

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

# TPCA8050-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:  $Q_{SW} = 10 \text{ nC}$  (typ.)
- Low drain-source ON-resistance:  $R_{DS(ON)} = 9.0 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 70 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 60 \text{ V}$ )
- Enhancement mode:  $V_{th} = 1.3 \text{ to } 2.3 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 0.5 \text{ mA}$ )

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

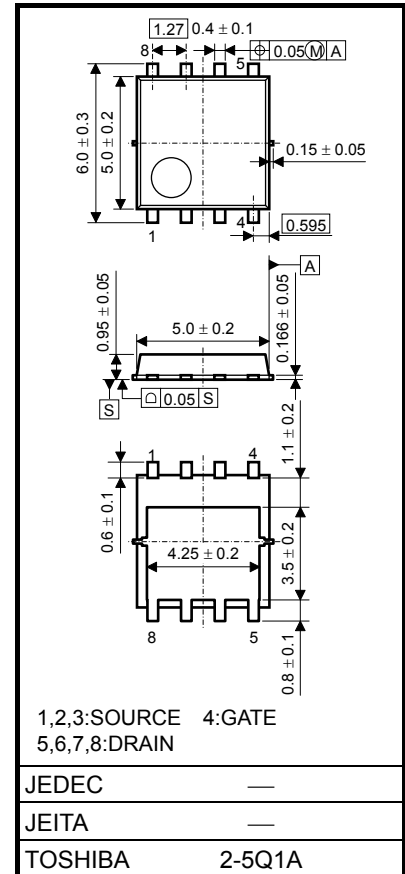
Characteristic		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	60	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	60	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	24	A
	Pulsed (Note 1)	$I_{DP}$	72	
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )		$P_D$	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)		$E_{AS}$	42	mJ
Avalanche current		$I_{AR}$	24	A
Repetitive avalanche energy ( $T_c = 25^\circ\text{C}$ ) (Note 4)		$E_{AR}$	2.68	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).

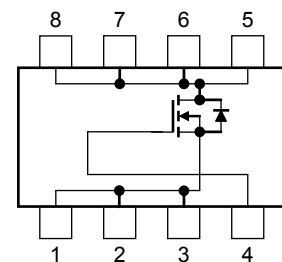
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.069 g (typ.)

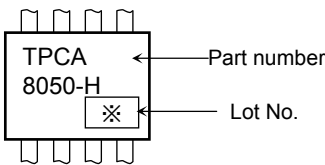
## Circuit Configuration



Thermal Characteristics

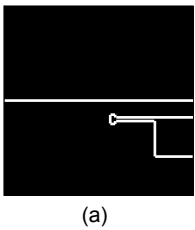
Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case (Tc = 25°C)	R <sub>th</sub> (ch-c)	2.78	°C/W
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	R <sub>th</sub> (ch-a)	44.6	°C/W
Thermal resistance, channel to ambient (t = 10 s) (Note 2b)	R <sub>th</sub> (ch-a)	78.1	°C/W

Marking (Note 5)

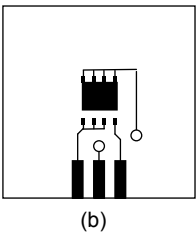


Note 1: Ensure that the channel temperature does not exceed 150°C.

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



FR-4  
25.4 × 25.4 × 0.8  
(Unit: mm)

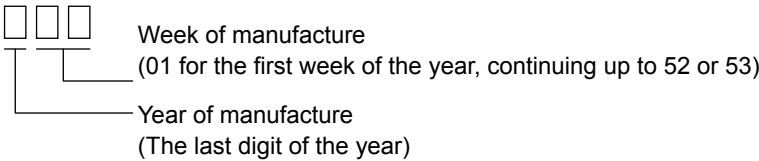


FR-4  
25.4 × 25.4 × 0.8  
(Unit: mm)

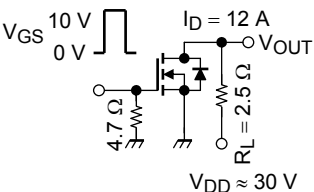
Note 3: V<sub>DD</sub> = 24 V, T<sub>ch</sub> = 25°C (initial), L = 100 μH, R<sub>G</sub> = 25 Ω, I<sub>AR</sub> = 24 A

