TOSHIBA Field Effect Transistor Silicon P Channel MOS Type (U-MOS III)

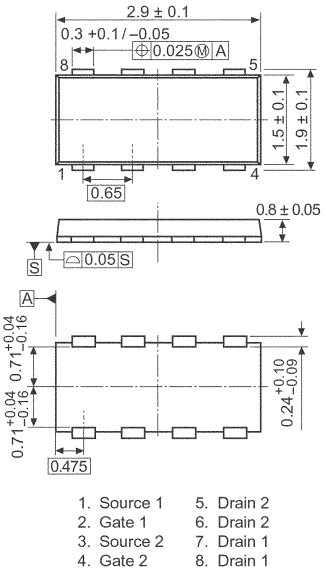
TPCF8301

Notebook PC Applications

Portable Equipment Applications

- Low drain-source ON resistance: $R_{DS\ (ON)}$ = 72 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 4.7 S (typ.)
- Low leakage current: I_{DSS} = −10 μA (max) (V_{DS} = −20 V)
- Enhancement model: V_{th} = −0.5 to −1.2 V
  (V_{DS} = −10 V, I_D = −200 μA)

Unit: mm



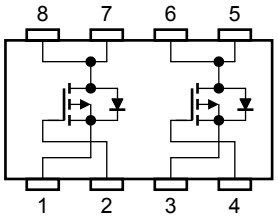
JEDEC	—
JEITA	—
TOSHIBA	2-3U1B

Weight: 0.011 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	−20	V
Drain-gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	−20	V
Gate-source voltage		V_{GSS}	±8	V
Drain current	DC (Note 1)	I_D	−2.7	A
	Pulse (Note 1)	I_{DP}	−10.8	
Drain power dissipation (t = 5 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 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	
Single pulse avalanche energy (Note 4)		E_{AS}	1.2	mJ
Avalanche current		I_{AR}	−1.35	A
Repetitive avalanche energy Single-device value at dual 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: 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).

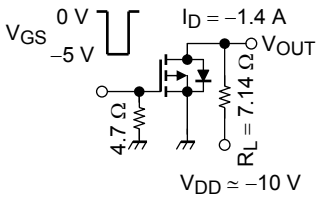
Thermal Characteristics

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

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

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

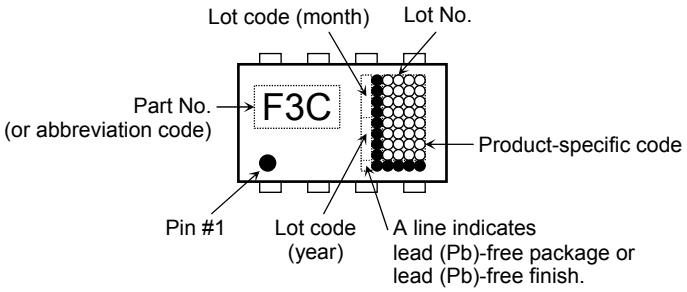
Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±8 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut-off current		I_{DSS}	V_{DS} = −20 V, V_{GS} = 0 V	—	—	−10	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = −10 mA, V_{GS} = 0 V	−20	—	—	V
		$V_{(BR)\ DSX}$	I_D = −10 mA, V_{GS} = 8 V	−12	—	—	
Gate threshold voltage		V_{th}	V_{DS} = −10 V, I_D = −200 μA	−0.5	—	−1.2	V
Drain-source ON resistance		$R_{DS\ (ON)}$	V_{GS} = −1.8 V, I_D = −0.7 A	—	215	300	mΩ
		$R_{DS\ (ON)}$	V_{GS} = −2.5 V, I_D = −1.4 A	—	110	160	
		$R_{DS\ (ON)}$	V_{GS} = −4.5 V, I_D = −1.4 A	—	72	110	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = −10 V, I_D = −1.4 A	2.4	4.7	—	S
Input capacitance		C_{iss}	V_{DS} = −10 V, V_{GS} = 0 V, f = 1 MHz	—	470	—	pF
Reverse transfer capacitance		C_{rss}		—	70	—	
Output capacitance		C_{oss}		—	80	—	
Switching time	Rise time	t_r	 Duty ≦ 1%, t_w = 10 μs	—	5	—	ns
	Turn-on time	t_{on}		—	9	—	
	Fall time	t_f		—	8	—	
	Turn-off time	t_{off}		—	26	—	
Total gate charge (gate-source plus gate-drain)		Q_g	V_{DD} ≃ −16 V, V_{GS} = −5 V, I_D = −2.7 A	—	6	—	nC
Gate-source charge		Q_{gs}		—	4	—	
Gate-drain (“miller”) charge		Q_{gd}		—	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}	—	—	—	−10.8	A
Forward voltage (diode)		V_{DSF}	I_{DR} = −2.7 A, V_{GS} = 0 V	—	—	1.2	V

