

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

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
	Pulse	I _{DP}	200

Q1, Q2 Common Ratings (Ta = 25°C)

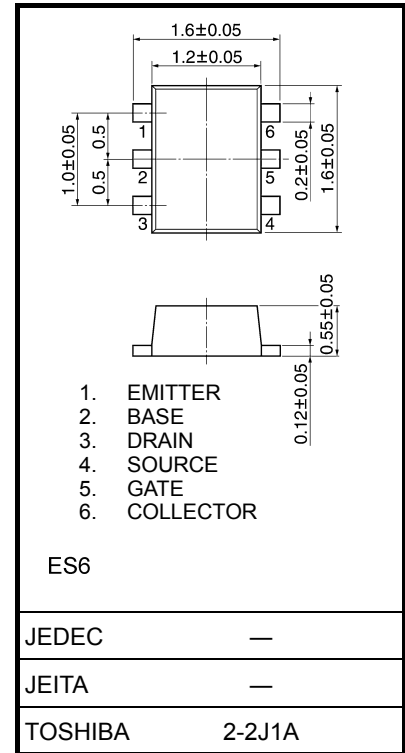
Characteristic	Symbol	Rating	Unit
Power dissipation	P _C (Note 1)	100	mW
Junction temperature	T _j	150	°C
Storage temperature range	T _{stg}	-55~150	°C

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).

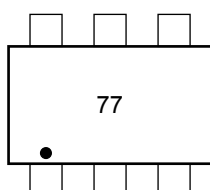
Note 1: Total rating.

Unit: mm

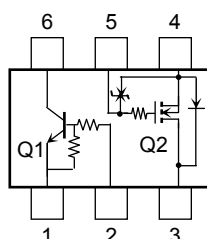


Weight: 0.003 g (typ.)

Marking



Equivalent Circuit (top view)



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

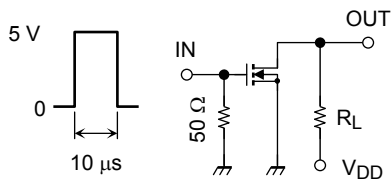
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cutoff current	I_{CBO}	$V_{CB} = 50\text{ V}, I_E = 0$	—	—	100	nA
	I_{CEO}	$V_{CE} = 50\text{ V}, I_E = 0$	—	—	500	nA
Emitter cutoff current	I_{EBO}	$V_{EB} = 10\text{ V}, I_C = 0$	0.082	—	0.15	mA
DC current gain	h_{FE}	$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$	80	—	—	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$	—	0.1	0.3	V
Input voltage (ON)	$V_{I(ON)}$	$V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$	1.5	—	5.0	V
Input voltage (OFF)	$V_{I(OFF)}$	$V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$	1.0	—	1.5	V
Transition frequency	f_T	$V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$	—	250	—	MHz
Collector output capacitance	C_{ob}	$V_{CB} = 10\text{ V}, I_E = 0, f = 1\text{ MHz}$	—	3	—	pF
Input resistor	R1	—	32.9	47	61.1	k Ω
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}	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0$	—	—	± 1	μA
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = 0.1\text{ mA}, V_{GS} = 0$	30	—	—	V
Drain cutoff current	I_{DSS}	$V_{DS} = 30\text{ V}, V_{GS} = 0$	—	—	1	μA
Gate threshold voltage	V_{th}	$V_{DS} = 3\text{ V}, I_D = 0.1\text{ mA}$	0.8	—	1.5	V
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 3\text{ V}, I_D = 10\text{ mA}$	25	—	—	mS
Drain-Source ON-resistance	$R_{DS(ON)}$	$I_D = 10\text{ mA}, V_{GS} = 4\text{ V}$	—	2.2	4.0	Ω
		$I_D = 10\text{ mA}, V_{GS} = 2.5\text{ V}$	—	4.0	7.0	
Input capacitance	C_{iss}	$V_{DS} = 3\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	7.8	—	pF
Reverse transfer capacitance	C_{rss}	$V_{DS} = 3\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	3.6	—	pF
Output capacitance	C_{oss}	$V_{DS} = 3\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	8.8	—	pF
Switching time	Turn-on time	$V_{DD} = 5\text{ V}, I_D = 10\text{ mA},$ $V_{GS} = 0 \sim 5\text{ V}$	—	50	—	ns
	Turn-off time		—	180	—	

