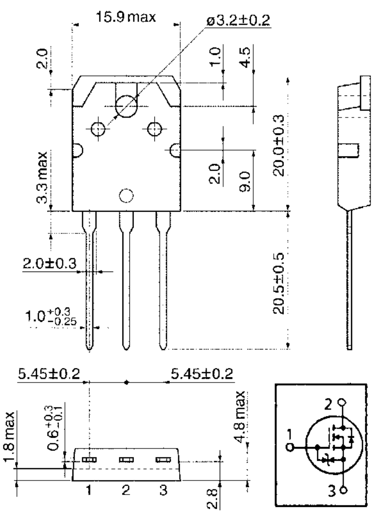
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (π−MOSIII)

2SK2611

DC−DC Converter, Relay Drive and Motor Drive Applications

Unit: mm



1. GATE
2. DRAIN (HEAT SINK)
3. SOURCE

JEDEC	—
JEITA	SC-65
TOSHIBA	2-16C1B

Weight: 4.6 g (typ.)

- Low drain−source ON resistance : $R_{DS\ (ON)}$ = 1.1 Ω (typ.)
- High forward transfer admittance : $|Y_{fs}|$ = 7.0 S (typ.)
- Low leakage current : I_{DSS} = 100 μA (max) (V_{DS} = 720 V)
- Enhancement−mode : V_{th} = 2.0~4.0 V (V_{DS} = 10 V, I_D = 1 mA)

Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain−source voltage		V_{DSS}	900	V
Drain−gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	900	V
Gate−source voltage		V_{GSS}	±30	V
Drain current	DC (Note 1)	I_D	9	A
	Pulse (Note 1)	I_{DP}	27	A
Drain power dissipation (Tc = 25°C)		P_D	150	W
Single pulse avalanche energy (Note 2)		E_{AS}	663	mJ
Avalanche current		I_{AR}	9	A
Repetitive avalanche energy (Note 3)		E_{AR}	15	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	$R_{th\ (ch-c)}$	0.833	°C / W
Thermal resistance, channel to ambient	$R_{th\ (ch-a)}$	50	°C / W

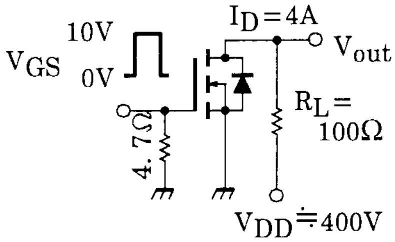
Note 1: Please use devices on condition that the channel temperature is below 150°C.

Note 2: V_{DD} = 90 V, T_{ch} = 25°C (initial), L = 15 mH, R_G = 25 Ω, I_{AR} = 9 A

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

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

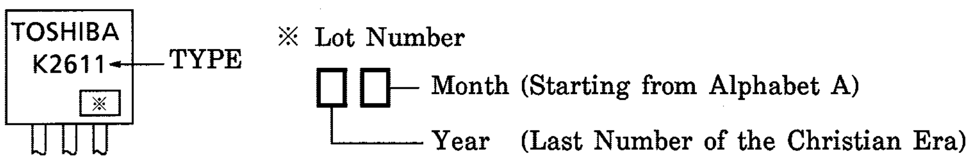
Electrical Characteristics (Ta = 25°C)

