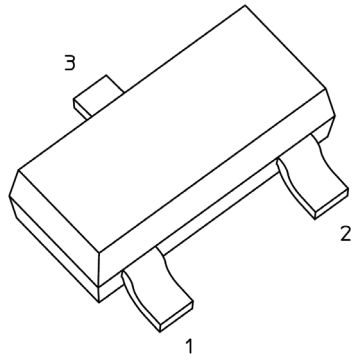
TOSHIBA Field-Effect Transistor Silicon N-Channel MOS Type

T2N7002AK

○ High Speed Switching Applications

- ESD protected gate
- Low ON-resistance $R_{DS(on)}$ = 2.8 Ω (typ.) (@V_{GS} = 10 V)
  $R_{DS(on)}$ = 3.1 Ω (typ.) (@V_{GS} = 5 V)
  $R_{DS(on)}$ = 3.2 Ω (typ.) (@V_{GS} = 4.5 V)



1. Gate
2. Source
3. Drain

SOT23

Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Drain–source voltage		V_{DSS}	60	V
Gate–source voltage		V_{GSS}	± 20	V
Drain current (Note1)	DC	I_D	200	mA
	Pulse	I_{DP} (Note 2)	760	
Power dissipation		P_D (Note 3)	320	mW
		P_D (Note 4)	1000	
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).

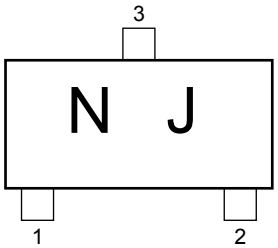
Note 1: The channel temperature should not exceed 150°C during use.

Note 2: Pulse width ≤ 10 μs, Duty ≤ 1%

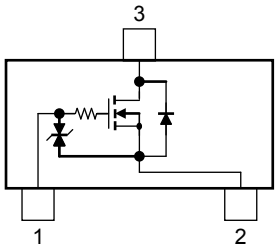
Note 3: Mounted on an FR4 board
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 0.42 mm^2 x 3)

Note 4: Mounted on an FR4 board
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 645 mm^2)

Marking



Equivalent Circuit (top view)



Start of commercial production
2015-01

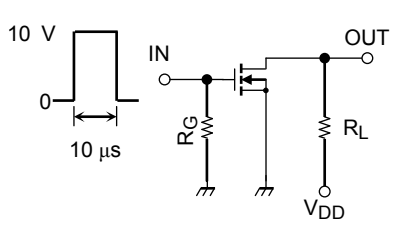
Electrical Characteristics (Ta = 25°C, Otherwise specified)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 250 μA, V_{GS} = 0 V	60	—	—	V
Drain cutoff current		I_{DSS}	V_{DS} = 60 V, V_{GS} = 0 V	—	—	1	μA
			V_{DS} = 60 V, V_{GS} = 0 V, Tj=150 °C	—	—	200	
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±2	μA
			V_{GS} = ±10 V, V_{DS} = 0 V	—	—	±0.5	
			V_{GS} = ±5 V, V_{DS} = 0 V	—	—	±0.1	
Gate threshold voltage		V_{th}	I_D = 250 μA, V_{DS} = V_{GS}	1.1	—	2.1	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 200 mA (Note 5)	—	450	—	mS
Drain-source ON-resistance		$R_{DS\ (ON)}$ (Note 5)	I_D = 100 mA, V_{GS} = 10 V	—	2.8	3.9	Ω
			I_D = 100 mA, V_{GS} = 10 V, Tj=150 °C	—	5.4	8.1	
			I_D = 100 mA, V_{GS} = 5 V	—	3.1	4.4	
			I_D = 100 mA, V_{GS} = 4.5 V	—	3.2	4.7	
Total Gate Charge		$Q_{G(tot)}$	V_{DS} = 30 V, I_D = 200 mA V_{GS} = 4.5 V	—	0.27	0.35	nC
Gate-Source Charge		Q_{GS}		—	0.08	—	
Gate-Drain Charge		Q_{GD}		—	0.08	—	
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	11	17	pF
Output capacitance		C_{oss}		—	3	—	
Reverse transfer capacitance		C_{rss}		—	0.7	—	
Switching time	Turn-on delay time	$t_{d(on)}$	V_{DD} = 40 V, I_D = 160 mA V_{GS} = 0 V to 10 V, R_G = 50 Ω	—	2	4	ns
	Rise time	t_r		—	3	—	
	Turn-off delay time	$t_{d(off)}$		—	7	14	
	Fall time	t_f		—	24	—	
Drain-source forward voltage		V_{DSF}	I_D = -115 mA, V_{GS} = 0 V (Note 5)	—	-0.87	-1.2	V

