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

TPC8403

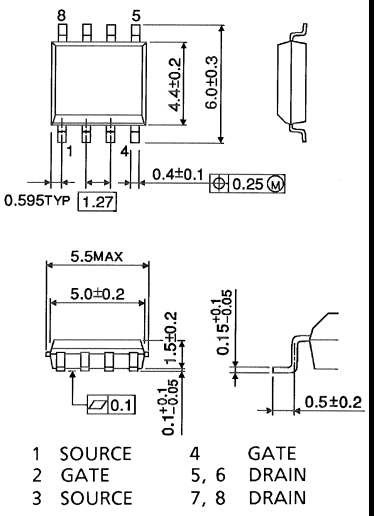
Motor Drive Applications

Notebook PC Applications

Portable Equipment Applications

- Low drain-source ON resistance: P Channel $R_{DS\ (ON)}$ = 45 mΩ (typ.)
  N Channel $R_{DS\ (ON)}$ = 25 mΩ (typ.)
- High forward transfer admittance: P Channel $|Y_{fs}|$ = 6.2 S (typ.)
  N Channel $|Y_{fs}|$ = 7.8 S (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} = −1.0~−2.2 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



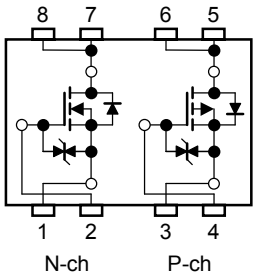
JEDEC	—
JEITA	—
TOSHIBA	2-6J1E

Weight: 0.080 g (typ.)

Absolute 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}	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		°C
Storage temperature range			T_{stg}	−55~150		°C

Circuit Configuration



Note: Note 1, Note 2ab, Note 3ab, Note 4and Note 5: See the next page.

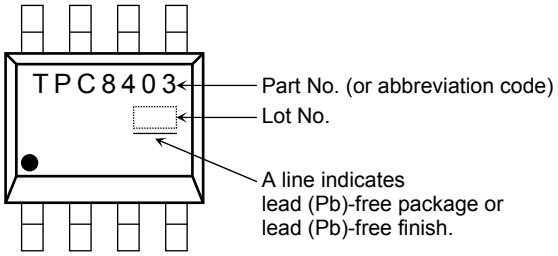
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within 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.

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 2a)	$R_{th\ (ch\text{-}a)\ (1)}$	167	
	Single-device value at dual operation (Note 2b)	$R_{th\ (ch\text{-}a)\ (2)}$	278	

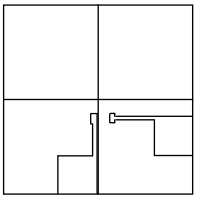
Marking



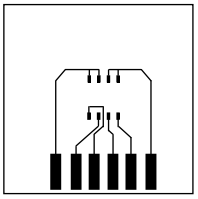
Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2:

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



(a)



(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:

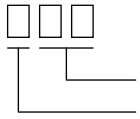
a) V_{DD} = −24 V, T_{ch} = 25°C (Initial), L = 1.0 mH, R_G = 25 Ω, I_{AR} = −4.5 A

b) V_{DD} = 24 V, T_{ch} = 25°C (Initial), L = 1.0 mH, R_G = 25 Ω, 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.

※ Weekly code: (Three digits)

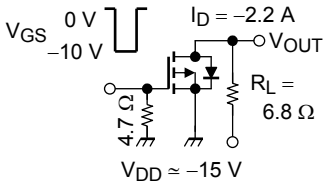


Week of manufacture
(01 for the first week of a year: sequential number up to 52 or 53)

Year of manufacture
(The last digit of a year)

P-channel

Electrical Characteristics (Ta = 25°C)

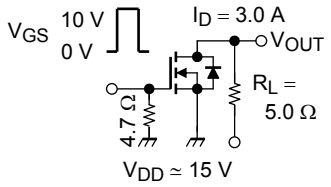
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut-OFF current		I_{DSS}	V_{DS} = −30 V, V_{GS} = 0 V	—	—	−10	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = −10 mA, V_{GS} = 0 V	−30	—	—	V
		$V_{(BR)\ DSX}$	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	 Duty ≦ 1%, t_w = 10 μs	—	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 A, V_{GS} = 0 V	—	—	1.2	V

