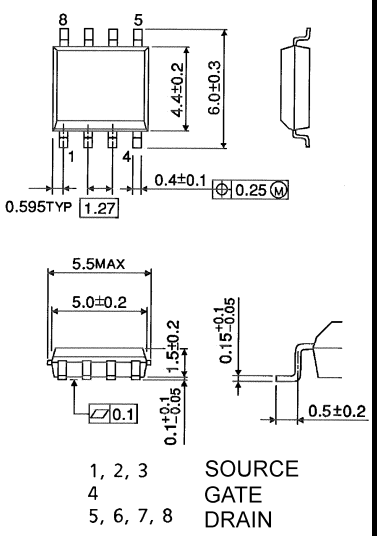
TOSHIBA Field Effect Transistor Silicon P Channel MOS Type (U-MOSⅥ)

TPC8123

Lithium Ion Battery Applications

Power Management Switch Applications

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-6J1B

Weight: 0.080 g (typ.)

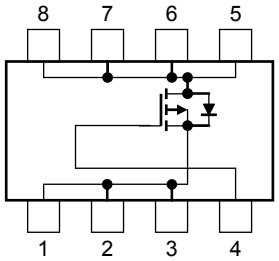
- Small footprint due to small and thin package
- Low drain-source ON-resistance: $R_{DS\ (ON)}$ = 7.0 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 36 S (typ.)
- Low leakage current: I_{DSS} = −10 μA (max) (V_{DS} = −30 V)
- Enhancement mode: V_{th} = −0.8 to −2.0 V (V_{DS} = −10 V, I_D = −0.5 mA)

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	−11	A
	Pulse (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 (Note 1)		I_{AR}	−11	A
Repetitive avalanche energy (Note 2a) (Note 4)		E_{AR}	0.04	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



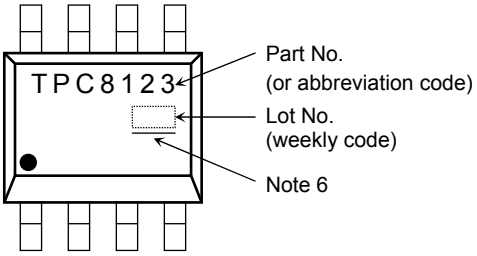
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within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

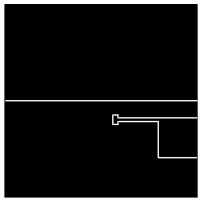


Note 6: A line under a Lot No. identifies the indication of product Labels [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

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.

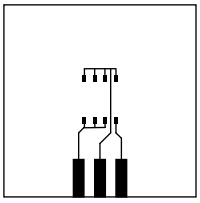
Note 1: Ensure that the channel temperature does not exceed 150°C.

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



FR-4
25.4 × 25.4 × 0.8
(Unit: mm)

(a)



FR-4
25.4 × 25.4 × 0.8
(Unit: mm)

(b)

Note 3: $V_{DD} = -24$ V, $T_{ch} = 25$ °C (initial), L = 500 μH, $R_G = 25\ \Omega$, $I_{AR} = -11$ A

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

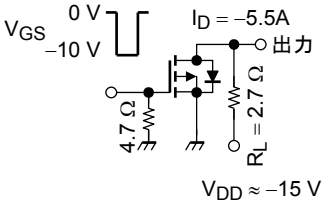
Note 5: • on lower left of the marking indicates Pin 1.

※ 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)

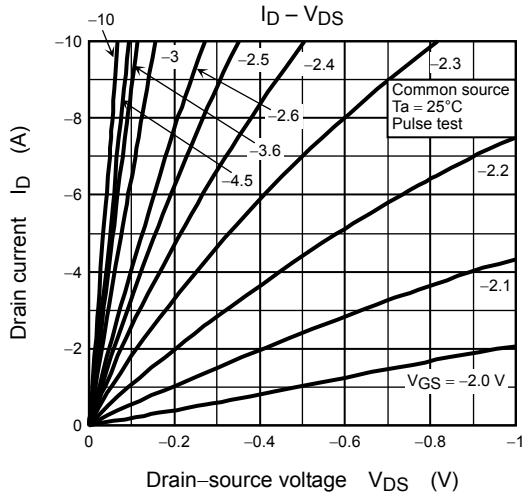
Electrical Characteristics (Ta = 25°C)

