

TOSHIBA Field Effect Transistor Silicon N-Channel MOS Type (Ultra-High-Speed U-MOSⅢ)

## TPCA8027-H

Switching Regulator Applications

Motor Drive Applications

Unit: mm

- Small footprint due to a small and thin package
- High-speed switching
- Small gate charge:  $Q_{SW} = 8.1 \text{ nC}$  (typ.)
- Low drain-source ON-resistance:  $R_{DS(ON)} = 8.0 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 44 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 40 \text{ V}$ )
- Enhancement mode:  $V_{th} = 2.0 \text{ to } 4.0 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

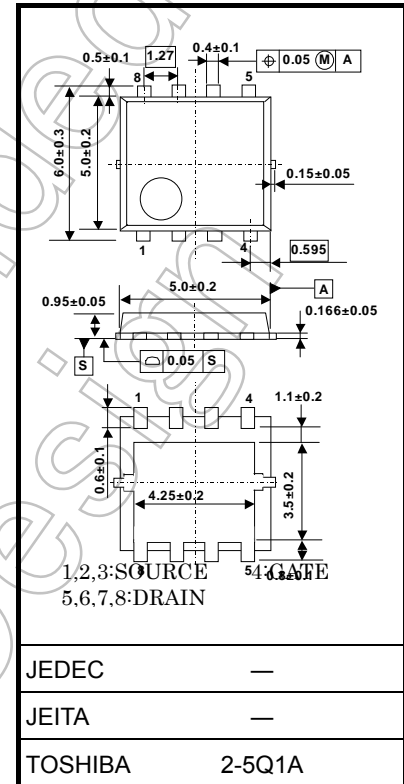
### Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristic		Symbol	Rating	Unit
Drain-source voltage		$V_{DS}$	40	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	40	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC (Note 1)	$I_D$	30	A
	Pulsed (Note 1)	$I_{DP}$	90	
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)		$E_{AS}$	84	mJ
Avalanche current		$I_{AR}$	30	A
Repetitive avalanche energy ( $T_c = 25^\circ\text{C}$ ) (Note 4)		$E_{AR}$	4.5	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.

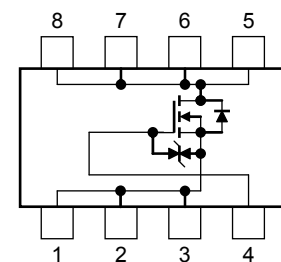
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within 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.



Weight: 0.080 g (typ.)

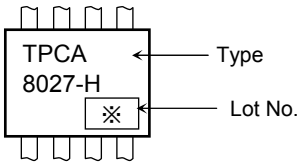
### Circuit Configuration



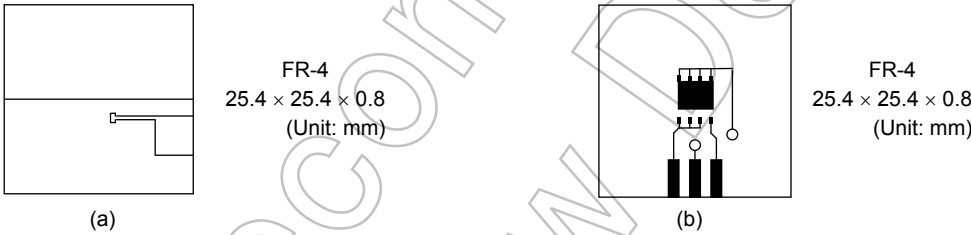
Thermal Characteristics

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	$^{\circ}\text{C/W}$

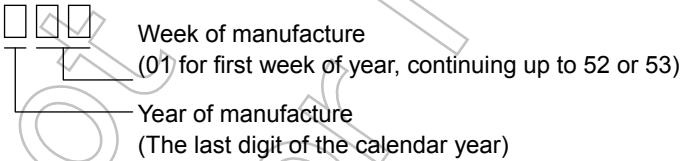
Marking (Note 5)



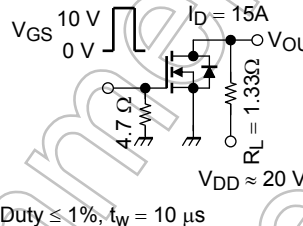
- Note 1: The channel temperature should not exceed  $150^{\circ}\text{C}$  during use.
- Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)



