

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (High speed U-MOS III)

# TPC8013-H

High Speed and High Efficiency DC-DC Converters  
 Notebook PC Applications  
 Portable Equipment Applications

- Small footprint due to small and thin package
- High speed switching
- Small gate charge:  $Q_g = 48 \text{ nc}$  (typ.)
- Low drain-source ON resistance:  $R_{DS(ON)} = 5.4 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 25 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 30 \text{ V}$ )
- Enhancement-mode:  $V_{th} = 1.1 \text{ to } 2.3 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

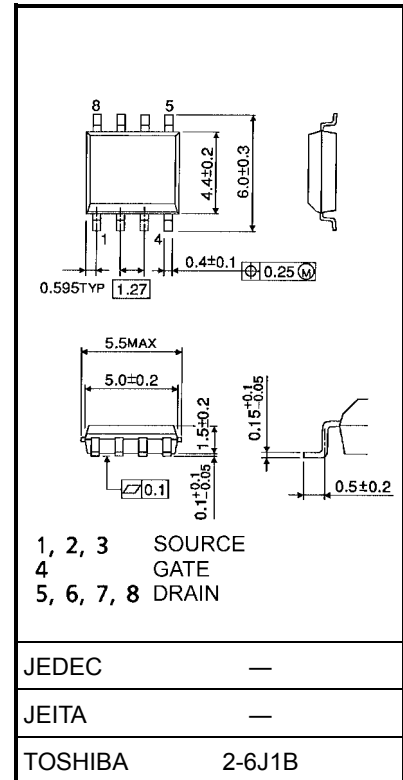
## Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

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	DC (Note 1)	$I_D$	15	A
	Pulse (Note 1)	$I_{DP}$	60	
Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2a)		$P_D$	1.9	W
Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2b)		$P_D$	1.0	W
Single pulse avalanche energy (Note 3)		$E_{AS}$	146	mJ
Avalanche current		$I_{AR}$	15	A
Repetitive avalanche energy (Note 2a) (Note 4)		$E_{AR}$	0.19	mJ
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	-55 to 150	$^\circ\text{C}$

Note: For (Note 1), (Note 2), (Note 3) and (Note 4), please refer to the next page.

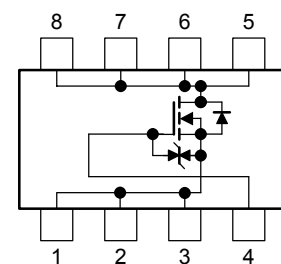
This transistor is an electrostatic sensitive device. Please handle with caution.

Unit: mm



Weight: 0.080 g (typ.)

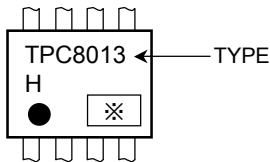
## Circuit Configuration



## Thermal Characteristics

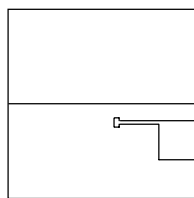
Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	$R_{th(ch-a)}$	65.8	°C/W
Thermal resistance, channel to ambient (t = 10 s) (Note 2b)	$R_{th(ch-a)}$	125	°C/W

## Marking (Note 5)



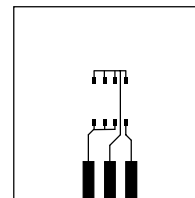
Note 1: Please use devices on condition that the channel temperature is below 150°C.

Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)



(a)

FR-4  
25.4 × 25.4 × 0.8  
(unit: mm)



(b)

FR-4  
25.4 × 25.4 × 0.8  
(unit: mm)

Note 3:  $V_{DD} = 24\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 0.5\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 15\text{ A}$

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

Note 5: • on lower left of the marking indicates Pin 1.

