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TOSHIBA Field Effect Transistor Silicon N, P Channel MOS Type

(P Channel U−MOS IV/N Channel U-MOS III)

TPC8405

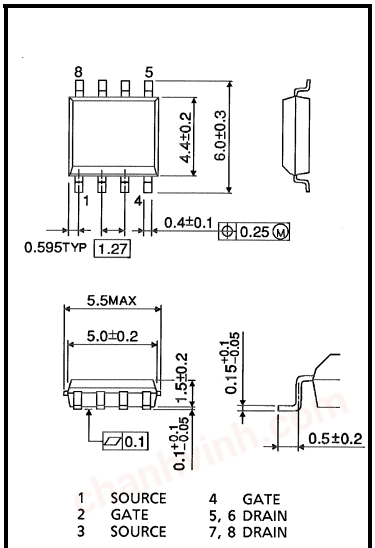
Lithium Ion Secondary Battery Applications

Portable Equipment Applications

Notebook PC Applications

- Low drain-source ON resistance
  : P Channel $R_{DS\ (ON)}$ = 25 mΩ (typ.)
  N Channel $R_{DS\ (ON)}$ = 20 mΩ (typ.)
- High forward transfer admittance
  : P Channel $|Y_{fs}|$ = 12S (typ.)
  N Channel $|Y_{fs}|$ = 14S (typ.)
- Low leakage current
  : P Channel I_{DSS} = −10 μA (V_{DS} = −30 V)
  N Channel I_{DSS} = 10 μA (V_{DS} = 30 V)
- Enhancement-mode
  : P Channel V_{th} = −0.8~ −2.0 V (V_{DS} = −10 V, I_D = −1 mA)
  N Channel V_{th} = 1.3~2.5 V (V_{DS} = 10 V, I_D = 1 mA)

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-6J1E

Weight: 0.080 g (typ.)

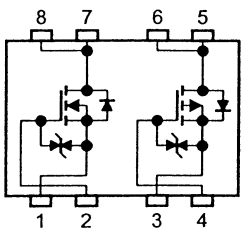
Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating		Unit
			P Channel	N Channel	
Drain-source voltage		V_{DSS}	−30	30	V
Drain-gate voltage (R_{GS} = 20 kΩ)		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 = 10s) (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 = 10s) (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}	13.2 (Note 4a)	23.4 (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}	0.1		mJ
Channel temperature		T_{ch}	150		°C
Storage temperature range		T_{stg}	−55~150		°C

Note: For Notes 1 to 5, refer to the next page.

This transistor is an electrostatic-sensitive device. Handle with care.

Circuit Configuration

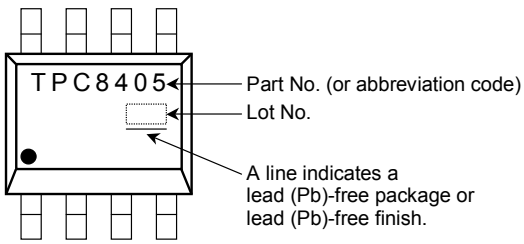


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Thermal Characteristics

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

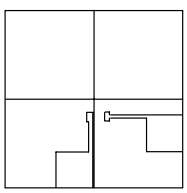
Marking



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

Note 2:

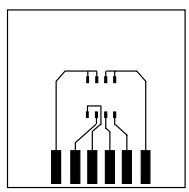
a) Device mounted on a glass-epoxy board (a)



FR-4
25.4 × 25.4 × 0.8
(unit: mm)

(a)

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



FR-4
25.4 × 25.4 × 0.8
(unit: mm)

(b)

Note 3:

a) The power dissipation and thermal resistance values shown are for a single device. (During single-device operation, power is applied to one device only.)

