

FMOSGTAC57N04-Q1-H

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**FMOSGTAC57N04-Q1-H****57A 40V N-Channel Shield Gate Trench Enhancement Mode Power MOSFET****Features**

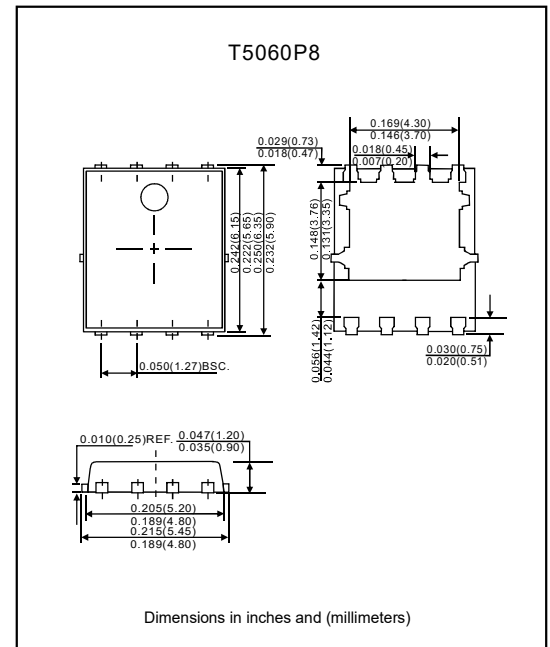
- $V_{DS}=40V$ ,  $I_D=57A$ .
- $R_{DS(ON)} \leq 7.4m\Omega$ , @  $V_{GS}=10V$ ,  $I_D=30A$ .
- $R_{DS(ON)} \leq 12.5m\Omega$ , @  $V_{GS}=4.5V$ ,  $I_D=30A$ .
- Good stability and uniformity with high  $E_{AS}$ .
- High density cell design for ultra-low on-resistance.
- Excellent package for good heat dissipation.
- Battery switch and load switch.
- Qualified to AEC-Q101 standards for high reliability.
- Lead-free parts meet RoHS requirements.
- Halogen-free (IEC61249-2-21).

**Applications**

- SMPS and general purpose applications.
- Uninterruptible power supply.
- Hard switching and high-speed frequency circuit.

**Mechanical data**

- Epoxy:UL94-V0 rated flame retardant.
- Case : Molded plastic,T5060P8.
- Weight : Approximated 105mg.

**Package outline****Maximum ratings** (At  $T_J=25^\circ C$  unless otherwise noted)

| Parameter                                                | Symbol          | Ratings     | Unit         |
|----------------------------------------------------------|-----------------|-------------|--------------|
| Drain-source voltage                                     | $V_{DS}$        | 40          | V            |
| Gate-source voltage                                      | $V_{GS}$        | $\pm 20$    | V            |
| Continuous drain current<br>( $T_c=25^\circ C$ ) (Note1) | $I_D$           | 57          | A            |
|                                                          |                 | 40          | A            |
| Pulsed drain current (Note2)                             | $I_{DM}$        | 228         | A            |
| Single pulse avalanche energy (Note3)                    | $E_{AS}$        | 90          | mJ           |
| Power dissipation (Note1)                                | $P_D$           | 39          | W            |
| Thermal resistance, junction to ambient (Note4)          | $R_{\theta JA}$ | 62.5        | $^\circ C/W$ |
| Thermal resistance, junction to case                     | $R_{\theta JC}$ | 3.8         | $^\circ C/W$ |
| Operating Junction temperature                           | $T_J$           | +175        | $^\circ C$   |
| Storage temperature range                                | $T_{STG}$       | -55 to +175 | $^\circ C$   |

