MOSFETs Silicon N-Channel MOS

SSM6K389NU

1. Applications

- Power Management Switches

2. Features

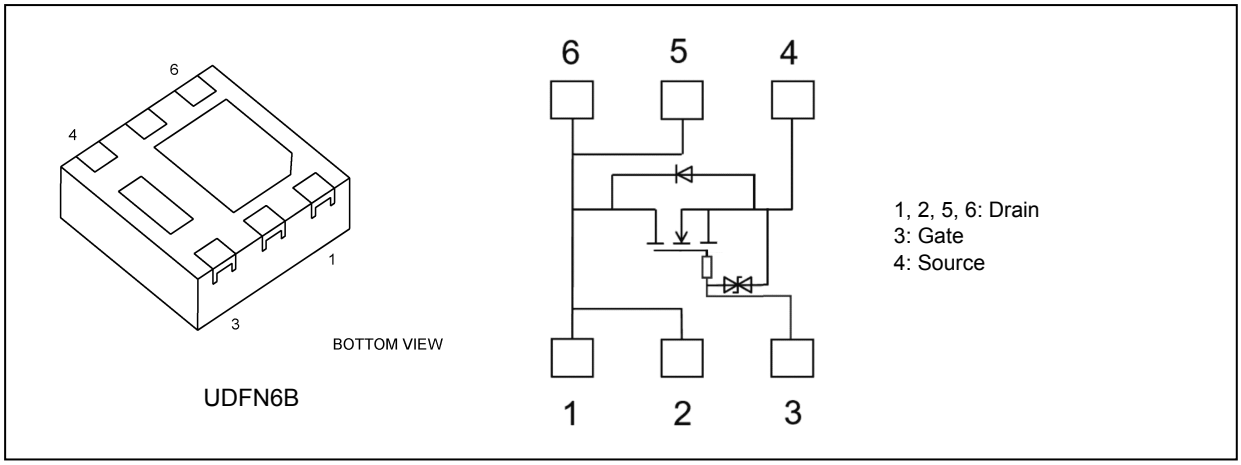
(1) Low drain-source on-resistance

: $R_{DS(ON)}$ = 200 mΩ(max.) ($@V_{GS}$ = 4.5 V)

: $R_{DS(ON)}$ = 180 mΩ(max.) ($@V_{GS}$ = 6.0 V)

: $R_{DS(ON)}$ = 171 mΩ(max.) ($@V_{GS}$ = 10.0 V)

3. Packaging and Internal Circuit



4. Orderable part number

Orderable part number	AEC-Q101	Note
SSM6K389NU,LF	—	General Use

Start of commercial production

2025-09

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5. Absolute Maximum Ratings (Note) (Unless otherwise specified, T_a = 25 °C)

Characteristics			Symbol	Rating	Unit
Drain-source voltage			V_{DSS}	60	V
Gate-source voltage			V_{GSS}	±20	
Drain current (DC)		(Note 1)	I_D	2.0	A
Drain current (pulsed)		(Note 1), (Note 2)	I_{DP}	4.0	
Power dissipation		(Note 3)	P_D	1.25	W
Power dissipation	(t ≤ 10 sec)	(Note 3)		3.0	
Channel temperature			T_{ch}	150	°C
Storage temperature			T_{stg}	-55 to 150	

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: Ensure that the channel temperature does not exceed 150 °C.

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

Note 3: Device mounted on a 25.4 mm × 25.4 mm × 1.6 mm FR4 glass epoxy board (Cu pad: 645 mm^2)

6. Thermal Characteristics

Characteristics		Symbol	Rating	Unit
Channel-to-ambient thermal resistance	(Note 1)	$R_{th(ch-a)}$	100	°C/W

Note 1: Device mounted on an 25.4 mm × 25.4 mm × 1.6 mm FR4 glass epoxy board (Cu pad: 645 mm^2)

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.

Note: 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.

