

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

TPCS8210

Lithium Ion Battery Applications

- Small footprint due to small and thin package
- Low drain-source ON resistance: $R_{DS(ON)} = 19 \text{ m}\Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 9.2 \text{ S}$ (typ.)
- Low leakage current: $I_{DSS} = 10 \text{ }\mu\text{A}$ (max) ($V_{DS} = 20 \text{ V}$)
- Enhancement mode: $V_{th} = 0.5 \sim 1.2 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 200 \text{ }\mu\text{A}$)
- Common drain

Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

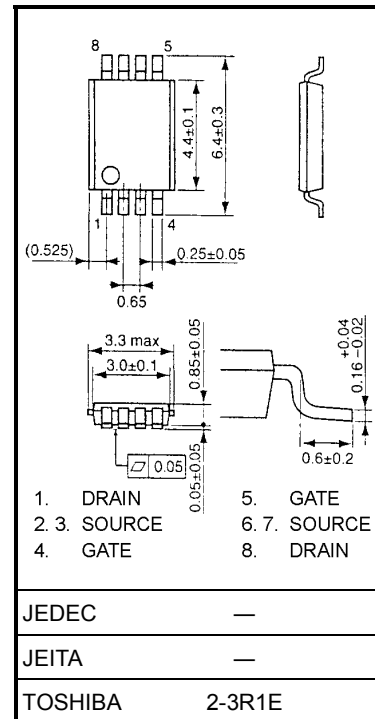
Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	20	V
Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$)		V_{DGR}	20	V
Gate-source voltage		V_{GSS}	± 12	V
Drain current	DC (Note 1)	I_D	5	A
	Pulse (Note 1)	I_{DP}	20	
Drain power dissipation ($t = 10 \text{ s}$) (Note 2a)	Single-device 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 ($t = 10 \text{ s}$) (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	$^\circ\text{C}$
Storage temperature range		T_{stg}	$-55 \sim 150$	$^\circ\text{C}$

Note: (Note 1), (Note 2), (Note 3), (Note 4) and (Note 5): See the next page.

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).

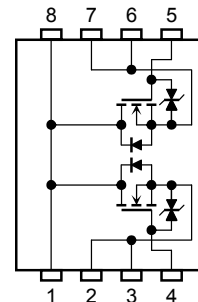
This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm



Weight: 0.035 g (typ.)

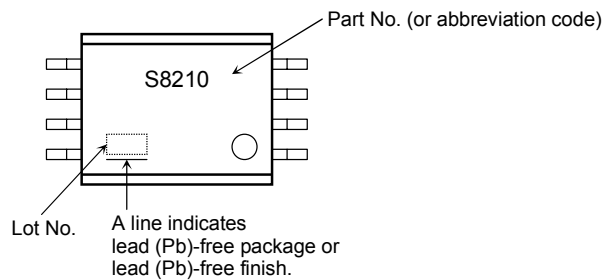
Circuit Configuration



Thermal Characteristics

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

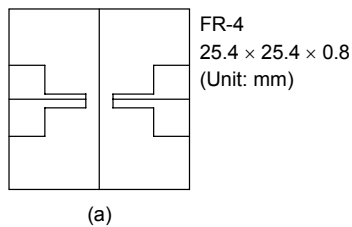
Marking (Note 6)



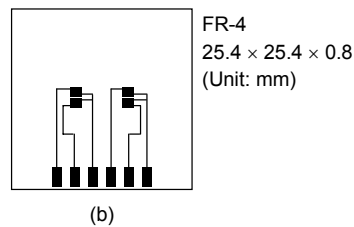
Note 1: Ensure that the channel temperature does not exceed 150°C .

