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

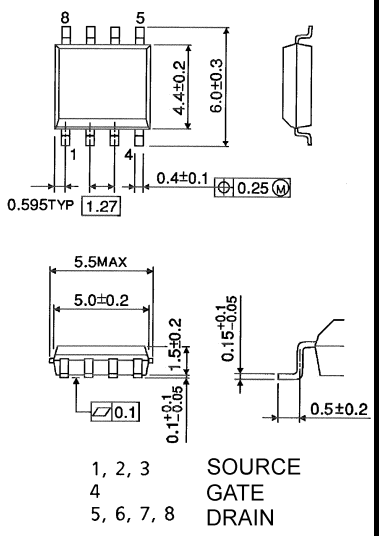
TPC8120

Lithium Ion Battery Applications

Power Management Switch Applications

- Small footprint due to small and thin package
- Low drain-source ON-resistance: $R_{DS\ (ON)}$ = 2.6 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 80 S (typ.)
- Low leakage current: I_{DSS} = −10 μA (max) (V_{DS} = −30 V)
- Enhancement mode: V_{th} = −0.8 to −2.0 V (V_{DS} = −10 V, I_D = −1 mA)

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-6J1B

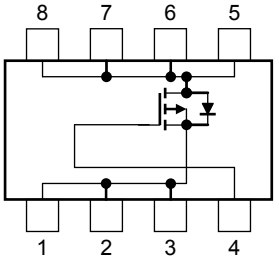
Weight: 0.080 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		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}	−25/+20	V
Drain current	DC (Note 1)	I_D	−18	A
	Pulse (Note 1)	I_{DP}	−72	
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}	211	mJ
Avalanche current		I_{AR}	−18	A
Repetitive avalanche energy (Note 2a) (Note 4)		E_{AR}	0.03	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55 to 150	°C

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

Circuit Configuration



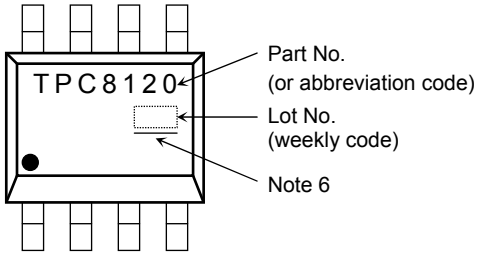
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within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

Characteristics	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)

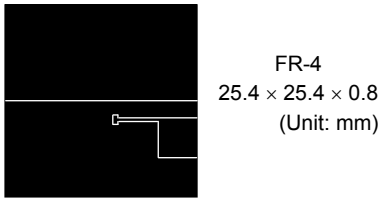


Note 6: A line under a Lot No. identifies the indication of product Labels [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

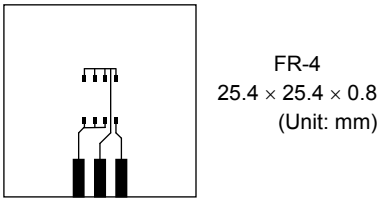
Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical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

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)



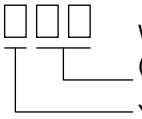
(b)

Note 3: V_{DD} = −24 V, T_{ch} = 25°C (initial), L = 500 μH, R_G = 25 Ω, I_{AR} = −18 A

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

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

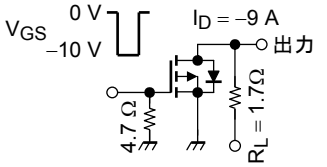
※ Weekly code: (Three digits)



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)

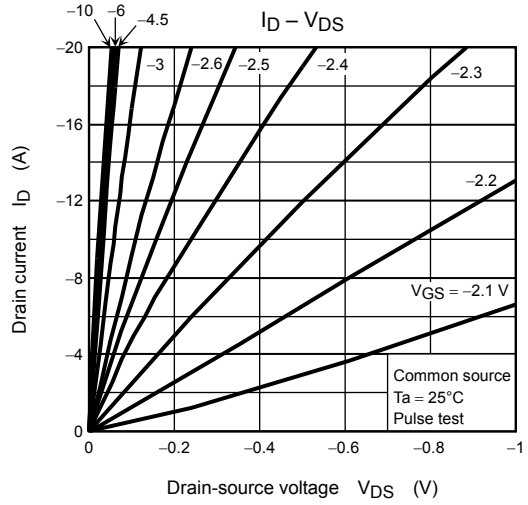
Electrical Characteristics (Ta = 25°C)