Note 5: Pulse test

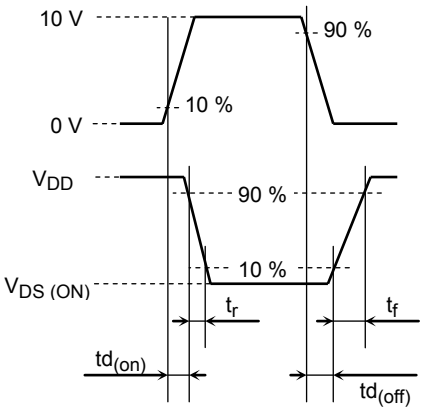
Switching Time Test Circuit

(a) Test Circuit



V_{DD} = 40 V
R_G = 50 Ω
D.U. ≤ 1%
V_{IN}: t_r, t_f < 5 ns
Common Source
Ta = 25°C

(b) V_{IN}



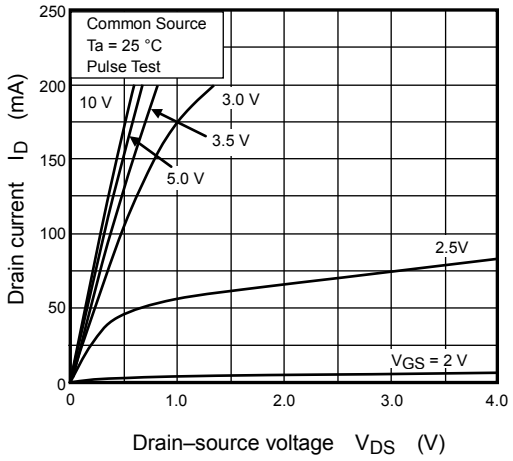
Notice of Usage

Let V_{th} be the voltage applied between gate and source that causes the drain current (I_D) to below (0.25 mA for this device). 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: $V_{GS(OFF)} < Vth < V_{GS(ON)}$.
Take this into consideration when using the device.

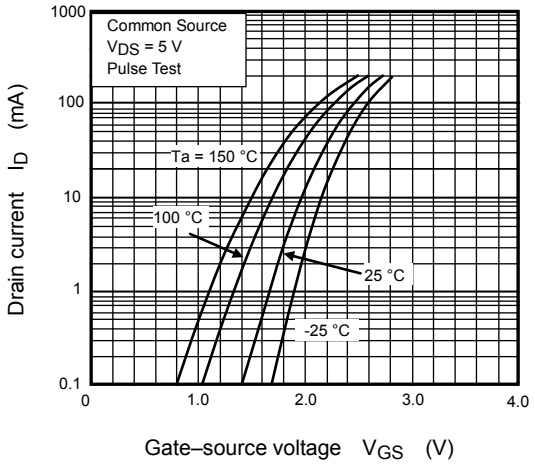
Handling Precaution

The MOSFETs in this device are sensitive to electrostatic discharge. When handling this device, the worktables, operators, soldering irons and other objects should be protected against anti-static discharge.

