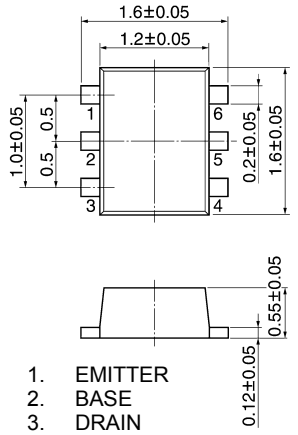
TOSHIBA Multichip Discrete Device

HN7G09FE

Power Management Switch Applications, Inverter Circuit Applications, Driver Circuit Applications and Interface Circuit Applications

Q1 (transistor): RN1104F equivalent
Q2 (MOSFET): SSM3K15FS equivalent

Unit: mm



1. EMITTER
2. BASE
3. DRAIN
4. SOURCE
5. GATE
6. COLLECTOR

ES6

JEDEC	—
JEITA	—
TOSHIBA	2-2J1A

Weight:0.003 g (typ.)

Q1 (Transistor) Absolute Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-base voltage	V_{CBO}	50	V
Collector-emitter voltage	V_{CEO}	50	V
Emitter-base voltage	V_{EBO}	10	V
Collector current	I_C	100	mA

Q2 (MOSFET) Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Drain-source voltage		V_{DS}	20	V
Gate-source voltage		V_{GSS}	± 20	V
DC drain current	DC	I_D	100	mA
	Pulse	I_{DP}	200	

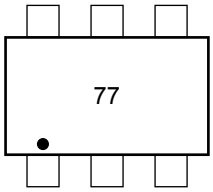
Q1, Q2 Common Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Power dissipation	P_C (Note 1)	100	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	−55~150	°C

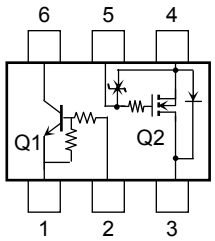
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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.

Marking



Equivalent Circuit (top view)



Q1 (Transistor) Electrical Characteristics (Ta = 25°C)

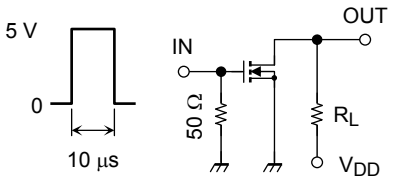
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cutoff current	I_{CBO}	V_{CB} = 50 V, I_E = 0	—	—	100	nA
	I_{CEO}	V_{CE} = 50 V, I_E = 0	—	—	500	nA
Emitter cutoff current	I_{EBO}	V_{EB} = 10 V, I_C = 0	0.082	—	0.15	mA
DC current gain	h_{FE}	V_{CE} = 5 V, I_C = 10 mA	80	—	—	
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	I_C = 5 mA, I_B = 0.25 mA	—	0.1	0.3	V
Input voltage (ON)	$V_{I(ON)}$	V_{CE} = 0.2 V, I_C = 5 mA	1.5	—	5.0	V
Input voltage (OFF)	$V_{I(OFF)}$	V_{CE} = 5 V, I_C = 0.1 mA	1.0	—	1.5	V
Transition frequency	f_T	V_{CE} = 10 V, I_C = 5 mA	—	250	—	MHz
Collector output capacitance	C_{ob}	V_{CB} = 10 V, I_E = 0, f = 1 MHz	—	3	—	pF
Input resistor	R1	—	32.9	47	61.1	kΩ
Resistor ratio	R1/R2	—	0.9	1.0	1.1	

