TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (U-MOSⅣ)

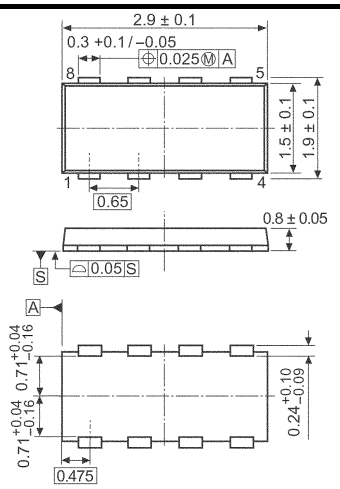
TPCF8003

Notebook PC Applications

Portable Equipment Applications

- Small footprint due to small and thin package
- Low drain-source ON-resistance: $R_{DS\ (ON)}$ =14 mΩ (typ.) (VGS= 4.5V)
- Low leakage current: I_{DSS} = 10 μA (max) (V_{DS} = 20 V)
- Enhancement mode: V_{th} = 0.5 to 1.2 V (V_{DS} = 10 V, I_D = 200 μA)

Unit: mm



1. Drain 5.Source
2. Drain 6. Drain
3. Drain 7. Drain
4. Gate 8. Drain

JEDEC	—
JEITA	—
TOSHIBA	2-3U1A

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}	±12	V
Drain current	DC (Note 1)	I_D	7	A
	Pulse (Note 1)	I_{DP}	28	
Drain power dissipation	(t = 5 s) (Note 2a)	P_D	2.5	W
Drain power dissipation	(t = 5 s) (Note 2b)	P_D	0.7	W
Single pulse avalanche energy (Note 3)		E_{AS}	3.2	mJ
Avalanche current		I_{AR}	3.5	A
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55 to 150	°C

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).

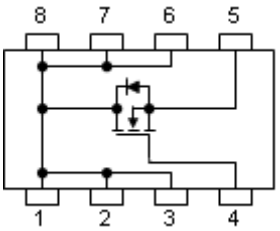
Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 5 s) (Note 2a)	$R_{th\ (ch-a)}$	50.0	°C/W
Thermal resistance, channel to ambient (t = 5 s) (Note 2b)	$R_{th\ (ch-a)}$	178.6	°C/W

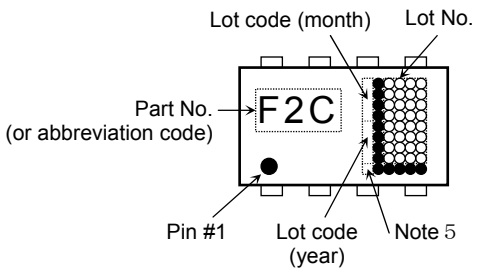
Note: For Notes 1 to 3, refer to the next page.

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

Circuit Configuration

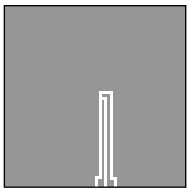


Marking (Note 4)



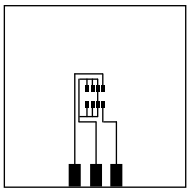
Note 1: Ensure that the channel temperature does not exceed 150°C.

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



FR-4
25.4 × 25.4 × 0.8
(Unit: mm)

(a)



FR-4
25.4 × 25.4 × 0.8
(Unit: mm)

(b)

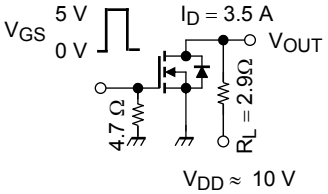
Note 3: V_{DD} = 16 V, T_{ch} = 25°C (initial), L = 0.2 mH, R_G = 25 Ω, I_{AR} = 3.5 A

Note 4: • on lower left of the marking indicates Pin 1.

