

TOSHIBA Field Effect Transistor Silicon N-Channel MOS Type (U-MOSVI-H)

## TPCA8040-H

High-Efficiency DC-DC Converter Applications

Notebook PC Applications

Portable Equipment Applications

- Small footprint due to a small and thin package
- High-speed switching
- Small gate charge:  $Q_{SW} = 5.7 \text{ nC (typ.)}$
- Low drain-source ON-resistance:  $R_{DS(ON)} = 6.1 \text{ m}\Omega \text{ (typ.)}$
- High forward transfer admittance:  $|Y_{fs}| = 70 \text{ S (typ.)}$
- Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A (max)} \text{ (} V_{DS} = 30 \text{ V)}$
- Enhancement mode:  $V_{th} = 1.3 \text{ to } 2.3 \text{ V (} V_{DS} = 10 \text{ V, } I_D = 0.2 \text{ mA)}$

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

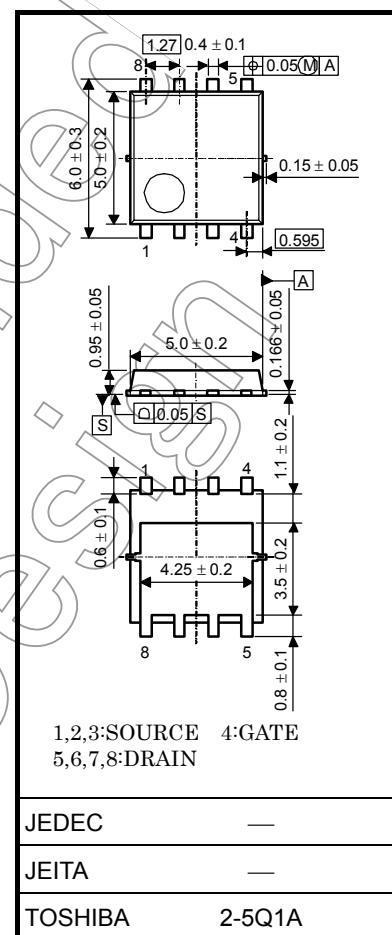
Characteristic		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	30	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	30	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	23	A
	Pulsed (Note 1)	$I_{DP}$	69	
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )		$P_D$	30	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)		$E_{AS}$	69	mJ
Avalanche current		$I_{AR}$	23	A
Repetitive avalanche energy ( $T_c = 25^\circ\text{C}$ ) (Note 4)		$E_{AR}$	2.1	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).

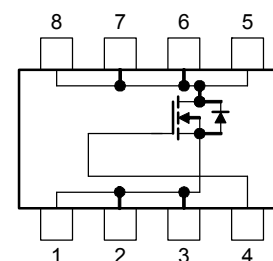
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.069 g (typ.)

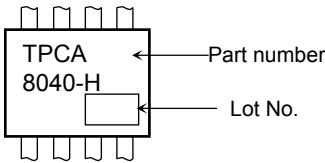
### Circuit Configuration



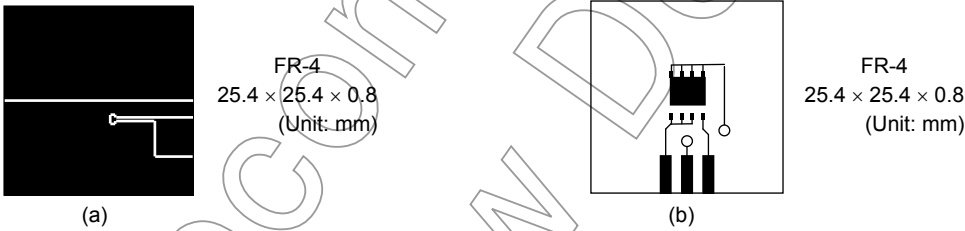
Thermal Characteristics

Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case ( $T_c = 25^{\circ}\text{C}$ )	$R_{th\ (ch-c)}$	4.17	$^{\circ}\text{C/W}$
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)

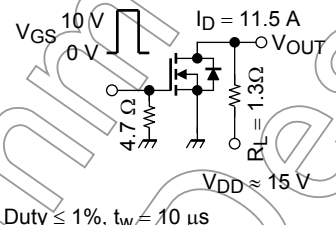


- Note 1: Ensure that the channel temperature does not exceed  $150^{\circ}\text{C}$ .
- Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)



