

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

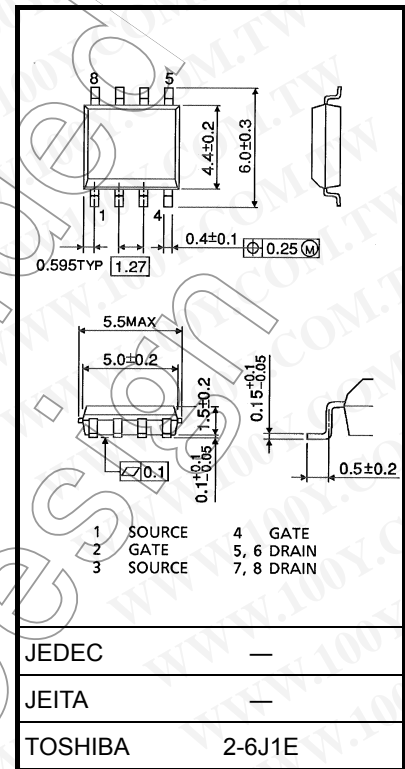
Characteristic		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	60	V
Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$)		V_{DGR}	60	V
Gate-source voltage		V_{GSS}	± 20	V
Drain current	D C (Note 1)	I_D	5	A
	Pulse (Note 1)	I_{DP}	20	
Drain power dissipation ($t = 10 \text{ s}$) (Note 2a)	Single-device 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}	$-55 \sim 150$	$^\circ\text{C}$

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).

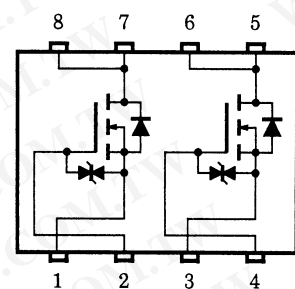
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.085 g (typ.)

Circuit Configuration

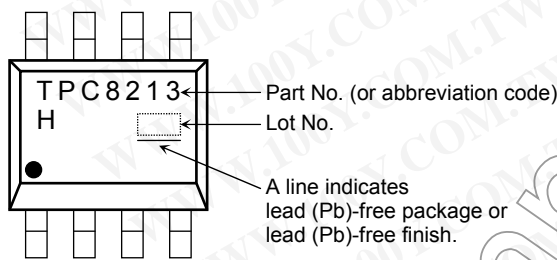


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Thermal Characteristics

Characteristic		Symbol	Max	Unit
Thermal resistance, channel to ambient ($t = 10$ s)	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)	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	

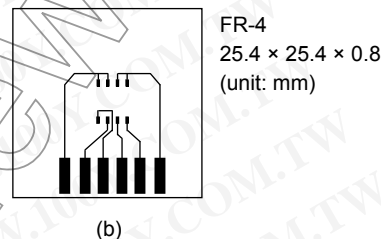
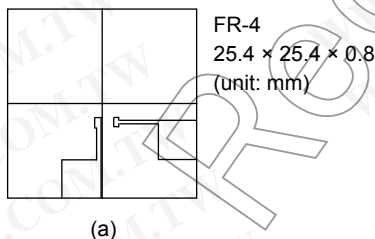
Marking



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:

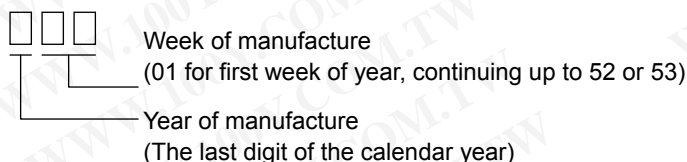
- a) The power dissipation and thermal resistance values are shown for a single device (During single-device operation, power is only applied to one device.)
b) The power dissipation and thermal resistance values are shown for a single device (During dual operation, power is evenly applied to both devices.)