Note 2:

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



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



Note 3:

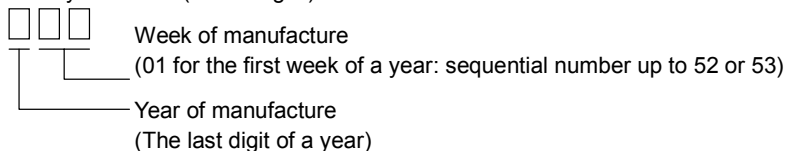
- a) The power dissipation and thermal resistance values are shown for a single device (During single-device operation, power is only applied to one device.).
- b) The power dissipation and thermal resistance values are shown for a single device (During dual operation, power is evenly applied to both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

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

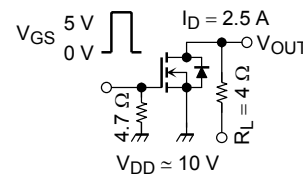
Note 5: Repetitive rating; pulse width limited by max channel temperature.

Note 6: \circ on lower right of the marking indicates Pin 1.

※ Weekly code: (Three digits)

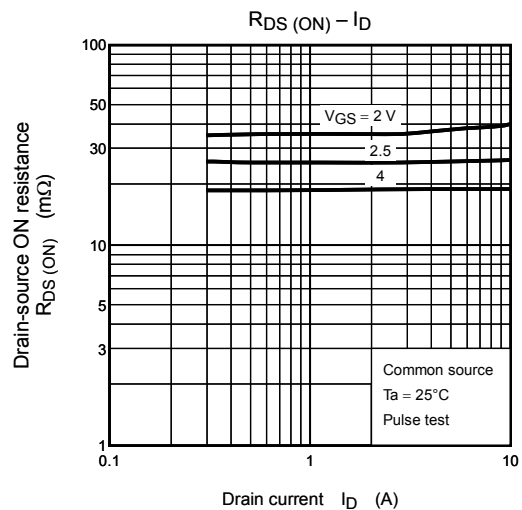
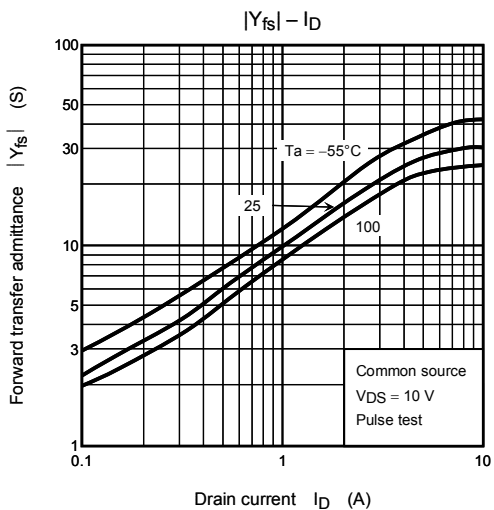
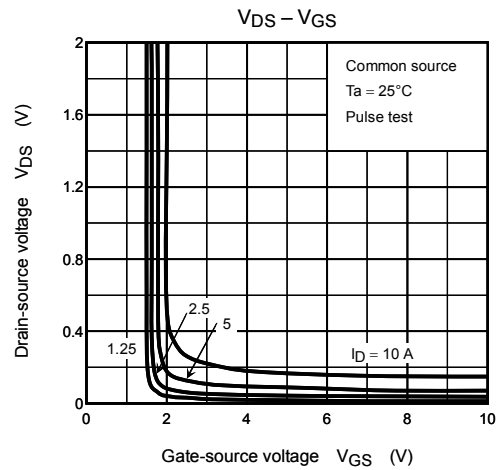
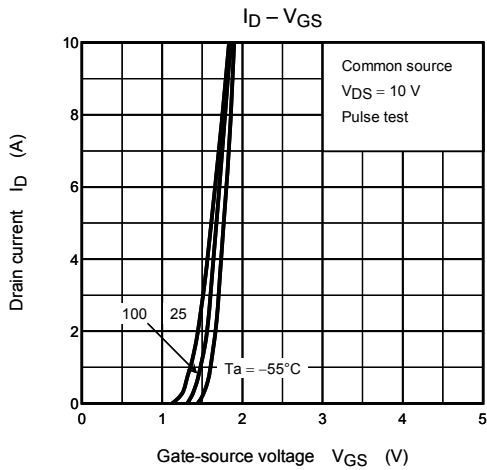
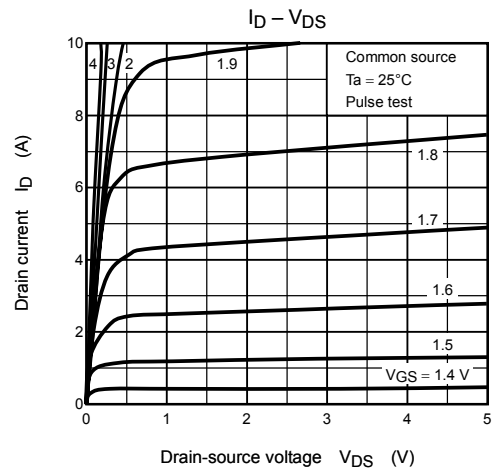
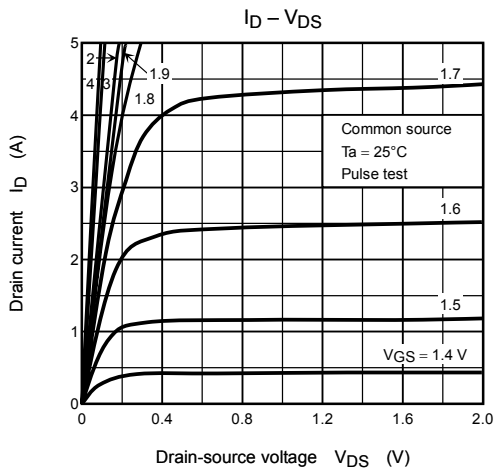