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

| Parameter                                      | Symbol               | Conditions                                                                                                  | Min | Typ  | Max  | Unit |
|------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------|-----|------|------|------|
| Off characteristics                            |                      |                                                                                                             |     |      |      |      |
| Drain-source breakdown voltage                 | BV <sub>DSS</sub>    | I <sub>D</sub> =1mA, V <sub>GS</sub> =0V                                                                    | 40  |      |      | V    |
| Drain-source leakage current                   | I <sub>DSS</sub>     | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C                                             |     |      | 1    | μA   |
|                                                |                      | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V, T <sub>J</sub> =150°C                                            |     |      | 100  |      |
| Gate-source leakage current                    | I <sub>GSS</sub>     | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                                                  |     |      | ±100 | nA   |
| On characteristics (Note5)                     |                      |                                                                                                             |     |      |      |      |
| Gate threshold voltage                         | V <sub>GS(TH)</sub>  | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250μA                                                    | 1.3 | 1.8  | 2.5  | V    |
| Static drain-source on-resistance              | R <sub>DS(ON)</sub>  | V <sub>GS</sub> =10V, I <sub>D</sub> =30A                                                                   |     | 6.1  | 7.4  | mΩ   |
|                                                |                      | V <sub>GS</sub> =4.5V, I <sub>D</sub> =30A                                                                  |     | 9.9  | 12.5 |      |
| Dynamic parameters                             |                      |                                                                                                             |     |      |      |      |
| Input capacitance                              | C <sub>iss</sub>     | V <sub>GS</sub> =0V, V <sub>DS</sub> =20V, f=1.0MHz                                                         |     | 780  |      | pF   |
| Out capacitance                                | C <sub>oss</sub>     |                                                                                                             |     | 322  |      |      |
| Reverse transfer capacitance                   | C <sub>rss</sub>     |                                                                                                             |     | 7    |      |      |
| Gate resistance                                | R <sub>g</sub>       | f=1.0MHz                                                                                                    |     | 5    |      | Ω    |
| Switching parameters                           |                      |                                                                                                             |     |      |      |      |
| Total gate charge                              | Q <sub>g</sub>       | V <sub>GS</sub> =10V, V <sub>DD</sub> =32V, I <sub>D</sub> =30A                                             |     | 13.6 |      | nC   |
| Gate to source charge                          | Q <sub>gs</sub>      |                                                                                                             |     | 2.6  |      |      |
| Gate to drain charge                           | Q <sub>gd</sub>      |                                                                                                             |     | 2.2  |      |      |
| Gate plateau voltage                           | V <sub>plateau</sub> |                                                                                                             |     | 3.1  |      | V    |
| Turn-on delay time                             | t <sub>d(on)</sub>   | V <sub>DD</sub> =20V, V <sub>GS</sub> =10V, R <sub>G</sub> =2.5Ω, I <sub>D</sub> =25A, R <sub>L</sub> =0.8Ω |     | 8.7  |      | ns   |
| Rise time                                      | t <sub>r</sub>       |                                                                                                             |     | 3.0  |      |      |
| Turn-off delay time                            | t <sub>d(off)</sub>  |                                                                                                             |     | 14.3 |      |      |
| Fall time                                      | t <sub>f</sub>       |                                                                                                             |     | 4.2  |      |      |
| Source-drain diode ratings and characteristics |                      |                                                                                                             |     |      |      |      |
| Drain-source diode forward voltage (Note 5)    | V <sub>SD</sub>      | I <sub>S</sub> =30A, V <sub>GS</sub> =0V                                                                    |     |      | 1.1  | V    |
| Continuous source current (Note 1)             | I <sub>S</sub>       |                                                                                                             |     |      | 41   | A    |
| Pulsed drain-source diode forward (Note 2)     | I <sub>SM</sub>      |                                                                                                             |     |      | 164  | A    |
| Reverse recovery time                          | t <sub>rr</sub>      | V <sub>R</sub> =20V, I <sub>F</sub> =30A, di <sub>F</sub> /dt=100A/μs                                       |     | 29   |      | ns   |
| Reverse recovery charge                        | Q <sub>rr</sub>      |                                                                                                             |     | 21   |      | nC   |

