

MOSFETs Silicon N-Channel MOS (π -MOSVII)

TK12A65D



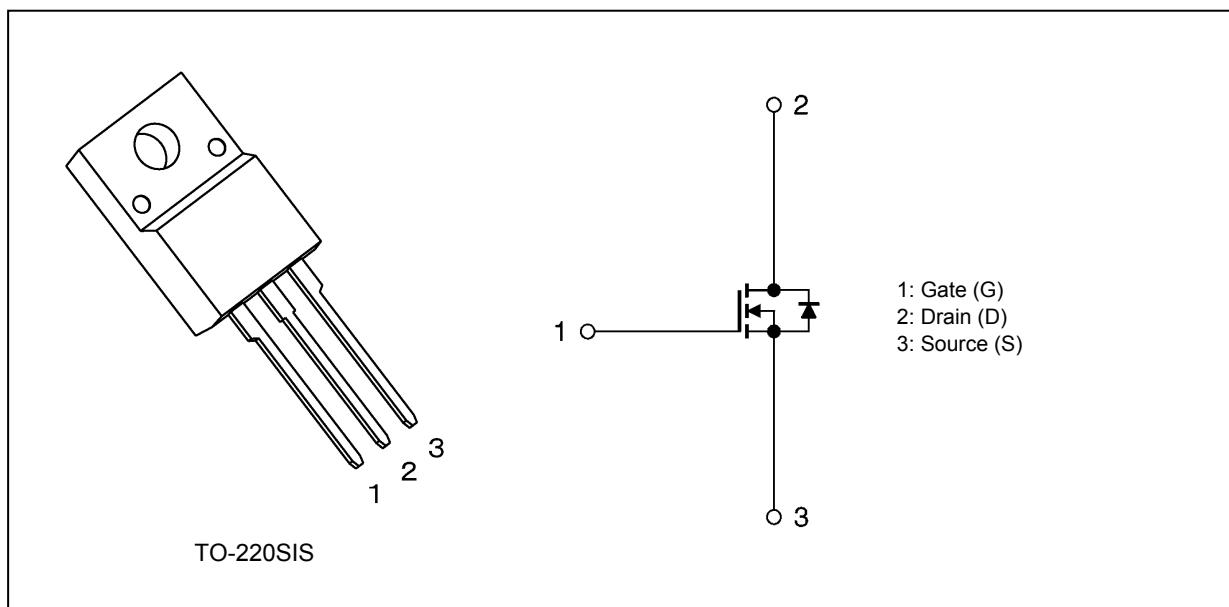
1. Applications

- Switching Voltage Regulators

2. Features

- (1) Low drain-source on-resistance: $R_{DS(ON)} = 0.46 \Omega$ (typ.)
- (2) High forward transfer admittance: $|Y_{fs}| = 6.0 S$ (typ.)
- (3) Low leakage current: $I_{DSS} = 10 \mu A$ (max) ($V_{DS} = 650 V$)
- (4) Enhancement mode: $V_{th} = 2.0$ to $4.0 V$ ($V_{DS} = 10 V$, $I_D = 1 mA$)

3. Packaging and Internal Circuit



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

Characteristics	Symbol	Rating	Unit
Drain-source voltage	V_{DSS}	650	V
Gate-source voltage	V_{GSS}	± 30	
Drain current (DC)	I_D	12	A
Drain current (pulsed)	I_{DP}	48	
Power dissipation ($T_c = 25^\circ C$)	P_D	50	W
Single-pulse avalanche energy	E_{AS}	611	mJ
Avalanche current	I_{AR}	12	A
Repetitive avalanche energy	E_{AR}	5.0	mJ
Channel temperature	T_{ch}	150	$^\circ C$
Storage temperature	T_{stg}	-55 to 150	

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	$R_{th(ch-c)}$	2.5	°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: $V_{DD} = 90$ V, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 7.5$ mH, $R_G = 25 \Omega$, $I_{AR} = 12$ 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}	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 1	μA
Drain cut-off current	I_{DSS}	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	650	—	—	
Gate threshold voltage	V_{th}	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	2.0	—	4.0	
Drain-source on-resistance	$R_{DS(\text{ON})}$	$V_{GS} = 10\text{ V}, I_D = 6\text{ A}$	—	0.46	0.54	Ω
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 6\text{ A}$	1.7	6.0	—	S

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}	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	2300	—	pF
Reverse transfer capacitance	C_{rss}		—	10	—	
Output capacitance	C_{oss}		—	200	—	
Switching time (rise time)	t_r	See Figure 6.2.1.	—	35	—	ns
Switching time (turn-on time)	t_{on}		—	90	—	
Switching time (fall time)	t_f		—	20	—	
Switching time (turn-off time)	t_{off}		—	150	—	

