

TOSHIBA Multi-Chip Device Silicon N Channel MOS Type (U-MOS III) / Schottky Barrier Diode

# TPCF8A01

Notebook PC Applications

Portable Equipment Applications

Unit: mm

- Low drain-source ON resistance:  $R_{DS(ON)} = 38 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 5.4 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 20 \text{ V}$ )
- Enhancement mode:  $V_{th} = 0.5 \text{ to } 1.2 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 200 \text{ }\mu\text{A}$ )
- Low forward voltage:  $V_{FM(2)} = 0.46\text{V}$ (typ.)

## Absolute Maximum Ratings

### MOSFET ( $T_a = 25^\circ\text{C}$ )

Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	20	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	20	V
Gate-source voltage		$V_{GSS}$	$\pm 12$	V
Drain current	DC (Note 1)	$I_D$	3	A
	Pulse (Note 1)	$I_{DP}$	12	
Single pulse avalanche energy (Note 4)		$E_{AS}$	1.46	mJ
Avalanche current		$I_{AR}$	1.5	A
Repetitive avalanche energy Single-device value at dual operation (Note 2a, 3b, 5)		$E_{AR}$	0.11	mJ

### SBD ( $T_a = 25^\circ\text{C}$ )

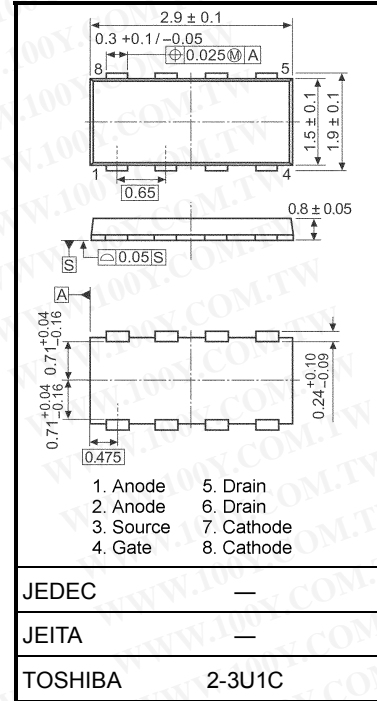
Characteristics	Symbol	Rating	Unit
Repetitive peak reverse voltage	$V_{RRM}$	20	V
Average forward current (Note 2a, 6)	$I_{F(AV)}$	1.0	A
Peak one cycle surge forward current (non-repetitive)	$I_{FSM}$	7(50Hz)	A

### Absolute Maximum Ratings for MOSFET and SBD ( $T_a = 25^\circ\text{C}$ )

Characteristics		Symbol	Rating	Unit
Drain power dissipation ( $t = 5 \text{ s}$ ) (Note 2a)	Single-device operation (Note 3a)	$P_D(1)$	1.35	W
	Single-device value at dual operation (Note 3b)	$P_D(2)$	1.12	
Drain power dissipation ( $t = 5 \text{ s}$ ) (Note 2b)	Single-device operation (Note 3a)	$P_D(1)$	0.53	
	Single-device value at dual operation (Note 3b)	$P_D(2)$	0.33	
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	-55~150	$^\circ\text{C}$

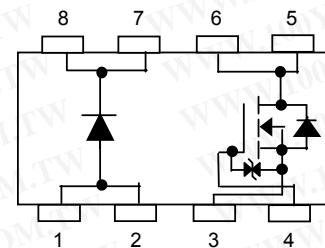
Note: (Note 1), (Note 2), (Note 3), (Note 4), (Note 5), (Note 6) and (Note 7): See the next page.

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).



Weight: 0.011 g (typ.)

