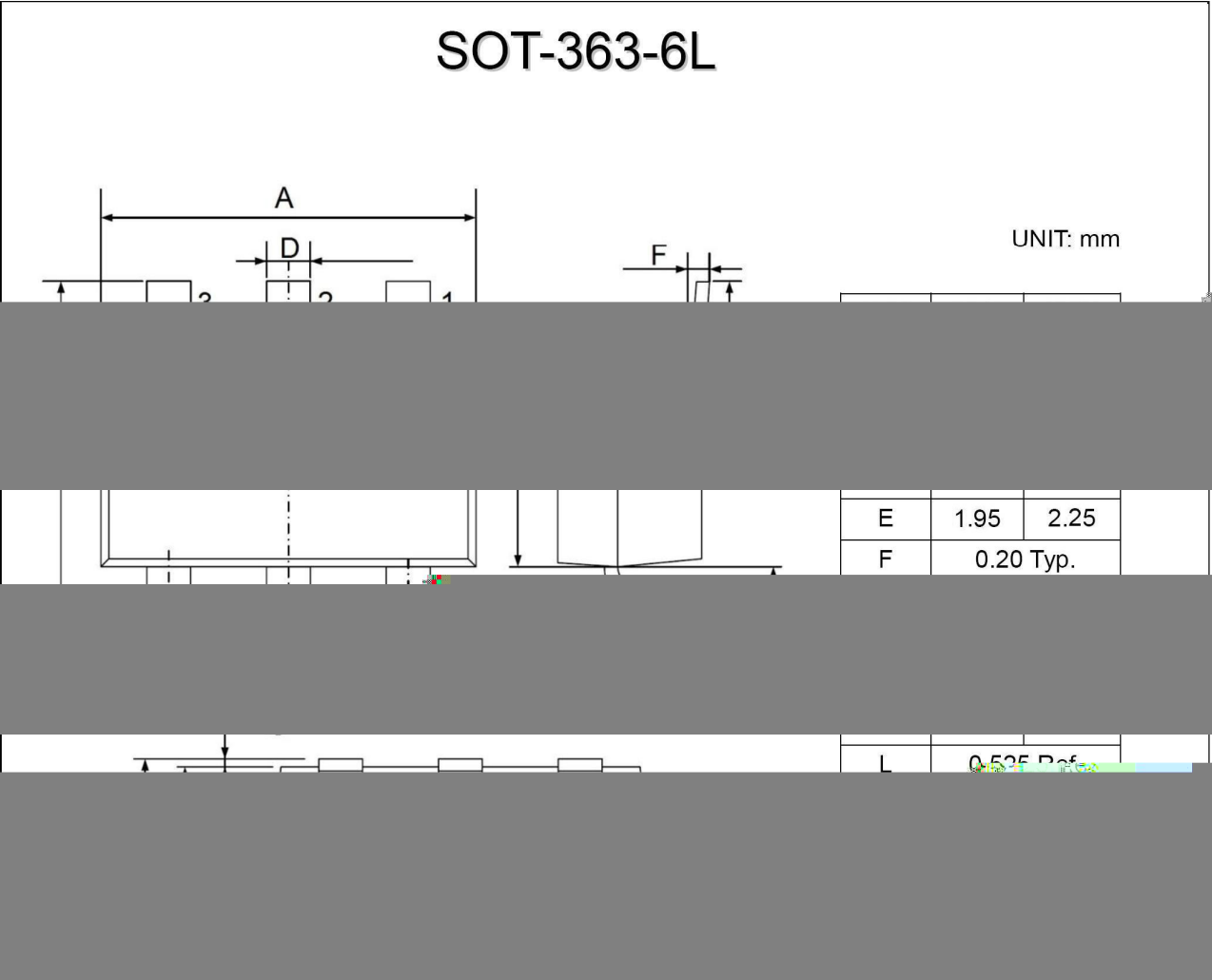
## / Electrical Characteristic Curve (NPN)



