

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

## TPCA8053-H

Switching Regulator Applications

Motor Drive Applications

DC-DC Converter Applications

- Small footprint due to a small and thin package
- High-speed switching
- Small gate charge:  $Q_{SW} = 6.9 \text{ nC}$  (typ.)
- Low drain-source ON-resistance:  $R_{DS(ON)} = 13.9 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 46 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 60 \text{ V}$ )
- 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 ( $T_a = 25^\circ\text{C}$ )

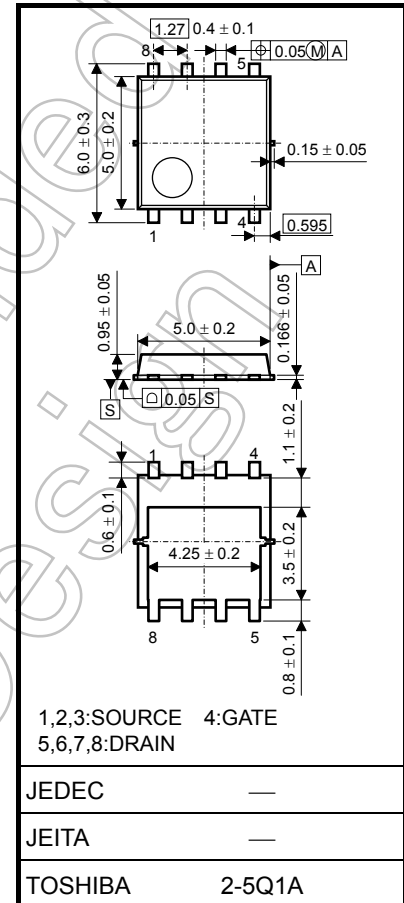
Characteristic		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	60	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	60	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	15	A
	Pulsed (Note 1)	$I_{DP}$	45	
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )		$P_D$	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)		$E_{AS}$	16	mJ
Avalanche current		$I_{AR}$	15	A
Repetitive avalanche energy ( $T_c = 25^\circ\text{C}$ ) (Note 4)		$E_{AR}$	1.53	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).

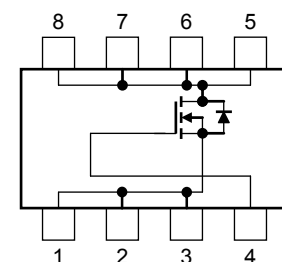
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.069 g (typ.)

### Circuit Configuration

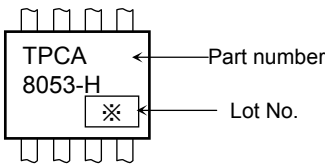


Start of commercial production  
2009-03

Thermal Characteristics

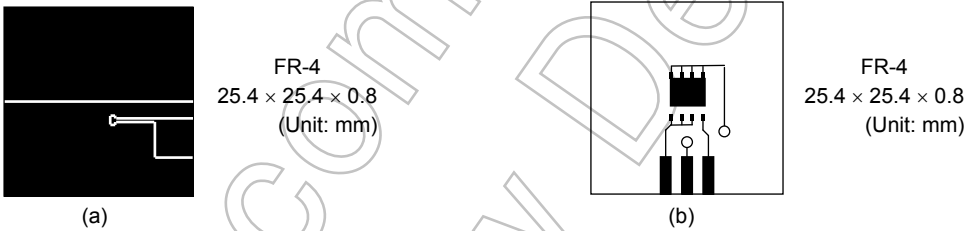
Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case ( $T_c = 25^{\circ}\text{C}$ )	$R_{th (ch-c)}$	4.17	$^{\circ}\text{C/W}$
Thermal resistance, channel to ambient ( $t = 10\text{ s}$ ) (Note 2a)	$R_{th (ch-a)}$	44.6	$^{\circ}\text{C/W}$
Thermal resistance, channel to ambient ( $t = 10\text{ s}$ ) (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°C.