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

Note 4:

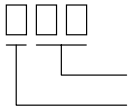
a) V_{DD} = −24 V, T_{ch} = 25°C (initial), L = 0.5 mH, R_G = 25 Ω, I_{AR} = −4.5 A

b) V_{DD} = 24 V, T_{ch} = 25°C (initial), L = 0.5 mH, R_G = 25 Ω, I_{AR} = 6.0 A

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

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

※ Weekly code: (Three digits)



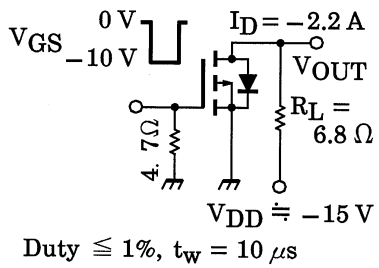
Week of manufacture
(01 for the first week of the year, continuing up to 52 or 53)

Year of manufacture
(the last digit of the calendar year)

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P-ch

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	−0.8	—	−2.0	V
Drain-source ON resistance		$R_{DS\ (ON)}$	V_{GS} = −4.5 V, I_D = −2.2 A	—	32	42	mΩ
		$R_{DS\ (ON)}$	V_{GS} = −10 V, I_D = −2.2 A	—	25	33	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = −10 V, I_D = −2.2 A	6	12	—	S
Input capacitance		C_{iss}	V_{DS} = −10 V, V_{GS} = 0 V, f = 1 MHz	—	1540	—	pF
Reverse transfer capacitance		C_{rss}		—	220	—	
Output capacitance		C_{oss}		—	250	—	
Switching time	Rise time	t_r		—	5.0	—	ns
	Turn-ON time	t_{on}		—	13	—	
	Fall time	t_f		—	35	—	
	Turn-OFF time	t_{off}		—	125	—	
Total gate charge (Gate-source plus gate-drain)		Q_g	V_{DD} ≈ −24 V, V_{GS} = −10 V, I_D = −4.5 A	—	40	—	nC
Gate-source charge 1		Q_{gs1}		—	4.4	—	
Gate-drain (“miller”) charge		Q_{gd}		—	8.2	—	

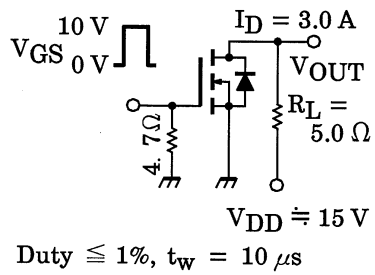
Source-Drain Ratings and Characteristics (Ta = 25°C)

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 A, V_{GS} = 0 V	—	—	1.2	V

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N-ch

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	—	25	33	mΩ
		$R_{DS\ (ON)}$	V_{GS} = 10 V, I_D = 3 A	—	20	26	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 3 A	7	14	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	1240	—	pF
Reverse transfer capacitance		C_{rss}		—	180	—	
Output capacitance		C_{oss}		—	230	—	
Switching time	Rise time	t_r		—	4.5	—	ns
	Turn-ON time	t_{on}		—	12.5	—	
	Fall time	t_f		—	6.6	—	
	Turn-OFF time	t_{off}		—	33	—	
Total gate charge (Gate-source plus gate-drain)		Q_g	V_{DD} ≈ 24 V, V_{GS} = 10 V, I_D = 6 A	—	27	—	nC
Gate-source charge 1		Q_{gs1}		—	3.9	—	
Gate-drain (“miller”) charge		Q_{gd}		—	7.0	—	

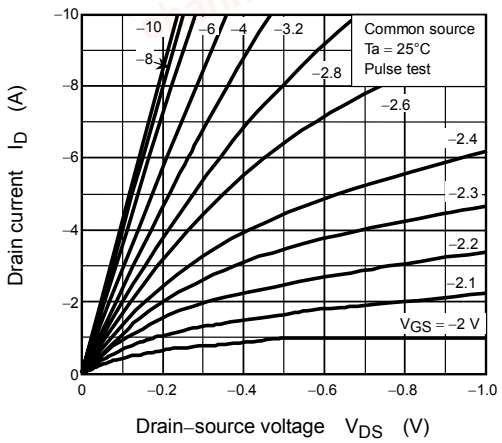
Source-Drain Ratings and Characteristics (Ta = 25°C)