### Circuit Configuration



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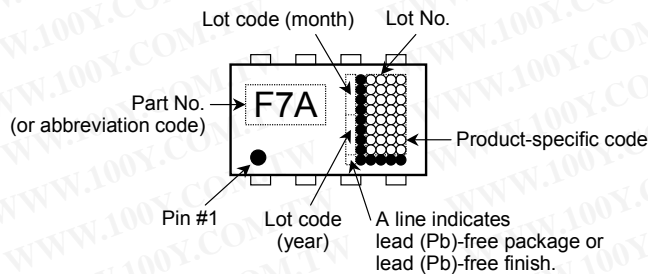
## Thermal Characteristics for MOSFET and SBD

Characteristics		Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 5 s) (Note 2a)	Single-device operation (Note 3a)	$R_{th(ch-a)}(1)$	92.6	°C/W
	Single-device value at dual operation (Note 3b)	$R_{th(ch-a)}(2)$	111.6	
Thermal resistance, channel to ambient (t = 5 s) (Note 2b)	Single-device operation (Note 3a)	$R_{th(ch-a)}(1)$	235.8	°C/W
	Single-device value at dual operation (Note 3b)	$R_{th(ch-a)}(2)$	378.8	

This transistor is an electrostatic-sensitive device. Please handle with caution.

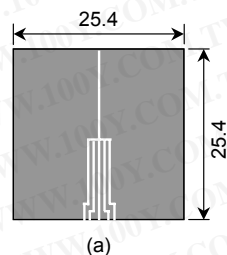
Schottky barrier diodes have large-reverse-current-leakage characteristic compared to other rectifier products. This current leakage and improper operating temperature or voltage may cause thermal runaway. Please take forward and reverse loss into consideration during design.

### Marking (Note 7)

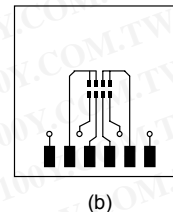


Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)



FR-4  
25.4 × 25.4 × 0.8  
(unit: mm)



FR-4  
25.4 × 25.4 × 0.8  
(unit: mm)

Note 3: a) The power dissipation and thermal resistance values are shown for a single device (During single-device operation, power is only applied to one device.).  
b) The power dissipation and thermal resistance values are shown for a single device (During dual operation, power is evenly applied to both devices.).

Note 4:  $V_{DD} = 16\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 0.5\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 1.5\text{ A}$

Note 5: Repetitive rating: pulse width limited by maximum channel temperature

Note 6: Rectangular waveform ( $\alpha = 180^\circ$ ),  $V_R = 15\text{ V}$ .

Note 7: ● on the lower left of the marking indicates Pin 1.

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## Electrical Characteristics (Ta = 25°C)

### MOSFET

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 10\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-off current		$I_{DSS}$	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	20	—	—	V
		$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -12\text{ V}$	8	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 200\ \mu\text{A}$	0.5	—	1.2	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 2.0\text{ V}, I_D = 1.5\text{ A}$	—	62	100	m $\Omega$
		$R_{DS(ON)}$	$V_{GS} = 2.5\text{ V}, I_D = 1.5\text{ A}$	—	50	66	
		$R_{DS(ON)}$	$V_{GS} = 4.5\text{ V}, I_D = 1.5\text{ A}$	—	38	49	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 1.5\text{ A}$	2.7	5.4	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	590	—	pF
Reverse transfer capacitance		$C_{rss}$		—	70	—	
Output capacitance		$C_{oss}$		—	85	—	
Switching time	Rise time	$t_r$	<p><math>V_{GS} = 5\text{ V}</math> <math>I_D = 1.5\text{ A}</math> <math>V_{DD} \approx 10\text{ V}</math> Duty <math>\leq 1\%</math>, <math>t_w = 10\ \mu\text{s}</math></p>	—	3.0	—	ns
	Turn-on time	$t_{on}$		—	7.5	—	
	Fall time	$t_f$		—	4.4	—	
	Turn-off time	$t_{off}$		—	26	—	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 16\text{ V}, V_{GS} = 5\text{ V}, I_D = 3.0\text{ A}$	—	7.5	—	nC
Gate-source charge 1		$Q_{gs1}$		—	1.3	—	
Gate-drain ("miller") charge		$Q_{gd}$		—	2.1	—	