N-channel

Electrical Characteristics (Ta = 25°C)

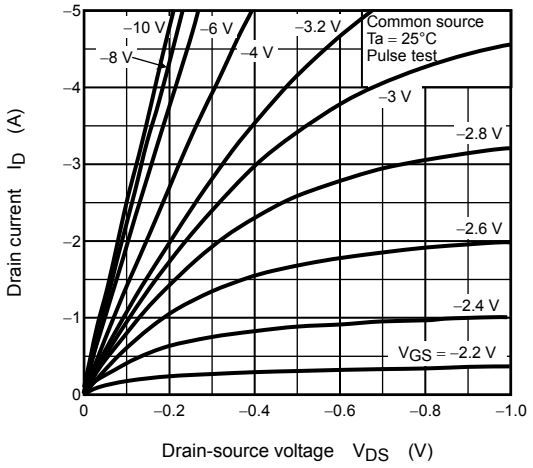
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut-OFF current		I_{DSS}	V_{DS} = 30 V, V_{GS} = 0 V	—	—	10	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 10 mA, V_{GS} = 0 V	30	—	—	V
		$V_{(BR)\ DSX}$	I_D = 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	 Duty ≦ 1%, t_w = 10 μs	—	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		$Q_{gs}1$		—	3	—	
Gate-drain (“miller”) charge		Q_{gd}		—	4	—	

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

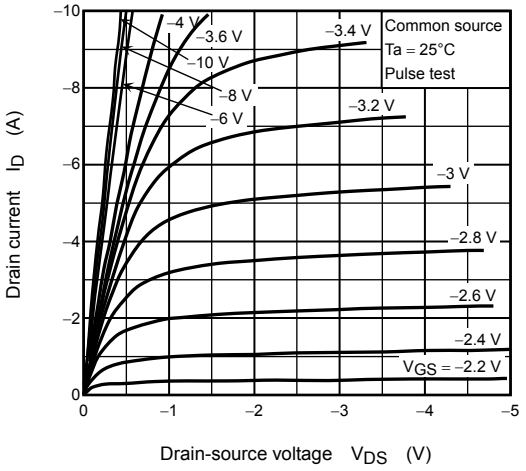
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	24	A
Forward voltage (diode)		V_{DSF}	I_{DR} = 6 A, V_{GS} = 0 V	—	—	−1.2	V

