

TOSHIBA Multi-Chip Device  
Silicon P-Channel MOS Type (U-MOS II) + N-Channel MOS Type (Planer)

# SSM6E01TU

## Load Switch Applications

- P-channel MOSFET and N-channel MOSFET incorporated into one package.
- Low power dissipation due to P-channel MOSFET that features low R<sub>DS (ON)</sub> and low-voltage operation

### Q1 Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V <sub>DS</sub>	-12	V
Gate-Source voltage		V <sub>GSS</sub>	±12	V
Drain current	DC	I <sub>D</sub>	-1.0	A
	Pulse	I <sub>DP</sub> (Note 2)	-2.0	

### Q2 Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V <sub>DS</sub>	20	V
Gate-Source voltage		V <sub>GSS</sub>	10	V
Drain current	DC	I <sub>D</sub>	0.05	A
	Pulse	I <sub>DP</sub> (Note 2)	0.2	

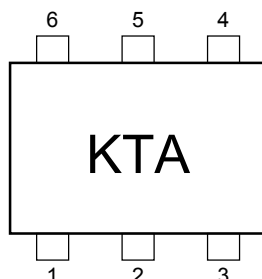
### Maximum Ratings (Q1, Q2 common) (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Drain power dissipation	P <sub>D</sub> (Note 1)	0.5	W
Channel temperature	T <sub>ch</sub>	150	°C
Storage temperature range	T <sub>stg</sub>	-55~150	°C

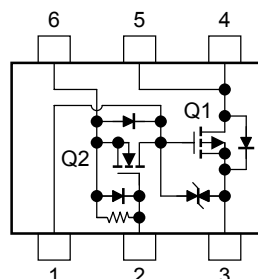
Note 1: Mounted on an FR4 board (25.4 mm × 25.4 mm × 1.6 t, Cu pad: 645 mm<sup>2</sup>)

Note 2: Pulse width limited by maximum channel temperature.

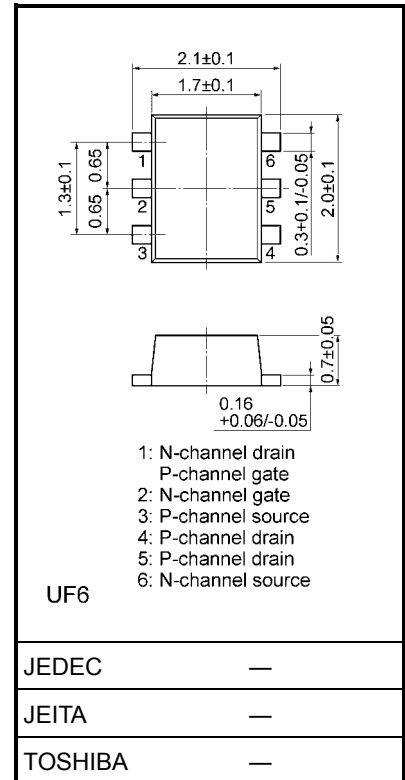
## Marking



## Equivalent Circuit (top view)



Unit: mm



Weight: 7.0 mg (typ.)

**Handling Precaution**

This product has a MOS structure and is sensitive to electrostatic discharge. When handling individual devices (that have not yet been mounted on a PCB), ensure that the environment is protected against static electricity. Operators should wear anti-static clothing, containers and other objects which may come into direct contact with devices should be made of anti-static materials.

Thermal resistance  $R_{th(j-a)}$  and drain power dissipation  $P_D$  vary depending on board material, board area, board thickness and pad area. When using this device, please take heat dissipation into consideration.

## Q1 Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward voltage (diode)	$V_{DSF}$	$I_{DR} = 1.0 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	1.2	V
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 10 \text{ V}, V_{DS} = 0$	—	—	$\pm 1$	$\mu\text{A}$
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = -1 \text{ mA}, V_{GS} = 0$	-12	—	—	V
Drain cut-off current	$I_{DSS}$	$V_{DS} = -12 \text{ V}, V_{GS} = 0$	—	—	-1	$\mu\text{A}$
Gate threshold voltage	$V_{th}$	$V_{DS} = -3 \text{ V}, I_D = -0.1 \text{ mA}$	-0.4	—	-1.1	V
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = -3 \text{ V}, I_D = -0.5 \text{ A}$ (Note 3)	1.3	2.5	—	S
Drain-Source ON resistance	$R_{DS(ON)}$	$I_D = -0.5 \text{ A}, V_{GS} = -4 \text{ V}$ (Note 3)	—	125	160	m $\Omega$
		$I_D = -0.5 \text{ A}, V_{GS} = -2.5 \text{ V}$ (Note 3)	—	180	240	
Input capacitance	$C_{iss}$	$V_{DS} = -10 \text{ V}, V_{GS} = 0, f = 1 \text{ MHz}$	—	310	—	pF