Q2 (MOSFET) Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0	—	—	±1	μA
Drain-Source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 0.1 mA, V_{GS} = 0	30	—	—	V
Drain cutoff current		I_{DSS}	V_{DS} = 30 V, V_{GS} = 0	—	—	1	μA
Gate threshold voltage		V_{th}	V_{DS} = 3 V, I_D = 0.1 mA	0.8	—	1.5	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 3 V, I_D = 10 mA	25	—	—	mS
Drain-Source ON-resistance		$R_{DS\ (ON)}$	I_D = 10 mA, V_{GS} = 4 V	—	2.2	4.0	Ω
			I_D = 10 mA, V_{GS} = 2.5 V	—	4.0	7.0	
Input capacitance		C_{iss}	V_{DS} = 3 V, V_{GS} = 0, f = 1 MHz	—	7.8	—	pF
Reverse transfer capacitance		C_{rss}	V_{DS} = 3 V, V_{GS} = 0, f = 1 MHz	—	3.6	—	pF
Output capacitance		C_{oss}	V_{DS} = 3 V, V_{GS} = 0, f = 1 MHz	—	8.8	—	pF
Switching time	Turn-on time	t_{on}	V_{DD} = 5 V, I_D = 10 mA, V_{GS} = 0~5 V	—	50	—	ns
	Turn-off time	t_{off}		—	180	—	

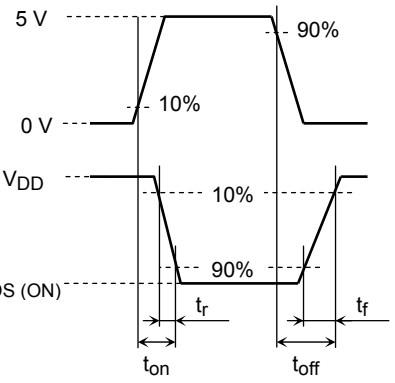
Switching Time Test Circuit

(a) Test circuit



V_{DD} = 5 V
D.U. ≦ 1%
V_{IN}: t_r, t_f < 5 ns
(Z_{out} = 50 Ω)
Common source
Ta = 25°C

(b) V_{IN}



(c) V_{OUT}

Precaution

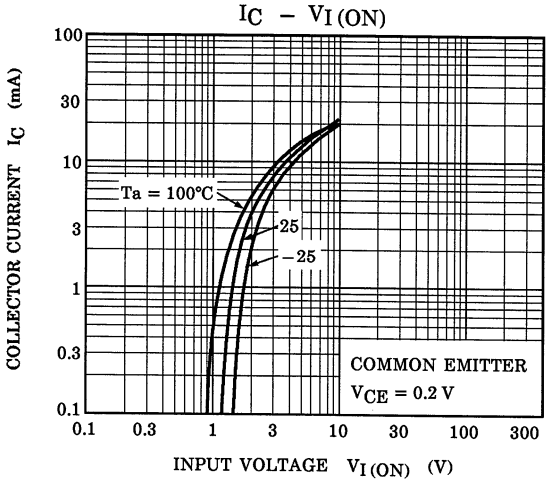
V_{th} can be expressed as the voltage between gate and source when the low operating current value is I_D = 100 μA for this product. For normal switching operation, $V_{GS\ (on)}$ requires a higher voltage than V_{th} and $V_{GS\ (off)}$ requires a lower voltage than V_{th}. (The relationship can be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

Take this into consideration when using the device.

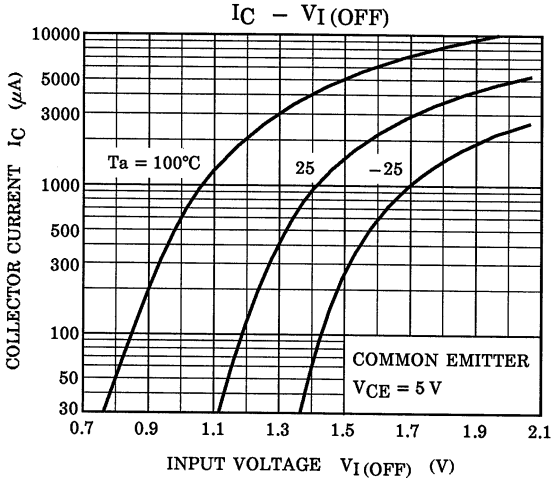
A V_{GS} recommended voltage of 2.5 V or higher is required for turning on this product.