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

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

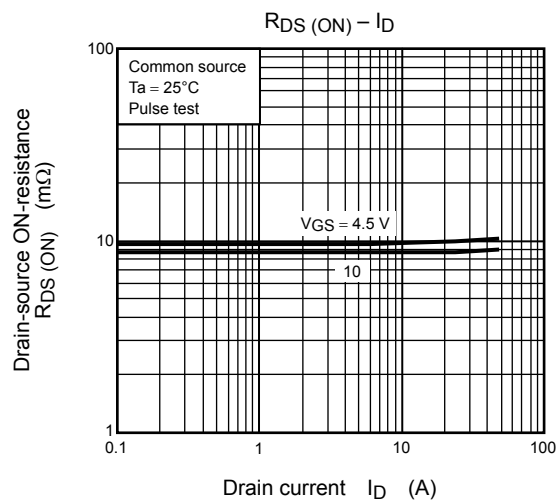
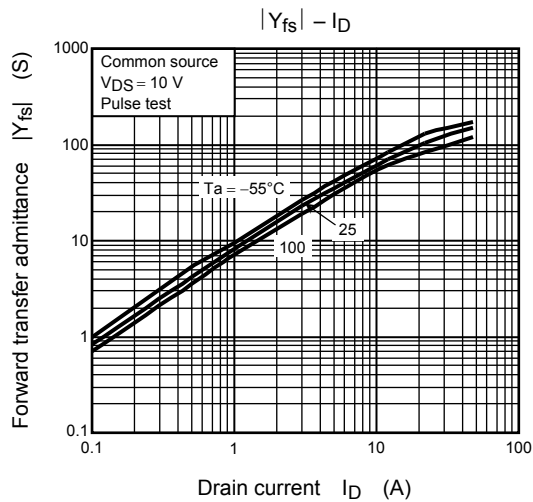
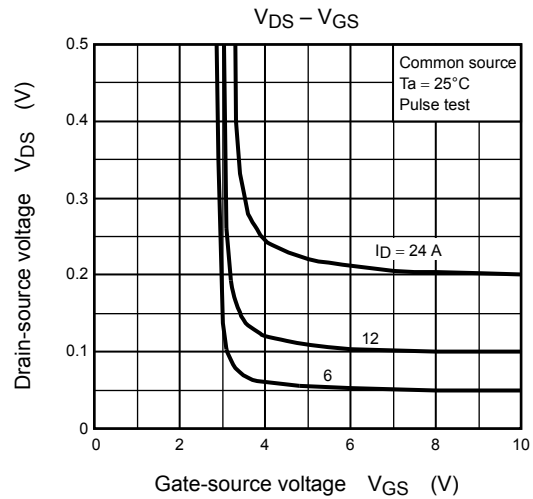
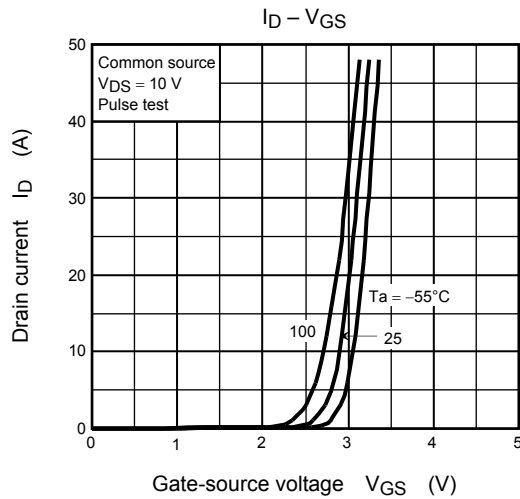
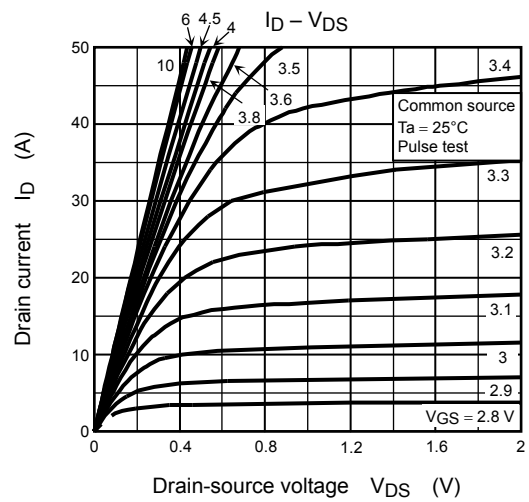
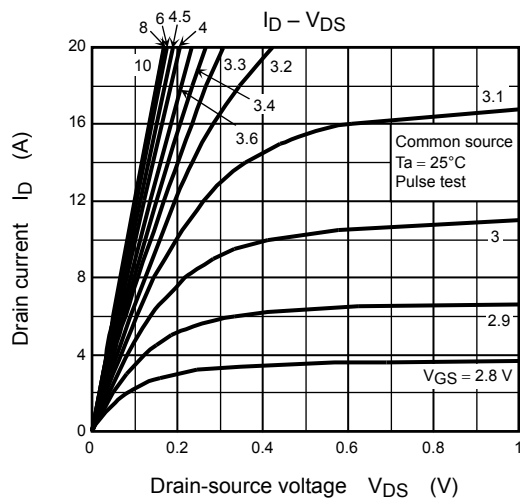