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



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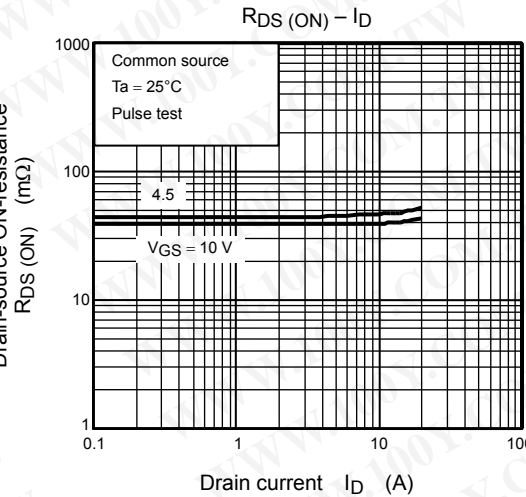
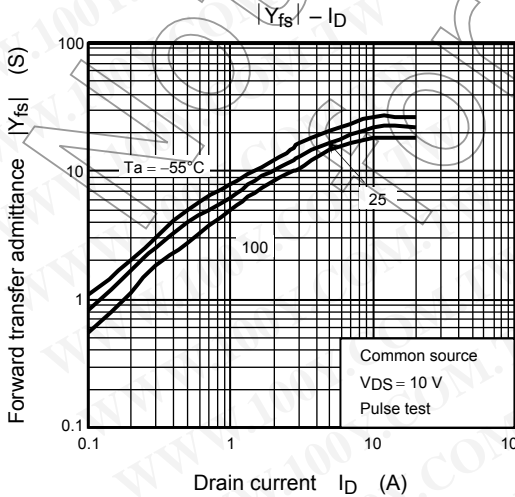
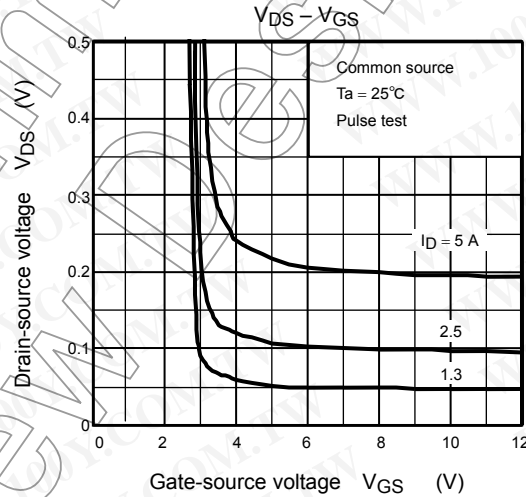
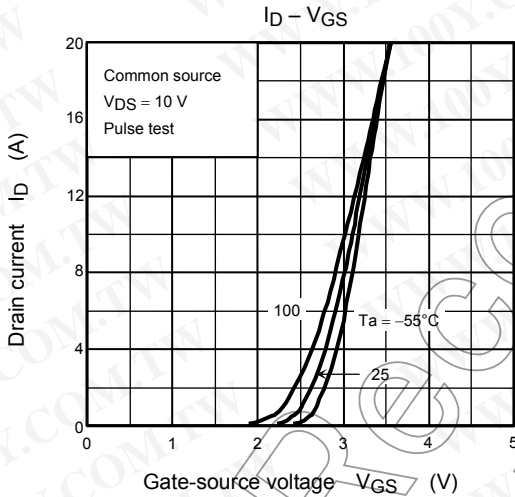
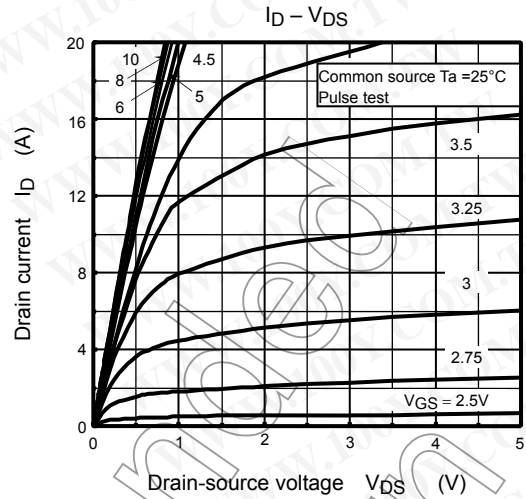
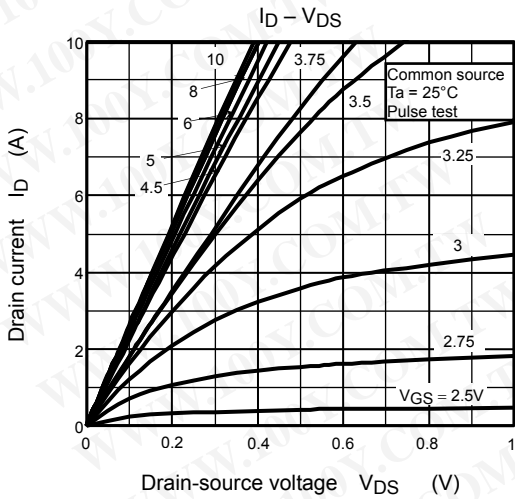
Electrical Characteristics (Ta = 25°C)

