TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (U−MOSII)

2SK2986

DC−DC Converter, Relay Drive and Motor Drive Applications

- Low drain−source ON resistance : $R_{DS\ (ON)}$ = 4.5 mΩ (typ.)
- High forward transfer admittance : $|Y_{fs}|$ = 80 S (typ.)
- Low leakage current : I_{DSS} = 100 μA (max) (V_{DS} = 60 V)
- Enhancement−mode : V_{th} = 1.3~2.5 V (V_{DS} = 10 V, I_D = 1 mA)

Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain−source voltage		V_{DSS}	60	V
Drain−gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	60	V
Gate−source voltage		V_{GSS}	±20	V
Drain current	DC (Note 1)	I_D	55	A
	Pulse (t≤10 s) (Note 1)	I_{DP}	70	
	Pulse (t≤1 ms) (Note 1)		280	
Drain power dissipation (Tc = 25°C)		P_D	100	W
Single pulse avalanche energy (Note 2)		E_{AS}	525	mJ
Avalanche current		I_{AR}	55	A
Repetitive avalanche energy (Note 3)		E_{AR}	10	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55~150	°C

Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th\ (ch-c)}$	1.25	°C / W
Thermal resistance, channel to ambient	$R_{th\ (ch-a)}$	83.3	°C / W

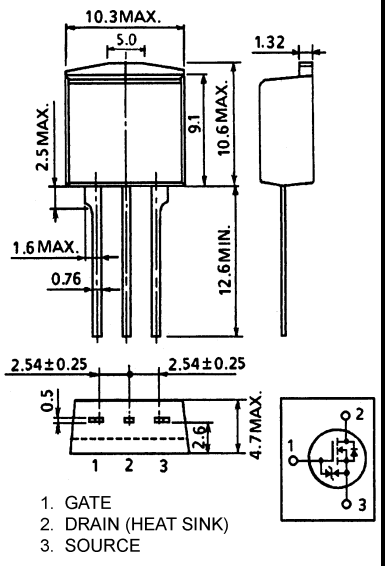
Note 1: Please use devices on condition that the channel temperature is below 150°C.

Note 2: V_{DD} = 25 V, T_{ch} = 25°C (initial), L = 236 μH, I_{AR} = 55 A, R_G = 25 Ω

Note 3: Repetitive rating: Pulse width limited by maximum channel temperature

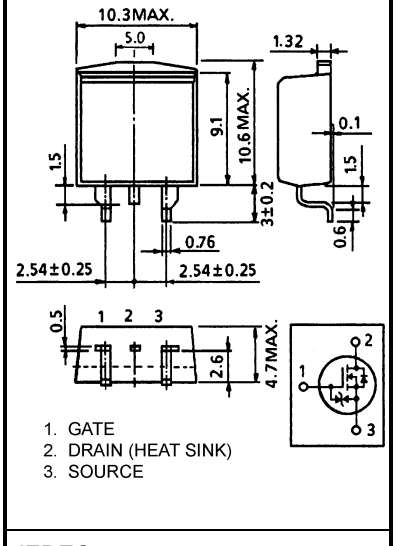
This transistor is an electrostatic sensitive device.
Please handle with caution.

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-10S1B

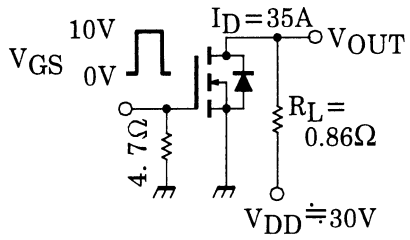
Weight: 1.5 g (typ.)



JEDEC	—
JEITA	—
TOSHIBA	2-10S2B

Weight: 1.5 g (typ.)

