

MOSFETs Silicon N-Channel MOS

## SSM6N55NU

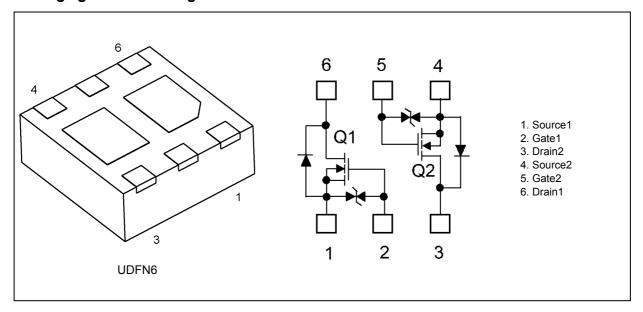
### 1. Applications

- · Power Management Switches
- DC-DC Converters

### 2. Features

- (1) 4.5V gate drive voltage.
- (2) Low drain-source on-resistance
  - :  $R_{DS(ON)}$  = 46 m $\Omega$  (max) (@ $V_{GS}$  = 10 V)  $R_{DS(ON)}$  = 64 m $\Omega$  (max) (@ $V_{GS}$  = 4.5 V)

### 3. Packaging and Pin Configuration





## 4. Absolute Maximum Ratings (Note) (Unless otherwise specified, T<sub>a</sub> = 25°C) (Q1,Q2 Common)

	Characteristics	Symbol	Rating	Unit	
Drain-source voltage			V <sub>DSS</sub>	30	V
Gate-source voltage			V <sub>GSS</sub>	±20	
Drain current (DC)		(Note 1)	I <sub>D</sub>	4.0	Α
Drain current (pulsed)		(Note 1), (Note 2)	I <sub>DP</sub>	10	
Power dissipation		(Note 3)	P <sub>D</sub>	1	W
Power dissipation	t ≤ 10 s	(Note 3)	P <sub>D</sub>	2	W
Channel temperature			T <sub>ch</sub>	150	°C
Storage temperature			T <sub>stg</sub>	-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).

- Note 1: Ensure that the channel temperature does not exceed 150°C.
- Note 2: Pulse width (PW)  $\leq$  10 ms, duty  $\leq$  1%
- Note 3: Device mounted on a 25.4 mm  $\times$  25.4 mm  $\times$  1.6 mm FR4 glass epoxy board (total dissipation) (with a dissipating copper surface of 25.4 mm  $\times$  25.4 mm)

Note: The MOSFETs in this device are sensitive to electrostatic discharge. When handling this device, the worktables, operators, soldering irons and other objects should be protected against anti-static discharge.

Note: The channel-to-ambient thermal resistance, R<sub>th(ch-a)</sub>, and the drain power dissipation, P<sub>D</sub>, vary according to the board material, board area, board thickness and pad area. When using this device, be sure to take heat dissipation fully into account.

### 5. Electrical Characteristics

### 5.1. Static Characteristics (T<sub>a</sub> = 25°C unless otherwise specified)(Q1,Q2 Common)

Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Gate leakage current		I <sub>GSS</sub>	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	_		±10	μΑ
Drain cut-off current		I <sub>DSS</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V			1	
Drain-source breakdown voltage		V <sub>(BR)DSS</sub>	$I_D$ = 10 mA, $V_{GS}$ = 0 V	30			V
Drain-source breakdown voltage	(Note 1)	V <sub>(BR)DSX</sub>	$I_D$ = 10 mA, $V_{GS}$ = -20 V	10			
Gate threshold voltage	(Note 2)	$V_{th}$	$V_{DS} = 10 \text{ V}, I_D = 0.1 \text{ mA}$	1.3		2.5	
Drain-source on-resistance	(Note 3)	R <sub>DS(ON)</sub>	$I_D = 4.0 \text{ A}, V_{GS} = 10 \text{ V}$		33	46	mΩ
			$I_D = 2.0 \text{ A}, V_{GS} = 4.5 \text{ V}$	_	48	64	
Forward transfer admittance	(Note 3)	Y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1.0 A	3.4	6.8		S

Note 1: If a reverse bias is applied between gate and source, this device enters  $V_{(BR)DSX}$  mode. Note that the drain-source breakdown voltage is lowered in this mode.

Note 2: Let  $V_{th}$  be the voltage applied between gate and source that causes the drain current ( $I_D$ ) to below (0.1 mA for this device). 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:  $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$ .

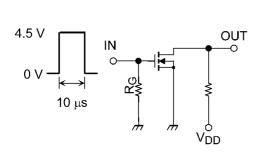
Take this into consideration when using the device.

