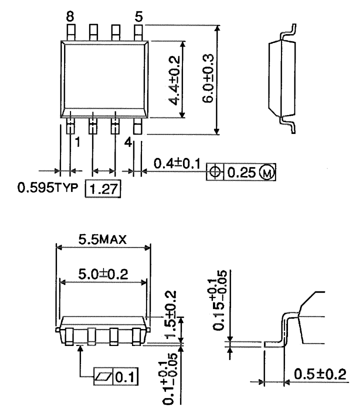
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (Ultra-High-Speed U-MOSIII)

TPC8021-H

High-Efficiency DC/DC Converter Applications
Notebook PC Applications
Portable-Equipment Applications

Unit: mm



1, 2, 3 SOURCE
4 GATE
5, 6, 7, 8 DRAIN

JEDEC	―
JEITA	―
TOSHIBA	2-6J1B

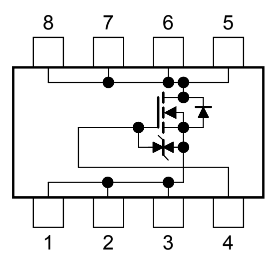
Weight: 0.085 g (typ.)

- Small footprint due to a small and thin package
- High-speed switching
- Small gate charge: Q_{SW} = 3.6 nC (typ.)
- Low drain-source ON-resistance: $R_{DS\ (ON)}$ = 13.5 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ =19 S (typ.)
- Low leakage current: I_{DSS} = 10 μA (max) (V_{DS} = 30 V)
- Enhancement mode: V_{th} = 1.1 to 2.3 V (V_{DS} = 10 V, I_D = 1 mA)

Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	30	V
Drain-gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	30	V
Gate-source voltage		V_{GSS}	±20	V
Drain current	DC (Note 1)	I_D	11	A
	Pulsed (Note 1)	I_{DP}	44	
Drain power dissipation (t = 10 s) (Note 2a)		P_D	1.9	W
Drain power dissipation (t = 10 s) (Note 2b)		P_D	1.0	W
Single-pulse avalanche energy (Note 3)		E_{AS}	79	mJ
Avalanche current		I_{AR}	11	A
Repetitive avalanche energy (Note 2a) (Note 4)		E_{AR}	0.14	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55 to 150	°C

Circuit Configuration



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

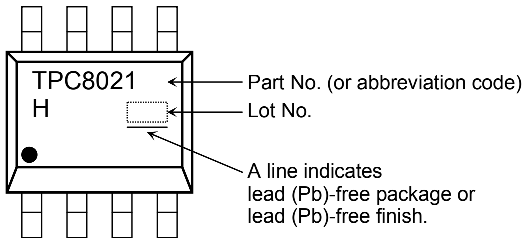
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within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

Thermal Characteristics

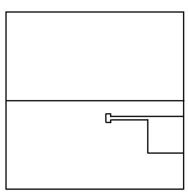
Characteristic		Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s)	(Note 2a)	$R_{th\ (ch\text{-}a)}$	65.8	°C/W
Thermal resistance, channel to ambient (t = 10 s)	(Note 2b)	$R_{th\ (ch\text{-}a)}$	125	°C/W

Marking (Note 5)



Note 1: The channel temperature should not exceed 150°C during use.

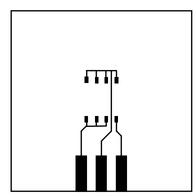
Note 2: (a) Device mounted on a glass-epoxy board (a)



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)

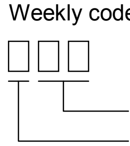
(b)

Note 3: V_{DD} = 24 V, T_{ch} = 25°C (initial), L = 0.5 mH, R_G = 25 Ω, I_{AR} = 11 A

Note 4: Repetitive rating: pulse width limited by max channel temperature

Note 5: • on the lower left of the marking indicates Pin 1.

