Composite Devices Silicon N-Channel MOS/Epitaxial Schottky Barrier

SSM6H19NU

1. Applications

- DC-DC Converters

2. Features

(1) N-channel MOSFET and a schottky barrier diode in one package.

2.1. MOSFET Features

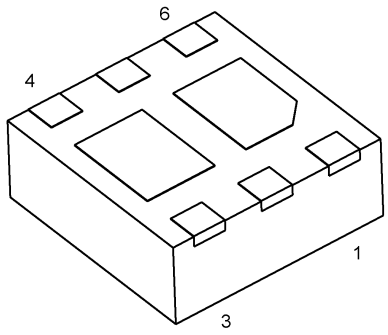
(1) Low drain-source on-resistance
: $R_{DS(ON)}$ = 160 mΩ (typ.) (@V_{GS} = 3.6 V)

(2) 1.8-V gate drive voltage.

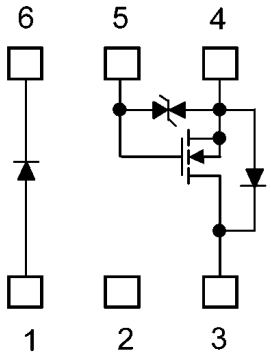
2.2. Diode Features

(1) Low forward voltage: V_F = 0.51 V (typ.) (@I_F = 500 mA)

3. Packaging and Internal Circuit



UDFN6



1.Anode
2.N.C.
3.Drain
4.Source
5.Gate
6.Cathode

4. Absolute Maximum Ratings (Note)

4.1. Absolute Maximum Ratings of the MOSFET (Unless otherwise specified, T_a = 25 °C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	40	V
Gate-source voltage		V_{GSS}	±12	
Drain current	(Note 1)	I_D	2.0	A
Drain current (pulsed)	(Note 1)	I_{DP}	4.0	
Channel temperature		T_{ch}	150	°C

Note 1: Ensure that the channel temperature does not exceed 150 °C.

Start of commercial production
2013-12

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4.2. Absolute Maximum Ratings of the Diode (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Rating	Unit
Reverse voltage	V_R	40	V
Average rectified current	I_O	500	mA
Non-repetitive peak forward surge current (t = 10 ms)	I_{FSM}	5	A
Junction temperature	T_j	125	°C

4.3. Absolute Maximum Ratings of the Common Section (Unless otherwise specified, T_a = 25 °C)

Characteristics			Symbol	Rating	Unit
Power dissipation		(Note 1)	P_D	1	W
Power dissipation	(t = 10 s)	(Note 1)		2	
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: P_D for the entire IC
Device mounted on a 25.4 mm × 25.4 mm × 1.6 mm FR-4 glass epoxy board (Cu pad: 645 mm^2)

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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5. Electrical Characteristics

5.1. Static Characteristics of the MOSFET (Unless otherwise specified, T_a = 25 °C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±10 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut-off current		I_{DSS}	V_{DS} = 40 V, V_{GS} = 0 V	—	—	1	
Drain-source breakdown voltage		$V_{(BR)DSS}$	I_D = 1 mA, V_{GS} = 0 V	40	—	—	V
Drain-source breakdown voltage	(Note 1)	$V_{(BR)DSX}$	I_D = 1 mA, V_{GS} = -12 V	25	—	—	
Gate threshold voltage	(Note 2)	V_{th}	V_{DS} = 3 V, I_D = 1 mA	0.5	—	1.2	
Drain-source on-resistance	(Note 3)	$R_{DS(ON)}$	I_D = 1.0 A, V_{GS} = 8.0 V	—	145	185	mΩ
			I_D = 1.0 A, V_{GS} = 4.5 V	—	155	198	
			I_D = 1.0 A, V_{GS} = 4.2 V	—	156	201	
			I_D = 1.0 A, V_{GS} = 3.6 V	—	160	208	
			I_D = 0.5 A, V_{GS} = 2.5 V	—	180	238	
			I_D = 0.2 A, V_{GS} = 1.8 V	—	220	390	
Forward transfer admittance	(Note 3)	$\|Y_{fs}\|$	V_{DS} = 3 V, I_D = 200 mA	—	2	—	S

Note 1: If a reverse bias is applied between gate and source, this device enters $V_{(BR)DSX}$ mode. Note that the drain-source breakdown voltage is lowered in this mode.

