

MOSFETs Silicon N-Channel MOS (DTMOSIV-H)

# **TK22A65X5**

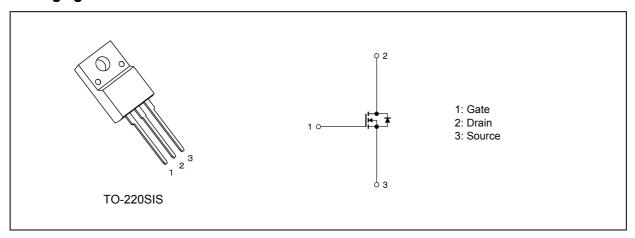
#### 1. Applications

· Switching Voltage Regulators

#### 2. Features

- (1) Low drain-source on-resistance:  $R_{DS(ON)}$  = 0.135  $\Omega$  (typ.) by using Super Junction Structure: DTMOS
- (2) Easy to control Gate switching
- (3) Enhancement mode:  $V_{th}$  = 3 to 4.5 V ( $V_{DS}$  = 10 V,  $I_{D}$  = 1.1 mA)

### 3. Packaging and Internal Circuit



## 4. Absolute Maximum Ratings (Note) (Ta = 25 °C unless otherwise specified)

Characteristics	Symbol	Rating	Unit		
Drain-source voltage			V <sub>DSS</sub>	650	V
Gate-source voltage			V <sub>GSS</sub>	±30	
Drain current (DC)	-	(Note 1)	I <sub>D</sub>	22	Α
Drain current (pulsed)		(Note 1)	I <sub>DP</sub>	88	]
Power dissipation	(T <sub>c</sub> = 25°C)		P <sub>D</sub>	45	W
Single-pulse avalanche energy	-	(Note 2)	E <sub>AS</sub>	361	mJ
Single-pulse avalanche current			I <sub>AS</sub>	5.5	Α
Reverse drain current (DC)		(Note 1)	I <sub>DR</sub>	22	Α
Reverse drain current (pulsed)		(Note 1)	I <sub>DRP</sub>	88	Α
Channel temperature			T <sub>ch</sub>	150	°C
Storage temperature			T <sub>stg</sub>	-55 to 150	
Isolation voltage (RMS)	(t = 1.0 s)		V <sub>ISO(RMS)</sub>	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).

Start of commercial production



#### 5. Thermal Characteristics

Characteristics		Max	Unit
Channel-to-case thermal resistance		2.78	°C/W
Channel-to-ambient thermal resistance	R <sub>th(ch-a)</sub>	62.5	

Note1: Ensure that the channel temperature does not exceed 150  $^{\circ}\text{C}$ .

Note2:  $V_{DD}$  = 90 V,  $T_{ch}$  = 25 °C (initial), L = 21.15 mH,  $R_G$  = 25  $\Omega$ ,  $I_{AS}$  = 5.5 A

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



#### 6. Electrical Characteristics

## 6.1. Static Characteristics (T<sub>a</sub> = 25 °C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Gate leakage current	I <sub>GSS</sub>	$V_{GS} = \pm 30 \text{ V}, V_{DS} = 0 \text{ V}$	_	_	±1	μА
Drain cut-off current	I <sub>DSS</sub>	V <sub>DS</sub> = 650 V, V <sub>GS</sub> = 0 V	-	_	100	
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 V	650	_	_	V
Gate threshold voltage	V <sub>th</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1.1 mA	3	_	4.5	
Drain-source on-resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 11 A	_	0.135	0.16	Ω

## 6.2. Dynamic Characteristics (T<sub>a</sub> = 25 °C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Input capacitance	C <sub>iss</sub>	$V_{DS} = 300 \text{ V}, V_{GS} = 0 \text{ V}, f = 100 \text{ kHz}$	_	2400	_	pF
Reverse transfer capacitance	C <sub>rss</sub>		_	6	_	
Output capacitance	C <sub>oss</sub>		_	60	_	
Effective output capacitance	C <sub>o(er)</sub>	V <sub>DS</sub> 0 to 400 V, V <sub>GS</sub> = 0 V	_	82	_	
Gate resistance	r <sub>g</sub>	V <sub>DS</sub> = OPEN, f = 1 MHz	_	1.7	_	Ω
Switching time (rise time)	t <sub>r</sub>	See Figure 6.2.1	_	20	_	ns
Switching time (turn-on time)	t <sub>on</sub>		_	55	_	
Switching time (fall time)	t <sub>f</sub>		_	4	_	
Switching time (turn-off time)	t <sub>off</sub>		_	80	_	
MOSFET dv/dt ruggedness	dv/dt	V <sub>DS</sub> = 0 to 400 V, I <sub>D</sub> = 11 A	50	_		V/ns

