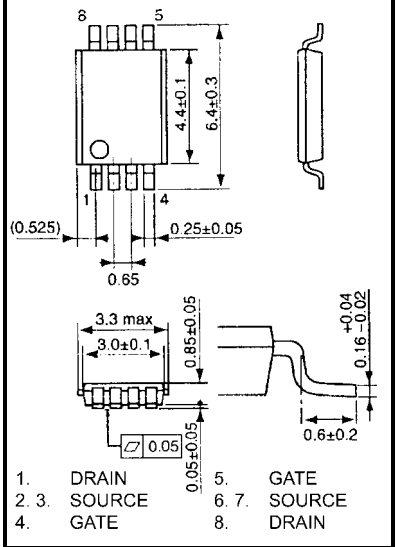
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (U-MOSIII)

T P C S 8 2 1 0

Lithium Ion Battery Applications

- Has a small footprint.
- Low drain-source ON resistance: $R_{DS\ (ON)}$ = 19 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 9.2 S (typ.)
- Low leakage current: I_{DSS} = 10 μA (max) (V_{DS} = 20 V)
- Enhancement-mode: V_{th} = 0.5~1.2 V (V_{DS} = 10 V, I_D = 200 μA)
- Common drain

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-3R1E

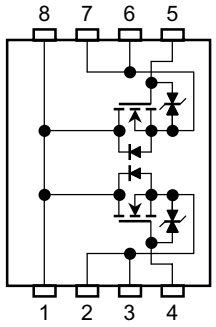
Weight: 0.035 g (typ.)

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	5	A
	Pulse (Note 1)	I_{DP}	20	
Drain power dissipation (t = 10 s) (Note 2a)	Single-device operation (Note 3a)	$P_{D\ (1)}$	1.1	W
	Single-device value at dual operation (Note 3b)	$P_{D\ (2)}$	0.75	
Drain power dissipation (t = 10 s) (Note 2b)	Single-device operation (Note 3a)	$P_{D\ (1)}$	0.6	W
	Single-device value at dual operation (Note 3b)	$P_{D\ (2)}$	0.35	
Single pulse avalanche energy (Note 4)		E_{AS}	32.5	mJ
Avalanche current		I_{AR}	5	A
Repetitive avalanche energy Single-device value at dual operation (Note 2a, 3b, 5)		E_{AR}	0.075	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55~150	°C

Note: (Note 1), (Note 2), (Note 3), (Note 4), (Note 5) Please see next page.

Circuit Configuration

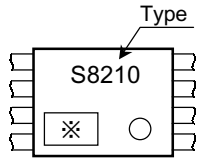


This transistor is an electrostatic sensitive device. Please handle with caution.

Thermal Characteristics

Characteristics		Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	Single-device operation (Note 3a)	$R_{th\ (ch\text{-}a)\ (1)}$	114	°C/W
	Single-device value at dual operation (Note 3b)	$R_{th\ (ch\text{-}a)\ (2)}$	167	
Thermal resistance, channel to ambient (t = 10 s) (Note 2b)	Single-device operation (Note 3a)	$R_{th\ (ch\text{-}a)\ (1)}$	208	°C/W
	Single-device value at dual operation (Note 3b)	$R_{th\ (ch\text{-}a)\ (2)}$	357	

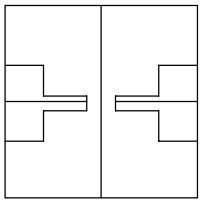
Marking (Note 6)



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

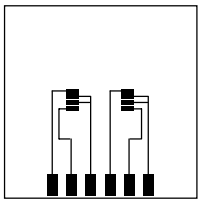
Note 2:

a) Device mounted on a glass-epoxy board (a)



(a)

b) Device mounted on a glass-epoxy board (b)



(b)

Note 3:

a) The power dissipation and thermal resistance values are shown for a single device (During single-device operation, power is only applied to one device.).

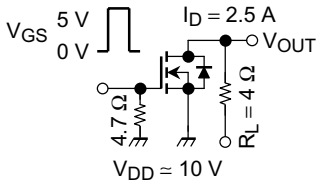
b) The power dissipation and thermal resistance values are shown for a single device (During dual operation, power is evenly applied to both devices.).