Note 2: 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 3: Pulse measurement.

5.2. Dynamic Characteristics of the MOSFET (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	—	130	—	pF
Reverse transfer capacitance	C_{rss}		—	7.5	—	
Output capacitance	C_{oss}		—	26	—	
Switching time (turn-on time)	t_{on}	V_{DD} = 10 V, I_D = 0.5 A, V_{GS} = 0 V to 2.5 V, R_G = 4.7 Ω, See Figure 5.2.1, 5.2.2.	—	13	—	ns
Switching time (turn-off time)	t_{off}		—	8	—	

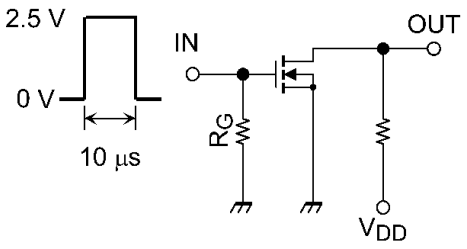


Fig. 5.2.1 Test Circuit of Switching Time

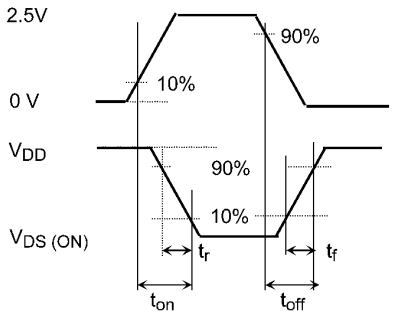


Fig. 5.2.2 Input Waveform/Output Waveform

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5.3. Gate Charge Characteristics of the MOSFET (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} = 10 V, I_D = 1.8 A V_{GS} = 4.2 V	—	1.1	2.2	nC
		V_{DD} = 10 V, I_D = 1.8 A V_{GS} = 3.6 V	—	1.0	2.0	
		V_{DD} = 10 V, I_D = 1.8 A V_{GS} = 2.5 V	—	0.75	1.5	

5.4. Source-Drain Characteristics of the MOSFET (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Diode forward voltage (Note 1)	V_{DSF}	I_D = -2.0 A, V_{GS} = 0 V	—	-0.85	-1.2	V

Note 1: Pulse measurement.

5.5. Characteristics of the Diode (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward voltage	$V_{F(1)}$	I_F = 100 mA	—	0.31	0.35	V
	$V_{F(2)}$	I_F = 500 mA	—	0.51	0.57	
Reverse current	I_R	V_R = 40 V	—	—	50	μA
Total capacitance	C_t	V_R = 0 V, f = 1 MHz	—	42	—	pF

6. Marking

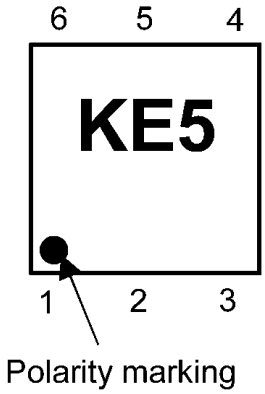


Fig. 6.1 Marking

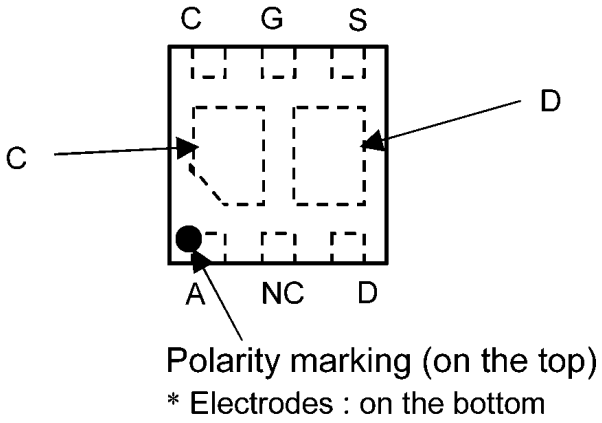


Fig. 6.2 Pin Condition(Top View)

