TOSHIBA Multi-chip Device

Silicon PNP Epitaxial Transistor , Field Effect Transistor Silicon N Channel MOS Type

TPCP8F01

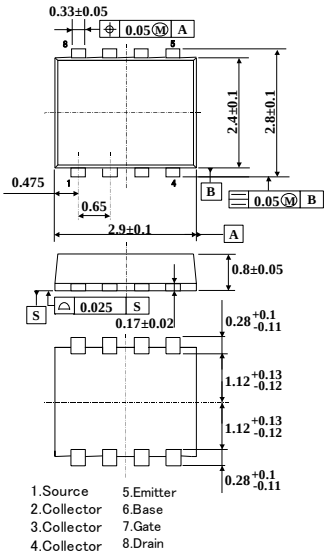
Unit: mm

○ Swtching 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)



JEDEC	—
JEITA	—
TOSHIBA	2-3V1B

Weight : 0.017g (Typ.)

Maximum Ratings (Ta = 25°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		Pc(Note 1)	1.0	W
Junction temperature		T_j	150	°C

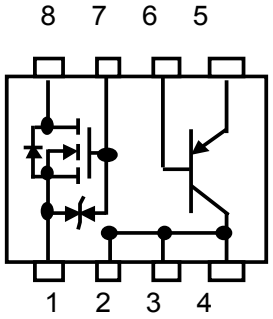
MOS FET

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	20	V
Gate-source voltage		V_{GSS}	±10	V
Drain current	DC	I_D	100	mA
	Pulse	I_{DP}	200	
Channel temperature		T_j	150	°C

Note 1 : Mounted on FR4 board (glass epoxy, 1.6mm thick, Cu area: 645mm^2)

Figure 1

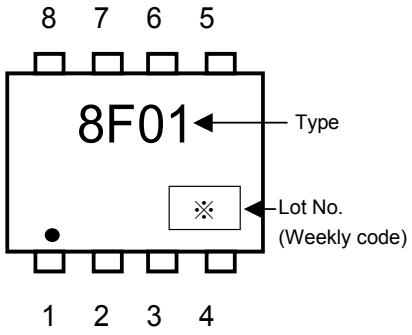
Circuit Configuration



Common Maximum Rating (Ta = 25°C)

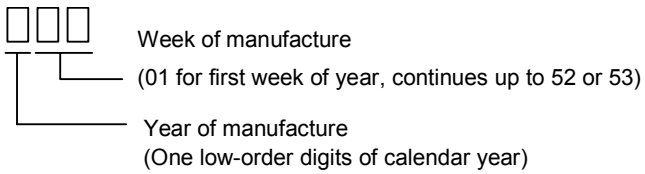
Characteristics	Symbol	Rating	Unit
Storage temperature range	T_{stg}	−55 to 150	°C

Figure 2 Marking (Note 2)



Note 2 : Black round marking "・" located on the left lower side of parts number marking "8F01" indicates terminal No.1

※ Weekly code: (Three digits)

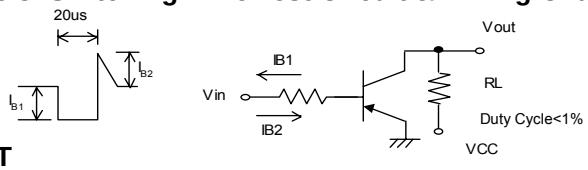


Electrical Characteristics (Ta = 25°C)

Transistor

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

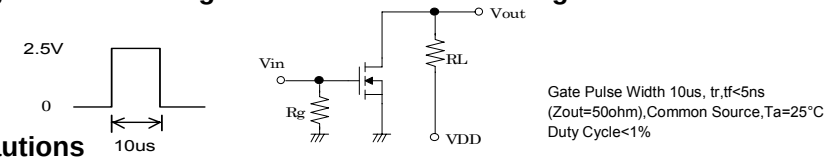
Figure 3. Switching Time Test Circuit & Timing Chart



