

TOSHIBA Field Effect Transistor Silicon P/N Channel MOS Type
(P Channel U-MOSII/N Channel U-MOSII)

TPC8403

Motor Drive Applications

Notebook PC Applications

Portable Equipment Applications

- Low drain-source ON resistance: P Channel $R_{DS(ON)} = 45 \text{ m}\Omega$ (typ.)
N Channel $R_{DS(ON)} = 25 \text{ m}\Omega$ (typ.)
- High forward transfer admittance: P Channel $|Y_{fs}| = 6.2 \text{ S}$ (typ.)
N Channel $|Y_{fs}| = 7.8 \text{ S}$ (typ.)
- Low leakage current: P Channel $I_{DSS} = -10 \text{ }\mu\text{A}$ ($V_{DS} = -30 \text{ V}$)
N Channel $I_{DSS} = 10 \text{ }\mu\text{A}$ ($V_{DS} = 30 \text{ V}$)
- Enhancement mode
: P Channel $V_{th} = -1.0 \sim -2.2 \text{ V}$ ($V_{DS} = -10 \text{ V}$, $I_D = -1 \text{ mA}$)
: N Channel $V_{th} = 1.3 \sim 2.5 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

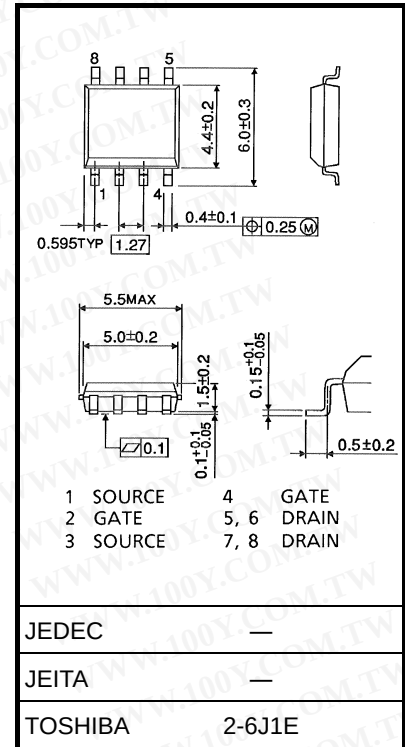
Characteristics		Symbol	Rating		Unit
			P Channel	N Channel	
Drain-source voltage		V_{DSS}	-30	30	V
Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$)		V_{DGR}	-30	30	V
Gate-source voltage		V_{GSS}	± 20	± 20	V
Drain current	DC (Note 1)	I_D	-4.5	6	A
	Pulse (Note 1)	I_{DP}	-18	24	
Drain power dissipation ($t = 10\text{s}$) (Note 2a)	Single-device operation (Note 3a)	$P_{D(1)}$	1.5	1.5	W
	Single-device value at dual operation (Note 3b)	$P_{D(2)}$	1.1	1.1	
Drain power dissipation ($t = 10\text{s}$) (Note 2b)	Single-device operation (Note 3a)	$P_{D(1)}$	0.75	0.75	
	Single-device value at dual operation (Note 3b)	$P_{D(2)}$	0.45	0.45	
Single pulse avalanche energy		E_{AS}	26.3 (Note 4a)	46.8 (Note 4b)	mJ
Avalanche current		I_{AR}	-4.5	6	A
Repetitive avalanche energy Single-device value at operation (Note 2a, 3b, 5)		E_{AR}	0.11		mJ
Channel temperature		T_{ch}	150		$^\circ\text{C}$
Storage temperature range		T_{stg}	-55~150		$^\circ\text{C}$

Note: Note 1, Note 2ab, Note 3ab, Note 4and Note 5: 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).

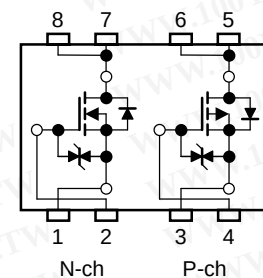
This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm



Weight: 0.080 g (typ.)

Circuit Configuration

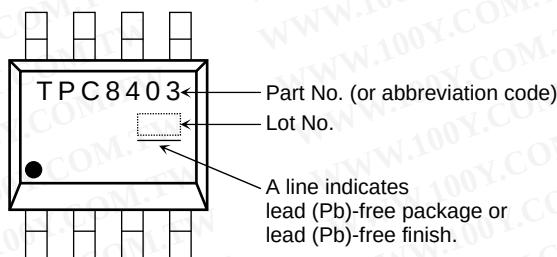


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Thermal Characteristics

Characteristics		Symbol	Max	Unit
Thermal resistance, channel to ambient ($t = 10s$)	Single-device operation (Note 3a)	$R_{th} (ch-a) (1)$	83.3	$^{\circ}C/W$
	Single-device value at dual operation (Note 3b)	$R_{th} (ch-a) (2)$	114	
Thermal resistance, channel to ambient ($t = 10s$)	Single-device operation (Note 2a)	$R_{th} (ch-a) (1)$	167	
	Single-device value at dual operation (Note 2b)	$R_{th} (ch-a) (2)$	278	

