

TOSHIBA Field-Effect Transistor Silicon N-Channel MOS Type (U-MOSIV)

# SSM3K131TU

○ High-Speed Switching Applications

- 4.5-V drive
- Low ON-resistance :  $R_{on} = 41.5 \text{ m}\Omega$  (max) (@ $V_{GS} = 4.5 \text{ V}$ )  
:  $R_{on} = 27.6 \text{ m}\Omega$  (max) (@ $V_{GS} = 10 \text{ V}$ )

**Absolute Maximum Ratings (Ta = 25°C)**

Characteristic		Symbol	Rating	Unit
Drain-Source voltage		$V_{DSS}$	30	V
Gate-Source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC	$I_D$ (Note 1)	6.0	A
	Pulse	$I_{DP}$ (Note 1)	12.0	
Drain power dissipation	$P_D$ (Note 2)		800	mW
	$P_D$ (Note 3)		500	
	$t = 10 \text{ s}$		1000	
Channel temperature		$T_{ch}$	150	°C
Storage temperature range		$T_{stg}$	-55 to 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).

Note 1: The junction temperature should not exceed 150°C during use.

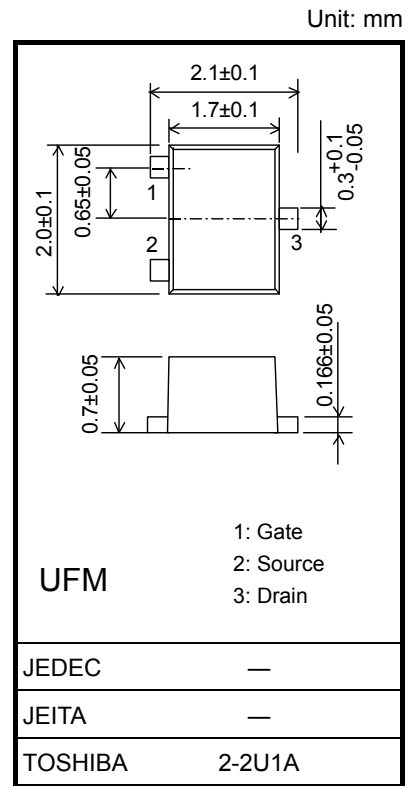
Note 2: Mounted on a ceramic board. (25.4 mm × 25.4 mm × 0.8 mm, Cu Pad: 645 mm<sup>2</sup>)

Note 3: Mounted on an FR4 board. (25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 645 mm<sup>2</sup>)

**Electrical Characteristics (Ta = 25°C)**

Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	30	—	—	V
	$V_{(BR)DSX}$	$I_D = 10 \text{ mA}, V_{GS} = -20 \text{ V}$	15	—	—	
Drain cut-off current	$I_{DSS}$	$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	1	μA
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 0.1$	μA
Gate threshold voltage	$V_{th}$	$V_{DS} = 5 \text{ V}, I_D = 1 \text{ mA}$	1.3	—	2.5	V
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 5 \text{ V}, I_D = 4 \text{ A}$ (Note 4)	11.5	23.0	—	S
Drain-source ON-resistance	$R_{DS(ON)}$	$I_D = 4.0 \text{ A}, V_{GS} = 10 \text{ V}$ (Note 4)	—	20.5	27.6	mΩ
		$I_D = 2.0 \text{ A}, V_{GS} = 4.5 \text{ V}$ (Note 4)	—	27.0	41.5	
Input capacitance	$C_{iss}$	$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	450	—	pF
Output capacitance	$C_{oss}$		—	120	—	
Reverse transfer capacitance	$C_{rss}$		—	77	—	
Total Gate Charge	$Q_g$	$V_{DS} = 15 \text{ V}, I_D = 6.0 \text{ A}$ $V_{GS} = 10 \text{ V}$	—	10.1	—	nC
Gate-Source Charge	$Q_{gs}$		—	7.6	—	
Gate-Drain Charge	$Q_{gd}$		—	2.5	—	
Switching time	Turn-on time	$t_{on}$	$V_{DD} = 15 \text{ V}, I_D = 2.0 \text{ A},$	—	21	ns
	Turn-off time	$t_{off}$	$V_{GS} = 0 \text{ to } 4.5 \text{ V}, R_G = 10 \Omega$	—	15	
Drain-Source forward voltage	$V_{DSF}$	$I_D = -6.0 \text{ A}, V_{GS} = 0 \text{ V}$ (Note 4)	—	-0.85	-1.2	V

