

TOSHIBA Multi-chip Device  
Silicon PNP Epitaxial Transistor , Field Effect Transistor Silicon N Channel MOS Type

## TPCP8F01

Unit: mm

- Switching Applications
- Load Switch Applications
- Multi-chip discrete device; built-in PNP Transistor for main switch and N-ch MOS FET for drive

- High DC current gain:  $h_{FE} = 200$  to  $500$  ( $I_C = -0.5$  A)  
(PNP Transistor)
- Low collector-emitter saturation:  $V_{CE(sat)} = -0.19$  V (max)  
(PNP Transistor)
- High-speed switching:  $t_f = 40$  ns (typ.) (PNP Transistor)

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

#### Transistor

| Characteristics             |       | Symbol         | Rating | Unit             |
|-----------------------------|-------|----------------|--------|------------------|
| Collector-base voltage      |       | $V_{CBO}$      | -30    | V                |
| Collector-emitter voltage   |       | $V_{CEO}$      | -20    | V                |
| Emitter-base voltage        |       | $V_{EBO}$      | -7     | V                |
| Collector current           | DC    | $I_C$          | -3.0   | A                |
|                             | Pulse | $I_{CP}$       | -5.0   |                  |
| Base current                |       | $I_B$          | -250   | mA               |
| Collector power dissipation |       | $P_C$ (Note 1) | 1.0    | W                |
| Junction temperature        |       | $T_j$          | 150    | $^\circ\text{C}$ |

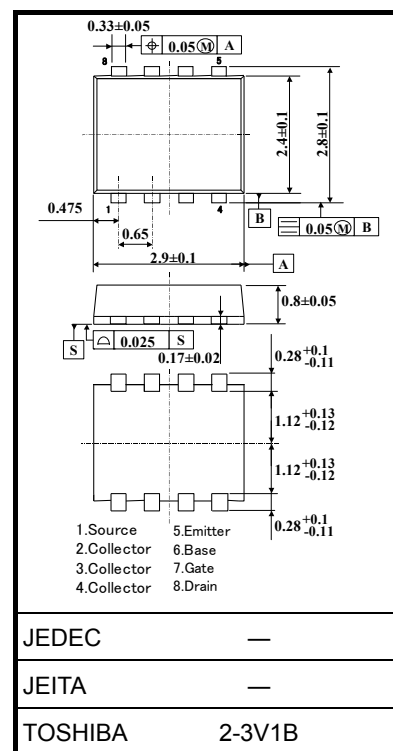
#### MOS FET

| Characteristics      |       | Symbol    | Rating   | Unit             |
|----------------------|-------|-----------|----------|------------------|
| Drain-source voltage |       | $V_{DSS}$ | 20       | V                |
| Gate-source voltage  |       | $V_{GSS}$ | $\pm 10$ | V                |
| Drain current        | DC    | $I_D$     | 100      | mA               |
|                      | Pulse | $I_{DP}$  | 200      |                  |
| Channel temperature  |       | $T_j$     | 150      | $^\circ\text{C}$ |

Note 1: Mounted on FR4 board (glass epoxy, 1.6mm thick, Cu area: 645mm<sup>2</sup>)

Note 2: 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).

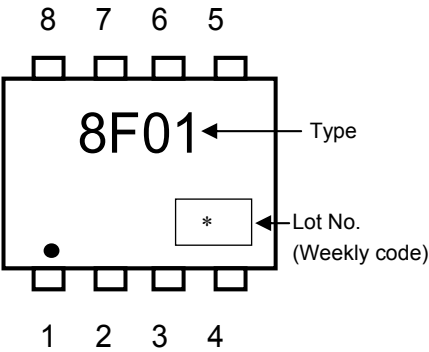


Weight : 0.017g (Typ.)