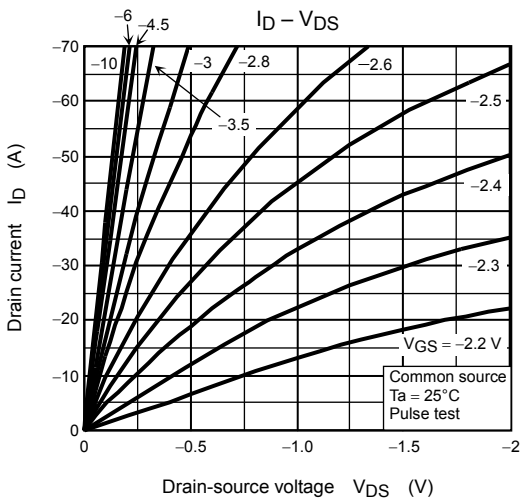
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±20 V, V_{DS} = 0 V	—	—	±100	nA
Drain cut-OFF current		I_{DSS}	V_{DS} = −30 V, V_{GS} = 0 V	—	—	−10	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = −10 mA, V_{GS} = 0 V	−30	—	—	V
		$V_{(BR)\ DSX}$	I_D = −10 mA, V_{GS} = 10V (Note 7)	−21	—	—	
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 = −9 A	—	3.3	4.2	mΩ
			V_{GS} = −10 V, I_D = −9 A	—	2.6	3.2	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = −10 V, I_D = −9 A	40	80	—	S
Input capacitance		C_{iss}	V_{DS} = −10 V, V_{GS} = 0 V, f = 1 MHz	—	7420	—	pF
Reverse transfer capacitance		C_{rss}		—	1180	—	
Output capacitance		C_{oss}		—	1440	—	
Switching time	Rise time	t_r	 Duty ≤ 1%, t_w = 10 μs	—	10	—	ns
	Turn-ON time	t_{on}		—	18	—	
	Fall time	t_f		—	275	—	
	Turn-OFF time	t_{off}		—	790	—	
Total gate charge (gate-source plus gate-drain)		Q_g	V_{DD} ≈ −24 V, V_{GS} = −10 V, I_D = −18 A	—	180	—	nC
Gate-source charge 1		Q_{gs1}		—	20	—	
Gate-drain (“miller”) charge		Q_{gd}		—	40	—	

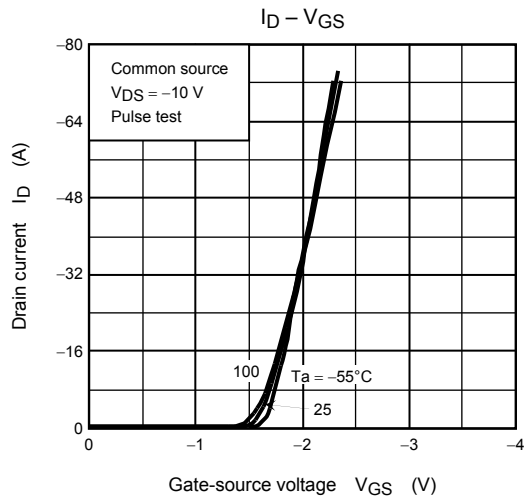
Source-Drain Ratings and Characteristics (Ta = 25°C)