Q1 (Transistor)

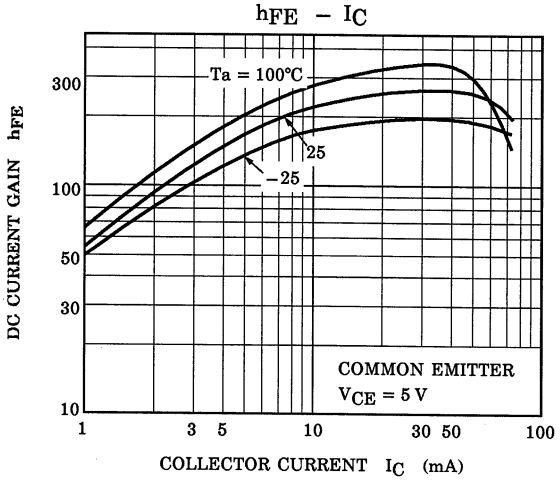
I_C – $V_{I(ON)}$



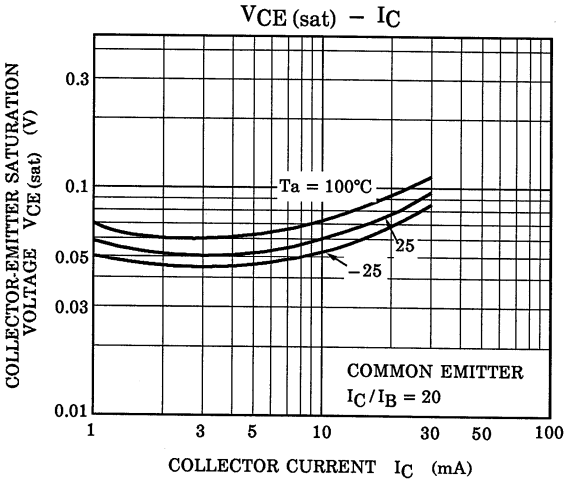
I_C – $V_{I(OFF)}$



h_{FE} – I_C

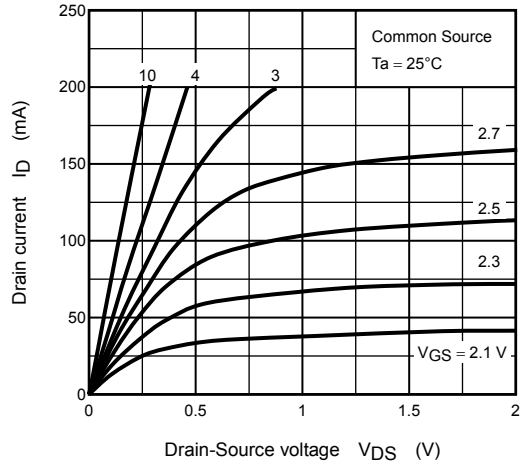


$V_{CE(sat)}$ – I_C

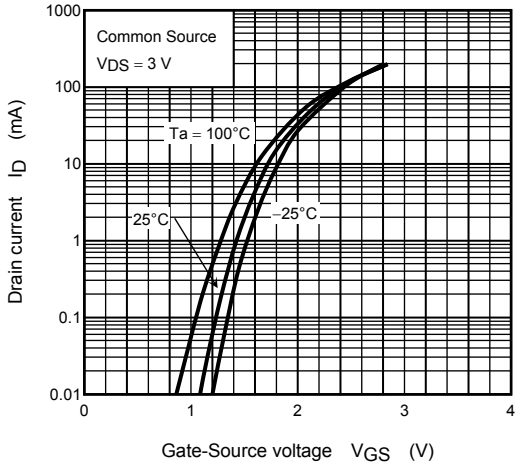


Q2 (MOSFET)