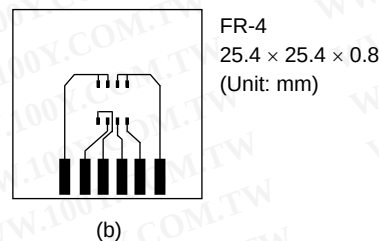
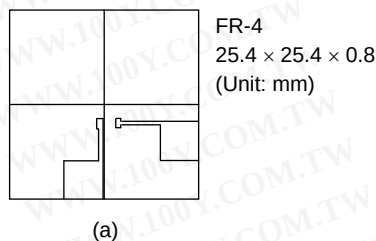
Marking



Note 1: Ensure that the channel temperature does not exceed $150^{\circ}C$.

Note 2:

- a) Device mounted on a glass-epoxy board (a) b) Device mounted on a glass-epoxy board (b)



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.).

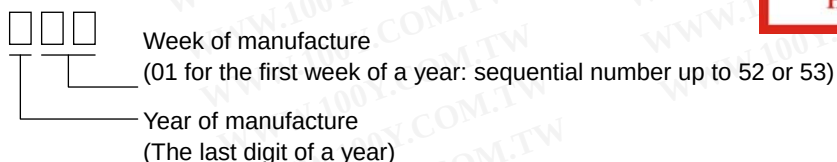
Note 4:

- a) $V_{DD} = -24 V$, $T_{ch} = 25^{\circ}C$ (Initial), $L = 1.0 mH$, $R_G = 25 \Omega$, $I_{AR} = -4.5 A$
- b) $V_{DD} = 24 V$, $T_{ch} = 25^{\circ}C$ (Initial), $L = 1.0 mH$, $R_G = 25 \Omega$, $I_{AR} = 6.0 A$

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

Note 6: • on lower left of the marking indicates Pin 1.

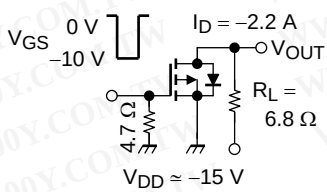
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P-channel

Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I _{GSS}	V _{GS} = ±16 V, V _{DS} = 0 V	—	—	±10	μA
Drain cut-OFF current		I _{DSS}	V _{DS} = -30 V, V _{GS} = 0 V	—	—	-10	μA
Drain-source breakdown voltage		V (BR) DSS	I _D = -10 mA, V _{GS} = 0 V	-30	—	—	V
		V (BR) DSX	I _D = -10 mA, V _{GS} = 20 V	-15	—	—	
Gate threshold voltage		V _{th}	V _{DS} = -10 V, I _D = -1 mA	-1.0	—	-2.2	V
Drain-source ON resistance		R _{DS} (ON)	V _{GS} = -4.5 V, I _D = -2.2 A	—	66	90	mΩ
			V _{GS} = -10 V, I _D = -2.2 A	—	45	55	
Forward transfer admittance		Y _{fs}	V _{DS} = -10 V, I _D = -2.2 A	3.1	6.2	—	S
Input capacitance		C _{iss}	V _{DS} = -10 V, V _{GS} = 0 V, f = 1 MHz	—	940	—	pF
Reverse transfer capacitance		C _{rss}		—	270	—	
Output capacitance		C _{oss}		—	390	—	
Switching time	Rise time	t _r		—	13	—	ns
	Turn-ON time	t _{on}		—	21	—	
	Fall time	t _f		—	25	—	
	Turn-OFF time	t _{off}		—	73	—	
Total gate charge (gate-source plus gate-drain)		Q _g	V _{DD} ≈ -24 V, V _{GS} = -10 V, I _D = -4.5 A	—	18	—	nC
Gate-source charge 1		Q _{gs} ¹		—	4	—	
Gate-drain ("miller") charge		Q _{gd}		—	4	—	

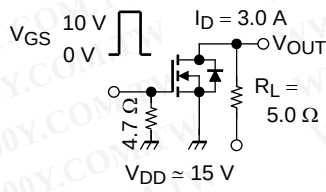
Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	-18	A
Forward voltage (diode)		V_{DSF}	$I_{DR} = -4.5 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	1.2	V

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N-channel

Electrical Characteristics (Ta = 25°C)

