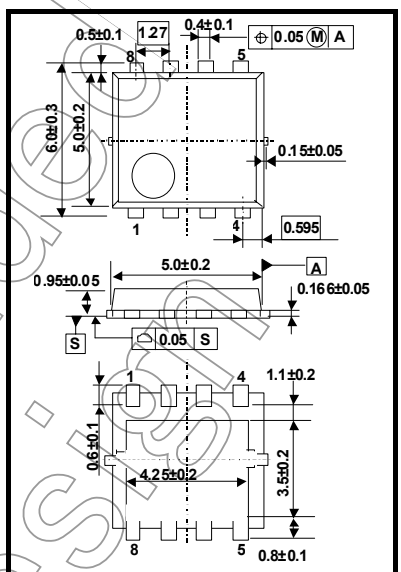
TOSHIBA Field Effect Transistor with Built-in Schottky Barrier Diode
Silicon N-Channel MOS Type (Ultra-High-Speed U-MOS Ⅲ)

TPCA8A01-H

High Efficiency DC-DC Converter Applications
Notebook PC Applications
Portable Equipment Applications

- Built-in schottky barrier diode
  Low forward voltage: V_{DSF} = −0.6 V (max)
- Small footprint due to a small and thin package
- High speed switching
- Small gate charge: Q_{sw} =11 nC (typ.)
- Low drain-source ON-resistance: $R_{DS\ (ON)}$ =4.3 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 70 S (typ.)
- Low leakage current: I_{DSS} = 100 μA (max) (V_{DS} = 30 V)
- Enhancement mode: V_{th} = 1.1 to 2.3 V (V_{DS} = 10 V, I_D = 1 mA)

Unit: mm



1,2,3 : SOURCE 4 : GATE
5,6,7,8 : DRAIN

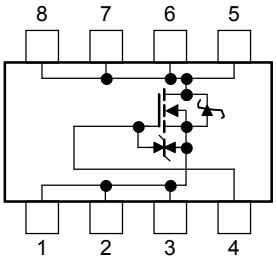
JEDEC	—
JEITA	—
TOSHIBA	2-5Q1A

Weight: 0.080 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	30	V
Drain-gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	30	V
Gate-source voltage		V_{GSS}	±20	V
Drain current	DC (Note 1)	I_D	36	A
	Pulsed (Note 1)	I_{DP}	108	
Drain power dissipation (Tc=25°C)		P_D	45	W
Drain power dissipation (t = 10 s) (Note 2a)		P_D	2.8	W
Drain power dissipation (t = 10 s) (Note 2b)		P_D	1.6	W
Single-pulse avalanche energy (Note 3)		E_{AS}	168	mJ
Avalanche current		I_{AR}	36	A
Repetitive avalanche energy (Tc=25°C) (Note 4)		E_{AR}	2.1	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55 to 150	°C

Circuit Configuration



Note: For Notes 1 to 4, refer to the next page.

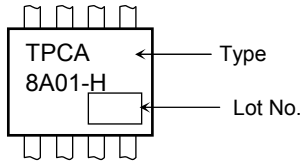
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within 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. Schottky barrier diodes have large-reverse-current-leakage characteristic compared to other rectifier products. This current leakage combined with improper operating temperature or voltage may cause thermal runaway. Please take forward and reverse loss into consideration during design.

Thermal Characteristics

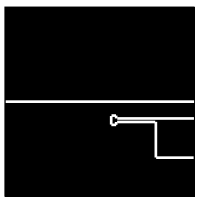
Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case (Tc=25°C)	$R_{th\ (ch-c)}$	2.78	°C/W
Thermal resistance, channel to ambient (t = 10 s) (Note 2a)	$R_{th\ (ch-a)}$	44.6	°C/W
Thermal resistance, channel to ambient (t = 10 s) (Note 2b)	$R_{th\ (ch-a)}$	78.1	°C/W

Marking (Note 5)