Note: The channel-to-ambient thermal resistance, $R_{th(ch-a)}$, and the drain power dissipation, P_D, vary according to the board material, board area, board thickness and pad area. When using this device, be sure to take heat dissipation fully into account.

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7. Electrical Characteristics

7.1. Static Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{DS} = 0 V, V_{GS} = ±16 V	—	—	±10	μA
Drain cut-off current		I_{DSS}	V_{DS} = 60 V, V_{GS} = 0 V	—	—	1	μA
Drain-source breakdown voltage		$V_{(BR)DSS}$	I_D = 250 μA, V_{GS} = 0 V	60	—	—	V
Gate threshold voltage	(Note 1)	V_{th}	V_{DS} = 10V, I_D = 1mA	1.1	—	2.1	
Drain-source on-resistance	(Note 2)	$R_{DS(ON)}$	I_D = 1.0 A, V_{GS} = 10 V	—	141	171	mΩ
			I_D = 1.0 A, V_{GS} = 6.0 V	—	148	180	mΩ
			I_D = 1.0 A, V_{GS} = 4.5 V	—	158	200	mΩ

Note 1: Let V_{th} be the voltage applied between gate and source that causes the drain current (I_D) to below (1 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: $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$.
Take this into consideration when using the device.

Note 2: Pulse measurement.

7.2. Dynamic Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	156	—	pF
Reverse transfer capacitance	C_{rss}		—	6.2	—	
Output capacitance	C_{oss}		—	24.5	—	
Switching time (rise time)	t_r	V_{DD} = 30 V, I_D = 200 mA, V_{GS} = 0 to 10 V, R_G = 50 Ω Duty ≤ 1%, V_{IN}: t_r, t_f < 5 ns, Common source	—	25	—	ns
Switching time (turn-on delay time)	$t_{d(on)}$		—	26	—	
Switching time (fall time)	t_f		—	85	—	
Switching time (turn-off delay time)	$t_{d(off)}$		—	264	—	

7.3. Switching Time Test Circuit

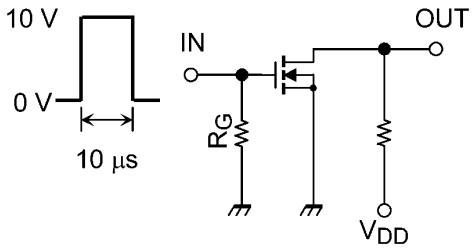

Fig. 7.3.1 Switching Time Test Circuit

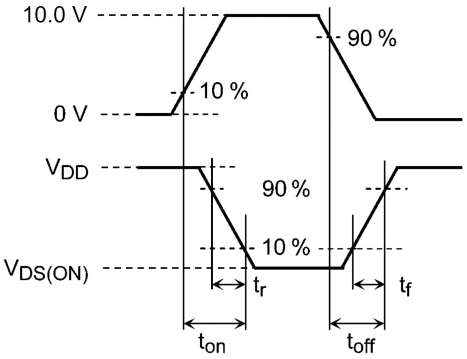

Fig. 7.3.2 Input Waveform/Output Waveform

7.4. Gate Charge Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Q_g	V_{DD} = 30 V, I_D = 0.2 A, V_{GS} = 4.5 V	—	1.84	—	nC
Gate-source charge	Q_{gs}		—	0.80	—	
Gate-drain charge	Q_{gd}		—	0.83	—	

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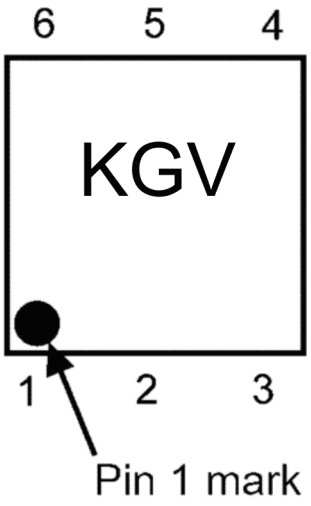
7.5. Source-Drain Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Diode forward voltage (Note 1)	V_{DSF}	I_{DR} = 2.0 A, V_{GS} = 0 V	—	0.8	1.2	V

Note 1: Pulse measurement.