MOS FET

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = −10 V, V_{DS} = 0	—	—	±1	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 0.1 mA, V_{GS} = 0	20	—	—	V
Drain cut-off current		I_{DSS}	V_{DS} = 20 V, V_{GS} = 0	—	—	1	μA
Gate Threshold voltage		V_{th}	V_{DS} = 3 V, I_D = 0.1 mA	0.6	—	1.1	V
Forward Transfer Admittance		$\|Y_{fs}\|$	V_{DS} = 3 V, I_D = 10 mA	40	—	—	mS
Drain-source ON resistance		$R_{DS(ON)}$	I_D = 10 mA, V_{GS} = 4.0 V	—	1.5	3	Ω
			I_D = 10 mA, V_{GS} = 2.5 V	—	2.2	4	
			I_D = 1 mA, V_{GS} = 1.5 V	—	5.2	15	
Input capacitance		C_{iss}	V_{DS} = 3 V, V_{GS} = 0, f = 1 MHz	—	9.3	—	pF
Reverse transfer capacitance		C_{rss}		—	4.5	—	
Output capacitance		C_{oss}		—	9.8	—	
Switching time	Turn-on time	t_{on}	V_{DD} ≃ −3 V, R_L = 300 Ω V_{GS} = 0 to 2.5V	—	70	—	ns
	Turn-off time	t_{off}		—	125	—	

Figure 4. Switching Time Test Circuit & Timing Chart



Precautions

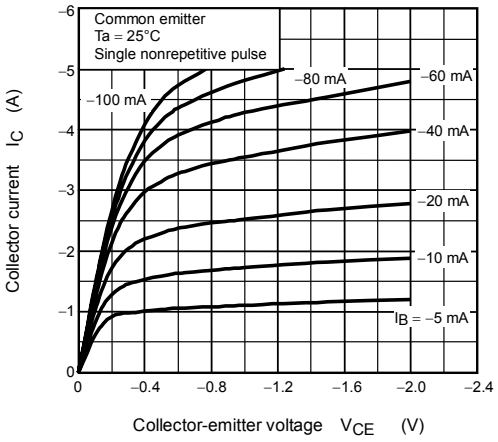
V_{th} can be expressed as voltage between gate and source when low operating current value is I_D = 100 μA for this product. For normal switching operation, $V_{GS(ON)}$ requires higher voltage than V_{th} snd $V_{GS(OFF)}$ requires lower voltage than V_{th}. (relationship can be established as follows: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

Please take this into consideration for using the device.

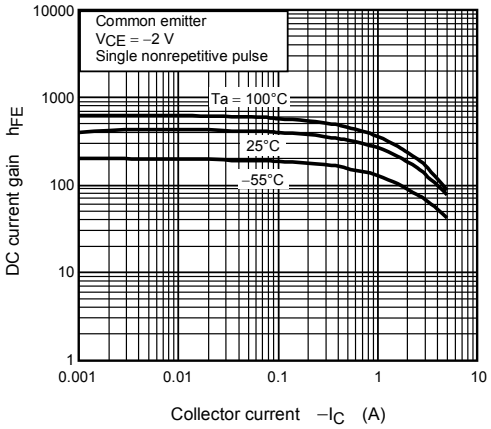
VGS recommended voltage of 2.5V or higher to turn on this product.

