

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

## SSM3K14T

DC-DC Converter  
High Speed Switching Applications

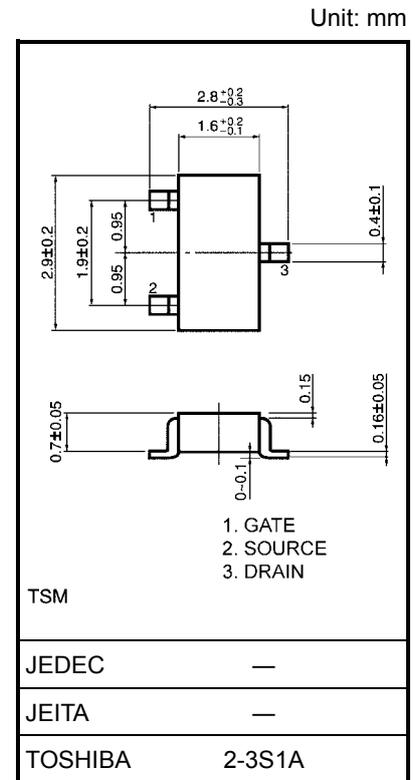
- Small Package
- Low ON-resistance:  $R_{on} = 39 \text{ m}\Omega$  (max) (@ $V_{GS} = 10 \text{ V}$ )  
:  $R_{on} = 57 \text{ m}\Omega$  (max) (@ $V_{GS} = 4.5 \text{ V}$ )
- High speed:  $t_{on} = 24 \text{ ns}$  (typ.)  
:  $t_{off} = 19 \text{ ns}$  (typ.)

### Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristic		Symbol	Rating	Unit
Drain-Source voltage		$V_{DS}$	30	V
Gate-Source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC	$I_D$	4.0	A
	Pulse	$I_{DP}$ (Note 2)	8.0	
Drain power dissipation ( $T_a = 25^\circ\text{C}$ )		$P_D$ (Note 1)	0.7	W
		$t = 10 \text{ s}$	1.25	
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	-55~150	$^\circ\text{C}$

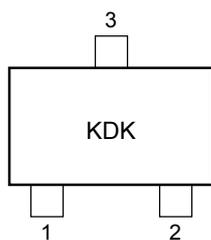
Note 1: Mounted on FR4 board  
(25.4 mm × 25.4 mm × 1.6 t, Cu pad: 645 mm<sup>2</sup>)

Note 2: The pulse width limited by max channel temperature.

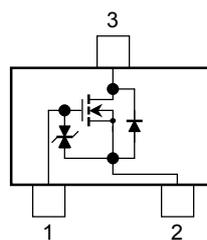


Weight: 10 mg (typ.)

### Marking



### Equivalent Circuit



### Handling Precaution

When handling individual devices (which are not yet mounted on a circuit board), be sure that the environment is protected against electrostatic electricity. Operators should wear anti-static clothing, and containers and other objects that come into direct contact with devices should be made of anti-static materials.

The Channel-to-Ambient thermal resistance  $R_{th(ch-a)}$  and the drain power dissipation  $P_D$  vary according to the board material, board area, board thickness and pad area, and are also affected by the environment in which the product is used. When using this device, please take heat dissipation fully into account.

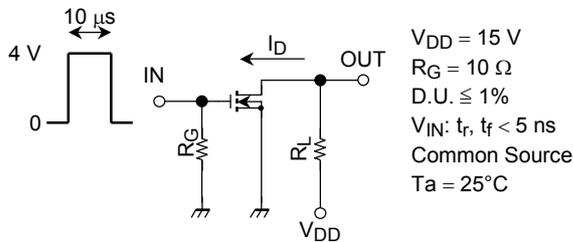
**Electrical Characteristics (Ta = 25°C)**