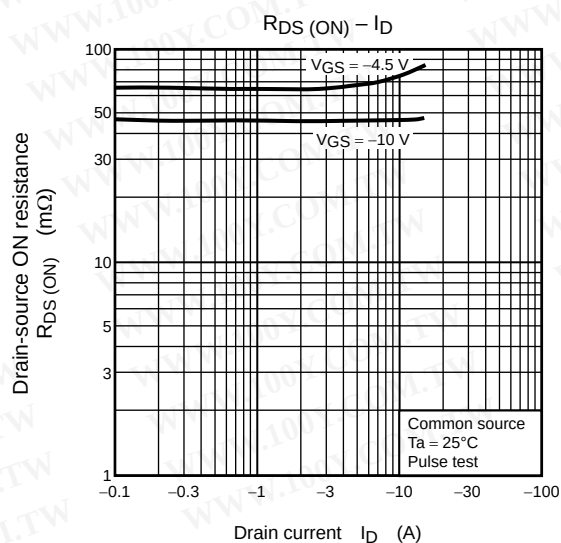
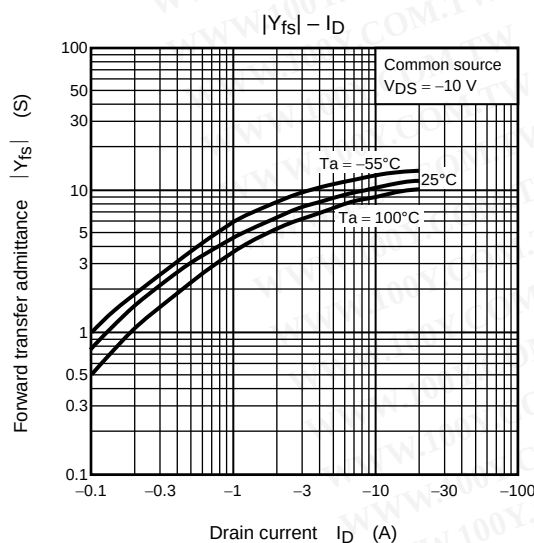
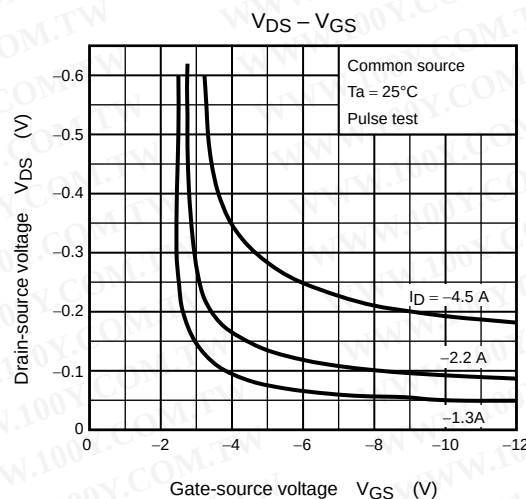
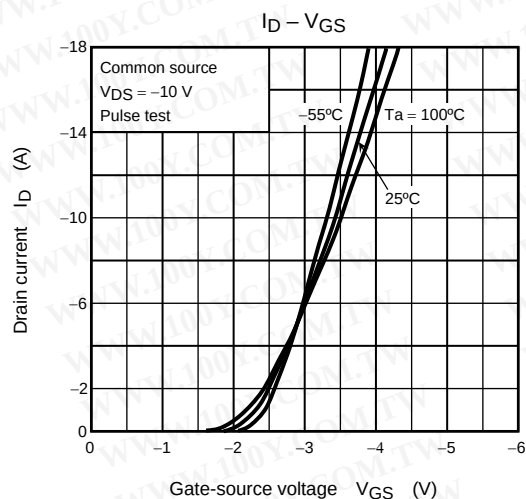
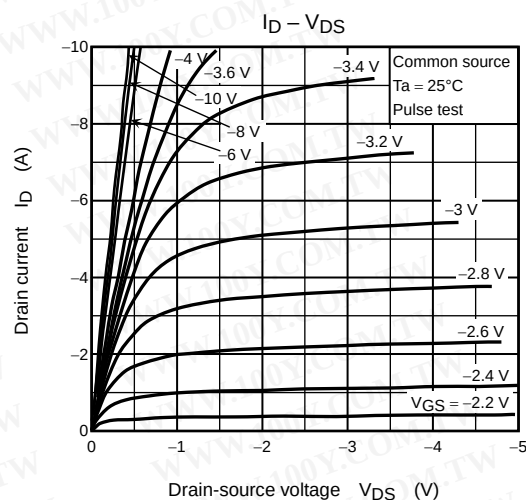
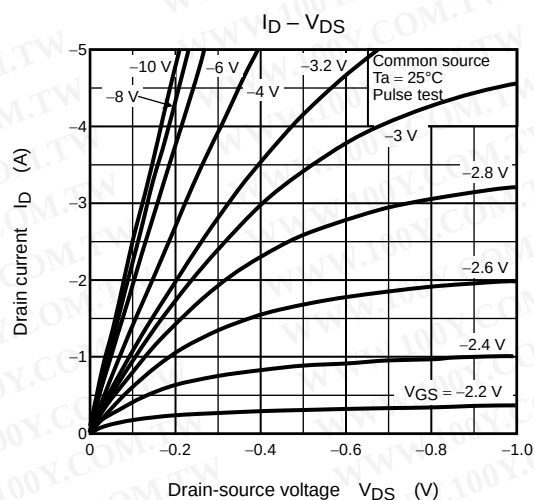
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I _{GSS}	V _{GS} = ±16 V, V _{DS} = 0 V	—	—	±10	μA
Drain cut-OFF current		I _{DSS}	V _{DS} = 30 V, V _{GS} = 0 V	—	—	10	μA
Drain-source breakdown voltage		V (BR) DSS	I _D = 10 mA, V _{GS} = 0 V	30	—	—	V
		V (BR) DSX	I _D = 10 mA, V _{GS} = -20 V	15	—	—	
Gate threshold voltage		V _{th}	V _{DS} = 10 V, I _D = 1 mA	1.3	—	2.5	V
Drain-source ON resistance		R _{DS (ON)}	V _{GS} = 4.5 V, I _D = 3 A	—	38	46	mΩ
			V _{GS} = 10 V, I _D = 3 A	—	25	33	
Forward transfer admittance		Y _{fs}	V _{DS} = 10 V, I _D = 3 A	3.9	7.8	—	S
Input capacitance		C _{iss}	V _{DS} = 10 V, V _{GS} = 0 V, f = 1 MHz	—	850	—	pF
Reverse transfer capacitance		C _{rss}		—	180	—	
Output capacitance		C _{oss}		—	270	—	
Switching time	Rise time	t _r		—	11	—	ns
	Turn-ON time	t _{on}		—	18	—	
	Fall time	t _f		—	6.5	—	
	Turn-OFF time	t _{off}		—	27	—	
Total gate charge (gate-source plus gate-drain)		Q _g	V _{DD} ≈ 24 V, V _{GS} = 10 V, I _D = 6 A	—	17	—	nC
Gate-source charge 1		Q _{gs1}		—	3	—	
Gate-drain (“miller”) charge		Q _{gd}		—	4	—	