8. Marking



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9. Characteristics Curves (Note)

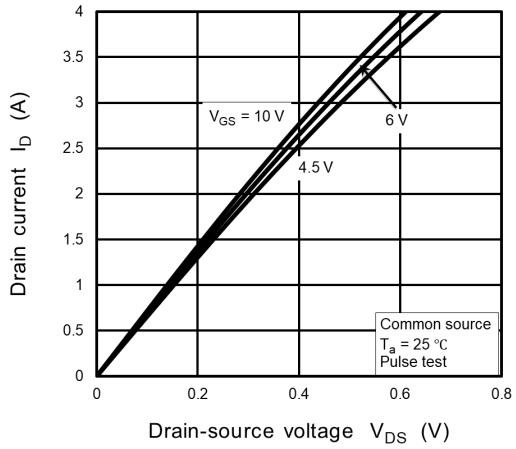

Fig. 9.1 I_D - V_{DS}

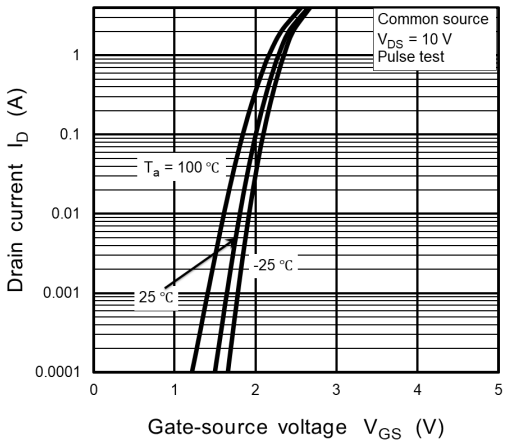

Fig. 9.2 I_D - V_{GS}

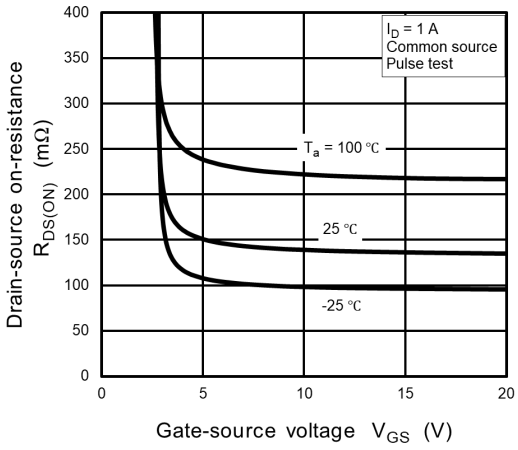

Fig. 9.3 $R_{DS(ON)}$ - V_{GS}