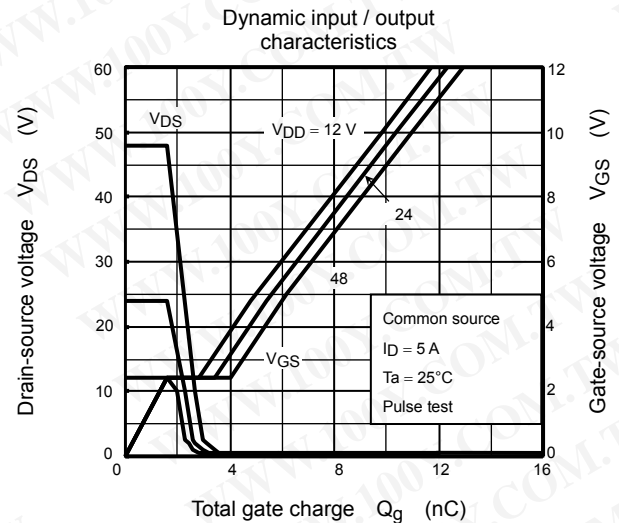
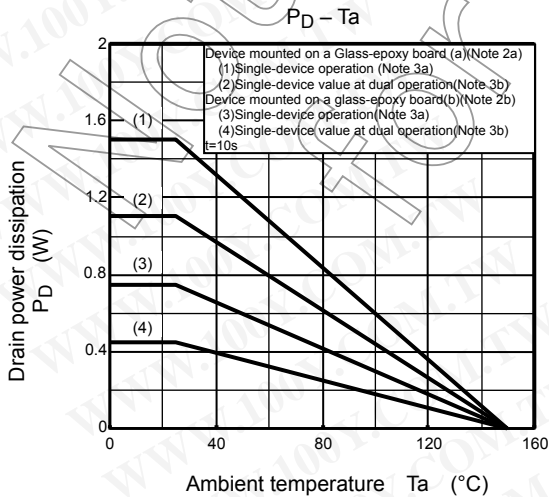
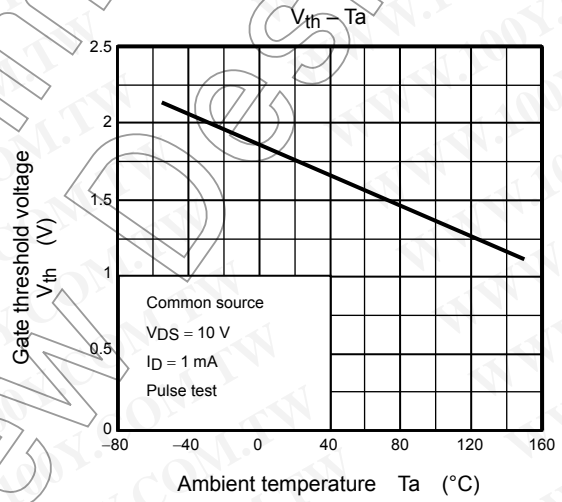
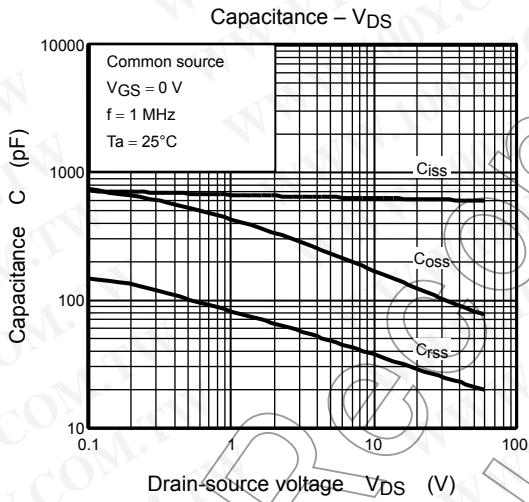
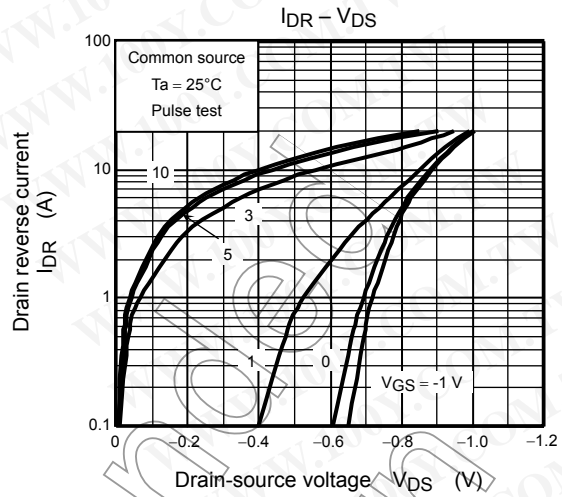
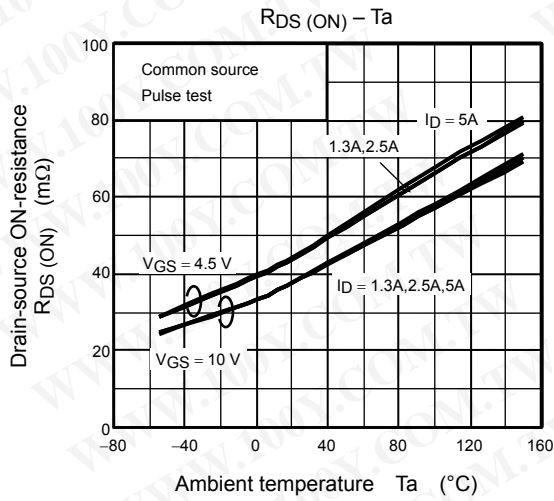
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 10	μA
Drain cutoff current		I_{DSS}	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	μA
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	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 Ω
		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}$	—	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>$V_{GS} = 10\text{ V}$ $V_{GS} = 0\text{ V}$ $I_D = 2.5\text{ A}$ $R_L = 12\ \Omega$ $V_{DD} \approx 30\text{ V}$</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	—	

