

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

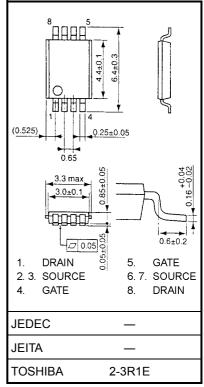
# **TPCS8209**

Lithium Ion Battery Applications Notebook PC Applications Portable Machines and Tools

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

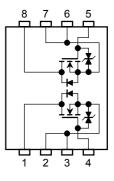
### Maximum Ratings (Ta = 25°C)

Char	acteristics	Symbol	Rating	Unit	
Drain-source voltage		V <sub>DSS</sub>	20	V	
Drain-gate voltag	je (R <sub>GS</sub> = 20 kΩ)	V <sub>DGR</sub>	20	V	
Gate-source volt	age	V <sub>GSS</sub>	±12	V	
Drain current	DC (Note 1)	I <sub>D</sub>	5	А	
Dialiticulterit	Pulse (Note 1)	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	~		
Drain power dissipation (t = 10 s) (Note 2a)	Single-device operation (Note 3a)	P <sub>D (1)</sub>	1.1	W	
	Single-device value at dual operation (Note 3b)	P <sub>D (2)</sub>	0.75		
Drain power dissipation (t = 10 s) (Note 2b)	Single-device operation (Note 3a)	P <sub>D (1)</sub>	0.6	W	
	Single-device value at dual operation (Note 3b)	P <sub>D (2)</sub>	0.35		
Single pulse avalanche energy (Note 4)		E <sub>AS</sub>	32.5	mJ	
Avalanche currei	nt	I <sub>AR</sub>	5	А	
Repetitive avalanche energy Single-device value at dual operation (Note 2a, 3b, 5)		E <sub>AR</sub>	0.075	mJ	
Channel tempera	Channel temperature		150	°C	
Storage temperature range		T <sub>stg</sub>	-55~150	°C	



Weight: 0.035 g (typ.)

# **Circuit Configuration**



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

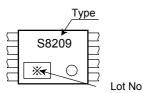
This transistor is an electrostatic sensitive device. Please handle with caution.

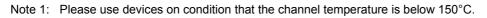
Unit: mm

# **Thermal Characteristics**

Characteristics	Symbol	Max	Unit		
	Single-device operation (Note 3a)	R <sub>th (ch-a) (1)</sub>	114	°C/W	
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	Single-device value at dual operation (Note 3b)	R <sub>th (ch-a) (2)</sub>	167		
Thermal resistance, channel to ambient	Single-device operation (Note 3a)	R <sub>th (ch-a) (1)</sub>	208		
(t = 10  s) (Note 2b)	Single-device value at dual operation (Note 3b)	R <sub>th (ch-a) (2)</sub>	357	°C/W	

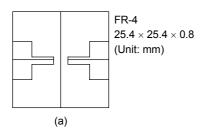
## Marking (Note 6)

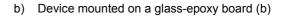


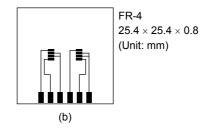


Note 2:

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







#### 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:  $V_{DD} = 16 \text{ V}, \text{ T}_{ch} = 25^{\circ}\text{C}$  (initial), L = 1.0 mH, R<sub>G</sub> = 25  $\Omega$ , I<sub>AR</sub> = 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)
 Week of manufacture (01 for first week of year, continues up to 52 or 53)
 Year of manufacture

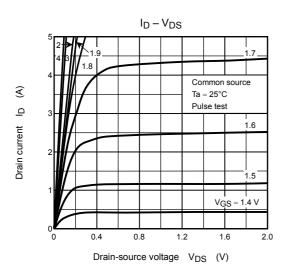
Electrical Characteristics (Ta = 25°C)

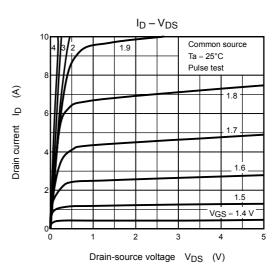
Cha	aracteristics	Symbol	Test Condition	Min	Тур.	Max	Unit	
Gate leakage cur	rent	I <sub>GSS</sub>	$V_{GS}=\pm 10~V,~V_{DS}=0~V$			±10	μA	
Drain cut-OFF cu	Drain cut-OFF current		$V_{DS} = 20 \text{ V}, \text{ V}_{GS} = 0 \text{ V}$		_	10	μA	
Drain-source breakdown voltage		V (BR) DSS	$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$		_	_	V	
Diam-source bie	akdown voltage		$I_D = 10 \text{ mA}, V_{GS} = -12 \text{ V}$	8	_	_	v	
Gate threshold ve	oltage	V <sub>th</sub>	$V_{DS} = 10 \text{ V}, \text{ I}_{D} = 200 \mu\text{A}$	0.5	_	1.2	V	
			$V_{GS} = 2.0 \text{ V}, \text{ I}_{D} = 3.5 \text{ A}$	_	34	60		
Drain-source ON resistance		R <sub>DS (ON)</sub>	$V_{GS} = 2.5 \text{ V}, \text{ I}_{D} = 3.5 \text{ A}$		26	40	mΩ	
			$V_{GS} = 4.0 \text{ V}, I_D = 4.0 \text{ A}$		19	30		
Forward transfer admittance		Y <sub>fs</sub>	$V_{DS} = 10 \text{ V}, \text{ I}_{D} = 2.5 \text{ A}$	4.6	9.2	_	S	
Input capacitance		C <sub>iss</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz		1280	_	pF	
Reverse transfer capacitance		C <sub>rss</sub>		_	130	_		
Output capacitance		C <sub>oss</sub>			150			
Switching time	Rise time	t <sub>r</sub>	$V_{GS} \begin{array}{c} 5 \\ 0 \\ V \end{array} \begin{array}{c} V_{GS} \\ 0 \\ V \end{array} \begin{array}{c} V \\ 0 \\ V \\ 0 \\ V \\ 0 \\ V \\ D \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0$	_	4.5	_	- ns	
	Turn-ON time	t <sub>on</sub>		_	11	_		
	Fall time	t <sub>f</sub>		_	7.3	_		
	Turn-OFF time	t <sub>off</sub>		_	33	_		
Total gate charge (gate-source plus gate-drain)		Qg			15			
Gate-source charge 1		Q <sub>gs1</sub>	$V_{DD} \simeq 16 \text{ V}, \text{ V}_{GS} = 5 \text{ V}, \text{ I}_{D} = 5 \text{ A}$		3.3	_	nC	
Gate-drain ("miller") charge		Q <sub>gd</sub>			3.5			

