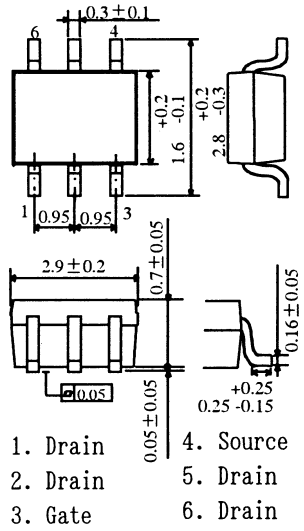
TOSHIBA Field Effect Transistor Silicon P Channel MOS Type (U-MOSⅥ)

TPC6110

Power Management Switch Applications

- Small footprint due to small and thin package
- Low drain-source ON resistance: $R_{DS\ (ON)}$ = 43 mΩ (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 = −0.1mA)

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-3T1A

Weight: 0.011 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	−4.5	A
	Pulse (Note 1)	I_{DP}	−18	
Drain power dissipation	(t = 5 s) (Note 2a)	P_D	2.2	W
Drain power dissipation	(t = 5 s) (Note 2b)	P_D	0.7	W
Single pulse avalanche energy (Note 3)		E_{AS}	3.4	mJ
Avalanche current		I_{AR}	−2.3	A
Repetitive avalanche energy (Note 4)		E_{AR}	0.025	mJ
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).

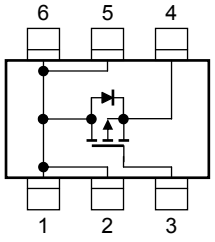
Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 5 s) (Note 2a)	$R_{th\ (ch\text{-}a)}$	56.8	°C/W
Thermal resistance, channel to ambient (t = 5 s) (Note 2b)	$R_{th\ (ch\text{-}a)}$	178.5	°C/W

Note: (Note 1), (Note 2), (Note 3), (Note 4) and (Note 5): See other pages.

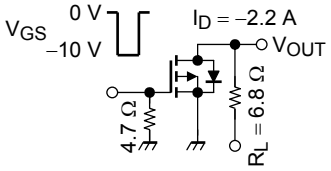
This transistor is an electrostatic-sensitive device. Please handle with caution.

Circuit Configuration



Start of commercial production
2009-08

Electrical Characteristics (Ta = 25°C)

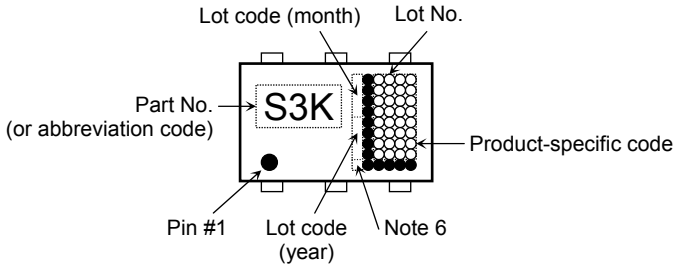
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 20$ V, $V_{DS} = 0$ V	—	—	±100	nA
Drain cut-off current		I_{DSS}	$V_{DS} = -30$ V, $V_{GS} = 0$ V	—	—	−10	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	$I_D = -10$ mA, $V_{GS} = 0$ V	−30	—	—	V
		$V_{(BR)\ DSX}$	$I_D = -10$ mA, $V_{GS} = 10$ V (Note 7)	−21	—	—	
Gate threshold voltage		V_{th}	$V_{DS} = -10$ V, $I_D = -0.1$ mA	−0.8	—	−2.0	V
Drain-source ON resistance		$R_{DS\ (ON)}$	$V_{GS} = -4.5$ V, $I_D = -2.2$ A	—	59	77	mΩ
			$V_{GS} = -10$ V, $I_D = -2.2$ A	—	43	56	
Forward transfer admittance		$\|Y_{fs}\|$	$V_{DS} = -10$ V, $I_D = -2.2$ A	4.2	8.4	—	S
Input capacitance		C_{iss}	$V_{DS} = -10$ V, $V_{GS} = 0$ V, f = 1 MHz	—	510	—	pF
Reverse transfer capacitance		C_{rss}		—	85	—	
Output capacitance		C_{oss}		—	110	—	
Switching time	Rise time	t_r	 Duty ≤ 1%, $t_w = 10$ μs	—	6	—	ns
	Turn-on time	t_{on}		—	12	—	
	Fall time	t_f		—	21	—	
	Turn-off time	t_{off}		—	70	—	
Total gate charge (gate-source plus gate-drain)		Q_g	$V_{DD} \approx -24$ V, $V_{GS} = -10$ V, $I_D = -4.5$ A	—	14	—	nC
Gate-source charge 1		Q_{gs1}		—	1.6	—	
Gate-drain (“miller”) charge		Q_{gd}		—	3.8	—	

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

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	−18	A
Forward voltage (diode)		V_{DSF}	$I_{DR} = -4.5$ A, $V_{GS} = 0$ V	—	—	1.2	V

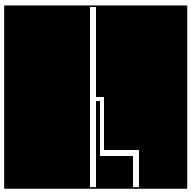
Note 7: VDSX mode (the application of a plus voltage between gate and source) may cause decrease in maximum rating of drain-source voltage.

