

# TPC8209

Lithium Ion Battery Applications  
 Portable Equipment Applications  
 Notebook PC Applications

- Small footprint due to small and thin package
- Low drain-source ON resistance:  $R_{DS(ON)} = 30 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 10 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 30 \text{ V}$ )
- Enhancement mode:  $V_{th} = 1.3 \text{ to } 2.5 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

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

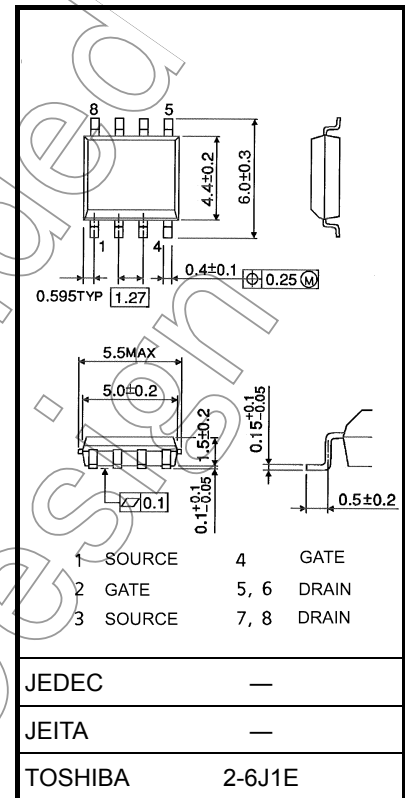
Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	30	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	30	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	D C (Note 1)	$I_D$	5	A
	Pulse (Note 1)	$I_{DP}$	20	
Drain power dissipation ( $t = 10\text{s}$ ) (Note 2a)	Single-device operation (Note 3a)	$P_{D(1)}$	1.5	W
	Single-device value at dual operation (Note 3b)	$P_{D(2)}$	1.1	
Drain power dissipation ( $t = 10\text{s}$ ) (Note 2b)	Single-device operation (Note 3a)	$P_{D(1)}$	0.75	W
	Single-device value at dual operation (Note 3b)	$P_{D(2)}$	0.45	
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)		$E_{AR}$	0.1	mJ
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	-55~150	$^\circ\text{C}$

Note: Note 1, Note 2, Note 3 and Note 4: 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.).

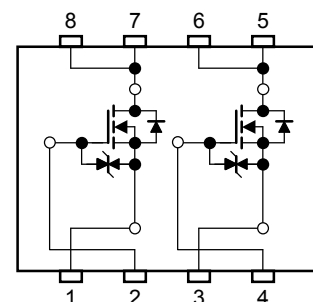
This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm



Weight: 0.08 g (typ.)

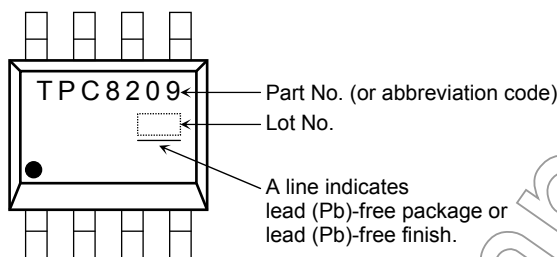
## Circuit Configuration



## Thermal Characteristics

Characteristics		Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10s)	Single-device operation (Note 2a)	$R_{th} (ch-a) (1)$	83.3	°C/W
	Single-device value at dual operation (Note 2b)	$R_{th} (ch-a) (2)$	114	
Thermal resistance, channel to ambient (t = 10s)	Single-device operation (Note 2a)	$R_{th} (ch-a) (1)$	167	
	Single-device value at dual operation (Note 2b)	$R_{th} (ch-a) (2)$	278	

