

MOSFETs Silicon N-channel MOS (U-MOSVIII-H)

TPN2R703NL

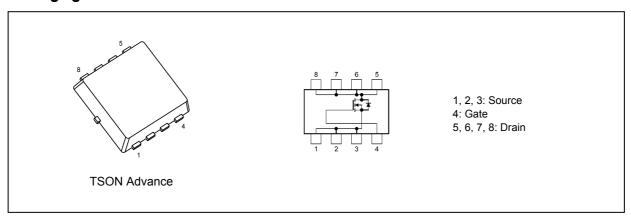
1. Applications

- · High-Efficiency DC-DC Converters
- · Switching Voltage Regulators

2. Features

- (1) High-speed switching
- (2) Small gate charge: $Q_{SW} = 5.2 \text{ nC (typ.)}$
- (3) Low drain-source on-resistance: $R_{DS(ON)} = 3.3 \text{ m}\Omega$ (typ.) ($V_{GS} = 4.5 \text{ V}$)
- (4) Low leakage current: $I_{DSS} = 10 \mu A \text{ (max) (V}_{DS} = 30 \text{ V)}$
- (5) Enhancement mode: V_{th} = 1.3 to 2.3 V (V_{DS} = 10 V, I_{D} = 0.3 mA)

3. Packaging and Internal Circuit



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

Characteristi	cs		Symbol	Rating	Unit
Drain-source voltage			V_{DSS}	30	V
Gate-source voltage			V _{GSS}	±20	
Drain current (DC)	(Silicon limit)	(Note 1), (Note 2)	I _D	90	Α
Drain current (DC)	(T _c = 25 °C)	(Note 1)	I _D	45	
Drain current (pulsed)	(t = 1 ms)	(Note 1)	I _{DP}	200	
Power dissipation	(T _c = 25 °C)		P _D	42	W
Power dissipation	(t = 10 s)	(Note 3)	P_{D}	1.9	
Power dissipation	(t = 10 s)	(Note 4)	P_{D}	0.7	
Single-pulse avalanche energy	'	(Note 5)	E _{AS}	121	mJ
Avalanche current			I _{AR}	45	Α
Channel temperature			T _{ch}	150	°C
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).

Start of commercial production



5. Thermal Characteristics

Characteristics			Symbol	Max	Unit
Channel-to-case thermal resistance	(T _c = 25 °C)		R _{th(ch-c)}	2.97	°C/W
Channel-to-ambient thermal resistance	(t = 10 s)	(Note 3)	R _{th(ch-a)}	65.7	
Channel-to-ambient thermal resistance	(t = 10 s)	(Note 4)	R _{th(ch-a)}	178	

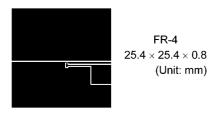
Note 1: Ensure that the channel temperature does not exceed 150 °C.

Note 2: Limited by silicon chip capability. Package limit is 45 A.

Note 3: Device mounted on a glass-epoxy board (a), Figure 5.1

Note 4: Device mounted on a glass-epoxy board (b), Figure 5.2

Note 5: V_{DD} = 24 V, T_{ch} = 25 °C (initial), L = 46 μ H, I_{AR} = 45 A



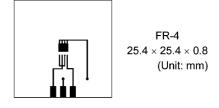


Fig. 5.1 Device Mounted on a Glass-Epoxy Board (a)

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.



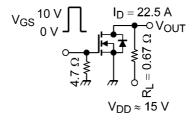
6. Electrical Characteristics

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

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Gate leakage current	I _{GSS}	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	_	_	±0.1	μА
Drain cut-off current	I _{DSS}	V _{DS} = 30 V, V _{GS} = 0 V	_		10	
Drain-source breakdown voltage	V _{(BR)DSS}	I _D = 10 mA, V _{GS} = 0 V	30			V
	V _{(BR)DSX}	$I_D = 10 \text{ mA}, V_{GS} = -20 \text{ V}$	15	_		
Gate threshold voltage	V_{th}	$V_{DS} = 10 \text{ V}, I_{D} = 0.3 \text{ mA}$	1.3	_	2.3	
Drain-source on-resistance	R _{DS(ON)}	$V_{GS} = 4.5 \text{ V}, I_D = 22.5 \text{ A}$	_	3.3	4.1	mΩ
		V _{GS} = 10 V, I _D = 22.5 A	_	2.2	2.7	

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} = 15 V, V _{GS} = 0 V, f = 1 MHz	_	1600	2100	pF
Reverse transfer capacitance	C_{rss}			53	120	
Output capacitance	C _{oss}			890		
Gate resistance	r _g	_	_	1.1	1.7	Ω
Switching time (rise time)	t _r	See Fig. 6.2.1	_	4.4		ns
Switching time (turn-on time)	t _{on}		_	11.5		
Switching time (fall time)	t _f		_	5.7	_	
Switching time (turn-off time)	t _{off}		_	24	_	



Duty \leq 1%, $t_{\text{W}}=$ 10 μs

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	Q_g	$V_{DD} \approx 15 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 45 \text{ A}$	_	21		nC
gate-drain)		$V_{DD} \approx 15 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 45 \text{ A}$		9.5		
Gate-source charge 1	Q _{gs1}	$V_{DD} \approx 15 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 45 \text{ A}$		5.6		
Gate-drain charge	Q_{gd}		_	2.3	_	
Gate switch charge	Q_{SW}		_	5.2	_	

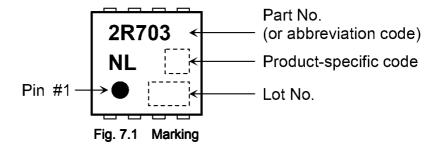
6.4. Source-Drain Characteristics (T_a = 25 °C unless otherwise specified)

Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Reverse drain current (pulsed)	(Note 6)	I _{DRP}	_	_	_	200	Α
Diode forward voltage		V _{DSF}	I _{DR} = 45 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)

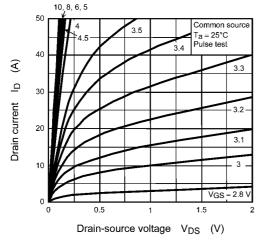
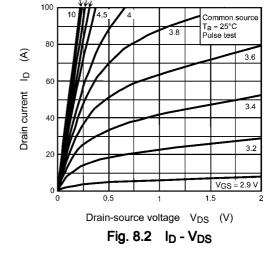


Fig. 8.1 I_D - V_{DS}



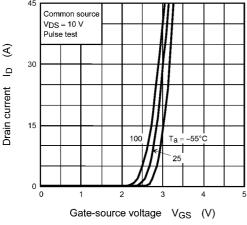


Fig. 8.3 I_D - V_{GS}

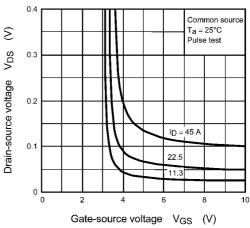


Fig. 8.4 V_{DS} - V_{GS}

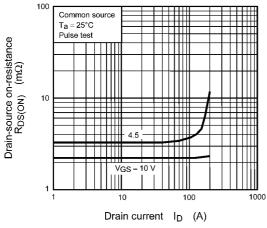


Fig. 8.5 R_{DS(ON)} - I_D

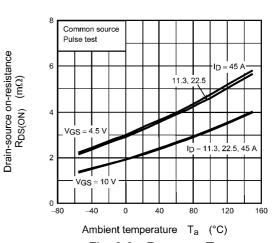


Fig. 8.6 R_{DS(ON)} - T_a

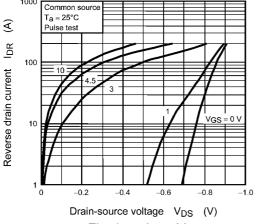


Fig. 8.7 I_{DR} - V_{DS}

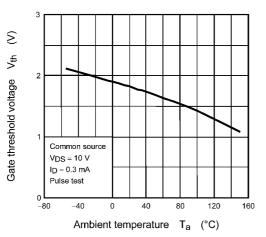


Fig. 8.9 V_{th} - T_a

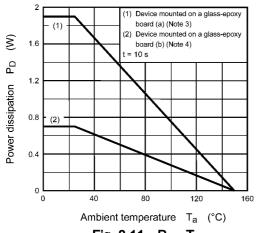


Fig. 8.11 P_D - T_a (Guaranteed Maximum)

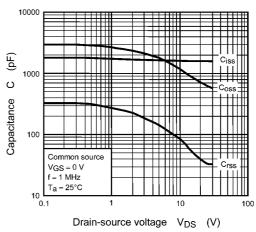


Fig. 8.8 Capacitance - V_{DS}

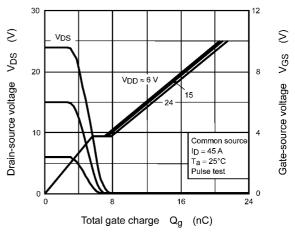


Fig. 8.10 Dynamic Input/Output Characteristics

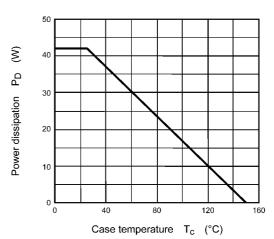


Fig. 8.12 P_D - T_c (Guaranteed Maximum)

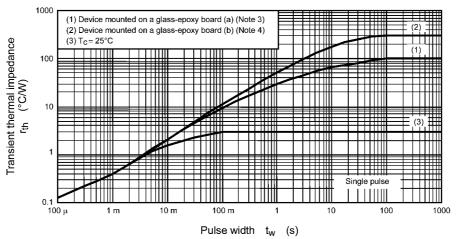


Fig. 8.13 r_{th} - t_w (Guaranteed Maximum)

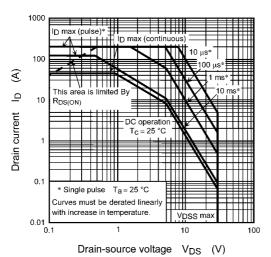


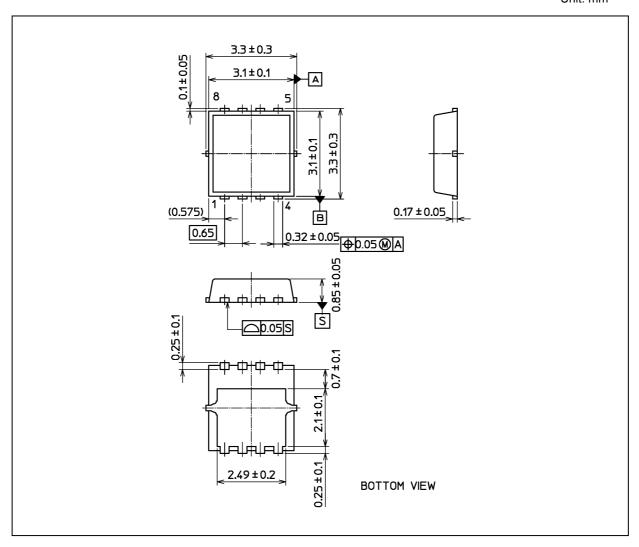
Fig. 8.14 Safe Operating Area (Guaranteed Maximum)

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.)

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



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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: ocean@oceanchips.ru

Web: http://oceanchips.ru/

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А