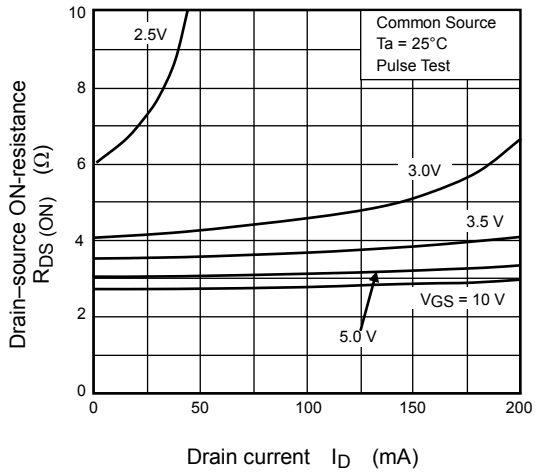
$I_D - V_{DS}$



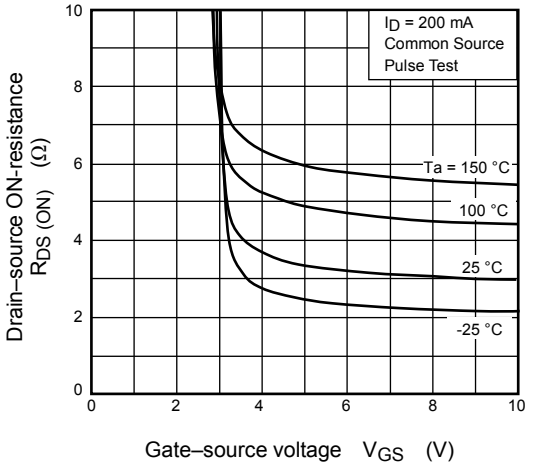
$I_D - V_{GS}$



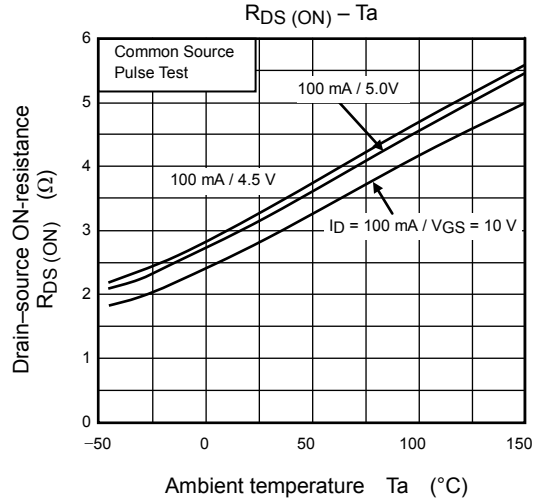
$R_{DS\ (ON)} - I_D$



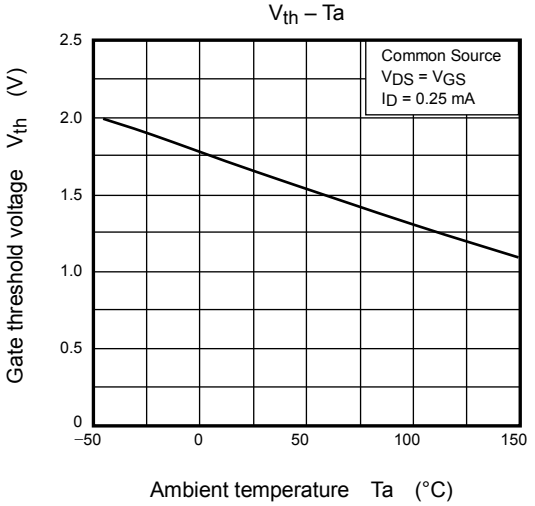
$R_{DS\ (ON)} - V_{GS}$



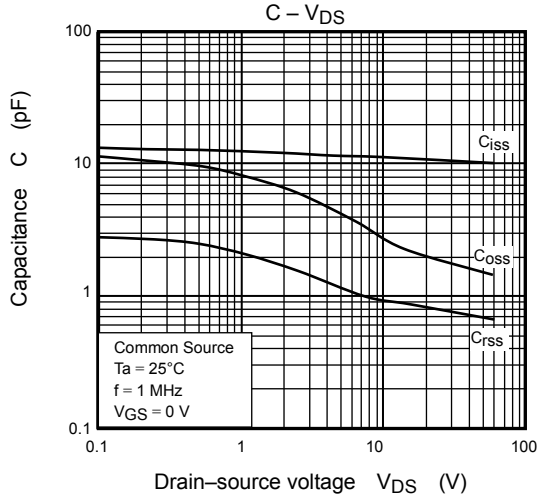
$R_{DS\ (ON)} - Ta$