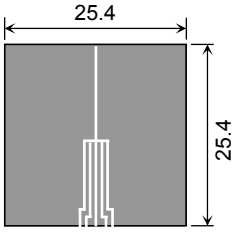
Marking (Note 6)



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

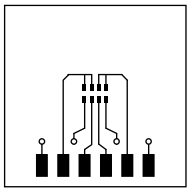
Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)

Note 3: a) The power dissipation and thermal resistance values are shown for a single device



FR-4
25.4 × 25.4 × 0.8
(unit: mm)

(a)



FR-4
25.4 × 25.4 × 0.8
(unit: mm)

(b)

(During single-device operation, power is only applied to one device.).

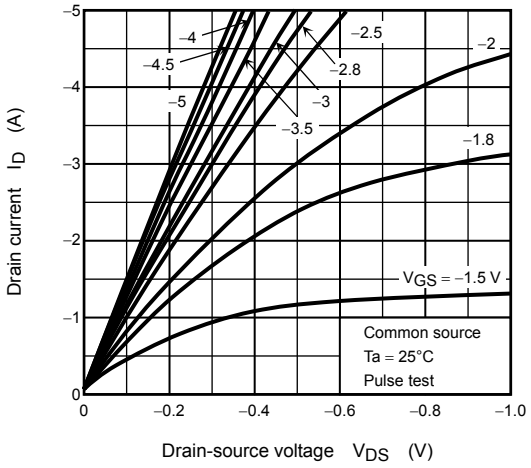
b) The power dissipation and thermal resistance values are shown for a single device
(During dual operation, power is evenly applied to both devices.).

Note 4: $V_{DD} = -16$ V, $T_{ch} = 25°C$ (initial), L = 0.5 mH, $R_G = 25\ \Omega$, $I_{AR} = -1.35$ A

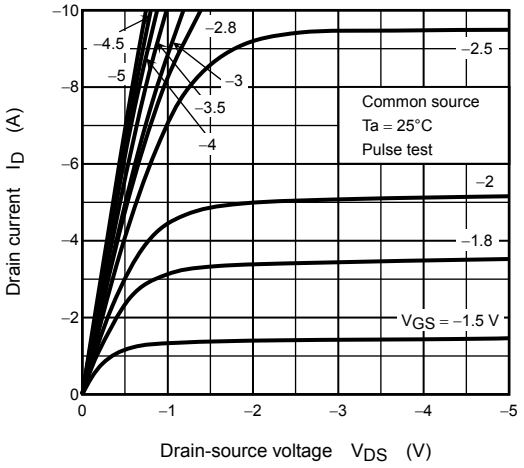
Note 5: Repetitive rating: Pulse width limited by maximum channel temperature.