## 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:

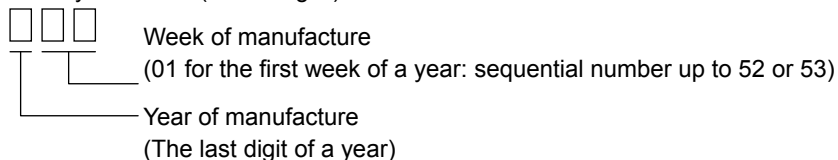
- a) The power dissipation and thermal resistance values are shown for a single device. (During single-device operation, power is only applied to one device.)
- b) The power dissipation and thermal resistance values are shown for a single device. (During dual operation, power is evenly applied to both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

Note 4:  $V_{DD} = 24\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 1.0\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 5\text{ A}$

Note 5: Repetitive rating: pulse width limited by maximum channel temperature

Note 6: • on lower left of the marking indicates Pin 1.

※ Weekly code: (Three digits)

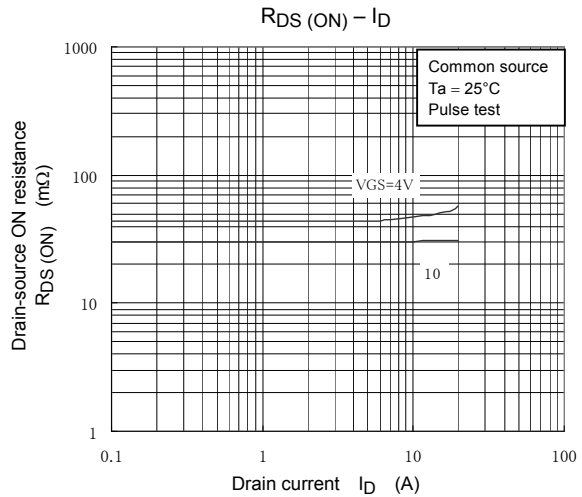
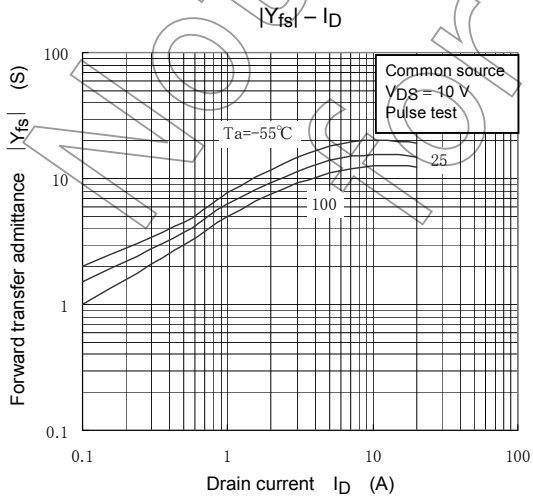
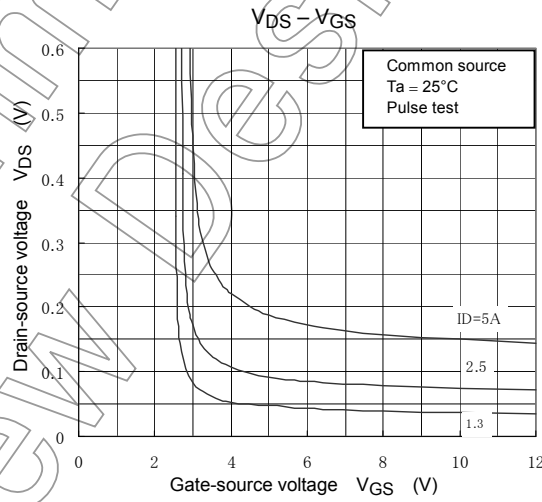
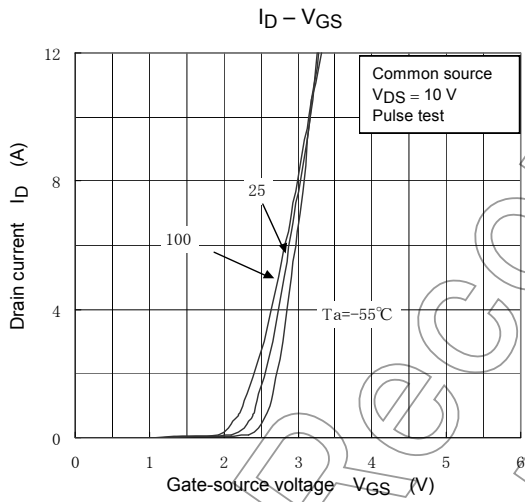
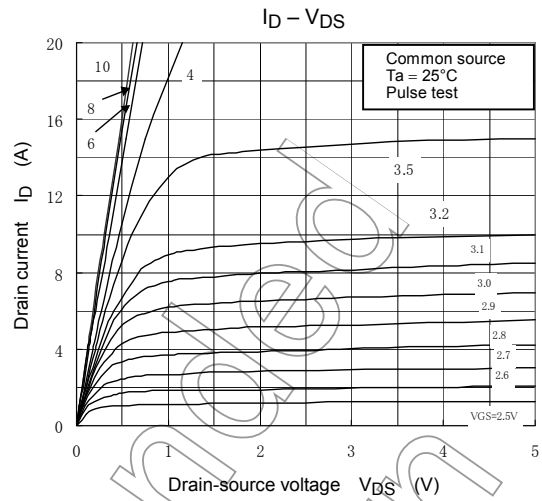
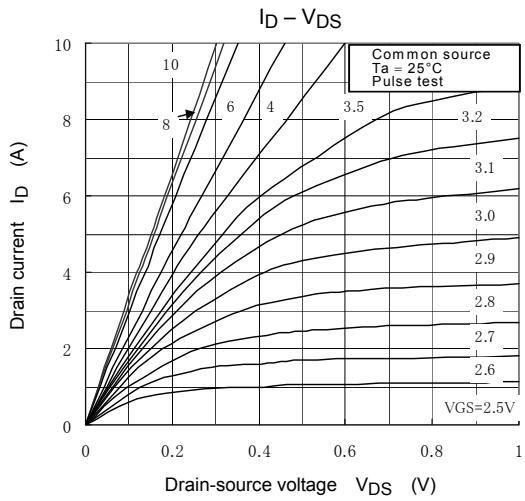