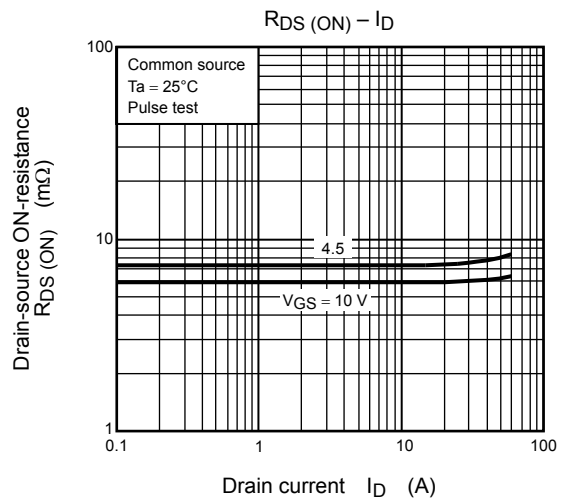
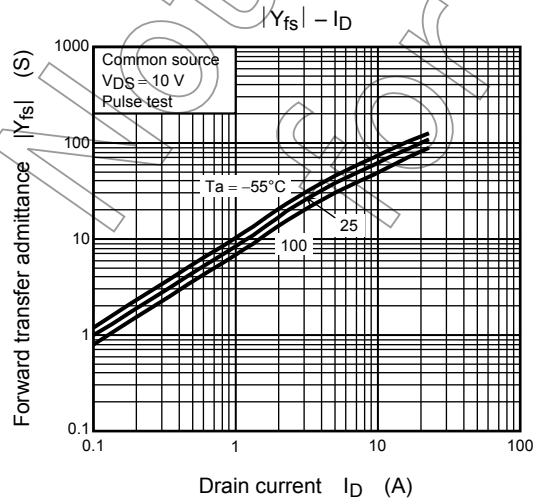
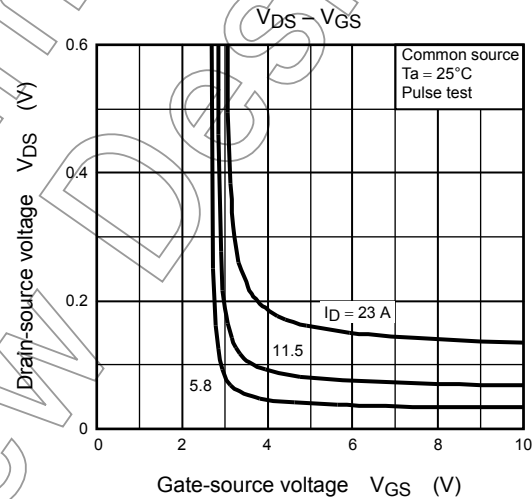
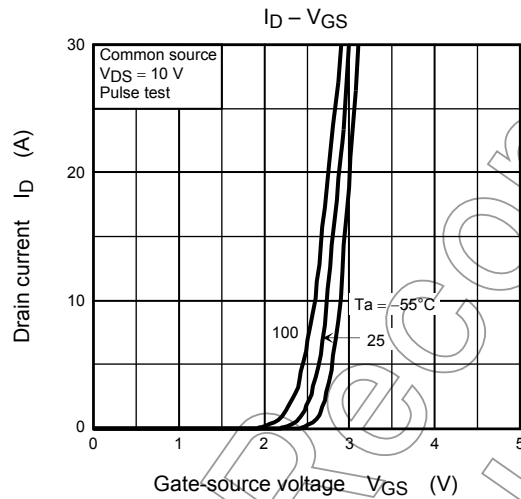
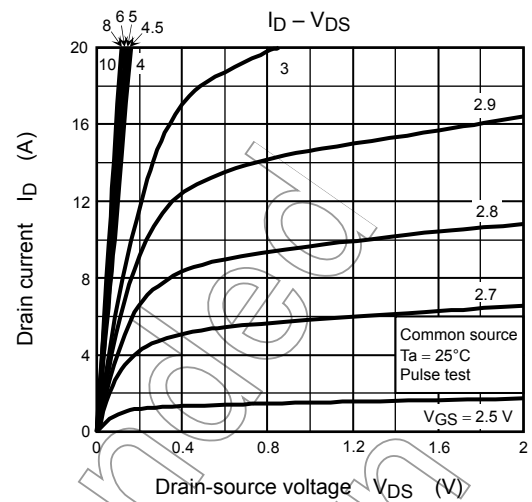
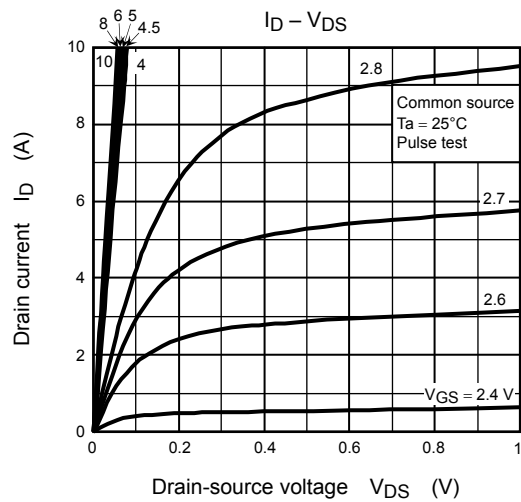
- Note 3:  $V_{DD} = 24\ \text{V}$ ,  $T_{ch} = 25^{\circ}\text{C}$  (initial),  $L = 100\ \mu\text{H}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 23\ \text{A}$
- Note 4: Repetitive rating: pulse width limited by maximum channel temperature
- Note 5: \* Weekly code: (Three digits)
- Week of manufacture  
(01 for the first week of the year, continuing up to 52 or 53)
- Year of manufacture  
(The last digit of the year)