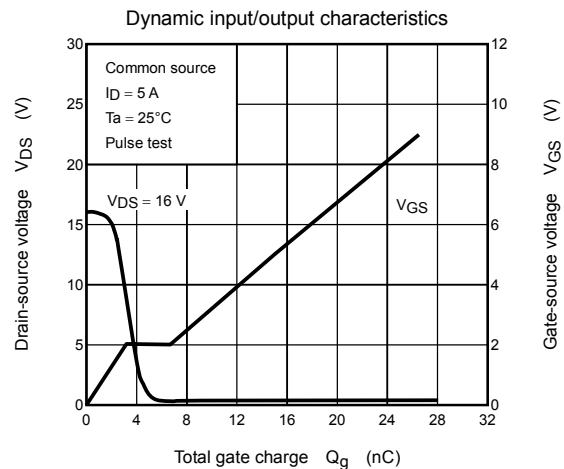
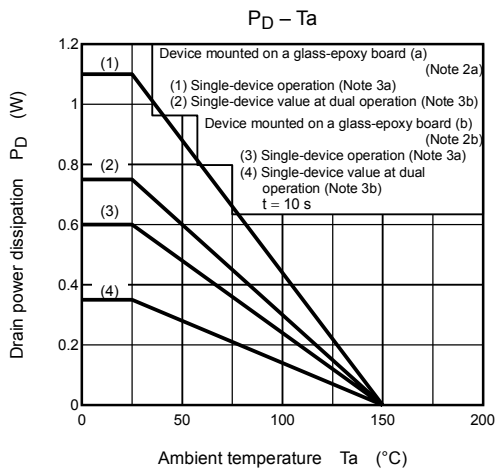
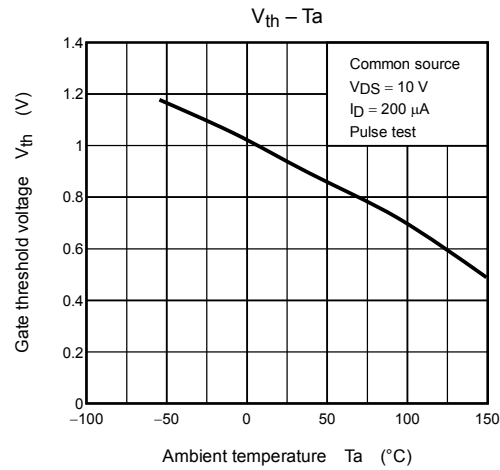
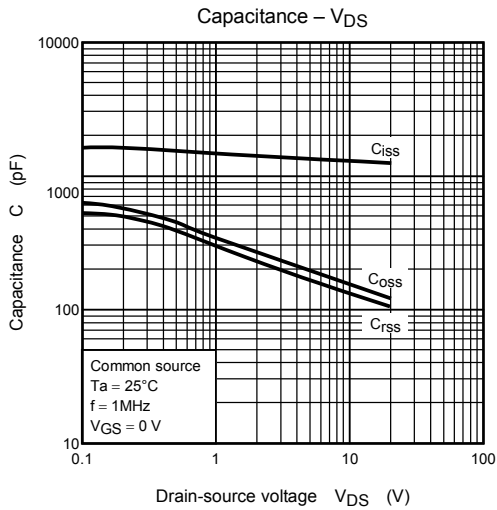
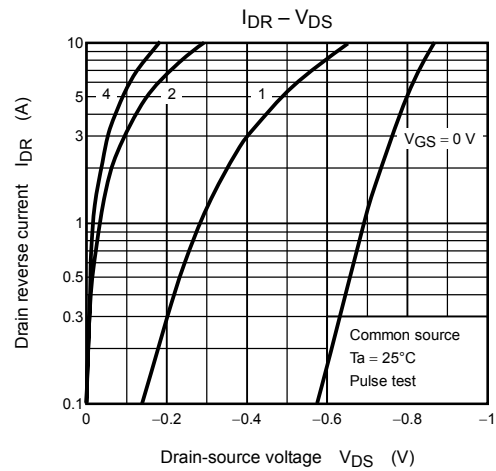
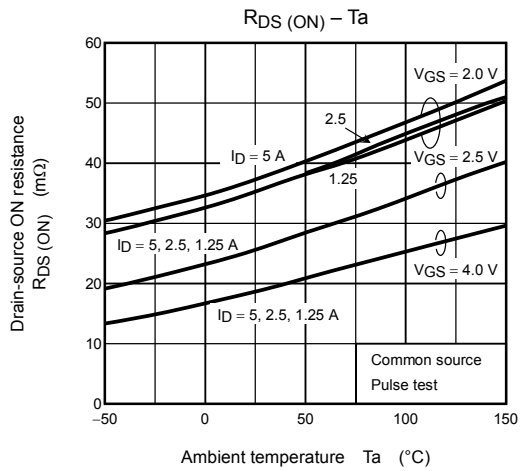
Electrical Characteristics (Ta = 25°C)