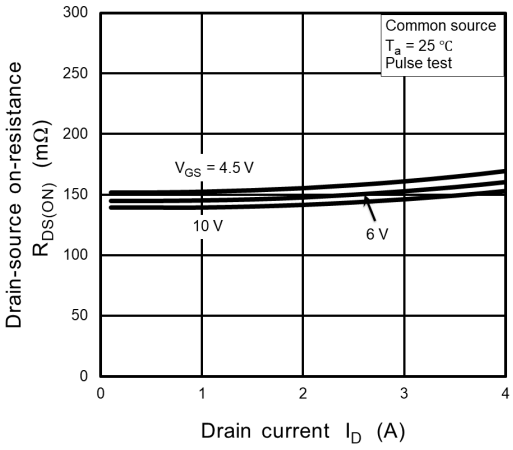

Fig. 9.4 $R_{DS(ON)}$ - I_D

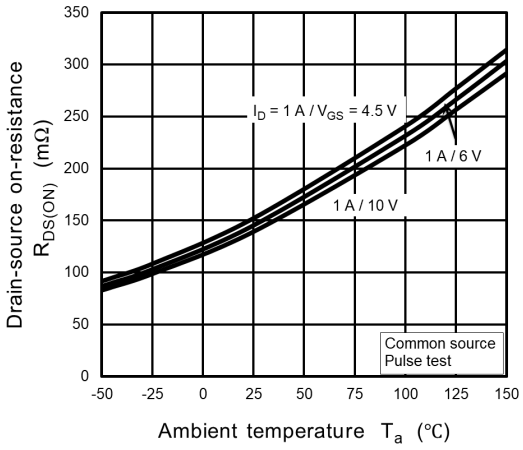

Fig. 9.5 $R_{DS(ON)}$ - T_a

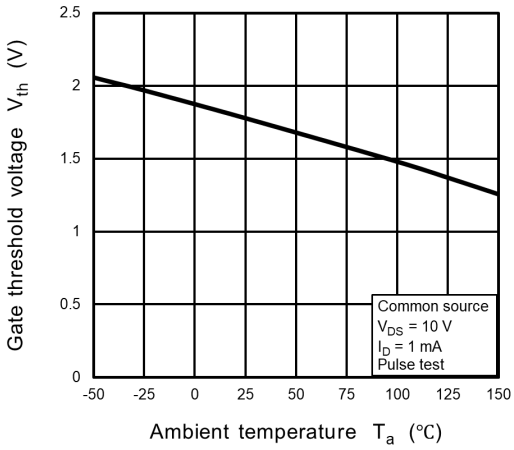

Fig. 9.6 V_{th} - T_a

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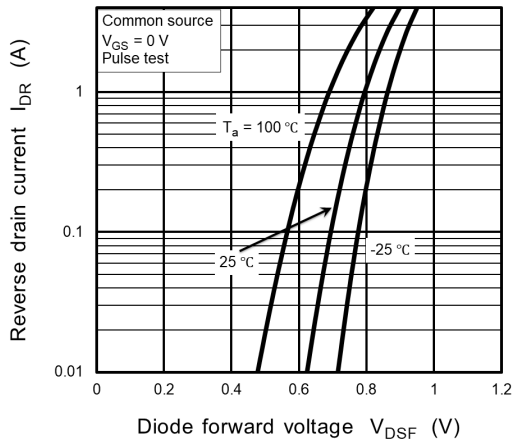

