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

TPN4R303NL

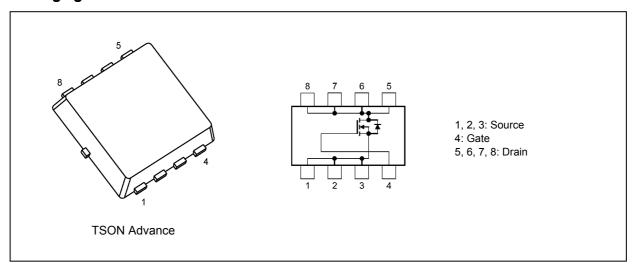
1. Applications

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

2. Features

- (1) High-speed switching
- (2) Small gate charge: $Q_{SW} = 3.9 \text{ nC (typ.)}$
- (3) Low drain-source on-resistance: $R_{DS(ON)} = 5.1 \text{ m}\Omega$ (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: $V_{th} = 1.3 \text{ to } 2.3 \text{ V } (V_{DS} = 10 \text{ V}, I_D = 0.2 \text{ mA})$

3. Packaging and Internal Circuit



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

Characterist	ics		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	63	Α
Drain current (DC)	(T _c = 25 °C)	(Note 1)	I _D	40	
Drain current (pulsed)	(t = 1 ms)	(Note 1)	I _{DP}	154	1
Power dissipation	(T _c = 25 °C)		P _D	34	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}	37	mJ
Avalanche current			I _{AR}	40	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).



5. Thermal Characteristics

Characteristics	Symbol	Max	Unit		
Channel-to-case thermal resistance	(T _c = 25 °C)		R _{th(ch-c)}	3.67	°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	

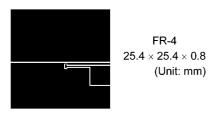
Note 1: Ensure that the channel temperature does not exceed 150 °C.

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 = 18 μ H, I_{AR} = 40 A



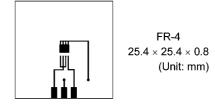


Fig. 5.1 Device Mounted on a Glass-Epoxy Board (a)

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	μΑ
Drain cut-off current	I _{DSS}	V _{DS} = 30 V, V _{GS} = 0 V	_		10	
Drain-source breakdown voltage	V _{(BR)DSS}	$I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$	30			V
	V _{(BR)DSX}	$I_D = 10 \text{ mA}, V_{GS} = -20 \text{ V}$	15	_	_	
Gate threshold voltage	V_{th}	V_{DS} = 10 V, I_{D} = 0.2 mA	1.3		2.3	
Drain-source on-resistance	R _{DS(ON)}	$V_{GS} = 4.5 \text{ V}, I_D = 9.5 \text{ A}$	_	5.1	6.3	mΩ
		V _{GS} = 10 V, I _D = 20 A	_	3.6	4.3	

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	_	1110	1400	pF
Reverse transfer capacitance	C_{rss}		_	39	88	
Output capacitance	C _{oss}		_	640		
Gate resistance	r _g	_	_	1.2	1.8	Ω
Switching time (rise time)	t _r	See Fig. 6.2.1		4.5		ns
Switching time (turn-on time)	t _{on}			10.5		
Switching time (fall time)	t _f		_	3.5	_	
Switching time (turn-off time)	t _{off}		_	19	_	

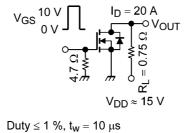


Fig. 6.2.1 Switching Time Test Circuit

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	$V_{DD} \approx 15 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 40 \text{ A}$	_	14.8		nC
gate-drain)		$V_{DD} \approx 15 \text{ V}, V_{GS} = 4.5 \text{ V}, I_{D} = 40 \text{ A}$	_	6.8		
Gate-source charge 1	Q _{gs1}	$V_{DD} \approx 15 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 40 \text{ A}$	_	3.7		
Gate-drain charge	Q_{gd}		_	1.9		
Gate switch charge	Q _{SW}			3.9	_	

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}	_	_	_	154	Α
Diode forward voltage		V_{DSF}	I _{DR} = 40 A, V _{GS} = 0 V	_	_	-1.2	V

Note 6: Ensure that the channel temperature does not exceed 150 $^{\circ}\text{C}.$



