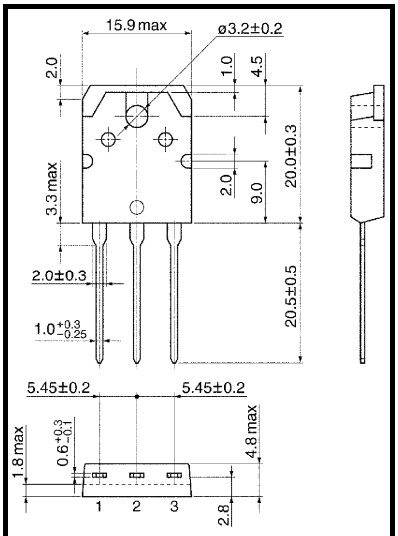
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (π−MOSII$^{.5}$)

2SK1359

DC−DC Converter and Motor Drive Applications

- Low drain−source ON resistance : $R_{DS\ (ON)}$ = 3.0 Ω (typ.)
- High forward transfer admittance : $|Y_{fs}|$ = 2.0 S (typ.)
- Low leakage current : I_{DSS} = 300 μA (max) (V_{DS} = 800 V)
- Enhancement mode : V_{th} = 1.5 to 3.5 V (V_{DS} = 10 V, I_D = 1 mA)

Unit: mm



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

JEDEC	—
JEITA	—
TOSHIBA	2-16C1B

Weight: 4.6 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain−source voltage		V_{DSS}	1000	V
Drain−gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	1000	V
Gate−source voltage		V_{GSS}	±30	V
Drain current	DC (Note 1)	I_D	5	A
	Pulse (Note 1)	I_{DP}	15	
Drain power dissipation (Tc = 25°C)		P_D	125	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).

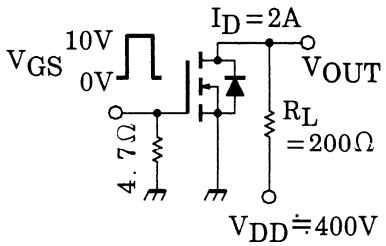
Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th\ (ch-c)}$	1.0	°C / W
Thermal resistance, channel to ambient	$R_{th\ (ch-a)}$	50	°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.

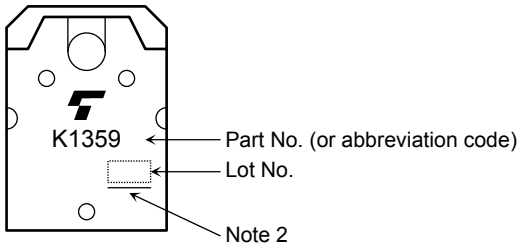
Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±25 V, V_{DS} = 0 V	—	—	±50	nA
Drain cut−off current		I_{DSS}	V_{DS} = 800 V, V_{GS} = 0 V	—	—	300	μA
Drain−source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 10 mA, V_{GS} = 0 V	1000	—	—	V
Gate threshold voltage		V_{th}	V_{DS} = 10 V, I_D = 1 mA	1.5	—	3.5	V
Drain−source ON resistance		$R_{DS\ (ON)}$	V_{GS} = 10 V, I_D = 2 A	—	3.0	3.8	Ω
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 20 V, I_D = 2 A	1.0	2.0	—	S
Input capacitance		C_{iss}	V_{DS} = 25 V, V_{GS} = 0V, f = 1 MHz	—	700	—	pF
Reverse transfer capacitance		C_{rss}		—	55	—	
Output capacitance		C_{oss}		—	100	—	
Switching time	Rise time	t_r	 Duty ≦ 1%, $t_w = 10\mu s$	—	18	—	ns
	Turn−on time	t_{on}		—	30	—	
	Fall time	t_f		—	12	—	
	Turn−off time	t_{off}		—	70	—	
Total gate charge (Gate−source plus gate−drain)		Q_g	V_{DD} ≈ 400 V, V_{GS} = 10 V, I_D = 4 A	—	60	—	nC
Gate−source charge		Q_{gs}		—	35	—	
Gate−drain (“miller”) charge		Q_{gd}		—	25	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Continuous drain reverse current (Note 1)	I_{DR}	—	—	—	5	A
Pulse drain reverse current (Note 1)	I_{DRP}	—	—	—	15	A
Forward voltage (diode)	V_{DSF}	I_{DR} = 4 A, V_{GS} = 0 V	—	—	−1.9	V