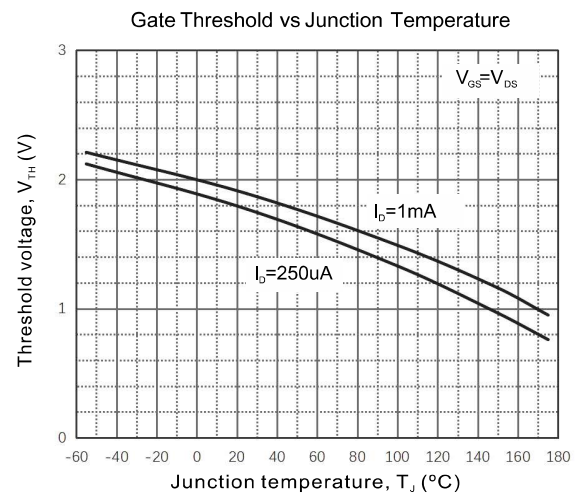
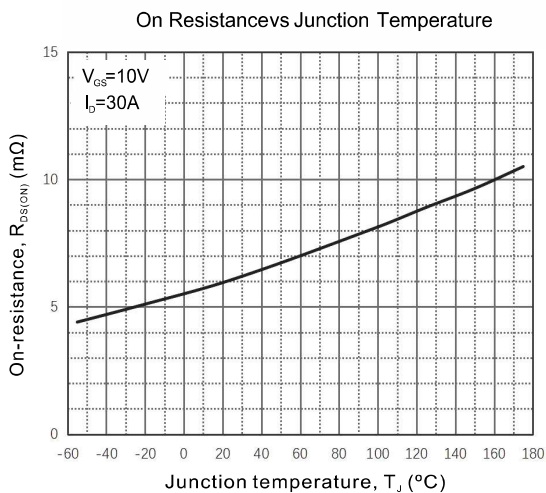
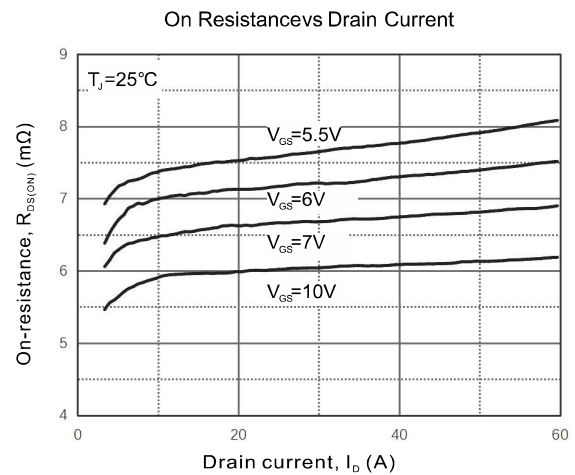
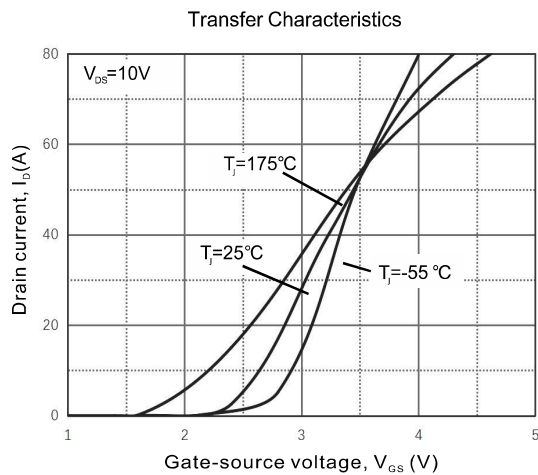
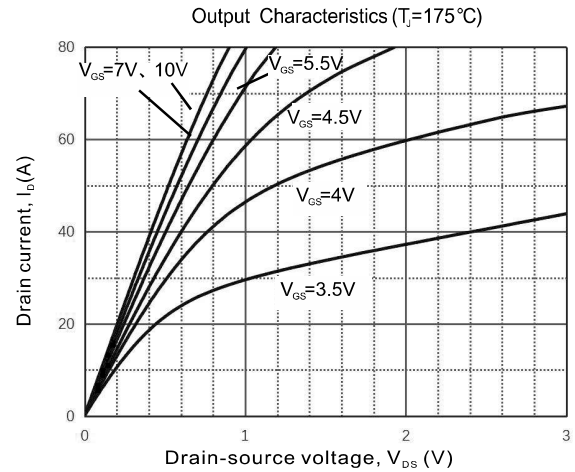
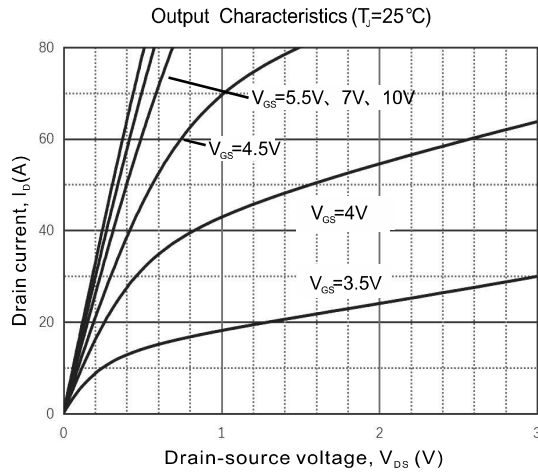
Note : 1.  $T_c=25^{\circ}\text{C}$ ,  $R_{\theta JC}=3.8^{\circ}\text{C}/\text{W}$ .

