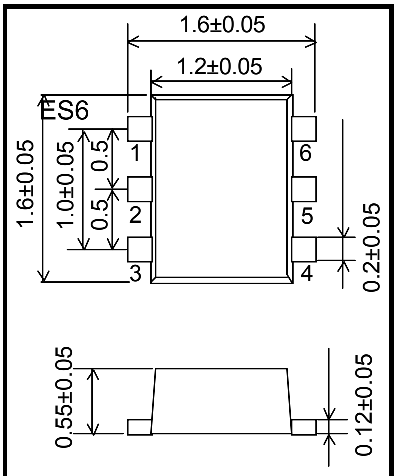
TOSHIBA Field-Effect Transistor Silicon N-Channel MOS Type

SSM6N42FE

○ Power Management Switch Applications
○ High-Speed Switching Applications

単位: mm



1.Source1 4.Source2
2.Gate1 5.Gate2
3.Drain2 6.Drain1

JEDEC	―
JEITA	―
TOSHIBA	2-2N1D

Weight: 3.0 mg (typ.)

- 1.5V drive
- N-ch 2-in-1
- Low ON-resistance : $R_{DS(ON)}$ = 600 mΩ (max) (@V_{GS} = 1.5V)
  : $R_{DS(ON)}$ = 450 mΩ (max) (@V_{GS} = 1.8V)
  : $R_{DS(ON)}$ = 330 mΩ (max) (@V_{GS} = 2.5V)
  : $R_{DS(ON)}$ = 240 mΩ (max) (@V_{GS} = 4.5V)

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

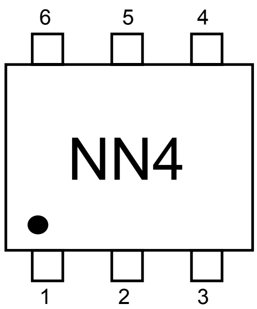
Characteristic		Symbol	Rating	Unit
Drain–source voltage		V_{DSS}	20	V
Gate–source voltage		V_{GSS}	± 10	V
Drain current	DC	I_D (Note 1)	800	mA
	Pulse	I_{DP} (Note 1)	1600	
Drain power dissipation		P_D (Note 2)	150	mW
Channel temperature		T_{ch}	150	°C
Storage temperature		T_{stg}	- 55 to 150	°C

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).

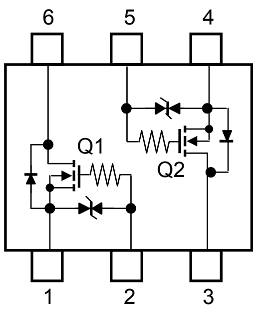
Note 1: The junction temperature should not exceed 150°C during use.

Note 2: Total rating
Mounted on an FR4 board
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 0.135 mm^2 × 6)

Marking



Equivalent Circuit (top view)



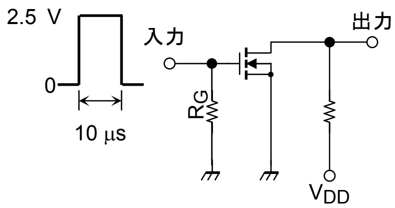
Electrical Characteristics (Ta = 25°C) (Q1, Q2 Common)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 1 mA, V_{GS} = 0 V	20	—	—	V
		$V_{(BR)\ DSX}$	I_D = 1 mA, V_{GS} = - 10 V	12	—	—	
Drain cutoff current		I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V	—	—	1	μA
Gate leakage current		I_{GSS}	V_{GS} = ±8 V, V_{DS} = 0 V	—	—	±1	μA
Gate threshold voltage		V_{th}	V_{DS} = 3 V, I_D = 1 mA	0.35	—	1.0	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 3 V, I_D = 500 mA (Note 3)	1.05	2.1	—	S
Drain-source ON-resistance		$R_{DS\ (ON)}$	I_D = 500 mA, V_{GS} = 4.5 V (Note 3)	—	185	240	mΩ
			I_D = 400 mA, V_{GS} = 2.5 V (Note 3)	—	245	330	
			I_D = 250 mA, V_{GS} = 1.8 V (Note 3)	—	310	450	
			I_D = 150 mA, V_{GS} = 1.5 V (Note 3)	—	370	600	
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	90	—	pF
Output capacitance		C_{oss}		—	21	—	
Reverse transfer capacitance		C_{rss}		—	15	—	
Total Gate Charge		Q_g	V_{DS} = 10 V, I_D = 0.8 A V_{GS} = 4.5 V	—	2.00	—	nC
Gate-Source Charge		Q_{gs}		—	1.02	—	
Gate-Drain Charge		Q_{gd}		—	0.98	—	
Switching time	Turn-on time	t_{on}	V_{DD} = 10 V, I_D = 200 mA V_{GS} = 0 to 2.5 V, R_G = 4.7 Ω	—	18	—	ns
	Turn-off time	t_{off}		—	50	—	
Drain-source forward voltage		V_{DSF}	I_D = -0.8 A, V_{GS} = 0 V (Note 3)	—	-0.84	-1.2	V