Common Absolute Maximum Rating (Ta = 25°C)

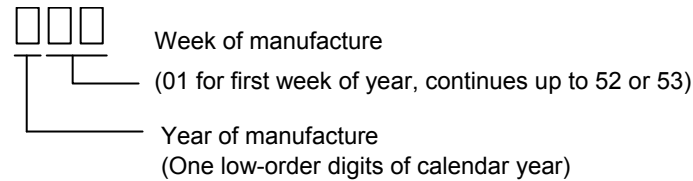
| Characteristics           | Symbol           | Rating     | Unit |
|---------------------------|------------------|------------|------|
| Storage temperature range | T <sub>stg</sub> | −55 to 150 | °C   |

Figure 2 Marking (Note 3)



Note 3 : Black round marking " • " located on the left lower side of parts number marking "8F01" indicates terminal No.1

\* Weekly code: (Three digits)

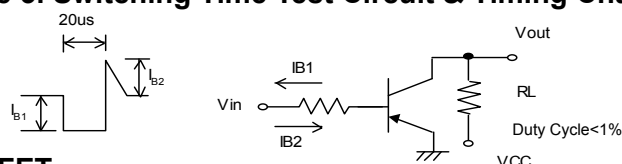


## Electrical Characteristics (Ta = 25°C)

## Transistor

| Characteristics                      |              | Symbol        | Test Condition                                                                                                         | Min | Typ. | Max   | Unit |
|--------------------------------------|--------------|---------------|------------------------------------------------------------------------------------------------------------------------|-----|------|-------|------|
| Collector cut-off current            |              | $I_{CBO}$     | $V_{CB} = -30\text{ V}, I_E = 0$                                                                                       | —   | —    | -100  | nA   |
| Emitter cut-off current              |              | $I_{EBO}$     | $V_{EB} = -7\text{ V}, I_C = 0$                                                                                        | —   | —    | -100  | nA   |
| Collector-emitter breakdown voltage  |              | $V_{(BR)CEO}$ | $I_C = -10\text{ mA}, I_B = 0$                                                                                         | -20 | —    | —     | V    |
| DC current gain                      |              | $h_{FE}(1)$   | $V_{CE} = -2\text{ V}, I_C = -0.5\text{ A}$                                                                            | 200 | —    | 500   |      |
|                                      |              | $h_{FE}(2)$   | $V_{CE} = -2\text{ V}, I_C = -1.6\text{ A}$                                                                            | 100 | —    | —     |      |
| Collector-emitter saturation voltage |              | $V_{CE(sat)}$ | $I_C = -1.6\text{ A}, I_B = -53\text{ mA}$                                                                             | —   | —    | -0.19 | V    |
| Base-emitter saturation voltage      |              | $V_{BE(sat)}$ | $I_C = -1.6\text{ A}, I_B = -53\text{ mA}$                                                                             | —   | —    | -1.10 | V    |
| Collector Output Capacitance         |              | $C_{ob}$      | $V_{CB} = -10\text{ V}, I_E = 0, f = 1\text{ MHz}$                                                                     | —   | 28   | —     | pF   |
| Switching time                       | Rise time    | $t_r$         | See Figure 3 circuit diagram<br>$V_{CC} \approx -12\text{ V}, R_L = 7.5\ \Omega$<br>$-I_{B1} = I_{B2} = -53\text{ mA}$ | —   | 70   | —     | ns   |
|                                      | Storage time | $t_{stg}$     |                                                                                                                        | —   | 150  | —     |      |
|                                      | Fall time    | $t_f$         |                                                                                                                        | —   | 40   | —     |      |

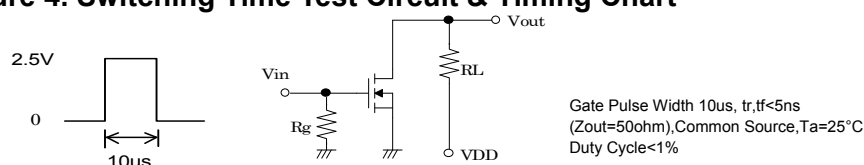
Figure 3. Switching Time Test Circuit &amp; Timing Chart