2. Limited by maximum junction temperature.

3. Test condition:  $V_{DD}=20\text{V}$ ,  $V_{GS}=10\text{V}$ ,  $L=0.5\text{mH}$ ,  $R_G=25\Omega$ , starting at  $T_J=25^{\circ}\text{C}$ .4. Measured with the device mounted on 1 inch<sup>2</sup> FR-4 board with 2oz. copper, in a still air environment with  $T_A=25^{\circ}\text{C}$ .5. Pulse test: pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .

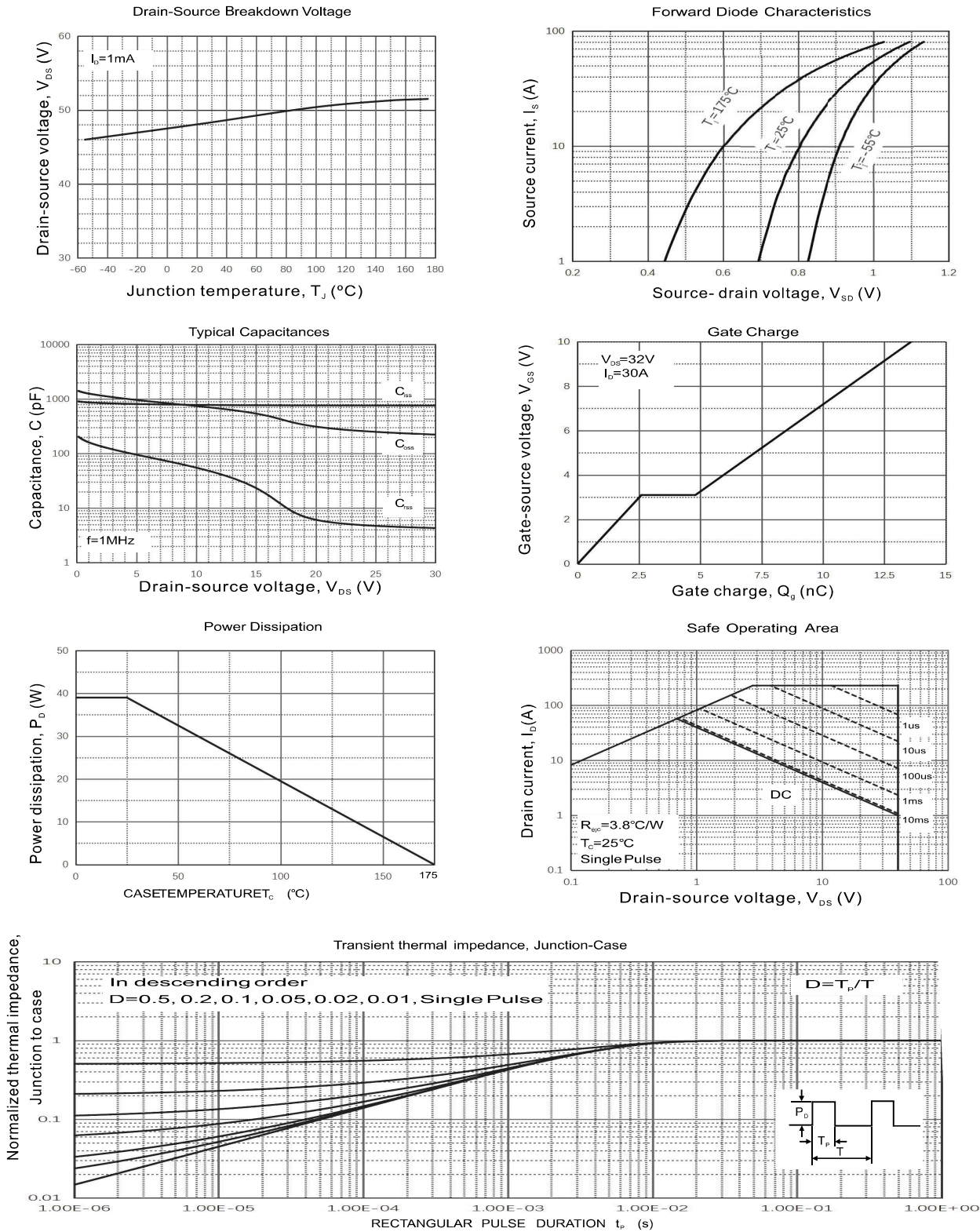
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## Rating and characteristic curves



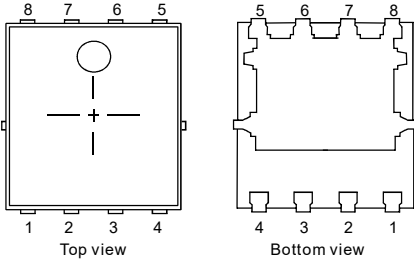
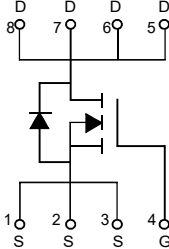
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## Rating and characteristic curves



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Pinning information

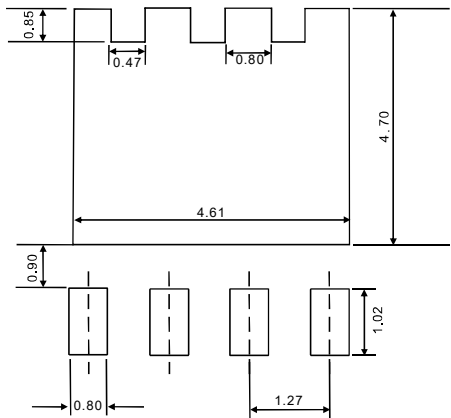
| Pin                                                       | Simplified outline                                                                 | Symbol                                                                              |
|-----------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Pin 1, 2, 3, Source<br>Pin 4 Gate<br>Pin 5, 6, 7, 8 Drain |  |  |

Marking

| Type number        | Marking code |
|--------------------|--------------|
| FMOSGTAC57N04-Q1-H | AC57N04      |