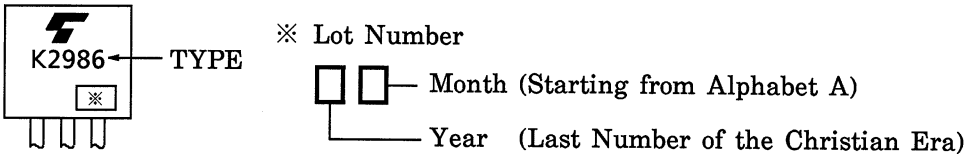
Electrical Characteristics (Ta = 25°C)

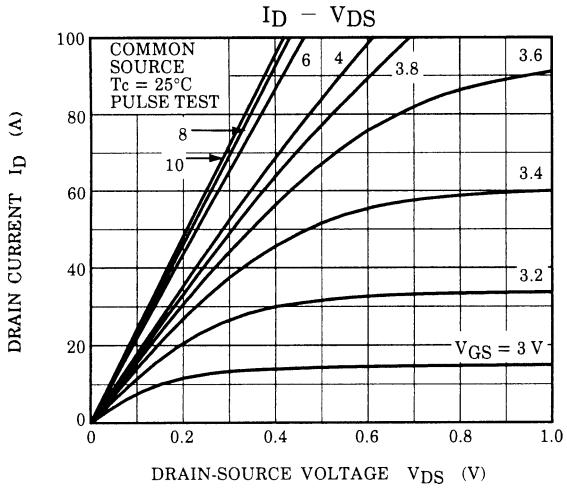
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±10	μA
Drain cut−off current		I_{DSS}	V_{DS} = 60 V, V_{GS} = 0 V	—	—	100	μA
Drain−source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 10 mA, V_{GS} = 0 V	60	—	—	V
		$V_{(BR)\ DSX}$	I_D = 10 mA, V_{GS} = −20 V	40	—	—	
Gate threshold voltage		V_{th}	V_{DS} = 10 V, I_D = 1 mA	1.3	—	2.5	V
Drain−source ON resistance		$R_{DS\ (ON)}$	V_{GS} = 10 V, I_D = 35 A	—	4.5	5.8	mΩ
			V_{GS} = 4 V, I_D = 35 A	—	5.8	10	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 35 A	40	80	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	9300	—	pF
Reverse transfer capacitance		C_{rss}		—	910	—	
Output capacitance		C_{oss}		—	1435	—	
Switching time	Rise time	t_r	 Duty ≦ 1%, t_w = 10μs	—	18	—	ns
	Turn−on time	t_{on}		—	50	—	
	Fall time	t_f		—	110	—	
	Turn−off time	t_{off}		—	480	—	
Total gate charge (gate−source plus gate−drain)		Q_g	V_{DD} ≈ 48 V, V_{GS} = 10 V, I_D = 55 A	—	210	—	nC
Gate−source charge		Q_{gs}		—	145	—	
Gate−drain (“miller”) Charge		Q_{gd}		—	65	—	

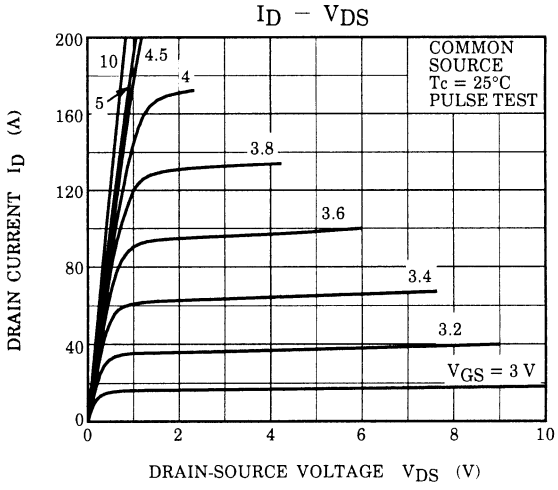
Source−Drain Ratings and Characteristics (Ta = 25°C)