Marking (Note 5)



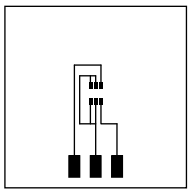
Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2: (a) Device mounted on a glass-epoxy board (a) (t = 5 s)
(b) Device mounted on a glass-epoxy board (b) (t = 5 s)



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 = 0.5 mH, R_G = 25 Ω, I_{AR} = −2.3 A

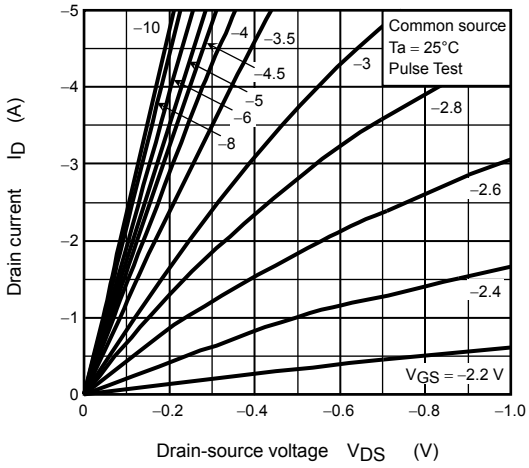
Note 4: Repetitive rating : pulse width limited by maximum channel temperature

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

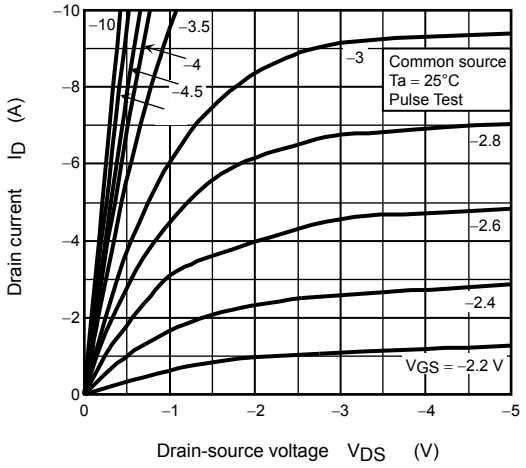
Note 6: A dot marking for identifying the indication of product Labels.
Without a dot: [[Pb]]/INCLUDES > MCV
With a dot: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