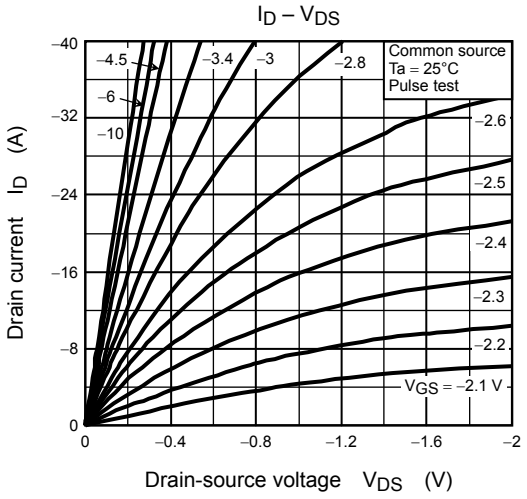
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 20$ V, $V_{DS} = 0$ V	—	—	±100	nA
Drain cut-OFF current		I_{DSS}	$V_{DS} = -30$ V, $V_{GS} = 0$ V	—	—	−10	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	$I_D = -10$ mA, $V_{GS} = 0$ V	−30	—	—	V
		$V_{(BR)\ DSX}$	$I_D = -10$ mA, $V_{GS} = 10$ V (Note 7)	−21	—	—	
Gate threshold voltage		V_{th}	$V_{DS} = -10$ V, $I_D = -0.5$ mA	−0.8	—	−2.0	V
Drain-source ON-resistance		$R_{DS\ (ON)}$	$V_{GS} = -4.5$ V, $I_D = -5.5$ A	—	9.5	12.5	mΩ
			$V_{GS} = -10$ V, $I_D = -5.5$ A	—	7.0	9.0	
Forward transfer admittance		$\|Y_{fs}\|$	$V_{DS} = -10$ V, $I_D = -5.5$ A	18	36	—	S
Input capacitance		C_{iss}	$V_{DS} = -10$ V, $V_{GS} = 0$ V, f = 1 MHz	—	2940	—	pF
Reverse transfer capacitance		C_{rss}		—	460	—	
Output capacitance		C_{oss}		—	520	—	
Switching time	Rise time	t_r	 Duty ≤ 1%, $t_w = 10$ μs	—	10	—	ns
	Turn-ON time	t_{on}		—	18	—	
	Fall time	t_f		—	80	—	
	Turn-OFF time	t_{off}		—	250	—	
Total gate charge (gate-source plus gate-drain)		Q_g	$V_{DD} \approx -24$ V, $V_{GS} = -10$ V, $I_D = -11$ A	—	68	—	nC
Gate-source charge 1		Q_{gs1}		—	7	—	
Gate-drain ("miller") charge		Q_{gd}		—	18	—	

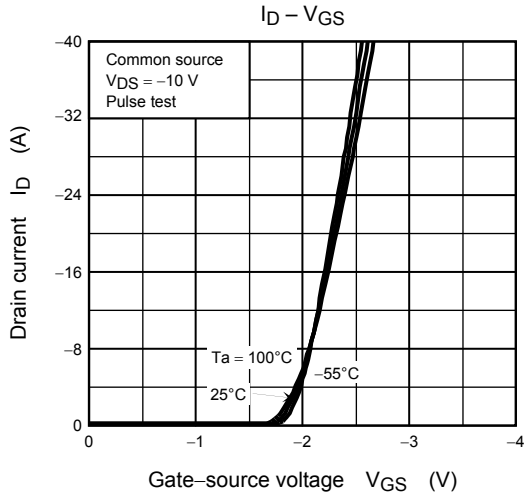
Source-Drain Ratings and Characteristics (Ta = 25°C)