Source-Drain Ratings and Characteristics (Ta = 25°C)

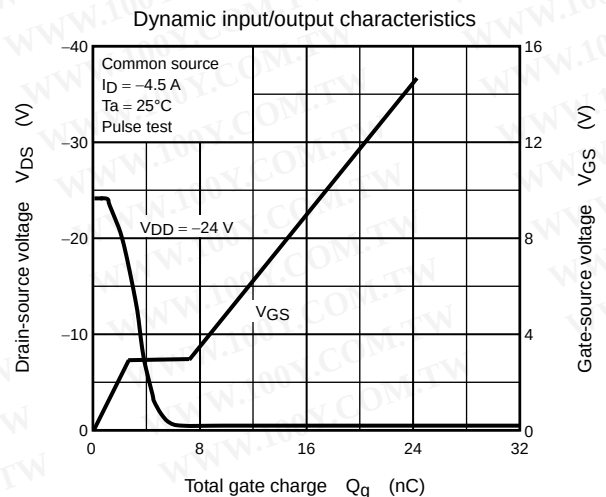
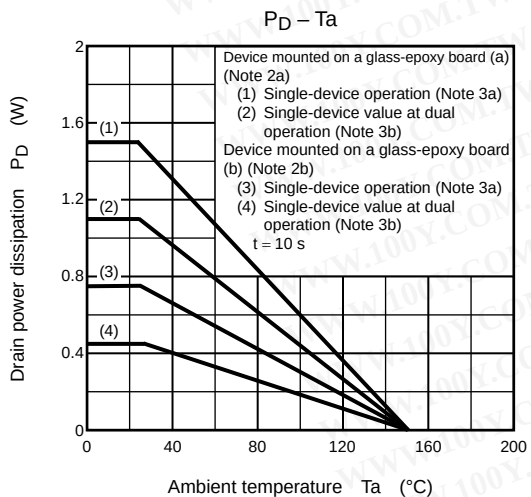
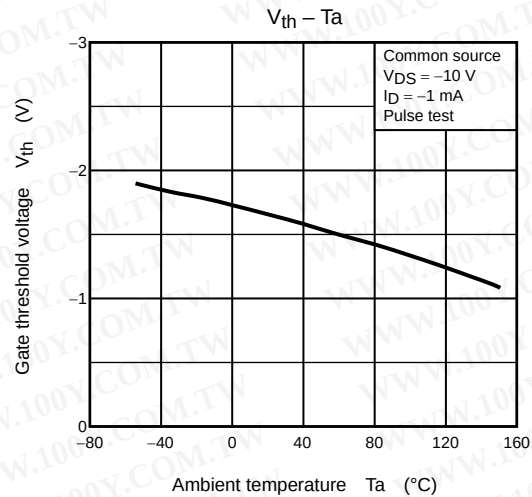
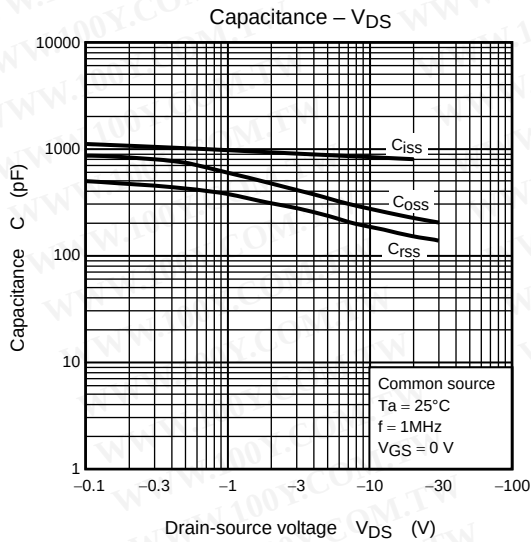
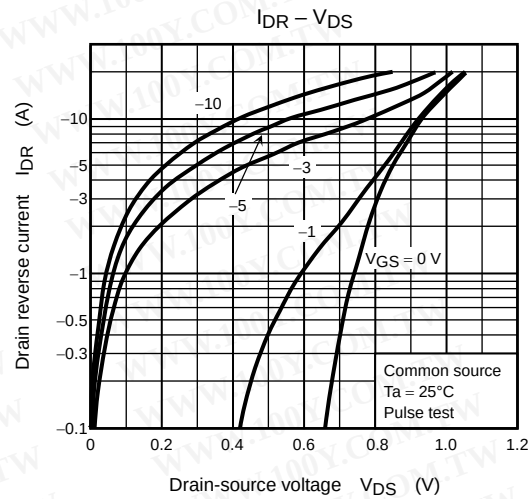
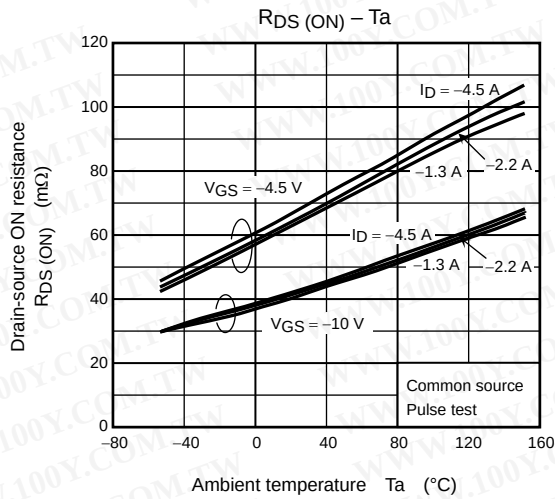
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	24	A
Forward voltage (diode)		V_{DSF}	$I_{DR} = 6 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.2	V