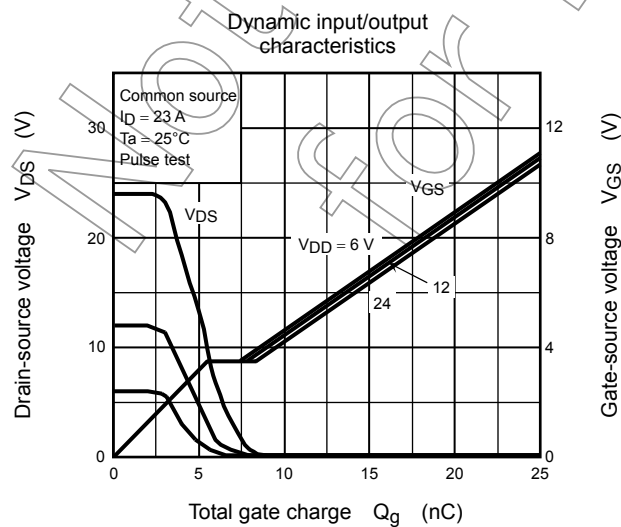
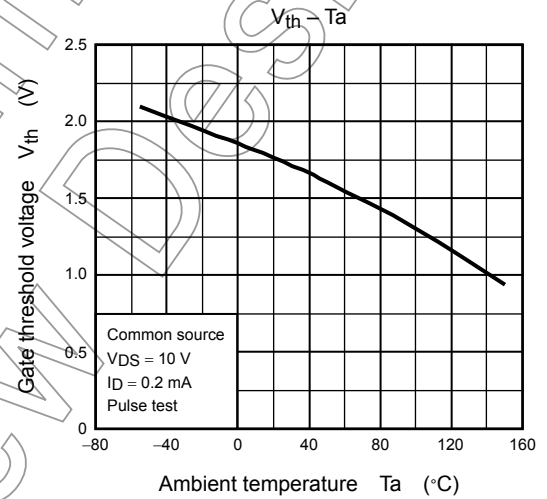
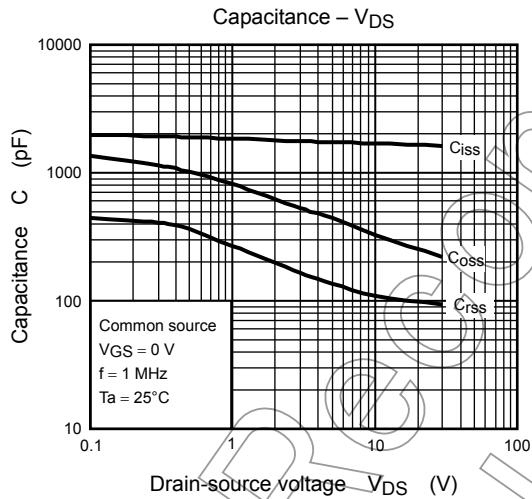
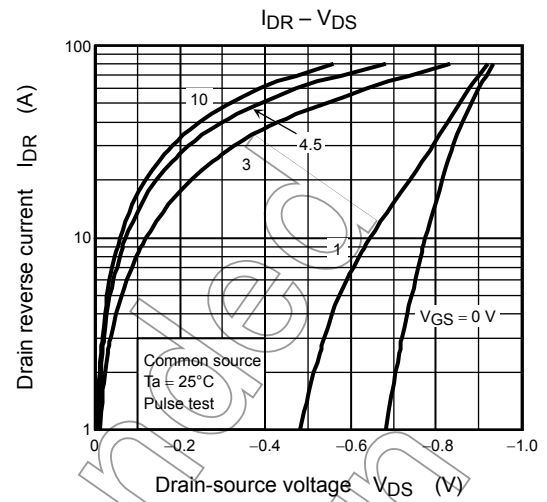
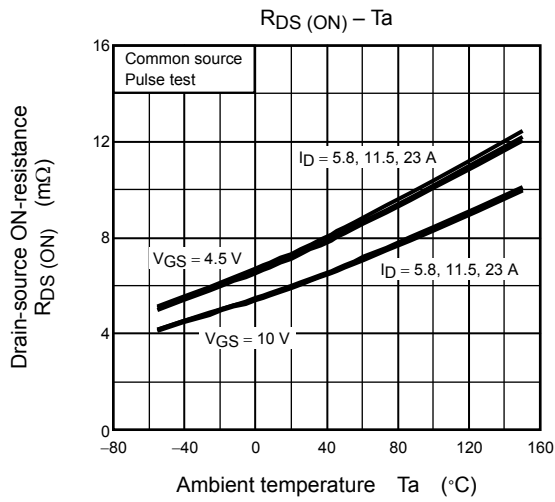
## Electrical Characteristics (Ta = 25°C)