Note 4: V_{DD} = 16 V, T_{ch} = 25°C (initial), L = 1.0 mH, R_G = 25 Ω, I_{AR} = 5 A

Note 5: Repetitive rating; pulse width limited by max channel temperature.

Note 6: ○ on lower right of the marking indicates Pin 1.
* shows lot number. (Year of manufacture: last decimal digit of the year of manufacture, Month of manufacture: January to December are denoted by letters A to L respectively)

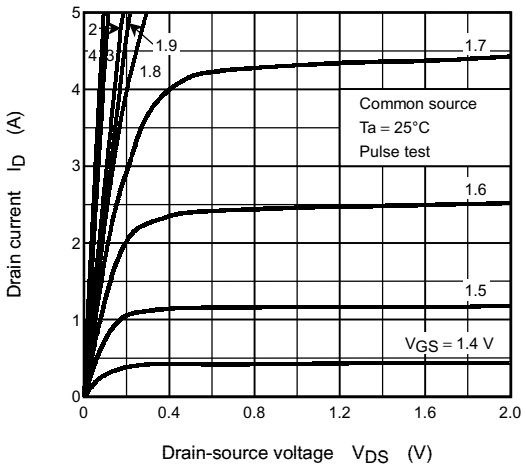
Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±10 V, V_{DS} = 0 V	—	—	±10	μA
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} = 2.0 V, I_D = 3.5 A	—	34	60	mΩ
			V_{GS} = 2.5 V, I_D = 3.5 A	—	26	40	
			V_{GS} = 4.0 V, I_D = 4.0 A	—	19	30	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 2.5 A	4.6	9.2	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	1280	—	pF
Reverse transfer capacitance		C_{rss}		—	130	—	
Output capacitance		C_{oss}		—	150	—	
Switching time	Rise time	t_r	 Duty ≦ 1%, t_w = 10 μs	—	4.5	—	ns
	Turn-ON time	t_{on}		—	11	—	
	Fall time	t_f		—	7.3	—	
	Turn-OFF time	t_{off}		—	33	—	
Total gate charge (gate-source plus gate-drain)		Q_g	V_{DD} ≃ 16 V, V_{GS} = 5 V, I_D = 5 A	—	15	—	nC
Gate-source charge 1		Q_{gs1}		—	3.3	—	
Gate-drain (“miller”) charge		Q_{gd}		—	3.5	—	

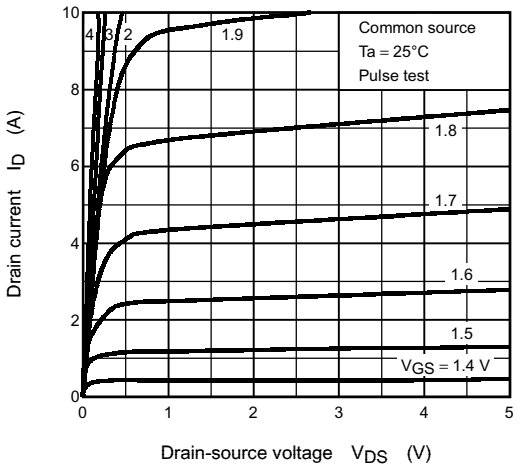
Source-Drain Diode Ratings and Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	20	A
Diode forward voltage		V_{DSF}	I_{DR} = 5 A, V_{GS} = 0 V	—	—	−1.2	V