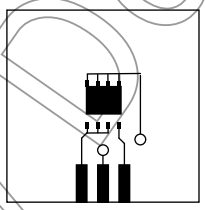
Note 1: The channel temperature should not exceed 150°C during use

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)

(a)



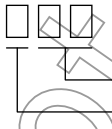
FR-4
25.4 × 25.4 × 0.8
(Unit: mm)

(b)

Note 3: V_{DD} = 24 V, T_{ch} = 25°C (initial), L = 0.1 mH, R_G = 25 Ω, I_{AR} = 36 A

Note 4: Repetitive rating: pulse width limited by max. channel temperature

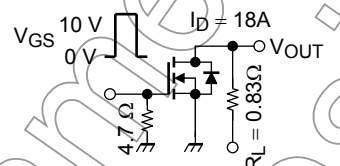
Note 5: * Weekly code: (Three digits)



Week of manufacture
(01 for first week of year, continuing up to 52 or 53)

Year of manufacture
(The last digit of the calendar year)

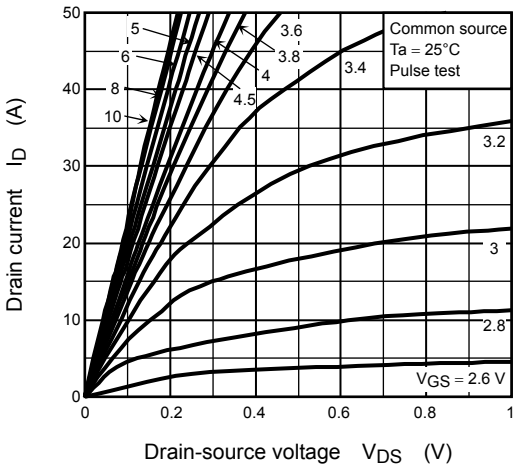
Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut-off current		I_{DSS}	V_{DS} = 30 V, V_{GS} = 0 V	—	—	100	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 10 mA, V_{GS} = 0 V	30	—	—	V
		$V_{(BR)\ DSX}$	I_D = 10 mA, V_{GS} = −20 V	15	—	—	
Gate threshold voltage		V_{th}	V_{DS} = 10 V, I_D = 1 mA	1.1	—	2.3	V
Drain-source ON-resistance		$R_{DS\ (ON)}$	V_{GS} = 4.5 V, I_D = 18 A	—	6.2	8.5	mΩ
			V_{GS} = 10 V, I_D = 18 A	—	4.3	5.6	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 18 A	35	70	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	1970	—	pF
Reverse transfer capacitance		C_{rss}		—	240	—	
Output capacitance		C_{oss}		—	950	—	
Switching time	Rise time	t_r		—	8	—	ns
	Turn-on time	t_{on}		—	18	—	
	Fall time	t_f		—	10	—	
	Turn-off time	t_{off}		—	44	—	
Total gate charge (gate-source plus gate-drain)		Q_g	V_{DD} ≈ 24 V, V_{GS} = 10 V, I_D = 36 A	—	35	—	nC
			V_{DD} ≈ 24 V, V_{GS} = 5 V, I_D = 36 A	—	19	—	
Gate-source charge 1		Q_{gs1}	V_{DD} ≈ 24 V, V_{GS} = 10 V, I_D = 36 A	—	6	—	
Gate-drain (“Miller”) charge		Q_{gd}		—	8.8	—	
Gate switch charge		Q_{SW}		—	11	—	