Note 3: Pulse test

## Q2 Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	$I_{GSS}$	$V_{GS} = 10 \text{ V}, V_{DS} = 0$	—	—	15	$\mu\text{A}$
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = 0.1 \text{ mA}, V_{GS} = 0$	20	—	—	V
Drain cut-off current	$I_{DSS}$	$V_{DS} = 20 \text{ V}, V_{GS} = 0$	—	—	1	$\mu\text{A}$
Gate threshold voltage	$V_{th}$	$V_{DS} = 3 \text{ V}, I_D = 0.1 \text{ mA}$	0.7	—	1.3	V
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 3 \text{ V}, I_D = 10 \text{ mA}$ (Note 3)	25	50	—	mS
Drain-Source ON resistance	$R_{DS(ON)}$	$I_D = 10 \text{ mA}, V_{GS} = 2.5 \text{ V}$ (Note 3)	—	4	10	$\Omega$
Input capacitance	$C_{iss}$	$V_{DS} = 3 \text{ V}, V_{GS} = 0, f = 1 \text{ MHz}$	—	11	—	pF
Gate-Source resistance	$R_{GS}$	$V_{GS} = 0 \sim 10 \text{ V}$	0.7	1.0	1.3	M $\Omega$

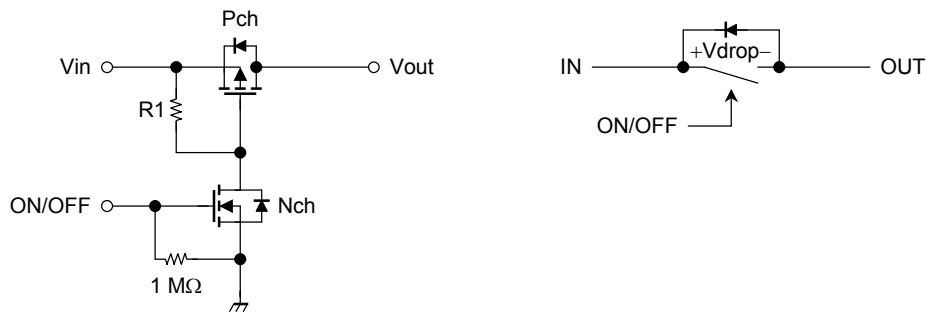
Note 3: Pulse test

## Precaution

$V_{th}$  can be expressed as voltage between gate and source when low operating current value is  $I_D = \pm 100 \mu\text{A}$  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. 2.5 V or higher is recommended for  $V_{GS}$  voltage to turn on the N-channel MOSFET of this product.