- Note 3:  $V_{DD} = 24\text{ V}$ ,  $T_{ch} = 25^{\circ}\text{C}$  (initial),  $L = 0.1\text{ mH}$ ,  $R_G = 25\text{ }\Omega$ ,  $I_{AR} = 30\text{ A}$
- Note 4: Repetitive rating: pulse width limited by max. channel temperature
- Note 5: \* Weekly code: (Three digits)

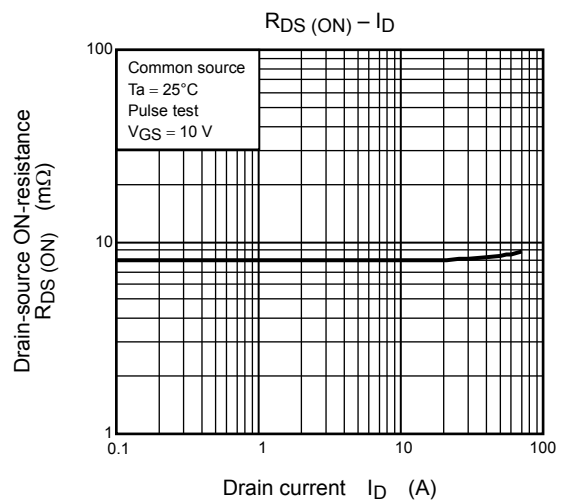
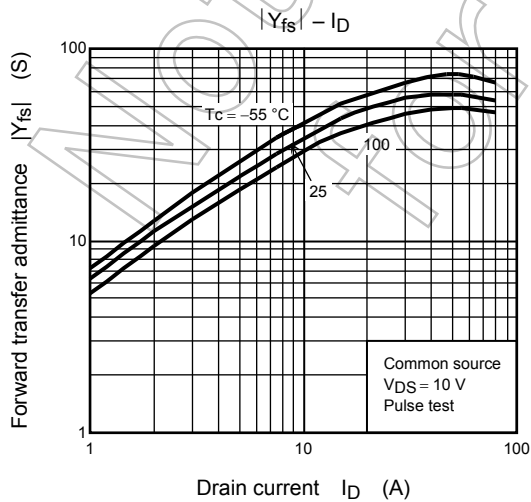
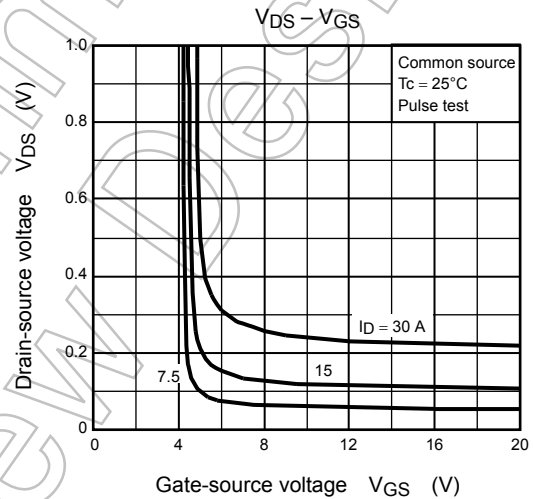
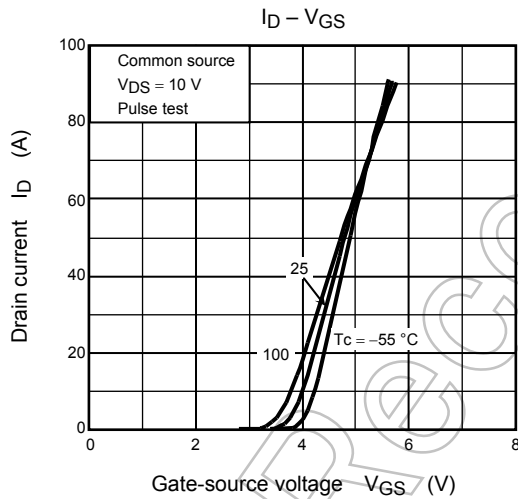
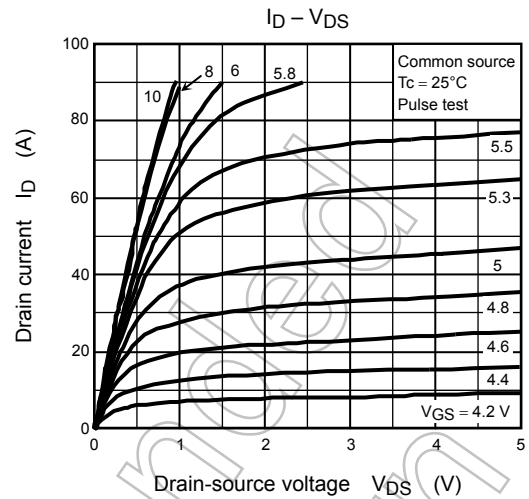
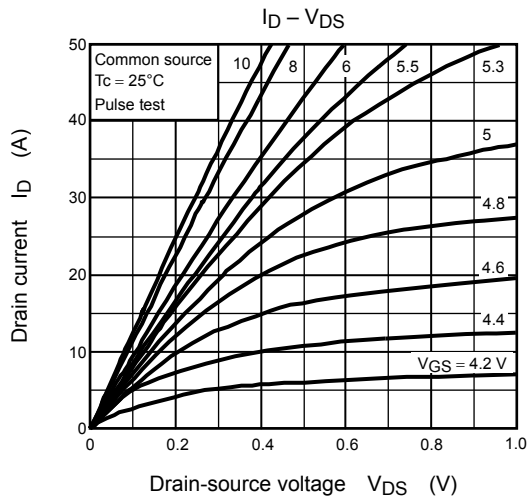


