

TOSHIBA Field Effect Transistor with Built-in Schottky Barrier Diode  
Silicon N-Channel MOS Type (U-MOS V-H)

# TPC8A04-H

High Efficiency DC-DC Converter Applications  
Notebook PC Applications  
Portable Equipment Applications

- Built-in schottky barrier diode  
Low forward voltage:  $V_{DSF} = 0.6 \text{ V(max)}$
- High-speed switching
- Small gate charge:  $Q_{SW} = 13 \text{ nC (typ.)}$
- Low drain-source ON-resistance:  $R_{DS(ON)} = 2.6 \text{ m}\Omega \text{ (typ.)}$
- High forward transfer admittance:  $|Y_{fs}| = 62 \text{ S (typ.)}$
- Low leakage current:  $I_{DSS} = 100 \mu\text{A (max)}$  ( $V_{DS} = 30 \text{ V}$ )
- Enhancement mode:  $V_{th} = 1.3 \text{ to } 2.3 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

## Absolute Maximum Ratings (Ta = 25°C)

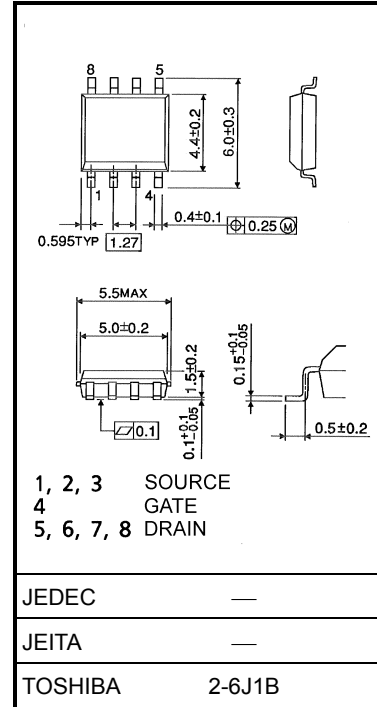
Characteristic		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	30	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	30	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	18	A
	Pulsed (Note 1)	$I_{DP}$	72	
Drain power dissipation	(t = 10 s) (Note 2a)	$P_D$	1.9	W
Drain power dissipation	(t = 10 s) (Note 2b)	$P_D$	1.0	W
Single-pulse avalanche energy (Note 3)		$E_{AS}$	211	mJ
Avalanche current		$I_{AR}$	18	A
Repetitive avalanche energy ( $T_c = 25^\circ\text{C}$ ) (Note 4)		$E_{AR}$	0.082	mJ
Channel temperature		$T_{ch}$	150	°C
Storage temperature range		$T_{stg}$	-55 to 150	°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).

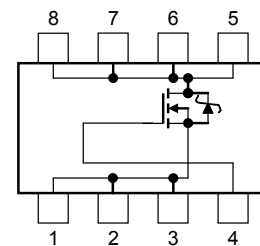
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.085g (typ.)

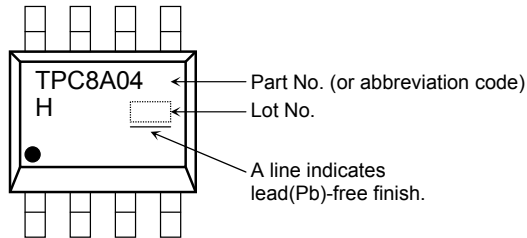
## Circuit Configuration



## Thermal Characteristics

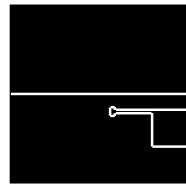
Characteristic	Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	$R_{th(ch-a)}$	65.8	°C/W
Thermal resistance, channel to ambient (t = 10 s) (Note 2b)	$R_{th(ch-a)}$	125	°C/W

## Marking (Note 5)



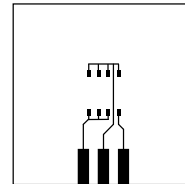
Note 1: Ensure that the channel temperature does not exceed 150°C.