PNP

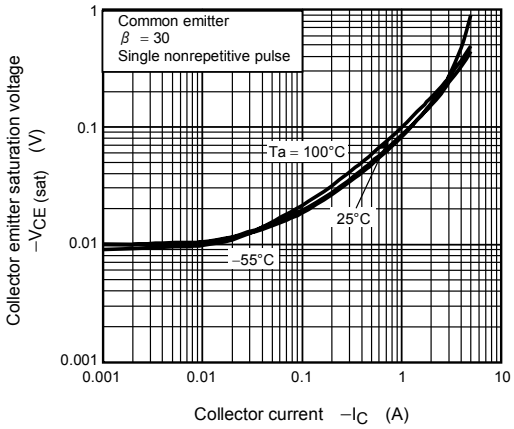
$I_C - V_{CE}$



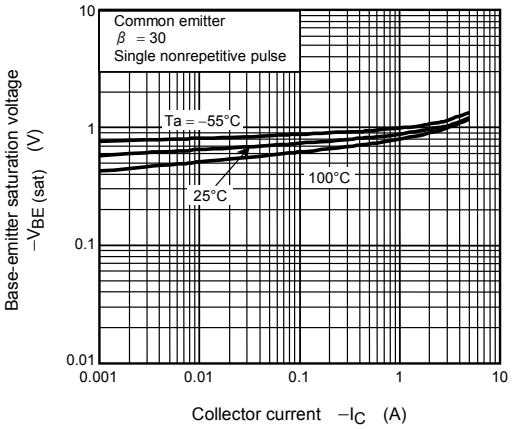
$h_{FE} - I_C$



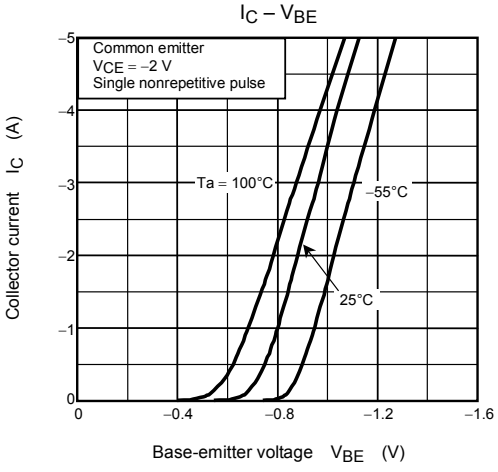
$V_{CE\ (sat)} - I_C$

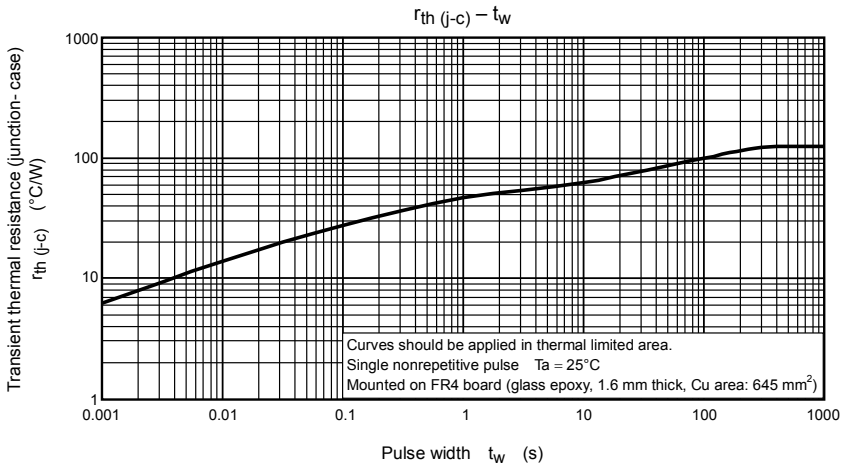


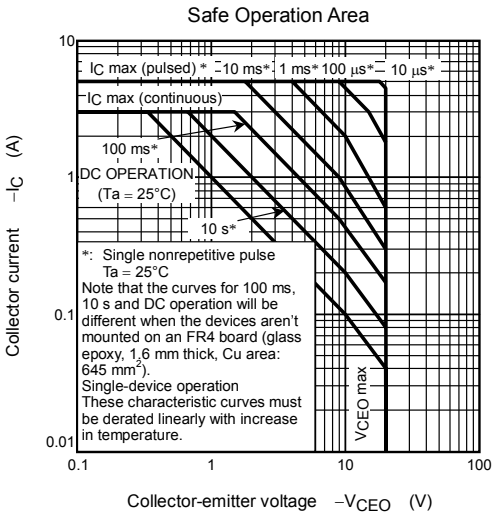
$V_{BE\ (sat)} - I_C$



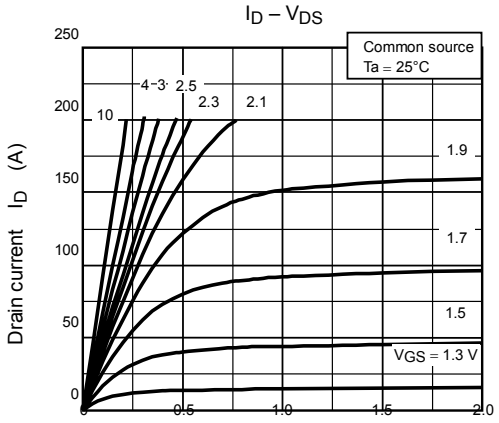
$I_C - V_{BE}$

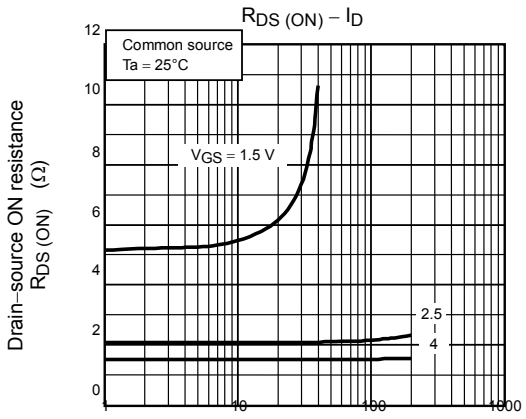


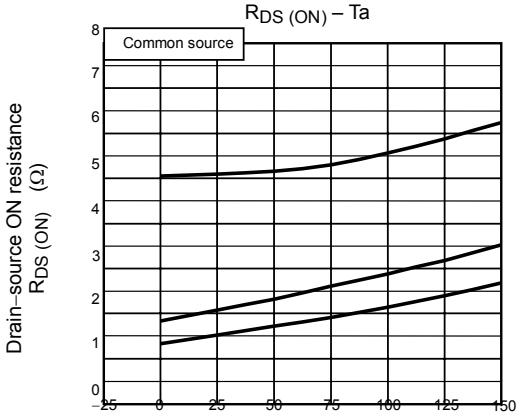

$r_{th\ (j\text{-}c)} - t_w$
Transient thermal resistance (junction- case) $r_{th\ (j\text{-}c)}$ (°C/W)
1000
100
10
1
0.001
0.01
0.1
1
10
100
1000
Curves should be applied in thermal limited area.
Single nonrepetitive pulse Ta = 25°C
Mounted on FR4 board (glass epoxy, 1.6 mm thick, Cu area: 645 mm²)
Pulse width t_w (s)

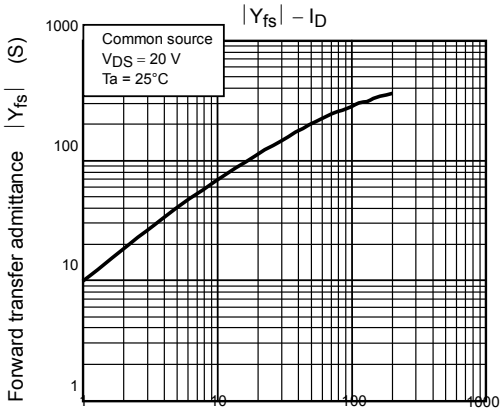