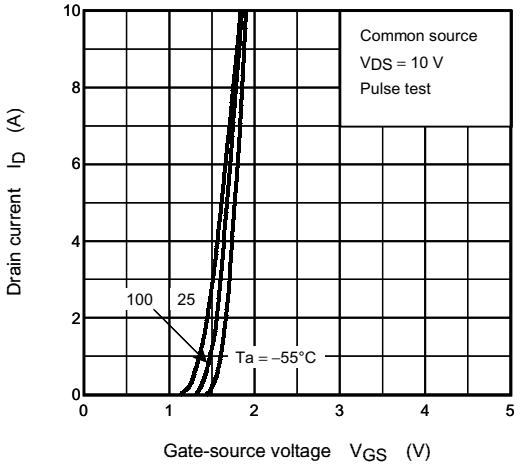
$I_D - V_{DS}$



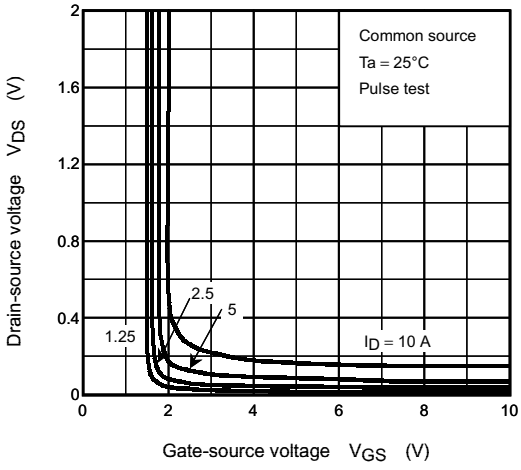
$I_D - V_{DS}$



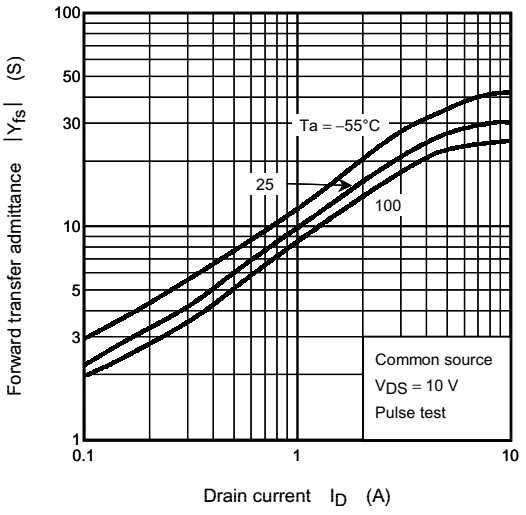
$I_D - V_{GS}$



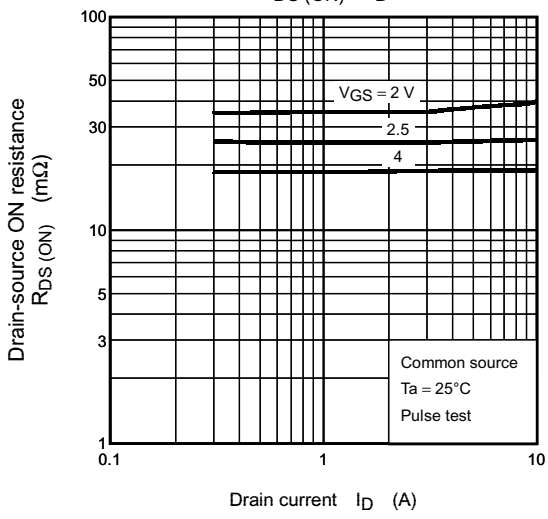
$V_{DS} - V_{GS}$



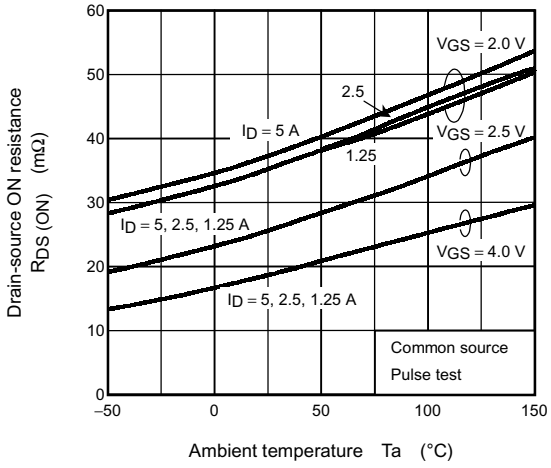
$|Y_{fs}| - I_D$



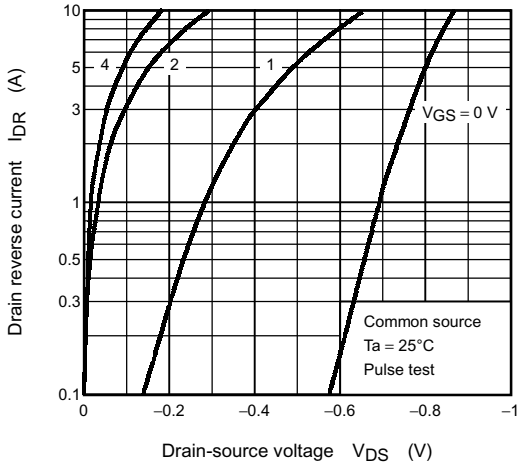
$R_{DS\ (ON)} - I_D$



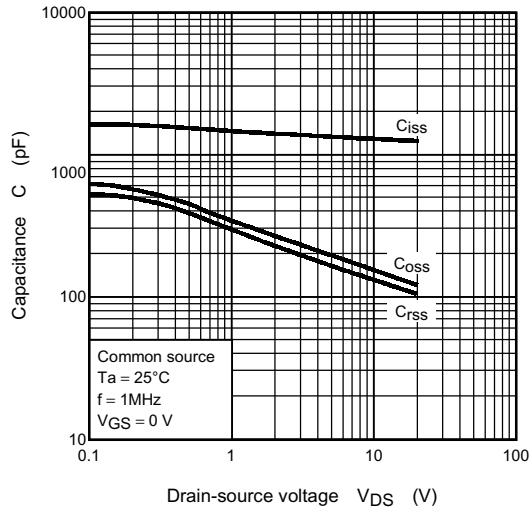
$R_{DS\ (ON)}$ – Ta



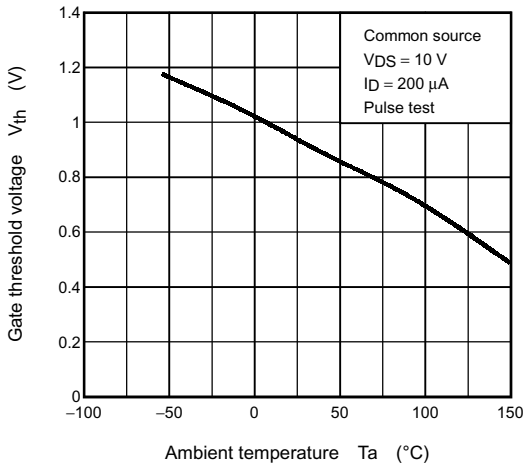
I_{DR} – V_{DS}



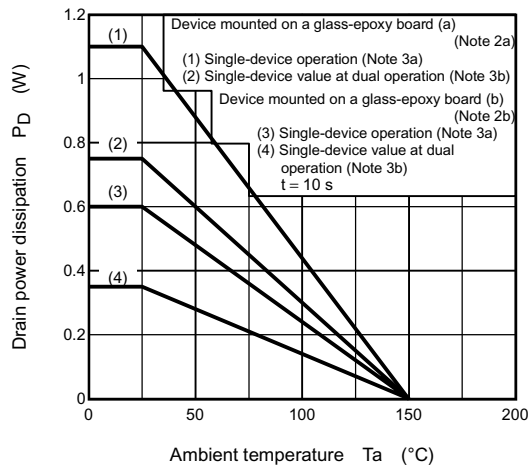