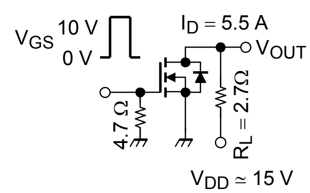
* Weekly code: (Three digits)



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

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

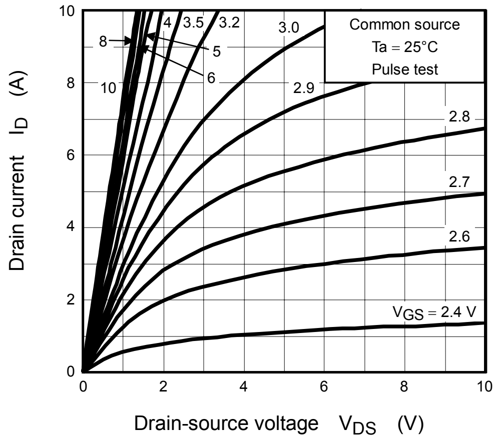
Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cutoff 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	1.1	—	2.3	V
Drain-source ON-resistance		$R_{DS\ (ON)}$	V_{GS} = 4.5 V, I_D = 5.5 A	—	18.5	25	mΩ
			V_{GS} = 10 V, I_D = 5.5 A	—	13.5	17	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 5.5 A	10	19	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	640	—	pF
Reverse transfer capacitance		C_{rss}		—	75	—	
Output capacitance		C_{oss}		—	300	—	
Switching time	Rise time	t_r		—	4	—	ns
	Turn-on time	t_{on}		—	8	—	
	Fall time	t_f		—	4	—	
	Turn-off time	t_{off}	Duty ≦ 1%, t_w = 10 μs	—	18	—	
Total gate charge (gate-source plus gate-drain)		Q_g	V_{DD} ≃ 24 V, V_{GS} = 10 V, I_D = 11 A	—	11	—	nC
			V_{DD} ≃ 24 V, V_{GS} = 5 V, I_D = 11 A	—	6.3	—	
Gate-source charge 1		Q_{gs1}	V_{DD} ≃ 24 V, V_{GS} = 10 V, I_D = 11A	—	2.2	—	
Gate-drain ("Miller") charge		Q_{gd}		—	2.6	—	
Gate switch charge		Q_{SW}		—	3.6	—	

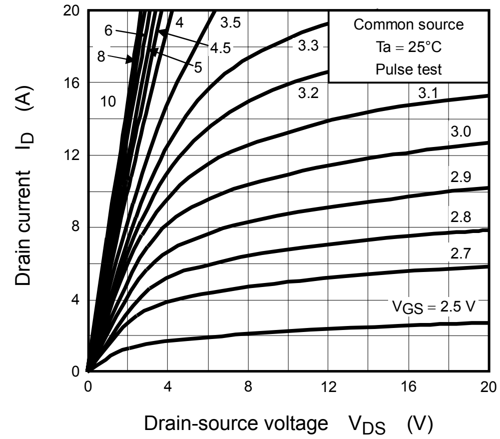
Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	44	A
Forward voltage (diode)		V_{DSF}	I_{DR} = 15 A, V_{GS} = 0 V	—	—	−1.2	V

