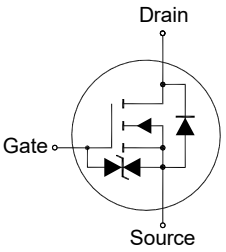
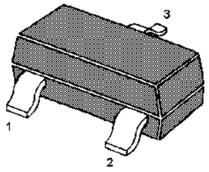
# MMBT7002K-AH

## N-Channel Enhancement Mode MOSFET




1.Gate 2.Source 3.Drain
TO-236 Plastic Package

### Features

- Low on resistance $R_{DS(ON)}$
- Low gate threshold voltage
- Low input capacitance
- ESD protected up to 2KV
- AEC-Q101 Qualified
- Halogen and Antimony Free(HAF), RoHS compliant

### Absolute Maximum Ratings (at $T_a$ = 25℃ unless otherwise specified)

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 60 | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 20 | V |
| Drain Current (Steady State 1sq in pad) [1] | $T_a$ = 25℃<br>$T_a$ = 85℃ | $I_D$ | 380<br>270 | mA |
| Drain Current (Steady State Minimum pad) [2] | $T_a$ = 25℃<br>$T_a$ = 85℃ | $I_D$ | 320<br>230 | mA |
| Peak Drain Current, Pulsed ($t_p$= 10 μs) | | $I_{DM}$ | 1.5 | A |
| Total Power Dissipation | | $P_{tot}$ | 350 | mW |
| Operating and Storage Temperature Range | | $T_j$, $T_{stg}$ | - 55 to + 150 | ℃ |

[1] Surface mounted on FR4 board using 1 sq in pad size with 1 oz Cu.

[2] Surface mounted on FR4 board using 0.08 sq in pad size with 1 oz Cu.



Dated: 08/09/2020 IMC1 Rev: 05

**Characteristics at $T_a$ = 25℃ unless otherwise specified**

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| **STATIC PARAMETERS** | | | | | |
| Drain Source Breakdown Voltage<br>at $I_D$ = 10 µA | $BV_{DSS}$ | 60 | - | - | V |
| Zero Gate Voltage Drain Current<br>at $V_{DS}$ = 60 V | $I_{DSS}$ | - | - | 1 | µA |
| Gate Source Leakage Current<br>at $V_{GS}$ = ± 20 V | $I_{GSS}$ | - | - | ± 10 | µA |
| Gate Threshold Voltage<br>at $V_{DS}$ = 10 V, $I_D$ = 250 µA | $V_{GS(th)}$ | 1 | - | 2.5 | V |
| Static Drain Source On-Resistance<br>at $V_{GS}$ = 10 V, $I_D$ = 500 mA<br>at $V_{GS}$ = 4.5 V, $I_D$ = 200 mA | $R_{DS(ON)}$ | -<br>- | -<br>- | 3<br>4 | Ω |
| **DYNAMIC PARAMETERS** | | | | | |
| Forward Transconductance<br>at $V_{DS}$ = 10 V, $I_D$ = 200 mA | $g_{FS}$ | 80 | - | - | mS |
| Gate Resistance<br>at $V_{GS}$ = 0 V, $V_{DS}$ = 0 V, f = 1MHz | $R_g$ | - | 200 | - | Ω |
| Input Capacitance<br>at $V_{GS}$ = 0 V, $V_{DS}$ = 25 V, f = 1 MHz | $C_{iss}$ | - | 22.5 | 50 | pF |
| Output Capacitance<br>at $V_{GS}$ = 0 V, $V_{DS}$ = 25 V, f = 1 MHz | $C_{oss}$ | - | 9 | 25 | pF |
| Reverse Transfer Capacitance<br>at $V_{GS}$ = 0 V, $V_{DS}$ = 25 V, f = 1 MHz | $C_{rss}$ | - | 7.5 | 10 | pF |
| Gate charge total<br>at $V_{DS}$ =10 V, $I_D$ = 0.5 A, $V_{GS}$ = 4.5 V | $Q_g$ | - | 0.44 | - | nC |
| Gate to Source Gate Charge<br>at $V_{DS}$ =10 V, $I_D$ = 0.5 A, $V_{GS}$ = 4.5 V | $Q_{gs}$ | - | 0.2 | - | nC |
| Gate to Drain Charge<br>at $V_{DS}$ =10 V, $I_D$ = 0.5 A, $V_{GS}$ = 4.5 V | $Q_{gd}$ | - | 0.1 | - | nC |
| Turn-On Delay Time<br>at $V_{DS}$ = 30 V, $V_{GS}$ = 10 V, $I_D$ = 0.5 A, $R_g$ = 25 Ω | $t_{d(on)}$ | - | 2.7 | - | ns |
| Turn-On Rise Time<br>at $V_{DS}$ = 30 V, $V_{GS}$ = 10 V, $I_D$ = 0.5 A, $R_g$ = 25 Ω | $t_r$ | - | 2.5 | - | ns |
| Turn-Off Delay Time<br>at $V_{DS}$ = 30 V, $V_{GS}$ = 10 V, $I_D$ = 0.5 A, $R_g$ = 25 Ω | $t_{d(off)}$ | - | 13 | - | ns |
| Turn-Off Fall Time<br>at $V_{DS}$ = 30 V, $V_{GS}$ = 10 V, $I_D$ = 0.5 A, $R_g$ = 25 Ω | $t_f$ | - | 8 | - | ns |
| **Body-Diode PARAMETERS** | | | | | |
| Drain-Source Diode Forward Voltage<br>at $V_{GS}$ = 0 V, $I_S$ = 0.5 A | $V_{SD}$ | - | 0.85 | - | V |
| Body Diode Reverse Recovery Time<br>at $I_S$ = 0.5 A, di/dt = 100 A / µs | $t_{rr}$ | - | 30 | - | ns |
| Body Diode Reverse Recovery Charge<br>at $I_S$ = 0.5 A, di/dt = 100 A / µs | $Q_{rr}$ | - | 29 | - | nC |