7. Characteristics Curves (Note)

7.1. Characteristics Curves of the MOSFET

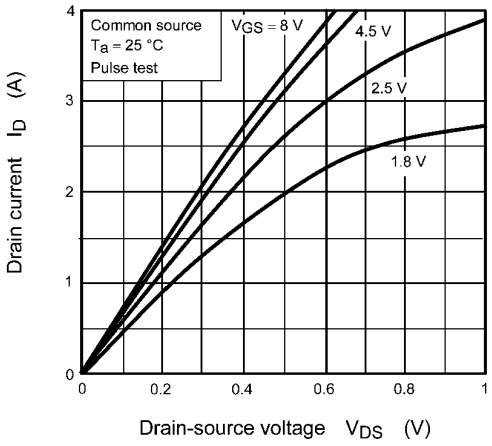


Fig. 7.1.1 I_D - V_{DS}

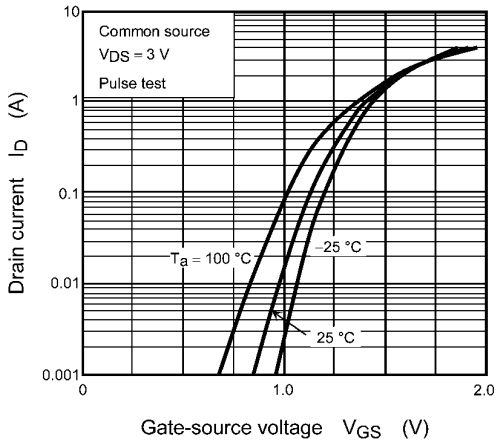


Fig. 7.1.2 I_D - V_{GS}

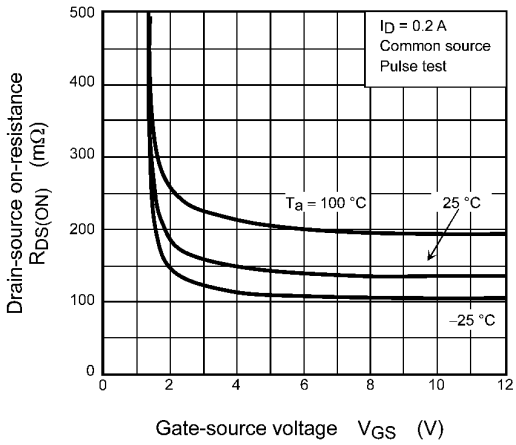


Fig. 7.1.3 $R_{DS(ON)}$ - V_{GS}