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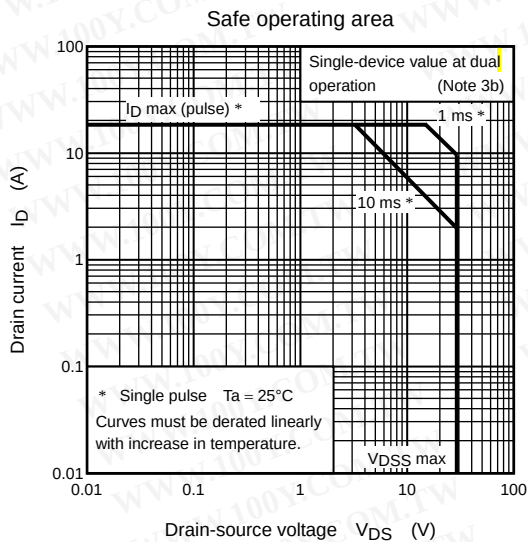
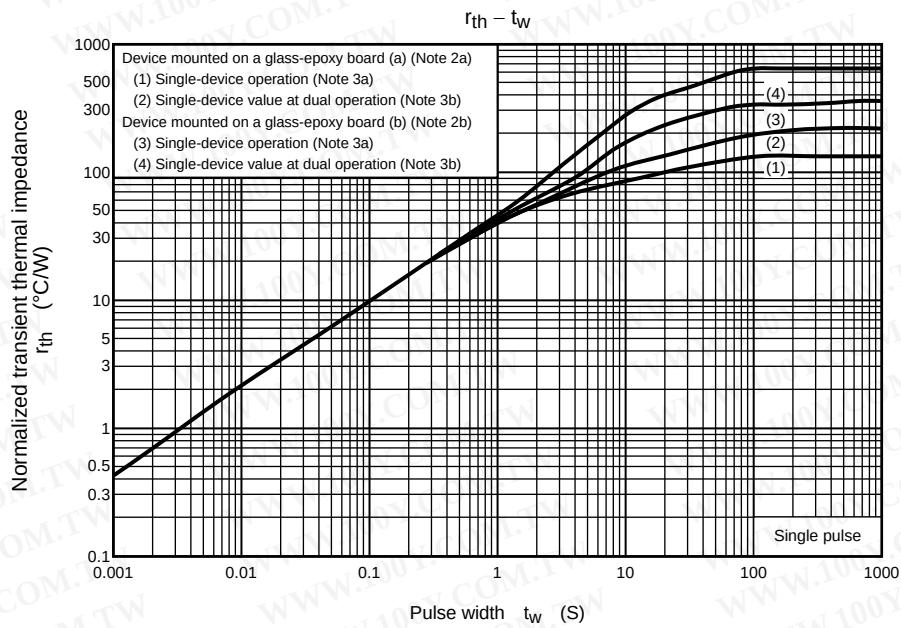
P-channel