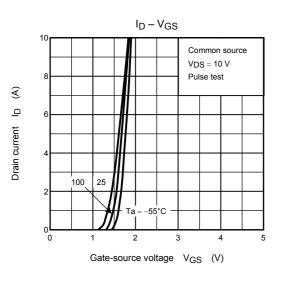
# Source-Drain Ratings and Characteristics (Ta = 25°C)

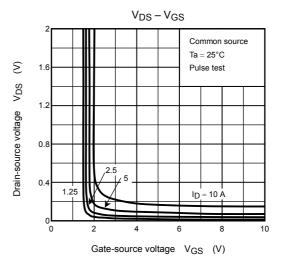
Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Drain reverse current	Pulse (Note 1)	I <sub>DRP</sub>	_	_	_	20	А
Forward voltage (diode)		V <sub>DSF</sub>	$I_{DR} = 5 \text{ A}, \text{ V}_{GS} = 0 \text{ V}$	_		-1.2	V

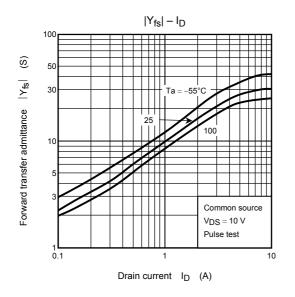
# **TOSHIBA**

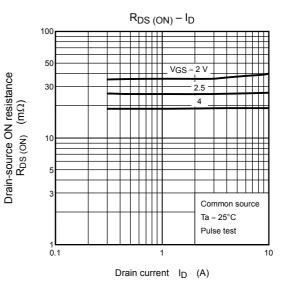




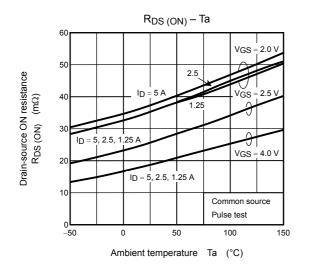


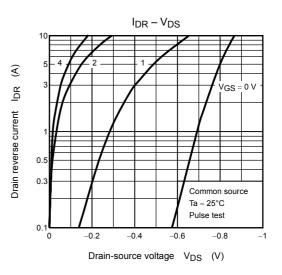


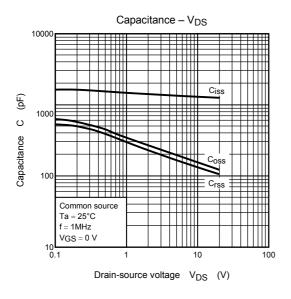


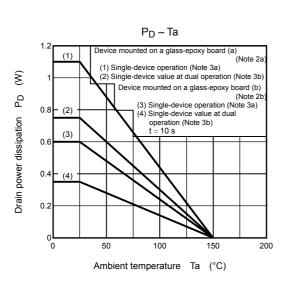


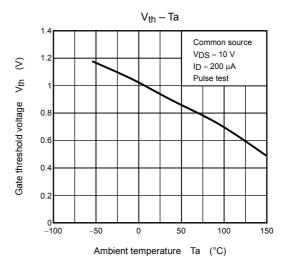
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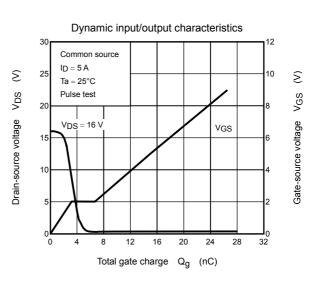








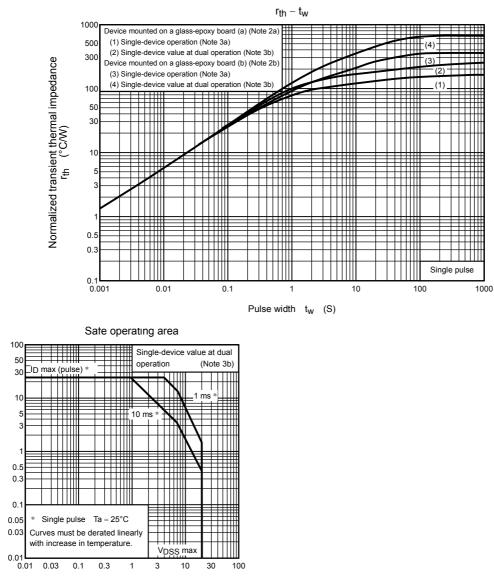




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Drain current



Drain-source voltage V<sub>DS</sub> (V)

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