

TOSHIBA Field Effect Transistor Silicon P Channel MOS Type

SSM6P36FE

○ Power Management Switches

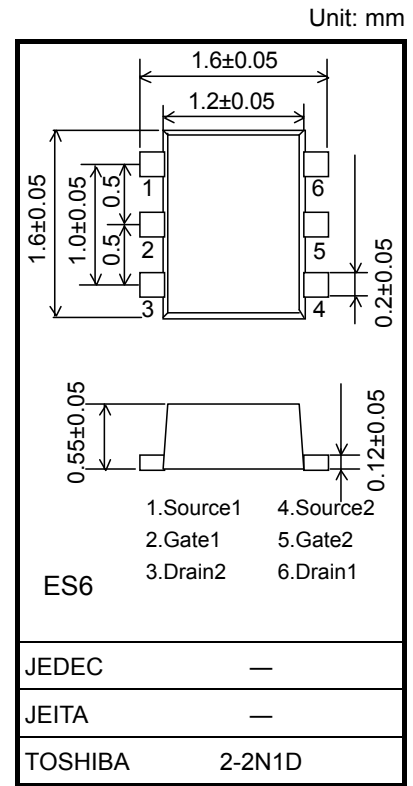
- 1.5-V drive
- Low ON-resistance: $R_{on} = 3.60 \Omega$ (max) (@ $V_{GS} = -1.5 V$)
 $R_{on} = 2.70 \Omega$ (max) (@ $V_{GS} = -1.8 V$)
 $R_{on} = 1.60 \Omega$ (max) (@ $V_{GS} = -2.8 V$)
 $R_{on} = 1.31 \Omega$ (max) (@ $V_{GS} = -4.5 V$)

Absolute Maximum Ratings (Ta = 25 °C)
(Common to the Q1, Q2)

| Characteristics | | Symbol | Rating | Unit |
|---------------------------|-------|---------------|------------|------|
| Drain-source voltage | | V_{DSS} | -20 | V |
| Gate-source voltage | | V_{GSS} | ± 8 | V |
| Drain current | DC | I_D | -330 | mA |
| | Pulse | I_{DP} | -660 | |
| Drain power dissipation | | P_D (Note1) | 150 | mW |
| Channel temperature | | T_{ch} | 150 | °C |
| Storage temperature range | | T_{stg} | -55 to 150 | °C |

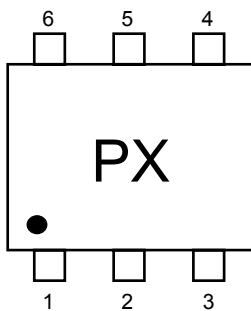
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.
 Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/ "Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: Total rating
 Mounted on an FR4 board
 (25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 0.135 mm² × 6)

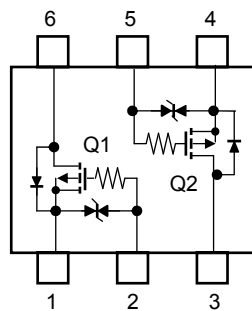


Weight: 3.0 mg (typ.)

Marking



Equivalent Circuit (top view)



Handling Precaution

When handling individual devices (which are not yet mounted on a circuit board), ensure that the environment is protected against static electricity. Operators should wear anti-static clothing, and containers and other objects that come into direct contact with devices should be made of anti-static materials.

Usage Considerations

Let V_{th} be the voltage applied between gate and source that causes the drain current (I_D) to below (-1 mA for the SSM6P36FE). Then, for normal switching operation, $V_{GS(on)}$ must be higher than V_{th} , and $V_{GS(off)}$ must be lower than V_{th} . This relationship can be expressed as: $V_{GS(off)} < V_{th} < V_{GS(on)}$.

Take this into consideration when using the device.

Start of commercial production
 2008-06

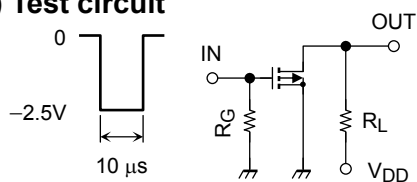
Electrical Characteristics (Ta = 25°C) (Q1, Q2 Common)

