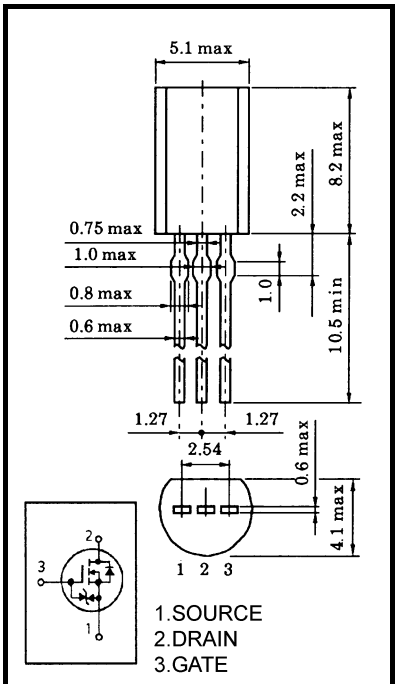
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (L^2−π−MOSV)

2SK2961

Relay Drive, Motor Drive and DC−DC Converter Application

- Low drain−source ON resistance : $R_{DS\ (ON)}$ = 0.2 Ω (typ.)
- High forward transfer admittance : $|Y_{fs}|$ = 2.0 S (typ.)
- Low leakage current : I_{DSS} = 100 μA (V_{DS} = 60 V)
- Enhancement mode : V_{th} = 0.8~2.0 V (V_{DS} = 10 V, I_D = 1 mA)

Unit: mm



JEDEC	TO-92MOD
JEITA	—
TOSHIBA	2-5J1C

Weight: 0.36 g (typ.)

Absolute 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	2.0	A
	Pulse (Note 1)	I_{DP}	6.0	
Drain power dissipation		P_D	0.9	W
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55~150	°C

Note: 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).

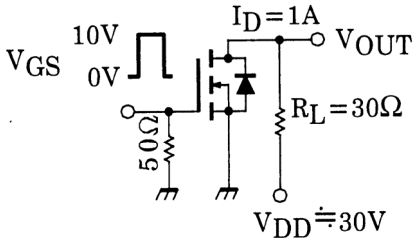
Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient	$R_{th\ (ch-a)}$	138	°C / W

Note 1: Ensure that the channel temperature does not exceed 150°C.

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

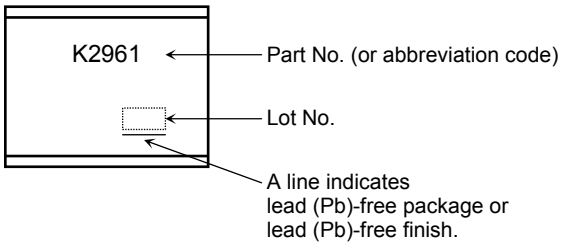
Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±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
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 = 1.0 A	—	0.26	0.38	Ω
			V_{GS} = 10 V, I_D = 1.0 A	—	0.20	0.27	
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 10 V, I_D = 1.0 A	1.0	2.0	—	S
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	170	—	pF
Reverse transfer capacitance		C_{rss}		—	25	—	
Output capacitance		C_{oss}		—	75	—	
Switching time	Rise time	t_r		—	10	—	ns
	Turn−on time	t_{on}		—	15	—	
	Fall time	t_f		—	50	—	
	Turn−off time	t_{off}		—	170	—	
Total gate charge (gate−source plus gate−drain)		Q_g	V_{DD} ≈ 48 V, V_{GS} = 10 V, I_D = 2 A	—	5.8	—	nC
Gate−source charge		Q_{gs}		—	4.1	—	
Gate−drain (“miller”) Charge		Q_{gd}		—	1.7	—	