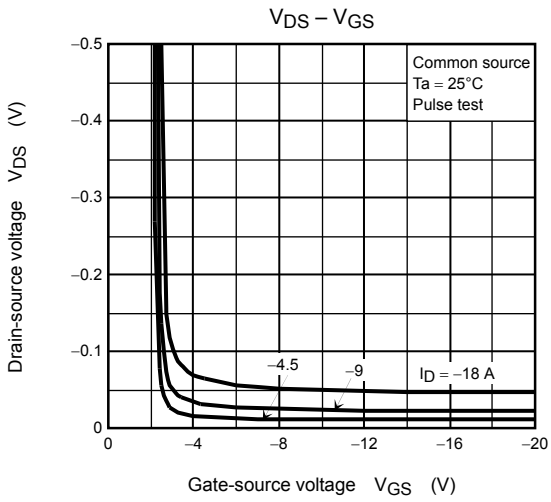
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	−72	A
Forward voltage (diode)		V_{DSF}	I_{DR} = −18 A, V_{GS} = 0 V	—	—	1.2	V

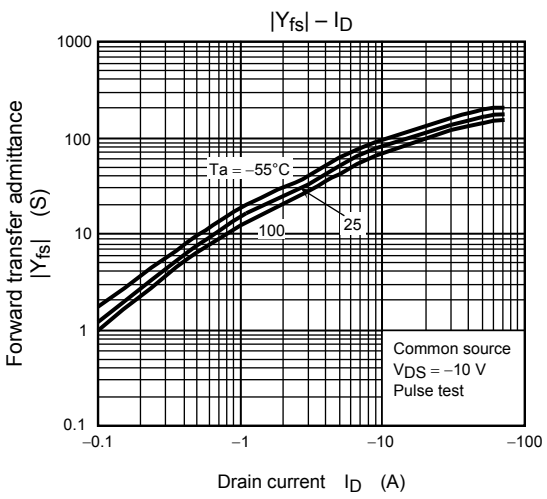
Note 7: V_{DSX} mode (the application of a plus voltage between gate and source) may cause decrease in maximum rating of drain-source voltage.

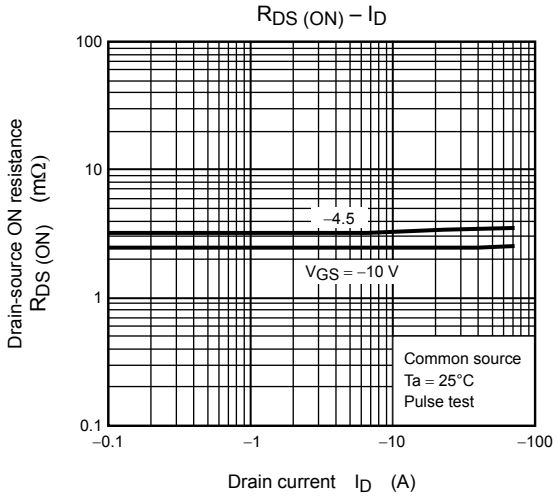

$I_D - V_{DS}$
−10
−6
−4.5
−3
−2.6
−2.5
−2.4
−2.3
−2.2
V_{GS} = −2.1 V
Common source
Ta = 25°C
Pulse test
Drain current I_D (A)
Drain-source voltage V_{DS} (V)


$I_D - V_{DS}$
−6
−4.5
−10
−3
−2.8
−2.6
−3.5
−2.5
−2.4
−2.3
V_{GS} = −2.2 V
Common source
Ta = 25°C
Pulse test
Drain current I_D (A)
Drain-source voltage V_{DS} (V)

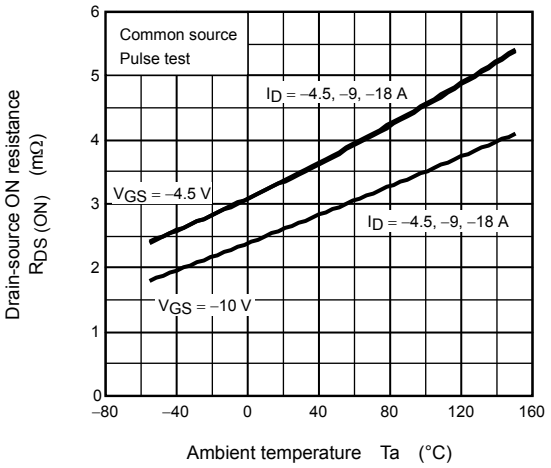

$I_D - V_{GS}$
Common source
V_{DS} = −10 V
Pulse test
100
Ta = −55°C
25
Drain current I_D (A)
Gate-source voltage V_{GS} (V)