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



(a)

FR-4  
 $25.4 \times 25.4 \times 0.8$   
 (Unit: mm)



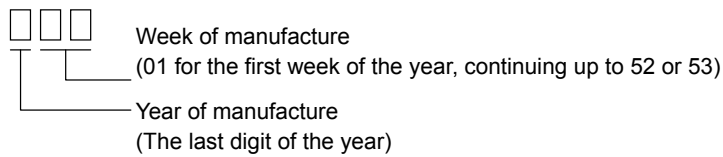
(b)

FR-4  
 $25.4 \times 25.4 \times 0.8$   
 (Unit: mm)

Note 3:  $V_{DD} = 24 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 500 \mu\text{H}$ ,  $R_G = 25 \Omega$ ,  $I_{AR} = 18 \text{ A}$

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

Note 5: \* Weekly code: (Three digits)

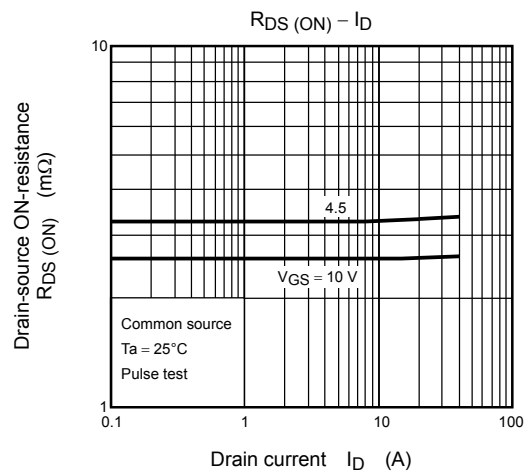
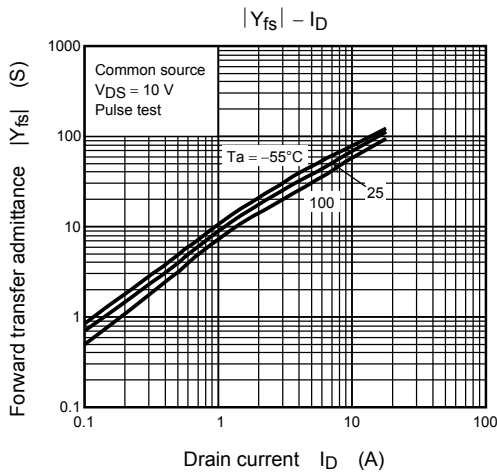
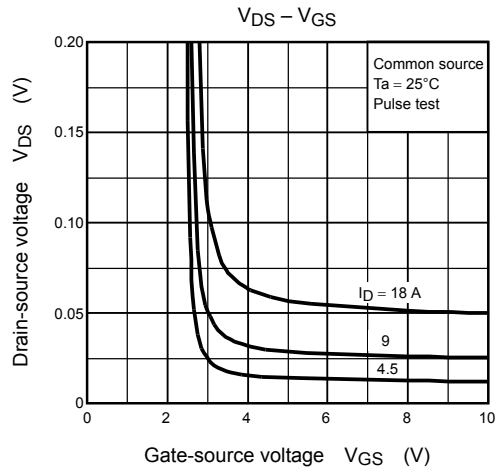
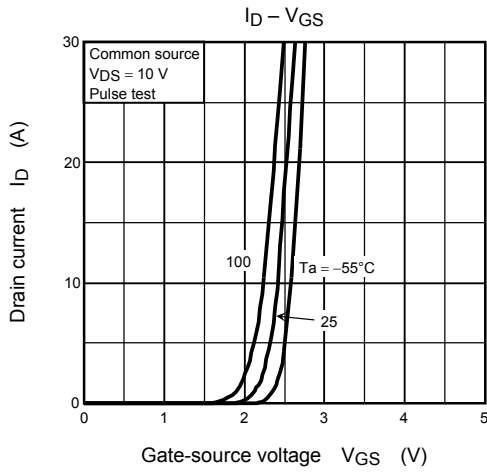
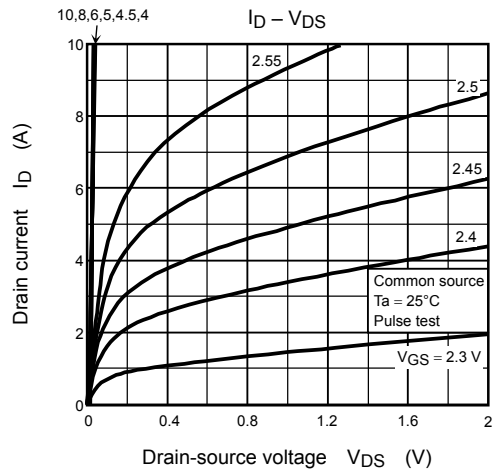
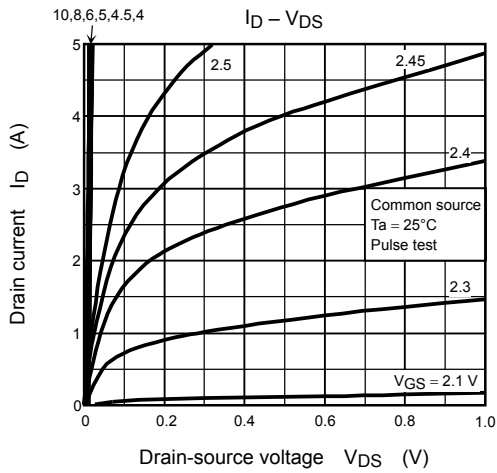