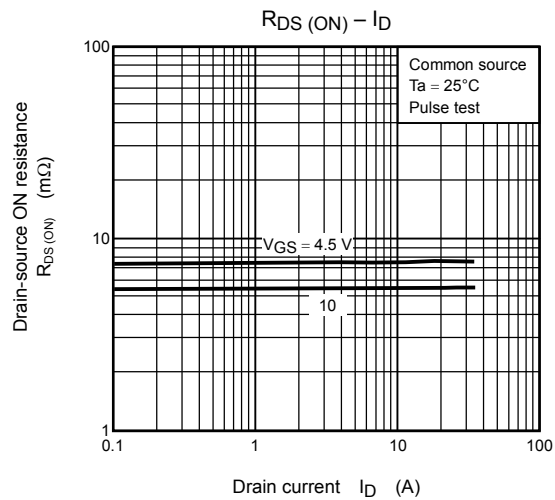
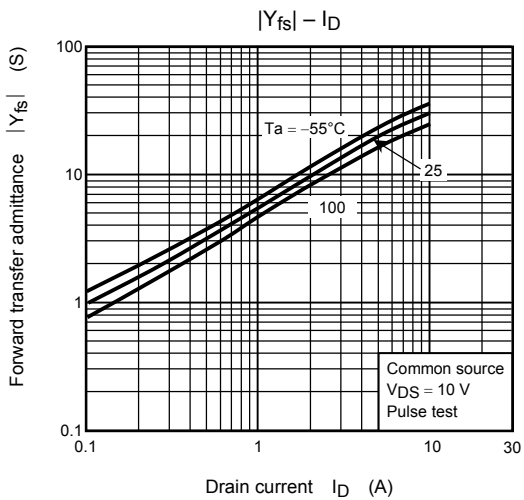
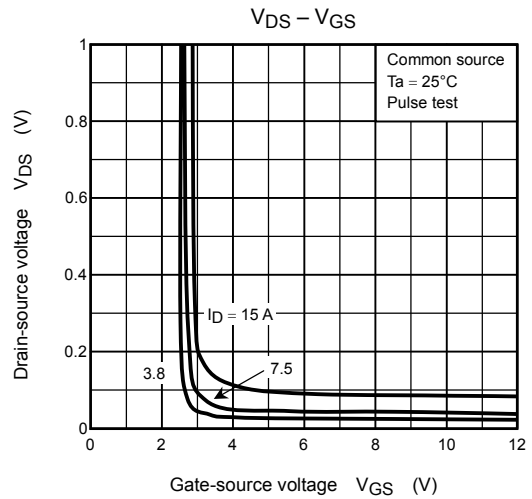
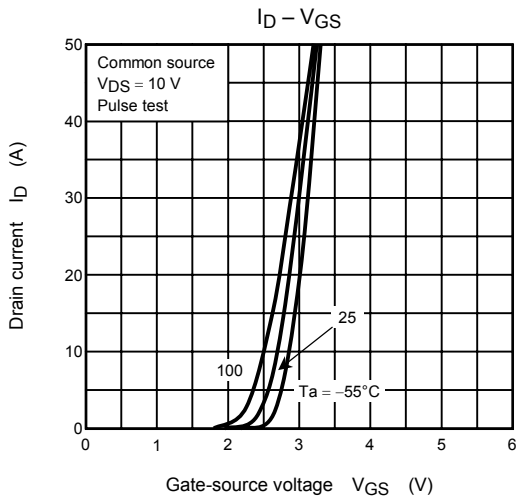
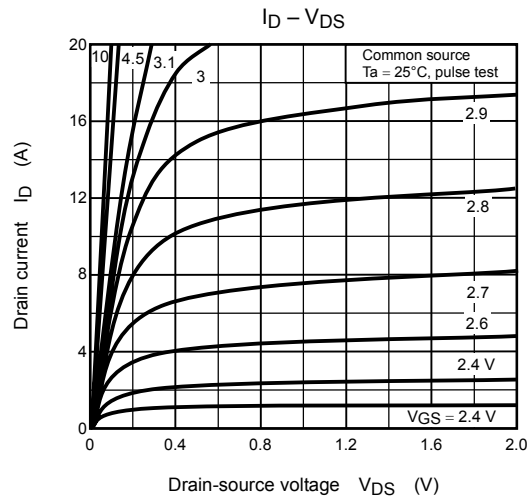
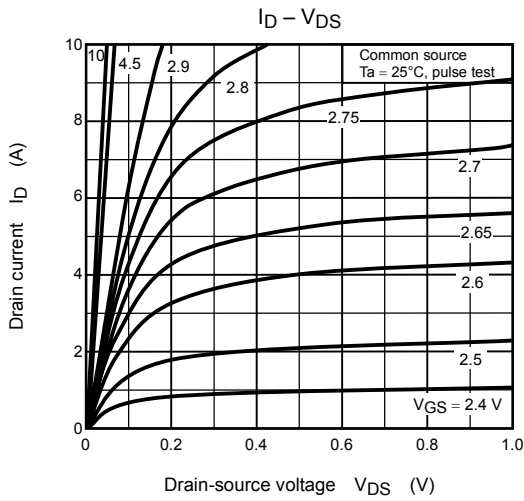
※ shows lot number. (year of manufacture: last decimal digit of the year of manufacture, month of manufacture: January to December are denoted by letters A to L respectively.)

