

# FMOS2301-Q1

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# FMOS2301-Q1

## -20V, -3A P-Channel Enhancement Mode Field Effect Transistor

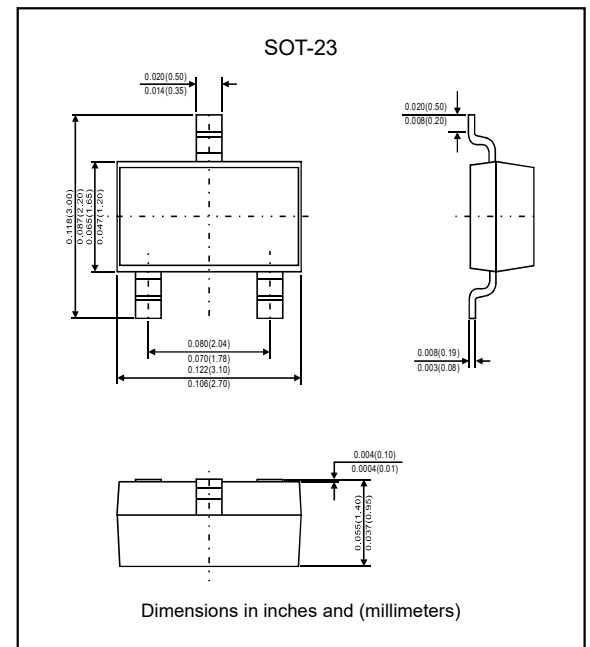
### Features

- $-V_{DS} = 20V$ ,  $I_D = 3A$ .
- $R_{DS(ON)} \leq 112m\Omega$  @  $-V_{GS} = 4.5V$ .
- $R_{DS(ON)} \leq 142m\Omega$  @  $-V_{GS} = 2.5V$ .
- Lead free product is acquired.
- Qualified to AEC-Q101 standards for high reliability.
- We declare that the material of product compliance with RoHS requirements.
- Suffix "-H" indicates Halogen-free part, ex.FMOS2301-Q1-H.

### Mechanical data

- Epoxy:UL94-V0 rated flame retardant
- Case : Molded plastic, SOT-23
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Mounting Position : Any
- Weight : Approximated 0.008 gram

### Package outline



### Maximum ratings ( $T_C = 25^\circ C$ unless otherwise noted)

| Parameter                                                    | Symbol          | Ratings     | Unit         |
|--------------------------------------------------------------|-----------------|-------------|--------------|
| Drain-source voltage                                         | $-V_{DS}$       | 20          | V            |
| Gate-source voltage                                          | $V_{GS}$        | $\pm 8$     | V            |
| Continuous drain current <sup>A</sup> ( $T_C = 25^\circ C$ ) | $-I_D$          | 3           | A            |
| Continuous source-drain diode current                        | $-I_S$          | 0.72        | A            |
| Pulsed drain current                                         | $-I_{DM}$       | 10          | A            |
| Power dissipation ( $T_A = 25^\circ C$ )                     | $P_D$           | 0.35        | W            |
| Thermal resistance form junction to ambient ( $t \leq 5s$ )  | $R_{\theta JA}$ | 357         | $^\circ C/W$ |
| Operating Junction temperature range                         | $T_J$           | +150        | $^\circ C$   |
| Storage temperature range                                    | $T_{STG}$       | -55 to +150 | $^\circ C$   |