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0$	—	—	$\pm 1$	$\mu\text{A}$
Drain-Source breakdown voltage		$V_{(BR)DSS}$	$I_D = 1\text{ mA}, V_{GS} = 0$	30	—	—	V
		$V_{(BR)DSX}$	$I_D = 1\text{ mA}, V_{GS} = -20\text{ V}$	15	—	—	
Drain Cut-off current		$I_{DSS}$	$V_{DS} = 30\text{ V}, V_{GS} = 0$	—	—	1	$\mu\text{A}$
Gate threshold voltage		$V_{th}$	$V_{DS} = 5\text{ V}, I_D = 0.1\text{ mA}$	1.0	—	2.5	V
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 5\text{ V}, I_D = 2\text{ A}$ (Note 3)	3.2	6.4	—	S
Drain-Source ON resistance		$R_{DS(ON)}$	$I_D = 2\text{ A}, V_{GS} = 10\text{ V}$ (Note 3)	—	31	39	m $\Omega$
			$I_D = 2\text{ A}, V_{GS} = 4.5\text{ V}$ (Note 3)	—	45	57	
			$I_D = 2\text{ A}, V_{GS} = 4.0\text{ V}$ (Note 3)	—	50	67	
Total gate charge		$Q_g$	$V_{DD} \approx 24\text{ V}, I_D = 4\text{ A}, V_{GS} = 4\text{ V}$	—	5.0	—	nC
Input capacitance		$C_{iss}$	$V_{DS} = 15\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	460	—	pF
Reverse transfer capacitance		$C_{rss}$	$V_{DS} = 15\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	62	—	pF
Output capacitance		$C_{oss}$	$V_{DS} = 15\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	106	—	pF
Switching time	Rise time	$t_r$	$V_{DD} = 15\text{ V}, I_D = 2\text{ A}$ $V_{GS} = 0\sim 4\text{ V}, R_G = 10\ \Omega$	—	15	—	ns
	Turn-on time	$t_{on}$		—	24	—	
	Fall time	$t_f$		—	6	—	
	Turn-off time	$t_{off}$		—	19	—	