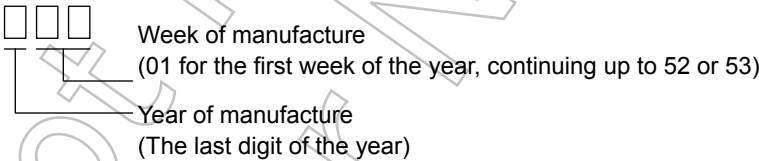
Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)



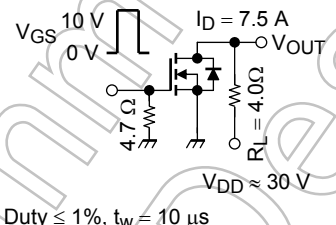
Note 3:  $V_{DD} = 24\text{ V}$ ,  $T_{ch} = 25^{\circ}\text{C}$  (initial),  $L = 100\text{ }\mu\text{H}$ ,  $R_G = 25\text{ }\Omega$ ,  $I_{AR} = 15\text{ A}$

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

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

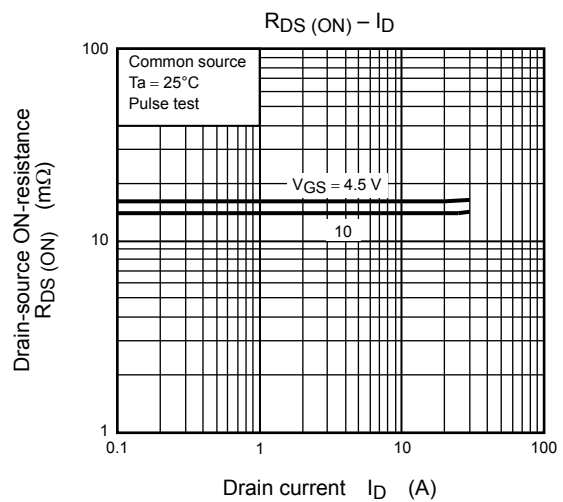
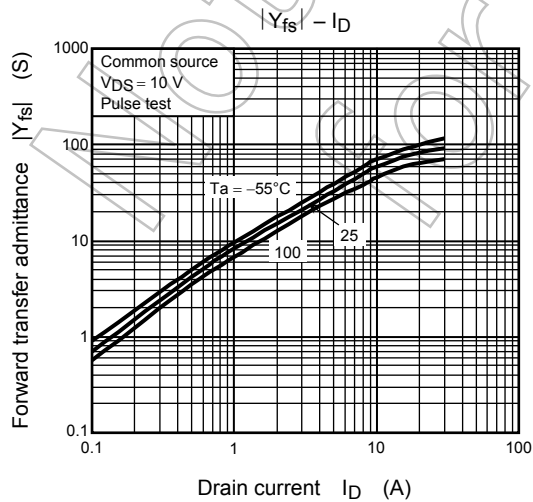
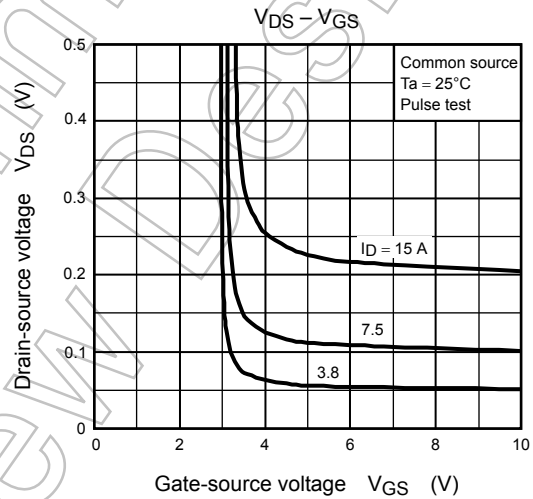
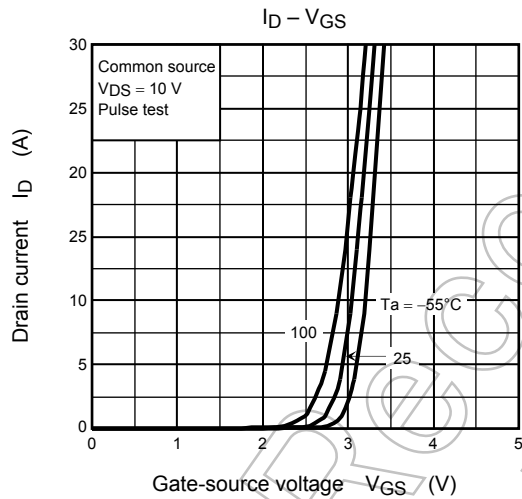
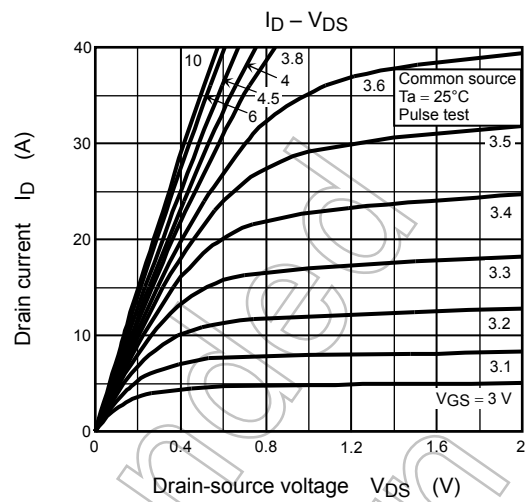
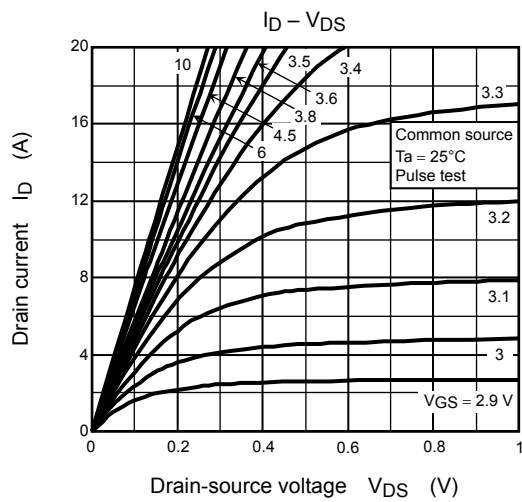