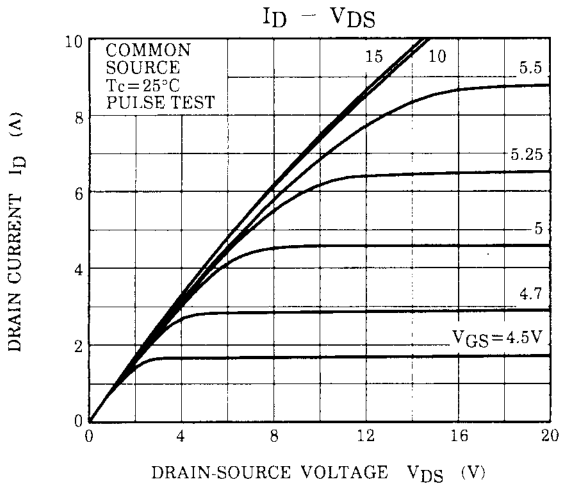
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±30 V, V_{DS} = 0 V	—	—	±10	μA
Gate−source breakdown voltage		$V_{(BR)\ GSS}$	I_G = ±10 μA, V_{DS} = 0 V	±30	—	—	V
Drain cut−off current		I_{DSS}	V_{DS} = 720 V, V_{GS} = 0 V	—	—	100	μA
Drain−source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 10 mA, V_{GS} = 0 V	900	—	—	V
Gate threshold voltage		V_{th}	V_{DS} = 10 V, I_D = 1 mA	2.0	—	4.0	V
Drain−source ON resistance		$R_{DS\ (ON)}$	V_{GS} = 10 V, I_D = 4 A	—	1.1	1.4	Ω
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 15 V, I_D = 4 A	3.0	7.0	—	S
Input capacitance		C_{iss}	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	—	2040	—	pF
Reverse transfer capacitance		C_{rss}		—	45	—	
Output capacitance		C_{oss}		—	190	—	
Switching time	Rise time	t_r		—	25	—	ns
	Turn−on time	t_{on}		—	60	—	
	Fall time	t_f		—	20	—	
	Turn−off time	t_{off}	Duty ≦ 1%, t_w = 10μs	—	95	—	
Total gate charge (gate−source plus gate−drain)		Q_g	V_{DD} ≈ 400 V, V_{GS} = 10 V, I_D = 9 A	—	58	—	nC
Gate−source charge		Q_{gs}		—	32	—	
Gate−drain ("miller") Charge		Q_{gd}		—	26	—	

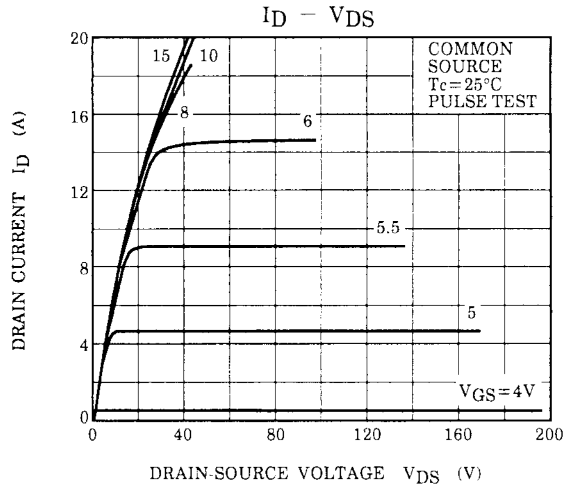
Source−Drain Ratings and Characteristics (Ta = 25°C)

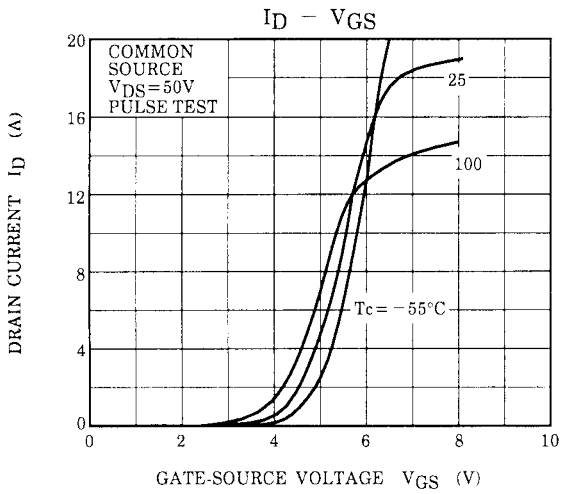
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	9	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	27	A
Forward voltage (diode)	V_{DSF}	I_{DR} = 9 A, V_{GS} = 0 V	—	—	−1.9	V
Reverse recovery time	t_{rr}	I_{DR} = 9 A, V_{GS} = 0 V, dI_{DR} / dt = 100 A / μs	—	1.6	—	μs
Reverse recovery charge	Q_{rr}		—	20	—	μC