Safe Operation Area
10
1
0.1
0.01
I_C max (pulsed) *
10 ms*
1 ms*
100 μs*
10 μs*
I_C max (continuous)
100 ms*
DC OPERATION
(Ta = 25°C)
10 s*
*: Single nonrepetitive pulse
Ta = 25°C
Note that the curves for 100 ms, 10 s and DC operation will be different when the devices aren't mounted on an FR4 board (glass epoxy, 1.6 mm thick, Cu area: 645 mm²).
Single-device operation
These characteristic curves must be derated linearly with increase in temperature.
V_{CEO} max
0.1
1
10
100
Collector current $-I_C$ (A)
Collector-emitter voltage $-V_{CEO}$ (V)

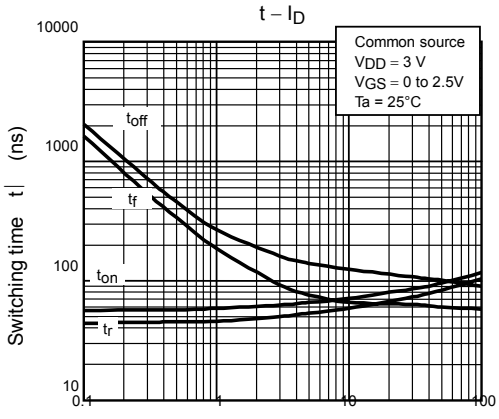
Nch-MOS

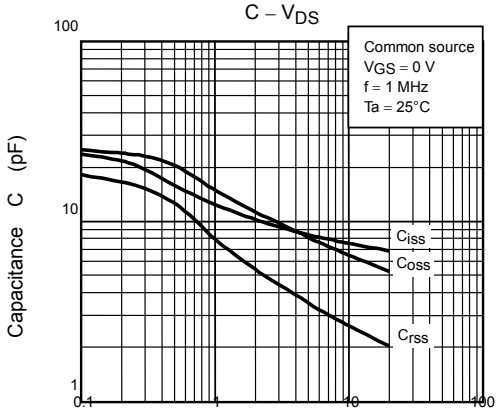

$I_D - V_{DS}$
Common source
Ta = 25°C
10
4
3
2.5
2.3
2.1
1.9
1.7
1.5
VGS = 1.3 V
Drain current I_D (A)
Drain–source voltage V_{DS} (V)