| Characteristics | Symbol | Test Conditions | Min | Typ. | Max | Unit |
|--------------------------------|---------------|---|---|------|---------|---------------|
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $I_D = -1 \text{ mA}, V_{GS} = 0 \text{ V}$ | -20 | — | — | V |
| | $V_{(BR)DSX}$ | $I_D = -1 \text{ mA}, V_{GS} = 8 \text{ V}$ | -12 | — | — | |
| Drain cutoff current | I_{DSS} | $V_{DS} = -16 \text{ V}, V_{GS} = 0 \text{ V}$ | — | — | -10 | μA |
| Gate leakage current | I_{GSS} | $V_{GS} = \pm 8 \text{ V}, V_{DS} = 0 \text{ V}$ | — | — | ± 1 | μA |
| Gate threshold voltage | V_{th} | $V_{DS} = -3 \text{ V}, I_D = -1 \text{ mA}$ | -0.3 | — | -1.0 | V |
| Forward transfer admittance | $ Y_{fs} $ | $V_{DS} = -3 \text{ V}, I_D = -100 \text{ mA}$ (Note2) | 190 | — | — | mS |
| Drain-source ON-resistance | $R_{DS(ON)}$ | $I_D = -100 \text{ mA}, V_{GS} = -4.5 \text{ V}$ (Note2) | — | 0.95 | 1.31 | Ω |
| | | $I_D = -80 \text{ mA}, V_{GS} = -2.8 \text{ V}$ (Note2) | — | 1.22 | 1.60 | |
| | | $I_D = -40 \text{ mA}, V_{GS} = -1.8 \text{ V}$ (Note2) | — | 1.80 | 2.70 | |
| | | $I_D = -30 \text{ mA}, V_{GS} = -1.5 \text{ V}$ (Note2) | — | 2.23 | 3.60 | |
| Input capacitance | C_{iss} | $V_{DS} = -10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$ | — | 43 | — | pF |
| Output capacitance | C_{oss} | | — | 10.3 | — | |
| Reverse transfer capacitance | C_{rss} | | — | 6.1 | — | |
| Total Gate Charge | Q_g | $V_{DS} = -10 \text{ V}, I_{DS} = -330 \text{ mA}$ $V_{GS} = -4 \text{ V}$ | — | 1.2 | — | nC |
| Gate-Source Charge | Q_{gs} | | — | 0.85 | — | |
| Gate-Drain Charge | Q_{gd} | | — | 0.35 | — | |
| Switching time | Turn-on time | t_{on} | $V_{DD} = -10 \text{ V}, I_D = -100 \text{ mA}$ $V_{GS} = 0 \text{ to } -2.5 \text{ V}, R_G = 50 \Omega$ | — | 90 | ns |
| | Turn-off time | t_{off} | | — | 200 | |
| Drain-source forward voltage | V_{DSF} | $I_D = 330 \text{ mA}, V_{GS} = 0 \text{ V}$ (Note2) | — | 0.88 | 1.2 | V |