## FMOS2301-Q1

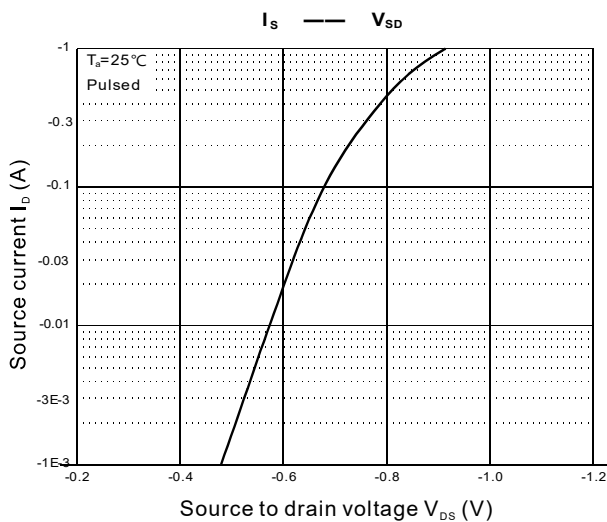
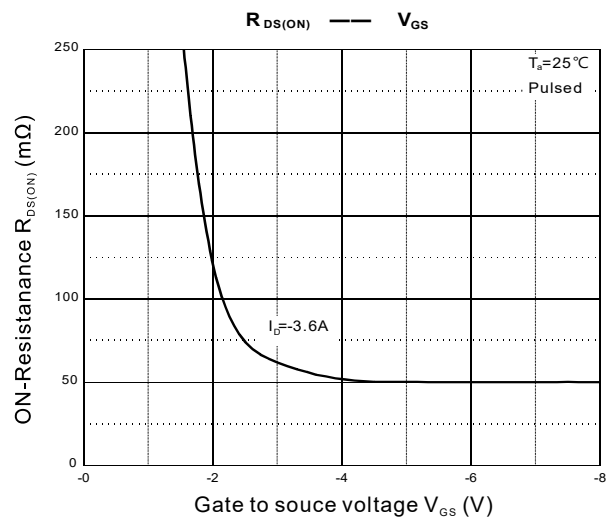
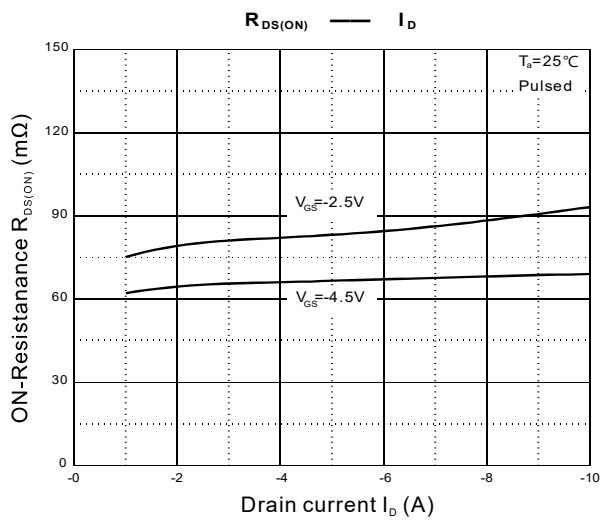
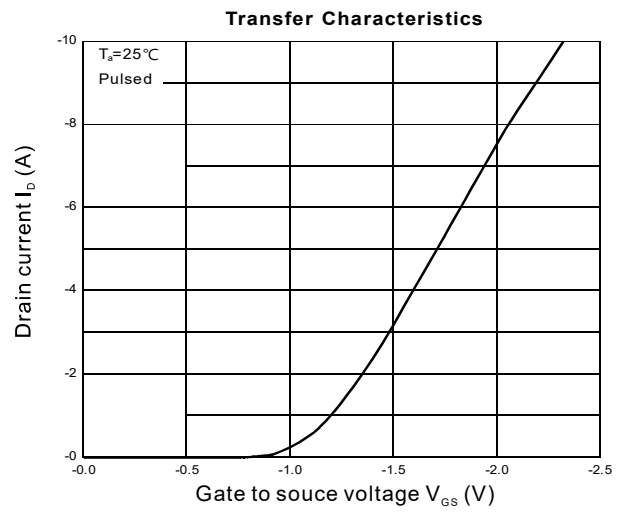
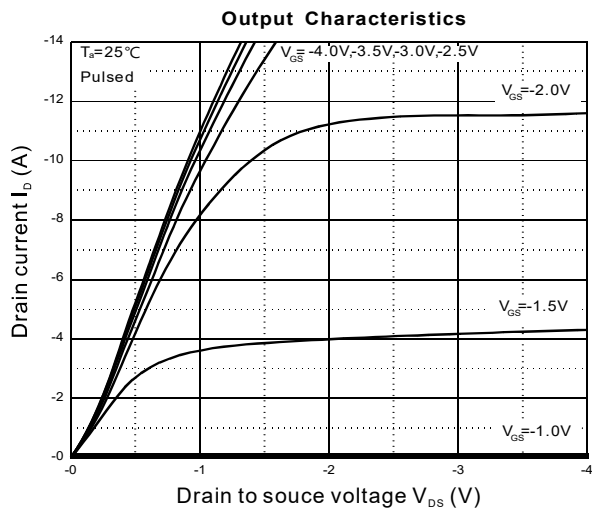
**Electrical characteristics** (At  $T_j=25^{\circ}\text{C}$  unless otherwise specified)