## MOS FET

| Characteristics                |               | Symbol                | Test Condition                                                                | Min | Typ. | Max | Unit |
|--------------------------------|---------------|-----------------------|-------------------------------------------------------------------------------|-----|------|-----|------|
| Gate leakage current           |               | I <sub>GSS</sub>      | V <sub>GS</sub> = −10 V, V <sub>DS</sub> = 0                                  | —   | —    | ±1  | μ A  |
| Drain-source breakdown voltage |               | V <sub>(BR)</sub> DSS | I <sub>D</sub> = 0.1 mA, V <sub>GS</sub> = 0                                  | 20  | —    | —   | V    |
| Drain cut-off current          |               | I <sub>DSS</sub>      | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0                                   | —   | —    | 1   | μ A  |
| Gate Threshold voltage         |               | V <sub>th</sub>       | V <sub>DS</sub> = 3 V, I <sub>D</sub> = 0.1 mA                                | 0.6 | —    | 1.1 | V    |
| Forward Transfer Admittance    |               | Y <sub>fs</sub>       | V <sub>DS</sub> = 3 V, I <sub>D</sub> = 10 mA                                 | 40  | —    | —   | mS   |
| Drain-source ON resistance     |               | R <sub>DS(ON)</sub>   | I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 4.0 V                               | —   | 1.5  | 3   | Ω    |
|                                |               |                       | I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 2.5 V                               | —   | 2.2  | 4   |      |
|                                |               |                       | I <sub>D</sub> = 1 mA, V <sub>GS</sub> = 1.5 V                                | —   | 5.2  | 15  |      |
| Input capacitance              |               | C <sub>iss</sub>      | V <sub>DS</sub> = 3 V, V <sub>GS</sub> = 0, f = 1 MHz                         | —   | 9.3  | —   | pF   |
| Reverse transfer capacitance   |               | C <sub>rss</sub>      |                                                                               | —   | 4.5  | —   |      |
| Output capacitance             |               | C <sub>oss</sub>      |                                                                               | —   | 9.8  | —   |      |
| Switching time                 | Turn-on time  | t <sub>on</sub>       | V <sub>DD</sub> ≈ −3 V, R <sub>L</sub> = 300 Ω<br>V <sub>GS</sub> = 0 to 2.5V | —   | 70   | —   | ns   |
|                                | Turn-off time | t <sub>off</sub>      |                                                                               | —   | 125  | —   |      |