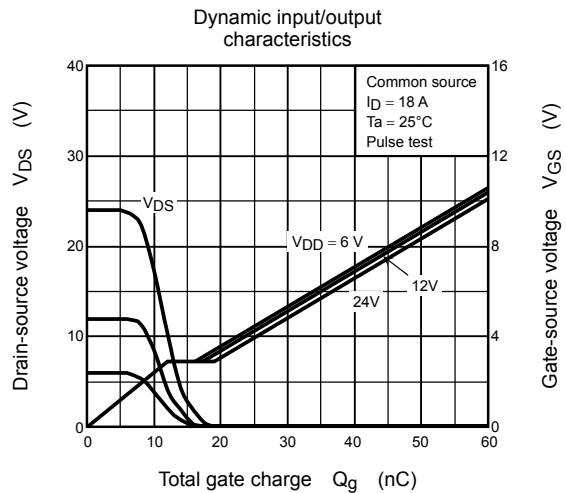
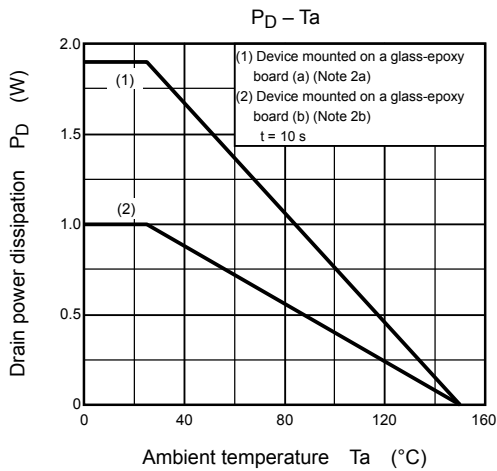
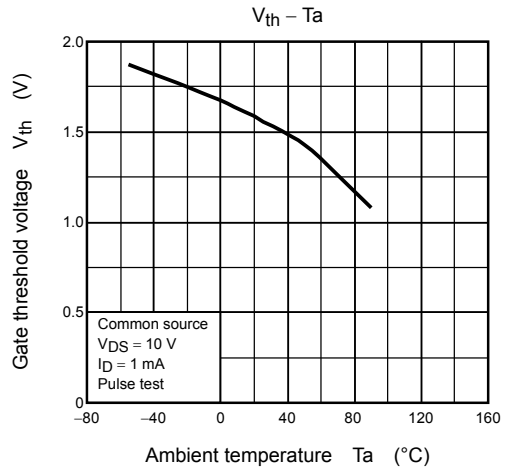
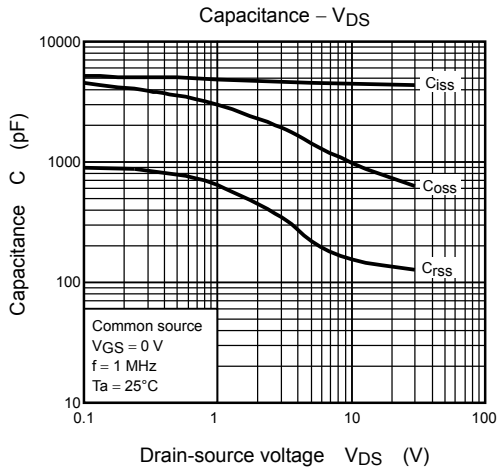
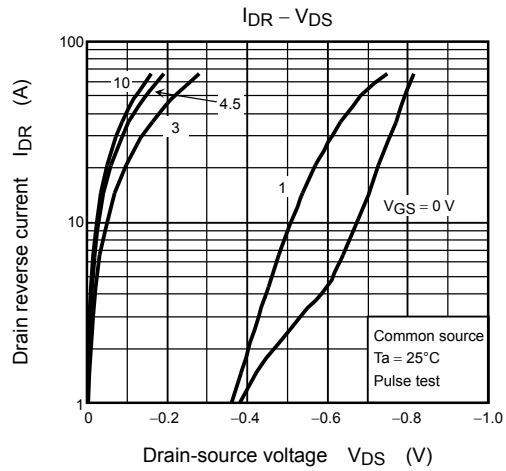
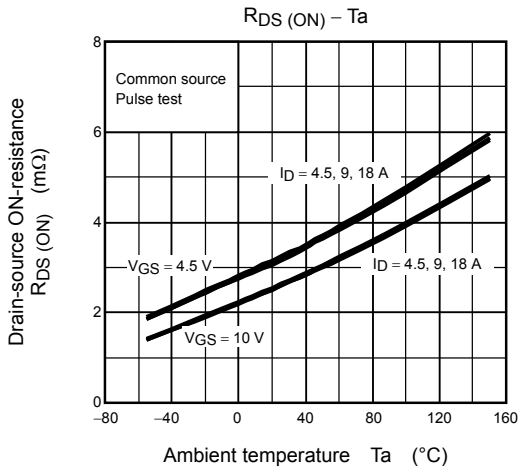
## Electrical Characteristics (Ta = 25°C)