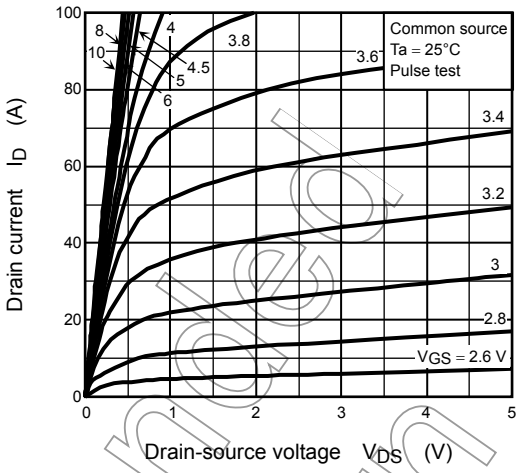
Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Peak forward current	Pulse (Note 1)	I_{DRP}	—	—	—	108	A
Forward voltage (diode)		V_{DSF}	I_{DR} = 1.0 A, V_{GS} = 0 V	—	− 0.45	− 0.6	V
			I_{DR} = 36 A, V_{GS} = 0 V	—	—	− 1.2	

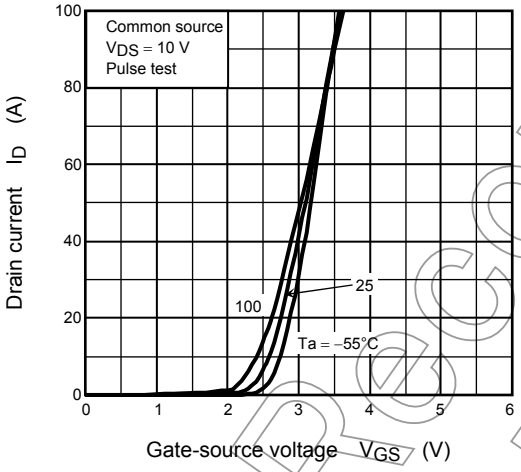
$I_D - V_{DS}$