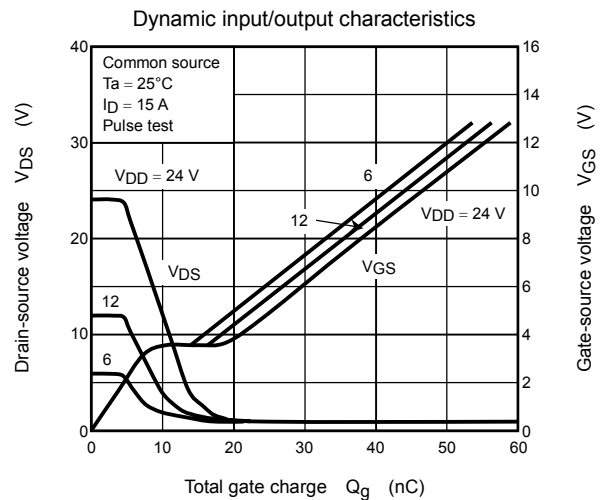
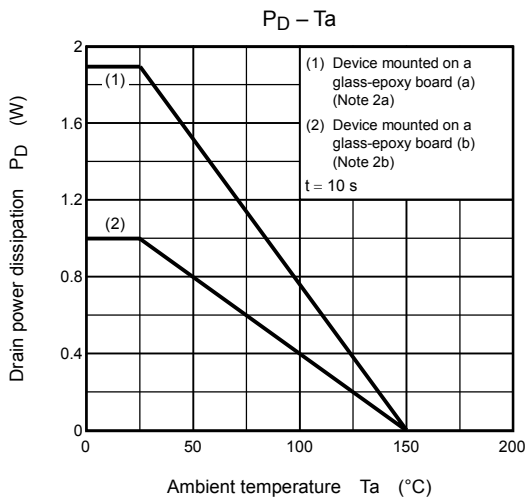
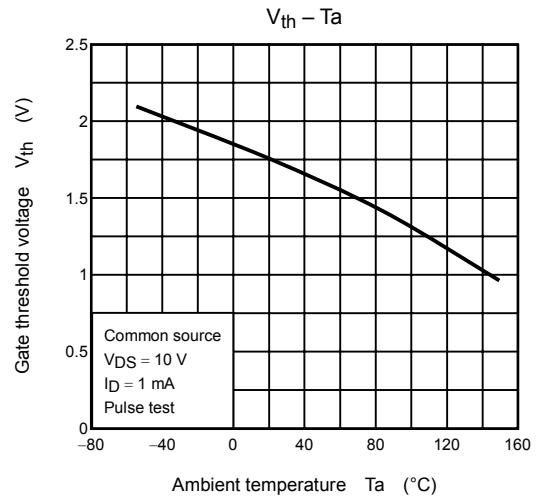
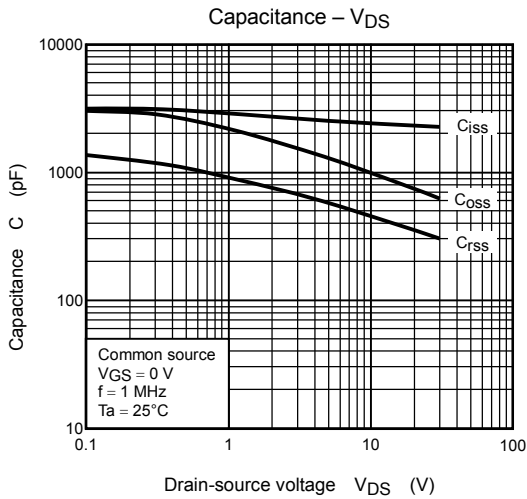