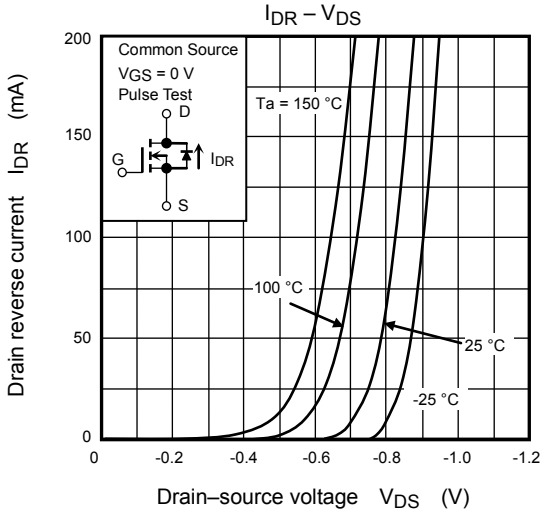
$V_{th} - Ta$



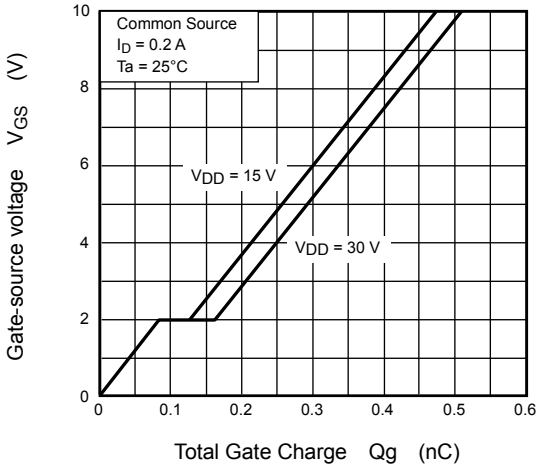
C – V_{DS}



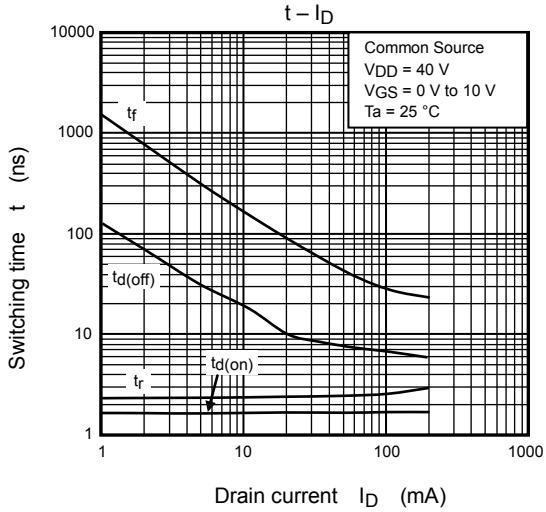
I_{DR} – V_{DS}



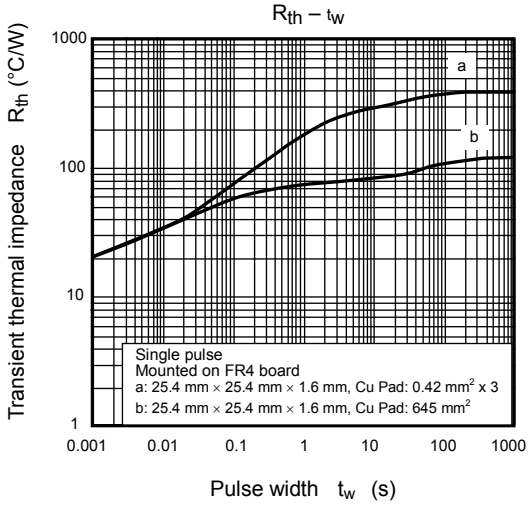
Dynamic Input Characteristic



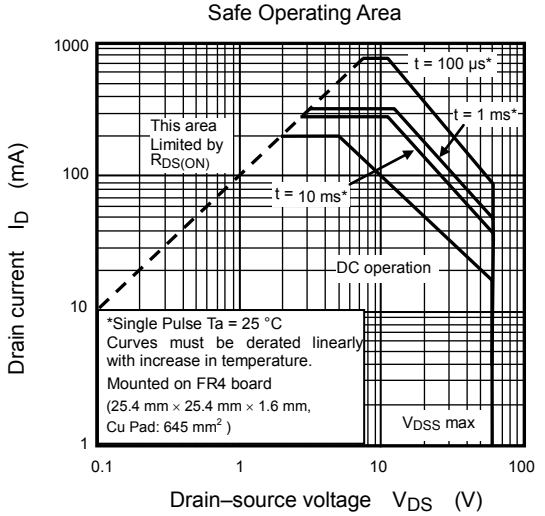
t – I_D