Note 6: A dot on the lower left of the marking indicates Pin 1

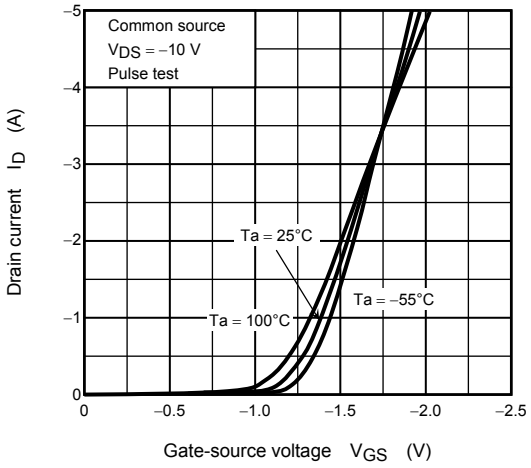
$I_D - V_{DS}$



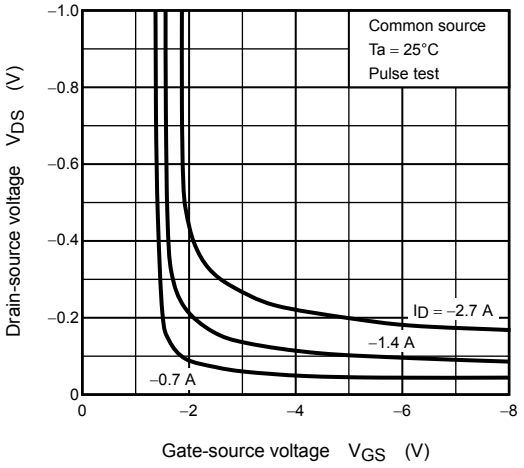
$I_D - V_{DS}$



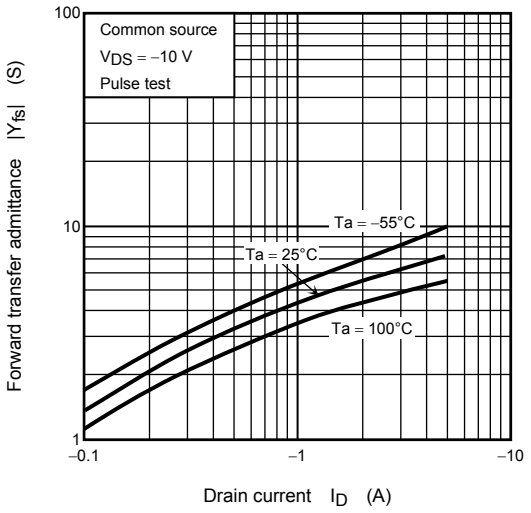
$I_D - V_{GS}$



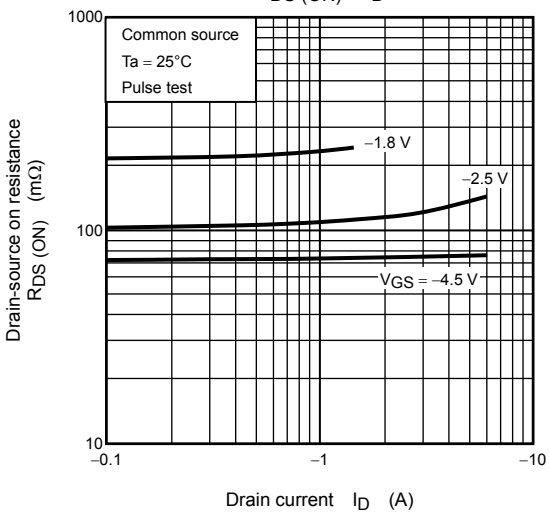
$V_{DS} - V_{GS}$



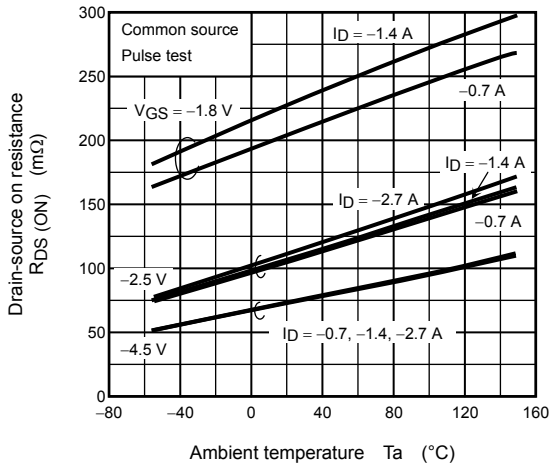
$|Y_{fs}| - I_D$



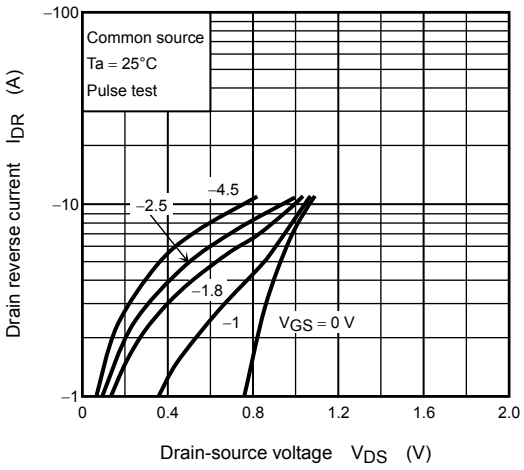
$R_{DS\ (ON)} - I_D$



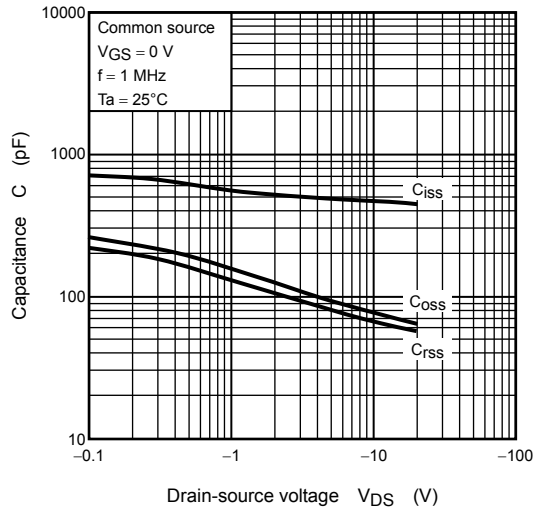
$R_{DS\ (ON)}$ – Ta



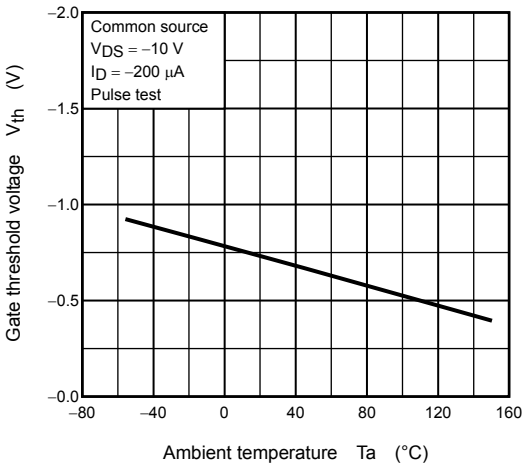