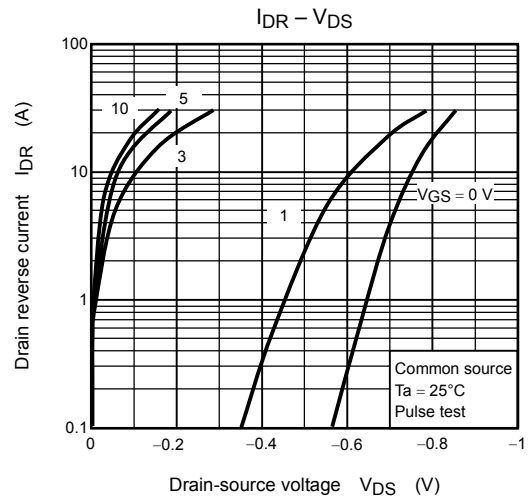
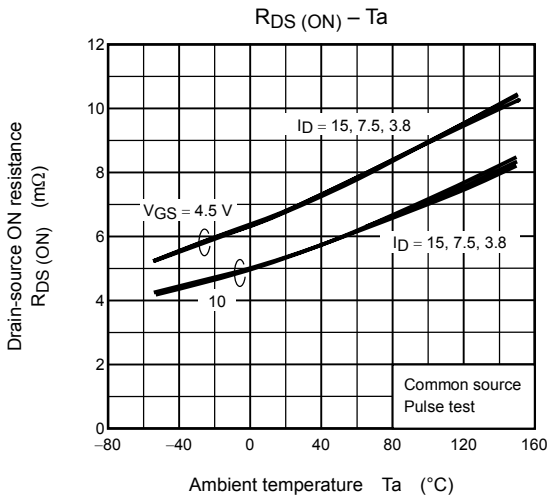
## Electrical Characteristics (Ta = 25°C)