Note 4: Pulse test

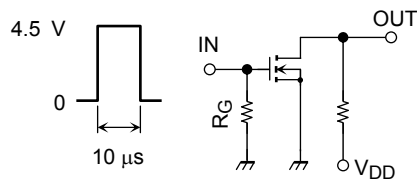


Weight: 6.6mg (typ.)

Start of commercial production  
2008-09

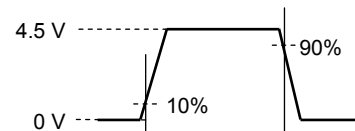
## Switching Time Test Circuit

### (a) Test Circuit

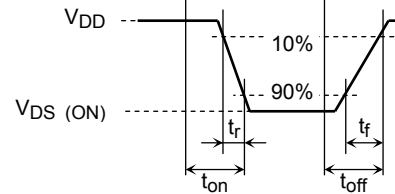


$V_{DD} = 15\text{ V}$   
 $R_G = 10\ \Omega$   
 Duty  $\leq 1\%$   
 $V_{IN}$ :  $t_r, t_f < 5\text{ ns}$   
 Common Source  
 $T_a = 25^\circ\text{C}$

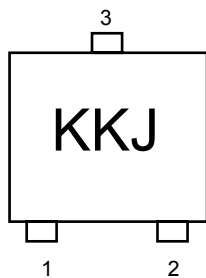
### (b) $V_{IN}$



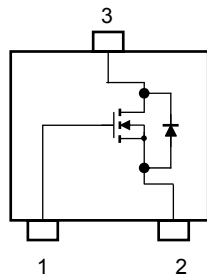
### (c) $V_{OUT}$



### Marking



### Equivalent Circuit (top view)



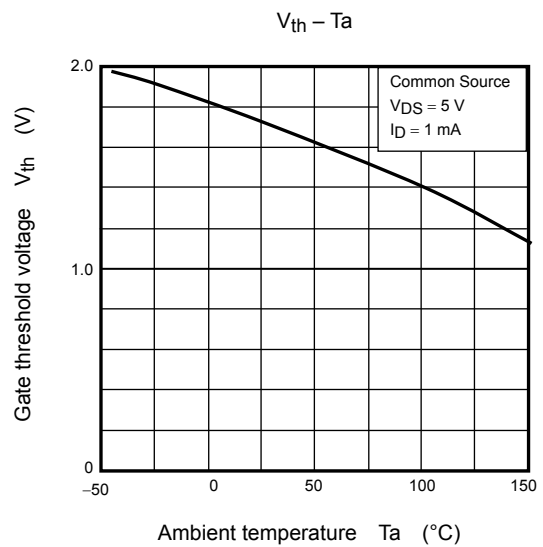
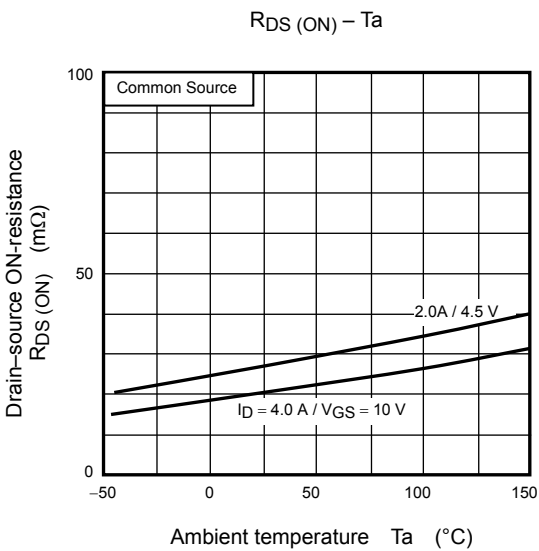
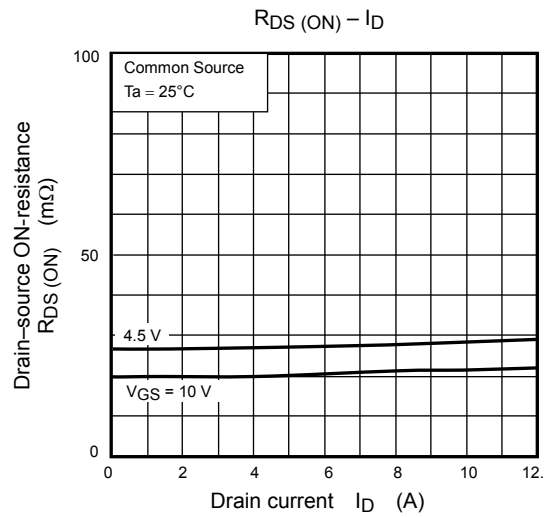
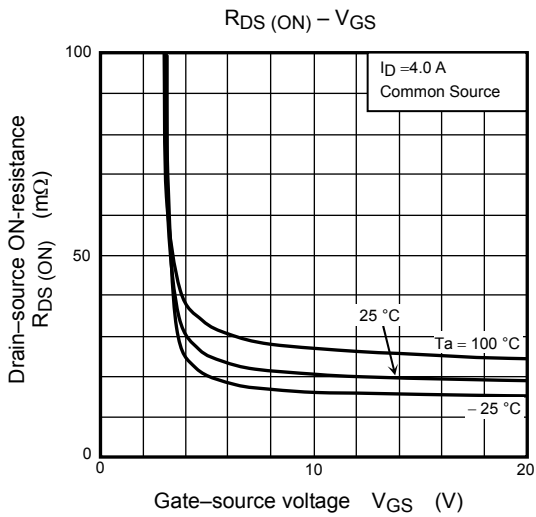
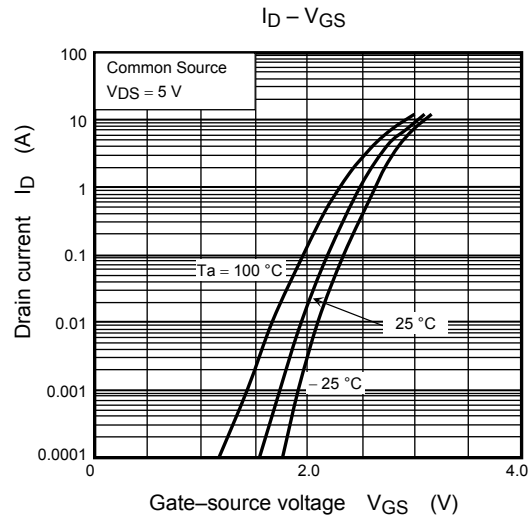
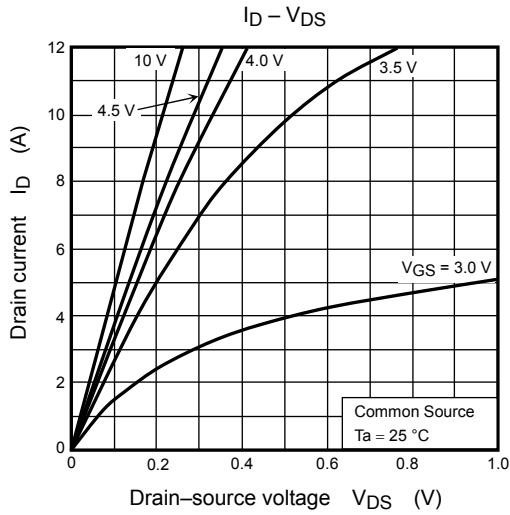
## Handling Precaution