Note 5: A dot marking for identifying the indication of product Labels.
Without a dot: [[Pb]]/INCLUDES > MCV
With a dot: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

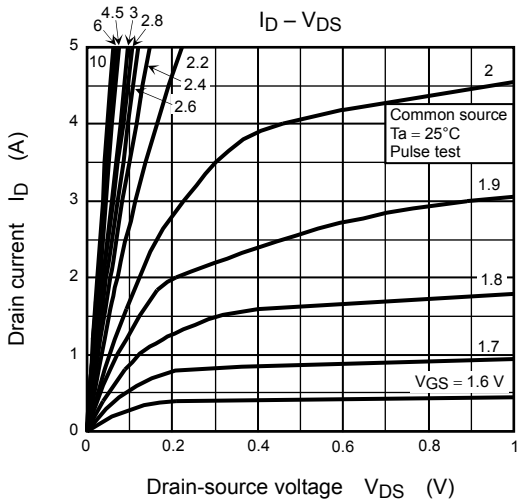
Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

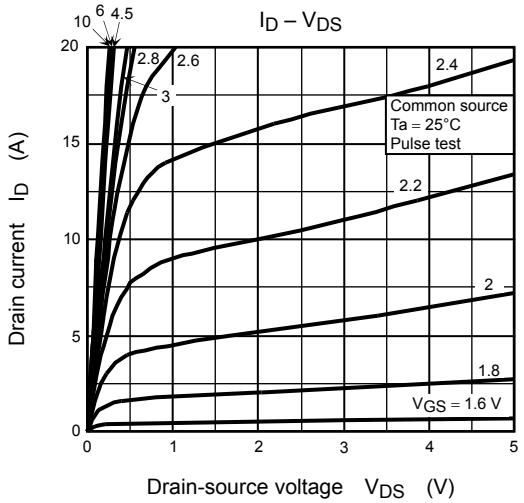
Electrical Characteristics (Ta = 25°C)

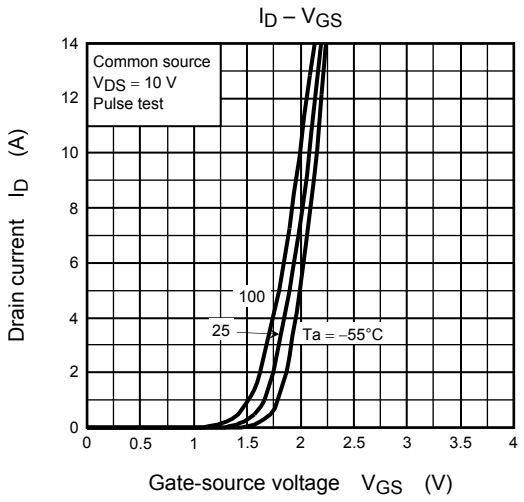
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±12 V, V_{DS} = 0 V	—	—	±100	nA
Drain cut-off current		I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V	—	—	10	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 10 mA, V_{GS} = 0 V	20	—	—	V
		$V_{(BR)\ DSX}$	I_D = 10 mA, V_{GS} = −12 V	8	—	—	
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} = 2.5 V, I_D = 3.5 A	—	24	34	mΩ
			V_{GS} = 4.5 V, I_D = 3.5 A	—	14	18	
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	500	—	pF
Reverse transfer capacitance		C_{rss}		—	155	—	
Output capacitance		C_{oss}		—	215	—	
Switching time	Rise time	t_r	 Duty ≤ 1%, t_w = 10 μs	—	5.2	—	ns
	Turn-on time	t_{on}		—	11	—	
	Fall time	t_f		—	10	—	
	Turn-off time	t_{off}		—	23	—	
Total gate charge (gate-source plus gate-drain)		Q_g	V_{DD} ≈ 16 V, V_{GS} = 5 V, I_D = 7.0 A	—	9.5	—	nC
Gate-source charge 1		Q_{gs1}		—	1.6	—	
Gate-drain ("miller") charge		Q_{gd}		—	4	—	