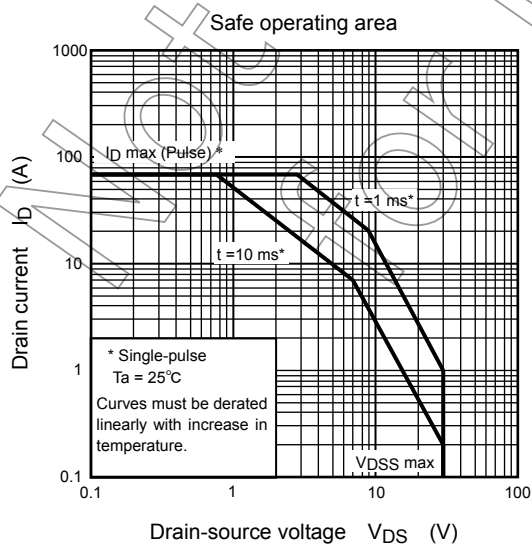
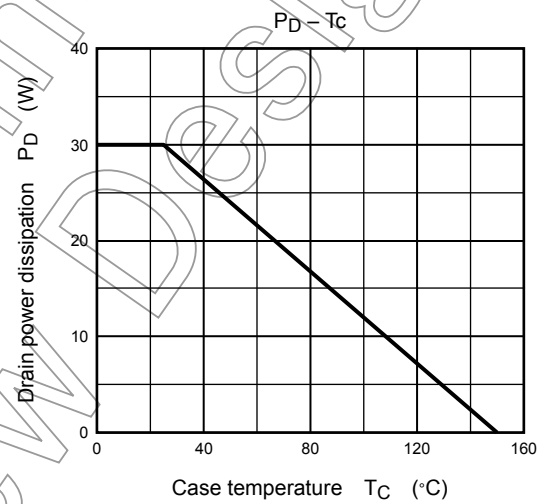
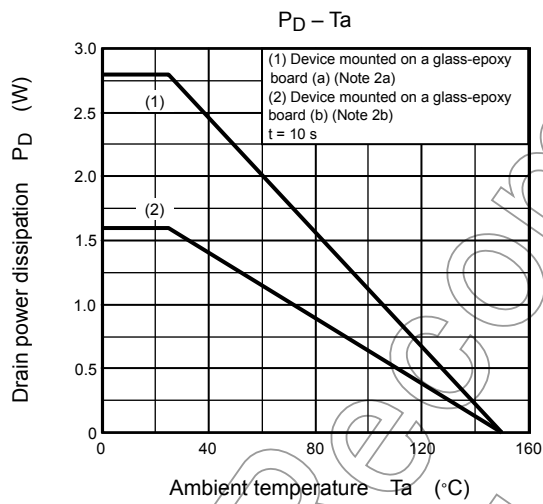
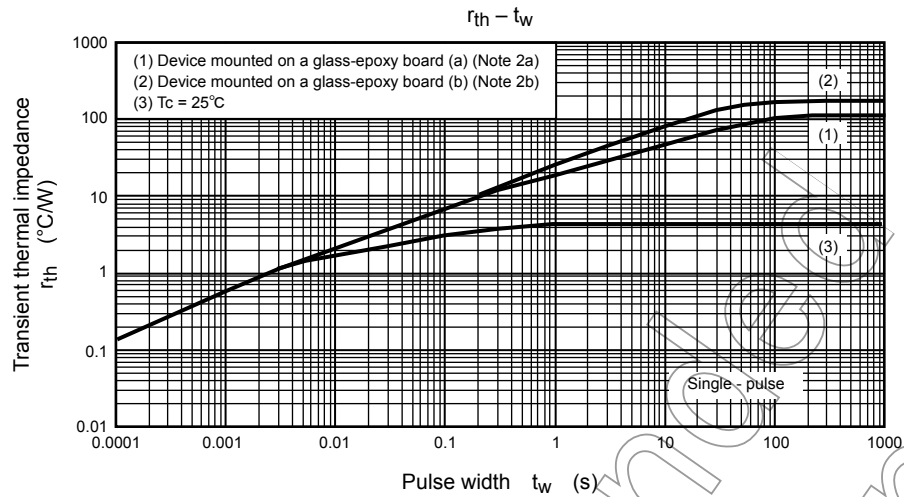
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I <sub>GSS</sub>	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V	—	—	±100	nA
Drain cutoff current		I <sub>DSS</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V	—	—	10	μA
Drain-source breakdown voltage		V (BR) DSS	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 V	30	—	—	V
		V (BR) DSX	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = -20 V	15	—	—	
Gate threshold voltage		V <sub>th</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.2 mA	1.3	—	2.3	V
Drain-source ON-resistance		R <sub>DS</sub> (ON)	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 11.5 A	—	7.4	10.8	mΩ
			V <sub>GS</sub> = 10 V, I <sub>D</sub> = 11.5 A	—	6.1	9.4	
Forward transfer admittance		Y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 12 A	35	70	—	S
Input capacitance		C <sub>iss</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz	—	1700	2200	pF
Reverse transfer capacitance		C <sub>rss</sub>		—	110	170	