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 A, V_{GS} = 0 V	—	—	−1.2	V

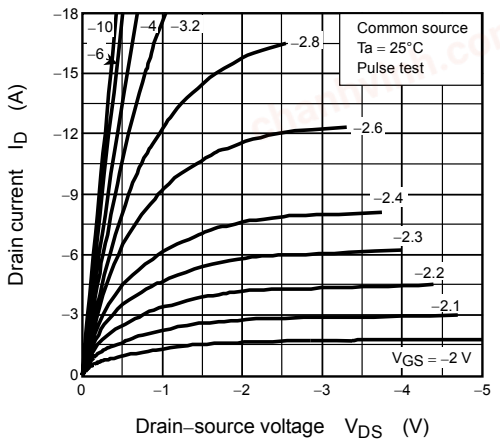
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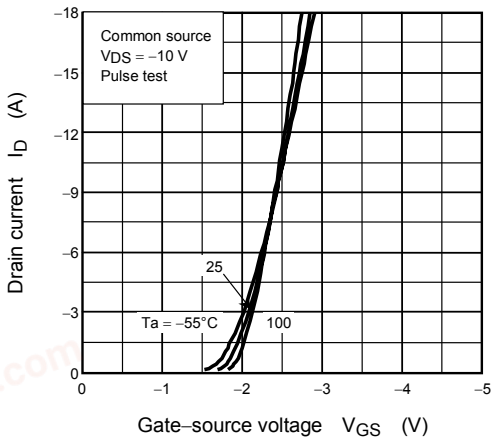
$I_D - V_{DS}$