$V_{DS} - V_{GS}$
Common source
Ta = 25°C
Pulse test
−4.5
−9
I_D = −18 A
Drain-source voltage V_{DS} (V)
Gate-source voltage V_{GS} (V)

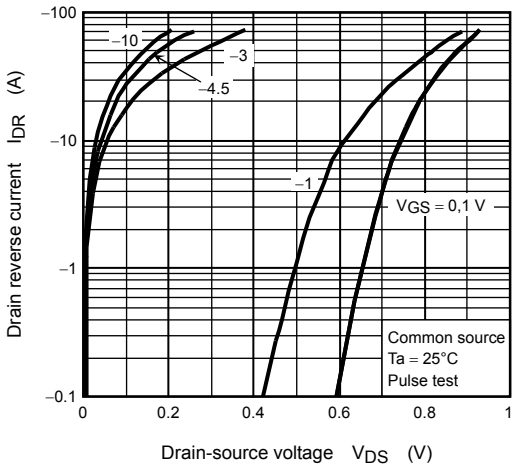

$|Y_{fs}| - I_D$
Ta = −55°C
100
25
Common source
V_{DS} = −10 V
Pulse test
Forward transfer admittance $|Y_{fs}|$ (S)
Drain current I_D (A)


$R_{DS\ (ON)} - I_D$
−4.5
V_{GS} = −10 V
Common source
Ta = 25°C
Pulse test
Drain-source ON resistance $R_{DS\ (ON)}$ (mΩ)
Drain current I_D (A)