R_{th} – t_w



Safe Operating Area

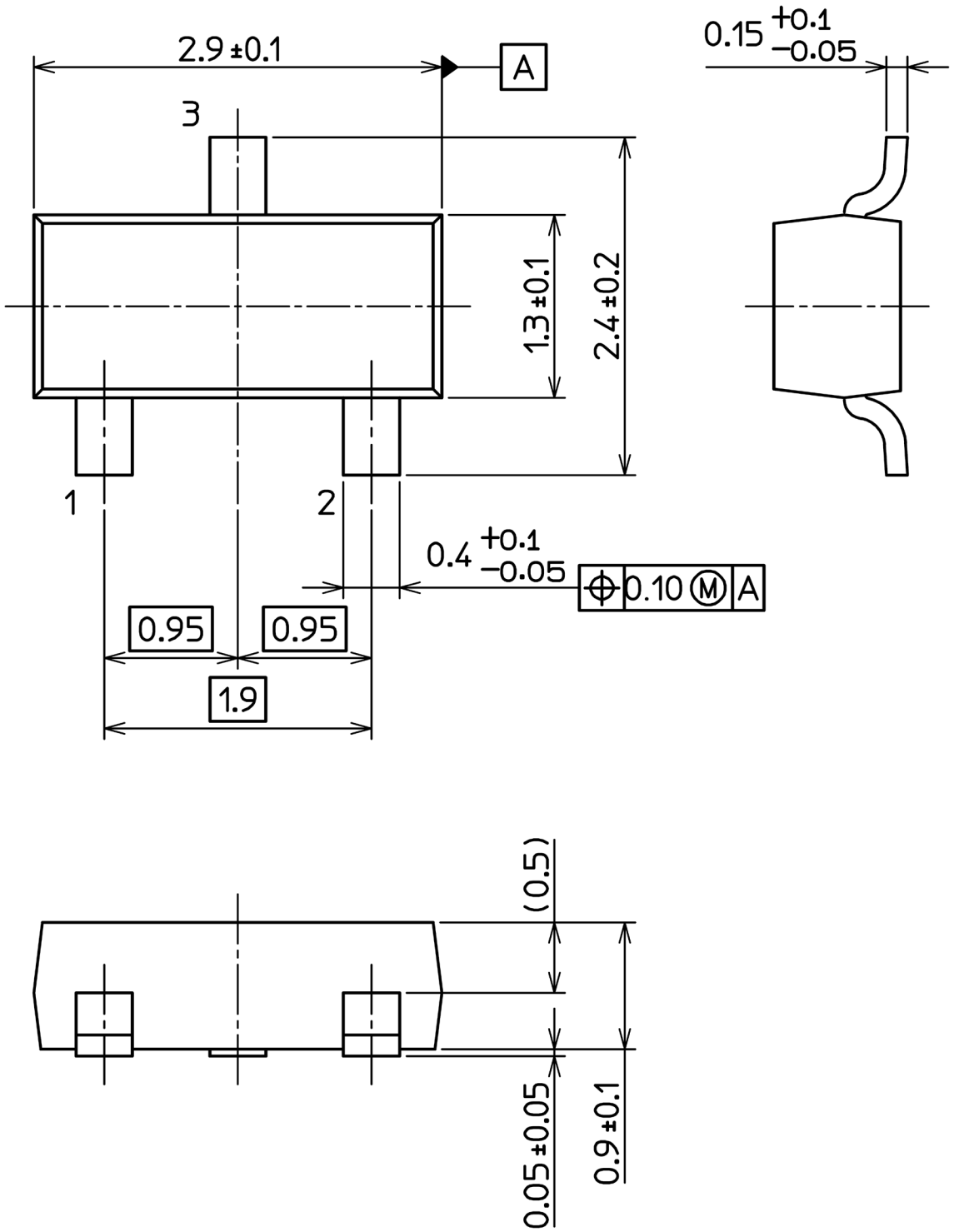


Note: The above characteristics curves are presented for reference only and not guaranteed by production test.

Package Dimensions

Unit: mm

SOT23



Weight: 0.009g (typ.)

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