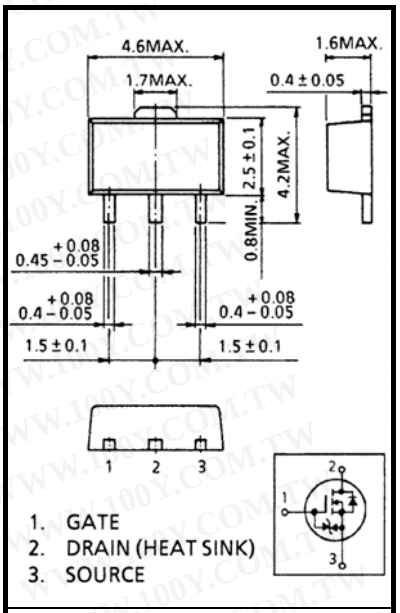
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (L^2-π-MOS V)

2SK2963

DC-DC Converter, Relay Drive and Motor Drive Applications

- 4 V gate drive
- Low drain-source ON resistance: $R_{DS\ (ON)}$ = 0.5 Ω (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 1.2 S (typ.)
- Low leakage current: I_{DSS} = 100 μA (max) (V_{DS} = 100 V)
- Enhancement-mode: V_{th} = 0.8 to 2.0 V (V_{DS} = 10 V, I_D = 1 mA)

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-5K1B

Weight: 0.05 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	100	V
Drain-gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	100	V
Gate-source voltage		V_{GSS}	±20	V
Drain current	DC (Note 1)	I_D	1	A
	Pulse (Note 1)	I_{DP}	3	
Drain power dissipation		P_D	0.5	W
Drain power dissipation (Note 2)		P_D	1.5	W
Single pulse avalanche energy (Note 3)		E_{AS}	137	mJ
Avalanche current		I_{AR}	1	A
Repetitive avalanche energy (Note 4)		E_{AR}	0.05	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55 to 150	°C

Note 1: Please use devices on condition that the channel temperature is below 150°C.

Note 2: Mounted on ceramic substrate (25.4 mm × 25.4 mm × 0.8 mm)

Note 3: V_{DD} = 25 V, T_{ch} = 25°C (initial), L = 221 mH, R_G = 25 Ω, I_{AR} = 1 A

Note 4: Repetitive rating: pulse width limited by maximum junction temperature.

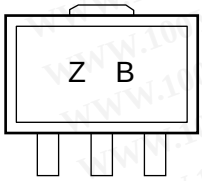
Note 5: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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.
Please handle with caution.

Thermal Characteristics

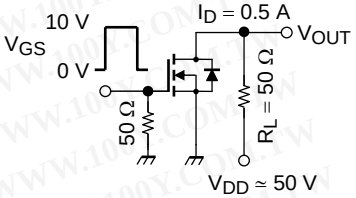
Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient	$R_{th\ (ch-a)}$	250	°C/W

Marking



(The two digits represent the part number.)

Electrical Characteristics (Ta = 25°C)

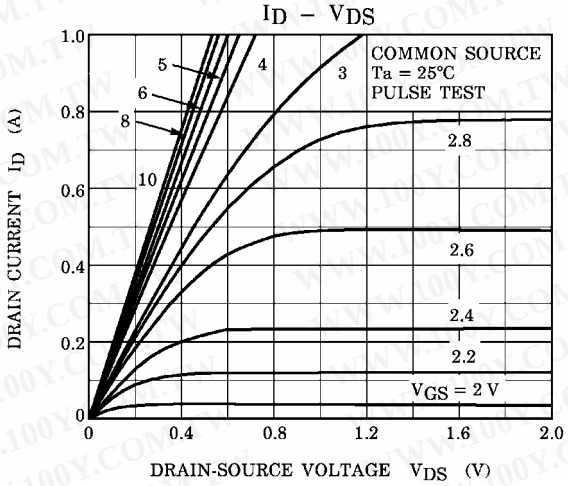
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut-off current		I_{DSS}	V_{DS} = 100 V, V_{GS} = 0 V	—	—	100	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 10 mA, V_{GS} = 0 V	100	—	—	V
Gate threshold voltage		V_{th}	V_{DS} = 10 V, I_D = 1 mA	0.8	—	2.0	V
Drain-source ON resistance		$R_{DS\ (ON)}$	V_{GS} = 4 V, I_D = 0.5 A	—	0.65	0.95	Ω
			V_{GS} = 10 V, I_D = 0.5 A	—	0.5	0.7	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 0.5 A	0.6	1.2	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	140	—	pF
Reverse transfer capacitance		C_{rss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	20	—	pF
Output capacitance		C_{oss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	45	—	pF
Switching time	Rise time	t_r		—	8	—	ns
	Turn-on time	t_{on}		—	13	—	
	Fall time	t_f		—	45	—	
	Turn-off time	t_{off}		—	175	—	
Total gate charge (gate-source plus gate-drain)		Q_g	V_{DD} ≃ 80 V, V_{GS} = 10 V, I_D = 1 A	—	6.3	—	nC
Gate-source charge		Q_{gs}	V_{DD} ≃ 80 V, V_{GS} = 10 V, I_D = 1 A	—	4.3	—	nC
Gate-drain (“miller”) charge		Q_{gd}	V_{DD} ≃ 80 V, V_{GS} = 10 V, I_D = 1 A	—	2	—	nC