Note 3: Pulse test

Switching Time Test Circuit (Q1, Q2 Common)

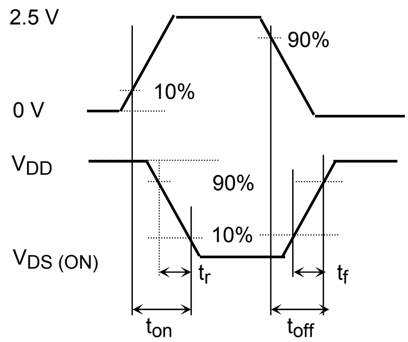
(a) Test Circuit



V_{DD} = 10 V
R_G = 4.7 Ω
Duty ≦ 1%
V_{IN}: t_r, t_f < 5 ns
Common Source
Ta = 25°C

(b) V_{IN}

(c) V_{OUT}



Notice on Usage

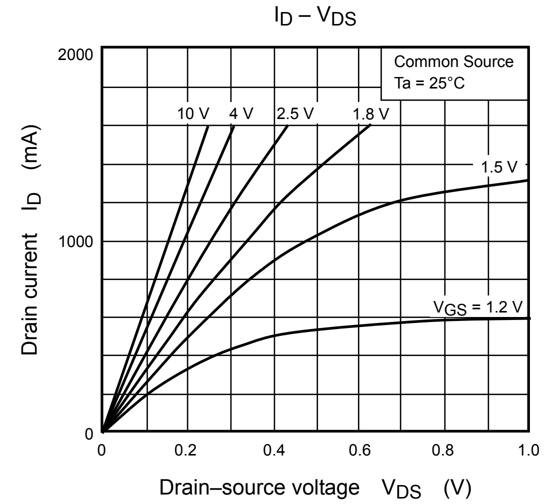
Let V_{th} be the voltage applied between gate and source that causes the drain current (I_D) to be low (1 mA for the SSM6N42FE). Then, for normal switching operation, $V_{GS(on)}$ must be higher than V_{th}, and $V_{GS(off)}$ must be lower than V_{th}. This relationship can be expressed as: $V_{GS(off)} < V_{th} < V_{GS(on)}$.

Take this into consideration when using the device.

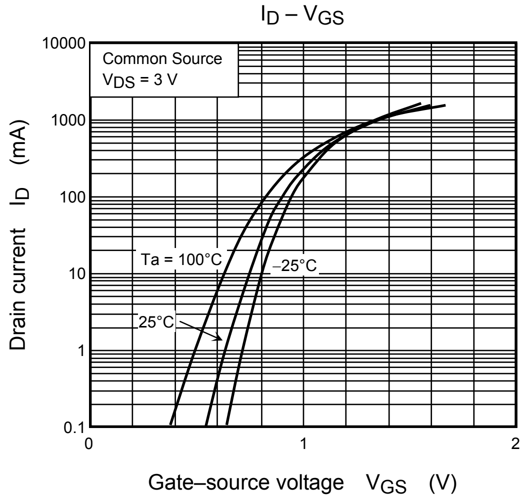
Handling Precaution

When handling individual devices that are not yet mounted on a circuit board, make sure that the environment is protected against electrostatic discharge. Operators should wear antistatic clothing, and containers and other objects that come into direct contact with devices should be made of antistatic materials.

