

MOSFETs Silicon P-Channel MOS (U-MOSVI)

TPCC8136

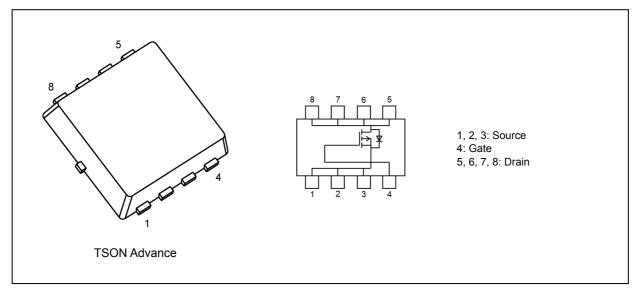
1. Applications

· Power Management Switches

2. Features

- (1) Small footprint due to a small and thin package
- (2) Low drain-source on-resistance: $R_{DS(ON)} = 13 \text{ m}\Omega$ (typ.) ($V_{GS} = -4.5 \text{ V}$)
- (3) Low leakage current: $I_{DSS} = -10 \,\mu\text{A} \,(\text{max}) \,(V_{DS} = -20 \,\text{V})$
- (4) Enhancement mode: V_{th} = -0.5 to -1.2 V (V_{DS} = -10 V, I_D = -1 mA)

3. Packaging and Internal Circuit



1



4. Absolute Maximum Ratings (Note) (Ta = 25°C unless otherwise specified)

Character	Symbol	Rating	Unit		
Drain-source voltage			V _{DSS}	-20	V
Drain-gate voltage	$(R_{GS} = 20 \text{ k}\Omega)$		V_{DGR}	-20	
Gate-source voltage			V _{GSS}	±12	
Drain current (DC)		(Note 1)	I _D	-9.4	Α
Drain current (pulsed)		(Note 1)	I _{DP}	-28.2	
Power dissipation	(T _c = 25°C)		P _D	18	W
Power dissipation	(t = 10 s)	(Note 2)	P _D	1.9	W
Power dissipation	(t = 10 s)	(Note 3)	P _D	0.7	W
Single-pulse avalanche energy		(Note 4)	E _{AS}	57	mJ
Avalanche current			I _{AR}	-9.4	Α
Channel temperature			T _{ch}	150	ů
Storage temperature			T _{stg}	-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

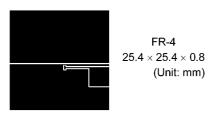
Characteristics				Max	Unit
Channel-to-case thermal resistance	$(T_c = 25^{\circ}C)$		R _{th(ch-c)}	6.94	°C/W
Channel-to-ambient thermal resistance	(t = 10 s)	(Note 2)	R _{th(ch-a)}	65.7	
Channel-to-ambient thermal resistance	(t = 10 s)	(Note 3)	R _{th(ch-a)}	178	°C/W

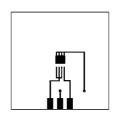
Note 1: Ensure that the channel temperature does not exceed 150°C.

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 Ω , I_{AR} = -9.4 A





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

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

6.1. Static Characteristics (T_a = 25°C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Gate leakage current	I _{GSS}	$V_{GS} = \pm 12 \text{ V}, V_{DS} = 0 \text{ V}$	_	_	±0.1	μА
Drain cut-off current	I _{DSS}	V _{DS} = -20 V, V _{GS} = 0 V	_	_	-10	
Drain-source breakdown voltage	V _{(BR)DSS}	I _D = -10 mA, V _{GS} = 0 V	-20	_	_	V
Drain-source breakdown voltage (Note 5)	V _{(BR)DSX}	I _D = -10 mA, V _{GS} = 8 V	-12	_	_	
Gate threshold voltage	V_{th}	$V_{DS} = -10 \text{ V}, I_{D} = -1 \text{ mA}$	-0.5	_	-1.2	
Drain-source on-resistance	R _{DS(ON)}	V _{GS} = -1.8 V, I _D = -2.4 A	_	26	60	mΩ
		$V_{GS} = -2.0 \text{ V}, I_D = -4.7 \text{ A}$	_	22	37	
		V _{GS} = -2.5 V, I _D = -4.7 A	_	17	22	
		V _{GS} = -4.5 V, I _D = -9.4 A	_	13	16	

Note 5: 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.