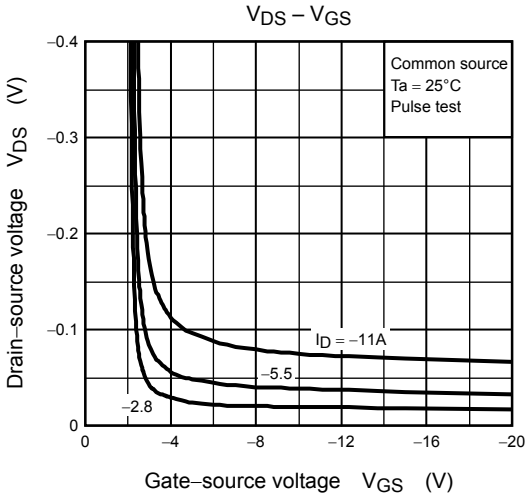
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	−44	A
Forward voltage (diode)		V_{DSF}	$I_{DR} = -11$ A, $V_{GS} = 0$ V	—	—	1.2	V

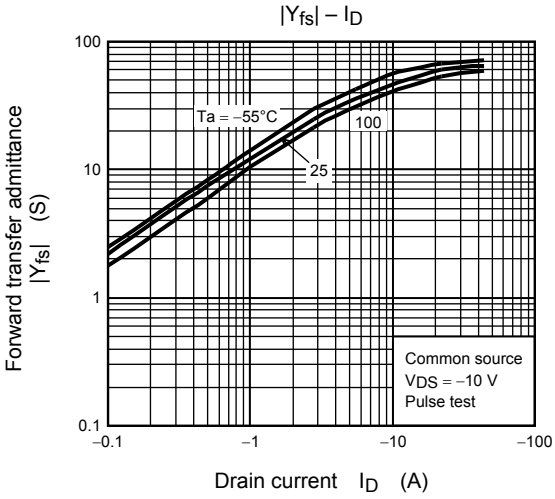
Note 7: VDSX mode (the application of a plus voltage between gate and source) may cause decrease in maximum rating of drain-source voltage.

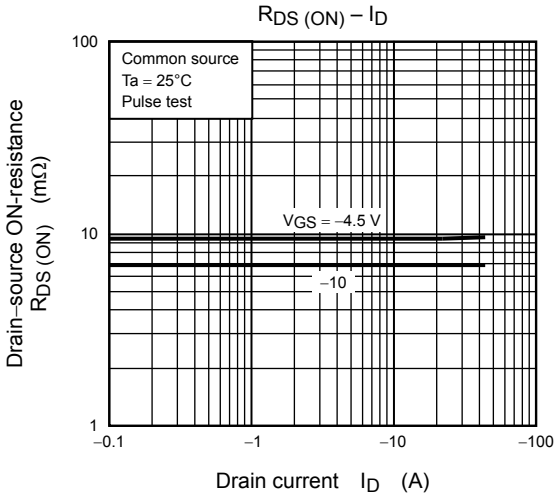

ID – VDS
Common source
Ta = 25°C
Pulse test
−10
−3
−2.5
−2.4
−2.3
−2.6
−3.6
−4.5
−2.2
−2.1
VGS = −2.0 V
Drain current ID (A)
Drain−source voltage VDS (V)


ID – VDS
Common source
Ta = 25°C
Pulse test
−4.5
−3.4
−3
−2.8
−6
−10
−2.6
−2.5
−2.4
−2.3
−2.2
VGS = −2.1 V
Drain current ID (A)
Drain-source voltage VDS (V)

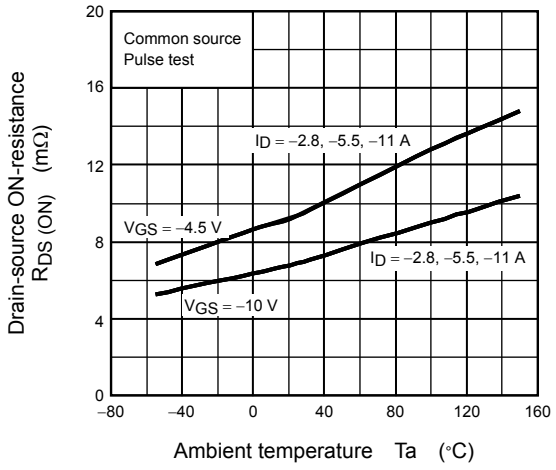

ID – VGS
Common source
VDS = −10 V
Pulse test
Ta = 100°C
−55°C
25°C
Drain current ID (A)
Gate−source voltage VGS (V)