## Electrical Characteristics Curves

Fig. 1 Typical Output Characteristic

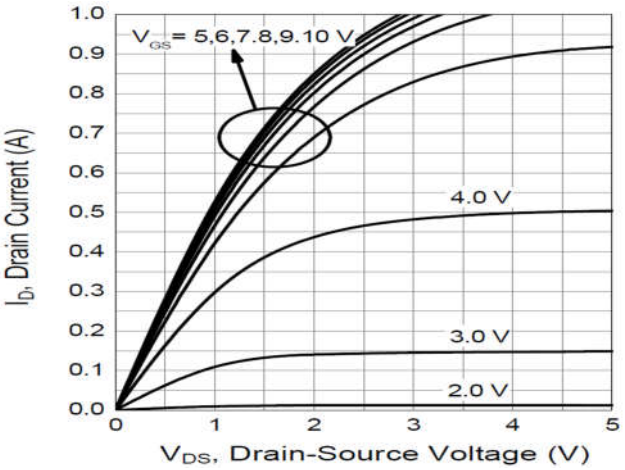



Fig. 2 Typical Transfer Characteristics

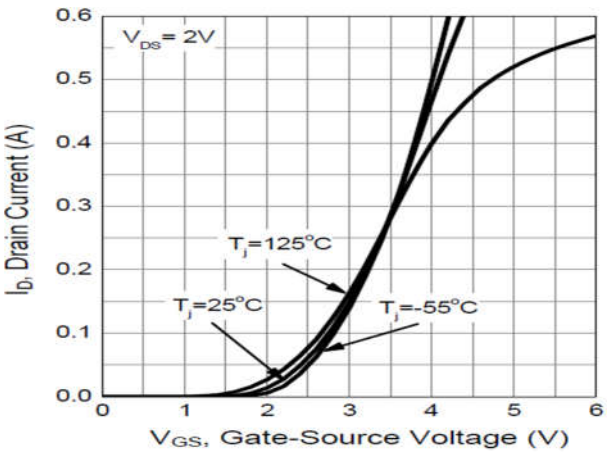



Fig. 3 Gate-Source Voltage vs.$R_{DS(on)}$

