

TOSHIBA Field Effect Transistor with Built-in Schottky Barrier Diode

Silicon N-Channel MOS Type (U-MOS V-H)

TPCA8A04-H

High Efficiency DC-DC Converter Applications

Notebook PC Applications

Portable Equipment Applications

- Built-in a schottky barrier diode
Low forward voltage: $V_{DSF} = 0.6 \text{ V (Max)}$
- High-speed switching
- Small gate charge: $Q_{SW} = 13.4 \text{ nC (typ.)}$
- Low drain-source ON-resistance: $R_{DS(ON)} = 2.3 \text{ m}\Omega \text{ (typ.)}$
- High forward transfer admittance: $|Y_{fs}| = 127 \text{ S (typ.)}$
- 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)

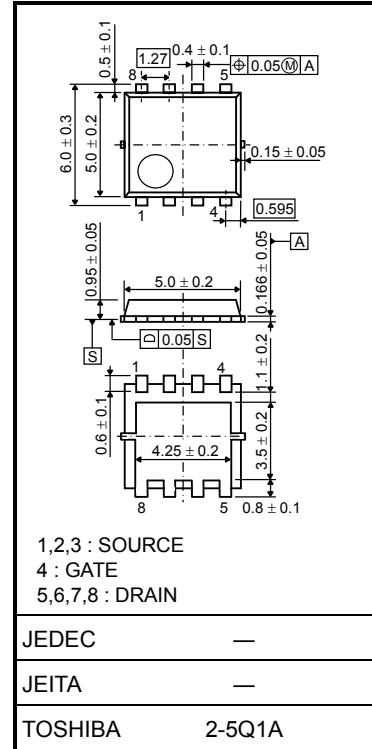
Characteristic		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	30	V
Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$)		V_{DGR}	30	V
Gate-source voltage		V_{GSS}	± 20	V
Drain current	DC (Note 1)	I_D	44	A
	Pulsed (Note 1)	I_{DP}	132	
Drain power dissipation ($T_c=25^\circ\text{C}$)		P_D	45	W
Drain power dissipation ($t = 10 \text{ s}$) (Note 2a)		P_D	2.8	W
Drain power dissipation ($t = 10 \text{ s}$) (Note 2b)		P_D	1.6	W
Single-pulse avalanche energy (Note 3)		E_{AS}	252	mJ
Avalanche current		I_{AR}	44	A
Repetitive avalanche energy ($T_c=25^\circ\text{C}$) (Note 4)		E_{AR}	3.32	mJ
Channel temperature		T_{ch}	150	$^\circ\text{C}$
Storage temperature range		T_{stg}	-55 to 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).

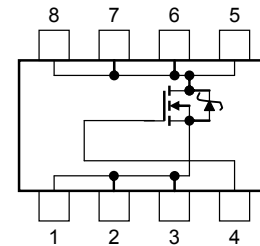
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.069 g (typ.)

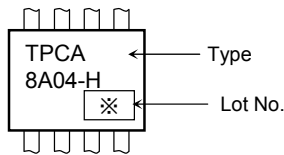
Circuit Configuration



Thermal Characteristics

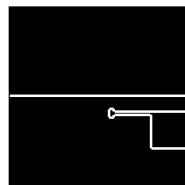
Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case ($T_c=25^\circ\text{C}$)	$R_{th(ch-c)}$	2.78	$^\circ\text{C/W}$
Thermal resistance, channel to ambient ($t = 10\text{ s}$) (Note 2a)	$R_{th(ch-a)}$	44.6	$^\circ\text{C/W}$
Thermal resistance, channel to ambient ($t = 10\text{ s}$) (Note 2b)	$R_{th(ch-a)}$	78.1	$^\circ\text{C/W}$

Marking (Note 5)



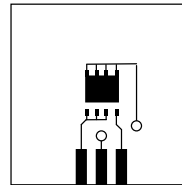
Note 1: Ensure that the channel temperature does not exceed 150°C .