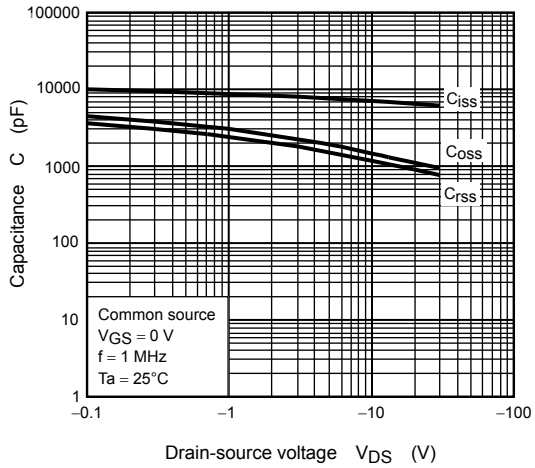
$R_{DS\ (ON)}$ – Ta



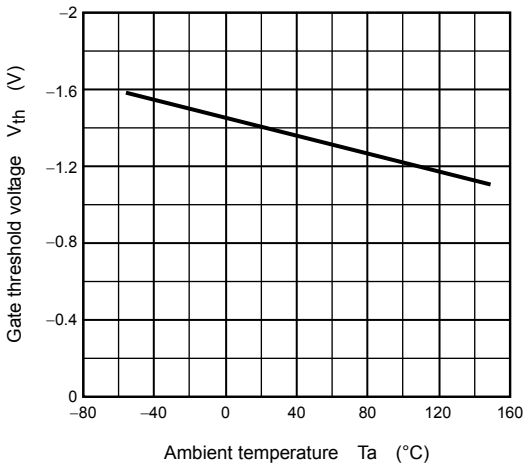
I_{DR} – V_{DS}



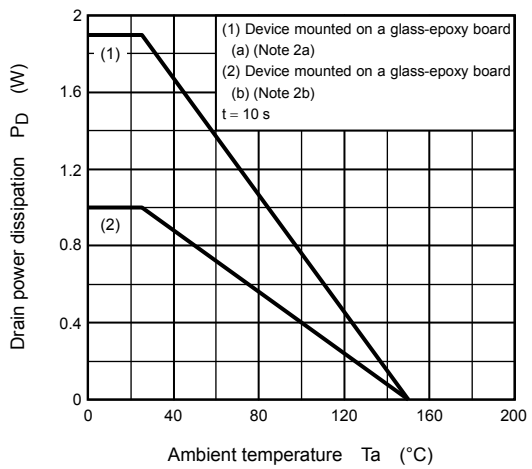
Capacitance – V_{DS}



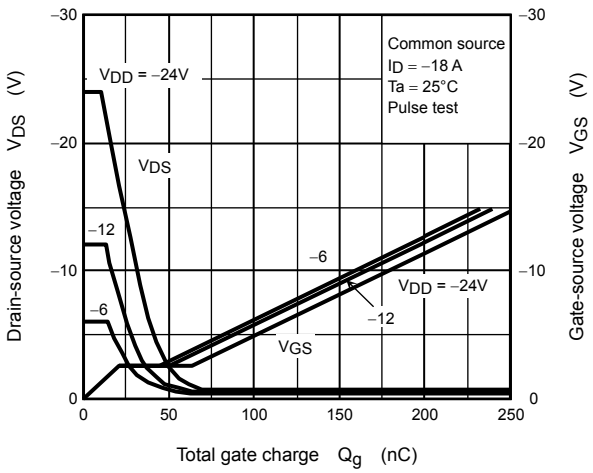
V_{th} – Ta

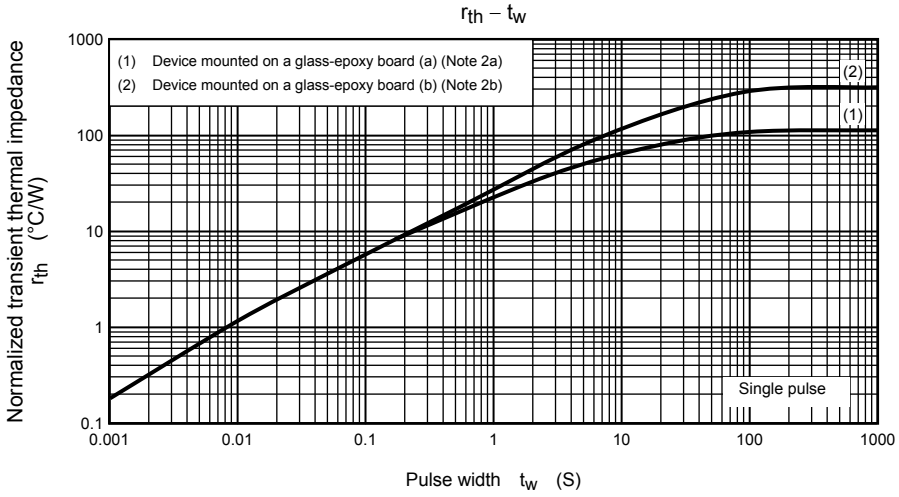


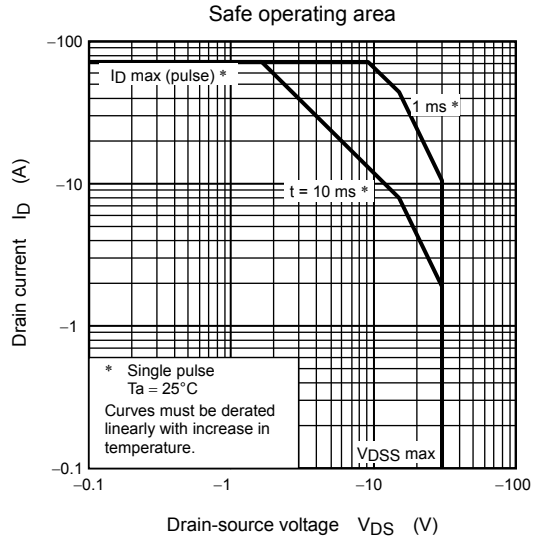
P_D – Ta



Dynamic input/output characteristics




$r_{th} - t_w$
(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
Normalized 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) *
1 ms *
t = 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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