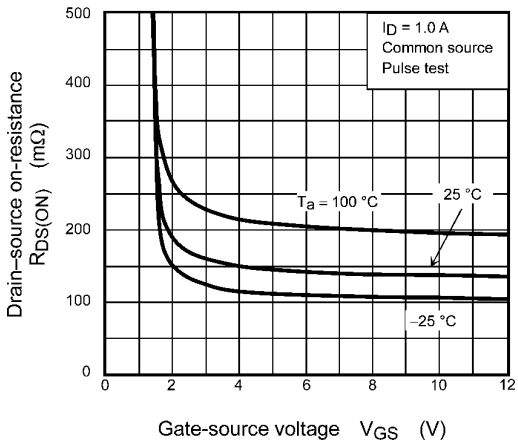


Fig. 7.1.4 $R_{DS(ON)}$ - V_{GS}

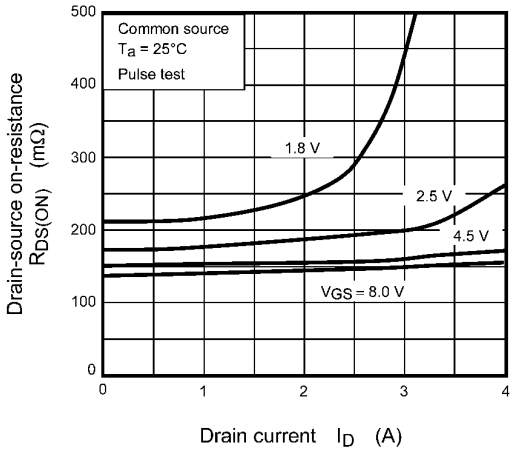


Fig. 7.1.5 $R_{DS(ON)}$ - I_D

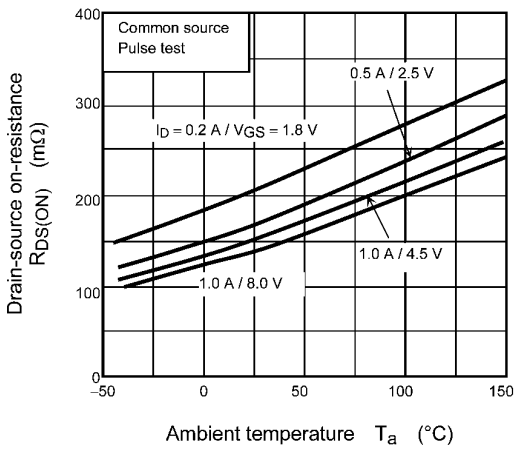


Fig. 7.1.6 $R_{DS(ON)}$ - T_a

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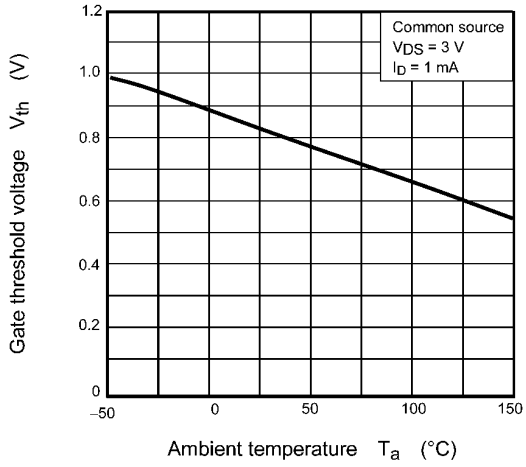