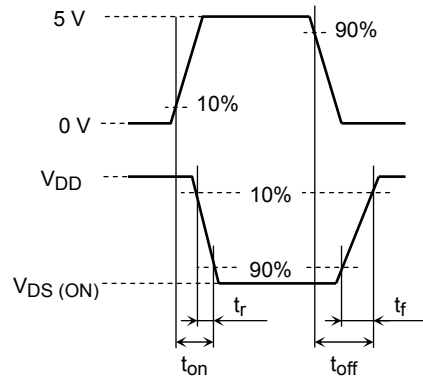
Switching Time Test Circuit

(a) Test circuit



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

(b) V_{IN}



(c) V_{OUT}

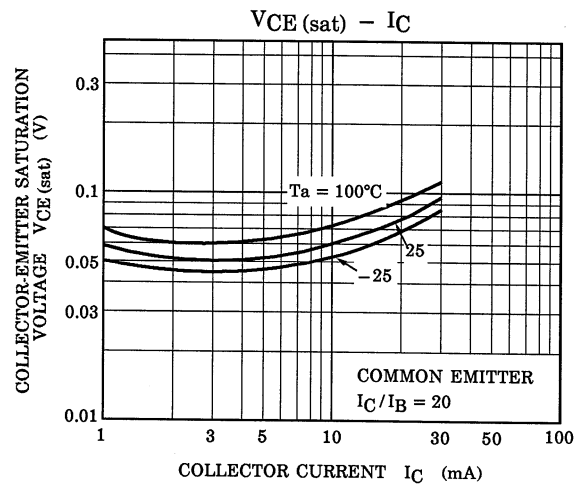
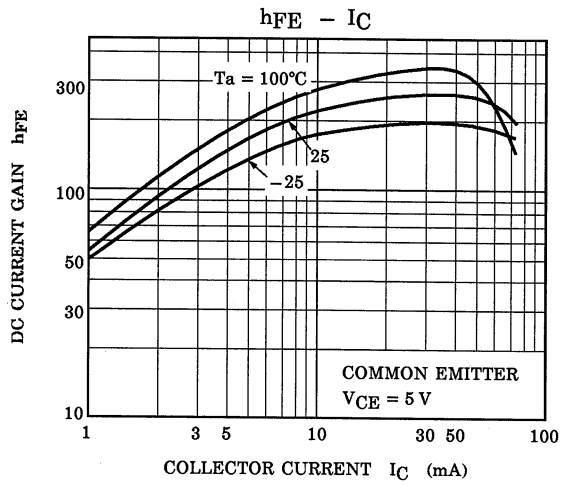
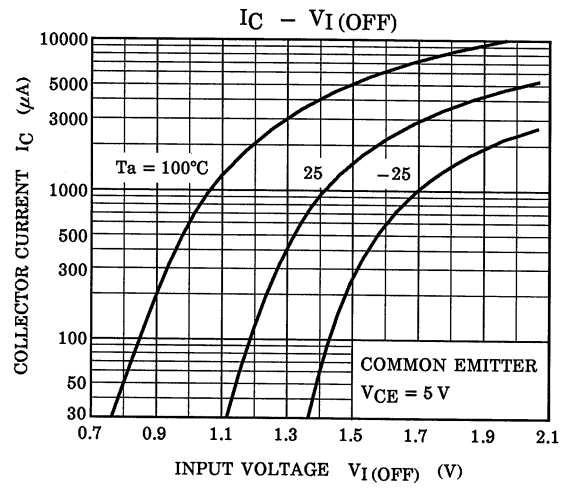
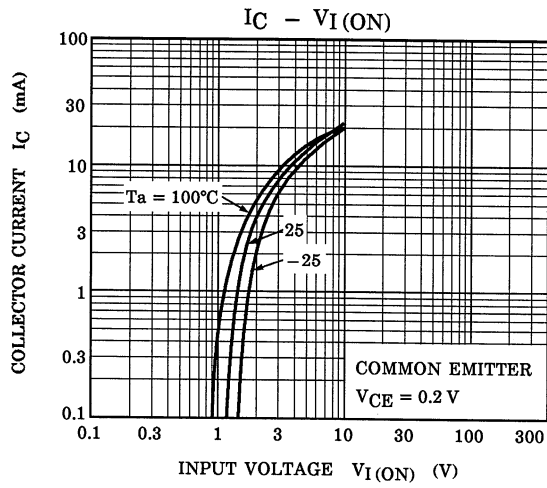
Precaution