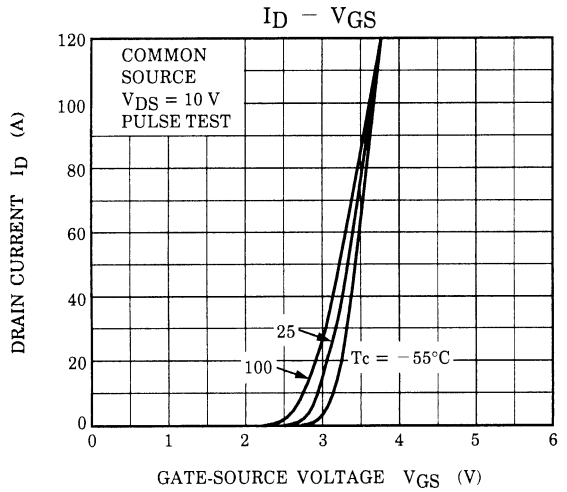
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	55	A
Pulse drain reverse current (Note 1)	I_{DRP}	t ≤ 10 s	—	—	70	A
		t ≤ 1 ms	—	—	280	
Forward voltage (diode)	V_{DSF}	I_{DR} = 55 A, V_{GS} = 0 V	—	—	−1.5	V
Reverse recovery time	t_{rr}	I_{DR} = 55 A, V_{GS} = 0 V, dI_{DR} / dt = 50 A / μs	—	60	—	ns
Reverse recovery charge	Q_{rr}		—	50	—	nC

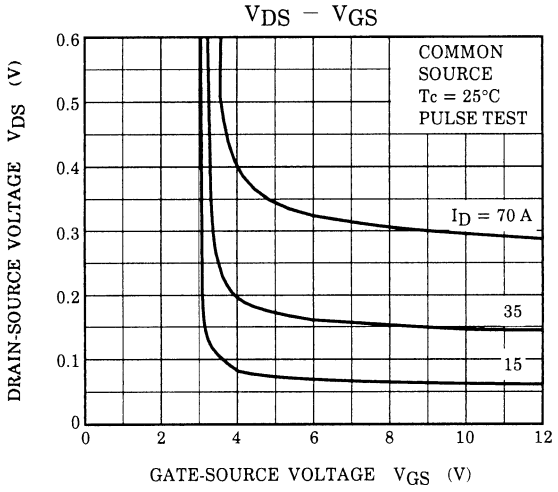
Marking

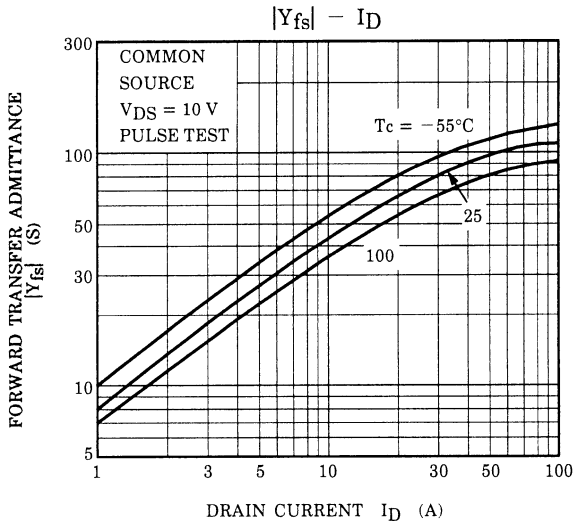


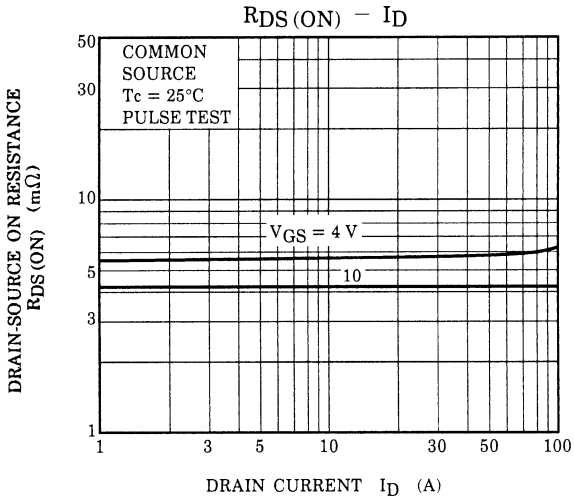

I_D – V_{DS}
COMMON SOURCE
Tc = 25°C
PULSE TEST
6
4
3.8
3.6
8
10
3.4
3.2
V_{GS} = 3 V
DRAIN CURRENT I_D (A)
DRAIN-SOURCE VOLTAGE V_{DS} (V)


