

TOSHIBA Field Effect Transistor Silicon N-Channel MOS Type (MACH II  $\pi$ -MOS V)

# TPCS8009-H

High-Speed Switching Applications  
 Switching Regulator Applications  
 DC/DC Converter Applications

- Low drain-source ON-resistance:  $R_{DS(ON)} = 0.27 \Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 2.1 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 100 \mu\text{A}$  (max) ( $V_{DS} = 150 \text{ V}$ )
- Enhancement model:  $V_{th} = 2.0\sim 4.0 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

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

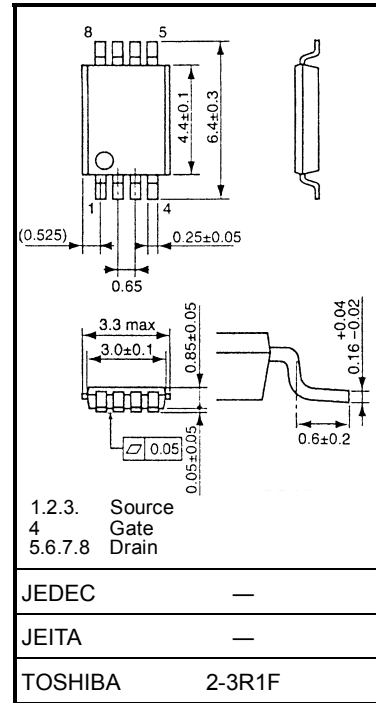
Characteristic		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	150	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	150	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	2.1	A
	Pulse (Note 1)	$I_{DP}$	8.4	
Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2a)		$P_D$	1.5	W
Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2b)		$P_D$	0.6	
Single-pulse avalanche energy(Note3)		$E_{AS}$	3	mJ
Avalanche current		$I_{AR}$	2.1	A
Repetitive avalanche energy (Note2a, Note 4)		$E_{AR}$	0.15	mJ
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	$-55\sim 150$	$^\circ\text{C}$

Note: For Notes 1 to 4, refer to 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).

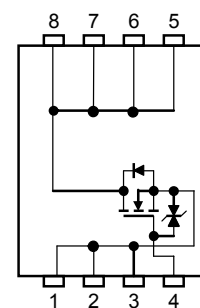
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.036 g (typ.)

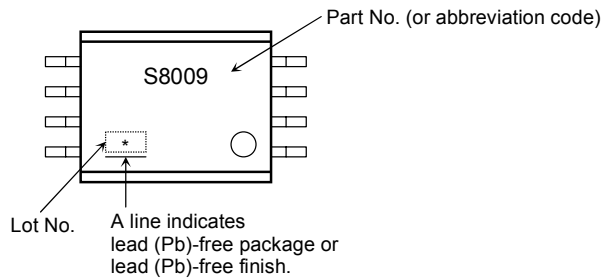
## Circuit Configuration



## Thermal Characteristics

Characteristic	Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	$R_{th(ch-a)}$	83.3	°C/W
Thermal resistance, channel to ambient (t = 10 s) (Note 2b)	$R_{th(ch-a)}$	208	°C/W

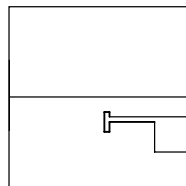
## Marking (Note 5)



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

Note 2:

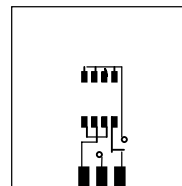
a) Device mounted on a glass-epoxy board (a)



FR-4  
25.4 × 25.4 × 0.8  
(unit: mm)

(a)

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



FR-4  
25.4 × 25.4 × 0.8  
(unit: mm)

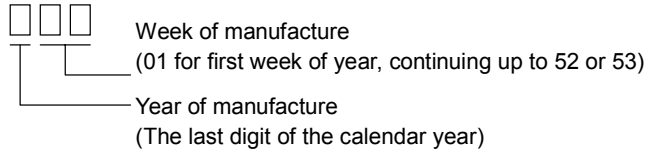
(b)

Note 3:  $V_{DD} = 50\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 1.0\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 2.1\text{ A}$

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

Note 5: ○ on the lower right of the marking indicates Pin 1.