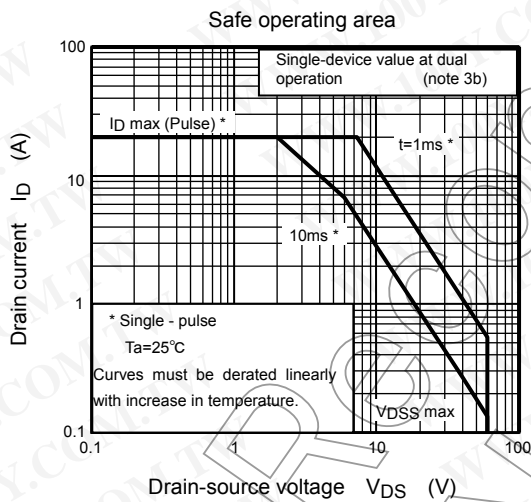
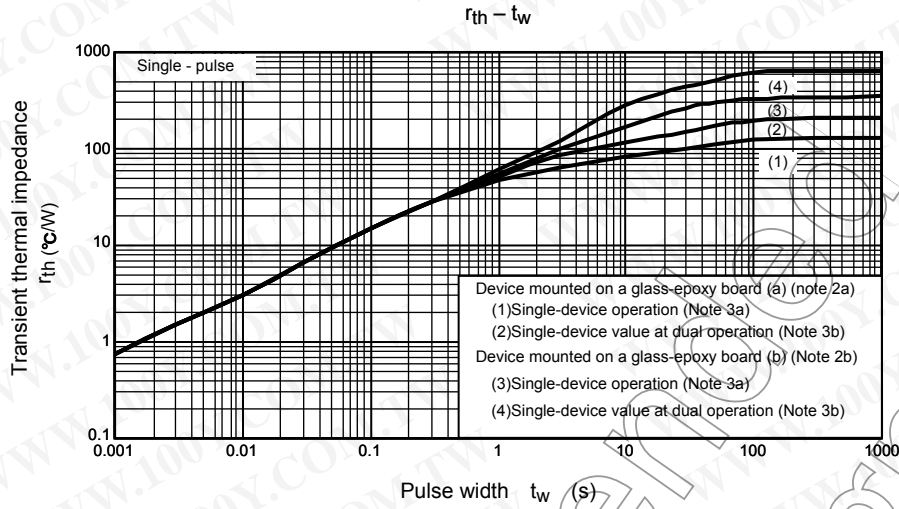
Source-Drain Ratings and Characteristics (Ta = 25°C)

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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