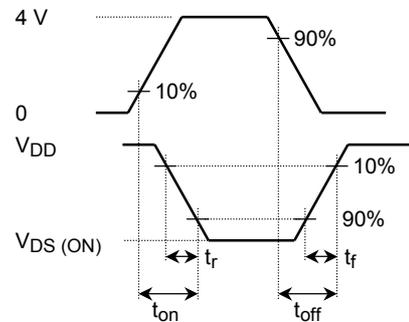
Note 3: Pulse test

**Switching Time Test Circuit**

**(a) Test circuit**



**(b) VIN**



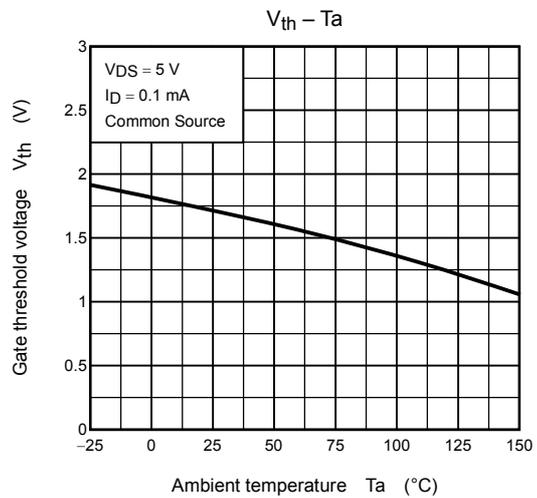
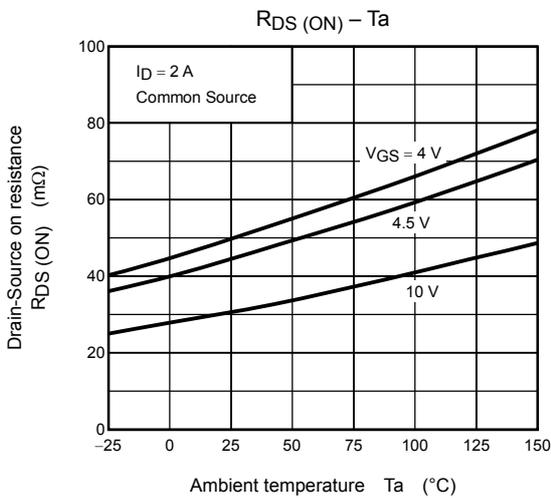
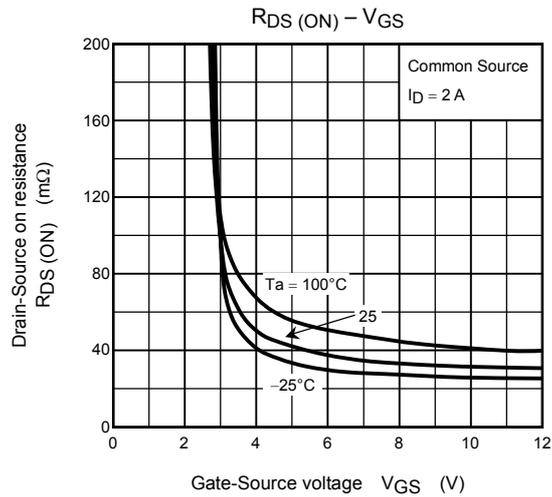
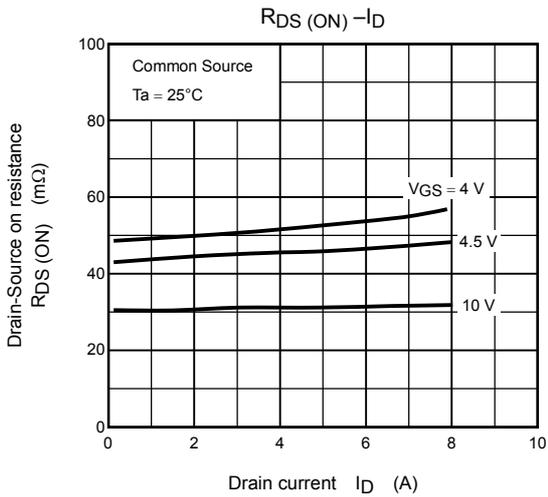
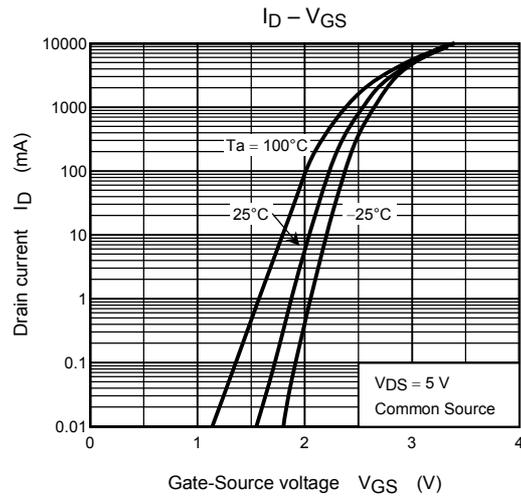
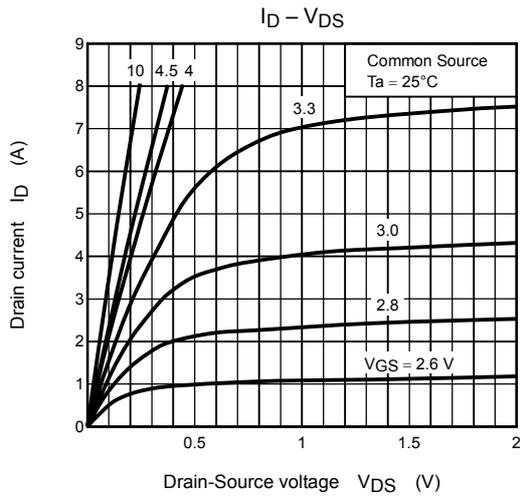
**Precaution**