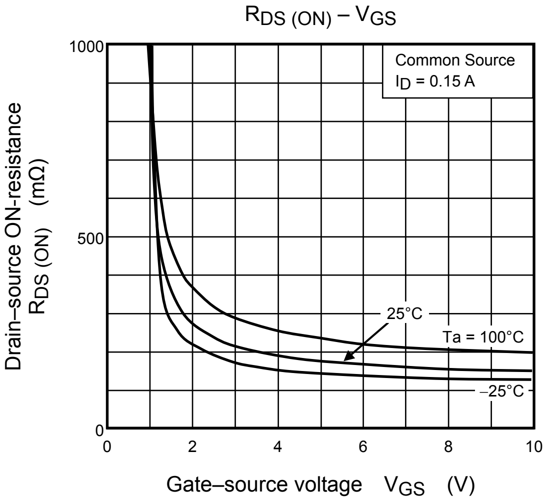
Q1, Q2 Common



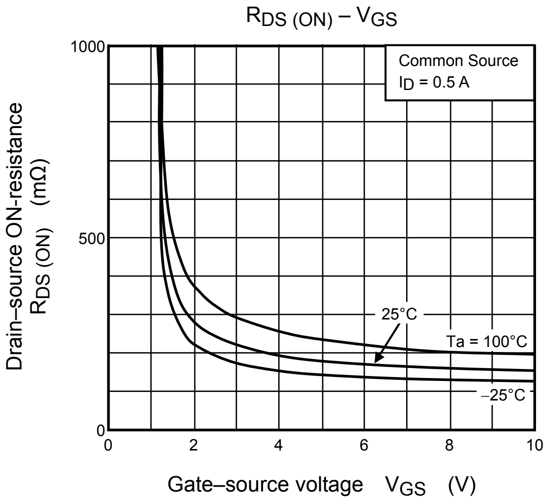
$I_D – V_{DS}$
Common Source
Ta = 25°C
10 V
4 V
2.5 V
1.8 V
1.5 V
V_{GS} = 1.2 V
Drain current I_D (mA)
Drain–source voltage V_{DS} (V)



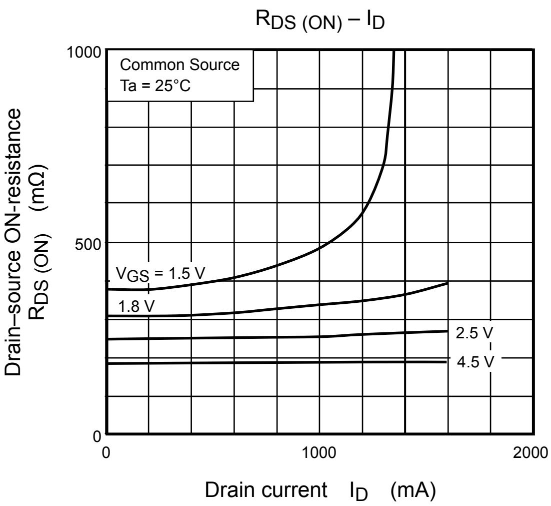
$I_D – V_{GS}$
Common Source
V_{DS} = 3 V
Ta = 100°C
−25°C
25°C
Drain current I_D (mA)
Gate–source voltage V_{GS} (V)



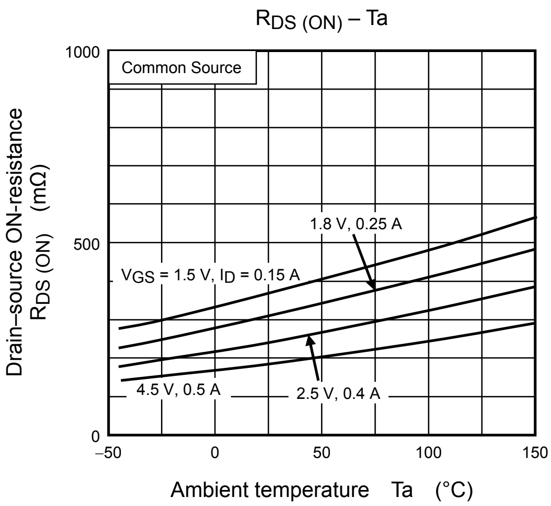
$R_{DS (ON)} – V_{GS}$
Common Source
I_D = 0.15 A
25°C
Ta = 100°C
−25°C
Drain–source ON-resistance $R_{DS (ON)}$ (mΩ)
Gate–source voltage V_{GS} (V)



$R_{DS (ON)} – V_{GS}$
Common Source
I_D = 0.5 A
25°C
Ta = 100°C
−25°C
Drain–source ON-resistance $R_{DS (ON)}$ (mΩ)
Gate–source voltage V_{GS} (V)