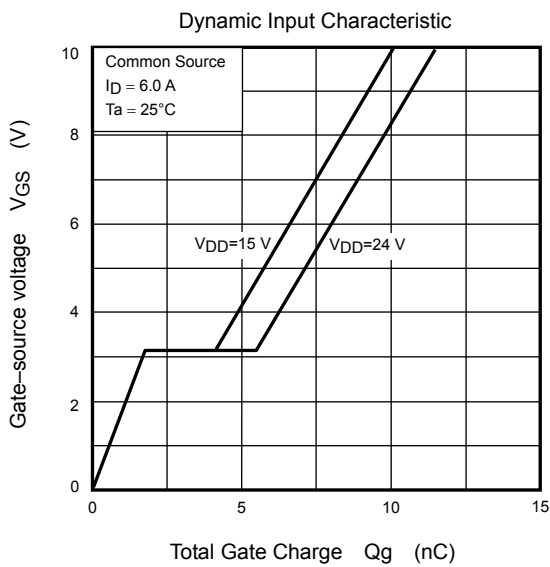
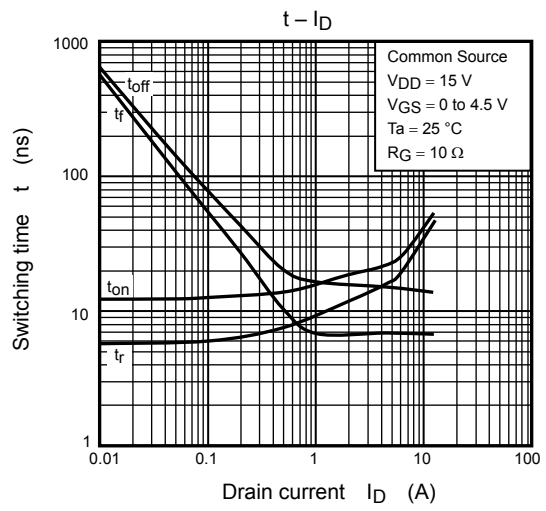
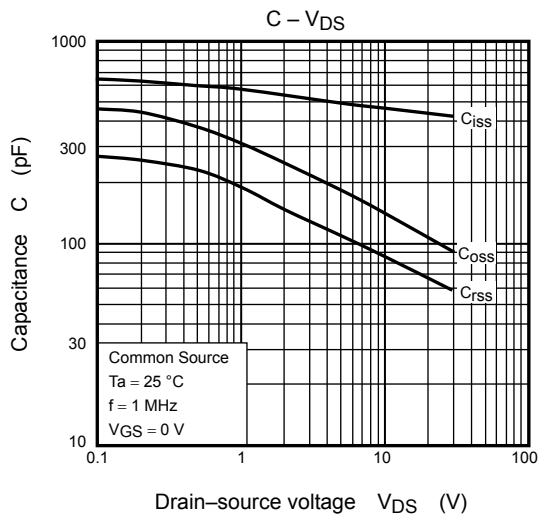
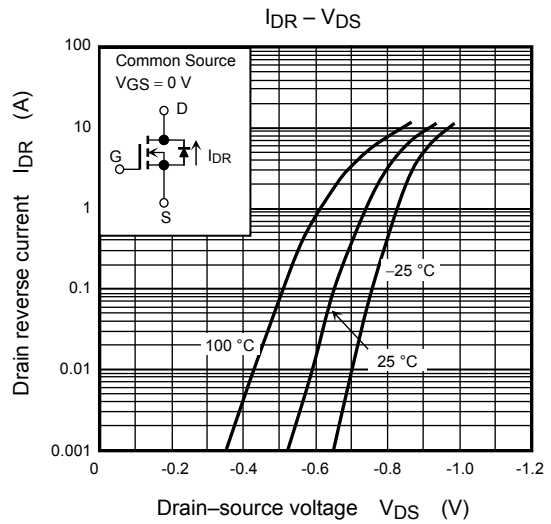
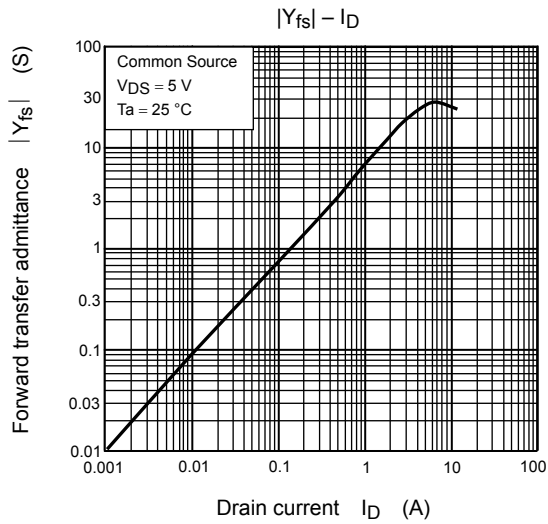
When handling individual devices that are not yet mounted on a circuit board, make sure that the environment is protected against electrostatic discharge. Operators should wear antistatic clothing, and containers and other objects that come into direct contact with devices should be made of antistatic materials.