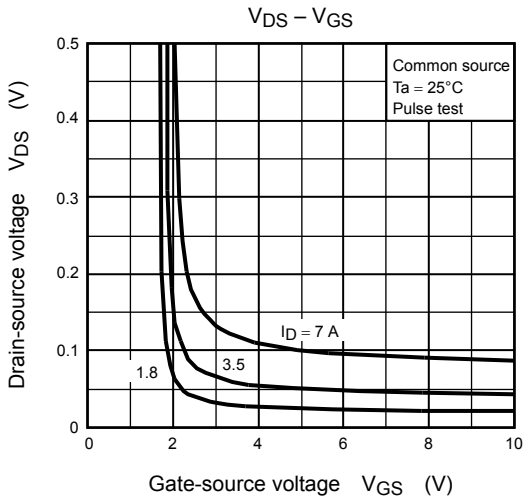
Source-Drain Ratings and Characteristics (Ta = 25°C)

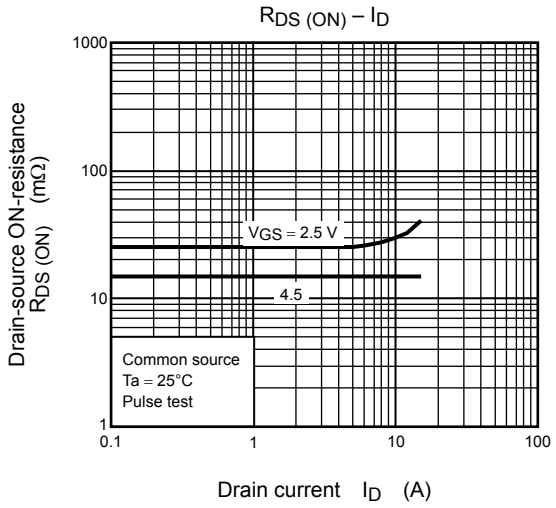
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	28	A
Forward voltage (diode)		V_{DSF}	I_{DR} = 7.0 A, V_{GS} = 0 V	—	—	−1.2	V

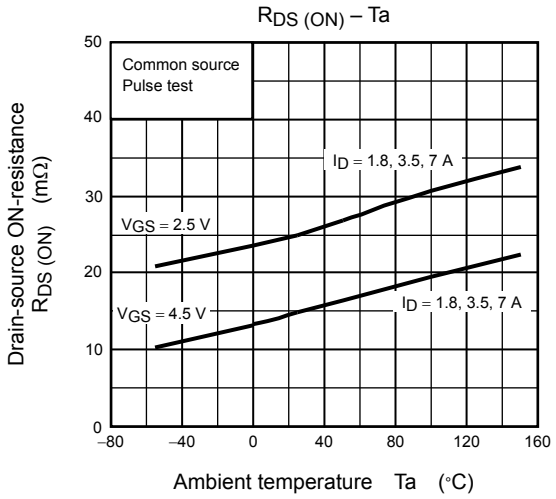

ID – VDS
Common source
Ta = 25°C
Pulse test
VGS = 1.6 V
Drain current ID (A)
Drain-source voltage VDS (V)

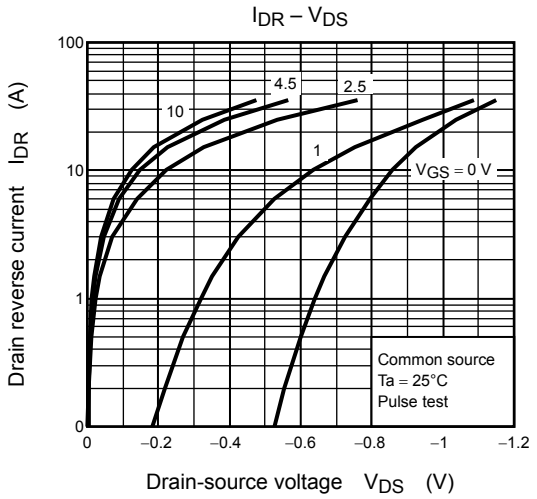

ID – VDS
Common source
Ta = 25°C
Pulse test
VGS = 1.6 V
Drain current ID (A)
Drain-source voltage VDS (V)

