

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

# TPC8213-H

High-Efficiency DC/DC Converter Applications

Notebook PC Applications

Portable-Equipment Applications

- Small footprint due to small and thin package
- High-speed switching
- Small gate charge:  $Q_{SW} = 2.9 \text{ nC}$  (typ.)
- Low drain-source ON-resistance:  $R_{DS(ON)} = 40 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 11 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10 \mu\text{A}$  (max) ( $V_{DS} = 60 \text{ V}$ )
- Enhancement mode:  $V_{th} = 1.1 \text{ to } 2.3 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

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

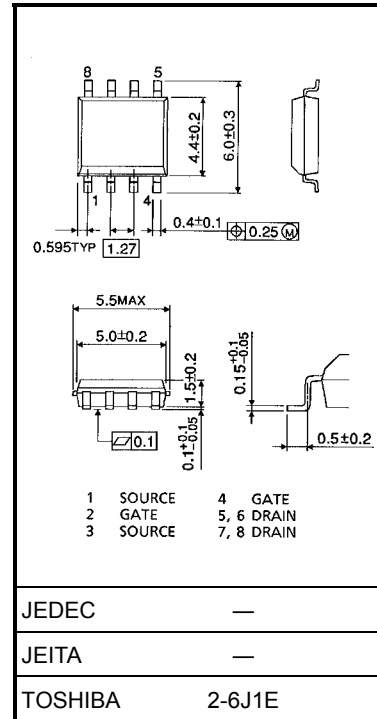
Characteristic		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	60	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	60	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	D C (Note 1)	$I_D$	5	A
	Pulse (Note 1)	$I_{DP}$	20	
Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 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)		$E_{AS}$	90	mJ
Avalanche current		$I_{AR}$	5	A
Repetitive avalanche energy (Note 2a, Note 3b, Note 5)		$E_{AR}$	0.087	mJ
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	-55~150	$^\circ\text{C}$

Note: For Notes 1 to 5, 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).

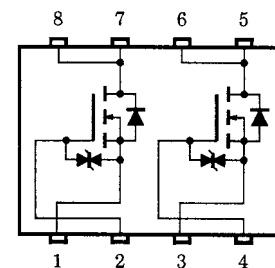
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.085 g (typ.)

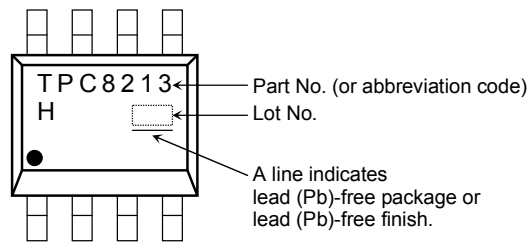
## Circuit Configuration



## Thermal Characteristics

Characteristic		Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	Single-device operation (Note 3a)	$R_{th(ch-a)}(1)$	83.3	°C/W
	Single-device value at dual operation (Note 3b)	$R_{th(ch-a)}(2)$	114	
Thermal resistance, channel to ambient (t = 10 s) (Note 2b)	Single-device operation (Note 3a)	$R_{th(ch-a)}(1)$	167	
	Single-device value at dual operation (Note 3b)	$R_{th(ch-a)}(2)$	278	

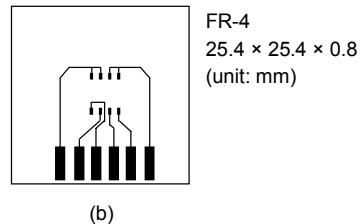
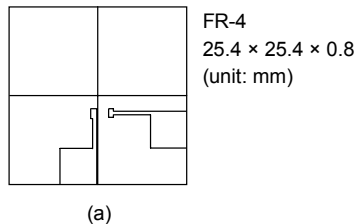
## Marking



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

Note 2:

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



Note 3:

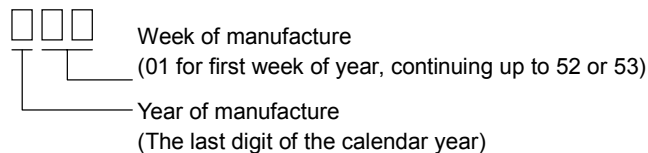
- a) The power dissipation and thermal resistance values are shown for a single device (During single-device operation, power is only applied to one device.)  
b) The power dissipation and thermal resistance values are shown for a single device (During dual operation, power is evenly applied to both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

Note 4:  $V_{DD} = 24\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (Initial),  $L = 5\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 5.0\text{ A}$

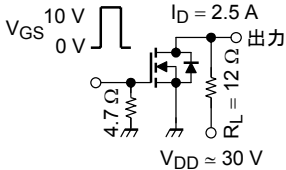
Note 5: Repetitive rating: pulse width limited by maximum channel temperature