Suggested solder pad layout

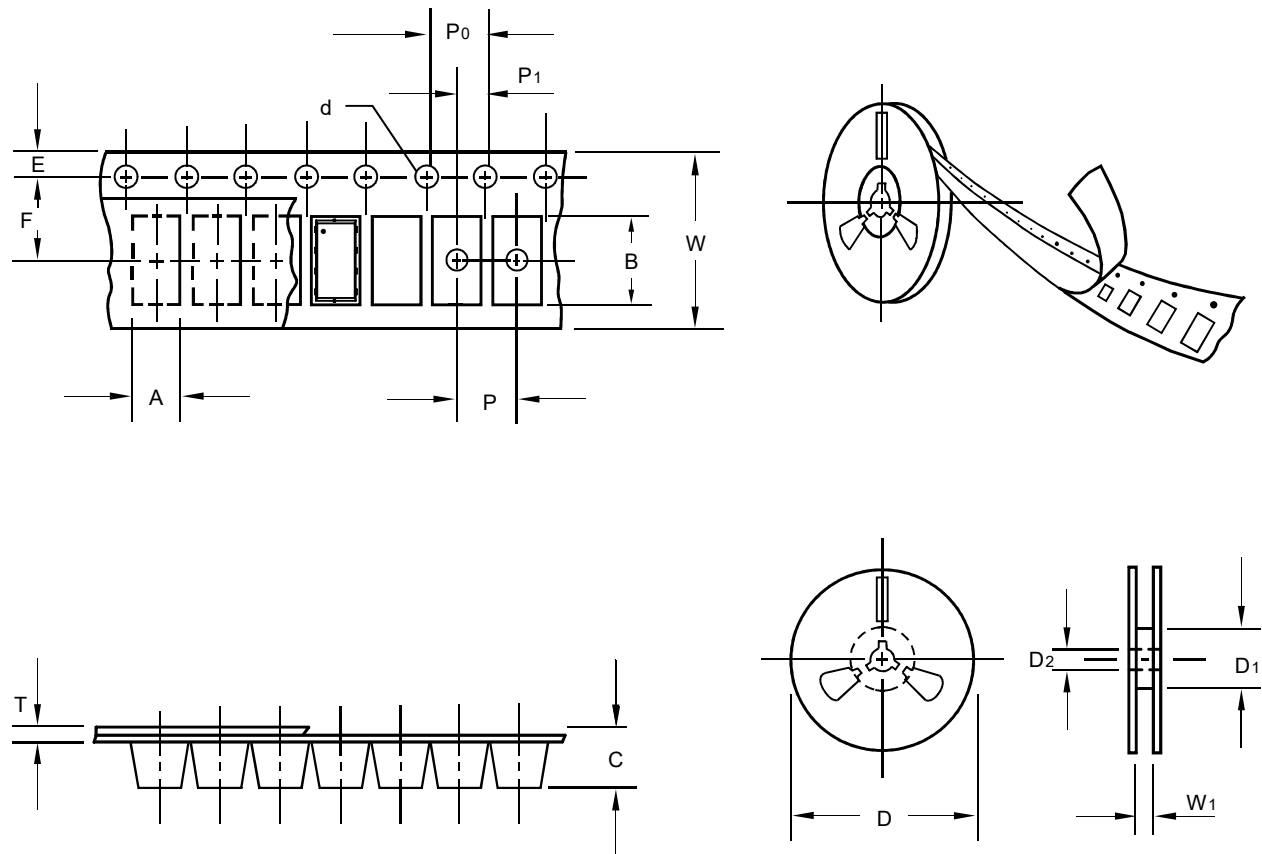
T5060P8



Note:  
1. Controlling dimension: in millimeters.  
2. General tolerance:  $\pm 0.1\text{mm}$   
3. The pad layout is for reference purposes only.