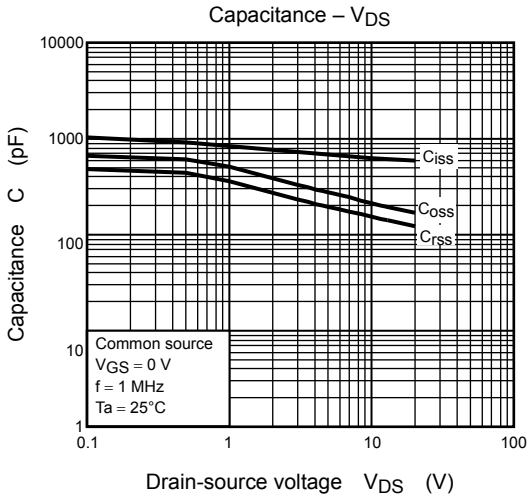

ID – VGS
Common source
VDS = 10 V
Pulse test
Ta = −55°C
Drain current ID (A)
Gate-source voltage VGS (V)

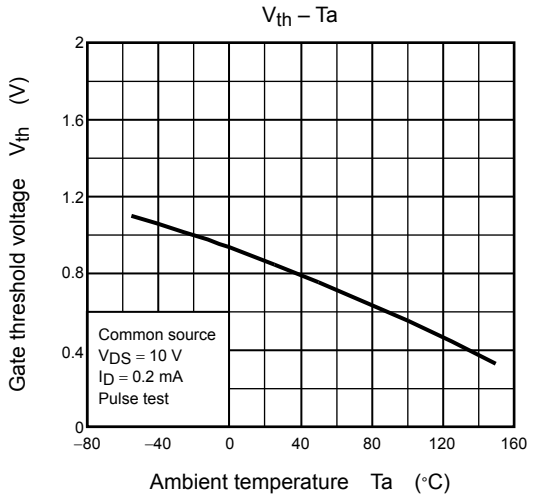

VDS – VGS
Common source
Ta = 25°C
Pulse test
ID = 7 A
Drain-source voltage VDS (V)
Gate-source voltage VGS (V)

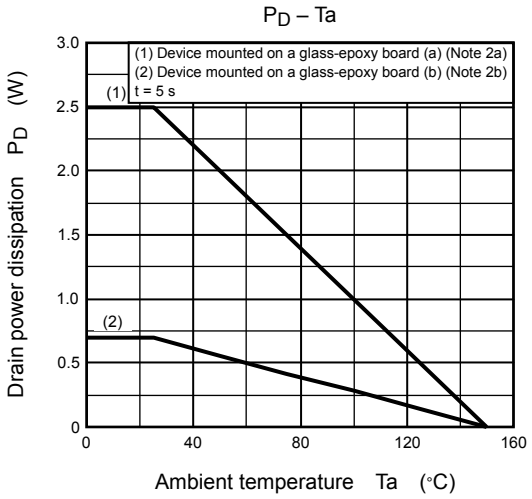

RDS (ON) – ID
VGS = 2.5 V
4.5
Common source
Ta = 25°C
Pulse test
Drain-source ON-resistance RDS (ON) (mΩ)
Drain current ID (A)

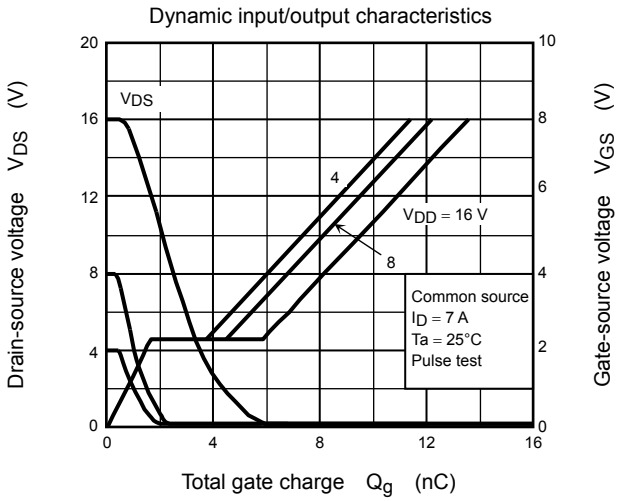

RDS (ON) – Ta
Common source
Pulse test
ID = 1.8, 3.5, 7 A
VGS = 2.5 V
VGS = 4.5 V
ID = 1.8, 3.5, 7 A
Drain-source ON-resistance RDS (ON) (mΩ)
Ambient temperature Ta (°C)