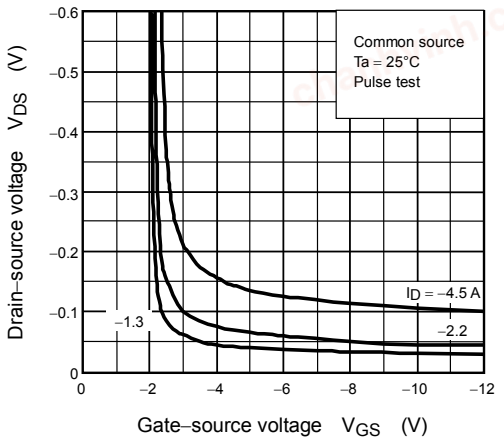
$I_D - V_{DS}$



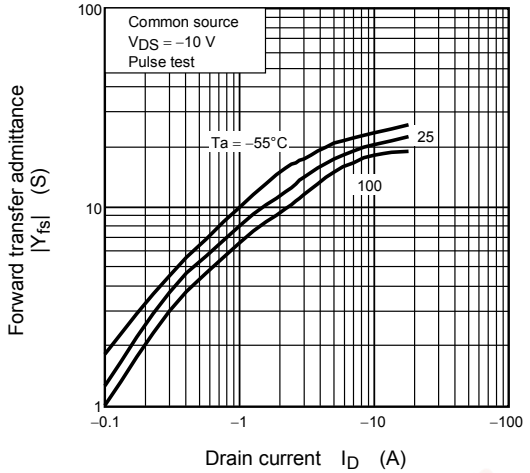
$I_D - V_{GS}$



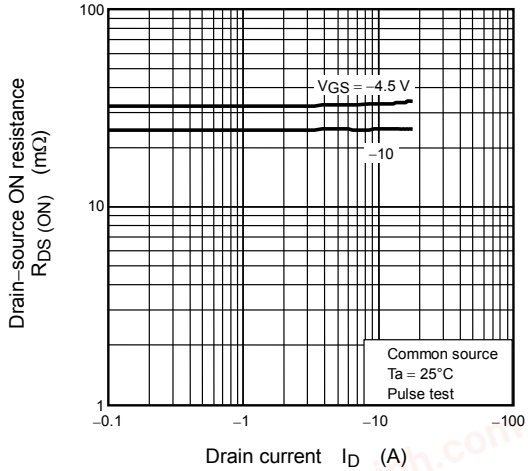
$V_{DS} - V_{GS}$



$|Y_{fs}| - I_D$



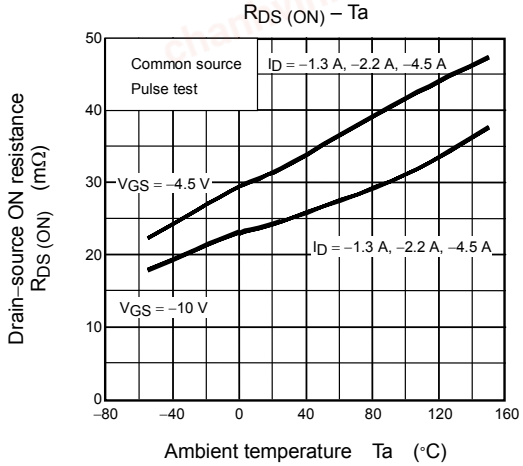
$R_{DS\ (ON)} - I_D$



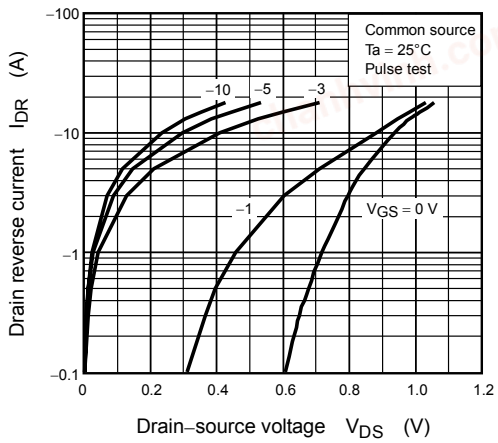
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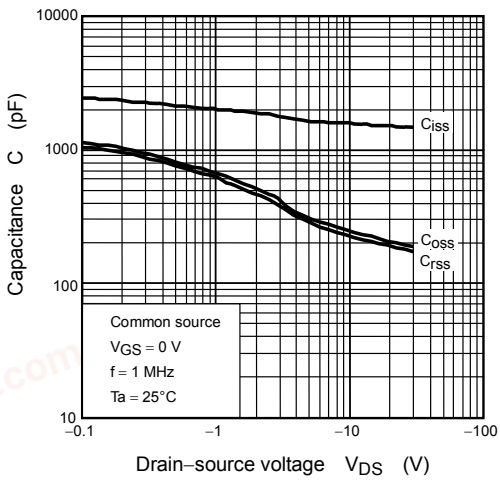
$R_{DS\ (ON)}$ – Ta