P-channel

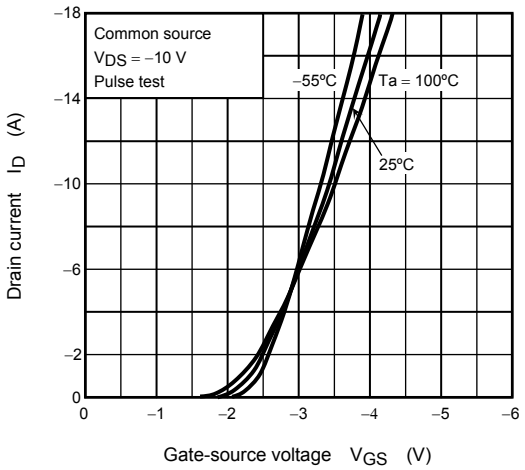
$I_D - V_{DS}$



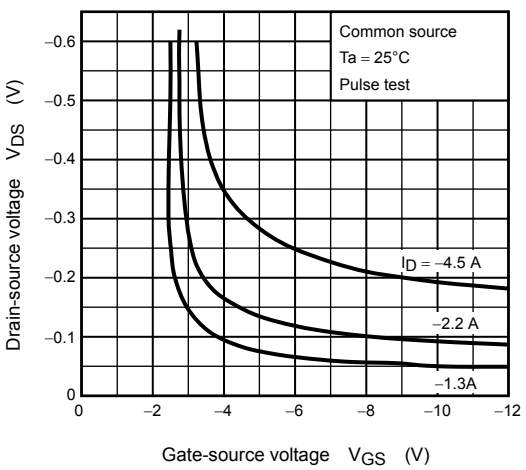
$I_D - V_{DS}$



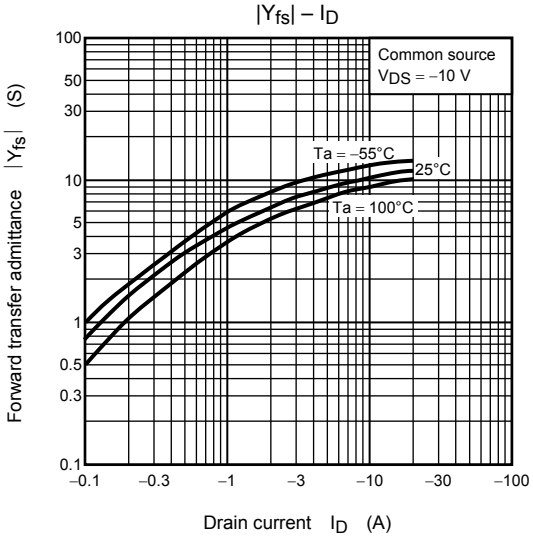
$I_D - V_{GS}$



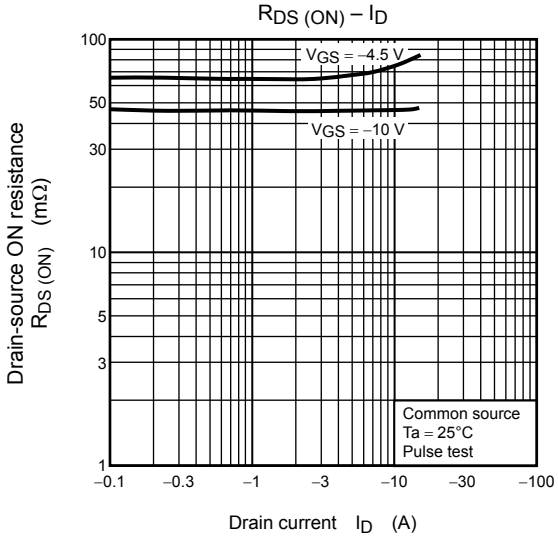
$V_{DS} - V_{GS}$



$|Y_{fs}| - I_D$

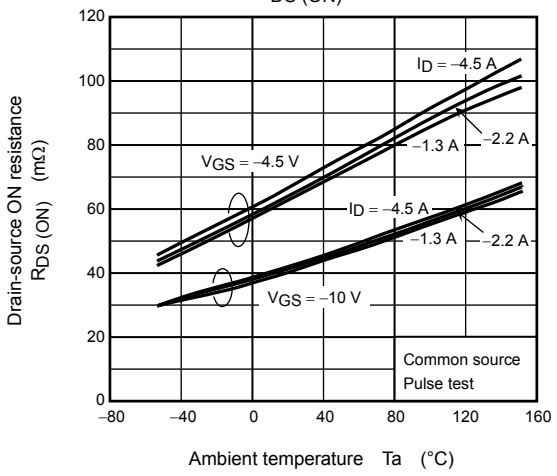


$R_{DS\ (ON)} - I_D$