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)



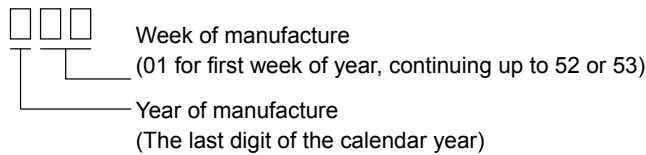
(b)

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), $L = 0.1\text{ mH}$, $R_G = 25\ \Omega$, $I_{AR} = 44\text{ A}$

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

Note 5: * Weekly code: (Three digits)

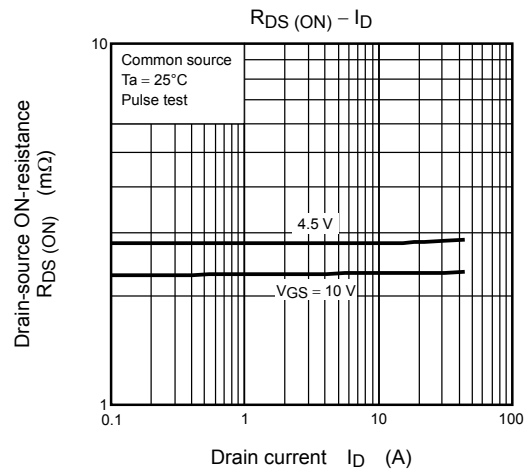
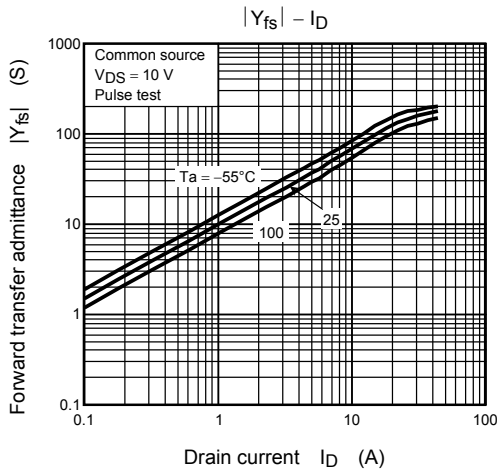
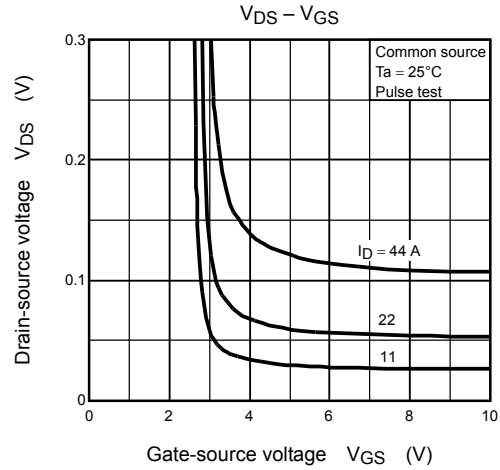
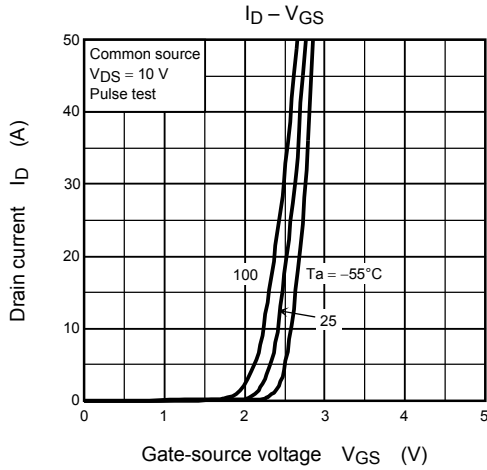
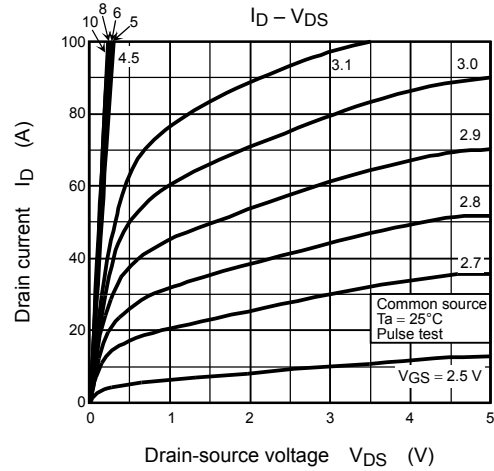
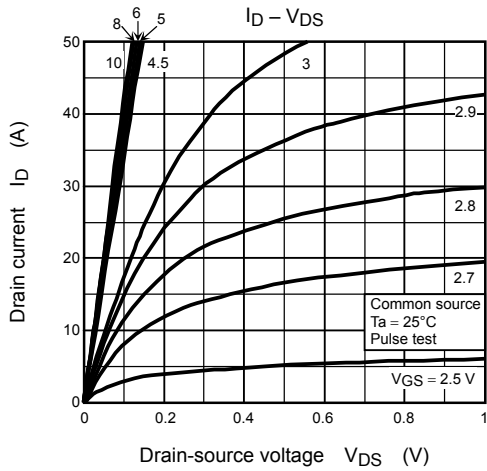