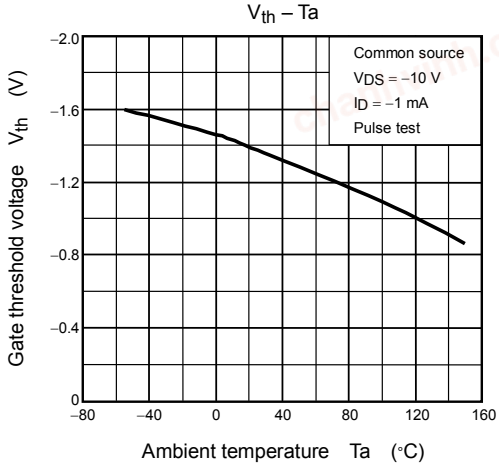
I_{DR} – V_{DS}



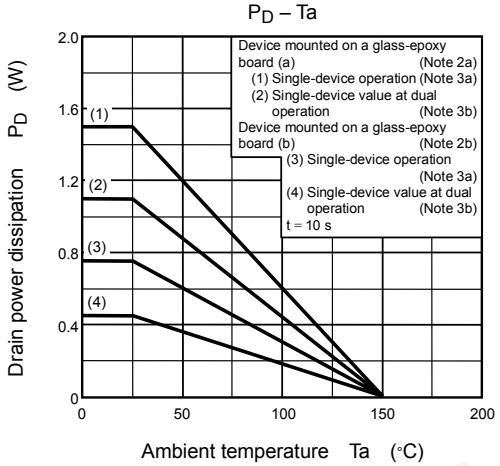
C – V_{DS}



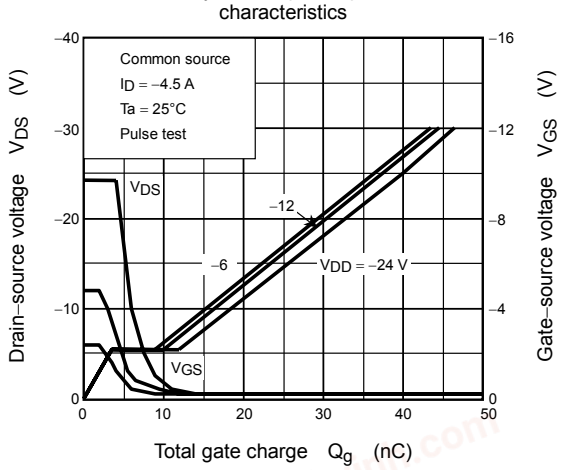
V_{th} – Ta



P_D – Ta

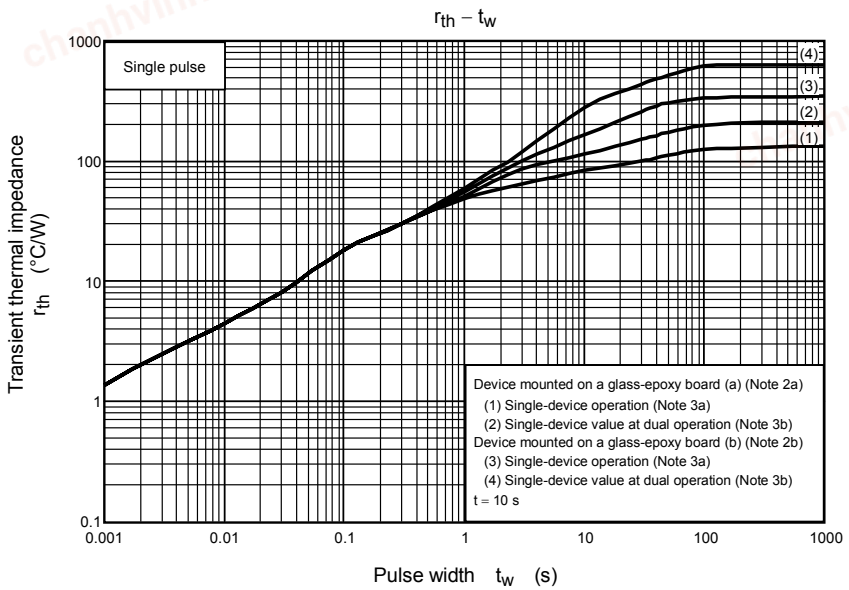


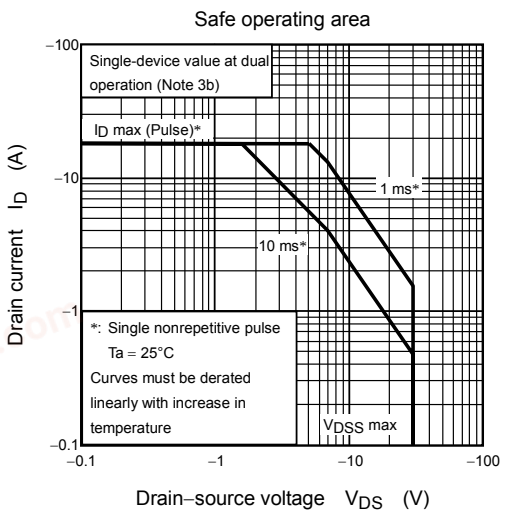
Dynamic input/output characteristics



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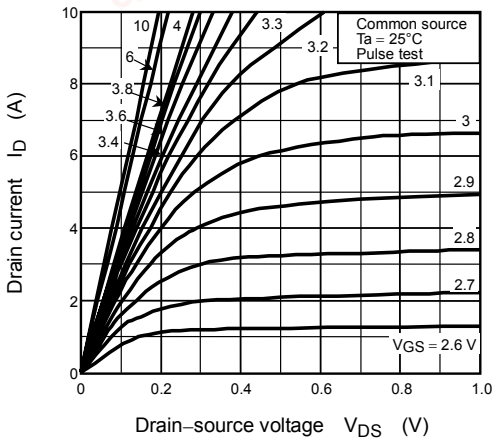