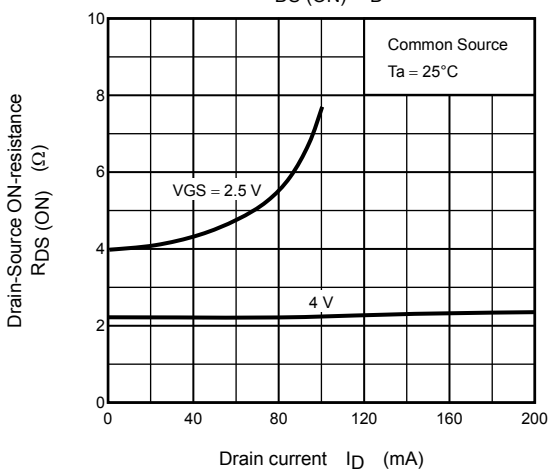
$I_D - V_{DS}$



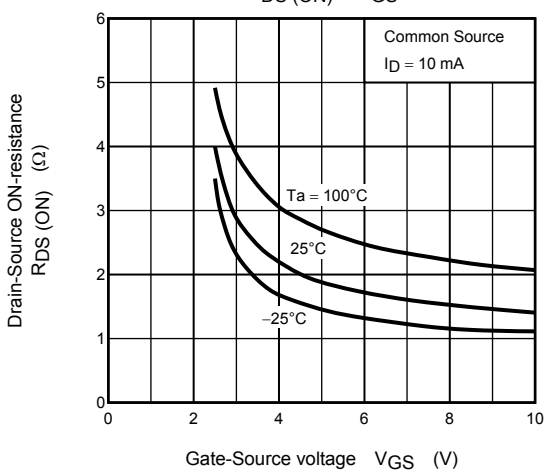
$I_D - V_{GS}$



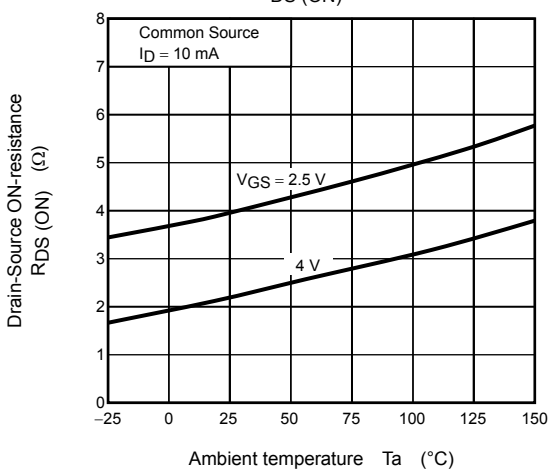
$R_{DS\ (ON)} - I_D$



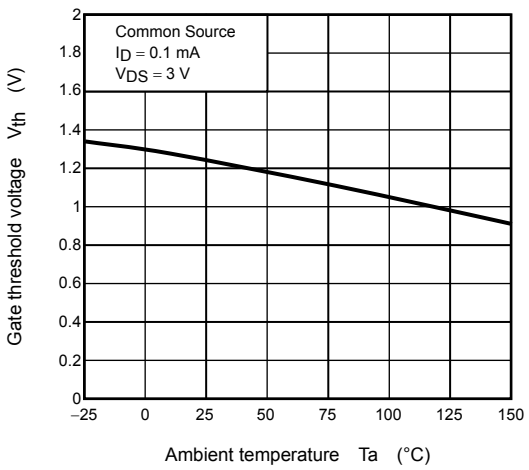
$R_{DS\ (ON)} - V_{GS}$



$R_{DS\ (ON)} - Ta$

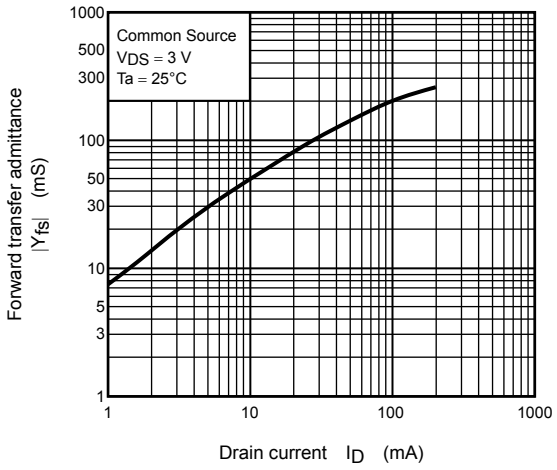


$V_{th} - Ta$

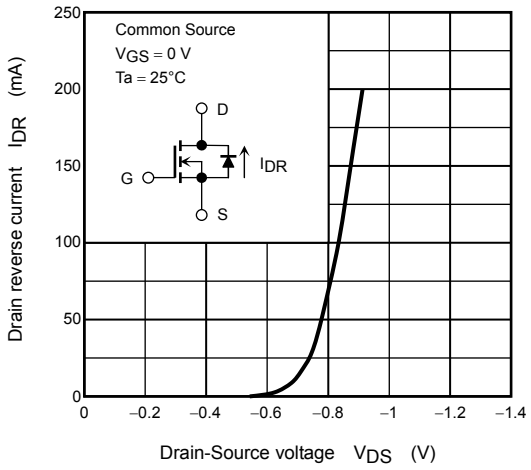


Q2 (MOSFET)