I_D – V_{DS}
COMMON SOURCE
Tc = 25°C
PULSE TEST
10
4.5
5
4
3.8
3.6
3.4
3.2
V_{GS} = 3 V
DRAIN CURRENT I_D (A)
DRAIN-SOURCE VOLTAGE V_{DS} (V)

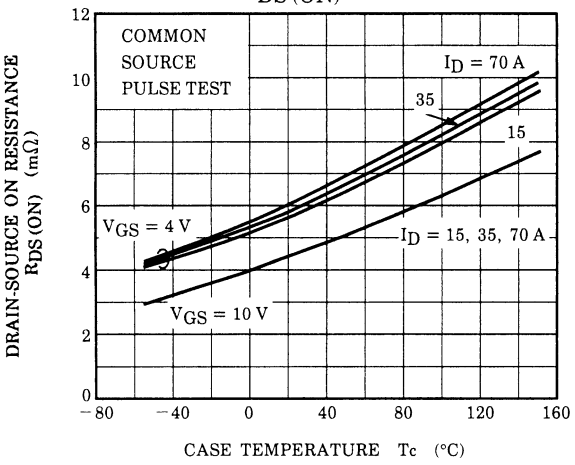

I_D – V_{GS}
COMMON SOURCE
V_{DS} = 10 V
PULSE TEST
25
100
Tc = −55°C
DRAIN CURRENT I_D (A)
GATE-SOURCE VOLTAGE V_{GS} (V)


V_{DS} – V_{GS}
COMMON SOURCE
Tc = 25°C
PULSE TEST
I_D = 70 A
35
15
DRAIN-SOURCE VOLTAGE V_{DS} (V)
GATE-SOURCE VOLTAGE V_{GS} (V)

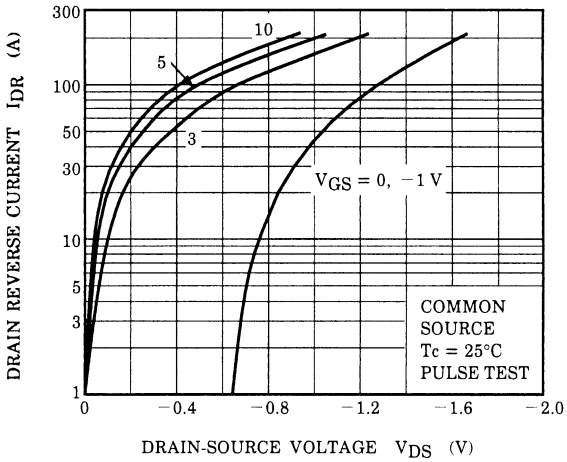

$|Y_{fs}|$ – I_D
COMMON SOURCE
V_{DS} = 10 V
PULSE TEST
Tc = −55°C
25
100
FORWARD TRANSFER ADMITTANCE $|Y_{fs}|$ (S)
DRAIN CURRENT I_D (A)


$R_{DS\,(ON)}$ – I_D
COMMON SOURCE
Tc = 25°C
PULSE TEST
V_{GS} = 4 V
10
DRAIN-SOURCE ON RESISTANCE $R_{DS\,(ON)}$ (mΩ)
DRAIN CURRENT I_D (A)