Note2: Pulse test

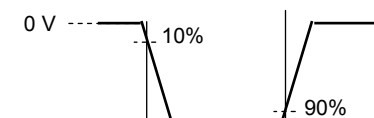
Switching Time Test Circuit

(a) Test circuit

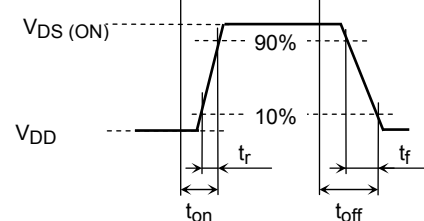


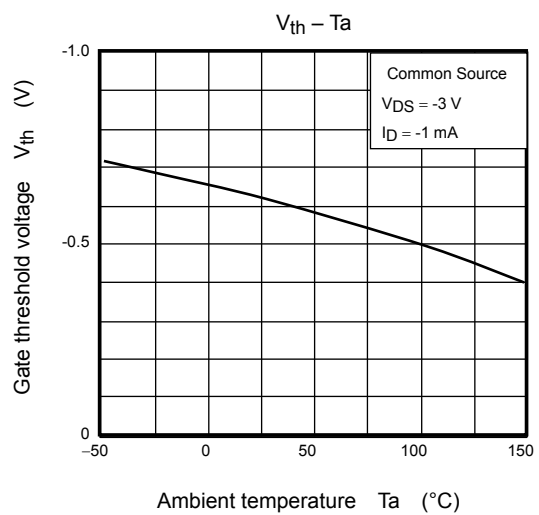
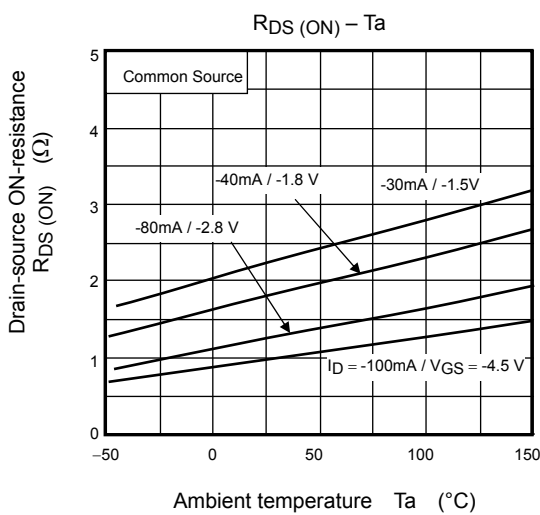
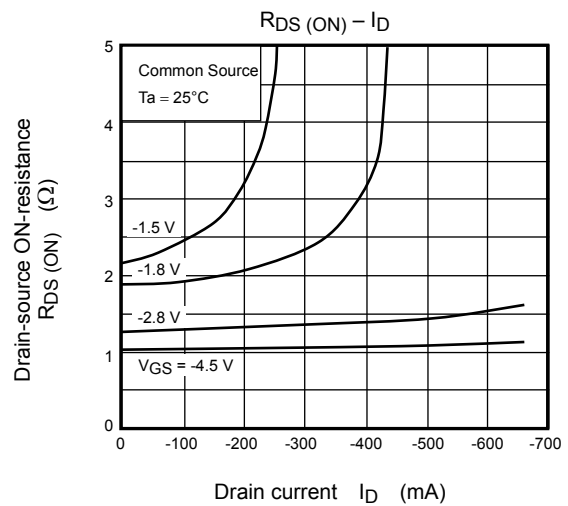
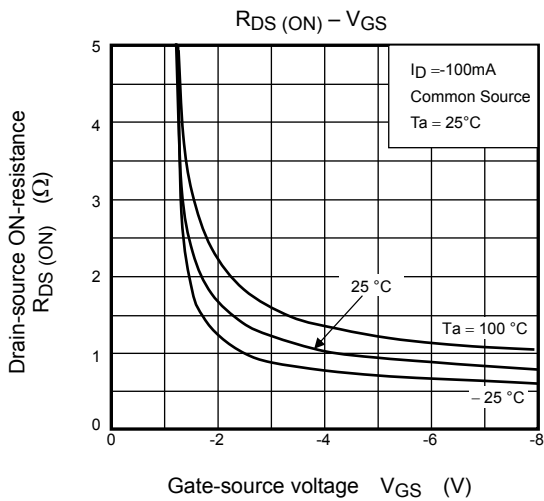
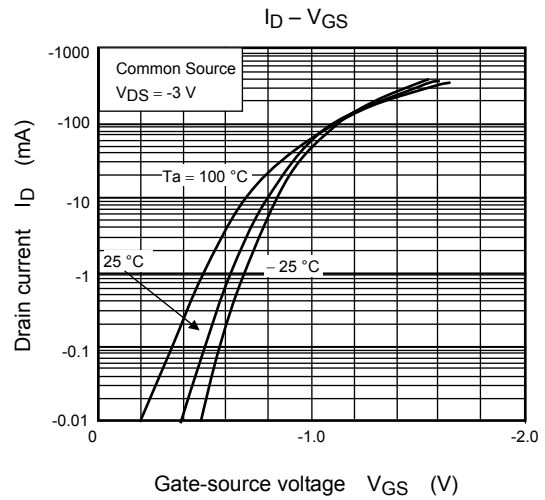
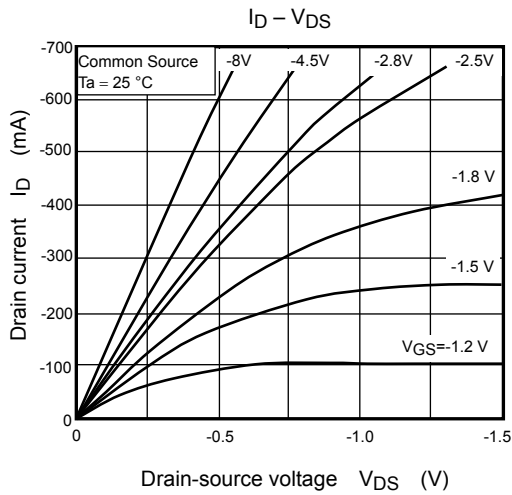
$V_{DD} = -10 \text{ V}$
 Duty $\leq 1\%$
 V_{IN} : $t_r, t_f < 5 \text{ ns}$
 ($Z_{out} = 50 \Omega$)
 Common Source
 $T_a = 25^\circ\text{C}$