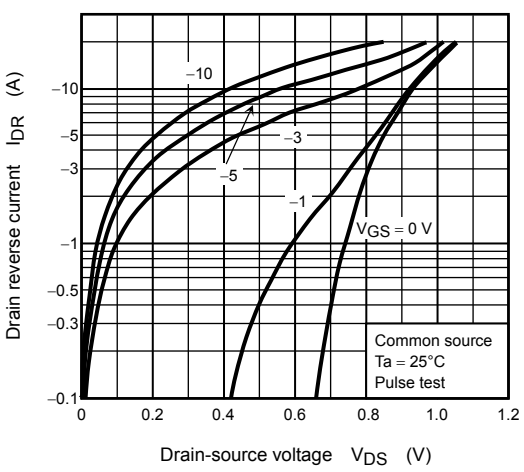


P-channel

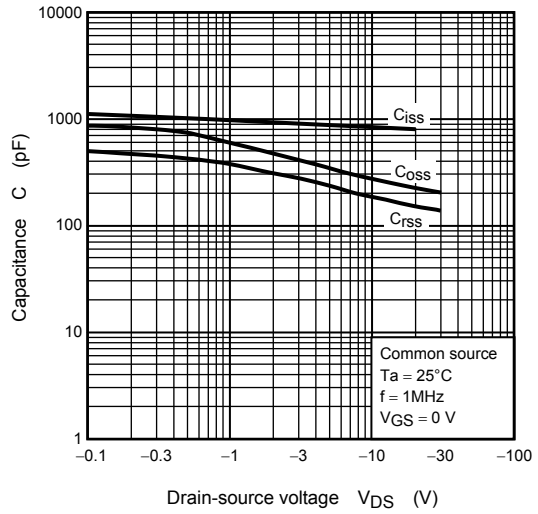
$R_{DS\ (ON)}$ – Ta



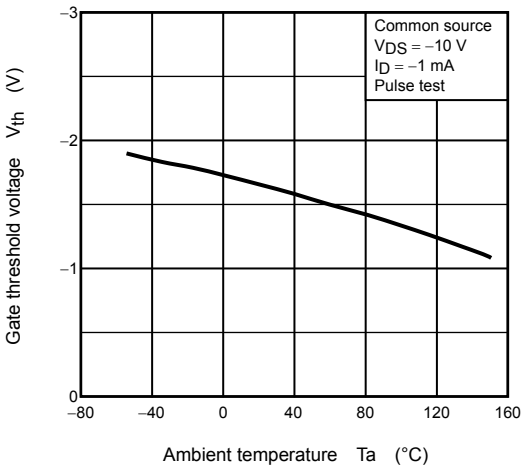
I_{DR} – V_{DS}



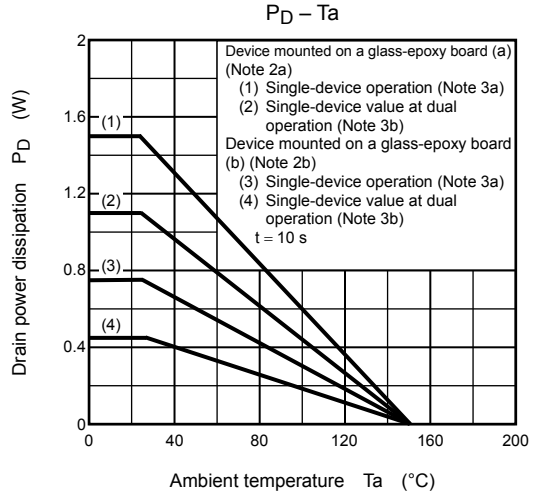
Capacitance – V_{DS}



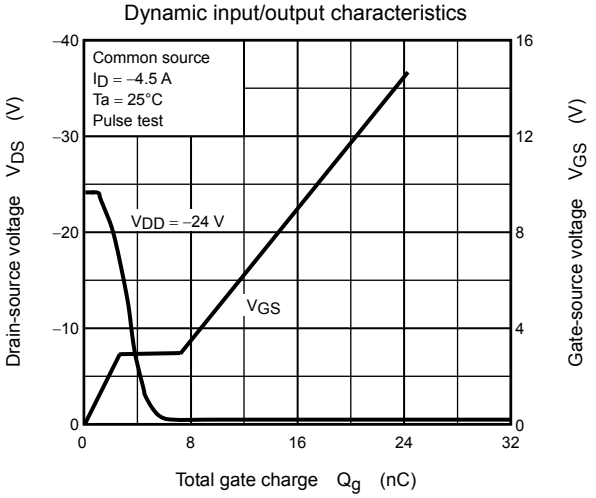
V_{th} – Ta



P_D – Ta

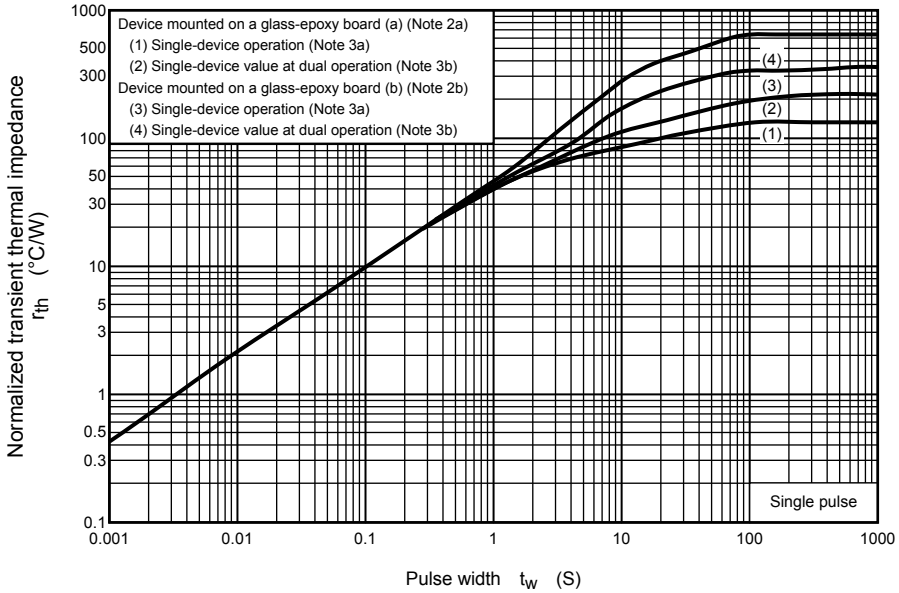