### MOSFET Source-Drain Ratings and Characteristics

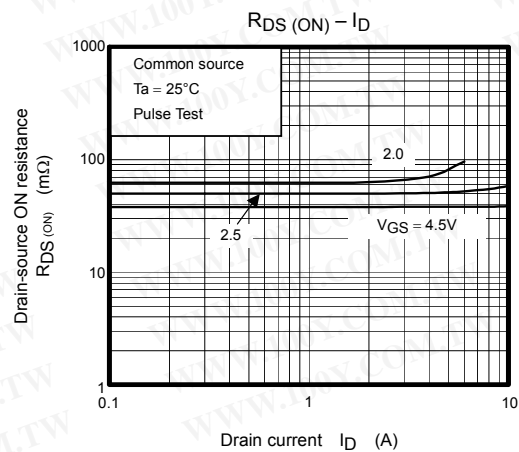
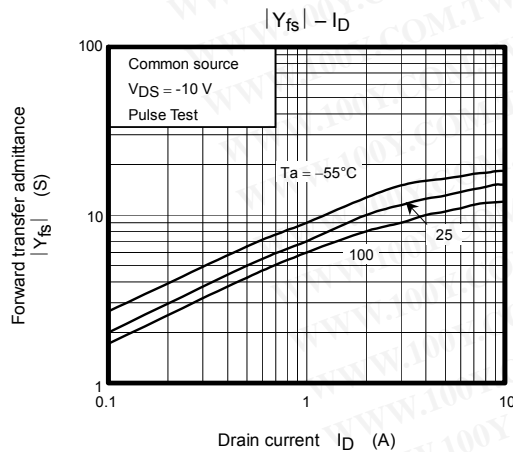
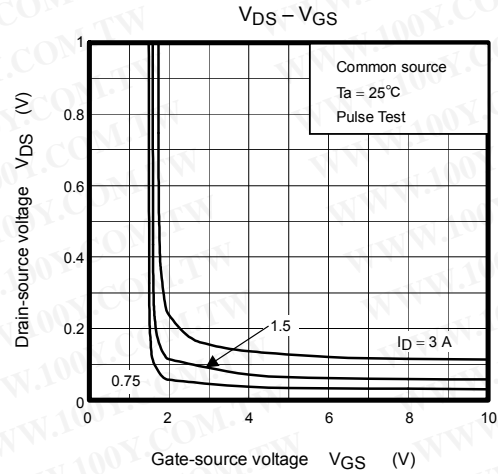
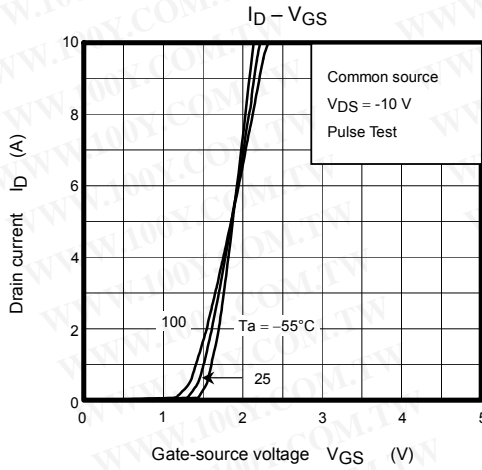
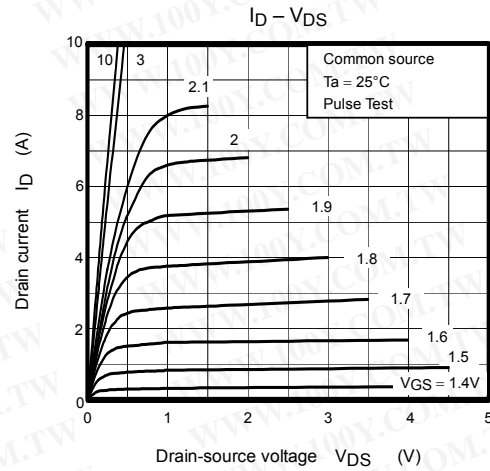
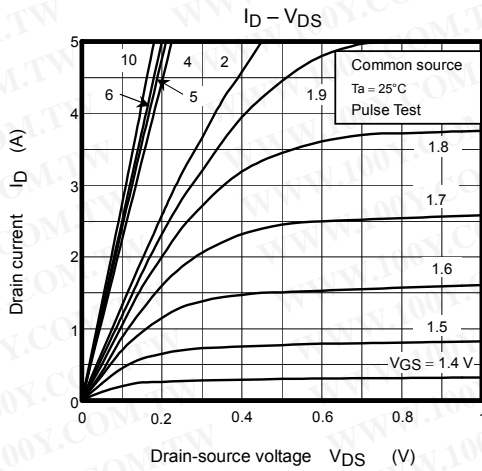
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	$I_{DRP}$	—	—	—	12	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = 3.0\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.2	V

