

MOSFETs Silicon N-Channel MOS (π -MOSVII)

TK15A20D

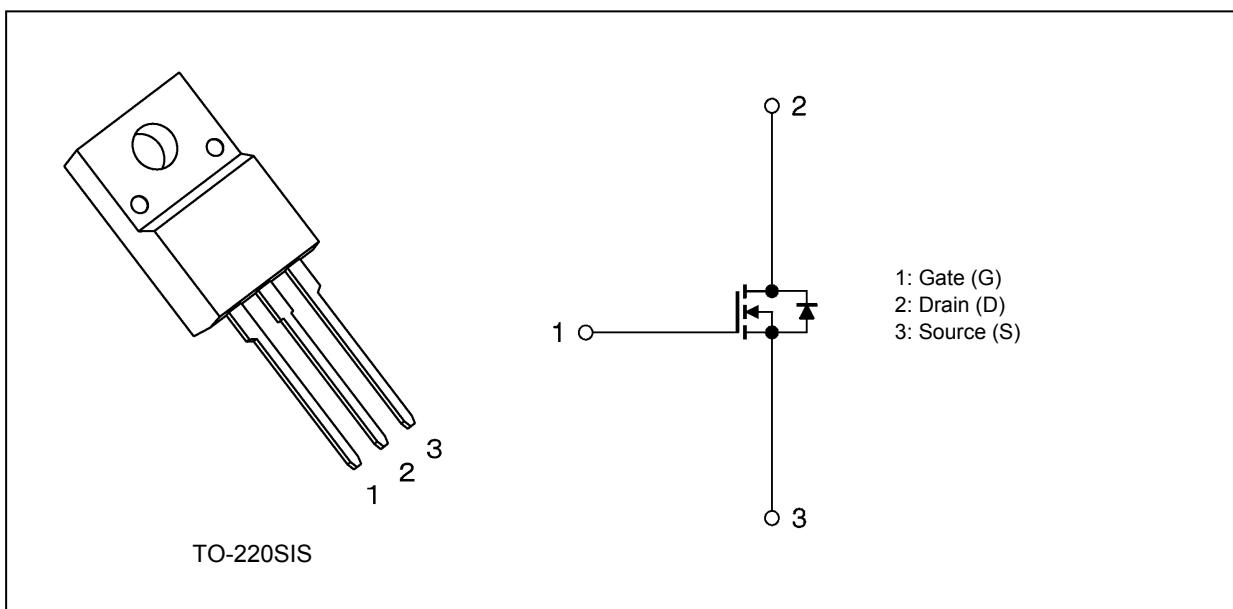
1. Applications

- Switching Voltage Regulators

2. Features

- (1) Low drain-source on-resistance: $R_{DS(ON)} = 0.12 \Omega$ (typ.)
- (2) Low leakage current: $I_{DSS} = 10 \mu\text{A}$ (max) ($V_{DS} = 200 \text{ V}$)
- (3) Enhancement mode: $V_{th} = 1.5$ to 3.5 V ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

3. Packaging and Internal Circuit



4. Absolute Maximum Ratings (Note) ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Rating	Unit
Drain-source voltage	V_{DSS}	200	V
Gate-source voltage	V_{GSS}	± 20	
Drain current (DC) (Note 1)	I_D	15	A
Drain current (pulsed) (Note 1)	I_{DP}	60	
Power dissipation ($T_c = 25^\circ\text{C}$)	P_D	35	W
Single-pulse avalanche energy (Note 2)	E_{AS}	90	mJ
Avalanche current (Note 3)	I_{AR}	15	A
Reverse drain current (DC) (Note 1)	I_{DR}	15	
Reverse drain current (pulsed) (Note 1)	I_{DRP}	60	
Channel temperature	T_{ch}	150	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to 150	
Isolation voltage (RMS) ($t = 1.0\text{s}$)	$V_{ISO(\text{RMS})}$	2000	V
Mounting torque	TOR	0.6	N · m

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.).

5. Thermal Characteristics

Characteristics	Symbol	Max	Unit
Channel-to-case thermal resistance	$R_{th(ch-c)}$	3.57	$^\circ\text{C/W}$
Channel-to-ambient thermal resistance	$R_{th(ch-a)}$	62.5	

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

Note 2: $V_{DD} = 50 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 0.63 \text{ mH}$, $R_G = 25 \Omega$, $I_{AR} = 15 \text{ A}$

Note 3: Repetitive rating; pulse width limited by maximum channel temperature

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.

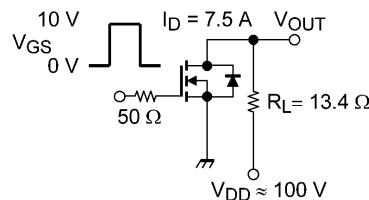
6. Electrical Characteristics

6.1. Static Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	I_{GSS}	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 1	μA
Drain cut-off current	I_{DSS}	$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	200	—	—	V
Gate threshold voltage	V_{th}	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.5	—	3.5	
Drain-source on-resistance	$R_{DS(\text{ON})}$	$V_{GS} = 10\text{ V}, I_D = 7.5\text{ A}$	—	0.12	0.18	Ω

6.2. Dynamic Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	C_{iss}	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	1050	—	pF
Reverse transfer capacitance	C_{rss}		—	9	—	
Output capacitance	C_{oss}		—	80	—	
Gate resistance	r_g	$V_{DS} = \text{OPEN}, f = 1\text{ MHz}$	—	5	—	Ω
Switching time (rise time)	t_r		—	50	—	ns
Switching time (turn-on time)	t_{on}		—	60	—	
Switching time (fall time)	t_f		—	30	—	
Switching time (turn-off time)	t_{off}		—	120	—	