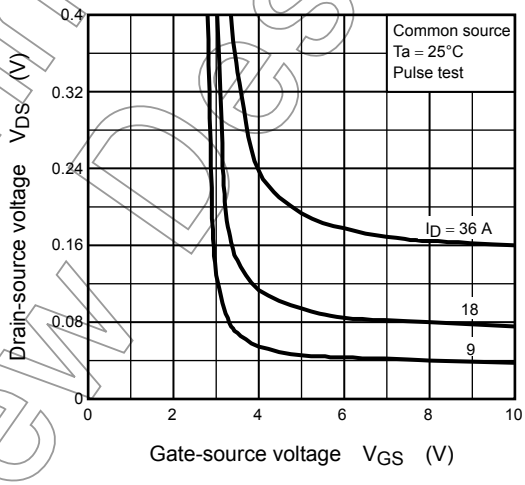
$I_D - V_{DS}$



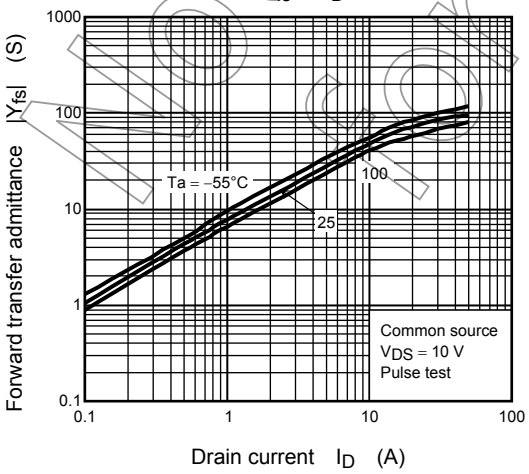
$I_D - V_{GS}$



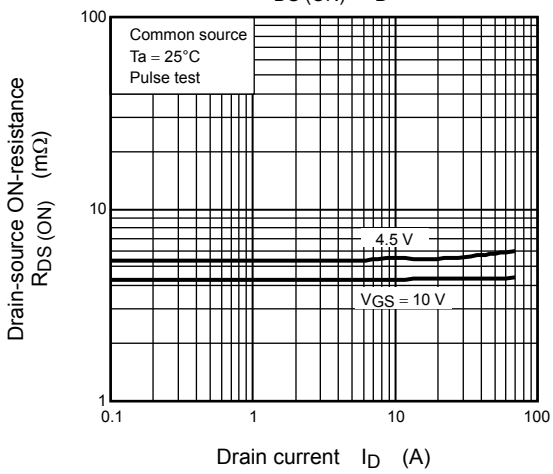
$V_{DS} - V_{GS}$



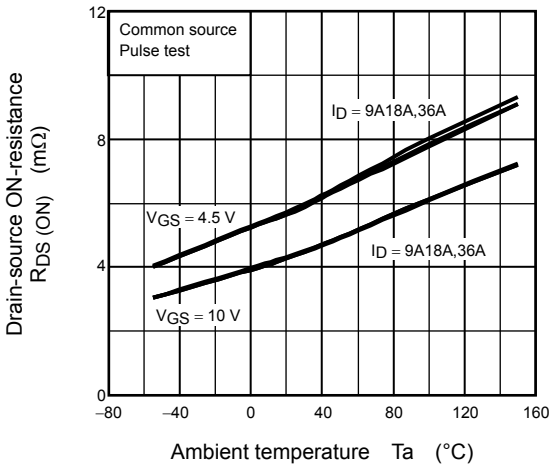
$|Y_{fs}| - I_D$



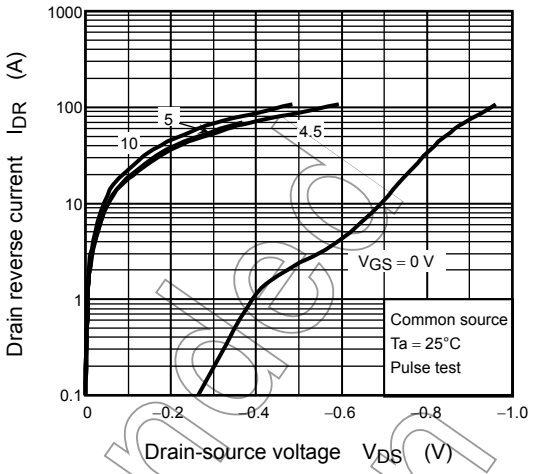
$R_{DS\ (ON)} - I_D$



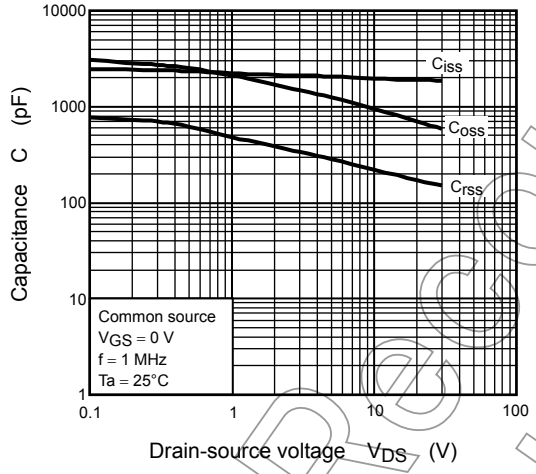