P-channel

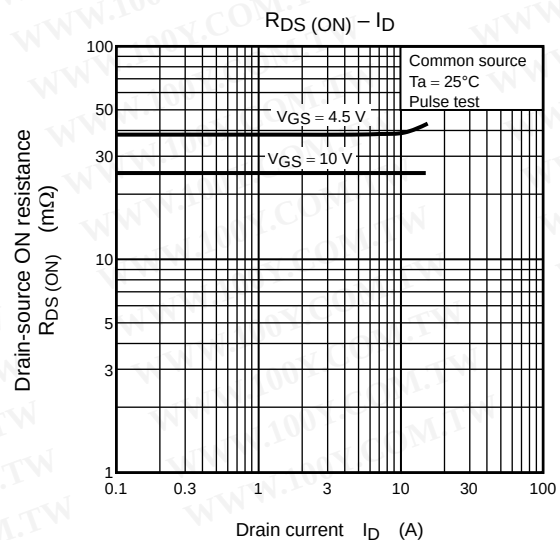
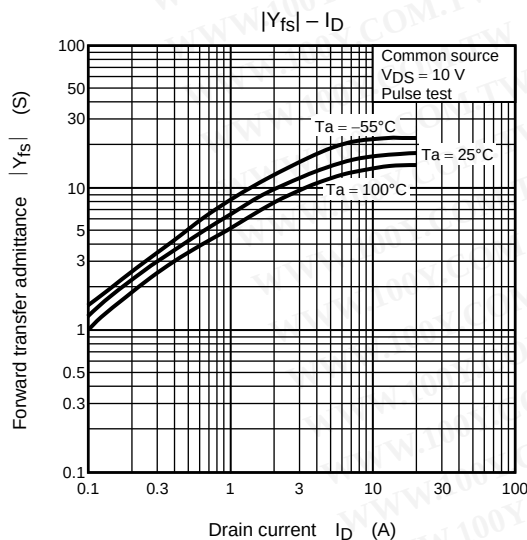
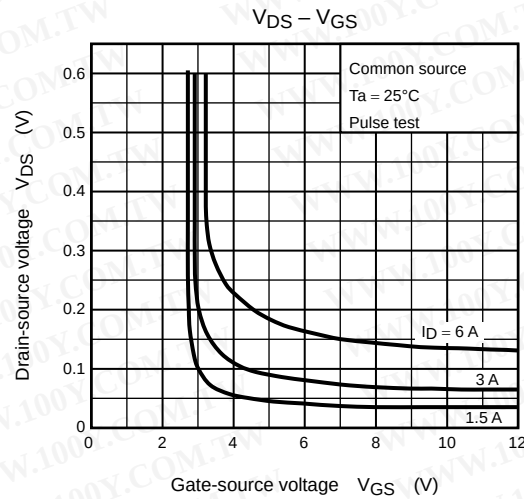
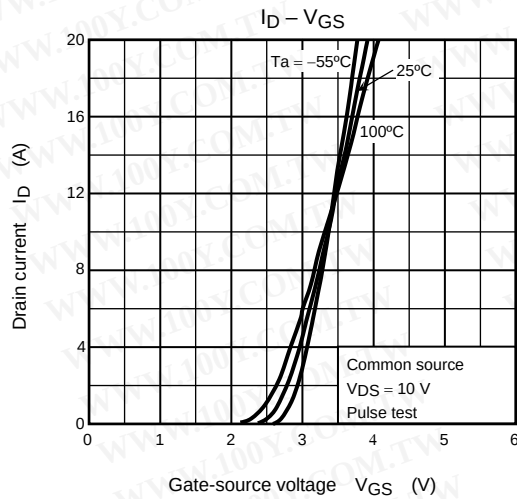
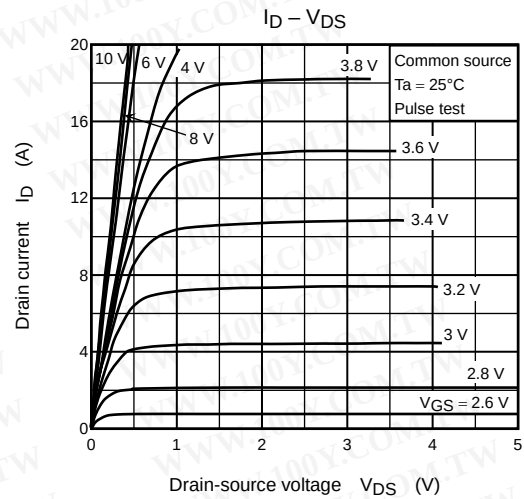
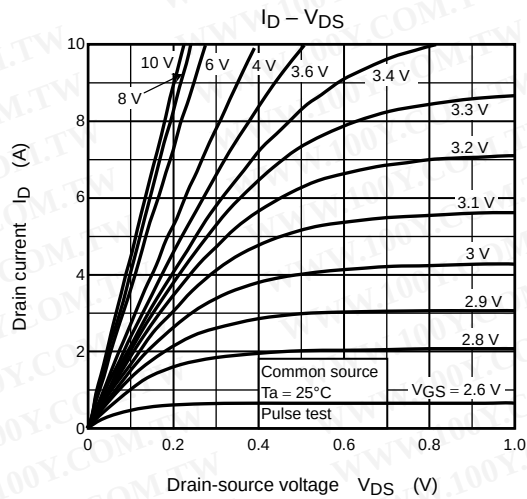