Note 3: Pulse measurement.

### 5.2. Dynamic Characteristics (T<sub>a</sub> = 25°C unless otherwise specified)(Q1,Q2 Common)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V,	I	280		pF
Reverse transfer capacitance	C <sub>rss</sub>	f = 1 MHz		20		
Output capacitance	C <sub>oss</sub>		I	53		
Switching time (turn-on time)	t <sub>on</sub>	$V_{DD}$ = 15 V, $I_{D}$ = 0.5 A $V_{GS}$ = 0 to 4.5 V, $R_{G}$ = 10 $\Omega$ ,		15		ns
Switching time (turn-off time)	t <sub>off</sub>	Duty $\leq$ 1%, Input: $t_r$ , $t_f$ < 5 ns Ground source, See Chapter 5.3	1	12	1	

### 5.3. Switching Time Test Circuit



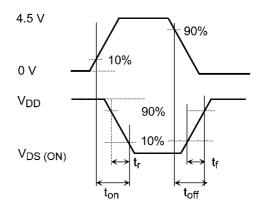


Fig. 5.3.1 Test Circuit of Switching Time

Fig. 5.3.2 Input Waveform/Output Waveform

## 5.4. Gate Charge Characteristics (T<sub>a</sub> = 25°C unless otherwise specified) (Q1,Q2 Common)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Total gate charge (gate-source plus gate-drain)	$Q_g$	V <sub>DD</sub> = 15 V, V <sub>GS</sub> = 4.5 V,	_	2.5	_	nC
Gate-source charge 1	Q <sub>gs1</sub>	I <sub>D</sub> = 4.0 A	_	1.6	_	
Gate-drain charge	$Q_{gd}$		_	0.5		

# 5.5. Source-Drain Characteristics (T<sub>a</sub> = 25°C unless otherwise specified) (Q1,Q2 Common)

Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Diode forward voltage	(Note 1)	$V_{DSF}$	$I_D = -4.0 \text{ A}, V_{GS} = 0 \text{ V}$	_	-0.85	-1.2	V

Note 1: Pulse measurement.

### 6. Marking

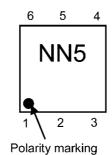
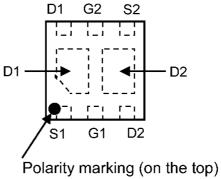


Fig. 6.1 Marking



\*Electrodes: on the bottom

Fig. 6.2 Pin Condition(Top View)