V_{th} can be expressed as the voltage between gate and source when the low operating current value is $I_D = 100\ \mu\text{A}$ 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: $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$.)

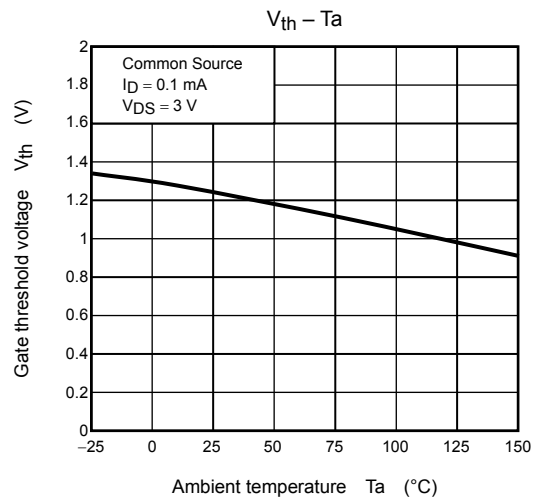
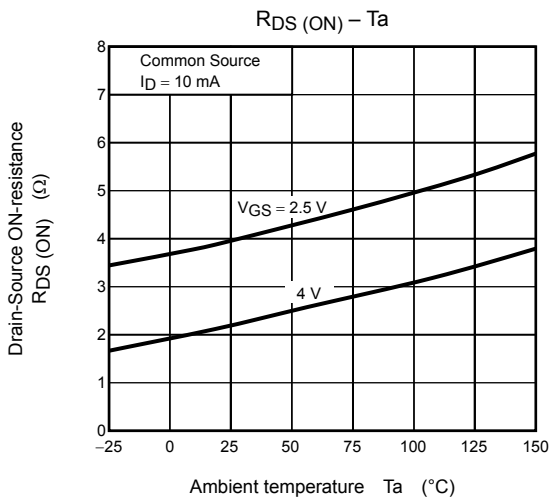
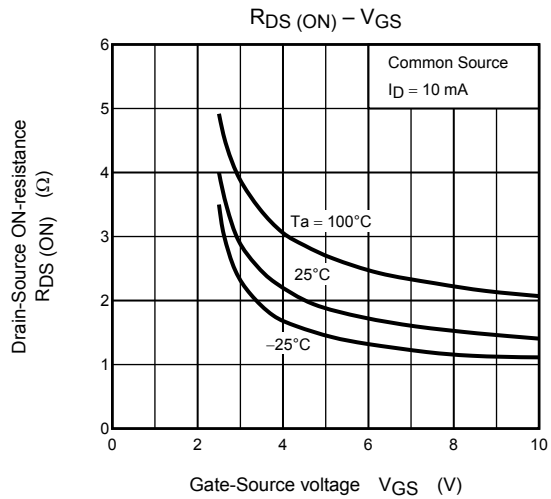
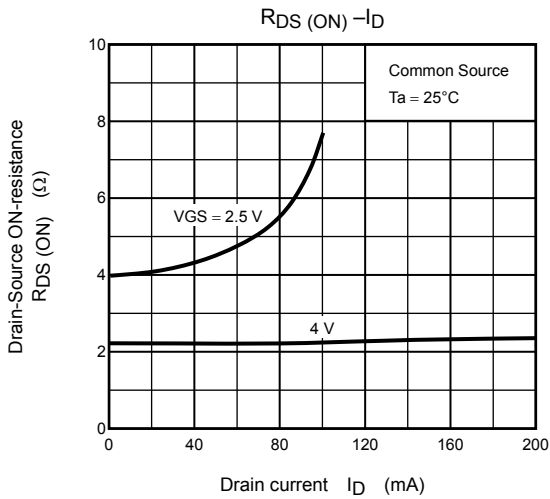
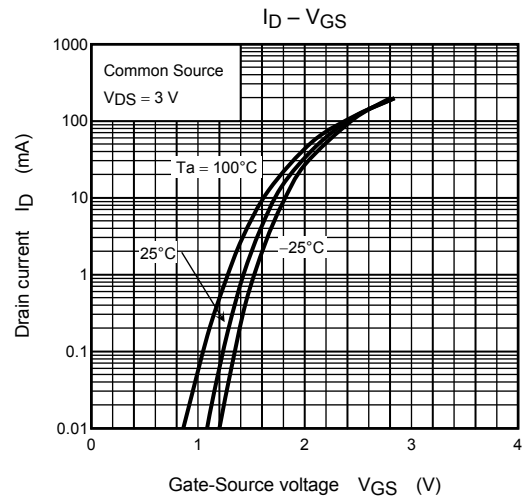
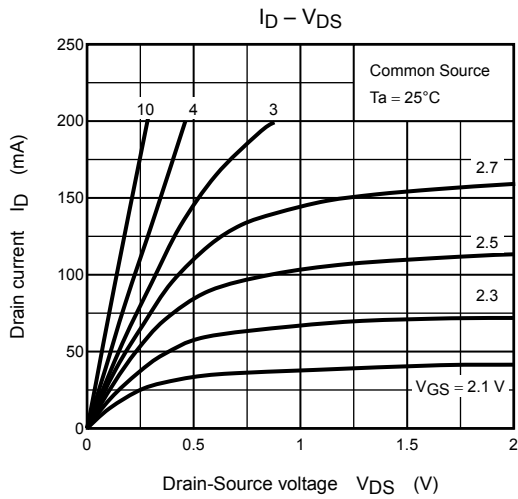
Take this into consideration when using the device.