$R_{DS\ (ON)} - I_D$
Common source
Ta = 25°C
VGS = 1.5 V
2.5
4
Drain–source ON resistance $R_{DS\ (ON)}$ (Ω)
Drain current I_D (A)

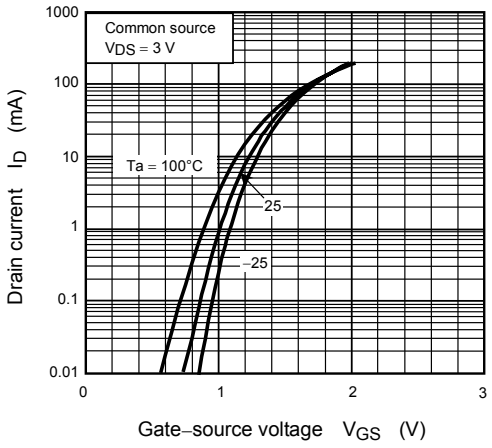

$R_{DS\ (ON)} - Ta$
Common source
Drain–source ON resistance $R_{DS\ (ON)}$ (Ω)
Ambient temperature Ta (°C)


$|Y_{fs}| - I_D$
Common source
VDS = 20 V
Ta = 25°C
Forward transfer admittance $|Y_{fs}|$ (S)
Drain current I_D (A)

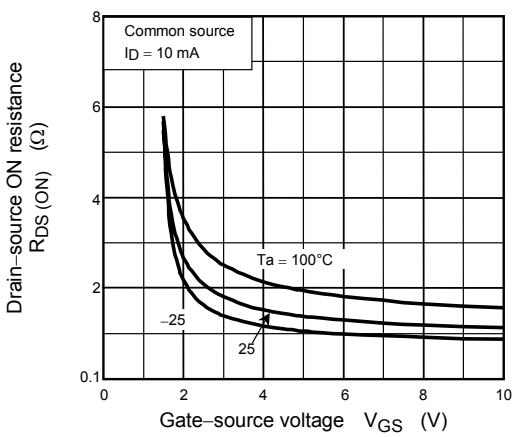

$t - I_D$
Common source
VDD = 3 V
VGS = 0 to 2.5V
Ta = 25°C
toff
tf
ton
tr
Switching time t (ns)
Drain current I_D (mA)


$C - V_{DS}$
Common source
VGS = 0 V
f = 1 MHz
Ta = 25°C
Ciss
Coss
Crss
Capacitance C (pF)
Drain–source voltage V_{DS} (V)

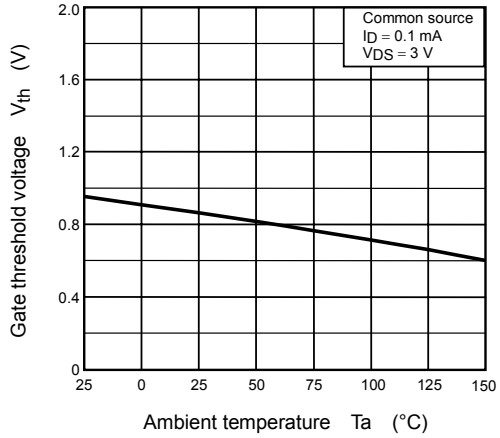
$I_D - V_{GS}$



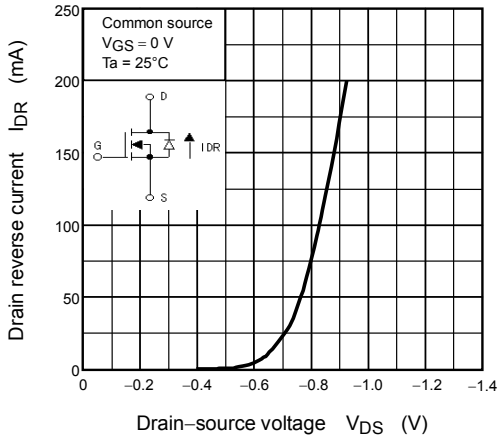
$R_{DS\ (ON)} - V_{GS}$



$V_{th} - Ta$



$I_{DR} - V_{DS}$



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