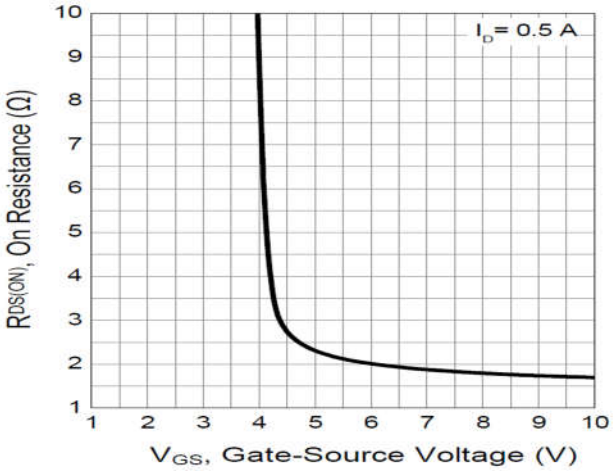



Fig. 4 on-Resistance vs.$T_j$

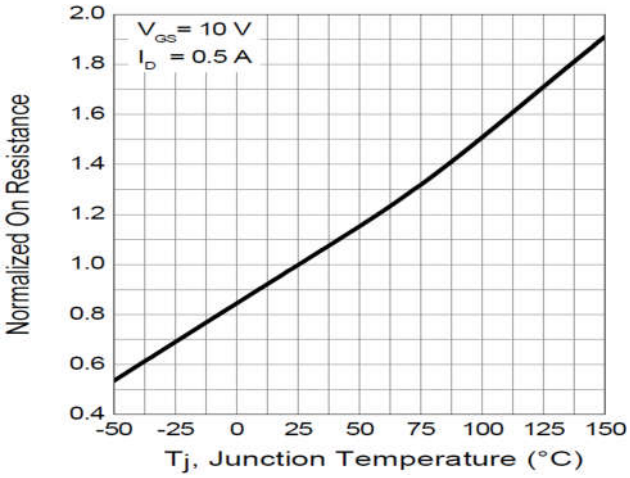



Fig. 5 Drain Current vs. on-Resistance

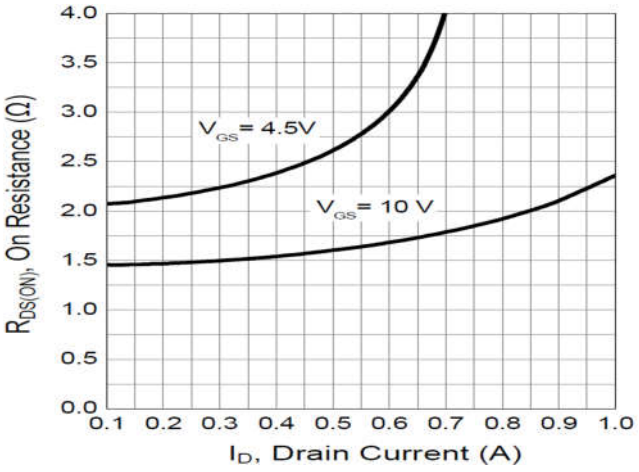
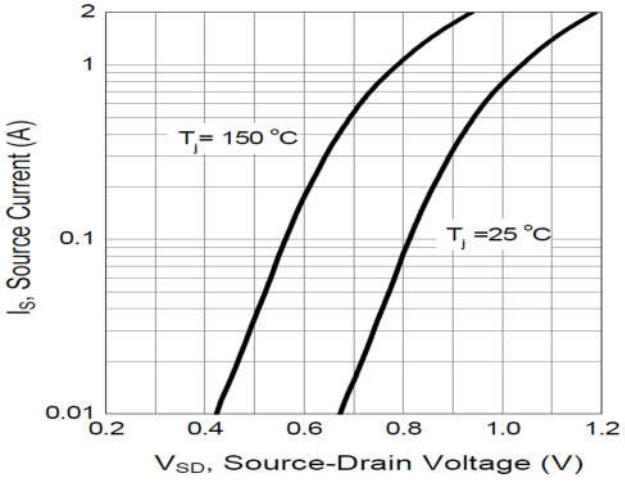