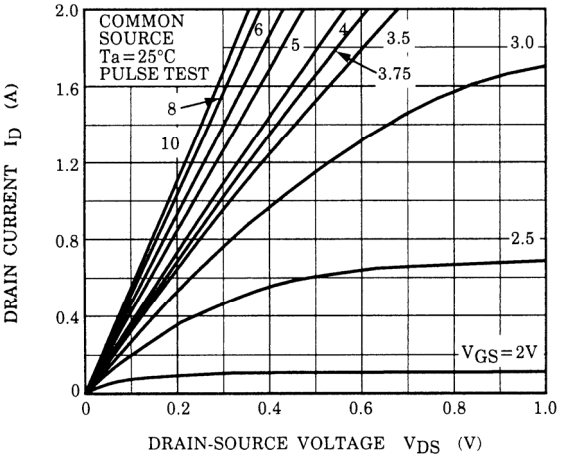
Source−Drain Ratings and Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	2.0	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	6.0	A
Forward voltage (diode)	V_{DSF}	I_{DR} = 2 A, V_{GS} = 0 V	—	—	−1.5	V
Reverse recovery time	t_{rr}	I_{DR} = 2 A, V_{GS} = 0 V, dI_{DR} / dt = 50 A / μs	—	45	—	ns
Reverse recovery charge	Q_{rr}		—	40.5	—	nC