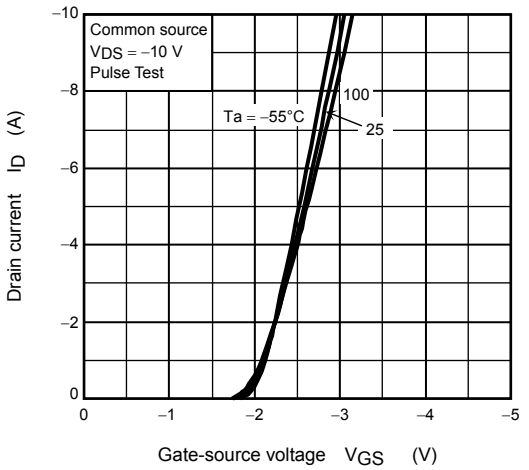
$I_D - V_{DS}$



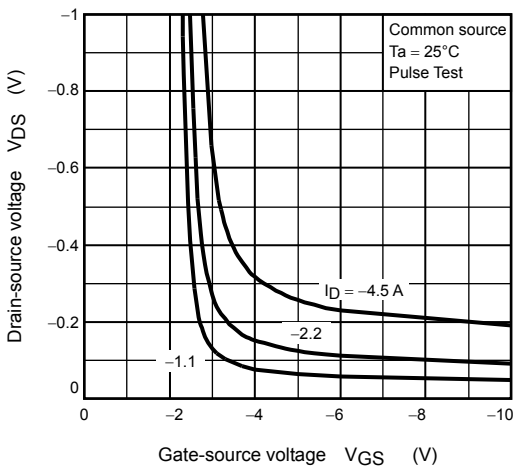
$I_D - V_{DS}$



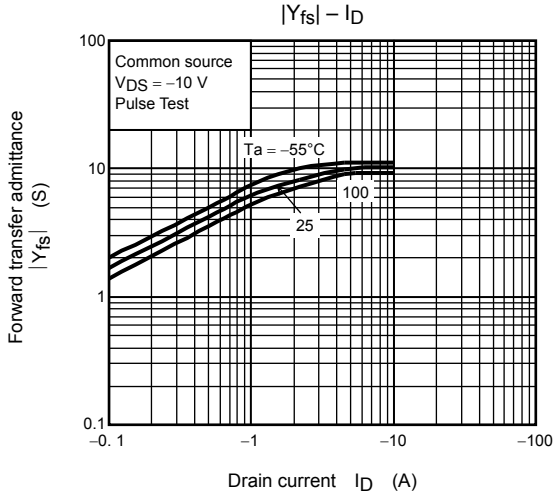
$I_D - V_{GS}$



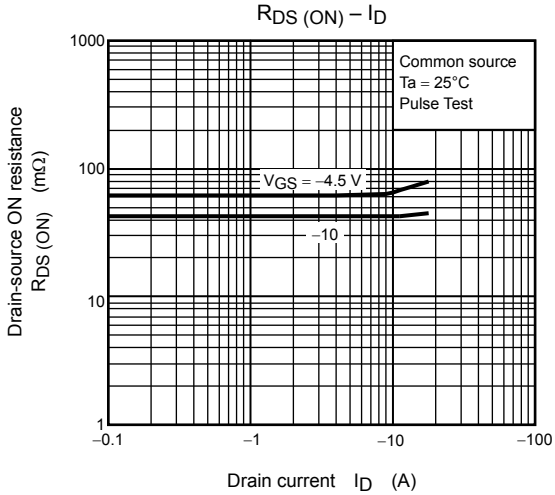
$V_{DS} - V_{GS}$



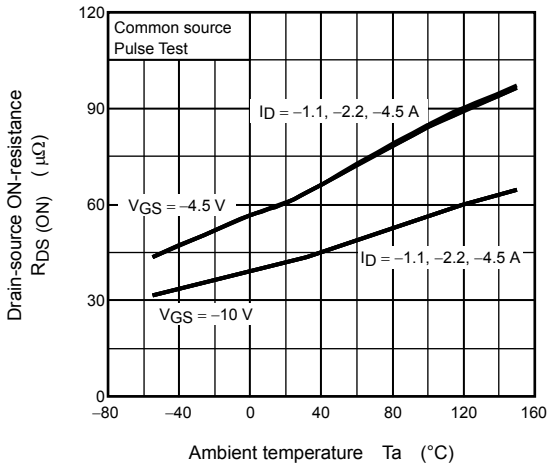
$|Y_{fs}| - I_D$



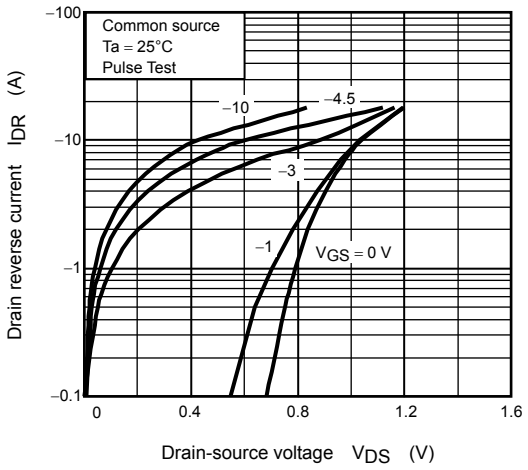
$R_{DS\ (ON)} - I_D$



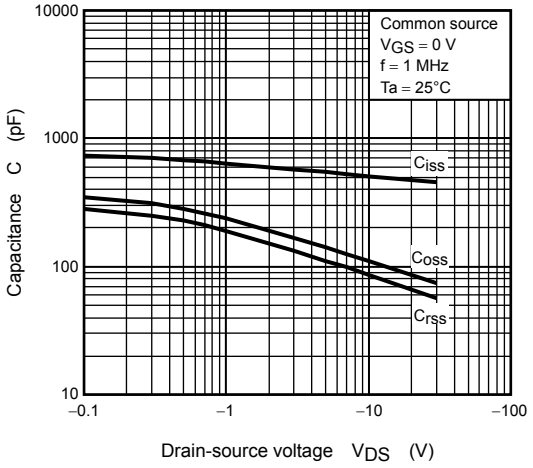
$R_{DS\ (ON)}$ – Ta



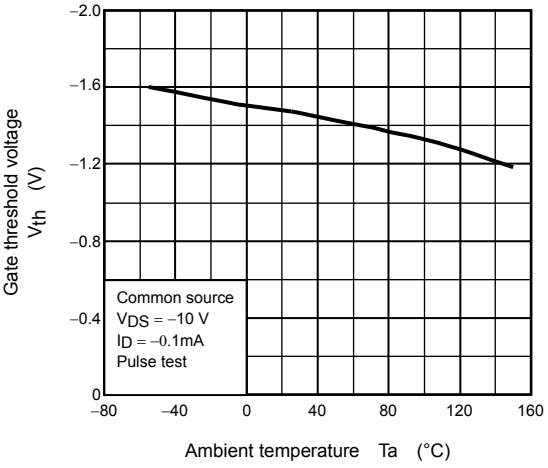
I_{DR} – V_{DS}



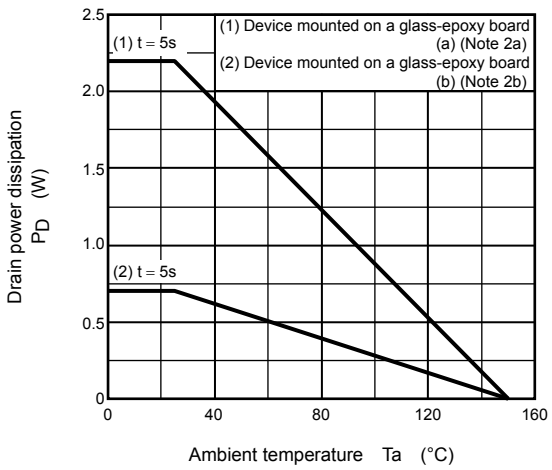