### 7. Characteristics Curves (Note)

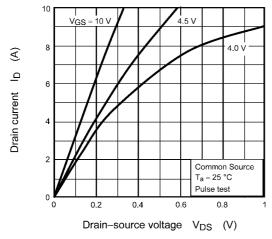


Fig. 7.1 I<sub>D</sub> - V<sub>DS</sub>

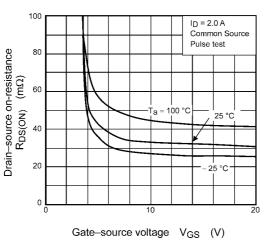


Fig. 7.3 R<sub>DS(ON)</sub> - V<sub>GS</sub>

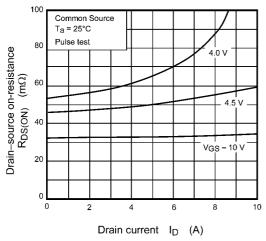


Fig. 7.5 R<sub>DS(ON)</sub> - I<sub>D</sub>

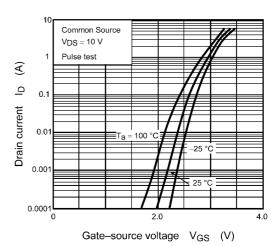


Fig. 7.2 I<sub>D</sub> - V<sub>GS</sub>

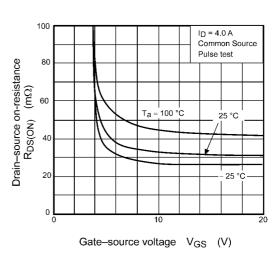


Fig. 7.4 R<sub>DS(ON)</sub> - V<sub>GS</sub>

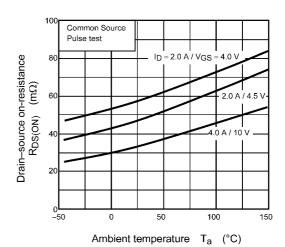


Fig. 7.6 R<sub>DS(ON)</sub> - T<sub>a</sub>

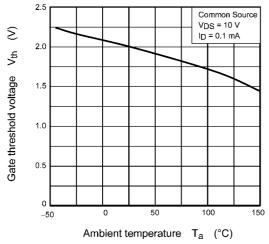


Fig. 7.7 V<sub>th</sub> - T<sub>a</sub>

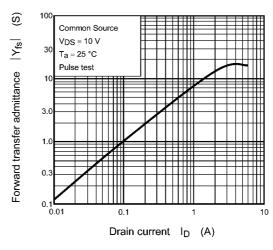


Fig. 7.8 |Y<sub>fs</sub>| - I<sub>D</sub>

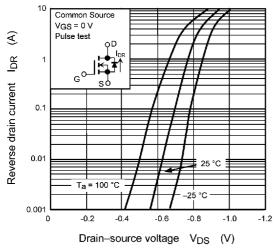


Fig. 7.9 IDR - VDS

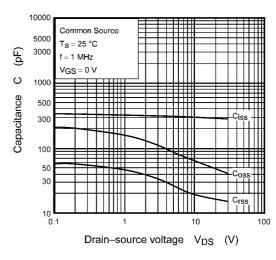


Fig. 7.10 C - V<sub>DS</sub>

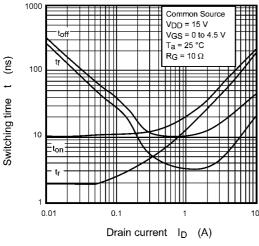


Fig. 7.11 t - ID

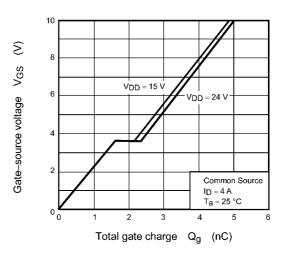


Fig. 7.12 Dynamic Input/Output Characteristics

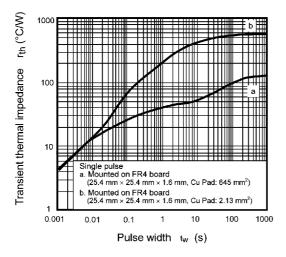


Fig. 7.13  $r_{th}$  -  $t_w$ 

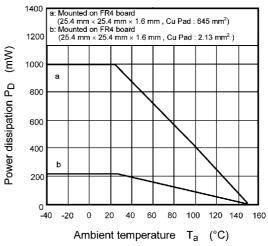


Fig. 7.14 PD - Ta

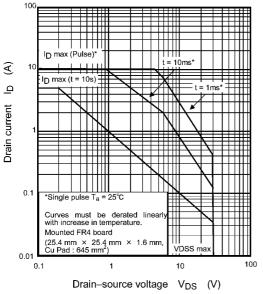


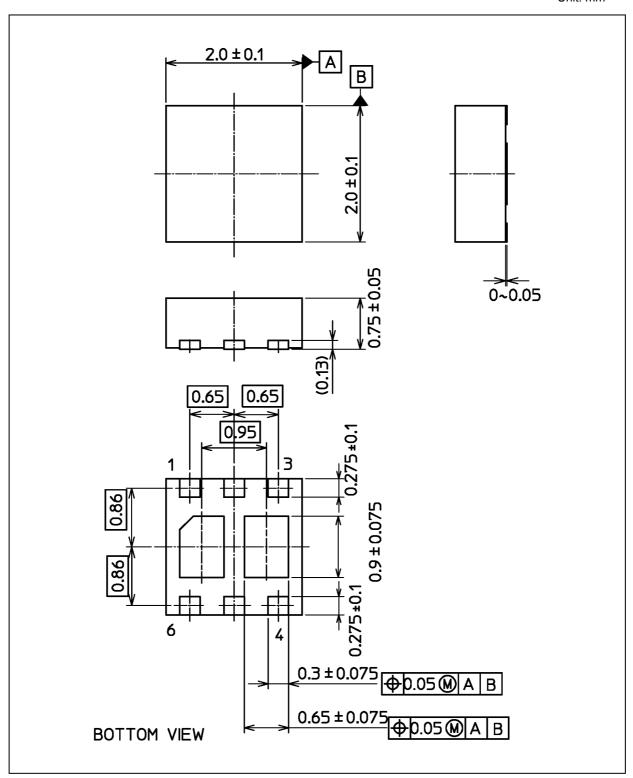
Fig. 7.15 Safe Operating Area

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



### **Package Dimensions**

Unit: mm



Weight: 8.5 mg (typ.)

Package Name(s)	
TOSHIBA: 2-2Y1A	
Nickname: UDFN6	



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