VDS – VGS
Common source
Ta = 25°C
Pulse test
ID = −11A
−5.5
−2.8
Drain−source voltage VDS (V)
Gate−source voltage VGS (V)

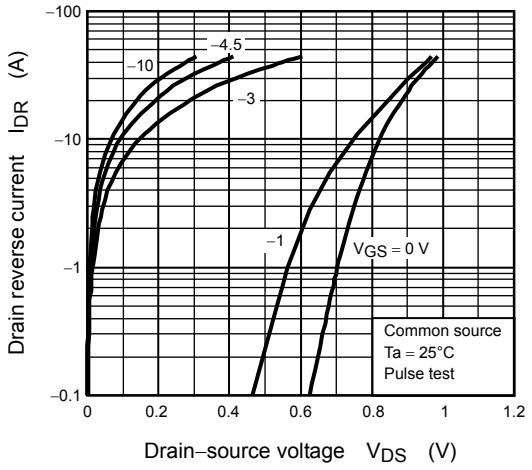

|Yfs| – ID
Ta = −55°C
100
25
Common source
VDS = −10 V
Pulse test
Forward transfer admittance |Yfs| (S)
Drain current ID (A)


RDS (ON) – ID
Common source
Ta = 25°C
Pulse test
VGS = −4.5 V
−10
Drain−source ON-resistance RDS (ON) (mΩ)
Drain current ID (A)