Dynamic input/output characteristics

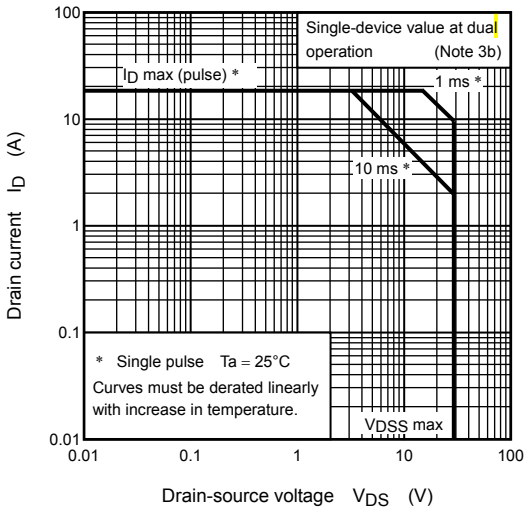


P-channel

$r_{th} - t_w$

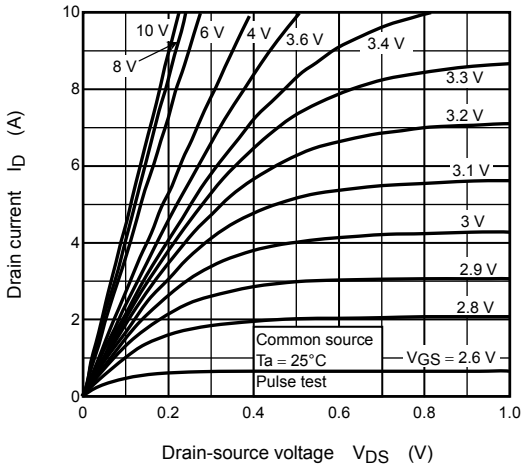


Safe operating area

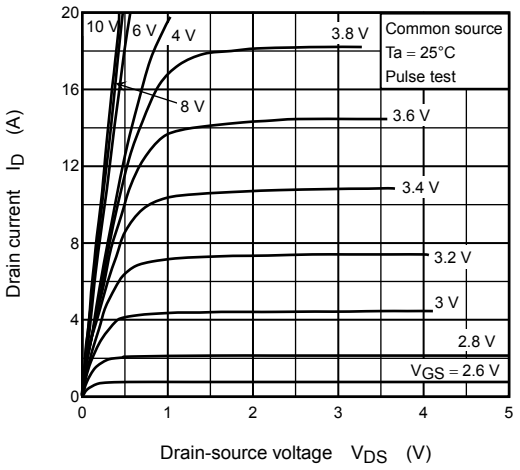


N-channel

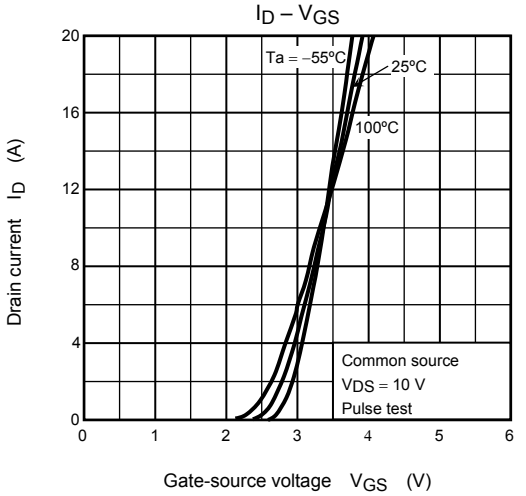
$I_D - V_{DS}$



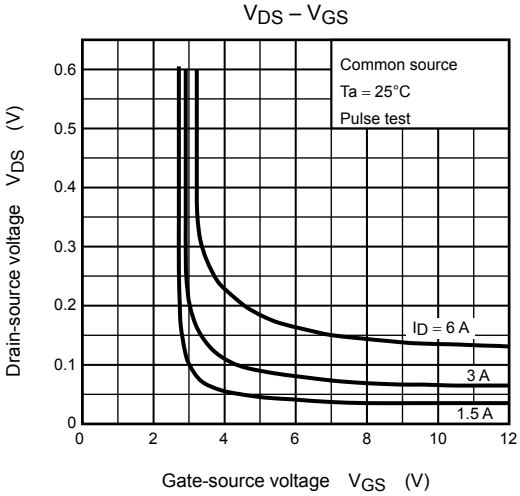
$I_D - V_{DS}$