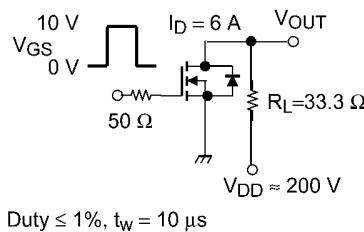


Fig. 6.2.1 Switching Time Test Circuit

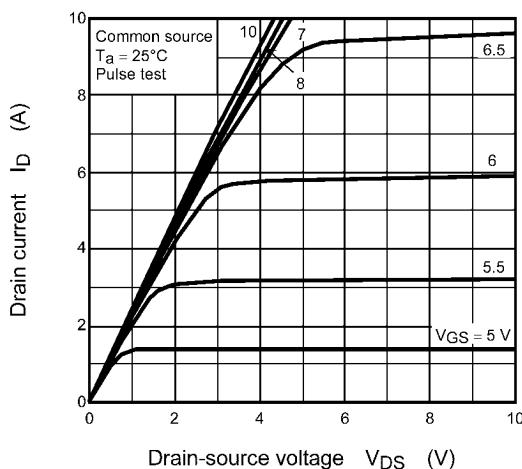
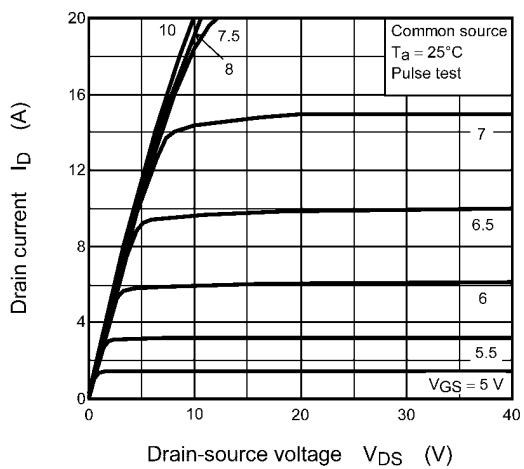
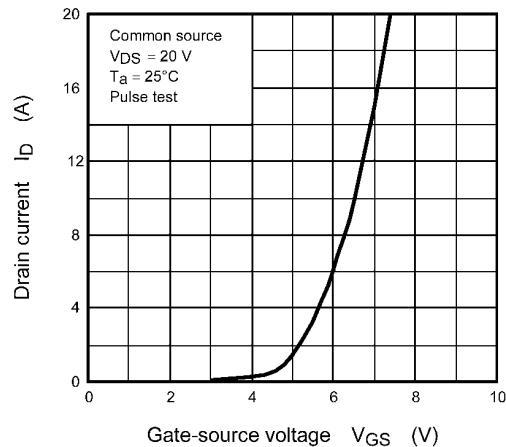
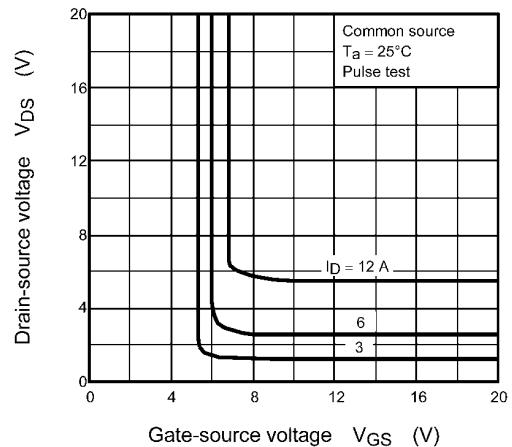
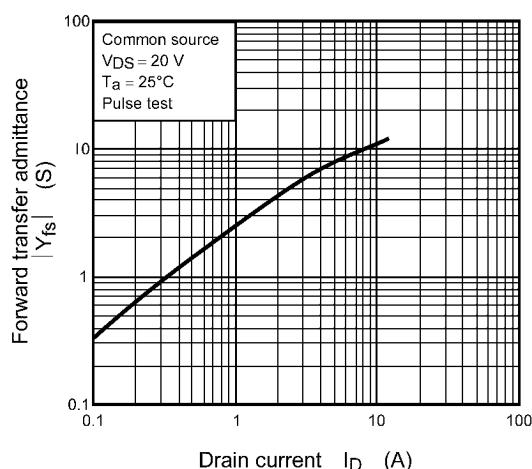
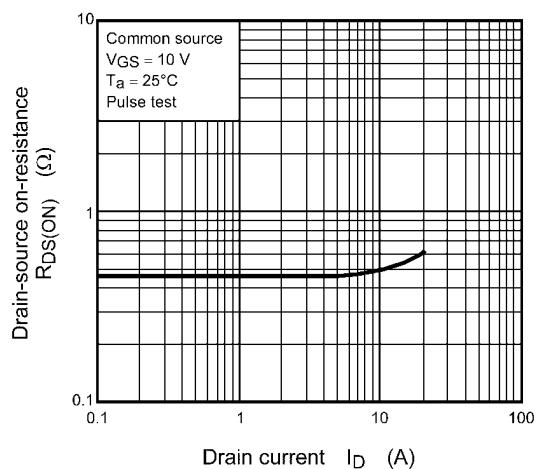
6.3. Gate Charge Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Q_g	$V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 12\text{ A}$	—	40	—	nC
Gate-source charge	Q_{gs}		—	28	—	
Gate-drain charge	Q_{gd}		—	12	—	

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Reverse drain current (DC) (Note 1)	I_{DR}	—	—	—	12	A
Reverse drain current (pulsed) (Note 1)	I_{DRP}		—	—	48	
Diode forward voltage	V_{DSF}	$I_{DR1} = 12\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.7	V
Reverse recovery time	t_{rr}		—	1400	—	
Reverse recovery charge	Q_{rr}	$I_{DR} = 12\text{ A}, V_{GS} = 0\text{ V}$ $-dI_{DR}/dt = 100\text{ A}/\mu\text{s}$	—	16	—	μC

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 $R_{DS(ON)} - I_D$