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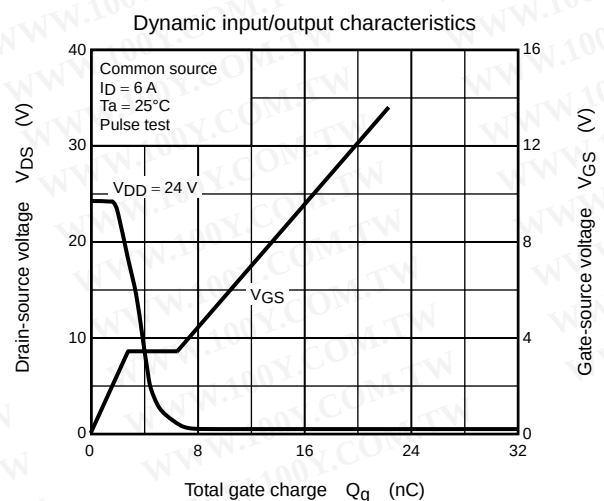
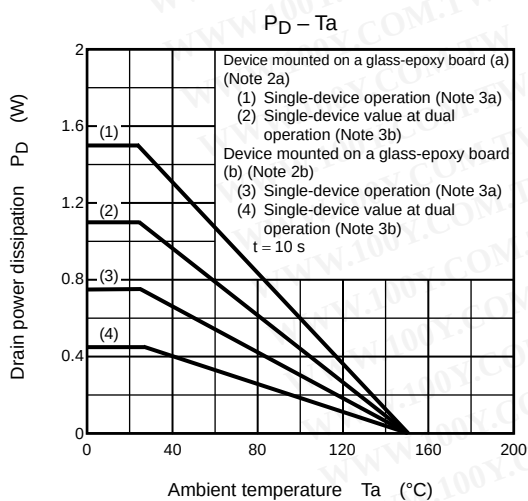
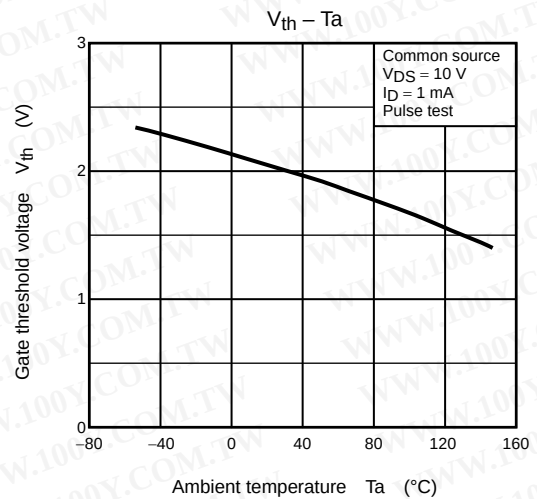
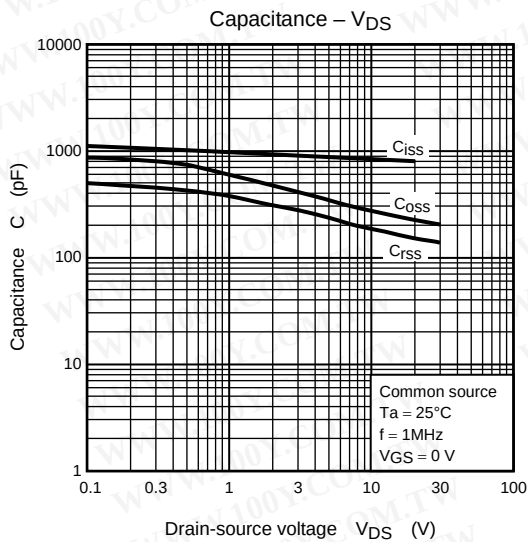
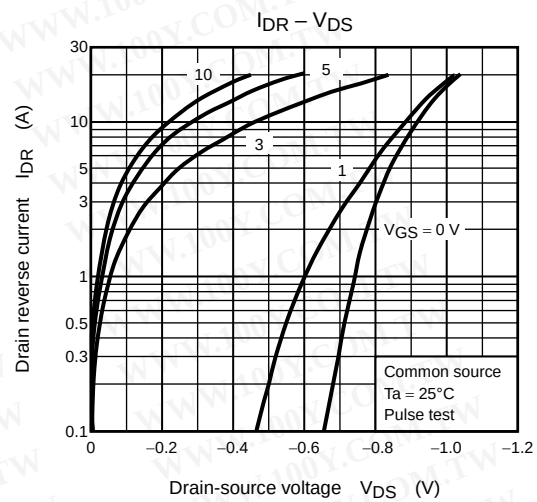
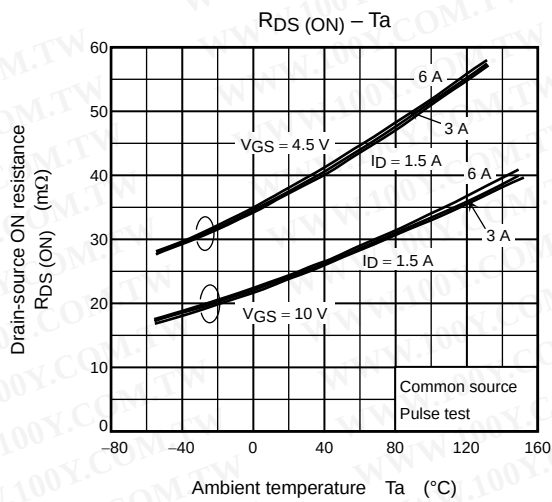