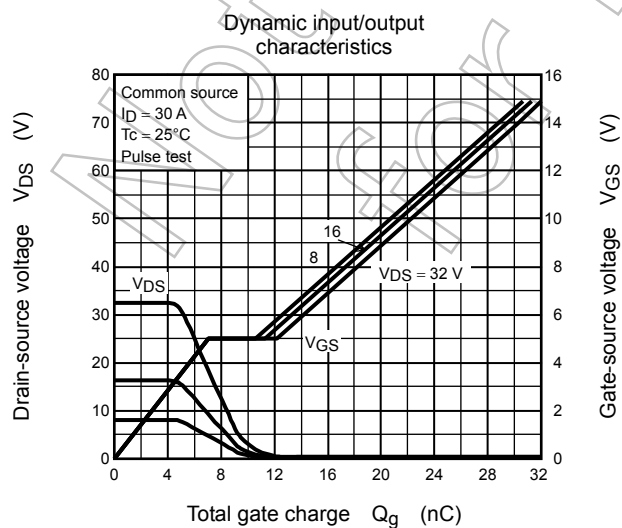
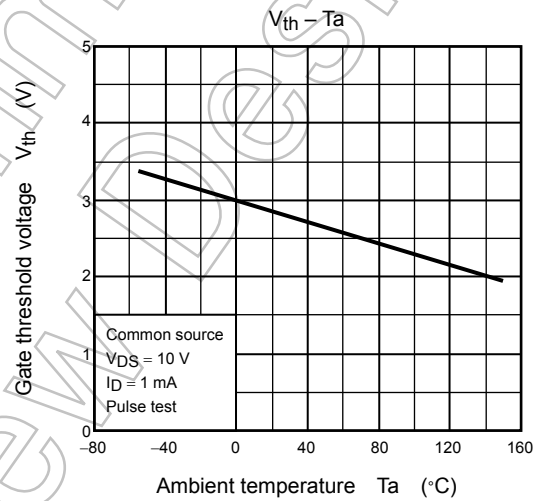
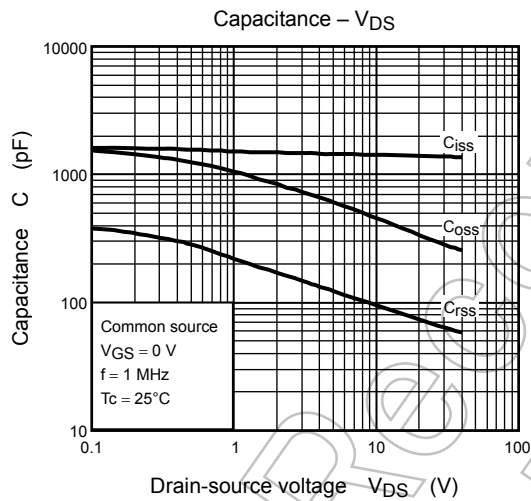
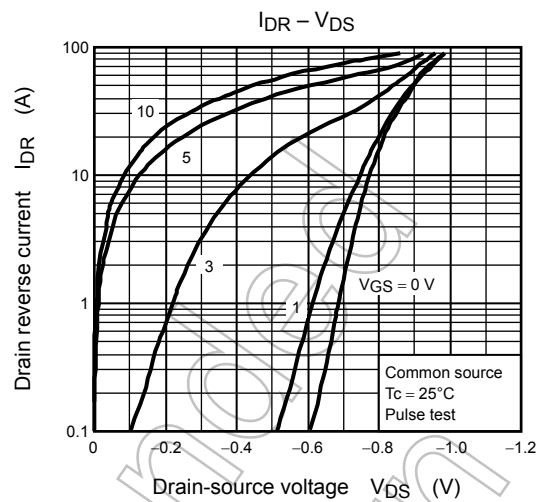
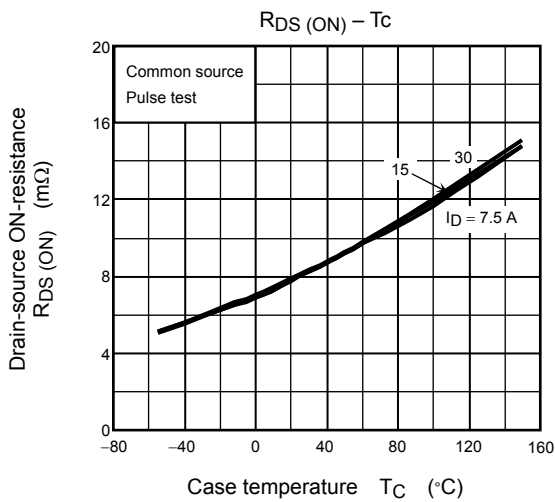
**Electrical Characteristics (Ta = 25°C)**