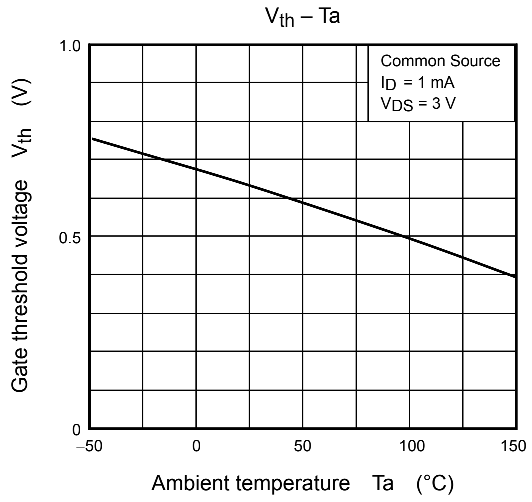


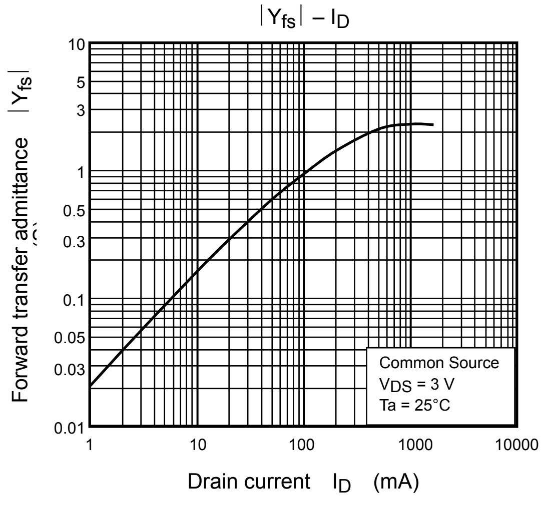
$R_{DS (ON)} – I_D$
Common Source
Ta = 25°C
V_{GS} = 1.5 V
1.8 V
2.5 V
4.5 V
Drain–source ON-resistance $R_{DS (ON)}$ (mΩ)
Drain current I_D (mA)

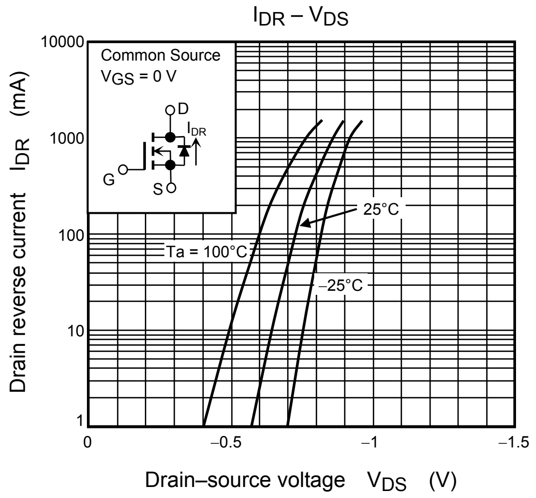


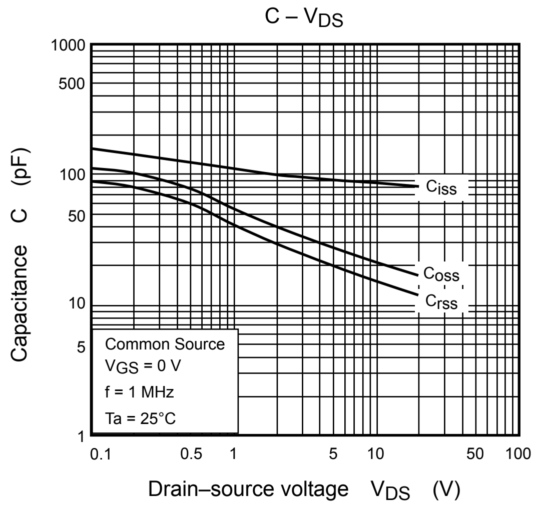
$R_{DS (ON)} – Ta$
Common Source
1.8 V, 0.25 A
V_{GS} = 1.5 V, I_D = 0.15 A
4.5 V, 0.5 A
2.5 V, 0.4 A
Drain–source ON-resistance $R_{DS (ON)}$ (mΩ)
Ambient temperature Ta (°C)