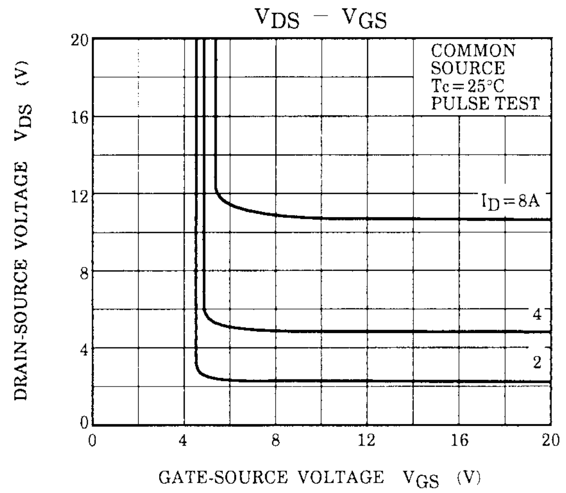
Marking

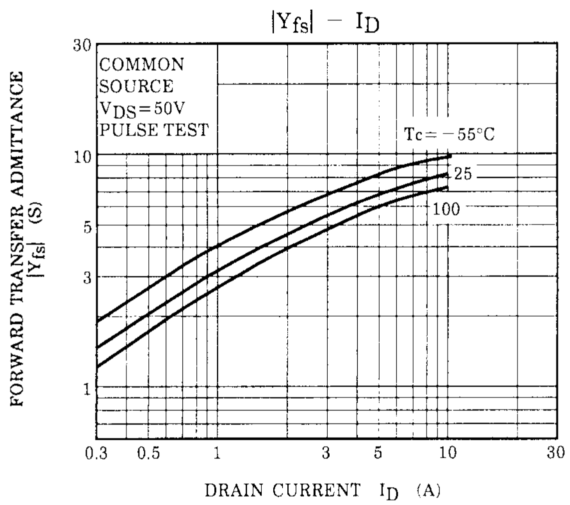


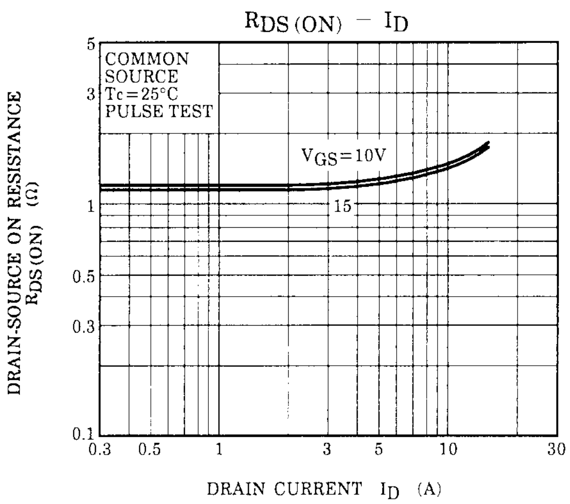

I_D – V_{DS}
COMMON SOURCE
Tc = 25°C
PULSE TEST
15
10
5.5
5.25
5
4.7
V_{GS} = 4.5V
DRAIN CURRENT I_D (A)
DRAIN-SOURCE VOLTAGE V_{DS} (V)

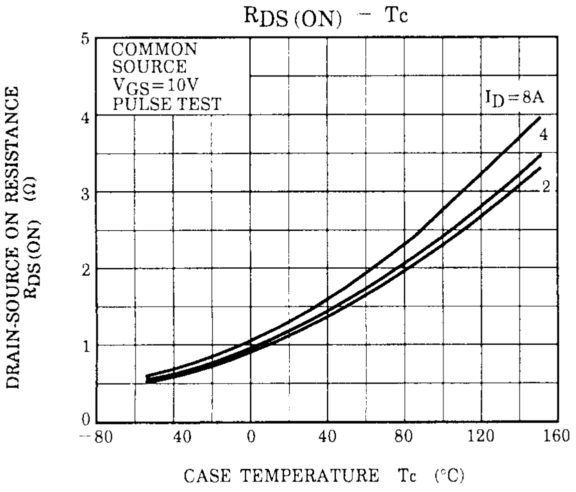

I_D – V_{DS}
COMMON SOURCE
Tc = 25°C
PULSE TEST
15
10
8
6
5.5
5
V_{GS} = 4V
DRAIN CURRENT I_D (A)
DRAIN-SOURCE VOLTAGE V_{DS} (V)