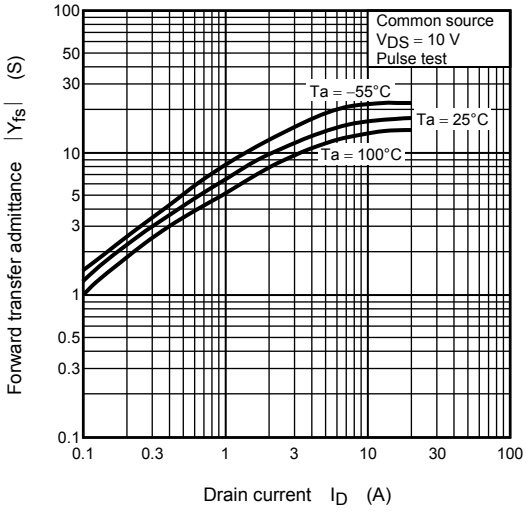
$I_D - V_{GS}$



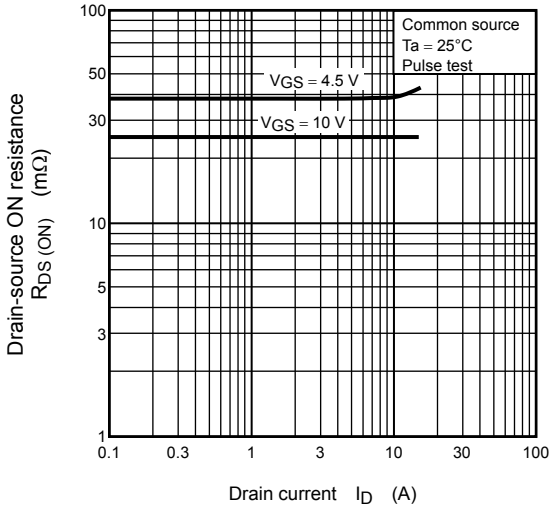
$V_{DS} - V_{GS}$



$|Y_{fs}| - I_D$

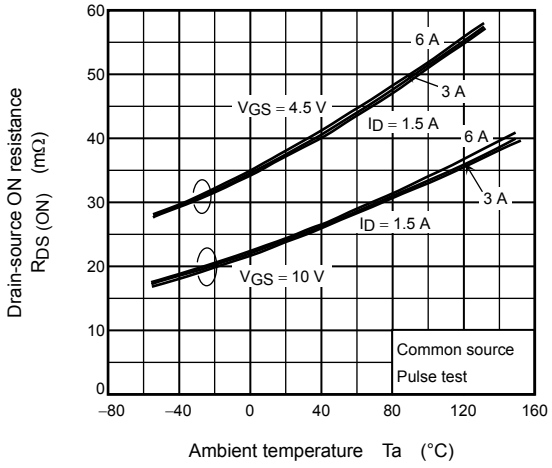


$R_{DS\ (ON)} - I_D$

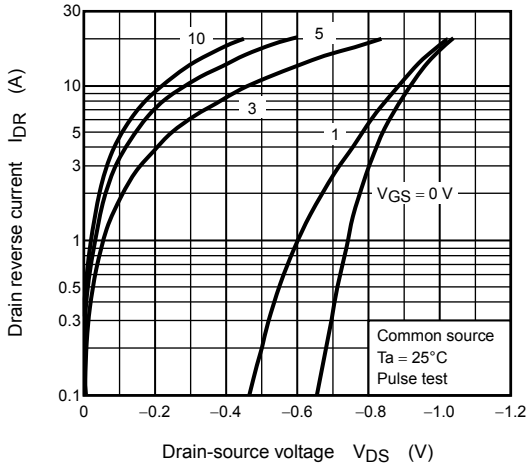


N-channel

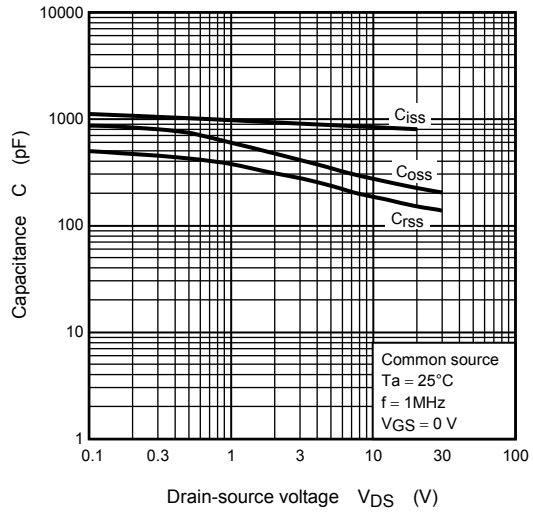
$R_{DS\ (ON)}$ – Ta



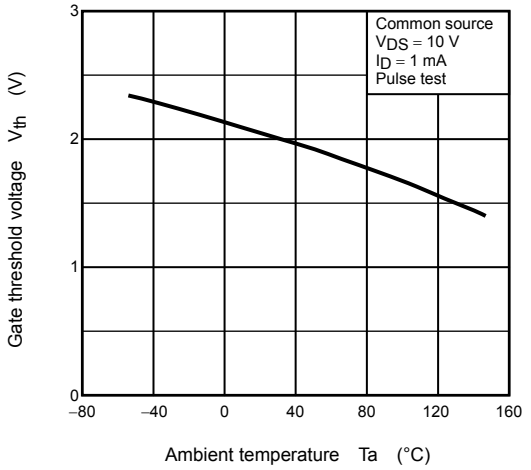