**Load Switch Application**



**Load Switch Ratings (Ta = 25°C)**

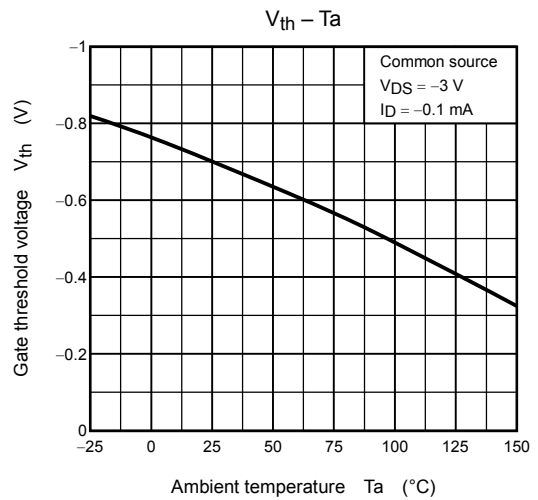
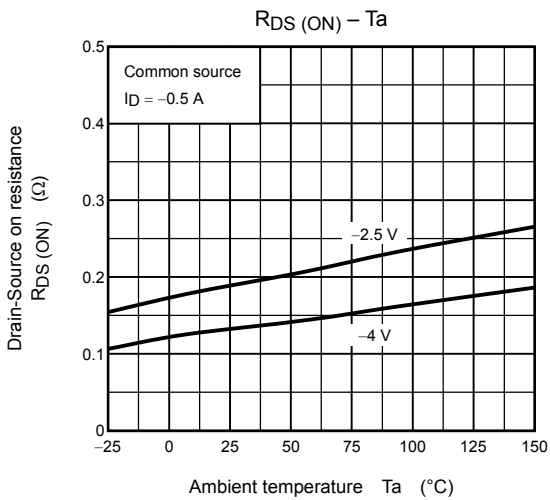
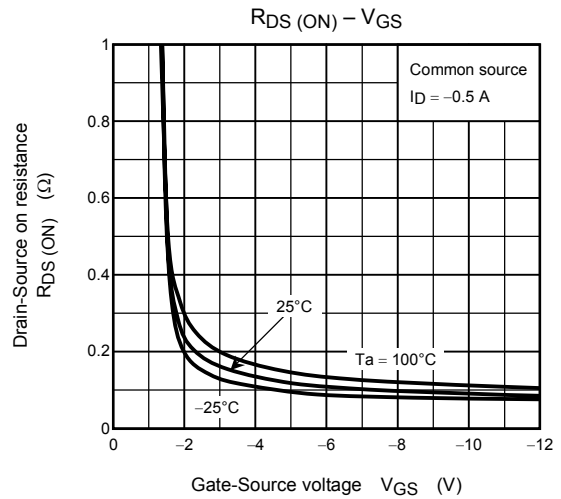
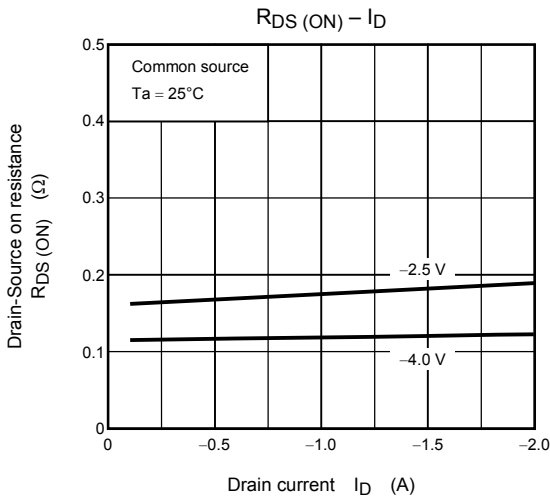
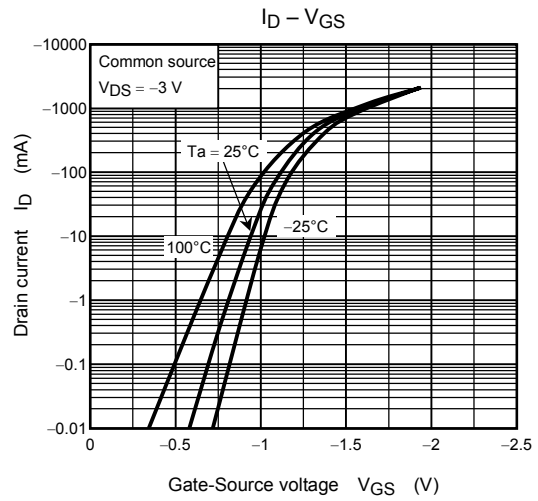
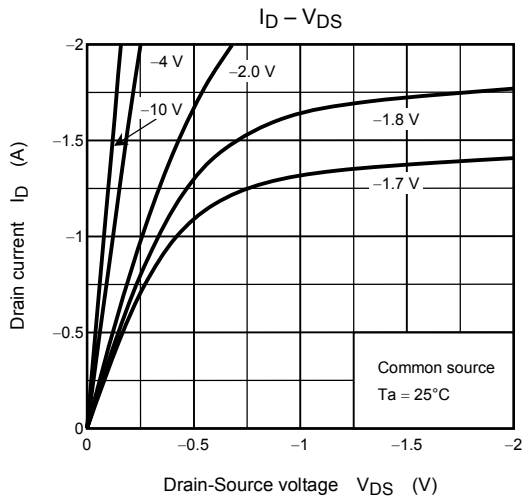
Characteristics	Symbol	Rating	Unit
Input voltage	$V_{in}$	2.5~12	V
ON/OFF voltage	$V_{on/off}$	2.5~10	V
Load current (DC)	$I_L$	1	A
Load current (pulse)	$I_{LP}$ (Note 4)	2	A
Channel temperature	$T_{ch}$	150	°C

Note 4: Pulse width limited by maximum channel temperature.