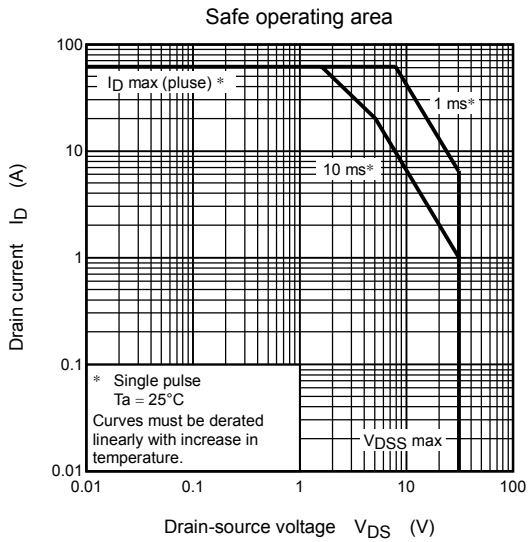
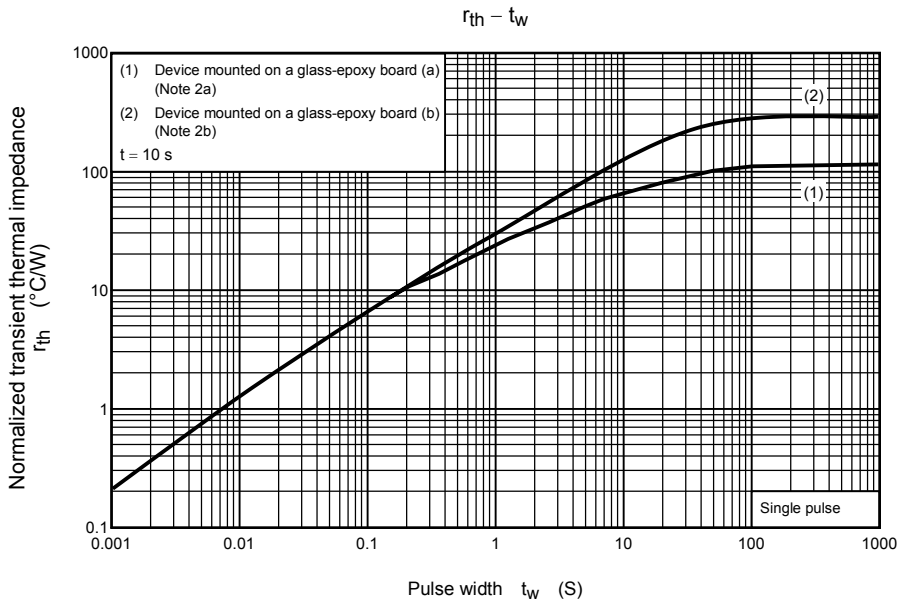
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cut-OFF current		$I_{DSS}$	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	30	—	—	V
		$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	15	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.1	—	2.3	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = 4.5\text{ V}, I_D = 7.5\text{ A}$	—	6.6	9.5	$\text{m}\Omega$
			$V_{GS} = 10\text{ V}, I_D = 7.5\text{ A}$	—	5.4	6.5	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 7.5\text{ A}$	12.5	25	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	2380	—	pF
Reverse transfer capacitance		$C_{rss}$		—	410	—	
Output capacitance		$C_{oss}$		—	980	—	
Switching time	Rise time	$t_r$	<p><math>V_{GS} = 10\text{ V}</math> <math>0\text{ V}</math> <math>I_D = 7.5\text{ A}</math> <math>V_{OUT}</math> <math>4.7\Omega</math> <math>R_L = 2\Omega</math> <math>V_{DD} \approx 15\text{ V}</math> Duty <math>\leq 1\%</math>, <math>t_w = 10\mu\text{s}</math></p>	—	9.8	—	ns
	Turn-ON time	$t_{on}$		—	21	—	
	Fall time	$t_f$		—	15	—	
	Turn-OFF time	$t_{off}$		—	60	—	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 24\text{ V}, V_{GS} = 10\text{ V}, I_D = 15\text{ A}$	—	46	—	nC
			$V_{DD} \approx 24\text{ V}, V_{GS} = 5\text{ V}, I_D = 15\text{ A}$	—	26	—	
Gate-source charge 1		$Q_{gs1}$	$V_{DD} \approx 24\text{ V}, V_{GS} = 10\text{ V}, I_D = 15\text{ A}$	—	7.2	—	
Gate-drain ("miller") charge		$Q_{gd}$	$V_{DD} \approx 24\text{ V}, V_{GS} = 10\text{ V}, I_D = 15\text{ A}$	—	12.2	—	
Gate switch charge		$Q_{sw}$	$V_{DD} \approx 24\text{ V}, V_{GS} = 10\text{ V}, I_D = 15\text{ A}$	—	15.6	—	

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

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	$I_{DRP}$	—	—	—	60	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = 15\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.2	V







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