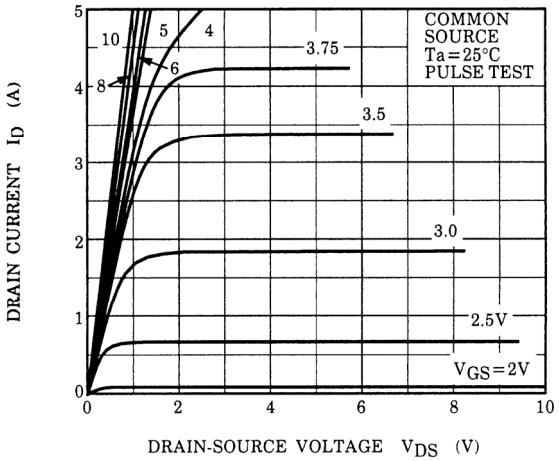
Marking



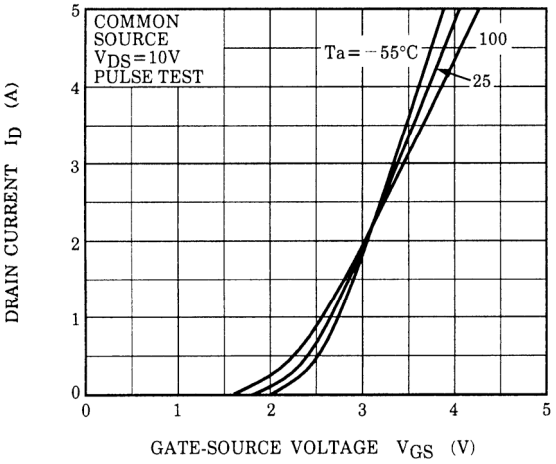
$I_C - V_{DS}$



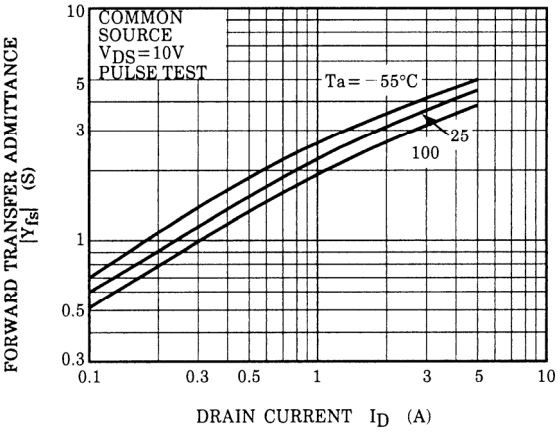
$I_D - V_{DS}$



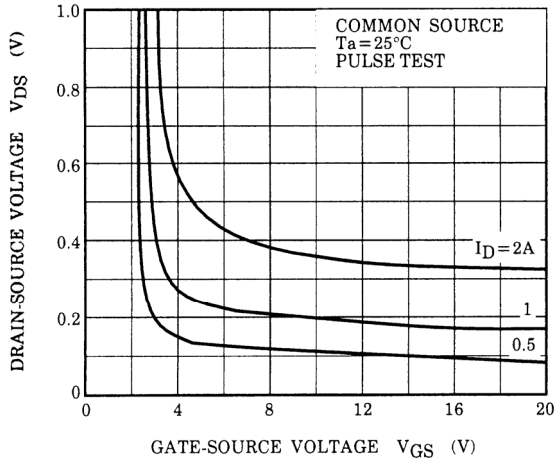
$I_D - V_{GS}$



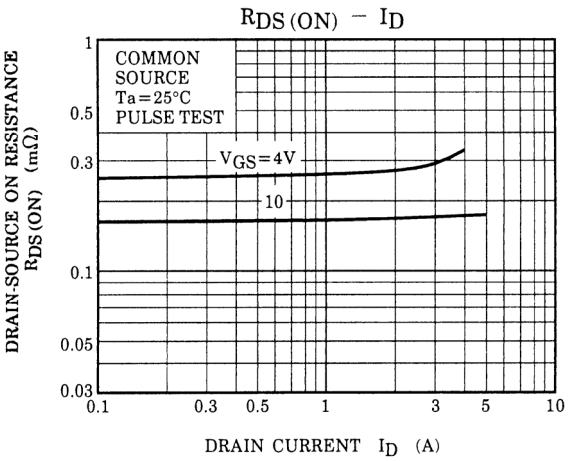
$|Y_{fs}| - I_D$



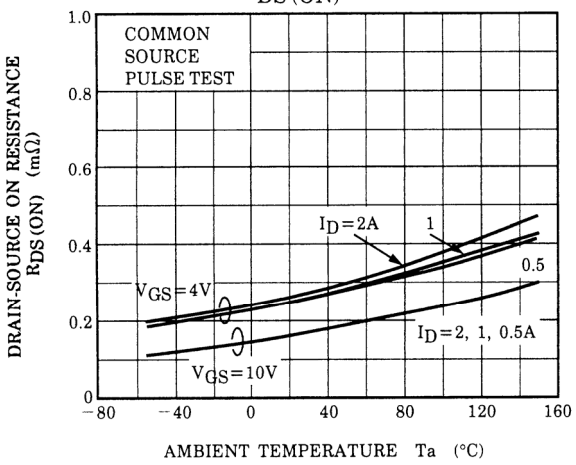
$V_{DS} - V_{GS}$



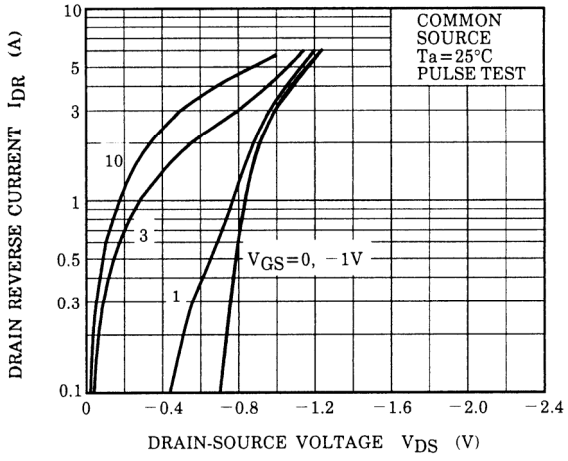
$R_{DS\,(ON)} - I_D$



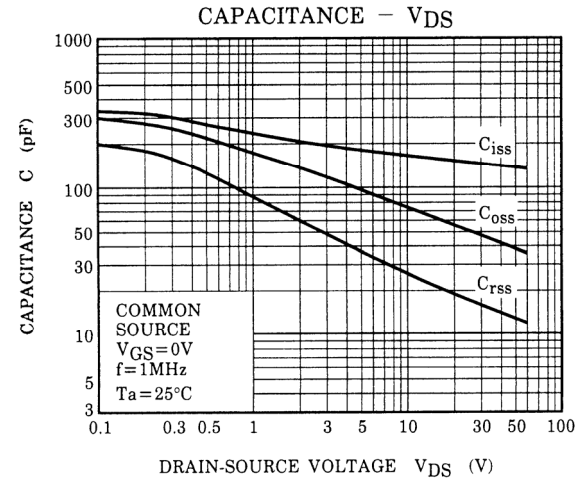
$R_{DS\,(ON)}$ – Ta



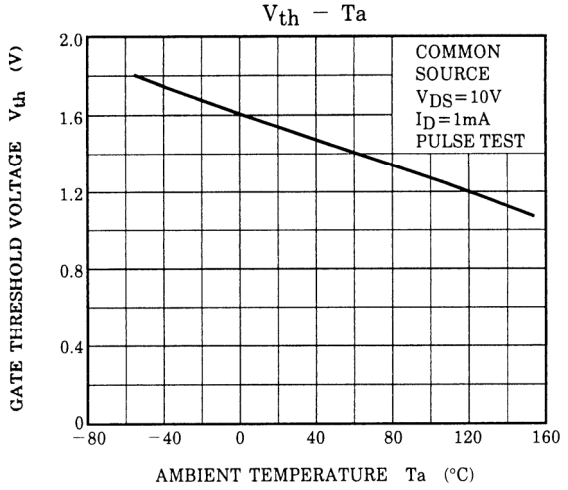