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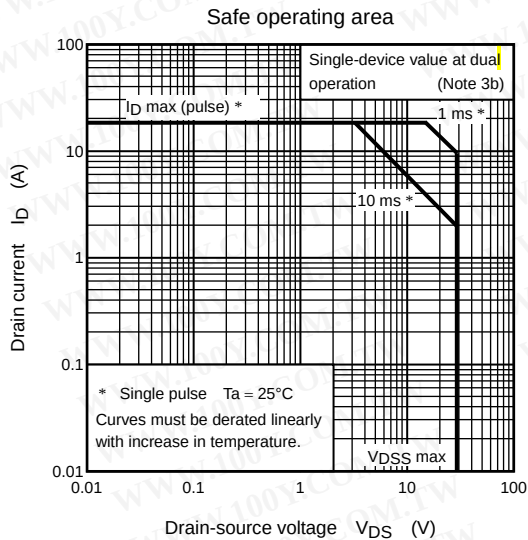
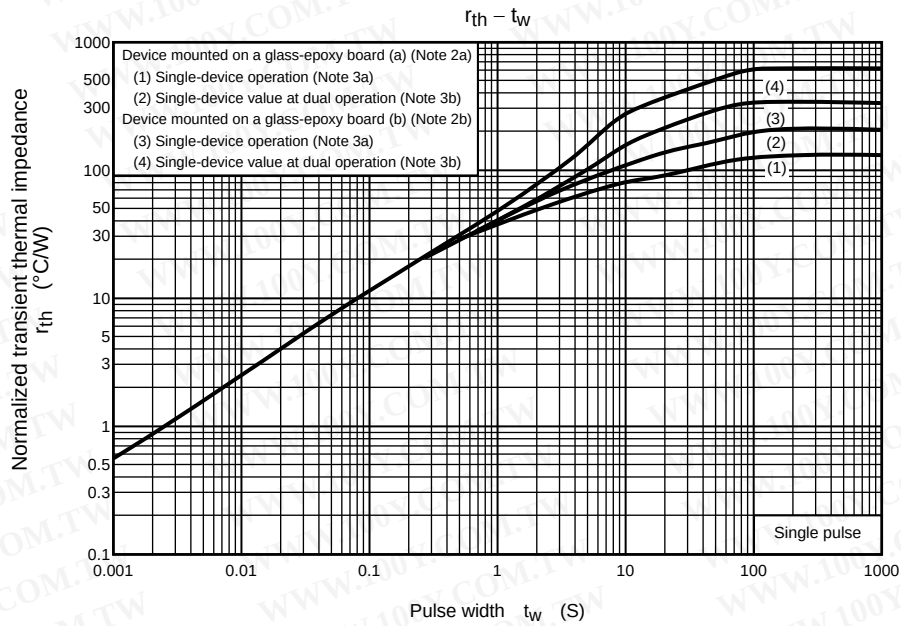
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