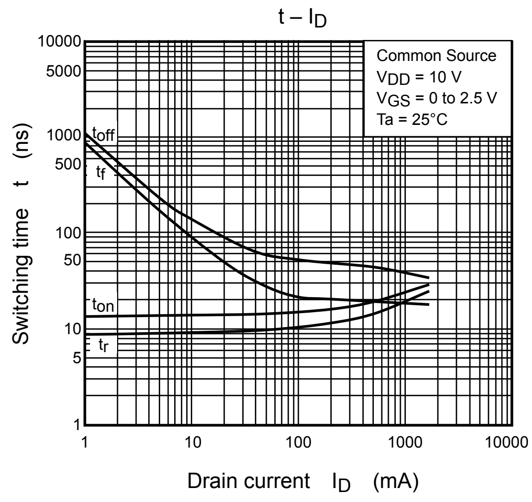
Q1, Q2 Common

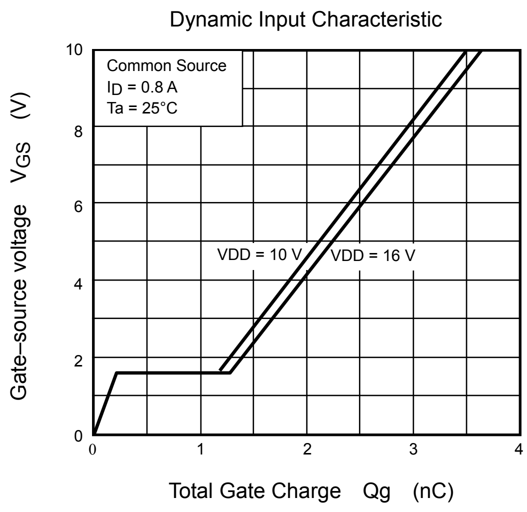

V_{th} – Ta
Common Source
I_D = 1 mA
V_{DS} = 3 V
Gate threshold voltage V_{th} (V)
Ambient temperature Ta (°C)


$|Y_{fs}|$ – I_D
Common Source
V_{DS} = 3 V
Ta = 25°C
Forward transfer admittance $|Y_{fs}|$
Drain current I_D (mA)

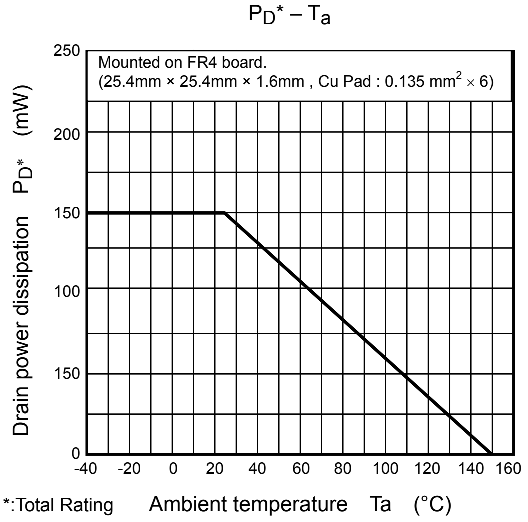

I_{DR} – V_{DS}
Common Source
V_{GS} = 0 V
D
G
S
I_{DR}
25°C
Ta = 100°C
–25°C
Drain reverse current I_{DR} (mA)
Drain–source voltage V_{DS} (V)


C – V_{DS}
C_{iss}
C_{oss}
C_{rss}
Common Source
V_{GS} = 0 V
f = 1 MHz
Ta = 25°C
Capacitance C (pF)
Drain–source voltage V_{DS} (V)


t – I_D
Common Source
V_{DD} = 10 V
V_{GS} = 0 to 2.5 V
Ta = 25°C
t_{off}
t_f
t_{on}
t_r
Switching time t (ns)
Drain current I_D (mA)


Dynamic Input Characteristic
Common Source
I_D = 0.8 A
Ta = 25°C
VDD = 10 V
VDD = 16 V
Gate–source voltage V_{GS} (V)
Total Gate Charge Qg (nC)

Q1, Q2 Common


P_D^* – T_a
Mounted on FR4 board.
(25.4mm × 25.4mm × 1.6mm , Cu Pad : 0.135 mm^2 × 6)
Drain power dissipation P_D^* (mW)
250
200
150
100
150
0
-40
-20
0
20
40
60
80
100
120
140
160
*:Total Rating
Ambient temperature Ta (°C)

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