Fig. 7.1.7 V_{th} - T_a

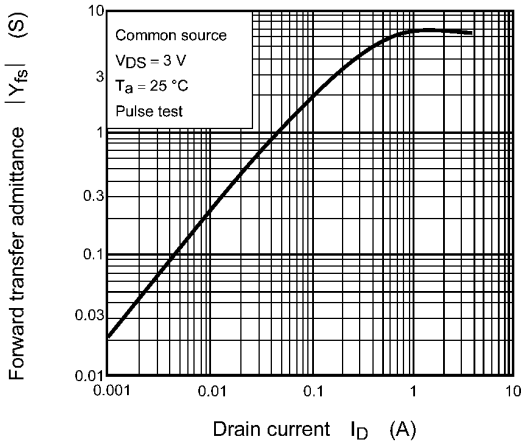


Fig. 7.1.8 $|Y_{fs}|$ - I_D

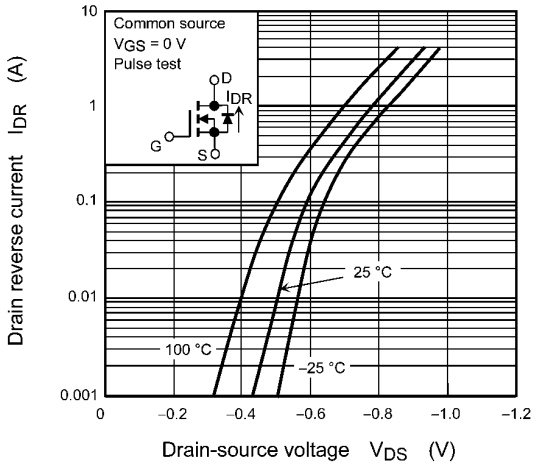


Fig. 7.1.9 I_{DR} - V_{DS}

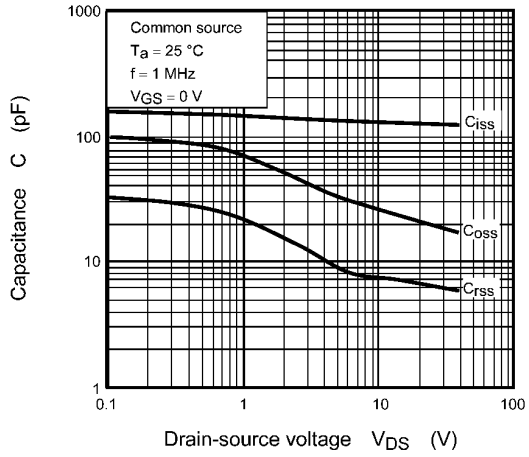


Fig. 7.1.10 C - V_{DS}

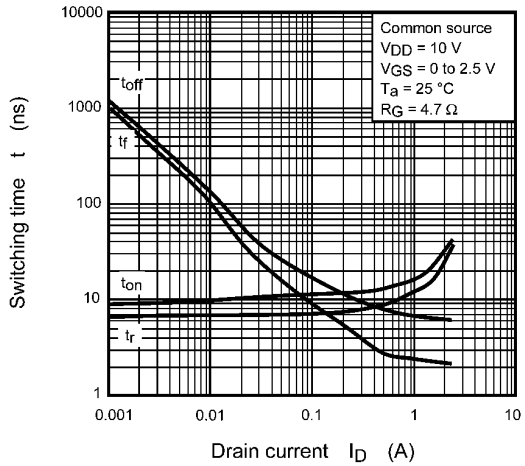


Fig. 7.1.11 t - I_D

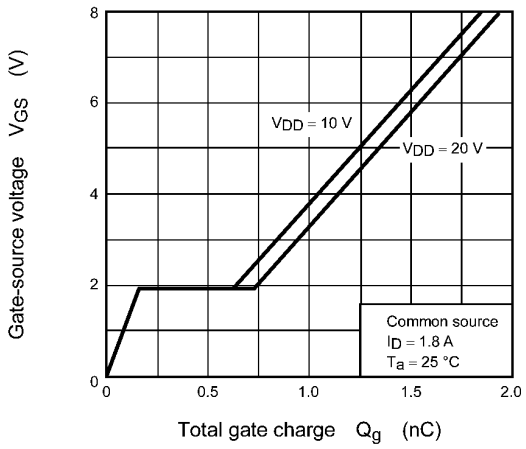


Fig. 7.1.12 Dynamic Input Characteristics

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7.2. Characteristics Curves of the Diode