Duty ≤ 1%, t_w = 10 μs

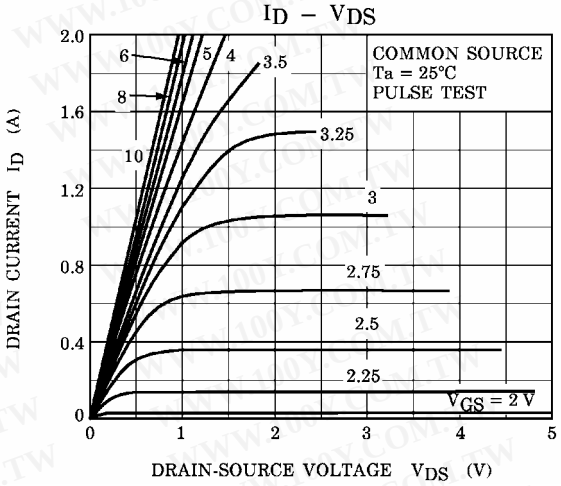
Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	1	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	3	A
Forward voltage (diode)	V_{DSF}	I_{DR} = 1 A, V_{GS} = 0 V	—	—	−1.5	V
Reverse recovery time	t_{rr}	I_{DR} = 1 A, V_{GS} = 0 V, dI_{DR}/dt = 50 A/μs	—	80	—	ns
Reverse recovery charge	Q_{rr}	I_{DR} = 1 A, V_{GS} = 0 V, dI_{DR}/dt = 50 A/μs	—	140	—	μC