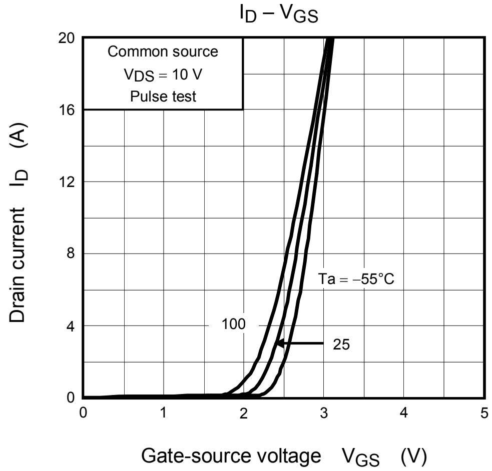
$I_D – V_{DS}$



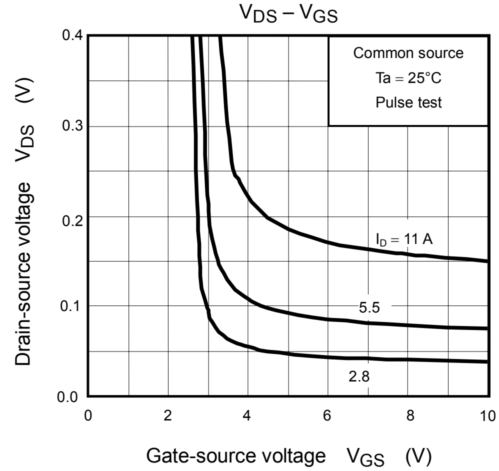
$I_D – V_{DS}$



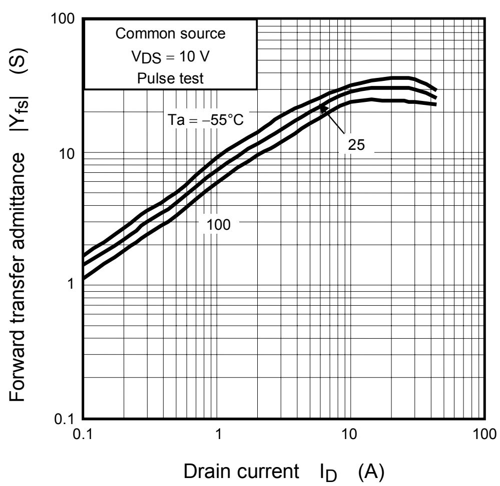
$I_D – V_{GS}$



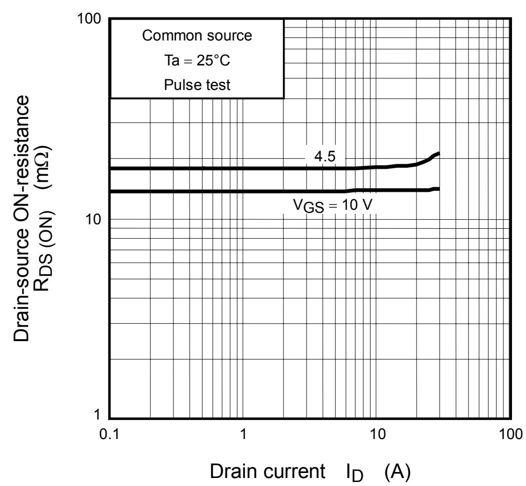
$V_{DS} – V_{GS}$

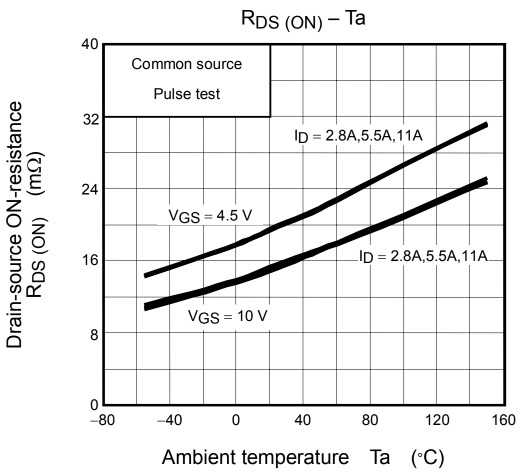


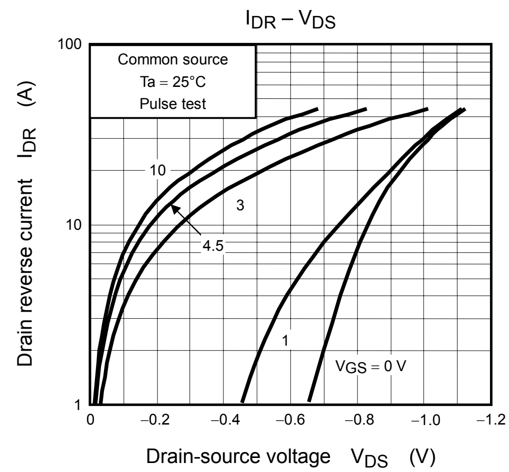
$|Y_{fs}| – I_D$

