

MOSFETs Silicon P-Channel MOS (U-MOSVI)

# **TPCF8105**

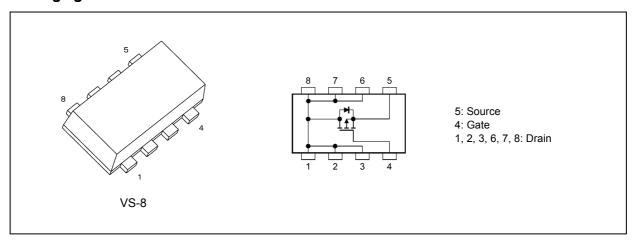
#### 1. Applications

- · Lithium-Ion Secondary Batteries
- · Power Management Switches

#### 2. Features

- (1) Small footprint due to a small and thin package
- (2) Low drain-source on-resistance:  $R_{DS(ON)} = 24 \text{ m}\Omega$  (typ.) ( $V_{GS} = -4.5 \text{ V}$ )
- (3) Low leakage current:  $I_{DSS} = -10 \mu A \text{ (max) (V}_{DS} = -20 \text{ V)}$
- (4) Enhancement mode:  $V_{th}$  = -0.5 to -1.2 V ( $V_{DS}$  = -10 V,  $I_D$  = -0.5 mA)

#### 3. Packaging and Internal Circuit



## 4. Absolute Maximum Ratings (Note) (T<sub>a</sub> = 25°C unless otherwise specified)

Characteris	Symbol	Rating	Unit		
Drain-source voltage			V <sub>DSS</sub>	-20	V
Gate-source voltage			V <sub>GSS</sub>	±12	]
Drain current (DC)		(Note 1)	I <sub>D</sub>	-6	Α
Drain current (pulsed)		(Note 1)	I <sub>DP</sub>	-24	
Power dissipation	(t = 5 s)	(Note 2)	P <sub>D</sub>	2.5	W
Power dissipation	(t = 5 s)	(Note 3)	P <sub>D</sub>	0.7	W
Single-pulse avalanche energy		(Note 4)	E <sub>AS</sub>	23.4	mJ
Avalanche current			I <sub>AR</sub>	-6	Α
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).



#### 5. Thermal Characteristics

Characteristics			Symbol	Max	Unit
Channel-to-ambient thermal resistance	(t = 5 s)	(Note 2)	R <sub>th(ch-a)</sub>	50.0	°C/W
Channel-to-ambient thermal resistance	(t = 5 s)	(Note 3)	R <sub>th(ch-a)</sub>	178.5	°C/W

Note 1: Ensure that the channel temperature does not exceed 150°C.

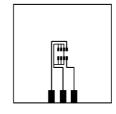
Note 2: Device mounted on a glass-epoxy board (a), Figure 5.1

Note 3: Device mounted on a glass-epoxy board (b), Figure 5.2

Note 4:  $V_{DD}$  = -16 V,  $T_{ch}$  = 25°C (initial), L = 0.5 mH,  $R_G$  = 25  $\Omega$ ,  $I_{AR}$  = -6 A



 $\begin{aligned} & \text{FR-4} \\ 25.4 \times 25.4 \times 0.8 \\ & \text{(Unit: mm)} \end{aligned}$ 



 $\begin{aligned} & \text{FR-4} \\ 25.4 \times 25.4 \times 0.8 \\ & \text{(Unit: mm)} \end{aligned}$ 

Fig. 5.1 Device Mounted on a Glass-Epoxy Board (a)

Fig. 5.2 Device Mounted on a Glass-Epoxy Board (b)