Capacitance – V_{DS}



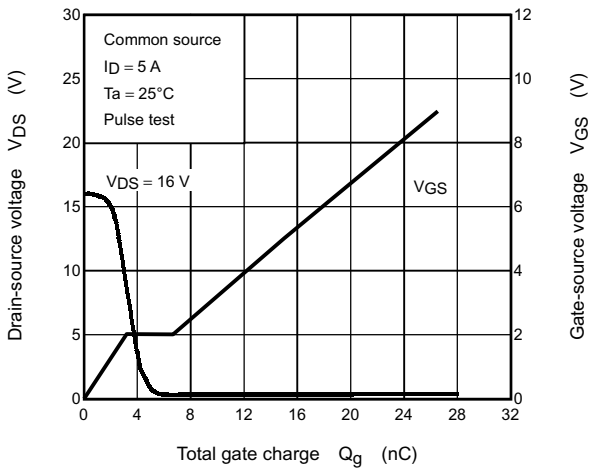
V_{th} – Ta



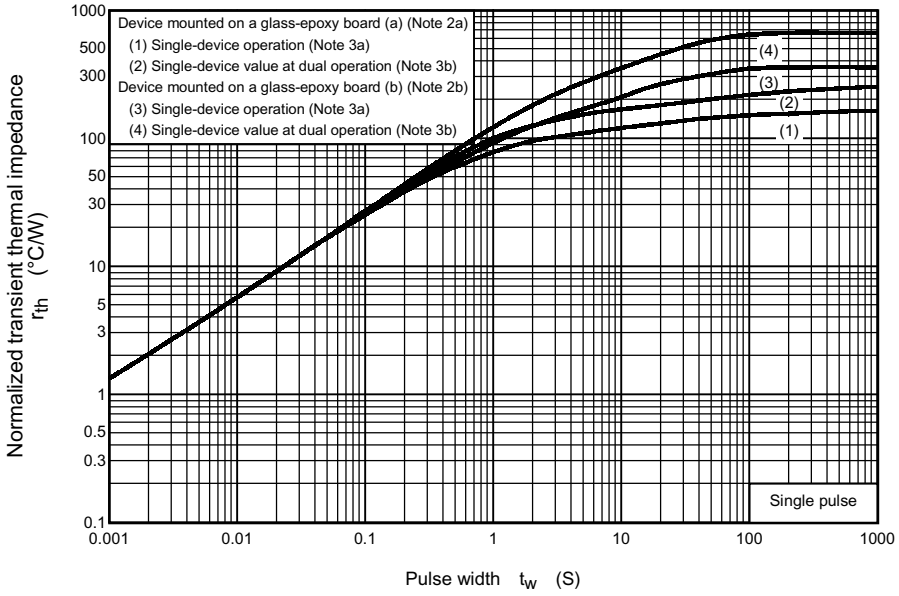
P_D – Ta

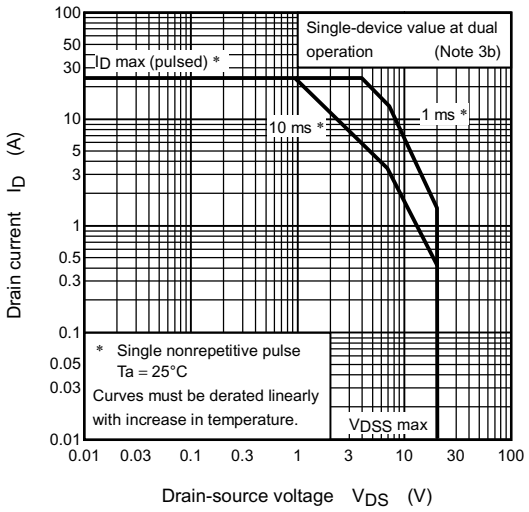


Dynamic input/output characteristics



$r_{th} - t_w$


Device mounted on a glass-epoxy board (a) (Note 2a)
(1) Single-device operation (Note 3a)
(2) Single-device value at dual operation (Note 3b)
Device mounted on a glass-epoxy board (b) (Note 2b)
(3) Single-device operation (Note 3a)
(4) Single-device value at dual operation (Note 3b)
(1)
(2)
(3)
(4)
Single pulse
Normalized transient thermal impedance r_{th} (°C/W)
1000
500
300
100
50
30
10
5
3
1
0.5
0.3
0.1
0.001
0.01
0.1
1
10
100
1000
Pulse width t_w (S)


Single-device value at dual operation (Note 3b)
ID max (pulsed) *
1 ms *
10 ms *
* Single nonrepetitive pulse
Ta = 25°C
Curves must be derated linearly with increase in temperature.
VDSS max
Drain current I_D (A)
100
50
30
10
5
3
1
0.5
0.3
0.1
0.05
0.03
0.01
0.01
0.03
0.1
0.3
1
3
10
30
100
Drain-source voltage V_{DS} (V)

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