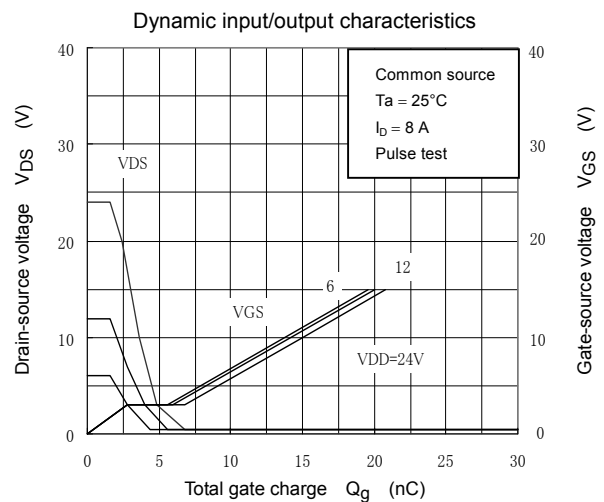
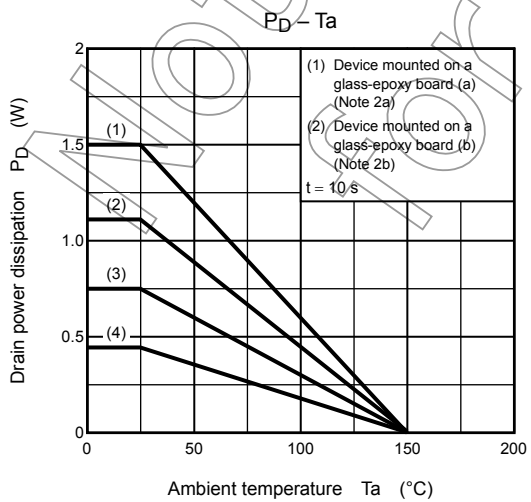
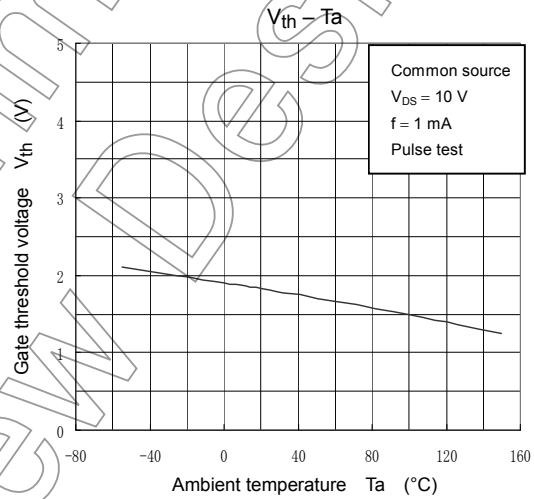
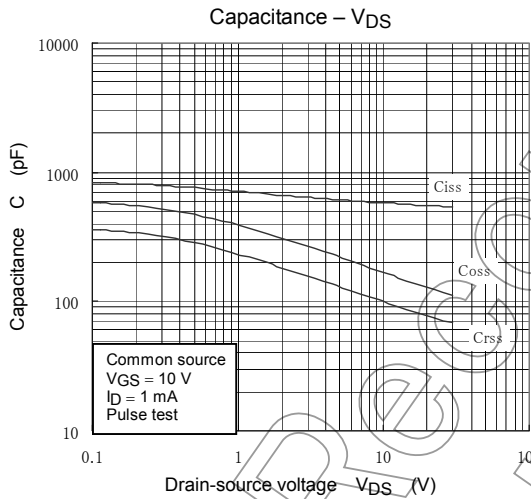
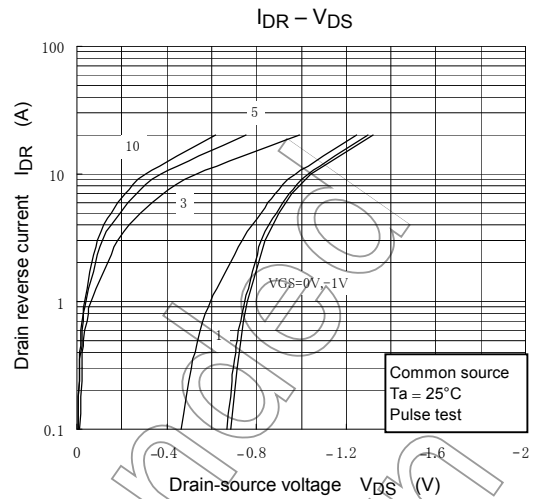
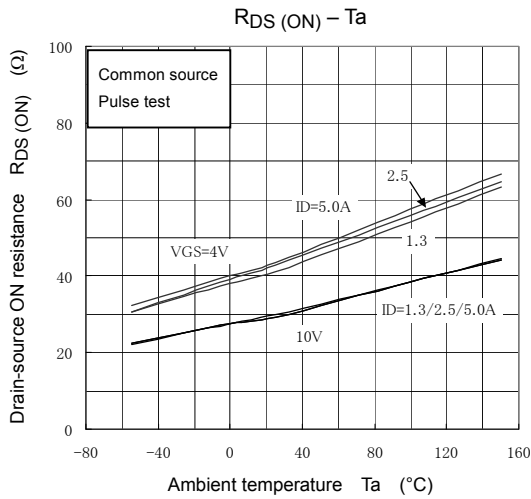
**Electrical Characteristics (Ta = 25°C)**