Fig. 9.7 I_{DR} - V_{DSF}

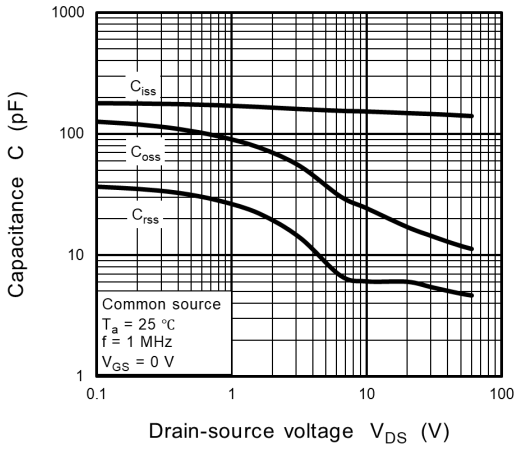

Fig. 9.8 C - V_{DS}

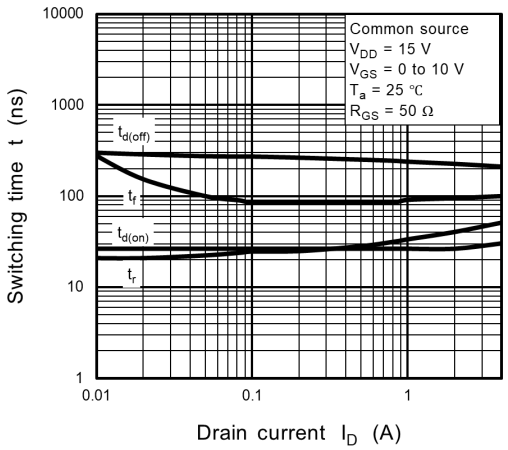

Fig. 9.9 t - I_D

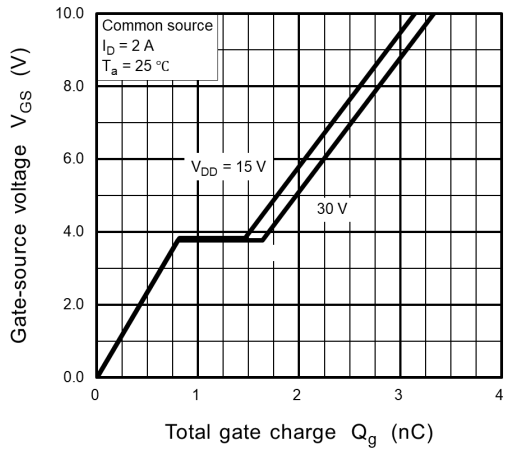

Fig. 9.10 Dynamic Input Characteristics

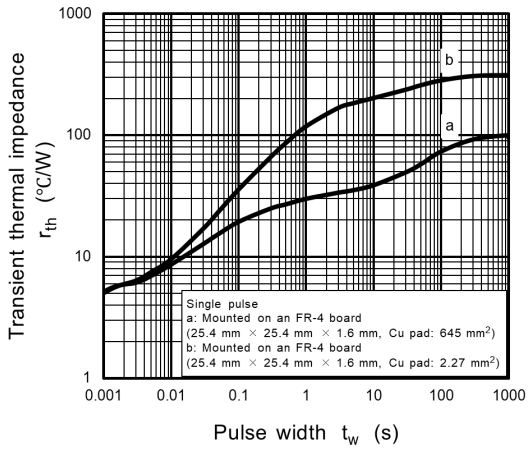

Fig. 9.11 r_{th} - t_w

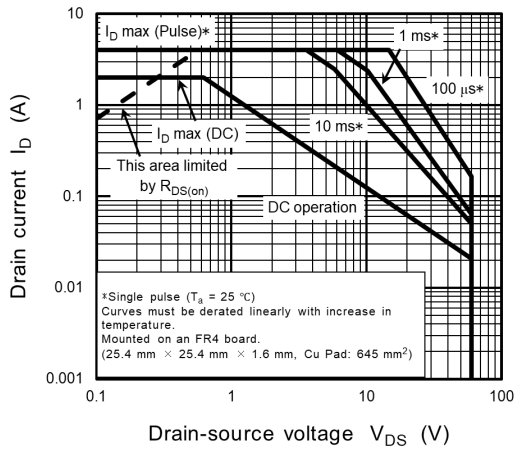

Fig. 9.12 Safe Operating Area