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

\* Weekly code: (Three digits)

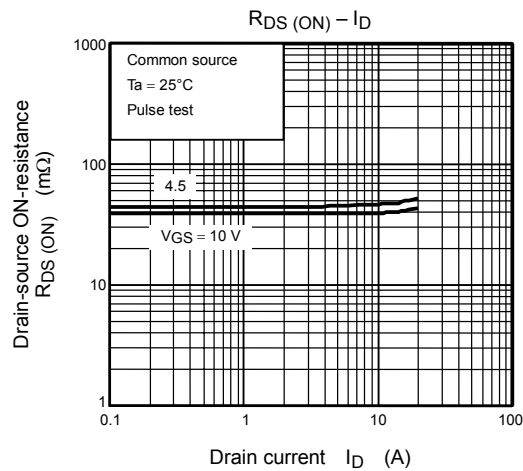
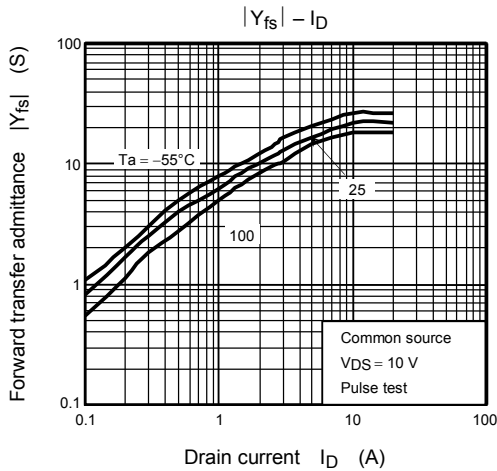
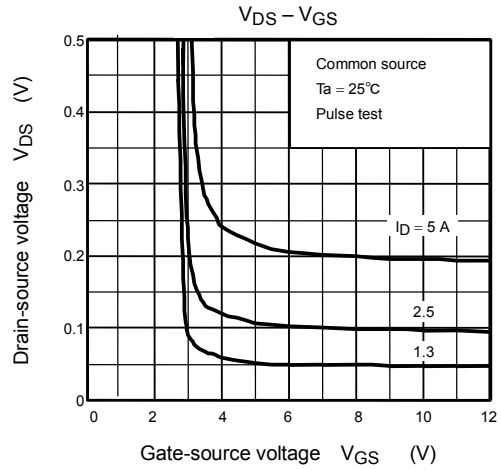
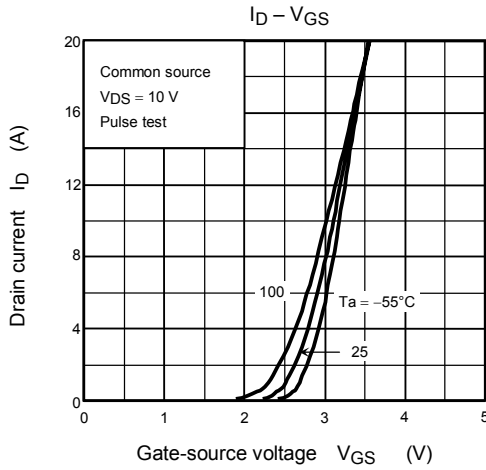
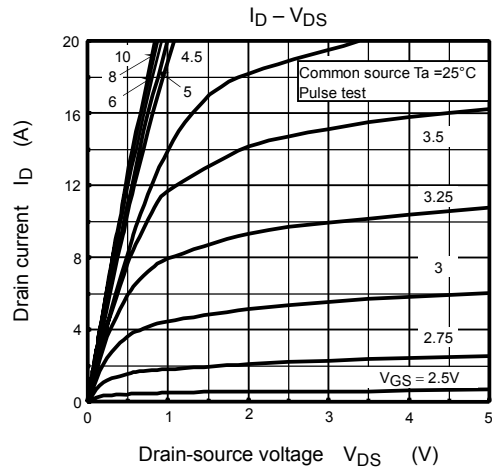
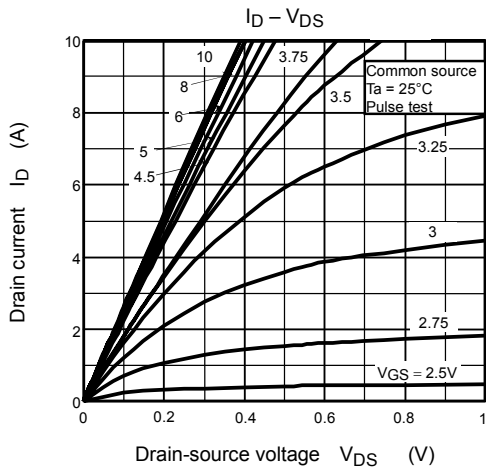