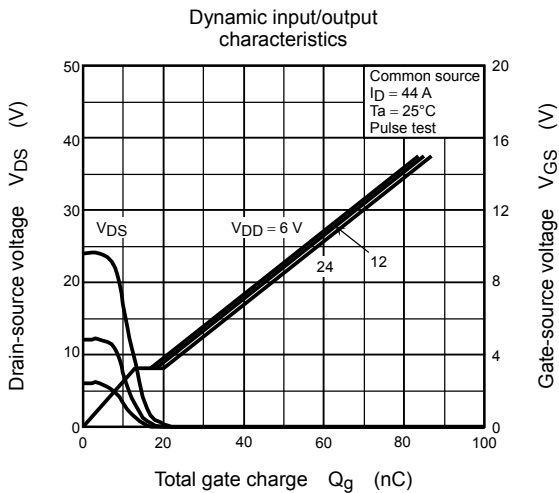
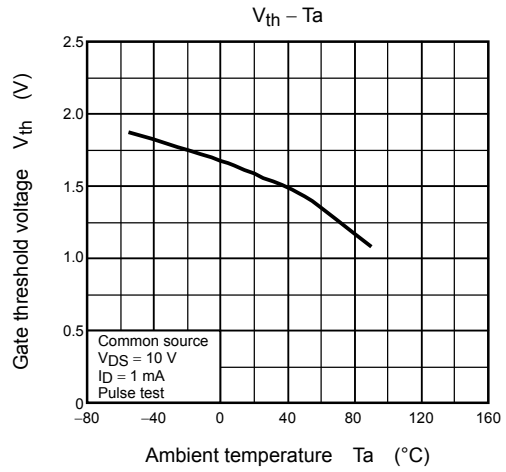
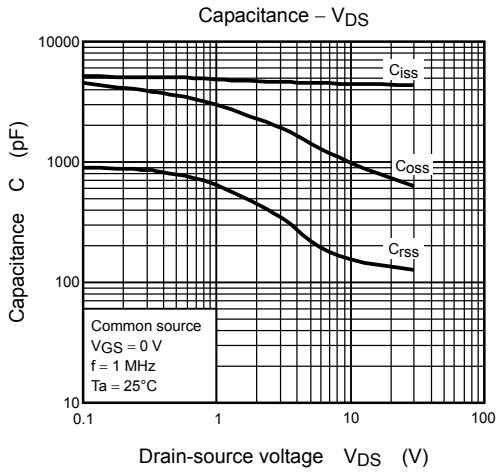
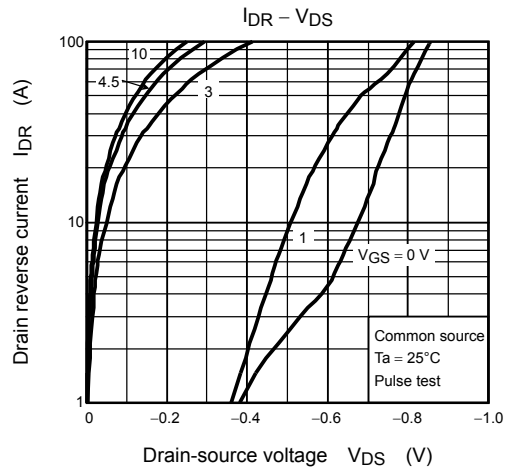
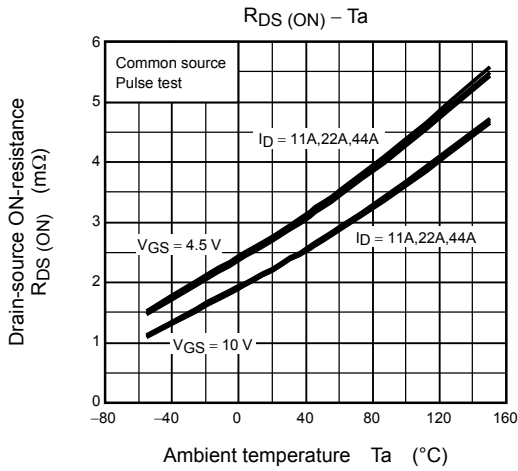
Electrical Characteristics (Ta = 25°C)