Figure 4. Switching Time Test Circuit &amp; Timing Chart



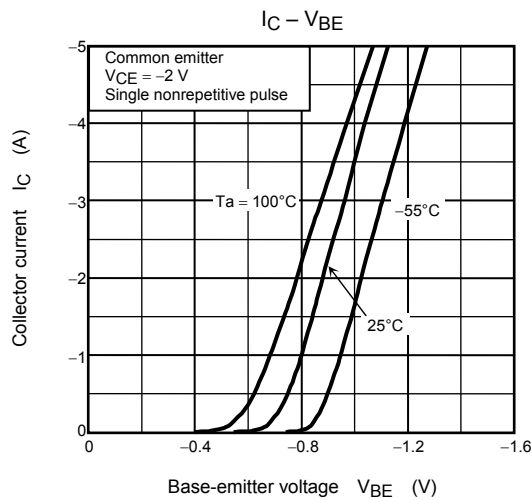
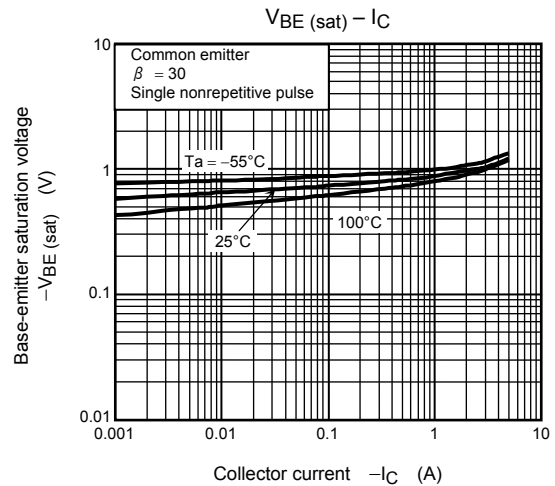
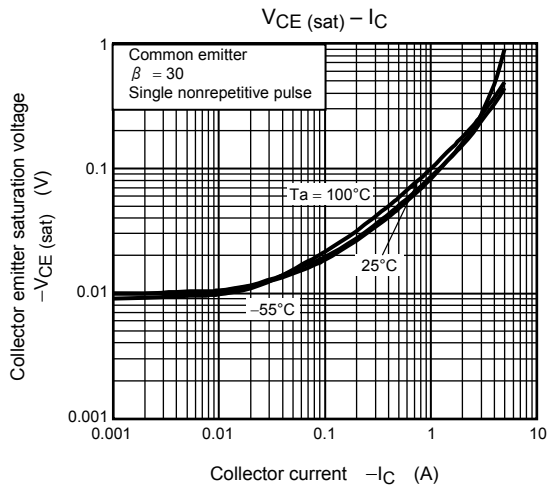
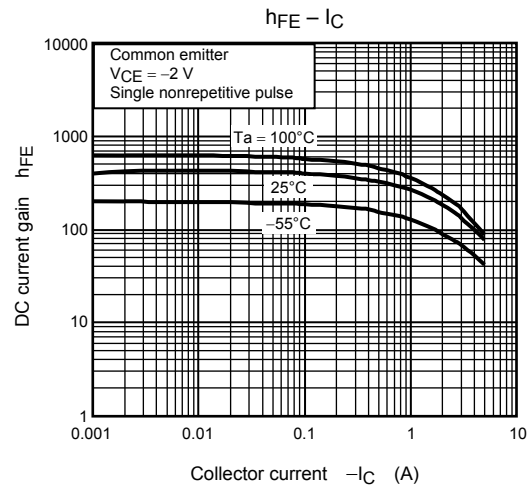
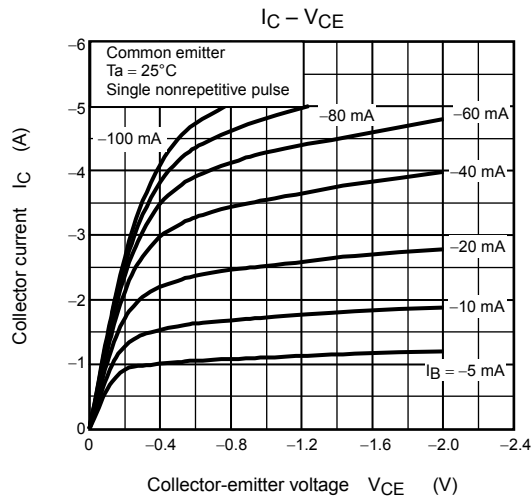
## Precautions