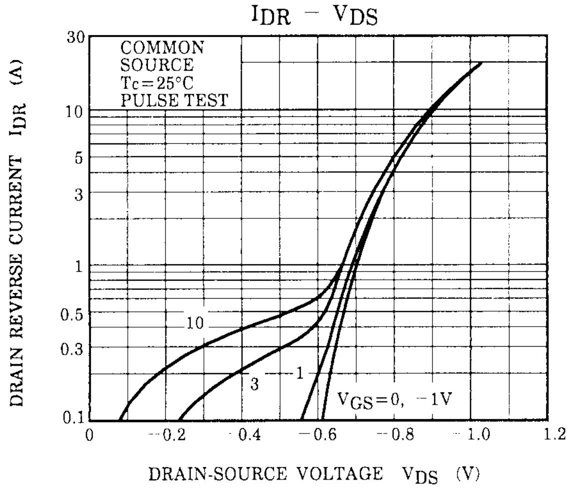

I_D – V_{GS}
COMMON SOURCE
V_{DS} = 50V
PULSE TEST
25
100
Tc = −55°C
DRAIN CURRENT I_D (A)
GATE-SOURCE VOLTAGE V_{GS} (V)

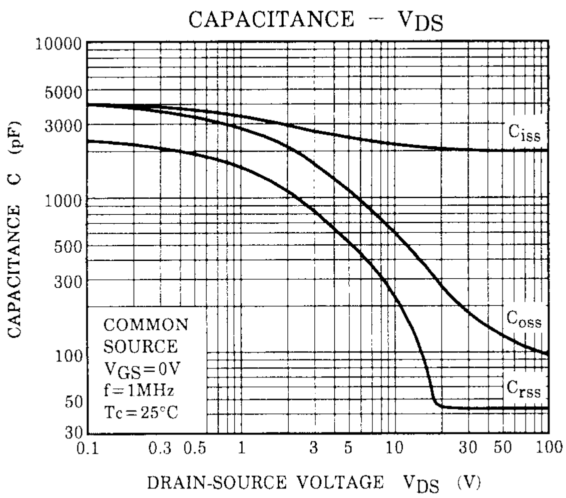

V_{DS} – V_{GS}
COMMON SOURCE
Tc = 25°C
PULSE TEST
I_D = 8A
4
2
DRAIN-SOURCE VOLTAGE V_{DS} (V)
GATE-SOURCE VOLTAGE V_{GS} (V)

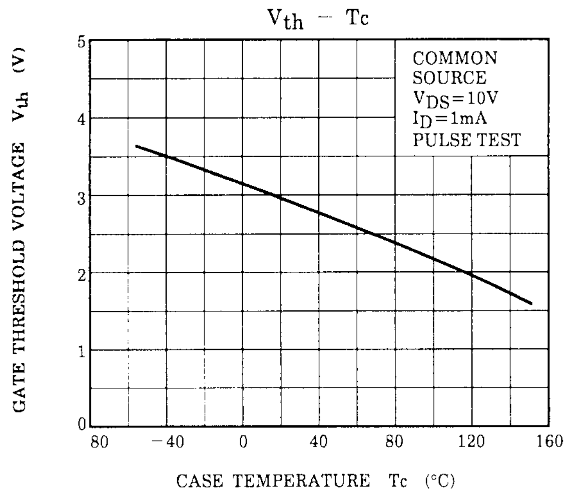

$|Y_{fs}|$ – I_D
COMMON SOURCE
V_{DS} = 50V
PULSE TEST
Tc = −55°C
25
100
FORWARD TRANSFER ADMITTANCE $|Y_{fs}|$ (S)
DRAIN CURRENT I_D (A)