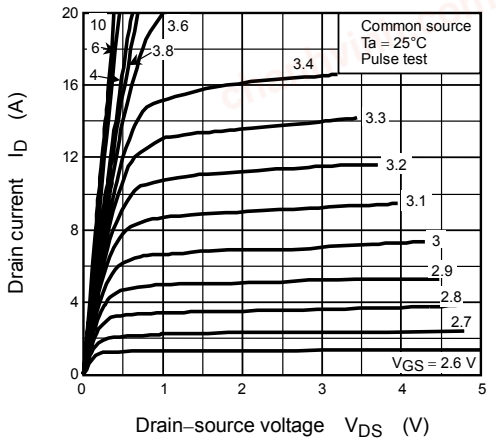
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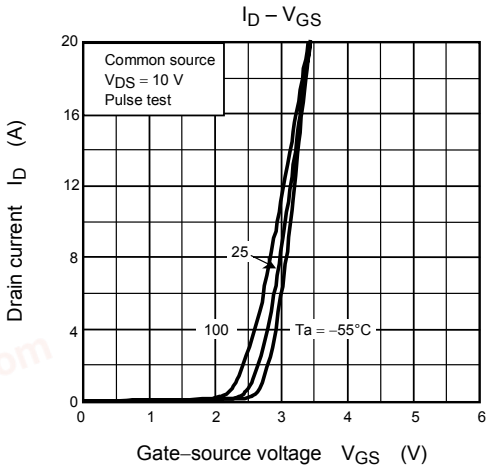
$I_D - V_{DS}$