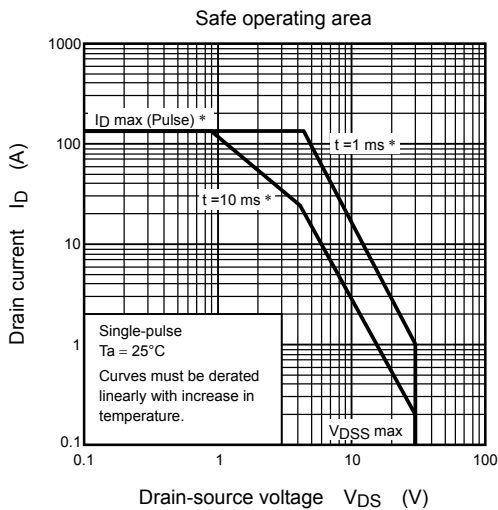
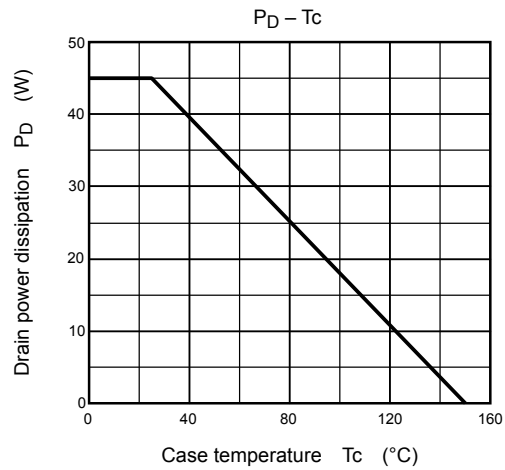
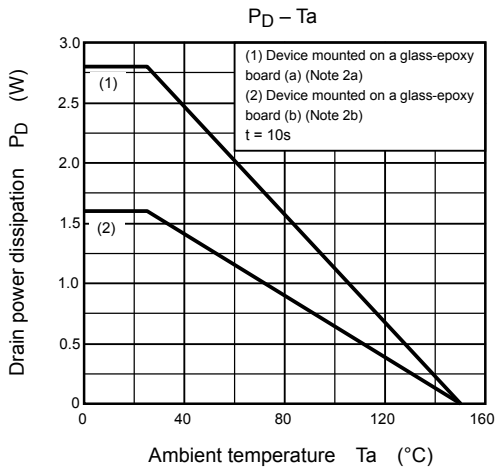
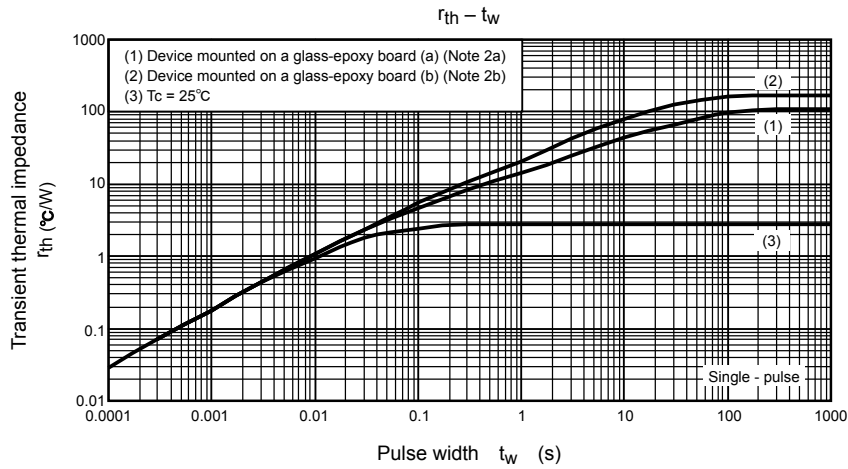
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	± 100	nA
Drain cutoff current		I_{DSS}	$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	100	μA
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	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		$R_{DS(ON)}$	$V_{GS} = 4.5 \text{ V}, I_D = 22 \text{ A}$	—	2.9	4.1	m Ω
			$V_{GS} = 10 \text{ V}, I_D = 22 \text{ A}$	—	2.3	3.2	
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10 \text{ V}, I_D = 22 \text{ A}$	64	127	—	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	Ω
Switching time	Rise time	t_r	<p>$V_{GS} = 10 \text{ V}$ 0 V $I_D = 22 \text{ A}$ $V_{DD} \approx 15 \text{ V}$ $R_L = 0.68 \Omega$ 4.7Ω V_{OUT} Duty $\leq 1\%$, $t_w = 10 \mu\text{s}$</p>	—	4.9	—	ns
	Turn-on time	t_{on}		—	15	—	
	Fall time	t_f		—	8.3	—	
	Turn-off time	t_{off}		—	57	—	
Total gate charge (gate-source plus gate-drain)		Q_g	$V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 44 \text{ A}$	—	59	—	nC
			$V_{DD} \approx 24 \text{ V}, V_{GS} = 5 \text{ V}, I_D = 44 \text{ A}$	—	30	—	
Gate-source charge 1		Q_{gs1}	$V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 44 \text{ A}$	—	13	—	
Gate-drain ("Miller") charge		Q_{gd}	$V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 44 \text{ A}$	—	7.0	—	
Gate switch charge		Q_{sw}	$V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 44 \text{ A}$	—	13.4	—	