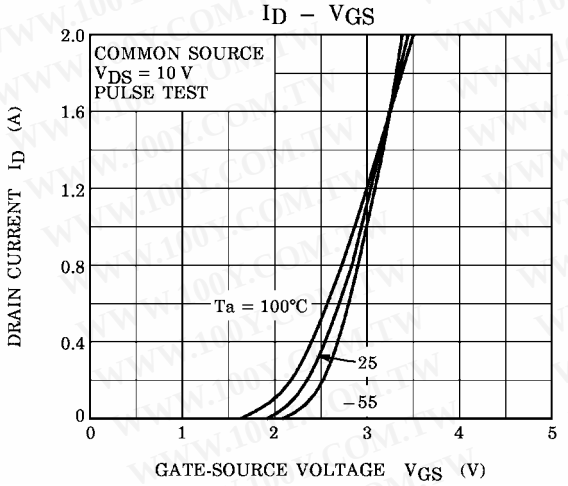
$I_D - V_{DS}$



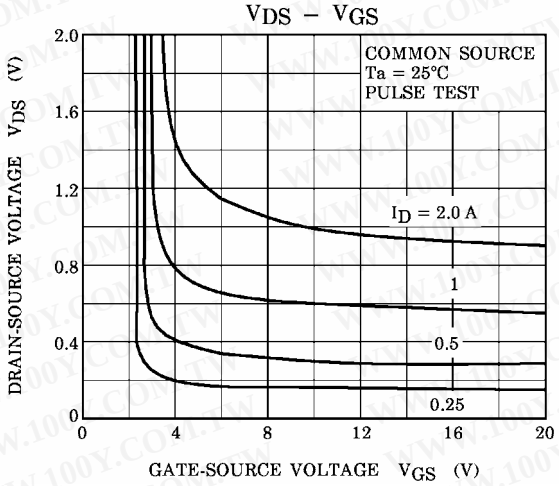
$I_D - V_{DS}$



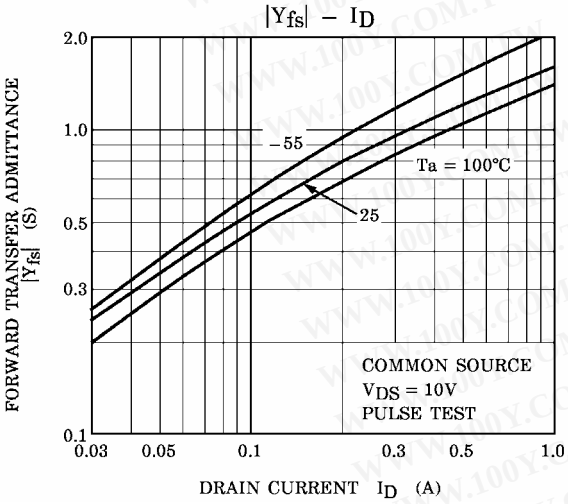
$I_D - V_{GS}$



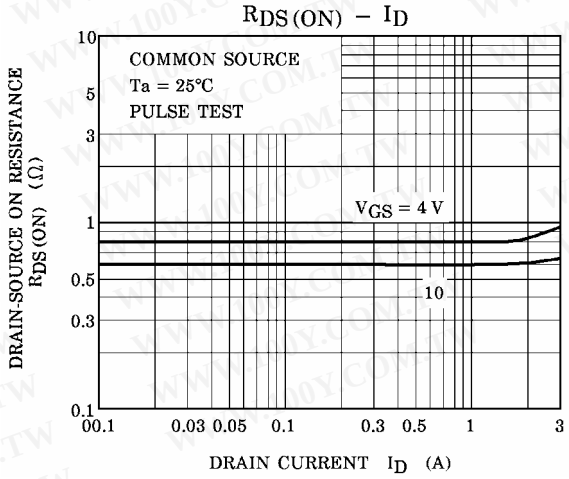
$V_{DS} - V_{GS}$



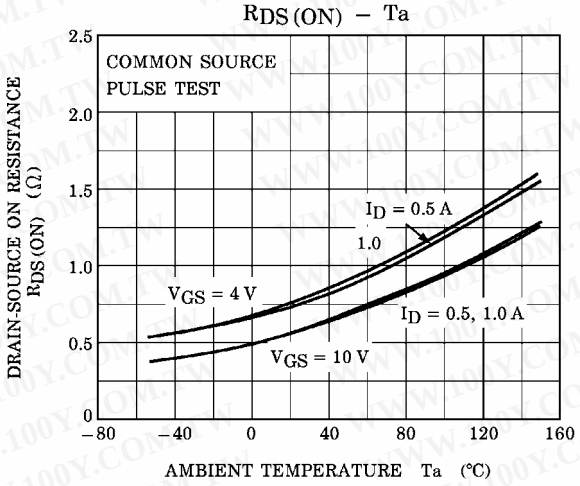
$|Y_{fs}| - I_D$



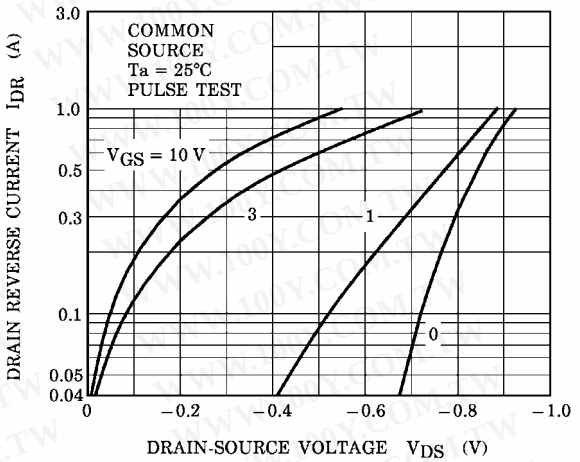
$R_{DS(ON)} - I_D$