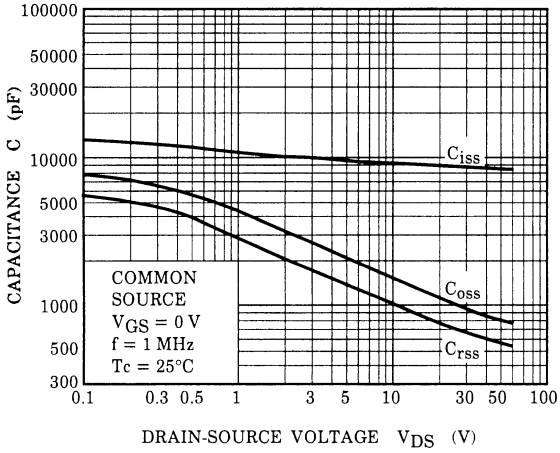
$R_{DS\,(ON)}$ – Tc



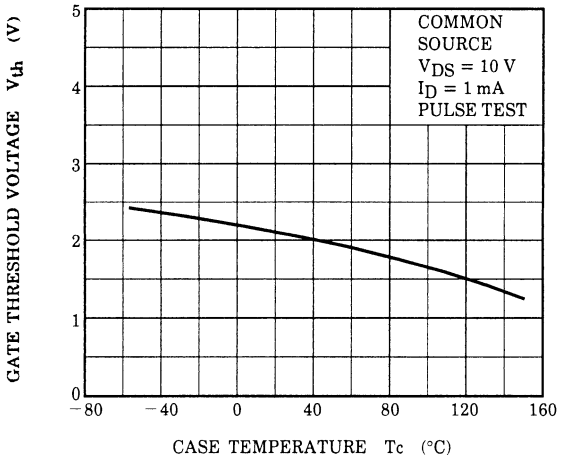
I_{DR} – V_{DS}



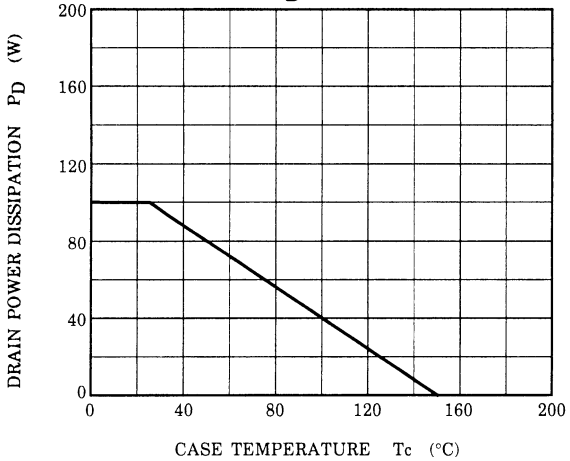
CAPACITANCE – V_{DS}



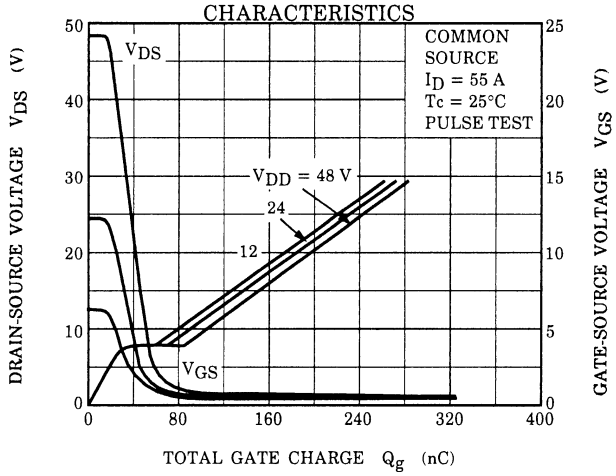
V_{th} – Tc



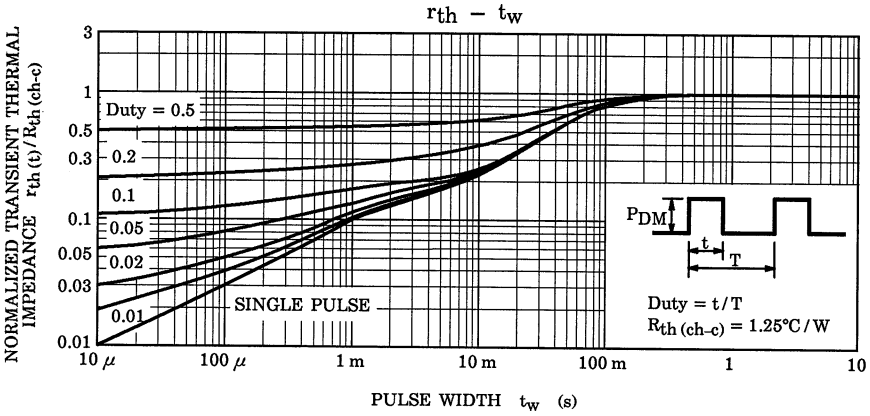
P_D – Tc



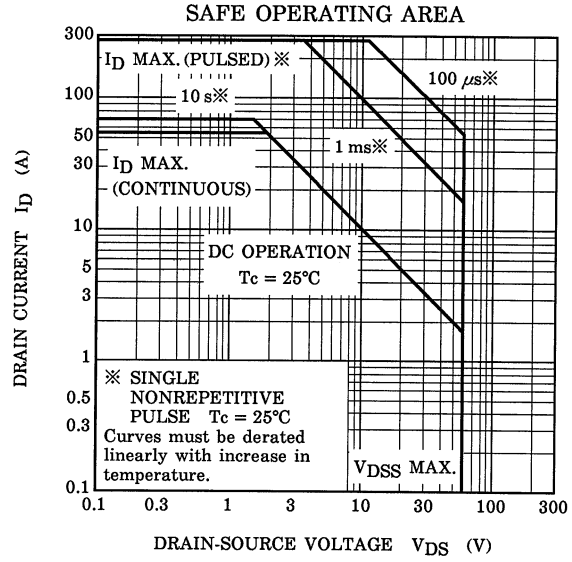
DYNAMIC INPUT / OUTPUT CHARACTERISTICS