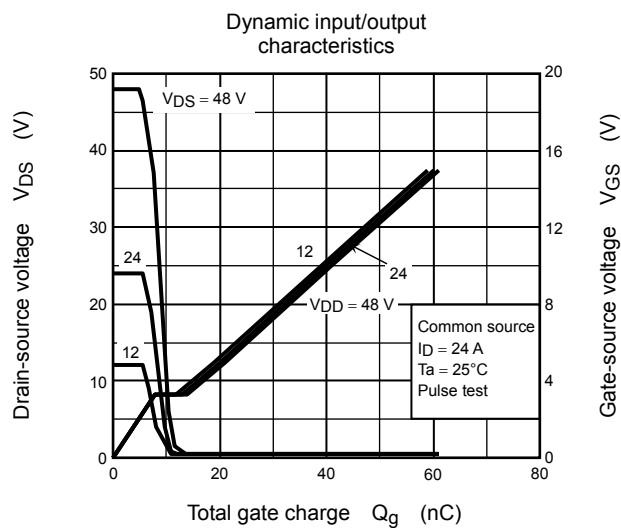
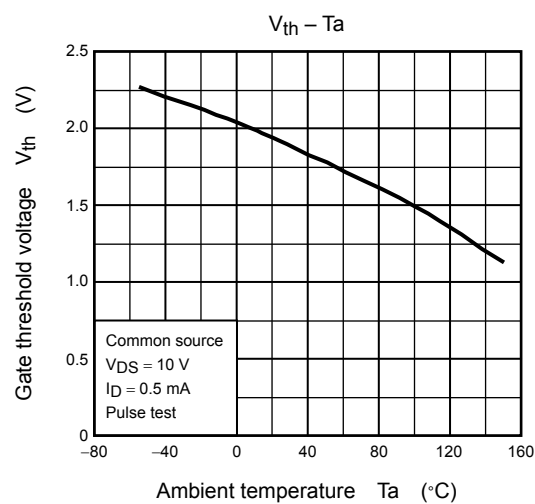
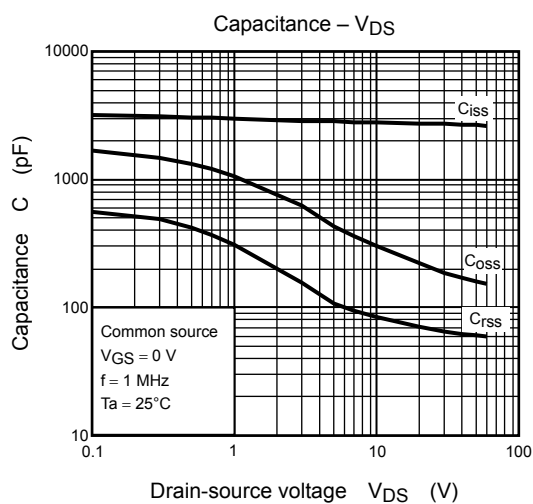
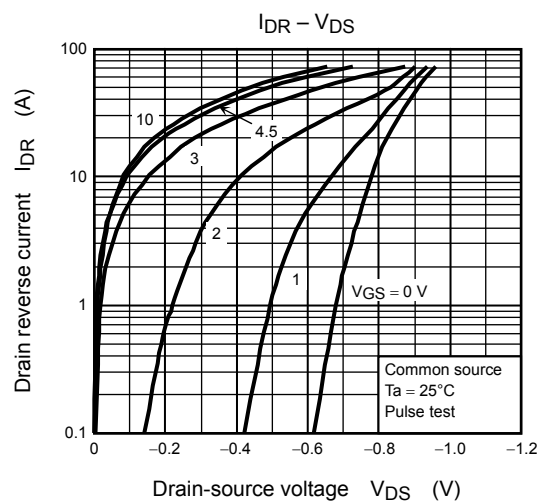
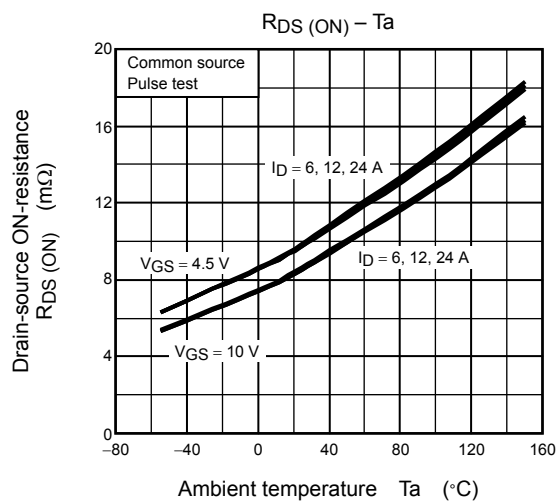
## Electrical Characteristics (Ta = 25°C)