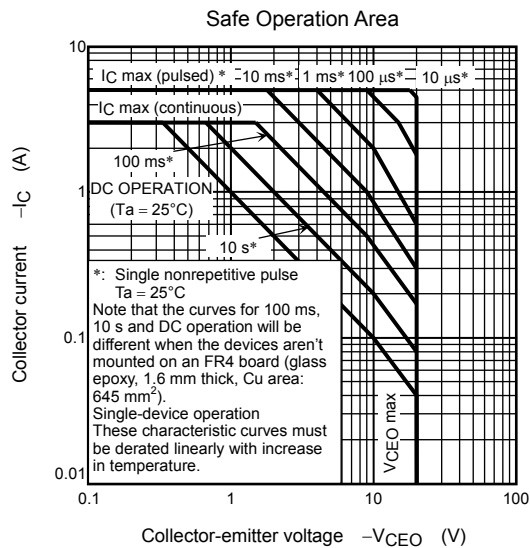
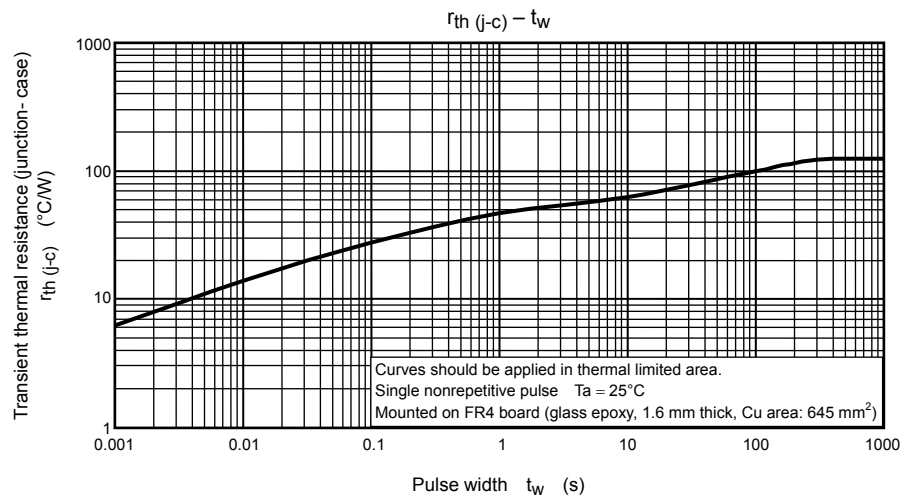
$V_{th}$  can be expressed as voltage between gate and source when low operating current value is  $I_D = 100\ \mu\text{ A}$  for this product. For normal switching operation,  $V_{GS(ON)}$  requires higher voltage than  $V_{th}$  and  $V_{GS(OFF)}$  requires lower voltage than  $V_{th}$ . (relationship can be established as follows:  $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$ )

Please take this into consideration for using the device.