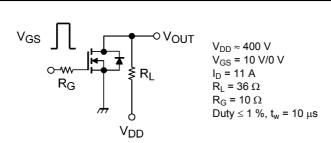


Fig. 6.2.1 Switching Time Test Circuit

## 6.3. Gate Charge Characteristics (T<sub>a</sub> = 25 °C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Qg	$V_{DD} \approx 400 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 22 \text{ A}$		50		nC
Gate-source charge 1	Q <sub>gs1</sub>			20		
Gate-drain charge	$Q_{gd}$			25		

#### 6.4. Source-Drain Characteristics (T<sub>a</sub> = 25 °C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Diode forward voltage	V <sub>DSF</sub>	I <sub>DR</sub> = 22 A, V <sub>GS</sub> = 0 V	_	_	-1.7	V
Reverse recovery time	t <sub>rr</sub>	I <sub>DR</sub> = 11 A, V <sub>GS</sub> = 0 V	_	110	180	ns
Reverse recovery charge	Q <sub>rr</sub>	-dI <sub>DR</sub> /dt = 100 A/μs	_	0.6	_	μС
Peak reverse recovery current	Irr		_	14	_	Α
Diode dv/dt ruggedness	dv/dt	I <sub>DR</sub> = 11 A, V <sub>GS</sub> = 0 V, V <sub>DD</sub> = 400 V	50	_	_	V/ns



## 7. Marking (Note)

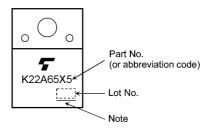


Fig. 7.1 Marking

Note: 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 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

## 8. Characteristics Curves (Note)

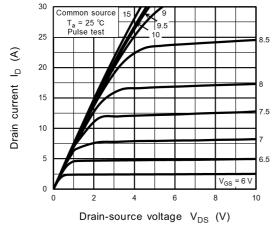
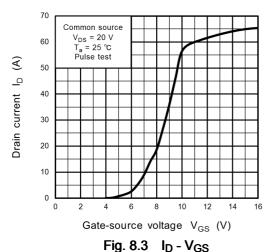


Fig. 8.1 I<sub>D</sub> - V<sub>DS</sub>



Common source V<sub>GS</sub> = 0 V I<sub>D</sub> = 10 mA Pulse test Drain-source voltage V<sub>DSS</sub> 700 650 600 550 L -100