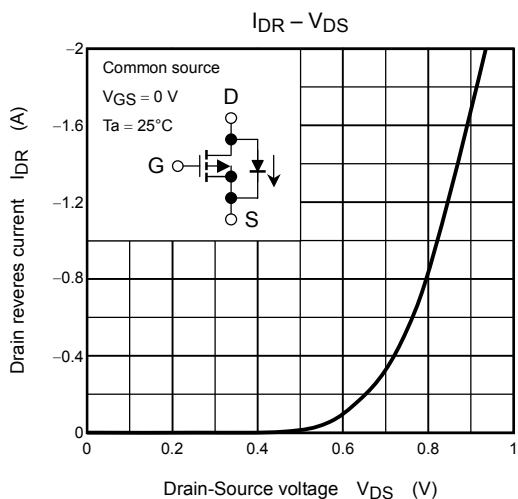
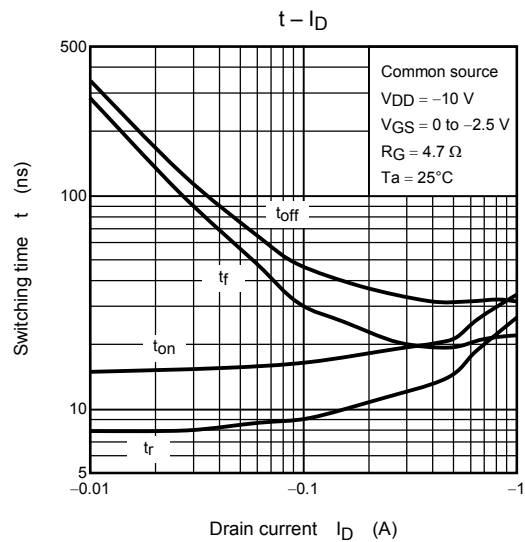
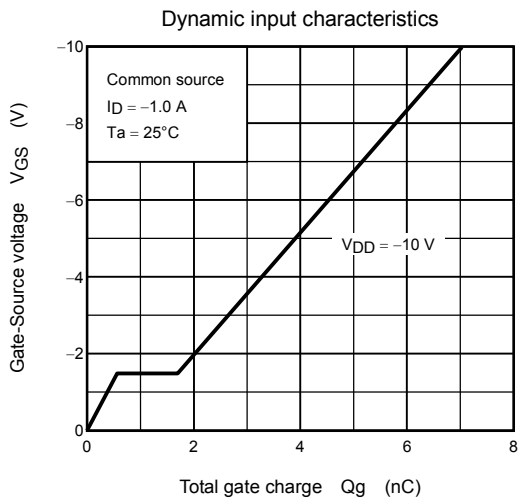
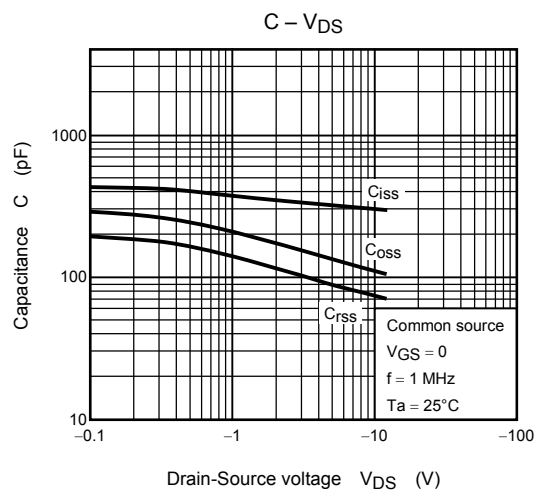
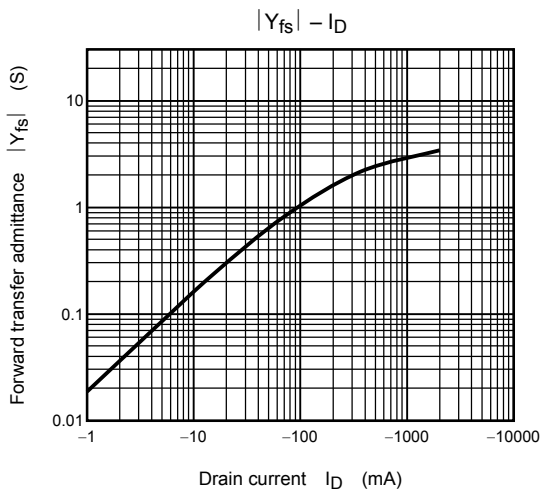
**Load Switch Electrical Characteristics (Ta = 25°C)**