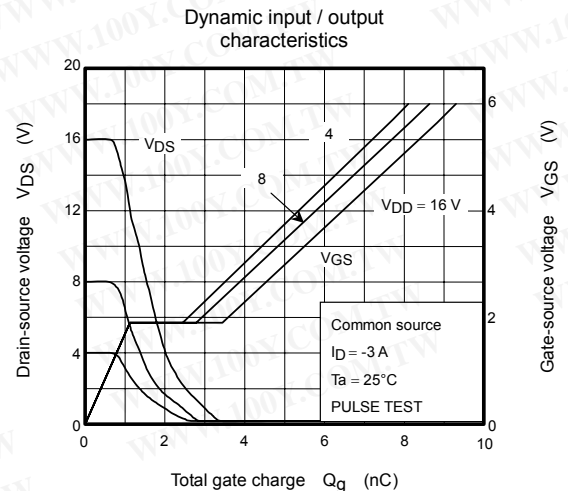
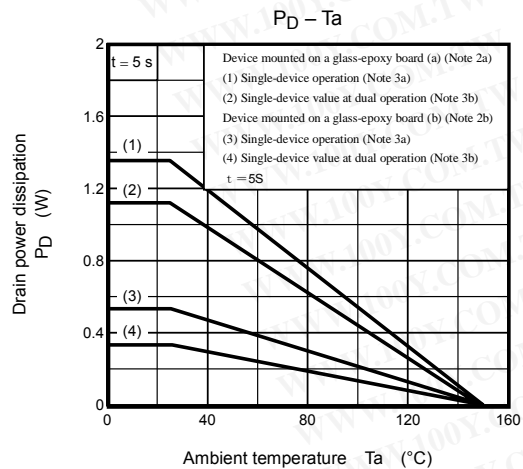
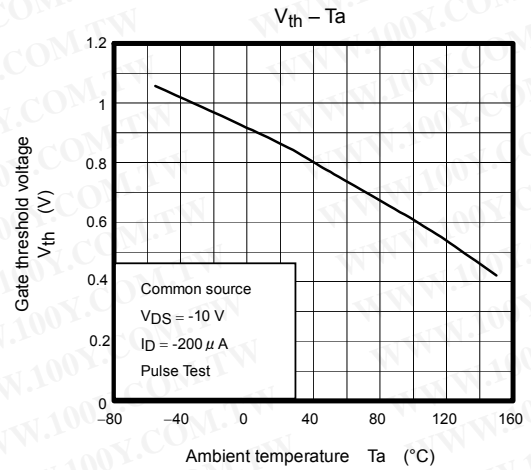
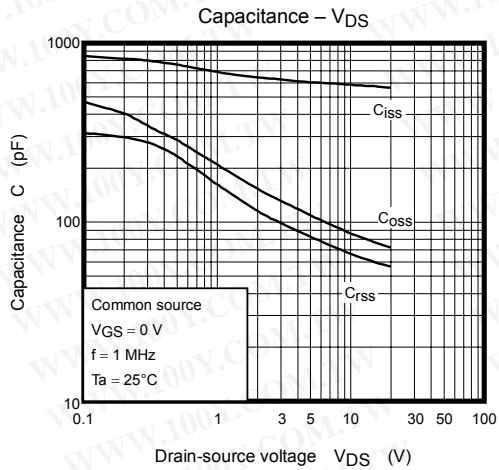
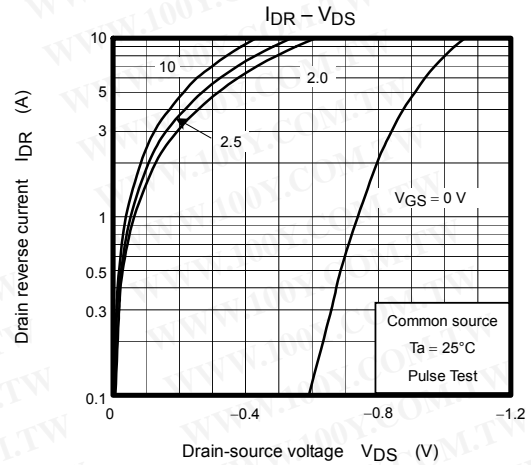
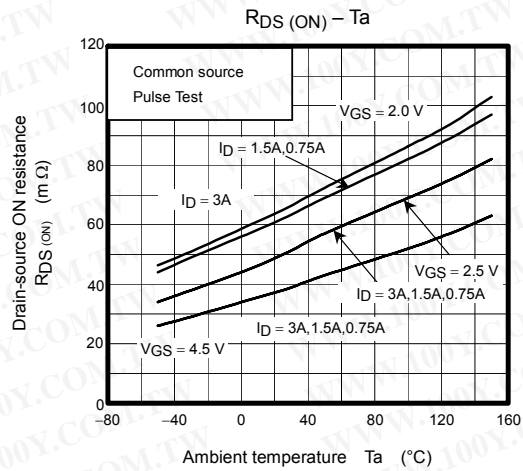
### SBD