6.2. Dynamic Characteristics (T_a = 25°C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Input capacitance	C _{iss}	V _{DS} = -10 V, V _{GS} = 0 V, f = 1 MHz	_	2350	_	pF
Reverse transfer capacitance	C _{rss}		_	330	_	
Output capacitance	C _{oss}		_	360	_	
Switching time (rise time)	t _r	See Figure 6.2.1	_	14	_	ns
Switching time (turn-on time)	t _{on}		_	21	_	
Switching time (fall time)	t _f		_	74	_	
Switching time (turn-off time)	t _{off}		_	234	_	

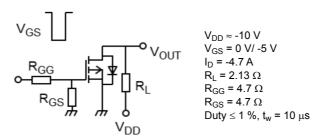


Fig. 6.2.1 Switching Time Test Circuit

6.3. Gate Charge Characteristics (T_a = 25°C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Q_g	$V_{DD} \approx -16 \text{ V}, V_{GS} = -5 \text{ V}, I_{D} = -9.4 \text{ A}$		36	1	nC
Gate-source charge 1	Q _{gs1}			9		
Gate-drain charge	Q_{gd}		_	6		

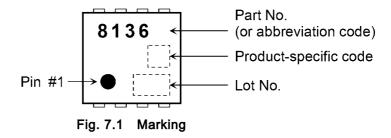
6.4. Source-Drain Characteristics (T_a = 25°C unless otherwise specified)

Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Reverse drain current (pulsed)	(Note 6)	I _{DRP}	_	_	_	-28.2	Α
Diode forward voltage		V_{DSF}	I _{DR} = -9.4 A, V _{GS} = 0 V		_	1.2	V

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



7. Marking





8. Characteristics Curves (Note)

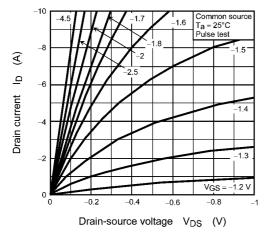


Fig. 8.1 I_D - V_{DS}

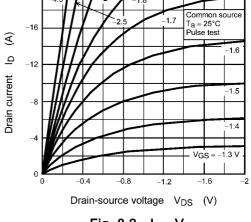


Fig. 8.2 I_D - V_{DS}

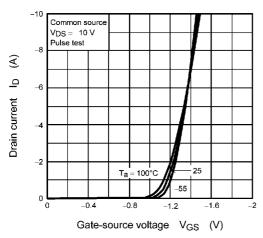


Fig. 8.3 ID - VGS

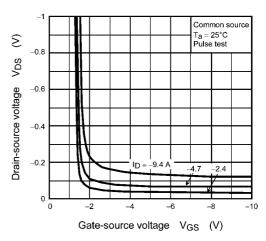


Fig. 8.4 V_{DS} - V_{GS}

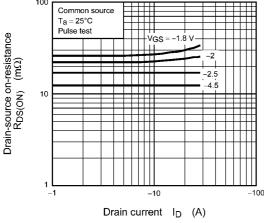


Fig. 8.5 R_{DS(ON)} - I_D

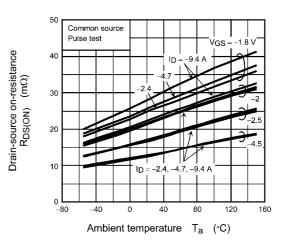


Fig. 8.6 R_{DS(ON)} - T_a



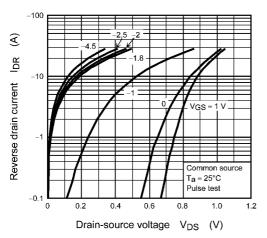


Fig. 8.7 IDR - VDS

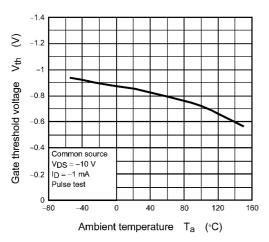


Fig. 8.9 V_{th} - T_a

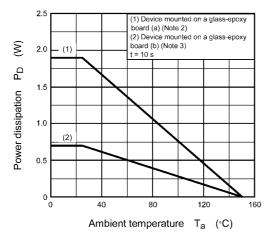


Fig. 8.11 P_D - T_a (Guaranteed Maximum)