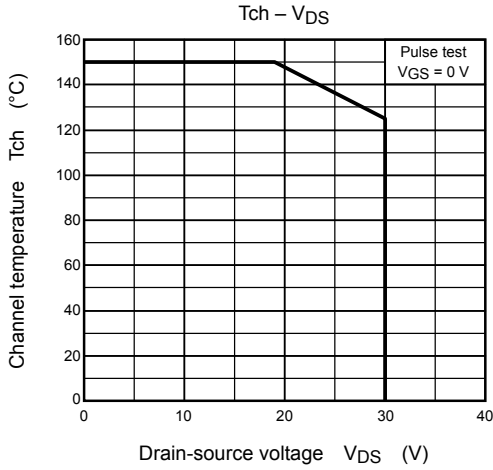
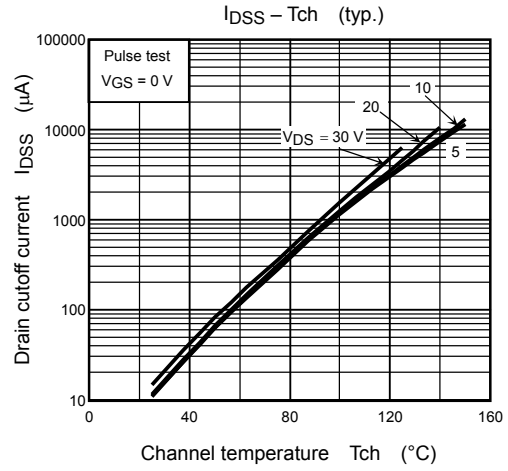
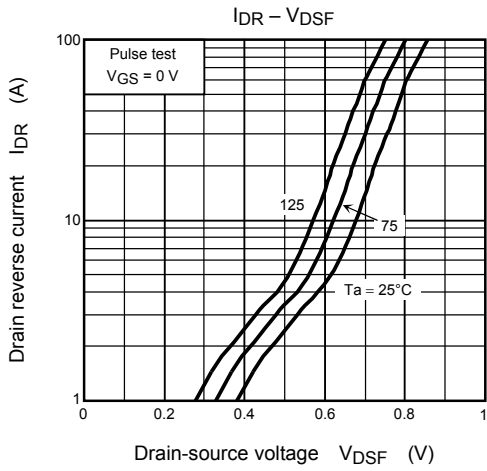
Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Peak forward current	Pulse (Note 1)	I_{FP}	—	—	—	132	A
Forward voltage (diode)		V_{DSF}	$I_{DR} = 1 \text{ A}, V_{GS} = 0 \text{ V}$	—	-0.4	-0.6	V
			$I_{DR} = 44 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.2	V









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20070701-EN GENERAL

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