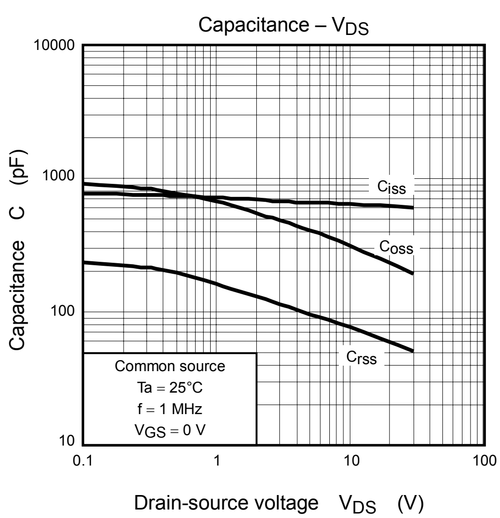


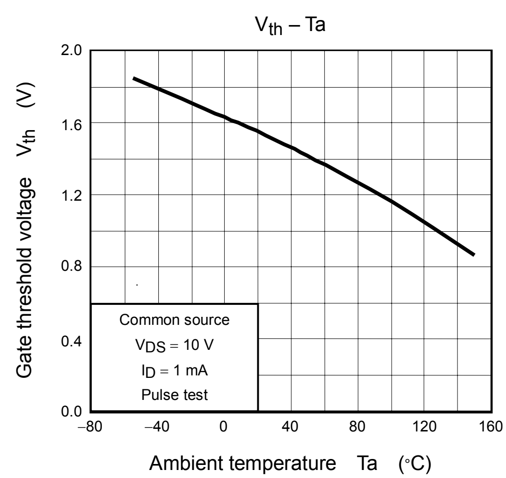
$R_{DS\ (ON)} – I_D$

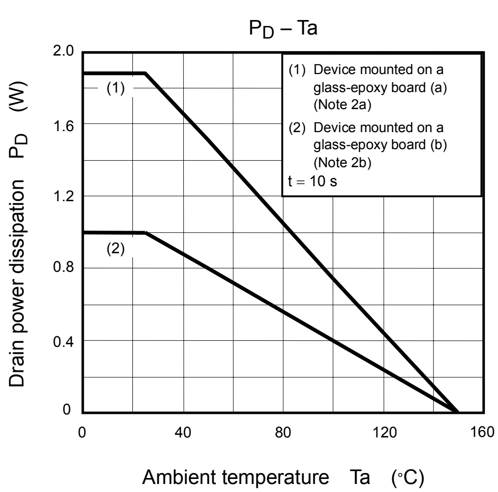


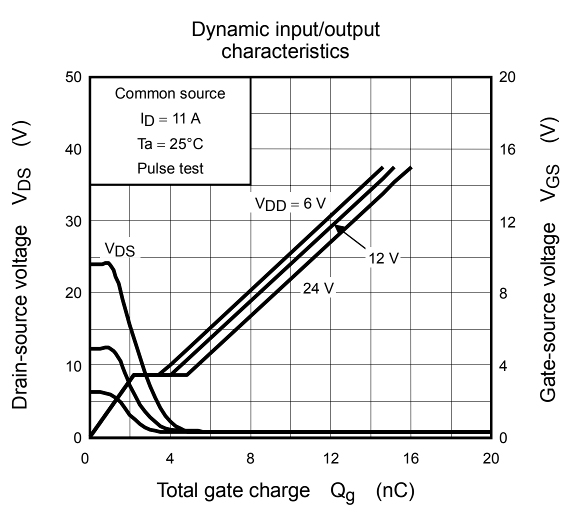

$R_{DS\ (ON)}$ – Ta
Common source
Pulse test
I_D = 2.8A,5.5A,11A
V_{GS} = 4.5 V
I_D = 2.8A,5.5A,11A
V_{GS} = 10 V
Drain-source ON-resistance $R_{DS\ (ON)}$ (mΩ)
Ambient temperature Ta (°C)