| Parameter                                          | Symbo                | Conditions                                                                                                                                 | Min. | Typ. | Max.      | Unit          |
|----------------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------|------|-----------|---------------|
| Off characteristics                                |                      |                                                                                                                                            |      |      |           |               |
| Drain-source breakdown voltage                     | $-BV_{\text{DSS}}$   | $-I_{\text{D}}=250\mu\text{A}$ , $V_{\text{GS}}=0\text{V}$                                                                                 | 20   |      |           | V             |
| Drain-source leakage current                       | $-I_{\text{DSS}}$    | $-V_{\text{DS}}=16\text{V}$ , $V_{\text{GS}}=0\text{V}$                                                                                    |      |      | 1         | $\mu\text{A}$ |
| Gate-source leakage current                        | $I_{\text{GSS}}$     | $V_{\text{GS}}=\pm 8\text{V}$ , $V_{\text{DS}}=0\text{V}$                                                                                  |      |      | $\pm 100$ | nA            |
| On characteristics                                 |                      |                                                                                                                                            |      |      |           |               |
| Gate threshold voltage                             | $-V_{\text{GS(TH)}}$ | $V_{\text{DS}}=V_{\text{GS}}$ , $-I_{\text{D}}=250\mu\text{A}$                                                                             | 0.4  |      | 1.0       | V             |
| Static drain-source on-resistance                  | $R_{\text{DS(ON)}}$  | $-V_{\text{GS}}=4.5\text{V}$ , $-I_{\text{D}}=2.8\text{A}$                                                                                 |      | 90   | 112       | m $\Omega$    |
|                                                    |                      | $-V_{\text{GS}}=2.5\text{V}$ , $-I_{\text{D}}=2.0\text{A}$                                                                                 |      | 110  | 142       |               |
| Forward Transconductance                           | $g_{\text{FS}}$      | $-V_{\text{GS}}=5\text{V}$ , $-I_{\text{D}}=2.8\text{A}$                                                                                   |      | 6.5  |           | S             |
| Dynamic Parameters                                 |                      |                                                                                                                                            |      |      |           |               |
| Input capacitance                                  | $C_{\text{iss}}$     | $V_{\text{GS}}=0\text{V}$ , $-V_{\text{DS}}=10\text{V}$ , $f=1.0\text{MHZ}$                                                                |      | 405  |           | pF            |
| Output capacitance                                 | $C_{\text{oss}}$     |                                                                                                                                            |      | 75   |           |               |
| Reverse transfer capacitance                       | $C_{\text{rss}}$     |                                                                                                                                            |      | 55   |           |               |
| Gate resistance                                    | $R_{\text{g}}$       | $f = 1\text{MHz}$                                                                                                                          |      | 6.0  |           | $\Omega$      |
| Switching parameters                               |                      |                                                                                                                                            |      |      |           |               |
| Total gate charge                                  | $Q_{\text{g}}$       | $-V_{\text{GS}}=2.5\text{V}$ , $-V_{\text{DS}}=10\text{V}$ , $-I_{\text{D}}=3\text{A}$                                                     |      | 3.3  | 6         | nC            |
| Gate to source charge                              | $Q_{\text{gs}}$      |                                                                                                                                            |      | 0.7  |           |               |
| Gate to Drain charge                               | $Q_{\text{gd}}$      |                                                                                                                                            |      | 1.3  |           |               |
| Turn-on delay time                                 | $t_{\text{D(ON)}}$   | $-V_{\text{DS}}=10\text{V}$ , $-V_{\text{GS}}=4.5\text{V}$ , $-I_{\text{D}}=1\text{A}$<br>$R_{\text{G}}=1\Omega$ , $R_{\text{L}}=10\Omega$ |      | 11   | 20        | ns            |
| Rise time                                          | $t_{\text{r}}$       |                                                                                                                                            |      | 35   | 60        |               |
| Turn-off delay time                                | $t_{\text{D(OFF)}}$  |                                                                                                                                            |      | 30   | 50        |               |
| Fall time                                          | $t_{\text{f}}$       |                                                                                                                                            |      | 10   | 20        |               |
| Body diode reverse recovery time                   | $t_{\text{rr}}$      | $V_{\text{GS}} = 0\text{V}$ , $-I_{\text{S}}= 4.1\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$                                             |      | 20   |           | ns            |
| Body diode reverse recovery charge                 | $Q_{\text{rr}}$      |                                                                                                                                            |      | 9    |           | nC            |
| Source-drain diode ratings and characteristics     |                      |                                                                                                                                            |      |      |           |               |
| Maximum body - Diode continuous current            | $-I_{\text{S}}$      |                                                                                                                                            |      |      | 1.3       | A             |
| Maximum pulse drain to source diode foward current | $-I_{\text{SM}}$     |                                                                                                                                            |      |      | 10        |               |
| Drain - source diode forward voltage (Note 1)      | $-V_{\text{SD}}$     | $-V_{\text{DS}}=0\text{V}$ , $-I_{\text{D}}=0.7\text{A}$                                                                                   |      | 0.8  | 1.2       | V             |