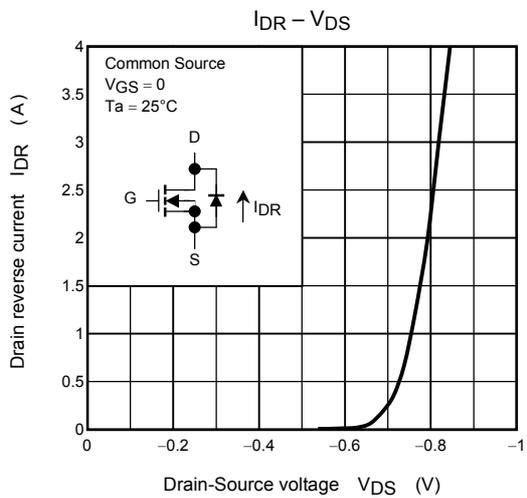
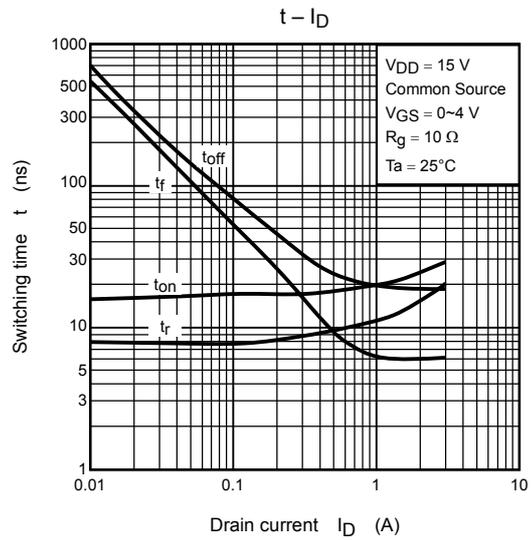
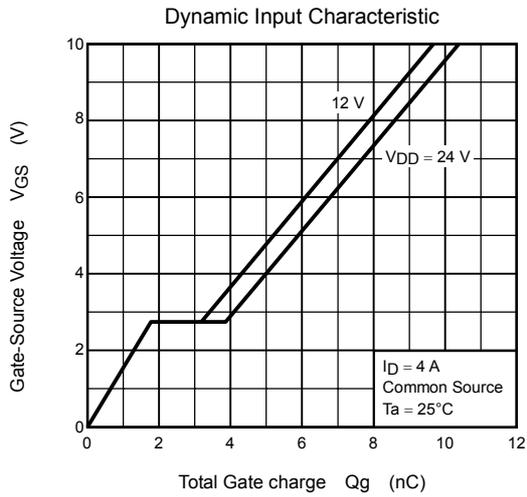
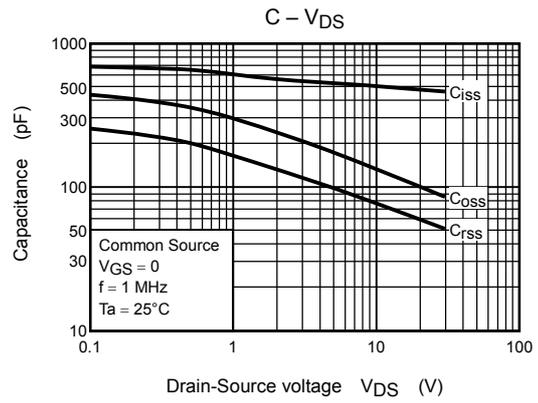
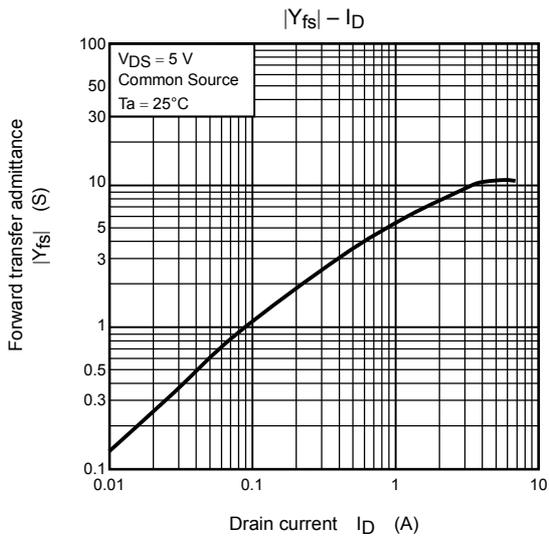
$V_{th}$  can be expressed as voltage between gate and source when low operating current value is  $I_D = 100\ \mu\text{A}$  for this product. For normal switching operation,  $V_{GS(ON)}$  requires higher voltage than  $V_{th}$  and  $V_{GS(OFF)}$  requires lower voltage than  $V_{th}$ .