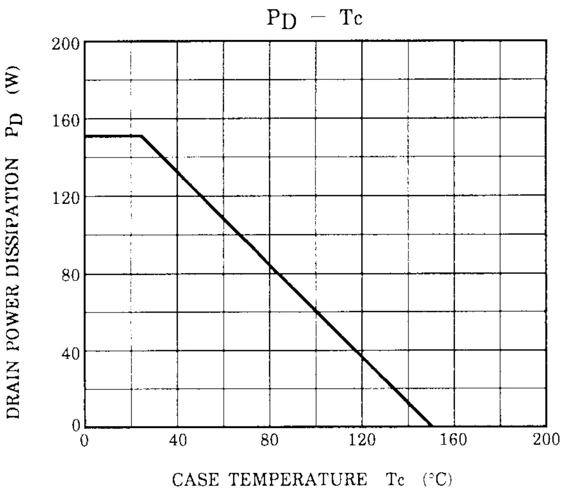

$R_{DS(ON)}$ – I_D
COMMON SOURCE
Tc = 25°C
PULSE TEST
V_{GS} = 10V
15
DRAIN-SOURCE ON RESISTANCE $R_{DS(ON)}$ (Ω)
DRAIN CURRENT I_D (A)

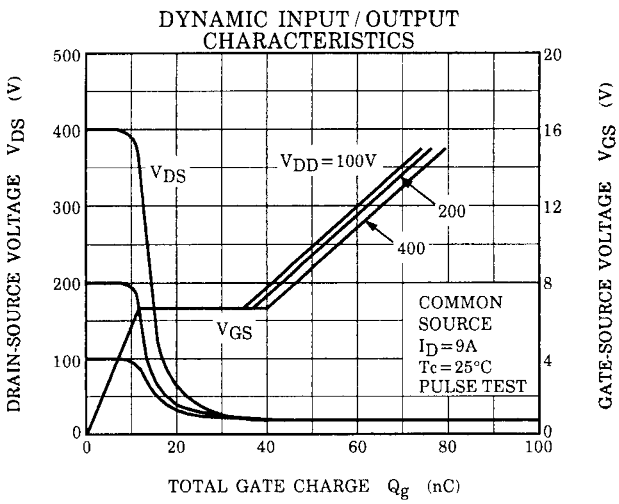

RDS (ON) – Tc
COMMON SOURCE
VGS = 10V
PULSE TEST
ID = 8A
4
2
DRAIN-SOURCE ON RESISTANCE RDS (ON) (Ω)
CASE TEMPERATURE Tc (°C)


IDR – VDS
COMMON SOURCE
Tc = 25°C
PULSE TEST
10
3
1
VGS = 0, –1V
DRAIN REVERSE CURRENT IDR (A)
DRAIN-SOURCE VOLTAGE VDS (V)

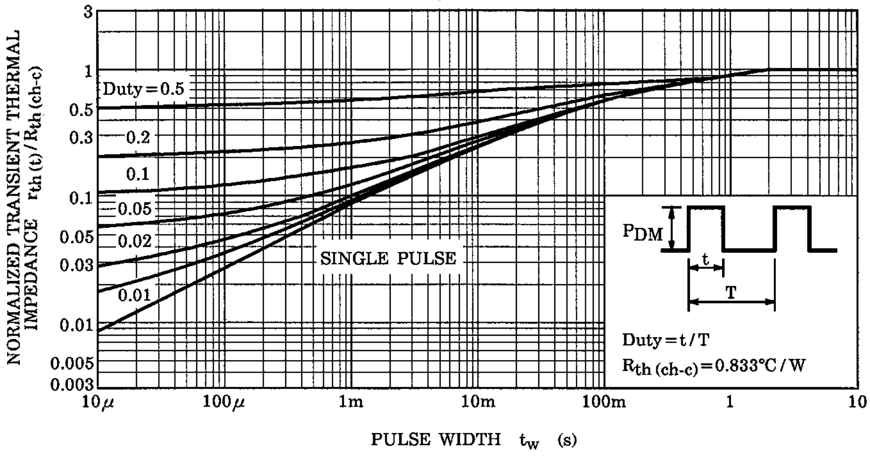

CAPACITANCE – VDS
Ciss
Coss
Crss
COMMON SOURCE
VGS = 0V
f = 1MHz
Tc = 25°C
CAPACITANCE C (pF)
DRAIN-SOURCE VOLTAGE VDS (V)