Note : 1.Pulse Test : pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$ .

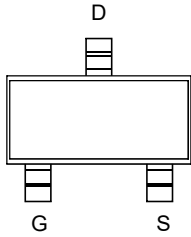
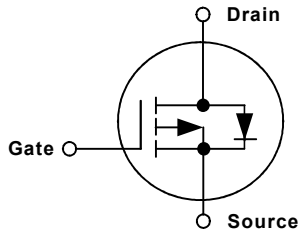
2.Guaranteed by design, not subject to production testing.

## Typical Performance Characteristics (FMOS2301-Q1)



# FMOS2301-Q1

## Pinning information

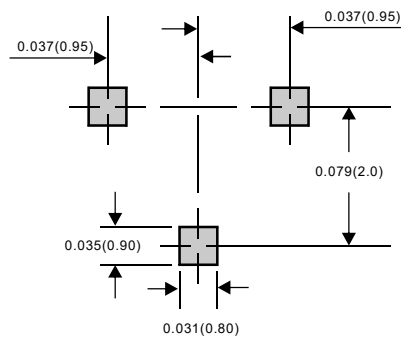
| Pin                                    | Simplified outline                                                                | Symbol                                                                              |
|----------------------------------------|-----------------------------------------------------------------------------------|-------------------------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

## Marking

| Type number | Marking Code |
|-------------|--------------|
| FMOS2301    | 2301         |