Capacitance – V_{DS}



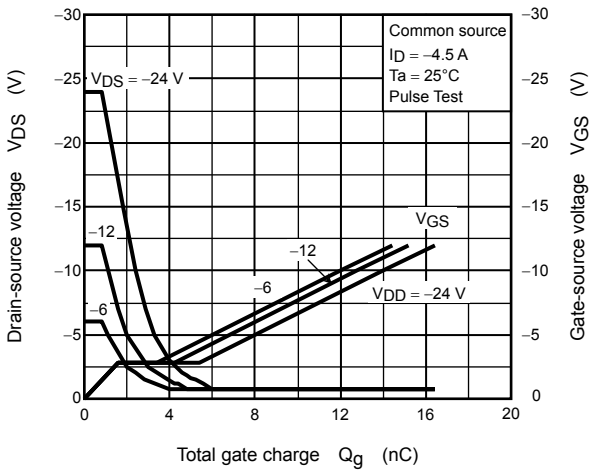
V_{th} – Ta

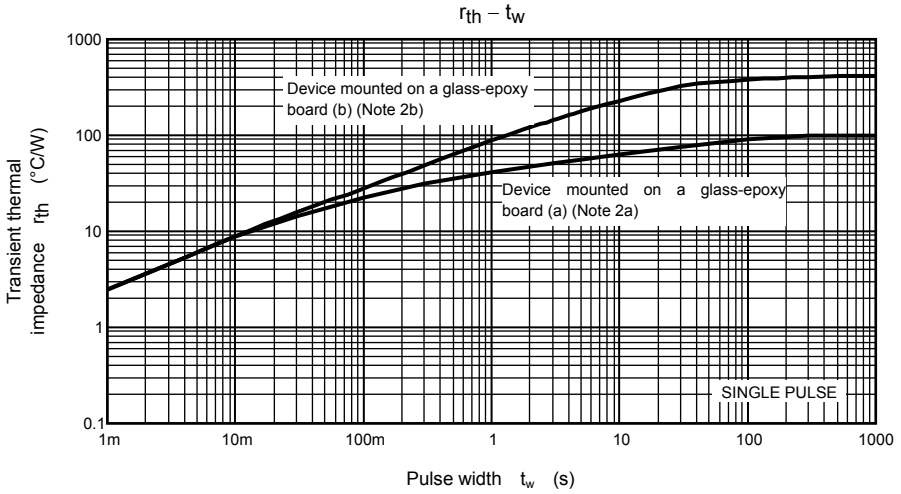


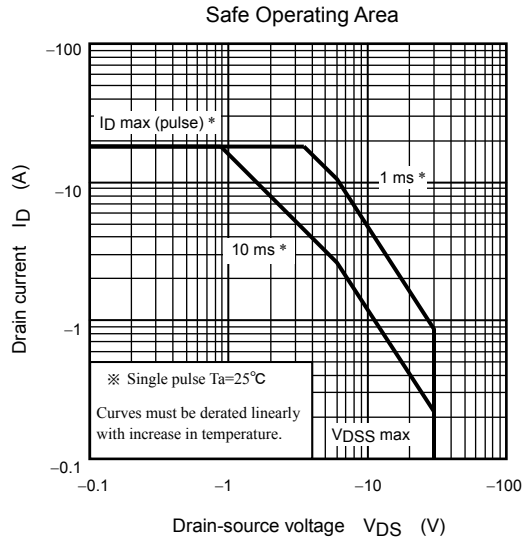
P_D – Ta



Dynamic input / output characteristics




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


Safe Operating Area
Drain current I_D (A)
−100
−10
−1
−0.1
I_D max (pulse) *
1 ms *
10 ms *
※ Single pulse Ta=25℃
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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