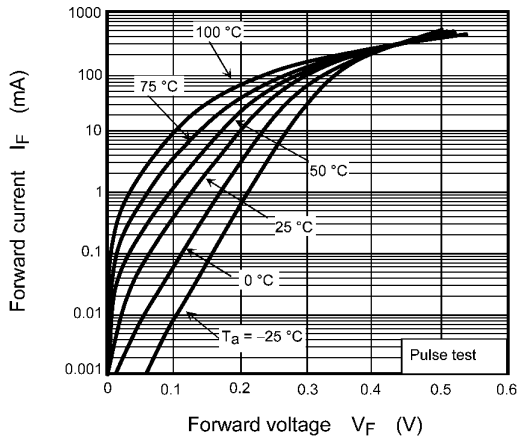


Fig. 7.2.1 I_F - V_F

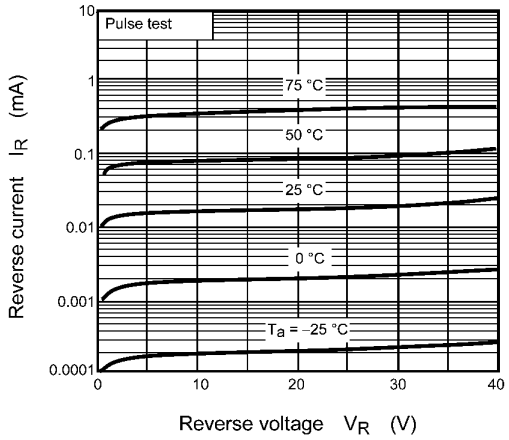


Fig. 7.2.2 I_R - V_R

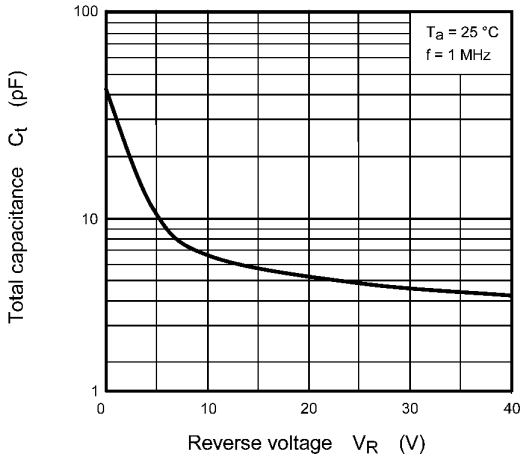


Fig. 7.2.3 C_t - V_R

7.3. Characteristics Curves of the MOSFET · Diodes Common

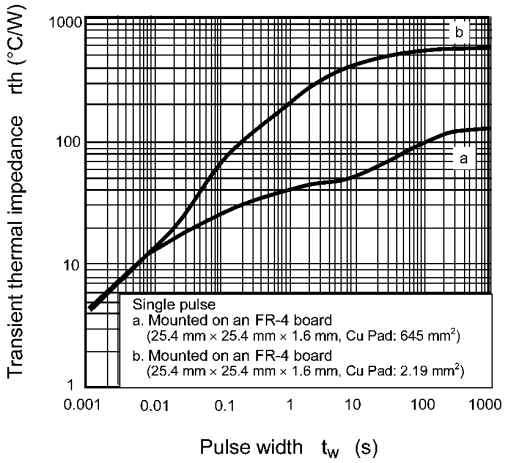