$R_{DS\ (ON)}$ – Ta



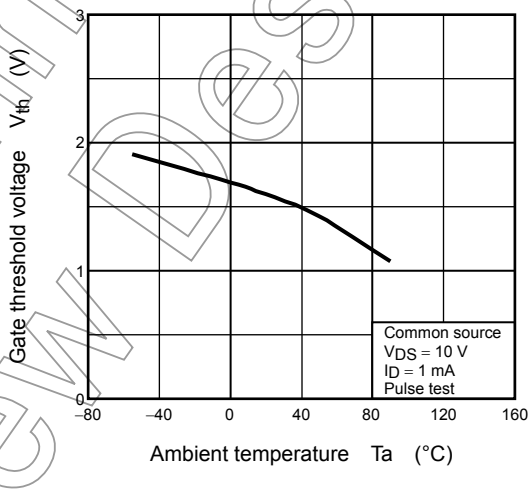
I_{DR} – V_{DS}



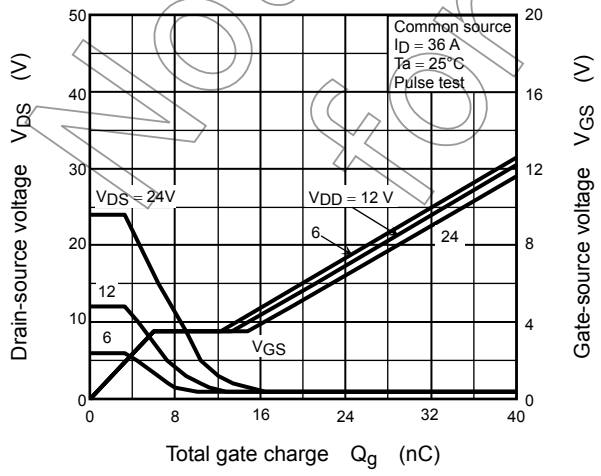
Capacitance – V_{DS}



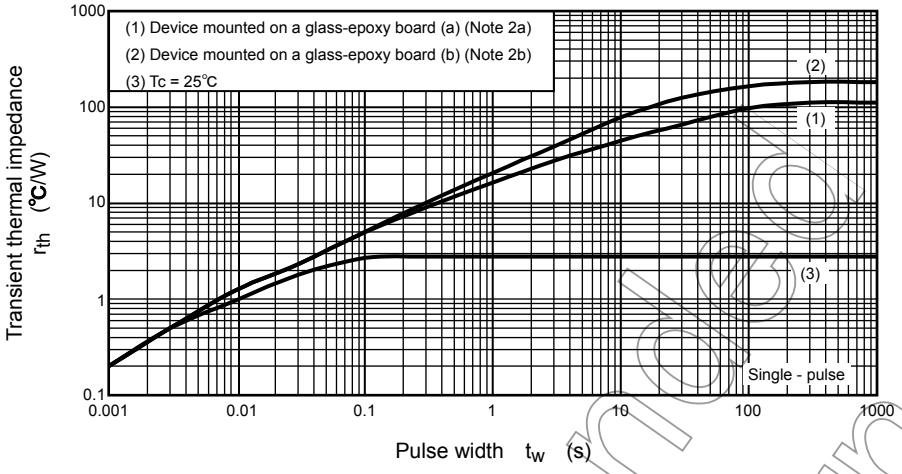
V_{th} – Ta



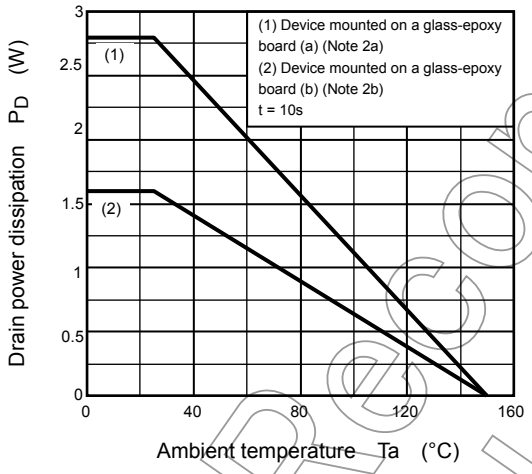
Dynamic input/output characteristics



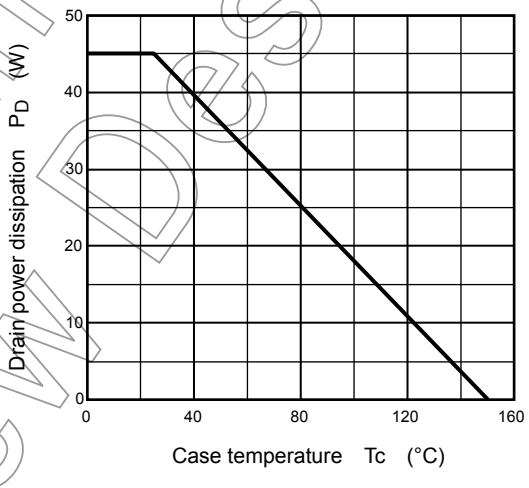