\* Weekly code: (Three digits)

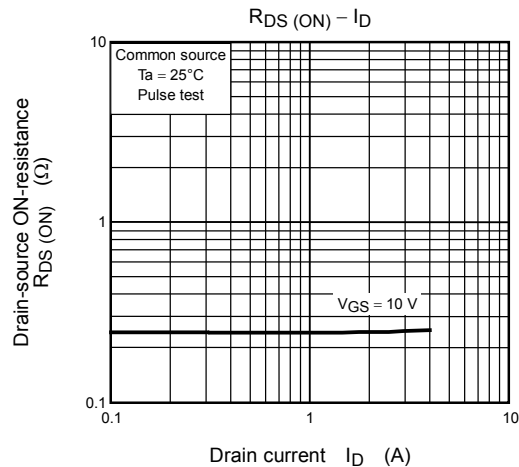
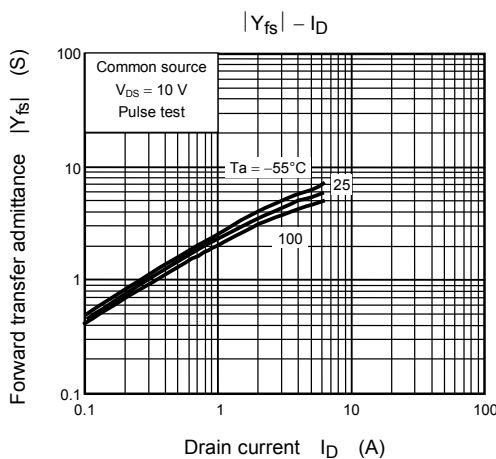
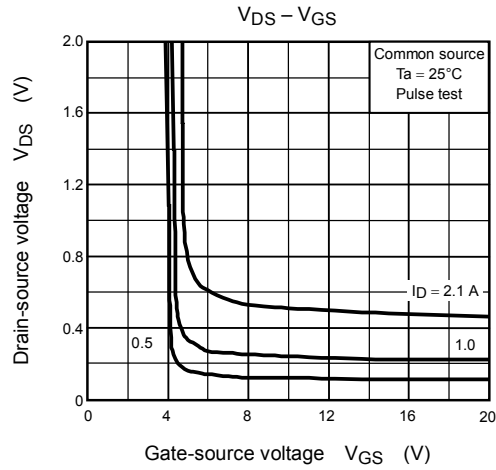
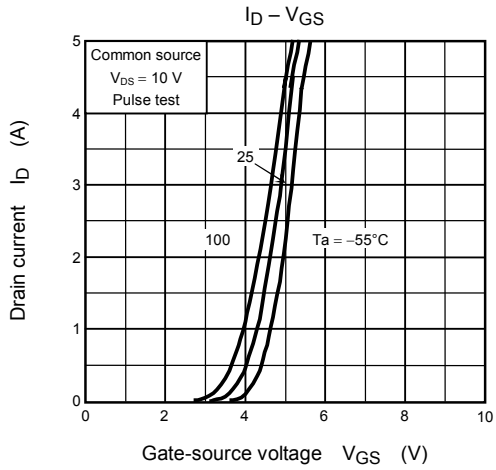
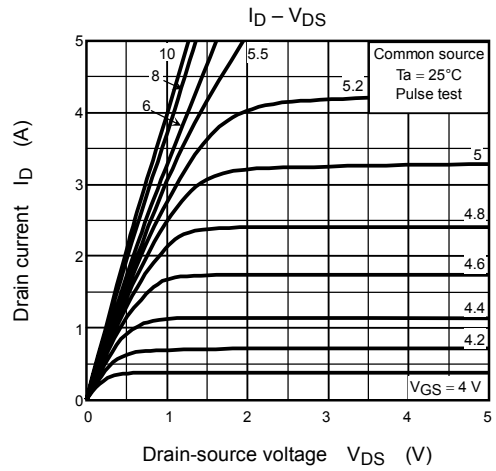
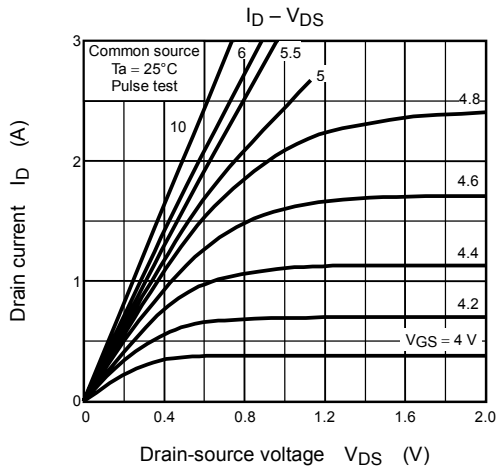