I_{DR} – V_{DS}



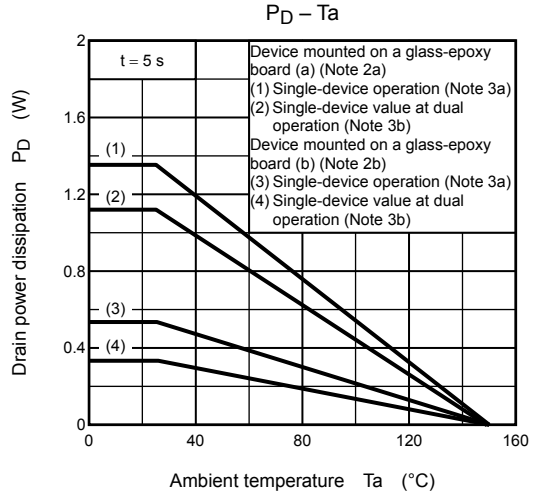
Capacitance – V_{DS}



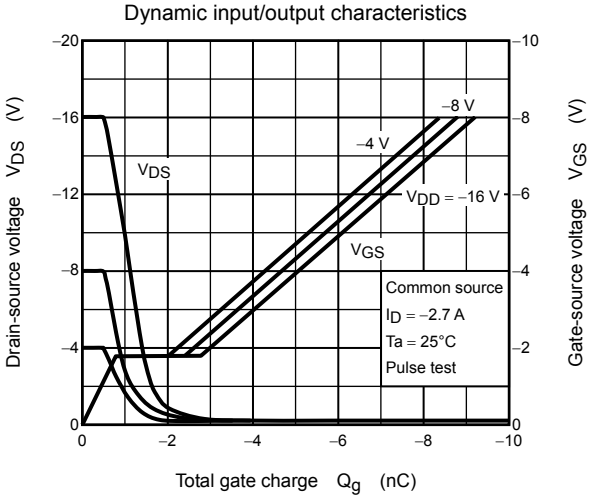
V_{th} – Ta

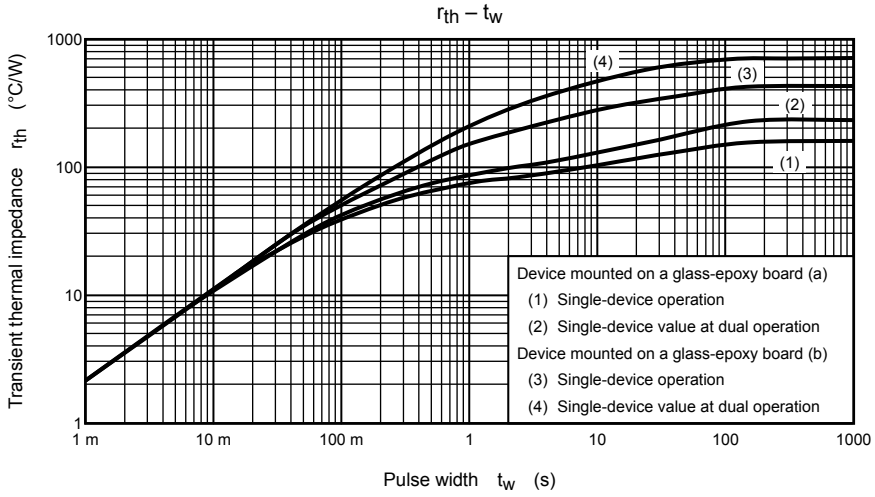


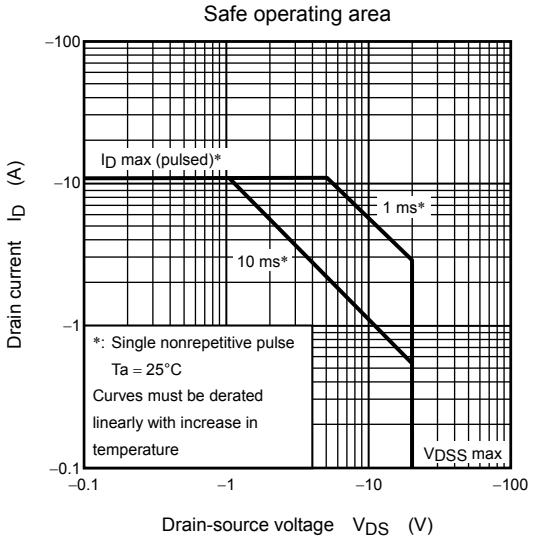
P_D – Ta



Dynamic input/output characteristics




$r_{th} - t_w$
Transient thermal impedance r_{th} (°C/W)
1000
100
10
1
1 m
10 m
100 m
1
10
100
1000
(4)
(3)
(2)
(1)
Device mounted on a glass-epoxy board (a)
(1) Single-device operation
(2) Single-device value at dual operation
Device mounted on a glass-epoxy board (b)
(3) Single-device operation
(4) Single-device value at dual operation
Pulse width t_w (s)


Safe operating area
Drain current I_D (A)
−100
−10
−1
−0.1
I_D max (pulsed)*
1 ms*
10 ms*
*: Single nonrepetitive pulse
Ta = 25°C
Curves must be derated
linearly with increase in
temperature
V_{DSS} max
−0.1
−1
−10
−100
Drain-source voltage V_{DS} (V)

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20070701-EN

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