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

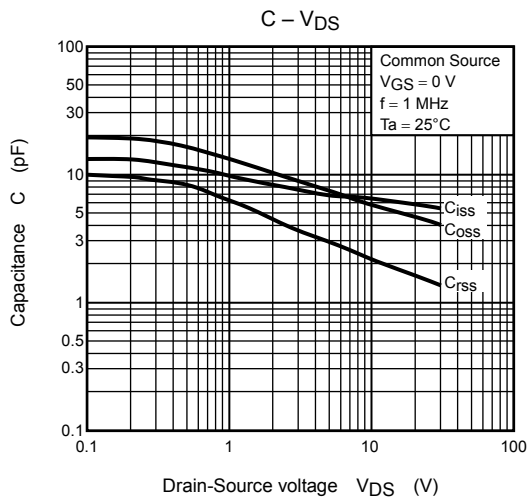
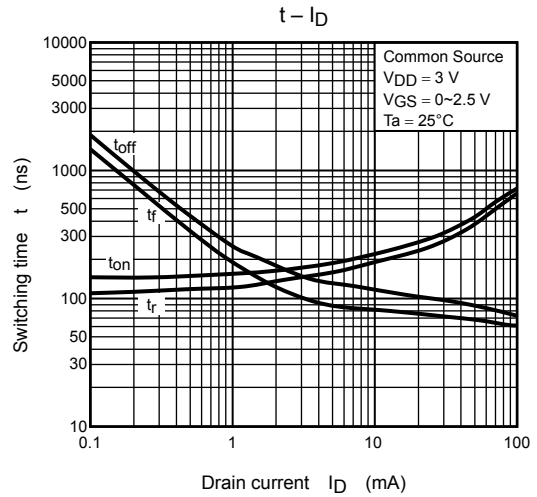
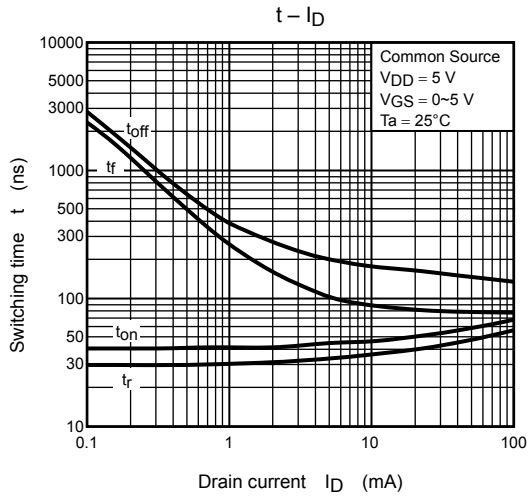
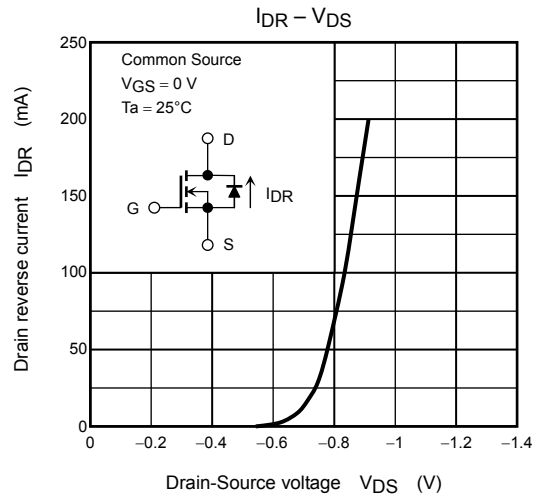
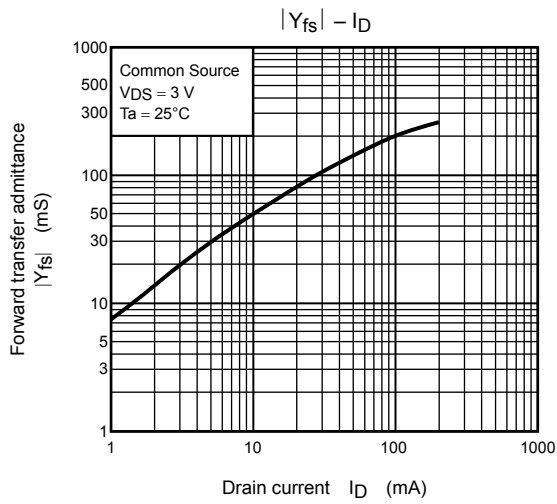
Q1 (Transistor)



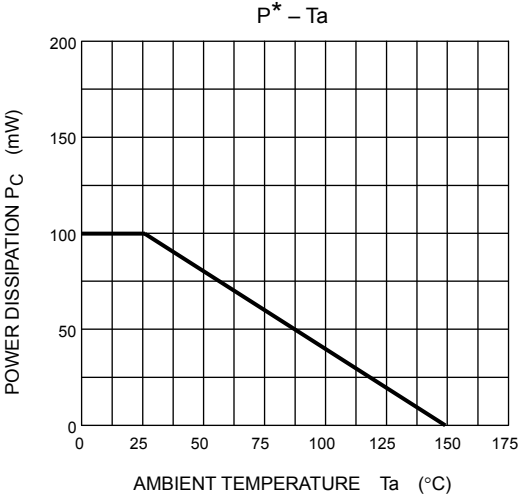
Q2 (MOSFET)



Q2 (MOSFET)



(Q1, Q2 Common)



*:Total rating

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20070701-EN GENERAL

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