Fig. 6 Typical Forward Characteristic



## Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

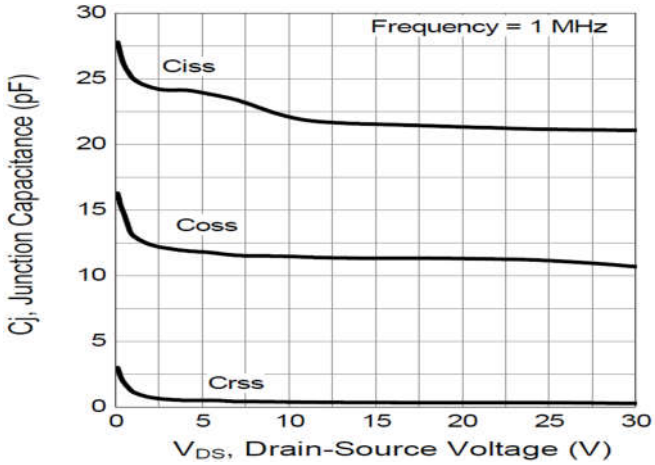



Fig. 8 Gate Threshold Variation vs. $T_j$

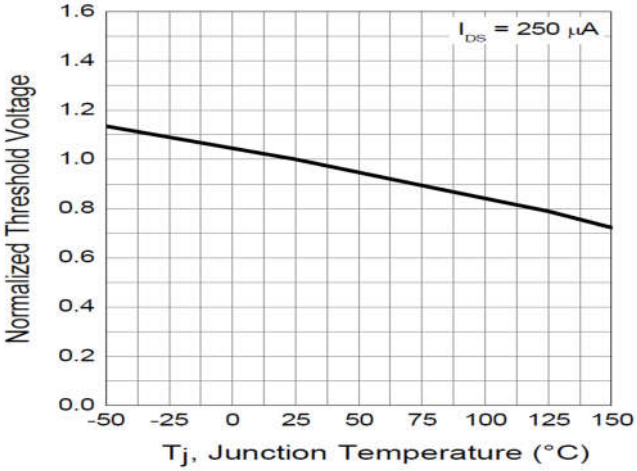
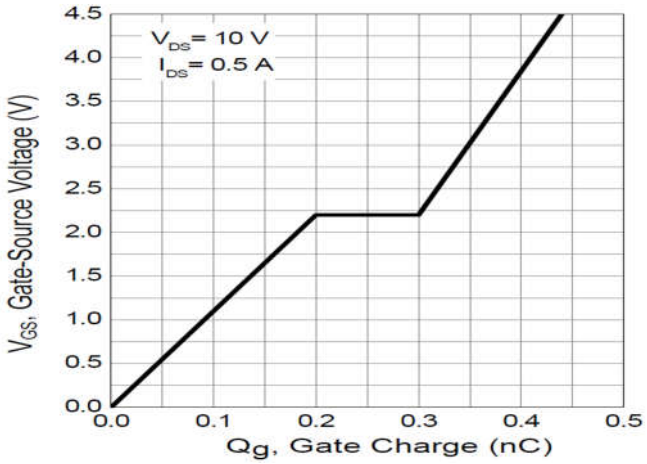