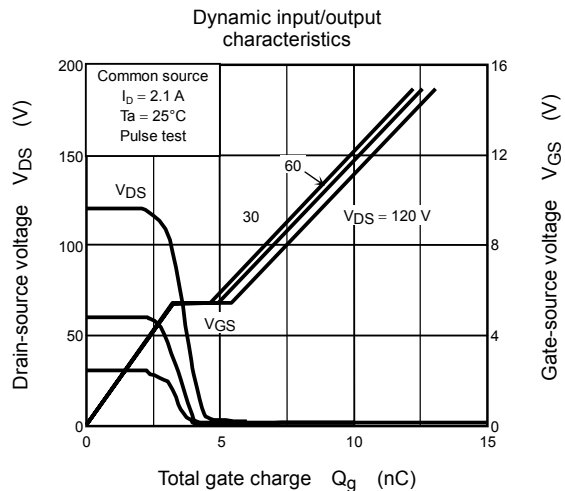
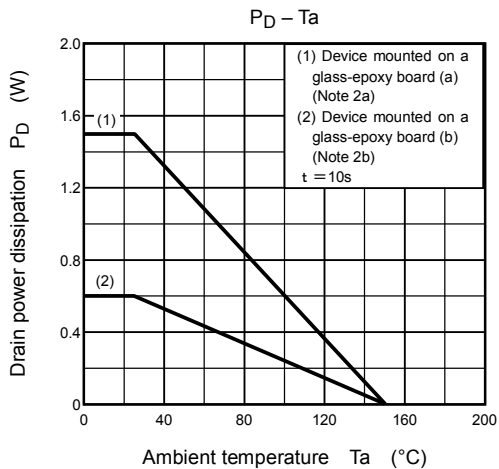
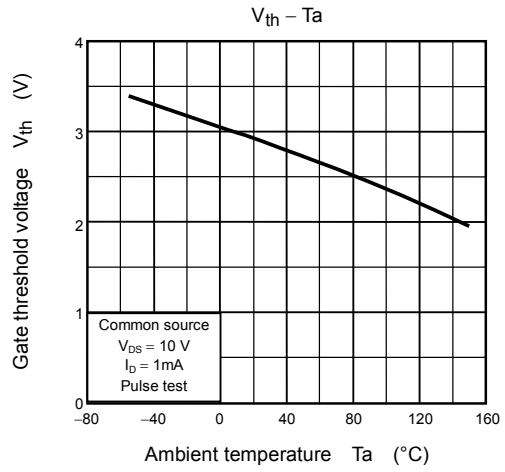
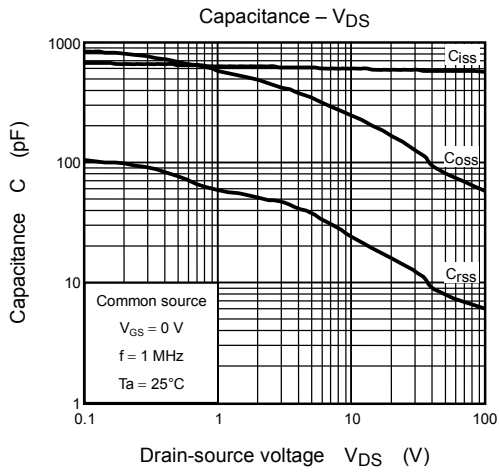
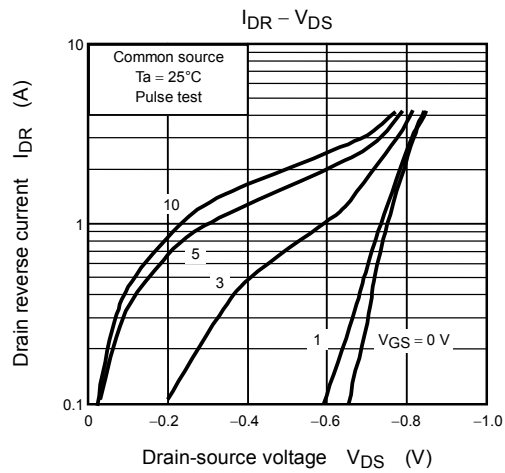
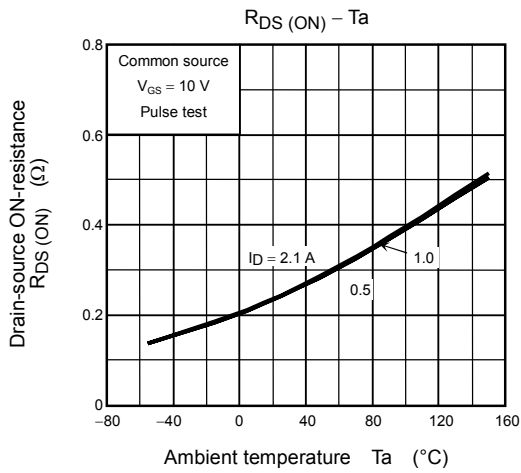
## Electrical Characteristics (Ta = 25°C)