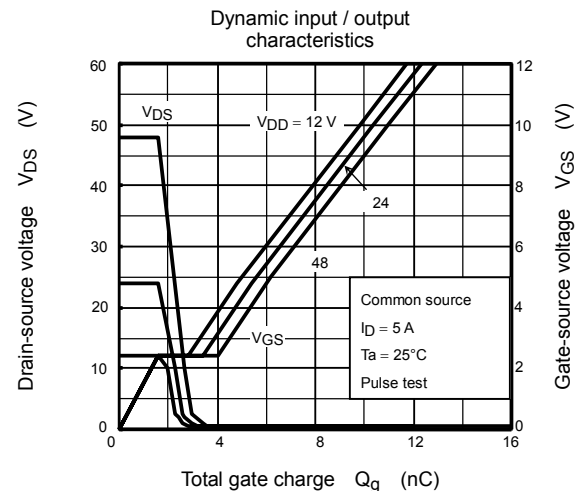
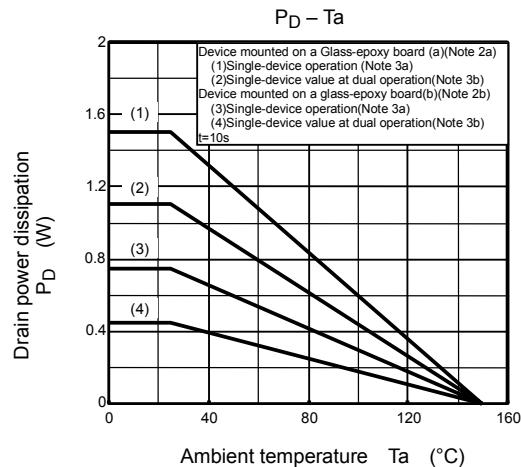
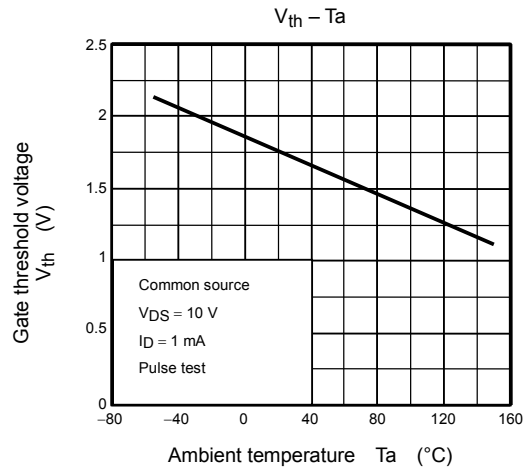
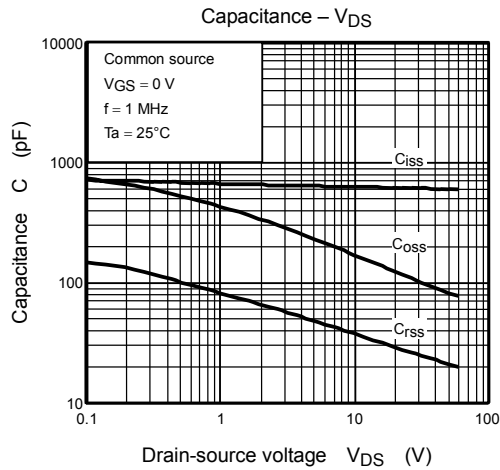
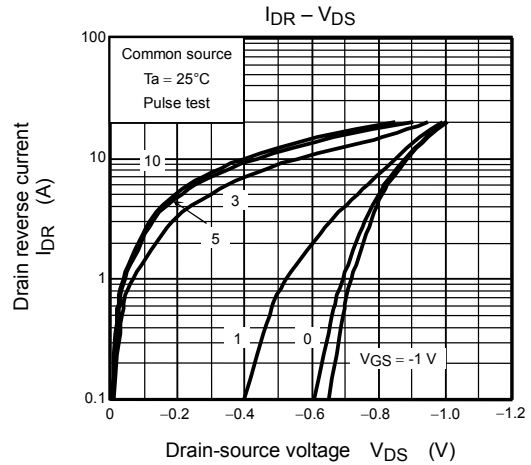
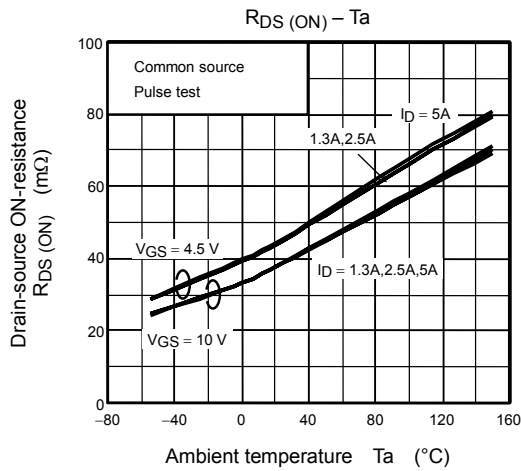
## Electrical Characteristics (Ta = 25°C)