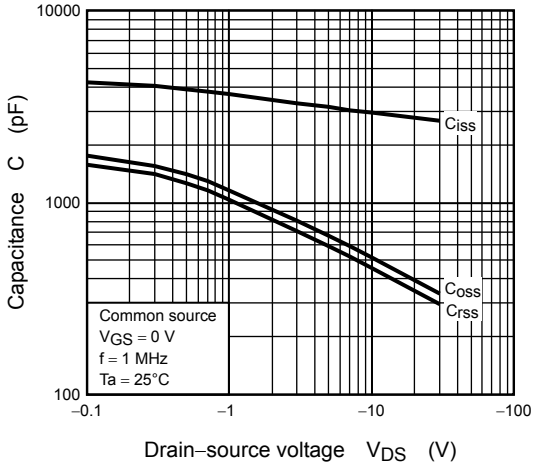
$R_{DS\ (ON)}$ – Ta



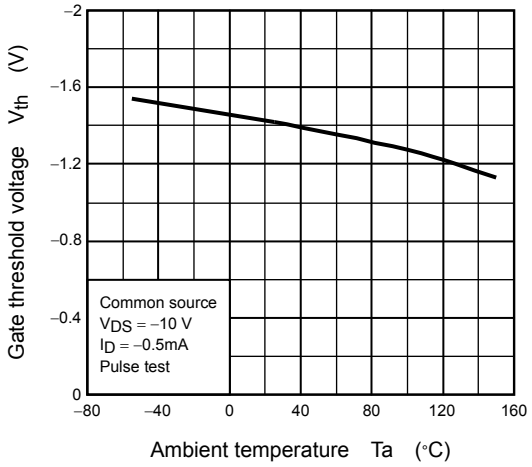
I_{DR} – V_{DS}



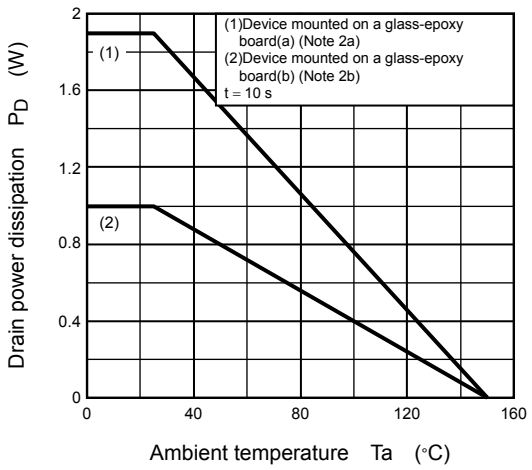
Capacitance – V_{DS}



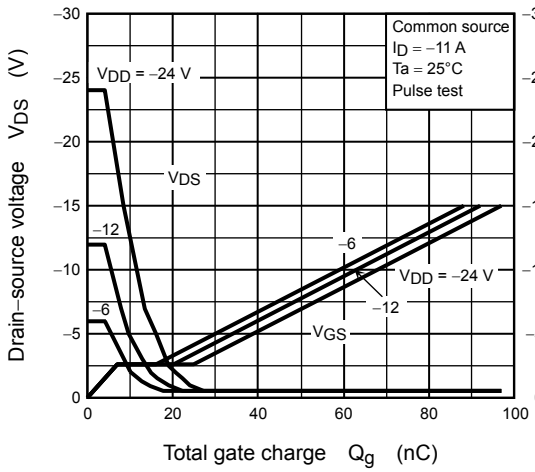
V_{th} – Ta

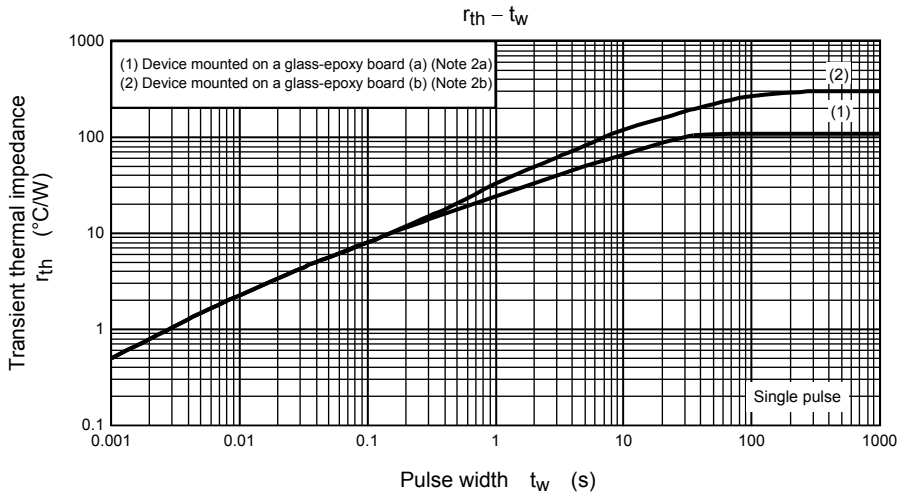


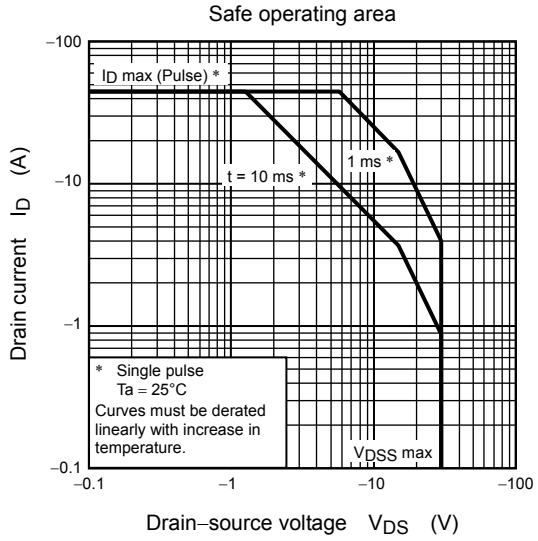
P_D – Ta



Dynamic input/output characteristics




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) *
1 ms *
t = 10 ms *
* Single pulse
Ta = 25°C
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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