Duty $\leq 1\%$, $t_w = 10\text{ }\mu\text{s}$

Fig. 6.2.1 Switching Time Test Circuit

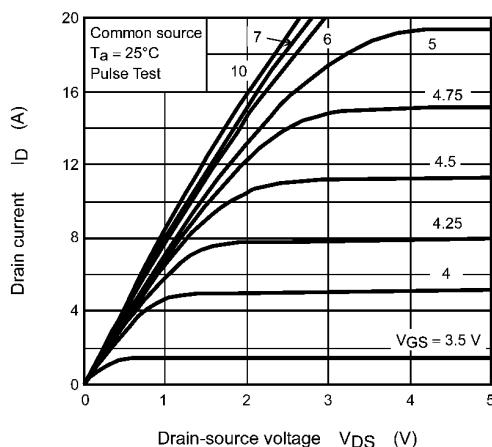
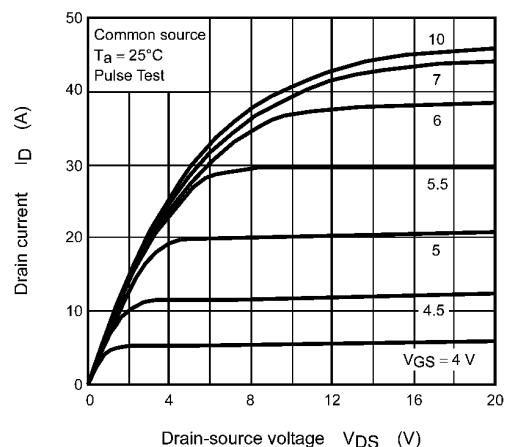
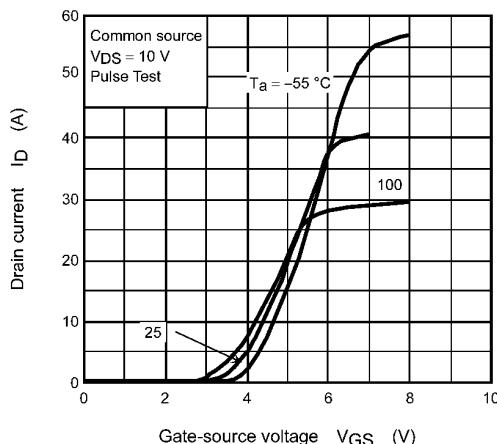
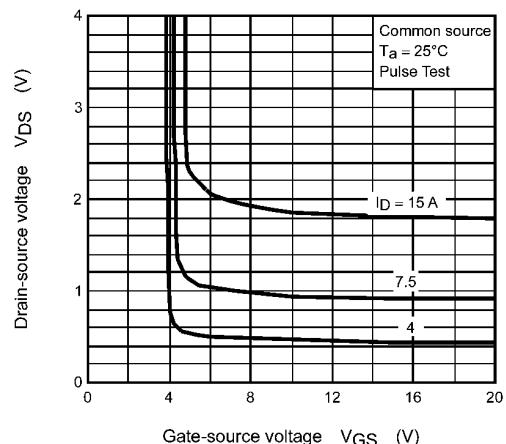
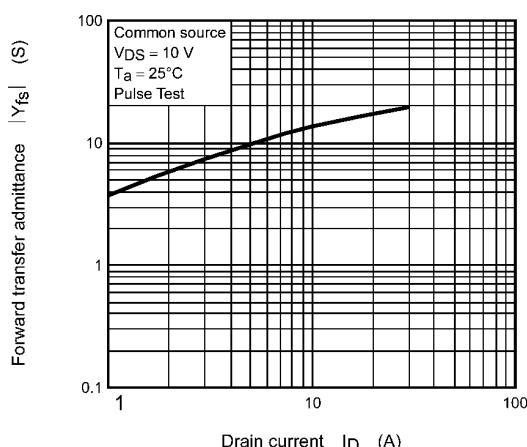
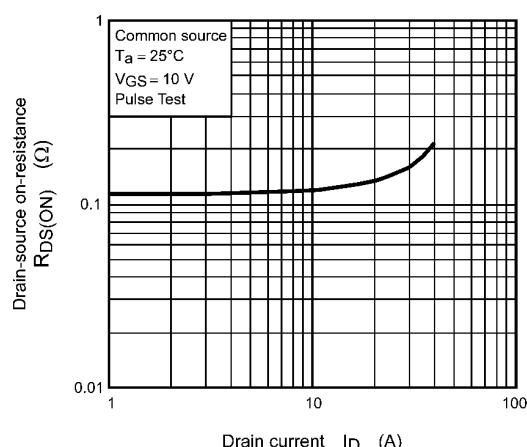
6.3. Gate Charge Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Q_g	$V_{DD} \approx 160\text{ V}, V_{GS} = 10\text{ V}, I_D = 15\text{ A}$	—	26	—	nC
Gate-source charge 1	Q_{gs1}		—	5	—	
Gate-drain charge	Q_{gd}		—	9	—	

6.4. Source-Drain Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Diode forward voltage	V_{DSF}	$I_{DR} = 15\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.7	V
Reverse recovery time	t_{rr}		—	140	—	ns
Reverse recovery charge	Q_{rr}		—	0.8	—	
Peak reverse recovery current	I_{rr}		—	12	—	A

8. Characteristics Curves (Note)

Fig. 8.1 I_D - V_{DS} Fig. 8.2 I_D - V_{DS} Fig. 8.3 I_D - V_{GS} Fig. 8.4 V_{DS} - V_{GS} Fig. 8.5 $|Y_{fs}|$ - I_D Fig. 8.6 $R_{DS(ON)}$ - I_D