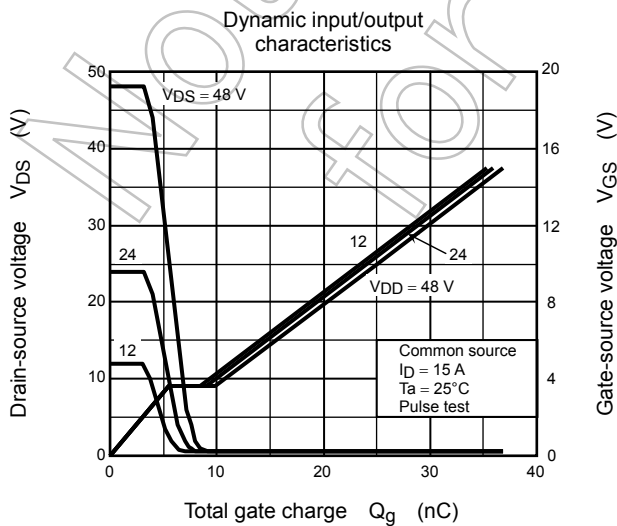
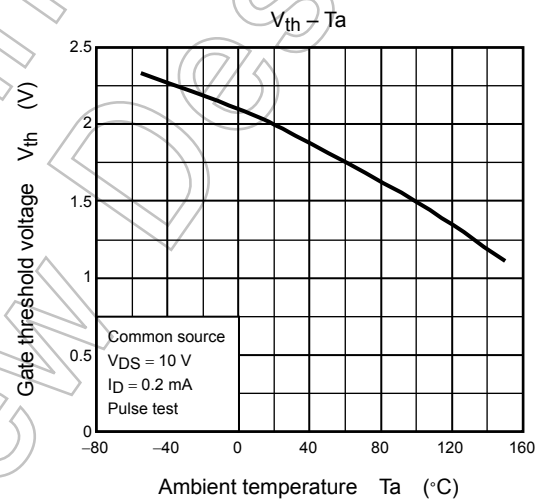
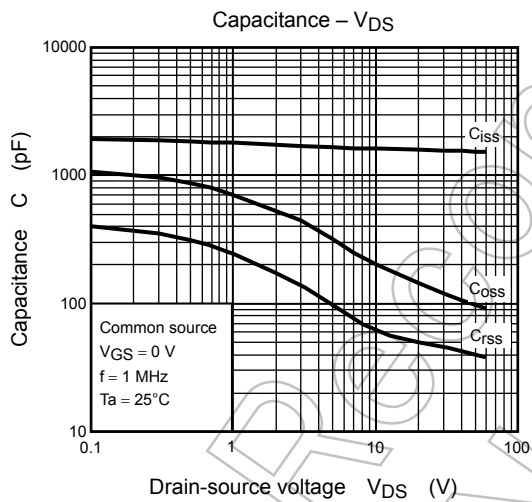
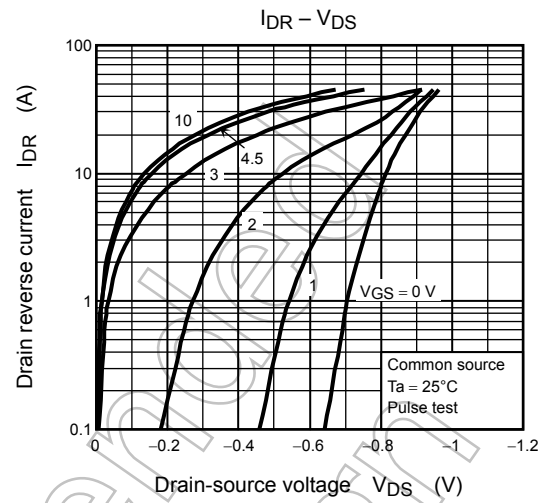
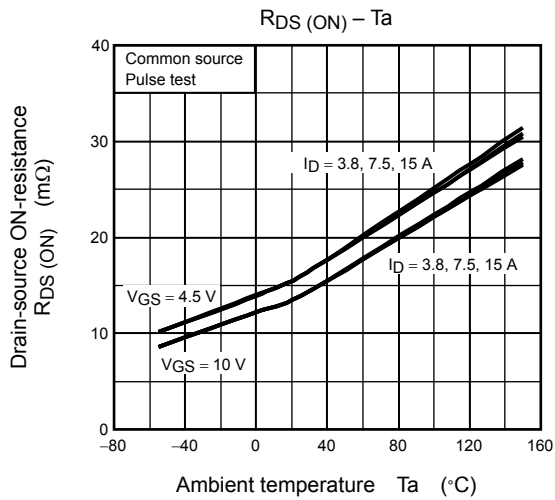
**Electrical Characteristics (Ta = 25°C)**