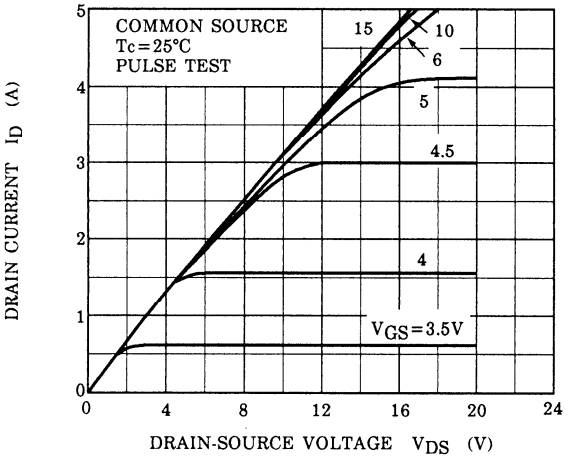
Marking



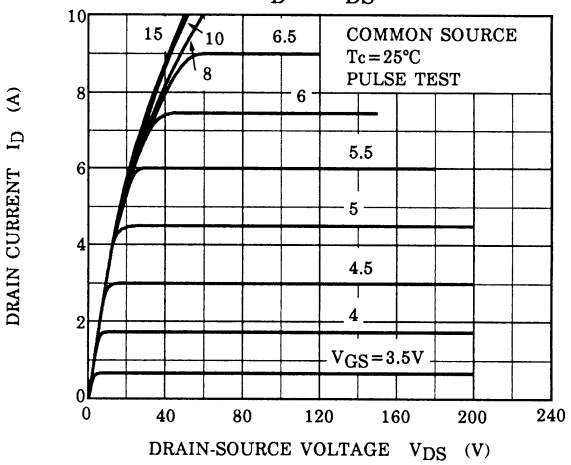
Note 2: A line under a Lot No. identifies the indication of product Labels.
Not underlined: [[Pb]]/INCLUDES > MCV
Underlined: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