## / Electrical Characteristic Curve (PNP)

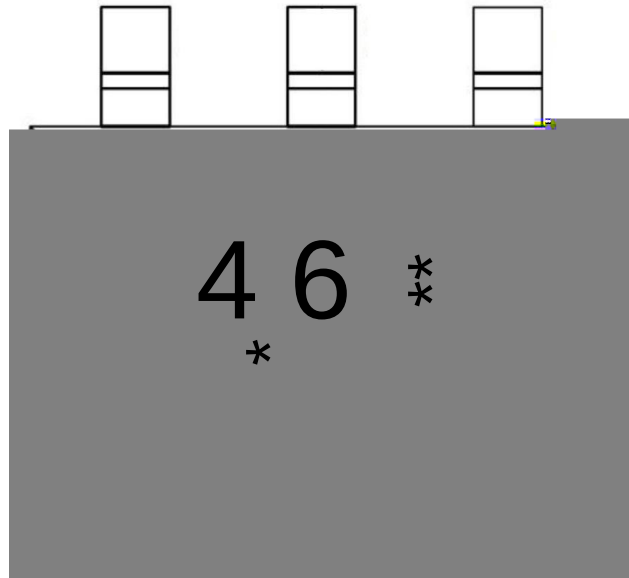


/ Package Dimensions





/ Marking Instructions



● “1”

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\*\*\*:

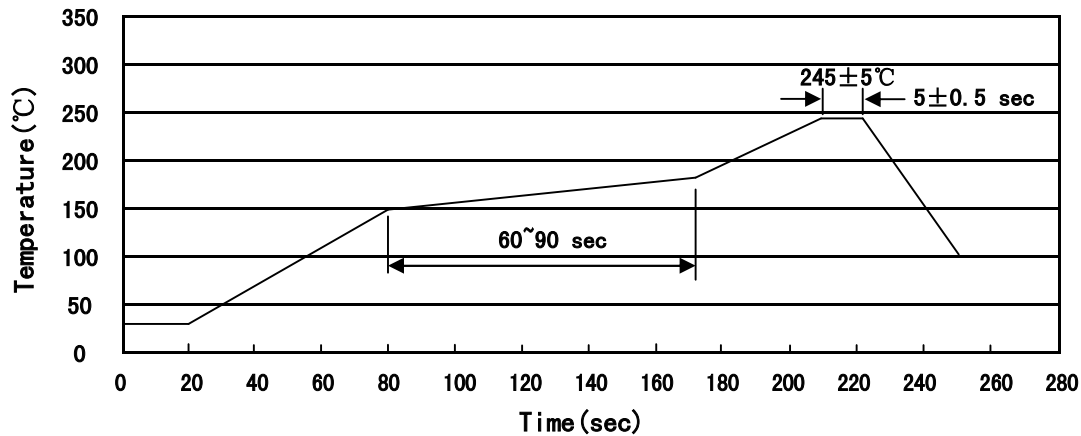
Note:

● “1” Pin

46 Product Type Code

\*\*\*: Lot No. Code, code change with Lot No.

## ( ) / Temperature Profile for IR Reflow Soldering(Pb-Free)



Note:

- |   |       |     |           |        |                                         |
|---|-------|-----|-----------|--------|-----------------------------------------|
| 1 | 150   | 180 | 60        | 90sec; | 1.Preheating:150~180 , Time:60~90sec.   |
| 2 | 245±5 |     | 5±0.5sec; |        | 2.Peak Temp.:245±5 , Duration:5±0.5sec. |
| 3 |       | 2   | 10        | /sec.  | 3. Cooling Speed: 2~10 /sec.            |

## / Resistance to Soldering Heat Test Conditions

260±5      10±1 sec.      Temp.:260±5℃      Time:10±1 sec

## / Packaging SPEC.

/ REEL

| Package Type<br>封装形式 | Units 包装数量         |                         |                        |                              |                        | Dimension 包装尺寸 (unit: mm <sup>3</sup> ) |             |             |
|----------------------|--------------------|-------------------------|------------------------|------------------------------|------------------------|-----------------------------------------|-------------|-------------|
|                      | Units/Reel<br>只/卷盘 | Reels/Inner Box<br>卷盘/盒 | Units/Inner Box<br>只/盒 | Inner Boxes/Outer Box<br>盒/箱 | Units/Outer Box<br>只/箱 | Reel                                    | Inner Box 盒 | Outer Box 箱 |
| SOT-363              | 3,000              | 10                      | 30,000                 | 6                            | 180,000                | 7" ×8                                   | 180×120×180 | 390×385×205 |

## / Notices