Vth – Tc
COMMON SOURCE
VDS = 10V
ID = 1mA
PULSE TEST
GATE THRESHOLD VOLTAGE Vth (V)
CASE TEMPERATURE Tc (°C)

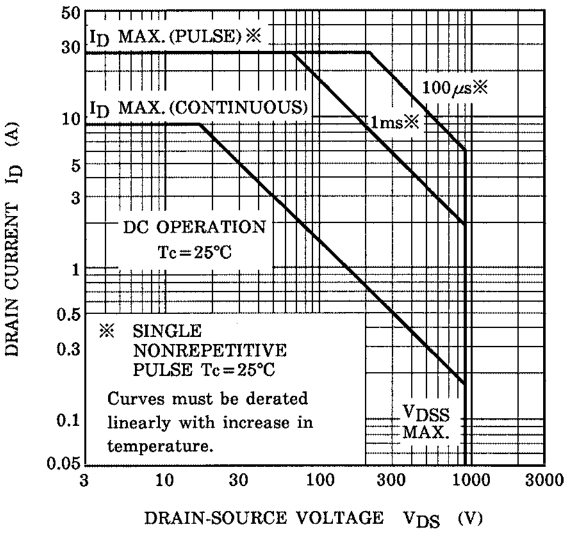

PD – Tc
DRAIN POWER DISSIPATION PD (W)
CASE TEMPERATURE Tc (°C)


DYNAMIC INPUT / OUTPUT CHARACTERISTICS
VDS
VDD = 100V
200
400
VGS
COMMON SOURCE
ID = 9A
Tc = 25°C
PULSE TEST
DRAIN-SOURCE VOLTAGE VDS (V)
GATE-SOURCE VOLTAGE VGS (V)
TOTAL GATE CHARGE Qg (nC)

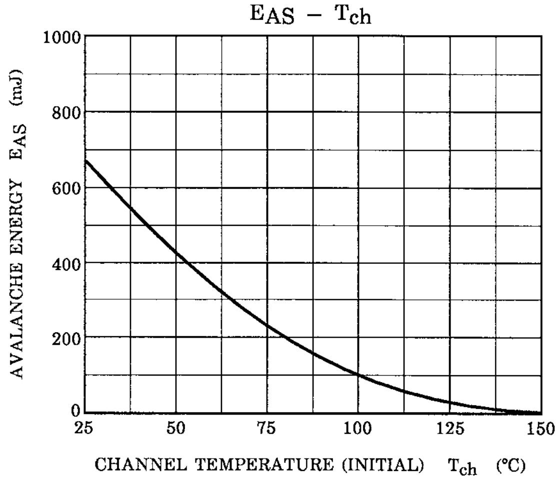
$r_{th} - t_w$

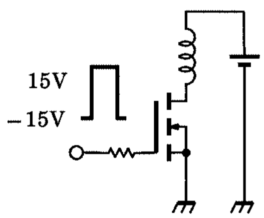


SAFE OPERATING AREA

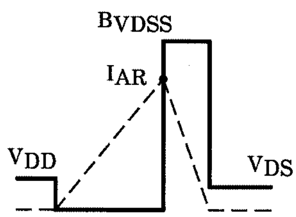


$E_{AS} - T_{ch}$





TEST CIRCUIT



WAVE FORM

$R_G = 25\ \Omega$

$V_{DD} = 90\ V, L = 15\ mH$

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

RESTRICTIONS ON PRODUCT USE