7. Marking

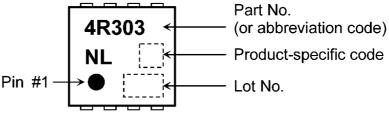


Fig. 7.1 Marking

8. Characteristics Curves (Note)

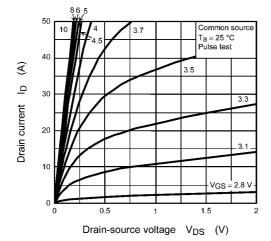


Fig. 8.1 $I_D - V_{DS}$

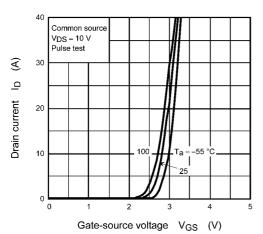


Fig. 8.3 I_D - V_{GS}

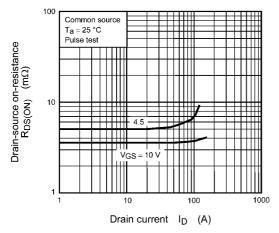


Fig. 8.5 R_{DS(ON)} - I_D

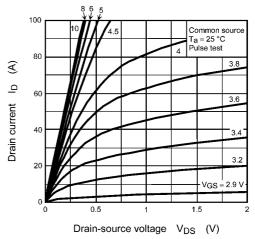


Fig. 8.2 $I_D - V_{DS}$

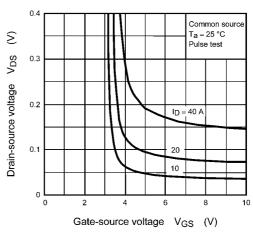


Fig. 8.4 V_{DS} - V_{GS}

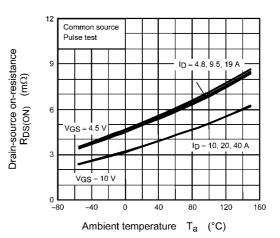


Fig. 8.6 R_{DS(ON)} - T_a

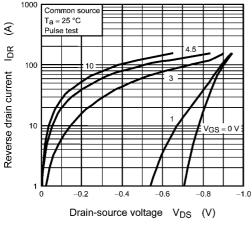


Fig. 8.7 I_{DR} - V_{DS}

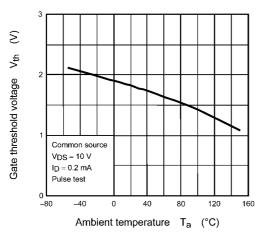


Fig. 8.9 Vth - Ta

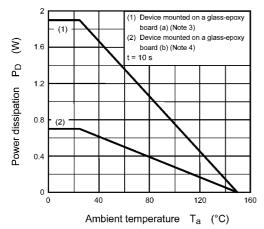


Fig. 8.11 P_D - T_a (Guaranteed Maximum)

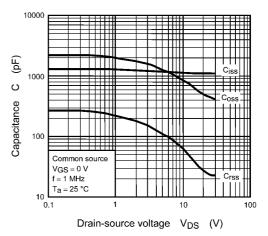


Fig. 8.8 Capacitance - V_{DS}

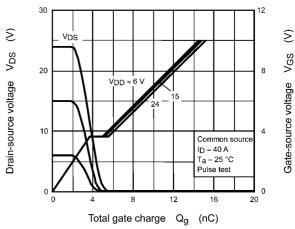


Fig. 8.10 Dynamic Input/Output Characteristics

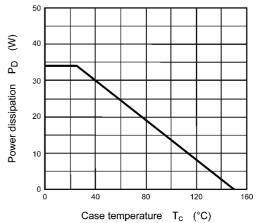


Fig. 8.12 P_D - T_c (Guaranteed Maximum)

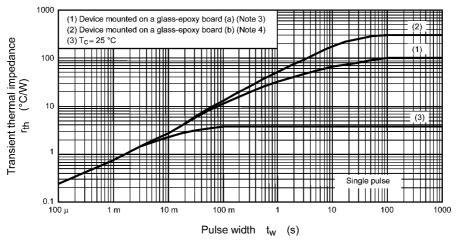


Fig. 8.13 r_{th} - t_w (Guaranteed Maximum)

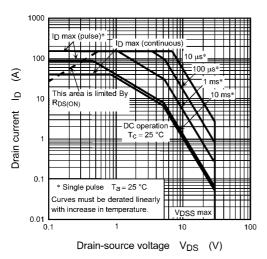


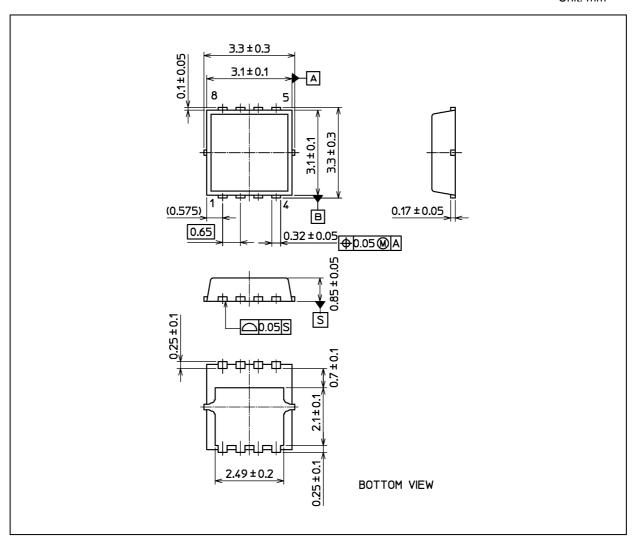
Fig. 8.14 Safe Operating Area (Guaranteed Maximum)

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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