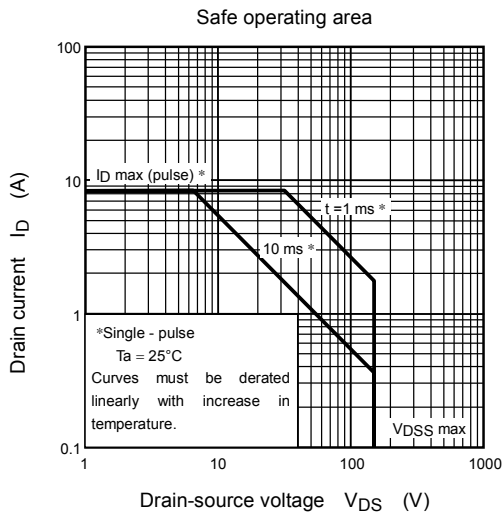
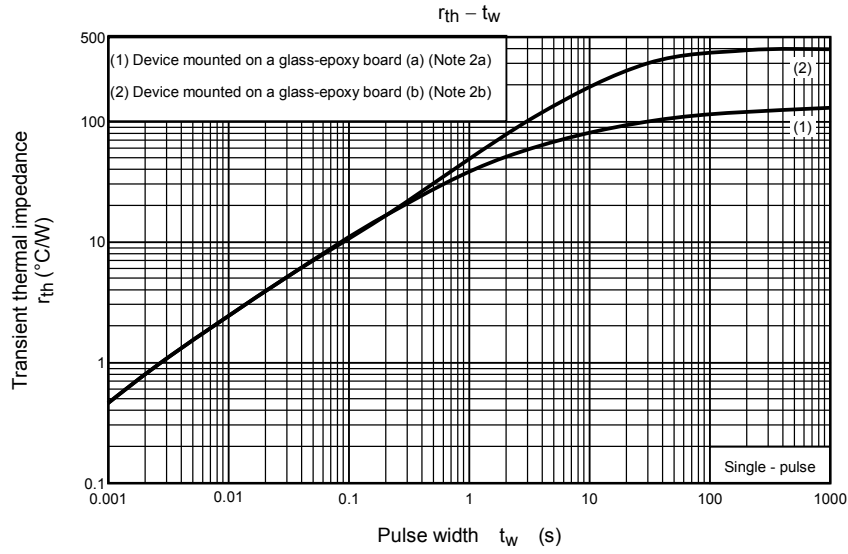
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cutoff current		$I_{DSS}$	$V_{DS} = 150\text{ V}, V_{GS} = 0\text{ V}$	—	—	100	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	150	—	—	V
		$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -5\text{ V}$	150	—	—	
		$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	100	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	2.0	—	4.0	V
Drain-source ON-resistance		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 1.0\text{ A}$	—	0.27	0.35	$\Omega$
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 1.0\text{ A}$	0.9	2.1	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	600	—	pF
Reverse transfer capacitance		$C_{rss}$		—	20	—	pF
Output capacitance		$C_{oss}$		—	220	—	pF
Switching time	Rise time	$t_r$	<p><math>V_{GS} = 10\text{ V}</math> <math>0\text{ V}</math> <math>I_D = 1.0\text{ A}</math> <math>V_{OUT}</math> <math>47\ \Omega</math> <math>V_{DD} \approx 75\text{ V}</math> <math>R_L = 75\ \Omega</math></p>	—	35	—	ns
	Turn-on time	$t_{on}$		—	95	—	
	Fall time	$t_f$		—	20	—	
	Turn-off time	$t_{off}$		Duty $\leq 1\%$ , $t_w = 10\ \mu\text{s}$	—	120	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 120\text{ V}, V_{GS} = 10\text{ V}, I_D = 2.1\text{ A}$	—	10	—	nC
Gate-source charge		$Q_{gs}$		—	7.5	—	nC
Gate-drain ("Miller") charge		$Q_{gd}$		—	2.5	—	nC
Gate switch charge		$Q_{sw}$		—	3.3	—	nC

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

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current (pulse)	(Note 1)	$I_{DRP}$	—	—	—	8.4	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = 2.1\text{ A}, V_{GS} = 0\text{ V}$	—	—	-2.0	V







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