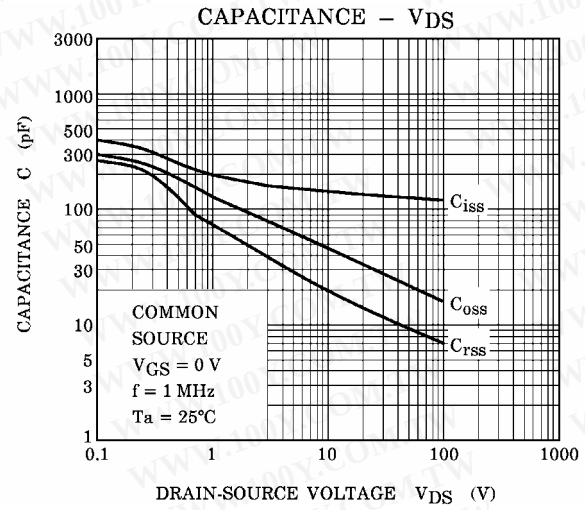
$R_{DS\,(ON)}$ – Ta



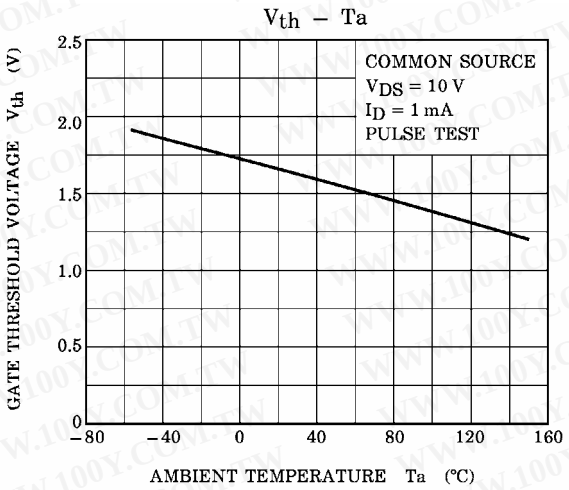
I_{DR} – V_{DS}



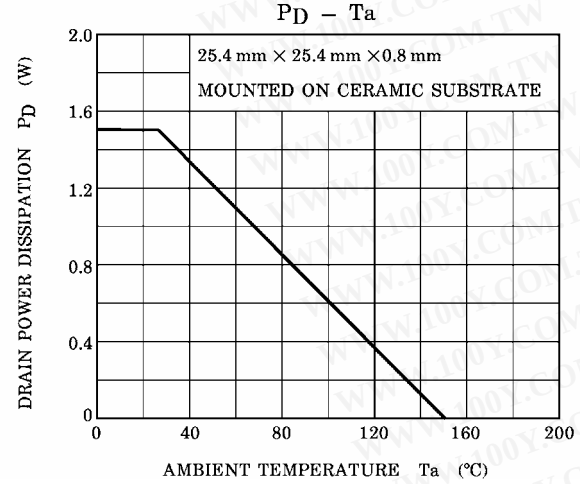
CAPACITANCE – V_{DS}



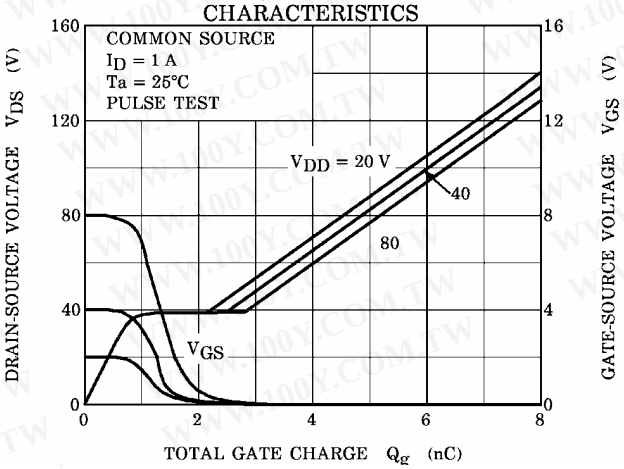
V_{th} – Ta

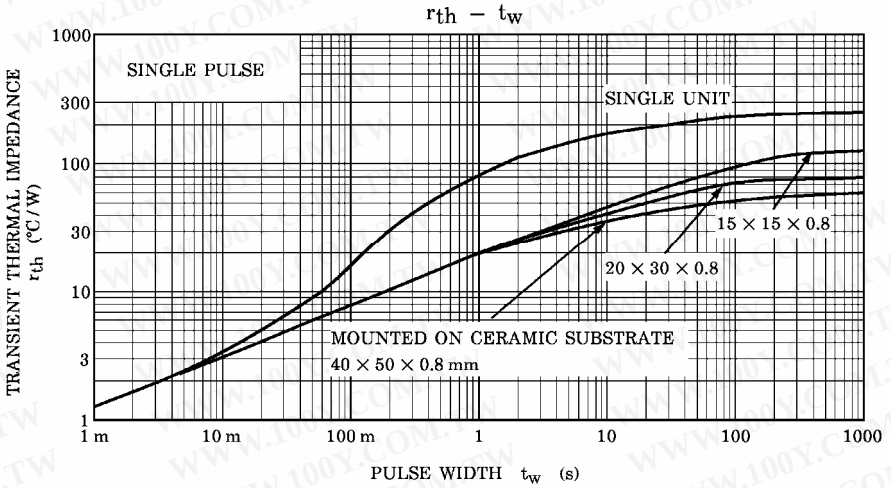


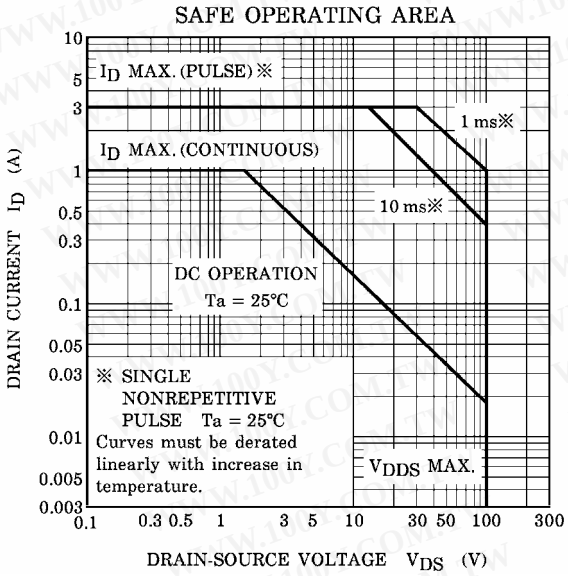
P_D – Ta

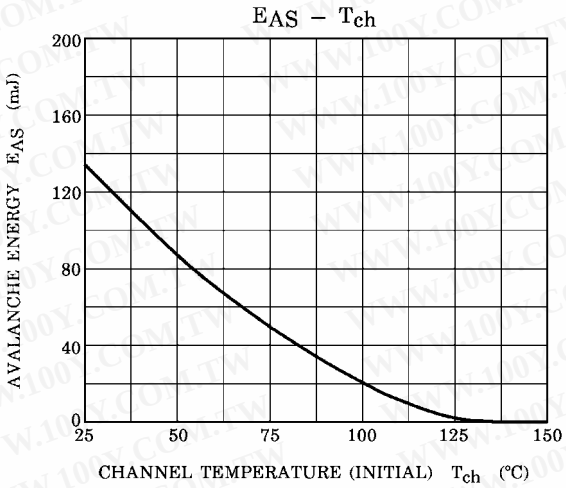


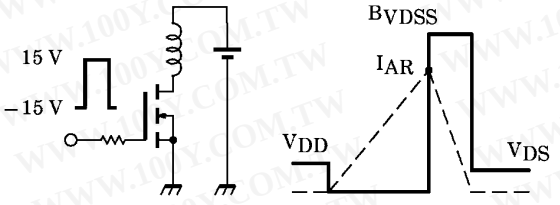
DYNAMIC INPUT/OUTPUT CHARACTERISTICS











TEST CIRCUIT WAVE FORM

$R_G = 25\ \Omega$
$V_{DD} = 25$ V, L = 221 mH

$$E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{B_{VDSS}}{B_{VDSS} - V_{DD}} \right)$$

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20070701-EN

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