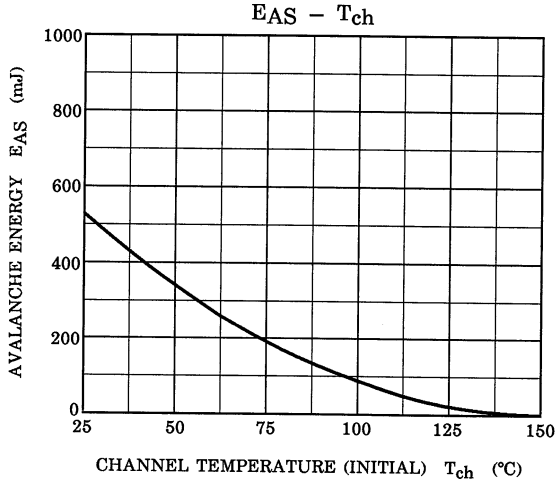
r_{th} – t_w



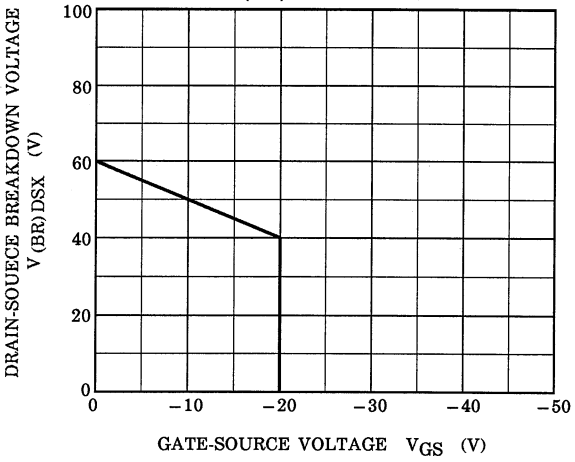
SAFE OPERATING AREA

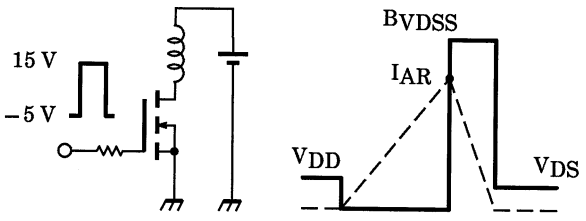


E_{AS} – T_{ch}



$V_{(BR)\ DSX}$ – V_{GS}





TEST CIRCUIT WAVE FORM

R_G = 25 Ω
V_{DD} = 25 V, L = 236 μH

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

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