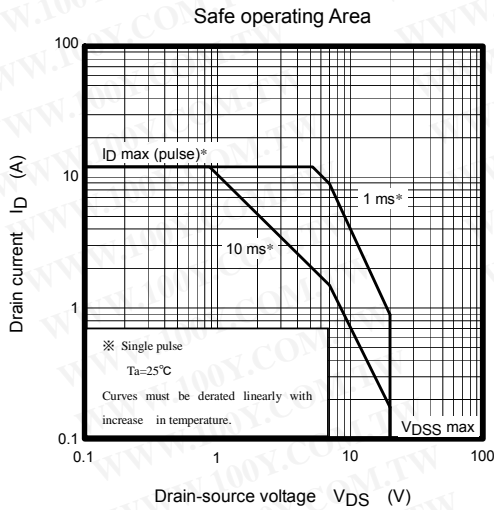
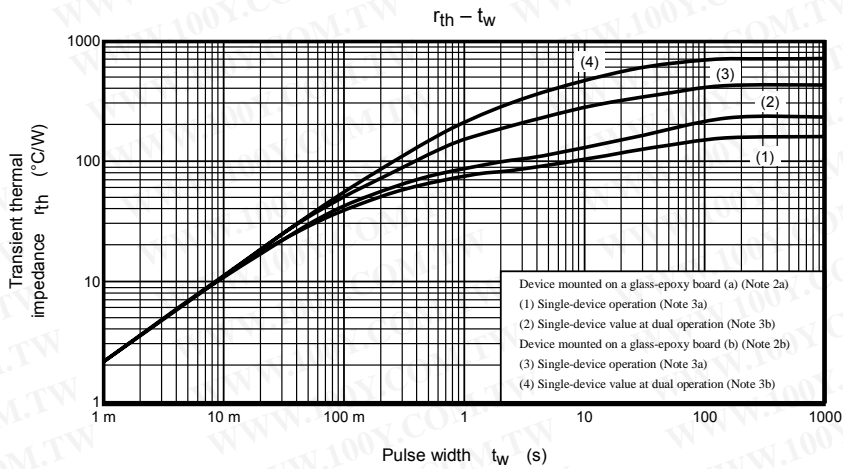
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Peak forward voltage		$V_{FM(1)}$	$I_{FM} = 0.7\text{ A}$	—	0.43	—	V
		$V_{FM(2)}$	$I_{FM} = 1.0\text{ A}$	—	0.46	0.49	V
Repetitive peak reverse current		$I_{RRM}$	$V_{RRM} = 20\text{ V}$	—	—	50	$\square\text{A}$
Junction capacitance		$C_j$	$V_R = 10\text{ V}, f = 1\text{ MHz}$	—	54	—	pF