Fig. 9 Gate Charge



## Test Circuits

Fig.1-1 Switching times test circuit

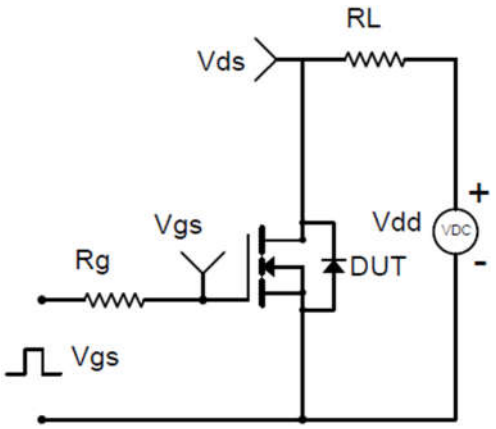



Fig.1-2 Switching Waveform

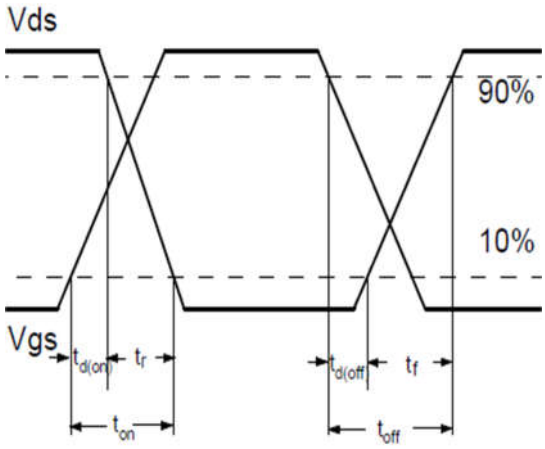



Fig.2-1 Gate charge test circuit

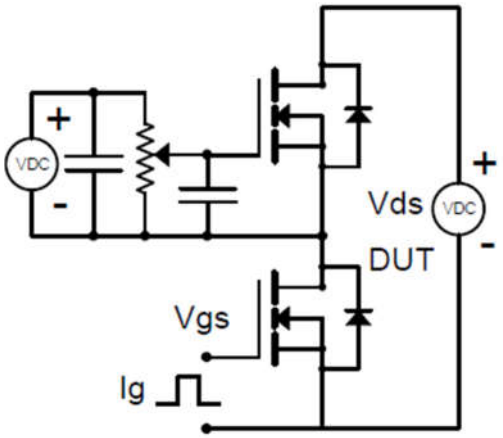
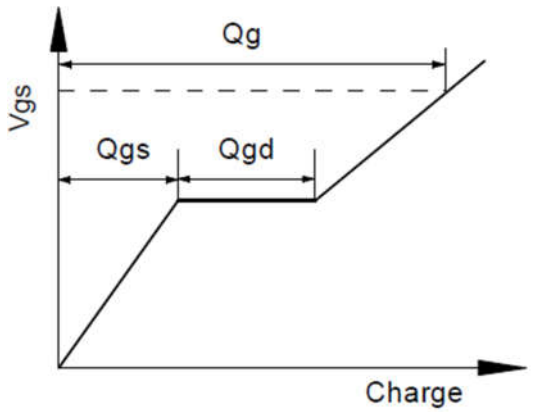
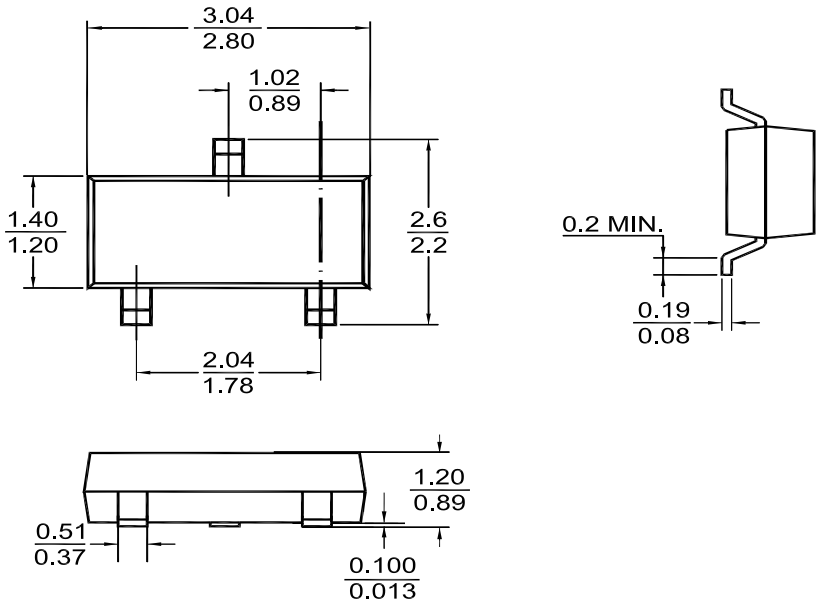



Fig.2-2 Gate charge waveform

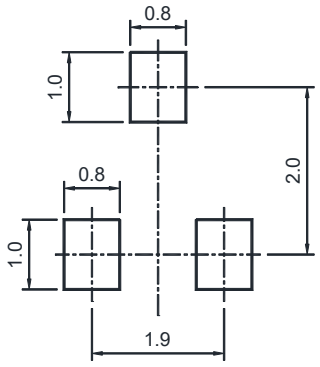


## PACKAGE OUTLINE

### Plastic surface mounted package (Dimensions in mm) TO-236




### Recommended Soldering Footprint




**Packing information**

| Package | Tape Width (mm) | Pitch | | Reel Size | | Per Reel Packing Quantity |
|---|---|---|---|---|---|---|
| | | mm | inch | mm | inch | |
| TO-236 | 8 | 4 ± 0.1 | 0.157 ± 0.004 | 178 | 7 | 3,000 |

### Marking information

" K72 " = Part No.

" • " = HAF (Halogen and Antimony Free)

"YM" = Date Code Marking

"Y" = Year

"M" = Month

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