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Leakage current	$I_{FL}$	$V_{in} = 8\text{ V}, V_{ON/OFF} = 0$	—	—	1	μA
P-channel drop voltage	$V_{DROP (1)}$	$V_{in} = 3.0\text{ V}, V_{ON/OFF} = 2.5\text{ V}, I_L = 0.5\text{ A}$	—	0.09	0.12	V
	$V_{DROP (2)}$	$V_{in} = 5.0\text{ V}, V_{ON/OFF} = 2.5\text{ V}, I_L = 1.0\text{ A}$	—	0.13	0.16	
N-channel drive voltage	$V_{on/off}$	$V_{DS} = 3\text{ V}, I_D = 0.1\text{ mA}$	0.7	—	1.3	V

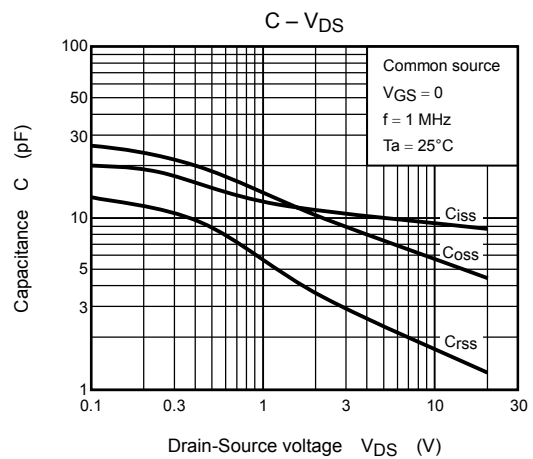
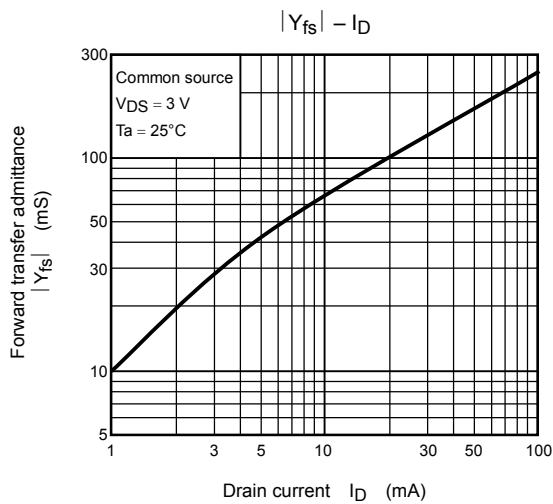
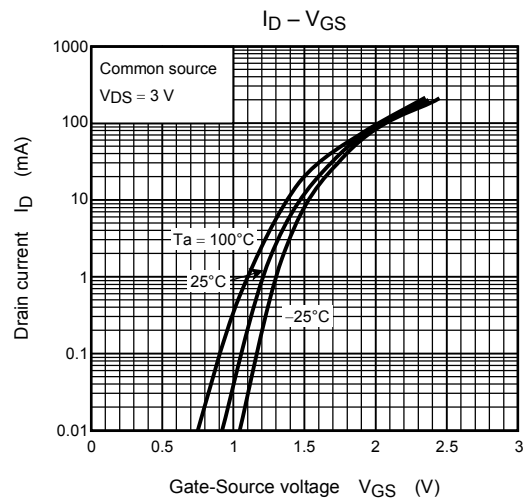
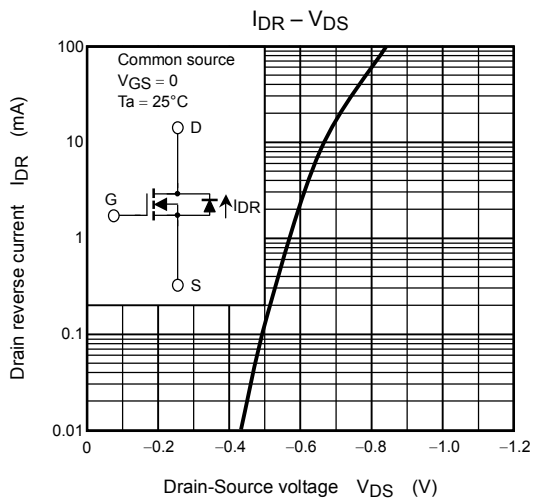
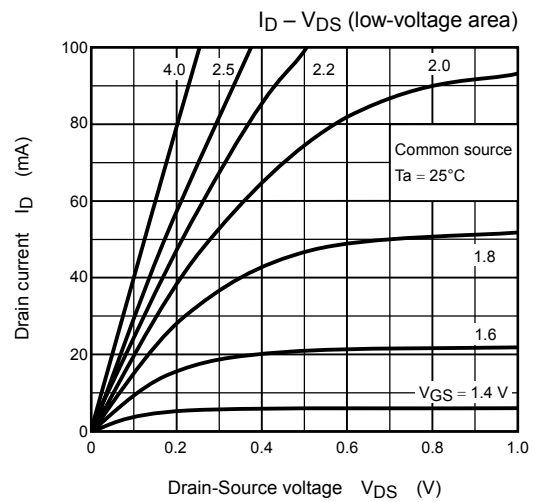
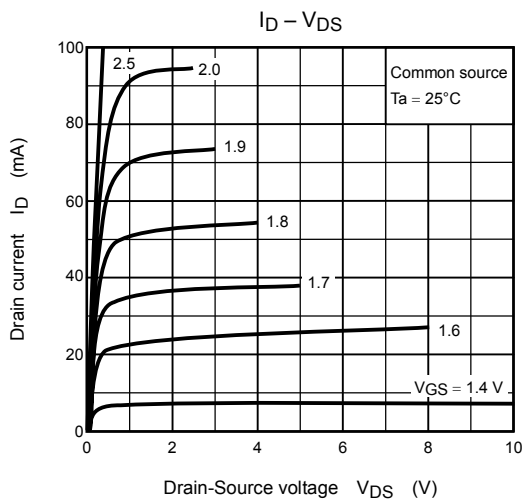
**Q1 (Pch MOSFET)**