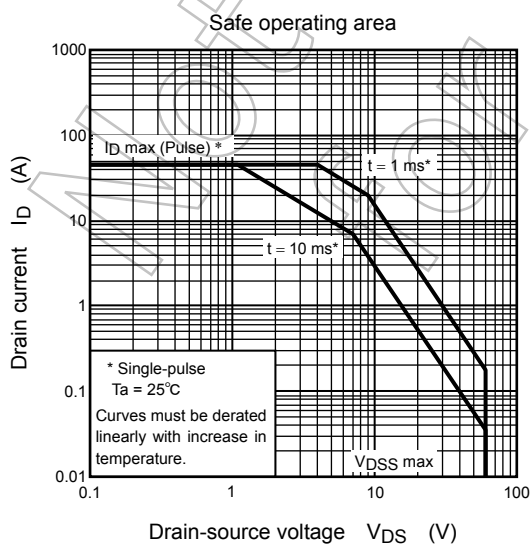
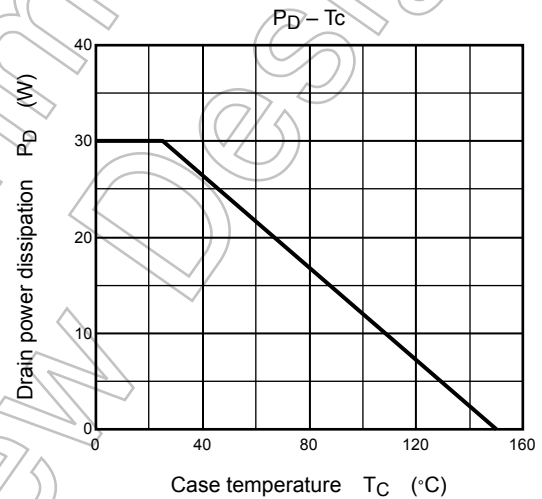
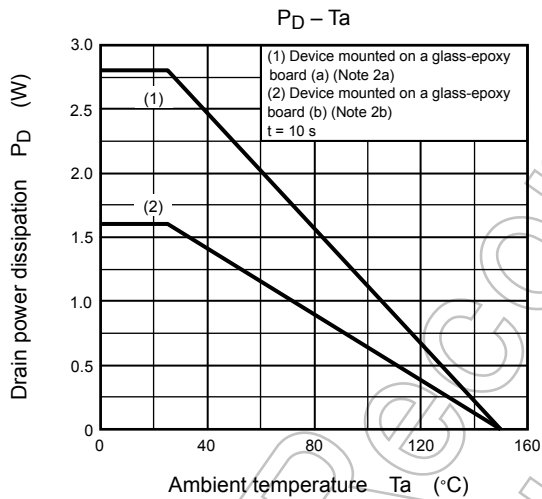
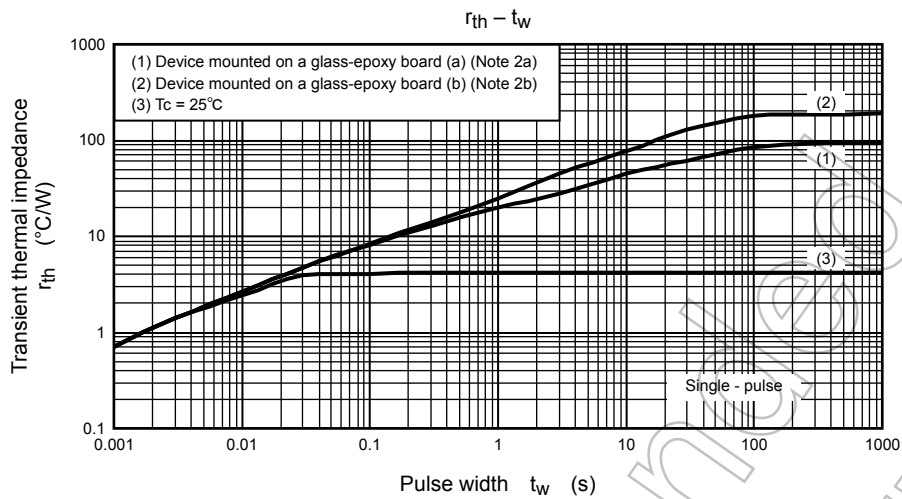
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I <sub>GSS</sub>	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V	—	—	±100	nA
Drain cutoff current		I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V	—	—	10	μA
Drain-source breakdown voltage		V (BR) DSS	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 V	60	—	—	V
		V (BR) DSX	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = -20 V	43	—	—	
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 (ON)</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 7.5 A	—	15.6	24.0	mΩ
			V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7.5 A	—	13.9	22.3	
Forward transfer admittance		Y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 7.5 A	23	46	—	S
Input capacitance		C <sub>iss</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz	—	1620	2110	pF
Reverse transfer capacitance		C <sub>rss</sub>		—	60	90	
Output capacitance		C <sub>oss</sub>		—	200	—	
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>		—	2.4	—	ns
	Turn-on time	t <sub>on</sub>		—	9.1	—	
	Fall time	t <sub>f</sub>		—	7.0	—	
	Turn-off time	t <sub>off</sub>		—	33	—	
Total gate charge (gate-source plus gate-drain)		Q <sub>g</sub>	V <sub>DD</sub> ≈ 48 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 15 A	—	25	—	nC
			V <sub>DD</sub> ≈ 48 V, V <sub>GS</sub> = 5 V, I <sub>D</sub> = 15 A	—	13	—	
Gate-source charge 1		Q <sub>gs1</sub>	V <sub>DD</sub> ≈ 48 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 15 A	—	5.5	—	
Gate-drain ("Miller") charge		Q <sub>gd</sub>		—	4.4	—	
Gate switch charge		Q <sub>SW</sub>		—	6.9	—	

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

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	$I_{DRP}$	—	—	—	45	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = 15 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.2	V







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