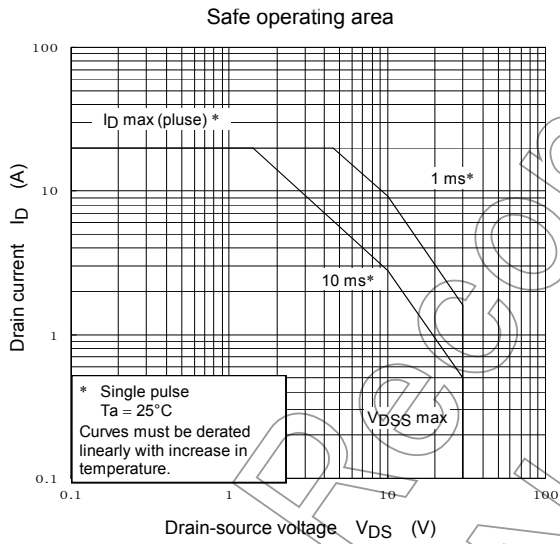
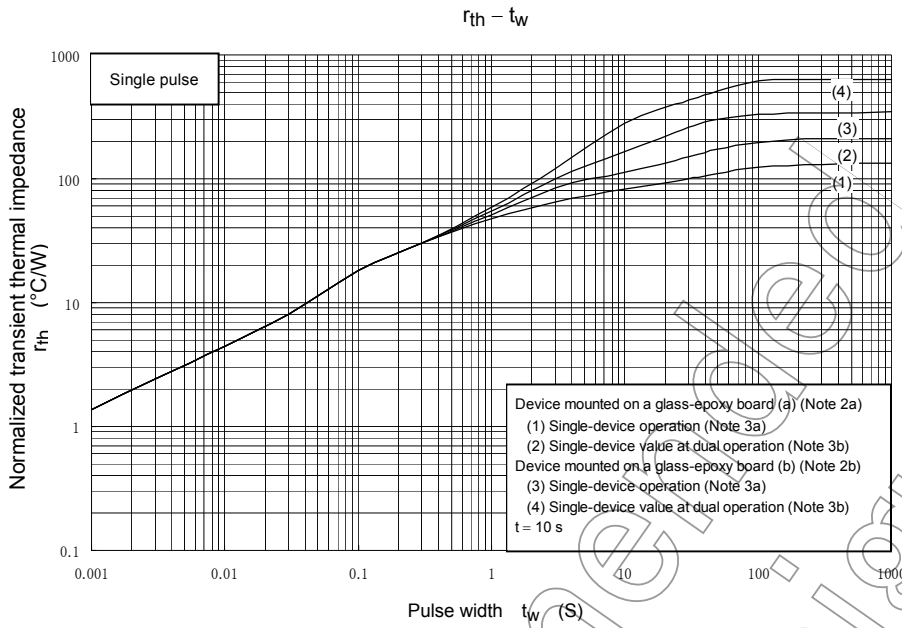
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-OFF current		$I_{DSS}$	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR) DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	30	—	—	V
		$V_{(BR) DSS}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	15	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.3	—	2.5	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 4.0\text{ V}, I_D = 2.5\text{ A}$	—	43	60	m $\Omega$
		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}$	—	30	40	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 2.5\text{ A}$	5	10	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	600	—	pF
Reverse transfer capacitance		$C_{rss}$		—	95	—	
Output capacitance		$C_{oss}$		—	160	—	
Switching time	Rise time	$t_r$		—	4	—	ns
	Turn-ON time	$t_{on}$		—	10	—	
	Fall time	$t_f$		—	9	—	
	Turn-OFF time	$t_{off}$		Duty $\leq 1\%$ , $t_w = 10\ \mu\text{s}$	—	35	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 24\text{ V}, V_{GS} = 10\text{ V}, I_D = 5\text{ A}$	—	15	—	nC
Gate-source charge		$Q_{gs}$		—	11	—	
Gate-drain ("miller") charge		$Q_{gd}$		—	4	—	

**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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