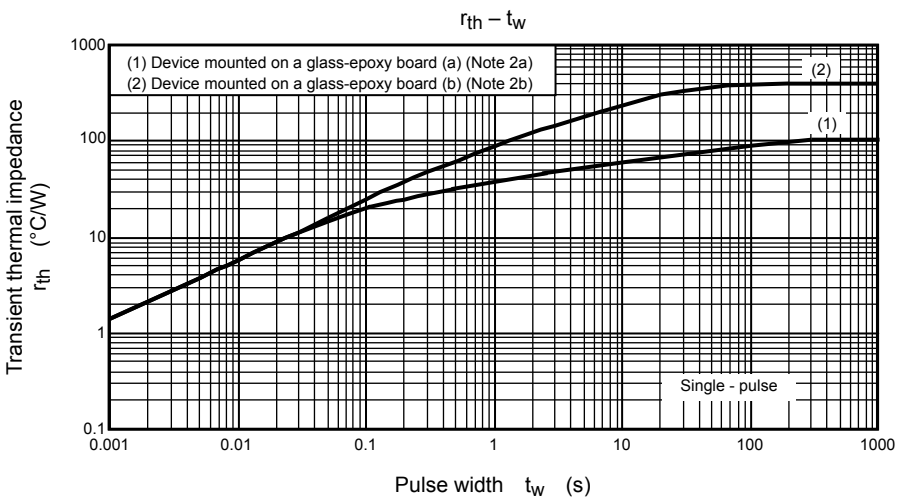

IDR – VDS
10
4.5
2.5
1
VGS = 0 V
Common source
Ta = 25°C
Pulse test
Drain reverse current IDR (A)
Drain-source voltage VDS (V)

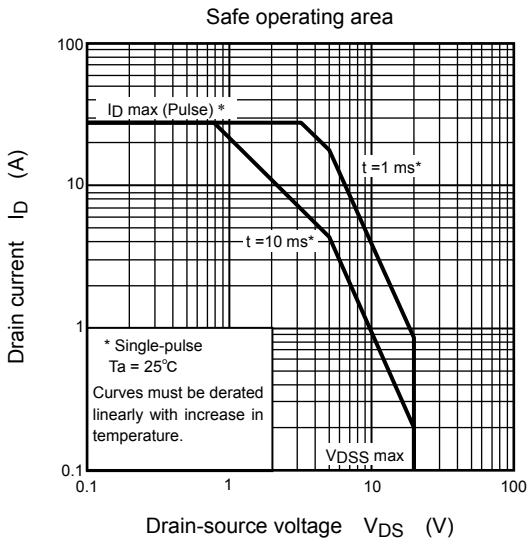

Capacitance – VDS
Ciss
Coss
Crss
Common source
VGS = 0 V
f = 1 MHz
Ta = 25°C
Capacitance C (pF)
Drain-source voltage VDS (V)


Vth – Ta
Common source
VDS = 10 V
ID = 0.2 mA
Pulse test
Gate threshold voltage Vth (V)
Ambient temperature Ta (°C)


PD – Ta
(1) Device mounted on a glass-epoxy board (a) (Note 2a)
(2) Device mounted on a glass-epoxy board (b) (Note 2b)
t = 5 s
(1)
(2)
Drain power dissipation PD (W)
Ambient temperature Ta (°C)


Dynamic input/output characteristics
VDS
4
VDD = 16 V
8
Common source
ID = 7 A
Ta = 25°C
Pulse test
Drain-source voltage VDS (V)
Gate-source voltage VGS (V)
Total gate charge Qg (nC)


rth – tw
(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 rth (°C/W)
1000
100
10
1
0.1
0.001
0.01
0.1
1
10
100
1000
Pulse width tw (s)


Safe operating area
ID max (Pulse) *
t =1 ms*
t =10 ms*
* Single-pulse
Ta = 25℃
Curves must be derated linearly with increase in temperature.
VDSS max
Drain current ID (A)
100
10
1
0.1
0.1
1
10
100
Drain-source voltage VDS (V)

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