I_{DR} – V_{DS}



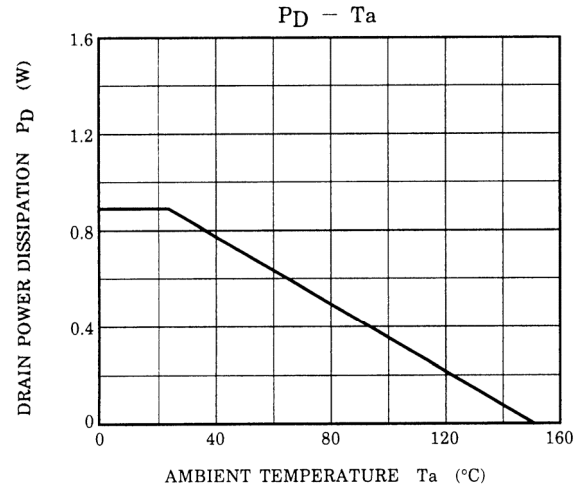
CAPACITANCE – V_{DS}



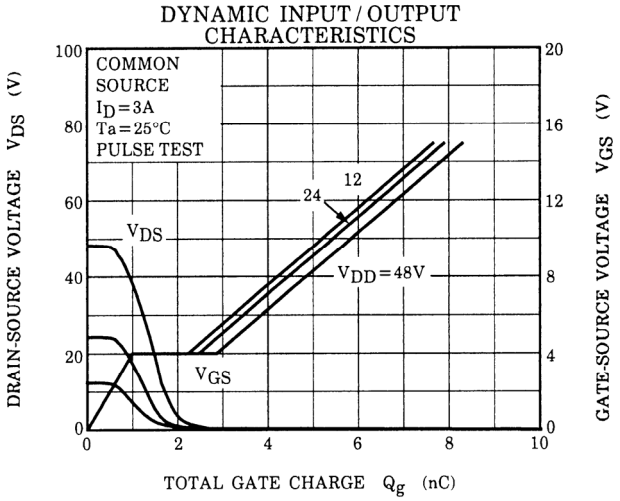
V_{th} – Ta

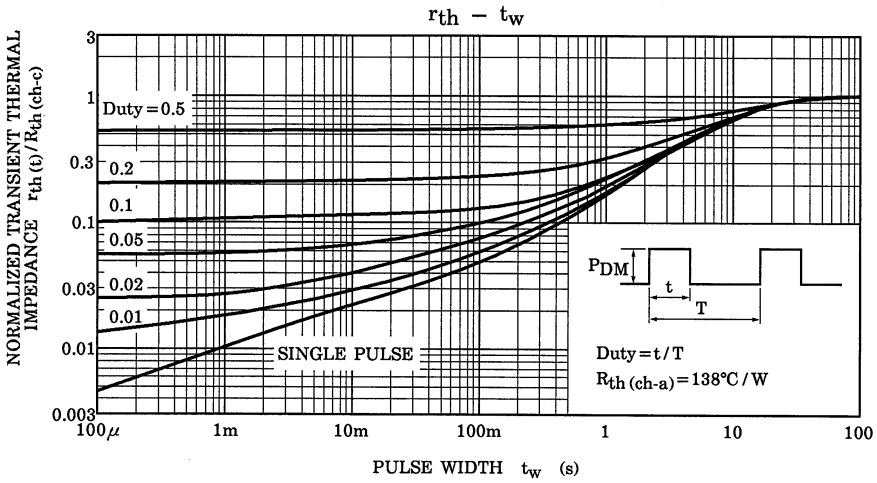


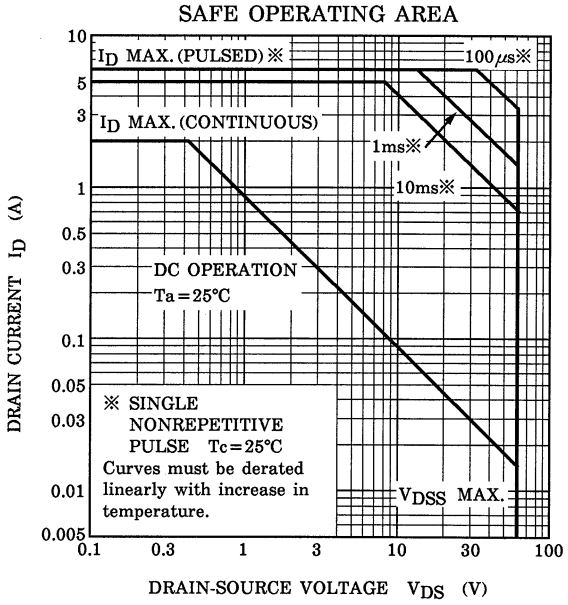
P_D – Ta



DYNAMIC INPUT / OUTPUT CHARACTERISTICS




r_{th} – t_w
NORMALIZED TRANSIENT THERMAL IMPEDANCE $r_{th}(t)/R_{th}(ch\text{-}c)$
Duty = 0.5
0.2
0.1
0.05
0.02
0.01
SINGLE PULSE
P_{DM}
t
T
Duty = t / T
$R_{th}(ch\text{-}a)$ = 138°C / W
3
1
0.3
0.1
0.03
0.01
0.003
100μ
1m
10m
100m
1
10
100
PULSE WIDTH t_w (s)


SAFE OPERATING AREA
DRAIN CURRENT I_D (A)
I_D MAX. (PULSED) ※
100μs※
I_D MAX. (CONTINUOUS)
1ms※
10ms※
DC OPERATION
Ta = 25°C
※ SINGLE NONREPETITIVE PULSE Tc = 25°C
Curves must be derated linearly with increase in temperature.
V_{DSS} MAX.
10
5
3
1
0.5
0.3
0.1
0.05
0.03
0.01
0.005
0.1
0.3
1
3
10
30
100
DRAIN-SOURCE VOLTAGE V_{DS} (V)

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20070701-EN

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