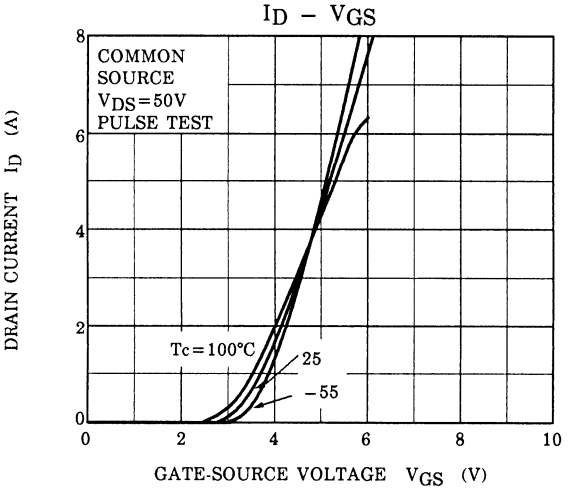
$I_D - V_{DS}$



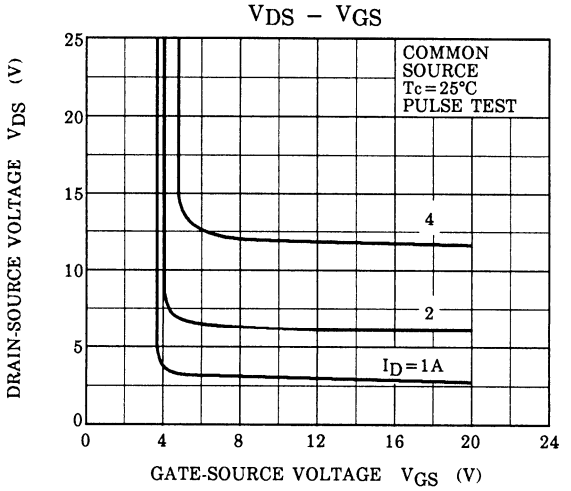
$I_D - V_{DS}$



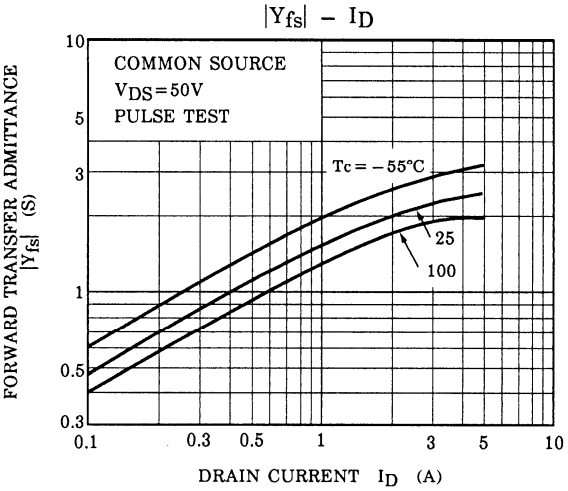
$I_D - V_{GS}$



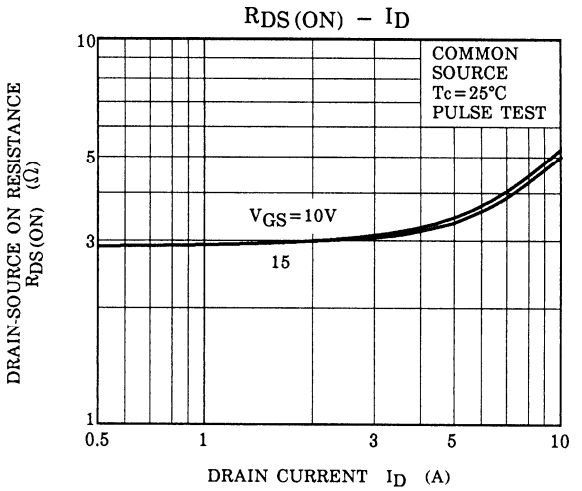
$V_{DS} - V_{GS}$



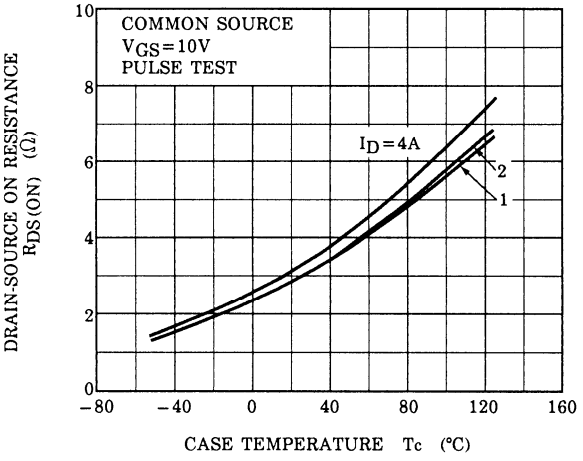
$|Y_{fs}| - I_D$



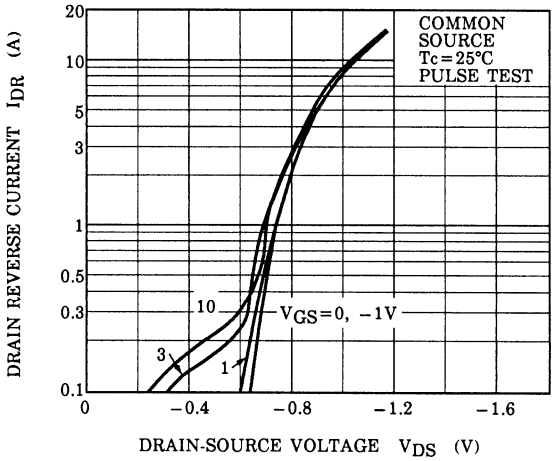
$R_{DS(ON)} - I_D$



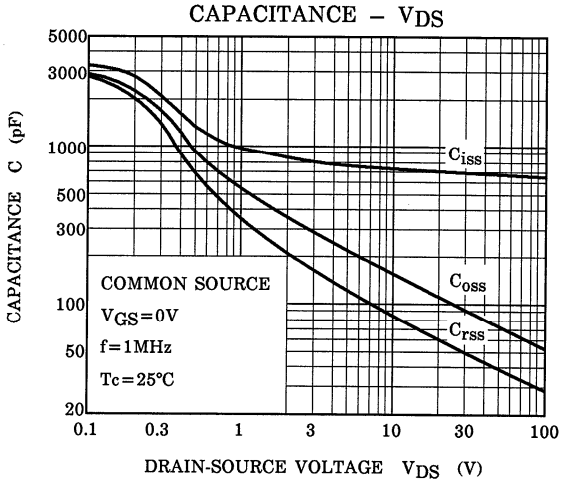
$R_{DS(ON)}$ – Tc



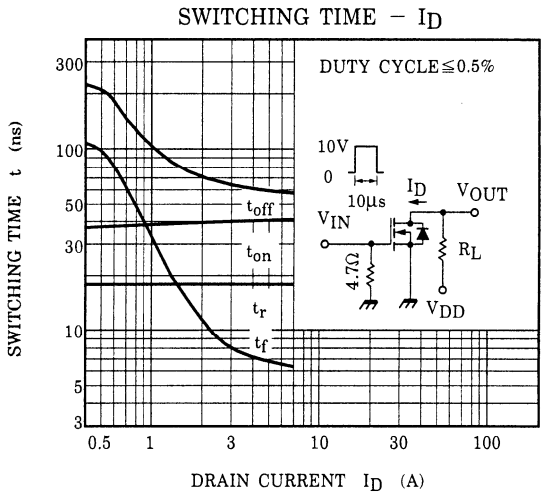
I_{DR} – V_{DS}



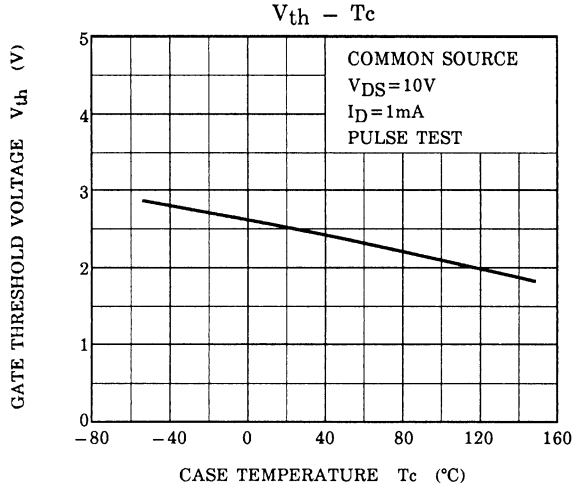
CAPACITANCE – V_{DS}