Ambient temperature  $T_a$  (°C) Fig. 8.5 V<sub>DSS</sub> - T<sub>a</sub>

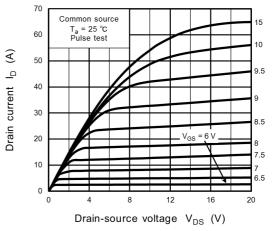


Fig. 8.2 I<sub>D</sub> - V<sub>DS</sub>

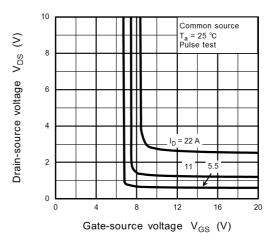


Fig. 8.4 V<sub>DS</sub> - V<sub>GS</sub>

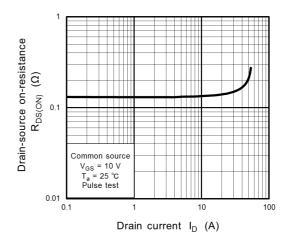


Fig. 8.6 R<sub>DS(ON)</sub> - I<sub>D</sub>

750

 $\leq$ 

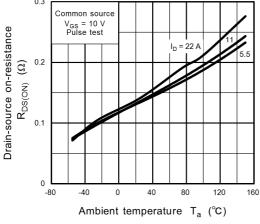


Fig. 8.7 R<sub>DS(ON)</sub> - T<sub>a</sub>

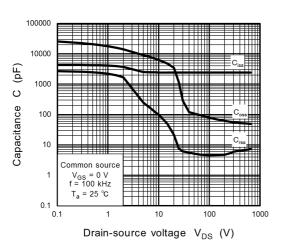


Fig. 8.9 C - V<sub>DS</sub>

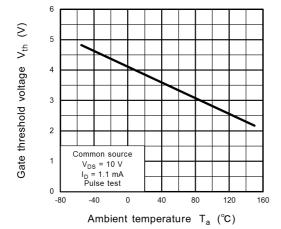


Fig. 8.11 V<sub>th</sub> - T<sub>a</sub>

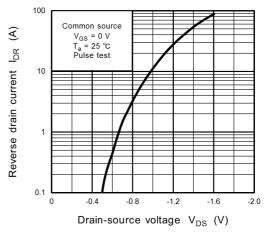


Fig. 8.8 IDR - VDS

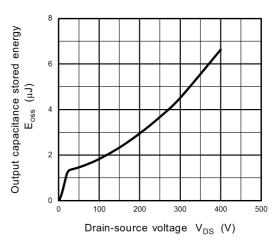


Fig. 8.10 Eoss - VDS

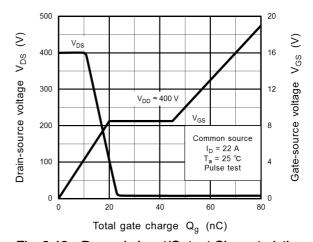


Fig. 8.12 Dynamic Input/Output Characteristics

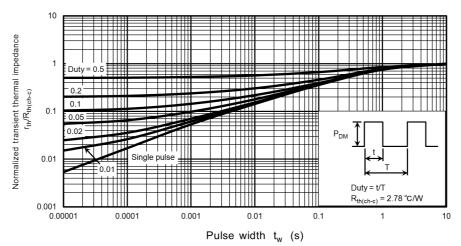


Fig. 8.13 r<sub>th</sub> - t<sub>w</sub> (Guaranteed Maximum)

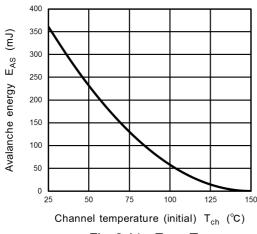
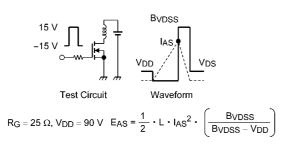


Fig. 8.14 E<sub>AS</sub> - T<sub>ch</sub> (Guaranteed Maximum)



60 45 40 40 40 80 120 16 Case temperature T<sub>c</sub> (°C)

Fig. 8.15 P<sub>D</sub> - T<sub>c</sub> (Guaranteed Maximum)

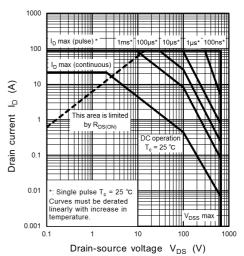


Fig. 8.17 Safe Operating Area (Guaranteed Maximum)

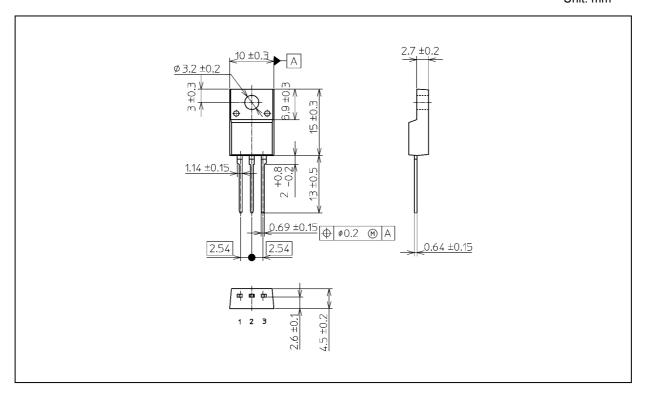
Fig. 8.16 Test Circuit/Waveform

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



## **Package Dimensions**

Unit: mm



Weight: 1.7 g (typ.)

Package Name(s)
JEITA: SC-67
TOSHIBA: 2-10U1S
Nickname: TO-220SIS

Rev.3.0



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