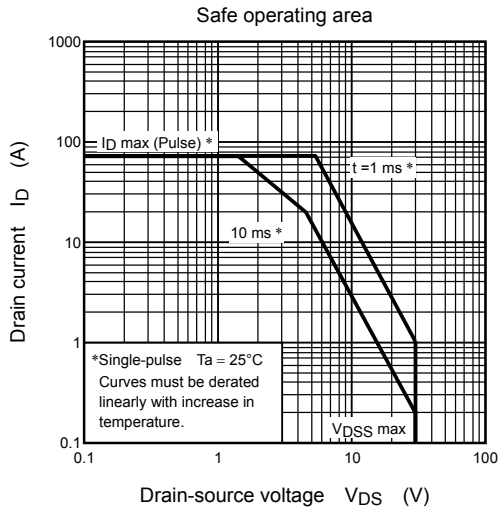
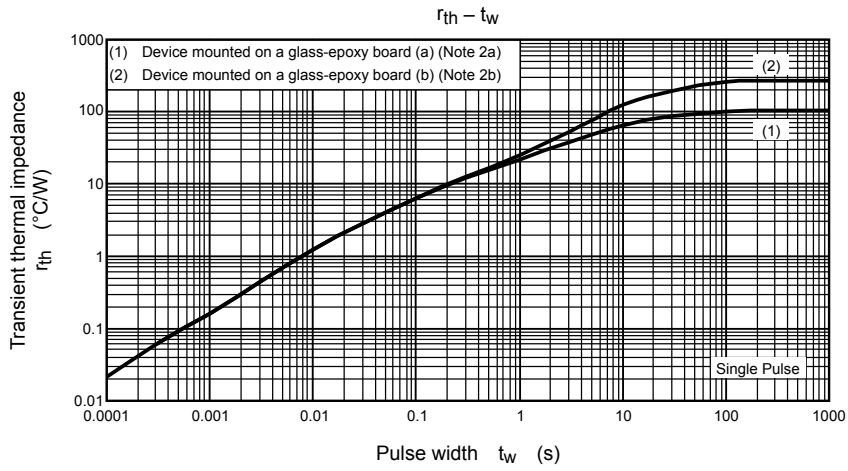
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 100$	nA
Drain cutoff current		$I_{DSS}$	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$	—	—	100	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	30	—	—	V
		$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	15	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.3	—	2.3	V
Drain-source ON-resistance		$R_{DS(ON)}$	$V_{GS} = 4.5\text{ V}, I_D = 9\text{ A}$	—	3.2	4.5	m $\Omega$
			$V_{GS} = 10\text{ V}, I_D = 9\text{ A}$	—	2.6	3.6	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 9\text{ A}$	31	62	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	4400	5700	pF
Reverse transfer capacitance		$C_{riss}$		—	180	270	
Output capacitance		$C_{oss}$		—	990	—	
Gate resistance		$r_g$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 5\text{ MHz}$	—	1.0	1.5	$\Omega$
Switching time	Rise time	$t_r$	<p><math>V_{GS} = 10\text{ V}</math> <math>0\text{ V}</math> <math>I_D = 9\text{ A}</math> <math>V_{OUT}</math> <math>4.7\Omega</math> <math>1.67\Omega</math> <math>R_L</math> <math>V_{DD} \approx 15\text{ V}</math> Duty <math>\leq 1\%</math>, <math>t_w = 10\ \mu\text{s}</math></p>	—	4.5	—	ns
	Turn-on time	$t_{on}$		—	13.2	—	
	Fall time	$t_f$		—	7.7	—	
	Turn-off time	$t_{off}$		—	54	—	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 24\text{ V}, V_{GS} = 10\text{ V}, I_D = 18\text{ A}$	—	56	—	nC
			$V_{DD} \approx 24\text{ V}, V_{GS} = 5\text{ V}, I_D = 18\text{ A}$	—	29	—	
Gate-source charge 1		$Q_{gs1}$	$V_{DD} \approx 24\text{ V}, V_{GS} = 10\text{ V}, I_D = 18\text{ A}$	—	12	—	
Gate-drain ("Miller") charge		$Q_{gd}$	$V_{DD} \approx 24\text{ V}, V_{GS} = 10\text{ V}, I_D = 18\text{ A}$	—	7.0	—	
Gate switch charge		$Q_{SW}$	$V_{DD} \approx 24\text{ V}, V_{GS} = 10\text{ V}, I_D = 18\text{ A}$	—	13	—	