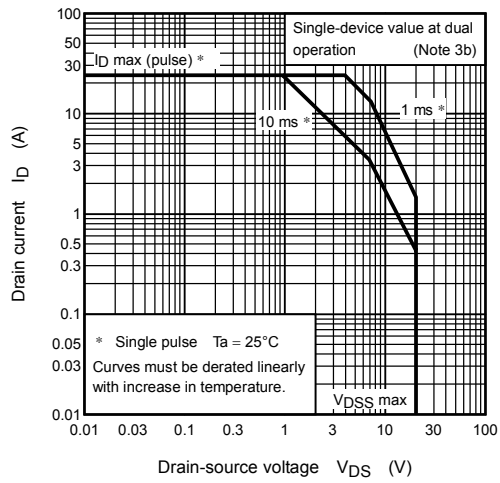
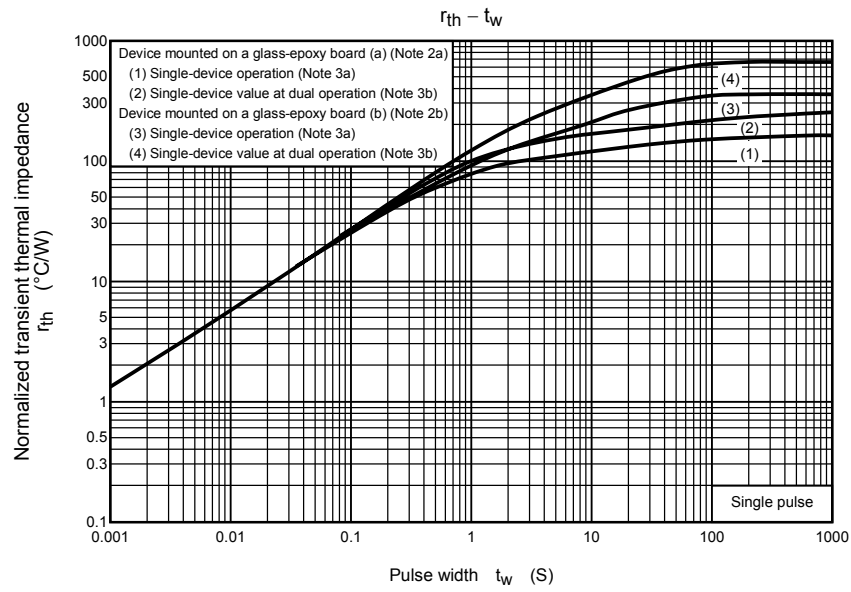
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 10 \text{ V}$, $V_{DS} = 0 \text{ V}$	—	—	± 10	μA
Drain cut-OFF current		I_{DSS}	$V_{DS} = 20 \text{ V}$, $V_{GS} = 0 \text{ V}$	—	—	10	μA
Drain-source breakdown voltage		$V_{(BR) DSS}$	$I_D = 10 \text{ mA}$, $V_{GS} = 0 \text{ V}$	20	—	—	V
		$V_{(BR) DSX}$	$I_D = 10 \text{ mA}$, $V_{GS} = -12 \text{ V}$	8	—	—	
Gate threshold voltage		V_{th}	$V_{DS} = 10 \text{ V}$, $I_D = 200 \mu\text{A}$	0.5	—	1.2	V
Drain-source ON resistance		$R_{DS (ON)}$	$V_{GS} = 2.0 \text{ V}$, $I_D = 3.5 \text{ A}$	—	34	60	$\text{m}\Omega$
			$V_{GS} = 2.5 \text{ V}$, $I_D = 3.5 \text{ A}$	—	26	40	
			$V_{GS} = 4.0 \text{ V}$, $I_D = 4.0 \text{ A}$	—	19	30	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10 \text{ V}$, $I_D = 2.5 \text{ A}$	4.6	9.2	—	S
Input capacitance		C_{iss}	$V_{DS} = 10 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$	—	1280	—	pF
Reverse transfer capacitance		C_{rss}		—	130	—	
Output capacitance		C_{oss}		—	150	—	
Switching time	Rise time	t_r	 <p>$V_{GS} \begin{matrix} 5 \text{ V} \\ 0 \text{ V} \end{matrix}$ $I_D = 2.5 \text{ A}$ V_{OUT} 4.7Ω $R_L = 4 \Omega$ $V_{DD} \approx 10 \text{ V}$ Duty $\leq 1\%$, $t_w = 10 \mu\text{s}$</p>	—	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	$V_{DD} \approx 16 \text{ V}$, $V_{GS} = 5 \text{ V}$, $I_D = 5 \text{ A}$	—	15	—	nC
Gate-source charge 1		Q_{gs1}		—	3.3	—	
Gate-drain ("miller") charge		Q_{gd}		—	3.5	—	

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

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	20	A
Forward voltage (diode)		V_{DSF}	$I_{DR} = 5 \text{ A}$, $V_{GS} = 0 \text{ V}$	—	—	-1.2	V







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