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Packing information



unit:mm

| Item                      | Symbol | Tolerance | T5060P8 |
|---------------------------|--------|-----------|---------|
| Carrier width             | A      | 0.1       | 6.30    |
| Carrier length            | B      | 0.1       | 5.30    |
| Carrier depth             | C      | 0.1       | 1.10    |
| Sprocket hole             | d      | 0.1       | 1.50    |
| 13" Reel outside diameter | D      | 2.0       | 330.00  |
| 13" Reel inner diameter   | D1     | min       | 100.00  |
| 7" Reel outside diameter  | D      | 2.0       | -       |
| 7" Reel inner diameter    | D1     | min       | -       |
| Feed hole diameter        | D2     | 0.5       | 13.50   |
| Sprocket hole position    | E      | 0.1       | 1.75    |
| Punch hole position       | F      | 0.1       | 5.50    |
| Punch hole pitch          | P      | 0.1       | 8.00    |
| Sprocket hole pitch       | P0     | 0.1       | 4.00    |
| Embossment center         | P1     | 0.1       | 2.00    |
| Tape width                | W      | 0.3       | 12.00   |
| Reel width                | W1     | 1.0       | 12.40   |

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

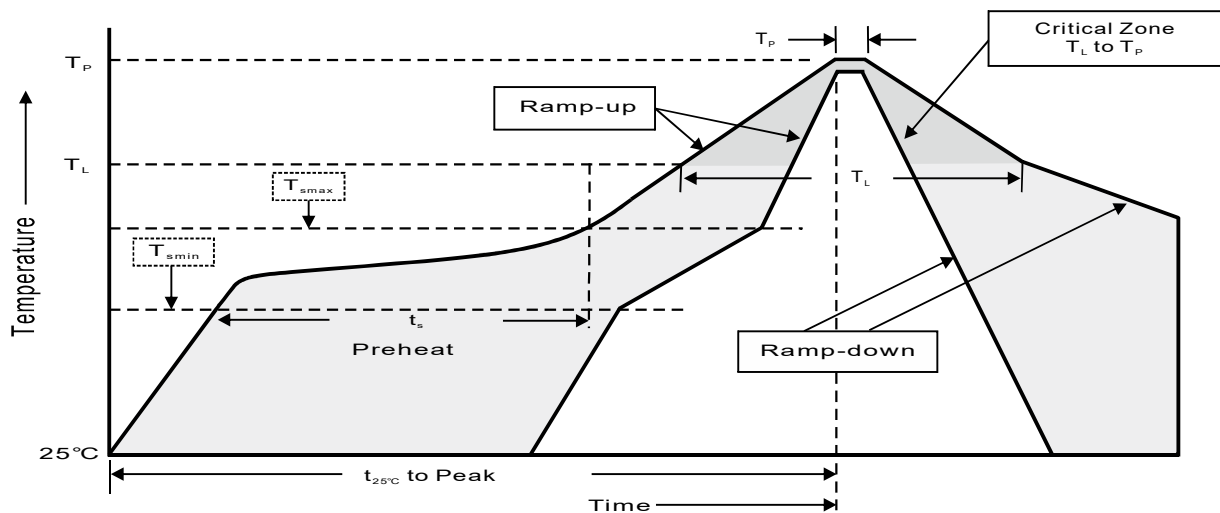
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## Reel packing

| Device             | Outline | Device Package | Reel Size | Reel (pcs) |
|--------------------|---------|----------------|-----------|------------|
| FMOSGTAC57N04-Q1-H | Taping  | T5060P8        | 13 inch   | 5,000      |

## 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 °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 ~ 120 sec |
| $T_{smax}$ 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 with 5°C of actual peak temperature ( $T_p$ )                                                               | 10 ~30 sec                     |
| Ramp-down rate                                                                                                   | < 6 °C/sec                     |
| Time 25°C to peak temperature                                                                                    | < 6 minutes                    |