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



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

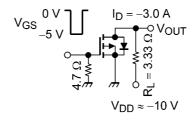
#### 6.1. Static Characteristics

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Gate leakage current	I <sub>GSS</sub>	$V_{GS} = \pm 12 \text{ V}, V_{DS} = 0 \text{ V}$	_	_	±0.1	μΑ
Drain cut-off current	I <sub>DSS</sub>	V <sub>DS</sub> = -20 V, V <sub>GS</sub> = 0 V	_	_	-10	
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	I <sub>D</sub> = -10 mA, V <sub>GS</sub> = 0 V	-20	_	_	V
Drain-source breakdown voltage (Note 5)	V <sub>(BR)DSX</sub>	I <sub>D</sub> = -10 mA, V <sub>GS</sub> = 8 V	-12	_	_	
Gate threshold voltage	$V_{th}$	$V_{DS} = -10 \text{ V}, I_{D} = -0.5 \text{ mA}$	-0.5		-1.2	
Drain-source on-resistance	R <sub>DS(ON)</sub>	$V_{GS} = -1.8 \text{ V}, I_D = -1 \text{ A}$	-	54	100	mΩ
		$V_{GS} = -2.5 \text{ V}, I_D = -3 \text{ A}$	_	32	41	
		$V_{GS} = -4.5 \text{ V}, I_D = -3 \text{ A}$	_	24	30	

Note 5: If a forward 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.

## 6.2. Dynamic Characteristics

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -10 V, V <sub>GS</sub> = 0 V, f = 1 MHz	_	1100		pF
Reverse transfer capacitance	$C_{rss}$		_	160	_	
Output capacitance	C <sub>oss</sub>		_	190	_	
Switching time (rise time)	t <sub>r</sub>	See Figure 6.2.1.	_	6.5	_	ns
Switching time (turn-on time)	t <sub>on</sub>		_	14	_	
Switching time (fall time)	t <sub>f</sub>		_	46	_	
Switching time (turn-off time)	t <sub>off</sub>		_	148		



Duty  $\leq$  1%,  $t_W=10~\mu s$ 

Fig. 6.2.1 Switching Time Test Circuit

## 6.3. Gate Charge Characteristics

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Total gate charge (gate-source plus gate-drain)	$Q_g$	$V_{DD} \approx -16 \text{ V}, V_{GS} = -5 \text{ V}, I_{D} = -6 \text{ A}$	1	17	1	nC
Gate-source charge 1	Q <sub>gs1</sub>			1.8		
Gate-drain charge	$Q_{gd}$		_	5.2	_	

#### 6.4. Source-Drain Characteristics

Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Pulsed reverse drain current (N	ote 6)	I <sub>DRP</sub>	_	_	_	-24	Α
Diode forward voltage		$V_{DSF}$	I <sub>DR</sub> = -6 A, V <sub>GS</sub> = 0 V	_	_	1.2	V

Note 6: Ensure that the channel temperature does not exceed 150°C.