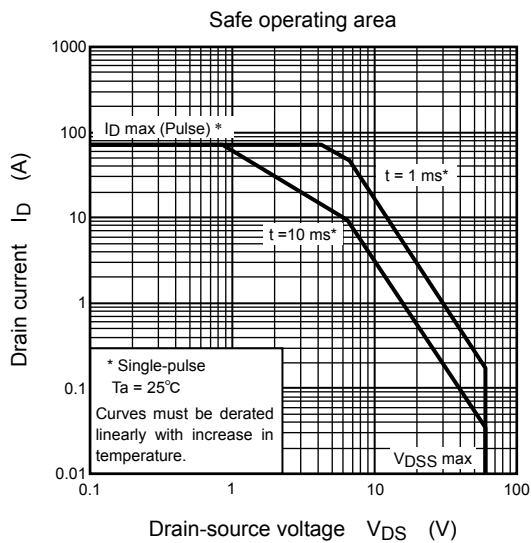
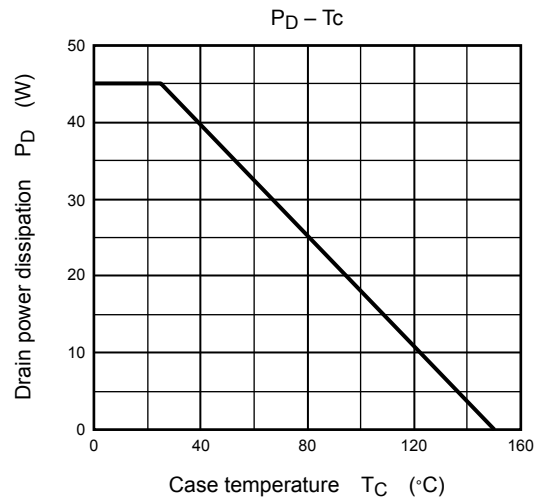
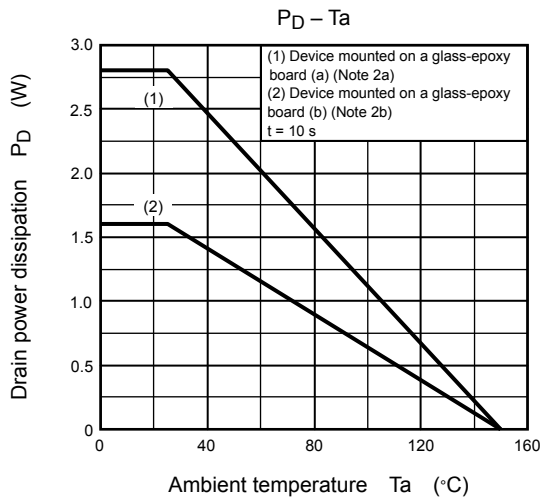
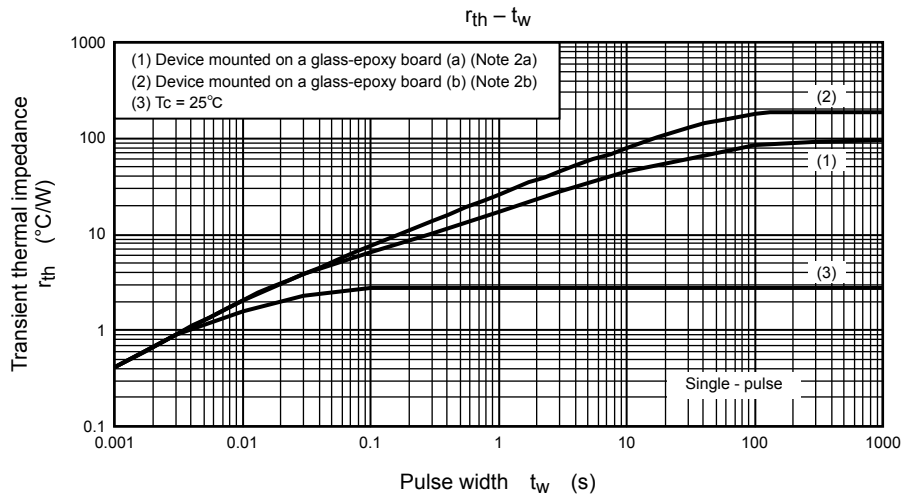
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I <sub>GSS</sub>	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V	—	—	±100	nA
Drain cutoff current		I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V	—	—	10	μA
Drain-source breakdown voltage		V <sub>(BR)</sub> DSS	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 V	60	—	—	V
		V <sub>(BR)</sub> DSX	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = -20 V	45	—	—	
Gate threshold voltage		V <sub>th</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.5 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> = 12 A	—	10.1	15.3	mΩ
			V <sub>GS</sub> = 10 V, I <sub>D</sub> = 12 A	—	9.0	14.2	
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	—	2590	3365	pF
Reverse transfer capacitance		C <sub>rss</sub>		—	95	140	
Output capacitance		C <sub>oss</sub>		—	300	—	
Gate resistance		rg	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz	—	1.0	1.5	Ω
Switching time	Rise time	t <sub>r</sub>		—	2.5	—	ns
	Turn-on time	t <sub>on</sub>		—	11	—	
	Fall time	t <sub>f</sub>		—	5.7	—	
	Turn-off time	t <sub>off</sub>		Duty ≤ 1%, t <sub>w</sub> = 10 μs	—	39	
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> = 24 A	—	41	—	nC
			V <sub>DD</sub> ≈ 48 V, V <sub>GS</sub> = 5 V, I <sub>D</sub> = 24 A	—	21	—	
Gate-source charge 1		Q <sub>gs1</sub>	V <sub>DD</sub> ≈ 48 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 24 A	—	7.8	—	
Gate-drain (“Miller”) charge		Q <sub>gd</sub>		—	6.1	—	
Gate switch charge		Q <sub>SW</sub>		—	10	—	

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

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	$I_{DRP}$	—	—	—	72	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = 24 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.2	V







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