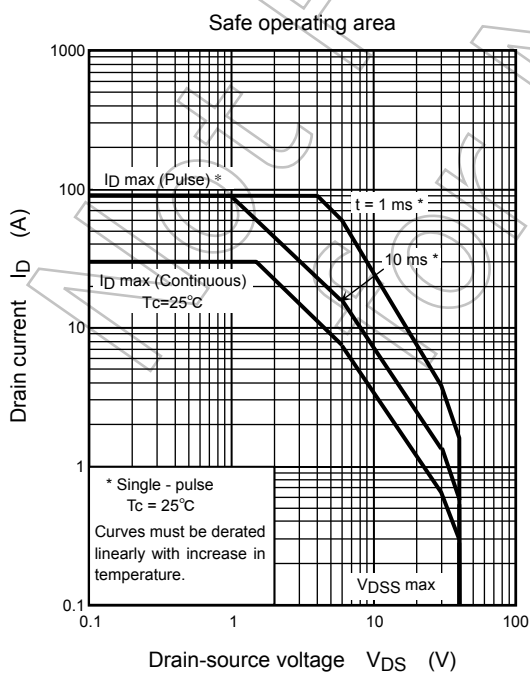
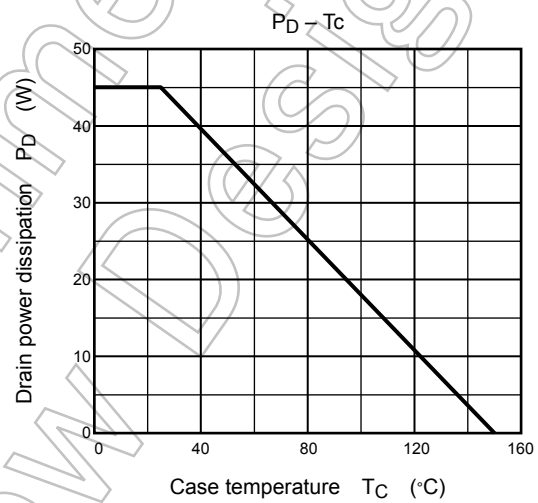
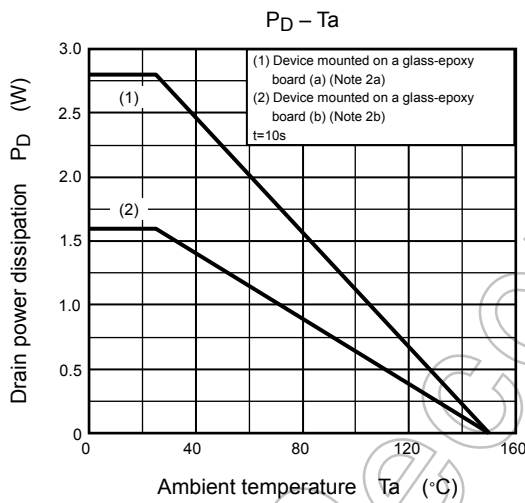
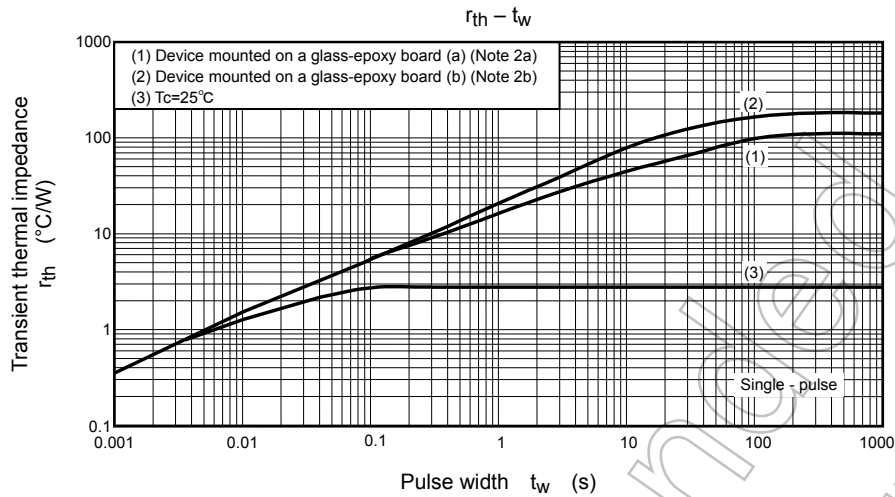
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 10$	$\mu\text{A}$
Drain cutoff current		$I_{DSS}$	$V_{DS} = 40 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	10	$\mu\text{A}$
Drain-source breakdown voltage	$V_{(BR) DSS}$		$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	40	—	—	V
	$V_{(BR) DSX}$		$I_D = 10 \text{ mA}, V_{GS} = -20 \text{ V}$	25	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA}$	2.0	—	4.0	V
Drain-source ON-resistance		$R_{DS(ON)}$	$V_{GS} = 10 \text{ V}, I_D = 15 \text{ A}$	—	8.0	10	$\text{m}\Omega$
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 10 \text{ V}, I_D = 15 \text{ A}$	22	44	—	S
Input capacitance		$C_{iss}$	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	1430	—	pF
Reverse transfer capacitance		$C_{rss}$		—	95	—	
Output capacitance		$C_{oss}$		—	450	—	
Switching time	Rise time	$t_r$	 <p><math>V_{GS}</math> 10 V 0 V <math>I_D = 15 \text{ A}</math> <math>V_{OUT}</math> 4.7 <math>\Omega</math> 1.33 <math>\Omega</math> <math>V_{DD} \approx 20 \text{ V}</math> Duty <math>\leq 1\%</math>, <math>t_w = 10 \mu\text{s}</math></p>	—	4	—	ns
	Turn-on time	$t_{on}$		—	13	—	
	Fall time	$t_f$		—	3	—	
	Turn-off time	$t_{off}$		—	19	—	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx 32 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 30 \text{ A}$	—	23	—	nC
Gate-source charge 1		$Q_{gs1}$		—	7.3	—	
Gate-drain ("Miller") charge		$Q_{gd}$		—	5.2	—	
Gate switch charge		$Q_{SW}$		—	8.1	—	

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

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	$I_{DRP}$	—	—	—	90	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = 30 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.2	V







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