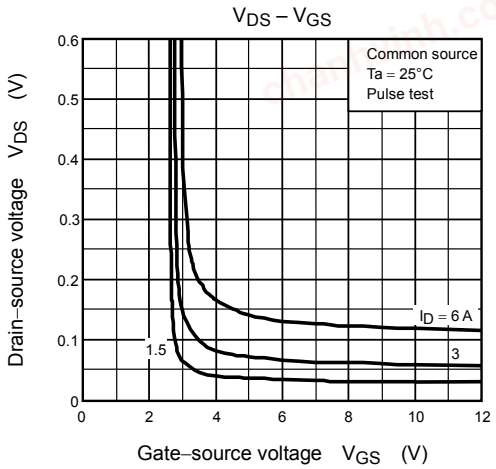
$I_D - V_{DS}$



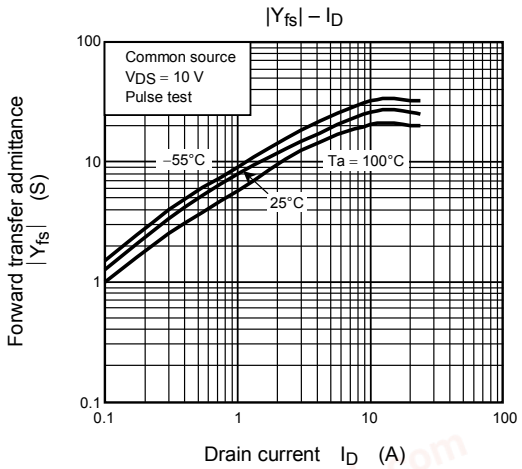
$I_D - V_{GS}$



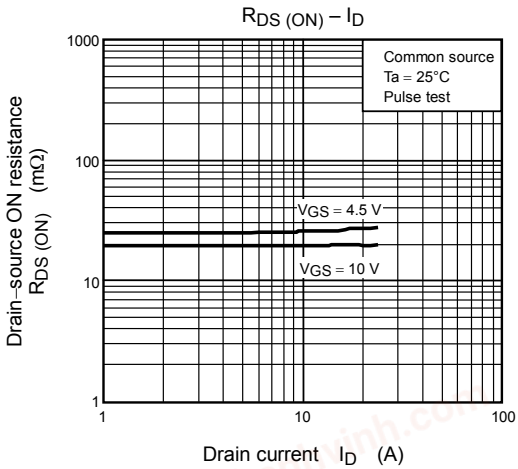
$V_{DS} - V_{GS}$



$|Y_{fs}| - I_D$



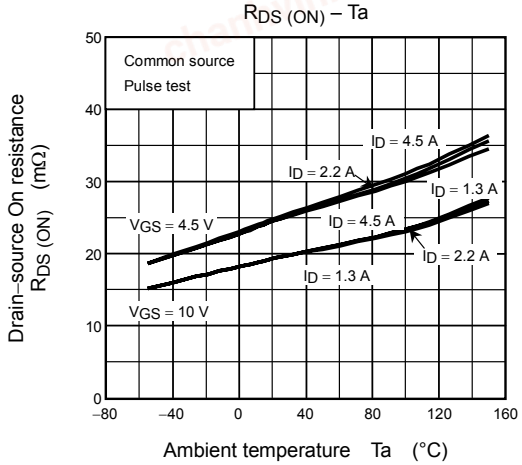
$R_{DS\ (ON)} - I_D$



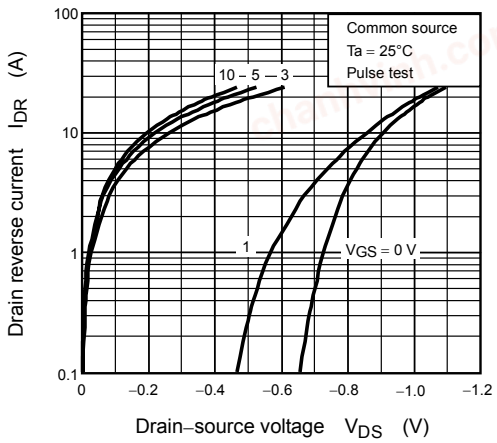
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N-ch