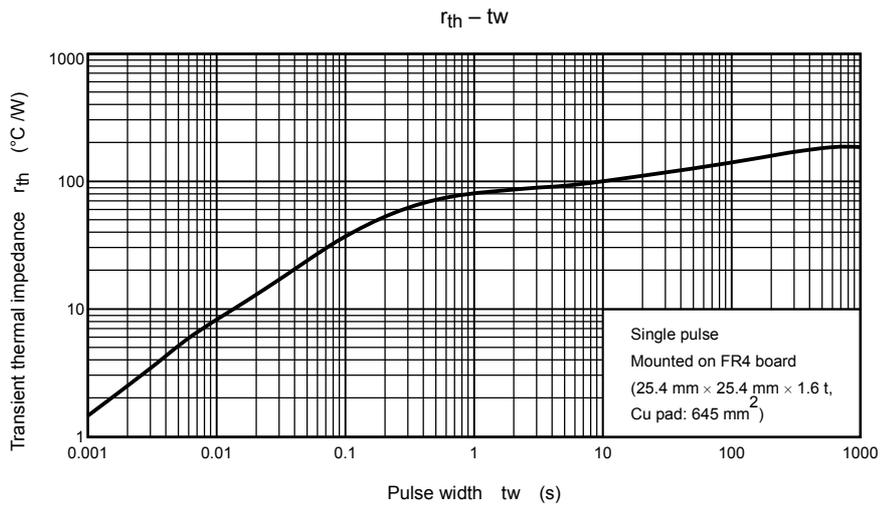
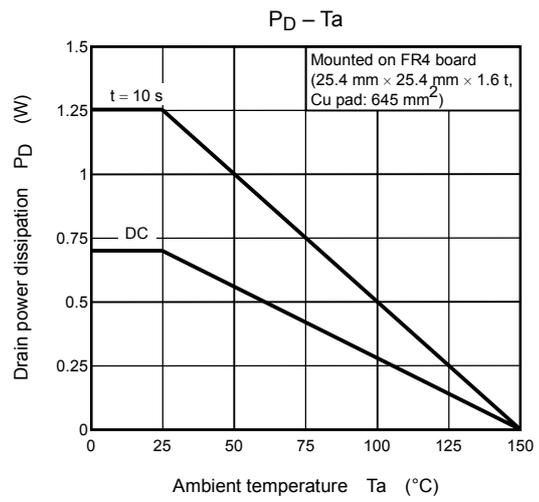
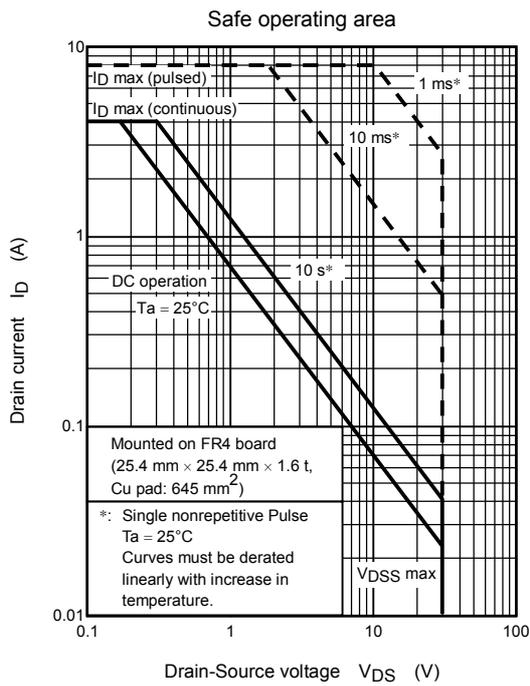
(relationship can be established as follows:  $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$ )

Please take this into consideration for using the device.

$V_{GS}$  recommended voltage of 4 V or higher to turn on this product.







**RESTRICTIONS ON PRODUCT USE**

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