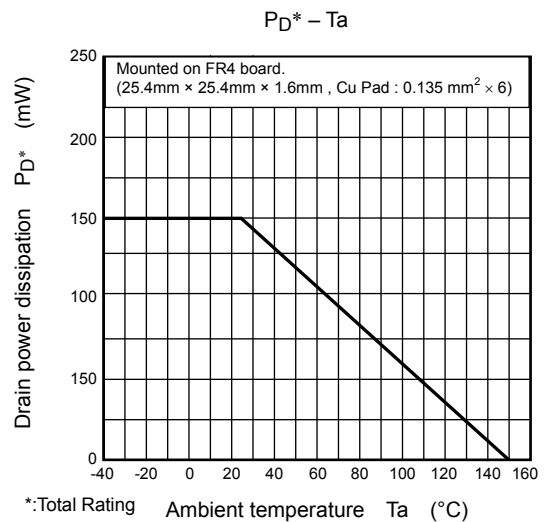
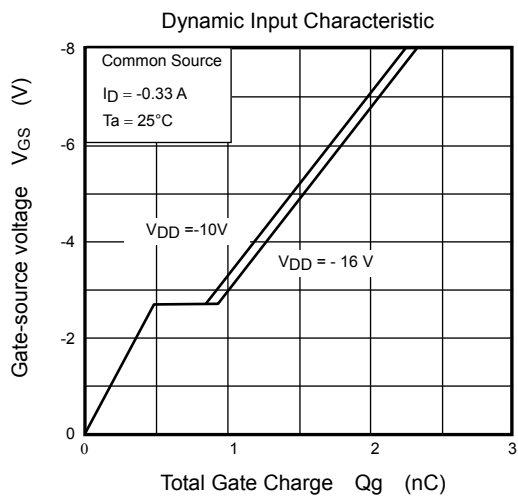
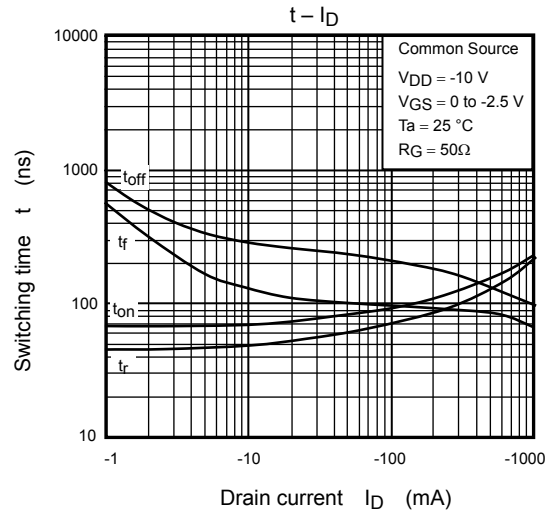
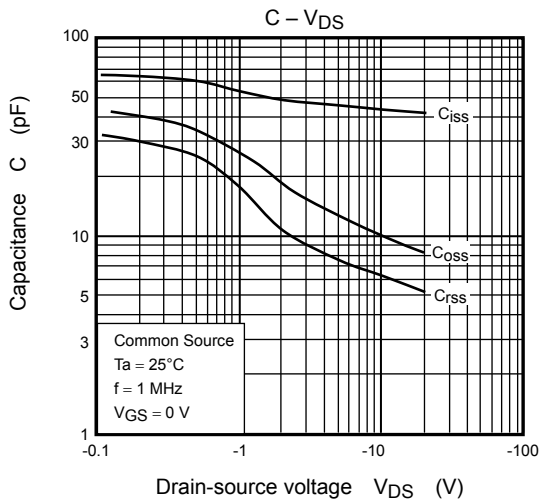
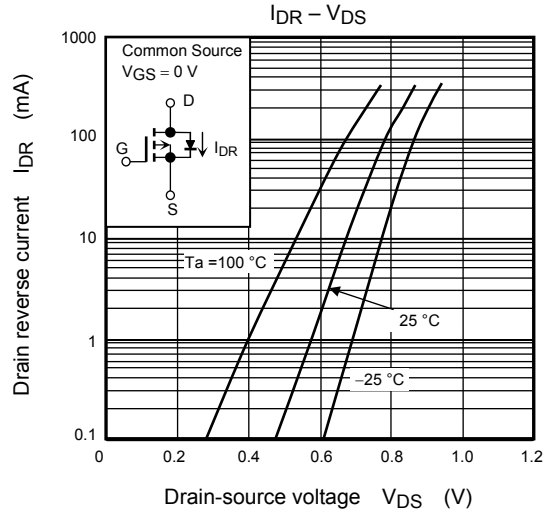
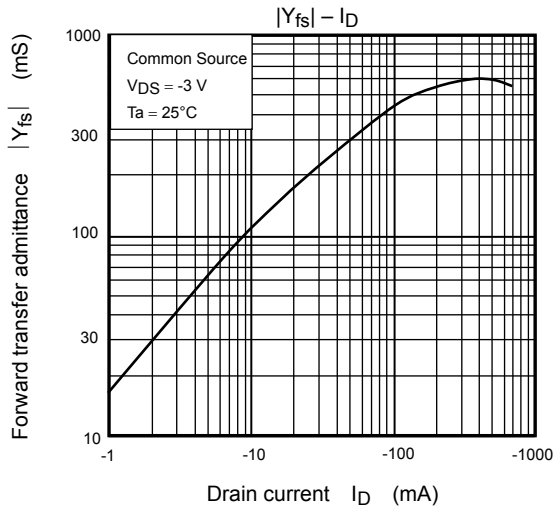
(b) V_{IN}



(c) V_{OUT}







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