Output capacitance		C <sub>oss</sub>		—	330	—	
Gate resistance		r <sub>g</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 5 MHz	—	2.3	3.5	Ω
Switching time	Rise time	t <sub>r</sub>		—	5.4	—	ns
	Turn-on time	t <sub>on</sub>		—	15	—	
	Fall time	t <sub>f</sub>		—	8.2	—	
	Turn-off time	t <sub>off</sub>		Duty ≤ 1%, t <sub>w</sub> = 10 μs	—	37	
Total gate charge (gate-source plus gate-drain)		Q <sub>g</sub>	V <sub>DD</sub> ≈ 24 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 23 A	—	23	—	nC
			V <sub>DD</sub> ≈ 24 V, V <sub>GS</sub> = 5 V, I <sub>D</sub> = 23 A	—	12	—	
Gate-source charge 1		Q <sub>gs1</sub>	V <sub>DD</sub> ≈ 24 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 23 A	—	5.4	—	
Gate-drain ("Miller") charge		Q <sub>gd</sub>		—	3.0	—	
Gate switch charge		Q <sub>SW</sub>		—	5.7	—	

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

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I <sub>DRP</sub>	—	—	—	69	A
Forward voltage (diode)		V <sub>DSF</sub>	I <sub>DR</sub> = 23 A, V <sub>GS</sub> = 0 V	—	—	-1.2	V







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