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## MOSFET

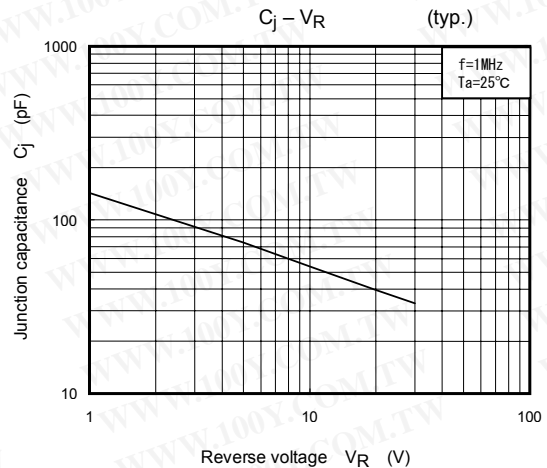
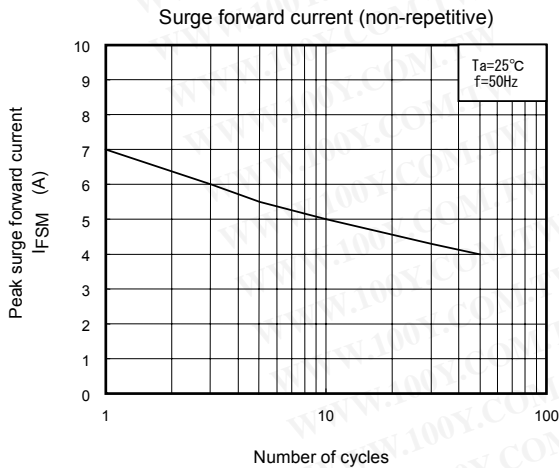
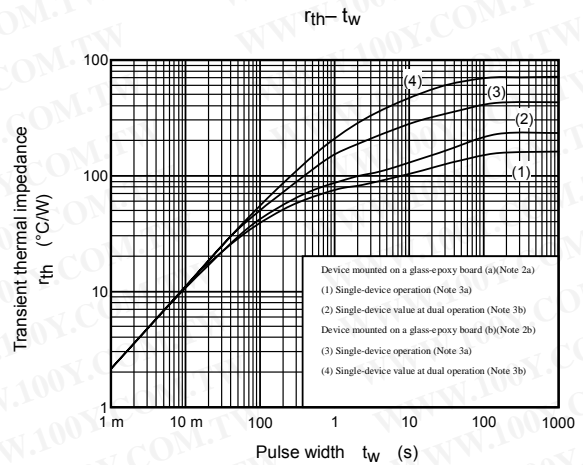
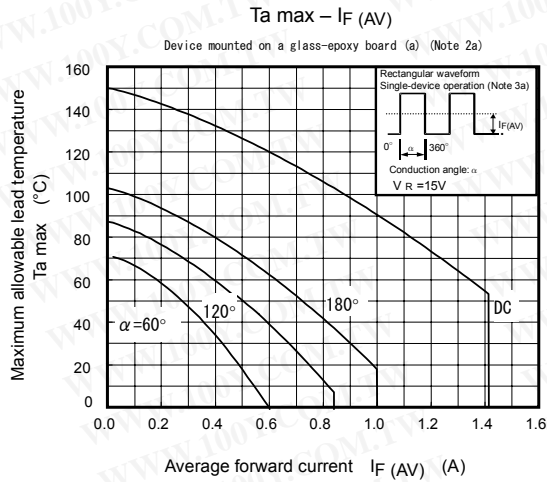
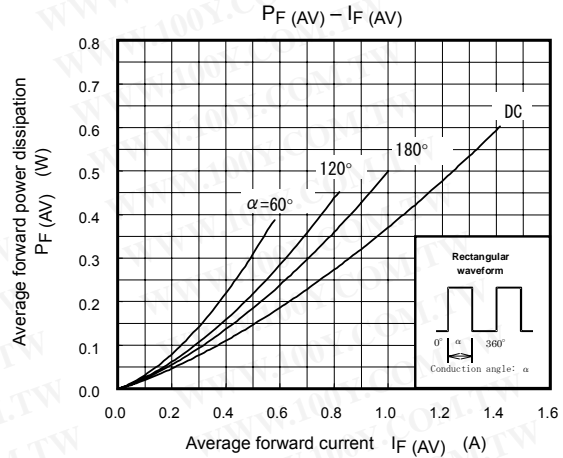
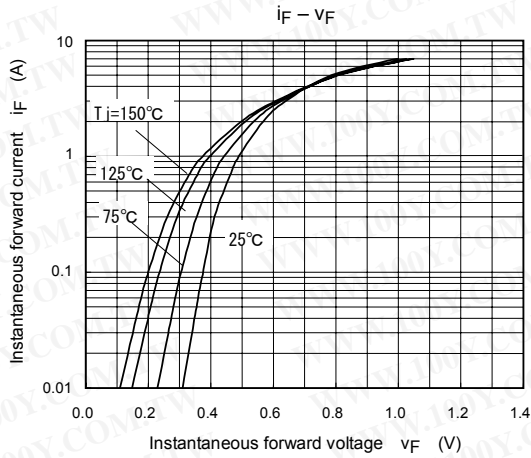