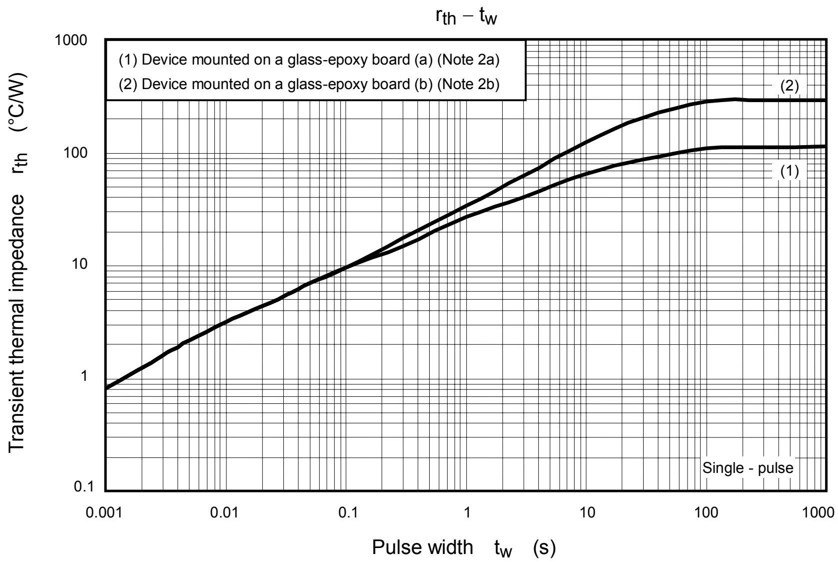

I_{DR} – V_{DS}
Common source
Ta = 25°C
Pulse test
10
3
4.5
1
V_{GS} = 0 V
Drain reverse current I_{DR} (A)
Drain-source voltage V_{DS} (V)


Capacitance – V_{DS}
C_{iss}
C_{oss}
C_{rss}
Common source
Ta = 25°C
f = 1 MHz
V_{GS} = 0 V
Capacitance C (pF)
Drain-source voltage V_{DS} (V)

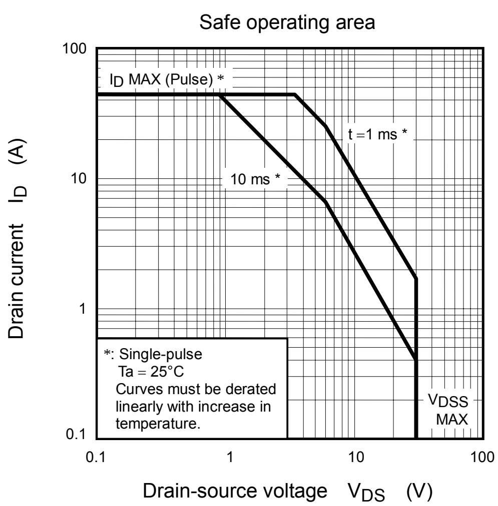

V_{th} – Ta
Common source
V_{DS} = 10 V
I_D = 1 mA
Pulse test
Gate threshold voltage V_{th} (V)
Ambient temperature Ta (°C)


P_D – Ta
(1) Device mounted on a glass-epoxy board (a) (Note 2a)
(2) Device mounted on a glass-epoxy board (b) (Note 2b)
t = 10 s
(1)
(2)
Drain power dissipation P_D (W)
Ambient temperature Ta (°C)


Dynamic input/output characteristics
Common source
I_D = 11 A
Ta = 25°C
Pulse test
V_{DD} = 6 V
12 V
24 V
V_{DS}
Drain-source voltage V_{DS} (V)
Gate-source voltage V_{GS} (V)
Total gate charge Q_g (nC)



$r_{th} - t_w$
(1) Device mounted on a glass-epoxy board (a) (Note 2a)
(2) Device mounted on a glass-epoxy board (b) (Note 2b)
(2)
(1)
Single - pulse
Transient thermal impedance r_{th} (°C/W)
1000
100
10
1
0.1
0.001
0.01
0.1
1
10
100
1000
Pulse width t_w (s)



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

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