# 7. Marking

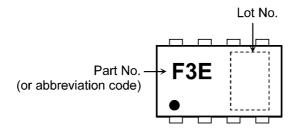


Fig. 7.1 Marking

## 8. Characteristics Curves (Note)

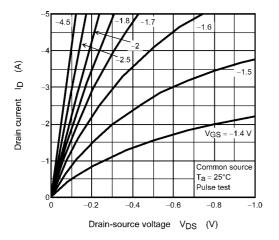


Fig. 8.1 I<sub>D</sub> - V<sub>DS</sub>

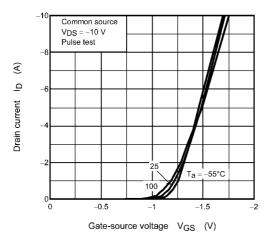


Fig. 8.3 I<sub>D</sub> - V<sub>GS</sub>

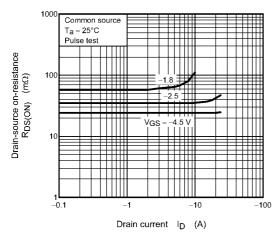


Fig. 8.5 R<sub>DS(ON)</sub> - I<sub>D</sub>

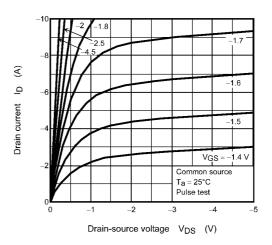


Fig. 8.2 I<sub>D</sub> - V<sub>DS</sub>

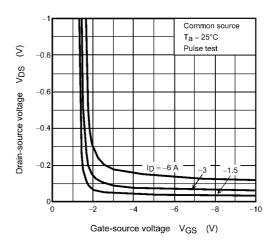


Fig. 8.4 V<sub>DS</sub> - V<sub>GS</sub>

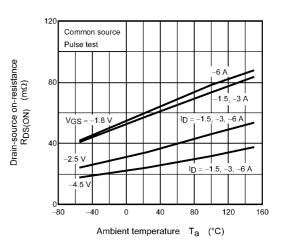


Fig. 8.6 R<sub>DS(ON)</sub> - T<sub>a</sub>

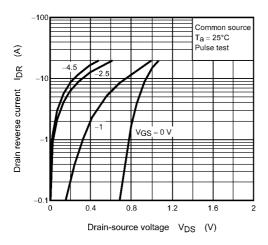


Fig. 8.7 IDR - VDS

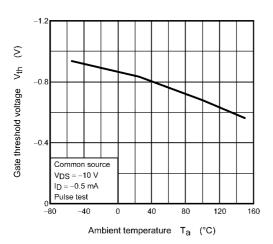


Fig. 8.9 V<sub>th</sub> - T<sub>a</sub>

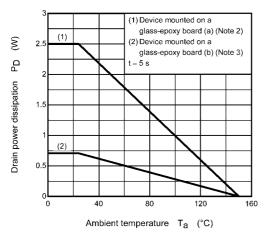


Fig. 8.11 P<sub>D</sub> - T<sub>a</sub> (Guaranteed Maximum)

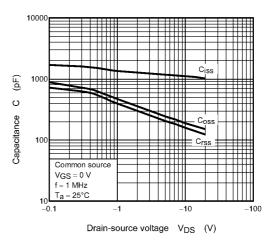


Fig. 8.8 Capacitance - V<sub>DS</sub>

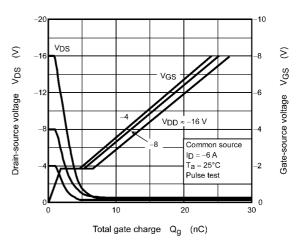


Fig. 8.10 Dynamic Input/Output Characteristics

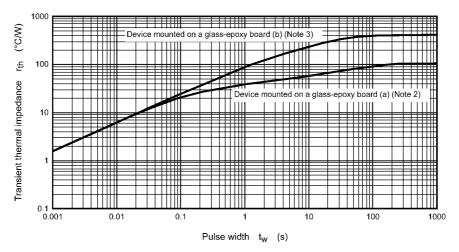


Fig. 8.12 r<sub>th</sub> - t<sub>w</sub> (Guaranteed Maximum)

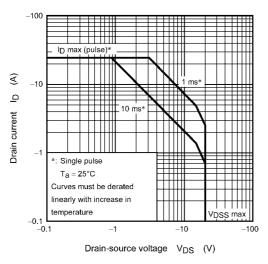


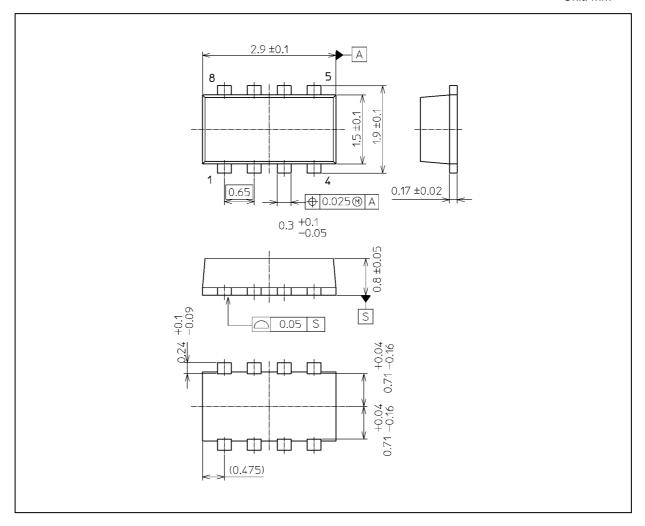
Fig. 8.13 Safe Operating Area (Guaranteed Maximum)

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



## **Package Dimensions**

Unit: mm



Weight: 0.011 g (typ.)

	Package Name(s)
TOSHIBA: 2-3U1S	
Nickname: VS-8	



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