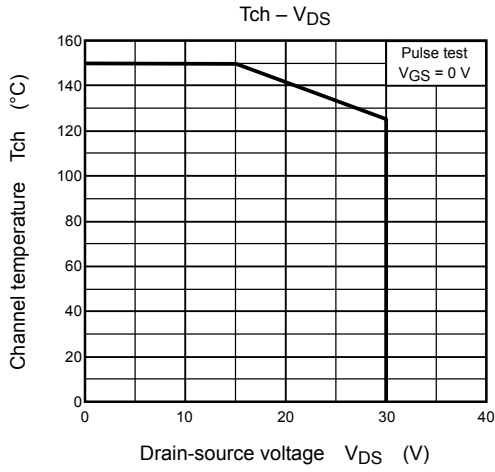
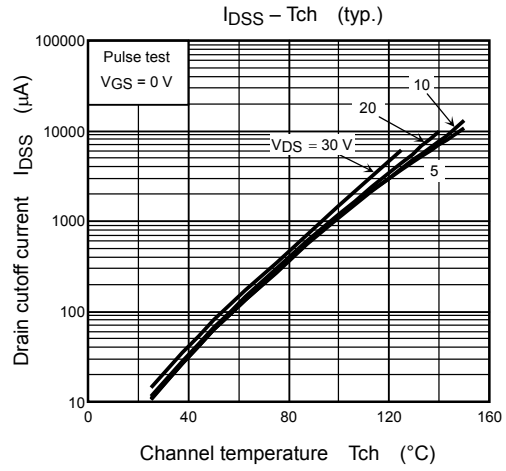
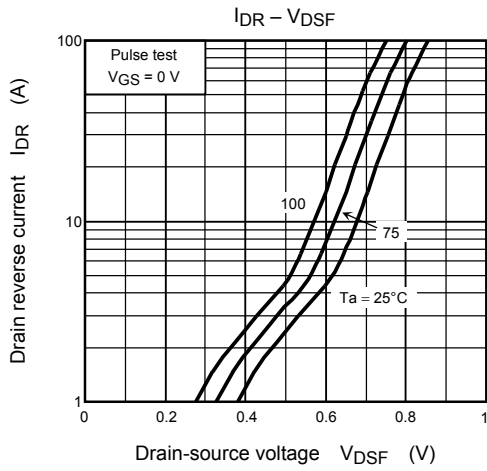
## Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Peak forward current	Pulse (Note 1)	$I_{FP}$	—	—	—	72	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = 1\text{ A}, V_{GS} = 0\text{ V}$	—	-0.4	-0.6	V
			$I_{DR} = 18\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.2	V









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20070701-EN GENERAL

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