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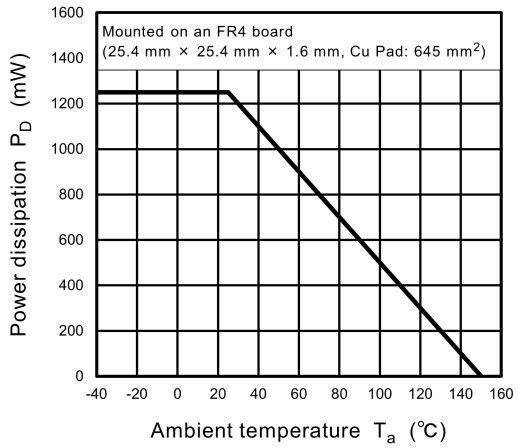
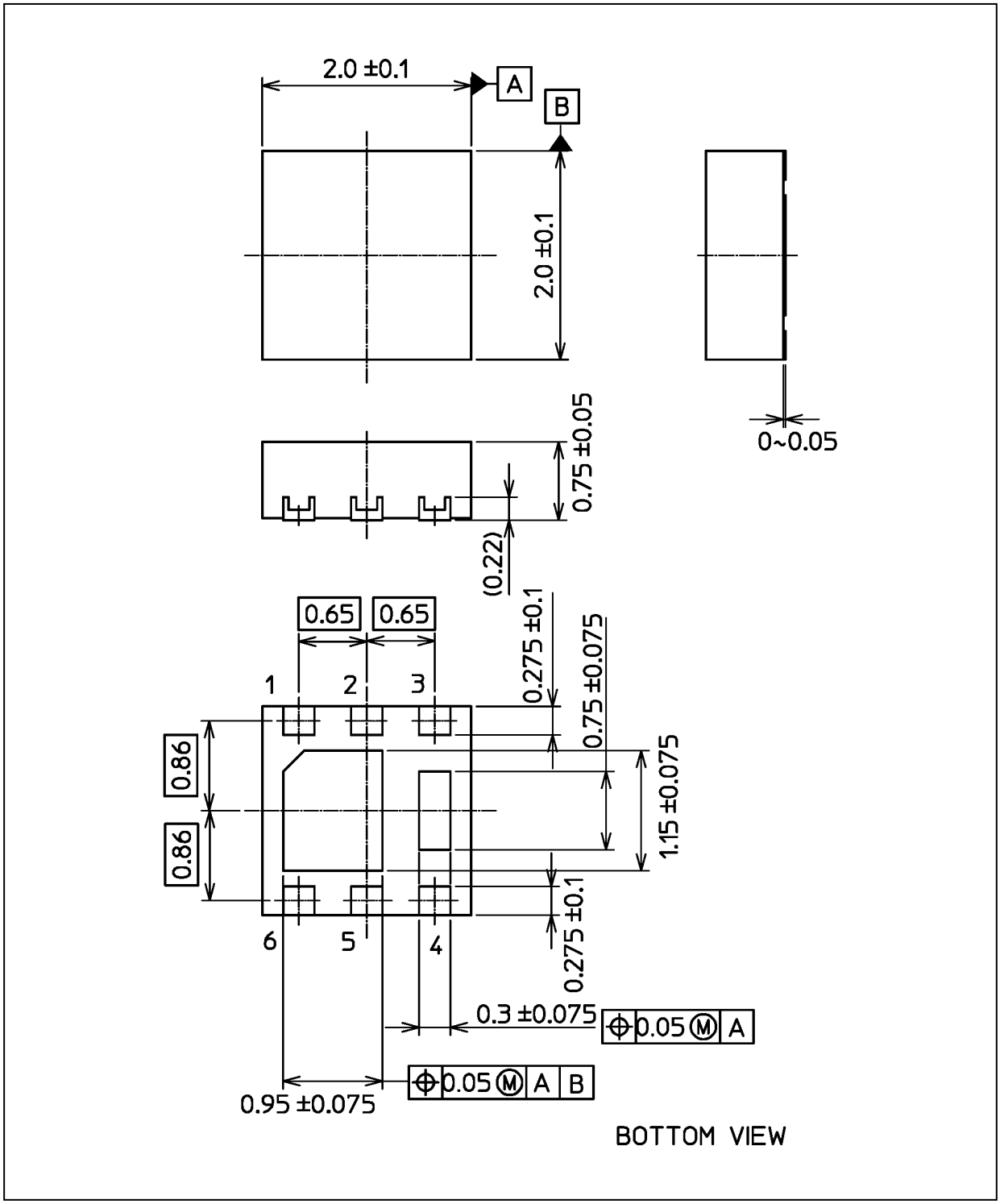


Fig. 9.13 P_D - T_a

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

Package Dimensions

Unit: mm



Weight: 8.5 mg (typ.)

Package Name(s)
Nickname: UDFN6B

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