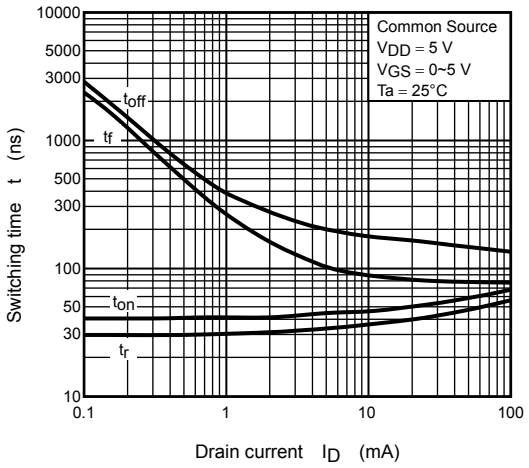
$|Y_{fs}| - I_D$



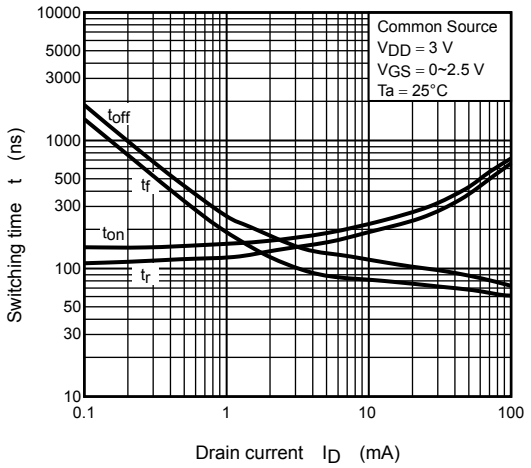
$I_{DR} - V_{DS}$



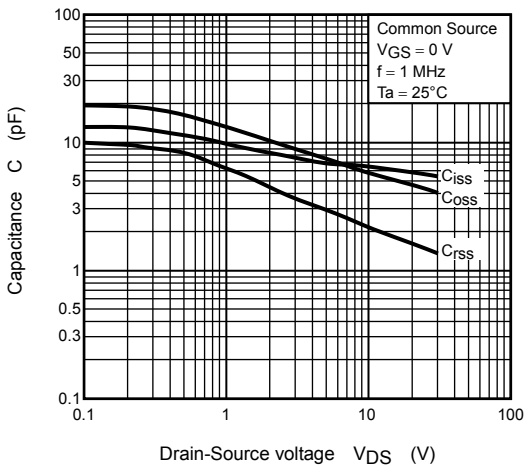
$t - I_D$



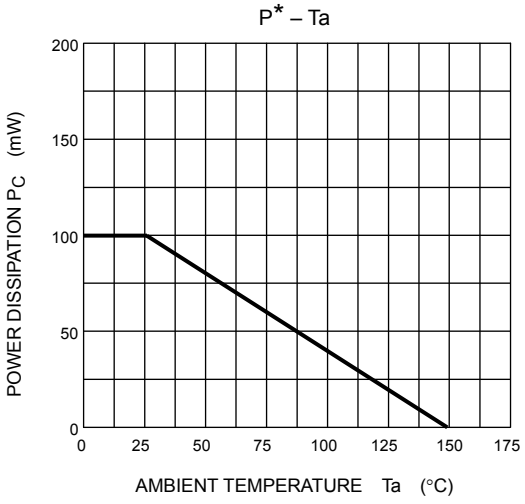
$t - I_D$



$C - V_{DS}$



(Q1, Q2 Common)



*:Total rating

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20070701-EN GENERAL

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