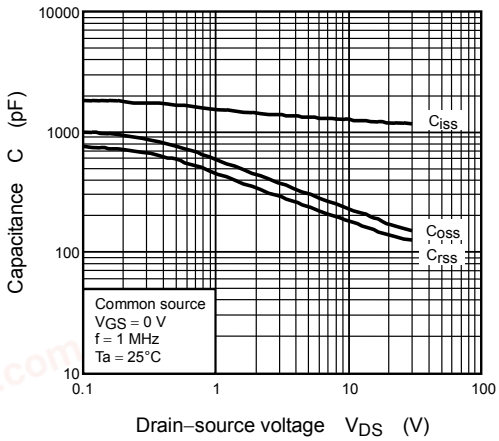
$R_{DS\ (ON)}$ – Ta



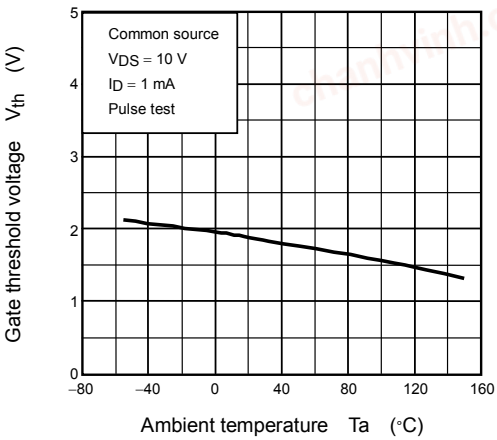
I_{DR} – V_{DS}



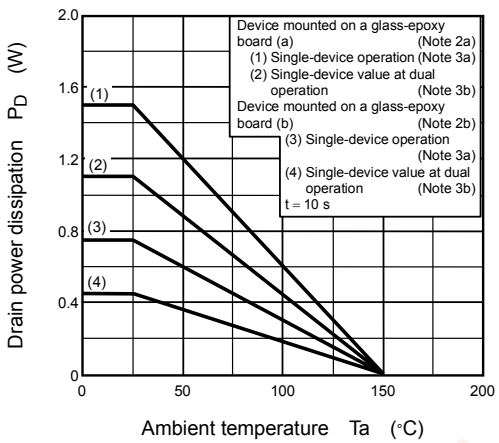
C – V_{DS}



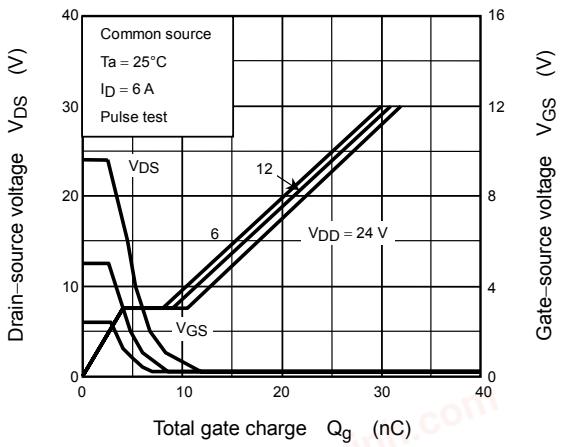
V_{th} – Ta



P_D – Ta

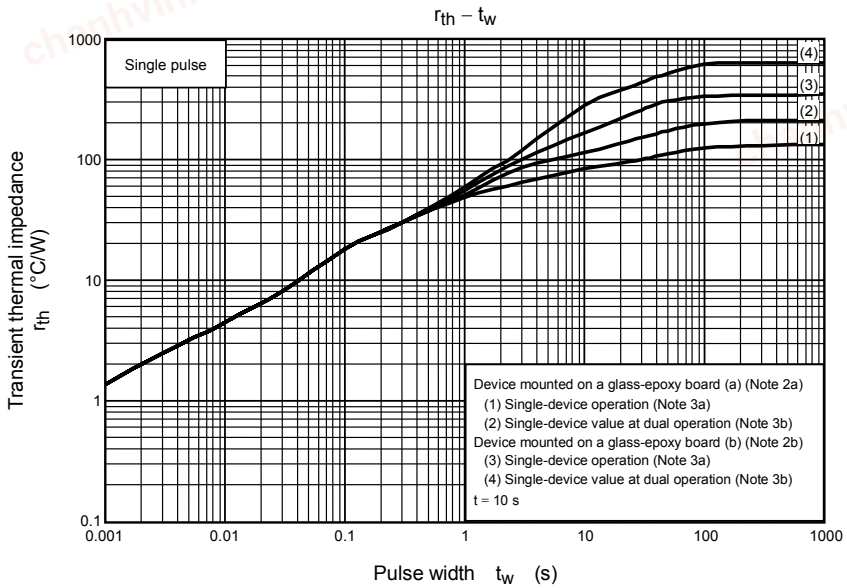


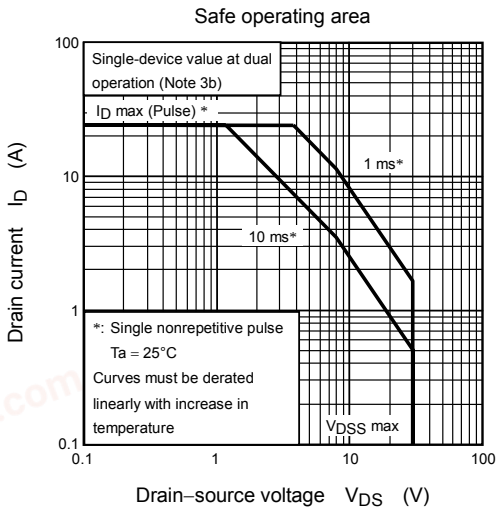
Dynamic input/output characteristics



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- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury (“Unintended Usage”). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer’s own risk.
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