Fig. 7.3.1 r_{th} - t_w

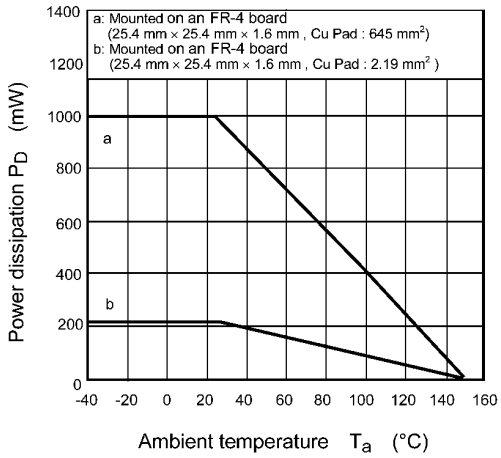


Fig. 7.3.2 P_D - T_a

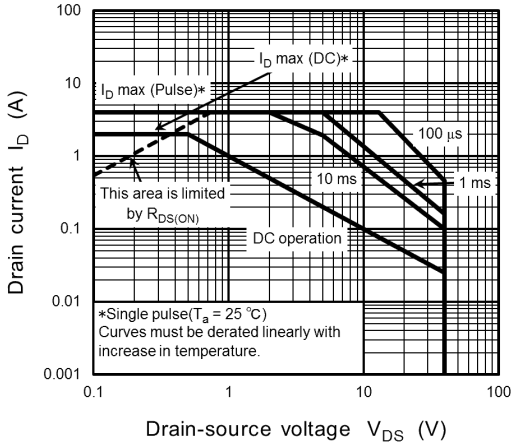
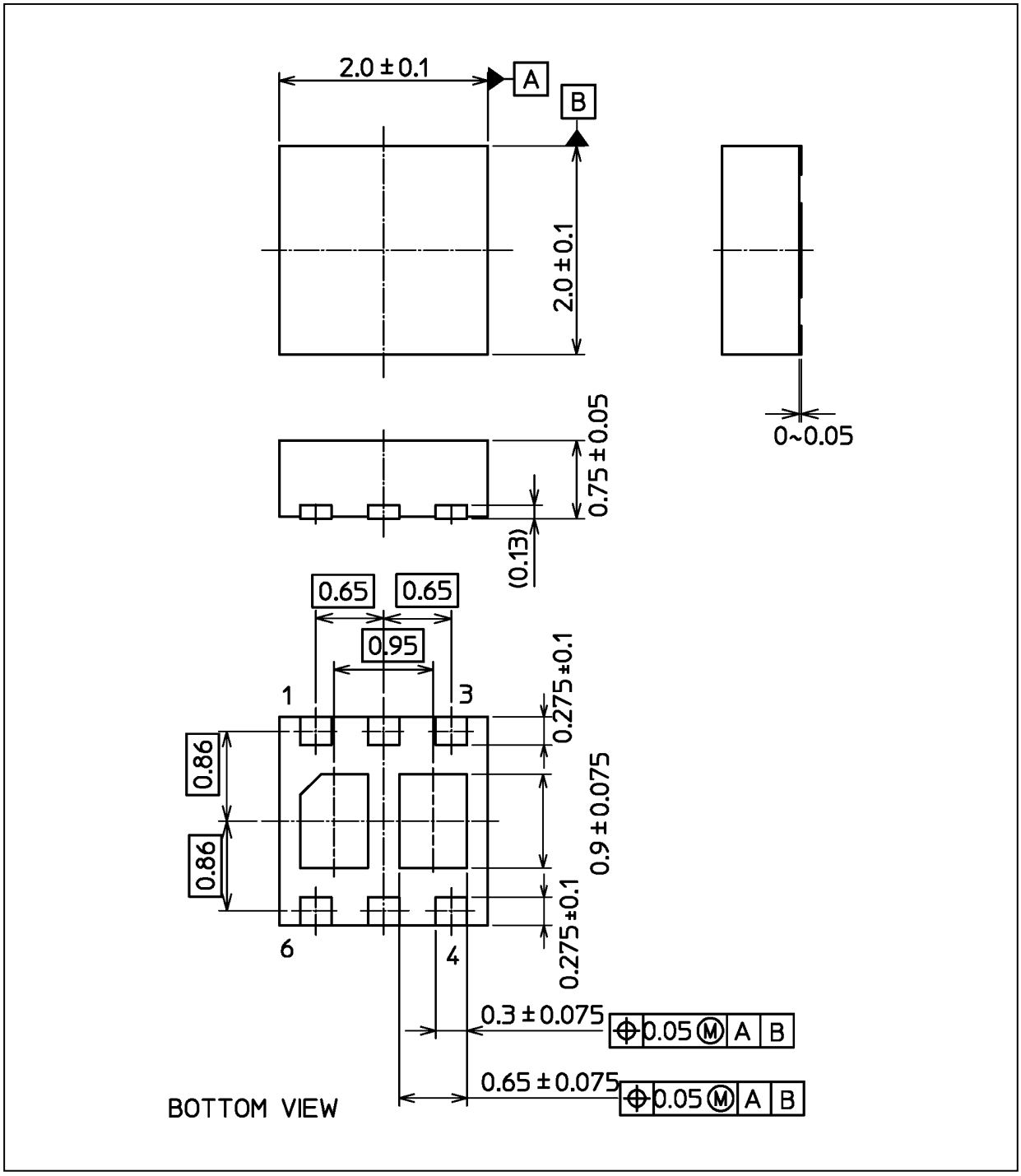


Fig. 7.3.3 Safe Operating Area

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: UDFN6

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