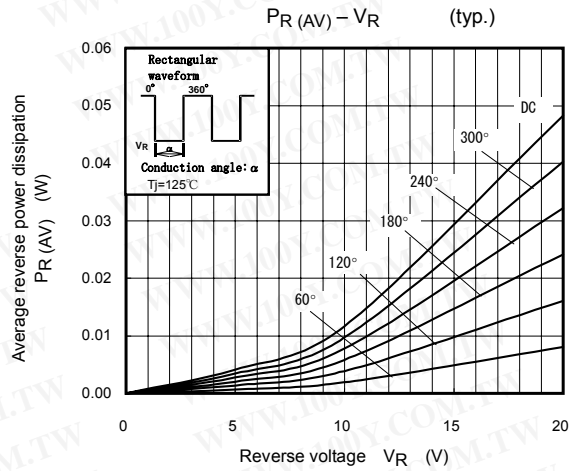
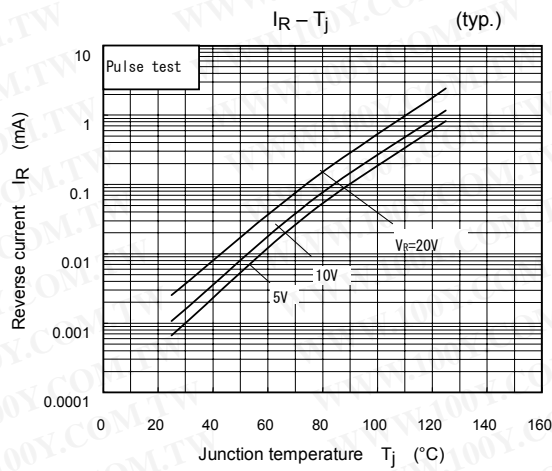


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