## Suggested solder pad layout

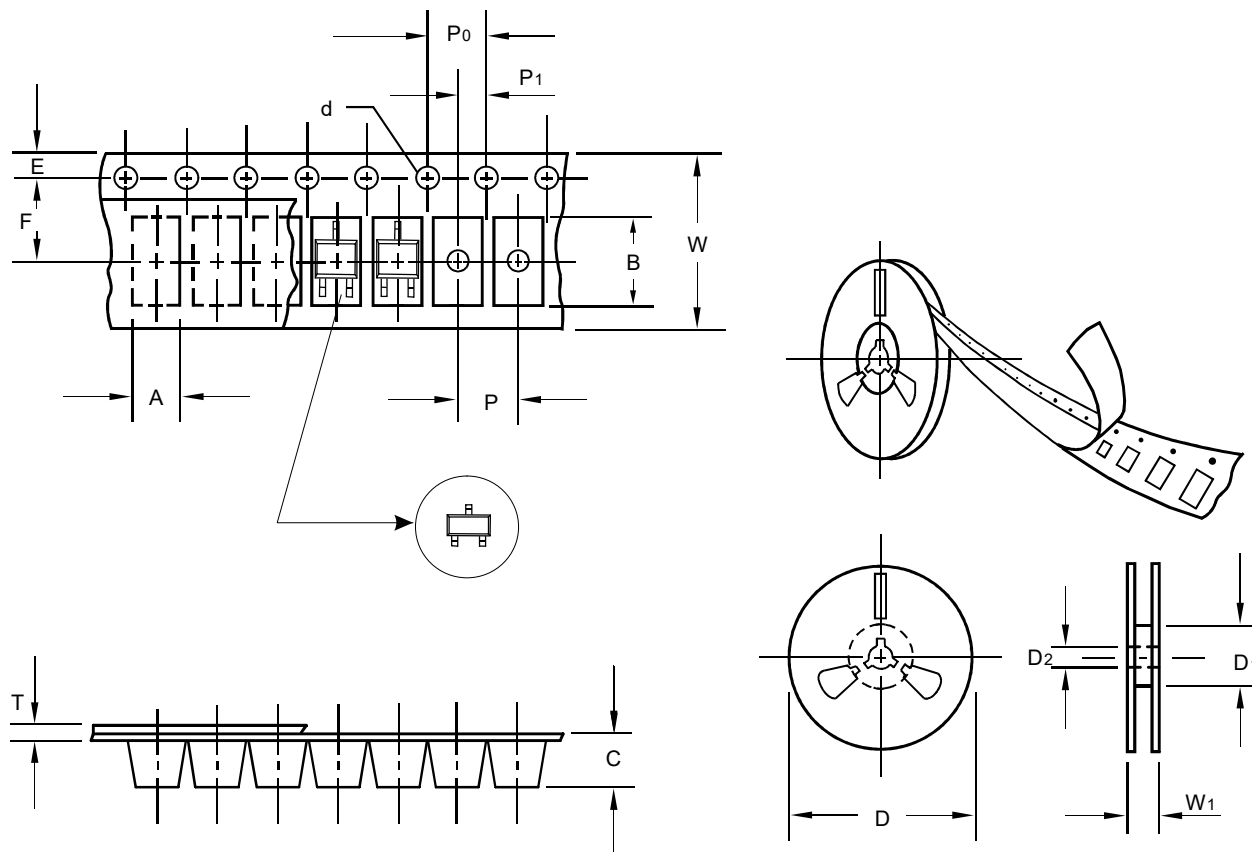
### SOT-23



Dimensions in inches and (millimeters)

## FMOS2301-Q1

## Packing information



unit:mm

| Item                      | Symbol | Tolerance | SOT-23 |
|---------------------------|--------|-----------|--------|
| Carrier width             | A      | 0.1       | 3.15   |
| Carrier length            | B      | 0.1       | 2.77   |
| Carrier depth             | C      | 0.1       | 1.22   |
| 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       | 11.40  |

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

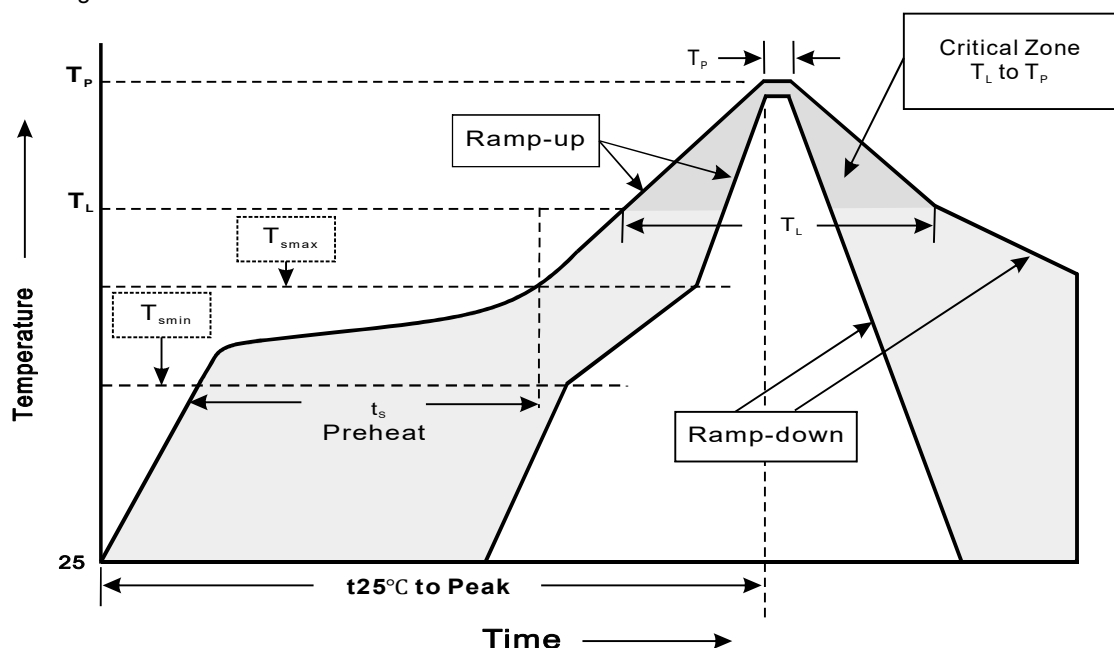
## FMOS2301-Q1

## 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-23  | 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                   |