$r_{th} - t_w$



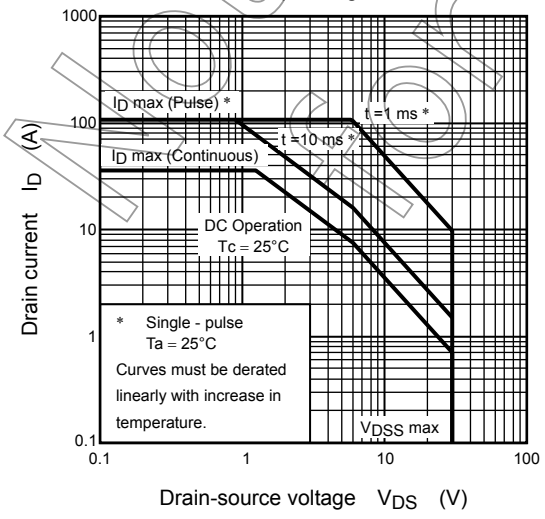
$P_D - Ta$



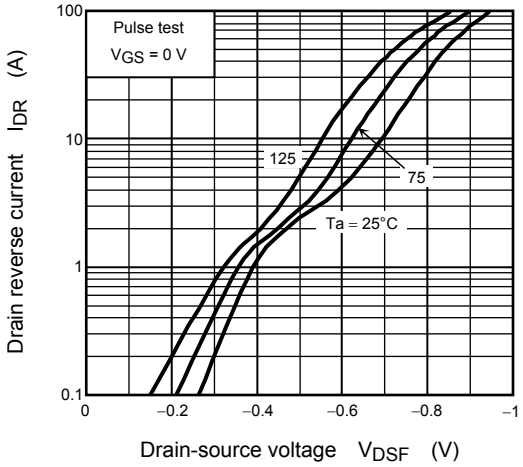
$P_D - Tc$



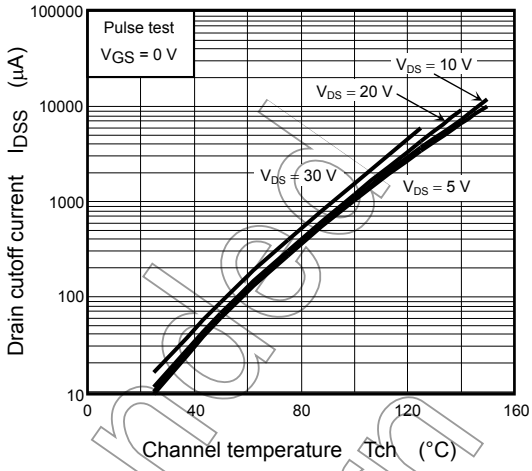
Safe operating area



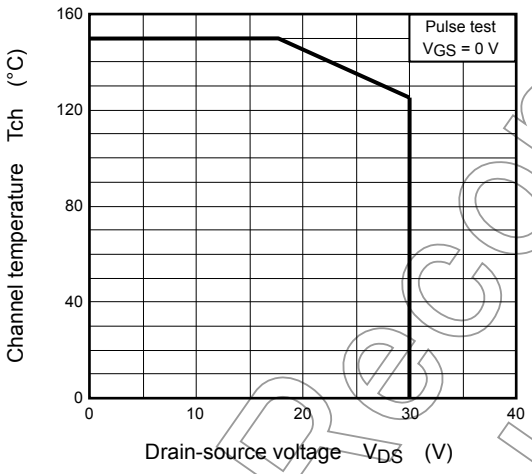
I_{DR} – V_{DSF}



I_{DSS} – Tch (typ.)



Tch – V_{DS}



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