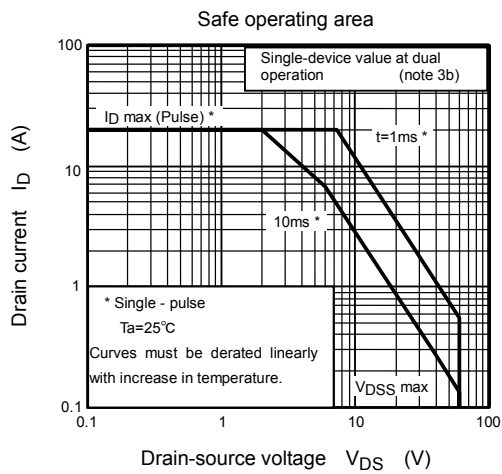
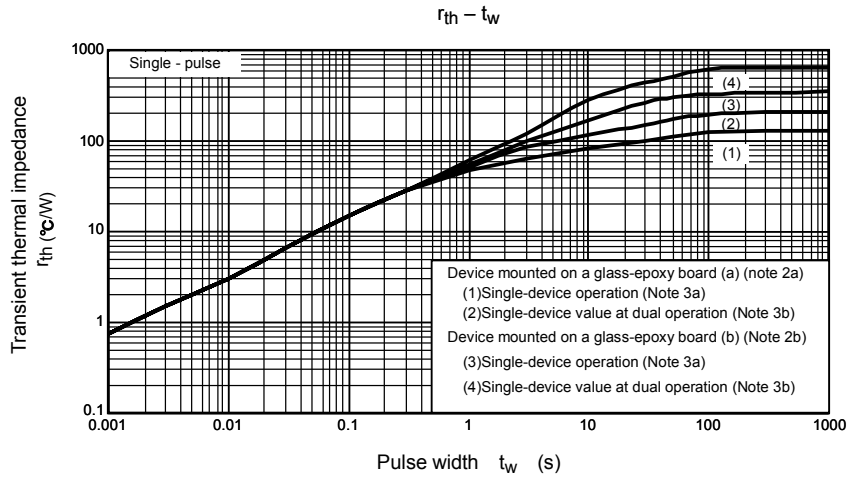
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cutoff current		$I_{DSS}$	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	60	—	—	V
		$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	45	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.1	—	2.3	V
Drain-source ON-resistance		$R_{DS(ON)}$	$V_{GS} = 4.5\text{ V}, I_D = 2.5\text{ A}$	—	45	56	m $\Omega$
		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}$	—	40	50	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 2.5\text{ A}$	5.5	11	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	625	—	pF
Reverse transfer capacitance		$C_{rss}$		—	35	—	
Output capacitance		$C_{oss}$		—	175	—	
Switching time	Rise time	$t_r$	 <p><math>V_{GS} = 10\text{ V}</math> <math>0\text{ V}</math> <math>I_D = 2.5\text{ A}</math> <math>R_L = 12\ \Omega</math> <math>V_{DD} \approx 30\text{ V}</math></p>	—	4	—	ns
	Turn-on time	$t_{on}$		—	10	—	
	Fall time	$t_f$		—	2	—	
	Turn-off time	$t_{off}$		Duty $\leq 1\%$ , $t_w = 10\ \mu\text{s}$	—	19	
Total gate charge (gate-source plus gate-drain) (Note 7)		$Q_g$	$V_{DD} \approx 48\text{ V}, V_{GS} = 10\text{ V}, I_D = 5\text{ A}$	—	11	—	nC
			$V_{DD} \approx 48\text{ V}, V_{GS} = 5\text{ V}, I_D = 5\text{ A}$	—	6	—	
Gate-source charge 1		$Q_{gs1}$	$V_{DD} \approx 48\text{ V}, V_{GS} = 10\text{ V}, I_D = 5\text{ A}$	—	1.6	—	
Gate-drain ("Miller") charge		$Q_{gd}$		—	2.4	—	
Gate switch charge		$Q_{SW}$		—	2.9	—	

## 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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