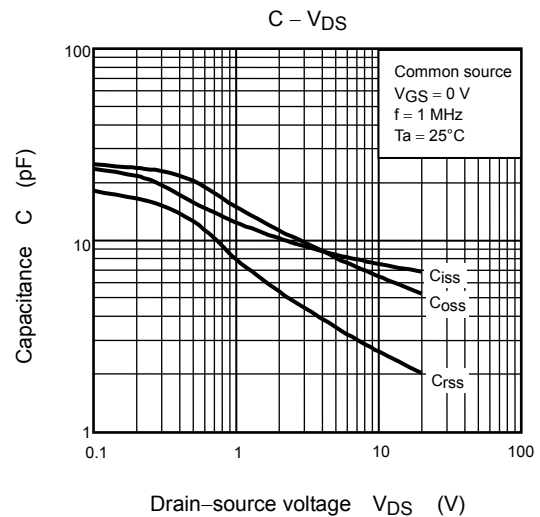
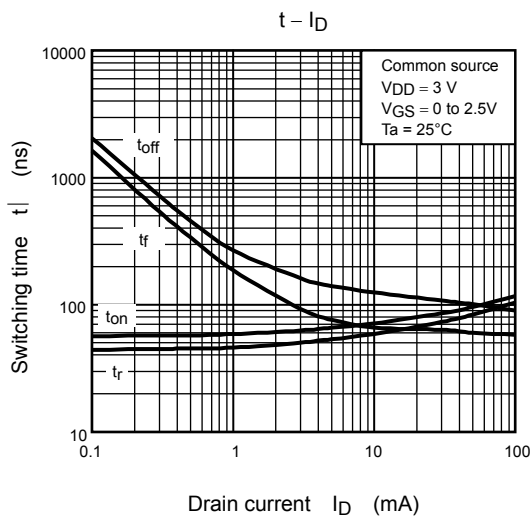
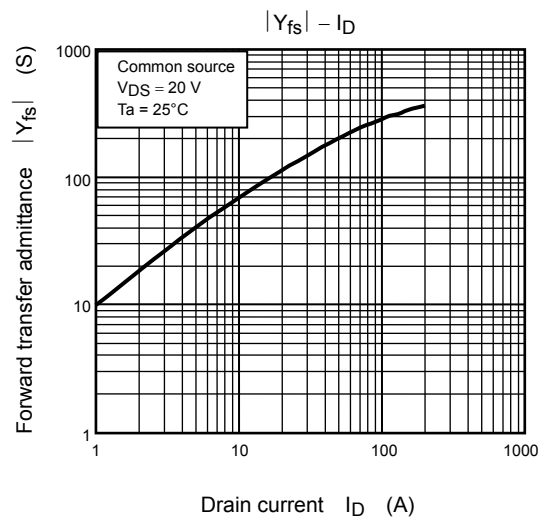
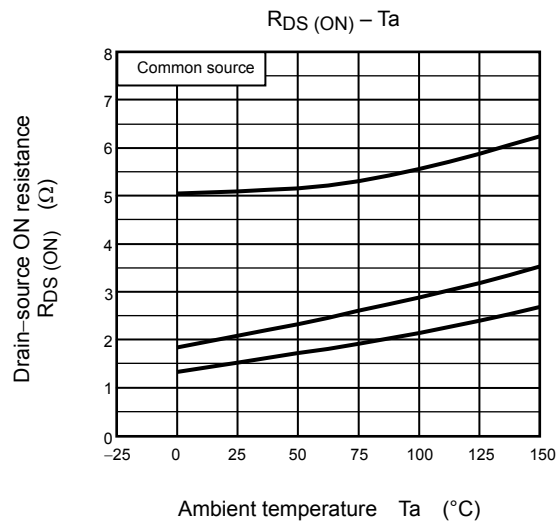
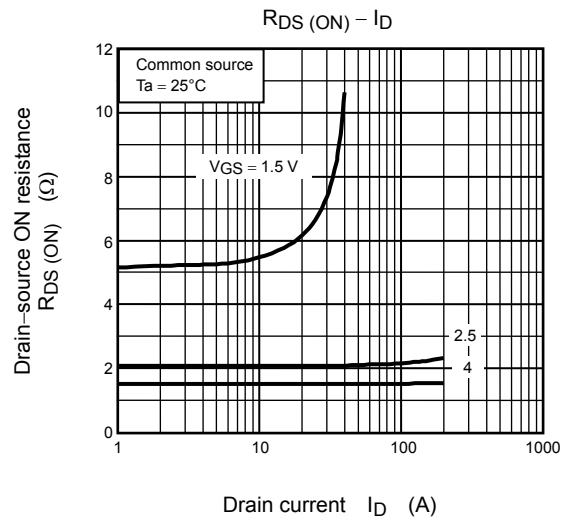
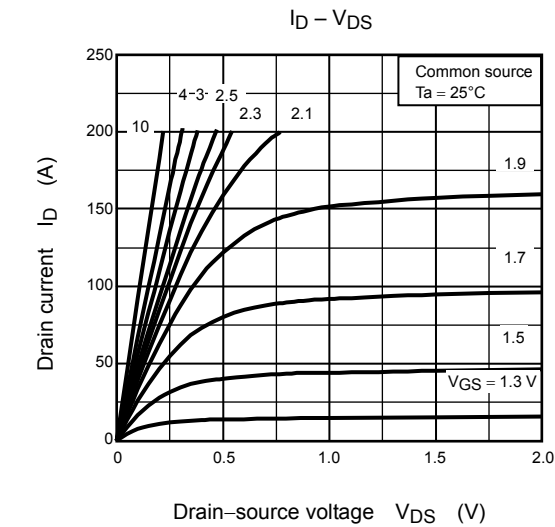
$V_{GS}$  recommended voltage of 2.5V or higher to turn on this product.