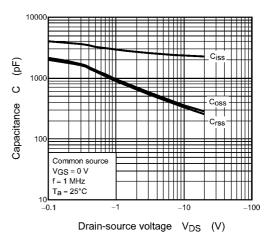


Fig. 8.8 Capacitance - V_{DS}

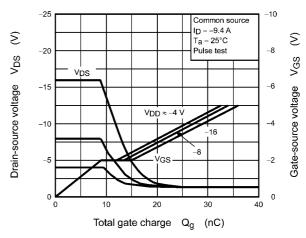


Fig. 8.10 Dynamic Input/Output Characteristics

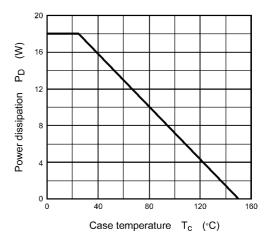


Fig. 8.12 P_D - T_c (Guaranteed Maximum)



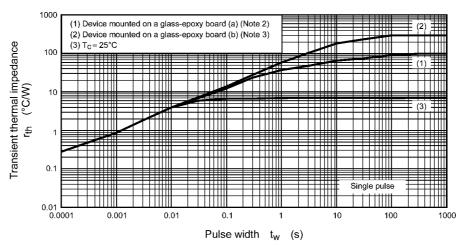


Fig. 8.13 r_{th} - t_w (Guaranteed Maximum)

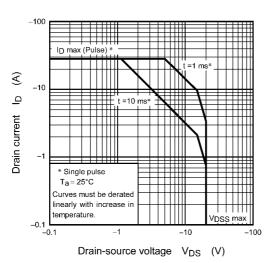


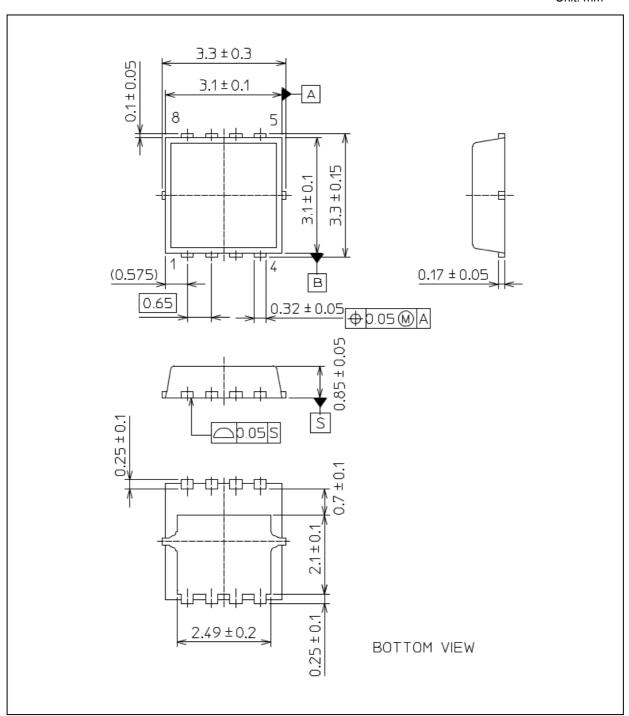
Fig. 8.14 Safe Operating Area (Guaranteed Maximum)

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



Package Dimensions

Unit: mm



Weight: 0.02 g (typ.)

Package Name(s)
TOSHIBA: 2-3X1S
Nickname: TSON Advance



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