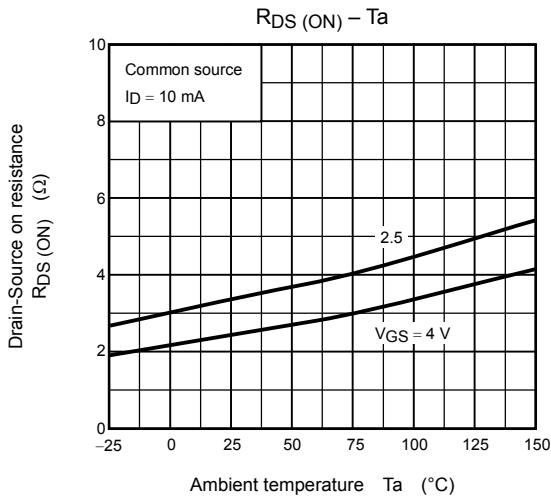
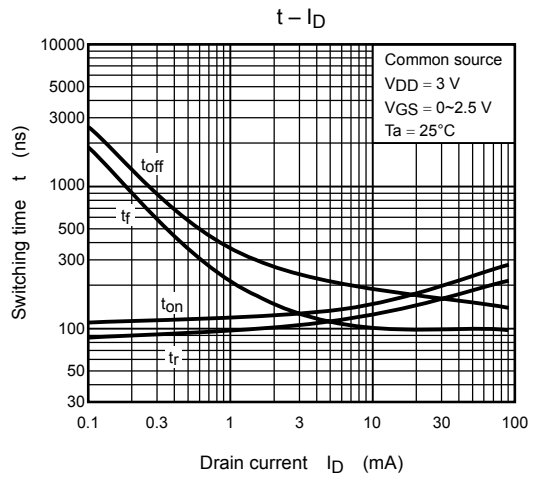
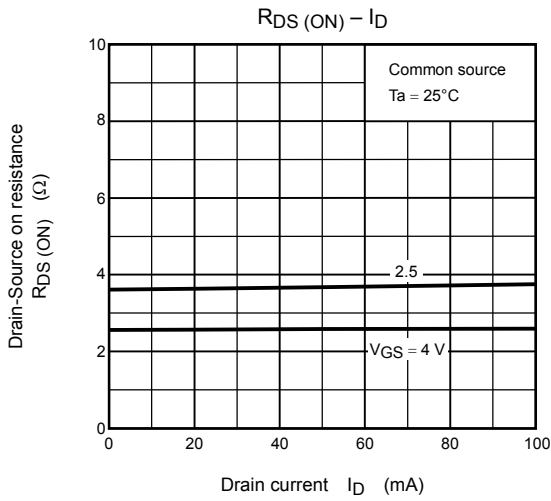
## Q1 (Pch MOSFET)



## Q2 (Nch MOSFET)



**Q2 (Nch MOSFET)**





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