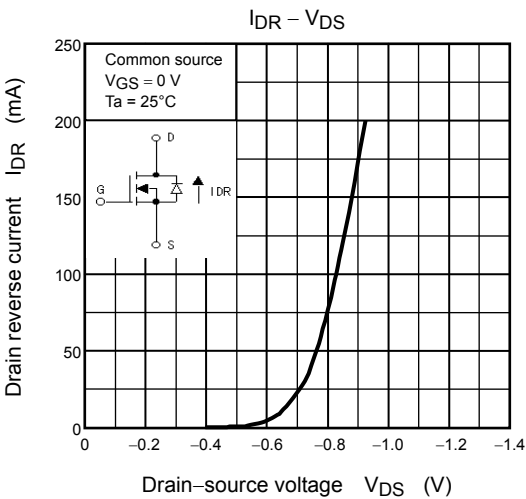
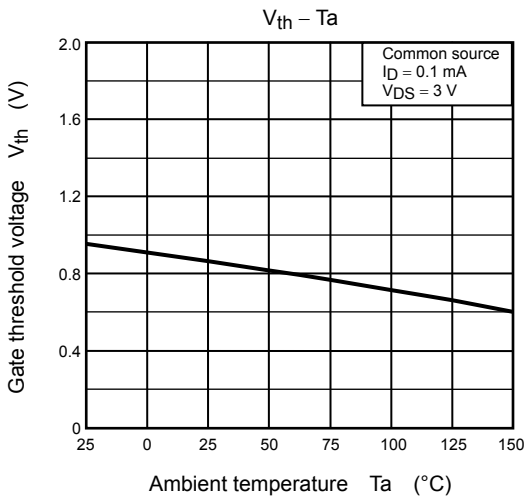
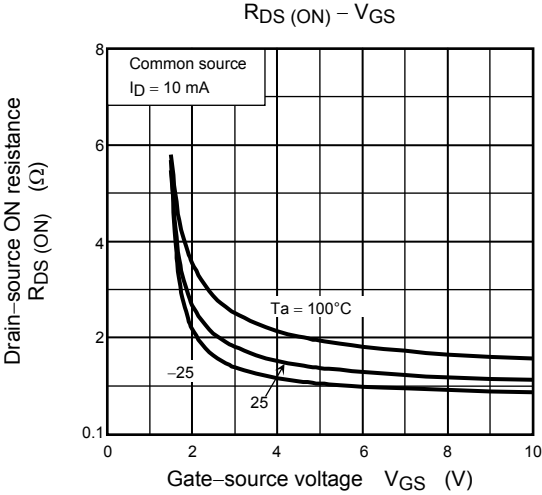
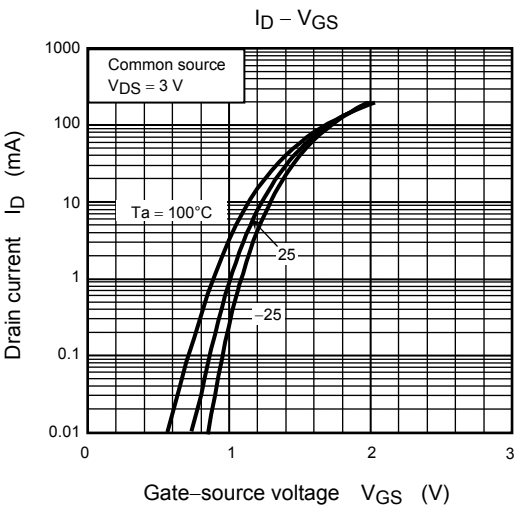
## PNP





## Nch-MOS





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