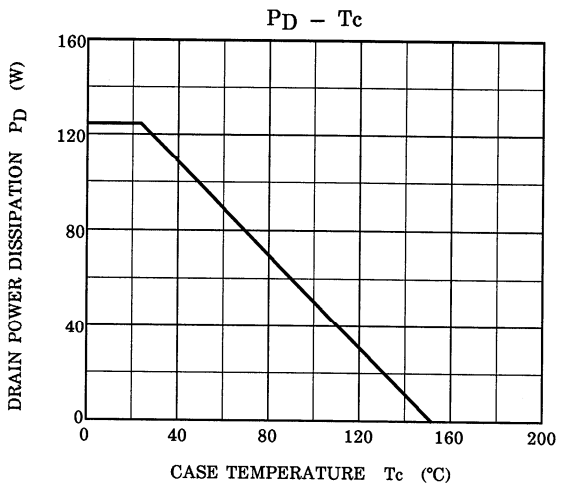
SWITCHING TIME – I_D

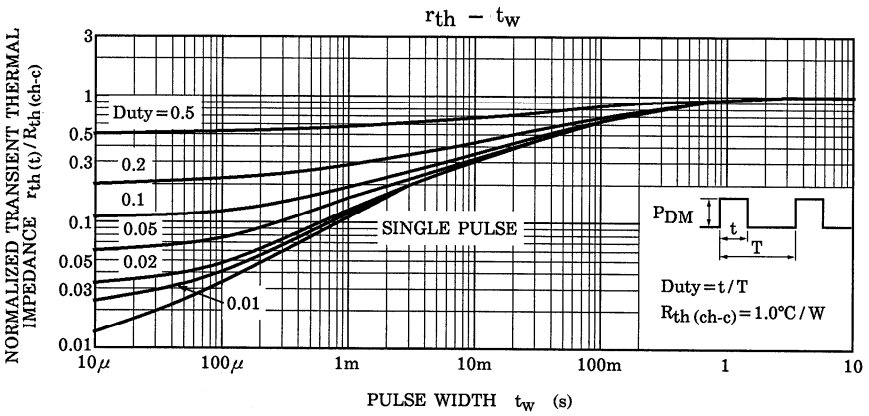


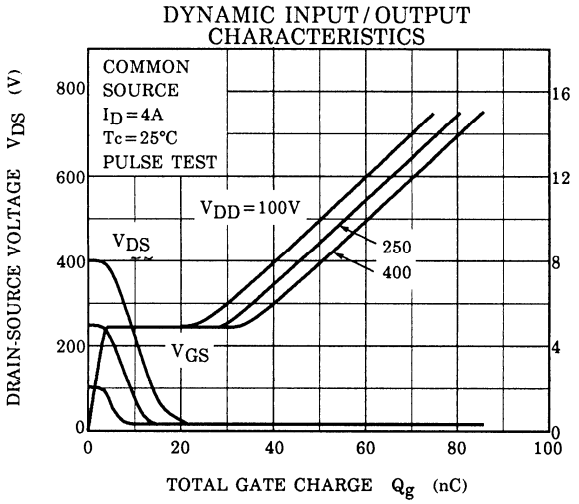
V_{th} – Tc

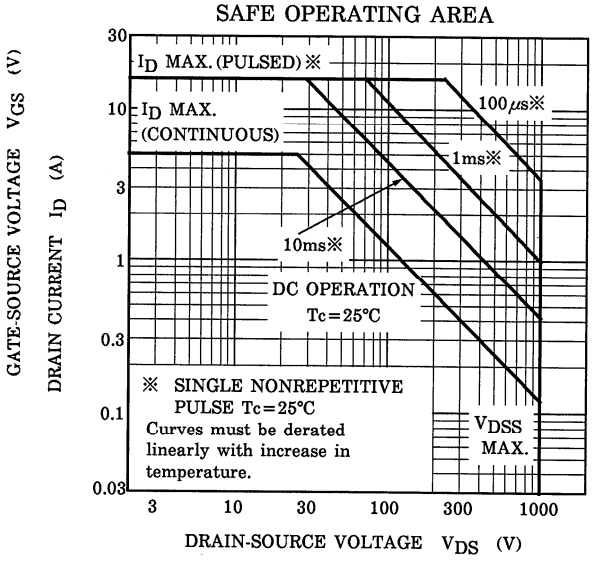


P_D – Tc




$r_{th} - t_w$
NORMALIZED TRANSIENT THERMAL IMPEDANCE $r_{th}(t)/R_{th(ch-c)}$
Duty = 0.5
0.2
0.1
0.05
0.02
0.01
SINGLE PULSE
P_{DM}
t
T
Duty = t/T
$R_{th(ch-c)} = 1.0°C/W$
3
1
0.5
0.3
0.1
0.05
0.03
0.01
10μ
100μ
1m
10m
100m
1
10
PULSE WIDTH t_w (s)


DYNAMIC INPUT/OUTPUT CHARACTERISTICS
COMMON SOURCE
$I_D = 4A$
Tc = 25°C
PULSE TEST
$V_{DD} = 100V$
V_{DS}
V_{GS}
250
400
DRAIN-SOURCE VOLTAGE V_{DS} (V)
GATE-SOURCE VOLTAGE V_{GS} (V)
800
600
400
200
0
16
12
8
4
0
0
20
40
60
80
100
TOTAL GATE CHARGE Q_g (nC)


SAFE OPERATING AREA
I_D MAX. (PULSED) ※
I_D MAX. (CONTINUOUS)
100μs※
1ms※
10ms※
DC OPERATION
Tc = 25°C
※ SINGLE NONREPETITIVE PULSE Tc = 25°C
Curves must be derated linearly with increase in temperature.
V_{DSS} MAX.
DRAIN CURRENT I_D (A)
30
10
3
1
0.3
0.1
0.03
3
10
30
100
300
1000
DRAIN-SOURCE VOLTAGE V_{DS} (V)

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