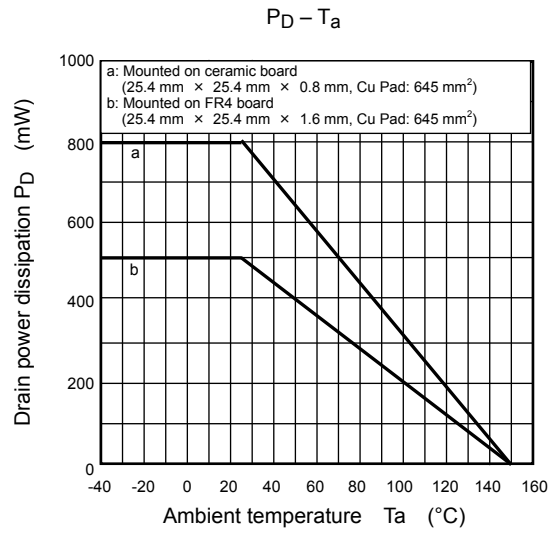
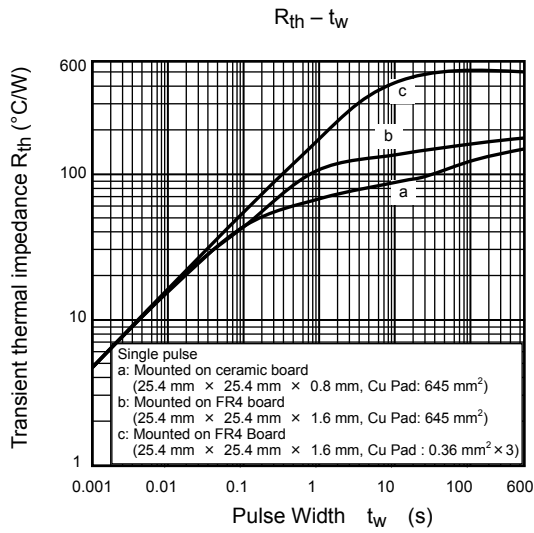
## Usage Considerations

Let  $V_{th}$  be the voltage applied between gate and source that causes the drain current ( $I_D$ ) to be low (1 mA for the SSM3K131TU). Then, for normal switching operation,  $V_{GS(on)}$  must be higher than  $V_{th}$ , and  $V_{GS(off)}$  must be lower than  $V_{th}$ . This relationship can be expressed as:  $V_{GS(off)} < V_{th} < V_{GS(on)}$ .

Take this into consideration when using the device.







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