I_{DR} – V_{DS}



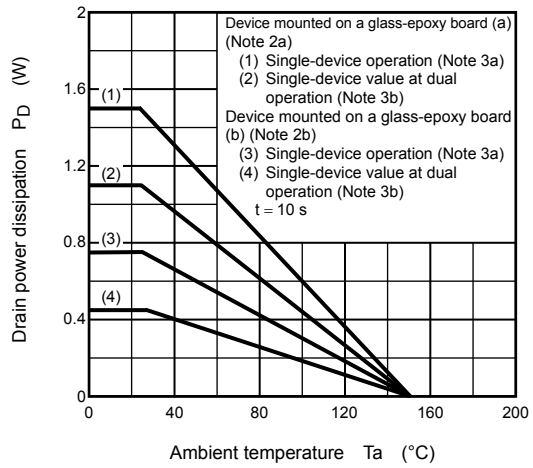
Capacitance – V_{DS}



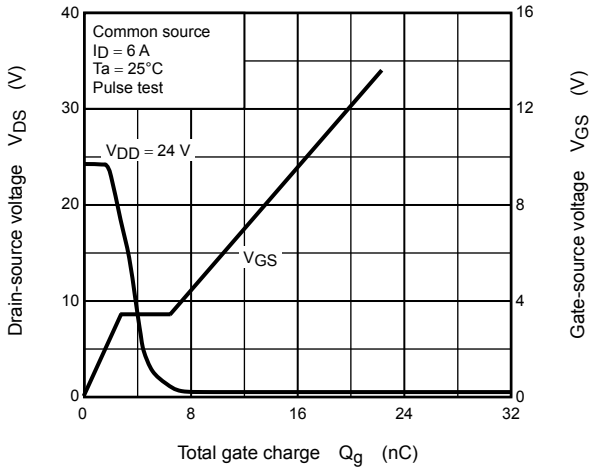
V_{th} – Ta



P_D – Ta

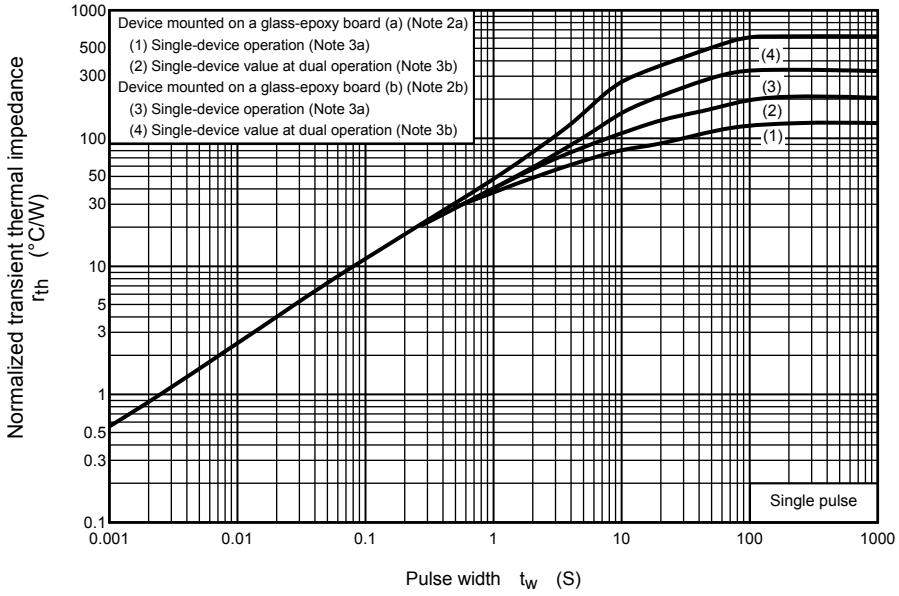


Dynamic input/output characteristics

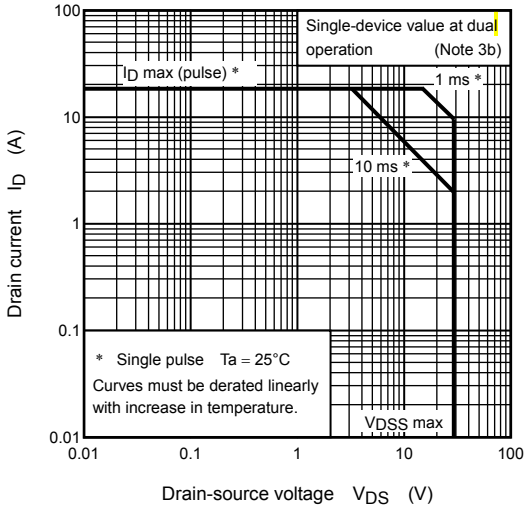


N-channel

$r_{th} - t_w$



Safe operating area



RESTRICTIONS ON PRODUCT USE

20070701-EN

- The information contained herein is subject to change without notice.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
  In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the “Handling Guide for Semiconductor Devices,” or “TOSHIBA Semiconductor Reliability Handbook” etc.
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